THERMAL GAS MASS FLOWMETER

INSTRUCTION MANUAL

2022Upgrade

Contents

1． About this manual……2
2． Safety attentions……2
2.1 Users ……2
2.2 Storage and Handling ……2
2.3 Application conditions ……3
2.4 Safety standards and specifications……3
2.5 Electromagnetic compatibility and CE certification……3
2.6 Explosion-proof ……3
2.7 Environmental protection……3
3． Overview……3
3.1 Measuring principle ……3
3.2 Product shape and dimension ……4
3.3 Product application ……5
4． Wiring……5
4.1 Wiring preparation……5
4.2 Wiring terminal description ……5
4.3 Sensor wiring terminal……6
4.4 Terminal wiring……6
5． Technical indicators……7
5.1 Technical parameters…… 8
5.2 Flow comparison of each diameter…… 8
6． Installation……9
6.1 Installation method ……9
6.2 Requirements for Pipeline Installation ……9
7． Operation ……11
7.1 Converter keyboard and display ……11
7.2 Menu description ……11
7.2.1 Display menu……11
7.2.2 Menu selection and password input menu……12
7.2.3 Parameters menu……13
7.2.4 Cumulative menu……15
7.2.5 Current menu ……16
7.2.6 Alarm menu ……16
7.2.7 Communication menu ……17
7.2.8 Saving menu ……17
7.2.9 System menu ……17
8． Quality assurance and after-sales service ……18
Appendix I Modbus address list ……19
Appendix II Conversion table of general gas density and relative air ……21
Appendix II Conversion table of general gas density and relative air ……22
Appendix IV Fault findg and maintenance ……23

1． About this manual

Thank you for choosing our products.

Through this manual, we strive to enable you to accurately understand the measuring principle,related concepts,technical terms of thermal gas mass flowmeter,and correct methods and conditions for installation and application. Symbols and meanings used in this manual:

Graphical symbols	meaning
 警告！ Warning	Operation and use that are incorrect or do not conform to relevant specifications or violate the requirements of this manual will cause damage to instruments and equipment
 注意！ Notes	Important concepts, definitions or methods
 小心！ Be careful	Improper or careless operation and application may lead to incorrect operation or even damage of the instrument
	Grounding identification
	Specifications and requirements that must be observed when using intrinsically safe instruments

2． Safety attentions

2.1 Users

The thermal gas mass flowmeter is a precision instrument that applies the latest technology and process and is produced according to ISO:9001 quality system and conforms to relevant EU standards.Improper installation and use may lead to abnormal operation and damage of instrument and even process control equipment.Engineers and technicians who install, set up and wiring the products must read this manual carefully and truly understand the accurate meaning of it and the working and process conditions at the application site before using the instrument.

2.2 Storage and Handling

·Storage temperature： -40℃~80℃

·Relative humidity： 20~90%

Be careful! During storage and handling, the instrument shall be placed in packing box to avoid bumping or impact.

2.3 Application conditions


警告！

Warning！ Before installation, it should be ensured that the maximum temperature and pressure of the measured medium do not exceed the nominal temperature and pressure.Determine whether the measured gas is pure, and the gas does not contain particulate matter, so as to avoid the damage to the sensor by particulate matter.

2.4 Safety standards and specifications

The installation, wiring and use of this product shall comply with the requirements specified in this manual, as well as the general international safety regulations,accident prevention measures and relevant local standards.

2.5 Electromagnetic compatibility and CE certification

This product complies with EMC specifications and has passed CE certification.

EMC ： IEC61326-1： 1997 / IEC801-3 / EN55011 Radiation： EN50081-1： 1992 Immunity： EN50082-1： 1992


小心！

Effective measures shall be taken to ensure the normal and safe operation of other instruments when other instruments that do not conform to IEC61326-1 electromagnetic compatibility specifications are used together with this product.

2.6 Explosion-proof

■Explosion-proof thermal flowmeter shall be used in hazardous areas where combustible gas and air mixture exists or may exist at the measuring site;

■Flameproof thermal flowmeter shall be used together with suitable safety barriers that have obtained the intrinsically safe explosion-proof certification;

■The installation, wiring and associated equipment of explosion-proof instrument system shall comply with relevant standards and specifications of the country.

2.7 Environmental protection

This product is packaged with paper materials that can be naturally degraded or recycled and meet ISO:14001 specification and will not pollute the environment.

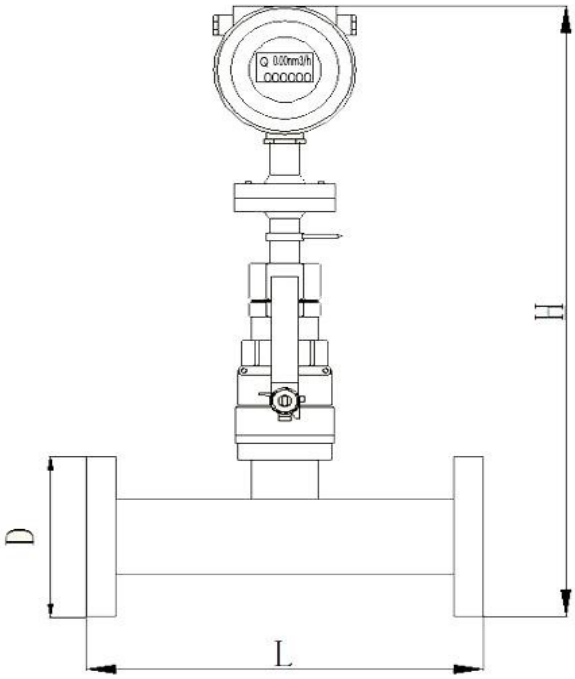
For scrapped products, please send them to a professional recycling company or send them back to us, so as not to pollute the environment.

3． Overview

3.1Measuring principle

The thermal gas mass flowmeter consists of a sensor and a signal analysis, processing and control unit.One part of the sensor measures temperature, while the other part is used for heating.The former monitors the actual process temperature value;The latter maintains a constant temperature value,which is always higher than the actual process temperature and maintains a constant temperature difference from the process temperature.The greater the mass flow of the gas, the greater the cooling effect, and the greater the energy required to maintain the differential temperature.Therefore, the mass flow of the measured gas can be obtained by measuring the energy of the heater.

3.2 Product shape and dimension



Nominal diameter	L	H	D
15	**280**	**395**	**90**
20	**280**	**405**	**105**
25	**280**	**412**	**115**
32	**280**	**430**	**140**
40	**280**	**440**	**150**
50	**280**	**452**	**165**
65	**280**	**470**	**185**
80	**280**	**485**	**200**
100	**340**	**507**	**220**
125	**340**	**535**	**250**
150	**340**	**566**	**285**
200	**340**	**619**	**340**
250	**340**	**679**	**405**
300	**340**	**738**	**460**

* Special sizes can be customized

3.3 Product application

■Compressed air
■Natural gas in boiler rooms or dryers
■Carbon dioxide gas in wineries
■Biogas and aeration in sewage treatment plants
■Generated gases(Argon, Nitrogen, Carbon dioxide, Helium, Oxygen)
■Gas leakage detection

4. Wiring

4.1 Wiring preparation

■Before wiring, you should carefully read the wiring methods and requirements of other unit instruments or systems used with the flowmeter;

■When connecting external cables, it is recommended to use two-core shielded cables and make the cable connections well sealed;

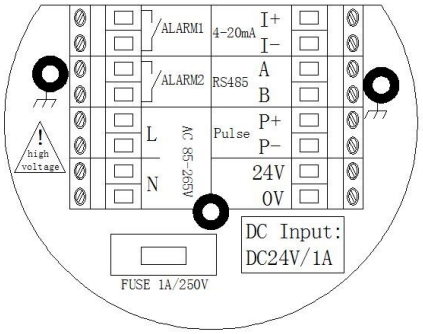
■ For intrinsically safe explosion-proof products, intrinsically safe instrument cables that meet relevant standards should be selected,and the cable parameters should meet the requirements of intrinsically safe explosion-proof instrument systems;;

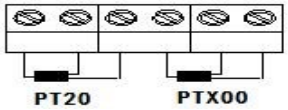
■The working voltage range is DC18~30V or AC85-220V. When the DC voltage is higher than DC30V, the instrument will be damaged, and measures should be taken to prevent the supply voltage from being higher than 30V;

■The 24V DC power supply to the flowmeter should meet the IEC-1010-1 or fairly standard SELV safety ultra-low voltage;

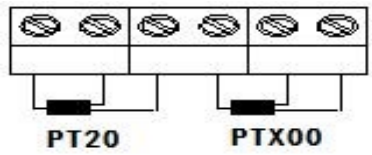
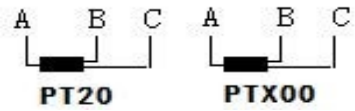
■Measure the supply voltage with a voltmeter before wiring with DC power supply , and make sure that the voltage loaded is DC24V;

4.2 Wiring terminal description

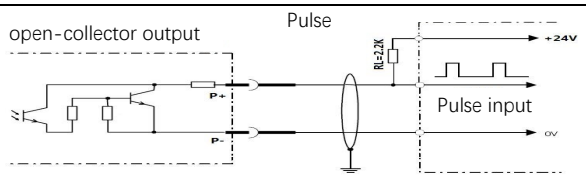
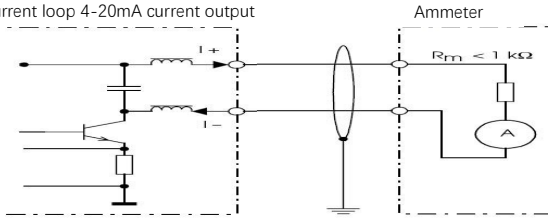
PCB diagram of wiring terminal	Identification	Meaning	Purpose
	24V	24V power input（positive)	Description of instrument working voltage: In actual use, only one of them needs to be selected
	0V	24V power input（negative)	
	L	AC input live line	
	N	AC input null line	
	P+	Pulse output(positive)	Metering cumulative pulse
	P-	Pulse output(negative)	
	I+	Current loop output (negative)	Analog output
	I-	Current loop output (negative)	
	485+/A	RS485 communication output A	MODBUS RTU reads instrument data
	485-/B	RS485 Communication output B	

	Identification	Meaning	Purpose
	ALAR M1	Alarm output 1	Lower alarm limit
	ALAR	Alarm output 2	Upper alarm limit
	M2		
		Mounting holes for converter and housing	
	Sensor wiring terminal PT20 and PT300 are the default combination, PT20/PT200, PT20/PT1000,PT20/PT100 are optional		
	RS232 interface, communication baud rate is fixed at 9600. Function 1 same as RS485 interface Function 2 is used to upgrade the instrument program		
	Upgrade button,press the button, RS232 interface is function 2,at this time the instrument has no display, in the state of upgrade preparation!There is no need to press the button under normal conditions.		

4.3 Sensor wiring terminal

 	Sensor PT20, two-wire type (no C point) or three-wire type The resistance value between points A and C is about 20 ohms when measured with a multimeter resistance gear The resistance value between points A and B is about 20 ohms when measured with a multimeter resistance gear The two points of B and C can be arbitrarily wired, if there is no C point,the terminals corresponding to B and C need to be short wired.
	Sensor PTX00, two-wire type (no C point) or three-wire type According to the selected sensor combination, the corresponding resistance value is measured.Take PT300 as an example:The resistance value between points A and C is about 300 ohms when measured with a multimeter resistance gear The resistance value between points A and B is about 300 ohms when measured with a multimeter resistance gear The two points of B and C can be arbitrarily wired,if there is no C point,the terminals corresponding to B and C do not need to be short wired.

4.4 Terminal wiring

Pulse output wiring	
Current output wiring	

5. Technical indicators

Power Supply	Working voltage	DC20~30V standard：DC24V/1.5A Allowable residual ripple：when 0~100Hz, Upp = 30Mv，Uss < 10mV Maximum noise：when 500Hz~10KHz，Ueff = 2.0mV AC85~265V standard：AC110V or AC220V
	Working current	<650mA DC <100mA AC
Output	Output current	4~20mA/Fixed current（Fixed output values are optional）
	RS485 output	Baud rate：1200/2400/4800/9600/19200
		Data bit：8
		Check bit：None/Odd/Even
		Stop bit：1
	RS232 output	Baud rate：Baud rate：9600 stop bit：1 9600 stop bit：1
	Communication protocol	MODBUS RTU
Performance	Ambient temperature	-20~150℃
	Relative humidity	45%~75%
	Ambient pressure	86~106Kpa
	Medium temperature	0~200℃
	Accuracy	±1%
	Preheating time	≤15S
	Response time	≤100mS

Performance	Technical parameters		
Accuracy	±1.5% reading		
Repeatability	±0.2%		
Upper range value	100Nm/s		
Lower range value	0.5Nm/s		
Pipe diameter	φ10-φ2000		
Flow range	0-770000Nm3/h（φ2000 Air）		
Pressure range	<2Mpa <10Mpa		
Medium temperature	-30-200℃、-30-250℃、-30-350℃		
Applicable media	All gases except acetylene gas.Dust-containing gas, sand-containing gas, various corrosive gases.		
Sensor diameter	φ18	Outside diameter of insertion-type sensor	φ18
Sensor material	1Cr18Ni9Ti、HC、Ti、316L、Aluminium、304 stainless steel		
Probe rod material (protective tube)	1Cr18Ni9Ti、HC、Ti、316L、Aluminium、304 stainless steel		
Transmitter housing material	Die-cast aluminum		
Power supply	AC220V AC110V DC20-30V		
Output	Output 4-20mA、RS232、RS485		
Live display	16 characters x 4 lines		

Supply type	Remote structure or integrated structure
Structure type	Insertion-type and Pipeline-type
Alarm	2-way relay，3A/250V AC、3A/30V DC
Protection class	IP65
Electrical interface	M20x1.5

5.1 Technical parameters

5.2 Flow comparison of each diameter

Pipe diameter (mm)	Minimum velocity (Nm/s)	Maximum velocity (Nm/s)	Minimum flow (Nm3/h)	Maximum flow (Nm3/h)	Normal flow range (Nm3/h)
10	0.1	100	0.028274334	28.27433385	0.5-14
15	0.1	100	0.063617251	63.61725116	0.3-40
20	0.1	100	0.113097335	113.0973354	0.5-75
25	0.1	100	0.176714587	176.7145866	0.85-100
32	0.1	100	0.289529179	289.5291786	1.5-200
40	0.1	100	0.452389342	452.3893416	2.5-340
50	0.1	100	0.706858346	706.8583463	4-500
65	0.1	100	1.194590605	1194.590605	6-700
80	0.1	100	1.809557366	1809.557366	9-1300
100	0.1	100	2.827433385	2827.433385	13-2000
125	0.1	100	4.417864664	4417.864664	24-3000
150	0.1	100	6.361725116	6361.725116	30-4000
200	0.1	100	11.30973354	11309.73354	55-7700
250	0.1	100	17.67145866	17671.45866	85-11000
300	0.1	100	25.44690047	25446.90047	125-16000
350	0.1	100	34.63605897	34636.05897	170-22000
400	0.1	100	45.23893416	45238.93416	240-30000
450	0.1	100	57.25552605	57255.52605	300-41000
500	0.1	100	70.68583463	70685.83463	350-50000
600	0.1	100	101.7876019	101787.6019	500-70000
700	0.1	100	138.5442359	138544.2359	700-100000
800	0.1	100	180.9557366	180955.7366	900-150000
900	0.1	100	229.0221042	229022.1042	1200-140000
1000	0.1	100	282.7433385	282743.3385	1500-200000
1500	0.1	100	636.1725116	636172.5116	3300-430000
2000	0.1	100	1130.973354	1130973.354	5500-770000

Note: Please refer to the normal flow range, maximum and minimum flow,please confirm with the technical personnel when you need to customize.

6．Installation

注意！ Stable flow field is the prerequisite for accurate measurement of thermal instrument. Therefore,please pay attention to the following points during instrument installation.

6.1 Installation method

●Horizontal installation

注意！ The maximum working pressure when installed horizontally is 2MPa.

●Vertical installatio

注意！ The working pressure o tical installatio shall not exceed 2MPa

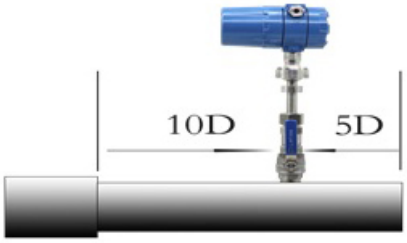
6.2 Requirements for Pipeline Installation

If interference sources(such as pipe bends, reducing pipes,valves,T-tubes, etc.) are located at the intake duct of the thermal instrument. Please take measures to minimize their impact on the measurement performance.

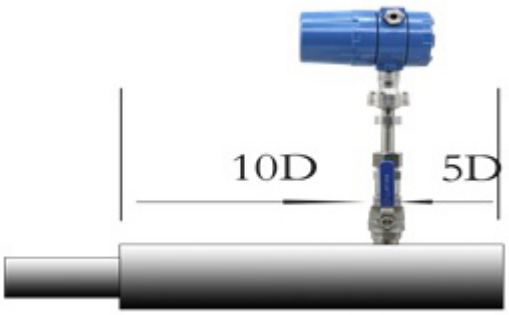
The following illustrations show the minimum recommended straight pipe section lengths for different types of pipes.If the measuring space is large enough,the length of straight pipe section shall be expanded as much as possible.Regardless of other factors, the minimum recommended straight pipe length of the sensor is as follows: :Upstream straight pipe section:minimum 20× DN　Downstream straight pipe section:minimum 5×DN

- The recommended values are the minimum value. Generally, increasing the length will improve the measurement performance of the flowmeter.
- If there are two or more interference sources in the upstream straight pipe section of the instrument, the recommended maximum upstream straight pipe length is the absolute minimum.
- It is recommended to install the control valve behind the flowmeter.
- For gases with lighter specific gravity such as helium and hydrogen, the length of the upstream straight pipe section shall be doubled.

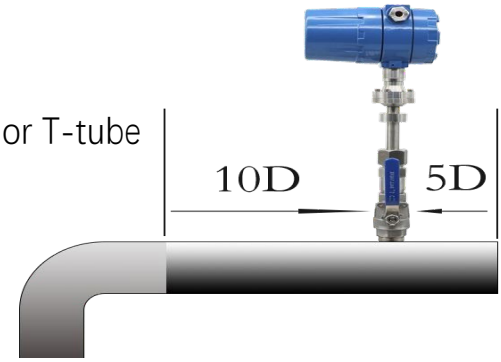
●Reducing pipe



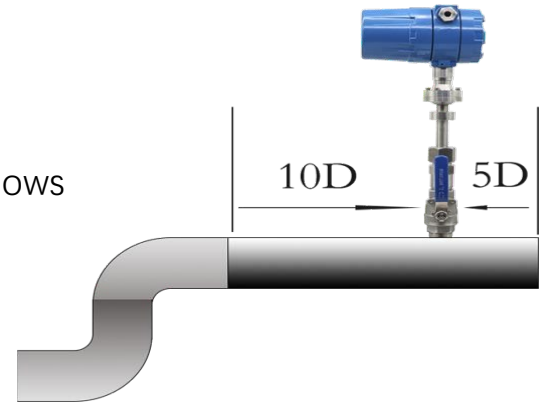
● Expanding pipe



● With a 90-degree elbow or T-tube



● With 2 90-degree elbows



a = Upstream straight pipe section b = Downstream straight pipe section

The control valve and buffer shut-off valve shall be installed behind the flowmeter as far as possible.

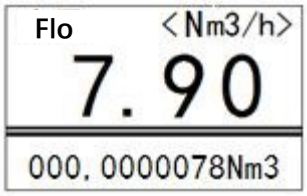
7． Operation

7.1 Converter keyboard and display

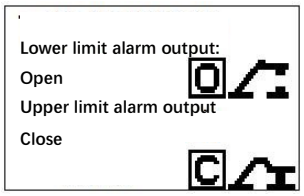
ESC	**ESC**: ESC: Cancel/Exit key
▶	Shift key
▲	Modify/Page key
ENT	**ENT**: Confirm/Enter key

7.2 Menu description

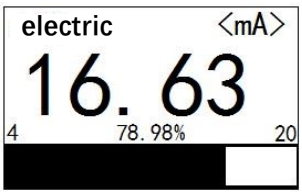
7.2.1 Display menu



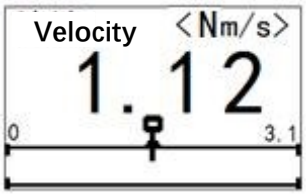
Display instantaneous flow, instantaneous flow unit, cumulative flow and unit



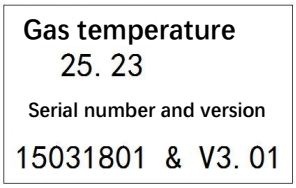
When the alarm state of the upper and lower limit alarm flow values indicates no alarm,the relay is in the normally open state.



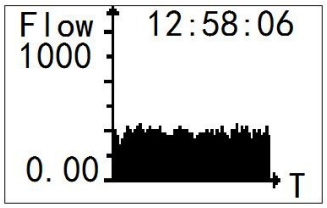
Strip dynamically display current output value and current output percentage



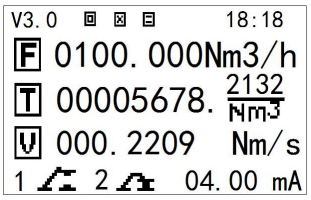
Display the instantaneous velocity in fixed m/s
0 and 3.1 are the measurement ranges of instantaneous velocity,which varies with the range setting value.The velocity displayed dynamically in the pipeline. The greater the velocity, the faster the point velocity in the pipeline.



Gas temperature value, serial number and version



Historical data, the last data is the data at the current time point,and the data interval time can be set.



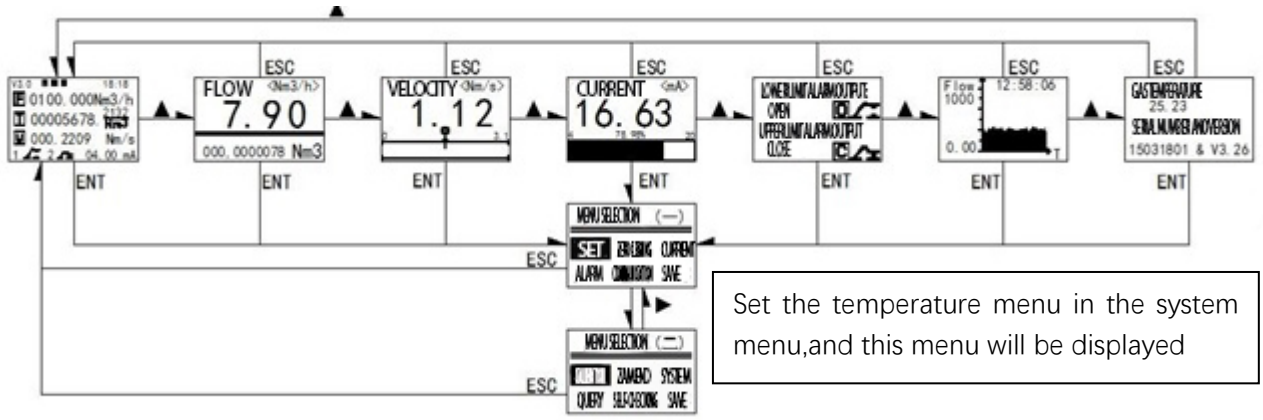
All information displayed in the window

The first line: V3.0 is the software version number, the box is the status indication, the first one from the left is the interface cyclic display. The second is that the backlight is always on.The third communication protocol is MODBUS RTU protocol.

18: 18 is the system time second row instantaneous flow third row cumulative flow fourth row flow fifth row relay and current

The five display interfaces can be viewed by pressing ▲ 'the Page key, 'and the menu selection interface can be entered by pressing the Confirm key.

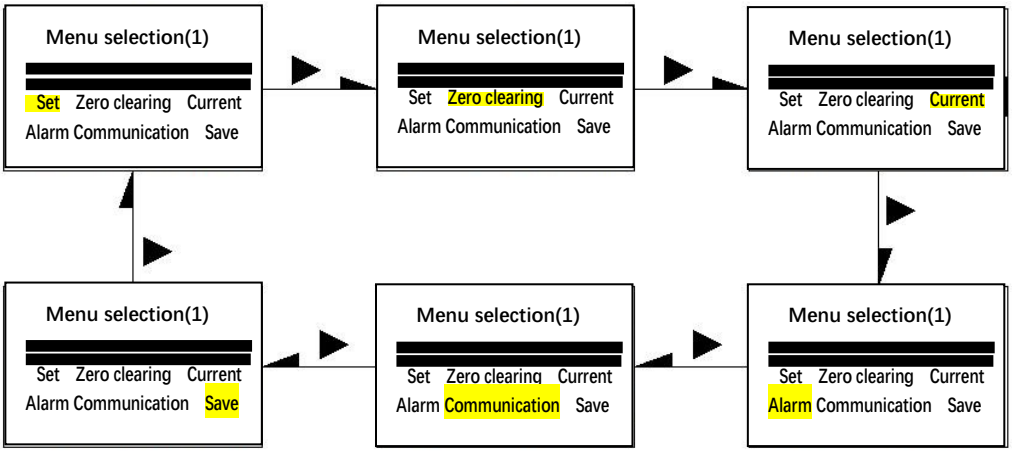
If you press the cancel key on the non-flow interface, you will return to the flow interface.



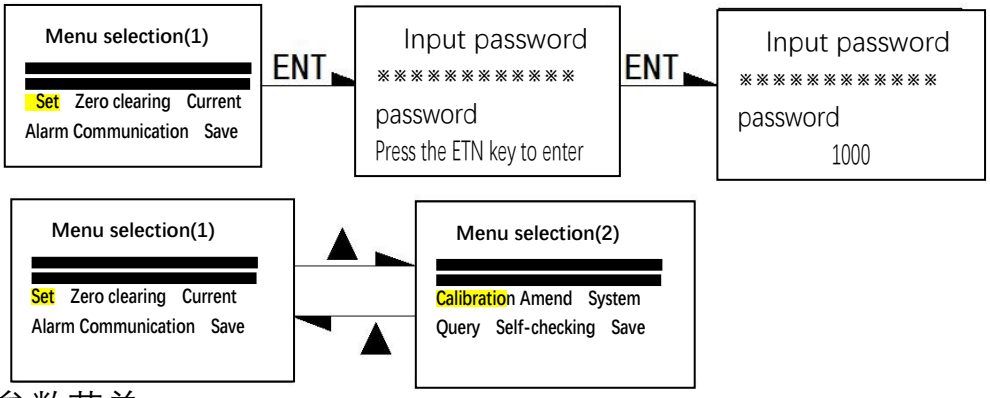
7.2.2 Menu selection and password input menu

Use the shift key to select the function menu you need to enter

Menu selection(1) Set Zero clearing Current Alarm Communication Save Menu selection(2) Calibration Amend System Query Self-checking Save	Menu selection settings : Basic parameter settings Zero clearing : Cumulative integer and decimal settings Current : Current parameter setting Alarm : Setting of upper and lower limits of alarm and alarm return difference Communication : RS485 communication parameter setting Save :Save and restore parameters Calibration : Calibration settings Amend : Secondary amendment of flow System : Settings of system parameters Query : Query of historical data Self-checking: Automatic detection of each function
Input password **************** password Press the ETN key to enter	Setting、Zero clearing、Current 、Alarm、Communication、Amend System password : 1000 Calibration password : 0603 Query、Self-checking、Save Password : None



When setting the basic parameter menu,move the black rectangular box to "Settings", press the "ENT" key, the password input menu appears, and then press the "ENT" key again, the flashing cursor appears, enter the password, press the "ENT" key again to confirm after the password is entered, if the password is correct,directly enter the parameter setting menu, if the password is incorrect,the "Error" character appears, press the "ENT" key again to re-enter.

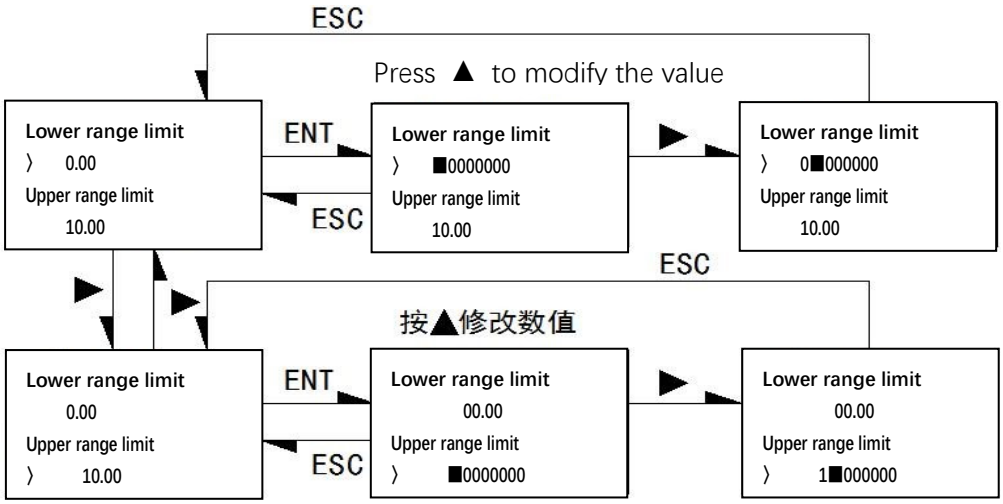


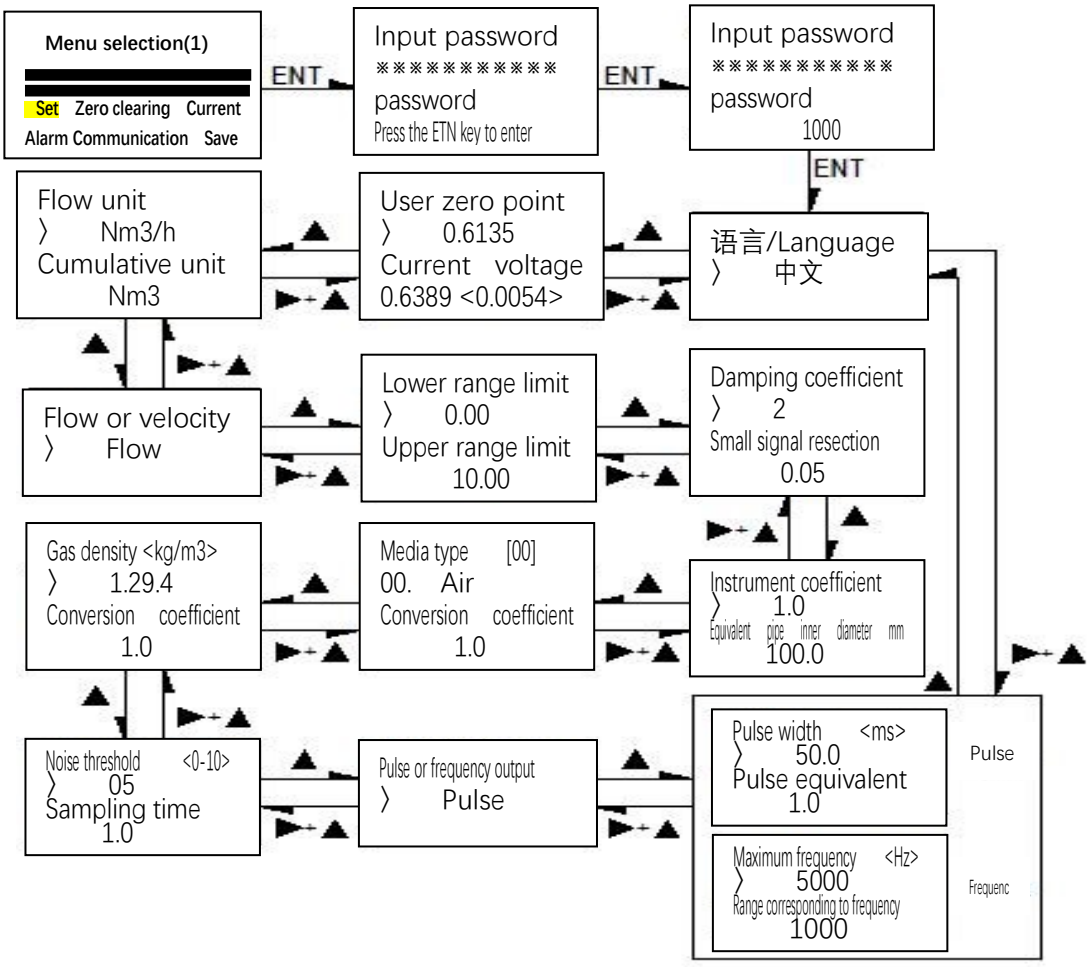
7.2.3 参数菜单

语言/Language > 中文	Language selection: Chinese or English
User zero point 〉0.6135 Current voltage 0.6389〈0.0054〉	User's zero point voltage setting,different on-site working status, user zero point voltage is also different, The user can set the zero point voltage according to the site conditions. When the user's zero point is set to zero, the instrument will automatically set the current actual voltage to the user's zero point voltage. When the pipeline has no flow, the meter shows that the flow is not zero, which can be adjusted by modifying the zero point.The value in <> is equal to the calibration zero point minus the user zero point.
Flow unit 〉 Nm3/h Cumulative unit Nm3	> indicates that can be set The flow units are as follows: g/min、g/s、 Kg/min、 Kg/h、 Nm3/h、 Nm3/min、NL/h、NL/min、SCFM Cumulative units: g、Kg、Nm3、NL、CFM,the cumulative unit changes with the flow unit and does not need to be set separately
Flow or velocity. 〉 Flow	Flow or velocity: Select whether the output 4-20mA indicates flow or velocity.If the velocity is selected, the upper and lower limits of the range are velocity.
Lower range limit 〉 0.00 Upper range limit 10.00	> indicates that can be set,press the shift key to move and switch‘ > ’between the upper and lower limits of the range. Press the ENT key to enter the settings,and the first character flashes after entering
Damping coefficient 〉 2 Small signal removal <%> 0.05	Damping coefficient: Default 2, range 0-50 Reducing the damping coefficient can quickly detect the flow jumping, and increasing the damping coefficient can smooth the current flow display value. Small signal resection: eliminate the zero point fluctuation, which is the percentage of the range

Instrument 〉 1.0 Equivalent pipe inner diameter mm 100.0	Instrument coefficients: The calibration correction coefficients can be changed to compensate for the interference of fluid cross-section velocity distribution and the influence of specific application environments. The instrument coefficient is a product coefficient of the linear flow signal. Displayed value =instrument coefficient x actual measured value
	Pipe inner diameter：input according to actual application, unit: mm
Media type [00] 00. Air Conversion coefficient 1.0	Medium type：00-59，see Appendix II If you need to modify the values,manually modify it in the next menu.
Gas density <kg/m3> 〉 1.2904 Conversion factor 1.0	Medium density：unit: Kg/m3 When the density of the measured medium is different from that of the calibration medium,it can be used for density correction,and also for conversion of volume units and weight units. Conversion coefficient: The conversion coefficient between the calibration gas and the measured gas.
Noise threshold <kg/m3> 〉 05 Sampling time <1-50> 01	Noise threshold: the value is 0-10, which is used to eliminate the noise signal. The larger the value is, the larger the noise signal will be eliminated. Sampling period: The default value is 200ms, which means that the sampling value is averaged within 200ms. The larger the time setting, the more samples are averaged and the smoother the flow value calculated from this value. The sampling period is set to 5 and the sampling period is 5x200ms = 1S
Pulse or frequency output 〉 Pulse	Output selection: frequency or pulse
Pulse width <ms> 〉 50.0 Pulse equivalent 1.0	Output pulse width time (50-1000ms) Single pulse quantity: Each pulse corresponds to four kinds of single quantity: 1.0, 10.0, 100.0, and 1000.0, and the single pulse quantity is set to 10.0, which means that each output pulse corresponds to a volume quantity of 10 units.
Maximum frequency 〉 5000 Range corresponding to frequency 1000	The maximum frequency is the maximum frequency of the output. For example, the flow is 0-1000Nm3/h, expressed by the frequency output of 0-5000Hz.Then the maximum frequency is set to 5000Hz, and the range corresponding to the frequency is 1000 Nm3/h.

On the menu selection interface, select the corresponding function menu and enter the password to enter. After entering the setting menu, press the "ESC" key to return to the menu selection interface, and press the "ENT" key to enter the value setting.





7.2.4 Cumulative menu

Cumulative decimal setting 〉 0.12 Cumulant integer setting 0	Cumulative decimal and integer clearing or setting

7.2.5 Current menu

Current output mode 〉 4-20mA Fixed current output value 4.0	Current output mode: 4-20mA and fixed current output When the fixed current output is selected, the fixed current output value can be set. Fixed current output value:4mA，8mA，12mA，16 mA，20 mA
Adjust the current output to zero point 〉 4.0 Adjust the current output to full point 20.0	For example, when the current output mode is 4-20mA with no flow, the output current value measured with the multimeter is 3.89 mA, adjust the current output zero point to 3.89 mA; and at the maximum flow, the output current value measured with the multimeter is 19.75 mA,adjust the current output zero point to 19.75 mA

Fixed current output mode and method of calibrating current output:

Step 1: Connect the multimeter into the current loop circuit;

Step 2: Set the current output mode to fixed current output;

Step 3: Press the shift key to move the '>' 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 the 4mA output, and press the confirm key to exit the setting state;

Step 4: Observe the multimeter display, if it is 4mA, there is no need to calibrate, if it is 3.90mA, press the modify/page key to enter the calibration menu, move '>' to before the zero current adjustment, press the "Confirm" key to enter the setting, enter 3.90, and press the "Confirm" key to exit the setting.

Step 5: Press the shift key and the modify/page key at the same time, the menu returns to the previous level, move the '>' 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 the 20mA output, press the confirm key to exit the setting state;

Step 6: Observe the multimeter display, if it is 20mA, there is no need to calibrate, if it is 19.90mA, press the modify/page key to enter the calibration menu, move '>' to before the zero current adjustment, press the "Confirm" key to enter the setting, enter 19.90 , and press the "Confirm" key to exit the setting.

Step 7: Press the shift key and the modify/page key at the same time, he menu returns to the previous level, move the '>' to the next line, press the confirm key to enter the setting state, press the modify/page key to select the output current value, and observe the display value on the multimeter at the same time.If consistent, the calibration is successful; if there is any difference, it needs to be recalibrated, and the recalibration steps are the same as above.

7.2.6 Alarm menu

Lower limit alarm value <%> 〉 2 Upper limit alarm value <%> 8	Upper and lower limit flow alarm value setting, which is expressed as a percentage of the range. If Low Alarm is set to 10% ,the alarm value =(upper range limit-lower range limit) *10%, when the alarm return difference value is set to 5.0, the current displayed value < the lower limit alarm value, then the alarm output. After the alarm, if the current displayed value recovers above the lower limit alarm value and is greater than (lower limit alarm value + return difference value), the alarm will be eliminated. The current displayed value > the upper limit alarm value,then the alarm output. After the alarm, if the current displayed value recovers below the upper limit alarm value and is less than (upper limit alarm value + return difference value), the alarm will be eliminated.
Lower limit alarm return difference <%> 〉 2 Upper limit alarm return difference <%> 0.5	

7.2.7 Communication menu

Modbus equipment ID 〉 1	MODBUS communication equipment ID,0-255
Communication parameters 〉Baud rate 9600 Check bit None Stop bit 1	For the setting of communication baud rate and check bit of RS485 communication interface, the stop bit cannot be set, but is fixed to 1 stop bit.
Communication protocol 〉Modbus RTIU	RS485 and RS232 interface communication protocols, Modbus RTU protocol, register address description see Appendix I, other protocols are customized by users.

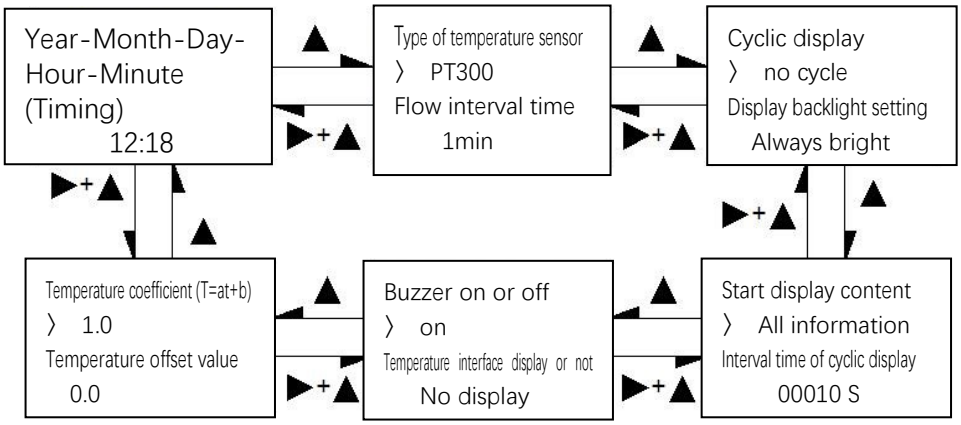
7.2.8 Saving menu

Save Parameters 〉save Restore parameters Restore Save Parameters	Save Parameters 〉save Restore parameters Restore Parameters are being saved···	Save Parameters 〉save ok Restore parameters Restore Save successful	Save Parameters 〉save Err Restore parameters Restore Save failed
Save Parameters 〉save Restore parameters Restore Restore parameters		Save Parameters 〉save Restore parameters Restore ok Restore successful	Save Parameters 〉save Restore parameters Restore Err Restore failed

7.2.9 System menu

Year-Month-Day-Hour-Minute (Timing) 12:18	System time calibration
Type of temperature sensor 〉PT300 Flow interval time 1min	The type and model of the temperature sensor are based on the hardware. After the circuit is determined, there is no need to modify the model of the sensor. The flow interval time is the interval time between updating the data of the historical data curv. The historical data of 64 points is displayed on the historical data curve, and the interval between two adjacent data is this interval time.
Cyclic display 〉no cycle Display backlight setting Always bright	Cycle display. If cycle is selected, all information, flow, velocity, current, relay, historical data and temperature (display is set) will be displayed in a cycle. Backlight setting, steady on and for a moment,and moment is the display screen bright for 30 seconds then off.

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



8． Quality assurance and after-sales service

In accordance with the ISO9001: 2000 quality management and control system, this product is made of new raw materials and components and has passed strict factory tests. The product quality and product performance comply with relevant standards and technical texts. However, due to the uncertainty that may occur in the process of transportation or use, we promise the following service guarantee terms:

■Within two weeks from the date of delivery, if the product you purchased has a quality defect that can be recognized, we will be responsible for replacing it free of charge;

■Within one year from the date of delivery of the product, if the product you purchased is damaged during normal use that is not caused by improper use or human factors, we will be responsible for repairing it free of charge;

Equipment damage caused by the following reasons during use is not included in the scope of free replacement or maintenance:

■Installation or use conditions that violate the relevant requirements and regulations of this manual;

■Incorrect or in violation of the relevant instrument installation, wiring or use specifications of the country;

■Use with other products that are electrically incompatible with this product or have no exact quality assurance and valid certification;

■Self-disassembly or repair;

■Natural aging or loss of equipment for more than one year;

■Applicable to force majeure as defined by law

For products within the warranty period, the user bears the cost of sending the product, and we bear the replacement or repair of the product and the cost of sending it back; If the product sent by the user is confirmed by us to be free from defects or damage, the relevant freight and insurance premiums incurred shall be borne by the user; Once the products sent by users are confirmed, we will send new or repaired products within 72 hours or three working days, unless special circumstances prevail; Please contact us if you find any defect or damage to the product.

Appendix I Modbus address list

Register address	Register name	Registers number	Data type	Data format
4x0001-4x0002	Instantaneous flow	2	float	IEEE754
	Transmitting	01 03 00 00 00 02 C4 0B		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0003-4x0004	Instantaneous velocity	2	float	IEEE754
	Transmitting	01 03 00 02 00 02 65 CB		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0005-4x0006	Current current value	2	float	IEEE754
	Transmitting	01 03 00 04 00 02 85 CA		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0007-4x0008	Cumulative integer	2	Unsigned long	Unsigned long integer
	Transmitting	01 03 00 06 00 02 24 0A		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0009-4x0010	Cumulative decimal	2	float	IEEE754
	Transmitting	01 03 00 08 00 02 45 C9		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0011-4x0012	Cumulative floating-point numbers	2	float	IEEE754
	Transmitting	01 03 00 0A 00 02 E4 09		
	Receiving	01 03 04 00 00 00 00 FA 33		
4x0013-4x0014	Medium temperature	2	float	IEEE754
	Transmitting	01 03 00 0C 00 02 04 08		
	Receiving	01 03 04 BA 4A 41 F8 CF 2F		
4x0015-4x0016	Current collected signal value	2	float	IEEE754
	Transmitting	01 03 00 0E 00 02 A5 C8		
	Receiving	01 03 04 82 1F 40 36 52 5B		
4x0017-4x0018	Lower velocity limit	2	float	IEEE754
4x0019-4x0020	Upper velocity limit	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 No	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 guidance	1	Unsigned int	Unsigned integer
4x0062	PWM value corresponding to fixed current output value	1	Unsigned int	Unsigned integer
4x0063	Zero point of current PWM value	1	Unsigned int	Unsigned integer
4x0064	Full point of current PWM value	1	Unsigned int	Unsigned integer
4x0065	Output pulse or frequency	1	Unsigned int	Unsigned integer
4x0066-4x0067	Pulse width	2	float	IEEE754
4x0068-4x0069	Equivalent 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 range limit	2	float	IEEE754
4x0080-4x0081	Upper range limit	2	float	IEEE754
4x0082-4x0083	Lower alarm limit	2	float	IEEE754
4x0084-4x0085	Upper alarm limit	2	float	IEEE754
4x0086-4x0087	Lower limit alarm return difference	2	float	IEEE754
4x0088-4x0089	Upper limit alarm return difference	2	float	IEEE754
4x0090-4x0091	Damping coefficient	2	float	IEEE754
4x0092-4x0093	Small signal resection	2	float	IEEE754
4x0094-4x0095	Gas density under standard condition	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	Internal diameter of the pipeline	2	float	IEEE754
4x0106-4x0107	Sampling time period	2	float	IEEE754
4x0108-4x0109	Noise coefficient	2	float	IEEE754

Appendix II Conversion table of general gas density and relative air

At present, the laboratory cannot calibrate the mass flow according to the actual gas used by users. The calibration is usually carried out after the flow of gas actually used by the user is converted into the flow of air.When the user is in use, the direct output shows the mass flow or volume flow of the gas actually used.

The conversion of different gases is carried out by conversion coefficient, and the conversion coefficient of single component gas can be found in the table.

The following table is as follows:

Serial number	Gas	Specific heat(J/g℃)	Density(g/L 0℃)	Conversion coefficient
00	Air Air	0.24	1.2048	1.0000
01	Argon Ar	0.125	1.6605	1.4066
02	Arsine AsH^3	0.1168	3.478	0.6690
03	Boron tribromide $BBr3$	0.0647	11.18	0.3758
04	Boron trichloride BCl^3	0.1217	5.227	0.4274
05	Boron trifluoride BF^3	0.1779	3.025	0.4384
06	Borane B_2H_6	0.502	1.235	0.5050
07	Carbon tetrachloride CCl^4	0.1297	6.86	0.3052
08	Carbon tetrafluoride CF^4	0.1659	3.9636	0.4255
09	Methane CH^4	0.5318	0.715	0.7147
10	Acetylene C_2H_2	0.4049	1.162	0.5775
11	Ethylene C_2H_4	0.3658	1.251	0.5944
12	Ethane C_2H_6	0.4241	1.342	0.4781
13	Propyne C_3H_4	0.3633	1.787	0.4185
14	Propylene C_3H_6	0.3659	1.877	0.3956
15	Propane C_3H_8	0.399	1.967	0.3459
16	Butyne C_4H_6	0.3515	2.413	0.3201
17	Butene C_4H_8	0.3723	2.503	0.2923
18	Butane C_4H_{10}	0.413	2.593	0.2535
19	Pentane C_5H_{12}	0.3916	3.219	0.2157
20	Methanol CH^3OH	0.3277	1.43	0.5805
21	Ethanol C^2H^6O	0.3398	2.055	0.3897
22	Trichloroethane $C^3H^3Cl^3$	0.1654	5.95	0.2763
23	Carbon monoxide CO	0.2488	1.25	0.9940
24	Carbon dioxide CO^2	0.2017	1.964	0.7326
25	Cyanami C_2N_2	0.2608	2.322	0.4493
26	Chlorine Cl^2	0.1145	3.163.	0.8529
27	Deuterium D^2	1.7325	0.1798	0.9921
28	Fluorine gas F^2	0.197	1.695	0.9255
29	Germanium tetrachloride $GeCl^4$	0.1072	9.565	0.2654
30	Germane GeH_4	0.1405	3.418	0.5656

31	Hydrogen H_2	3.4224	0.0899	1.0040
32	Hydrogen bromide HBr	0.0861	3.61	0.9940
33	Hydrogen chloride HCI	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 H_2S	0.2278	1.52	0.8390
37	Helium He	1.2418	0.1786	1.4066
38	Kryptonite Kr	0..0593	3.739	1.4066
39	Nitrogen N_2	0.2486	1.25	0.9940
40	Neon Ne	0.2464	0.9	1.4066
41	Ammonia NH_3	0.5005	0.76	0.7147
42	Nitric oxide NO	0.2378	1.339	0.9702
43	Nitrogen dioxide NO_2	0.1923	2.052	0.7366
44	Nitrous oxide N_2O	0.2098	1.964	0.7048
45	Oxygen O_2	0.2196	1.427	0.9861
46	Phosphorus trichloride PCI 3	0.1247	6.127	0.3559
47	Phosphine PH_3	0.261	1.517	0.6869
48	Phosphorus pentafluoride PF5	0.1611	5.62	0.3002
49	Phosphorus oxychloride POCI3	0.1324	6.845	0.3002
50	Silicon tetrachloride SiCI4	0.127	7.5847	0.2823
51	Silicon tetrafluoride SiF4	0.1692	4.643	0.3817
52	Silane SiH_4	0.3189	1.433	0.5954
53	Dichlorosilicon SiH2CI2	0.1472	4.506	0.4095
54	Trichlorosilicon $SiHCI_3$	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 $TiCI_4$	0.1572	8.465	0.2048
58	Tungsten hexafluoride WF_6	0.0956	13.29	0.2137
59	Xenon Xe	0.0379	5.858	1.4066

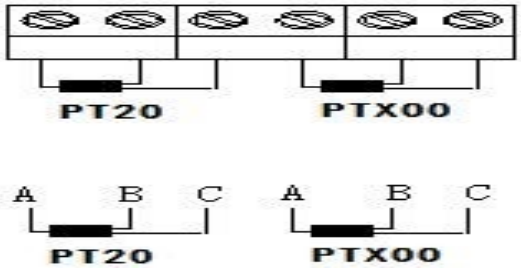
Appendix III Sensor calibration

Steps:

1.Find the Ro temperature value (resistance measured at ºC) and Alpha value on the instrument calibration book.

2.Turn off the power supply of the instrument and self-cool for 6 minutes.

3.Open the instrument cover and remove the PT20 and PT300 leads, as shown below.



4.Set the multimeter to ohmic (2K) and connect PT200A and PT200B (temperature sensor). Measure the resistance between A and B. Record it in Table 1.

5.Set the multimeter to ohmic (200 Ω) and connect PT20A and PT20B(speed sensor), measure the resistance between A and B and record it in Table 1.

6.Use the measured resistance value and Ro and Alpha Ro value to calculate the temperature of each sensor:

Among them,: T=Celsius degree

Rfinal=Resistance measured value of sensor

Ro=Resistance value at 0ºC (calibration book)

Alpha=Specific value for each sensor (calib

$$T = \frac{R_{final} - R_o}{A_{lpha} \times R_o}$$

7. Compare Table 1. If the temperature difference is within 10 ℃, the sensor is normal.

8.Remove the multimeter and connect 4 leads. Before power on, make sure that the leads are connected and the instrument cover is covered.

Table 1:

Temperature sensor resistance	T
Temperature sensor resistance	T

Appendix IV Fault finding and maintenance

Troubleshooting of flow instrument

Before taking any hardware maintenance work, please confirm whether the following contents are correct, which will affect the working performance of the system.

1.Check whether the instrument has power supply and whether its voltage grade and polarity are correct.

2.Check whether the instrument wiring is correct as described in Chapter 2.

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

4.Check whether the direction pointer of the instrument points directly downstream.

5.Ensure that there is no leakage in the measured pipeline.

Please disconnect the power before removing the instrument!

Please ensure that there is no pressure in the pipeline before maintenance!

Problems	Possible causes	Solutions
Abnormal or fluctuating velocity	Abnormal or irregular fluid	See 6.2 for the straight pipe section required for installation
	The rectifier is not installed on the front of the sensor	Correct the direction of the flowmeter
	Probe element damaged	Return to the manufacturer for replacement
	Abnormal electronic components	Return to the manufacturer
	Ground loop	Check wiring
Velocity measured too high or too low	Misalignment between sensor and fluid direction	Flow direction indicator shall indicate the downstream of the fluid
	The rectifier is not installed on the front of the sensor	Correct the direction of the flowmeter
No response to flow	No power supply	Power on the instrument
	Water vapor in gas fluid	Install a dehydrator or install a filter upstream

Problems	Possible causes	Solutions
No response to traffic	The low flow cut-off is set too high	Set by keyboard or upper computer software
	Flow below instrument minimum flow rating	Set the user range, reduce the flow to the maximum calibration value or contact the manufacturer to recalibrate
	Sensor fault	Return to the manufacturer
	Circuit board fault	Return to the manufacturer