# AI-500/AI-501
## INTELLIGENT INDICATING/ALARM INSTRUMENT
## Operation Instruction(V9.0)

## 1. SUMMARY

### 1.1 Main Features

● Programmable and modular inputs, supporting multiple input types of thermocouples, RTDs, voltage/current and two-wire transmitters. Suitable for measuring and displaying temperature, pressure, flow, level, humidity, etc with measurement accuracy of 0.3% full scale.

● Supports up to 4 loops of alarms including 2 loops of high limit alarms plus 2 loops of low limit alarms. Alarms can be output to different relays or shared one.

● With functions of digital calibrating, digital filtering, and thermocouple cold junction auto compensating, it is free of maintenance and easy operated.

### 1.2 Ordering Code Definition

The ordering code of AI-500/AI-501 is made up of 8 parts, for example:

AI-500   A   N   X3   L3   N   S4   —   24VDC
  ①    ②   ③   ④    ⑤    ⑥    ⑦     ⑧

This means an instrument with ① model AI-500, ② dimension A (96x96), ③ no module in MIO (multiple input/output) slot, ④ X3 linear current output module installed in OUTP (main output) slot, ⑤ L3 dual relay output module in ALM (alarm) slot, ⑥ no module in AUX (auxiliary output), ⑦ RS485 communication interface module S4 in COMM (communication) slot, and ⑧ 24VDC power supply.

The meanings of the 8 parts of ordering code are as below:

① **Shows the model of instrument:**
AI-500 indicating/alarm instrument with single display and measurement accuracy of 0.3%FS.
AI-501 indicating/alarm instrument with dual display and measurement accuracy of 0.3%FS.

② **Shows the front panel dimension:**

| AI-500 | AI-501 | Size | Front Panel Width×Height (mm) | Cut Out Width×Height (mm) | Depth Behind (mm) | Light Bar (mm) |
|---|---|---|---|---|---|---|
| ● | ● | A / A1 | 96×96 | 92×92 | A:100 / A1:70 | --- |
|  | ● | A2/A21 | 96×96 | 92×92 | A2:100 / A21:70 | 25 segments and 4 levels |
| ● | ● | B / B1 | 160×80 | 152×76 | B:100 / B1:70 | |
|  | ● | B2/B21 | 160×80 | 152×76 | B2:100 / B21:70 | 25 segments and 4 levels |
| ● | ● | C / C1 | 80×160 | 76×152 | C:100 / C1:70 | |
|  | ● | C3/C31 | 80×160 | 76×152 | C3:100 / C31:70 | 50 segments and 2 levels |
| ● | ● | D | 72×72 | 68×68 | 95 | --- |
| ● | ● | D2 | 48×48 | 45×45 | 95 | --- |
|  | ● | D6 | 48×48 | 46×46 | 95 | --- |
|  | ● | D71 | 22.5×100mm, DIN rail mount. compact dual LED display, hot-plugged terminals | | | |
| ● | ● | E / E1 | 48×96 | 45×92 | E:100 / E1:70 | --- |
|  | ● | E2/E21 | 48×96 | 45×92 | E2:100 / E21:70 | 25 segments and 4 levels |
|  | ● | F / F1 | 96×48 | 92×45 | F:100 / F1:70 | --- |
| ● | | F0/F10 | 96×48 (large font) | 92×45 | F0:100 / F10:70 | --- |

③ **Shows the module types of multiple input/output (MIO). Selectable modules are as follows:**
**V5/V10/V12/V24** Isolated 5V/10V/12V/24VDC voltage output for transmitter or transducer input. **Remark**: Model of short depth behind panel ( Depth Behind 70mm) does not support 0-5V,0-10V,0-20V input. Additional module can be installed on OUTP slot if those input are required.
**I7** 0~5A AC current input module
**I8** 0~500V AC voltage input module

④ **Shows the module types of main output (OUTP):**
**I**nstalling X3 or X5 (isolated type) current output module can retransmit process value (PV).

⑤ **Shows the module type of alarm output (ALM):**
Can output alarms by installing L0, L2, or L4 relay output module or L3 dual relay output module.

⑥ **Shows the module type of auxiliary output (AUX):**
Can output alarms by installing L0, L2, L4 or L3 relay output module.

⑦ **Shows the module type of communication (COMM):**
Installing S, S4 or S6 (standard MODBUS-RTU) for RS485 communication.

⑧ **Shows type of power supply:**
Null indicates 100~240VAC power supply, and "24VDC" indicates 20~32VDC/AC power.

Note 1: 4~20mA or 0~20mA standard current signal can be inputted by converting to 1~5V/0~5V voltage signal with a 250 ohm resistor or installingI4, module in MIO slot. I4 can supply 24VDC power to 2-wire transmitter.

Note 2: D dimension instruments have no MIO slot, and its COMM and ALM share the same slot and can't be installed at the same time. Its ALM only,support AL1 single loop alarm. D2 dimension instruments have only OUTP slot and COMM / AUX slot.

Note 3: Current module X3 and RS485 communication module S share the same power supply in the instrument, and are not electric isolated to each other. Therefore, if X3 current module is installed in OUTP slot and RS485 communication is need at the same time, then RS485 communication module should be S4 which itself has isolated power supply.

### 1.3 TECHNICAL SPECIFICATION

● **Input type:**
Thermocouple: K, S, R, E, J, N
Resistance thermometer: Pt100, Cu50
Linear voltage: 0~5V, 0~1V, 0~500mV, 0~100mV, 0~60mV, 0~20mV, 100~500mV, 0~10V, 0~20V
Linear current (should connect a external resistor or install I4 module in MIO slot): 0~20mA, 4~20mA
Linear resistor: 0~80 ohm, 0~400 ohm

● **Measurement range :**
K(0~+1300 ℃ ), S(0~1700 ℃ ), R(0~1700 ℃ ), E(0~800 ℃ ), J(0~1000 ℃ ), N(0~1300℃ ),Pt100(-200~+800℃ ), Cu50(-50~+150℃ )

● **Linear input :** -9990~+30000 unit defined by user
● **Measurement accuracy :** 0.3%FS±1
● **Temperature display resolution :** 0.1℃ for K, E, J, N, Pt100 and 1℃ for S, R
● **Temperature shift :** ≤ 0.015%FS/℃ (typical value is 75ppm/℃ )
● **Electromagnetic compatibility (EMC) :** IEC61000-4-4, ± 4KV/5KHz; IEC61000-4-5, 4KV

● **Retransmission :**
When X3 or X5 current module is installed in OUTP slot, process value (PV) can be retransmitted to standard current with maximum load resistor 500 ohm.
● **Alarm function :** High limit, low limit, second high limit and second low limit
● **Isolation withstanding voltage :**
Between power, relay contact or signal terminals ≥ 2300VDC; between isolated electroweak signal terminals ≥ 600VDC
● **Power supply :** 100~240VAC, -15%, +10% / 50-60Hz; 24VDC / AC, -15%, +10%
● **Power consumption :** ≤ 5W
● **Operating Ambient :**Temperature -10~+60℃ ; humidity ≤ 90%RH
● **Front panel dimension:** 96×96mm, 160×80mm, 80×160mm, 48×96mm,96×48mm, 72×72mm, 48×48mm
● **Panel cutout dimension:** 92×92mm, 152×76mm, 76×152mm, 45×92mm,92×45mm, 68×68mm, 45×45mm
● **Depth behind mounting surface:** ≤ 100mm

## 2. DISPLAYS AND OPERATIONS

### 2.1 Front Panel Description

① Upper display window, displays PV, or code of a parameter
② Lower display window, displays alarming code or parameter value
③ Setup key, for accessing parameter tables, and confirming change
④ Data shift key
⑤ Data decrease key
⑥ Date increase key
⑦ Indicator lamps: OP1 and OP2 indicate the status of current retransmission. AL1, AL2, AU1and AU2 indicate the I/O actions ofThe corresponding modules



**Basal display status :** When power on, the upper display window of the instrument shows the process value (PV). This status is called basal display status. When the input signal is out of the measurable range (for example, the thermocouple or RTD circuit is break, or input specification sets wrong), the upper display window will alternately display "orAL" and the high limit or the low limit of PV.

### 2.2 Parameter Setting

In basal display status, press ◎ and hold for about 2 seconds, can access Field Parameter Table. If the parameter lock"Loc"isn't locked (Loc=0), we can modify the value of parameters by ◁ / ▽ or △ . Press ▽ key to decrease the value, △ key to increase the value, and ◁ key to move to the digit expected to modify. Keep pressing △ or ▽ , the speed of increasing or decreasing value get quick. Pressing◎ can go to the next parameter. Press◁ and hold can return to the preceding parameter. Press◁ (don't release) and then press ◎ simultaneously can escape from the parameter table. The instrument will escape automatically from the parameter table if no key is pressed within 30 seconds.Setting Loc=808 and then press can access System Parameter Table.

**When the parameters editing is done, press and hold◎ key until the display status quits from parameter editing. The parameters will be saved.**

## 3. The Parameter Table

### 3.1 Field parameter table (Press ◎ and hold for 2 seconds to access)

| Code | Name | Description | Setting Range |
|---|---|---|---|
| HIAL | High limit alarm | Alarm on when PV(Process Value)>HIAL; Alarm off when PV<HIAL-AHYS | -9990~ +30000 units |
| LoAL | Low limit alarm | Alarm on when PV<LoAL; alarm off when PV>LoAL+AHYS | |
| HdAL | Second high limit alarm | Alarm on when PV>HdAL; alarm off when PV<HdAL-AHYS | |
| LdAL | Second Low limit alarm | Alarm on when PV<LdAL; alarm off when PV>LdAL+AHYS | |
| Loc | Parameter lock | 0~3:allowed to modify field parameters 4~255:can only modify "Loc"; setting Loc=808 and then pressingcan access system parameter table | 0~9999 |

### 3.2 System parameter table (set Loc=808 and then press ◎ to access)

| Code | Name | Description | Setting Range |
|---|---|---|---|
| AHYS | Alarm hysteresis | Avoid frequent alarm on-off action because of the fluctuation of PV. For temperature alarm, it is recommended to be 0.5~2℃ . | 0~200 |

| AoP | Alarm output allocation | Alarm Output to | LdAL (x1000) | HdAL (x100) | LoAL (x10) | HIAL (x1) | 0~4444 |
|---|---|---|---|---|---|---|---|
| | | None | 0 | 0 | 0 | 0 | |
| | | AL1 | 1 | 1 | 1 | 1 | |
| | | AL2 | 2 | 2 | 2 | 2 | |
| | | AU1 | 3 | 3 | 3 | 3 | |
| | | AU2 | 4 | 4 | 4 | 4 | |

Example:

$$AOP = \underset{LdAL}{3} \; \underset{HdAL}{3} \; \underset{LoAL}{0} \; \underset{HIAL}{1} ;$$

shows that HdAL and LdAL are sent to AU1, LoAL has no output, HIAL is sent to AL1.
Note : Installing L 5 dual relay output module in ALM or AUX can implement AL2 or AU2 alarm.

| INP | Input specification Code | InP | Input type | InP | Input type | 0~36 |
|---|---|---|---|---|---|---|
| | | 0 | K | 20 | Cu50 | |
| | | 1 | S | 21 | Pt100 | |
| | | 2 | R | 26 | 0~80omhs | |
| | | 3 | SPARE | 27 | 0~400omhs | |
| | | 4 | E | 28 | 0~20mV | |
| | | 5 | J | 29 | 0~100mV | |
| | | 6 | SPARE | 30 | 0~60mV | |
| | | 7 | N | 31 | 0~500mV | |
| | | 8~14 | SPARE | 32 | 100~500mV | |
| | | 15 | 4~20mA, (I4 module need) | 33 | 1~5V | |
| | | | | 34 | 0~5V | |
| | | 16 | 0~20mA, (I4 module need) | 35 | 0~10V | |
| | | 16 | 0~5A, (I7 module need) | 36 | 2~10V | |
| | | 16 | 0~500VAC, (I8 module need) | | | |

Remark: Model of short depth behind panel (Depth Behind 70mm) does not provide input specification from 33 ~36. Additional module can be installed on OUTP slot if those input are required.

| dPt | Radix point position | Four formats (0, 0.0, 0.00, 0.000) are selectable For thermocouples or RTD inputs, only 0 and 0.0 are selectable, and the internal resolution is 0.1. For linear input, if the value of PV or any parameter is probably greater than 9999, format 0.000 is recommended. | 0 / 0.0 / 0.00 / 0.000 |
|---|---|---|---|
| SCL | Signal scale low limit | Define scale low limit of input signal. It is also the scale of the low limit of retransmission output. For example, to transform 1~5V input signal into process value of 0~200.0, we shall set dPt=0.0, SCL=0, SCH=200.0 | -9990~ +30000 |
| SCH | Signal scale high limit | Define scale high limit of input signal. It is also the scale of the high limit of retransmission output. For example, to transform 0~5V input signal into process value of 1000~2000, we shall set dPt=0, SCL=1000, SCH=2000. | -9990~ +30000 |
| Scb | Input shift adjustment | Scb is used to compensate the error produced by sensor or input signal. PV_after_compensation= PV_before_compensation + Scb. For example, for same input signal, if measured temperature PV is 500.0℃ when Scb=10.0, then PV should be 510.0℃. | -1999~ +4000 |
| FILt | Input filter | The value of FILt will determine the ability of filtering noise. When a large value is set, the measurement input is stabilized but the response speed is slow. Generally, it can be set to 1 to 3. If great interference exists, then you can increase parameter "FILt" gradually to make momentary fluctuation of measured value less than 2 to 5. When the instrument is being metrological verified, "FILt" s can be set to 0 or 1 to shorten the response time. | 0~40 |
| CtrL | Control mode (only for AI-501) | POP, transmit PV; SOP, transmit SV, SV can be -9990~+30000. When CtrL=SOP, lower window shows transmit value and can be modified. | |

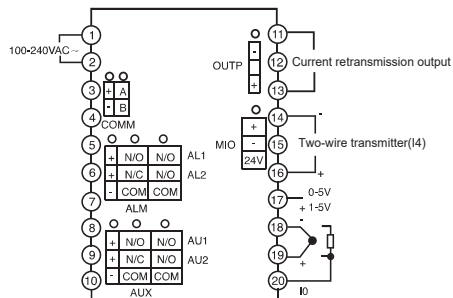| OPt | Output Type | 0-20: 0~20mA linear current retransmission output; 4-20: 4~20mA linear current retransmission output. | |
|---|---|---|---|
| SPL | Lower Limit for SV(only for AI-501) | Minimum value allowed for SV setting. | -9990~ +30000 |
| SPH | Upper Limit for SV(only for AI-501) | Maximum value allowed for SV setting. | |
| SPSL | Lower limit of transmission output scale | When used to define the current transmission output, it is the defined value of the output lower limit scale. | |
| SPSH | Upper limit of transmission output scale | When used to define the current transmission output, it is the defined value of the output upper limit scale. | |
| Addr | Communication address | Each instrument should be assigned a unique address in one RS485 communication line. | 0~80 |
| bAud | Baud rate | The range of baud rate is 1200~19200 bit/s. Can be set to 4800, 9600 or 19200. | 0~ 19200 |

## 4. Rear Terminal Layout and Wiring

The compensation wires for different kinds of thermocouple are different, and should be directly connect to the terminals. Connecting the common wire between the compensation wire and the terminals will cause measurement error.

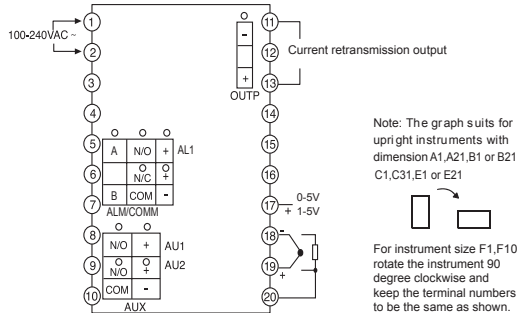**Wiring graph for instrument with dimensions A, A2, E, E2 or F**

Note:
Linear voltage signal with its range below 500mV can be inputted from terminals 19+ and 18-. 0~5V, 1~5V or 0~10V signal can be inputted from terminals 17+ and 18-. 420mA current signal can be converted to voltage signal with an 250 ohm external resistor and then inputted from terminals 17+ and 18-.If I4 module is installed in MIO slot, current signal can also be inputted from terminals 14+ and 15-, and 2-wire transmitter can be inputted from terminals 16+ and 14-.



Note: The graph suits for upright instruments with dimension A, A2, B or B2 C, C3, E or E2

For instrument size F,F0, rotate the instrument 90 degree clockwise and keep the terminal numbers to be the same as shown.

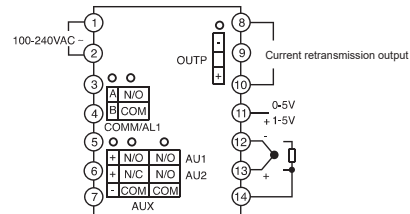**Wiring graph for instrument with dimensions A1, A21, B,B21,C,C31,E1, E21 or F1,F10**

Note: : The series of short depth instrument do not support loop power, nor communication but at most support two alarm outputs and retransmission.



Note: The graph suits for upright instruments with dimension A1,A21,B1 or B21 C1,C31,E1 or E21

For instrument size F1,F10 rotate the instrument 90 degree clockwise and keep the terminal numbers to be the same as shown.

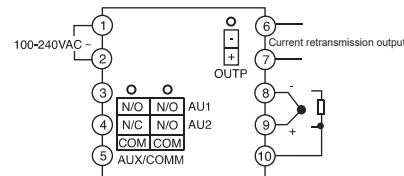**Wiring graph for D dimension(72mmX72m) instruments:**

Note:
Linear voltage signal of range below 500mV should be inputted from terminals 13+ and 12-, Signal of 0~5V, 1~5V or 0~10V should be inputted from terminals 11+ and 12-. 4~20mA linear current signal can be converted to 1~5V voltage signal with a 250 ohm resistor and inputted from terminals 11+ and 12-.

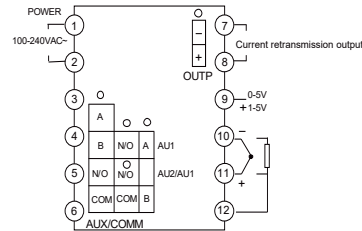

**Wiring graph for D2 dimensio (48mmX48mm) instruments**

Note: Linear voltage signal of range below 500mV should be inputted from terminals 8- and 9+-,D2 dimension not support 0~5V or 1~5V input. However, 0~5V or 1~5V can be converted to 0~500mV or 100~500mV by connecting external resistor (it belong to custom made order, please contact our sales or agent).
4~20mA linear current signal can be converted to 100~500mV voltage signal with a 25 ohm resistor and inputted from terminals 8- and 9+.



**Wiring graph for D6 dimensio (48mmX48mm) instruments**

Note: Linear voltage below 500mV should be inputted by terminals 10- and 11+; 0-5V and 1-5V should be inputted by terminals 10- and 9+. 4~20mA linear current can be converted to 1~5V voltage with a 250 ohm resistor by terminals 10- and 9+.



**Wiring graph for D71 dimensio (22.5mmX100mm) instruments**



Note 1: Input
0~5V/1~5V input from 16+, 15-
500mV below input from 14+, 15-
4~20mA with 250ohm shunt resistor converted to 1~5V, input from 16+, 15-
Note 2:
Fixed with one channel alarm and communication
Main output can be selected among X3.
Alarm is mandatorily defined as AU1.