ASY Electronics (Jiaxing) Co., Ltd

Business inquiries：+86 181 5734 3325

E-mail：sales@king-sen.com Website：www.asyjx.com

Address：Room 302, Building 11, No. 79 Jinsui Road, Economic and Technological Development Zone, Jiaxing , Zhejiang P.R. China

Thermal gas mass flowmeter

AI-FT High-performance type

Manual

Product feature：

★ It adopts platinum resistance sensor and stainless steel protective sleeve；

★ Zero point stability, high precision and good repeatability；

★ The range ratio is wide and the flow range is selectable；

★ The display direction (0°, 180°) is selectable；

★ Multiple signal outputs are available for selection；

★ Standard mechanical interfaces are optional；

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Table of contents

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1. About this manual

Thank you for choosing our company's products.

This manual is written for native Chinese-speaking professionals in the Chinese market. From the date of publication of this manual, we will no longer provide English manuals with products supplied to the Chinese market. For customers with special needs, you can also contact our authorized local distributors or agents to obtain English manuals.

This manual aims to help you accurately understand the measurement principles, related concepts, terminology, and correct methods and conditions for the installation and application of thermal mass flow meters.

Symbols and their meanings used in this manual:

graphic symbols	meaning
	Incorrect or non-compliant operation or use, or violation of the requirements of this manual, may result in damage to the instruments and equipment.
	Important concepts, definitions or methods
	Improper or careless operation and application can cause instruments to malfunction or even be damaged.
	Grounding mark
	Specifications and requirements that must be followed when using intrinsically safe instruments

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2. Safety Precautions

2.1. User

The AI-FT high-performance thermal gas mass flow meter is a high-performance thermal gas flow sensor designed and manufactured using a high-precision platinum resistance sensor. It features zero-point stability, high accuracy, excellent repeatability, and a wide range.

This flow meter is a precision instrument manufactured using the latest technology and processes, in accordance with the ISO 9001 quality system, and conforming to relevant EU standards . Before using the flow meter, the engineering technicians responsible for its installation, setup, and wiring must carefully read this manual to fully understand its precise meaning and the operating conditions and process conditions at the application site. Improper installation and use may cause the flow meter to malfunction or even be damaged .

2.2. Storage and transportation

小心！

- Storage temperature: -40℃~80℃
- Relative humidity: 20~90%
- During storage and transportation, the instrument should be placed in its packaging box to prevent bumps or impacts.

2.3. Application conditions

警告！ Before installation, ensure that the maximum temperature and pressure of the measured medium do not exceed the nominal temperature and pressure. Confirm that the measured gas is pure and free of particulate matter to avoid damage to the sensor.

2.4. Safety standards and regulations

When installing, wiring, and using this product, the requirements set forth in this manual, as well as general international safety regulations, accident prevention measures,

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and relevant local standards, shall be followed.

2.5. Intrinsic safety Ex I explosion protection

◆ Intrinsically safe explosion-proof thermal mass flow meters should be selected for hazardous locations where flammable gas mixtures with air exist or may exist.

◆ Intrinsically safe explosion-proof thermal mass flow meters must be used in conjunction with suitable safety barriers that have obtained intrinsic safety explosion-proof certification;

◆ The installation, wiring, and associated equipment of intrinsically safe instrument systems should comply with the relevant standards and specifications of the country in which they are installed.

2.6. Environmental protection

The packaging of this product is made of biodegradable or recyclable paper material that complies with ISO 14001 standards and will not cause pollution to the environment.

Please hand over any discarded products to a professional recycling company or send them back to us to avoid polluting the environment.

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3. Overview

3.1. Measurement principle

Thermal gas mass flow meters are designed based on the principle of thermal diffusion. These instruments use a constant temperature difference method to accurately measure gases. They offer advantages such as small size, high degree of digitization, easy installation, and accurate measurement.

The sensor section consists of two reference-grade platinum resistance temperature sensors. During operation, one sensor continuously measures the medium temperature T1 ; the other sensor self-heats to a temperature higher than the medium temperature T2 and is used to sense the fluid flow rate, called the velocity sensor. The temperature ΔT = T2 - T1 , where T2 > T1 . When fluid flows through, gas molecules collide with the sensor and carry away heat from T2 , causing the temperature of T2 to drop. To keep ΔT constant , the supply current to T2 must be increased . A faster gas flow rate results in more heat being carried away. There is a fixed functional relationship between gas flow rate and the increase in heat; this is the principle of constant temperature difference.

$$V = \frac{K\left[\left[\frac{Q}{\Delta T}\right]\right]^{1.87}}{\rho_g} \qquad \text{..... (1)}$$

Among them ρ_g, fluid specific gravity (related to density)

V — Flow velocity

K — Balance coefficient

Q — Heating capacity (related to specific heat and structure)

ΔT — Temperature difference

Since the sensor temperature is always automatically and constantly about 30 ℃ higher than the medium (ambient) temperature, the thermal gas flow meter does not require temperature compensation in principle.

The thermal gas mass flow meter is suitable for media temperatures ranging from -40 to 220 ℃.

(1) The fluid specific gravity and density are related.

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$$\rho = \rho_n \times \frac{101.325 + P}{101.325} \times \frac{273.15 + 20}{273.15 + T}$$

Wherein ρ_E— the density of the medium under operating conditions (kg/m3)

ρn — Density of the medium under standard conditions (101.325 kPa , 20 ℃) (kg/m3)

P — Operating pressure (kPa)

T — Operating temperature (°C)

from equations (1) and (2) that the functional relationships between flow velocity, operating pressure, gas density, and operating temperature have been determined.

Thermostatic differential thermal mass flow meter is unaffected by both temperature and pressure. It is a true direct mass flow meter, eliminating the need for users to correct for pressure and temperature.

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3.2. Technical parameters

Thermal gas mass flow meters have the following technical advantages:

- A true mass flow meter requires no temperature or pressure compensation for gas flow measurement, making it convenient and accurate. It can obtain the mass flow rate or standard volumetric flow rate of the gas.
- With a wide measurement range, it can measure gas flow rates from 100 Nm/s to 0.5 Nm/s , and can be used for gas leak detection.
- It has good shock resistance and a long service life. The sensor has no moving parts or pressure sensing components, so it is not affected by vibration on measurement accuracy.
- Installation and maintenance are simple. Installation and maintenance can be carried out without interrupting production, provided site conditions permit. (Special customization required)
- Digital design. Overall digital circuit measurement ensures accurate measurements and convenient maintenance.
- Using RS-485 communication, factory automation and integration can be achieved.

performance	Technical parameters
Structural form	Pipeline
Measuring medium	Various gases (except acetylene)
Pipe diameter range	DN25～50mm
Flow velocity range	1～100 Nm/s
Accuracy	±1～2.5%
Operating temperature	Sensor: -40～+250℃; Converter: -20～+55℃
Work pressure	Medium pressure ≤ 3.0MPa
Power supply	DC24V/25W
Response speed	1s
Output signal	4-20mA (maximum load 500Ω), RS485
Call the police	none
Supply type	Split structure or integrated structure

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Pipe Material	Anodized aluminum, stainless steel
On-site display	Four lines of Chinese characters LCD display
Display content	Standard volumetric flow rate, cumulative flow rate, standard flow velocity, etc.
Protection level	IP40
Sensor material	316 stainless steel

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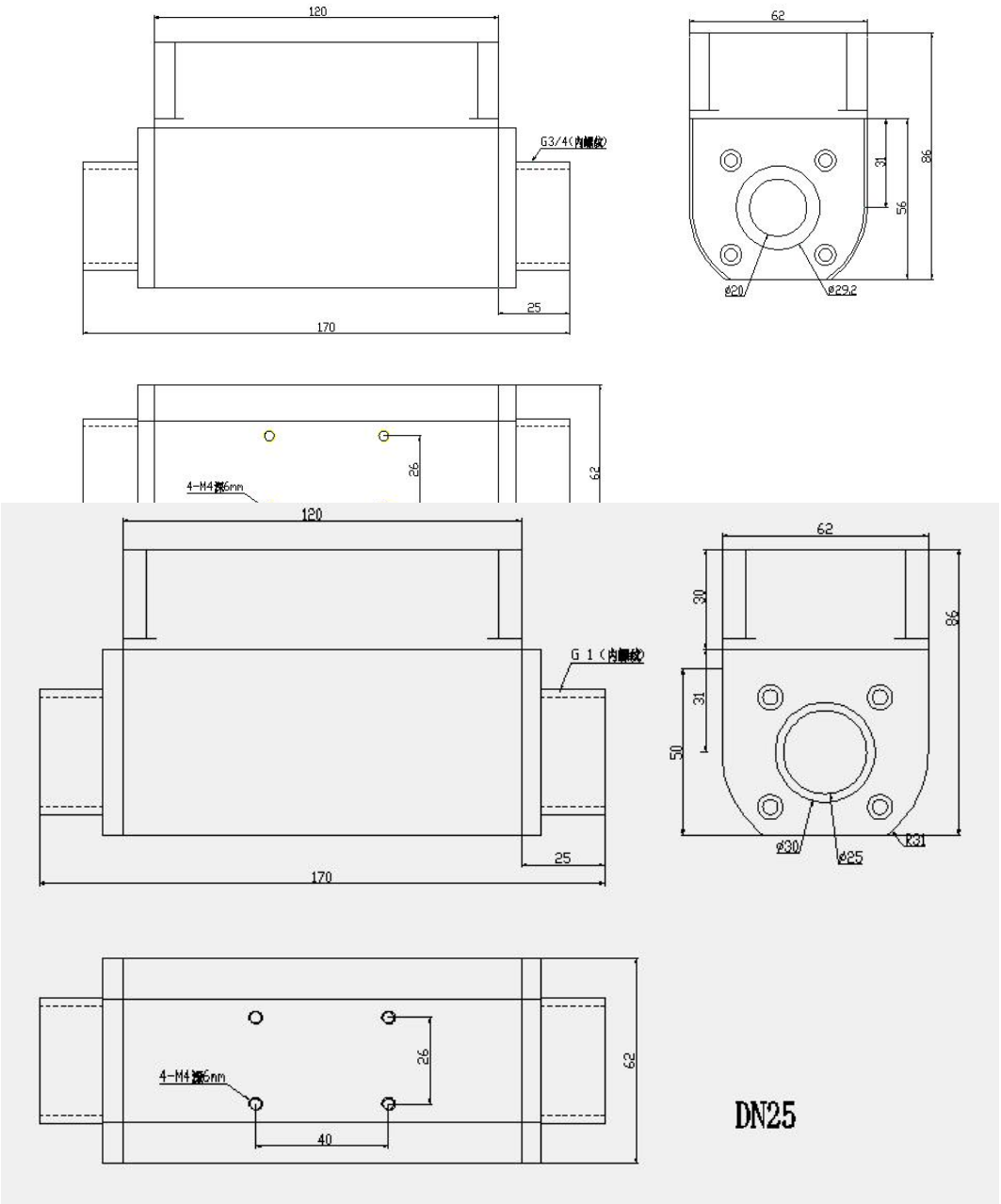
3.3. Structural Diagram - External Dimensions

and

Applicable to pipe diameters of DN25 and above , DN50 and below.

Threaded full-pipe gas mass flow meter

Pipe thread installation dimensions



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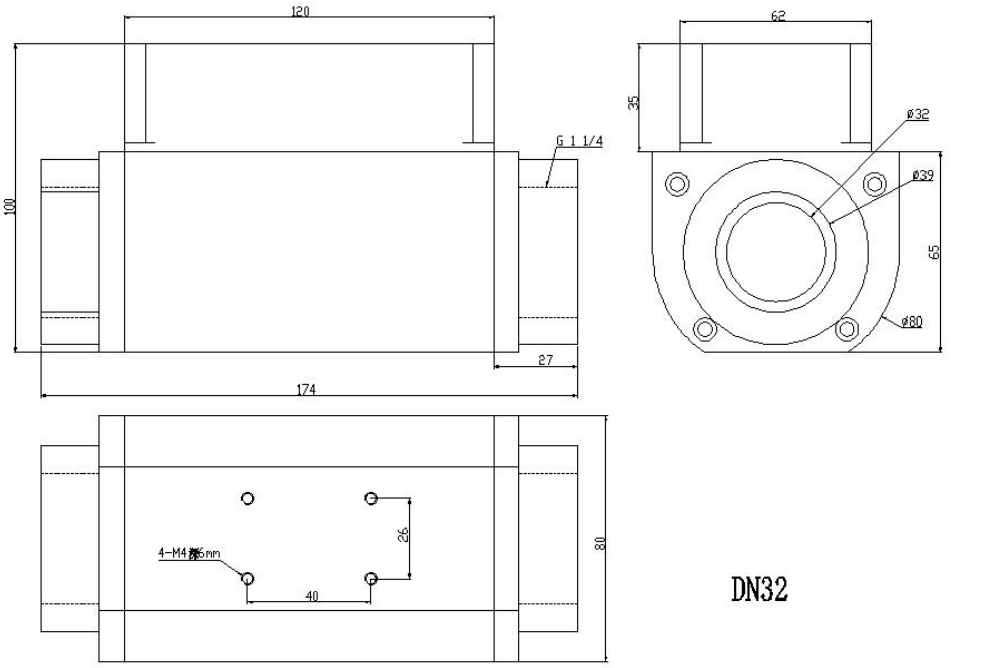
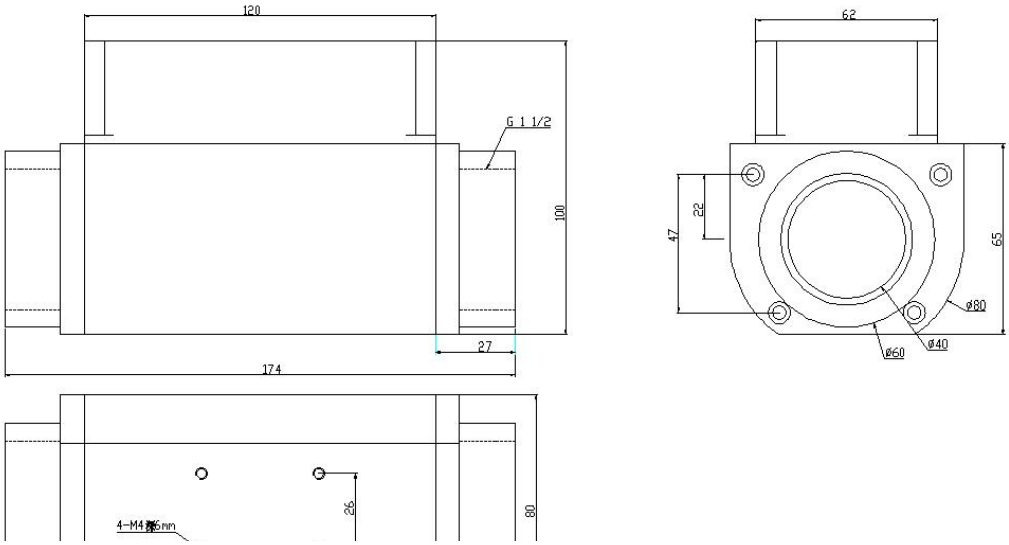
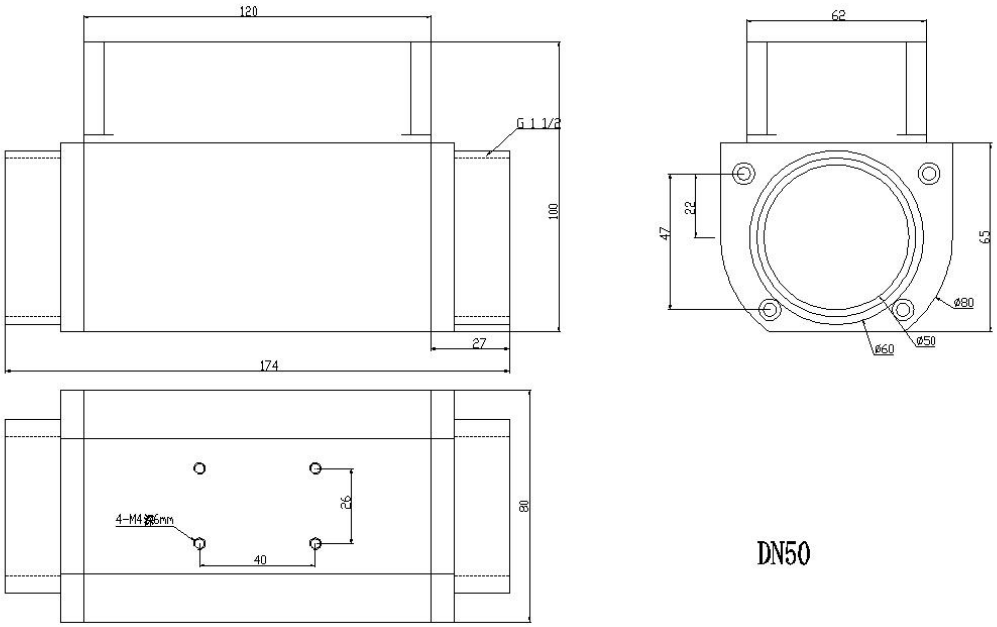


DN32





DN50

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4. Wiring instructions

4.1. Wiring preparation

- Before wiring, carefully read the wiring methods and requirements of other unit instruments or systems used with the thermal gas mass flow meter;
- When connecting external cables, it is recommended to use two-core shielded cables and ensure that the cable connections are properly sealed.
- For intrinsically safe explosion-proof products, intrinsically safe instrument cables that meet relevant standards should be selected, and it should be ensured that the cable parameters meet the requirements of the intrinsically safe explosion-proof instrument system.
- The operating voltage range is DC18~30V or AC85-220V . A DC voltage higher than DC30V will damage the instrument; measures should be taken to prevent the supply voltage from exceeding 30V .
- 24V DC power supply for the thermal gas mass flow meter should meet the SELV safety ultra-low voltage standard of IEC-1010-1 or equivalent .
- Before connecting the DC power supply, measure the supply voltage with a voltmeter to ensure that the applied voltage is DC24V .

4.2. Terminal block instructions

logo	meaning	logo	meaning
1 - Black	24V- / Current I-	4 - Red	24V+
2 - Brown	Current I +	5 - Yellow	RS485 communication output A
3 - Green	Reserved (other functions can be customized)	6 – White	RS485 communication output B

4.3. Wiring connection

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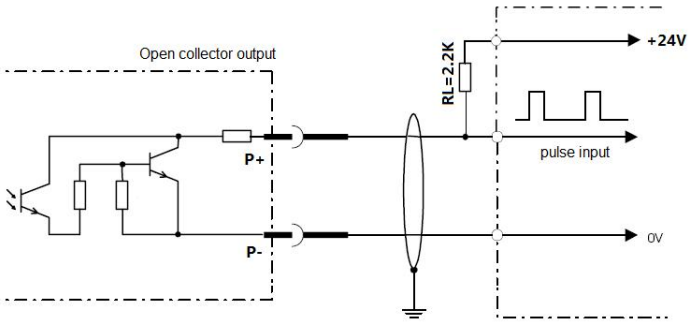
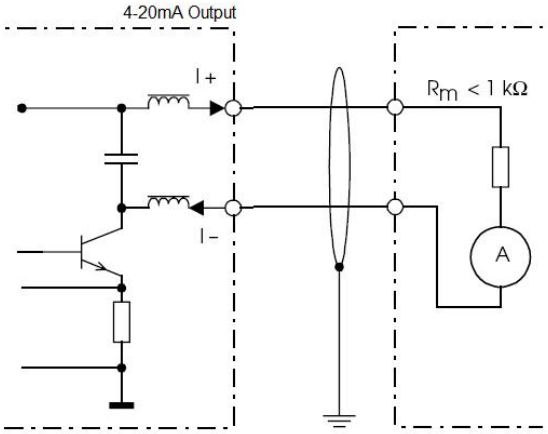
Pulse output wiring (optional)



Current output wiring



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5. Technical parameters

Power supply	Operating voltage	DC20~30V Standard: DC24V/1.5A Permissible residual ripple: Upp = 30MV , Uss < 10mV at 0~100Hz . Maximum noise: Ueff = 2.0mV at 500Hz~10KHz .	
	Operating current	< 7 50mA	
Output signal	Output current	4~20mA/ fixed current (fixed output value selectable)	
	RS485 output	Baud rate: 2400/4800/9600/19200	
		Data bits: 8	
		Checksum: None/Odd/Even	
		Stop bit: 1	
	Communication Protocol	MODBUS RTU	
Measurement accuracy	± (1.5 FS) %	**Output method**	4 -20mA \RS485
Response time	1 - 5 s	**Work pressure**	≤1.6MPa
Zero Drift	± 20m V	**Display format**	Instantaneous traffic, cumulative traffic
Operating temperature	-10~55℃	**Calibration media**	Air (25 ℃ , 101.325 kPa)
Storage temperature	-10~65℃	**Operating humidity**	<95%RH (no frost, no ice)

6. Install

A stable flow field is a prerequisite for accurate measurements by thermal instruments. Therefore, please pay attention to the following points during instrument

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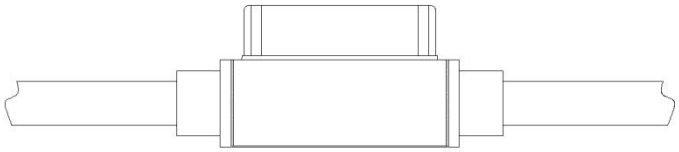
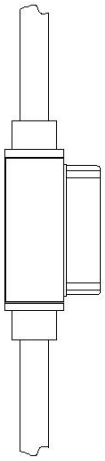
installation.

6.1. Installation method



● Horizontal installation ●

MPa when installed horizontally .



● Vertical installation ●

The working pressure for vertical installation must not exceed 1.6 MPa .

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6.2. Pipeline installation requirements

If the source of interference (such as a bend in the pipe, a tapered pipe, a valve, a T-tube, etc.) is located at the air inlet of a thermal instrument, be sure to take measures to minimize its impact on measurement performance.

The diagram below illustrates the minimum recommended straight pipe length for different types of pipes. If the measurement space is large enough, the straight pipe length should be maximized. Ignoring other factors, the minimum recommended straight pipe length for the sensor is:

Upstream straight pipe section: minimum 20 × DN

Rear straight pipe section: minimum 5 × DN

- The recommended values are all minimum values; generally, increasing the length will improve the flow meter's measurement performance.
- If there are two or more sources of interference in the straight pipe section upstream of the instrument, the recommended maximum upstream straight pipe length is the absolute minimum.

Notice!

- It is recommended to install the control valve after the thermal gas mass flow meter.
- For lighter gases like helium and hydrogen, the length of the initial straight section should be doubled.

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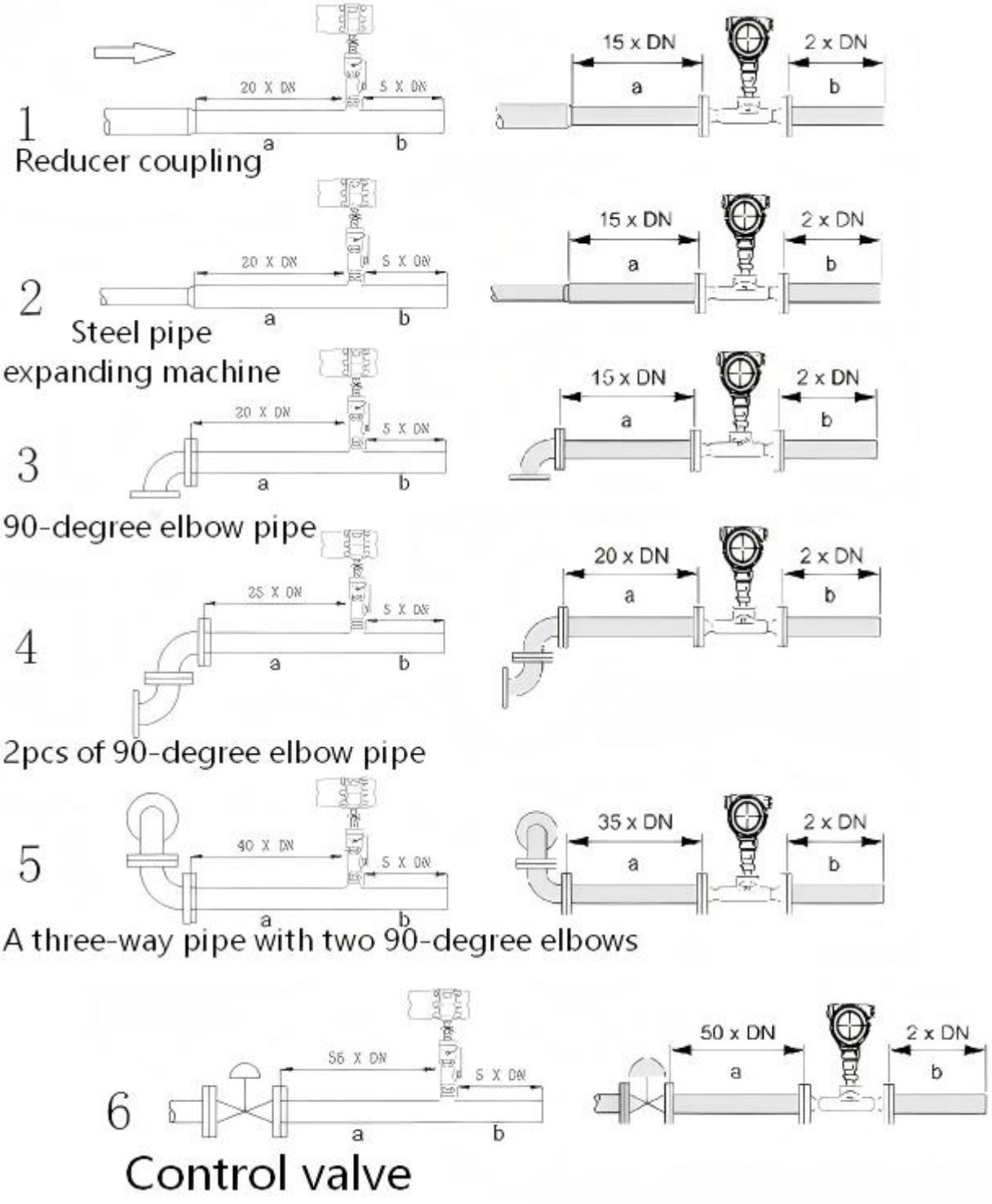


Notice!

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.

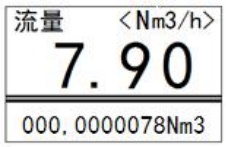
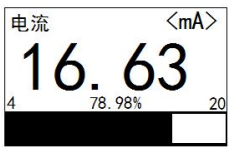
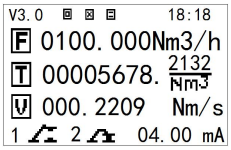
7. operate

7.1. Keyboard Instructions

	ESC	ESC: Cancel/Exit key
	▶	shift key
	▲	Modify/Page Turn Key
	ENT	ENT: Confirm/Enter button

7.2. Menu Description

7.2.1. Show menu

	Displays instantaneous flow rate, instantaneous flow rate per unit, cumulative flow rate, and unit.		Upper and lower limit alarm flow value alarm status indication When there is no alarm, the relay is in the normally open state.
	Current output current value and current output percentage bar-shaped dynamic display		Gas temperature value, serial number and version
	All information display window The first line: V3.0 is the software version number, and the box indicates the	The second ☒ To keep the backlight on, ☐ For a moment The third ☒ e communication protocol is other ☐	

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status. MODBUS RTU protocol

The first one from the left for The interface displays

a loop.

To prevent looping display

18:18 For system time

The second line is the instantaneous flow rate.

The third behavior is to accumulate traffic

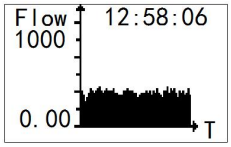
The fourth behavior is flow velocity

The fifth line is relay and current.

Displays instantaneous flow velocity in fixed m/s.

0 and 3.1 represent the measurement range for instantaneous flow velocity, which varies with the range setting.

The flow velocity displayed dynamically in the pipeline is as follows: the greater the flow velocity, the faster the velocity of the points inside the pipeline.



Historical data, with the last data point being the current time. The data interval can be set.

be viewed by pressing the 'page up' button, and the 'OK' button will take you to the menu selection interface.

If you press the cancel button on a non-traffic screen, you will return to the traffic screen.

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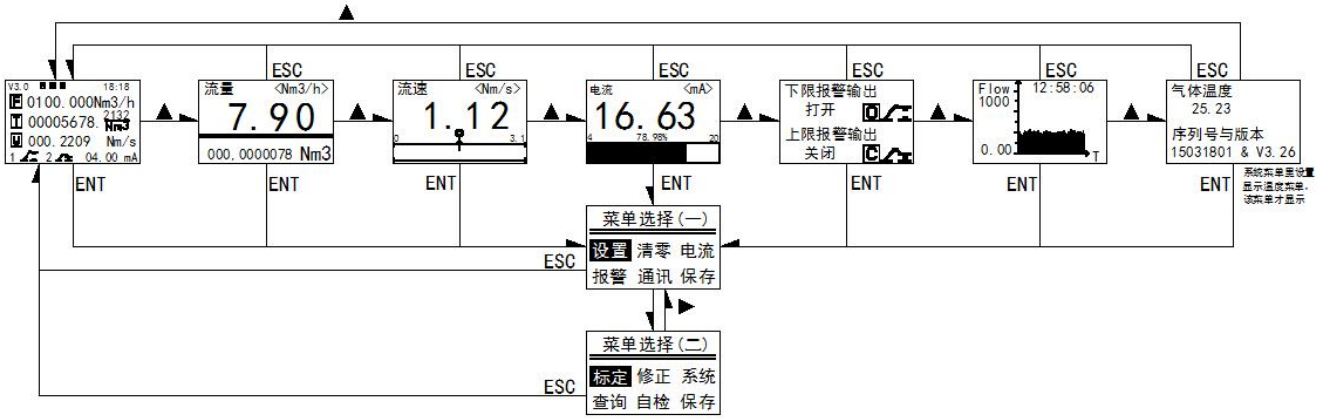

7.2.2. Menu selection and password input

菜单选择(一) 设置 清零 电流 报警 通讯 保存 菜单选择(二) 标定 修正 系统 查询 自检 保存	Menu selection Settings: Basic parameter settings Clear: Cumulative integer and decimal settings Current: Current parameter settings Alarm: Alarm upper and lower limits and alarm hysteresis settings Communication: RS485 communication parameter settings Save: Parameter saving and restoration	Calibration: Calibration settings Correction: Secondary correction of traffic. System: System parameter settings Query: Historical data query Self-test: Automatic detection of each function.
输入密码 ********** 密码 按ENT键输入	Settings, Reset, Current, Alarm, Communication, Correction, System Password: 1000 Code name: 0603 Query, self-check, and save password: None	

Use the shift keys to select the desired function menu.

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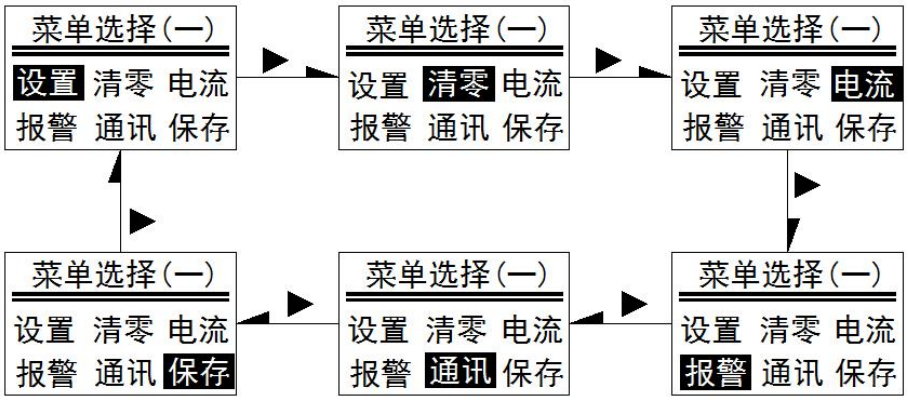
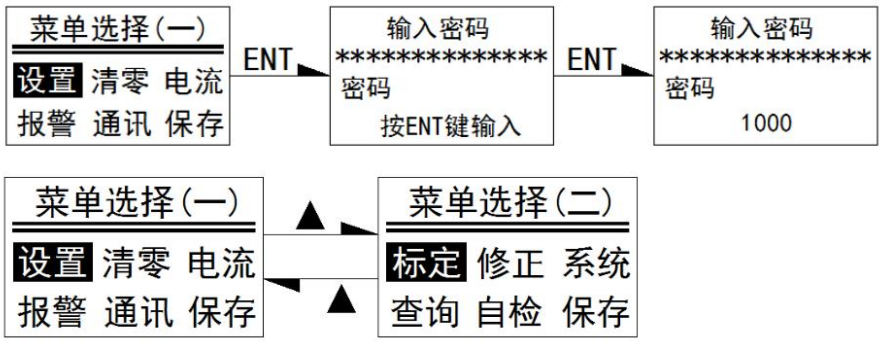


To access the basic parameters menu, move the black rectangle to "Settings," press the "ENT" key, and a password input menu will appear. Press the "ENT" key again, and a flashing cursor will appear. Enter your password, and press the "ENT" key again to confirm. If the password is correct, you will directly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



7.2.3. Settings Menu

语言/Language > 中文	Language selection: Chinese or English
用户零点 > 0. 6135 当前电压 0. 6389 <0. 0054>	The user zero-point voltage setting varies depending on the on-site operating conditions. Users can set the user zero point according to the specific on-site situation. When the user zero point is set to zero, the instrument will automatically set the current actual voltage as the user

	zero-point voltage. When there is no flow in the pipeline, the meter will show a flow rate that is not zero. This can be adjusted by modifying the zero point. The value in <> is equal to the calibrated zero point minus the user's zero point.
流量单位 > Nm3/h 累积单位 Nm3	> indicates that the following flow units can be set: g / min, g/s, K g / min, K g / h, Nm³/ h, Nm³/ min, N L/ h, N L/ min, SCFM Cumulative units include: g, kg, Nm3, NL, CFM. The accumulation unit changes with the flow unit and does not require separate configuration.
流量或流速 > 流量	Flow rate or velocity: Select whether the output 4-20mA indicates flow rate or velocity. If velocity is selected, the upper and lower limits of the range will be the velocity.
量程下限 > 0.00 量程上限 10.00	> indicates that it is configurable; pressing the shift key will move ">" between the upper and lower limits of the range. Press the ENT key to enter settings. The first character will flash after entering.
阻尼系数 > 2 小信号切除 <%> 0.05	Damping coefficient: 2 by default, range 0-50 Reducing the damping coefficient allows for rapid detection of flow rate fluctuations. Increasing the damping coefficient can smooth out the current flow rate display value. Small signal cutoff: Eliminates zero-point fluctuations as a percentage of the measurement range.
仪表系数 > 1.0 等效管道内径 mm 100.0	Instrument coefficient: This can be adjusted by changing the calibration correction coefficient to compensate for interference from fluid cross-sectional velocity distribution and the effects of specific application environments. The instrument coefficient is a product coefficient of the linear flow signal. Display value = Instrument coefficient x Actual measured value Pipe inner diameter: Enter according to actual application, unit is mm
介质类型 [00] 00.空气 转换系数 1.0	Media type: 00-59, see Appendix II If you need to modify the value, you can do so manually in the next menu.

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气体密度 <kg/m3> > 1.2904 转换系数 1.0	Medium density: Unit Kg/m3 When the density of the measurement medium differs from that of the calibration medium, it can be used for density correction. It is also used for conversion between units of volume and units of weight. Conversion factor: The conversion factor between the calibration gas and the measured gas.
噪声阀值 <0-10> > 05 采样时间 <1-50> 01	Noise threshold: The value is 0-10, used to eliminate noise signals. The higher the value, the greater the noise signal eliminated. Sampling period: The default is 200ms, which means that the average value of the sampled values within 200ms will be taken. The longer the time setting, the more samples are taken for averaging, and the more stable the traffic value calculated from this value will be. The sampling period is set to 5, which is 5 x 200 ms = 1 second.
脉冲或频率输出 > 脉冲	Output selection: frequency or pulse
脉冲宽度 <ms> > 50.0 脉冲当量 1.0	Output pulse width and time (50-1000ms) Pulse quantity: There are four quantities corresponding to each pulse: 1.0, 10.0, 100.0, and 1000.0. The pulse quantity is set to 10.0, which means that each output pulse corresponds to 10 units of volume.
最大频率 <Hz> > 5000 频率对应的量程 1000	The maximum frequency is the maximum output frequency. Example: Flow rate 0-1000 Nm3/h, expressed in frequency output 0-5000 Hz.

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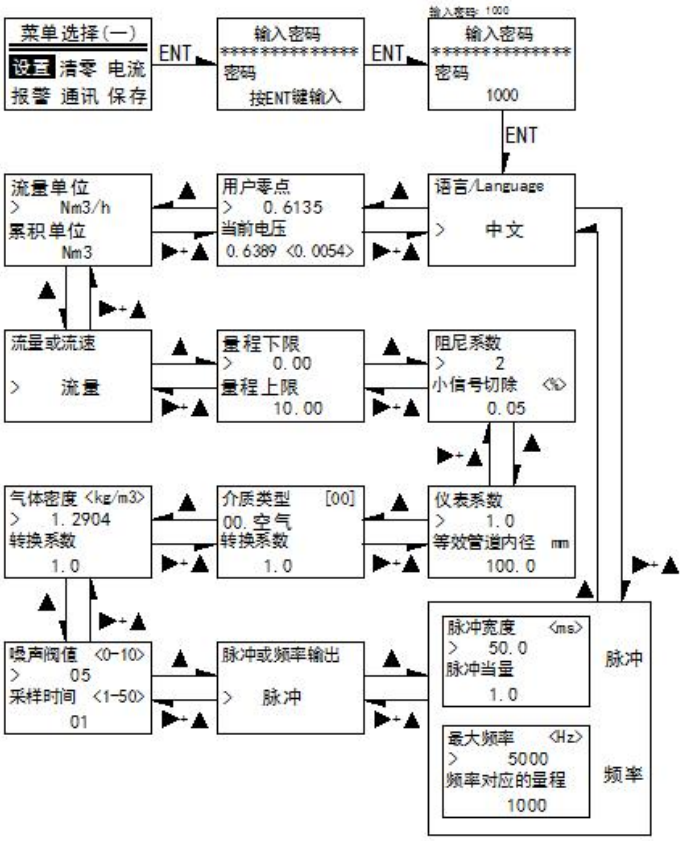
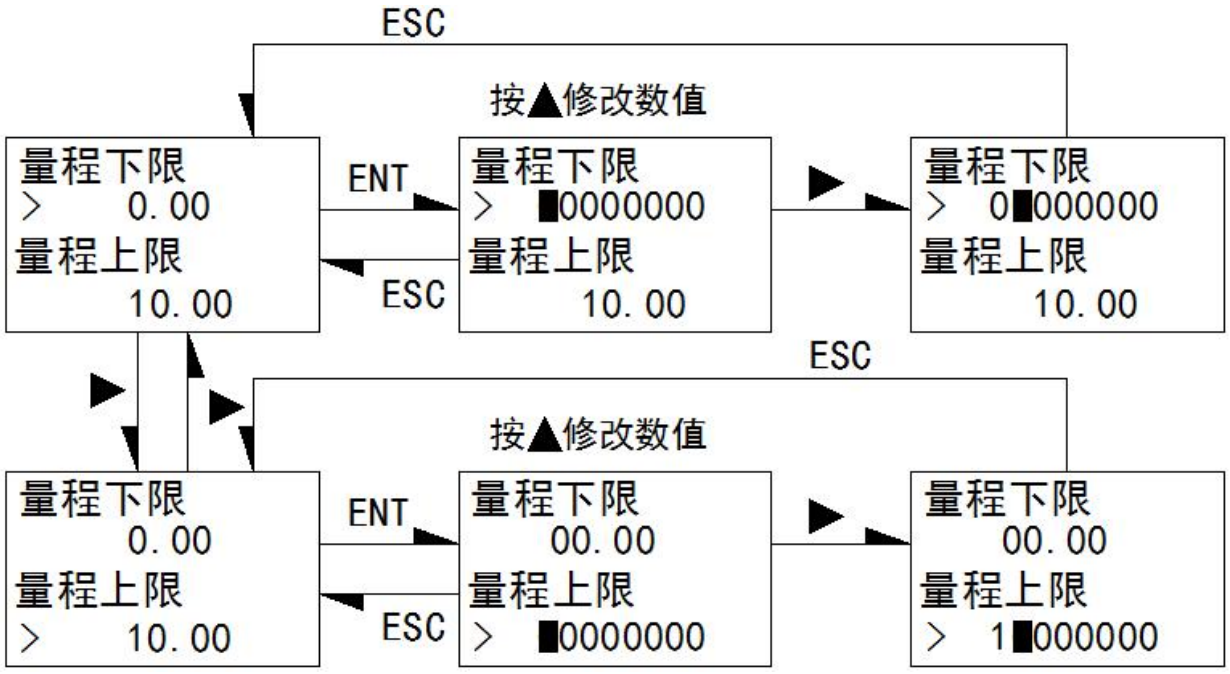
On the menu selection screen, select the corresponding function menu and enter the password to enter .

After entering the settings menu, press the "ESC" key to return to the menu selection interface, and press the "ENT" key to enter the value settings.





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7.2.4. Cumulative Menu

累积量小数设置 > 0. 12 累积量整数设置 0	Clear or set accumulated decimal and integer values.

7.2.5. Current Menu

电流输出模式 > 4-20mA 固定电流输出值 4. 0	Current output modes: 4-20mA and fixed current output When a fixed current output is selected, the fixed current output value can be set. Fixed current output values: 4mA, 8mA, 12mA, 16mA, 20mA
调整电流输出零点 > 4. 0 调整电流输出满点 20. 0	Example: 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.
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 Iout 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 Iout Span), press the OK key to enter the settings, enter 19.90, and	

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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.

外部测量电流值 > 4.0 电流修正系数 1.0	HART protocol current loop calibration, for example: current output mode 4-20mA. When there is no flow, the output current measured with a multimeter is 4.02 mA. The external current measurement value is set to: 4.02 mA The current correction factor will be calculated automatically.

7.2.6. Alarm Menu

下限报警值 <%>
> 2
上限报警值 <%>
8

Upper and lower flow limit alarm values are set, and these values are expressed as a percentage of the flow range.
For example, set the Low Alarm to 10%.
Alarm value = (Upper limit of range - Lower limit of range) * 10%

下限报警回差 <%>
> 0.5
上限报警回差 <%>
0.5

The alarm hysteresis value is set to 5.0.
If the current displayed value is less than the lower alarm limit, an alarm will be output.
After an alarm is triggered, if the current displayed value recovers to above the lower alarm limit and is greater than (lower alarm limit + hysteresis value), the alarm is cleared.
If the current displayed value is greater than the upper limit alarm value, an alarm will be output.
After an alarm is triggered, if the current displayed value

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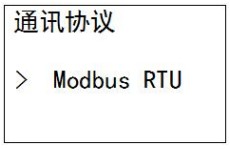
returns to below the upper limit alarm value and is less than (upper limit alarm value + hysteresis value), the alarm is cleared.

7.2.7. Communication Menu



For explanations of the communication protocols for RS485 and RS232 interfaces, the Modbus RTU protocol, and register addresses, please refer to Appendix 1.

MODBUS communication device ID, 0-255

For MODBUS communication, the baud rate and parity settings of the RS485 communication interface are configured. The stop bit is not set and is fixed at 1 stop bit.

7.2.8. Save and restore menu

Save parameters

Parameters are being saved...

Saved successfully

Save failed

Restore parameters

Recovery successful

Recovery failed

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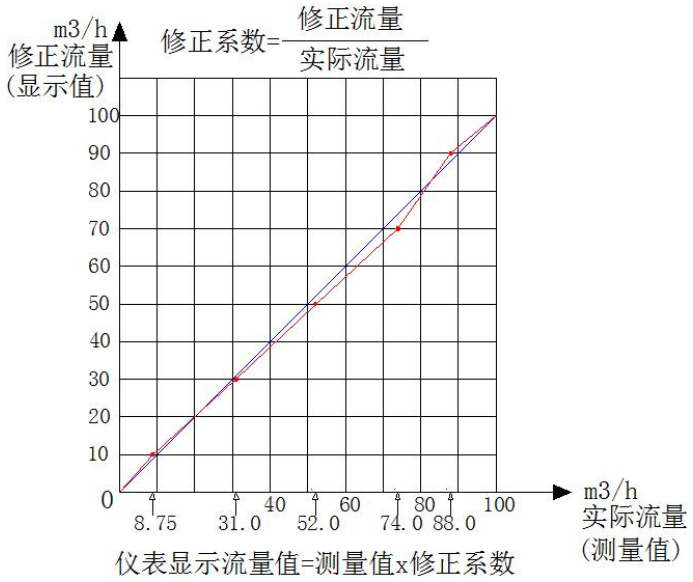
7.2.9. Modify menu

Traffic secondary correction can be set up to 5 segments. When correcting, the segments must be arranged in ascending order. The number of segments to be corrected can be less than 5, but the correction must start from the first segment and continue !

流量修正 >>01 > 10.00<10.00> 修正系数 >>01 1.143 <8.75>
流量修正 >>02 > 30.00<30.00> 修正系数 >>02 0.899 <31.00>
流量修正 >>03 > 50.00<50.00> 修正系数 >>03 0.952 <52.00>
流量修正 >>04 > 70.00<70.00> 修正系数 >>04 0.909 <74.00>
流量修正 >>05 > 90.00<90.00> 修正系数 >>05 1.429 <88.00>



Correction factor 1.143 = 10.00/8.75

Correction factor 0.899 = (30.00 - 10.00) / (31.00 - 8.75)

Correction factor 0.952 = (50.00 - 30.00) / (52.00 - 31.00)

Correction factor 0.909 = (70.00-50.00)/(74.00-52.00)

Correction factor 1.429 = (90.00 - 70.00) / (88.00 - 74.00)

7.2.10. System Menu

年 - 月 - 日 2015-11-30 时 : 分 （校时） 12:18

System time calibration

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测温修正电阻选择 > 300R 流量间隔时间 1min	The selection of the temperature correction resistor depends on the model of the temperature sensor. It is fixed by default at the factory and does not need to be modified. The flow interval is the interval at which historical data curves are updated. The historical data curve displays historical data for 60 points, and the interval between two adjacent data points is this flow interval.
循环显示 > 不循环 显示屏背光设置 常亮	Cyclic display: Selecting cyclic display will cycle through all information, flow rate, velocity, current, relays, historical data, and temperature (if display is set). Backlight settings: Always On or Briefly On. Briefly On means the display backlight is on for 30 seconds and then turns off.
启动显示内容 > 所有信息 循环显示间隔时间 00010 S	Startup display content, used to set the content displayed when the computer is powered on. The loop display interval is the time interval between loop displays when the interface is set to loop.
蜂鸣器打开或关闭 > 打开 温度界面是否显示 不显示	The buzzer is turned on or off. Turning it on means pressing the button will make the buzzer sound, and turning it off means pressing the button will not make the buzzer sound. Whether the temperature interface is displayed: If set to display, the temperature value can be viewed in the displayed interface.
温度系数(T=at+b) > 1.0 温度偏移值 0.0	The temperature coefficient is coefficient 'a' in the formula, and the temperature offset is coefficient 'b' in the formula. T = at + b

On the menu selection screen, select the corresponding function menu and enter the password to enter.

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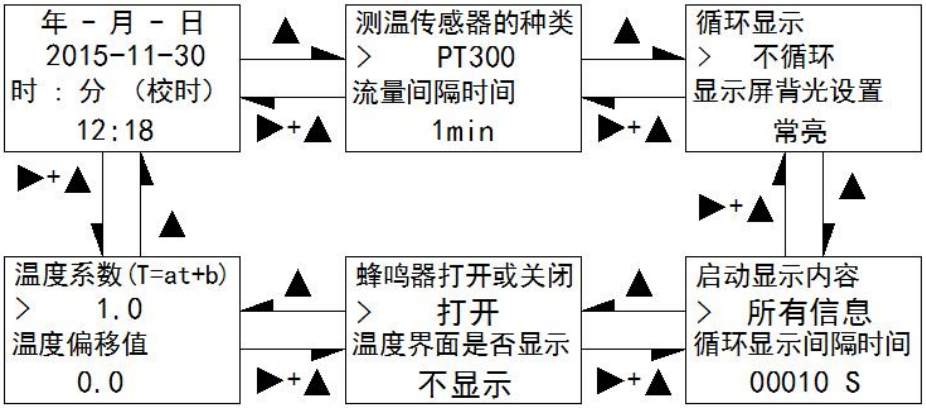

7.2.11. Query Menu

Enter the date you want to query, and the following two lines will display the flow rate and cumulative value. The meter automatically saves the current flow rate and cumulative value at 8:00 AM every day.

7.2.12. Self-test menu

Press the confirmation button for self-test. A checkmark (√) indicates that all functional modules are working normally, while an × indicates that the module has an error.

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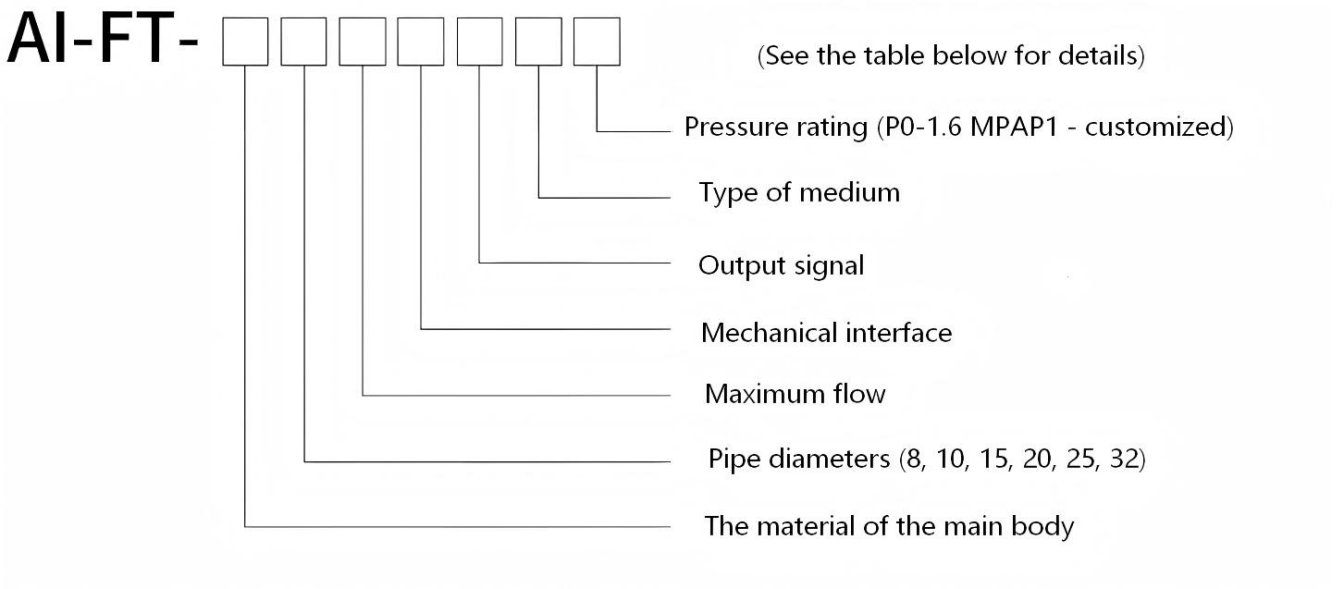
8. Product Selection



Product Series	Body material	Pipe diameter	flow	Mechanical interface	Output signal	medium	Pressure level
AI-FT	F2	20	M50	GN3	N0	AIR	P0
For example: Model: AI-FT- F2 20M50GN3N0AIRP0 Parameters: **AI-FT** : High-performance model; **Body material** : 316 stainless steel; **Pipe diameter** : DN20; **Flow range** : 0.5-50 Nm³/h; **Mechanical interface** : G3/4 internal thread; **Output signal** : 4-20mA + RS485; **Measuring medium** : Air; **Pressure rating** : ≤ 1.6MPa							

Body material	F2: 316 stainless steel		
Pipe diameter	20	DN20	Flow measurement range: 0.6-60 Nm³/h
	25	DN25	Flow measurement range 1-100 Nm3/h
	32	DN32	Flow measurement range: 1.6-160 Nm³/h
	40	DN40	Flow measurement range: 2.4-240 Nm³/h
Maximum flow	M 5 0 indicates 5 0 Nm3/h; M100 indicates 100 Nm3/h; M40 indicates 40 Nm3/h		

Mechanical interface	GN	3	G3/4 internal thread (DN20)
		4	G1 internal thread (DN25)
		5	G1-1/4 internal thread (DN32)
		6	G1-1/2 Internal Thread (DN40)
	GN indicates G internal thread (default), NT is special custom thread;		
Output signal	N0 indicates RS485 and 4-20mA (default).		
	N1 indicates RS485 and 1-5V.		
	N2 indicates RS485, 4-20mA, pulse.		
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.		
Other suffixes	Default: None; HT represents high temperature resistance.		

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%
7	Carbon dioxide (CO2)	0.7326	73.26%
8	Methane CH4	0.7147	71.47%
9	Ethane C2H6	0.4781	47.81%

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10	Propane C3H8	0.3459	34.59%

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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; **communication protocol: MODBUS RTU must be selected .**

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		

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	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		
	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		
4x0017-4x0018	Lower limit of flow rate	2	float	IEEE754
4x0019-4x0020	upper limit of flow rate	2	float	IEEE754
4x0021	Lower limit relay status	1	Unsigned int	Unsigned integer
4x0022	Upper limit relay status	1	Unsigned int	Unsigned integer
4x0051-4x0052	Product ID Number	2	Unsigned long	Unsigned long integer
4x0053	Modbus device ID	1	Unsigned int	Unsigned integer
4x0054	baud rate	1	Unsigned int	Unsigned integer
4x0055	Check bit	1	Unsigned int	Unsigned integer
4x0056	Stop bit	1	Unsigned int	Unsigned integer
4x0057	language	1	Unsigned int	Unsigned integer
4x0058	instantaneous flow unit	1	Unsigned int	Unsigned integer
4x0059	Cumulative flow unit	1	Unsigned int	Unsigned integer
4x0060	Current output mode	1	Unsigned int	Unsigned integer
4x0061	Fixed current output value guide	1	Unsigned int	Unsigned integer

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4x0062	PWM value corresponding to fixed current output value	1	Unsigned int	Unsigned integer
4x0063	Current PWM value zero point	1	Unsigned int	Unsigned integer
4x0064	Current PWM value full point	1	Unsigned int	Unsigned integer
4x0065	Output pulse or frequency	1	Unsigned int	Unsigned integer
4x0066-4x0067	Pulse width	2	float	IEEE754
4x0068-4x0069	Single quantity corresponding to pulse output	2	float	IEEE754
4x0074-4x0075	Zero-point current calibration	2	float	IEEE754
4x0076-x40077	Full-point current calibration	2	float	IEEE754
4x0078-4x0079	Lower limit of measurement range	2	float	IEEE754
4x0080-4x0081	Upper limit of measurement range	2	float	IEEE754
4x0082-4x0083	Alarm lower limit	2	float	IEEE754
4x0084-4x0085	Alarm limit	2	float	IEEE754
4x0086-4x0087	Lower limit alarm hysteresis	2	float	IEEE754
4x0088-4x0089	Upper limit alarm hysteresis	2	float	IEEE754
4x0090-4x0091	Damping coefficient	2	float	IEEE754

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4x0092-4x0093	small signal resection	2	float	IEEE754
4x0094-4x0095	Gas Standard Density	2	float	IEEE754
4x0096-4x0097	Gas conversion coefficient	2	float	IEEE754
4x0098-4x0099	spare			
4x0100-4x0101	spare			
4x0102-4x0103	Instrument coefficient	2	float	IEEE754
4x0104-4x0105	Pipe inner diameter	2	float	IEEE754
4x0106-4x0107	Sampling time period	2	float	IEEE754
4x0108-4x0109	Noise figure	2	float	IEEE754

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Appendix 2: Conversion Coefficients of Gases Relative to Air

Currently, the laboratory cannot calibrate the mass flow rate according to the actual gas used by the user. Calibration is typically performed by converting the actual gas flow rate into air flow rate. When in use, the user directly displays the actual mass flow rate or volumetric flow rate of the gas being used.

The conversion between different gases is done using conversion coefficients. The conversion coefficients for a single-component gas can be found in a table, as shown below:

	gas body	Specific heat (cal / g°C)	Density (g / L 0 ℃)	Conversion factor
0 0	Air	0.24	1.2 93	1.0000
0 1	Argon	0.125	1.6605	1.4066
0 2	Arsine AsH3	0.1168	3.478	0.6690
0 3	Boron tribromide (BBr3)	0.0647	11.18	0.3758
0 4	Boron trichloride (BCl3)	0.1217	5.227	0.4274
0 5	Boron trifluoride (BF3)	0.1779	3.025	0.4384
0 6	Borane B2H6	0.502	1.235	0.5050
0 7	Carbon tetrachloride (CCl4)	0.1297	6.86	0.3052
0 8	Carbon tetrafluoride CF4	0.1659	3.9636	0.4255
0 9	Methane CH4	0.5318	0.715	0.7147
10	Acetylene C2H2	0.4049	1.162	0.5775
11	Ethylene C2H4	0.3658	1.251	0.5944
12	Ethane C2H6	0.4241	1.342	0.4781
13	Propylene C3H4	0.3633	1.787	0.4185
14	Propylene C3H6	0.3659	1.877	0.3956
15	propane C3H8	0.399	1.967	0.3459
16	Butyne C4H6	0.3515	2.413	0.3201
17	Butene C4H8	0.3723	2.503	0.2923
18	Butane C4H10	0.413	2.593	0.2535
19	Pentane C5H12	0.3916	3.219	0.2157
20	Methanol CH3OH	0.3277	1.43	0.5805

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twenty one	Ethanol C2H6O	0.3398	2.055	0.3897
twenty two	Trichloroethane (C3H3Cl3)	0.1654	5.95	0.2763
twenty three	carbon monoxide (CO)	0.2488	1.25	0.9940
twenty four	Carbon dioxide (CO2)	0.2017	1.964	0.7326
25	Cyanide (C2N2)	0.2608	2.322	0.4493
26	Chlorine (Cl2)	0.1145	3.163.	0.8529
27	Deuterium D2	1.7325	0.1798	0.9921
28	Fluorine F2	0.197	1.695	0.9255
29	Germanium tetrachloride (GeCl4)	0.1072	9.565	0.2654
30	Germanane GeH4	0.1405	3.418	0.5656
31	Hydrogen (H2)	3.4224	0.0899	1.0040
32	Hydrogen bromide (HBr)	0.0861	3.61	0.9940
33	Hydrogen chloride (HCl)	0.1911	1.627	0.9940
34	Hydrogen fluoride HF	0.3482	0.893	0.9940
35	Hydrogen iodide (HI)	0.0545	5.707	0.9930
36	Hydrogen sulfide (H2S)	0.2278	1.52	0.8390
37	Helium (He)	1.2418	0.1786	1.4066
38	Kr	0..0593	3.739	1.4066
39	Nitrogen N2	0.2486	1.25	0.9940
40	Neon	0.2464	0.9	1.4066
41	Ammonia (NH3)	0.5005	0.76	0.7147
42	Nitric oxide (NO)	0.2378	1.339	0.9702
43	Nitrogen dioxide (NO2)	0.1923	2.052	0.7366
44	Nitrous oxide (N_2 O)	0.2098	1.964	0.7048
45	Oxygen (O2)	0.2196	1.427	0.9861
46	Phosphorus trichloride PCl 3	0.1247	6.127	0.3559
47	Phosphine PH3	0.261	1.517	0.6869

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48	Phosphorus pentafluoride PF5	0.1611	5.62	0.3002
49	Phosphorus oxychloride (POCl3)	0.1324	6.845	0.3002
50	Silicon tetrachloride (SiCl4)	0.127	7.5847	0.2823
51	Silicon tetrafluoride (SiF4)	0.1692	4.643	0.3817
52	Silane SiH4	0.3189	1.433	0.5954
53	dichlorosilane SiH2Cl2	0.1472	4.506	0.4095
54	Trichlorosilane SiHCl3	0.1332	6.043	0.3380
55	Sulfur hexafluoride (SF6)	0.1588	6.516	0.2624
56	Sulfur dioxide (SO2)	0.1489	2.858	0.6829
57	Titanium tetrachloride (TiCl4)	0.1572	8.465	0.2048
58	Tungsten hexafluoride WF6	0.0956	13.29	0.2137
59	Xenon	0.0379	5.858	1.4066

Appendix 3 Troubleshooting

Flow meter troubleshooting

Before performing any hardware repair work, please confirm that the following information is correct, as these factors can affect system performance.

1. Check if the instrument has a power supply and whether its voltage level and polarity are correct.

2. Check the instrument wiring as described in Chapter 2 to ensure it is correct.

3. Check if the instrument has the upstream straight pipe section length as described in 6.2.

4. Check if the meter flow rate is correct.

5. Ensure that there are no leaks in the pipes being tested.

Disconnect the power supply before removing the instrument!

Please ensure the pipeline is depressurized before maintenance!

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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.