YUDIAN

Quick Operation Guide for AI Multi-loop High Precision Artificial Intelligence Thermostat

(V9.1)

Precautions

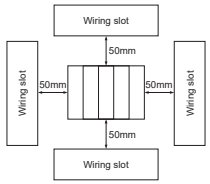
1.Those who use this product must have sufficient knowledge of electrical systems and ensure that this product will not be used in situations where there is danger to people and property.
2.The content of this guide is for reference only. Depending on the product model and version, part of the functions 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:
J0: supports up to 4 three-wire thermal resistances
J1: supports up to 6 thermocouples (non-isolated)
J2: supports up to 6 two-wire thermal resistance
J6:supports up to 6 thermocouples (1V weak electrical isolation between each other)
Thermocouples: K, S, R, E, J, T, B, N, WRe3-WRe25, WRe5-WRe26, etc.
Thermal resistance: Cu50, Pt100, Ni120
● Measurement range:
K(-50~+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℃)
● Measurement accuracy (depending on the model): level 0.15/ level 0.2/ level 0.25/ level 0.3 (an additional ±1 ℃ compensation error will be added for thermocouple input)
● Measuring temperature drift: ≤ 50PPm/ ℃ (level 0.15); ≤ 100PPm/ ℃ (level 0.2~0.3)
● Control cycle: 0.5~5.0 seconds adjustable
● Adjustment method: position adjustment, AI artificial intelligence adjustment
● Output specifications (modular):
SSR voltage output: 12VDC/30mA; using modules: G5, G6, etc.
● Alarm function: each channel has two conditions: upper limit alarm and lower limit alarm, using modules: L0, L3, etc.
● Communication function: RS485, MOBUS-TCP (to be used with externally installed TCP rail module); modules used: S, S1, S4, S6, etc.
● Electromagnetic compatibility: IEC61000-4-4 (electric fast transient burst) ±6KV/5KHz, IEC61000-4-5 (surge) 6KV and under 10V/m high frequency electromagnetic field interference, the instrument does not crash and I/ O port malfunction, the fluctuation of the measured value does not exceed ±5% of the range
● Isolation withstand voltage: power supply terminals, relay contacts and signal terminals are mutually ≥ 2300V; communication and current output terminals are weakly isolated ≥ 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)
● Environment for use: temperature -10~60℃; humidity ≤ 90%RH

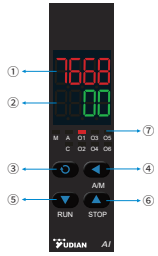
2. Installation Method of Rail Instrument

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 When wiring the terminals, please set the tightening torque to 0.39 ~ 0.58N·m.



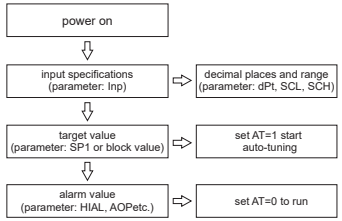
3. D71 Rail Panel Description

① The upper display window displays the measured value PV, parameter name, etc.
② The lower display window displays the given value SV, alarm code, parameter value, etc.
③ Setting key (also switch between manual/automatic cycle display)
④ Data shift (also switch to display the given value setting)
⑤ Data reduction key (also switch to display the previous channel)
⑥ Data increase key (also switch to display the next channel)
⑦ 9 LED indicators, of which O1, O2, O3, O4, O5, O6 correspond to 6 output actions respectively; when the C light is on, it means that it is communicating with the upper computer. M corresponds to AL1 alarm, A corresponds to AL2 alarm output.



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 transmission function is required.
③ Auto-tuning is only required when PID 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.



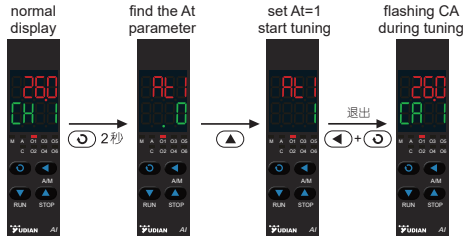
5. Operation Process

5.1 Parameter setting process

The parameters are divided into two parts: on-site parameters and complete parameters. Press and hold ⟲ for 2 seconds, then press ⟲ to enter the menu to switch parameters. After LOC is set to the normal password (default is 808), it's allowed to enter the complete parameter table, please find the corresponding parameters and press the direction keys to modify them. After modification, press ⟲ to confirm. For specific parameters, please check the complete parameter table.

5.2 Auto-tuning Process

The instrument can determine the PID parameters through auto-tuning. When the measured value PV is room temperature, please set the parameter of the set value SPx (x represents the channel number, the same below) to about 60% of the common temperature (for signals such as pressure or flow, it can be directly set to the common set value), refer to the parameter setting process to call out the Atx parameter from the parameter menu, and change it to 1 to start the tuning, then the instrument can work normally after the auto-tuning CA x symbol does not flash automatically.



5.3 Running the Stop Process

The multi-loop instrument switches the running and stopping through the Atx parameter, Atx is changed to 10 to enter the stop, and Atx is changed to 0 or 5 to enter the operation. Among them, 0 corresponds to PID control, and 5 corresponds to bit control.

5.4 Compensation of lead resistance during two-wire connection of thermal resistance

If the resistance signal such as Pt100 or Cu50 is used for two-wire connection, an offset value (parameter ScB) needs to be set to offset the lead resistance value. The instrument provides an action to automatically set this offset value, as follows:

① Short-circuit both ends of the thermal resistance of the channel that needs to be corrected (note that the short-circuit point is at the sensor instead of the instrument).

② Set the parameter Loc=168, then return to the temperature interface and press and holdfor more than 2 seconds, until the first digit on the left side of the display under the instrument displays the symbol A. If there is an alarm set, please cancel the alarm first to avoid the alarm symbol affecting the indication.

③ When the A displayed by the instrument disappears automatically, remove the short-circuit line at the sensor, set Loc to 0 or 1, and restore the normal measurement state of the instrument. This operation enables the instrument to invert the measured value and record it into the ScB parameter of the corresponding channel to compensate for the measurement error caused by lead resistance. This operation has no effect if the measurement signal is not of the resistance type, or if the short wire is not connected. After the operation is completed, please check the ScB parameter to understand the lead resistance, which has been calculated as the value when 0Ω.

6. Complete parameter table

The complete parameter table is divided into 8 blocks, including alarm, adjustment control, input, output, communication, system function, given value/program and on-site 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
Loc Loc	Parameter modification level	When Loc is set to a value other than 808, the instrument can only display and set 0~12 on-site parameters (defined by EP1~EP12) and the Loc parameter itself. When Loc=808, the user can set all parameters. The Loc parameter provides a variety of different parameter operation permissions, as follows: Loc=0, allowed to display and modify on-site parameters. Loc=1, only on-site parameters can be displayed, but cannot be modified. Loc=808, all parameters can be displayed and set. Note: This setting is only for the external display, and the parameter modification by communication will not be affected.	0~9999
bAud bRud	Baud rate	When the COMM module interface of the instrument is used for communication, the bAud parameter defines the communication baud rate, and the definable range is 4800~19200bit/s (19.2K).	0~19.2K BIT/S
Addr Rddr	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. When the communication protocol adopts AIBUS, the multi-loop thermostat has 2~6 loops, corresponding to 2~6 addresses, which is equivalent to 2~6 single-loop instruments on the communication line. For example, the number of measurement loops (the single digit of parameter Cn) is set to 4, and Addr=1, then the addresses 1~6 are used by this instrument, and other instruments cannot use addresses 1~6. If the number of measurement loops Cn is set to 3, and Addr=10, then the addresses 10~12 are used by the instrument. Only 1 address is occupied in MODBUS mode.	0~80
InP InP	Input specification	InP is the input specification shared by 6 channels.	0~33

InP	Input specification	InP	Input specification
0	K	1	S
2	R	3	T
4	E	5	J
6	B	7	N
8	WRe3-WRe25	9	WRe5-WRe26
10	User-specified extended input specification	11-18	For spare use
19	Ni120	20	Cu50
21	PT100	22	PT100 (-80.00~+300.00℃)

dPt dPt	Decimal point position	ddPt is the decimal point position and resolution shared by 6 channels. (1) For linear input, dIP=0, 1, 2, 3 correspond to the display modes of 0, 0.0, 0.00 and 0.000. (2) When using thermocouple or thermal resistance input, dIP selects the resolution of temperature display, set dIP=0, and the temperature display resolution is 1℃ . dIP=1, the temperature display resolution is 0.1℃ . Note: This setting is only valid for display, the internal temperature measurement resolution is fixed at 0.1℃ or 1 linear definition unit, so it does not affect the communication or transmission output effect. When the temperature display resolution is set to 0.1° C, the temperature measurement value above 1000° C will automatically switch to 1° C resolution.	0~3
Cn Cn	Number of measu-rement channels	The single digit of parameter Cn indicates the actual number of measurement channels used by the instrument. The settable range of 7648 is 1~4, and the settable range of 7668 is 1~6. Unneeded channels can be closed, which will affect the address occupied by the AIBUS protocol. If Cn is set to 3, the first 3 channels will be displayed in a circular display, and AIBUS communication occupies 3 addresses.	1~6
Cno Cno	Channel display starting number	Cno is used to indicate the starting number of the channel indication in the display window under the instrument, such as 7648. Usually, the channel number of the instrument is 1~4. When multiple machines are used, the initial channel number can also be modified. For example, the 1st instrument displays CH 1~CH4, if the Cno parameter of the 2nd instrument is changed from 1 to 5, the 2nd instrument can display CH5~CH8.	
Ctl Ctl	Output period	The Ctl parameter value can be set between 0.5~5S. SSR (Solid State Relay) is used as the output execution device. Generally, it is recommended to set it for 0.5~2 seconds, which can improve the control accuracy.	0.5~5
HYS HYS	Hyste-resis	The hysteresis shared by the 6 channels is used to avoid frequent alarm actions due to fluctuation of the measured input value, and also to avoid the auto-tuning of the AT time-position adjustment due to the interference of the measured value, which leads to the wrong PID parameters. This parameter is also called dead zone, dead zone, hysteresis, etc.	0~999.9℃
AF AF	System function selection	AF is used to select some system functions, and its numerical meanings are as follows: AF=A X 1+B X 2+C X 4+D X8 + E X16+F X32+G X64+H X128 A=0, standby function. B=0, the resistance input wiring is 2-wire; B=1, the resistance input wiring is 3-wire. (For AI-7648, B should be set to 1. For AI-7668, B should be set to 0.) C=0, C should be set to 1 for AI-7648 models. D=0, normal use; D=1, change the lower limit alarm L.AL of each channel of the instrument to the upper limit alarm. E=0, standby function. F=0, standby function. G=0, standby function. H=0, the instrument communication protocol is AIBUS; H=1, the instrument communication protocol is standard MODBUS.	
AF2 AF2	System function selection 2	AF2 is also used to select some system functions, and its numerical meanings are as follows: AF2=A X 1+B X 2+C X 4+E X 16 A=0, normal use; A=1, change the upper limit alarm H.AL of each channel of the instrument to the deviation upper limit alarm. When the deviation (measured value PV-set value SV) is greater than HAL1~6, a deviation upper limit alarm will be generated. When the deviation is less than HAL1~6-HYS, the alarm will be canceled. If HAL1~6 is set to the maximum, the alarm function will be canceled. B=0, normal use; B=1, change the lower limit alarm L.AL of each channel of the instrument to the deviation lower limit alarm. When the deviation (measured value PV-set value SV) is less than LAL1~6, a negative deviation alarm will be generated. When the deviation is greater than LAL1~6+HYS, the alarm will be canceled. If LAL1~6 is set to the minimum, the alarm function will be canceled. C=0, reverse action (corresponding to heating); C=1, positive action (corresponding to cooling) E=0, 4~20mA output; E=1, 0~20mA output. (X6 module is required)	

nonc nonc	Normally open/ normally closed selection	When installing a single-channel alarm relay (AL1), it can have both normally open and normally closed outputs, but when installing a dual-channel alarm module (AL1+AL2), there is only a normally open output, and the normally open output can be defined as a normally closed output through the nonc parameter. When nonc=0 is set, the L3 relays installed in AL1, AL2 and other positions are normally open outputs. When nonc=127 is set, the instrument alarms are normally closed outputs.	0~127
At1~6 At 1~At6	Auto-tuning	0, the auto-tuning At function is disabled. 1. Start the auto-tuning function, and it will automatically return to 0 after the auto-tuning is over. 5, ON-OFF control mode. 10. Turn off the output.	0~1，10
P1~6 P 1~P6	Propor-tional Bands	Defines the proportional bands for PID regulation, in the same unit as the PV value, not as a percentage of span. For familiar systems, the known correct P, I, D, Ctl can be directly entered without starting the auto-tuning (AT) function.	10~ 9999 unit
I1~6 I 1~I 6	Integral time	Define the integral time of PID adjustment, the unit is second, when I=0, the integral action is canceled.	0~9999 s
d1~6 d 1~d6	Differen-tial time	Defines the derivative time of PID tuning, the unit is 0.1 seconds. The differential action is canceled when d=0.	0~999.9 s
OPH1~6 OPH 1~ OPH6	Output upper limit	Percentage of maximum value to limit OUTP regulated output.	0~100
Scb1~6 Scb 1~ Scb6	Input trans-lation correc-tion	The Scb parameter is usually used for translation correction of the input to compensate the error of the sensor or the input signal itself, or to correct the compensation error of the cold junction of the instrument. For thermocouple and three-wire PT100 input, the Scb correction is the actual temperature, for example, setting Scb= -10.0 will cause the measured value to be 10.0° C lower than when Scb=0.0. When the input is a two-wire heating resistance, the correction is the resistance value. InP=19 Scb=7.0 corresponds to 1 ohm InP=20 Scb=28.0 corresponds to 1 ohm InP=21 Scb=7.0 corresponds to 1 ohm InP=22 Scb=1.40 corresponds to 1 ohm. For the automatic compensation setting method of the lead resistance of the two-wire heating resistor, please refer to 5.4 Operation Instructions When the instrument is subjected to annual metrological verification, for the instrument that has been used for a period of time in harsh environments, if the error of the instrument exceeds the range, the inside of the instrument can be cleaned and dried first, which can generally solve the problem. Correction is made by modifying the Scb parameter.	-1990~ +9990 defined unit or 0.1℃
FIL1~6 FIL 1~ FIL6	Digital filter strength	FIL is used to set the strength of digital filtering, 0 means no filtering, 1 only takes median filtering, 2~40 has both median filtering and integral filtering. The larger the FIL, the more stable the measurement, but the slower the response. Generally, when the measurement is greatly disturbed, the FIL value can be gradually increased, and adjusted so that the instantaneous jump of the measurement value is less than 2~5 words. When the instrument is calibrated in the laboratory, the FIL should be set to 0 or 1 to improve the response speed.	0~40
SP1~6 SP 1~SP6	The given value	Respectively represent the given values of 1~6 channels.	-999~ +3200℃
H.AL1~6 HAL 1~ HAL6	Upper limit absolute value alarm value	Respectively represent the upper limit alarm values of 1~6 measurement channels. When the measured value of the corresponding channel is greater than H.ALx (x is 1~6, indicating the corresponding measurement channel, the same below), an upper limit alarm will be generated. After the upper limit alarm is generated, the alarm will be released when the corresponding measured value is less than H.ALx-HYS.	-999~ +3200℃
L.AL1~6 LAL 1~ LAL6	Lower limit absolute value alarm value	Respectively represent the lower limit alarm values of 1~6 measurement channels. When the measured value of the corresponding channel is less than L.ALx, the lower limit alarm will be generated. After the lower limit alarm is generated, it will be released when the corresponding measured value is greater than L.ALx+HYS. The alarm can control the action of the relay module on ALM, AUX or OUTP, which is programmed by parameters AOP1~6.	Same as above

AOP1~6 AOP 1~ AOP6	Alarm output position definition para-meter	AOP is used to define the output position of H.AL and L.AL alarm functions. The single digit of the parameter AOP represents the output position of the H.AL alarm, the value range is 0~4, 0~2 means that the alarm is not output from any port, 3 and 4 respectively means that the alarm is output by AL1 and AL2. The ten digit of this parameter indicates the output position of the L.AL alarm, and the meaning of the value is the same as above. For example, setting AOP1=43 means that the upper limit alarm of loop 1 is output by AL1, and the lower limit alarm is output by AL2. Another example: AOP2=34, it means that the upper limit alarm of loop 2 is output by AL2, and the lower limit alarm is output by AL1.	0~77
EP1~12 EP 1~ EP 12	On-site para-meter definition	When the setting of the instrument is completed, the parameters that do not need to be changed frequently can be shielded, and only the parameters that need to be changed frequently are left for the on-site operators to modify. EP1~EP12 parameters are used to define when the parameter lock is locked, which parameters can be displayed (ie on-site parameters), while the other parameters are shielded and cannot be displayed and modified. EP1~EP12 in the parameter table can define 0~12 on-site parameters for the field operator to use. Its parameter values are other parameters other than the EP parameter itself, such as H.AL1, L.AL1, etc. When Loc is locked, only the defined parameters or program setting values can be displayed, and other parameters cannot be displayed and modified. This function can speed up the speed of modifying parameters, and can prevent important parameters from being modified by mistake. Parameter EP1~EP12 can define up to 12 on-site parameters. If there are less than 12 on-site parameters (sometimes even none), the parameters to be used should be defined in sequence from EP1 to EP12, and the first parameter that is not used should be defined as nonE. For example: an instrument site often needs to modify the given value SP parameters of each channel, and the EP parameters can be set as follows: EP1=SP1, EP2=SP2, EP3=SP3, EP4=SP4, EP5=nonE, Loc=0 At this time, the external display of the instrument can only display and modify 4 parameters such as SP1~SP4, but the communication will not be affected.	NonE~ EP12

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

After the instrument is powered on, it enters the basic display state, and the SV display window can alternately display symbols or display symbols to indicate the state, as shown in the following table:

Para-meters	Description	Solution
CA 1 CA 1	Power on and start PID initialization and auto-tuning flags	Wait for it to stop flashing automatically. If users want to close the tuning in advance, please change the At1 parameter to 0, and the same is true for other paths.
Ar 1 Ar 1	Indicates that the meter automatically corrects the resistance of the wire	Wait for the automatic correction to finish.
H.A 1 H.A 1	Indicates that the upper limit alarm occurs in the first channel	When the measured value PV is less than the H.AL1-HYS value, the alarm will be canceled automatically, or the alarm will be canceled by modifying H.AL1 to 3200.0, and the same for other channels.
L.A 1 L.A 1	Indicates that a lower limit alarm occurs in the first channel	When the measured value PV is greater than the L.AL1+HYS value, the alarm will be canceled automatically, or modify L.AL1 to -999.0 to cancel the alarm, and the same is true for other routes.
Er 1 Er 1	Indicates that an error is detected within the system, such as parameter loss, etc.	Need to return to the factory for repair.

Note: The over-range of the multi-loop instrument is indicated by the display of the maximum or minimum value while the PV is flashing. At this time, please 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.