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# Thermal gas mass flowmeter

## AI-FK Explosion-proof type

### Manual



#### **Application area :**

Aerospace、 Semiconductor processing、  
Medical Biochemistry、 Electronic powered automobile、  
Ferrous metallurgy、 Vessel electronic integrated system、  
The industrial gas production and other industries.



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## I. Product Introduction

The AI-FK explosion-proof thermal gas mass flow meter is an explosion-proof thermal gas flow sensor designed and developed using an advanced microelectromechanical system (MEMS) flow sensing chip. This explosion-proof flow meter features high accuracy, high sensitivity, and strong anti-interference capabilities, making it suitable for measuring and controlling various small-flow-rate clean gases. Designed according to explosion-proof standards, this flow meter is suitable for various harsh environments, offering low cost, easy installation, and no need for temperature and pressure compensation. It can replace traditional volumetric or differential pressure flow meters.

## II. Product Features

- Employing a microelectromechanical system (MEMS) flow sensing chip, the sensor features high precision, high sensitivity, and strong anti-interference capabilities.
- Zero-point stability of the sensor.
- It has high accuracy and good repeatability within its measurement range .
- Standard mechanical interface, easy to install .
- RS485 communication output, standard MODBUS RTU protocol .
- The LCD displays instantaneous and cumulative flow rates, which are clear, intuitive, and easy to read.
- 4~20mA standard current signal output and one PNP output (PNP pulse output or 0-5V/0-10V output can be customized).
- Intrinsically safe explosion-proof certification.

## III. Technical Parameters

Working power supply	DC24V/2.5W	Accuracy (%)	±(1.5FS)
Medium temperature	-10~ 50 °C	Zero Drift	± 20m V



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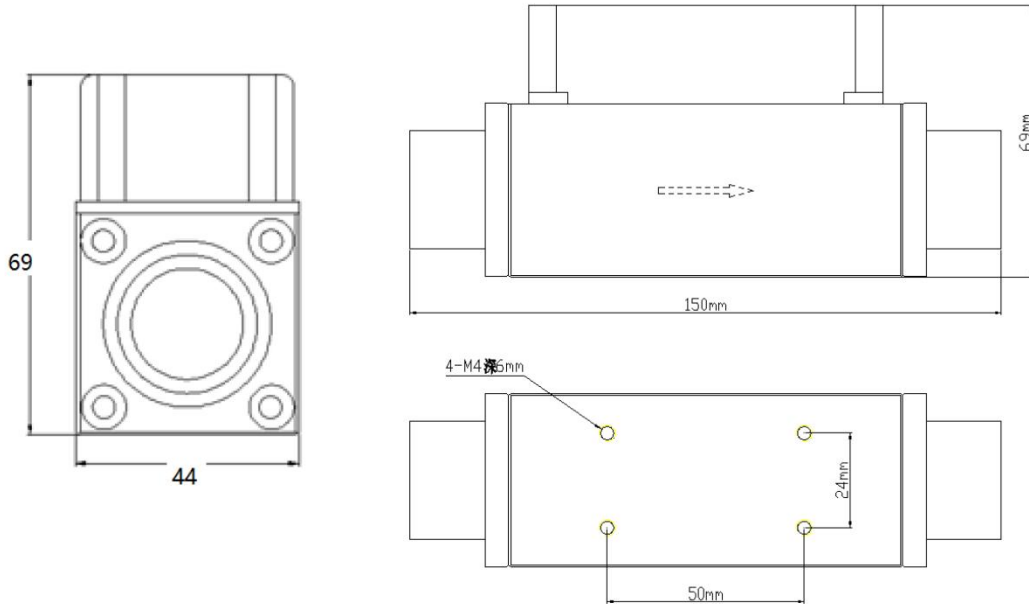
Work pressure	≤1.6 MPa ( default ), customizable with integrated pressure measurement and display for higher pressure ratings .	Mechanical connection	BSPT internal thread and G internal thread are optional See mechanical interface connection dimensions for details.
Output method	4-20mA	Communication methods	RS485 (Modbus RS tu protocol )
Show	Instantaneous traffic, cumulative traffic	Response time (ms)	50-1000 ms
Storage temperature	-10~65°C	humidity	<95%RH (no frost, no ice)

Were measured at 25 °C, 101.32 kPa, and in dry air .

Minimum measurable flow rate: 0.3 NL/ min

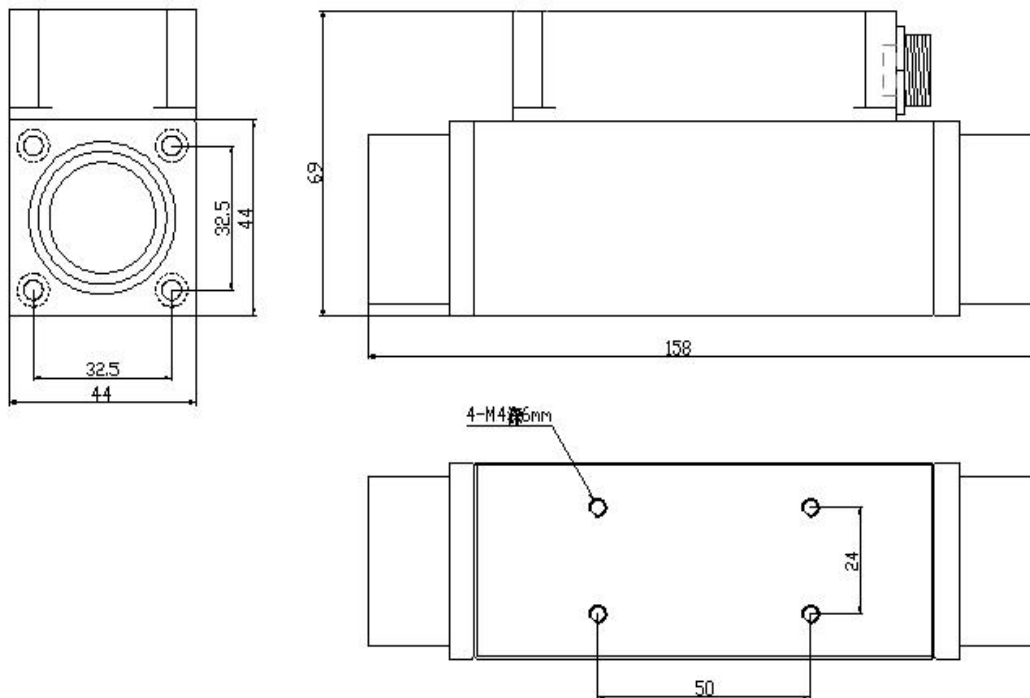
Maximum measurable flow rate: 3000 NL/ min

Customizable with temperature and pressure measurement functions

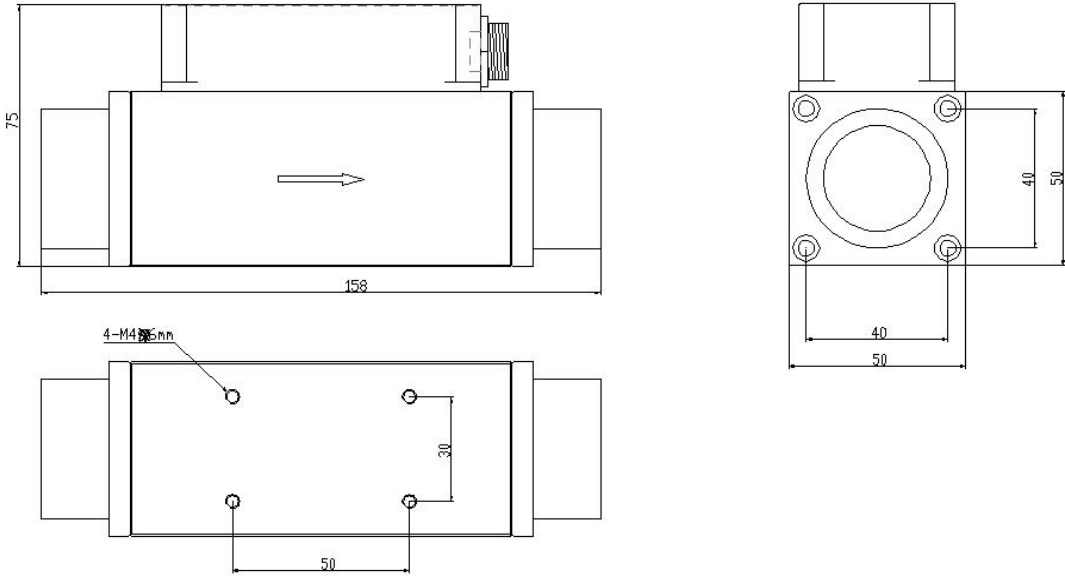


## IV. Mechanical Dimensions

### Dimension drawings for DN8-DN20



### DN25 Dimension Drawing



DN32 pipe diameter dimension drawing

Mechanical interface connection dimensions					
DN8	DN10	DN15	DN20	DN25	DN32
G1/4 Internal Thread	G3/8 internal thread	G1/2 Internal Thread	G3/4 internal thread	G1 internal thread	G1-1/4 Internal Thread
BSPT1/4 internal thread	BSPT3/8 internal thread	BSPT1/2 internal thread	BSPT3/4 internal thread	BSPT1 internal thread	BSPT1-1/4

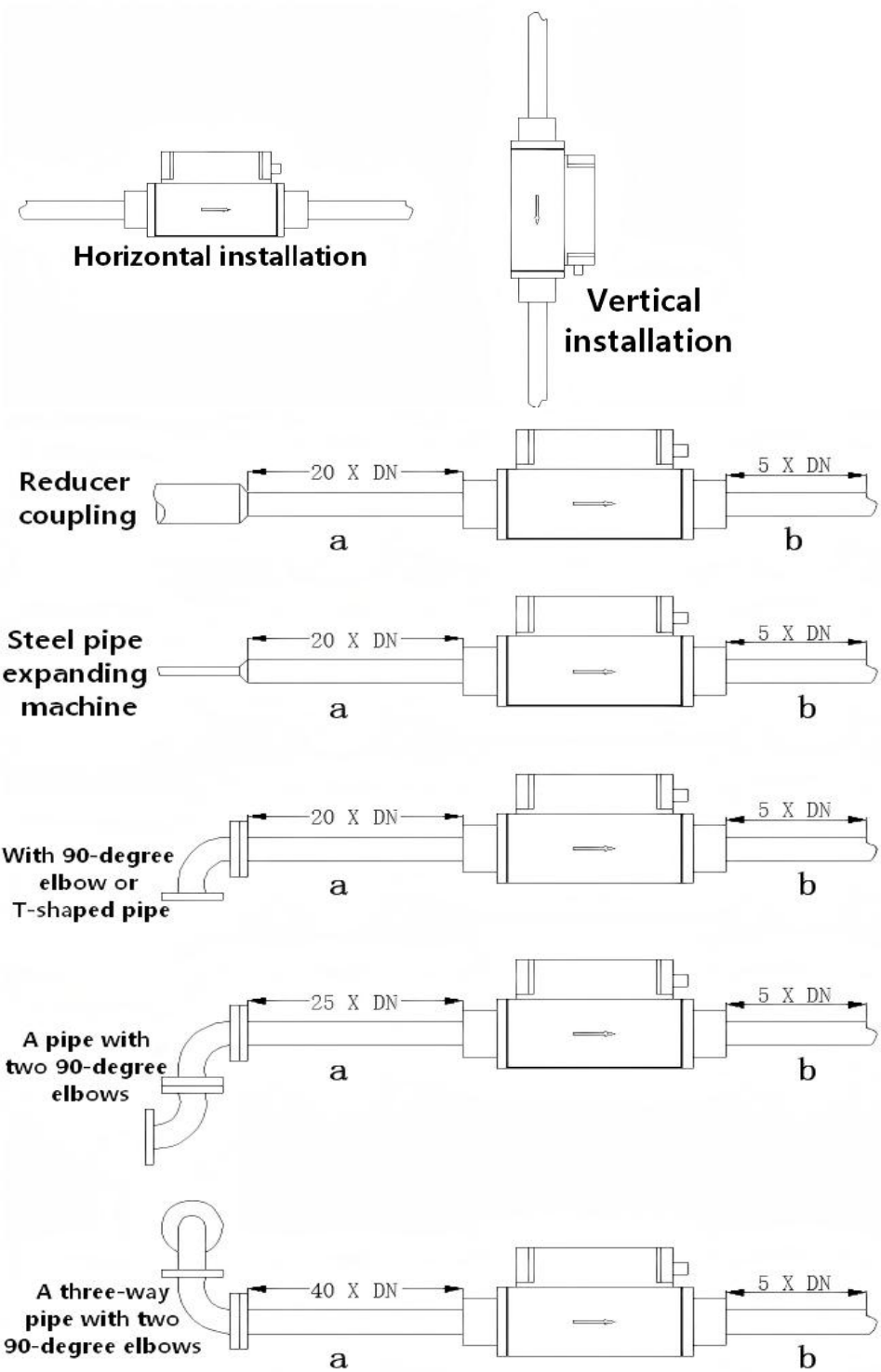
Maximum measurable flow rate					
DN8	DN10	DN15	DN20	DN25	DN32
100L/MIN	300L/MIN	500L/MIN	1000L/MIN	2000L/MIN	3000L/Min

Customization is available if more bandwidth is required.

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

Adapter	quick-connector	Pagoda connector
		

## V. Installation Method





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Notice!

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

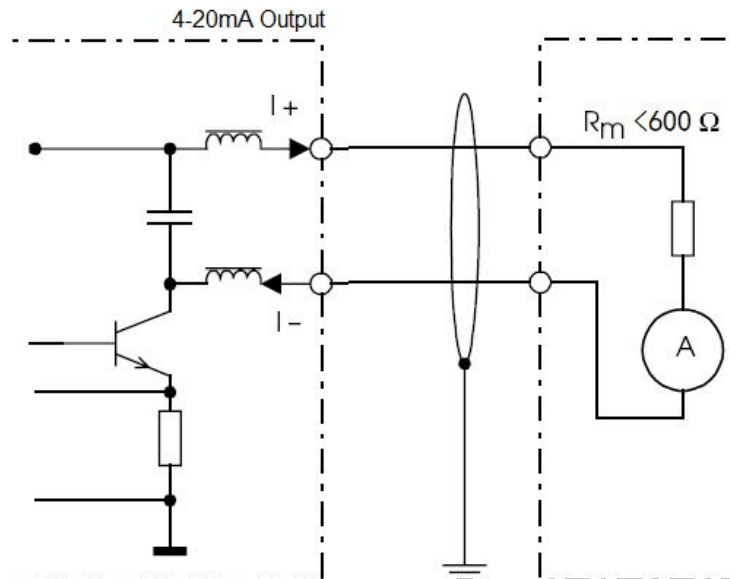
Try to install the control valve and buffer shut-off valve after the thermal gas mass flow meter.

## VI. Wiring Instructions

M8 6-core aviation cable description	
Logo	Meaning
1 — Pink	24V- / Current I-
2 — Black	Current I+
3 — Blue	Shell
4 — White	24V+
5 — Brown	RS485 communication output A
6 — Gray	RS485 communication output B

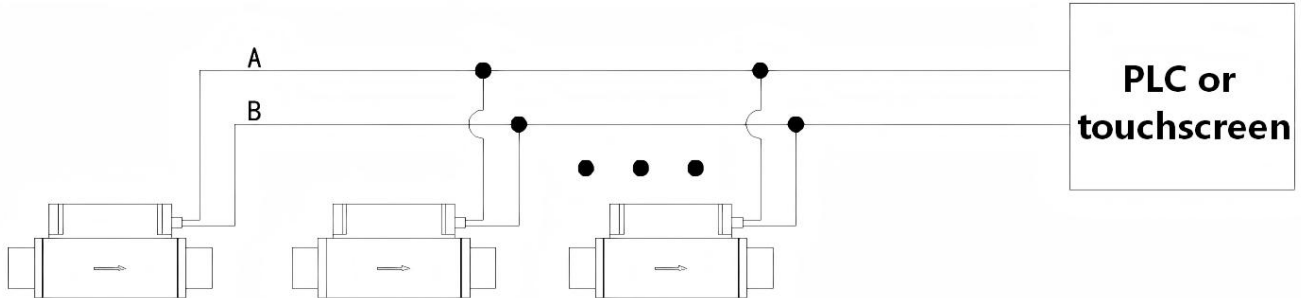
GX16 6-core aviation cable description	
Logo	Meaning
1 — Red	24V+
2 — Black	24V- / Current I-
3 — Green	Alarm Output (PNP)
4 — Brown	Current I+
5 — White	RS485 communication output B
6 — Huang	RS485 communication output A

### 4-20mA Current Output Wiring Instructions







## RS485 bus wiring instructions




The default configuration for 485 bus communication is 32 units

## VII. Operating Instructions

### Button Instructions

logo	meaning	logo	meaning
ESC	Cancel or exit the interface		shift key
ENT	Confirm/Enter button		Modify/Page Turn Key

### Show menu

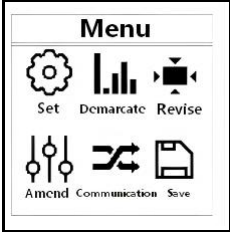
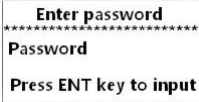
	<p>All information display window</p> <p>First line: Displays instantaneous flow rate and unit.</p> <p>The second line displays the instantaneous flow rate and its unit.</p> <p>The third line displays the cumulative flow and unit.</p> <p>The fourth line displays the version number and the current current loop output current value.</p>
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<b>Menu selection and password input</b>	
 <p>Enter via the ENT menu.</p>	<p>Menu selection</p> <p>Settings : Basic Parameter Settings</p> <p>Calibration : Calibration Settings</p> <p>Calibration : Set zero-point voltage, calibrate current, and reset accumulated flow to zero.</p> <p>Communication : RS485 communication parameter settings</p> <p>Save: Parameter saving and restoration</p> <p>Correction : Secondary correction of traffic</p>
	<p>Settings, calibration, communication, saving, password : 1000</p>

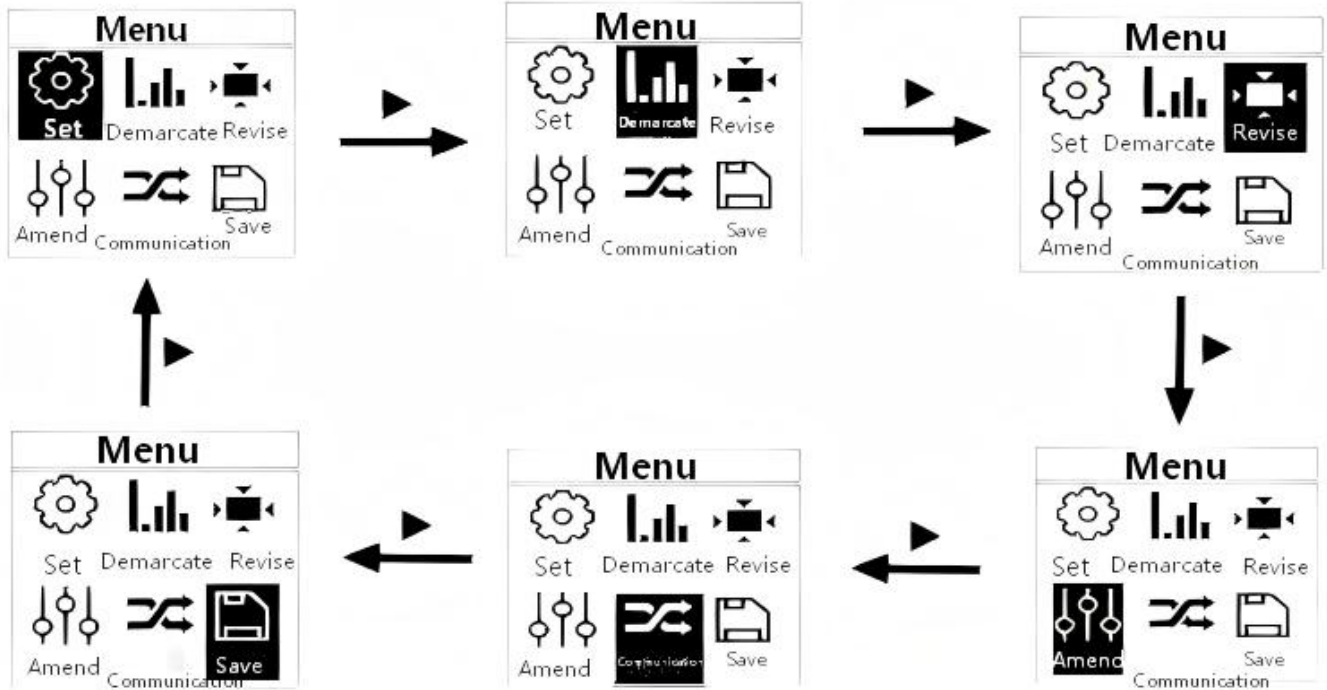


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**Use the shift keys to select the desired function menu.**


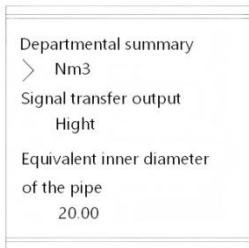
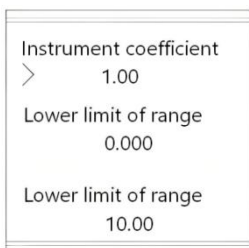
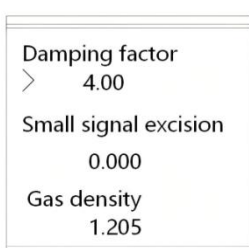


To access the basic parameters menu, move the black rectangle to "Settings," press the "ENT" key, and a password input menu will appear. Press the "ENT" key again, and a flashing cursor will appear. Enter your password, and press the "ENT" key again to confirm. If the password is correct, you will directly enter the parameter settings menu. If the password is incorrect, the character "Error" will appear. Press the "ENT" key again to re-enter the password.





**Settings Menu**

	<p>Language selection: Chinese or English .</p> <p>Backlight options: Auto and Always On .</p> <p>Gases measured: air, oxygen, nitrogen, argon, carbon dioxide, hydrogen, helium, methane, propane.</p> <p>Flow rate units include: g / min, g/s, K g / min, K g / h, Nm<sup>3</sup>/ h, Nm<sup>3</sup>/ min, N L/ h, N L/ min, mL/min . Note: <b>After changing the flow rate unit, be sure to recalculate the upper limit of the flow range according to the current unit and reset the upper limit of the flow range .</b></p>
	<p>Cumulative units include: g, kg, Nm<sup>3</sup>, NL.</p> <p>Alarm Output: High indicates a high-level alarm output, Low indicates a low-level alarm output. The default is High. When an alarm is triggered, the PNP output is 24V; when no alarm is triggered, it is 0V.</p> <p>Pipe inner diameter: Input according to actual application, unit is mm .</p>
	<p>Instrument coefficient: The calibration correction coefficient can be changed to compensate for the interference of fluid cross-sectional velocity distribution and the influence of specific application environments.</p> <p>Metering limits: Set the maximum and minimum flow rates, with the corresponding unit being the currently displayed flow rate unit.</p>
	<p>Damping coefficient: 4.0 by default, range 0-50.</p> <p>Decreasing the damping coefficient can quickly detect changes in flow rate, while increasing the damping coefficient can smooth out the current flow rate display value.</p> <p>Small signal cutoff: Eliminates zero-point fluctuations as a percentage of the measurement range.</p> <p>Gas density: Unit Kg/m<sup>3</sup>. The current instrument defaults to the gas density of air. If you are measuring the mass of other gases, please set it to the gas density of the current gas.</p>



	<p><b>Conversion factor:</b> The conversion factor between the calibration gas and the measured gas.</p> <p><b>Noise threshold:</b> The value is 0-10, used to eliminate noise signals. The higher the value, the greater the noise signal eliminated.</p> <p><b>Alarm limit:</b> An alarm will sound when the measured flow rate exceeds the alarm limit. A value of 0 indicates that no alarm is set. The default value is 0.</p>
	<p><b>Alarm lower limit:</b> An alarm will sound when the measured flow rate falls below the alarm threshold. A value of 0 indicates that no alarm is set. The default value is 0.</p> <p><b>Display rotation:</b> Selectable rotation angles: 0, 90, 180, 270.</p>

**Correction**

	<p><b>Current output modes:</b> 4-20mA and fixed current output Selecting fixed current output allows you to set a fixed current output value.</p> <p><b>Fixed current output values:</b> 0 mA, 4 mA, 8 mA, 12 mA, 16 mA, 20 mA</p> <p><b>Example:</b> Current output mode is 4-20mA When there is no flow, the output current measured with a multimeter is 3.89 mA. The zero point of the adjusted current output is set to: 3.89 mA At maximum flow rate, the output current measured with a multimeter is 19.75 mA. The zero point of the adjusted current output is then set to: 19.75 mA.</p>
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**Method for calibrating current output in fixed current output mode:**  
The first step is to connect the multimeter in series with the current loop circuit;  
The second step is to set the current output mode to fixed current output.  
Third step, press the shift key to move ">" to the next line, press the confirmation key to enter the setting state, press the modify/page key to select the output current value, select 4mA output, and press the confirmation key to exit the setting state;



Fourth step, observe the multimeter display. If it is 4mA, no calibration is needed. If it is 3.90mA, press the Modify/Page Up key to enter the calibration menu, move '>' to before Zero Point Current Adjustment (Adjust lout Zero), press the OK key to enter the settings, enter 3.90, and press the OK key to exit the settings.

Fifth step, press the shift key and the modify/page key at the same time to return to the previous level of the menu, move ">" to the next line, press the confirm key to enter the setting state, press the modify/page key to select the output current value, select 20mA output, and press the confirm key to exit the setting state;

Step 6: Observe the multimeter display. If it is 20mA, no calibration is required. If it is 19.90mA, press the Modify/Page Up key to enter the calibration menu, move '>' to before Zero Point Current Adjustment (Adjust lout Span), press the OK key to enter the settings, enter 19.90, and press the OK key to exit the settings.

Step 7: Press the shift key and the edit/page up key simultaneously to return to the previous menu level. Move the ">" to the next line.

Press the OK button to enter the setting state, press the Modify/Page Turn button to select the output current value, and observe the display value on the multimeter. If they match, the calibration is successful. If there is still a difference, you need to recalibrate. The recalibration steps are the same as above.

User zero point	√
1.113	
Current voltage	√
0.756	
Adjusting zero	√
0.756	
The total flow is reset to zero	
> 0.00	
Standard temperature	
25	

User zero point and current voltage settings  
 When there is no flow in the pipeline, the meter will display a non-zero flow rate. This can be adjusted by modifying the user's zero point, provided there is no pressure and the pipeline is filled with the current gas.  
 Zero point calibration: Select the current zero point by moving the cursor, press the ENT key to confirm the selection, and press the ENT key again to complete the zero point calibration. After successful calibration, the user's zero point will match the current voltage.

Clear or set accumulated decimal and integer values.

Standard temperatures are available in 0°C, 20°C, and 25°C.



Save and restore menu		
<p>The password 0603 will access the save/restore menu. Saving parameters will back up the current parameters; this is generally used for factory resets, and users should avoid overwriting the factory settings unless absolutely necessary. Restoring parameters will restore the backed-up parameters,</p>		
<pre>保存参数 &gt; save 恢复参数 Restore</pre> <p>Save parameters</p>	<pre>保存参数 &gt; save OK 恢复参数 Restore</pre> <p>Saved successfully</p>	<pre>保存参数 &gt; save Err 恢复参数 Restore</pre> <p>Save failed</p>
<pre>保存参数 save 恢复参数 &gt; Restore</pre> <p>Restore parameters</p>	<pre>保存参数 save 恢复参数 Restore OK</pre> <p>Recovery successful</p>	<pre>保存参数 save 恢复参数 Restore Err</pre> <p>Recovery failed</p>

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

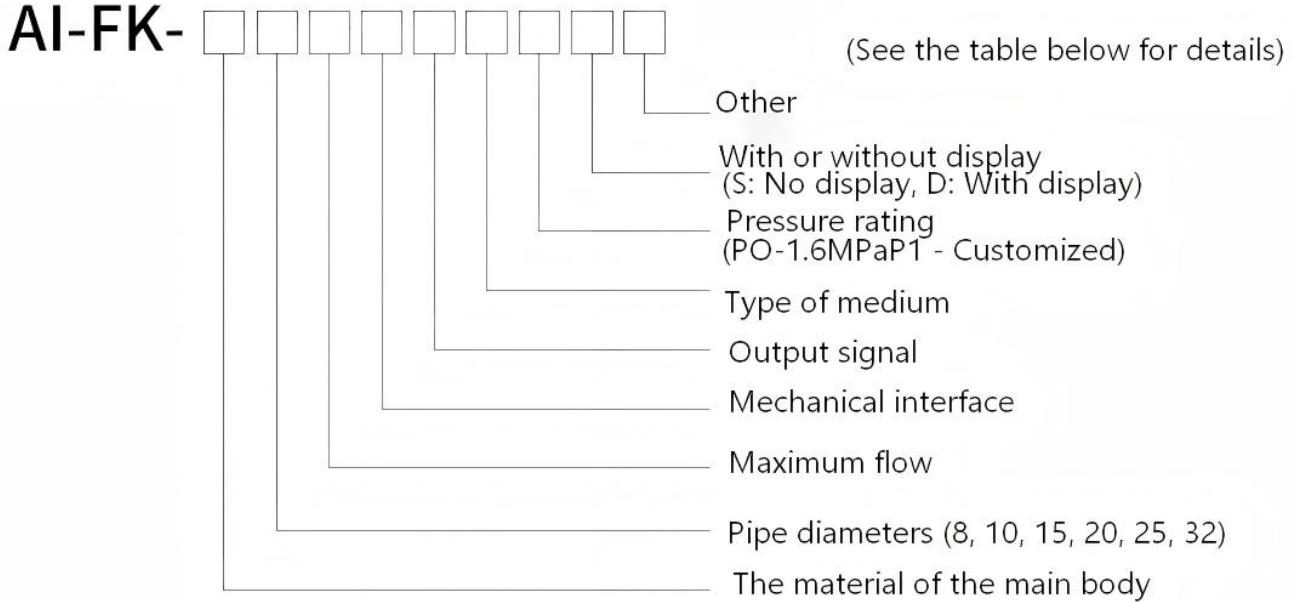


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## VIII. Product Selection



Product Series	Body material	Pipe diameter	flow	Mechanical interface	Output signal	medium	Pressure level	Is there a display?	other
AI-F K	F1	10	L200	PN1	N0	AIR	P0	D	T1

For example:

Model: AI-F K - F 1 10L200PN1N0AIRP0 DT1

**Product Series** : AI-F K Explosion-proof Model ; **Body Material** : 304 Stainless Steel ; **Pipe diameter** : DN10;

**Flow rate range** : 2-200L/min; **Mechanical interface** : PT3/8 internal thread; **Output signals** : RS485 and 4-20mA;

**Measuring medium** : air; **Pressure rating** : less than 1.6 MPa; **Display** : D has a display; **Other** : Temperature display

Body material	F0: Aluminum alloy (default); F1: 304 stainless steel ; F2: 316 stainless steel		
Pipe diameter	08	DN8	Flow measurement range: 1.8-180 L/min
	10	DN10	Flow measurement range: 2.8-280 L/min
	15	DN15	Flow measurement range 6-600L/min
	20	DN20	Flow measurement range 10-1000L/min
	25	DN25	Flow measurement range 20-2000L/min
	32	DN32	Flow measurement range 30-3000L/min





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Maximum flow	L1 represents 1 L/min; L200 represents 200 L/min; L1500 represents 1500 L/min; M represents m <sup>3</sup> /h		
Mechanical interface	PN	0	PT1/4 internal thread (DN8)
		1	PT3/8 internal thread (DN10)
		2	PT1/2 internal thread (DN15)
		3	PT3/4 internal thread (DN20)
		4	PT1 internal thread (DN25)
		5	PT1-1/4 Internal Thread (DN32)
	GN indicates G internal thread, NPT indicates NPT internal thread, NW indicates NPT external thread, and NT is a special custom thread; (default PN)		
Output signal	N represents PNP (default), P represents NPN. Output		
	0 indicates RS485 and 4-20mA		
	1 indicates RS485 and 1-5V		
	2 indicates RS485 and 0-5V PNP		
	3 indicates RS485 and 0-10V		
Media type	The measurement medium type is specified as follows: AIR for air (default), N2 for nitrogen, O2 for oxygen, CO2 for carbon dioxide, and MG for mixed gas.		
Pressure level	P0 indicates ≤1.6MPa (default), P1 indicates a customized higher pressure rating.		
Is there a display?	S: No display; D : With display		
Other suffixes	T1 represents temperature display; T2 represents temperature compensation and temperature display; PT represents temperature and pressure compensation.		

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

**Medium type: Air calibration is used to measure the range of other medium gases .**

Serial Number	gas	Conversion factor	Range percentage
1	Air	1.0	100%
2	Oxygen (O2)	0.9861	98.61%
3	Nitrogen N2	0.994	99.4%
4	Argon AR	1.4066	140.66%
5	Nitric oxide (NO)	0.9702	97.02%
6	Nitrogen dioxide (NO2)	0.7366	73.66%



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7	Carbon dioxide (CO <sub>2</sub> )	0.7326	73.26%
8	Methane CH <sub>4</sub>	0.7147	71.47%
9	Ethane C <sub>2</sub> H <sub>6</sub>	0.4781	47.81%
10	Propane C <sub>3</sub> H <sub>8</sub>	0.3459	34.59%



## Appendix 1: MODBUS Register Address Table

**Communication baud rate: 9600, 8, 1, NONE; Floating-point data arrangement: 2<sup>143</sup>**

**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	Instantaneous flow rate	2	float	IEEE754
	send	01 03 00 02 00 02 65 CB		
	take over	01 03 04 00 00 00 00 FA 33		
4x0005-4x0006	Current current value	2	float	IEEE754
	send	01 03 00 04 00 02 85 CA		
	take over	01 03 04 00 00 00 00 FA 33		
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	medium temperature	2	float	IEEE754
	send	01 03 00 0C 00 02 04 08		



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	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		
4x00 23	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.		



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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.