AI-6516G Multi-Channel Measuring Instrument User Manual (V9.5)

Precautions for Use

1. The user of this product must have sufficient knowledge of electrical systems and ensure that this product is not used in situations that may pose a danger to personal safety or property.
2. Before using this product for the first time, please read the entire user manual carefully to ensure proper use.
3. The company's responsibility is limited to the product itself, and it is not liable for any other direct or indirect losses or liabilities.

1. Model Identification Method

●When the instrument is powered on, the PV window will display the model number, and the SV window will display the version number. (For models without a display, the E85 handheld panel is required.)

● Call the customer service hotline to check the machine serial number information.

2. Overview

The instrument supports up to 16 channels of thermocouple isolated inputs, with an optional alarm channel. It is a purely measurement instrument. If control is required, it can be used as an input expansion module, with external control instruments such as the 6016 or 6032.

3. Technical Specifications

● **Communication Method:**

Bottom RS485 bus terminal; Support MODBUS-RTU protocol; Baud rate adjustable from 2400 to 115200.

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.

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

● **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℃)

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

● **Measurement Accuracy**: AI-6516G (Class 0.2).

● **Measurement Temperature Drift** : ≤100PPm/°C

● **Control Cycle**: Minimum 600ms.

● **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)

The instrument does not experience crashes or I/O malfunctions under 6KV and 10V/m high-frequency electromagnetic interference, and measurement fluctuations do not exceed ±5% of the full scale

● **Isolation Voltage:** Between input signals ≥200V.

● **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

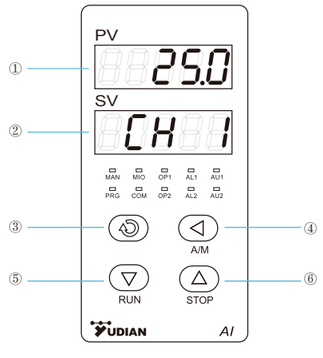
4. Display Panel and Keyboard Operation Instructions

4.1 Panel Description

The instrument can be connected to an E85 handheld device, which allows for display panel and keyboard operation. This enables quick viewing and modification of parameters using the Yudian control panel-style interface. It also allows for convenient operation in case the host computer is malfunctioning or unavailable.

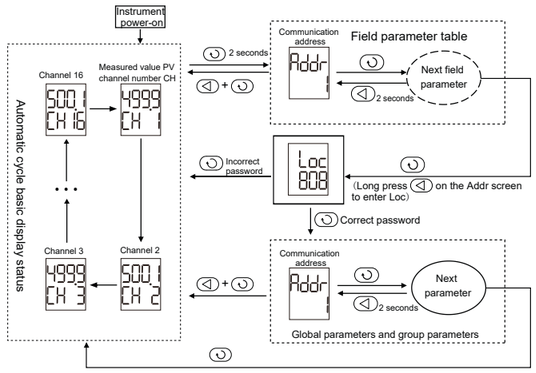
Upon powering on the instrument, it will automatically cycle through the measurement values of each channel. By pressing the Up and Down buttons, users can quickly switch between channels and lock the display to show the measurement value of a specific channel. Pressing the circle button will exit the lock and restore the automatic cycling display of measurement values

① Upper Display Window: Display measured values PV, parameter names, etc.
② Lower Display Window: Display alarm codes, parameter values, etc.
③ Set Key (Also used for toggling between manual/automatic cycling display modes)
④ Data shift (Also used to toggle display settings)
⑤ Data Decrease Key (Also used to switch to the previous channel display)
⑥ Data Increase Key (Also used to switch to the next channel display)



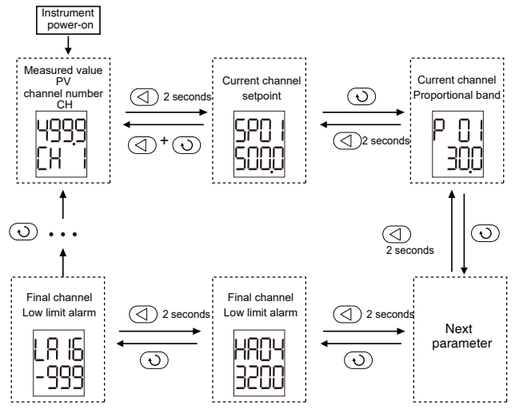
4.2 Global and Group Parameter Settings

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.



4.3 Channel Parameter Settings

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. Communication Protocol and Parameter Register Description

This series of instruments can be connected to the host computer via an RS485 serial port, or through Yudian's TCP-Modbus or EtherCAT communication controllers. The AI-8xx8 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 2400 to 115200 bps. If the baud rate exceeds 28800 bps, an optional high-speed optocoupler communication module is required. For long communication distances, a baud rate of 4800 bps is recommended.

The AI-8xx8 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 to 2 stop bits, no parity or even parity, and instrument addresses in the range of 0~80.

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

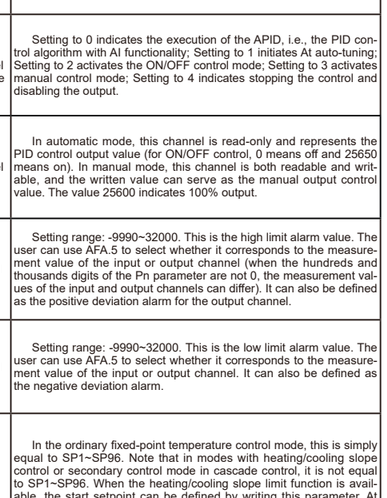
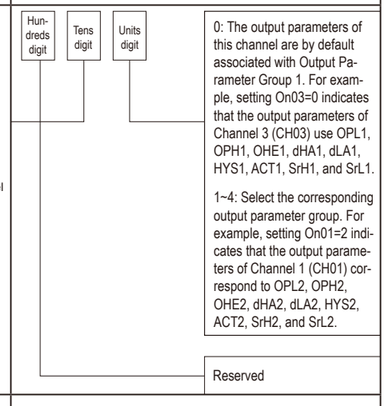
For the 06H command, one data is written at a time. The command sent would be:

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 parameter types are divided into channel-independent parameters, configuration group parameters, and global parameters. The channel-independent parameters consist of 12×96 parameters. Each channel can independently define the following 12 parameters: setpoints, proportional band, integral time, derivative time, control mode, output value (including manual value write settings), control output parameter group number, and table programming entry address, input channel and setpoint allocation, PID parameter groups, input specification groups, and input table correction entry addresses, input offset correction, high limit and low limit alarms. Configuration group parameters include 4 groups of input configuration parameters and 4 groups of control output configuration parameters (including alarm configurations). The measurement input group parameters include input specifications, filter intensity, scale lower limit, scale upper limit, and other parameters. The output group parameters include output limits, positive and negative deviation alarms, hysteresis, and functional configurations. Configuration group parameters are effective for the channels that select these parameters, and multiple channels can share one or more configuration groups. In addition, there are global parameters such as communication address and baud rate. Global parameters are applicable to all channels, and the parameter addresses are listed in the table below (Note: depending on the extension software, some products may not have all the parameters. In the document, "XX" represents the channel number).

Address Code	Register	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	P 01~P 96 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	d 01~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	0576~0671	On01~On96 Output Channel Configuration Parameters	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 with output parameter group 1.
		On01~On96 Output Channel Configuration Parameters Description	
02A0F~02FFH	0672~0767	Pn01~ Pn96 Output Channel PID Configuration Parameter Group and Measurement Channel Selection	Spare
0300H~035FH	0768~0863	At01~At96 Output Channel Operating Mode	Setting to 0 indicates the execution of the APID, i.e., the PID control algorithm with AI functionality; Setting to 1 initiates At auto-tuning; Setting to 2 activates the ON/OFF control mode; Setting to 3 activates manual control mode; Setting to 4 indicates stopping the control and disabling the output.
0360H~03BFH	0864~0959	OP01~OP96 Output Channel Output Value	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 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. This is the high limit alarm value. The user can use AFA.5 to select whether it corresponds to the measurement value of the input or output channel (when the hundreds and thousands digits of the Pn parameter are not 0, the measurement values of the input and output channels can differ). It can also be defined as the positive deviation alarm for the output channel.
0420H~047FH	1056~1151	LA01~LA96 Multifunctional Parameter 2	Setting range: -9990~32000. This is the low limit alarm value. The user can use AFA.5 to select whether it corresponds to the measurement value of the input or output channel. It can also be defined as the negative deviation alarm.
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.
04F0H~04F3H	1264~1267	Forced Manual Operation	For channels 1~4 can be forced into manual operation. Setting the value to 1 forces the corresponding channel into manual mode. A value of 0 or any other value allows the channel to operate according to the At parameter. However, if the At parameter is set to a mode greater than 4, such as in cascade control output modes, this parameter will not control the operation.
04F0H~04FFH	1268~1279	Alternate Address	Reserved for future version upgrades. Please do not use.
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.
0660H~066FH	1632~1647	Channel 1~8 Measurement Values 32-bit data	Read-only; provide high-resolution 32bit data for channels 1~8 (positive values only). This data is suitable for applications requiring high-resolution displays and can be subjected to secondary filtering defined by the FL32.
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.

Alarm Status Bits		Description (x or xx represents the channel number)
Even channels e.g. CH02	Bit0	0: AT Auto-tuning in progress 1: Non-auto-tuning in progress
	Bit1	0: Normal control mode 1: Current channel is in stop control state (STOP mode)
	Bit2~bit7	Spare
Odd Numbered Channels e.g. CH01	Bit8	0: AT Auto-tuning in progress 1: Non-auto-tuning in progress
	Bit9	0: Normal control mode 1: Current channel is in stop control state (STOP mode)
	Bit10~bit15	Spare

06F0H~07FFH	1776~2047	Alternate Address	Reserved for future version upgrades. Please do not use.
0800~0803H	2048~2051	InP1~4; Input Specification Definition	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 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:

0 K	13 T (0~300.00℃)
1 S	17 K (0~300.00℃)
2 R	18 J (0~300.00℃)
3 T	25 0~75mV voltage input
4 E	28 0~20mV voltage input
5 J	29 0~50mV voltage input
6 B	35 -10~+10mV
7 N	36 -37.5~+37.5mV voltage input
8 WRe3-WRe25	38 10~50mV voltage input
9 WRe5-WRe26	39 15~75mV voltage input
12 F2 radiation high-temperature thermometer	

0804H~0807H	2052~2055	ScL1~4 Linear Input Calibration Lower Limit Value	Define the lower limit of the linear input scale, with units 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.

0818H~ 081BH			

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 Low 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 High 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 OHE, the output is limited by OPH. When the measurement value exceeds OHE, 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 Lower limit	Belong to the output configuration parameter group, used to set the lower 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.
083CH~ 083FH	2108~ 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 number of input loops for this device	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 enabled control loops.
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	CtI	Define the control cycle, up to 0.6~50.0 seconds, with 0.6 being the minimum cycle achievable by the system.
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 Functional Parameters 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). AFA.5: Set to 0 for HA and LA alarms to correspond to input channels, or 1 for HA and LA alarms to correspond to output channels (Note: do not use HA and LA as deviation alarms in this mode). AFA.6: Set to 0 for AL1 to be defined according to ALAL, or 1 for AL1 to be a global alarm AFA.7: Set to 0 for AL2 to be defined according to ALAL, or 1 for AL2 to be a global alarm
084BH	2123	AFB Function Parameter Configuration B	AFB.0 = 0: No multi-group PID functionality. AFB.0 = 1: Multi-group PID functionality is enabled. In this mode, there are 5 preset PID groups with automatic switching functionality. At this time, the maximum number of effective independent PID control channels is 16. The instrument divides the SV and PID parameter groups into 5*16 groups, where groups 1~16 correspond to the PID parameters currently used by channels 1~16. The subsequent 80 PID groups are arranged in order for each channel to use 5 groups. This means that each channel can preset up to 5 PID groups, which will automatically switch based on the current SP value. For example: If the setpoint SP1 is less than or equal to SP17, then P1, I1, and d1 will automatically be set to P17, I17, and d17. If SP1 is greater than SP17 but less than SP18, then P1, I1, and d1 will automatically be set to P18, I18, and d18. If SP1 is greater than SP18 but less than SP19, then P1, I1, and d1 will automatically be set to P19, I19, and d19. If SP1 is greater than all 5 preset SP values for switching, the PID parameters will remain unchanged. Similarly, channel 2 is associated with the PID group of channel 22~26, 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, input refresh rate 640ms. EAF=1, input refresh rate 640ms. EAF=2, input refresh rate 1280ms. EAF=3, input refresh rate 320ms.
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 indicate O1~O8 of the host computer respectively, affected by the number of channels; for a 4-channel instrument, only O1~O4 will be available. BIT11 corresponds to AL1, and BIT12 corresponds to AL2. 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
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.
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
085BH	2139	dIFA	Used by the manufacturer's debugging personnel
085CH	2140	SPSr	Used by the manufacturer's debugging personnel
		OPSn	Used by the manufacturer's debugging personnel
0861H~ 088FH	2145~ 2191	Spare	
0898H~ 08FBH	2200~ 2099	Input Nonlinearity Calibration Table Data, etc.	Include input calibration curves, high-temperature furnace output limiting curves, etc., totaling 100 data.
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.

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.

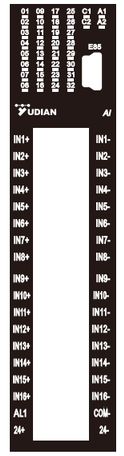
HYS1-4: Hysteresis, the difference by which the alarm is cleared.

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

6. AI-6516G Panel and Wiring Description



O1~O16 will blink when the corresponding input encounters an error, and will not light up when the input is normal. The C1 light blinking indicates 485 communication, the C2 light indicates 422 communication (PV transmission input), the A1 light indicates a global alarm, and the A2 light indicates AL1 alarm.

For input, taking the first channel as an example, IN1+ connects to the positive terminal of the thermocouple, and IN1- connects to the negative terminal of the thermocouple.

An optional alarm can correspond to the global alarm. When the G module is installed, AL1 connects to the positive terminal of the solid-state relay, and COM- connects to the negative terminal of the solid-state relay. When the L21 or G61 module is installed, an external 24V switch power supply is required. If AL1 connects to the negative terminal of the relay, COM- connects to the negative terminal of the switch power supply, and the positive terminal of the relay connects to the positive terminal of the switch power supply.

When using a bus terminal block connection, there is no need to connect the 24+ and 24- terminals on the front. When using a multi-in-one method, the 24+ and 24- terminals on the front can be used to power the instrument.

This product is restriction of use in the industrial environment.

ADDRESS: No.6 Longku East Road, Xiang'an District, Xiamen, Fujian, 361101, China

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