AI-8x88/8x68 Multi-Loop Intelligent Controller User Manual

V9.5

Xiamen Yudian Automation Technology Co., Ltd.

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1 Overview

The Yudian AI-8x88 is a multifunctional 8-loop controller with the capability to externally expand a variety of input and output modules. By adding external expansion modules, the AI-8x88 can support up to 96 measurement and control loops, meeting the needs of emerging industries that require compact size and multi-loop control. In the expanded mode, the host computer only needs to communicate with a single instrument to control up to 96 measurement and control loops, significantly improving communication efficiency compared to the model that requires accessing multiple addressable instruments. Its commonly used parameters allow unlimited write operations from the host computer, ensuring that the instrument's internal memory is not damaged by frequent writes. The parameter write restriction feature allows modifications to specific or all instrument parameters only when the Loc is set to a specific value, reducing the possibility of instrument malfunctions caused by errors in communication software programming. Compared to similar products on the market, the AI-8x88 offers many unique advantages, as outlined below:

● Highly reliable and low power consumption design, featuring group pulse anti-interference capability tested up to 8KV, high-temperature resistance validated through 100°C aging tests, and typical power consumption of less than 0.3W without output conditions.

● Expandable up to 96 channels of control outputs and 256 channels of alarm outputs, and with input expandability to 96 analog measurement inputs and 16 switch event input channels. Each output channel has 4 alarm settings and input error alarms, totaling 5 alarm signals. All alarm signals can be defined as independent output or common output to conserve alarm output ports.

● Equipped with a new multi-channel operation interface featuring an LED digital display, it allows quick viewing and modification of parameter settings for any channel. All internal register values of the instrument can be edited, enabling emergency operation even in the event of a host computer failure.

● When selecting different control loop numbers and functions, the usage and register addresses remain identical. This means that customers only need to learn how to use the single model of the AI-8x88 instrument to meet various functional needs, significantly reducing learning costs.

● An operation mode that combines high flexibility and efficiency. The full functionality of the AI-8x88 can be realized through reading and writing register parameters. Its registers are divided into channel parameters, input/output group parameters, and common parameters. Channel parameters are independently set for each channel, with 12 parameters per channel, including setpoint, PID parameters, and alarm parameters. Input/output parameters each have 4 different configuration groups, which can be selected and applied by the respective input and output channels. Common parameters are global parameters used across the system, such as baud rate and communication address. Based

on the parameter group definition model, the AI-8x88 can significantly reduce the total number of registers while maintaining flexibility and powerful functionality. This simplifies the operating mode and improves the read/write efficiency of the host computer. For example, if the 96 input loops of the AI-8x88 have uniform specifications, all input parameters can be configured using the 1st parameter group, which means that only 1 set of input configuration parameters needs to be set to define the input specifications for all loops. Alternatively, different parameter groups can be selected to define different input specification types. An AI-8x88 can define up to 4 different types of input specifications, which is sufficient for most application scenarios.

● The AI-8x88 allows virtually unlimited expansion of input and output modules and can be quickly customized to meet customer requirements. When no new mold development is required, the customization cycle is as short as approximately 2 weeks. Additionally, the system reserves a portion of spare registers to facilitate the addition of new functions for customers.

2 Model Definition

The AI-8x88 multi-loop controller host features a modular design for its internal I/O, allowing up to 3 modules to be installed. The modules can be selected and freely combined based on specific needs. The instrument consists of 7 parts, for example:

AI-8688	D91	J1	G71	G71	G61	S2	-24VDC
①	②	③	④	⑤	⑥	⑦	⑧

This indicates that a single instrument: ① The basic function is AI-8688; ② D71 rail mounting size, with 4-digit digital display; ③ J1 indicates a thermocouple input type (a fixed input type, not modular);

④ and ⑤ are equipped with G71, providing 8 NPN outputs, which can be used for control; ⑥ Equipped with G61, supporting 2 NPN outputs, which can be used for alarms; ⑦ A fixed 485 communication module S2; ⑧ The instrument power supply is 24VDC. The meanings of each part in the instrument model are as follows:

① indicates the basic function of the instrument

8688 represents a 0.15 accuracy, 8-channel controller with 8 thermocouple inputs, non-isolated input type, available in D71/D72 sizes. When paired with D92J0, it supports 8 three-wire RTD inputs.

8688G represents a 0.15 accuracy, 8-channel controller with 8 thermocouple inputs, isolated input type, available in D71/D72/D91/D92 sizes. D71/D72/D91 sizes have isolation every two channels, while D92 has isolation per channel.

8668G represents a 0.15 accuracy, 6-channel controller with 6 thermocouple inputs, isolated input type, currently available only in D91 size.

8288 represents a 0.3 accuracy, 8-channel controller with 8 thermocouple inputs, non-isolated input type, available in D71/D72/D91 sizes.

8188 represents an 8-channel controller with 8 thermocouple inputs, non-isolated input type, an industry-custom model. Please consult the salesperson for details.

② indicates the instrument size

D71 rail-mounted size, with a width of only 22.5mm, DIN rail mounting mode, double-row LED display, with button operation, power and communication using pluggable bus terminals, and a 4-digit digital display panel.

D72 rail-mounted size, single-row 2-digit digital display panel, showing the instrument communication address.

D91 rail-mounted size, double-row LED display, with button operation.

D92 rail-mounted size, no display or buttons, can be set and operated via communication or by connecting an external E85 keyboard and display.

(Note: The D91/D92 sizes can only be connected to low-voltage circuits. This includes using relay modules such as L21 and L3, which can only handle low-voltage circuits. To control high-voltage circuits, a 24V intermediate relay should be used in series, and the intermediate relay's output should be used to control the high-voltage circuit.)

③ indicates supported input type (fixed input type, non-modular)

J0 indicates a three-wire RTD input, temporarily only supports the D92 size

J1 indicates thermocouple input

④ indicates the specification of the module to be installed for the first output (OUTP) of the instrument: Modules such as G3, G6, G61, G62, etc., can be installed in the D71/D72 size. Modules such as G7, G71, X74, etc., can be installed in the D91/D92 size.

⑤ indicates the module specifications to be installed for the second output (AUX) of the instrument: Modules such as G3, G6, G61, G62, etc., can be installed in the D71/D72 size. Modules such as G7, G71, X74, etc., can be installed in the D91/D92 size.

⑥ indicates the specifications of the module to be installed for the third output (ALM) of the instrument: Modules such as G3, G6, G61, G62, etc., can be installed.

⑦ Fixed 485 communication module S2, supports MODBUS-RTU protocol.

⑧ **indicates instrument power supply**; The 8x88 fixed power supply is 24VDC.

Note 1: This instrument uses automatic zeroing and digital calibration technology, making it a

maintenance-free instrument. If the instrument fails to meet calibration standards, it can usually be restored to accuracy 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.

Note 2: The instrument is free of charge for repair during the warranty period. If the instrument requires repair, please provide a description of the failure symptoms and causes to ensure proper and comprehensive repairs.

Note 3: Commonly used module models and functions are as follows:

Module Name	Functional Description
G6	Three-channel isolated solid-state relay driver voltage output module (12V/30mA, non-energy-saving type).
G61	Three-channel isolated NPN output, can be externally connected to 5~24VDC to drive SSR or intermediate relay, maximum external voltage 28VDC, maximum drive current per channel 100mA
G7	Four-channel isolated solid-state relay driver voltage output module (12V/12mA, non-energy-saving type), for D91/D92 size.
G71	Four-channel isolated NPN output, can be externally connected to 5~24VDC to drive SSR or intermediate relay, maximum external voltage 28VDC, maximum drive current per channel 100mA, for D91/D92 size
X72	Two-channel optical isolated linear current output module with built-in isolated power supply (does not occupy internal isolated power supply of the instrument), maximum output voltage greater than 6V.
X73	Three-channel optical isolated linear current output module with built-in isolated power supply (does not occupy internal isolated power supply of the instrument), maximum output voltage greater than 6V.
X74	Four-channel optical isolated linear current output module with built-in isolated power supply (does not occupy internal isolated power supply of the instrument), maximum output voltage greater than 6V, for D91/D92 size.
G62	Three-channel isolated PNP output, can be externally connected to 5~24VDC to drive SSR or intermediate relay, maximum external voltage 28VDC, maximum drive current per channel 100mA

Note: For other unlisted modules, please refer to the selection manual or contact technical support.

3 Technical Specifications

●**Communication Method:**

Bottom RS485 bus terminal; Support MODBUS-RTU protocol; Baud rate adjustable from 4,800 to 115,200.

The bottom RS485 bus terminal can connect to the company's TCP-MODBUS and EtherCAT communication controllers, supporting related communication protocols.

Internal dedicated communication protocol is adopted between the host, slave, and expansion modules, with a reliable communication distance of 30m.

Communication delay: the communication delay of each input or output expansion module node is approximately 10mS (including data transmission time) when connected in series.

●**Input Specifications:**

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

RTD: Cu50, Pt100, Ni120, etc.

Linear voltage: 0~75mV, 0~20mV, 0~50mV, etc.

External expansion input modules: See relevant expansion input module specifications for performance details.

●**Measurement Range:** Measurement range:K(-200~+1300℃), S(-50~+1700℃), R(-50~+1700℃), T(-200~+350℃), E(0~800℃), J(0~1000℃), B(200~1800℃), N(0-1300℃), WRe3-WRe25 (0~2300℃), WRe5-WRe26(0~2300℃),

Cu50(-50~+150℃), Pt100(-200~+800℃), Pt100(-200.00~+300.00℃)

Linear input: -9,990~+32,000, defined by user

●**Measurement Accuracy:** 0.15 class (AI-8688); 0.3 class (AI-8288).

●**Measurement Temperature Drift:** ≤75PPm/°C (AI-8688); ≤125PPm/°C (AI-8288)

●**Control Cycle:** Minimum 20mS (single-loop control); for multiple loops, each loop occupies 10mS.

● **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

Manual control mode

● **Output Specifications (Modular):**

Linear current output: 0~20mA; 4~20mA, resolution approximately 20,000 counts, maximum load 260 ohms (energy-saving type) or 525 ohms

Linear voltage output: 1~5V; 0~10V, etc., resolution approximately 10,000~20,000 counts

SSR drive output: 5VDC/30mA (energy-saving type) or 12VDC/30mA

NPN or PNP switching output: Maximum voltage 28V, maximum current 100mA. When driving a relay coil, a fast-recovery diode must be connected in parallel with the relay coil to absorb reverse voltage

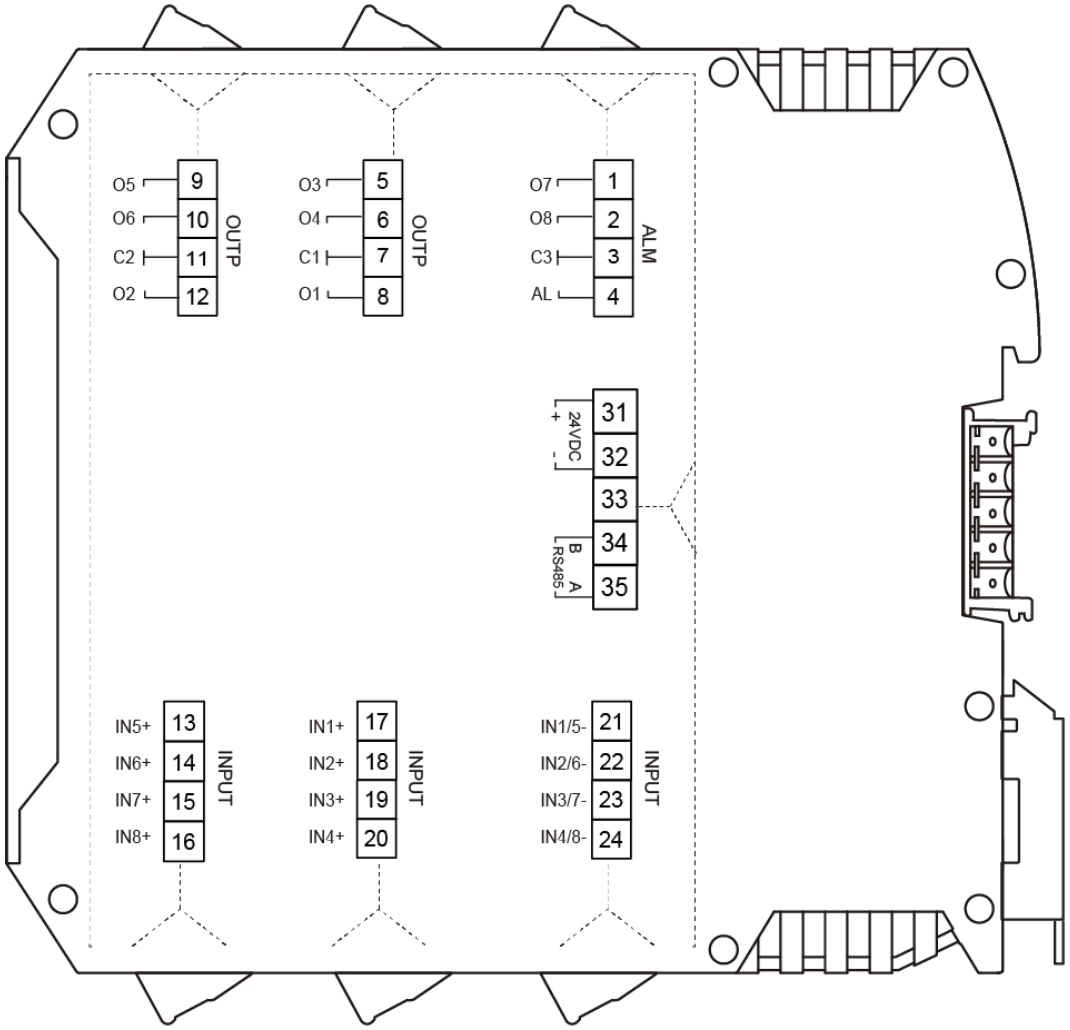
When using external expansion output modules, refer to the relevant module user manual for

technical specifications

- **Alarm Functions:** high limit, low limit, deviation high limit, deviation low limit, and other methods
- **Electromagnetic Compatibility:** IEC61000-4-4 (Electrical Fast Transient) ±6KV/5KHz, IEC61000-4-5 (Surge) 6KV, and the instrument operates without freezing or malfunctioning of I/O ports under 10V/m high-frequency electromagnetic interference, with measurement value fluctuation not exceeding ±5% of the full scale
- **Isolation Withstand Voltage:** ≥2300V between the power supply, relay contacts, and signal terminals; ≥600V between mutually isolated low-voltage signal terminals
- **Power Supply:** 24VDC, -15%, +10%
- **Power Consumption:** ≤0.3W (when there is no output or external power feeding consumption); total maximum power consumption of the entire unit ≤3W
- **Operating Environment:** Temperature -10~60℃; Humidity ≤90%RH

4 Wiring Methods

4.1 D71 Host Wiring Diagram



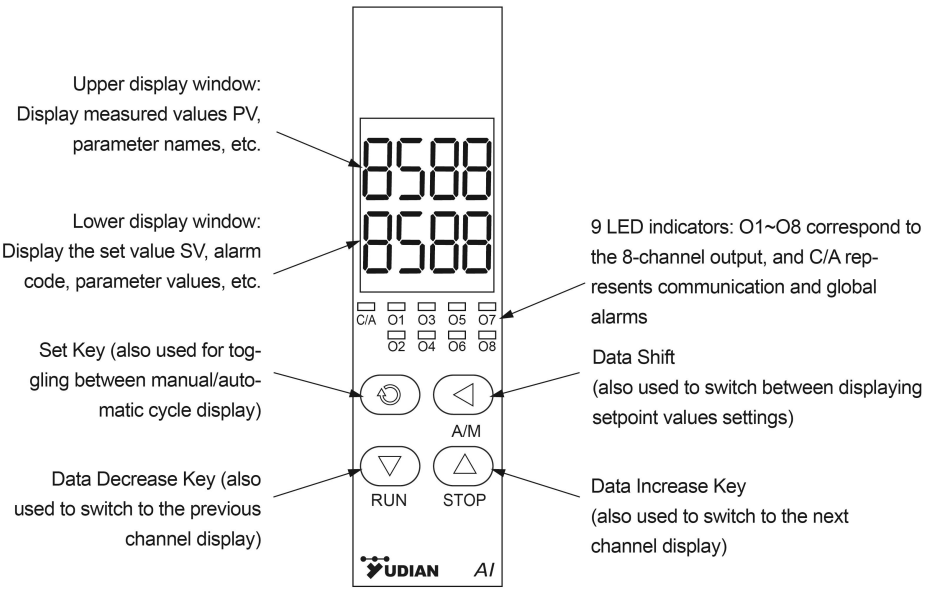
Note 1: This wiring diagram is for reference only. Depending on the configuration and version, the actual wiring diagram provided with the instrument may differ from this manual. Please refer to the provided wiring diagram.

Note 2: If the RS422 interface is selected, the host will be unable to output O7 and O8. An additional expansion output module is required to enable control for the 7th and 8th channels.

5 Display Panel and Keyboard Operation Instructions

5.1 Panel Description

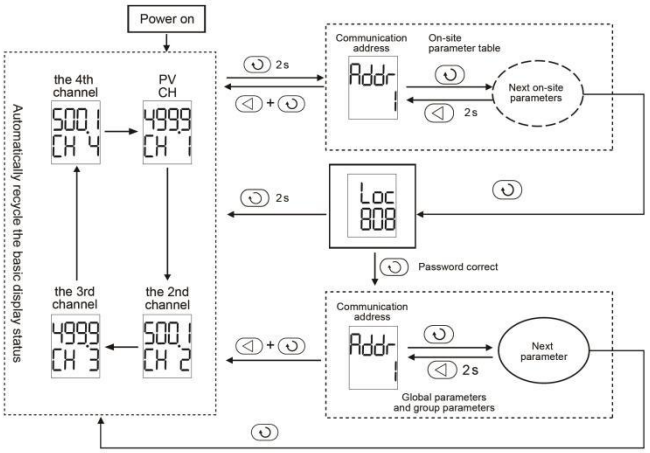
The AI-8x88 comes with a display panel and keyboard operation function, allowing quick viewing and modification of parameters using the Yudian panel-mounted instrument operating style. In the event of a host computer failure or when it is inconvenient to use, operations can still be easily performed directly on the device.



After the instrument is powered on, it will automatically cycle through the measurement values of each channel. By pressing the Up or Down keys, users can quickly switch between channels and fix the display of a particular channel's measurement value. At this point, pressing the Set Key will display the setpoint of the selected channel for approximately 2 seconds. After automatically exiting, the display will return to the automatic cycling mode for measurement values. Pressing the Shift Key allows entry into the setpoint setting mode for the currently displayed channel.

5.2 Global and Group Parameter Setting Methods

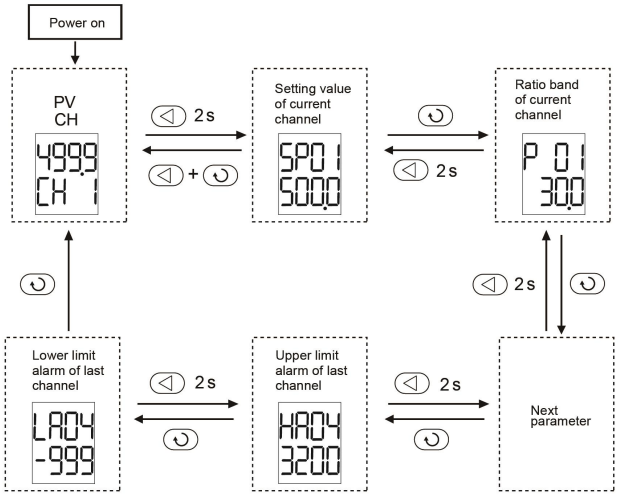
Long press and hold the Set Key to enter the group and global parameter setting mode. Initially, the quick parameters defined by the EP parameters will be displayed. Continuing to press the Set Key will display the LOC parameters. After unlocking, the 4 preset input/output configuration parameters and global function parameters can be displayed and configured. In the parameter setting mode, long pressing the



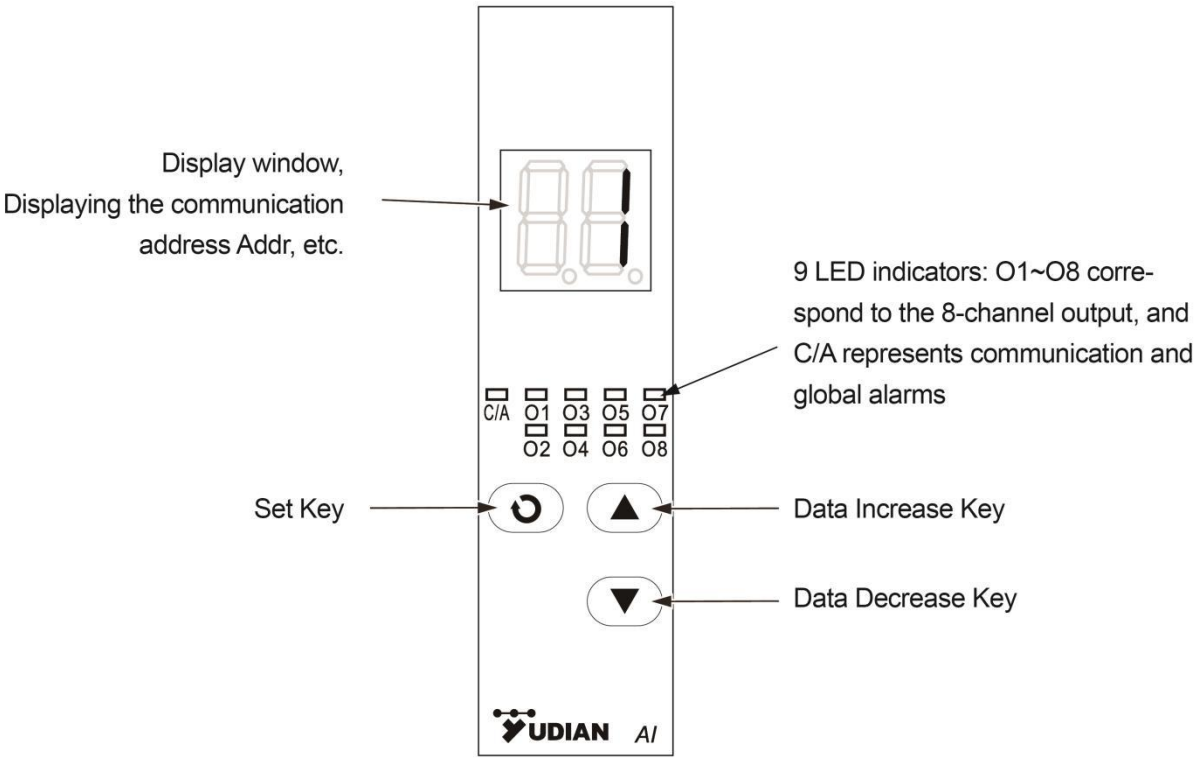
Shift Key will return to the previous parameter. If the Set Key is pressed simultaneously, the user can exit the parameter setting mode immediately.

5.3 Channel Parameter Setting Methods

Long pressing the Shift Key will enter the parameter setting mode for the currently displayed channel. Users can view and modify setpoint values, PID parameters, etc. If the parameter lock Loc is unlocked, the values can be modified. In the parameter setting mode, long pressing the Shift Key will return to the previous parameter. If the Set Key is pressed simultaneously, the user can exit the parameter setting mode immediately.

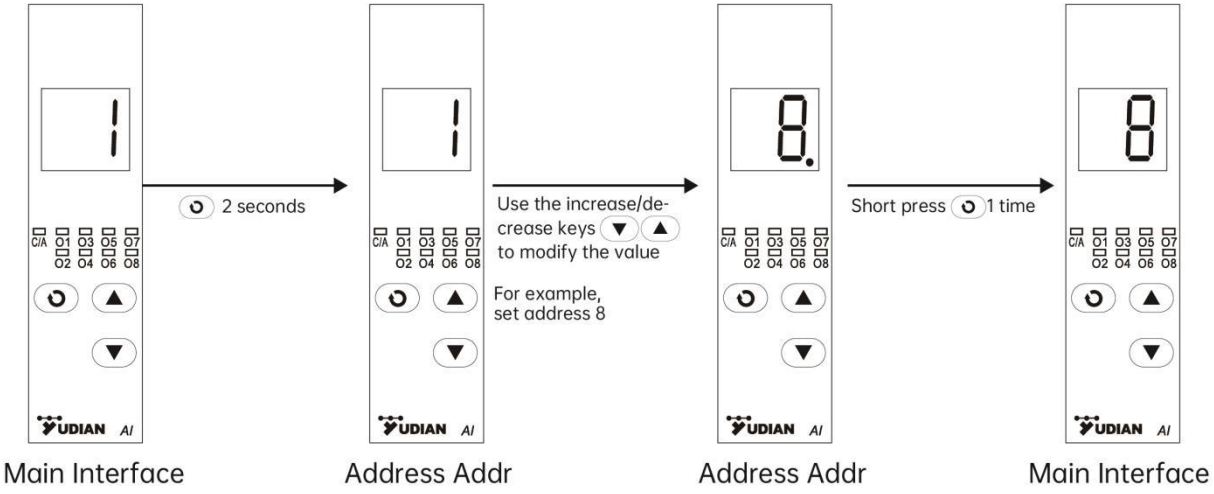


5.4 D72 Panel Description



5.5 D72 Operating Instructions

Power on to enter the main interface. Long press the Set Key for two seconds to enter the address Addr setting interface. Use the increase/decrease keys to modify the value. Press the Set Key once more to save the changes and return to the main interface.

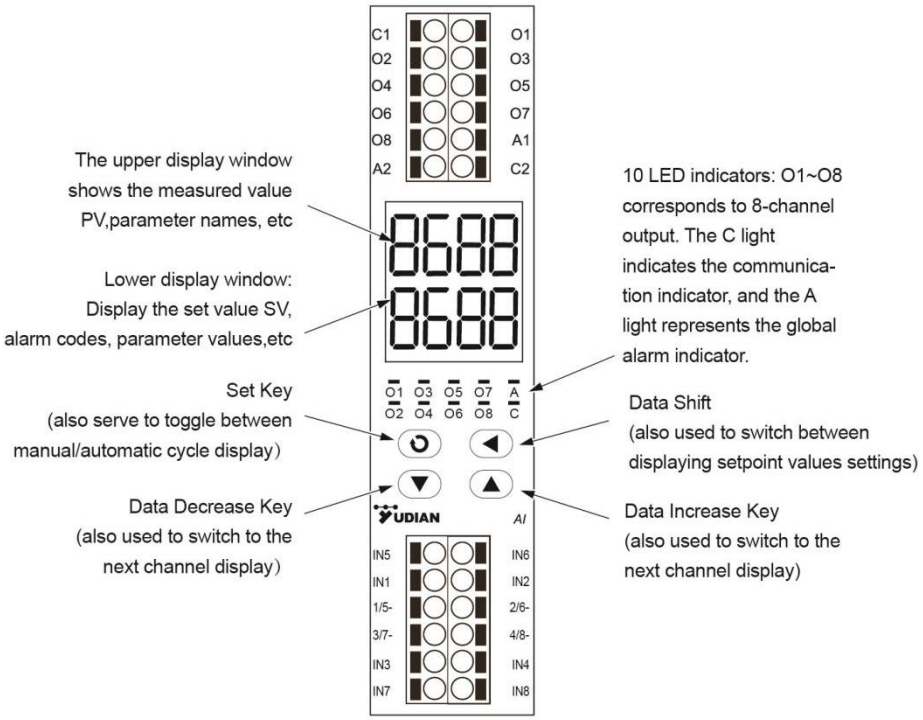


When selecting the D72 size, the address and baud rate are automatically associated with the default settings:

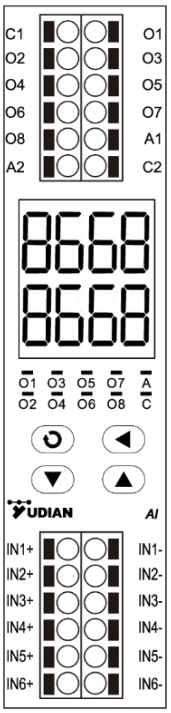
When ADDR=1-31, the host computer can communicate using addresses 1-31 and a baud rate of 19200. The window displays 1-31.

When ADDR=33-63, the host computer can communicate using addresses 1-31 and a baud rate of 38400. The window displays 1-31.

5.6 8688D91 Panel and Wiring Description



▲ 8-channel thermocouple input wiring diagram



▲ 6-channel thermocouple input wiring diagram

The D91 comes with a display panel and keyboard operation functionality, allowing for quick viewing and modification of various parameters using the Yudian panel-mounted instrument operating style. In the event of a host computer failure or when it is inconvenient to use, operations can still be easily performed directly on the device.

After the instrument is powered on, it will automatically cycle through the measurement values of each channel. By pressing the Up or Down keys, users can quickly switch between channels and fix the display of a particular channel's measurement value. At this point, pressing the Set Key will display the setpoint of the selected channel for approximately 2 seconds. After automatically exiting, the display will return to the automatic cycling mode for measurement values. Pressing the Shift Key allows entry into the setpoint setting mode for the currently displayed channel.

The 8-channel thermocouple input wiring is as follows: IN1 and 1/5-, IN2 and 2/6-, IN3 and 3/7-, IN4 and 4/8-, IN5 and 1/5-, IN6 and 2/6-, IN7
3/7-, IN8 and 4/8-.

The 6-channel thermocouple input wiring is as follows: IN1+ and IN1-, IN2+ and IN2-, IN3+ and

IN3-, IN4+ and IN4-, IN5+ and IN5-, IN6+ and IN6-.

Main output O1~O8, with the common terminal as C1. Depend on the number of channels of the instrument. For example, if the instrument has 4 channels, only O1~O4 are available.

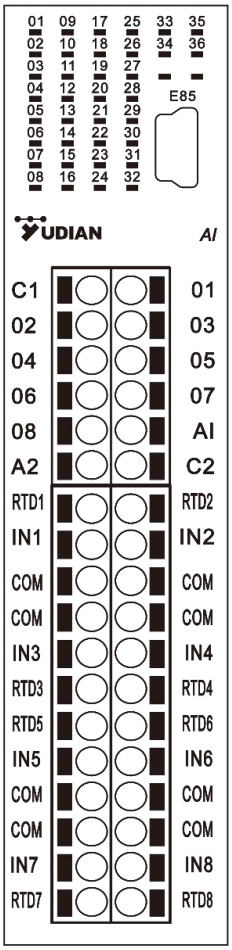
Alarm output A1/A2, with the common terminal as C2.

When installing active output modules such as G5, G7, X74, X72, C1 and C2 are the negative terminals, while O1~O8, A1, and A2 are the positive terminals corresponding to the output logic.

When installing NPN output modules such as G71 or G61, the common terminals C1 and C2 should be connected to the negative terminal of the 24V switch power supply. The outputs O1~O8, A1, and A2 should be connected to the negative terminal of the rear-end solid-state relays (or other devices), while the positive terminal of the solid-state relays (or other devices) should be connected to the positive terminal of the 24V switch power supply.

When installing relay modules such as L21 or L3 for ALM, C2 is the common terminal, and A1 and A2 are the alarm output logic points AL1 and AL2. Note that only low voltage (below 28V) can pass through.

5.7 D92 Panel and Wiring Description



The D92 model itself does not have a built-in display or keyboard. It can be connected to a host computer or touchscreen via the RS485 communication interface to enable the display and operation functions. Alternatively, an external E85 keyboard and display can be used for display and parameter settings.

The 8-channel three-wire RTD input wiring is connected to RTDX, INX, and COM. For the first channel, 2 wires with the same color or a very small resistance value are connected to IN1 and COM, and the remaining wire of the RTD is connected to RTD1.

Main output O1~O8, with the common terminal as C1.

Alarm output A1/A2, with the common terminal as C2.

The indicator D33 stays on during normal operation, turns off during alarms, D34 flashes during communication, and D35 lights up when there is an alarm. Other indicators are not currently in use.

6 Communication Protocol and Parameter Register Description

The AI-8x88 instrument can connect to the host computer via an RS485 serial port, or it can connect to the host computer through the Yudian TCP-Modbus or EtherCAT communication controller. The AI-8x88 uses an asynchronous serial communication interface, with the interface level compliant with the specifications in the RS485 standard. The data format consists of 1 start bit, 8 data bits, no parity bit or even parity bit, and 1 stop bit. The communication baud rate can be adjusted from 4,800 to 115,200 bps. If the baud rate exceeds 28,800 bps, an optional high-speed optocoupler communication module is required. For long communication distances, a baud rate of 4,800 bps is recommended.

The AI-8x88 supports the MODBUS-RTU protocol with the following commands: 03H (read parameters and data), 06H (write a single parameter), and 10H (write multiple parameters). It can communicate with other MODBUS devices. To ensure the communication speed, the AI instrument uses RTU (binary) mode. The communication interface settings allow for the selection of 1~2 stop bits, with no parity or even parity.

For the 03H command, a maximum of 32 datas can be read at a time, with each data being 2 bytes. For example, to read 2 data, the command would be as follows:

Instrument address	Read command (function code)	Read parameter address code	Read data length	Check code
XXH	03H	00H 01H	00H 02H	CRC

For the 06H command, one data is written at a time. The command sent would be:

Instrument address	Write command (function code)	Write parameter address code	Write data value	Check code
XXH	06H	00H 01H	03H E8H	CRC

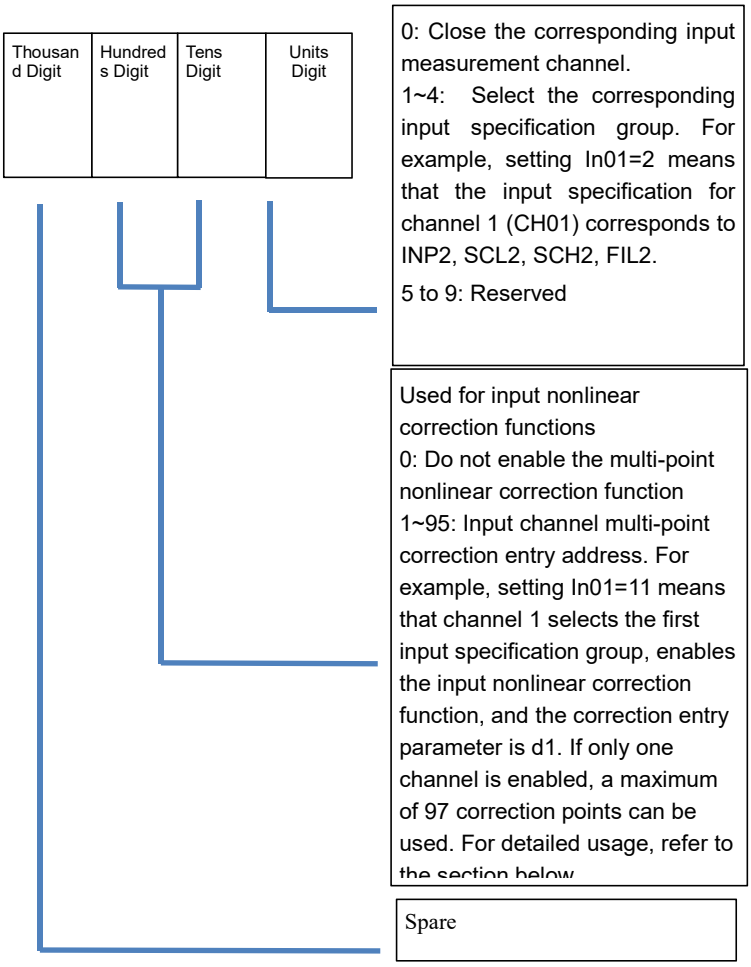
The format for the 10H write command allows a maximum of 16 data (32 bytes) to be written at a time. For example, the command to write a single data would be:

Instrument address	Write command	Write parameter address code	Write number of data	Write bytes	Write data value	Check code
XXH	10H	00H 01H	00H 01H	02H	03H E8H	CRC

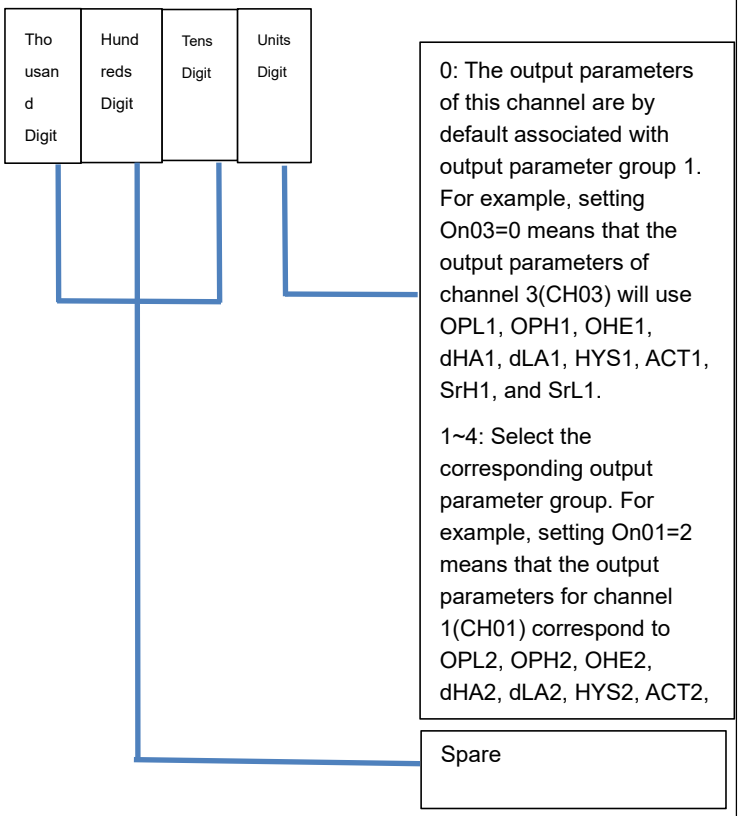
The AI-8x88 features 96 sets of channel-independent parameters. Each channel includes 12 parameters: setpoint, proportional band, integral time, derivative time, control mode, output value (also serves as manual value input setting), control output parameter group number and table programming entry address, input channel and allocation of setpoint and PID parameter group, input specification group and input table correction entry address, input offset correction, high limit alarm, and low limit

alarm. The configuration group parameters consist of 4 input configuration groups and 4 control output configuration groups (including alarm settings) parameters. Measurement input group parameters include input specifications, filter intensity, scale lower limit, scale upper limit, and other parameters. Output group parameters include output limits, positive and negative deviation alarms, hysteresis, and function configuration parameters. These configuration group parameters apply only to the channels that select the corresponding group parameters. In addition, there are global parameters such as communication address and baud rate. Global parameters are valid for all channels. The parameter addresses are listed in the table below (Note: Depending on the model, some products may not have all parameters).

Hexadecimal Parameter Code	Decimal Parameter Code	Parameter Name	Functional Description
0000H~005FH	0000~0095	SP01~SP96 Group 1~96 Preset Setpoints	Setting range: -9990~32000. The setpoint and PID together form a parameter group consisting of 4 parameters. Output channels can select different groups as setpoint and PID parameters via the PnXX parameter. Typically, the output channel number and PID parameter group number are the same, but the output channel can also switch to choose different setpoint and PID parameter groups. Different output channels can share the same PID and setpoint parameter groups.
0060H~00BFH	0096~0191	P01~P96 Proportional Band	Setting range: 0~32000, with the same unit as the setpoint.
00C0H~011FH	0192~0287	I 01~I 96 Integral Time	Unit: 0.1 seconds, setting range: 0.0~3200.0 seconds.
0120H~017FH	0288~0383	d01~d96 Derivative Time	Unit: 0.01 seconds, setting range: -327.60~+327.60 seconds. (The maximum result for auto-tuning is +327.60. For larger values, you can manually write the value as an unsigned 16-bit number, which will be displayed as the corresponding signed 16-bit value on the table.)
0180H~01DFH	0384~0479	In01~In96 Input Channel Configuration Parameter Group Selection	Setting range 0~9999. The unit digit is set to 1~4 to select the input specification group for the configured measurement channel. Setting it to 0 disables measurement for that channel. The tens and hundreds digits configure the multi-segment curve correction address for the measurement channel. Setting it to 0 disables the

			correction. For example, setting In01=112 means that Channel 1 selects the 2nd input configuration parameter group, and the multi-segment curve correction entry address for that channel is d11.
		In01~In96 Input Channel Configuration Parameter Group Selection Description	
01E0H~ 023FH	0480~ 0575	Sc01~Sc96 Input Channel Measurement Value Offset	Setting range: -9990~32000, used for offsetting and correcting the measurement value. Specifically, if the input channel measurement is disabled, the physical measurement value will be 0. Writing this value is equivalent to assigning the measurement value for that channel via the host computer or program.

0240H~ 029FH	0576~067 1	On01~On96 Output Channel Configuration	Setting range 0~9999. The unit digit is set to 1~4 to select the output channel configuration parameter group. The tens, hundreds, and thousands digits are reserved for future use. When the default value is 0, it is associated

		Parameters	with output parameter group 1.
		On01~On96 Output Channel Configuration Parameters Description	
029FH~ 02FFH	0672~0767	Pn01~ Pn96	Alternate parameter, this parameter must be fixed at 0 for this model.

0300H~ 035FH	0768~ 0863	At01~At96 Output Channel Operating Mode	Setting to 0 enables APID, representing a PID control algorithm with AI functionality. Setting to 1 activates Auto-Tuning At. Setting to 2 enables ON/OFF control mode. Setting to 3 enables manual control mode. Setting to 4 stops control and disables output. Setting to 1XX defines a cascade control mode for the secondary controller (inner loop), where the setpoint of this channel will be defined by the parameters LA and SP as the lower and upper limits, respectively. For example, setting At10=101 means that the setpoint for channel 10 will be calculated as: Setpoint=LA10+(SP10-LA10)*OP01/25600. Note that if the measurement value PV10 is lower than LA10, the low limit alarm will still be triggered. If SP10 is smaller than LA10, cascade control will not be performed. Setting

<table>
<tr><td></td><td></td><td></td><td>to 2XX disables PID control. The output of this channel will proportionally follow the output of channel XX, with the proportional band parameter setting the relative output proportion from 0~3200.0%. For example, setting At10=206 means that the output value OP10 for channel 10 is calculated as OP10=OP6*P10*0.1%. Here, OP10 follows the output of OP6, and the P10 value is expressed in units of 0.1%. The valid range of this function XX is 1~16.</td></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>AT01~AT96 Definition Description</th><th>Function</th><th>Description</th></tr>
<tr><td>0</td><td>APID Control Mode</td><td>Indicate that the channel executes APID, which is the PID control algorithm with AI functionality.</td></tr>
<tr><td>2</td><td>Bit Control Mode</td><td>The channel executes the ON/OFF bit control mode.</td></tr>
<tr><td>3</td><td>Manual Output Mode</td><td>Switch the channel to manual mode, allowing the output size to be adjusted by modifying OPxx.</td></tr>
<tr><td>4</td><td>Stop Control</td><td>The channel stops control and disables output.</td></tr>
<tr><td>1xx</td><td>Cascade Control Mode</td><td>Set to 1XX (where XX represents the channel number) to define a cascade control secondary control (inner loop) mode. The setpoint for this channel will be defined by the parameters LA and SP as the lower and upper limits, respectively. For example, setting At10=101 means the setpoint for channel 10 =LA10+(SP10-LA10)*OP01/25600. Note: If the measured value PV10 is lower than LA10, the low limit alarm will still be triggered. If SP10 is less than LA10, cascade control functionality will not be executed.</td></tr>
<tr><td>2xx</td><td>Follow Output Mode</td><td>Set to 2xx, the PID control is not executed, and the output of this channel follows the output of channel XX in proportion. The proportional band parameter can be used to adjust the relative output ratio in the range of 0~3200.0%.
For example: At10=206, it indicates the output value of channel 10 is calculated as OP10 = OP6 * P10 * 0.1%, which means OP10 follows OP6 output, with P10 being expressed in units of 0.1%. The valid range for the channel number xx in this function is 1~16</td></tr>
</table>
</td></tr>
<tr><td>0360H~03BFH</td><td>0864~0959</td><td>OP01~OP96 Output Channel Output Value</td><td>In automatic mode, this channel is read-only and represents the PID control output value (for ON/OFF control, 0 means off and 25650 means on). In manual mode, this channel is both readable and writable, and the</td></tr>
</table>

			written value can serve as the manual output control value. The value 25600 indicates 100% output.
03C0H~ 041FH	0960~ 1055	HA01 ~HA96 Multifunctional Parameter 1	Setting range:-9990~32000, multifunctional parameter. By default, it used as the high limit alarm value for the measurement value selected by the 1st output channel. It can also be defined as a positive deviation alarm or used for scaling definition in transmission output, etc.
0420H~ 047FH	1056~ 1151	LA01~LA96 Multifunctional Parameter 2	Setting range: -9990~32000, multifunctional parameter. By default, it serves as the low limit alarm value for the measurement value selected by the 1st output channel. It can also be configured as a negative deviation alarm, etc.
0480H~ 04DFH	1152~ 1247	SV1~SV96 PID Actual Setpoint	In the ordinary fixed-point temperature control mode, this is simply equal to SP1~SP96. Note that in modes with heating/cooling slope control or secondary control mode in cascade control, it is not equal to SP1~SP96. When the heating/cooling slope limit function is available, the start setpoint can be defined by writing this parameter. At the same time, by inputting data for multiple channels , synchronized heating and cooling curves for multiple channels can be achieved.
04E0H~ 05FFH	1248~ 1535	Alternate Address	Reserved for future version upgrades. Please do not use.
0600H ~065FH	1536~ 1631	Channel 1~96 Measurement Value	Read only; if the measurement value needs to be transmitted from the host computer, the channel can be closed and the Sc parameter written to achieve this. The system will automatically refresh this parameter.
0680H~ 06AFH	1664~ 1711	Alarm Status, 48 Parameters	Each parameter contains the alarm status for two channels. The high byte corresponds to the odd-numbered channel, and the low byte corresponds to the even-numbered channel. BIT0 to BIT4 correspond to the following alarms: input error, HA, LA, dHA, and dLA. When the alarm lock function is enabled, this parameter can be written to unlock.

		Alarm Status Bits		**Description (x or xx represents the channel number)**
		Even channels e.g. CH02	Bit0	0: Sensor input signal is normal 1: Sensor input error or input signal exceeds the range oral
			Bit1	0: Input signal does not exceed the set upper limit HAxx value 1: Input signal exceeds the set upper limit HAxx value, triggering HA alarm
			Bit2	0: Input signal does not exceed the set lower limit LAxx value 1: Input signal exceeds the set lower limit LAxx value, triggering LA alarm
			Bit3	0: Input signal does not exceed the set upper limit deviation dHALx value 1: Input signal exceeds the set upper limit deviation dHAx value, triggering dHA alarm
			Bit4	0: Input signal does not exceed the set lower limit deviation dLAx value 1: Input signal exceeds the set lower deviation dLAx value, triggering dLA alarm
			Bit5~bit7	Spare
		Odd Numbered Channels e.g. CH01	Bit8	0: Sensor input signal is normal 1: Sensor input error or input signal exceeds the range oral
			Bit9	0: Input signal does not exceed the set upper limit HAxx value 1: Input signal exceeds the set upper limit HAxx value, triggering HA alarm
			Bit10	0: Input signal does not exceed the set lower limit LAxx value 1: Input signal exceeds the set lower limit LAxx value, triggering LA alarm
			Bit11	0: Input signal does not exceed the set upper limit deviation dHALx value 1: Input signal exceeds the set upper limit deviation dHAx value, triggering dHA alarm
			Bit12	0: Input signal does not exceed the set lower limit deviation dLAx value 1: Input signal exceeds the set lower deviation dLAx value, triggering dLA alarm
			Bit13~bit15	Spare
06C0H~ 06EFH	1728~ 1775	Control Status, 48 Parameters		Read only; each parameter includes the control status of 2 channels. BIT0: 0 indicates auto-tuning state, 1 indicates non-auto-tuning state; BIT1: 0 indicates normal control, 1 indicates stop control state. Note: Do not write to this parameter. If need to change the related control status, write to the corresponding parameter. The system will automatically refresh this parameter.

<table>
<tr><td></td><td></td><td colspan="2"><table>
<tr><th colspan="2">Control Status</th><th>Description, this parameter is read-only</th></tr>
<tr><td rowspan="3">Even channels e.g. CH02</td><td>Bit0</td><td>0: AT Auto-tuning in progress
1: Non-auto-tuning in progress</td></tr>
<tr><td>Bit1</td><td>0: Normal control mode
1: Current channel is in stop control state (STOP mode)</td></tr>
<tr><td>Bit2~bit7</td><td>Spare</td></tr>
<tr><td rowspan="3">Odd Numbered Channels e.g. CH01</td><td>Bit8</td><td>0: AT Auto-tuning in progress
1: Non-auto-tuning in progress</td></tr>
<tr><td>Bit9</td><td>0: Normal control mode
1: Current channel is in stop control state (STOP mode)</td></tr>
<tr><td>Bit10~bit15</td><td>Spare</td></tr>
</table></td></tr>
<tr><td>06F0H~ 07FFH</td><td>1776~ 2047</td><td>Alternate Address</td><td>Reserved for future version upgrades. Please do not use.</td></tr>
<tr><td>0800~ 0803H</td><td>2048~ 2051</td><td>InP1~4; Input Specification Definition</td><td>This parameter is one of the input group parameters and is used to select the input specification. It needs to match the corresponding module. For example, the thermocouple input module must be set to thermocouple
<table>
<tr><td>0 K</td><td>21 Pt100</td></tr>
<tr><td>1 S</td><td>22 Pt100 (-200.00~+300.00℃)</td></tr>
<tr><td>2 R</td><td>25 0~75mV voltage input</td></tr>
<tr><td>3 T</td><td>27 0~320 ohm resistor input</td></tr>
<tr><td>4 E</td><td>28 0~20mV voltage input</td></tr>
<tr><td>5 J</td><td>29 0~50mV voltage input</td></tr>
<tr><td>6 B</td><td>35 -10~+10mV</td></tr>
<tr><td>7 N</td><td>36 -37.5~+37.5mV voltage input</td></tr>
<tr><td>8 WRe3-WRe25</td><td>38 10~50mV voltage input</td></tr>
<tr><td>9 WRe5-WRe26</td><td>39 15~75mV voltage input</td></tr>
<tr><td>12 F2 radiation high-temperature thermometer</td><td></td></tr>
<tr><td>13 T (0~300.00℃)</td><td></td></tr>
<tr><td>17 K (0~300.00℃)</td><td></td></tr>
<tr><td>18 J (0~300.00℃)</td><td></td></tr>
<tr><td>19 Ni120</td><td></td></tr>
<tr><td>20 Cu50</td><td></td></tr>
</table>
as the input specification. There are 4 sets of input parameters in total, each including 4 parameters: InP, ScL, ScH, and FIL.
InP is used to select the input specification whose value corresponds to the following:</td></tr>
<tr><td>0804H~</td><td>2052~</td><td>ScL1~4 Linear</td><td>Define the lower limit of the linear input scale, with units</td></tr>
</table>

0807H	2055	Input Calibration Lower Limit Value	the same as the measured value.
0808H~ 080BH	2056~ 2059	ScH1~4 Scale upper limit value	Define the upper limit of the linear input scale, with units the same as the measured value.
080CH~ 080FH	2060~ 2063	FIL1~4 Digital Filtering	Define the intensity of digital filtering for the input. A setting of 0 means no filtering, 1 represents median value filtering, and values greater than 2 represent integration filtering. The unit is the sampling period.
0810H~ 0813H	2064~ 2067	dHA1~4 Alarm Parameters	The default is positive deviation alarm, but it can also be defined as an high limit alarm. This is one of the output group parameters. The output parameter group can either select the same numbered parameter group as the input or choose a different parameter group. The instrument has a total of 4 sets of output parameters.
0814H~ 0817H	2068~ 2071	dLA1~4 Alarm Parameters	The default is negative deviation alarm, but it can also be defined as a low limit alarm.
0818H~ 081BH	2072~2075	AAF1~4 Alarm Function Selection	AAF.0~AAF.4 select whether the input fault, HA alarm, LA alarm, dHA, and dLA alarms will be automatically reset or not. If set to 1, the alarm will not be automatically reset, and the customer needs to send a write command to clear the corresponding alarm status register to release the alarm action.

AAF Detailed Explanation	Description
Bit0	0: The alarm status automatically resets after the input signal error is cleared. 1: The alarm status does not automatically reset after the input signal error is cleared. To manually reset, write 0 to the corresponding bit of the alarm status parameter for the corresponding channel. For odd-numbered channels, write bit8=0 in the alarm status; for even-numbered channels, write bit0=0.
Bit1	0: The alarm status automatically resets after the HA alarm is cleared. 1: The alarm status does not automatically reset after the HA alarm is cleared. To manually reset, write 0 to the corresponding bit of the alarm status parameter for the corresponding channel. For odd-numbered channels, write bit9=0 in the alarm status; for even-numbered channels, write bit1=0.
Bit2	0: The alarm status automatically resets after the LA alarm is cleared. 1: The alarm status does not automatically reset after the LA alarm is cleared. To manually clear the alarm, write 0 to the corresponding bit in the alarm status parameter for the respective channel. For odd-numbered channels, write bit10=0 in the alarm status; for even-numbered channels, write bit2=0.

		Bit3	0: The alarm status automatically resets after the dHA alarm is cleared. 1: The alarm status does not automatically reset after the dHA alarm is cleared. To manually clear the alarm, write 0 to the corresponding bit in the alarm status parameter for the respective channel. For odd-numbered channels, write bit11=0 in the alarm status; for even-numbered channels, write bit3=0.
		Bit4	0: The alarm status automatically resets after the dLA alarm is cleared. 1: The alarm status does not automatically reset after the dLA alarm is cleared. To manually clear the alarm, write 0 to the corresponding bit in the alarm status parameter for the respective channel. For odd-numbered channels, write bit10=0 in the alarm status; for even-numbered channels, write bit4=0.
		Bit5~bit7	Spare
081CH~081FH	2076~2079	HYS1~4 Hysteresis	The unit is the same as the measurement value. It is used as the hysteresis for alarms, ON/OFF control, and PID auto-tuning. However, auto-tuning can also use EHYS as the hysteresis by selecting it in Act.1.
0820H~0823H	2080~2083	OPL1~4 Output Lower Limit	Setting range 0~100, default as output lower limit. It can also be defined as the output value in the event of input faults/overload.
0824H~0827H	2084~2087	OPH1~4 Output Upper Limit	Setting range: 0~105, used as the output upper limit.
0828H~082BH	2088~2091	OHE1~4 Segmented Power Limit Setting	OPH valid range, with the same unit as the measurement value. This is used to implement the segmented output limit function. When the measurement value is less than OHEF, the output is limited by OPH. When the measurement value exceeds OHEF, the output is not limited, i.e., it is 100%.
082CH~082FH	2092~2095	Act1~4 Control Function Selection	Act.0: Set to 0 for reverse action (heating), or 1 for direct action (cooling). Act.1: Set to 0 for using the HYS value of this parameter group as the hysteresis for self-tuning and ON/OFF control; set to 1 to use the global parameter EHYS as the hysteresis. Act.2: Set to 0 to force the output to 0 when an input fault occurs on this channel; set to 1 to force the output to OPL when an input fault occurs.

			Act.3: Set to 0 to define the output lower limit as OPL; set to 1 to fix the output lower limit at 0. Act.4: Set to 1 to force the output to the input fault state when a HA alarm occurs.

ACT Detailed Explanation	Description
Bit0	0: Reverse action mode (heating control) 1: Direct action mode (cooling control).
Bit1	0: The At auto-tuning and (ON/OFF) bit control use the HYS value of this parameter group as the hysteresis. For example, if On01 = 2, then the hysteresis value for channel 2 will use HYS2. 1: The At auto-tuning and (ON/OFF) bit control use the global parameter EHYS as the hysteresis
Bit2	0: When an input fault occurs on this channel, the output will be forced to 0 1: When an input fault occurs, the output will be forced to OPL
Bit3	0: When an input fault occurs, the output will be forced to OPL 1: The output lower limit will be fixed at 0
Bit4	0: The output will not be affected during the HA alarm 1: During the HA alarm, the output will also be forced to the same state as the input fault condition.
Bit5~bit7	Spare

0830H~ 0833H	2096~2099	Srh1~4 Heating Slope Limit Value	Indicate the heating rate in degrees per minute. A value of 0 means no limit. When the SP value changes, the rate of change will be limited. Upon initial power-up or when control is started, the current measured value PV will be automatically set as the initial setpoint value. Additionally, if set AFC.3=1, any modification to the setpoint value SPXX will also automatically use the current measured value PV as the initial setpoint. Note this function does not apply to secondary control channels in cascade control mode. Note that the control cycle CTI value should be divisible by 60.0, such as 0.5, 0.8, 1.0, 1.2, 1.5, 2.0 seconds, etc. If other values are set, such as 0.9 or 1.1 seconds, there will be calculation errors in the heating slope value.
0834H~ 0837H	2100~2103	SrL1~4 Cooling Slope Limit Value	Indicate the cooling rate in degrees per minute. A value of 0 means no limit. The usage is the same as the Srh parameter.
0838H~ 083FH	2104~2107	SPL1~4 Setpoint	Belong to the output configuration parameter group, used to set the lower limit of the setpoint for channels 1~4.

		Lower limit	Note that it only restricts the range of the actual set value SV and does not limit the setting range for the setpoint SP
083CH~ 083FH	108~2111	SPH1~4 Setpoint Upper Limit	Belong to the output configuration parameter group, used to set the upper limit of the setpoint for channels 1~4. Note that it only restricts the range of the actual set value SV and does not limit the setting range for the setpoint SP.
0840H	2112	Addr Communication Address	Define the communication address of this device, with a range of 0~88.
0841H	2113	bAud Communication Baud Rate	Define the baud rate, the unit is 0.1K, setting range: 9.6K~115.2K.
0842H	2114	Adn Extended Input Loop Count	Define the number of input loops for this device.
0843H	2115	ACH Extended Input Loop Count	If the communication input interface of the device's expansion module fails to receive sufficient measurement values from the input modules defined by ACH, a corresponding input fault alarm signal will be triggered. If the actual input exceeds the set value, it is meaningless. This parameter is only used to define the communication input alarm prompt range and does not disable the measurement channel. To disable the measurement channel, the In parameter should be set.
0844H	2116	Ctn Control Loop Count	Indicate the number of control loops enabled. Each control loop occupies 10ms of processing time. If set to 96, the actual control cycle will be at least 0.96 seconds.
0845H	2117	Srun Run/Stop Selection	Normally, the instrument operates in automatic control mode, but each channel can independently set the At parameter to turn off. If Srun is set to 9655, all PID channels will stop control output, and one command shutdown can be realized. If Srun is set to 15, the control mode remains active; however, when the power is turned off and then back on, the system will automatically enter the 9655 global stop state.
0846H	2118	Ctl	Define the control cycle, with a range of 0.4~50.0 seconds. 0.4 is the system's minimum achievable cycle. For example, if the total number of control loops Ctn=32,

			the actual execution control cycle will be 0.32 seconds, meaning the Ctl cannot be less than 0.32. If Ctl is modified, the instrument must be restarted.
0847H	2119	ALAL Alarm Common Output Configuration (requires external alarm module expansion)	ALAL.0~4 define whether input fault, HA alarm, LA alarm, dHA, and dLA alarms will be output as a common alarm. Set to 0 for no output; set to 1 for output. Any alarm will trigger the global common alarm output AL0 action. The global common alarm output requires the alarm output terminal to be installed on the host.
0848H	2120	ALCH Alarm Independent Output Range Configuration (requires external alarm module expansion)	Define the start and end numbers of the independent alarm output channels for expansion. Although up to 5*97 alarm signals can be generated, note that the maximum number of extended alarm output channels is 256. For instance, if each channel requires 4 independent alarms, the difference between the output channel end number and the output channel start number should not exceed 64.
0849H	2121	ALbt Alarm Independent Output Configuration	ALbt.0~4 define whether input fault (including over-range, open circuit, communication disconnection, etc.), HA alarm, LA alarm, dHA, and dLA alarms are output. Set to 0 for no output; set to 1 for output. For example, if ALAL = 7, ALbt = 3, and ALCH = 16, the extended alarm output module will output 3 common alarms and 32 independent alarm signals. The output terminal numbers 1~3 will correspond to the common input alarm, high limit alarm, and low limit alarm; terminals 4~7 will sequentially correspond to channel 1 input error alarm, channel 1 HA alarm, channel 2 input error alarm, channel 2 HA alarm, and so on. For another example, if ALAL = 0, ALbt = 31, and ALCH = 616, the system will output 55 alarm signals, with 5 alarms for each of channels 6~16.
084AH	2122	AFA Function Parameter Configuration A	AFA.0: Set to 0 for HA as the default high limit alarm, or 1 for positive deviation alarm. AFA.1: Set to 0 for LA as the default lower limit alarm, or 1 for negative deviation alarm. AFA.2: Set to 0 for dHA as the default positive deviation alarm, or 1 for high limit alarm.

			AFA.3: Set to 0 for dLA as the default negative deviation alarm, or 1 for low limit alarm. AFA.4: Set to 0 for LA as the default low limit alarm, or 1 for high limit alarm (this adds an additional high limit alarm).
084BH	2123	AFB Function Parameter Configuration B	When AFB.1=0, the PID group operates in common mode. When AFB.1=1, the instrument switches to a mode with 5 preset PID groups for automatic switching. In this mode, the maximum number of independent PID control channels is 16. The instrument divides the SV and PID parameter groups into 16*6 groups. Groups 1~16 correspond to the PID parameters currently used by channels 1~16. The following 80 PID groups are arranged in 5 sets for each channel, meaning each channel can preset up to 5 sets of PID parameters that automatically switch according to the current SP value. For example: If SP1 is less than SP17, P1, I1, and d1 are automatically set to P17, I17, and d17. If SP1 is greater than SP17 but less than SP18, P1, I1, and d1 are automatically set to P18, I18, and d18. If SP1 is greater than SP18 but less than SP19, P1, I1, and d1 are automatically set to P19, I19, and d19, and so on.
084CH	2124	AFC Function Parameter Configuration C	AFC.0: Select communication parity bit. Set to 0 for no parity, or 1 for even parity. AFC.1=0: Choose linear output as 4~20mA or 2~10V; AFC.1=1: Choose current output as 0~20mA or 0~10V. AFC.2=0: No sensor backup function; AFC.2=1: Sensor backup function enabled. AFC.3=0: When using slope control, changes in the setpoint do not trigger the measurement value startup (PV START) function; AFC.3=1: When using slope control, changes in the setpoint trigger the measurement value startup function. Note that when using this function, the maximum number of control channels should not exceed 4. AFC.4=0: ADC converter provides better resistance to interference from a 50Hz power grid; AFC.4=1: ADC converter provides better resistance to interference from a 60Hz power grid. This setting is only applicable for countries using a 60Hz power grid. AFC.5=0: 0851H address master host status BIT0~BIT7

			port status mode, where 1 indicates an output action and 0 indicates no action; AFC.5=1: 0851H address master host status BIT0~BIT7 port 0 indicates an action, and 1 indicates no action. AFC.6=0: the transmitter output scale is defined by the corresponding SCL and SCH; AFC.6=1: the transmitter output scale is defined by the corresponding SPL and SPH. AFC.7=0: When an external expansion module, such as YL-1016, is connected, output values are transmitted; AFC.7=1: When an external host is connected, PV measurement values are transmitted.
084DH	2125	Nonc	Nonc.0~5: Define the output as normally open (NO) or normally closed (NC) for input fault, HA alarm, LA alarm, dHA alarm, dLA alarm, and common alarm, respectively. 0: Normally open (closes when an alarm occurs). 1: Normally closed. Note that if the system is powered off, the relay is disconnected regardless of the settings.
084EH	2126	EAF host sampling parameter configuration; note that this is only valid for the host's sampling rate. The sampling rate of the extended input module is configured by the extension module itself.	EAF=0: The main input refresh rate is automatically selected based on the CTI control cycle parameter, with thermocouples and voltage/current having a maximum refresh rate of 20ms per channel. EAF=1: Fixed at 20ms per channel. EAF=2: Fixed at approximately 40ms per channel. EAF=3: Fixed at approximately 80ms per channel.
084FH	2127	EHYS Additional Hysteresis	If a different hysteresis value is required for auto-tuning and ON/OFF control compared to the HYS alarm hysteresis, EHYS can be selected as the hysteresis value for auto-tuning and ON/OFF control through Act.1.
0850H	2128	dPt	The data range is 0~3, set the display decimal point position of the host operation panel. This setting is only

			for the convenience of displaying values on the basic operation panel and does not affect the data read by the host computer, the host computer program can handle the decimal point display by itself.
0851H	2129	Host Status	Read only. BIT0~7 represent the status of the host's O1~O8, the 8 I/O ports. A value of 1 indicates output (which can be defined by AFC.5). BIT8 is set to 1 to indicate a system fault, such as a memory data error, while BIT9 is set to 1 to signal the presence of a global alarm.
0852H	2130	Loc Parameter Locking	When Loc.5 is set to 0, all parameters can be written; when set to 1, writing parameters in the range of 0800H~08FFH is not allowed. Loc.6, when set to 0 and 1, respectively, indicates whether single-byte write commands are allowed or not. Loc.7, when set to 0 and 1, respectively, indicates whether multi-byte write commands are allowed or not. When writing is not allowed, the instrument will still return the command but will not actually modify the parameter.
0853H	2131	Instrument Model Characteristic Code	Read only, indicate the instrument model, with a reading of 8588
0854H	2132	Machine Number High Bits	Read-only, indicate the high 4 digits of the machine number.
0855H	2133	Machine Number Low Bits	Read-only, indicate the lower 4 digits of the machine number.
0856H	2134	OPCH Output Start Channel	OPCH local output start channel of this device: When set to 1, output 1 corresponds to channel 1. If set to 5, output 1 corresponds to the output value OP5 of channel 5. This function is used when channels 1~4 are only used for calculations and do not directly output.
0857H	2135	FL32 High-Resolution Measurement Filtering Constant	The unit is the sampling period, with a setting range of 0~999. This parameter applies high-resolution secondary filtering to the 32-bit data of 8 channels, improving the stability of the displayed data. This filtering does not apply to PID regulation. Typically, the workpiece being heated has a larger mass-to-volume ratio than the temperature sensor, so its thermal conductivity is slower than the sensor’s response. By properly setting this filtering

			parameter, a more accurate representation of the actual internal temperature of the heated workpiece can be obtained.
0858H	2136	AIF1 Heating and Overshoot Adjustment Parameter 1	Used by the manufacturer's debugging personnel
0859H	2137	AIF2 Heating and Overshoot Adjustment Parameter 2	Used by the manufacturer's debugging personnel
085AH	2138	AIF3 Heating and Overshoot Adjustment Parameter 3	Used by the manufacturer's debugging personnel
		OPSn	Used by the manufacturer's debugging personnel
0861H~ 088FH	2145~2191	Spare	
0898H~ 08FBH	2200~2099	D1~D100 Input Nonlinearity Correction Table Data, etc.	Used to implement the multi-point correction function. The first three defined parameters are used to set the starting value, full-scale value, and segmented range, followed by the corresponding number of correction values. When IN1=11, it indicates that the correction table is defined starts from D1, where D1 corresponds to the starting value, D2 to the full-scale value, and D3 to the segmented range. Assuming the input is temperature, D1=0, D2=1000.0, and D3=500.0, the first correction point is at 0°C, with subsequent points added at 500°C increments. D4 corresponds to the correction value at 0°C, D5 at 500°C, and D6 at 1000°C.
0900H~	2305~	Temporarily Disable Read/Write	

Description:

1. When developing the host computer software, ensure that the instrument responds to each valid command within 0~5mS (Note: this excludes data transmission time and the interval required by the

MODBUS protocol, which should be calculated based on different baud rates and data lengths). The host computer must wait for the instrument to return data before sending a new command; otherwise, errors may occur. If the instrument does not respond within the maximum response time, the potential reasons could include invalid commands, incorrect instrument or parameter addresses, communication line faults, the instrument being powered off, or mismatched communication addresses. In such cases, the host computer should resend the command or skip that instrument's address.

2. Except for input errors, all other alarms on the instrument are generated based on the selected input values of the control channels. Typically, the input and control channel numbers are the same, but if they are different, e.g., if control channel 2 selects input channel 1 for the measurement value PV input, then the alarms for channel 2 will be based on the absolute value and control deviation of input channel 1, and will not relate to input channel 2. In particular, if two control channels select the same input channel for the measurement value, that channel's measurement value can have up to 8 related alarm settings at most. In addition, for input channels that are not selected, they should typically be disabled. Otherwise, the measurement behavior of that channel may affect the input error flags of the selected input channel associated with the output channel of the same number.

3. If any alarm condition is met, an additional global public alarm signal will be triggered. This alarm does not come from the extended alarm module but instead illuminates the host's own alarm indicator. It can be read through BIT9 of the 0851H. If the host has an optional alarm output module, this alarm can be output from the host.

4. The instrument will impose write range restrictions on parameter values in the address range 0800H~088FH. If an attempt is made to write data outside of this range, the error will still be executed, but the system will limit the range to prevent system malfunctions caused by writing out-of-range data.

5. When AFB.1=0, the PID group operates in normal mode. When AFB.1=1, it switches to the preset 5-group PID automatic switching mode. In this mode, the maximum number of effective independent PID control channels is 16. The instrument divides the SV and PID parameter groups into 16*6 groups. Groups 1~16 correspond to the PID parameters used by channels 1~16. The next 80 PID groups are arranged in a sequence of 5 groups per channel, meaning each channel can preset up to 5 sets of PID parameters, which will automatically switch according to the current SP value. For example, if SP1 is less than SP17, P1, I1, and d1 will automatically be set to P17, I17, and d17. If SP1 is greater than SP17 but less than SP18, P1, I1, and d1 will automatically be set to P18, I18, and d18. Similarly, if SP1 is greater than SP18 but less than SP19, P1, I1, and d1 will automatically be set to P19, I19, and d19, and so on. This function needs to be realized in conjunction with APLC.

6. Alarm Explanation

How to set up and drive AL1 and AL2, with related alarm parameters:

HA01~HA96: These are set as high limit absolute value alarms by default, but can be reconfigured as high deviation alarms.

LA01~LA96: These are set as low limit absolute value alarms by default, but can be reconfigured as low deviation alarms.

dHA1~dHA4: These are set as high deviation alarms by default, but can be reconfigured as high absolute value alarms.

dLA1~dLA4: These are set as low deviation alarms by default, but can be reconfigured as low absolute value alarms.

AAF1~4: Alarm function selection, which determines whether the output and status are reset after the alarm is automatically cleared.

HYS1-4: Hysteresis, the difference by which the alarm is cleared.

ALAL: Define whether each alarm will output

ALCH: Used when connecting an external alarm output module

ALbt: Also used when connecting an external alarm output module

AL, AL1, and AL2 actions as shown in the table below

ALAL parameter, public alarm parameter,

Bit 0 Input Exception	Bit 1 HA	Bit 2 LA	Bit 3 dHA	Bit 4 dLA	AL1	AL2	AL
1	0	0	0	0	ON when input exception alarm is triggered	Always OFF	ON for any alarm
0	1	0	0	0	ON when HA alarm is triggered	Always OFF	ON for any alarm
1	1	0	0	0	ON when input exception alarm is triggered	ON when HA alarm is triggered	ON for any alarm
0	0	1	0	0	ON when LA alarm is triggered	Always OFF	ON for any alarm
1	0	1	0	0	ON when input exception alarm is triggered	ON when LA alarm is triggered	ON for any alarm
0	1	1	0	0	ON when HA alarm is triggered	ON when LA alarm is triggered	ON for any alarm
1	1	1	0	0	ON when input exception alarm is triggered	ON when HA alarm is triggered	ON for any alarm
0	0	0	1	0	ON when dHA alarm is triggered	Always OFF	ON for any alarm
…	…	…	…	…	…	…	ON for any alarm
…	…	…	…	…	…	…	ON for any alarm
1	1	1	1	1	ON when input exception alarm is triggered	ON when HA alarm is triggered	ON for any alarm

The first 5 bits of NONC correspond to the first 5 bits of the ALAL parameter. As long as the corresponding alarm bit in the NONC parameter is set to 1, the alarm will be inverted, and the action will also be inverted.

For example, if NONC=2 (high limit alarm inverted), and ALAL=2, AL1 will trigger an action under normal conditions. The action will continue until a high limit alarm is triggered on any channel, at which point AL1 will stop the action.