

# Split Micro Thermal Gas Mass Flow Meter Manual



## Catalogue

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## I 、 Product Introduction

Micro gas mass flowmeter is specially designed for the measurement and process control of various small flow gases. This series of sensors are made of advanced micro-electromechanical system ( MEMS ) flow sensor chips and are suitable for all kinds of clean gases. The unique packaging technology makes it applicable to various pipe diameters, low cost, easy to install, no need for temperature and pressure compensation, and can replace traditional volumetric or differential pressure flowmeters.

## II 、 Features

- Using micro-electromechanical system ( MEMS) flow sensor chip, the sensor has the characteristics of high precision, high sensitivity and strong anti-interference.
- This product has a display screen and setting buttons for simple operation and direct reading. (Optional)
- The zero point stability of the sensor is greatly improved compared to general thermal flow meters.
- High stability over the entire range.
- High accuracy and excellent repeatability over the entire range.
- Combined with structural optimization, the flow meter has significantly reduced pressure loss and lowered energy consumption compared to traditional mechanical meters.
- LCD is used to display instantaneous flow and accumulated flow, which is clear and intuitive and easy to read.
- 4~ 20mA standard current signal output and alarm output.

### III 、 Technical Parameters

| Model                    | xx-xx                                             | xx-xx                      | Unit         |
|--------------------------|---------------------------------------------------|----------------------------|--------------|
| Flow Range               | 0-500                                             | 0-1000                     | <i>L/min</i> |
| Range Ratio              | 100:1                                             |                            |              |
| Accuracy                 | ±1.5FS                                            |                            | %            |
| Repetition Rate          | < 1.0                                             |                            | %            |
| Working Power Supply     | DC12-24V                                          |                            |              |
| Output Method            | 4-20mA , Flow Alarm , RS485<br>( Modbus Protocol) |                            |              |
| Display Mode             | LCD Screen                                        |                            |              |
| Maximum Working Pressure | 1.0                                               |                            | Mpa          |
| Medium Temperature       | -10~55 (High temperature can be customized)       |                            | ℃            |
| Humidity                 | <95%RH (No Frost, No Ice)                         |                            |              |
| Calibration Conditions   | Air ( 20 °C , 101.325kPa )                        |                            |              |
| Protection Level         | IP40                                              |                            |              |
| Diameter                 | DN 8-DN15                                         | DN20                       |              |
| Mechanical Interface     | G1/ 4 G3/8 G1/2<br>(Internal)<br>External Thread  | G3/4<br>External<br>Thread |              |

## IV、Unboxing Instructions

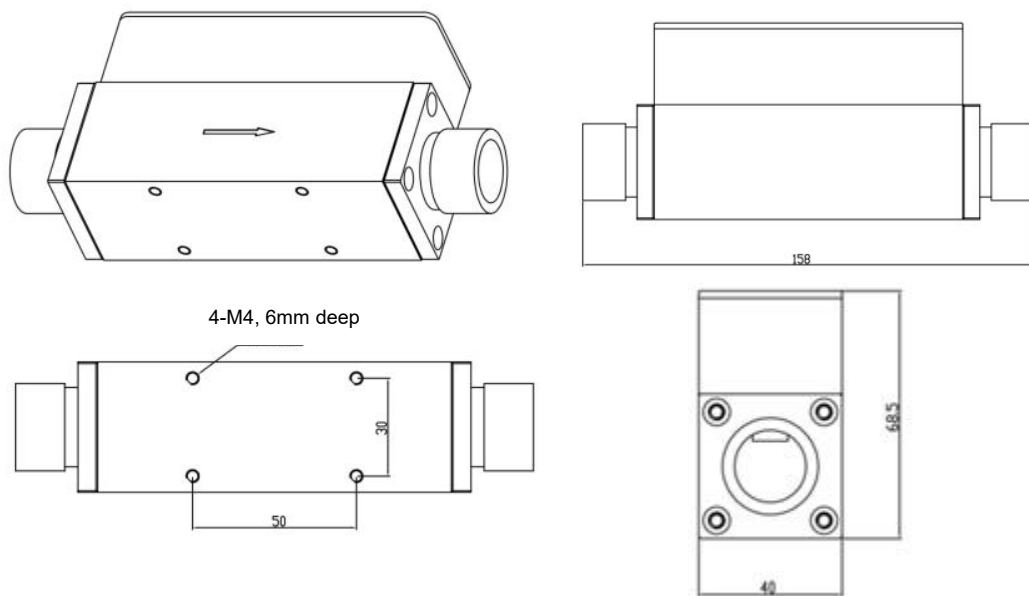
1. Open the product box, the box should contain the following items

- |                                          |           |
|------------------------------------------|-----------|
| a) Main Body Base                        | one piece |
| b) Display Module                        | one piece |
| c) Product Manual                        | one piece |
| d) Aviation Cable (4 cores length 1.0m ) | one piece |
| e) Aviation Cable (7 cores length 1.0m ) | one piece |
| f) Certificate                           | one piece |

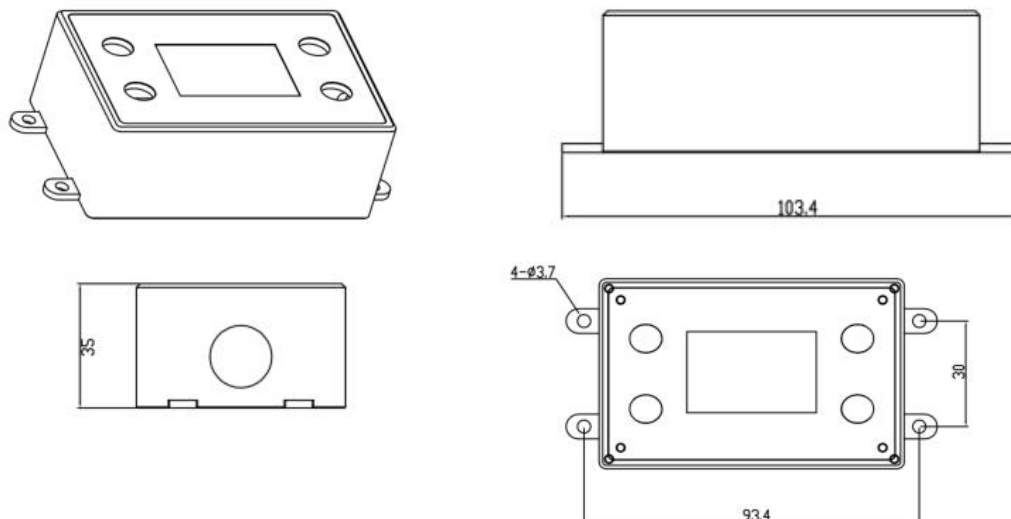
After confirming that there is no mechanical damage to the main body, tear off the protective film outside the display

## V、Mechanical and Installation Dimensions

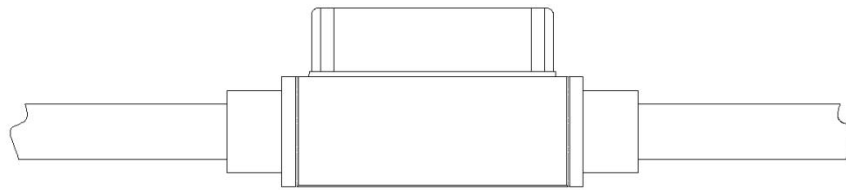
### Main Body Base



### Split Display Part

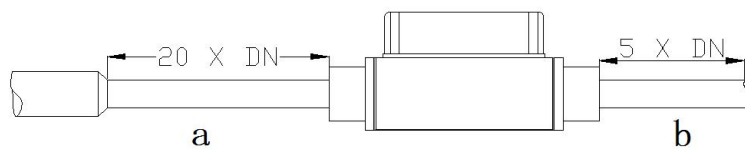


## VI、Installation Mode

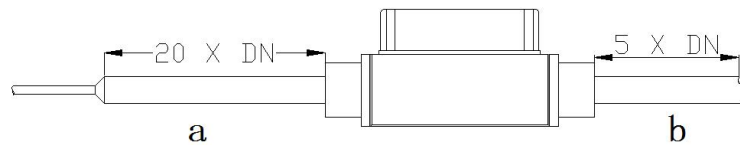


## VII、Installation Notes

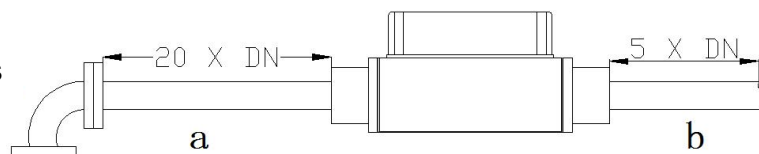
Reduce the pipe diameter



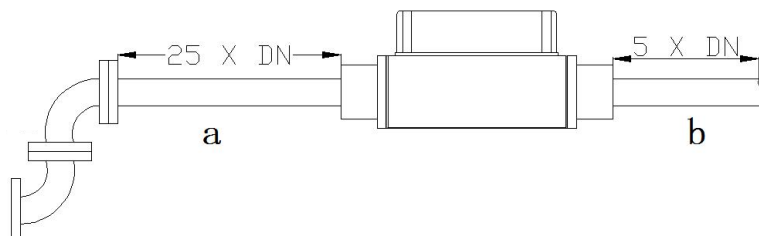
Increase the pipe diameter



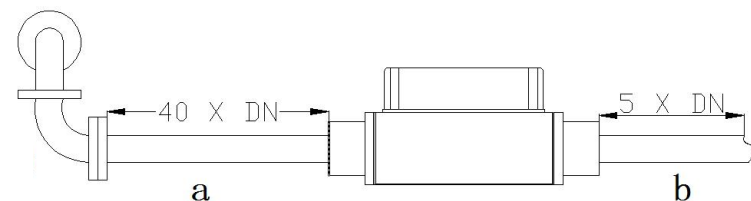
With 90-degree elbows or T-shaped pipes



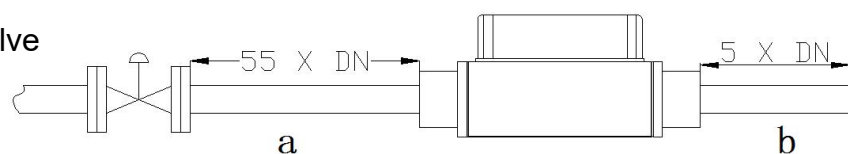
A pipe with two 90-degree elbows



3. Pipe with 2 90-degree elbows



control valve



 Note: When installing and using, be sure to ensure that the front and rear pipe ends are within the above distance, and the straight

pipe section is concentric with the pipe on the flow meter, and the flow meter is fixed reliably. If the straight pipe section cannot be guaranteed, the accuracy of the flow meter cannot be guaranteed.

## VIII、Wiring

### 1) Terminal Block Description :

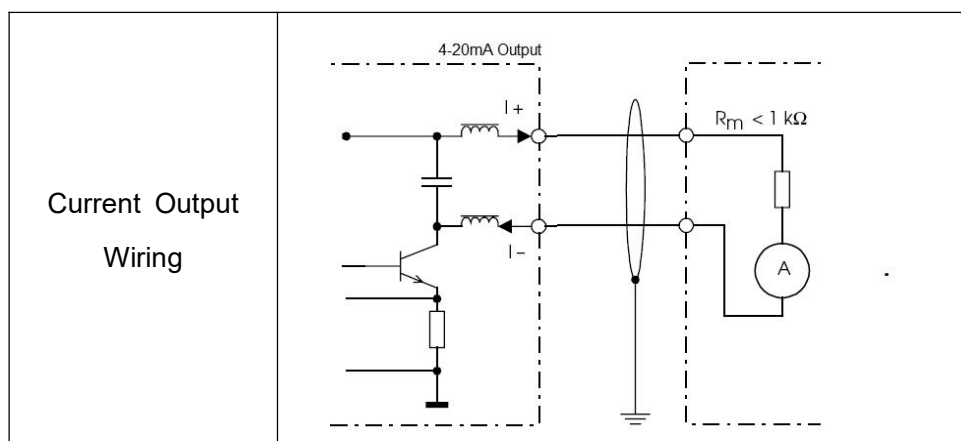
7 -core aviation cable 1 meter long for user input/output interface

| Logo     | Meaning                      |
|----------|------------------------------|
| 1-Red    | Current Output I+            |
| 2-Yellow | High Flow Alarm Output+      |
| 3-Green  | RS485 Communication Output A |
| 4-Black  | RS485 Communication Output B |
| 5-Brown  | Low Flow Alarm Output+       |
| 6-White  | DC24V                        |
| 7-Blue   | GND/ I-                      |

4-core aviation cable, 1 meter long, used for connection with the display module.



### 2) Wiring Connection :



IX、 Instructions :

1. Key Description

| Logo                                                                              | Meaning           |
|-----------------------------------------------------------------------------------|-------------------|
|  | Cancel / Exit Key |
|  | Confirm/Enter Key |
|  | Shift Key         |
|  | Edit/Page Key     |



2. Menu Description

a) Flow Display

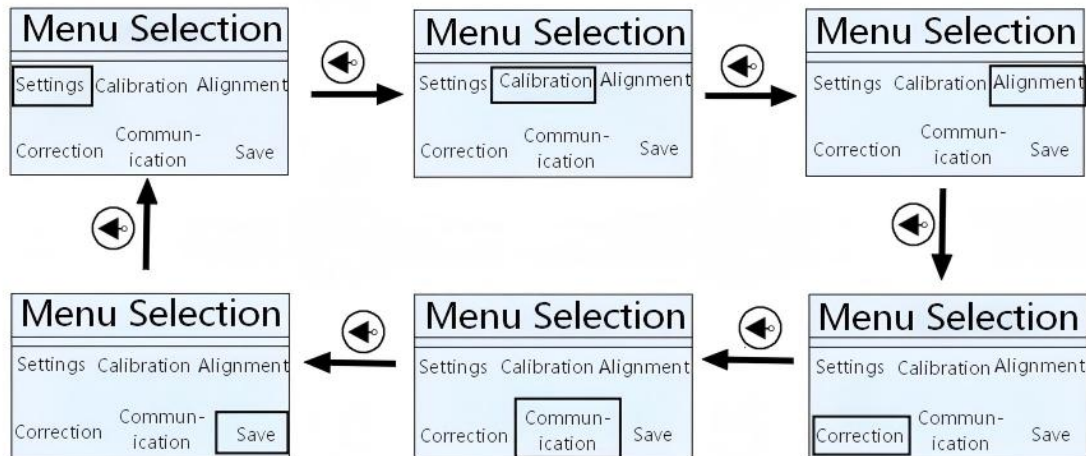
|                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><div>flowNL/m</div><div>0.00</div><div>0 NL</div></div> <p>Display instantaneous flow rate and instantaneous flow rate unit</p> <p>Cumulative flow and unit, according to  access the detailed display window</p> | <div><div>OK</div><div>F 00000030.2 NL/m</div><div>T 0000023.10 NL</div><div>V 00000080.2 Nm/s</div><div>1.123v</div></div> <p>All information display windows</p> <p>First row: The boxes are status indicators.</p> <p>OK means the communication is normal, err means the communication is wrong</p> <p>The second line is the instantaneous flow</p> <p>The third line is the cumulative flow</p> <p>The fourth line is the flow rate</p> <p>The fifth line is the real-time voltage</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

b) Menu Display

|                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Press ENT menu to enter</p> <div><div>Menu Selection</div><div>SettingsCalibrationAlignment</div><div>CorrectionCommunicationSave</div></div> | <p>Menu Selection</p> <p>Settings : Basic parameter settings</p> <p>Calibration : Calibration settings</p> <p>Calibration : Set zero voltage, current calibration, and clear accumulated flow</p> <p>Communication : RS485 communication parameter setting</p> <p>Save: Parameter save and restore</p> <p>Correction : Secondary correction of flow</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                           |                                                                                                    |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Enter Password<br>*****<br>Password<br>Press ENT to enter | Setup, Calibration, Communication, Save, Password : 1000<br>Calibration, Correction Password: 0603 |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------|

Use the shift key to select the function menu you want to enter.



Set the basic parameter menu, move the black rectangle to "Settings", press **ENT** key, the password input menu appears, then press **ENT**. A flashing cursor appears, enter the password, and after entering the password, press **ENT**. If the password is correct, the system will directly enter the parameter setting menu. If the password is incorrect, the character "Error" will appear. Press again to confirm. **ENT** key to re-enter.



### c) Settings Menu

|                                                 |                                                                                      |
|-------------------------------------------------|--------------------------------------------------------------------------------------|
| Language<br>> Chinese<br>Backlight<br>Always on | Language Selection: Chinese or English<br>Backlight Options: Automatic and Always On |
|-------------------------------------------------|--------------------------------------------------------------------------------------|

|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Flow unit<br/>&gt; Nm3/h</p> <p>Cumulative unit<br/>Nm3</p>                               | <p>&gt; Indicates that it can be set</p> <p>The flow units are as follows: g / min, g/s, Kg / min , Kg / h, Nm3/ h, Nm3 / min, N L/ h, N L/ min, mL/ min</p> <p>Cumulative units are: g, Kg, Nm3, NL</p> <p>The cumulative unit changes with the flow unit and does not need to be set separately</p>                                                                                                                                                          |
| <p>Instrument coefficient<br/>&gt; 1.0</p> <p>Equivalent pipe inner diameter mm<br/>10.0</p> | <p>Instrument coefficient: The calibration correction coefficient can be changed to compensate for the disturbance of fluid cross-sectional velocity distribution and the influence of specific application environment.</p> <p>The instrument factor is a multiplication factor of the linear flow signal.</p> <p>Display value = instrument factor x actual measured value</p> <p>Pipe inner diameter: input according to actual application, unit is mm</p> |
| <p>Range upper limit<br/>&gt; 120.0</p> <p>Range lower limit<br/>10.0</p>                    | <p>&gt; means it can be set. Press the shift key to move '&gt;' between the upper and lower limits of the range.</p> <p>according to  Press key to enter the setting, the first character will flash after entering</p>                                                                                                                                                       |
| <p>Damping coefficient<br/>&gt; 5</p> <p>Small signal cut-off<br/>0.06</p>                   | <p>Damping coefficient: Default 10 , Range 0-50</p> <p>Reducing the damping coefficient can quickly detect the jump in flow rate.</p> <p>Increasing the damping factor can smooth the current flow display value.</p> <p>Small signal cutoff: eliminate zero fluctuations, as a percentage of the range</p>                                                                                                                                                    |
| <p>Current output type<br/>&gt; Flow rate</p> <p>Noise threshold &lt;0-10&gt;<br/>2</p>      | <p>Current output type: You can choose flow rate and flow rate, and decide whether the upper and lower limits of the range are converted by flow rate or flow rate.</p> <p>Noise threshold: The value is 0-10, used to eliminate noise signals. The larger the value, the larger the noise signal eliminated.</p>                                                                                                                                              |
| <p>Gas density kg/m3<br/>&gt; 1.2904</p> <p>Conversion factor<br/>1.0</p>                    | <p>Medium density: unit Kg/m3</p> <p>When the density of the measured medium is different from that of the calibration medium, it can be used to make density corrections.</p> <p>Also used for conversion between volume units and weight units.</p> <p>Conversion factor: The conversion factor between the calibration gas and the measured gas.</p>                                                                                                        |

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



the Modify/Page key to enter the calibration menu, move the '>' to before zero current adjustment (Adjust lout Span), 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. The menu returns to the previous level and moves 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 displayed value on the multimeter at the same time. If they are consistent, it means the calibration is successful. If there is still a difference, recalibration is required. The recalibration steps are the same as above.

|                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; background-color: #e6f2ff;"> User Zero Point<br/> &gt; 1.023<br/> Current Voltage<br/> 1.213 </div> | <p>User zero point and current voltage settings</p> <p>When there is no flow in the pipeline, the flow displayed on the meter is not zero and can be adjusted by modifying the user zero point.</p> <p>To set the user zero point with one key, move the arrow to the current voltage item and press the E NT key twice to set the zero point voltage to the current voltage.</p> |
| <div style="border: 1px solid black; padding: 5px; background-color: #e6f2ff;"> Clear total traffic<br/> &gt; 100.00 </div>                            | <p>Clear the accumulated flow.</p>                                                                                                                                                                                                                                                                                                                                                |

#### e) Communications Menu

|                                                                                                                                         |                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; background-color: #e6f2ff;"> Device ID<br/> &gt; 001<br/> Baud Rate<br/> 9600 </div> | <p>Device ID for MODBUS communication, 0-255</p> <p>Baud Rate Selection: 4800/9600/19200/38400/57600</p> |
| <div style="border: 1px solid black; padding: 5px; background-color: #e6f2ff;"> Check bit<br/> &gt; None<br/> Stop bit<br/> 1bit </div> | <p>Check Digit: None/Odd/Even</p> <p>Stop Bit: 1 bit / 2 bit</p>                                         |

#### f) Save Recovery Menu

Password 0603 can enter the save and restore menu. Saving parameters can be used as a backup of the current parameters. Generally, the factory will use the factory settings. Users should not overwrite the factory configuration unless necessary. Restoring parameters can restore the backup parameters, which is generally used to restore the factory configuration.

|                                                                                                       |                                                                                                          |                                                                                                        |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <div>Save parameters<br/>&gt; save<br/>Restore parameters<br/>Restore</div> <p>Save Parameters</p>    | <div>Save parameters<br/>&gt; save OK<br/>Restore parameters<br/>Restore</div> <p>Saved successfully</p> | <div>Save parameters<br/>&gt; save Err<br/>Restore parameters<br/>Restore</div> <p>Save failed</p>     |
| <div>Save parameters<br/>&gt; save<br/>Restore parameters<br/>Restore</div> <p>Restore Parameters</p> | <div>Save parameters<br/>&gt; save<br/>Restore parameters<br/>Restore OK</div> <p>Recovery Success</p>   | <div>Save parameters<br/>&gt; save<br/>Restore parameters<br/>Restore Err</div> <p>Failed recovery</p> |

## X. Quality Assurance and After-Sales Service

Following the ISO9001:2000 quality management and control system, this product is produced with brand new raw materials and components and has undergone strict factory testing. The product quality and performance meet the relevant standards and technical specifications. However, due to the uncertainty that may arise during 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 recognized quality defect, we will replace it free of charge;
- Within one year from the date of product delivery, if the product you purchased is damaged during normal use and not caused by improper use or human factors, we will repair it free of charge;
- Equipment damage caused by the following reasons during use is not within the scope of free replacement or repair:
  - Installation or use conditions that violate the relevant requirements and regulations of this manual;
  - Incorrect or violation of relevant instrument installation, wiring or usage regulations of the country;
  - Use with other products that are electrically incompatible with this product or have no definite quality assurance and valid certification;
  - Dismantle or repair by yourself;

- Natural aging or loss of equipment that is more than one year old;
- Force majeure as defined by applicable law
- For products within the warranty period, the user shall bear the shipping cost of the product, and we shall bear the replacement or repair and return costs of the product;
- When the products sent by the user are confirmed by us to be free of defects or damage, the relevant shipping and insurance costs incurred shall be borne by the user;
- Once the product sent by the user is confirmed, unless there are special circumstances, we will send out the new or repaired product within 48 hours or two working days;
- If you find any defective or damaged product, please contact your local supplier or us.

## Appendix 1 Modbus Protocol Description

**Communication Baud Rate:** 38400,8,1 ,NONE.

**Instrument Address:** The default is 255 , which can be set through the menu ( 1-255 ) .

**Protocol Selection:** MODBUS RTU.

### Register

| Parameter Name             | Parameter Description                                     | Register Address |
|----------------------------|-----------------------------------------------------------|------------------|
| Mod Bus Address            | RS485 Modbus Address ( R/W)                               | 0x0081           |
| Flow                       | The instantaneous flow rate of the current gas ( R)       | 0x003A ~0x003B   |
| Total                      | Total amount of gas flowing ( R)                          | 0x003C ~0x003E   |
| Baud Rate                  | RS485 communication baud rate ( R /W)                     | 0x0082           |
| GCF                        | Gas correction factor ( R/W)                              | 0x008B           |
| Unit                       | Instantaneous flow and total volume unit ( R/W)           | 0x0090           |
| High Flow Alarm Value      | Set the instantaneous flow upper limit alarm value ( R/W) | 0x0098 ~0x0099   |
| Low Flow Alarm Value       | Set the instantaneous flow lower limit alarm value ( R/W) | 0x009A ~0x009B   |
| Password                   | Set user password ( R/W)                                  | 0x00AE ~0x00AF   |
| Automatic Zero Calibration | Forced automatic zeroing operation ( W)                   | 0x00F0           |
| Total Removal              | Clear cumulative total ( W)                               | 0x00f2           |
| Write Protection           | Temporarily disable write protection ( W)                 | 0x00FF           |

Illustrate:

1. R - read only, W - write only, R/W - read and write.
2. For parameters marked with \* , write protection needs to be disabled before modification.

| Modbus Address        | 0x00 81                                                                                  | Revise | allow |
|-----------------------|------------------------------------------------------------------------------------------|--------|-------|
|                       |                                                                                          | Read   | allow |
| Parameter Description | RS485 Modbus address, default value is 255 .                                             |        |       |
| Data Types            | UINT16                                                                                   |        |       |
| Data Representation   | from 1 to 255 , 0 represents the broadcast address, and this machine cannot be set to 0. |        |       |
| Baud rate             | 0x0082                                                                                   | Revise | allow |

|                       |                                                                                                                                                                                                                                                                                                                                     |        |             |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|
|                       |                                                                                                                                                                                                                                                                                                                                     | Read   | allow       |
| Parameter Description | Modbus communication rate, default 1, is 9600 .                                                                                                                                                                                                                                                                                     |        |             |
| Data Types            | UINT16                                                                                                                                                                                                                                                                                                                              |        |             |
| Data Representation   | Baud rate index value.<br>0 is 4800 , 1 is 9600 , 2 is 19200 , 3 is 38400                                                                                                                                                                                                                                                           |        |             |
| flow                  | 0x003A ~0x003B                                                                                                                                                                                                                                                                                                                      | Revise | Not allowed |
|                       |                                                                                                                                                                                                                                                                                                                                     | Read   | allow       |
| Parameter Description | Current instantaneous gas flow rate, unit <i>L/min</i> .                                                                                                                                                                                                                                                                            |        |             |
| Data Types            | UINT32                                                                                                                                                                                                                                                                                                                              |        |             |
| Data Representation   | 0x003A~0X003B constitute a U INT32 unsigned integer, representing the instantaneous flow rate of the current gas.<br>$F = ( \text{value}(0 \times 003A) * 65536 + \text{value}(0x003B)) / 1000$ ;<br>For example: read address 0x003A is 0x0000, address 0X003B is 0x4f79, then the flow $F = (0 * 65536 + 320345) / 1000 = 20.345$ |        |             |
| Total                 | 0x003C ~0x003E                                                                                                                                                                                                                                                                                                                      | Revise | Not allowed |
|                       |                                                                                                                                                                                                                                                                                                                                     | Read   | allow       |
| Parameter Description | Total amount of gas flowing through, unit $Nm^3$                                                                                                                                                                                                                                                                                    |        |             |
| Data Types            | UINT32 + UINT16                                                                                                                                                                                                                                                                                                                     |        |             |
| Data Representation   | $A = \text{value}(0 \times 003C) * 65536 + \text{value}(0x003D) + \text{value}(0x003E) / 1000$ ;<br>For example: read address 0 x 003C is 0, 0 x 003D is 3452 , 0x003E is 245 , then the total amount $A = 0 * 65536 + 3452 + 245 / 1000 = 3452.245$                                                                                |        |             |
| G CF                  | 0x008B                                                                                                                                                                                                                                                                                                                              | Revise | allow       |
|                       |                                                                                                                                                                                                                                                                                                                                     | Read   | allow       |
| Parameter Description | Sets the gas correction factor.<br> Note: Turn off the write protection register before writing.                                                                                                                                                 |        |             |
| Data Types            | UINT16                                                                                                                                                                                                                                                                                                                              |        |             |
| Data Representation   | For example: when the gas factor is 1 000 , the written data is 1 000 (0X03 E 8) .                                                                                                                                                                                                                                                  |        |             |
| Unit                  | 0x0090                                                                                                                                                                                                                                                                                                                              | Revise | allow       |
|                       |                                                                                                                                                                                                                                                                                                                                     | Read   | allow       |
| Parameter Description | Set the unit for instantaneous flow and total flow.<br> Note: Turn off the write protection register before writing.                                                                                                                             |        |             |
| Data Types            | UINT16                                                                                                                                                                                                                                                                                                                              |        |             |
| Data Representation   | Instantaneous flow and total volume index corresponding units<br>5 is the instantaneous flow rate $m^3/h$ , total amount $m^3$<br>8 is the instantaneous flow rate $L/min$ , total amount $m^3$                                                                                                                                     |        |             |
| High Flow             | 0x0098 ~0x0099                                                                                                                                                                                                                                                                                                                      | Revise | allow       |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                  |               |             |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|
| <b>Alarm Value</b>                |                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | allow       |
| <b>Parameter Description</b>      | Set the instantaneous flow upper limit alarm value, unit <i>L/min</i> .<br> Note: Turn off the write protection register before writing.                                                                                                                                                        |               |             |
| <b>Data Types</b>                 | UINT32                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>        | High flow alarm value<br>$ALAM\_H = (value(0 \times 0098) * 65536 + value(0x0099)) / 1000;$<br>For example: read address 0x0098 is 0x0003, 0x0099 is 0x0D40, then $ALAM\_H = (3 * 65536 + 3392) / 1000 = 200.0 \text{ L/min.}$                                                                                                                                                   |               |             |
| <b>Low Flow Alarm Value</b>       | <b>0x009A ~0x009B</b>                                                                                                                                                                                                                                                                                                                                                            | <b>Revise</b> | allow       |
|                                   |                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | allow       |
| <b>Parameter Description</b>      | Set the instantaneous flow upper limit alarm value, unit <i>L/min</i> .<br> Note: Turn off the write protection register before writing.                                                                                                                                                        |               |             |
| <b>Data Types</b>                 | UINT32                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>        | High flow alarm value<br>$ALAM\_H = (value(0 \times 009A) * 65536 + value(0x009B)) / 1000;$<br>For example: read address 0x009A is 0x0, 0x009B is 0x1388, then $ALAM\_H = (0 * 65536 + 5000) / 1000 = 5.0 \text{ L/min.}$                                                                                                                                                        |               |             |
| <b>Password</b>                   | <b>0x00AE ~0x00AF</b>                                                                                                                                                                                                                                                                                                                                                            | <b>Revise</b> | allow       |
|                                   |                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | allow       |
| <b>Parameter Description</b>      | Set User Password<br> Note: Turn off the write protection register before writing.                                                                                                                                                                                                            |               |             |
| <b>Data Types</b>                 | UINT32                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>        | The password is 5 digits in decimal, such as 1 2345, 9 9999.<br>$PASSWD = value(0 \times 00AE) * 65536 + value(0x00AF);$<br>For example: read address 0x00AE is 0x0001, 0x00AF is 0x869F, then $PASSWD = 1 * 65536 + 34463 = 99999$ .                                                                                                                                            |               |             |
| <b>Automatic Zero Calibration</b> | <b>0x00F0</b>                                                                                                                                                                                                                                                                                                                                                                    | <b>Revise</b> | allow       |
|                                   |                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | Not allowed |
| <b>Parameter Description</b>      | Forces the zero voltage of the gas to be reset when it is at rest.<br> Note: When writing, the gas in the flow meter pipeline is at rest.<br> Note: Turn off the write protection register before writing. |               |             |
| <b>Data Types</b>                 | UINT16                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>        | by writing 0 XAA55 to address 0x00F0.                                                                                                                                                                                                                                                                                                                                            |               |             |
| <b>Total Amount Removed</b>       | <b>0x00F2</b>                                                                                                                                                                                                                                                                                                                                                                    | <b>Revise</b> | allow       |
|                                   |                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | Not allowed |
| <b>Parameter Description</b>      | Clear the flow totals.<br> Note: Turn off the write protection register before writing.                                                                                                                                                                                                       |               |             |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                  |               |             |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|
| <b>Data Types</b>            | UINT16                                                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>   | writing 0X0001 to address 0x00F2 .                                                                                                                                                                                                                                                                                                                                                                               |               |             |
| <b>Write Protection</b>      | <b>0x00FF</b>                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Revise</b> | allow       |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Read</b>   | Not allowed |
| <b>Parameter Description</b> | Write protection register, you need to turn off write protection when modifying other registers.                                                                                                                                                                                                                                                                                                                 |               |             |
| <b>Data Types</b>            | UINT16                                                                                                                                                                                                                                                                                                                                                                                                           |               |             |
| <b>Data Representation</b>   | <p>by writing 0X0AA55 to address 0x00FF .</p> <p> Note: Except for the Modbus address and baud rate, other registers need to be disabled for write protection when they are modified. If there is no other modification within 3 minutes after a modification, the write protection function will be automatically enabled.</p> |               |             |

## Appendix 2 Conversion Coefficient Table of Gases Relative to Air

At present, laboratories cannot calibrate the mass flow rate according to the gas actually used by users. Usually, the calibration is performed after converting the actual gas flow rate into air flow rate. When the user is using it, the direct output shows the actual mass flow rate or volume flow rate of the gas used.

The conversion of different gases is done through conversion coefficients. The conversion coefficients of single-component gases can be found in the table. See the table below:

|    | Gas                             | Specific Heat<br>( cal / g °C ) | Density ( g / L<br>0 °C ) | Conversion<br>Factor |
|----|---------------------------------|---------------------------------|---------------------------|----------------------|
| 00 | Air                             | 0.24                            | 1.2 93                    | 1.0000               |
| 01 | Argon                           | 0.125                           | 1.6605                    | 1.4066               |
| 02 | Arsenic AsH 3                   | 0.1168                          | 3.478                     | 0.6690               |
| 03 | Boron tribromide BBr 3          | 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 2 H 6                  | 0.502                           | 1.235                     | 0.5050               |
| 07 | Carbon tetrachloride CCl<br>4   | 0.1297                          | 6.86                      | 0.3052               |
| 08 | Carbon tetrafluoride CF<br>4    | 0.1659                          | 3.9636                    | 0.4255               |
| 09 | Methane CH 4                    | 0.5318                          | 0.715                     | 0.7147               |
| 10 | Acetylene C 2 H 2               | 0.4049                          | 1.162                     | 0.5775               |
| 11 | Ethylene C 2 H 4                | 0.3658                          | 1.251                     | 0.5944               |
| 12 | Ethane C 2 H 6                  | 0.4241                          | 1.342                     | 0.4781               |
| 13 | Propylene C 3 H 4               | 0.3633                          | 1.787                     | 0.4185               |
| 14 | Propylene C 3 H 6               | 0.3659                          | 1.877                     | 0.3956               |
| 15 | Propane C 3 H 8                 | 0.399                           | 1.967                     | 0.3459               |
| 16 | Butyne C 4 H 6                  | 0.3515                          | 2.413                     | 0.3201               |
| 17 | Butene C 4 H 8                  | 0.3723                          | 2.503                     | 0.2923               |
| 18 | Butane C 4 H 10                 | 0.413                           | 2.593                     | 0.2535               |
| 19 | Pentane C 5 H 12                | 0.3916                          | 3.219                     | 0.2157               |
| 20 | Methanol CH 3 OH                | 0.3277                          | 1.43                      | 0.5805               |
| 21 | Ethanol C 2 H 6 O               | 0.3398                          | 2.055                     | 0.3897               |
| 22 | Trichloroethane C 3 H 3<br>Cl 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 | Cyanide gas C 2 N 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<br>GeCl 4 | 0.1072 | 9.565  | 0.2654 |
| 30 | Germane GeH 4                     | 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 H 2 S            | 0.2278 | 1.52   | 0.8390 |
| 37 | Helium                            | 1.2418 | 0.1786 | 1.4066 |
| 38 | Krypton                           | 0.0593 | 3.739  | 1.4066 |
| 39 | Nitrogen N 2                      | 0.2486 | 1.25   | 0.9940 |
| 40 | Neon                              | 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 2 O               | 0.2098 | 1.964  | 0.7048 |
| 45 | Oxygen O 2                        | 0.2196 | 1.427  | 0.9861 |
| 46 | Phosphorus trichloride<br>PCl 3   | 0.1247 | 6.127  | 0.3559 |
| 47 | Phosphine PH 3                    | 0.261  | 1.517  | 0.6869 |
| 48 | Phosphorus<br>Pentafluoride PF 5  | 0.1611 | 5.62   | 0.3002 |
| 49 | Phosphorus oxychloride<br>POCl 3  | 0.1324 | 6.845  | 0.3002 |
| 50 | Silicon tetrachloride SiCl<br>4   | 0.127  | 7.5847 | 0.2823 |
| 51 | Silicon Tetrafluoride SiF<br>4    | 0.1692 | 4.643  | 0.3817 |
| 52 | Silane SiH 4                      | 0.3189 | 1.433  | 0.5954 |
| 53 | Dichlorosilane SiH 2 Cl 2         | 0.1472 | 4.506  | 0.4095 |
| 54 | Trichlorosilane SiHCl 3           | 0.1332 | 6.043  | 0.3380 |
| 55 | Sulfur hexafluoride SF 6          | 0.1588 | 6.516  | 0.2624 |
| 56 | Sulfur dioxide SO 2               | 0.1489 | 2.858  | 0.6829 |
| 57 | Titanium Tetrachloride<br>TiCl 4  | 0.1572 | 8.465  | 0.2048 |
| 58 | Tungsten Hexafluoride<br>WF 6     | 0.0956 | 13.29  | 0.2137 |
| 59 | Xenon                             | 0.0379 | 5.858  | 1.4066 |

