Quick Operation Guide for AI Artificial Intelligence Industrial Regulator

（Suitable for precise control of temperature, pressure, flow, liquid level, humidity）

（V9.2）

Precautions

1.Those who use this product must have sufficient knowledge of electrical systems and ensure that this product will not be used in situations where there is danger to people and property.
2.The content of this guide is for reference only. Depending on the product model and version, part of the functions for some models or versions have been described in this guide while other functions are not introduced. If you have any questions, please go to our official website www.yudian.com to download the PDF file of the latest version of the complete manual.
3.Before using this product for the first time, please carefully read the complete manual of this product to ensure correct use.
4.The company's liability for the product is limited to the product itself, and is not responsible for any other direct or indirect losses or liabilities.

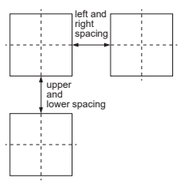
1. Technical Specifications

● **Input specifications (8*9 requires selecting the corresponding input module):**
Thermocouples: K, S, R, E, J, T, B, N, WRe3-WRe25, WRe5-WRe26, etc.
Thermal resistance: Cu50, Pt100, Ni120
Linear voltage: 0~5V、1~5V、0-60mV、0~20mV、-20mV~+20mV, etc
Linear current (requires external shunt resistor or I44 module installed): 0~10mA, 0~20mA, 4~20mA, etc.
Extended Specifications: On the basis of retaining the above input specifications, users are allowed to customize an additional input specification.
● **Measurement range**:
K(-200~+1300 ℃)、S(-50~+1700 ℃)、R(-50~+1700 ℃)、T(-200~+350 ℃)、E(0~800 ℃)、J(0~1000 ℃)、B（200~1800 ℃）、N(0~1300 ℃)、WRe3-WRe25（0~2300 ℃）、WRe5-WRe26（0~2300 ℃）、Cu50(-50~+150 ℃)、Pt100(-200~+800℃)、Pt100(-80.00~+300.00℃)
Linear input: -9990~+32000 defined by user
● **Measurement accuracy** (depending on the model):
level 0.05~0.1/level 0.1/level 0.15/level 0.2/level 0.25/level 0.3 (Note: When higher accuracy is required for thermocouple input, an external PT100 thermal resistor should be used for compensation, and an additional ± 1 ℃ compensation error will be added during internal compensation. Level 0.05 refers to the fact that some input specifications of AI-898, including PT100, S and B type thermocouples, and mV input support a measurement accuracy of 0.05 level.)
● **Measurement temperature drift**: ≤ 25PPm/℃ (level 0.05~0.1); ≤ 50PPm/℃ (level 0.1~0.15); ≤ 100PPm/℃ (level 0.2~0.3)
● **Control period**: 0.1~300.0 seconds adjustable
● **Regulating method**: On-off control mode (dead band adjustable), AI-PID with fuzzy logic PID regulating and auto tuning with advance artificial intelligence algorithm, Standard PID regulation, cascade regulation.
● **Output specifications (modular):**
Relay output (NO+NC): 250VAC/2A or 30VDC/2A
TRIAC no contact discrete output (NO or NC): 100~240VAC/0.2A (continuous), 2A (20mS instantaneous, repeat period ≥ 5s)
SSR Voltage output: 12VDC/30mA (To drive solid-sate relay SSR).
Thyristor zero-crossing trigger output: To trigger TRIAC of 5~500A, a pair of inverse paralleled SCRs or SCR power module.
Linear current output: 0~10mA or 4~20mA customized. (energy-saving modules installed, maximum output voltage ≥ 5.5V; high-voltage modules installed, maximum output voltage ≥ 10.5V)
● **Alarm :** upper limit, lower limit, upper limit deviation, lower limit deviation, Up to 4 channels of alarms can be output, with power-on exemption alarm selection function;
● **Communication** : RS485, RS232, MODBUS-TCP ; modules available: S, S1, S4, S6, R, etc.
● **Retransmission:** measured value transmission, set value transmission; modules available (OUTP or COMM port): X3, X5, etc.
● **Electromagnetic compatibility**: IEC61000-4-4 (electrical fast transient burst) ±6KV/5KHz, IEC61000-4-5 (surge) 6KV and there will not appear crash and the I/O port malfunctions under 10V/m high-frequency electromagnetic field interference, in addition, the fluctuation of the measured value does not exceed ±5% of the range
● **Isolation withstand voltage**: the voltage between power supply terminal, relay contact and signal terminal is ≥ 2300V; weak current signal terminals isolated from each other are ≥ 600V
● **Power supply:** 100~240VAC or DC, -15%, +10% / 50~60Hz; or 24VDC/AC, -15%, +10%
● **Power consumption**: ≤ 0.3W (including CPU, measurement, display and communication, excluding any output or external power consumption)
● **Operating environment**: temperature -10~60℃ ; humidity ≤ 90%RH

2. Installation Method

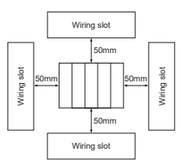
2.1 Panel-mounted Instrument

① The spaces among panel cut-out should be set at an appropriate distance according to different sizes and mounting brackets. If it is necessary, the instruments are allowed to be installed side by side closely. It is recommended that the left and right spacing of A/D/D61/C/E size is ≥ 8mm, and the upper and lower spacing is ≥ 30mm; the left and right spacing of B/F size is ≥ 30mm, and the upper and lower spacing is ≥ 8mm.
② Insert the instrument into the panel cut-out, and press the mounting bracket from the opening side of the case to temporarily fix the main body.
③ When tightening the mounting bracket and terminal wiring, please set the tightening torque to 0.39~0.58N·m.



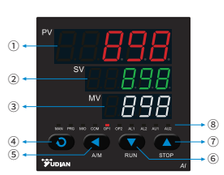
2.2 Rail-mounted Instrument

① Mount the module on a 35mm DIN rail.
② The rail module must be installed vertically, and the recommended distance is at least 50mm.
③ The tightening torque to 0.39 ~ 0.58N·m.during wiring.



3. Panel Description

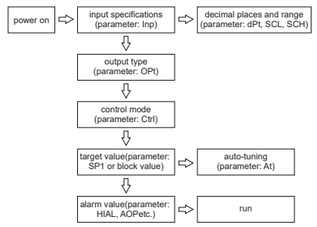
① The upper display window displays the measured value PV, parameter title, etc.
② The middle display window displays the set value SV, alarm code, parameter value, etc.
③ The lower display window displays the output percentage MV. When there is feedback signal position proportional output, it displays the valve feedback value.
④ Setting key is used to enter parameter setting state and confirm parameter modification.
⑤ Data shift (also fixed-point control operation)
⑥ Data reduction key (also run/pause operation)
⑦ Data increase key (also stop operation)



⑧ When 10 LED indicators and the MAN indicator is on, it means it is in the manual output state; when the PRG indicator is on, it means the program is running, and the flashing means it is in the waiting function state; while MIO, OP1, OP2, AL1, AL2, AU1, AU2 lights respectively correspond to the input and output actions of the corresponding position module; and COM light flashes to indicate that it is communicating with the host computer.
Note: Some panels do not have the third row display window (lower display window)

4. Typical Setting Process and Common Parameters

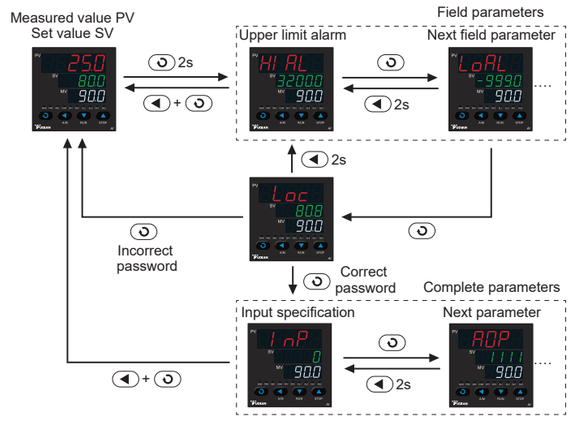
① Please refer to the complete parameter table for the description of the parameters in the figure. For other functions, please refer to the description of common functions.
② The input range does not need to be set when the thermocouple or thermal resistance is selected for the input specification, and the range is only set when the analog signal is input or the retransmission function is required.
③ Auto-tuning is only required when APID or nPID is selected as the control mode. It must be performed when the equipment can work normally.
④ After the setting, if the instrument is in the stop or pause state, it needs to run manually or execute the running command from the host computer.



5. Operation Process Flow

5.1 Parameter setting process Flow

The parameters are divided into two parts: field parameters and complete parameters, the complete parameter table can be entered after the LOC is set to the correct password (808 by default).



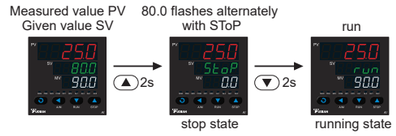
5.2 Auto-tuning Process Flow

If the control mode Ctrl adopts APID or nPID mode, the PID parameters can be determined by auto-tuning. When the measured value PV is room temperature, please set the set value SV (parameter SP1) to about 60% of the commonly set temperature (for signals such as pressure or flow, it can be directly set to the commonly used set value), Pressand hold ◁ for two seconds to call out the At parameter(if At=FOFF, the tuning cannot be started quickly, to modify the At value to start the tuning can be achieved by entering the complete parameter to change At value), then change the parameter value from OFF to on and click ⟲ to start the auto-tuning, When the auto-tuning At symbol does not flash automatically, the instrument can work normally.

Rapid auto-tuning function AAT: press and hold ◁ for two seconds, the At parameter will appear, press △ to change the OFF of the lower display window to AAt, and press ⟲ to confirm, then the instrument will automatically start the AAT advanced rapid parameter auto-tuning function, and the PID parameters can be preset without the need for traditional periodic oscillation auto-tuning when the instrument is in full power heating output state after power-on. In most cases, accurate control can be achieved after heating for the first time; if the instrument exits the full power output state before the AAt is automatically completed, then the AAT fails; terminating rapid auto-tuning will not lead to the modification of the PID parameters; next time when the instrument is in full power heating output state, the AAT function will be activated again. When AAT is rapidly auto-tuning, the lower display of the instrument will flash and display "AAt". When the auto-tuning is done, , the At parameter will automatically returns to OFF.

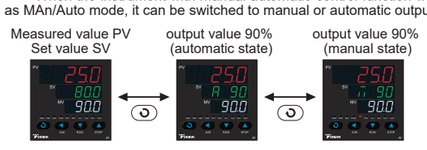
5.3 Run / Stop Switching Process Flow

For those parameters Pno ≥ 1 or Pno=0 and Srun=StoP/run, the panel keys can quickly switch the stop or running state of the instrument.



5.4 Manual / Automatic Control Switching Process

When the instrument with manual automatic control function with the A-M parameter set as MAn/Auto mode, it can be switched to manual or automatic output state through the panel.

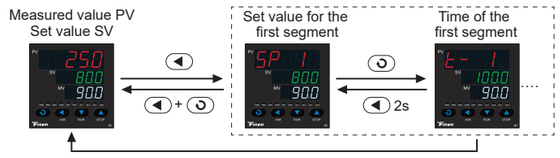


5.5 Segment Running Status Viewing Process Flow

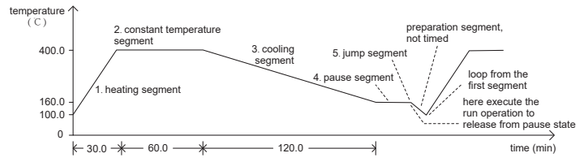
When the parameter Pno of the program segment number is ≥ 1, program segment number currently running , the set time of the current segment, and the running time of the current segment can be viewed through the panel keys.

5.6 Segment Setting Process Flow

When the parameter Pno of program segment number of the instrument is ≥ 1 (the number of program segments varies with models up to 50 segments), users can program the instrument to change the set value rising and falling at different slope; with programmable/operable commands such as jump, run, pause and stop, The program can be modified during program control operation; with power failure processing mode, measurement value start function and preparation function, to compete and increase efficiency of program execution.



Program segment setting example: The format of temperature – time – temperature is uniformly used in program programming, which is defined as setting the temperature from the current segment, and reaching the next temperature after the time set in this segment.
SP 1=100.0t 1=30.0; from 100 ° C, the temperature rises linearly to SP 2, the heating time is 30 minutes, and the heating slope is 10 ° C/min.
SP 2=400.0t 2=60.0; hold at 400 ° C for 60 minutes.
SP 3=400.0t 3=120.0; cooling to SP 4, cooling time is 120 minutes, cooling slope is 2℃ / min.
SP 4=160.0t 4=0.0; after cooling to 160 ° C, it enters the pause state, and it needs to execute the run to continue to run the next stage.
SP 5=160.0t 5=-1.0; jump to the first segment to execute, and start the cycle from the beginning.



6. Complete parameter table

6.1 Parameter lock Loc

The parameter lock Loc can provide a variety of different parameter operation privileges and password input operation to enter the complete parameter table, and its functions are as follows:
Loc=0, Allowed to modify the field parameters and allowed to directly modify the set value in the basic display state;
Loc=1, Forbidden to modify the field parameters, but allowed to directly modify the given value in the basic display state;
Loc=2~3, Allowed to modify the field parameters but forbidden to directly modify the set value in the basic display state;
Loc=4~255, Forbidden to modify any parameters other than Loc and all shortcut operations .

6.2 Complete Parameter Table

The complete parameter table is divided into 8 blocks, including alarm, adjustment control, input, output, communication, system function, set value/program and field parameter definition. Please note that there are differences in the parameter sequence and number of parameters for different models. Please follow the corresponding parameters displayed on the actual purchased instrument. The specific parameters are as follows:

Parameters	Meaning	Description	Range
Addr	Communication address	The Addr parameter is used to define the communication address of the instrument, the valid range is 0~80. Instruments on the same communication line should set a different Addr value to distinguish them from each other.	0-80
bAud	Baud rate	The bAud parameter defines the communication baud rate, and the definable range is 0~28800bit/s (28.8K). When the COM position is not used for the communication function, the bAud parameter can be set to use the COM port as other functions: BAUD=0, COMM transmitted as a process value of 0~20ma for output; BAUD=1, as an external switch input, whose function is the same as MIO. When MIO is occupied, the I2 module can be installed in COMM; BAUD=2, COMM as AU1+AL1 output, suitable for small-sized instruments; BAUD=3, COMM as AU1+AU2 output, suitable for small-sized instruments; BAUD=4, COMM transmittedas a process value of 4~20mA for output; BAUD=8, COMM transmitted as a set value of 0~20mA for output; BAUD=12, COMM transmitted as a set value of 4~20mA for output .	0~28.8K
AFC	Communication mode	The AFC parameter is used to select the communication mode, and its calculation method is as follows: AFC=A × 1+D × 8+ G x 64 A=0: Standard MODBUS; A=1: t AIBUS; A=2: MODBUS compatible mode; A=4, S6 module compatible communication mode. D=0: no parity; D=1, even parity. G=0, AUX used normally; G=1, AUX as event input. Note: When AFC is set to MODBUS protocol, 03H (read parameters and data) and 06H (write single parameter). Among them, when AFC=0, 4, the 03H instruction can read up to 20 words of data at a time; when AFC=2, the 03H instruction read data is fixed to 4 words. For details, please refer to the description of individual the communication protocol document .	0~255
InP	Input specification code	InP is used to select the input specification, and the input specification corresponding to its value is as follows:	0~106
AOP	Alarm output definition	The 4-digit ones, tens, hundreds and thousands of AOP are used to define the output positions of 4 alarms such as HIAL, LoAL, HdAL and LdAL, as follows: AOP =__3__ __3__ __0__ __1__ ; LdAL HdAL LoAL HIAL The value range is 0-4. 0 means that there is alarm output allocated to any port. any port, 1, 2, 3, 4 means that the alarm is output by AL1, AL2, AU1, AU2 respectively. Example:It shows that HdAL and LdAL are sent to AU1, LoAL has no output, HIAL is sent to AL1. Note 1: When AUX is used as auxiliary output in the two-way regulation system, the output of alarm designated AU1 and AU2 is invalid. Note 2: If AL2 or AU2 is required, the L3 dual relay module can be installed in the ALM or AUX slot.	0~4444

0	K	21	Pt100
1	S	22	Pt100 (-80.00~+300.00℃)
2	R	25	0~75mV voltage input
3	T	26	0~100 ohm resistance input
4	E	27	0~400 ohm resistance input
5	J	28	0~20mV voltage input
6	B	30	0~60mV voltage input
7	N	31	0~1V voltage input
8	WRe3-WRe25	32	0.2~1V voltage input
9	WRe5-WRe26	33	1~5V voltage input
10	User-specified extended input specification	34	0~5V voltage input
12	F2 Radiation Pyrometer	35	-20~+20mV voltage input
13	T（0~300.00℃）	37	-5V~+5V voltage input
15	MIO input 1 (4~20mA when I44 is installed)	42	0~10V voltage input
16	MIO input 2 (0~20mA when I44 is installed)	43	2~10V voltage input
17	K（0~300.00℃）	44	-10V~+10V voltage input
18	J（0~300.00℃）	45	0~100mV voltage input
19	Ni120	46	20~100mV voltage input
20	Cu50		

While InP=10, the non-linear table can be self-defined or input by factory under a paid service.

OPt	Output type	**SSr**: Output SSr drive voltage or thyristor zero crossing trigger signal. G, K1 or K3 module should be installed. The output power can be adjusted by the on-off time proportion. The period (Ctl) is generally 0.5~4 seconds. **rELy**: for relay contact output or for execution system with mechanical contact switch(such as contactor or compressor). To protect the mechanical switch, the output period (Ctl) is limited to 3~120 seconds, **0-20:** 0~20mA linear current output. X3 or X5 module should be installed. **4-20**: 4~20mA linear current output. X3 or X5 module should be installed. **PHA**: Single-phase phase-shift output. K50/K60 module should be installed. In this status, AUX cannot serve as the cold output terminal for regulating output. **nFED**: position proportional output without feedback signal, directly controls the forward/reverse direction of the valve motor, and the travel time of the valve is defined by the parameter Strt. **FEd**: position proportional output with feedback signal, the travel time of the valve should be more than 10 seconds, and the feedback signal is input from the 0~5V/1~5V input terminal of the instrument. Note: The external given function cannot be used in this output mode. **FEAt**: position of the auto valve. The instrument will record the feedback signal in SPSL after closing the valve, and then fully open the valve to remember the feedback signal in SPSH. After completion, it will automatically return to the FEd control mode. **SSr4**, 4-channel solid-state synchronous output. (Only available for 8 * 9) **Note**: The AI-8 * 6 series does not have position proportional control output	
At	Auto-tuning	**oFF:** Auto tuning is off. **on:** Active auto turning of PID and Ctl parameter, automatically return to FoFF after auto tuning **FoFF** : Auto tuning is off, cannot activate again by pressing key from panel **AAt**, fast auto-tuning, automatically returns to OFF after auto tuning. **Note**: If AAt is selected as the AT parameter, the AAt auto-tuning can be automatically started when the instrument is in the output status of full power heating after power on. PID parameters can be set in advance without traditional periodic oscillation. In most cases, accurate control can be achieved by first heating. If the AAT has not completed the auto-tuning, but the instrument has already exited the full power output status, then the AAT fails and the auto-tuning will be terminated, but the PID parameters will not be modified.	
A-M	Automatic/ manual control selection	**MAn**: manual control, the output magnitude of OUTP is adjusted manually by the operator. **Auto:** automatic control , The output of OUTP is calculated according to the control method set in CtrL parameter. **FSv**: compatible to the hands-free automatic mode. It is forbidden to enter the manual automatic switching interface. **FAut:** fixed in the automatic control mode. This mode prohibits switching from the direct key operation on the front panel to the manual state.	
Srun	Running status	**run**, running status, indicator PRG turns on. **StoP,** stop status, the lower display flashes StoP, and the indicator PRG turns off. **HoLd,** keep running status. When in an unlimited thermostatic control status(Pno=0), it indicates that the instruent is in a normal operation status and prohibited to run or stop from the panel; When under program control (Pno>0), the instrument will maintain the control output status, but pause the timing. At the same time, the lower display will flash to display "HoLd" and the PRG light will flash. The buttons on the panel can be used to execute or stop to release the hold running status.	
Pno	Segment number	It is used to define the effective number of program segments, reduce the number of unnecessary program segments and make the operation as well as the program setting convenient for the end customer. Pno=0, in constant temperature mode and SPr can also be set to limit the heating rate; Pno=1, under the control of a single program mode, the instrument only needs to set a set value and an insulation time. After the insulation time ends, it enters a stop status; Pno=2~50, in normal program mode. Note: The 8 * 6 series only supports one program segment.	0~50
PonP	Power-on auto-running mode	Cont: if it is in the stop state before the power failure, it will continue to stop otherwise it will continue to execute at the original termination point after the instrument is powered on. **StoP**: no matter what happens after the power is turned on, the instrument will enter the stop state. **run1**:if it is in the stop state before the power failure, it will continue to stop otherwise the program will automatically start from the first segment after the power is turned on. **dASt**: after power- is turned on, if there is no deviation alarm, the program will continue to execute, and if there is a deviation alarm, it will stop running. **HoLd** (only when Pno ≥ 1), the instrument is powered off during operation it will enter the pause state . However, if the instrument is in the stopped state before the power failure, it will remain in the stopped state after the power is turned on.	
Et	Event input type *(I2 module installed in MIO or COMM position)*	The Et parameter has been extended to 2 inputs (modules such as I5 need to be installed if dual inputs are used), Et=Et1*10+Et2, where Et1 and Et2 represent event input 1 and input 2, respectively. The numerical meanings of Et1 or Et2 are as follows: **0（nonE）**: event input function disabled. **1（ruSt:）** run/stop function, Short-connecting MIO for a short time will activate running control (run), Keep connecting for more than 2 seconds, the instrument will stop the control (StoP). **2（SP1.2）**: In fixed-point control (Pno=0), set value SV=SP1 when MIO is open. SV=SP2 when MIO is closed. **3（Pid2）**: Switching first group of PID and second group PID parameters. In single direction control (not heating and cooling bi-directional control), P, I, d and Ctl are used for regulating when MIO is open. P2, I2, d2 and Ctl2 are used instead when MIO is closed. **4（EAct）**: external switch toggles heating/cooling control functions. When the MIO is open, the parameters P, I, d and Ctl are used for heating regulation, . When the MIO is closed, the parameters P2, I2, d2 and Ctl2 are switched to be used for cooling regulation. **5（Erun）**: for external switch to switch run/stop. The instrument stops when MIO is open. The instrument runs MIO is closed. **6（Eman）**: External switch to RUN/STOP. Instrument stops when switch is off and runs when switch is on. **7(Eout):** Forces the main output to be 0 or Ero when the external switch turns on. (Based on the AF2. E parameter function). **Note:** If Et1=Et2 is set, the system will execute Et1 first and then Et2, and the result will be based on Et2.	0~77
CtrL	Control method	OnoF: on-off control, for situation not requiring high precision. APID: an advanced artificial intelligence PID control, is recommended. nPID: the standard PID adjustment algorithm, with anti-windup integral function. PoP: direct PV retransmission, working as a temperature re-transmitter. SoP: direct SV retransmission, working as a program generator.	

OPL oPL	Output low limit	0~100%: OPL is the minimum output of OUTP in single directional control system. -1~-110%: The instrument works as a bidirectional system, and has heating/ refrigerating dual output. When ACt=rE or rEbA, OUTP (main output) works for heating, and AUX (Auxiliary output) works for refrigerating. When Act=dr or drbA, OUTP works for refrigerating, and AUX works for heating. In a bidirectional system, OPL for defining the limitation of maximum cooling output. So when OPL=-100%, it means no limitation on cooling output. If OPL=-110%, it can make current output(4~20mA) excess 10% on maximum output. When the output type is SSR output or relay output, maximum of cooling output should not be set more than 100% .	-110~ +110%
OPH oPH	Output upper limit	PV<OEF, limit the maximum output value of OUTP (main output); PV>OEF, output upper limit corrected to 100%; When there is no feedback from the position proportional output (OPt=nFED), if OPH<100, automatically set the position of the valve when powered on; OPH=100, automatically set the position of the valve when the output is 0% and 100%, which can shorten the time for powering on and starting. The OPH shoould be set greater than OPL.	0~110%
Aut Aut	Cooling output type	Define AUX only when AUX works as the auxiliary output of a heating/ refrigerating bidirectional system. **SSr:** to output SSr driver voltage or thyristor zero crossing trigger signal, G or K1 module should be installed. The output power can be adjusted by adjusting the on-off time proportion. The period (Ctl) is generally 0.5~4 seconds. **rELy:** for relay contact output or for executing system with mechanical contact switch(such as contactor or compressor). To protect the mechanical switch, the output period (Ctl) is limited to 3~120 seconds, and generally is 1/5 to 1/10 of derivative time. **0~20:** 0~20mA linear current output. X3 or X5 module should be installed in AUX slot. **4~20:** 4~20mA linear current output. X3 or X5 module should be installed in AUX slot. **Note:** If OPt or Aut=rELy is set, the output period is limited to 3~120 seconds in principle. If the heating or refrigeration output signal is 4~20mA, when there is an output from heating, the refrigeration output will return to zero, and the output is 0mA instead of 4mA; When there is an output from refrigeration, the signal at the heating output terminal is zero, and the output is 0mA instead of 4mA.	
CHYS CHYS	Control hysteresis (dead zone, hyster-esis)	It is used to avoid frequent action of control of relay. For a reverse acting (heating) system, when PV > SV, output turns off; when PV<SVCHYS, output turns on. For a direct acting (cooling) system, when PV<SV, output turns off; when PV>SV+CHYS, output turns on.	0~2000 unit
Act Act	Acting method	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.	
P P	Propor-tional bands	To define the proportional band for APID and PID control,Instead of percentage of the measurement range, the unit is the same as PV. Note: Generally, optimal P, I, D and Ctl can be obtained by AT auto tuning. But for users who are familiar with the system, they can manually input the correct parameters of P, I, D and Ctl when batch production of heating equipment is required.	1~32000 unit
I I	Integral time	To define the integral time of PID adjustment, the unit is second, No integral effect when I=0	0~9999 s
d d	Differential time	To define the differential time of PID adjustment, the unit is 0.1 seconds, No derivative effect when d=0.	0~3200 s
Ctl Ctl	Control period	For SSR, thyristor or linear current output, it is generally 0.5~3 sec. For Relay output or in a heating/refrigerating dual output control system, generally 15~40 sec, because if the control cycle is too short, it will shorten the lifespan of the mechanical switch or cause frequent switching of cold/hot output, otherwise it will reduce the control accuracy, Ctl is recommended to be 1/5 ~ 1/10 of derivative time. (It should be integer times of 0.5 second.) When the parameter OPt or Aut = rELy, Ctl will be limited whitnin3 seconds. Auto tuning will automatically set Ctl to suitable value considering both control precision and mechanical switch longevity. If the output is a control valve, it is recommended to set Ctl=3~15 seconds, taking into account the response speed and avoiding frequent valve actions. When the parameter CtrL = ON-OFF, Ctl will used as timer to delay time to avoid the power restart in short period. It suits for compressor protection.	0.2~ 300.0s
P2 P2	Propor-tional band for cold output	To define the cold output proportional band for APID and PID regulation, Instead of percentage of the measurement range, the unit is the same as PV.	1~32000 unit
I2 I2	Integral time of cold output	To define the integral time of cold output PID adjustment, the unit is second, No integral effect when I=0.	0~9999 s
d2 d2	Differential time of cold output	To define the differential time for cold output PID tuning, in units of 0.1 seconds. No derivative effect when d=0.	0~3200 s
Ctl2 Ctl 2	Cold output period	Typically set to 0.5-3.0 seconds with SSR, SCR, or current output. When the output is a relay (OPt or Aut set to rELY), the actual Ctl will be limited to more than 3 seconds, generally recommended to be 20~40 seconds.	0.2~ 300.0s
dPt dPt	Display Resolution	Four formats (0, 0.0, 0.00, 0.000) are selectable Note 1: For thermocouples or RTD input, only 0 or 0.0 is selectable, Even if the 0 format is selected, the internal resolution is still maintained at 0.1 ℃ to control the operation. When using S, R, and B type thermocouples, dPt is recommended to be 0. If INP= 17,18 or 22, resolution 0.01℃ will support display 0.0 or 0.00 Note 2: When using linear input, it is recommended to use 0.000 instead of 0 if there is a possibility that the measured value or other related parameter values are greater than 9999, because the display format will change to 00.00 after exceeding 9999.	
Scb Scb	Input Shift Adjustment	Scb is used to shift input to compensate the error caused by transducer, input signal, or auto cold junction compensation of thermocouple. Note: It is generally set to 0. The incorrect setting will cause inaccurate measurement.	-9990~ +4000 unit
SCL SCL	Signal scale low limit	Define scale low limit of input. It is also the low limit of transmitter output (CtrL=POP or SOP) and light bar display.	-9990~ +32000 unit
SCH SCH	Signal scale high limit	Define scale high limit of input. It is also the high limit of retransmission output (CtrL=POP or SOP) and light bar display.	
FILt FILt	PV input filter	FILt determines the ability of filtering noise. The larger the value is set, the more stable the measurement input is, but the slower the response speed is. If great interference exists, then it is allowable to increase parameter “FILt” gradually to make momentary fluctuation of process value less than 2~5. When the instrument is being metrological verified, “FILt” s can be set to 0 or 1 to shorten the response time. The unit of FILt is 0.5 second.	0~40

Fru Fru	Selection of power frequency and temper-ature scale	50C: 50Hz,display ℃ . 50F: 50Hz, display ℉ 60C: 60Hz, display ℃ 60F: 60Hz, display ℉	
SPSL SPSL	Lower limit of the external given scale	Define the lower limit of the external given input signal scale; Define the lower limit of the valve position feedback signal, which can be automatically adjusted by the valve auto-tuning function.	-9990~ +32000 unit
SPSH SPSH	Upper limit of the external given scale	Define the upper limit of the scale of the external given input signal; Define the upper limit of the valve position feedback signal, which can be determined by the valve self-tuning function. Warning: the values after valve position auto-tuning are for display reference only, unless professionals, otherwise, do not modify SPSH and SPSL parameters.	
AF AF	Advanced function code	Below is used to select advanced functions and is calculated as felow: AF=A×1+B×2 +C×4 +D×8+E×16+F×32+G×64+H x128 A=0: HdAL and LdAL work as deviation high and low limit alarms; A=1: HdAL and LdAL work as high and low limit alarms, and the instrument can have two groups of high and low limit alarms. B=0: Alarm and control hysteresis work as unilateral hysteresis; B=1: As bilateral hysteresis. C=0, displayed in the third row with a decimal point; C=1, displayed in the third row without a decimal point. D=0, Loc=808 can access the parameter list; D=1, Loc=PASd can access the parameter list. E=0, HIAL and LOAL work as high and low limit alarms respectively; E=1, HIAL and LOAL work as deviation high and low limit alarms respectively, then there are four deviation alarms. F=0, Fine control, internal control resolution was demonstration’ s 10 times. When on linear input mode, biggest display value is 3200 units; F=1, Wide range display mode, when the value is required to be larger than 3200, it is recommended to choose this mode. G=0, When the thermocouple or RTD input is burnt out, PV value will increase and trigger the high limit alarm(set value of the upper limit alarm should be less than the upper limit of signal range). G=1, When the thermocouple or RTD input is burnt out, PV value will increase and NOT trigger the high limit alarm. After it was set, high limit alarm(HIAL) will have 15s delay to trigger in normal usage. H=0, HIAL and LOAL can alarm independently; H=1, HIAL and LOAL become interval alarm, and will alarm only when LOAL>PV>HIAL is met. The alarm code is HIAL, and HIAL is also used for output. Note: AF=0 is recommended for ordinary usage.	0~255
AF2 AF2	2nd advanced function code	AF2 is used to select the second set of advanced function codes, and its calculation method is as follows: AF2=AX1+BX2 +CX4 +DX8+EX16+FX32+GX64+HX128 A=0, set value is internally given; A=1, the set value is externally given, and the externally given signal is input from the 5V input terminal. B=0, the externally given signal is 1~5V; while B=1, 0~5V. C=0, normal input mode; C=1, square root processing with linear input signals. D=0, define the scale with SCH SCL when transmitting output; D=1, define the scale with SPSL SPSH when transmitting output (note: do not use when there is a valve feedback signal input). E=0, output 0 when the sensor is disconnected, E=1, output Ero when the sensor is disconnected. F=0, Ero is automatically set, F=1, Ero is manually set. Automatic definition of Ero is one of the autonomous control contents of AI artificial intelligence, which means that the instrument will automatically remember the average output value when the current process value and the set value are consistent, for the reference of PID adjustment calculation, which can improve the control effect. For the sake of safety, the maximum learning value of Ero is 70% of the output power. If a higher Ero value is required, it can be manually set as the safest commonly used output. G=0, standby. H=0, CT function is disabled; The CT measurement function must be disabled during position proportional output (valve motor servo) to avoid conflicts between the two; H=1, the CT function is activated and needs to work with I9 module to detect current, which can be used for judging load disconnection or actuator short circuit. Note: The AI-8 * 6 series does not support external functions.	0~255
PAF PAF	Program running mode (Pno ≥ 1)	This parameter is used to select the function controlled by the program, and its calculation method is as follows: PAF = AX1 + BX2 + CX4 + DX8 + EX16 + FX32+ HX128 When A=0: disable Preparation/Ready (rdy) function; A=1: enable Preparation/Ready (rdy) function B=0: Ramp mode. During the program is running and there is temperature difference in SV, the temperature points migrates as a line graph. Various heating mode can be defines, as well as cooling mode; B=1: Soak mode (Constant temperature mode). Each program step defines the set point and soaking time. When it reaches the next step, it is limited by rdy and the heating/ cooling rate can be limited by the SPr/SPrL. On the other hand, even if B=0, if the last step in the program is not a command for ending, the constant temperature mode will also be executed, and it will automatically end when the time is up. C=0: Time unit in minute; C=1: Time unit in hour. D=0: Disable PV Startup function; D=1: Enable PV Startup function. E=0: Select AL1 and AL2 for event outputs 1 and 2 respectively; E=1, select AU1 and AU2 for event outputs 1 and 2 respectively. F=0: Standard RUN mode; F=1: Activate RUN shortcut will enter Hold status when the program is running. G=0, program time determined by item C; G=1, time unit in second. H=0: Standard RUN mode; H=1: Under ramp mode, Ready (rdy) function is avaiable for each step.	0~255
SPr SPr	Heating rate limit	If SPr is set to be valid, when the program runs or changes the set value, and PV<SV, the instrument will heat up to the set value at the temperature limit defined by SPr. When the heating rate is limited, the PRG light will flash. SPr is effective for fixed point control (Pno=0) and platform mode, and slope mode does not use this function. When PAF’ s item C=1, the units of parameters SPr and SPrL are ℃ /hour.	0~3200 ℃ /min
SPrL SPrL	Cooling Rate Limit	If SPrL is set to be valid, when the program runs or changes the set value, and PV>SV, the instrument will cool down to the set value at the temperature limit defined by SPrL. When the cooling rate is limited, the PRG light will flash. SPrL is effective for fixed point control (Pno=0) and platform mode, and slope mode does not use this function. If there is no cooling output, when the natural cooling rate <SPrL, the instrument cannot guarantee the cooling slope, and will cool down according to the natural cooling rate. When PAF’ s item C=1, the units of parameters SPr and SPrL are ℃ /hour.	0~3200 ℃ /min
Ero Ero	Output value when overrange	When the instrument control mode is PID or APID, Ero defines the output value to be adjusted when the input is over-range (usually caused by sensor failure or disconnection). AF2 can define whether Ero is valid and the setting mode. When Ero is in automatic setting mode, if the deviation is less than 4 measurement units, the instrument will automatically store the integral output value, so the Ero value will automatically change with the system. When Ero is in manual setting mode, the Ero value is manually set.	-110 ~110%

OPrt oPrt	Soft-start time	After the instrument is powered on\ off, and PV is<OEF, the maximum allowable output of the main output OUTP only rises to 100% after passing through OPrt; if PV>OEF, the rise time of the output is limited to 5 seconds. This function is only needed by customers with special requirements; During manual output or auto tuning, the maximum output is not limited by soft start. If soft start is needed to reduce the impulse current of inductive loads, Ctl=0.5 seconds and OPrt=5 seconds can be set.	0~3600 s
OEF oEF	Work range of OPH	When PV<OEF, the upper limit of OUTP is OPH; when PV>OEF, the upper limit of OUTP is 100%. Note: This function is used in some occasions where full power heating is not available at low temperature. For example, to avoid that the temperature raises too quickly, under 150℃ , a heater can work only under 30% of power, then set OEF=150.0 (℃), OPH=30 (%)	-999.0~ +3200.0 ℃ or linear unit
HIAL HI AL	High limit alarm	Alarm on when PV>HIAL Alarm off when PV<HIAL-AHYS Note: All alarms can be assigned to AL1, AL2, AU1, AU2 or none. More alarm allocation is explained in AOP section below.	-9990~ +32000 unit
LoAL LoAL	Low limit alarm	Alarm on when PV<LoAL; Alarm off when PV>LoAL+AHYS Note: HIAL and LoAL can be assigned as deviation alarms. Details please refer to the description of parameter AF.	
HdAL HdAL	Deviation high limit alarm	Alarm on when PV-SV>HdAL; Alarm off when PV-SV<HdAL-AHYS When the value set to Max. will disable this function	
LdAL LdAL	Deviation low limit alarm	Alarm on when PV-SV<LdAL; Alarm off when PV-SV>LdAL+AHYS When the value set to Min. will disable this function Note: HdAL and LdAL can be assigned as absolute high limit and low limit alarms. Details please refer to the description of parameter AF.	
AHYS AHYS	Alarm hysteresis	Avoid frequent alarm on-off action because of the fluctuation of PV	0~2000 unit
AdIS AdI S	Alarm display	OFF, Will not display alarm message in the lower display window when alarming; ON: Alternately display alarm message in the lower display window when alarming. FOFF, energy saving/confidential display mode; In this mode, the instrument will not only turn off the display of process value and set value, which can save power consumption of the instrument or keep the process temperature confidential, but also display the current program number in the lower display window, and display the alarm symbol when giving an alarm.	
SPL SPL	SV low limit	The minimum value of SP allowed .	-9990~ +32000 unit
SPH SPH	SV high limit	The maximum value of SP allowed.	
SP1 SP 1	Set point 1	When parameter Pno=0 or 1, the given value SV=SP1.	SPL~ SPH
SP2 SP2	Set point 2	When Pno=0 or 1, MIO has I2 module installed and Et=SP1.2 is set, SP1/SP2 can be switched through an external switch; When the switch is off, SV=SP1, and when the switch is on, SV=SP2.	
PASd PASd	Password	PASd=0~255 or AF.D=0, set Loc=808 to enter the complete parameter table. PASd=256~9999 and AF.D=1, set Loc=PASd to enter the parameter table. Note: Only expert users can set PASd, it is recommended to use a unified password to avoid forgetting.	0-9999
Strt Strt	Valve Rotation travel Time	Strt is used to define the travel time of valve rotation when the instrument is in position proportional output; If there is a valve feedback signal, the instrument will automatically select the return difference of the valve control signal based on the Strt setting. The shorter the travel time, the greater the return difference, and the lower the valve positioning accuracy. If there is no valve feedback signal or if the valve feedback signal generates an over range fault, the instrument will determine the operating time of the valve motor based on the comparison of the travel time defined by Strt.	10~240s
nonc nonc	normally open and normally closed	A single channel alarm relay can simultaneously output normally open and normally closed, while a dual channel alarm module L3 only has normally open output. However, the normally open output can be defined as normally closed output through the non c parameter. nonc=0, L3 relays installed in AL1, AL2, AU1, and AU2 are all normally open outputs; nonc=15, all instrument alarms are normally closed outputs. When it is necessary to keep some channels open and some channels closed, the nonc value can be calculated according to the following formula. Nonc=AX1+BX2+CX4+DX8 A, B, C, and D represent the normally open and normally closed outputs of AL1, AL2, AU1, and AU2, respectively. When the value is 1, it is the normally closed output, while 0, it is the normally open output.	
EFP1 EFP 1	Lower limit of current alarm value	The percentage is used by EFP1~3. The CT function (AF2. H=1) needs to be enabled, paired with the I9 module, and the external transformer needs to be converted to AC 0~50mA. Try to match two or more transformers, so that the normal current percentage is around 20%~40%. For example, the normal current is about 15A, and 50mA is optional. This way, EFP3 will display around 30 during normal use, indicating a current of 30%; At this point, set EFP1=20 for load disconnection judgment, and EFP2=50 for actuator short circuit judgment;	0~100
EFP2 EFP2	Upper limit of current alarm value		0~100
EFP3 EFP3	Current percentage	When a current alarm is generated, the instrument will flash CtAL while AU1 outputs. Setting AF. C=1, the three row display instrument can display the EFP3 current percentage on the third row. Note: SSR output or relay output should be selected, and the output cycle should be greater over 0.2 seconds.	
OPH1 oPH 1	Output high limit	High limit of output 1.	0~100%
OPH2 oPH2	Output high limit	High limit of output 2.	
OPH3 oPH3	Output high limit	High limit of output 3.	
OPH4 oPH4	Output high limit	High limit of output 4.	

EAF EAF	Parameter selection for expanding advanced functions	The EAF parameter is used to extend advanced functions, and its calculation method is as follows: EAF=Ax1+Cx4+Dx8+Ex16+Fx32 A=0, automatically selects the refresh speed of the main input based on the setting of CTI control cycle parameters (120mS~960mS; 100~800mS when Fru=60Hz). A=1, standby, the refresh speed of the main input is customized by special VIP users; A=2, the refresh speed of the main input is about 60mS (approximately 50mS when Fru=60Hz); A=3, the refresh speed of the main input is about 120mS (approximately 100mS when Fru=60Hz); C=0, disable automatic switching of two sets of PID parameters based on SV size; C=1, enable automatic switching of two sets of PID parameters based on SV size. D=0, PID parameter switching set value is defined by parameter OEF; If SV>OEF, use the second set of PID parameters, otherwise, use the first set of PID parameters; If D=1, the parameter switching set value is defined by the parameter SPSH; Note: To avoid output disturbance during switching, the output cycles of the two sets of PIDs should usually be set to be consistent, and the differential time should be consistent too. E=0, AUX slot is in normal use; E=1, AUX slot for transmission output, needs to be paired with AUX. F=0, AUX for transmission output and transmits PV; F=1, AUX for transmitting output and transmits SV. Note: AI-8 * 6 series does not have EAF function	0~255
Cc Cc	Cascade function and dual input mode selection	Cc=0, normal control mode Cc=1~200, cascade control mode, input 1 is the main control, input 2 is the secondary control, the specification of input 1 should be the same as input 2, the output of the main control is the set value of the secondary control, it will output after the instrument completes the calculation . The smaller the delay time of the secondary control loop is relative to the delay time of the main control loop, the larger the allowable Cc parameter value can be. If Cc is set too high, it will cause oscillation. Cc=201, dual input hot backup mode Cc=202, Small value mode (dual input) , and the measured value of the two channels with the lowest measured value is taken as the main control measured value. Cc=203, tLarge value mode (dual input), and the measured value of the two channels with the highest measured value is taken as the main control measured value. Cc=204, the secondary input can be forcibly selected as the process value of the main control.	0~204
Prn Prn	Functional parameters for selecting multiple program segments	Prn represents the number of the currently selected program group (0-9); When the Prn value is modified and the instrument is in the STOP status, the instrument will automatically save the previous 50 program segments to FLASH memory and load a new numbered program segment. Even if the number of program segments in the instrument is set to 0, modifying Prn will switch between 10 different sets of given values for SP1 and SP2. Note: FLASH large capacity memory is used to store data. According to the chip manufacturer's manual, the switching write life is 100,000 times, which is different from the instrument's description (including the currently loaded program) that the number of write times exceeds 2 billion. When switching program segments, the system will pause for about 10ms to write to FLASH memory, which will affect some real-time communication and control functions. Therefore, when the instrument is in the STOP status, the command to switch the program is executed. Note: AI-8 * 6 series does not have Prn function	0~9
EP1 -EP8 EP1 - EP8	Field parameter definition	Define 0~8 of the parameters as field parameters	

Note: Due to different product versions and models, the number and order of parameters will change, which does not affect the use or the arrangement of parameter addresses during communication.

7. Display/alarm symbols

Power on the instrument, it enters the basic display state, and the SV display window can alternately display symbols or display symbols to indicate the state, as following table:

Para-meters	Description	Solution
At At	Indicates that the instrument is in auto-tuning state	Wait for the end of the tuning, or manually modify the At parameter to OFF
AAt AAt	Indicates that the instrument is in the fast auto-tuning state	Wait for the end of the tuning, or manually modify the At parameter to OFF
StoP StoP	Indicates that the instrument is stopped	Press (▽) for two seconds to run the instrument. If it fails to run, please check whether there are functions such as communication and event input to limit the running operation.
run run	Indicates that the instrument is running	This symbol is displayed once when the run operation is successful and does not need to be handled
HoLd HoLd	Indicates that the instrument program function is suspended	Press (▽) for two seconds to run the instrument, if it can't run, please check whether there are functions such as communication, block setting, etc. to restrict the running operation
rdy rdy	Indicates that the instrument program function is in a ready state	After waiting for the measurement signal to meet the setting requirements, it will automatically continue to run the program, or modify the PAF parameters to cancel this function
A 50 A 50	Indicates that the instrument is in automatic output state, and the number represents the output percentage	Press (↻) to switch to the SV value display state or press (◁) to switch to the manual output state
M 50 M 50	Indicates that the instrument is in the manual output state, and the number represents the output percentage	At this time, the MAN light on the panel is on, press (◁) to switch to the automatic output state, and press (△) and (▽) to modify the output percentage.
orAL orAL	Indicates that the input measurement signal is out of range	Check whether the input specifications and parameters are set correctly, check whether the input wiring is correct, and check whether the input signal is normal
HIAL HI AL	Indicates that an upper limit alarm has occurred	When the measured value PV is less than the HIAL-AHYS value, the alarm will be canceled automatically, or modify HIAL to 32000 to cancel the alarm
LoAL LoAL	Indicates that a lower limit alarm has occurred	When the measured value PV is greater than LoAL+AHYS, the alarm will be canceled automatically, or modify LoAL to -9990 to cancel the alarm
HdAL HdAL	Indicates that a deviation upper limit alarm has occurred	When the deviation between PV and SV of the measured value is less than HdAL-AHYS, the alarm will be canceled, or modify HdAL to 32000 to cancel the alarm
LdAL LdAL	Indicates that a deviation lower limit alarm has occurred	When the deviation between PV and SV of the measured value is greater than LdAL+AHYS, the alarm will be canceled, or modify LdAL to -9990 to cancel the alarm
FErr FErr	Indicates that the valve feedback or external given signal is over-range	Check whether the valve feedback signal and wiring are normal
EErr EErr	Indicates that an error is detected within the system, such as parameter loss, etc.	Need to return to the factory for repair
CtAL CtAL	current alarm warning	When a current upper or lower limit alarm is generated after pairing with the I9 module, please check the load circuit. Set EFP1 and EFP2 to 0 to cancel this function

Note: If necessary, it’ s allowed to close the upper, lower limit and deviation alarm character flashing function to avoid excessive flashing (set the ADIS parameter to oFF).