Single Channel AIP Series

Paperless Recorder and True Color

HMI Touch Screen

User Guide

1. Product Overview

The AIP series features a new industrial-grade touchscreen interface, where key parameter settings can be easily completed on a single screen. Moreover, all the settings menus are displayed in Chinese, allowing customers to operate the system with the same ease as using a smartphone. The product is available in three screen sizes: 5-inch, 7-inch, and 9-inch. The 9-inch product is only 38mm thick, which reduces installation space requirements, making it easy to install on the control panels of various equipments.

The above instruments offer the following functions:

- Various Yudian secondary instruments can be optionally configured as lower-level devices, such as single-channel or multi-channel measurement and alarm instruments, intelligent PID controllers, and temperature controllers. These can be configured as needed, purchased separately, and freely combined or expanded.
- With a built-in web server and Ethernet interface, users can remotely monitor and operate the instrument via the Yudian computer configuration browser through the Ethernet interface. (Available for AIP Series-W/Y)
- Featuring the world’s first P2P cloud functionality (no public IP is required to penetrate intranet surveillance.), it allows remote monitoring and operation through mobile devices such as smartphones and tablets. (Available for AIP Series-Y).

AI Series True Color HMI Touch Screen (3270S/3270W/3290S/3290W) can be configured by the users according to their specific needs and can connect to various lower-level devices such as PLCs and temperature controllers. (The software operation described in point five of this manual does not apply to this type. Configuration must be done by the user before use, and the configuration software can be downloaded from the official website.)

2. Functional Features

2.1 Display Function

Screen size: 5 inch / 7 inch / 9 inch

Color: TFT true color

Resolution: 800×480

Backlight: Long-life LEDs

Input method: Touch control

2.2 Storage Function

Storage capacity: 150MB   Recording interval (S): Any setting, such as 1, 2, 3, 4, etc.

2.3 Communication Function

Interface types: RS232, RS485, Ethernet interface (10/100M adaptive Ethernet interface)

Serial communication baud rate: 1200-57600

2.4 General Parameters

Electromagnetic Compatibility: IEC61000-4-4 (Electrical Fast Transient) ±4KV/5KHz, IEC61000-4-5 (Surge)

The instrument remains stable without crashing or I/O malfunction under 4KV and 10V/m high-frequency electromagnetic field interference, with measurement fluctuations not exceeding ±5% of the range.

Isolation Withstand Voltage: Between power supply,

relay contacts, and signal terminals ≥ 2,300V;

between isolated low-voltage signal terminals

≥ 600V

Power Supply: 100~240VAC, -15%, +10%/50-60Hz

Power: ≤5W

Operating Environment: Temperature: -10℃~ + 60℃; Humidity: ≤ 90%RH

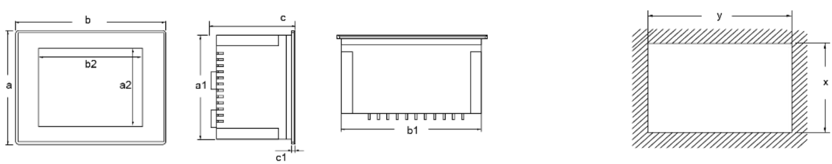
Storage Temperature: -20℃~ + 80℃

Weight: 5 inch: 0.55Kg   7 inch / 9 inch: 0.7Kg

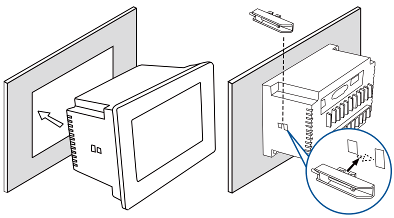
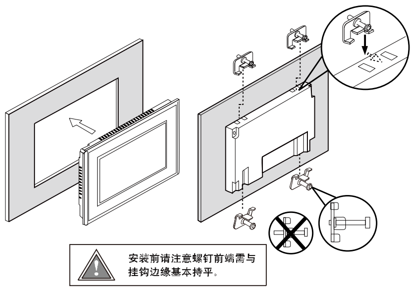
Cooling Method: Natural air cooling

3. Instrument Installation

3.1 Dimensional Drawing



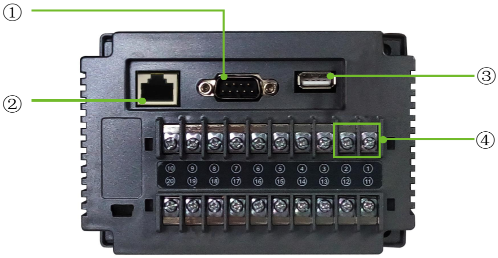
3.2 Hook Mounting Diagram

<table>
<tr><th>AI-3150</th><th>AI-3170/3270/3190/3290</th></tr>
<tr><td></td><td>
</td></tr>
</table>

4. Instrument Wiring

4.1 AI-3150 Interface Types

	Display Dimensions (mm)			Overall Dimensions (mm)						Cutout Dimensions (mm)	
		a2	b2	a	b	c	a1	b1	c1	x	y
3150	5 inch	64	102	105	145	100	94	133	6	96	135
3170/3270	7 inch	86	154	150	203	40	137	190	6	139	192
3190/3290	9 inch	112	198	170	231	38	158	219	6	160	221



① RS485/RS232
② Ethernet Interface
③ USB Flash Drive/Mouse
④ Power Supply

Communication Pin Definitions

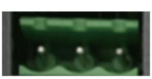
Interface	COM2(RS485)		COM3(RS232)		
PIN	1	6	2	3	5
Pin Definition	RS485+	RS485-	RS232 RXD	RS232 TXD	RS232 GND

Note: No wiring is required for communication if no expansion is needed.

4.2 AI-3170/3270/3190/3290 Interface Types

① RS485/RS232
② Ethernet Interface
③ USB Flash Drive/Mouse
④ Power Supply
⑤ RS485

Power Wiring

 1 2 3	Interface	POWER		
	PIN	1	2	3
	Pin Definition	L	Empty	N

Communication Wiring

	Interface	COM2(RS485)	
	PIN	1	2
	Pin Definition	RS485+	RS485-

	Interface	COM2(RS485)		COM3(RS232)		
	PIN	1	6	2	3	5
	Pin Definition	RS485+	RS485-	RS232 RXD	RS232 TXD	RS232 GND

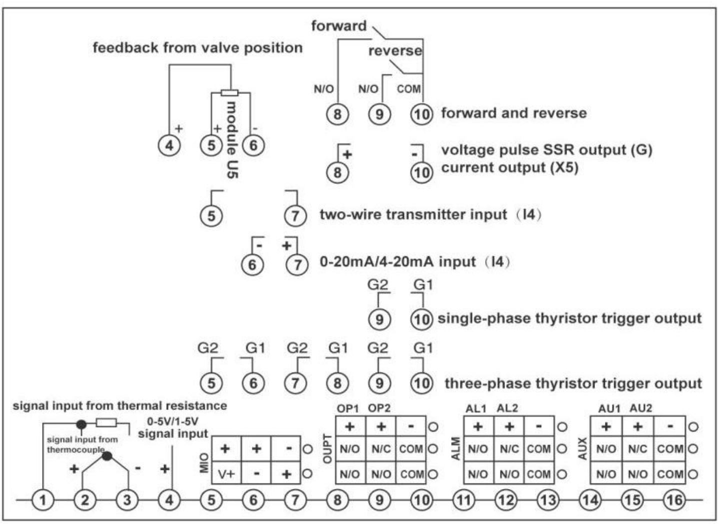
Note: No wiring is required for communication if no expansion is needed.

4.3 AIP5 Series Input/Output Wiring

For the 5-inch screen, terminals 3 and 4 are not available. Other wiring can be fully referenced according to the wiring instructions for Instrument A.

4.4 AIP7/AIP9 Series Input/Output Wiring

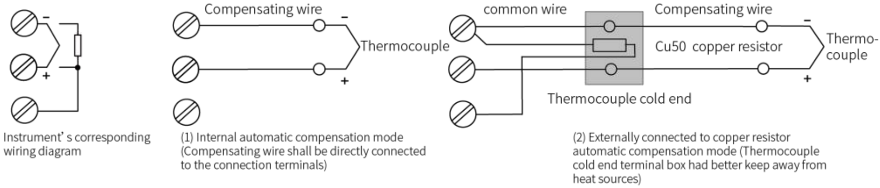
4.4.1 Single Channel Large Screen Series Controller



Note: Linear voltage ranges below 100mV should be input via terminals 2+ and 3-. Signals of 0-5V and 1-5V should be input via terminals 4+
and 3-. The 4~20mA linear current input can be converted to 1~5V voltage signal with 250 ohm, and then input from terminals 4+ and 3-. Alternatively, an I4 module can be installed at the MIO position for input from terminals 7+ and 6-, or it can be directly connected to a two-wire transmitter from terminals 5+ and 6-. Different thermocouple types require different compensation wires. When using the internal automatic compensation mode, the compensation wires should be connected directly to the wiring terminals on the back cover of the instrument. They should not be switched to regular wires in between, as this could cause measurement errors.

Use the wiring method to select the thermocouple cold junction automatic compensation mode: When a thermocouple is used as the input signal, temperature compensation of the thermocouple's cold junction is required according to the thermocouple temperature measurement principle. The AI instrument can measure the temperature near the rear wiring terminals and automatically compensate for the thermocouple's cold junction. However, due to factors such as errors in the measuring element, heat generated by the instrument itself, and other nearby heat sources,

the automatic compensation method may often result in significant deviation, which in the worst case could exceed 2°C. Therefore, when high temperature measurement accuracy is required, an external junction box can be used to place a Cu50 copper resistance (to be purchased separately) and the thermocouple's cold junction together, away from any heat-emitting objects. This setup can reduce measurement inconsistencies caused by compensation to less than 0.3°C. Due to the inherent error of the Cu50 copper resistance, slight inaccuracies may occur at room temperature, which can be corrected using the Sc parameter. By replacing the external copper resistance with a precision fixed resistor, the constant temperature bath compensation function can also be achieved. For example, by connecting a 60-ohm fixed resistor, the compensation temperature can be determined as 46.6°C from the Cu50 calibration table. In this case, placing the thermocouple's cold junction in a constant temperature bath controlled at 46.6°C will also provide precise compensation, with compensation accuracy better than that of the copper resistance. If the external resistor is replaced with a short circuit, ice point compensation can be achieved. In this case, the thermocouple’s cold junction (the connection between the thermocouple or compensation wire and the regular wire) must be placed in an ice-water mixture (0°C). The compensation accuracy can be as high as 0.1°C or better. The wiring diagrams for the two compensation modes are shown below:



Note: For version 9.2 and above, the room temperature compensation is changed from Cu50 to Pt100.

5. Software Operation

5.5.1 Instructions for First Operation:

After powering on, press the [System Settings] button, enter the initial password 111, and then proceed with the following steps in the [System Settings] interface:

1) Select the current channel's instrument type (The AIP series automatically recognizes the instrument type, so no selection is needed).

Click the [Instrument Type] drop-down box and select the corresponding instrument type.

2) View the current channel instrument parameters

Once in the [System Settings] interface, or when switching channels by clicking [Previous Channel] or [Next Channel], the system will automatically read the parameters.

3) Modify the current channel instrument parameters

Click the edit box or the drop-down identification box for the instrument parameter you wish to modify, and set the instrument parameters.

For multi-channel versions, repeat the above three steps for each channel after completing the above operation.

After performing the above operations, you can perform other required operations according to the contents of the operating instructions.

Note 1: This is a general version of the manual, some functions are only available for specific models.

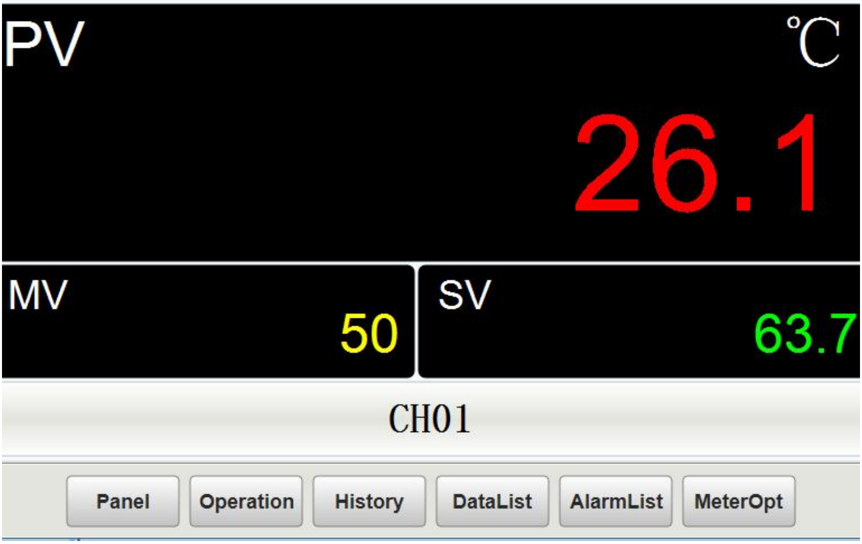
5.2 Display Screen Interface Operation Instructions

1) Interface Display Content

The interface centrally displays parameters such as the instrument's [PV], [SV], and [Measurement Unit].

2) Instrument Status

When the instrument is in an alarm state, the [Channel Name] will be displayed in red. You can click the [Alarm Information] button to access the [Alarm Information] screen and view the specific alarm details.



5.3 Operation Screen Interface Operation Instructions

5.3.1 Interface Display Content

The [Operation Screen] interface displays the [Channel Name], along with the corresponding instrument's [PV] value, [SV] value, [MV] value, [Operation Status], and [Manual/Auto Status]. For programmable controllers, it will also display the [Program Segment Set Time], [Program Segment Run Time], and [Number of Running Segments].

SV value modification. For non-programmable temperature controllers, the SV value can be modified directly by clicking on it. For programmable temperature controllers, the SV value can be modified by clicking the [Program Recipe] button to enter the [Program Settings] screen and set the program parameters. For detailed information on program settings, refer to section 5.3.4.

The curves of [PV] value and [SV] value are displayed, with the red curve representing the [PV] value and the green curve indicating the [SV] value.

5.3.2 Operation Status Operations

When the [Run], [Stop], or other buttons are clicked for the first time, a password is required. The initial password is 111, and it can be changed in the [System Settings] interface. (If the button font is gray, it indicates that the instrument does not support this function.)

5.3.3 Field Parameter Settings

In the operation screen, click the [Set] button to open the [Field Parameter Settings] window, where the following operations can be performed:

1) Reading and writing of high limit alarm, low limit alarm, offset correction, and alarm hysteresis.

2) Modification of MV value. When the instrument with manual/automatic mode functionality is in manual operation, the MV value can be modified.

3) Modification of program segment number.

4) Click the [Auto-Tuning On] / [Auto-Tuning Off] button to toggle the auto-tuning state (this function is available on PID instruments).

5） SV value modification. For non-programmable temperature controllers, the SV value can be directly modified. For programmable temperature controllers, the program parameters can be set by clicking the [Program Recipe] button to enter the [Program Settings] interface. For detailed information on program settings, refer to section 5.3.4.

5.3.4 Program Settings

1) Modifying Program Segment Parameters:

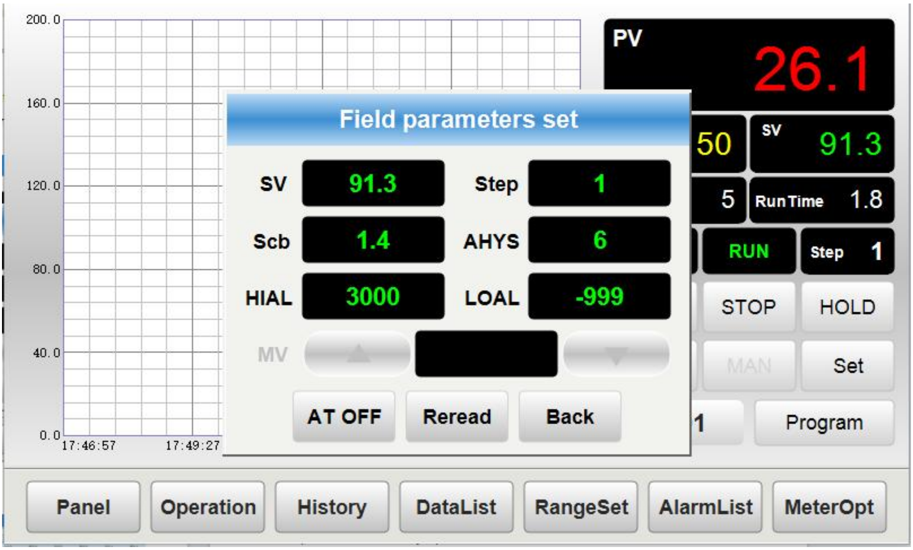
Method 1: Click the edit box under [SP1] and [T-1] to modify the corresponding parameter values (similarly, modify the values of [SP**], [T**], and [C**], where the meaning of [C**] is the same as [SP**]).

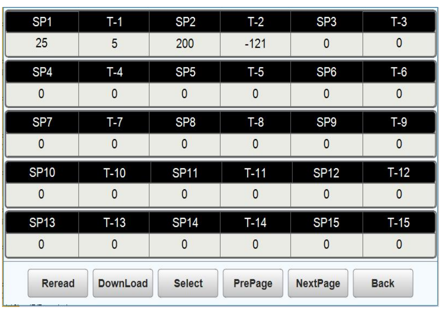
Method 2: Click the [Program Selection] button to open the recipe window. Click the desired recipe, such as pro1. After selection, click [Apply Recipe], then click [Return]. The parameters in the recipe will be written in bulk to the corresponding program setting edit boxes.

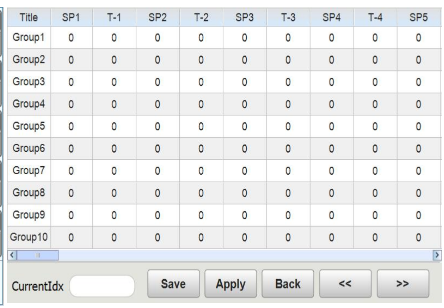
Note: The parameters are not immediately written to the instrument after being changed, and the text will turn red to indicate this. To apply the changes, click the [Program Write] button to write the parameters to the instrument.

2) Recipe Settings

Click the [Program Selection] button in the [Program Settings] interface to open the recipe window, where you can modify, add, delete and apply the recipes.



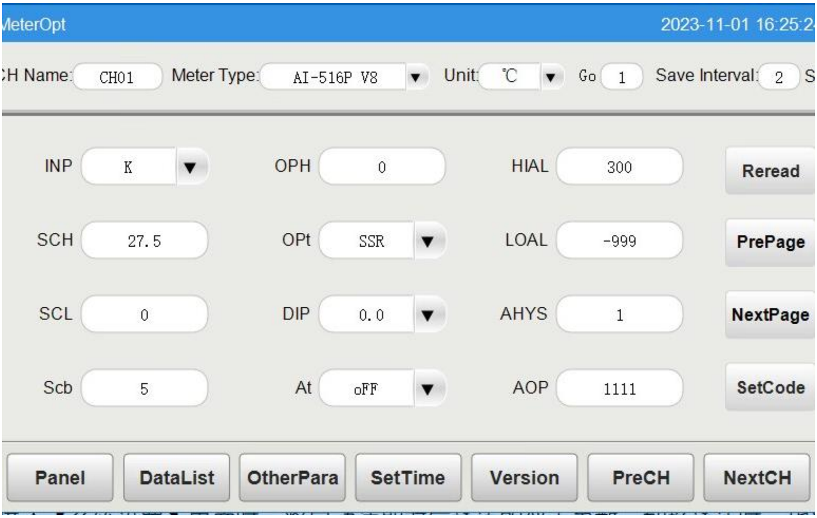




5.3.5 Range Settings

Click the [Range Settings] button below to set the curve range and curve duration in the [Operation Screen].

5.4 System Settings Interface Operation Instructions



When entering the [System Settings] interface, the corresponding instrument parameters for the selected channel will be automatically read. When switching channels, the parameters will also be automatically read. The following operations can be performed:

1) The instrument type, instrument unit, channel name, and recording interval can be set individually. To set, simply click the corresponding field and select from the dropdown box or directly input the text.

2) When entering the interface or switching channels, parameters will be automatically read once. If the parameters are modified on the instrument panel, click the [Re-read Parameters] button to update the instrument parameters.

3) To write parameters, click the desired instrument parameter field or drop-down identification box to set the parameters. For multi-channel versions, repeat the above three steps for each channel after completing the above operation.

4) Password Settings

Click the [Reset Password] button. The [Field Parameter Authorization] button in the window can be used to manage password authorization for operations on the operation screen. The [System Password Settings] button allows modification of the system password. Enter the 3-digit old password. If correct, the prompt will read "Please enter a new 3-digit password." After entering the new 3-digit password, click “confirm” to reset the password successfully.

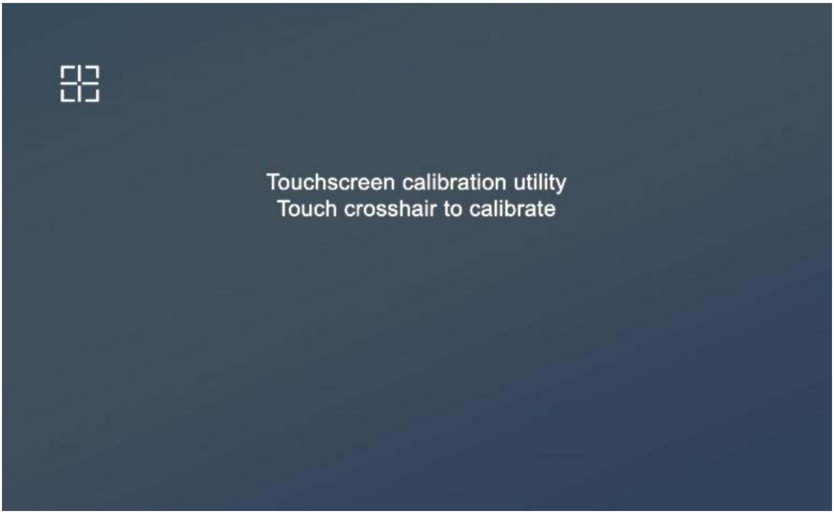
5) Reset Time

Clicking the [Time Reset] button will pop up the device time setting window, where the system time can be modified.

6) Touch Calibration

When the [Touch Calibration] position is incorrect, you can enter calibration mode by clicking the [Touch Calibration] button with the mouse, then click the corresponding cross on the screen. After finishing, manually restart the device.

If there is no mouse on-site, you can also enter the extra menu by holding down the screen immediately after powering on, and continue holding the screen to enter the calibration mode.



5.5 Other Operations

In the [Real-time Trend] Interface

1) Click the button with the number on the right to toggle the visibility of the corresponding curve.

2) Click the [Real-Time Settings] button at the bottom to set the total duration and range of the real-time trend curve.

In the [Historical Trend] Interface

1) Click the button on the right with a number to toggle the visibility of the corresponding curve.

2) Click the [Historical Settings] button to set the duration, range, and start time of the

historical trend chart.

3) Clicking the [Back] or [Forward] button will offset the curve backward or forward by 3/4 of the time axis length. If the offset exceeds the current system time, no offset will occur.

In the [Data Report] Interface

The historical table in the [Data Report] interface records the [PV] values of each channel.

Click [Select Time] to adjust the data displayed in the current table. The data will be shown according to the set time range, and the query interval setting will display the time gap between each data entry.

In the [Alarm Information] Interface

1) The alarm table in the [Alarm Information] interface records alarm-related information, which can be filtered and viewed through user operations.
2) When entering the [Alarm Information] interface, the real-time alarm information is displayed by default. Clicking [Real-time Alarm] will switch to display historical alarm information
3) Click the [Display Options] button at the top to pop up the [Alarm Display Options] window. By selecting the needed conditions, the relevant alarm information will be filtered and displayed.

[Data Report] Export

1) Partial Export: After inserting a USB flash drive, click the [Select Time] button in the [Data Report] interface. After selecting the desired time range, click [Export]. The selected data will be exported to the USB drive with the file name "Hisdata.csv”. When performing partial export, the data can be directly viewed on a computer using Excel spreadsheet software.
2) Full Export: After inserting a USB flash drive, in the [Data Report] interface, do not click the [Select Time] button. Instead, click the [Full Export] button directly. All recorded data will be exported to the USB drive with the file name "RecData”. To view the data, you need to first install the "Data Viewer.exe" file. Once installed, an icon for "Data Viewer Runtime" will be generated. Next, right-click on the [Data View Runtime] > [Open File Location / Find Target] > [Project] > [Data View]. Then, copy the "RecData" folder from the USB drive and paste it into the [Data View] directory.

(If a "RecData" folder already exists in the [Data View] directory, please delete it first before pasting the new one.) After completing these steps, you can click on "Data View and Run Chart" to view the data report and curves. (For detailed instructions on using the Data View, please refer to the Data View software manual. Download address: Yudian official website (www.yudian.com) -> Resources Download -> Data View Software)

Note 1: It may take some time for the USB drive to be recognized. Please wait a moment before performing the export operation after inserting the USB drive.

Note 2: The partially exported data can only be viewed in the form of a report, whereas the fully exported data can be viewed both in the form of a report and as a curve.

[Alarm Information] Export

Insert the USB flash drive, then click the [Export] button on the [Alarm Information] interface. After confirming, the data displayed in the current table will be exported to the USB drive, generating a file named "almdata.csv" on the USB drive. (Please wait a moment after inserting the USB drive before performing the export operation.)

[Ethernet Access] (This function is available on screens with Ethernet functionality)

1) Local Area Network (LAN) Access:

After configuring the gateway, subnet mask, and IP address on the screen, connect the screen to the LAN via the network cable or directly to the computer. Then, access the screen by entering the "IP address: port number" in the Yudian dedicated configuration browser. The engineering port is 8888, and the default IP address is 192.168.1.113.

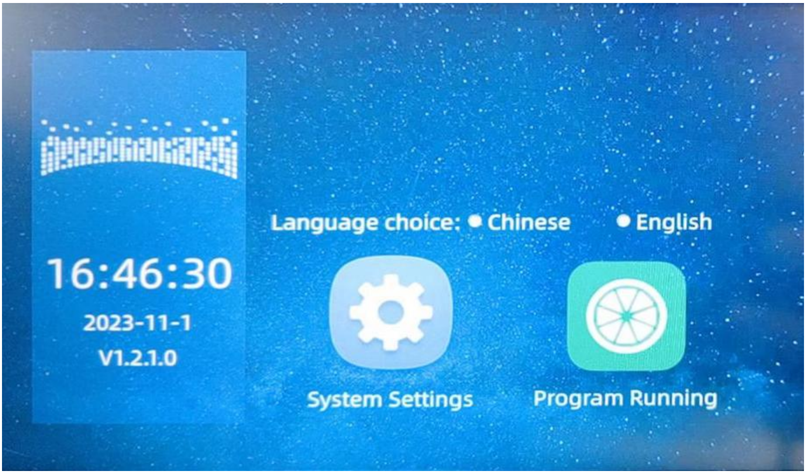
2) External Network Access:

a. Access using a fixed IP: A public IP is required, and IP address and port mapping need to be configured. The port should be the one set in the project. Once the mapping is done, the screen can be accessed through a browser.

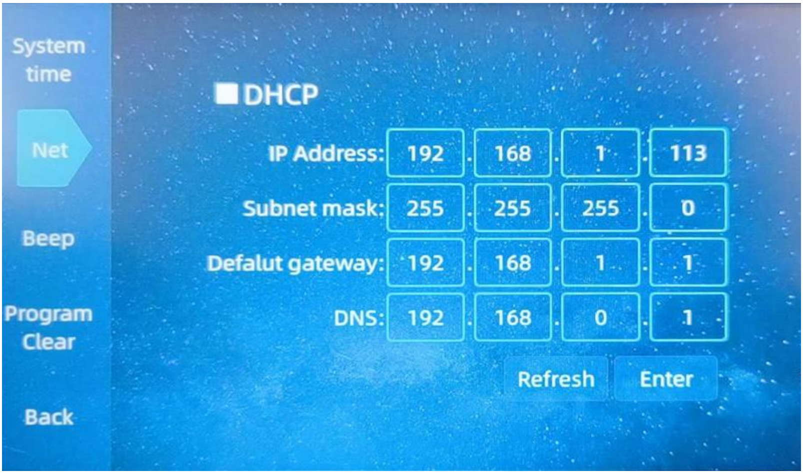
b. Access using P2P cloud: Simply enter “p2p: Project ID” in the client to access it. The client can be either Yudian’s dedicated PC configuration browser or the mobile APP client (this function is only available on screens with cloud access functionality).

3）Screen IP Settings:

First, when the screen is powered on, long press any location on the screen. Once the progress bar appears, the screen will enter the internal settings interface. As shown below:



Click the [System Settings] button, enter the password 111 to access the system



settings screen, and then click [Network Settings] to open the interface shown below:

6. Single Channel Instrument Parameter Description

Parameters	Parameter Meaning	Description	Setting 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 have different Addr values to distinguish them from each other. (This parameter is not available on the screen)	0~99
bAud	Baud Rate	The bAud parameter defines the communication baud rate, with a valid range of 0~28800bit/s (28.8K). When the COM port is not used for communication, the bAud parameter can be used to configure the COM port for other functions: BAUD=0: Configure the COMM port to output a 0-20mA measurement value. BAUD=1: Configure the COMM port as an external switch input, with functionality equivalent to the MIO position. If the MIO position is occupied, the I2 module can be installed in the COMM position. BAUD=2: Configure the COMM port as AU1+AL1 output, suitable for small-sized instruments. BAUD=3: Configure the COMM port as AU1+AU2 output, suitable for small-sized instruments. BAUD=4: Configure the COMM port to output a 4-20mA measurement value. BAUD=8: Configure the COMM port to output a 0-20mA setpoint value. BAUD=12: Configure the COMM port to output a 4-20mA setpoint value. (This parameter is not available on the screen)	0~28.8K
AFC	Communication Mode	The AFC parameter is used to select the communication mode, calculated as follows: AFC=A×1+D×8+G×64. A = 0: The communication protocol used by the instrument is standard MODBUS. A = 1: The communication protocol used by the instrument is AIBUS. A = 2: The communication protocol used by the instrument is MODBUS compatibility mode. A = 4: The communication protocol used by the instrument is compatible with S6 module communication functionality. D = 0: No parity check. D = 1: Even parity check. G = 0: AUX is used for normal operation. G = 1: AUX is used as an event input. When the AFC is set to the MODBUS protocol, it supports two commands: 03H (read parameter and data) and 06H (write single parameter). When AFC = 0 or 4, the 03H command can read up to 20 words of data in a single request. When AFC= 2, the 03H command will read a fixed amount of 4 words of data. For detailed information, please refer to the communication protocol instruction. (This parameter is not available on the screen)	0~255
InP	Input Specifications	0 K | 21 Pt100 1 S | 22 Pt100（-80.00~+300.00℃） 2 R | 25 0~75mV voltage input	

<table>
<tr>
<td></td>
<td></td>
<td>
<table>
<tr><td>3 T</td><td>26 0~100 ohm resistance input</td></tr>
<tr><td>4 E</td><td>27 0~400 ohm resistance input</td></tr>
<tr><td>5 J</td><td>28 0~20mV voltage input</td></tr>
<tr><td>6 B</td><td>30 0~60mV voltage input</td></tr>
<tr><td>7 N</td><td>31 0~1V voltage input</td></tr>
<tr><td>8 WRe3-WRe25</td><td>32 0.2~1V voltage input</td></tr>
<tr><td>9 WRe5-WRe26</td><td>33 1~5V voltage input</td></tr>
<tr><td>10 User-specified extended input specifications</td><td>34 0~5V voltage input</td></tr>
<tr><td>12 F2 radiation high-temperature thermometer</td><td>35 -20~+20mV voltage input</td></tr>
<tr><td>13 T (0~300.00℃)</td><td>37 -5V~+5V voltage input</td></tr>
<tr><td>15 MIO Input 1 (Installed with I44 module for 4~20mA)</td><td>38 10~50mV voltage input</td></tr>
<tr><td>16 MIO Input 2 (Installed with I44 module for 0~20mA)</td><td>39 15~75mV voltage input</td></tr>
<tr><td>17 K (0~300.00℃)</td><td>42 0~10V voltage input</td></tr>
<tr><td>18 J (0~300.00℃)</td><td>43 2~10V voltage input</td></tr>
<tr><td>19 Ni120</td><td>44 -10V~+10V voltage input</td></tr>
<tr><td>20 Cu50</td><td></td></tr>
</table>
Note: When setting InP= 10, you can either define a custom input nonlinear table or obtain one from the manufacturer for an additional fee.
</td>
<td></td>
</tr>
<tr>
<td>AOP</td>
<td>Alarm Definition</td>
<td>
The four digits of the AOP—the ones digit, tens digit, hundreds digit, and thousands digit—are used to define the output positions for the four alarms: HIAL, LoAL, HdAL, and LdAL, respectively, as shown below:
AOP = 3 (LdAL) 3 (HdAL) 0 (LoAL) 1 (HIAL);

The value range is 0-9. A value of 0 indicates that no alarm is output from any port. Values 1, 2, 3, and 4 correspond to the alarm being output from AL1, AL2, AU1, and AU2, respectively. Values 5, 6, 7, and 8 indicate that the alarm is output from AL1, AL2, AU1, or AU2, and when the alarm is triggered, the main output OUTP will be forced to 0 or the value defined by Ero (set by AF2). A value of 9 forces the main output OUTP to 0 or the value defined by Ero (set by AF2), but no alarm is output.
For example, setting AOP=3301 means that the high limit alarm (HIAL) is output from AL1, the low limit alarm (LoAL) has no output, and both HdAL and LdAL are output from AU1. Thus, either HdAL or LdAL triggering an alarm will cause AU1 to activate.
Note 1: When AUX is used as an auxiliary output in a bidirectional control system, the alarm output to AU1 and AU2 is invalid.
Note 2: To use AL2 or AU2, an L3 dual relay module can be installed at the ALM or AUX position.
</td>
<td>0~9999</td>
</tr>
</table>

OPt	Output Type	SSr: Output the SSR drive voltage or the zero-crossing trigger time signal for the silicon-controlled rectifier (SCR). G, K1 or K3 modules should be installed to adjust the output power by controlling the on-off time ratio, typically within a cycle of 0.5-4.0 seconds. rELy: This setting should be used when the output is for a relay contact switch or when the system has mechanical contact switches (such as in contactors or compressors). To protect the lifespan of mechanical contacts, the system limits the output cycle to 3-120 seconds. 0-20: 0~20mA linear current output, the installation of the X3 or X5 linear current output module is required. 4-20: 4~20mA linear current output, the installation of the X3 or X5 linear current output module is required. PHA1: Single-phase phase-shift output, requiring the installation of the K50/K60 phase-shift trigger output module to achieve phase-shift trigger output. In this setting state, AUX cannot be used as the cold output terminal for the control output. nFEd: Position proportional output with no feedback signal, directly controlling the valve motor's forward/reverse rotation. The valve stroke time is defined by the Strt parameter. FEd: Position proportional output with a feedback signal. The valve stroke time must be at least 10 seconds. The feedback signal is input through the instrument's 0~5V/1~5V input terminal. Note: The external setpoint function cannot be used in this output mode. FEAt: Auto-tuning valve position. The instrument will first close the valve and record the feedback signal in the SPSL parameter, then fully open the valve and store the feedback signal in the SPSH parameter. Once completed, the control mode will automatically return to FEd. **Note: The AI-**8*6 **series does not support position proportional control output**	
At	Auto-tuning Switch	OFF: The auto-tuning At function is turned off. on: Start the auto-tuning function for PID and CtI parameters; after the tuning is complete, it automatically returns to FOFF. FOFF: The auto-tuning function is turned off, and starting auto-tuning from the panel is prohibited. AAt: Fast auto-tuning function. After auto-tuning function is complete, it automatically returns to OFF. Note: When the At parameter is set to the AAt option, the instrument can automatically activate the advanced fast auto-tuning function after power-on when the instrument is in full power heating output state. This allows the PID parameters to be pre-set without the need for traditional cycle oscillation auto-tuning, enabling accurate control in most cases with the first heating. If the AAt function fails to complete before the instrument exits the full power output state, the auto-tuning process will be terminated, and the PID parameters will not be modified.	
A-M	Automatic/Manual Control Selection	MAn: Manual control mode, where the operator manually adjusts the output of OUTP.	

		Auto: Automatic control mode, where the OUTP output is determined by the calculations based on the method set in CtrL. FSv: Compatible with instruments that do not support manual/automatic switching functions, preventing access to the manual/automatic switching interface. FAut: Fixed automatic control mode, which prevents direct switching to manual mode from the front panel via keypress. (This parameter is not available in system settings, switch the automatic/manual modes through the operation interface.)	
Srun	Operating Status	run: Running control state, PRG indicator light is on. StoP: Stop state. HoLd: Hold running control state. If the instrument is set for non-timed constant temperature control (Pno=0), this state is equivalent to the normal operating state, but operation or stop actions are prohibited from the panel. If the instrument is under program control (Pno>0), in this state, the instrument's program segment time does not advance, and PID control is carried out based on the current SV. (Note: This parameter is not available in system settings, switch the operation state via the operation interface)	
Pno	Number of Program Segments	Used to define the number of active program segments. Unnecessary program segments can be reduced as needed to simplify operations and program settings, making it more convenient for end users. Which Pno=0 is set, the instrument operates in constant temperature mode. The SPr parameter can also be set to limit the heating rate. When Pno=1 is set, the instrument enters single-segment program mode, requiring only one setpoint value and a holding time. Once the holding time expires, it enters the stop state. When setting Pno= 2~50, the instrument operates in normal program control mode. Note: The 8*6 series supports only 1 program segment.	0~50
PonP	Power-on Operation Mode	Cont: If the instrument was in a stop state before power-off, it will continue in the stop state; otherwise, it will resume execution from the last stopped point after power-on. StoP: After power-on, regardless of the situation, the instrument will enter the stop state. run1: If the instrument was in a stop state before power-off, it will continue in the stop state; otherwise, after power-on, it will automatically start the program from the 1stsegment. dASt: After power-on, if there is no deviation alarm, the program will continue to execute; if there is a deviation alarm, the operation will stop. HoLd (only when Pno≥1): If the instrument is powered off during operation, it will enter a hold state upon power-on, regardless of the situation. However, if the instrument was in a stop state before power-off, it will remain in the stop state after power-on.	
Et	Event Input Types	Et event input is extended to 2 channels (for dual inputs, a module such as I5 must be installed). The Et parameter is defined as Et = Et1 * 10 + Et2, where Et1 and Et2 represent event inputs 1 and 2, respectively. The numeric meanings of Et1 or Et2 are as follows:	0~77

		0 (nonE): Event input function is not enabled. 1 (ruSt): Button-type Run/Stop function. A brief connection of the MIO starts the run control (RUN). A long press (holding for more than 2 seconds) stops the control (STOP). 2 (SP1.2): When in fixed-point temperature control mode (Pno=0), it switches the setpoint. When the MIO switch is off, the setpoint is SV = SP 1, and when the MIO is on, the setpoint is SV = SP 2. 3 (PId2): For unidirectional control (non-heating/cooling dual output control), when the MIO switch is off, P, I, D, and CtI parameters are used for calculation and regulation. When the MIO switch is on, P2, I2, D2, and CtI2 parameters are used for regulation and calculation. 4 (EAct): External switch for switching between heating/cooling control functions. When the MIO switch is off, the P, I, D, and CtI parameters are used for heating regulation. When the MIO switch is on, the P2, I2, D2, and CtI2 parameters are used for cooling regulation. 5 (Eman): External switch quantity for toggling between manual/automatic modes. When the switch is off, the instrument is in automatic mode. When the switch is on, the instrument is in manual mode. 6 (Erun): External switch quantity for toggling between run/stop. When the switch is off, the instrument stops; when the switch is on, the instrument runs. 7 (Eout): When the external switch is on, the main output is forcibly set to 0 or the Ero output. (Based on the AF2.E parameter settings). Note: If Et1 = Et2 is set, the system will execute Et1 first, then Et2, with the result determined by Et2.	
CtrL	Control Mode	OnoF: Adopt position control (ON-OFF), only suitable for applications with low control requirements. APID: Advanced AI-based PID control algorithm, recommended for use. nPID: Standard PID control algorithm with anti-saturation integral function. PoP: Directly output the PV value, allowing the instrument to function as a temperature transmitter. SoP: Directly output the SV value; when Pno≥1, the instrument functions as a program generator.	
OPL	Output Low Limit	When set to 0~100%, it serves as the minimum limit for the regulation output OUTP in standard unidirectional control. When set to - 1 ~ -110%, the instrument operates as a bidirectional output system, supporting both heating and cooling outputs. When the Act setting is rE or rEbA, the main output OUTP is used for heating, and the auxiliary output AUX is used for cooling. Conversely, when Act is set to dr or drbA, OUTP is used for cooling, and AUX is used for heating. When the instrument operates in bidirectional output mode, OPL is used to reflect the maximum cooling output limit. When OPL=- 100 %, there is no restriction on the cooling output. Setting OPL to - 110 % allows the current output (e.g., 4~20mA) to exceed the maximum range by more than 10 %,	-110~ +110%

		which is suitable for special applications. However, for SSR or relay outputs, the maximum cooling output limit should not exceed 100%.	
OPH	Output High Limit	When the measured value PV is less than the OEF, the maximum output value of the main output OUTP is limited. Once PV exceeds the OEF, the system adjusts the output high limit to 100%. In the case of no feedback position proportional output (when OPt=nFEd), if OPH is set to less than 100, the instrument will automatically tune the valve position upon power-up. If OPH=100, the instrument will automatically tune the valve position at 0% and 100% output, which helps reduce the power-up time. The OPH setting must be greater than the OPL.	0~110%
Aut	Cooling Output Specifications	The output type of AUX is defined only when AUX is used as the auxiliary output in heating/cooling bi-directional control. SSr: The output provides SSR driving voltage or zero-crossing trigger time signal for silicon-controlled rectifier (SCR). Modules such as G or K 1 module should be installed to adjust the output power by modifying the on-off time ratio, with a typical cycle of 0.5-4.0 seconds. rELy: This setting should be used when the output is for a relay contact switch or when the system has mechanical contact switches (such as in contactors or compressors). To protect the lifespan of mechanical contacts, the system limits the output cycle to 3-120 seconds, typically 1/5-1/10 of the system's delay time. 0-20: 0~20mA linear current output, the AUX port requires installation of the X3 or X5 linear current output module. 4-20: 4~20mA linear current output, the AUX port requires installation of the X3 or X5 linear current output module. Note: If the OPt or Aut output is set to rELy, the output cycle is generally limited to between 3-120 seconds. If the heating or cooling output signal is 4-20mA, when the heating output is active, the signal at the cooling output terminal will be zero, with an output of 0mA, not 4mA. When the cooling output is active, the heating output signal will be zero, with an output of 0mA instead of 4mA.	
CHYS	Control Hysteresis	This is used to prevent the relay from frequent switching in ON-OFF control mode. For reverse action (heating) control, when PV is greater than SV, the relay turns off. The output reconnects when PV is less than SV-CHYS. For direct action (cooling) control, when PV is less than SV, the output turns off. The output reconnects when PV is greater than SV+CHYS.	0~9999 Unit
Act	Direct/Reverse Action	rE: Reverse action control mode. When the input increases, the output decreases, such as in heating control. dr: Direct action control mode. When the input increases, the output increases, such as in cooling control. rEbA: Reverse action control with the added feature of eliminating the low limit alarm and deviation low limit alarm upon power-up. drbA: Direct action control with the added feature of eliminating the high limit alarm and deviation high limit alarm	

		upon power-up.	
P	Proportional Band	Define the proportional band for APID and PID regulation, with the unit being the same as the PV value, rather than a percentage of the range. Note: The At function is typically used to determine the P, I, D, and Ctl parameter values, but for familiar systems, such as batch-produced heating equipment, the known correct P, I, D, and Ctl values can be directly input.	1~32000 Unit
I	Integral Time	Define the integral time for PID regulation in seconds, and the integral action is canceled when I=0.	0~9999 seconds
D	Derivative Time	Define the derivative time for PID control, with the unit in 0.1 seconds. When d=0, the derivative action is disabled.	0~3200 seconds
Ctl	Control Cycle	When SSR, SCR or current output is used, the control cycle is typically set to 0.5-3.0 seconds. When the output uses relay switching or is part of a heating/cooling dual-output control system, a short control cycle may shorten the mechanical switch lifespan or cause frequent switching between heating and cooling outputs. Conversely, a longer cycle reduces control accuracy. Therefore, the control cycle is generally set between 15-40 seconds. It is recommended that the Ctl be set to 1/5~1/10 of the system's delay time (which is roughly equivalent to the system's lag time). If the output uses relay switching (when OPt or Aut is set to rELY), the actual Ctl will be limited to over 3 seconds, and the auto-tuning At will automatically set Ctl to an appropriate value, balancing control accuracy and mechanical switch lifespan. For valve control outputs, it is recommended to set Ctl=3~15 seconds to balance response speed and avoid frequent valve movements. When the control mode parameter CtrL is set to ON-OFF mode, Ctl defines the delay time for output disconnection or ON action after power-up, preventing immediate reconnection after disconnection. This function is designed to protect the compressor's operation.	0.2~ 300.0 seconds
P2	Cooling Proportion Band	Define the proportional band for cooling output in APID and PID regulation, with the unit being the same as the PV value, rather than as a percentage of the range.	1~32000 Unit
I2	Cooling Integral	Define the integral time for cooling output PID control, with the unit in seconds. When I=0, the integral function is disabled.	0~9999 seconds
d2	Cooling Derivative	Define the derivative time for the cooling output PID control, with the unit in 0.1 seconds. When d=0, the derivative action is disabled.	0~3200 seconds
Ctl2	Cold Output Cycle	When SSR, SCR or current output is used, the control cycle is typically set to 0.5-3.0 seconds. When the output is a relay switch (with OPt or Aut set to rELY), the actual Ctl will be restricted to a minimum of 3seconds. A typical recommendation is to set it within the range of 20~40 seconds.	0.2~ 300.0 seconds
dPt	Decimal Point Position	Four display formats are available for selection: 0, 0.0, 0.00, and 0.000. Note 1: For thermocouple or resistance temperature detector inputs, either the 0 or 0.0 display format can be selected. Even	

<table>
<tr><td></td><td></td><td>if the 0 format is selected, an internal resolution of 0.1°C is maintained for control calculations. For S, R, or B-type thermocouples, it is recommended to select the 0 format. When INP=17, 18, or 22, the instrument internally uses a resolution of 0.01℃, and either the 0.0 or 0.00 display format can be selected.
Note 2: When using linear inputs, if the measured value or other related parameters are expected to exceed 9999, it is recommended not to select the 0 format but instead use the 0.000 format. This is because, once the value exceeds 9999, the display format will change to 00.00.</td><td></td></tr>
<tr><td>Scb</td><td>Input Correction</td><td>The Scb parameter is used to apply a translation correction to the input, compensating for errors in the sensor, input signal, or thermocouple cold-junction compensation.
Note: It is generally recommended to set this to 0. Incorrect settings may lead to measurement errors.</td><td>-9990~
+4000
Unit</td></tr>
<tr><td>SCL</td><td>Input Low Limit</td><td>Used to define the lower scale value for the linear input signal. When the instrument is used for transmission output or bar graph display, it also defines the lower scale limit for the signal.</td><td rowspan="2">-9990~
+32000
Unit</td></tr>
<tr><td>SCH</td><td>Input High Limit</td><td>Used to define the upper scale value for the linear input signal. When the instrument is used for transmission output or bar graph display, it also defines the upper scale limit for the signal.</td></tr>
<tr><td>FILt</td><td>Digital Filtering</td><td>The FILt determines the strength of the digital filter. The higher the setting, the stronger the filtering, but the slower the response speed of the measurement data. When the measurement is subject to significant interference, gradually increase the FILt setting until the instantaneous fluctuation of the measured value is reduced to less than 2~5 digits. When the instrument undergoes metrological calibration, FILt should be set to 0 or 1 to enhance the response time. The unit of FILt is 0.5 seconds.</td><td>0~100</td></tr>
<tr><td>Fru</td><td>Temperature Unit Selection</td><td>50C indicates that the power supply frequency is 50Hz, and the input has the maximum immunity to interference at this frequency. The temperature unit is °C. (Register value: 0)
50F indicates that the power supply frequency is 50Hz, and the input has the maximum immunity to interference at this frequency. The temperature unit is °F. (Register value: 1)
60C indicates that the power supply frequency is 60Hz, and the input has the maximum immunity to interference at this frequency. The temperature unit is °C. (Register value: 2)
60F indicates that the power supply frequency is 60Hz, and the input has the maximum immunity to interference at this frequency. The temperature unit is °F. (Register value: 3)</td><td></td></tr>
<tr><td>SPSL</td><td>External Setpoint Low Limit</td><td>When using the external setpoint function, this defines the lower scale limit for the external input signal. When using position proportional output, it defines the low limit for the valve position feedback signal. This parameter can be automatically adjusted by the valve auto-tuning function.</td><td rowspan="2">-9990~
+32000
Unit</td></tr>
<tr><td>SPSH</td><td>External Setpoint High Limit</td><td>When using the external setpoint function, this is used to define the high limit of the external input signal scale; when using position-proportional output, it defines the high limit of</td></tr>
</table>

		the valve position feedback signal. This parameter can be determined by the valve auto-tuning function. **WARNING: The values after the valve position auto-tuning are for reference display only. Do not manually modify the** SPSH **and** SPSL **parameters unless performed by a professional.**	
AF	Advanced Function 1	The AF parameter is used to select the advanced function, and its calculation method is as follows: AF=A×1+B×2 +C×4 +D×8+E×16+F×32+G×64+H×128 A=0: HdAL and LdAL function as deviation alarms. A= 1: HdAL and LdAL function as absolute value alarms, allowing the instrument to have 2 groups of absolute value high limit alarms and absolute value low limit alarms. B=0: The alarm and position control hysteresis work as unilateral hysteresis. B=1: As bilateral hysteresis. C=0: The third row of the instrument includes one decimal place. C=1: The third row of the instrument does not include a decimal point (only applicable for three-row display). D=0: The password to access the parameter table is the public 808. D=1: The password is the value of the parameter PASd. Long press the left button to find LOC after switching to the field parameter. E=0:HIAL and LOAL function as the absolute value high limit alarm and the absolute value low limit alarm, respectively. E=1: HIAL and LOAL change to deviation high limit alarm and deviation low limit alarm, respectively, allowing for 4 deviation alarms F=0 indicates fine control mode, where the internal control resolution is 10 times the display resolution, but for linear input, the maximum display value is limited to 3,200 units. F=1 is high-resolution display mode, select this mode when the required display value is greater than 3,200 units. F=1 represents high-resolution display mode. This mode should be selected when the required display value exceeds 3,200. G=0: A high limit alarm is allowed when the measurement value increases due to sensor disconnection (the high limit alarm setting value should be below the signal's upper range limit). G=1: A high limit alarm is not allowed when the measurement value increases due to sensor disconnection. Please note that in this mode, even normal high limit alarms (HIAL) will be delayed by approximately 15 seconds before being triggered. H=0: HIAL and LOAL follow independent alarm logic. H=1: HIAL and LOAL are changed to interval alarms, where an alarm will only trigger when LOAL>PV>HIAL. The alarm code will be HIAL, and the output will also use HIAL. Note: Non-expert users can set this parameter to 0.	0~255
AF2	Advanced Function 2	AF 2 is used to select the second set of advanced function codes, and its calculation method is as follows: AF2=A×1+B×2 +C×4 +D×8+E×16+F×32+G×64+H×128 A=0: The setpoint value is internal. A=1: tThe setpoint value is external, with the external setpoint signal input through the 5V input terminal.	0~255

		B=0: The external setpoint signal is 1~5V. B= 1 : The external setpoint signal is 0~5V. C=0: Normal input mode. C=1: The linear input signal is processed by square root transformation. D=0: The transmit output scale is defined by SCH\SCL. D=1: The transmit output scale is defined by SPSL\SPSH (Note: Do not use when valve feedback signal is input). E=0: Output 0when the sensor is disconnected. E=1: Output the Ero parameter when the sensor is disconnected. F=0: Ero is set automatically by the system. F=1: Ero is set manually. Automatic definition of Ero is one of the AI self-learning control functions. The instrument will automatically memorize the average output value when the measured value and setpoint are consistent, which is then used as a reference for PID control calculations to improve control performance. For safety, the maximum learnable value of Ero is 70% of the output power. If a higher Ero value is required, it can be manually set, but it should be adjusted to the safest commonly used output. G=0: Reserved. H=0: Disable CT function. Note that when using position proportional output (valve motor servo), the CT measurement function must be disabled to avoid conflicts between the two. H=1: Enable CT function, which requires the I9 module for current detection. It can be used for detecting load disconnection or actuator short circuits. Note: AI-8* 6 does not support the external setpoint function.	
PAF	Program Running Mode (Pno≥1)	The PAF parameter is used to select the program control function, and its calculation method is as follows: PAF=A×1+B×2 +C×4 +D×8+E×16+F×32+G × 64+H×128 A=0: The preparation function (rdy) is disabled. A=1: The preparation function is enabled. B=0: Slope mode. When there is a temperature difference during program operation, the temperature transition follows a stepped profile. Different heating modes can be defined, and cooling operation is also possible. B=1: Platform mode (constant temperature mode). Each program segment defines a setpoint value and hold time. The transition to the next segment can be limited by the rdy function, and the heating/cooling rate can be restricted by the SPr/SPrL parameters. Additionally, even if B=0is set,if the last program segment is not an end command, the system will still operate in constant temperature mode and automatically finish when the set time is reached. C=0: Program time is in minutes. C=1: Time is in hours. D=0: No measurement-based start function. D=1: Measurement-based start function is enabled. E = 0: Program event outputs 1 and 2 are assigned to AL1 and AL2 outputs, respectively. E = 1: Program event outputs 1 and 2 are assigned to AU1 and AU2 outputs, respectively. F=0: Standard operation mode. F=1: During program operation, executing the RUN operation will enter a pause (HoLd) state. G = 0: Program time is determined by item C. G=1: Time is in	0~255

		seconds. H=0: Standard operation mode. H=1: In slope mode, each segment has a preparation function (rdy).	
SPr	Heating Rate Limit	If SPr is set to active, during program operation or when changing the setpoint, the instrument will heat up to the setpoint at the heating rate defined by SPr, provided the measured value is lower than the setpoint. When the heating rate limit is active, the PRG indicator will flash. SPr is effective in point control mode (Pno=0) and program platform mode. This function is not used in slope mode. When the C item of PAF is set to 1, the units of SPr and SPrL change to ℃/hour.	0~3200 ℃/minute
SPrL	Cooling Rate Limit	If SPrL is enabled, during program operation or when adjusting the setpoint, the instrument will reduce the temperature to the setpoint at the cooling rate defined by SPrL, provided the measured value exceeds the setpoint. During the cooling rate limit state, the PRG light will flash. SPrL is effective in point control (Pno=0) and program platform mode; this function is not used in slope mode. If the system has no cooling output, and the natural cooling rate is lower than SPrL, the instrument cannot guarantee the cooling slope and will cool at the natural cooling rate. When the C item of PAF is set to 1, the units of SPr and SPrL change to ℃/hour.	0~3200 ℃/minute
Ero	Over-range Output Value	When the instrument is operating in PID or APID control mode, Ero determines the adjustment output value when the input exceeds its range (usually caused by sensor failure or disconnection). The AF2 parameter can define whether Ero is enabled and set the mode. When Ero is set to automatic mode, the instrument automatically stores the integral output value when the deviation is less than 4 measurement units, causing the Ero value to change automatically with the system. In the Ero manual setting mode, the Ero value is set manually.	-110 ~110%
OPrt	Soft Start Time	If the instrument is powered on or in a stop state and the measured value PV is less than OEF, the maximum allowable output of the main output OUTP will gradually rise to 100% over the time defined by OPrt. If the measured value at power-up or stop state is greater than OEF, the output rise time will be limited to 5 seconds. This function is only required for special customer needs. During manual output or auto-tuning, the maximum output is not limited by the soft start function. If a soft start function is needed to reduce the inrush current of inductive loads, set CtI= 0.5 seconds and OPrt= 5 seconds.	0~3600 seconds

OEF	Output High Limit Range	When the measured value PV is less than the OEF, the output high limit of OUTP is OPH. When PV exceeds the OEF value, the regulator output is not limited and reaches 100%. Note: This function is used in situations where full power heating is not allowed at low temperatures. For example, when drying moisture in a furnace or preventing too rapid heating, a heater may be allowed to operate at a maximum of 30% heating power when the temperature is below 150°C. In this case, the settings can be: OEF=150.0(°C), OPH=30(%).	-999.0~ +3200.0℃ or linear units
HIAL	High Limit Alarm	When the measured value PV exceeds the HIAL value, the instrument will trigger a high limit alarm. When the measured value PV drops below HIAL-AHYS, the high limit alarm will be cleared. Note: Each alarm can be freely defined to trigger actions on control outputs such as AL1, AL2, AU1, AU2, or no action at all. For further details, please refer to the description of the alarm output definition parameter (AOP).	-9990~ +32000 Unit
LoAL	Low Limit Alarm	When the PV is below LoAL, a low limit alarm is triggered. When the PV exceeds LoAL+AHYS, the low limit alarm is cleared. Note: If necessary, HIAL and LoAL can also be set as deviation alarms (refer to the AF parameter description).	-9990~ +32000 Unit
HdAL	High Deviation Alarm	When the deviation (measured value PV - setpoint SV) exceeds HdAL, a high deviation alarm is triggered. When the deviation is less than HdAL-AHYS, the alarm is cleared. This alarm function is disabled when HdAL is set to the maximum value.	-9990~ +32000 Unit
LdAL	Low Deviation Alarm	When the deviation (measured value PV - setpoint SV) falls below LdAL, a low deviation alarm is triggered. When the deviation exceeds LdAL+AHYS, the alarm is cleared. This alarm function is disabled when LdAL is set to the minimum value. Note: If necessary, HdAL and LdAL can also be set as absolute value alarms (refer to the AF parameter description).	-9990~ +32000 Unit
AHYS	Alarm Hysteresis	Also known as alarm dead zone or hysteresis, this function helps prevent frequent triggering of the alarm relay at the threshold. Its role is explained above.	0~9999 Unit
AdIS	Alarm Indication	OFF: The alarm symbol will not be displayed on the lower display when an alarm occurs. on: The alarm symbol will alternate with the measurement values on the lower display when an alarm occurs, serving as a reminder. This mode is recommended. FOFF: Energy-saving/Confidential display mode. In this mode, the instrument will turn off the display of measurement and setpoint values, helping to save power or maintain confidentiality of process temperatures. The lower display will show the current station number, and the alarm symbol will appear when an alarm occurs. (This parameter is not available on the screen)	

<table>
<tr><td>SPL</td><td>Setpoint
Low Limit</td><td>The minimum value that SP allows to be set.</td><td rowspan="2">-9990~
+32000
Unit</td></tr>
<tr><td>SPH</td><td>Setpoint
High Limit</td><td>The maximum value that SP allows to be set.</td></tr>
<tr><td>SP1</td><td>Setpoint
One</td><td>When the parameter Pno=0 or 1, the setpoint value SV = SP1.</td><td rowspan="2">SPL~SPH</td></tr>
<tr><td>SP2</td><td>Setpoint Two</td><td>When the parameter Pno=0 or 1, and the I2 module is installed at the MIO position with the parameter Et=SP1.2, an external switch can be used to toggle between SP1/SP2. When the switch is open, SV=SP1. When the switch is closed, SV=SP2.</td></tr>
<tr><td>PASd</td><td>Password</td><td>When PASd is set to 0-255 or AF.D=0, setting Loc=808 will allow access to the full parameter table.
When PASd is set to 256-9999 and AF.D=1, Loc=PASd must be set in order to access the parameter table.
Note: Only expert-level users are allowed to set PASd. It is recommended to use a unified password to avoid forgetting it.
(This parameter is not available on the screen)</td><td>0-9999</td></tr>
<tr><td>Strt</td><td>Valve Stroke Time</td><td>Strt defines the stroke time of the valve rotation when the instrument is set to position-based proportional control output. If a valve feedback signal is present, the instrument will automatically select the hysteresis of the valve control signal based on the Strt setting. The shorter the stroke time, the larger the hysteresis, which may reduce the valve positioning accuracy. In the case of no valve feedback signal or when a feedback signal causes an over-range fault, the instrument will use the stroke time defined by Strt to compare the output and determine the duration of the valve motor's action.</td><td>5~300
seconds</td></tr>
<tr><td>nonc</td><td>Normally
Open/Normally
Closed</td><td>A single alarm relay can simultaneously provide both normally open and normally closed outputs. However, the dual-channel alarm module L3 only has a normally open output. The normally open output can be defined as a normally closed output through the nonc parameter. When nonc=0, the L3 relays installed at positions AL1, AL2, AU1, and AU2 will all be normally open outputs. When nonc=15, the instrument will output normally closed alarms. When some channels require normally open outputs and others require normally closed outputs, the nonc value can be calculated using the following formula.
nonc=A X 1+B X 2+C X 4+D X 8
In the formula, A, B, C, and D represent the normally open/closed selection for AL1, AL2, AU1, and AU2, respectively. A value of 1 indicates a normally closed output for the corresponding alarm, while a value of 0 indicates a normally open output.</td><td>0~15</td></tr>
</table>

EFP1	Low Limit Current Alarm	Note that EFP1~3 are all in percentage. The CT function (AF2.H=1) must be enabled, and the I9 module should be used in conjunction with an external current transformer that converts AC to 0~50mA. It is recommended to use a current transformer with a rating at least twice the expected current, so that the normal current percentage is around 20%~40%. For example, if the normal operating current is around 15A, a 50A transformer can be used with a 50mA output. In this case, when the instrument displays approximately 30 on EFP3, it indicates that the current is at 30%. At this point, EFP1 can be set to 20 for load disconnection detection, and EFP2 can be set to 50 for actuator short-circuit detection. When a current alarm is triggered, the instrument will flash CtAL and output a signal through AU1. The three-row display instrument, paired with AF.C=1, can display the EFP3 current percentage on the third row. Note: The output type should be selected as SSR output or relay output, and the output period should be greater than 0.2 seconds.	0~100
EFP2	High Limit Current Alarm		0~100
EFP3	Current Percentage		
EAF	Extended Advanced Function	The EAF parameter is used for extended advanced functions. Its calculation method is as follows: EAF=A×1+C×4 +D×8+E×16+F×32 A=0: Automatically select the main input refresh rate based on the CTI control cycle parameter (120ms ~ 960ms, when the grid frequency is set to 60Hz via the Fru parameter, the refresh rate will be 100ms ~ 800ms). A=1: Reserved; the main input refresh rate can be customized for special VIP large users. A=2: The main input refresh rate is approximately 60mS (for a 60Hz grid frequency, the Fru parameter results in approximately 50mS). A=3: The main input refresh rate is approximately 120mS (for a 60Hz grid frequency, the Fru parameter results in approximately 100mS). C=0: Disable automatic switching between two sets of PID parameters based on the setpoint SV. C=1: Allow automatic switching between two sets of PID parameters based on the setpoint SV. D=0: The PID parameter switching threshold is defined by the OEF parameter. If SV is greater than OEF, the second set of PID parameters is used; otherwise, the first set is used. D=1: The parameter switching threshold is defined by the SPSH parameter. Note: To avoid output disturbances during switching, the output periods of the two PID sets should generally be set to be consistent, and the derivative times should also be as similar as possible. E=0: Normal use of the AUX port. E=1: The AUX port is used for transmission output, and the AUX parameter must be configured accordingly. F=0: When the AUX port is used for transmission output, it transmits PV. F=1: When the AUX port is used for transmission output, it transmits SV. **Note: AI-**8*6 **series does not support the EAF function.**	0~255

Prn	Multi-Group Program Segment Selection Function Parameters	Prn represents the currently selected program group number (0–9). When the Prn value is modified while the instrument is in the STOP state, the instrument will automatically save the old 50 program segments to FLASH memory and load the program segments of the new group number. Even if the number of program segments is set to 0, modifying the Prn will switch between 10 different SP1 and SP2 setpoints. Note: Since FLASH memory is used for data storage, the write endurance of this memory is limited to 100,000 write cycles, as specified in the chip manufacturer's manual. This is different from the instrument's ability to write to parameters (including the currently loaded program), which can exceed 2 billion writes. When switching program segments, the system will pause for approximately 10 mS to write to the FLASH memory. During this time, some real-time communication and control functions may be affected. Therefore, the instrument must be in the STOP state for the program switch command to be executed. **Note: AI-**8*6**series does not support Prn function** (This parameter is not available on the screen)	0~9
EP1-EP8	Field Use Parameter Definition	1~8 field parameters can be defined as commonly used parameters that require modification by the on-site operator after the Loc lock is applied. If there are fewer than 8 field parameters, their values can be set to nonE. (This parameter is not available on the screen)	

7. Multi-point Parameter Description

Advanced parameters

A00	0	D00	0	D10	0	D20	0	D30	0	D40	0	D50	0
A01	0	D01	0	D11	0	D21	0	D31	0	D41	0	D51	0
A02	0	D02	0	D12	0	D22	0	D32	0	D42	0	D52	0
A03	0	D03	0	D13	0	D23	0	D33	0	D43	0	D53	0
A04	0	D04	0	D14	0	D24	0	D34	0	D44	0	D54	0
		D05	0	D15	0	D25	0	D35	0	D45	0	D55	0
		D06	0	D16	0	D26	0	D36	0	D46	0	D56	0
		D07	0	D17	0	D27	0	D37	0	D47	0	D57	0
		D08	0	D18	0	D28	0	D38	0	D48	0	D58	0
		D09	0	D19	0	D29	0	D39	0	D49	0	D59	0

Reread Cancel

7.16 Custom Input Specifications

When the parameter InP=10 is set, the instrument input specification is defined as a custom input type, and a nonlinear table can be edited. The setup method is as follows: The parameter 00 defines the table's usage: 0 is used for input nonlinear measurement or multi-segment linear correction of input signals. 1 is used for nonlinear power control in high-temperature furnaces. The parameters include A01~A04 and d00~d59(In which, the values of A02~A04 and d00~d59 have decimal places; for example, if dPt is set to 0.0, the values of A02~d59 should be divided by 10). They are set as follows:

A 00：0

A 01: Define the input type, with the following value definitions:

A 01=A×1 +Hx128

A represents the input signal range as follows: 0: 0~20mV; 1: 0~40mV: 2: 0~80mV (80mV corresponds to full scale 32000, linear range up to 75mV); 4: 0~5V (When H=1, 4V corresponds to SCH value); 10: 0~20mA (When the I44 module is installed at the MIO position, and H=1, approximately 13.5mA corresponds to SCH value). 64: 0-100 ohms; 65: 0-200 ohms; 66: 0-400 ohms

The full-scale range for thermocouples corresponds to 32000, for 0~20mA corresponds to 30000, and for other ranges, it corresponds to 25000.

H for thermocouple and resistance temperature detector type input signals display:

0 indicates that the table output value is the same as the displayed value. 1 indicates that for linear input signals, the table output value needs to be further calibrated by the SCH/SCL parameters.

For example: If the signal is a 0~40mV voltage input, then set A01=1×1+0x128=1

A02 : Define the low limit of the input signal, which is equal to the signal low limit × full-scale range / signal range. For example, for a 10~40mV signal input, set A02=10× 32,000/40=8,000.

A 03: Define the input signal range, which is equal to the signal range × full-scale range / signal range. For example, for a 10-40mV input, the range is 40-10mV=30mV, then set

A03=30× 32,000/40=24,000.

A 04: Define the table spacing of the input signal, where A04=A03/number of curve segments. If there is only one segment, then A04 equals A03; if there are 2 segments, then

A04=A03/2。

d 00: Represent the starting value of the curve table, corresponding to the output value when the input signal equals A 02 . For example, it can be set to 0.

d 01: indicate the value of the 1 segment in the curve table, which corresponds to the output value when the input signal is A 02 +A 04 . For example, in a 10-40mV input, it can be set to 32,000.

d 02-d59: Represent the values of segments 2-59 in the curve table. When all segments are applied, it can correct very complex curves, such as square root, logarithmic, and exponential curves.

7.17 Multi-Segment Linear Correction Function for Input Signals

When the input specification InP is set by adding 64, the instrument enables the multi-segment linear correction function for the input signal. The setting method is as follows: set the Loc parameter to 3698 to enter the table setting mode. (If the original Loc=808, first change Loc to 0, exit the parameter setting mode, then re-enter the parameter setting mode and set Loc to 3698). The separate settings are as follows:

A00: 0;

A01: 0;

A02: Starting temperature

A03: Measurement range = Maximum measurement value - A02

A04: Temperature interval per segment = A03/number of segments

d00~d59: Temperature values for each segment

For example: The type K thermocouple input range is from 0 to 300 degrees, with one decimal place, and corrections are applied every 100 degrees. Then set the parameters: A00=0, A01=0, A02=0.0, A03=300.0, A04=100.0, d00=0.0, d01=100.0, d02=200.0, d03=300.0. To make a correction, simply adjust the corresponding temperature point higher or lower. For example, if the instrument displays 200.0 degrees but the calibration device measures 202.0, change d02=200.0 to d02=202.0.

Note: The correction value applies to each point, and the transition between points is automatically linear. Once this function is enabled, the instrument will only display values within the temperature range set in the table. If the actual temperature exceeds the table range, the instrument will display an "orAL" over-range alarm.

7.18 High-Temperature Furnace Nonlinear Power Control Function

For loads like nonlinear high-temperature furnaces, the resistance changes drastically with temperature. Taking a silicon-molybdenum rod furnace as an example, the resistance at room temperature is only

about 6% of the resistance at 1,600 degrees. If the instrument's output power is not limited or adjusted, two issues may arise. First, during low-temperature startup, the furnace current may be too large, exceeding the maximum allowable load for the power grid, SCR, and transformers, potentially causing damage to the SCR, furnace, transformer, or leading to a grid outage. Additionally, since the instrument outputs the same power, the power required by the furnace in the low-temperature and high-temperature zones can differ by more than 10 times This means that the proportional band P in the PID parameters needs to change by over 10 times at different temperatures in order to achieve precise temperature control in both the low and high-temperature zones. Using the limiting parameter OPH only restricts the output power and cannot achieve the necessary change in proportional band. To ensure accurate temperature control in both the low and high-temperature zones, multiple sets of PID parameters need to be configured. This approach is not only complex but also not very effective. The custom output limit transformation function solves both the output limitation and the transformation of the proportional band P. This function limits and adjusts the instrument's output based on the measured temperature. It not only restricts the power in the low-temperature zone but also automatically corrects the proportional band parameters at different temperatures. Both the power limitation and the changes in the proportional band are applied in a continuous piecewise linear manner, which is more effective than using proportional grouping. The power limitation only proportionally reduces the instrument's actual output, while the display range of the instrument remains 0~100%. For example, when used with a silicon-molybdenum rod furnace, the settings can be as follows (customers may modify the data according to their requirements):

A00=1, A 01=1050, A02=100.0; A03=1500; A04=750.0， d00=120.0; d01=1100, d02=2000

When setting parameter A00=1 and A01=1050, the instrument enables the custom output limitation transformation function. A02 represents the starting temperature for the output limitation, A03 indicates the temperature range for the output limitation, and A04 represents the segment length of the non-linear data temperature range. In this example, 1500/750.0=2, indicating there are 2 segments. The more segments, the more complex and refined the curve can be. d00 represents the maximum output power below A02, with the unit being 100%×(1/2000), d00=120.0 indicates 6%, d01 represents 55%, d02 indicates 100%. This curve means that when the temperature is below 100℃, the output limitation is 6%. For temperatures between 100~850℃, the power limit smoothly transitions from 6% to 55%. For temperatures between 850~1600℃, the power limit transitions from 55% to 100%. Above 1600℃, there is no limitation, and the output is 100%.

Note: The range of d values is 0~59which corresponds to a maximum of 60 segments for power limitation. This function cannot be used simultaneously with the multi-segment linear correction function. If special input specifications are required at the same time, please contact the sales personnel to discuss embedding them into the instrument. However, this may incur a one-time additional fee.

8. Program Control (when parameter Pno≥1)

AI-8*8 program-type instrument is used in situations where the setpoint needs to automatically change according to a specific time pattern for control purposes. It features a 50-step program sequencing function, allowing the setting of arbitrary values for both ramp-up and ramp-down slopes. The instrument includes programmable and operable commands such as jump, run, pause, and stop, enabling program modifications during execution. Additionally, it offers power failure handling, measurement startup, and preparation functions, enhancing the efficiency and completeness of program execution.

8.1 Functions and Concepts

Program Segment: The segment number can range from 1~50. The current segment (StEP) refers to the segment that is currently being executed.

Set Time: Refer to the total time allocated for running the program segment, measured in minutes or hours, with valid values ranging from 0.1~3,200.

Run Time: Refer to the run time of the current segment. When the run time reaches the set segment time, the program automatically proceeds to the next segment.

Jump: Program segments can be programmed to automatically jump to any segment, enabling loop control. Jump can also be achieved by modifying the StEP value.

Run (run/HoLd)**:** When the program is in the run state, the time is counted, and the setpoint change according to the pre-arranged program curve. In the run state (pause), the timing stops, and the setpoint remains unchanged. The pause operation (HoLd) can be programmed into the program segment.

Stop(StoP)**:** Executing the stop operation will halt the program. At this point, the run time is reset to 0 and timing stops, while control output is also stopped. When the run operation is executed in the stop state, the instrument will start the program from the step number set in StEP. An automatic stop function can be programmed into the program segment, with the StEP value of the running segment also being set simultaneously. The stop operation can also be manually executed at any time (after execution, the StEP will be set to 1, but the user can modify it again). If the program segment reaches the last segment defined in the Pno parameter, it will stop automatically.

Power-down/Power-up Event: Refer to the event when the instrument is powered on or experiences an unexpected power outage during operation. Various handling options can be selected by setting the PonP parameter.

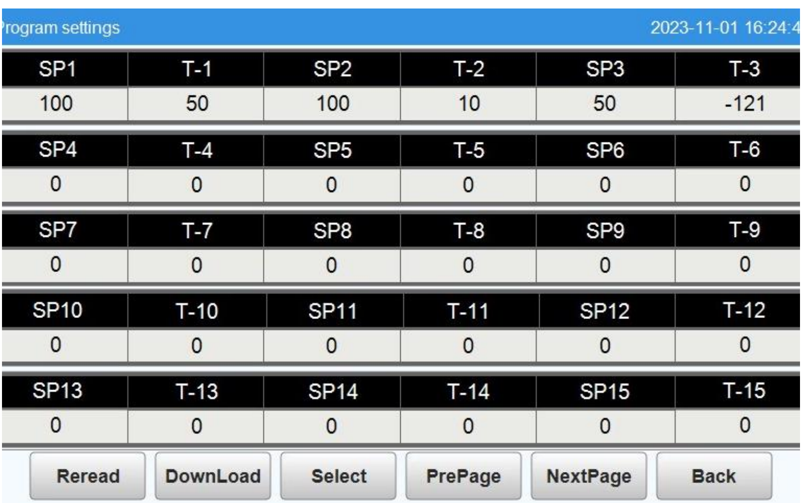
Preparation (rdy) **Function:** When starting the running program, or after an unexpected power-down/power-up, if the instrument needs to continue running the program, and the measured value differs from the setpoint (if the measurement value start function is enabled, the system will first process using this function; if the measurement value start function is effective, the ready function will not be needed, and it will only be applied if the conditions for the measurement value start function are not met), and if the difference exceeds the deviation alarm values (HdAL and LdAL), the instrument will not immediately trigger a positive (or negative) deviation alarm. Instead, the system will first adjust the measured value so that the error is within the deviation alarm threshold. During this time, the program will pause and no deviation alarm signal will be output. The program will resume once the positive and negative deviations meet the required conditions. The ready function is also very useful for setting segments where the heating/cooling time is unpredictable. To enable or disable the ready function, it can be configured in the PAF parameter. The preparation function ensures the integrity of the entire program curve during operation, but the inclusion of the preparation time may result in an increased overall running time. Both the preparation function and the measurement value start function are designed to address the uncertainty caused by discrepancies between the measured value and the setpoint at the start of operation, ensuring that the program runs efficiently, completely, and in accordance with the user's requirements.

Measurement Value Start Function: When the program is started, or after an unexpected power-down/power-up event, and the program needs to continue running, the actual measured value of the instrument often differs from the setpoint calculated by the program. This difference is sometimes unpredictable and undesirable for the user. For example: In a heating program, the instrument is set to heat from 25℃ to 625℃ over 600 minutes, with a temperature rise of 1℃. Assuming the program starts from the initial point of this segment, if the measured value is exactly 25℃, the program will execute smoothly according to the original plan. However, if the system temperature hasn't yet dropped at the start and the measured value is 100℃, the program will have difficulty executing as planned. The measurement value start function allows the instrument to automatically adjust the runtime to align the measured value with the setpoint. For example, in the case above, if the measured temperature at the start of operation is 100℃, the instrument will automatically set the runtime to 75 minutes, allowing the program to start directly from the 100℃.

Curve Fitting: Curve fitting is a control technology used in the AI-8 series instrument. Since controlled objects typically exhibit time lag characteristics, the instrument automatically smooths the linear heating, cooling, and constant temperature curves at inflection points. The degree of smoothing is related to the system's lag time t (t = derivative time d + control cycle Ctl). The larger the t, the greater the smoothing; conversely, the smaller the t, the less smoothing. The smaller the lag time of the controlled object (such as thermal inertia), the better the program control effect. By processing the program curve using curve fitting, overshoot can be avoided.

Note: The characteristics of curve fitting cause the program control to produce a fixed negative deviation during linear heating and a fixed positive deviation during linear cooling. The magnitude of this deviation is proportional to the lag time (t) and the heating (cooling) rate. This is a normal phenomenon.

8.2 Program Recipe Function



8.2.1 Slope Mode

When the program operating mode PAF.B=0, the program is arranged in a unified temperature-time-temperature format. This is defined as: starting from the current segment's set temperature, the program will reach the next temperature after the set duration for that segment. The temperature setting values use the same unit as the measured value PV, while the time values can be set in minutes or hours. In slope mode, if the program reaches the last segment defined by Pno, and the command is neither a stop command nor a jump command (the time setting can be edited later), it indicates that after holding the temperature for the set time in that segment, the program will automatically end. The following is an example of a 5-segment program that includes linear heating, constant temperature, linear cooling, jump loop, preparation, and pause.

Segment 1: SP 1=100.0, t 1=30.0; Linear heating starts at 100°C and heats up to SP 2, with a heating time of 30 minutes and a heating rate of 10℃/min.

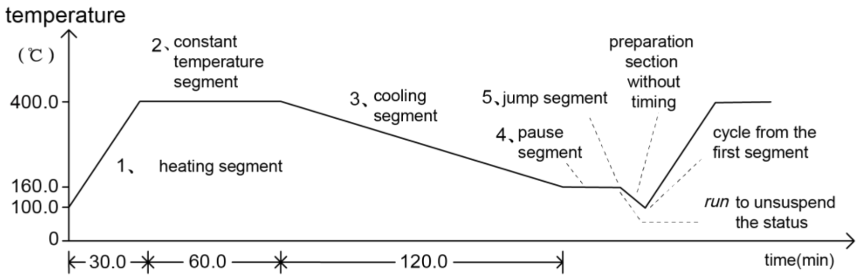
Segment 2: SP 2=400.0, t 2=60.0; Maintain at 400℃ for 60 minutes.

Segment 3: SP 3=400.0, t 3=120.0; Cool down to SP 4, with a cooling time of 120 minutes and a cooling rate of 2℃/min.

Segment 4: SP 4=160.0, t 4=0.0; After cooling down to 160℃, enter the pause state. The "run" command must be executed to continue to the next segment.

Segment 5: SP 5=160.0, t 5=-1.0; Jump to Segment 1 and start the cycle from the beginning.

In this example, after jumping from Segment 5 to Segment 1, the temperature is 160℃, while C 01 is set to 100℃, which are not equal. Since Segment 5 is a jump segment and assuming the deviation high alarm limit is set to 5℃, the program will first enter the preparation state after jumping from Segment 5 to Segment 1. The temperature



will be controlled to below the deviation high alarm limit, i.e., to 105℃, before proceeding with the heating program in Segment 1. This temperature control program is shown in the figure below:

The advantage of using the temperature-time programming method is that it provides a very wide range for setting the heating and cooling slopes. The heating and constant temperature segments have a unified setting format, making them easy to learn. The setting curve is more flexible, allowing for continuous heating segments (e.g., using heating segments with different slopes to approximate a function-based heating curve), or continuous constant temperature segments.

8.2.2 Platform Mode

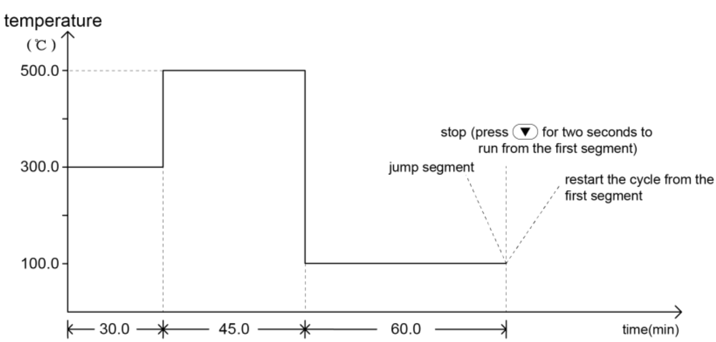
By setting the program running mode to PAF.B=1, the platform mode can be selected. This mode is suitable for applications that do not require independent settings for the heating slope or cooling slope. It simplifies programming and makes better use of the available segments. Each segment represents a temperature and its corresponding holding time. An heating rate limit can also be defined between segments using the SPr parameter. If SPr is set to 0, it indicates a full-speed heating process. Since the heating time cannot be determined and may occupy the holding time, the rdy function can be enabled to ensure the correct holding time.

Segment 1: SP 1=300.0, t 1=30.0; Maintain a temperature of 300°C for 30 minutes

Segment 2: SP 2=500.0, t 2=45.0; Maintain a temperature of 500℃ for 45 minutes

Segment 3: SP 3=100.0, t 3=60.0; Maintain a temperature of 100℃ for 60 minutes

Segment 4: SP 4=160.0, t 4=-121.0; The program enters the stop state



In platform mode, only the temperature and hold time need to be set, with no need to configure the heating process. In the illustration above, operations such as jump, stop, cycle, and others can be set. The example setting shown is “stop”.

8.2.3 Setting Program Setpoint and Time

Each program segment includes a setpoint and time. The range of values for the setpoint is limited by the setpoint low limit SPL and high limit SPH, with the default range being - 999~+3,200℃, indicating the temperature to be controlled (°C) or linearly defined units. In addition to representing the runtime, the time also has special control functions, as explained below:

t-XX＝0.1~3,200 (minutes) indicates the time value set for segment XX (Note: the time unit can also be changed to hours using the PAF parameter).

t-XX ＝ 0.0 means the instrument enters the hold state (HoLd) for segment XX, and the program pauses, stopping the timing.

t-XX＝-121.0 indicates the program executes the StoP operation and enters the stop state.

t-XX ＝ -0.1~-122.0: A negative time value represents a jump + event output command. The integer part -1~-120 indicates the jump to the corresponding segment, but it becomes invalid if it exceeds the number of segments defined by Pno. When the integer part is 0 (with the decimal not being 0), it means to move to the next segment, and the decimal part is for event output programming. During program execution, it can be used to trigger AL1 and AL2 actions. -XXX.0 indicates that the program event status is not affected; it is simply a jump. Note that if alarm outputs are defined in AOP, the alarm will be triggered by AL1 or AL2. Both program events and alarms can cause AL1 or AL2 to activate. -XXX.1~-XXX.4 have the following meanings:

-XXX.1: AL1 activated, AL2 deactivated.

-XXX.2: AL1 deactivated, AL2 activated.

-XXX.3: Both AL1 and AL2 activated.

-XXX.4: Both AL1 and AL2 deactivated.

For example, setting t- 5=-1.1 means that when the program reaches segment 5, AL1 will be activated, AL2 will be deactivated, and the program will jump to segment 1 and continue running.

Another example: Setting t- 6=-0.3means that when the program reaches the segment 6, both the AL1 and AL2 will be activated, and the program will continue to the next segment (segment 7).

Note: Except for cases where a jump segment is encountered during the execution of the run operation or after power is turned on, in the event of a jump to another jump segment during program execution, the program will automatically pause (i.e., the instrument will insert a pause operation between two consecutive jumps). The pause state must be cleared by an external run operation to resume program execution. If a jump segment leads to itself (e.g., t- 6=-6), the pause state cannot be cleared because such a segment is essentially meaningless. Since the program will jump back to the first segment when stopped, t-1 must also be greater than 0.