

Flow sensor FR_n03H series manual



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Zhengzhou Winsen Electronic Technology Co., Ltd

statement

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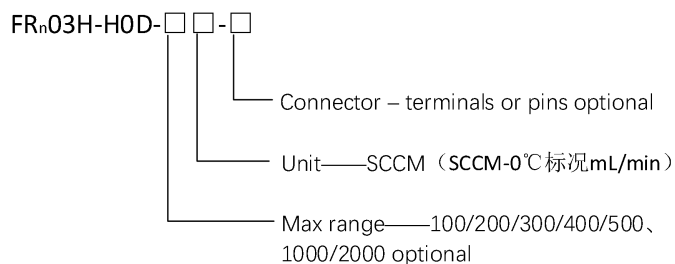
1. Product Overview

The FRn03H series micro -flow gas mass flow sensor is specifically designed for various micro-flow process control applications. This product is an upgrade from the FR03H, with significantly improved zero-point stability and full-range signal stability. It is widely used for various gas measurements, offering low cost, easy installation, and low pressure loss, and can replace traditional flow sensors.

2. Product Features

- ✧ The sensor has high sensitivity and extremely low starting flow rate.
- ✧ Multiple signal outputs
- ✧ High stability and high repeatability across the entire measurement range

3. Product Selection :



4. Technical Specifications

4.1 Technical Parameters

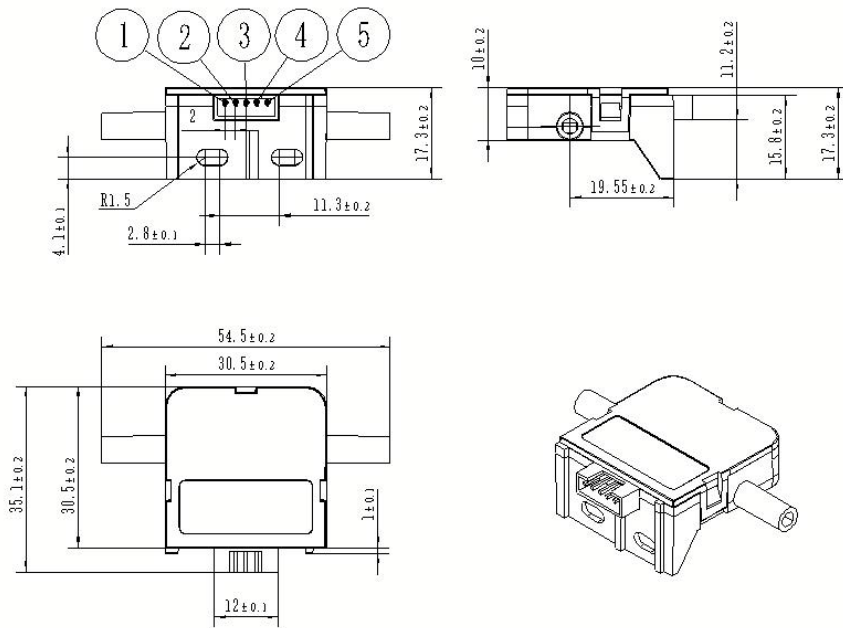
	parameter	numerical values	unit
Flow measurement	Maximum flow	50/100/200/300/400/500 1000/2000	SCCM
	Measurement accuracy	± (2+0.5FS)	%

	Repeatability	(0.5 + 0.15FS)	%
	Maximum working pressure	200	kPa
	Maximum flow rate pressure loss	≤110 ≤150	Pa
	Operating temperature	0~50	°C
Output signal	Output method	Digital I ² C and analog 0.5V to 4.5V DC	
	I ² C communication rate	1 00	kH z
	Signal response time	≤50	ms
Electrical parameters	Operating voltage	5 ~ 15	V D C
	Operating current	≤ 30	mA
	Electrical interface	P H2.0-5P plug connector Alternatively, a 2.54-5 pin header is available.	
other	Storage temperature	-20~ 65	°C
	Mechanical interface	Detachable hose connector	
	Measuring medium	Dry, clean, non-corrosive gases	

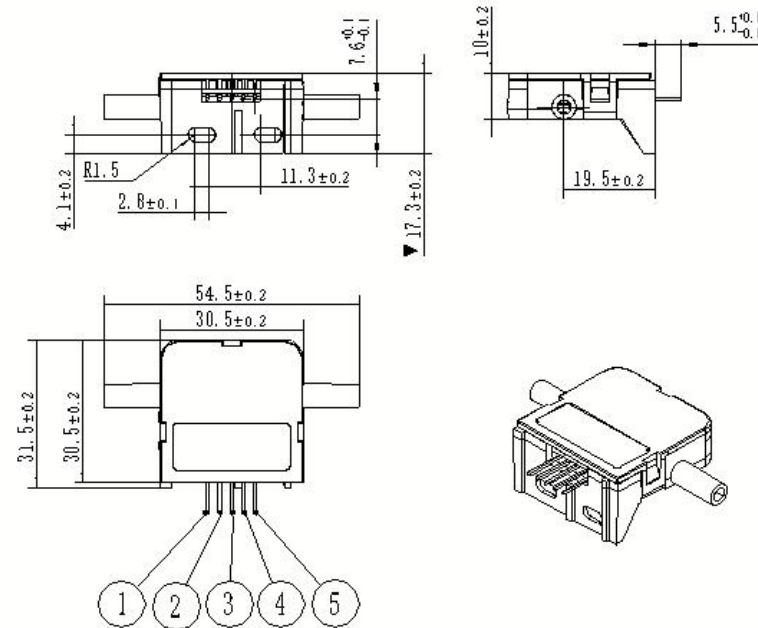
* Our flow sensors are calibrated by default at 20°C and 101.325kPa in air. Production conditions are (22 ±2)°C, clean environment, and 30 %RH ~ 35 %RH . If there are special requirements, calibration will be performed according to customer specifications.

4.2 Structural Parameters

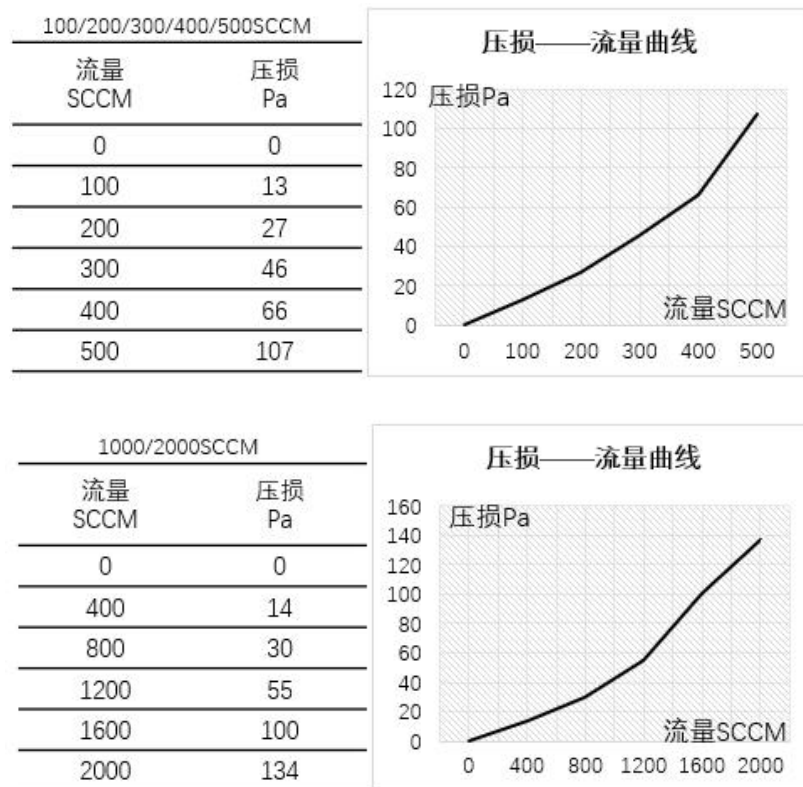
4.2.1 Terminal Version



4.2.2 Pin Insert Version



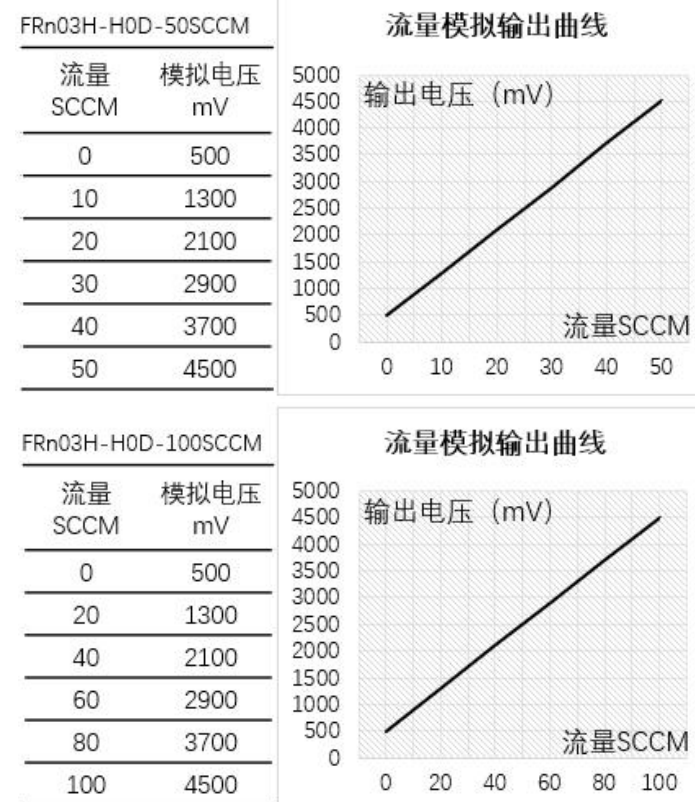
4.3 Flow rate and pressure loss curve



4.4 Interface Definition

pin	Terminal version	Pin version
PIN 1	S DA	S CL
PIN 2	S CL	Vout
PIN 3	GND	VCC
PIN 4	VCC	GND
PIN 5	Vout	S DA

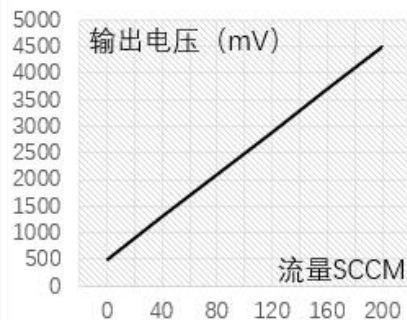
4.5 Analog Signal Output Curve



FRn03H-H0D-200SCCM

流量 SCCM	模拟电压 mV
0	500
40	1300
80	2100
120	2900
160	3700
200	4500

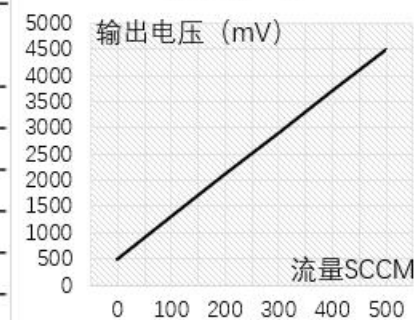
流量模拟输出曲线



FRn03H-H0D-500SCCM

流量 SCCM	模拟电压 mV
0	500
100	1300
200	2100
300	2900
400	3700
500	4500

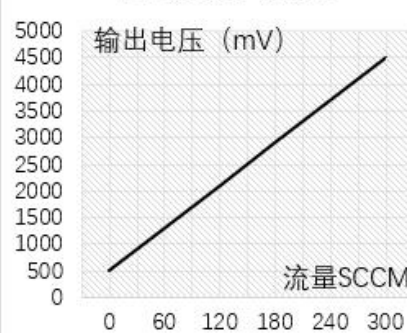
流量模拟输出曲线



FRn03H-H0D-300SCCM

流量 SCCM	模拟电压 mV
0	500
60	1300
120	2100
180	2900
240	3700
300	4500

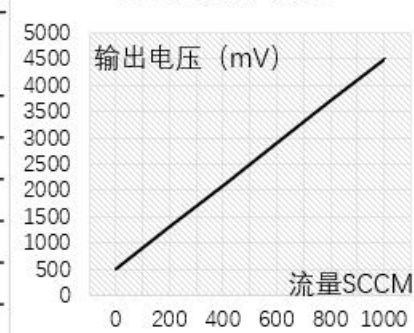
流量模拟输出曲线



FRn03H-H0D-1000SCCM

流量 SCCM	模拟电压 mV
0	500
200	1300
400	2100
600	2900
800	3700
1000	4500

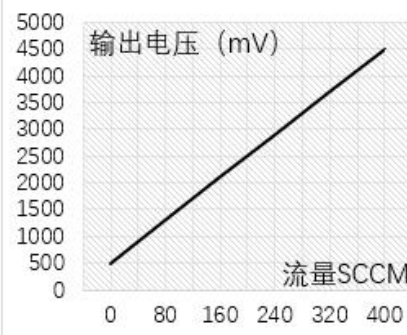
流量模拟输出曲线



FRn03H-H0D-400SCCM

流量 SCCM	模拟电压 mV
0	500
80	1300
160	2100
240	2900
320	3700
400	4500

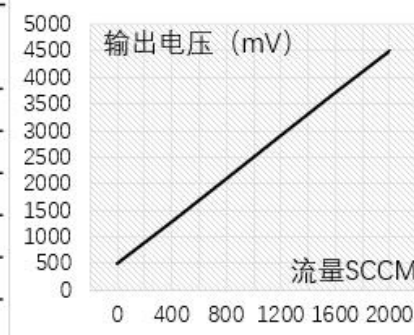
流量模拟输出曲线



FRn03H-H0D-2000SCCM

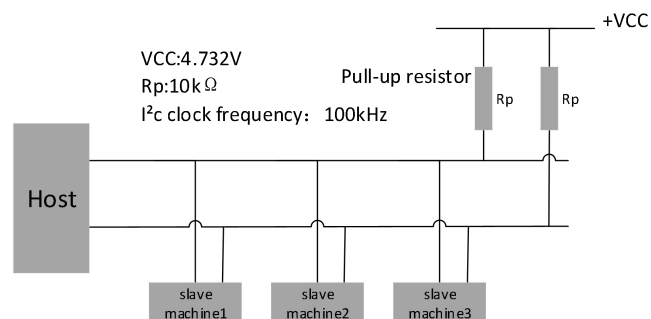
流量 SCCM	模拟电压 mV
0	500
400	1300
800	2100
1200	2900
1600	3700
2000	4500

流量模拟输出曲线



5 I²C Communication

5.1 I²C Connection



5.2 I²C address

The default address is 0x40, followed by a 1-bit read (1) or write (0) data bit.

5.3 I²C Communication

Transmission start signal (S) – When the clock line SCL is high, a falling edge appears on the data line SDA.

Transmission Stop Signal (P) – A rising edge from low to high occurs on the data line SDA when the clock line SCL is high.

Acknowledge ACK – SCL sends a positive pulse while SDA is low.

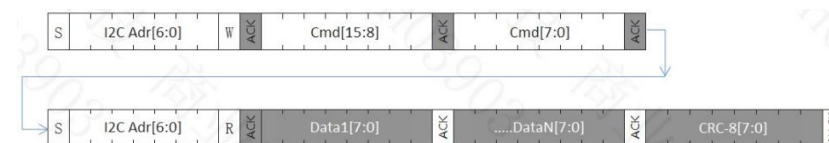
Not Acknowledge NACK – SCL sends a positive pulse while SDA is high.

5.4 I²C command codes

command code	Returns the number of bytes.	Command Description	Remark
0x1000	5	Read traffic value	Read instantaneous flow value
0xCCDD	41	Read sensor parameters	Read sensor configuration parameters

5.5 I²C Communication Timing and Analysis

5.5.1 I²C Timing



5.5.2 Read the traffic data list :

Data1	Current traffic Measured values	HEX
Data2		High byte first
Data3	/	/ -
Data4		/ -
Data 5	CRC-8	Check value

5.5.3 Read the sensor parameter data list:

Data 1- Data 4	/	/
Data 5 Data 6	unit	HEX High byte first 0x1 5--mL/min 0x1 6--L/min
Data 7 Data 8	range	HEX High byte first
Data 9 Data 10	offset	HEX High byte first
Data 11 Data 12	Conversion factor	
Data 13- Data 16	/	/
Data 17- Data 20	Output voltage lower limit - mV	HEX High byte first
Data 21- Data 24	Output voltage upper limit - mV	
Data 25- Data 29	/	/
Data 30- Data 33	Product ID	A SCII code format
Data 34- Data 40	/	/
Data41	CRC-8	Check value

5.5.4 Offset and Medium Coefficient Table:

Maximum flow	Storage units	offset	Dielectric coefficient
0.05 ~ 1	S L M	30000	2 500 0
2	S L M	30000	2,500

Note: 1 SLM = 1000 SCCM

5.6 Digital Flow Calculation

$$\text{mass flow} = \frac{\text{Flow measurement value} - \text{Offset}}{\text{Conversion factor}}$$

5.7 CRC Check

The CRC check uses CRC-8, with an initial value of 0x00 and a polynomial of 0x131(x⁸ + x⁵ + x⁴ + 1). Example code is as follows:

```
//Function name: Calc_CRC8
//Function: CRC8 calculation, initial value: 0x00, polynomial: 0x131(x8 + x5 + x4 + 1)

// Parameter: unsigned char *data: pointer to CRC check array
// unsigned char num: CRC checksum length
//Returns: crc : the calculated CRC8 value
unsigned char Calc_CRC8(unsigned char *data, unsigned char num)
{
    unsigned char bit,byte ,crc = 0x00;
    for( byte = 0; byte < num; byte++)
    {
        crc ^= data[byte];
        for( bit = 8; bit > 0; --bit)
        {
            if ( crc & 0x80)
                crc = ( crc << 1)^ 0x131;
```

```

else
    crc = ( crc << 1);
}
}
return crc ;
}

```

6. Installation and Use

Due to the sensor's low pressure drop, the flow cannot be entirely regulated by the sensor itself. The piping leading to the sensor also affects the airflow distribution passing through it, thus impacting the measurement results . To obtain optimal measurement performance, laminar flow configuration is recommended whenever possible. Specifically:

6.1 The gas used must be purified and should be free from dust, liquids, and oil. If necessary , a filter device can be installed at the gas inlet.

6.2 The pressure of the medium used should not exceed 1.6 times the maximum operating pressure of the product .

6.3 To ensure the accuracy of the sensor measurement in the application scenario, it is recommended that the inlet and outlet pipes be connected with silicone flexible tubing with an inner diameter of $\varnothing$ 3mm. It is also recommended that a straight pipe section of at least 5 times the nominal diameter be installed at the sensor inlet and a straight pipe section of at least 3 times the nominal diameter be installed at the outlet .

6.4 Thermal flow sensors are generally not suitable for measuring pulsating airflow. This sensor has an extremely fast signal update frequency and signal response rate, and can be used to reproduce the pulsating state of the air source. If flow measurement must be performed in a pulsating flow scenario, the following operations can be performed to output an accurate and stable signal:

6.4.1 The sensor should be installed as far away from the source of pulsation as

possible;

6.4.2 Try adding an adjustment device to the pipeline between the pulsation source and the sensor to isolate the pulsation (such as a regulating valve, buffer container, pulsation damper, etc.) .

6.4.3 The application side can try to adjust the sampling speed and filtering depth according to the actual application requirements.

7. Fault Diagnosis

7.1 Preliminary Inspection

7.1.1 Check that the gas source and inlet gas lines are open.

7.1.2 Ensure that the communication lines are connected correctly.

7.1.3 Check whether the medium pressure and ambient temperature meet the product technical specifications .

7.2 Fault Inspection

Serial Number	Fault phenomenon	Possible reasons	processing method
1	When ventilation is blocked, there is no signal output or the output value is a non-zero fixed value.	Sensor damage	Return to factory for repair
		incorrect thread sequence	Check if the terminal connections are correct.
2	No signal change during ventilation	Sensor installed backwards	Change installation direction
		incorrect thread sequence	Check if the terminal connections are correct.
		Sensor damage	Return to factory for repair

3	The sensor responds normally during ventilation, but exhibits a specific pattern of deviation compared to the reference instrument.	Inconsistent reference standards	Investigate and convert the units of measurement used by the reference instruments and sensors.
	The sensor responds normally during ventilation, but the signal exhibits large, irregular fluctuations. However, the average value of the sampled signal is close to that of the reference instrument over a period of time.	Turbulence exists in the installed pipeline.	Refer to 6.4 to increase the signal integration time.
	The sensor responds normally during ventilation, but there is a significant negative deviation.	There is a jet flow in the pipe leading to the sensor.	Refer to section 6.3 for pipeline optimization . Or consult the manufacturer to jointly analyze solutions.
	During ventilation, the sensor responds normally, and the signal fluctuates in a specific pattern, but the average value of the sampled signal is close to that of the reference instrument over a period of time.	The airflow exhibits periodic pulsations.	Refer to 5.4 to increase the signal integration time.

8. Disclaimer

Our company is not liable for damages caused by the following circumstances:

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- (2) Failure to install, use, or operate in accordance with the instructions.
- (3) Operate or store in unsuitable or harsh environments.
- (4) Unauthorized modification, alteration, disassembly, reassembly, or repair of the product by private individuals or other third parties may result in product damage, personal injury, property loss, infringement of others' intellectual property rights, or other harmful consequences.
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