AI-708J Artificial Controller/Servo Amplifier

Operation Instruction

(V7.0)

1. SUMMARY

1.1 Main Features

- The functions of the artificial controller and servo amplifier are integrated. The product can be used with the regulator or DCS and is easy to operate, learn and use.
- The advanced modular structure is used, and the product can be quickly delivered and easily maintained.
- The valve position feedback signal can adopt the resistance, voltage or current signal. The sampling period is upgraded from V6.0 version of 0.48s to 0.24s . The valve positioning accuracy is doubled within the same travel time. The product is suitable for various valves with the travel time more than 15s.
- The product can be powered by the globally universal switching power supply of 100-240VAC input or the 24VDC power supply and has multiple size options for customers to choose.
- The product has passed the new ISO9001 quality certification (2000) and the quality is reliable.
- The product has passed CE certification of the third-party authoritative testing organization, and the anti-jamming performance complies with the requirements of electromagnetic compatibility (EMC) under harsh industrial conditions.

Points for Attention

- This manual introduces the AI-708J artificial controller/servo amplifier (V7.0). Certain functions described in the manual may not be suitable for other versions. The instrument model and software version number will be displayed on the display after the instrument is powered on. The user should pay attention to differences between instruments of different models and versions. Please read this manual carefully for proper and full utilization of the instrument.
- Please correctly set the parameters of the AI instrument according to the input/output specifications and the functional requirements. Only the instrument with the set parameters should be put into use.

1.2 Model Definition

The advanced modularized hardware design is utilized for the AI-708J instrument. There are five functional module sockets: auxiliary input, main output, alarm, auxiliary output and communication. The modules can be purchased together with the instrument or purchased separately and combined freely. The input model of the instrument can be freely set as the commonly used thermocouple, thermal resistor and linear voltage/current. The AI series artificial intelligent control instruments consist of eight parts, shown as follows:

AI-708J	A	N	X3	L5	N	S4	-	24VDC
①	②	③	④	⑤	⑥	⑦		⑧

This means: ① the basic function is AI-708J; ② the panel size is of Type A (96×96mm); ③ no module is installed for auxiliary input (MIO); ④ the X3 linear current output module is installed for main output (OUTP); ⑤ the L5 dual relay contact output module is installed for alarm (ALM); ⑥ no module is installed for auxiliary output (AUX); ⑦ the photoelectric isolation RS485 communication interface with the built-in isolation power supply is installed for communication (COMM); and ⑧ the instrument adopts the 24VDC power supply. The meanings of eight parts of the instrument model are as follows:

① Basic model

AI-708J means the artificial controller/servo amplifier with multiple programmable functions.

② Panel size

A: (A2 with 25-segment Level 4 bright light column), with the panel of 96×96mm, opening of 92×92mm and insertion depth of 100mm.
B: with the panel of 160×80mm (width×height), horizontal, opening of 152×76mm and insertion depth of 100mm.
C: (C3 with 50-segment two levels of light column), with the panel of 80×160mm (width×height), vertical, opening of 76×152mm and insertion depth of 100mm.
D: Panel of 72×72mm, opening of 68×68mm and insertion depth of 95mm.
E: Panel of 48×96mm (width×height), opening of 45×92mm and insertion depth of 100mm.
E2: Additional 25-segment of four levels light column on top of E. the panel of 48×96mm, opening of 45×92mm and insertion depth of 100mm.
E5: No display panel, installed on the DIN guide rail, 48×96×110mm (width×height×depth).
F: Panel of 96×48mm (width×height), opening of 92×45mm and insertion depth of 100mm.

③ Module for auxiliary input (MIO) of the instrument. N means no module, the same below.

U5 5VDC power output module, with the maximum current of 50mA, for 1K valve feedback resistance.
I2 Switching input module for photoelectric isolation, using the external switch for manual/auto operation.

④ Module for main output (OUTP) , which is used for adjusting the instrument output or SV/PV transmitting output.

L5 Dual normally open relay output module ,250VAC/2A, controlling the forward/reverse of the valve motor respectively via OP1 and OP2.
W5 Dual thyristor contactless NO switch output module, 100-240VAC/1A, controlling the forward/reverse of the valve motor respectively via OP1 and OP2.
G5 Dual solid-state relay (SSR) voltage output module, 5VDC/30mA, controlling the forward/reverse of the valve motor respectively via OP1 and OP2.

X3 Photoelectric isolation type linear current output module, supporting the output of 0-20mA and 4-20mA, using the 12VDC power supply inside the instrument.
X5 Photoelectric isolation type linear current output module with the built-in isolation power supply, supporting the output of 0-20mA and 4-20mA, not using the 12VDC power supply inside the instrument

⑤ Module for instrument alarm (ALM) (used for AL1 and AL2 alarm output of the instrument)
L1/L2/L4 One-way relay output module, supporting AL1 alarm.
L5 Dual normally open relay output module, supporting AL1 and AL2 alarm.

⑥ Module for auxiliary output (AUX) of the instrument (used for AU1 and AU2 alarm of the instrument or external manual/auto switching of switch input).
L1/L2/L4 Single relay output module, supporting AU1 alarm or used as auxiliary output of heating/cooling output.
L5 Dual normally open relay output module, supporting AU1 and AU2 alarm.
R Photoelectric isolation type RS232C communication interface, using the 12VDC power supply inside the instrument.

⑦ Module for instrument communication (COMM)
X3 Photoelectric isolation type linear current output module, supporting PV transmitting output, using the 12VDC power supply inside the instrument.
X5 Photoelectric isolation type linear current output module with the built-in isolation power supply, supporting PV transmitting output, not using the 12VDC power supply inside the instrument.
S Photoelectric isolation type RS485 communication module, using the 12VDC power supply inside the instrument.
S4 Photoelectric isolation type RS485 communication module, with the isolation DC/DC power converter, not using the power supply inside the instrument.
I2 (Parameter bAud=1) On-off switch input with photo-electric isolation, acting as exteral switch in manual/auto operation.

⑧ Power supply of instrument. Default power supply is 100~240VAC while 24V refers to 20~32V AC/DC.

Note 1: W5 module occupies two slots: OUTP and MIO. When W5 is installed for OUTP, no module can be installed in the MIO position, however, 5V voltage feedback output will be provided in the MIO, equivalent to use of U5, which can supply power for the external valve position feedback resistor.

Note 2: Such power output modules as U5 are usually used for supplying power to the external feedback resistor and can be installed onto any module socket. In order to standardize wiring, it is recommended to install them on MIO in sequence based on whether the module position is idle. For the D-sized instrument with no MIO, these modules can be installed in the AUX or COMM.

Module replacement: the modules have been installed In factory upon order with parameters well set.. Modules can be replaced by users in case of mal-function modules or functional requirement..The corresponding parameter settings of the module should be changed.

Signals are electrically isolated when multiple modules are installed. Internationally there are one 24VDC power supply and one 12VDC power supplies isolated from the main circuit in the instrument to supply power to modules. Voltage output modules, such as V24/V12/V10 (24V/12V/10V voltage output) and I5 (switching input module) or I4 are powered by 24V.. Main output and communication are powered by 12V. As the relay and thyristor trigger output modules are generally equipped with the built-in isolation power supply or require no isolation power supply and the SSR voltage output module (G module) generally requires no additional isolation and has the isolation function, the isolation of the communication interface and current output should be mainly taken into account. Such modules as S (RS485 communication interface), R (RS232 communication interface) and X3 (linear current output) adopt the photoelectric isolation technology for isolation from the input circuit of the instrument. However, these modules should be powered on by the 12V isolation power supply inside the instrument. When installed simultaneously, two modules with the isolation function cannot be electrically isolated as they share one isolation power supply, therefore, the modules with high-efficiency DC/DC power isolation converter such as S4 (RS485 communication interface) and X5 (linear current output) are designed, which does not require the isolation power supply inside the instrument. For example, when the X3 module is installed in the main output (OUTP) position of the instrument and the S or X3 module is installed on the communication interface (COMM), the X3 modules or the S and X3 modules cannot be isolated, and the S4 or X5 module should be installed.

Thyristor contactless switch module: W5 dual contactless switch module can substitute the previous relay contact switch output to control the AC contactor to greatly reduce the interference spark of the equipment and improve the system reliability. Driven by the thyristor, the contactless switch is only applicable to control of the 100-240VAC power but not DC power. The maximum continuous control current is 1A and the allowable instantaneous current is 5A. The switch can be used for directly driving various common servo motors.

Relay module: it is the only module with life time limit and height limit. L2 module is a small-sized single-circuit relay output module, free from volume limit, but with the NO and NC contact and the function of varistor spark absorption. Due to the small contact capacity, it is suitable for alarm output. L5 is a large dual relay output module and cannot be simultaneously installed on the motherboard and side plate of the 48mm wide (E, F, etc.) instrument; otherwise, collision may occur. Therefore, when the L5 module is installed on one side, there must be no L5 module on the other side. In addition, when L5 cannot be installed due to mechanical contact or height limitations, G5 (dual SSR voltage output module) can be connected to the external solid-state relay (SSR) to drive the load.

Calibration and maintenance: this instrument is maintenance-free, using the technology of automatic zero calibration and digital calibration and requiring no calibration or maintenance. The problem of over range in measurement and calibration can be solved generally by cleaning and drying the inside of the instrument. In case of failure to recover the accuracy by means of drying and cleaning, the instrument should be sent back to the manufacturer for repair as a faulty instrument.

Maintenance: Free maintenance will be given within the warranty period.For the instrument to be repaired, please describe the faults and causes so as to ensure the proper and comprehensive recovery.

1.3 DIN Rail Mounted Instrument

No display is provided in E5 rail mounted panel. The instrument parameters can be set by E8 external keypad. The parameters and operation can be done by a computer or HMI through RS485 communication.

After modification of the address or baud rate, the instrument should be restarted so that the new parameters take effect.

The LED indication light blinks during communication of the instrument and host computer. The light blinks whenever there is an attempt of comunication with the host computer. When the instrument hasn’t received signal from the host computer for 6 seconds, the indication light blinks

at even time interval. The meanings are as follows:

The light slowly blinks at 1.6 sec long interval indicating there is no signal nor alarm (normal working).

The light blinks at 0.6 sec short inteval indicating there is no signal but with alarm or such error occurs.

The light blinks at 0.3 sec short internal indicating there is no communication but severe errors such as input over range (such as open-circuiting of the thermocouple and thermal resistor).

The light keeping off means that the instrument is off or damaged.

The light keeping on (longer than 8 seconds) means that the instrument is on but is damaged.

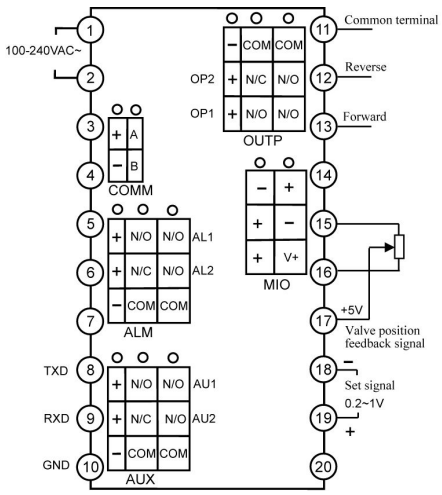
1.4 TECHNICAL SPECIFICATIONS

- Valve position signal input PV:
  Linear voltage: 0-5V and 1-5V
  Linear current (with the external 250 precision resistance for shunting): 0-20mA, 4-20mA, etc.
  Linear resistance: 1K valve feedback input resistance
  Others: contact the technical support personnel.
- Set signal input SV:
  Linear voltage: 0-1V and 0.2-1V
  Linear current (with the external 50 precision resistance for shunting): 0-20mA, 4-20mA, etc.
  Others: contact the technical support personnel.
- Measurement range:
  Linear input: -9990 to +30000, defined by the user.
- Measurement accuracy: Grade 0.2 (0.2%FS±1 display unit)
- Temperature drift: ≤0.01%FS/℃ (typically about 50ppm/℃)
- Response time: ≤0.3s (when digital filter parameter dL=0)
- Output regulation mode:
  Position proportion output: directly controlling the forward/reverse of the servo motor of the valve, using the L5, W5 or G5 module.
  Standard current signal output: 0-20mA, 4-20mA, etc.
- Output mode (modularized):
  Relay contact switch output (NO + NC): 250VAC/1A or 30VDC/1A
  Thyristor contactless switch output (NO + NC): 100-240VAC/0.2A (continuous), 2A (instantaneously 20mS, with the repetition period of more than 5S)
  SSR voltage output: 12VDC/30mA (used for driving the solid-state relay SSR)
  Linear current output: 0-10mA or 4-20mA, definable (when the X3 module is installed, the output voltage is no less than 10.5V; when the X5 module is installed, the output voltage is no less than 7V)
- Electromagnetic compatibility: IEC61000-4-4 (electrical transient burst), ±4KV/5KHz; IEC61000-4-5 (surge), 4KV.
- Isolation withstand voltage: no less than 2300VDC among the power ends, relay contacts and signal terminals; and no less than 600VDC between isolated weak-current signal terminals.
- Power supply: 100-240VAC, -15%, +10% / 50-60Hz; or 24VDC/AC, -15%, +10%
- Power consumption: ≤5W
- Operating environment: temperature: -10 to +60℃; humidity: ≤90%RH
- Panel size: 96×96mm, 160×80mm, 80×160mm, 48×96mm, 96×48mm, 48×48mm and 72×72mm
- Opening size: 92×92mm, 152×76mm, 76×152mm, 45×92mm, 92×45mm, 45×45mm and 68×68mm
- Insertion depth: ≤100mm

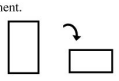
Note; the input signal specifications can be changed by means of module replacement of AI-708J. For example, the 0-5V/1-5V signal input (J3 module) or standard current signal input (J4 module) can be used for SV and PV. For the specific indicators and wiring modes, consult the technical support.

1.5 Instrument Wiring

The terminal layout on the rear cover of the instrument is shown in the figure:



Note: The figure indicates the wiring of Type A, C and E upright-panel instrument.



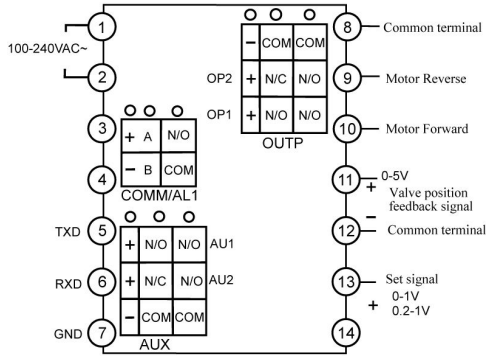
After 90-degree clockwise rotation, the figure indicates the wiring of Type B and F horizontal-panel instrument, with no change in terminal S/N.

Note 1: The set signal SV is input by the 19+ and 18- terminal, and the 4-20mA signal can be connected to the 50-ohm precision resistor in parallel to be converted into 0.2-1V voltage.

Note 2: The valve position feedback signal PV can be input by 17+ and 18- when the voltage is 0-5V or 1-5V. The current signal can be converted by the 250-ohm resistor into the voltage signal and input by 17+ and 18-. The 1K resistance signal can be input as shown in the figure after the U5 module is installed in the MIO position.

Note 3: In the COMM position, the S or S4 communication interface module can be installed for communication; the X3/X5 current output module can be used for transmitting output of the valve position feedback signal; and when the I2 module is installed and the bAud parameter is set as 1, the switching input function of the MIO module can be simulated, and the manual/auto switching can be realized by the external switch at the terminal 3 and 4.

The wiring diagram of the D sized panel instrument is shown below:

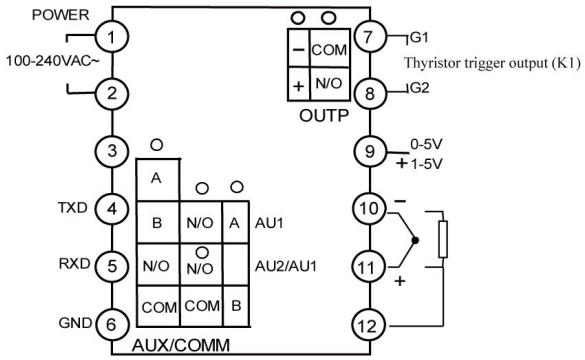


Note 1: The set signal SV is input by the 13+ and 12- terminal, and the 4-20mA signal can be connected to the 50-ohm precision resistor in parallel to be converted into 0.2-1V voltage.

Note 2: The valve position feedback signal PV can be input by 11+ and 12- when the voltage is 0-5V or 1-5V. The current signal can be converted by the 250-ohm resistor into the voltage signal before input. The 1K resistance signal can be input after conversion into the voltage signal and installation of the U5module in the COMM/AL1 or AUX position.

Note 3: In the COMM position, the S or S4 communication interface module can be installed for communication; the X3/X5 current output module can be used for transmitting output of the valve position feedback signal; and when the I2 module is installed and the bAud parameter is set as 1, the switching input function of the MIO module can be simulated, and the manual/auto switching can be realized by the external switch at the terminal 3 and 4.

The wiring diagram of Type D6 panel instrument (48X48mm) is shown below:



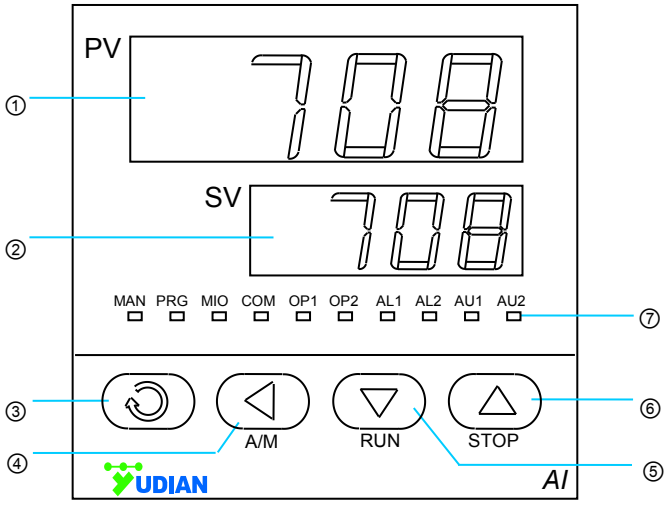
Note 1: For the D6 panel instrument, the 0-5V/1-5V signal is input by 9+ and 10-, the signal below 500MV is input by 11+ and 10-, and the 4-20mA linear current signal is converted into the 1-5V signal by the 250-ohm resistor and input by 9+ and 10-.

Note 2: When the L6 module is installed at the COMM/AUX terminal, two alarms can be enabled. When the SL module is installed, one way is used for RS485 communication and one way is used for alarm.

2 DISPLAYS AND OPERATIONS

2.1 Panel Description

① Upper display window
② Lower display window
③ Setup key
④ Data shift key (also used for manual/auto switching)
⑤ Data decrease key
⑥ Data increase key
⑦ 10 LED indicators: the MAN light indicates automatic control mode in the OFF state and manual output mode in the ON state; the PRG light is not used in this model; the MIO, OP1, OP2, AL1, AL2, AU1 and AU2 respectively correspond to the module input/output actions; and the COM light indicates communication with the host computer in the ON state.



2.2 Operations

Basic display status: the instrument enters the basic display status after being powered on. Then the upper display window of the instrument displays the valve position feedback signal (PV), and the lower display window displays the signal value (SV) input from the regulator output. Press ⟲ to switch to the output value displayed by the lower display window. In the basic status, the SV window can indicate some statuses of

the system by alternating characters. The flashing “orAL” indicates the over range of the input measurement signal (which may be caused by incorrect setting of the sensor and breakage or short-circuiting of the input wire). The flashing “HIAL”, “LoAL” and “dHAL” respectively indicate the upper limit alarm, lower limit alarm and deviation alarm of the valve position feedback signal. The alarm flashing function can be disabled (see the cF parameter setting). When the alarm is used for control, the alarm character flashing function can be disabled to avoid excessive flashing.

Measured value of valve position feedback signal (PV): PV indicates the valve opening, with unit of 0.1%,input from 0-5V input terminal. The 0-10mA and 4-20mA linear current input can be converted into voltage input respectively by the 500-ohm and 250-ohm resistor. The potentiometer signal can be converted into the voltage signal by additionally installing the 5V power supply. The scale of this signal can be defined by the parameter dIL and dIH. dIL and dIH respectively correspond to the displayed values at 0V and 5V and should be set correctly so that the displayed value of the valve position is in percentage. If the valve position feedback signal is 1-5V, dIL should be set as -25.0, and dIH should be set as 100.0. If the valve position feedback signal is 0-5V, dIL should be set as 0.0, and dIH should be set as 100.0.

Set value of valve position (SV): the position and specifications of the input signal can be selected by Sn (see the description of the parameter Sn in the parameter list). Generally, the 0.2-1V signal input end is used (connected to the 50-ohm resistor in parallel, capable of receiving 4-20mA signal). SV is generally the signal output by the regulator or DCS to AI-708J, displayed as 0-100.0% on the instrument. If the system only has the main input signal but no valve position feedback signal, it is recommended to input the SV signal by the 0-5V or 1-5V end for virtual indication of the valve position signal.

Set value of manual output: when  is pressed, the lower display window can switch the display of SV and M XX (or A XX). M XX indicates the manual output valve, and the display and setting unit is 1%. A XX indicates that the auto status has been enabled. Press  to switch the auto/manual state. When M XX is displayed, the output value can be adjusted by pressing  or  .

Undisturbed manual/auto switching: when PV and SV are not consistent, the definition can be carried out by setting the parameter t.

Setting of valve position: when the parameter OP1 is set as 7, the valve will be fully closed. When the valve is fully open, the feedback signal can be defined as 100.0% and 0% corresponding to the fully-open and fully-closed state of the valve. After setting, the parameter OP1 will be automatically set as 6 for normal servo amplification.

Positioning accuracy: positioning accuracy=instrument sampling period/valve travel time. The sampling period of AI-708J is 0.24s. If the valve travel time is 60s, the positioning accuracy is 0.24/60=0.4%. For the valve with the travel time of 15s, the positioning accuracy is reduced to 1.6%.

Parameter setting: press  and keep about 2s in the basic status (display status ① or ②) to enter the parameter setting status (display status ⑤). When  is pressed in the parameter setting status, the instrument will display the parameters in sequence, such as the upper limit alarm HIAL, parameter lock Loc, etc. When the configuration has been completed and the parameter lock has been locked, the instrument only display the parameters required by the operator (field parameters). The parameters can be modified by pressing  ,  ,  , etc. The AI instrument also has the functions of rapid data increasing/decreasing and decimal point shifting. Press to decrease the data and  to increase the data. The decimal point corresponding to the digit to be modified will flash (like the cursor). The value can be rapidly increased/decreased by keeping the button pressed. In addition, the speed will increase automatically with rightward shifting of the decimal point (Level 3). When  is pressed, the position of the digit to be modified can be directly moved (like the cursor), and the operation can be completed rapidly. If the parameter is locked (described below), only the field parameter defined by the EP parameter can be displayed (the parameters and procedures which are always required on the working field can be defined by the user), and other parameters will not be displayed. At least, however, the Loc parameter is displayed.

Return to display of previous parameter and exit of parameter setting status: keep  pressed in the parameter setting status to return to display of the previous parameter. Press  and  simultaneously to exit the parameter setting status. In case of no button operation, the system will automatically exit the parameter setting status after about 20s.

Alarm output: AL1, AL2 and AU2 can be used for alarm output and are defined via the ALP parameters. The AU1 is used for manual/auto status output. In the manual status, the relay in the AU1 position is closed. In the auto status, the relay in the AU1 position is released.

External auto/manual switch input: when the external switch is closed from the open status, the instrument is in the manual status. When the external switch is in the closed status, the auto status can be enabled by the instrument panel keyboard. When the external switch is opened from the closed status, the instrument will switch to the auto status. When the external switch is open, however, the auto status can be enabled by the instrument panel keyboard. The control of external switching input is free from limitations of prohibition of manual status in the run parameters.

Communication/transmitting: COMM can be used for communication or PV current transmitting output (depending on the set value of the parameter bAud). When used as the current transmitting output, PV is the valve position feedback input signal and can be used as the tracking current output of the DCS system or regulator.

Valve position feedback signal abnormality alarm: the HIAL (upper limit alarm) and LoAL (lower limit alarm) of the instrument can be used as the alarm output in case of abnormality of valve position signal. For example, when the valve feedback signal is 1-5V, the voltage will be lower than 1V in case of open circuiting or abnormality of the feedback signal, and then a negative number will be displayed corresponding to the valve position feedback signal. The alarm relay driven by this fault will act based on LoAL alarm.

Delay deviation alarm function: dHAL is defined as the deviation alarm in the artificial controller mode and can be used for alarm in case of inconsistency of SV (regulator output signal) and PV (valve position feedback signal). In the artificial controller mode, dHAL can not only be used for positive deviation alarm, but also is effectively for positive/negative deviation, and dLAL will be disabled. With the delay function, the alarm will be subject to no hysteresis. As SV and PV may be inconsistent in a short time during valve rotation, the CtI parameter of the artificial controller is designed as the delay time (in second). Generally, it is set as the valve motor travel time. Thus, the alarm will be uttered in case of inconsistency of PV and SV in a short time during valve rotation. If the deviation is still larger than dHAL beyond the CtI time, the instrument will utter the deviation alarm (dHAL), which can drive the relay in AL1, AL2 or AU2 to act.

Slow manual/auto switching function: the artificial controller has the undisturbed two-way manual/auto switching function and the function of slow changes in the time constant, that is, if the manual output is different from the automatic output of the regulator during switching from the manual mode to the auto mode, the manual output will slowly change into the auto output, and the time constant depends on the parameter t (in second). The large t is, the slower the change is. If the setting is t=0, the slow varying function will be disabled. In this case, the manual output will immediately switch to the auto output.

3 PARAMETERS AND FUNCTIONS

The input, output, alarm, communication and control of the AI series instruments are defined by parameters. Below is the table of parameter functions.

<table>
<tr><th>Code</th><th>Parameter Name</th><th>Description</th><th>Setting Range</th></tr>
<tr><td>HIAL</td><td>Upper limit alarm</td><td>When the measured value of valve signal (PV) is larger than the HIAL value, the instrument will utter the upper limit alarm. When PV is smaller than the HIAL-dF value, the instrument will terminate the upper limit alarm. HIAL can be set as the maximum value to avoid alarm.
Each alarm can be freely defined to control the actions of such output ports as AL1, AL2 and AU2 (see the description of the parameter ALP below).</td><td rowspan="2">-199.9-
+999.9%</td></tr>
<tr><td>LoAL</td><td>Lower limit alarm</td><td>When the measured value of valve signal (PV) is smaller than LoAL, the lower limit alarm will be uttered. When PV is larger than LoAL+dF, the lower limit alarm will be terminated. LoAL can be set as the minimum value to avoid alarm.</td></tr>
<tr><td>dF</td><td>Hysteresis (dead zone and hysteresis)</td><td>The hysteresis is used to avoid frequent uttering/termination of alarm caused by fluctuations of the measurement input.
Example: the parameter dF has the following effects on upper limit alarm control. Assuming that the upper limit alarm parameter HIAL is 80.0 and the parameter dF is 1.0:
(1) When the measured value is more than 80.0% in the normal state, the upper limit alarm will be uttered by the instrument.
(2) When the measured value is less than 79.0% (HIAL-dF) in the upper limit alarm state, the alarm of the instrument will be terminated.</td><td>0-200.0%</td></tr>
<tr><td>dHAL</td><td>Deviation alarm setting</td><td>dHAL can be used for alarm in case of inconsistency of SV (regulator output signal) and PV (valve position feedback signal) and is simultaneously effective for positive/negative deviation. As SV and PV may be inconsistent in a short time during valve rotation, the parameter CtI of the artificial controller is set as the delay time (in second) and is generally set as the valve motor travel time. Therefore, no alarm will be uttered in case of inconsistency of PV and SV in a short time during valve rotation. If the deviation of PV and SV is still larger than dHAL beyond the CtI time, the instrument will utter the deviation alarm, which can drive the relay on AL1, AL2 or AU2 to act. With the delay function, the deviation alarm is not subject to hysteresis.</td><td>0-999.9%</td></tr>
<tr><td>CtI</td><td>Deviation alarm delay time</td><td>The parameter CtI, as the delay time (in second), is generally set as the valve motor travel time. Therefore, no alarm will be uttered in case of inconsistency of PV and SV in a short time during valve rotation.</td><td>0-125
×0.5 s</td></tr>
<tr><td>t</td><td>Undisturbed slow switching time</td><td>If the manual output is different from the auto output of the regulator during switching from the manual model to auto mode, the manual output should slowly change into the auto output. The time constant depends on the parameter t (in second). The larger t is, the slower the change is. When the setting is t=0, the slow varying function will be disabled. In this case, the manual output will immediately switch to the auto output.</td><td>0-2000 s</td></tr>
<tr><td>Sn</td><td>Input specifications</td><td>Sn is used to select the input specifications of the set signal output (SV). The values and corresponding input specifications are as follows:
<table>
<tr><td>15 4~20mA (with I4 in MIO)</td><td>16 0~20mA (with I4 in MIO)</td></tr>
<tr><td>31 0~1V</td><td>32 0.2~1V</td></tr>
<tr><td>33 1~5V voltage input</td><td>34 0~5V voltage input</td></tr>
</table>
The unlisted Sn values are reserved and must not be used.</td><td>0-37</td></tr>
<tr><td>dIL</td><td>Displayed value of lower limit of input</td><td>It is used for defining the lower limit scale of the valve input signal PV and also effective for transmitting output and light column display.</td><td>-199.9-
+999.9%</td></tr>
<tr><td>dIH</td><td>Displayed value of upper limit of input</td><td>It is used for defining the upper limit scale of the input signal PV and used together with dIL. dIL and dIH should be set correctly so that the valve position is displayed in percentage. If the valve position feedback signal is 1-5V, dIL should be set as -25.0, and dIH should be set as 100.0. If the valve position feedback signal is just 0-5V, dIL should be set as 0.0, and dIH should be set as 100.0.</td><td>Ditto</td></tr>
<tr><td>Sc</td><td>Input Offset</td><td>To compensate the error by sensor, input signal or automatic cold junction compensation of a thermocouple $PV_{after\ compensation} = PV_{before\ compensation} + Sc$. Generally, the set value should be 0. Incorrect setting may cause measurement errors.</td><td>-199.9-
+400.0%</td></tr>
</table>

OPt	Output mode	OPt indicates the type of main output (OUTP). The type of the module installed on OUTP should suit for OUTP. OPt=0: time scale output (generally not suitable for the artificial controller) OPt =1: 0-10mA linear current output, with the linear current output module installed on the main output module. OPt =2: 0-20mA linear current output, with the linear current output module installed on the main output module. OPt =3: Reserved. OPt =4: 4-20mA linear current output, with the linear current output module installed on the main output module. OPt =5-7: position scale output. OP1 and OP2 can be used for directly driving forward and reverse of the valve motor. OPt.A=5 is suitable for control with no valve feedback signal, and the valve travel time should be 60s. For OPt.A=6, the valve position feedback signal should be input via the 0-5V input end, and the valve travel time should be more than 10s. For OPt.A=7, the valve position can be set automatically, and OPt.A will automatically change into 6 after setting. The insensitive valve position can be adjusted by setting the parameter dF. The recommended setting range is 1.0-3.0(%). The parameter dF can be increased to avoid frequent rotation of the valve. However, if the dF value is too large, the control accuracy will drop.	0-48
oPL	Lower limit of output	To limit the percentage of the minimum value of the OUTP output.	-110-0%
oPH	Upper limit of output	To limit the percentage of the maximum value of the OUTP output.	0-110%
ALP	Alarm output programming	The unit place, ten place, hundred place among four digits of ALP are respectively used for defining the output position of three alarms: HIAL, LoAL and dHAL, as follows: ALP = 4 (dHAL) 0 (LoAL) 3 (HIAL) ; The numerical value range is 0-6. The value 0-2 and 5 indicate no alarm output from any port. 3, 4 and 6 respectively indicate the alarm output from AL1, AL2 and AU2. When AL2 or AU2 is used, the L5 dual relay module can be installed in the ALM or AUX position. Example: when ALP is set as 403, the upper limit alarm HIAL will be output by AL1, the lower limit alarm LoAL has no output and dHAL is output by AL2.	0-9999
CF	System function selection	The parameter CF is used for selecting certain system functions: CF=A×1+B×2+C×4+D×8+E×16+F×32+G×64+H×128 A, B, C and D in the formula does no effect in this instrument and must be set zero. F=0: the light column of the instrument indicates the output; F1=1: the light column of the instrument indicates the measured value PV. G=0: the alarm symbol is displayed alternately on the lower display in case of alarm, and the causes of instrument alarm can be known rapidly; G=1: no alarm symbol is displayed on the lower display in case of alarm, and this is generally application to alarm use for control. H=0: the alarm is subject to unilateral hysteresis; H=1: the alarm is subject to bilateral hysteresis (compatible with the version V6.X). Example: the light column should display the output value. If the alarm symbol is not displayed alternately on the lower display in case of alarm, then: A, B, C, D and E are all 0, F=0, G=1, and H=0. The parameter CF should be set as follows: CF=0×32+1×64+0×128=64	0-255
Addr	Communication address	When the auxiliary function module of the instrument is used for communication (the RS485 communication interface is installed, and the setting range of bAud should be 1200-19200). The communication address Addr ranges 0~100 and each instrument should set an unique address among others linked in a single communication line.The appropriate software or host computer or PLC can be installed to read the data of the instrument through the communication interface and carry out various operations. For the communication protocol or relevant software information, consult the technical support.	0-100
bAud	Communication Baud rate	When the COMM module of the instrument is used for communication, bAud is used for defining the communication Baud rate, within the range of 1200-19200bit/s (19.2K). When the communication function is not used, the X3 or X5 current output module can be installed in the COMM module position to transmit the measured value PV into the 0-20mA or 4-20mA standard current signal for external recorders or other equipment by setting corresponding Addr and baud values. Addr indicates the lower limit of output, and bAud indicates the upper limit of output of unit in percentage. Example: for the 4-20mA transmitting output current, Addr=20 and bAud=100; and for the 0-20mA transmitting output current, Addr=0 and bAud=100.	0-19.2K

dL	Input digital filtering	The AI instrument includes one median filter using the median value and one first-order integral digital filtering system. Median filter takes values of three consecutive input values. The integral filtration is equivalent to the resistance-capacity integral filtering in the electronic circuit. The value changes caused by input interference can be smoothed by the digital filter. The setting range of dL is 0-20. 0 indicates no filtering, 1 indicates filtering in which the median value is used, and 2-20 indicate simultaneous operation of filtering in which the median value is used and the integral filtering. The larger dL is, the more stable the measured value is, but the slower the response is. In general, the dL value can be increased gradually in case of large disturbance in measurement and should be adjusted until the instantaneous jump of the measured value is less than 2-5 characters. When the instrument is calibrated in the laboratory, dL should be set as 0 or 1 in order to increase the response speed.	0-20
run	Running status and power-on signal processing	run=0: manual adjustment mode. run=1: auto adjustment mode. run=2: auto adjustment mode, with prohibition of manual operation. When the manual function is not required, this function can prevent the manual mode from being enabled as a result of error operations. When the instrument operation is controlled by the RS485 communication interface, the manual/auto switching of the instrument can be realized via the computer (host) by modifying the parameter run.	0-127
Loc	Parameter modification level	When Loc of the AI instrument is set as any value except for 808, the instrument only allows the display and setting of 0-8 field parameter(s) (defined by EP1 to EP8) and the parameter Loc. When Loc=808, all parameters can be set. The technical personnel of the user can set Loc as any value except for 808 after configuration of input, output and other important parameters of the instrument so as to avoid unintentional modification of some important operation parameters by the field operator. The setting is as follows: Loc=0: allowing modification of the field parameters and set value. Loc=1: capable of displaying and viewing field parameters, allowing no modification, but allowing setting of the set value. Loc=2: capable of displaying and viewing field parameters, allowing no modification or setting of the set value. Loc=808: capable of setting all parameters and set values. If Loc is set as other values, the result may be one of the above results. When the parameter Loc is set as 808 in setting of field parameters, temporary unlocking can be carried out. After setting, Loc will automatically change into 0. When Loc in the parameter table is set as 808 after unlocking, Loc will be saved as 808, equivalent to permanent unlocking.	0-9999
EP1-EP8	Field parameter definition	After instrument setting, the majority of parameters will require no setting by the field worker. In addition, the field operator may not understand certain parameters and may set parameters as wrong values as a result of error operations to cause failure of normal operation of the instrument. In generally, the intelligent instrument has the parameter locking (Loc) function. However, the ordinary parameter locking function will lock all parameters and sometimes the field operator should modify and adjust some parameters such as the upper limit alarm HIAL. EP1 to EP8 in the parameter table can define 1-8 field parameter(s) for use of the field operator. For the other parameters except for EP parameters, such as HIAL and LoAL, when Loc is 0. 1, 2, etc., only the defined parameters or program settings can be displayed, and the other parameters cannot be displayed or modified. This function can accelerate the speed of parameter modification and avoid improper modification of important parameters (such as input and output parameters). The parameters EP1 to EP8 only define 8 field parameters at most. If there are less than 8 field parameters (even zero sometimes), the required parameters should be defined in sequence from EP1 to EP8, and the unused first parameter should be defined as nonE. Example: when HIAL (upper limit alarm) and LoAL (lower limit alarm) of the instrument need to be modified, EP parameters can be set as follows: Loc=0, EP1=HIAL, EP2=LoAL and EP3=nonE If no field parameter is required after instrument commissioning, the parameter EP1 can be set as nonE.	NonE-run