GENERAL

AI-508, an economical and easy operated model of Yudian artificial intelligence industry controller, is specially designed for use in the industries of plastic machinery, food machinery, packaging machinery, baking machinery and environmental testing equipment. It features:

- Application of artificial intelligence control algorithm with auto tuning function, avoiding the overshoot problem of standard PID algorithm and achieving precise control.
- Multiple thermocouples and RTDs are selectable. Integrated non-linear graduation tables, digital calibration and auto zero technology, and achieving accurate and stable measurement.
- Advanced modularized structure, conveniently providing various outputs options, and making quick delivery and easy maintenance.
- High quality and performance hardware design, using high performance tantalum capacitor or ceramic capacitor. Compared to competing models, it consumes less electricity, experiences less temperature shifting, provides higher stability and reliability and can work in a wider range of temperature.
- ISO9001 certification and CE certified, achieving world class level of quality, anti-interference ability and safety.

MODEL CODE SYMBOL

The model code of AI-508 is made up of 5 parts, for example:

AI-508	A	G	L2	L2
①	②	③	④	⑤

① **shows the basic function of instrument:**

AI-508 economical artificial intelligence temperature controller

② **shows the front panel dimension :**

A Front panel 96×96mm(width×height), cut out 92×92mm, depth behind mounting surface 100mm

D Front panel 72×72mm(width×height), cut out 68×68mm, depth behind mounting surface 95mm

D2 Front panel 48×48mm(width×height), cut out 45×45mm, depth behind mounting surface 95mm

E Front panel 48×96mm(width×height), cut out 45×92mm, depth behind mounting surface 100mm

F Front panel 96×48mm(width×height), cut out 92×45mm, depth behind mounting surface 100mm

③ **shows the module types of main output. Selectable modules are as follows:**

L1 Relay contact output module (Capacity: 2A/250VAC, only normally open terminal can absorb electrical spark)

L2 Relay contact output module (Capacity: 1A/250VAC, small volume)

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

W1 TRIAC no contact normally open discrete output module, suitable for AC contactors up to 80A, and has low interference and long life.

K1 Thyristor zero crossing trigger output module. One loop of output, suitable for single-phase power.

K3 Three phases Thyristor zero crossing trigger output module (can trigger three-phase of TRIAC, a pair of inversely parallel connected SCRs or SCR power module of current 5~500A)

④ **shows the module type of alarm output. Selectable modules are as follows:**

N (or null) no module installed

L1 Relay contact output module (Capacity: 2A/250VAC, normally open terminal can absorb spark, support AL1 alarm output)

L2 Relay contact output module (Capacity: 1A/250VAC, small volume, support AL1 alarm output)

L5 Dual normally open relay output module (Capacity: 2A/250VAC, support AL1 and AL2 alarm outputs)

⑤ **shows the module type of Auxiliary output (AUX). Selectable modules are as follows:**

N (or null) no module installed

L1 Relay contact output module (Capacity: 2A/250VAC, normal open terminal can absorb spark, support AU1 alarm output)

L2 Relay contact output module (Capacity: 1A/250VAC, small volume, support AU1 alarm output)

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

Note1: For instrument of dimension D2, because of its limited volume, when L1 or L5 module is installed in the ALM slot, L1 can't be installed in the OUPT slot, but L2, which is smaller, can be installed instead.

Note2: K3 can't be installed in instruments with dimension D or D2. There is no AUX slot D2 instruments. L5 module can't be installed in the ALM slot of instrument with dimension D.

TECHNICAL SPECIFICATION

- **Input type :** K, S, R, E, J, N, Pt100
- **Measurement range :** K(0～1300℃), S(0～1700℃), R(0～1700℃), E(0～1000℃), J(0～1200℃), N(0～1300℃), Pt100(-200～800℃)
- **Measurement accuracy :** 0.3%FS±1℃
- **Temperature display resolution :** 1℃
- **Control mode :** On-off control or Artificial Intelligence PID control with auto tuning.
- **Output mode (modularized) :**
  - L1 Relay contact output module (Normally open + normally close. Capacity: 2A/250VAC or 30VDC/2A)
  - G SSR voltage output module (DC 12V/30mA)
  - W1 TRIAC no contact normally open discrete output module (Capacity: 100～240VAC/0.2A, instantaneous current 2A with time<20ms and repeat period>5s)
  - K1 Thyristor zero crossing trigger output module (can trigger TRIAC, a pair of inversely parallel connected SCRs or SCR power module with current of 5～500A)
  - K3 Three-phase Thyristor zero crossing trigger output module (can trigger three phases of TRIAC, 2 inversely parallel connected SCRs or SCR power module of current 5～500A)
- **Alarm function :** High limit, low limit, and deviation high alarm.
- **Power supply :** 100～240VAC, -15%, +10% ; 50～60Hz.
- **Power consumption :** ⩽3W.
- **Ambient :** Temperature of -10～60℃, humidity of 0～90RH%
- **Reliability :** repairing and returning rate ⩽0.8% (according to the statistics data from 2003 to 2004.)
- **Electromagnetic compatibility (EMC) :** IEC61000-4-4: ± 4KV/5KHz; IEC61000-4-5: 4KV

FRONT PANEL AND OPERATION

① Upper display window, displays PV, or code of a parameter
② Lower display window, displays SV, alarming code, or value of a parameter
③ Setup key, for accessing parameter table, and confirming change.
④ Data shift key, also for activating auto turning
⑤ Data decrease key
⑥ Date increase key
⑦ Indicator lamps (OP1, AL1, AL2, AU1and AU2 indicate the I/O actions of the corresponding modules)

Basic display status : When power on, the upper display window of the instrument shows the process value (PV), and the lower window shows the setpoint (SV). This status is called basic display status. When the input signal is out of the measurable range (for example, the thermocouple or RTD circuit is break, or input specification sets wrong), the upper display window will alternately display "orAL" and the high limit or the low limit of PV, and the instrument will automatically stop output.

OPERATION DESCRIPTION

Setpoint Setting:

In basic display status, if the parameter lock "Loc" isn't locked, we can set setpoint (SV) by pressing ◀ 、▼ or ▲ .Press ▼ to decrease the value, ▲ to increase the value, and ◀ to move to the digit expected to modify. Keep pressing ▼ or ▲ , the speed of decreasing or inscreasing value gets quick. The range of setpoints is between the parameter SPL and SPH. The default range is 0～400℃.

Parameter Setting:

In basic display status, press ↻ and hold for about 2 seconds can access Field Parameter Table. Pressing ↻ can go to the next parameter; pressing ◀ 、▼ or ▲ can modify the ralue of a parameter. Press and hold ◀ can return to the preceding parameter. Press ◀ (don't release) and then press ↻ simultaneously can escape from the parameter table. The instrument will escape auomatically from the parameter table if no key is pressed within 25 seconds. Setting Loc=808 and then press ↻ can access System Parameter Table.

Artificial Intelligence PID control and auto tuning

When AI PID control mode is chosen (CtrL=APId), the PID parameters can be obtained by running auto-tuning. In basic display status, press ◀ for 2 seconds, the "At" parameter will appear. Press ▲ to change the value of "At" from "oFF" to "on", then press ↻ to active the auto-tuning process. During auto tuning, the instrument executes on-off control. After 2 cycles of on-off action, the instrument will obtain the values of PID parameters. If you want to escape from auto tuning status, press and hold ◀ 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.

Note 1: 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. For the ovens with good heat preservation, the setpoint can be set at the highest applicable temperature. It is forbidden to change SV during auto tuning. Depending on the system, the auto-tuning time can be from several seconds to several hours.

Note 2: Parameter CHYS (on-off differential, control hysteresis) has influence on the accuracy of auto-tuning. Generally, the smaller the value of CHYS, the higher the precision of auto tuning. But CHYS parameter value should be large enough to prevent the instrument from error action around setpoint due to the oscillation of input. CHYS is recommended to be 2℃.

Note 3: AI series instrument has the function of self-learning. It is able to learn the process while working. The control effect at the first run after auto tuning is probably not perfect, but optimal control result will be obtained after a period of time because of self-learning.

PARAMETERS AND SETTINGS

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

Code	Name	Description	Setting Range	Default
HIAL	High limit alarm	Alarm on when PV (Process Value) >HIAL; alarm off when PV<HIAL-AHYS Alarm output action can be defined by parameter AOP.	-999 ~ +3000	3000
LoAL	Low limit alarm	Alarm on when PV<LoAL; alarm off when PV>LoAL+AHYS To avoid mis-alarming because of low temperature at the beginning of power on, the low limit alarm will be disable until the temperature first rises higher than LoAL.	-999 ~ +3000	-999
HdAL	Deviation high alarm	Alarm on when PV-SV>HdAL; alarm off when PV-SV<HdAL-AHYS	-999 ~ +3000	3000
P	Proportional band	Proportional band in PID with unit℃ or °F Generally, optimal P, I, D and CtI can be obtained by auto tuning. They can also be manually inputted if you already know the correct values.	1 ~ 999	30
I	Time of Integral	No integral effect when I=0	0 ~ 9999 seconds	100 seconds
d	Time of Derivative	No derivative effect when d=0	0 ~ 999.9 seconds	50.0 seconds
CtI	Control period	Small value can improve control accuracy. For SSR or Thyristor output, generally 0.5 to 3 seconds. For Relay output, generally 15 to 40 seconds, because small value will cause frequent on-off action of mechanical switch and shorten its service life. CtI is recommended to be 1/4 ~1/10 of derivative time. (It should be integer times of 0.5 second.)	0.5 ~ 120 seconds	2 or 20 seconds
FILt	PV input filter	The value of FILt will determine the ability of filtering noise. When a large value is set, the measurement input is stabilized but the response speed is slow. Generally, it can be set to 1 to 3. 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.	0-4	1
Loc	Parameter Lock	0: auto-tuning and modification of field parameters and setpoint are allowed. 1: allowed to modify field parameters and setpoint value, but can't run auto-tuning. 2: allowed to modify field parameters, but can't change the setpoint or run auto-tuning. 3 ~ 255: can only modify "Loc" 808: setting Loc=808 and then pressing ↻ can access system Parameter Table	0-9999	0

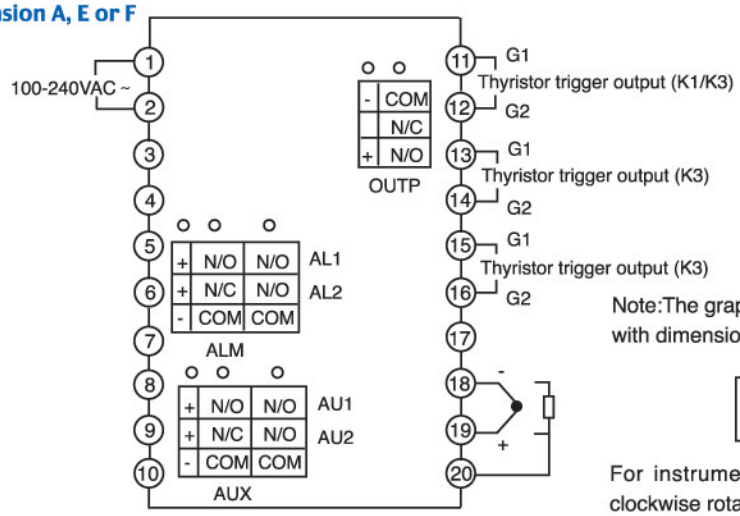
System parameter table (set Loc=808 and then press ↻ to access)

AHYS	Alarm Hysteresis	Avoid frequent alarm on-off action because of the fluctuation of PV	0 ~ 200	2
AOP	Alam output assignment	From right side to left side, the first, second and third digit of AOP individually indicate the alarm outputs of HIAL, LoAL and HdAL. 0 shows no output. 1,2,3 or 4 indicates alarm outputted to AL1, AL2, AU1 or AU2. For example, AOP = 1 (HdAL) 0 (LoAL) 1 (HIAL) It shows that HIAL and HdAL are sent to AL1, and LoAL has no output.	0 ~ 444	111
CtrL	Control mode	onoF : On-off control APId : AI PID control, high precision and no-overshoot	onoF APId	APId
CHYS	Control Hysteresis	CHYS is used for on-off control to avoid frequent on-off action of relay. For a heating system, if PV > SV, output turns off; PV<SV-CHYS, output turns on.	0~200	2
InP	Input specification	InP: 0 K, 1 S, 2 R, 3 Spare, 4 E, 5 J, 6 Spare, 7 N, 8-20 Spare, 21 Pt100	0 ~ 21	0
Scb	Input Shift Adjustment	Scb is used to make input shift to compensate the error produced by sensor or input signal. PV_after_compensation= PV_before_compensation + Scb.	-200 ~ 400	0
Fru	Selection of power frequency and temperature scale	50C: 50Hz, ℃. Input has maximum anti-interference ability to 50Hz frequency; 50F: 50Hz, °F. Input has maximum anti-interference ability to 50Hz frequency; 60C: 60Hz, ℃. Input has maximum anti-interference ability to 60Hz frequency; 60F: 60Hz, °F. Input has maximum anti-interference ability to 60Hz frequency;	50C 50F 60C 60F	50C
SPL	Low limit of SV	Minimum value that SV allowed to be.	-999 ~ 3000	0
SPH	Upper imit of SV	Maximum value that SV allowed to be.		400

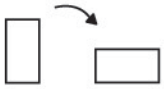
INSTRUMENT INSTALLATION AND WIRING

Wiring graph for instruments with dimension A, E or F

Note: The compensation wires for different kinds of thermocouple are different,and should be directly connect to the terminals. Connecting the common wire between the compensation wire and the terminals will cause measurement error.

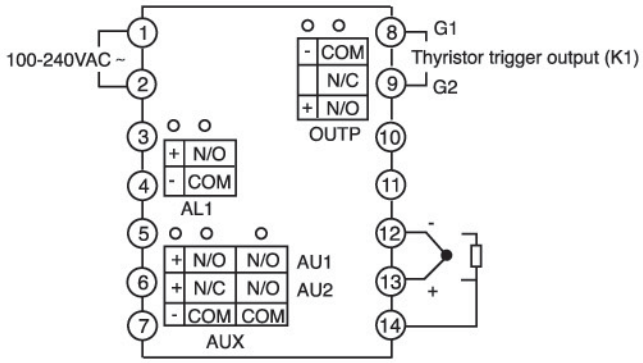


Note:The graph suits for upright intrments with dimension A or E

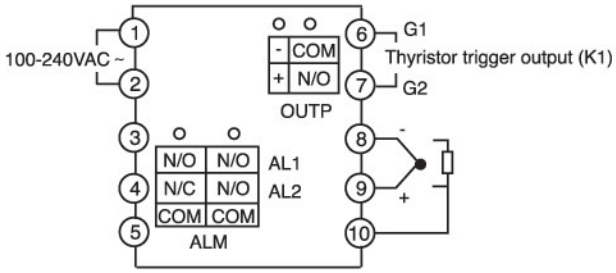


For instruments with dimension F,just clockwise rotate the graph 90 degree and the terminal numbers keep the same.

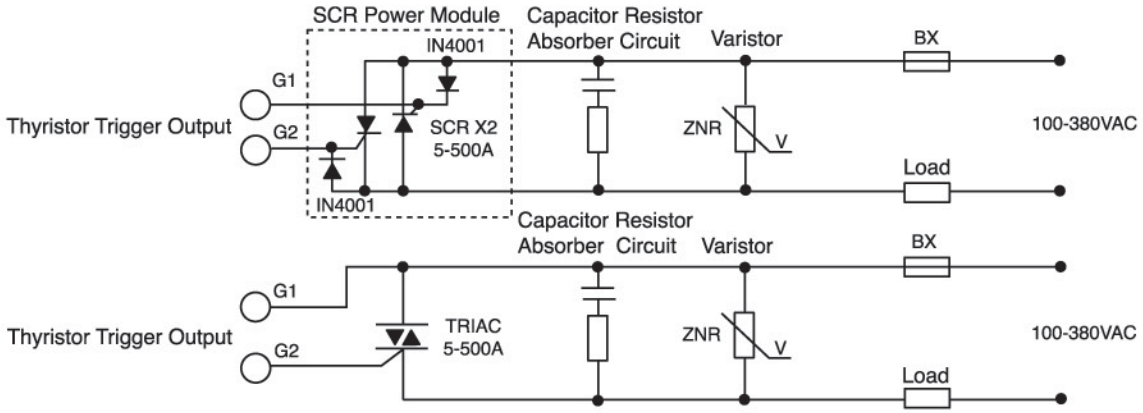
Wiring graph for D dimension (72X72mm) instruments



Wiring graph for D2 dimension(48X48mm)instruments



Wiring Graph for Thyristor Trigger Output



Note: it is recommended to use the SCR power module,which includes a pair of SCRs and diodes.Compared to TRIAC, it is more reliable and consumes less electricity.

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