ASY Electronics (Jiaxing) Co., Ltd

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# Thermal gas mass flowmeter AI-FC proportional valve control type Manual


**Application area**:
Aerospace、Semiconductor processing、
Medical biochemistry、
Electronic powered automobile、
Ferrous metallurgy、VEIS、
the industrial gas production and related industries.

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# I、Product Introduction

The AI-FC proportional valve controlled thermal gas mass flow meter is a thermal gas flow sensor with proportional valve flow control designed and developed using an advanced microelectromechanical system (MEMS) flow sensing chip. It combines digital signal processing technology and flow control algorithms to achieve precise control and intelligent processing of the flow rate of various gases .

Proportional valve-controlled flow meters are characterized by high accuracy and strong anti-interference capabilities. The bypass fluid in the distributor is in a laminar flow state, which makes the measurement and control more stable and accurate, making it suitable for the measurement and process control of various small-flow clean gases.

# II、Features

- using a microelectromechanical system (MEMS) flow sensor chip , a bypass shunt, and an electromagnetic proportional valve.
- Electromagnetic proportional valves are characterized by long service life and high sensitivity .
- Zero-point stability of the sensor.
- It has high accuracy and good repeatability within its measurement range .
- Fast response time.
- Standard mechanical interface, easy to install .
- RS485 communication output, standard MODBUS RTU protocol .
- The LCD displays instantaneous and cumulative flow rates, providing a clear and intuitive reading experience . Flow rates can be controlled via button input, and the controlled and real-time flow rates are directly displayed on the LCD screen.
- Standard configuration includes 4-20mA input/output control .
- Customizable 0-5V or 0-10V input/output control

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## III、Technical parameters

| | |
|---|---|
| working power supply | DC24V/12W |
| Accuracy (%) | Control accuracy: ±1.0% SP, Measurement accuracy: 1% fs |
| Control and measurement range ratio | 1:100 |
| Valve type | Normally closed type |
| Operating temperature | -10~55℃ |
| humidity | <95%RH (no frost, no ice, no condensation) |
| Flow Specifications | (0~10, 20, 30, 50, 100, 200, 300, 500) SCCM<br>(0~1, 2, 3, 5, 10, 20, 30)SLM<br>(0~50, 100) SLM<br>(0-200, 300) SLM |
| Working pressure range | Measurement: 0-1.5MPa<br>Control: 10SCCM-30SPLM Pressure: 0.1-1.0MPa<br>100 SPLM pressure: 0.1-0.65 MPa<br>300SPLM Pressure: 0.1-0.5MPa |
| Typical control response time | Less than 1.5 seconds (T90) |
| Measure response time | <50ms |
| Output method | 4-20mA (1-5V), 0-5V and 0-10V can be customized. |
| Communication methods | RS485 (Modbus RS485 protocol ) |
| Control method | Button operation, Modbus, 4-20mA (1-5V), 0-5V and 0-10V can be customized. |
| Mechanical connection | G1/4, PT1/2 internal threads; other threads can be customized. |
| Protection level | IP40 |

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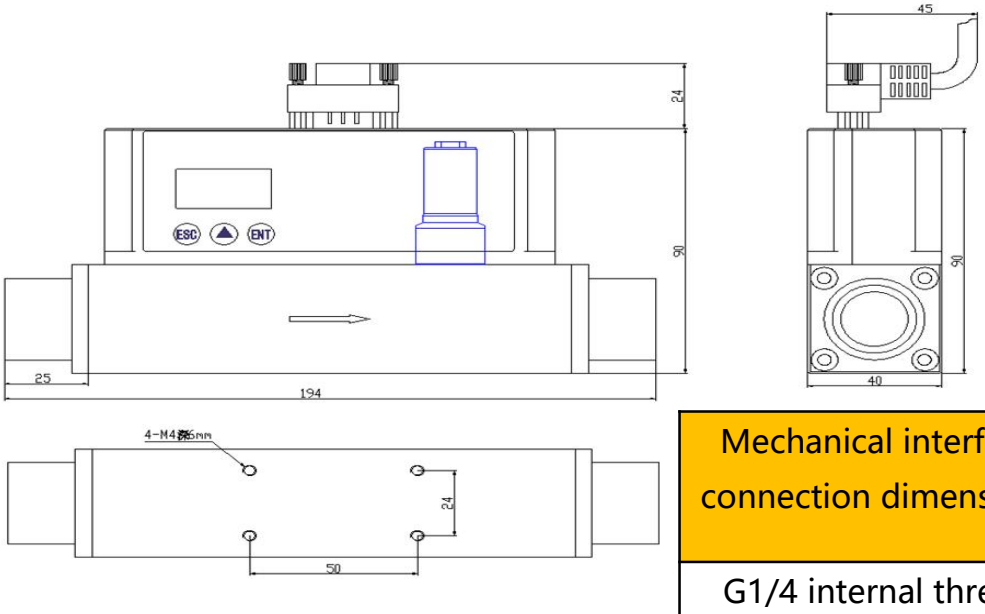
were measured at 25 ℃, 101.32 kPa, and in dry air .

Other features

| | |
|---|---|
| Selectable standard temperature conditions | 0°, 20°, 25°, adjustable by the user, default is 25° |
| Selectable gas type | Air, N2, O2, CH4, Ar, CO2, He, H2 , C3H8 |
| Normal operating pressure difference | 0.1-0.8 MPa, flow rate <= 30 SLM<br>0.1MPA-0.6MPA 30SLM < Flow Rate Specification <= 100SLM<br>0.1MPa -0.4MPa 100SLM < Flow Specification < 300SLM |
| Unconventional working pressure difference | Customized consultation available |

## IV、Mechanical dimensions

### 0-30SLPM Standard Differential Pressure Flow Rate Specifications and Dimensions




| Mechanical interface connection dimensions |
|---|
| G1/4 internal thread |
| PT1/2 internal thread-1 |

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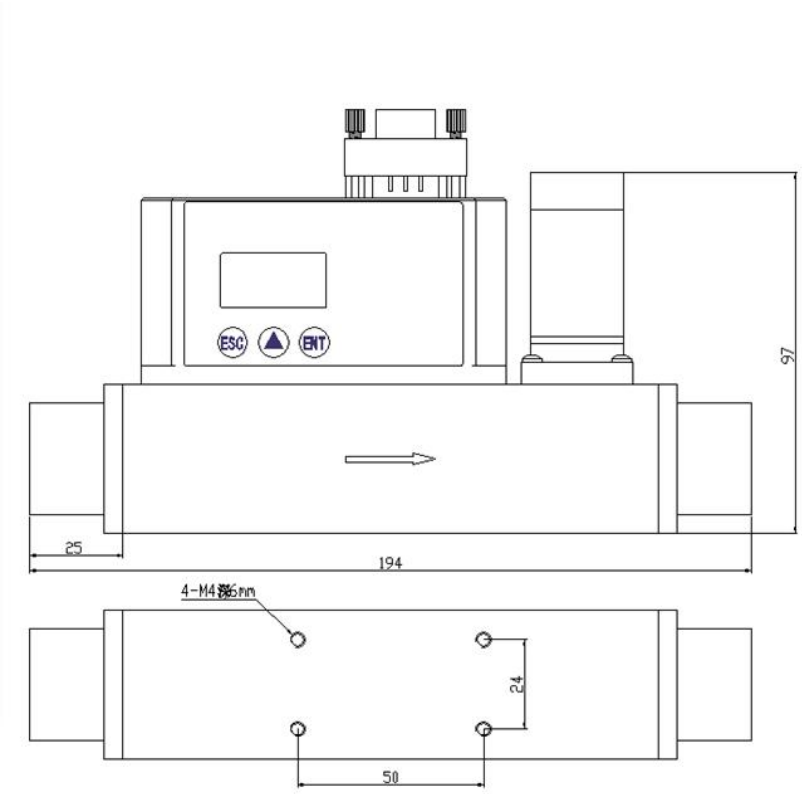
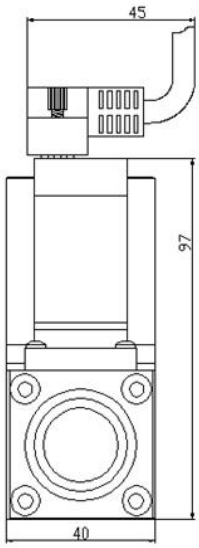
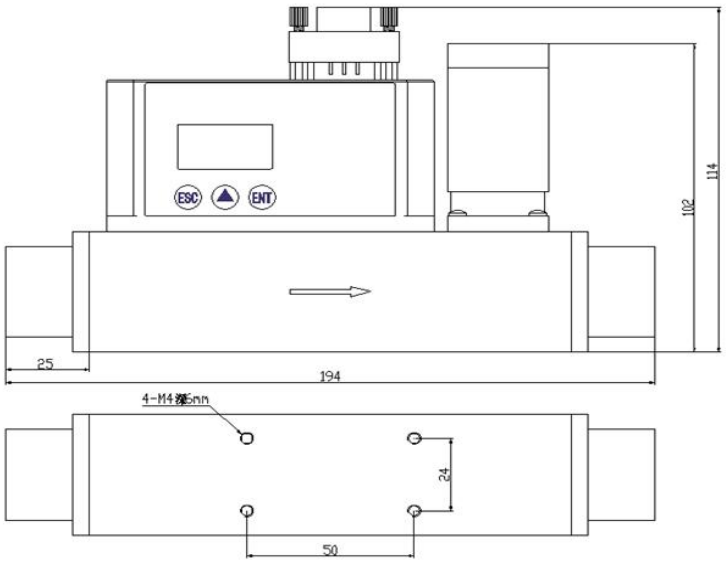
## 30-100SPLM External Valve Standard Differential Pressure Dimensions

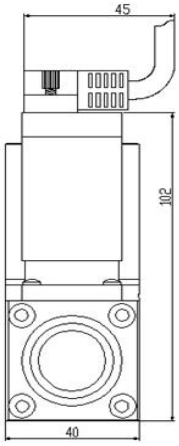



| Mechanical interface connection dimensions |
|---|
| G1/4 internal thread |
| PT1/2 internal thread-1 |

## 200-300SPLM External Valve Standard Differential Pressure Dimensions




| Mechanical interface connection dimensions |
|---|
| G1/4 internal thread |
| PT1/2 internal thread-1 |

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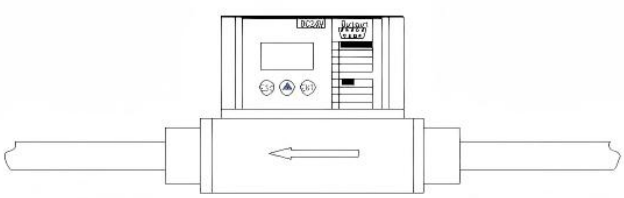
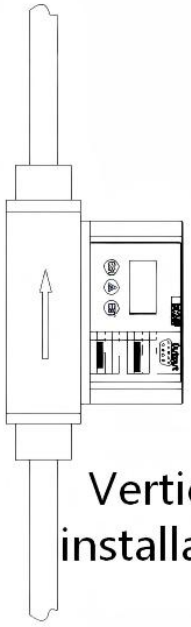
**Standard connectors can be used for interface conversion as needed, or custom connectors can be used.**

| Adapter | quick-connector | Pagoda connector |
|---|---|---|
|  |  |  |

## V、Installation method



Horizontal installation



Vertical installation

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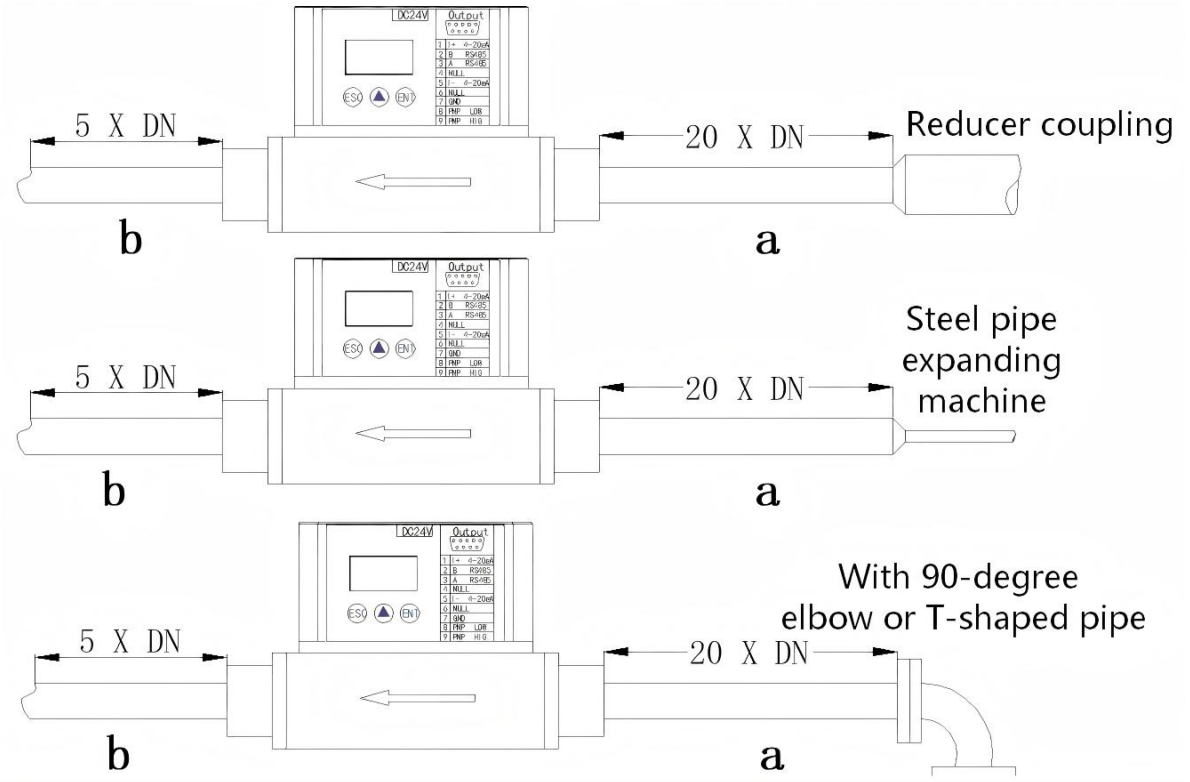


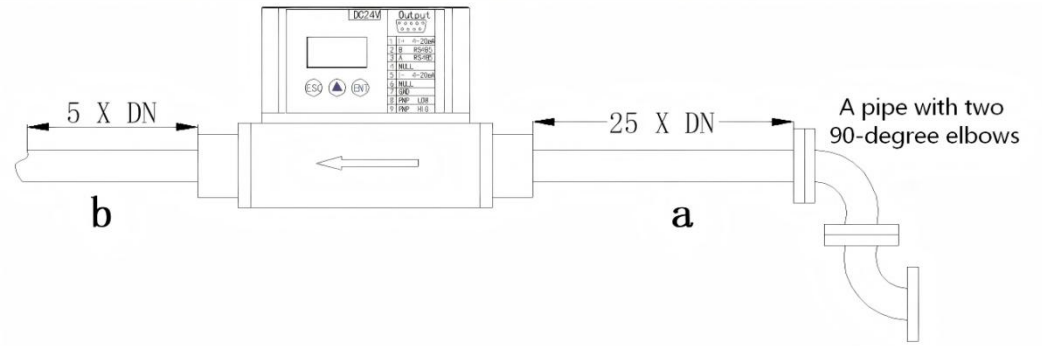


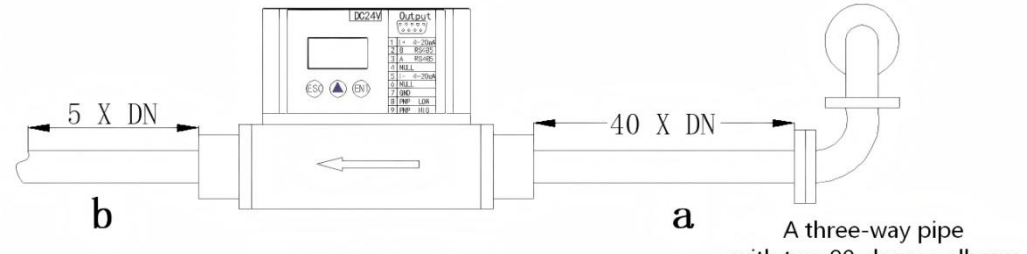


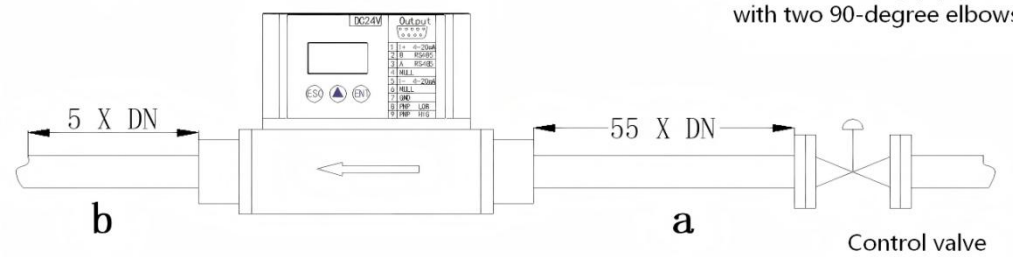

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a = upstream straight pipe section b = downstream straight pipe section

## VI、Wiring instructions

| DB9 Interface Definition | |
|---|---|
| PIN | meaning |
| 1 | 4-20mA output current I+ |
| 2 | RS485 communication output B |
| 3 | RS485 communication output A |
| 4 | PNP LOW (optional) |
| 5 | 4-20mA current I- |
| 6 | 24V power supply positive |
| 7 | GND power supply negative |
| 8 | 4-20mA current input I- |
| 9 | 4-20mA current input I+ |

| DB9 Lead Specifications | |
|---|---|
| color | meaning |
| green | Positive power supply |
| blue | negative terminal of power supply |
| red | RS485 communication output A |
| brown | RS485 communication output B |
| black | 4-20mA current I+ output/voltage controlled output |
| White | Current 4-20mA, I+ input control/voltage control input |
| yellow | 4-20mA current output I- / voltage output - |
| grey | 4-20mA input current I- / voltage input- |
| orange color | PNP optional |

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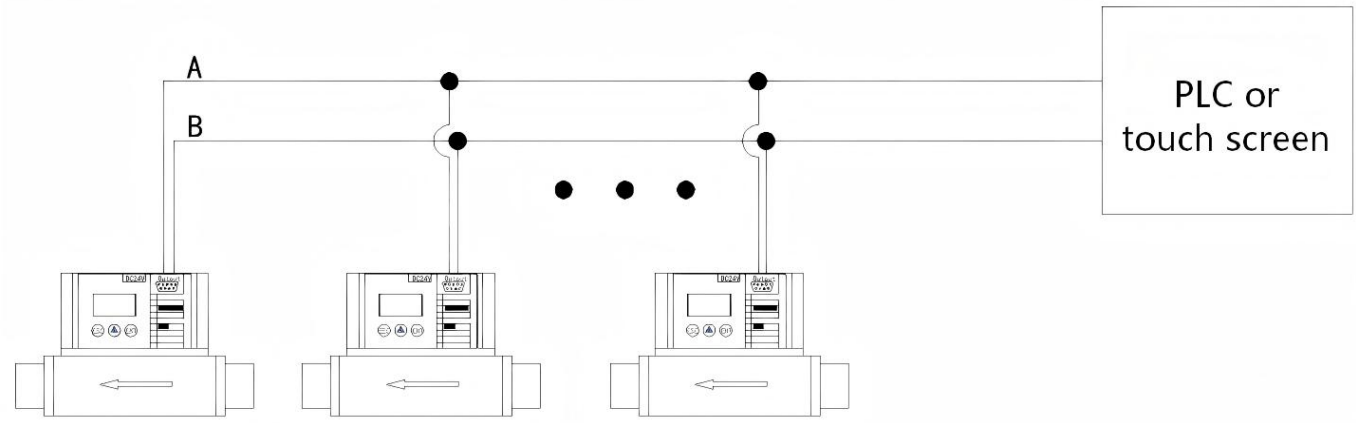
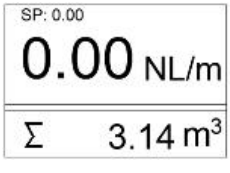
## RS485 bus wiring instructions




The default configuration for 485 bus communication is 32 units

# VII、Interface Description

| Button Instructions | | |
|---|---|---|
| logo | meaning | |
| | Short press (press and release immediately) | Press and hold (for more than 1.2 seconds) |
| ESC | quit | Enter system configuration |
| ▲ | Shift/Select | Enter communication configuration |
| ENT | Adjust upwards | Confirm configuration |

| Display and control interface | |
|---|---|
|  | The first line displays the flow rate at the setting point.<br>The second line displays the measured flow rate and unit. |

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| | |
|---|---|
| | The second line displays the cumulative flow and unit. |
|  | Press ENT to enter the control interface, and press ESC to return.<br>SP is used to set the flow point.<br>F represents the test traffic value.<br>V represents the sensor voltage, and K represents the solenoid valve current (percentage). |

**System configuration menu (press and hold the ESC key for more than 1.2 seconds to enter)**

| Communication Menu | |
|---|---|
| **Device ID**<br>**> 001**<br>**Baud rate 9600**<br>**Parity None**<br>**Stop bits 1 bit** | MODBUS communication device ID, 0-255 |
| | Baud rate selection: 4800/9600/19200/38400 |
| | Checksum: None/Odd/Even |
| | Stop bits: 1 bit / 2 bits |

## VIII 、Troubleshooting

**Please troubleshoot according to the table below.**

| Serial | Fault | Possible causes of | processing method |
|---|---|---|---|
| 1 | When there is no ventilation, | The gas is still | Check if the shut-off valve is closed. |
| | | Zero Drift | Reset to zero |
| | | Other faults | Please contact the manufacturer. |
| 2 | Unable to control traffic | Incorrect gas line | Check that the MFC is connected |
| | | Differential pressure | Check pressure |
| | | Power supply | Check if the power supply and |
| | | Incorrect signal | There are priorities; button and |
| | | Sensor problems | Please contact the manufacturer. |

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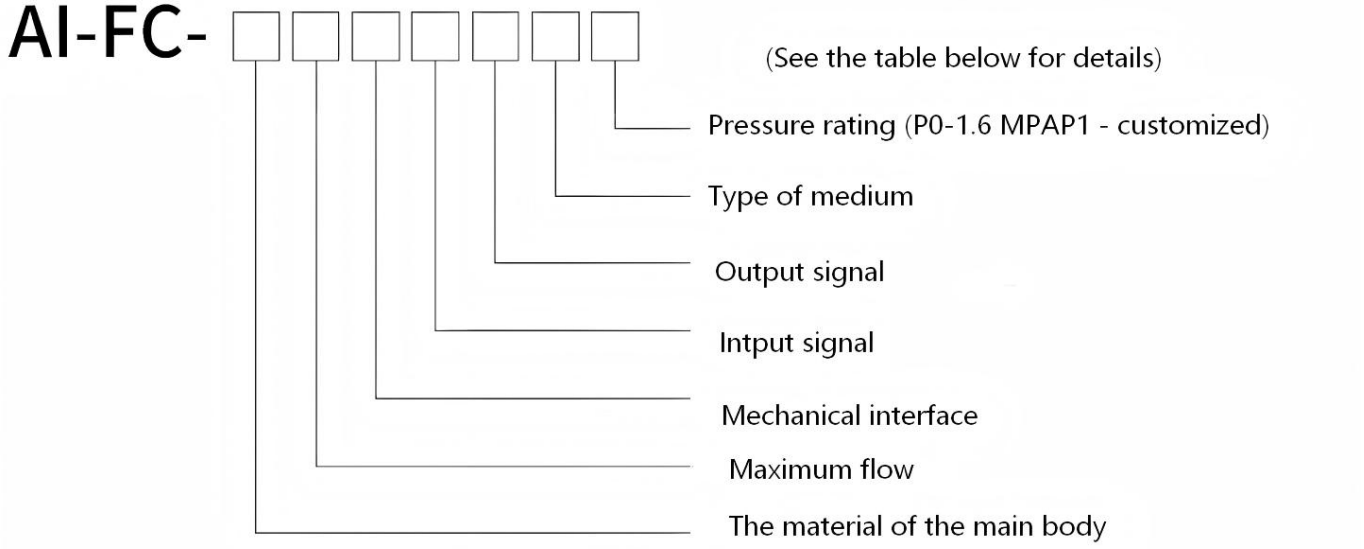
## IX、Product Selection




| Product Series | Body material | Flow range | Mechanical interface | Input signal | Output signal | medium | Pressure level |
|---|---|---|---|---|---|---|---|
| AI-FC | F1 | S0 | GN0 | P0 | N0 | AIR | P0 |

For example:

Model: AI-FC -F1S0GN0P0N0AIR Parameters: **AI-FC** : Proportional valve; **Body material** : 304 stainless steel; **Measuring range** : 1~100SCCM ; **Mechanical interface** : G3/4 internal thread ; **Input control signal** : 4-20mA ; **Output signal** : 4-20mA+RS485 ; **Measuring medium** : Air ; **Pressure rating** : Less than 1.5 MPa

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| | | |
|---|---|---|
| Body material | F0 - Anode Aluminum, F1 - 304, F2 - 316 | |
| Flow range | S0 | 1~100SCCM |
| | S1 | 5~500SCCM |
| | S2 | 10~1000SCCM |
| | S3 | 0.1~10 SLPM |
| | S4 | 0.3~30 SLPM |
| | S5 | 0.5~50 SLPM |
| | S6 | 1~100 SLPM |
| | S7 | 2~200 SLPM |
| | S8 | 3~300 SLPM |
| Mechanical interface | GN0 | G1/4 Internal Thread |
| | PT2 | PT1/2 internal thread |
| | NT stands for custom thread; | |
| Input/output signals | P0 | 4-20mA (default) 485 |
| | P1 | 1-5V 485 |
| | P2 | 0-5V 485 |
| | P3 | 0-10V 485 |
| Output signal | N0 | RS485 and 4-20mA (default) |
| | N1 | RS485 and 1-5V |
| | N2 | RS485, 0-5V |
| | N3 | RS485, 0-5V |
| Media type | The measurement medium type is specified as follows: AIR for | |
| Pressure level | P0 represents <1.5 MPa (default); P1 represents 2-3 MPa | |

Note: Flow rate measurement ranges are all based on air measurements.

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# X、Appendix 1 MODBUS Register Address Table

**Communication baud rate: 9600, 8, 1, NONE; Floating-point data arrangement: 2^143**

**Read data function code: 03 (HOLDING REGISTER)**

**Instrument address: can be set via menu, 0-255**

| Register address | Register Name | Number of registers | Data types | Data format |
|---|---|---|---|---|
| 4x0001-4x0002 | Instantaneous flow | 2 | float | IEEE754 |
| | send | 01 03 00 00 00 02 C4 0B | | |
| | take over | 01 03 04 00 00 00 00 FA 33 | | |
| 4x0003-4x0004 | Traffic settings | 2 | float | IEEE754 |
| | send | 01 03 00 02 00 02 65 CB | | |
| | take over | 01 03 04 00 00 00 00 FA 33 | | |
| 4x0005 | Zero point calibration | 1 | Unsigned int | Unsigned integer |
| | send | 01 0 6 00 04 55 AA 77 24 | | |
| | take over | 01 0 6 00 04 55 AA 77 24 | | |
| 4x0007-4x0008 | Cumulative integers | 2 | Unsigned long | Unsigned long integer |
| | send | 01 03 00 06 00 02 24 0A | | |
| | take over | 01 03 04 00 00 00 00 FA 33 | | |
| 4x0009-4x0010 | Cumulative decimals | 2 | float | IEEE754 |
| | send | 01 03 00 08 00 02 45 C9 | | |
| | take over | 01 03 04 00 00 00 00 FA 33 | | |
| 4x0011-4x0012 | Cumulative floating-point number | 2 | float | IEEE754 |
| | send | 01 03 00 0A 00 02 E4 09 | | |
| | take over | 01 03 04 00 00 00 00 FA 33 | | |
| 4x0013-4x0014 | Negative cumulative | 2 | float | IEEE754 |

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| | | | | |
|---|---|---|---|---|
| | floating-point number | | | |
| | send | 01 03 00 0C 00 02 04 08 | | |
| | take over | 01 03 04 BA 4A 41 F8 CF 2F | | |
| 4x0015-4x0016 | Current acquired signal value | 2 | float | IEEE754 |
| | send | 01 03 00 0E 00 02 A5 C8 | | |
| | take over | 01 03 04 82 1F 40 36 52 5B | | |
| 4x0021 | Register write protection | 1 | Unsigned int | Unsigned integer |
| | send | 01 06 00 16 55 AA D 7 21 | | |
| | take over | 01 06 00 16 55 AA D 7 21 | | |
| | illustrate | Write 0x55AA to this register to unlock the write protection, at which point you can write to other registers. The write protection will automatically lock after 10 seconds, and you will need to unlock it again before you can continue writing. | | |

# XV、Quality Assurance and After-Sales Service

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Adhering to the ISO9001 quality management and control system, this product is manufactured using brand-new raw materials and components and undergoes rigorous factory testing. Product quality and performance meet relevant standards and technical specifications. However, due to uncertainties that may arise during transportation or use, we commit to the following service guarantee terms:

Within one year from the date of product delivery, if the product you purchased malfunctions during normal use due to reasons other than improper use or human error...
We will repair any product damage caused by any factors free of charge.

Damage to the equipment caused by the following reasons during use is not covered by the free replacement or repair policy:

- Installation or use conditions that violate the relevant requirements and regulations in this manual;
- Incorrect or contrary to the relevant instrument installation, wiring, or usage specifications of the country in which it is located;
- This product may not be used in conjunction with other products that are electrically incompatible with it or that lack reliable quality assurance and valid certification.
- Self-disassembly or repair;
- Equipment that has been in use for more than one year may experience natural aging or wear and tear.
- Force majeure as defined by applicable law

For products within the warranty period, the user shall bear the cost of sending the product out, and we shall bear the cost of replacement or repair and return of the product.
If the product sent by the user is confirmed by us to be free from defects or damage, the user shall bear the relevant shipping and insurance costs.