AI-226 Artificial Intelligence Temperature Controller User Manual (V9.3)

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1 Overview

1.1 Main Features

●The input adopts a highly accurate and stable digital calibration system, supporting multiple thermocouple and RTD types with a maximum resolution of 0.01℃.

●Utilize an advanced AI-based PID control algorithm with no overshoot and auto-tuning (AT) capability.

● Featuring an advanced welded modular design, it offers a wide range of output specifications to meet diverse application needs, ensuring fast delivery and easy maintenance.

●User-friendly operation design for easy learning and use.

●Support self-editing operation permissions and interface, allowing users to “tailor” the instrument to their needs.

● Powered by a globally compatible 100 – 240VAC/DC input range switching power supply or 24VDC power supply, with a variety of panel and size options available.

●The anti-interference performance meets the requirements of electromagnetic compatibility (EMC) under harsh industrial conditions.

⚠Precautions
This manual introduces the AI-226 Artificial Intelligence PID Temperature Controller, V9.3. Some of the features mentioned in this manual may not be applicable to other versions of the instrument. The model and software version number of the instrument will be shown on the display during startup. Users should be aware of the differences between different models and versions when operating the device. Please read this manual carefully to ensure the proper use of the instrument and fully utilize its functionalities. Before use, the AI instrument must be configured correctly according to their input/output specifications and functional requirements. The instrument can only be put into operation after the parameters have been properly set.

1.2 Model Definition

The AI series instruments feature advanced modular hardware design. The AI-226 instrument supports up to 5 modules to be selected, allowing flexible configuration of outputs, alarms, communication, and other functions by selecting the corresponding modules as needed. The input method of the instrument can be freely set to thermocouple, RTD, or linear voltage (current). The AI-226 instrument model consists of 9 parts, for example:

AI－226	A1	N	X3	L3	N	S4	－	24VDC	－(F2)
①	②	③	④	⑤	⑥	⑦		⑧	⑨

This indicates a single instrument with the following specifications: ① Basic function: AI-226 type; ② Panel size: A1 type (96×96mm); ③ Auxiliary input (MIO): No module; ④ Main output (OUTP): Linear current output module; ⑤ Alarm ALM: L3 dual relay contact output module; ⑥ Auxiliary output (AUX): No module; ⑦ Communication interface (COMM): optically isolated RS485 communication interface S4 with built-in isolated power supply; ⑨ Expanded input specification: F2 type (radiation-type high-temperature thermometer). The following are the meanings of the 9 parts of the instrument model.

① indicates the basic function of the instrument

AI-226 (An economical temperature controller with 0.3-class accuracy, featuring AI-based artificial intelligent control technology, multiple alarm modes, and transmission functions)

② indicates the instrument panel size specification

	Code	Dimensions Width × Height (mm)	Insertion Depth (mm)	Cutout Size Width × Height (mm)	Light Bar
Short Version	A1	96×96	70	$92^{+0.5}$×$92^{+0.5}$	---
	B1	160x80	72	$152^{+0.5}$x$76^{+0.5}$	---
	E1	48×96	70	$45^{+0.5}$×$92^{+0.5}$	---
	F1	96×48	70	$92^{+0.5}$×$45^{+0.5}$	---
	D	72×72	95	$68^{+0.5}$×$68^{+0.5}$	---
	D61	48×48	80	$46^{+0.5}$×$46^{+0.5}$	---
DIN Rail Table	E51	48×96	70	DIN rail mounting mode, supports external connection of E8 keyboard and display for configuration and operation.	
	D71	22.5×100	112	The wiring method for power supply and communication adopts a plug-and-play bus terminal form, with other aspects being the same as those of the E7 model.	

③ indicates the module specifications for instrument auxiliary input (MIO) selection: Selectable module specifications include I2, K3, V, etc. “N” indicates no module installed (same for the following items).

④ indicates the specification of the module to be installed for the first output (OUTP) of the instrument: Selectable module specifications include L1, L21, W1, W2, G, K1, K3, X3, X51, X51,X56, etc.

⑤ indicates the module specifications selected for instrument alarm (ALM): Selectable module specifications include L0,L21, L3, W1, W2, G, etc.

⑥ indicates the module specifications selected for the instrument auxiliary output (AUX); Selectable module specifications include L0, L21, L3, and G.

⑦ indicates the module specifications selected for instrument communication (COMM): Selectable module specifications include S, S4, V, etc.

⑧ indicates the instrument power supply: If not specified, it uses a 100~240VAC/DC power supply; 24VDC indicates the use of a 20-32VDC power supply.

⑨ indicates the extended type specification of instrument (leave blank if not applicable). The AI-226 comes with built-in support for commonly used thermocouple and RTD input types (see the technical specifications section for details). However, if input signals other than the above standard types are used, the user is allowed to extend the instrument with one additional input specification.

Note: This instrument uses automatic zeroing and digital calibration technology, making it a maintenance-free instrument. If the instrument exceeds the specified tolerance limits during metrological verification, the issue can typically be resolved by cleaning and drying the internal components. If drying and cleaning do not restore accuracy, the instrument should be considered faulty and returned to the manufacturer for repair.

1.3 Module Usage

1.3.1 Module Location Function Definition

The AI-226 instrument is equipped with 5 optional module slots (with the D61 model featuring 3 slots: OUTP, AUX, and COMM). By installing different modules, various output specifications and functional requirements can be achieved.

Auxiliary Input (MIO): When selected together with OUTP for the K3 module, it enables three-phase zero-crossing SCR trigger output.

Main Output (OUTP): Serve as output for ON-OFF control, standard PID control, or AI artificial intelligent APID control. It can also output measured values or setpoint transmission. Select the L1 module for relay contact output; choose the X3 or X51 module for 0-20mA/4-20mA/0-10mA linear current output; select the G module for SSR voltage output; choose the W1 or W2 module for SCR contactless switch output.

Alarm (ALM): Select L0、 L21 for one normally open + normally closed relay alarm output (AL1), or select L3 for two normally open relay alarm outputs (AL1 + AL2).

Auxiliary Output (AUX): Relay modules L0, L1, L21, or L3 can be selected for alarm outputs. Alternatively, the R module (RS232C interface) can be chosen to enable communication with a computer.

Communication Interface (COMM): Modules S or S4 (RS485 communication interfaces) can be selected for computer communication. Additionally, a voltage output module can be selected to supply power to external sensors.

1.3.2 Common Module Types

L0 Large-size, High-Capacity Relay Contact Output Module (Suitable for alarm systems)

N (or left blank): No module selected.

L1 Large-capacity, large-size relay module with normally open contacts (Capacity: 30VDC/2A, 250VAC/2A).

L21 Small-capacity, compact relay module with normally open and normally closed contacts (Capacity: 30VDC/1A, 250VAC/1A, suitable for alarm use)

L3 Dual-channel large-capacity, large-size relay module with normally open contacts (Capacity: 30VDC/2A, 250VAC/2A).

W1, W2 SCR contactless normally open (W2 is normally closed type) output modules (Capacity: 100~240VAC/0.2A, featuring “burn-proof” characteristics).

G solid-state relay driver voltage output module (12VDC/30mA).

G5 solid-state relay driver voltage output module.

K1/K3 Single-phase/Three-phase “Burnout-Proof” SCR Zero-Cross Trigger Output Module (Each channel can trigger a 5~500A bidirectional or two anti-parallel unidirectional SCRs).

K50/K60　Single-Channel 220VAC/380VAC "Burnout-Proof" Single-Channel SCR Phase-Shift Trigger Output Module

X3　Optically isolated programmable linear current output module.

X51: Optically isolated programmable linear current output module with built-in isolation power supply.

S　Optically isolated RS485 communication interface module.

S1　Optically isolated RS485 communication interface module powered by the instrument's internal 24V isolated power supply.

S4　Optically isolated RS485 communication interface module with built-in isolation power supply.

V24/V12/V10　Isolated 24V/12V/10V DC voltage output modules for powering external transmitters or other circuits. Maximum current: 50 mA.

I2　Switch/frequency signal input interface for external switch contacts or frequency signals, including 12VDC power output for external sensors.

1.3.3 Electrical Isolation of Modules

The instrument includes one set of 24V and one set of 12V power supplies that are electrically isolated from the main circuit and are provided for use by functional modules. The 24V power supply is typically used by voltage output modules, such as V24/V12/V10 (providing 24V/12V/10V DC outputs), and I2 (frequency/digital input module, whose 12V output can also be electrically isolated). The 12V power supply is used by output and communication modules. Relay and SCR trigger output modules are generally self-isolated or do not require isolated power, so the primary consideration is the isolation between communication interfaces and current output modules. Modules such as S (RS485 communication interface), R (RS232 communication interface), and X3 (linear current output) feature input and output terminals that are electrically isolated from the instrument's input circuit, i.e., the main circuit. However, these modules rely on the instrument's internal 12V isolated power supply. If the user selects two of these isolated-function modules simultaneously, they will not be electrically isolated from each other, since they share the same isolated power supply. To this end, new modules such as S4 (RS485 communication interface) and X5/X51 (linear current output) have been designed. These modules come equipped with high-efficiency DC/DC power isolation converters and do not draw power from the instrument's internal isolation supply.

For example, if an X3 module is selected at the main output (OUTP) position, and an S module is selected at the communication interface (COMM), electrical isolation between X3 and S cannot be achieved. In such cases, an S4 or X5/X51 module should be selected instead. Relay contact outputs and SCR contactless switch outputs are electrically isolated from other circuits and are not affected by the selection of other modules. For the SSR voltage output module (G module), additional isolation is generally not required, as standard SSRs typically include built-in isolation.

1.3.4 Application Description for Selected Modules

Voltage Output Modules: Modules such as V24, V10, and V12 are typically used to supply power to external sensors, transmitters, or feedback resistors. These modules can be installed in any available module slot. However, to ensure standardized wiring, it is recommended to assign them sequentially to the MIO, AUX, and COMM positions, based on slot availability.

Contactless Switch Module: The W1/W2 modules are new-generation solid-state switches designed with advanced "burn-proof" protection and zero-crossing turn-on technology. They can replace traditional relay contact output modules for controlling AC contactors or servo motors in electric actuators. Compared to relay contact outputs, they offer significantly longer service life and greatly reduce arcing interference, thereby substantially enhancing overall system reliability. The contactless switchs are driven by SCRs, which means it is only suitable for controlling AC power sources with specifications of 100-240VAC and cannot be used to control DC power sources. Since a protective device is connected in series at the output, the maximum continuous control current is

0.2A, while the peak current can reach up to 2A. With this level of drive capability, it can directly control AC contactors rated for 220AC and up to 80A. However, for larger loads, an intermediate relay is required.

Relay Module: The relay module is a widely used output module in industrial control. However, among all types of modules, it is the only one with issues regarding service life and height restrictions. In addition, relay operation often generates significant electromagnetic interference, so choosing the correct relay module is extremely important. For controlling mechanical switch outputs such as contactors and solenoid valves powered by 220 VAC, the W1 module is recommended. If the control voltage is DC or AC above 50 VAC, relay modules must be used; in this case, the L1 module is suitable. The L3 module is the only dual-relay module available and can be used for two alarm outputs, such as AL1 and AL2. If mechanical contacts are undesirable or height constraints prevent their use, the G5 (SSR voltage) can be selected to drive loads via external solid-state relays (SSRs).

1.4 Technical Specifications

●**Input specifications** (Compatible with a single instrument)**:**

Thermocouple: K, S, R, E, J, T, B, N, WRe3-WRe25, WRe5-WRe26, etc.

RTD: Cu50, Pt100

Linear voltage: 0~100mV, 20~100mV, 0~20 mV, 0~60mV, etc.

Expanded specifications: The users are allowed to specify an additional input specification while retaining the above input specifications (a reference table may be required)

●**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℃)

Cu50(-50~+150℃), Pt100(-200~+800℃), Ni120(-50~+270℃)

●**Linear input:** -9990~+32000, defined by user

●**Measurement accuracy:** 0.3 class

●**Sampling period:** 8 samples per second; when the digital filter parameter FILt=0, the response time is ≤ 0.5 seconds

●**Control period:** Adjustable from 0.24-300.0 seconds

●**Control mode:**

ON/OFF control mode(adjustable hysteresis)

AI artificial intelligence adjustment, featuring advanced control algorithms with fuzzy logic PID control and auto-tuning function

●**Output specifications** (Soldered modular)**:**

Relay Contact Switch Output (Normally Open + Normally Closed): 250VAC/1A or 30VDC/1A

SCR Contactless Switch Output (Normally Open or Normally Closed): 100~240VAC/0.2A (continuous), 2A (20ms instantaneous, with a repetition cycle greater than 5 seconds)

SSR voltage output: 12VDC/30mA (for driving SSR solid-state relay)

SCR trigger output: Capable of triggering bidirectional SCRs from 5~500A, two anti-parallel connected unidirectional SCRs, or SCR power modules

Linear current output: 0~20mA or 4~20mA, configurable (When selecting the X3 module, output voltage ≥ 10.5V; When selecting the X5/X51 module, output voltage ≥ 7V)

●**Alarm functions:** 4 types - high limit, low limit, deviation high limit, deviation low limit, support up to 4 channels with power-on alarm bypass option

●**Electromagnetic compatibility:** IEC61000-4-4 (electrical fast transient), ±4KV/5KHz; IEC61000-4-5 (surge), 4KV

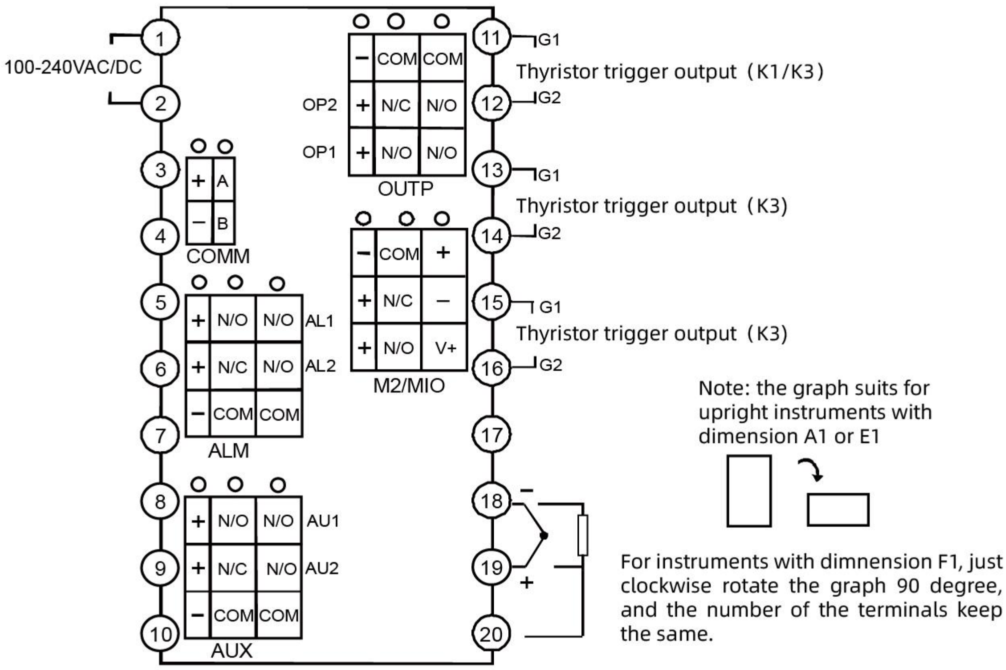
● **Isolation withstand voltage:** ≥2300V between the power supply, relay contacts, and signal terminals; ≥600VDC between isolated low-voltage signal terminals

●**Power supply:** 100~240VAC/DC, -15%, +10% / 50~60Hz; or 24VDC, -15%, +10%
(Note: Instruments powered by 24V cannot share the same 24V power supply with inductive loads.)
●**Power consumption:** ≤5W
●**Operating environment:** -10~60℃; Humidity ≤90%RH

1.5 Wiring Methods

Note: Due to technical upgrades or special orders, if the wiring diagram provided with the instrument differs from this manual, please refer to the included wiring diagram.

The terminal layout of the instrument's rear cover is shown in the diagram:



Note: ① Linear voltage ranges below 100mV should be input via terminals 19 and 18.

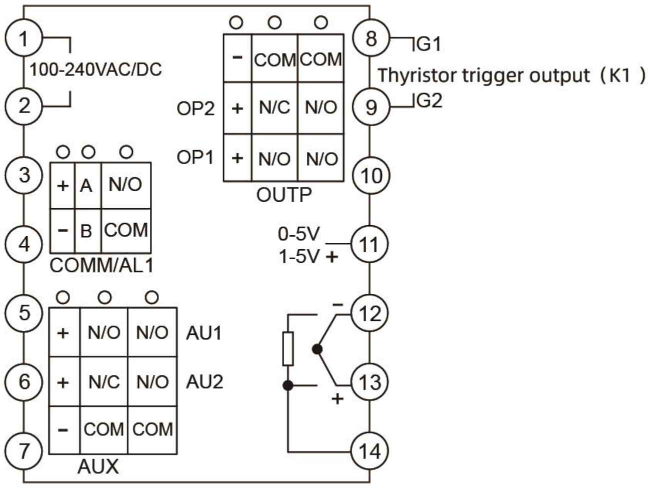
② A 4~20mA linear current input can be converted to a 20~100mV voltage signal using a 5-ohm high-precision resistor, and then input through terminals 18- and 19+.

③ 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.

④ When the main output is current or single-channel SSR voltage output, it is delivered via terminals 13+ and 11-.

⑤ When selecting single-channel relay modules such as L1 or L21, OP1, AL1, and AU1 are normally open contacts, while OP2, AL2, and AU2 are normally closed contacts.

The wiring diagram for the D-type panel instrument (72mm x 72mm) is as follows:

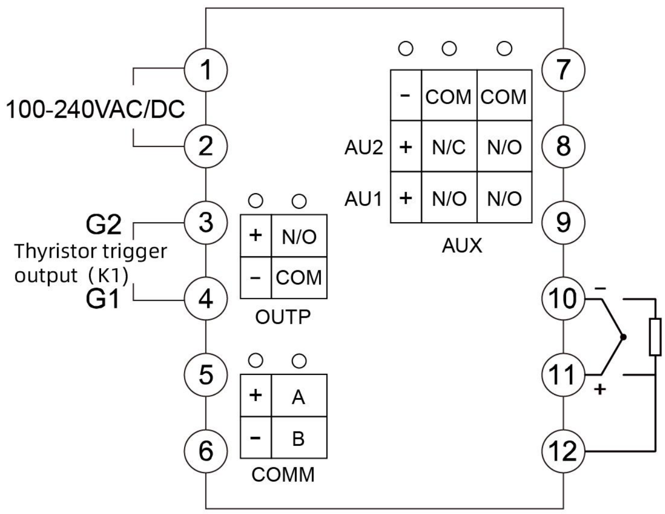


Note 1: Linear voltage ranges below 100mV should be input via terminals 13 and 12. Signals of 0~5V and 1~5V should be input via terminals 11 and 12.

Note 2: A 4~20mA linear current input can be converted to a 1~5V voltage signal using a 250Ω resistor, and then input through terminals 11 and 12.

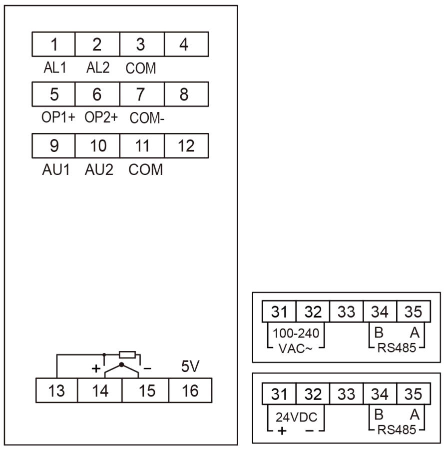
Note 3: When an S or S4 communication interface module is installed in the COMM position, it is used for communication; when a relay, contactless switch, or SSR voltage output module is installed, it is used for AL1 alarm output.

The wiring diagram for the D61 panel instrument (48X48mm) is as follows:



Note 1: For 4~20mA linear current input, use a 5-ohm high-precision resistor to convert it to 20~100mV, then input it through terminals 11 and 10.

The wiring diagram for the D71 panel instrument (22.5X100mm) is as follows:



Note 1: For 0–5V/1–5V input, connect to terminals 15－ and 16+. For inputs below 100mV, connect to terminals 14+ and 15－. For 4–20mA linear current input, convert to 1－5V using a 250Ω resistor, then connect to terminals 15－ and 16+.

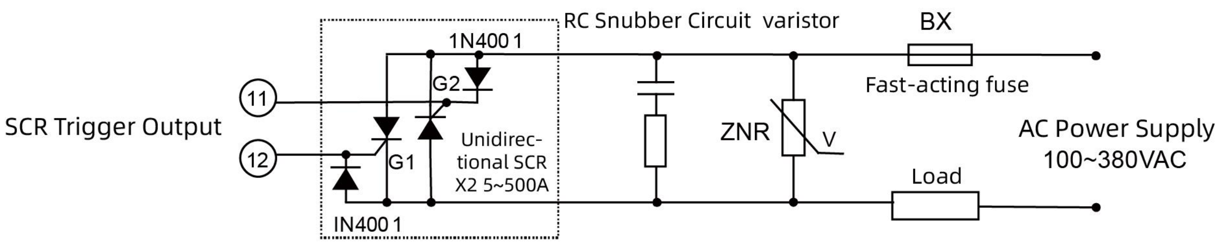
Note 2: The main output module can be selected from G, X3, L2, K1, K50, K60, or W1.

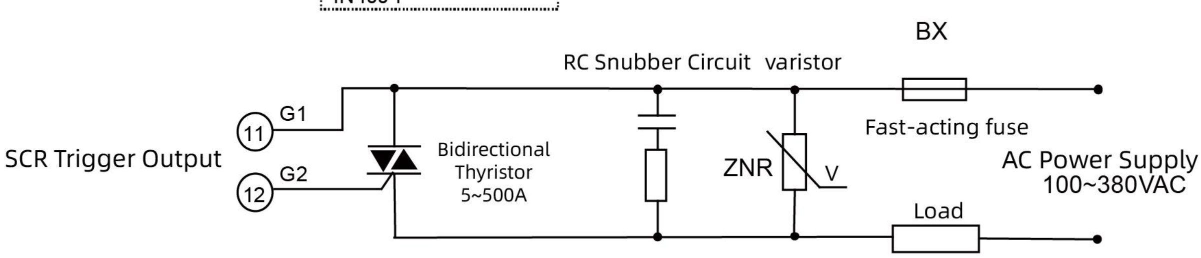
Note 3: This is the new D71 wiring diagram. If the wiring diagram label on the actual device differs from this, please contact the Technical Department for consultation.

Note 1: Select the varistor according to the voltage and current of the load to protect the SCR. For inductive loads or when using phase-shift triggering, a RC snubber must be added.

Note 2: It is recommended to use a SCR power module, each of which contains two unidirectional SCRs, as shown in the dashed section of the diagram.

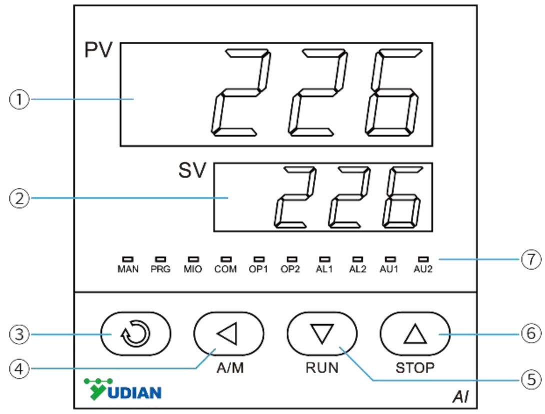
Note 3: When using the K60 module, the power supply should be 380VAC. When using the K50 phase-shift trigger output module, the AC power supply range is reduced to 200~240VAC, and the power frequency must be 50HZ.





2 Display and Operation

2.1 Panel Description



① Upper display window: Display measured values PV, parameter names, etc.

② Lower display window: Display the set value SV, alarm code, parameter values, etc.

③ Set key: Used to enter the parameter setting mode and confirm parameter modifications

④ Data shift (also serves as a fixed-point control operation)

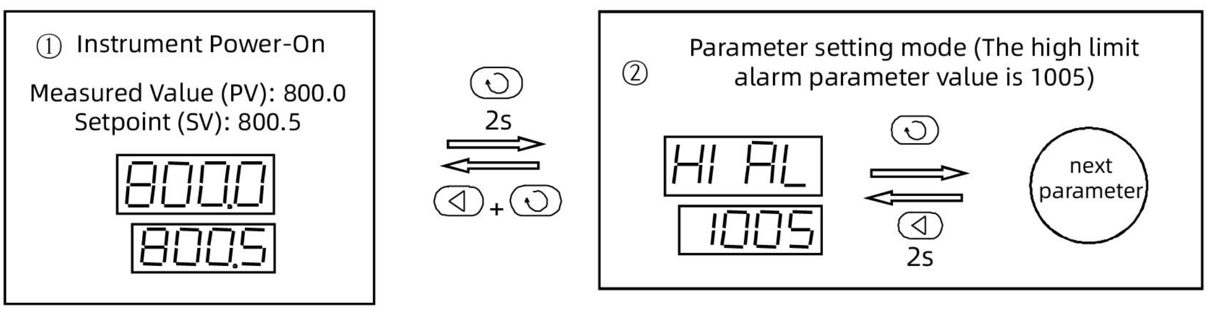
⑤ Data decrease key (also serves as Run/Pause operation)

⑥ Data Increase key (also serves as Stop operation)

⑦ There are 10 LED indicators. The MAN light is not used in this product series. The PRG light indicates that the device is in control operation mode. The MIO, OP1, OP2, AL1, AL2, AU1, AU2, and other lights correspond to various module input and output actions. The COM light indicates communication with the host computer.

power-on. At this time, the upper and lower display windows show the measured value (PV) and setpoint (SV), respectively. The lower display window may also alternately display the following characters to indicate status: ① "orAL": Indicates that the input measurement signal is out of range. ② "HIAL", "LoAL", "HdAL", or "LdAL": Indicate high limit alarm, low limit alarm, deviation high limit alarm, or deviation low limit alarm, respectively. ③ "StoP": Indicates the system is in a stopped state.

2.2 Display State



2.3 Operation Methods

2.3.1 Setting Parameters

Press the ↺ key in the basic display state and hold it for about 2 seconds to enter the customized field parameter setting state. Parameter values can be modified directly by pressing the keys such as ◁, ▽, and △. Press the ▽ key to decrease the value and the △ key to increase the value. The decimal point of the modified value will flash (acting as a cursor). Press and hold the key to quickly increase/decrease the value, with the speed increasing automatically as the decimal point shifts to the right. The users can also press the ◁ key to directly move the position (cursor) and modify the data, making the operation faster. Press the ↺ key to save the modified parameter value and display the next parameter. Hold the ↺ key to go down quickly. Press the ◁ key and hold it for more than 2 seconds to return to display the previous parameter. First press and hold ◁ key, then press the ↺ key again to directly exit the parameter setting mode. If no key is pressed, the instrument will automatically return to the basic display mode after approximately 25 seconds.

2.3.2 Shortcut Operation Functions

All functions of the AI-226 can be completed by modifying parameters. However, for some commonly used functions, such as modifying the setpoint and controlling the program's run/stop operations, shortcut operations have been designed to simplify usage. These shortcut functions can also be disabled to prevent accidental operations.

Setting setpoint: Press the ◁ key to enter the current setpoint modification mode. Then press the ◁, ▽, △ or other keys to directly modify the setpoint value.

Run control: To start the run control, press and hold the ▽ key for approximately 2 seconds until the lower display shows the "run" symbol.

Stop control: Press the "△" key and hold it for about 2 seconds until the lower display shows the "StoP" symbol, which will stop the output control of the instrument.

Auto-tuning AT: Press the ◁ key and hold it for 2 seconds, the At parameter will appear. Press the △key to change the "OFF" to "ON" in the lower display window, then press the ↺ to confirm, the auto-tuning function will begin. (Note: If the instrument's SPr parameter is set to be active and the temperature is in the heating limit state, the auto-tuning will pause and will automatically start after the heating is completed.) The lower display will blink the "At" symbol, and after 2 oscillation cycles of ON-OFF control, the instrument will automatically calculate the PID parameters. To cancel the auto-tuning process in advance, press the ◁ key again and hold it for about 2 seconds to call out the At parameter, then set "ON" to "OFF" and press the ↺ key to confirm. If the instrument is in program run mode, the auto-tuning will cause the program timer to pause to ensure that the setpoint remains unchanged.

Note 1: The AI-226 utilizes an advanced PID control algorithm integrated with AI technology, addressing the issue of overshooting typically associated with standard PID algorithms while offering high control accuracy. This improved PID algorithm is referred to as the APID algorithm. When the instrument is set to use either APID or PID control mode for the first time, the auto-tuning function can be activated to assist in determining the appropriate PID control parameters.

Note 2: The parameter values obtained during auto-tuning may vary with different setpoints. Before performing the auto-tuning function, set the setpoint SV to the most commonly used value or the middle value. If the system is a well-insulated electric furnace, set the setpoint to the maximum value used by the system. The SV value should not be modified during the auto-tuning process. Depending on the system, the time required for auto-tuning can range from several seconds to several hours.

Note 3: The control hysteresis parameter CHYS also affects the results of auto-tuning. Generally, the smaller the CHYS setting, the higher the accuracy of the auto-tuning parameters. However, if the CHYS value is too small, it may cause misoperation in the on/off control due to input fluctuations, which could lead to completely incorrect tuning parameters. CHYS=2.0 is recommended.

Note 4: The control effect immediately after auto-tuning may not be optimal. However, due to the learning function, the best performance will be achieved after running for a period of time.

3 Parameter Function

3.1 Custom Parameter Table

The AI-226's parameter table programmable definition function allows users to define custom parameters for the instrument. To protect important parameters from unauthorized modification, the parameters that need to be displayed or modified on-site are called on-site parameters. The on-site parameter table is a subset of the complete parameter table and can be defined by the user. These parameters can be directly accessed for modification, while the complete parameter table can only be accessed by entering a password. The parameter lock Loc provides various levels of operation permissions and password input for accessing the complete parameter table. Its functions are as follows:

Loc=0: Allow modification of on-site parameters and direct modification of the setpoint in the basic display state.

Loc=1: Prohibit modification of on-site parameters, but allow direct modification of the setpoint in the basic display state.

Loc=2~3: Allow modification of on-site parameters, but prohibit modification of the setpoint and program values operation via shortcuts. However, shortcut operations such as program run/pause/stop and setpoint control are allowed.

Loc=4~255: Prohibit modification of any parameters other than Loc itself, and also disable shortcut operations.

Set Loc=808 and press ⟲ to confirm, the users can enter the display and modify the complete parameter table. Once the complete parameter table is accessed, all parameters except for read-only ones can be modified.

Parameters EP1~EP8 allow users to define 1~8 on-site parameters. If fewer than 8 on-site parameters are needed, the first unused parameter should be defined as nonE. For example, if the required parameter table includes HIAL, HdAL, and At, the EP parameters can be set as follows: EP1=HIAL, EP2=HdAL, EP3=At, EP4=nonE.

Note: Starting from version V9.1, the Loc parameter can be set to restrict communication writing. Please refer to the communication protocol documentation for more details.

3.2 Complete Parameter Table

The complete parameter table is divided into 8 major sections: Alarm, Regulation and Control, Input, Output, System Functions, Setpoint/Program, and On-Site Parameter Definitions. These sections are arranged in the following order:

Parameter	Parameter Meaning	Description	Setting Range
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 output ports such as AL1, AL2, AU1, AU2, or no action at all. Please refer to the later section for 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).	
HdAL	Deviation High Limit 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.	
LdAL	Deviation Low Limit 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).	
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.	

AOP	Alarm Output Definition	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 3 0 1 ; LdAL HdAL LoAL 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. A value of 9 forces the main output OUTP to 0, 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: To use AL2 or AU2, an L3 dual relay module can be installed at the ALM or AUX position.	0~9999
nonc	Normally Open/Normally Closed Selection	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 configured 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.	0~15
CtrL	Control mode	OnoF: Adopt ON-OFF control, 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: The SV value is directly used as the output value.	
Srun	Operating Status	run: Running control state, PRG indicator light is on. StoP: Stop state, with the lower display flashing "StoP" and the PRG light off. HoLd: Hold running control state. If the instrument is set for non-timed constant temperature control, this state is equivalent to the normal operating state, but operation or stop actions are prohibited from the panel.	

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.	
At	Auto-tuning	OFF: The auto-tuning At function is turned off. on: Start the auto-tuning function for PID and Ctl 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 AAT process fails, the auto-tuning process will be terminated, and the PID parameters will not be modified.	
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.	1~9999 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, it is typically set between 0.5-3.0 seconds. When using relay switch outputs or in heating/cooling dual-output control systems, a short control cycle can shorten the lifespan of mechanical switches or cause frequent switching between heating and cooling outputs. If the cycle is too long, it may reduce control accuracy. Therefore, it is generally set between 15-40 seconds, with the recommended Ctl set to 1/5~1/10 of the differential time (which should roughly equal the system's lag time). If the output uses relay switch (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. 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.	0.1~300.0 seconds

<table>
<tr><td>CHYS</td><td>Control Hysteresis (Dead Zone, Hysteresis)</td><td>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.</td><td>0~9999 Unit</td></tr>
<tr><td>InP</td><td>Input Specifications Code</td><td>InP is used to select the input specification, and its value corresponds to the following input specification:
<table>
<tr><td>0 K</td><td>21 Pt100</td></tr>
<tr><td>1 S</td><td>22 Pt100 (-80.00~+300.00℃)</td></tr>
<tr><td>2 R</td><td>25 0~75mV voltage input
0~20mA current input</td></tr>
<tr><td>3 T</td><td>26 0~100 ohm resistor input</td></tr>
<tr><td>4 E</td><td>27 0~400 ohm resistor 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/I45 module for 0~20mA)</td><td>38 10~50mV voltage input</td></tr>
<tr><td>16 MIO Input 2 (Installed withI44/I45 module for 0~20mA)</td><td>39 15~75mV voltage input
4~20mA current input (D61 only, please specify J4 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></td><td></td></tr>
<tr><td>dPt</td><td>Decimal Point Position</td><td>Four display formats are available for selection: 0, 0.0, 0.00, and 0.000.
Note: When using a standard thermocouple or RTD input, only the 0 or 0.0 formats can be selected. Even when the 0 format is selected, an internal resolution of 0.1 ° C is maintained for control calculations. For type S thermocouples, it is recommended to select the 0 format. When INP=17, 18, or 22, the instrument has an internal resolution of 0.01 ° C, and the display formats 0.0 or 0.00 can be selected.</td><td></td></tr>
<tr><td>SCL</td><td>Input Scale Lower 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 Scale Upper 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>Scb</td><td>Input Offset 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: Generally it should be set to 0. Incorrect settings can lead to measurement errors.</td><td>-9990~ +4000 Unit</td></tr>
</table>

FILt	Input Digital Filtering	The FILt determines the strength of the digital filtering. 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 FILt to reduce the instantaneous fluctuations of the measurement value to less than 2~5 counts. When the instrument undergoes metrological verification, FILt should be set to 0 or 1 to improve the response speed. The unit of FILt is 0.5 seconds.	0~100
Fru	Power Supply Frequency and Temperature Unit Selection	50C indicates that the power supply frequency is 50Hz, providing maximum resistance to interference for inputs at this frequency. The temperature unit is℃. 50F indicates that the power supply frequency is 50Hz, providing maximum resistance to interference for inputs at this frequency. The temperature unit is ℉. 60C indicates that the power supply frequency is 60Hz, providing maximum resistance to interference for inputs at this frequency. The temperature unit is ℃ 60F indicates that the power supply frequency is 60Hz, providing maximum resistance to interference for inputs at this frequency. The temperature unit is ℃	
OPt	Output Type	SSr: The output provides SSR driving voltage or zero-crossing trigger time signal for SCR. Modules such as G, K1, or K3 should be selected 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 mechanical contacts' lifespan, the system limits the output cycle to 3-120 seconds. It is generally recommended to set the cycle time to 1/5-1/10 of the system's lag time. 0-20: 0~20mA linear current output, the selection of the X3 or X5/X51 linear current output module is required. 4-20: 4~20mA linear current output, the selection of the X3 or X5/X51 linear current output module is required. PHA1: Single-phase phase-shift output. To achieve phase-shift output, the K50/K60 phase-shift trigger output module must be selected.	
OPL	Output Low Limit	When set to 0~100%, this represents the minimum output limit for the adjustment output OUTP in typical unidirectional control.	0~110%
OPH	Output High Limit	When the measured value PV is lower than the OEF, it limits the maximum output value of the main output OUTP. The OPH setting must be greater than the OPL.	0~110%
OEF	OPH effective 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 only up to 30% of the maximum 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
Addr	Communication Address	The Addr parameter is used to define the instrument communication address, and the valid range is 0~100. Instruments on the same communication line should have different Addr values to distinguish them from each other.	0~100

bAud	COMM Module Function Selection	The bAud parameter defines the communication baud rate, which can be set within the range of 0~28800bit/s (28.8K). When the baud rate exceeds 9600 bit/s and a 4-digit LED display is used, values like 19.20 represent 19200 bit/s. If the COM position is not used for communication, the bAud parameter can be configured to repurpose 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 event input. BAUD=2: Configure the COMM port to output AU1 + AL1. BAUD=3: Configure the COMM port to output AU1 + AU2. 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.	0~28.8K
AF	Advanced Function Code	The AF parameter is used to select the advanced function, and its calculation method is as follows: $AF=A\times1+B\times2+C\times4+D\times8+E\times16+F\times32+G\times64+H\times128$ 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 ON-OFF 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 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: For non-expert users, this parameter can be set to 0.	0~255

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. Note: 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.	0~12
PASd	Password	When PASd is set between 0-255 or AF.D=0, setting Loc=808 allows access to the complete parameter table. When PASd is set between 256-9999 and AF.D=1, Loc=PASd must be set 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.	0-9999
SPL	Setpoint Lower limit	The minimum value allowed to be set for the SP* parameter.	9990~ +30000 Unit
SPH	Setpoint Upper Limit	The maximum value allowed to be set for the SP* parameter.	
PonP	Power-on Automatic 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, it automatically restarts the program from the beginning after power-on. 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: If the instrument is powered off during operation, it will enter a paused 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.	
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.	

3.3 Special Functions Supplementary Notes

3.3.1 Single-Phase Phase-Shift Trigger Output

When OPt is set to PHA1, selecting the K50/K60 module at the OUTP position enables SCR phase-shift trigger output. This allows continuous adjustment of heating power by controlling the conduction angle of the SCRs (either 2 anti-parallel unidirectional SCRs or 1 bidirectional SCR). Additionally, it performs nonlinear power correction based on the characteristics of the sine wave, achieving optimal control performance. The trigger uses self-synchronizing technology, allowing the instrument power supply and the heater power supply to be different. Phase-shift triggering can introduce high-frequency interference into the power grid. When applying this method, ensure that other electrical equipment has sufficient electromagnetic interference resistance. This module is currently only compatible with regions that use a 50Hz power supply.

3.3.2 Alarm Bypass on Power-On

When the instrument is just powered on, it often leads to unnecessary alarms. For example, in electric furnace temperature control (heating control), when powered on, the actual temperature is far below the set temperature. If the user has configured low limit alarms or deviation low limit alarms, the instrument will trigger an alarm immediately upon power-on, even though there may not be any actual issues with the control system. On the contrary, in cooling control (direct-acting control), powering on may lead to high limit alarms or deviation high limit alarms. Therefore, the AI instrument provides a power-on alarm bypass feature. When the Act parameter is set to rEbA or drbA, the instrument will not trigger an alarm immediately upon power-on, even if the corresponding alarm conditions are met. The alarm will only occur if the alarm condition is cleared, and the same condition is met again.

3.3.3 Communication Function

The AI series instruments can be equipped with an S or S4 type RS485 communication interface module at the COMM position to enable multi-device connection with a computer. Through the computer, various operations and functions of the instrument can be controlled. For computers without an RS485 interface, an RS232C/RS485 converter or USB/RS485 converter can be added. Each communication port can directly connect 1-60 instruments, and with the addition of an RS485 repeater, up to 80 instruments can be connected. A single computer can support multiple communication ports for connection. Note that each instrument should be set to a different address. When a large number of instruments are involved, two or more computers can be used, with these computers forming a local network. The manufacturer provides AIFCS application software, which can run on Chinese Windows operating systems. It allows for centralized monitoring and management of 1~120 AI series instruments of various models, and can automatically record measurement data and print reports. If users wish to develop their own configuration software and need to obtain the communication protocol, they can request it for free from the instrument sales personnel. There are various configuration software options available that support communication with AI instruments.

3.3.4 Temperature Transmitter

In addition to conventional APID/PID or ON-OFF control, the instrument can also directly output the measured value (PV) or setpoint value (SV) from the OUTP terminal. When defined as a current output, the AI-226 can function as a temperature transmitter, with a 4~20mA current output accuracy of 0.3% FS corresponding to the displayed value. The related parameter settings are as follows:

CtrL=PoP for the transmitting output PV value and CtrL=SoP for the transmitting output SV value.

OPt: select the output specification, usually select 4~20mA output or 0~20mA output.

Parameters such as InP, SCH, SCL, and Scb are used to select the thermocouple or RTD specification for input, as well as the lower and upper limits of the PV value for the transmitter output and any translation corrections.

For example: The instrument is required to have a K-type thermocouple transmitter function, with a temperature range of 0~400℃ and an output of 4~20mA. Then each parameter is set as follows: InP=0, ScL=0.0, ScH=400.0, OPt=4-20. For the transmitter defined as such, when the temperature is less than or equal to 0℃, selecting the X3 or X5 linear current output module at the OUTP position will output 4mA; when the temperature is 400℃, the output will be 20mA. Between 0~400℃, the output varies continuously between 4mA and 20mA.

3.3.5 Fine Control

Fine control refers to the fact that the resolution of the PID calculation is 10 times higher than the display resolution. For example, while the instrument may display the temperature signal as 1°C, the internal PID calculation and control will still operate with a resolution of 0.1°C. This allows for significantly higher control accuracy compared to the displayed resolution. In previous versions of the AI series instruments, only the temperature signal used fine control mode. In the new version, fine control mode is applied by default for linear inputs whenever the display value range is below 3000 counts (as most industrial applications typically do not exceed 3000). This ensures higher control accuracy and more stable output. However, if a display value range greater than 3000 is required, the setting AF.F = 1 can be used.

3.3.7 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: Input signal and display setting:

A 01=A×1+E×16+G×64

A indicates signal range: A=0, 0~20mV (0-80 ohm); A=1, 0~60mV (0-240 ohm); A=2, 0~100mV (0-400 ohm).

E indicates signal display: E=0, no effect; E=1, the table d00~d59 setting value correspond to the display value.

G indicates signal type: G=0, thermocouple; G=1, RTD.

For example: If the signal is thermocouple input, temperature class, then set A01=2×1+1×16+0×64=18

A02: Starting temperature

A03: Measurement range = Maximum measurement value-A02

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

d00~d59:: Temperature setting value per 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 parameters A00=0, A01=18, 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 set the corresponding temperature point higher or lower. For example, if the instrument displays 200.0°C, but the calibration device measures 202.0°C, 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.

3.3.8 High-Temperature Furnace Nonlinear Power Control Function

For high-temperature furnaces with nonlinear loads, the resistance changes drastically with temperature. Taking a silicon-molybdenum rod furnace as an example, the room temperature resistance is only about 6% of the resistance at 1600°C. If the output power of the instrument is not limited or adjusted, two issues may arise. First, during low-temperature startup, the furnace current may exceed the maximum allowable load of the power grid, SCR, and transformer, potentially damaging the SCR, furnace, and transformer or causing the power grid to trip. Additionally, since the furnace power varies by more than 10 times between the low and high temperature regions at the same instrument output, this means that the proportional band P in the PID parameters must change by more than 10 times across different temperatures to achieve accurate temperature control in both the low and high-temperature regions. Using the OPH limiting parameter method can only limit the output power and cannot adjust the proportional band. To ensure precise temperature control in both low and high-temperature regions, multiple sets of PID parameters must be configured, which not only complicates the setup but also reduces the effectiveness. 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 the parameters A00=1 and A01=1050 are set, the instrument enables the custom output limit transformation function. A02 represents the starting temperature for output limitation, A03 represents the temperature range for output limitation, and A04 represents the segment length for the non-linear data temperature segments. In this case, 1500/750.0=2, which means there are 2 segments. The more segments there are, the more complex and detailed the curve can be. d00 indicates the maximum output power below A02, with the unit being 100% × (1/2000). d00=120.0 represents 6%, d01 represents 55%, and d02 represents 100%.

This curve means that when the temperature is below 100°C, the output power is limited to 6%. Between 100°C and 850°C, the power limit smoothly transitions from 6% to 55%. Between 850°C and 1600°C, the power limit transitions from 55% to 100%. Above 1600°C, there is no power limitation, and it remains at 100%.

Note: The range of d-value is 0~59, which corresponds to a maximum of 60 segments of 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.

4 Frequently Asked Questions

4.1 How to Auto-Tune?

When the measured value PV is at room temperature, set the setpoint SV to approximately 60% of the commonly used temperature (for signals like pressure or flow, the commonly used setpoint value can be directly set). then press and hold for two seconds to call out the At parameter, change the parameter value from OFF to ON and press to confirm to enable auto-tuning. Once the At symbol stops flashing, the instrument will be ready to operate normally.

4.2How to enter the internal parameter list?

Press and hold for two seconds to enter the parameter list, then press briefly to find the next parameter. If the full parameter is locked, find the password lock parameter LOC and set it to 808, then press briefly to view all parameters.

4.3 How to determine whether the instrument has output?

First, check if the OP1 indicator light on the instrument panel is on. If it is not lit, verify whether the instrument is operating properly and check if the instrument parameters are set correctly. If the indicator is on, it means the instrument output status is normal. A multimeter can then used to test whether the output terminal signal is normal. If the output signal is normal but the downstream actuator does not work, trace the output wiring to check for faults in other devices or wiring. If there is no output signal, it can be concluded that the instrument output module is faulty.

4.4 The instrument panel is flashing “orAL”?

This indicates that the instrument has not detected an input signal. First, check whether the sensor model corresponds to the input specification parameter Inp. Then, verify if the wiring to the instrument’s input terminal is correct. If no issues are found, measure whether the signal from the sensor is correct, as the sensor may be damaged.

4.5 How to set the alarm parameters?

First, set the alarm parameter to the desired value (e.g., to set a 200°C high limit alarm, change the HIAL parameter to 200). Then, go to the internal parameters and find the AOP parameter to define the alarm signal output port (e.g., to output the high limit alarm from AL1, set the units digit of the AOP to 1. For specific definition, please refer to the user manual for the AOP parameter description.)

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