ARANKA

USER MANUAL

AIMTMF

MICRO THERMAL MASS FLOWMETER

FOR AIR & GAS

Ver. 1.0

Instructions for Micro Thermal Gas Mass Flow Meter

version	instructions	note
V1.0	First Edit	
V1.1	Modified aviation plug definition	
V1.2	Modified some information on the Settings page	
V1.3	Adding Installation Information	
V1.5	Modified schematic diagram	
V1.6	Optimized layout	

Content

I、Product introduction

Micro gas mass flow meters is specially designed for the measurement and process control of various types of small flow gases. This series of sensors are made with advanced micro-electro-mechanical system (MEMS) flow sensing chips, and are suitable for all types of clean gases. The Unique packaging technology makes it suitable for a wide range of pipe sizes, low cost, easy installation, no temperature and pressure compensation, and can replace traditional volumetric or differential pressure flow meters.

II、Product features

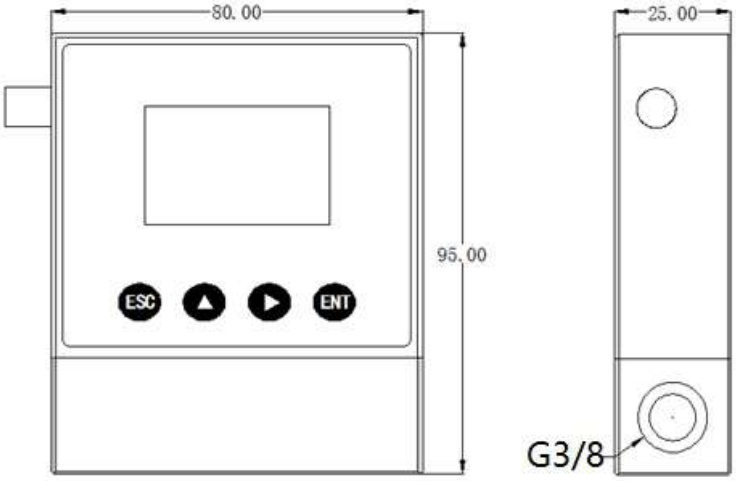
- ➢ Using MEMS flow sensor chip, the sensor has the characteristics of high precision, high sensitivity and strong anti-interference.
- ➢ This product has display screen and setting buttons, which is easy to operate and read directly.(optional)
- ➢ The zero point stability of the sensor is greatly improved compared with the ordinary thermal flow meters.
- ➢ Full range high stability.
- ➢ Full range precision and excellent repeatability.
- ➢ Combined with structural optimization, the flow meter can greatly reduce pressure loss and energy consumption compared with traditional mechanical instruments.
- ➢ LCD display instantaneous flow and cumulative flow, clear and intuitive, easy to read.
- ➢ 4~20mA standard signal output and second impulse output to choose.

III、Technical parameters

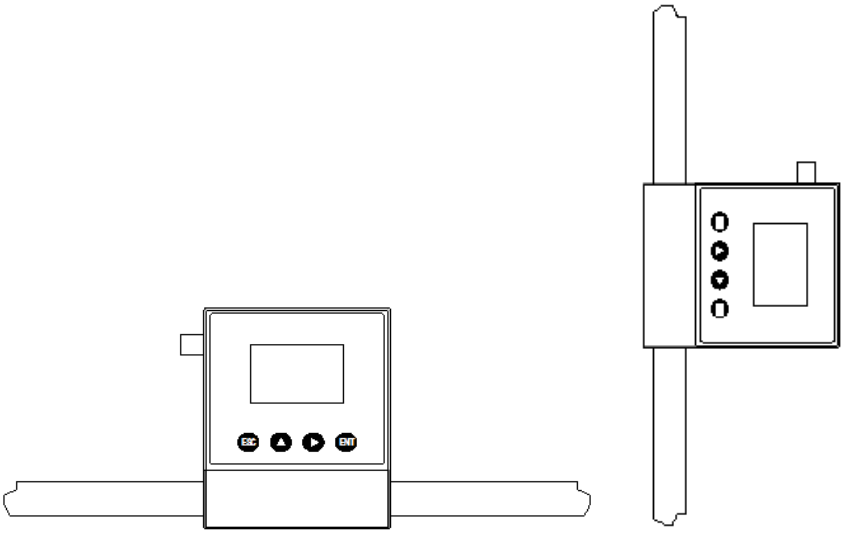
Precision(%)	+ 1.5 + 0.2 (FS)	Medium temperature(℃)	- 10 ~ 55
Response time (MS)	50- 1000.	Humidity	<95%RH(no frost, no icing)
Maximum working pressure (Mpa)	1.0	Connection	G3/8 OR G1/4
Working power	15v- 24v 100mA	The overall power consumption	< 2.4 W.
Output model	4- 20mA, pulse (optional)	Communication methods	RS485 (Modbus protocol)
Display	Instantaneous flow, cumulative flow	Calibration	Air (20℃, 101.325kPa)

Note: The above data were measured at 20℃, 101.32kPa, dry air

IV、 Mechanical dimensions(mm)

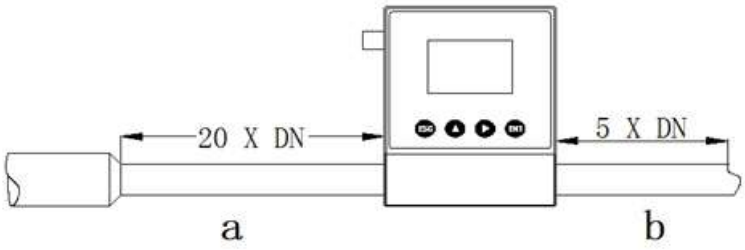


V、 installation

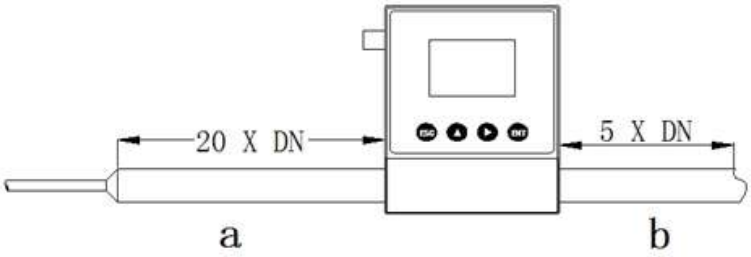


VI、 InstallationNotes

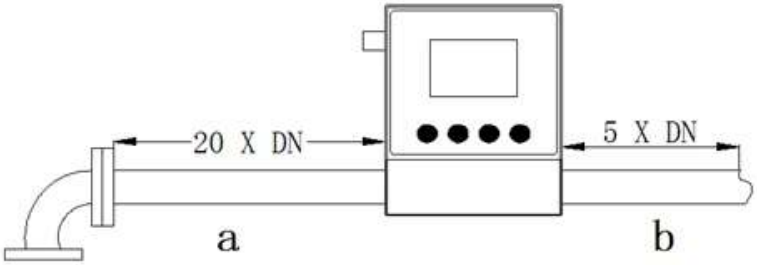
Reducing Coupling:



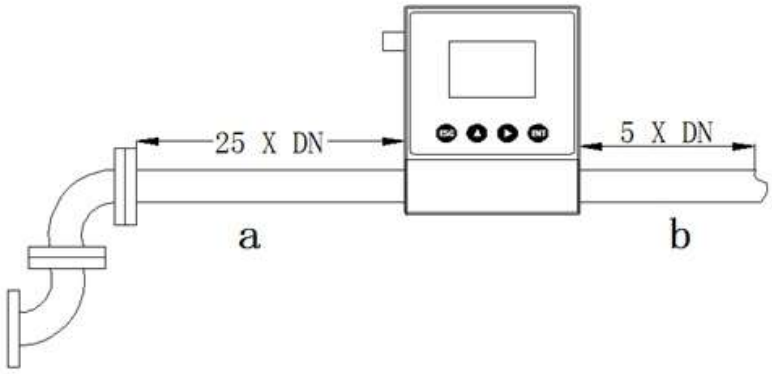
Expansion pipe :



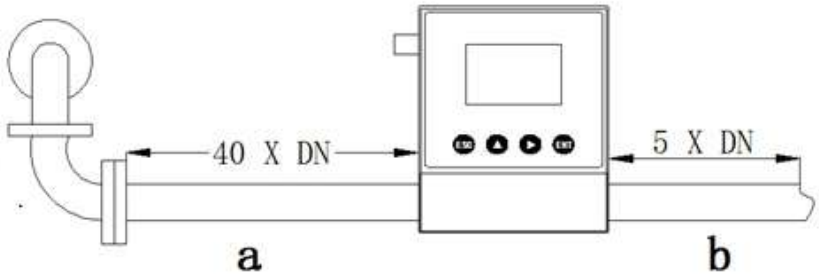
With a 90 degree joint or t-pipe:



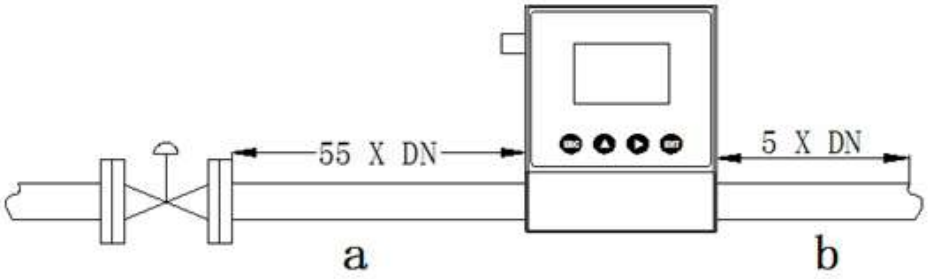
With two 90 degree joints:



With three 90 degree joints:



With control value:

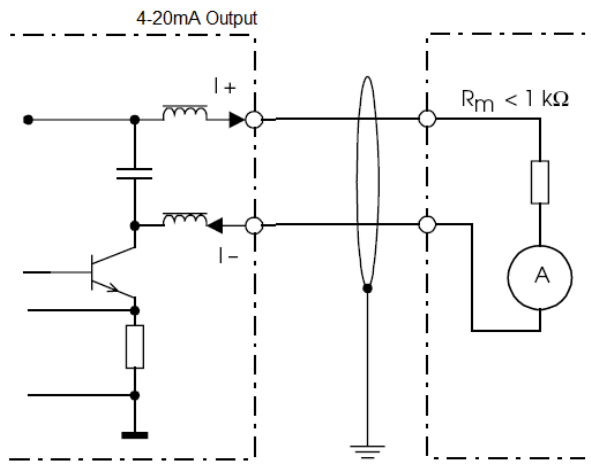


VII、 Wiring diagram

1) Description of wiring terminal:

logo	meaning
1 - pink	24 V-/ electric current I-
2 - black	electric current (I) +
3 - blue	PE
4 - white	24V+
5 - brown	RS485 communication output A
6 - gray	RS485 communication output B

2) Wiring connection:

electric current output wiring	

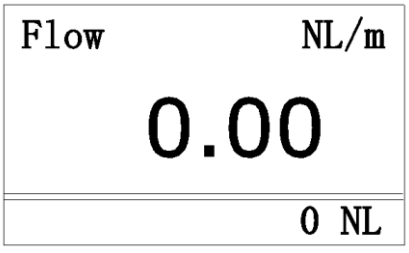
VIII、 Operation instructions:

Button Description

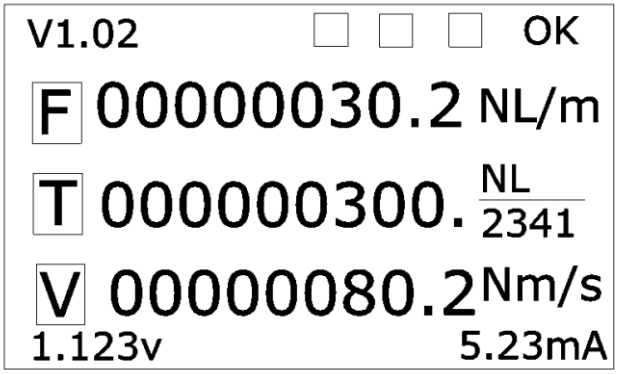
logo	meaning
ESC	Cancel or exit the interface
▶	The shift key
◀	Modify/page key
ENT	Confirm/Enter key

1) Menu description

a) Display the menu



Display instantaneous flow and instantaneous flow rate unit
Cumulative flow and unit: Press ▶ to enter the detailed display window



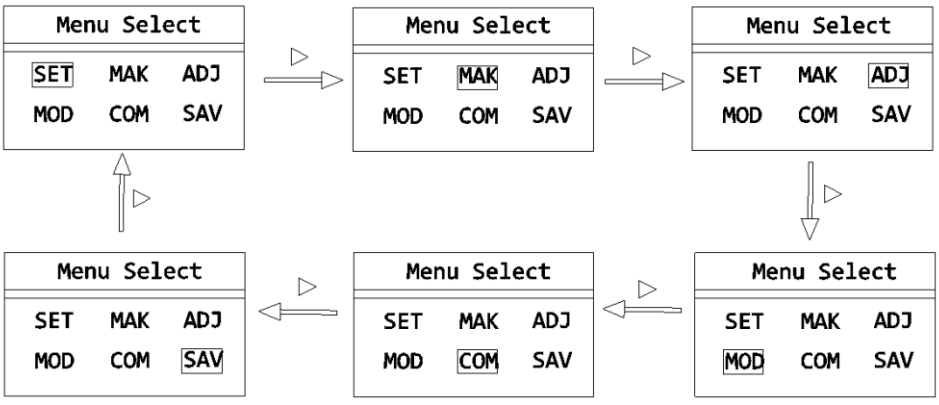
All information display window
The first line: V1.02 is the software version number, the box is the status indicator,
OK indicates that the sensor is normal. Err indicates

	that the sensor is faulty The second line: instantaneous flow The third line: accumulate traffic The fourth line: velocity The fifth line: real-time voltage and 4-20mA output

b) Menu selection and password input

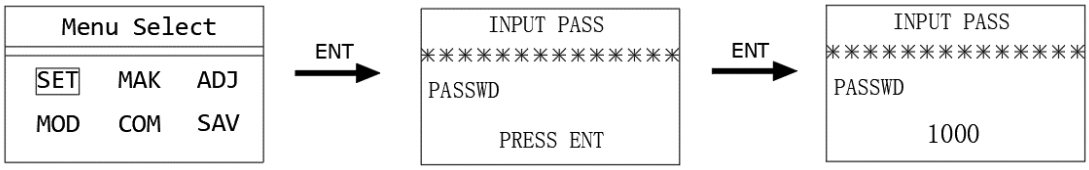
Press ENT menu to enter Menu Select SET MAK ADJ MOD COM SAV	Menu selection SET: Basic parameter Settings MAK: Calibration Settings ADJ: set zero voltage, current calibration, cumulative flow zero COM: RS485 communication parameter setting SAV: Save and restore parameters MOD: Secondary correction of flow
INPUT PASS ********** PASSWD PRESS ENT	SET, ADJ, COM, password: 1000 MAK, MOD, SAV, password: 0603

Select the function menu to enter through the shift key



Set Basic parameters menu, remove the black rectangle to to the "Settings", press "ENT" key, the password input menu appears, press "ENT" key again, a flashing cursor appears, enter the password, after the password input is completed, press "ENT" key to confirm. if the password is correct, it will directly enter into the parameter Settings menu. if the

password is incorrect, "Error" will appear, Press ENT key again to re-enter.

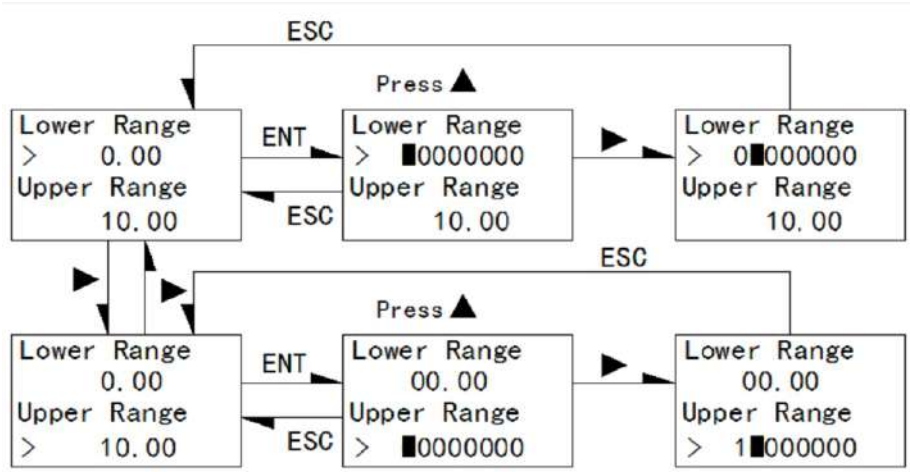


c) The Settings menu

Flow Unit > Nm3/h Totalizer Unit Nm3	> indicates that it can be set The flow unit: g/min, g/s, Kg/min, Kg/h, Nm3/h, Nm3/min, NL/h, NL/min, and mL/min The cumulative unit: G, Kg, Nm3, and NL
MeterFactor > 1.0 I.Diameter mm 10.0	Instrument coefficient: calibration correction coefficient can be changed to compensate for the interference of fluid cross-section velocity distribution and the influence of specific application environment. Meter factor is a product coefficient of linear flow signal. Display value = instrument coefficient x actual measured value Pipe diameter: input according to actual application, unit is mm
Lower Range > 0.00 Upper Range 10.0	> indicates that it can be set. Press the shift key to move '>' between upper and lower ranges to switch. Press ENT key to enter setting, the first character flashes after entering
Damp Factor > 2 Signal CutOff<%> 0.05	Damping coefficient: default 10, range 0-50 Decreasing the damping coefficient can quickly detect the jump in flow, increasing the damping coefficient can smooth the current flow display value. Small signal excision: eliminate zero fluctuation as a percentage of range
ImA Output Type > Flow NoiseValue<0-10> 5.0	Current output type: you can choose flow rate and flow rate to determine whether the upper and lower ranges are converted by flow rate or flow rate. Noise threshold: the value is 0-10, which is used to eliminate noise signal, the greater the value, the greater the noise signal to be eliminated.

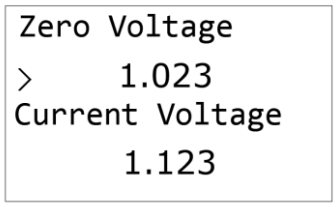
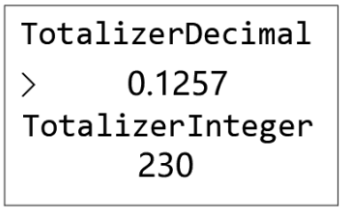
GasDichte <kg/m3> > 1.2904 Conver Factor 1.0	Medium density: unit Kg/m3 When the density of the measured medium is different from the calibrated medium, it can be used for density correction. Also used to convert between volume units and weight units. Conversion factor: conversion factor between calibrated gas and measured gas.

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

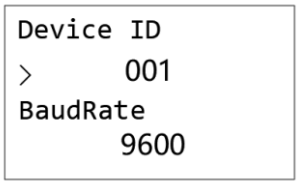
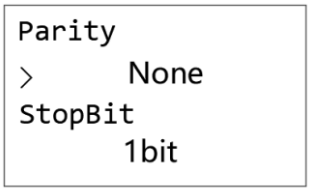


d) correction

I Output Mode > 4-20mA Fixed Output 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: 0 mA, 4mA, 8mA, 12mA, 16 mA, 20 mA
Adjust Iout Low > 4.0 Adjust Iout High 20.0	Example: The current output mode is 4-20mA When there is no flow, the output current measured with a multimeter is 3.89 mA Then adjust the current output zero to 3.89 mA At maximum flow, the output current measured with a multimeter is 19.75 mA Then adjust the current output zero to 19.75 mA
Method of calibrating current output in fixed current output mode: The first step is to connect the multimeter in series with the current loop; The second step is to set the current output mode to fixed current output (Fixed); The third step, press the shift key, 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;	

The fourth step, observe the multimeter display, if it is 4mA, no need to calibrate, if it is 3.90mA, press the modify/page key to enter the calibration menu, move '>' to the zero current adjustment (Adjust Iout Zero), press the enter key Enter the setting, enter 3.90, and press the enter key to exit the setting. The fifth step, press the shift key and the modify/page key at the same time, the menu returns to the previous level, move '>' to the next line, press the confirm key to enter the setting state, press the modify/page key to select the output current value, select 20mA output, press the enter key to exit the setting state; The sixth step, observe the multimeter display, if it is 20mA, no need to calibrate, if it is 19.90mA, press the modify/page key to enter the calibration menu, move the '>' to the zero current adjustment (Adjust Iout Span), press the enter key Enter the setting, input 19.90, and press the enter key to exit the setting. The seventh step, 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 Enter 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 it is consistent, the calibration is successful.	
	User zero and current voltage Settings When there is no flow in the pipeline, the table shows that the flow is not zero. You can modify the user zero to adjust the flow. To set the user zero point, click the arrow to the current voltage, press ENT twice to set the zero point voltage to the current voltage.
	Cumulative decimal and integer clear or set

e) Communications menu

	MODBUS communication device ID,0-255 Baud rate choose 1200/2400/19200/4800/9600
	Parity bit: None/Odd/Even Stop bit: 1bit/2bit

f) Save recovery menu

The password 0603 can enter the save and restore menu. The current parameters can be used as a backup for saving the factory Settings. Generally, the factory Settings will be saved.Restore parameters You can restore backup parameters to factory Settings.

Save Parameters > Save Restore Factory Reset	Save Parameters > Save Ok Restore Factory Reset	Save Parameters > Save Err Restore Factory Reset
Save the parameters	Save success	Save failed
Save Parameters Save Restore Factory > Reset	Save Parameters Save Restore Factory > Reset Ok	Save Parameters Save Restore Factory > Reset Err
Restore the parameters	Restore success	Restore failure

IX、 Quality assurance and aftesales 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. Product quality and product performance conform to relevant standards and technical texts. However, due to possible uncertainties 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 an acceptable quality defect, we will replace it free of charge;
- Within two weeks from the date of delivery, if the product you purchased has an acceptable quality defect, we will replace it free of charge;
- Equipment damage caused by the following reasons in the process of use is not within the scope of free replacement or maintenance:

Any installation or use conditions in violation of the relevant requirements and provisions of this manual;

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

It can be used with other products that are not compatible with the product electrically or without exact quality assurance and valid certification.

Self-disassembly or maintenance;

Natural aging or wear out of equipment for more than one year;

Force majeure as defined by applicable law

- For the products within the warranty period, the user shall bear the cost of sending the products, and we shall bear the cost of replacing or repairing the products and sending back the products;

- When the products sent by users are confirmed by us to be free from defects or damage, the relevant shipping premiums shall be borne by users;
- Once the product sent by the user is confirmed, unless there are special circumstances, we will send the new or repaired product within 48 hours or two working days;
- If any defect or damage is found, please contact your local supplier or us.

Appendix 1 Modbus register address table

Communication baud rate: 9600,8,1, NONE, floating point data arrangement: 2143
Reading data Function code: 03 (HOLDING REGISTER)
Meter address: can be set through the menu, 0-255, communication protocol to select MODBUS RTU

Register address	Register name	Number of registers	The data type	The data format
4x0001-4x0002	instantaneous flow rate	2	float	IEEE754
	send	01 03 00 00 00 02 C4 0B		
	receive	01 03 04 00 00 00 00 FA 33		
4x0003-4x0004	instantaneous flow velocity	2	float	IEEE754
	send	01 03 00 02 00 02 65 CB		
	receive	01 03 04 00 00 00 00 FA 33		
4x0005-4x0006	Current current value	2	float	IEEE754
	send	01 03 00 04 00 02 85 CA		
	receive	01 03 04 00 00 00 00 FA 33		
4x0007-4x0008	The cumulative integer	2	Unsigned long	Unsigned long integer
	send	01 03 00 06 00 02 24 0A		
	receive	01 03 04 00 00 00 00 FA 33		
4x0009-4x0010	The cumulative decimal	2	float	IEEE754
	send	01 03 00 08 00 02 45 C9		
	receive	01 03 04 00 00 00 00 FA 33		
4x0011-4x0012	Cumulant Floating point number	2	float	IEEE754
	send	01 03 00 0A 00 02 E4 09		
	receive	01 03 04 00 00 00 00 FA 33		
4x0013-4x0014	Medium temperature	2	float	IEEE754
	send	01 03 00 0C 00 02 04 08		
	receive	01 03 04 BA 4A 41 F8 CF 2F		
4x0015-4x0016	Current collected signal value	2	float	IEEE754

	send	01 03 00 0E 00 02 A5 C8		
	receive	01 03 04 82 1F 40 36 52 5B		
4x0017-4x0018	Velocity lower limit	2	float	IEEE754
4x0019-4x0020	Upper limit of velocity	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	The Modbus device ID	1	Unsigned int	Unsigned integer
4x0054	Baud rate	1	Unsigned int	Unsigned integer
4x0055	Check digit	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 guidelines	1	Unsigned int	Unsigned integer
4x0062	The current fixes the PWM value corresponding to the output value	1	Unsigned int	Unsigned integer
4x0063	Current PWM value zero	1	Unsigned int	Unsigned integer
4x0064	Current PWM value full point	1	Unsigned int	Unsigned integer
4x0065	The output pulse is still the frequency	1	Unsigned int	Unsigned integer

4x0066-4x0067	The pulse width	2	float	IEEE754
4x0068-4x0069	Pulse output corresponds to a scalar	2	float	IEEE754
4x0074-4x0075	Zero current calibration	2	float	IEEE754
4x0076-x40077	Full point current calibration	2	float	IEEE754
4x0078-4x0079	The lower limit range	2	float	IEEE754
4x0080-4x0081	Maximum range	2	float	IEEE754
4x0082-4x0083	Alarm limit	2	float	IEEE754
4x0084-4x0085	Alarm limit	2	float	IEEE754
4x0086-4x0087	Lower limit alarm return difference	2	float	IEEE754
4x0088-4x0089	Upper limit alarm return error	2	float	IEEE754
4x0090-4x0091	Damping coefficient	2	float	IEEE754
4x0092-4x0093	Small signal excision	2	float	IEEE754
4x0094-4x0095	Gas state density	2	float	IEEE754
4x0096-4x0097	Gas conversion coefficient	2	float	IEEE754
4x0098-4x0099	The standby			
4x0100-4x0101	The standby			
4x0102-4x0103	Instrument coefficient	2	float	IEEE754
4x0104-4x0105	Pipe diameter	2	float	IEEE754
4x0106-4x0107	Sampling time period	2	float	IEEE754
4x0108-4x0109	Noise factor	2	float	IEEE754

Appendix 2 Table of conversion coefficients of gases with respect to air

At present, the laboratory cannot calibrate the mass flow rate according to the gas flow rate actually used by users.When the user uses, the direct output shows the actual mass flow rate or volume flow rate of the gas.

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

	The gas body	Specific heat (CAL/g ℃)	Density (g/L 0℃)	Conversion factor
00	Air Air	0.24	1.293	1.0000
01	Argon Ar	0.125	1.6605	1.4066
02	The arsenic hydride 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	Vinyl C^2H^4	0.3658	1.251	0.5944
12	Ethane C^2H^6	0.4241	1.342	0.4781
13	Propiolic 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	Ding acetylene 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	Cyanide gas C^2N^2	0.2608	2.322	0. 4493
26	Chlorine Cl^2	0.1145	3.163.	0. 8529
27	Deuterium gas D^2	1.7325	0.1798	0. 9921
28	Fluorine 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 gets	0.0861	3.61	0. 9940
33	Hydrogen chloride HCI	0.1911	1.627	0. 9940
34	HF 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	Krypton 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 $oxide_2O$	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	Phosphorus alkanes PH_3	0.261	1.517	0. 6869
48	Phosphorous pentafluoride PF_5	0.1611	5.62	0. 3002
49	Phopoci $triclosan_3$	0.1324	6.845	0. 3002
50	Silicon tetrachloride $SiCI_4$	0.127	7.5847	0. 2823
51	Silicon tetrafluoride SiF_4	0.1692	4.643	0. 3817
52	The silane SiH_4	0.3189	1.433	0. 5954
53	Dichlorosilane SiH_2CI_2	0.1472	4.506	0. 4095

54	Trichlorosilicon $SiHCI_3$	0.1332	6.043	0. 3380
55	Sulfur hexafluoride SF_6	0.1588	6.516	0. 2624
56	$So2_2$	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

$$Qs = \frac{0.101325+p}{0.10325} * \frac{273.15+20}{273.15+t} * Qn$$

Qs: The flow rate in standard condition (Nm3/h).
Qn: The flow rate in working condition (m3/h).
t: The medium temperature in working condition (□).
p: The medium pressure in working condition (Gauge pressure, kPa).

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