Air Flow sensor

FRn20 Series

Manual

Version: 1.1

Date：2025.10.15

Statement

Thanks for purchasing our product. In order to let customers use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes &etc, please in kind prevail.

We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users' comments on optimized using way are welcome.

Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronic Technology Co., Ltd

1. Product Description

The FRn20 series micro-flow gas mass flow sensor is specifically designed for various micro-flow process control applications. This product is an upgrade based on the FR20 series, offering significantly enhanced zero stability and full-scale signal stability. It is suitable for industrial process monitoring.

2. Product Features

- ✧ High sensor sensitivity with extremely low start-up flow
- ✧ Multiple signal output options
- ✧ High stability and repeatability across the entire range

3. Product Selection

FRn20-H0□-□□

- 流量单位——SLM（SLM——0℃标况L/min）
- 最大流量——可选150/200/300
- 输出方式——可选D和A
  （D-i²c信号，A-模拟电压信号）

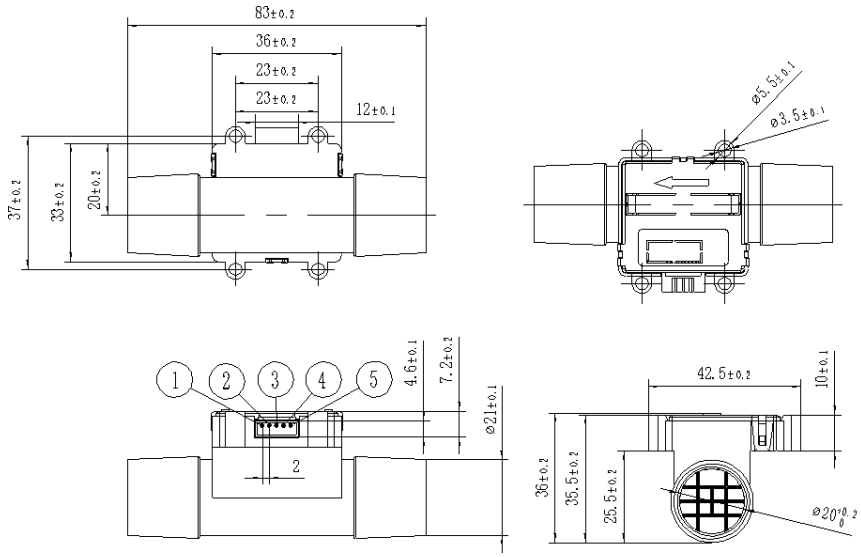
4. Technical Specifications

4.1 Technical parameters

	Parameter	Value	Unit
	Nominal diameter	20	mm
Flow measurement	Max flow	150、200、300	SLM
	Accuracy	±(2+0.5FS)	%
	Repeatability	0.5	%
	Maximum working pressure	200	kPa
	Working temperature	0～50	℃
Output signal	Output	Digital I²C & Analog 0.5V～4.5VDC	
	IIC communication rate	100	kHz
	Signal response time	≤50	ms
Electrical Parameters	Working voltage	5～15	VDC
	Working current	≤30	mA
	Electrical interface	PH2.0-5P plug-in connector or 2.54-5pin pin header optional	
Other	Storage temperature	-20℃～65℃	
	Measurement medium	Dry, clean non-corrosive gases	

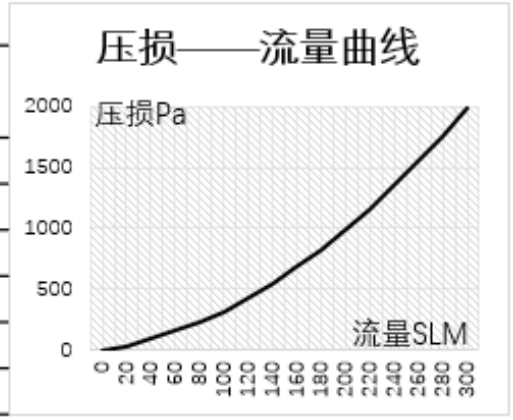
*Our company's flow sensors are calibrated by default under conditions of 20°C, 101.325 kPa, and using air as the reference. The production environment is maintained at a temperature of 22±2°C, in a cleanroom setting with 30%–35% relative humidity. If special requirements exist, calibration will be performed according to the customer's specifications.

4.2 Structural Parameters



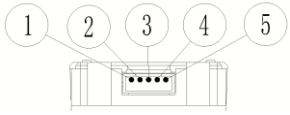
4.3 Flow-Pressure Loss Curve

150/200/300SLM	
流量 SLM	压损 Pa
0	0
60	157
120	424
180	813
240	1344
300	1990



4.4 Interface Definition

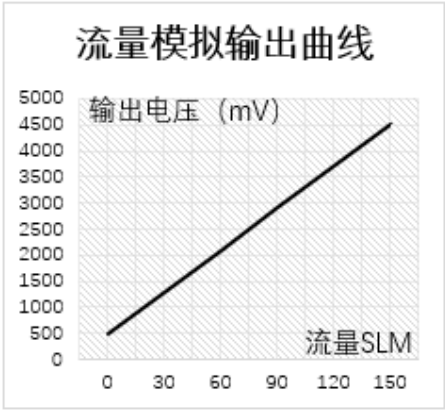
The sensor incorporates a PH2.0-5P connector, with the specific signal definitions as outlined in the table below:



PIN1	SDA
PIN2	SCL
PIN3	GND
PIN4	VCC
PIN5	Vout

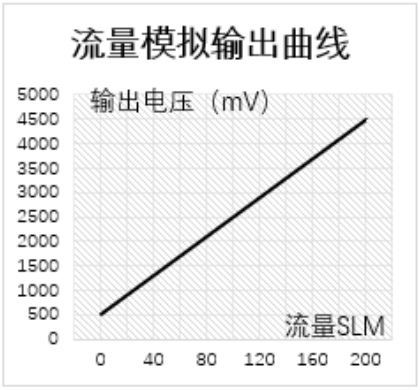
4.5 Analog Signal Output Curve

FRn20-H0D-150SLM	
流量 SLM	模拟电压 mV
0	500
30	1300
60	2100
90	2900
120	3700
150	4500



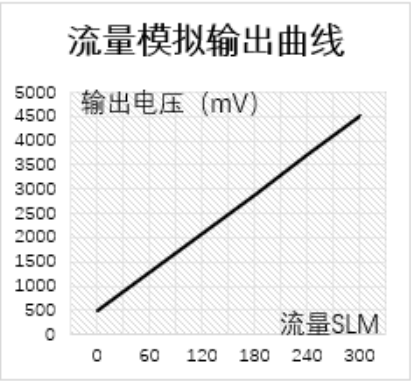
FRn20-H0D-200SLM

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



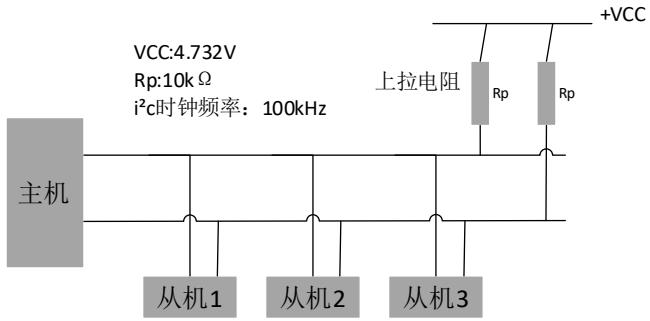
FRn20-H0D-300SLM

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



5. I²C Communication

5.1 I²C Connection



5.2 I²C Address

The default address is 0x40, followed immediately by 1 bit for read (1) or write (0).。

5.3 I²C Communication

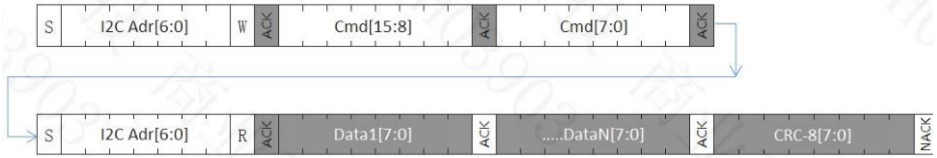
Start Condition (S): A high-to-low transition on the SDA line while SCL is high.
Stop Condition (P): A low-to-high transition on the SDA line while SCL is high.
Acknowledge (ACK): During the low level of SDA, SCL transmits a positive pulse.
Non-Acknowledge (NACK): During the period when SDA is high, SCL transmits a positive pulse.

5.4 I²C Command Codes

Command code	Return Bytes (bytes)	Command Description	**Note**
0x1000	5	Read Flow Value	Reads instantaneous flow value
0xCCDD	41	Read Sensor Parameters	Reads sensor configuration parameters

5.5 I²C Communication Timing and Parsing

5.5.1 I²C Timing:



5.5.2 Read Flow Data List:

Data1 Data2	Current Flow Measurement Value	HEX High Byte First
Data3 Data4	/	/-
Data5	CRC-8	Check Value

5.5.3 Read Sensor Parameter Data List:

Data1- Data4	/	/
Data5 Data6	Unit	HEX High Byte First 0x15--mL/min 0x16--L/min
Data7 Data8	Range	HEX High Byte First
Data9 Data10	Offset	HEX High Byte First
Data11 Data12	Conversion Factor	
Data13- Data16	/	/
Data17- Data20	Output Voltage Lower Limit —mV	HEX High Byte First
Data21- Data24	Output Voltage Upper Limit —mV	
Data25- Data29	/	/
Data30- Data33	Product ID	ASCII Format
Data34- Data40	/	/
Data41	CRC-8	Check Value

5.5.4 Offset and Medium Coefficient Table:

Max Flow Rate	Unit	Offset	Medium Coefficient
150-200	SLM	20000	200
300	SLM	2000	200

5.6 Digital Flow Calculation

Mass Flow = (Flow Measurement Value - Offset) / Medium Coefficient

5.7 CRC Check

The CRC check uses CRC-8 with an initial value of 0x00 and a polynomial of 0x131 ($x^8 + x^5 + x^4 + 1$). Example code is as follows:

```
// Function name: Calc_CRC8
// Function: CRC8 calculation with initial value 0x00, polynomial 0x131 (x^8 + x^5 + x^4 + 1)
// Parameters: unsigned char *data: pointer to the CRC check array
// unsigned char num: length of CRC check data
// Return: crc: 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 Usage

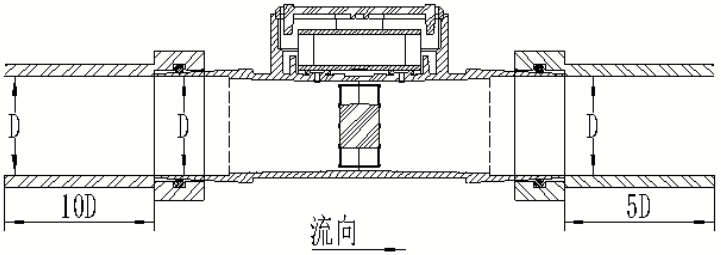
Due to the low pressure drop of the sensor, the flow cannot be entirely regulated by the sensor itself. The piping leading to the sensor also affects the distribution of airflow through the sensor, which in turn influences the measurement results. To achieve optimal measurement performance, it is recommended to configure for laminar flow as much as possible. Specific guidelines are as follows:

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

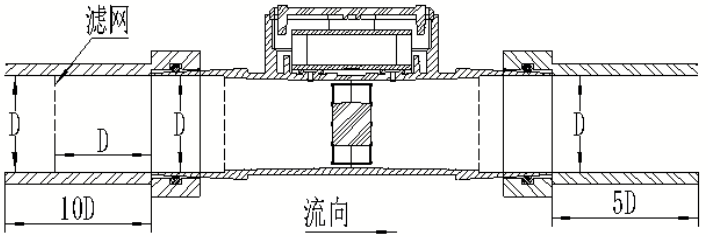
6.2 The pressure of the medium used should not exceed 1.6 times the product's maximum operating pressure.

6.3 It is recommended to install a straight pipe section of at least 5 times the nominal diameter at the sensor inlet and at least 3 times the nominal diameter at the outlet (illustrated as 10D upstream and 5D downstream straight pipe sections). To ensure measurement accuracy in the application scenario, installation should be implemented as follows:

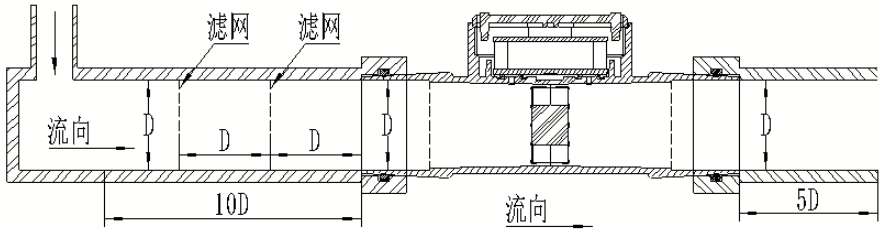
6.3.1 For silicone hose connections: Suitable for silicone hoses with an inner diameter of Ø20mm. It is recommended to connect a rigid adapter to the intake end as shown in the diagram below.



6.3.2 For installations with limited space, add flow straightening measures or a filter screen inside the rigid duct at the air inlet as shown below to adjust airflow distribution. This solution is suitable for fan-driven duct networks.



6.3.3 For space-constrained applications such as ventilators, the air inlet duct structure can be adjusted as shown below to optimize airflow distribution.



7 Troubleshooting

7.1 Preliminary Checks

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

7.1.2 Ensure the communication lines are correctly connected.

7.1.3 Verify that the medium pressure and ambient temperature comply with the product's technical specifications.

7.2 Fault Diagnosis

No.	Fault Phenomenon	Possible Causes	Solution
1	No signal output or non-zero fixed value output when no gas flow	Sensor damaged	Return to factory for repair
		Incorrect wiring sequence	Check if the terminal connections are correct
2	No signal change when gas is flowing	Sensor installed in reverse	Change the installation direction
		Incorrect wiring sequence	Check if the terminal connections are correct
		Sensor damaged	Return to factory for repair
3	Sensor responds normally during gas flow but shows a specific patterned deviation compared to the reference instrument	Inconsistent reference standards	Check the measurement units used by the reference instrument and the sensor, and perform necessary conversions
	Sensor responds normally during gas flow, but the signal exhibits significant irregular fluctuations, while the average sampled signal over a period is close to the reference instrument	Turbulent flow in the installation pipeline	Increase signal integration time or refer to Section 5.3 for pipeline optimization.
	Sensor responds normally during gas flow, but exhibits a large negative deviation	Jet flow in the pipeline leading to the sensor	Refer to Section 5.3 for pipeline optimization or consult the manufacturer to jointly analyze solutions.
	Sensor responds normally during gas flow, but the signal exhibits specific patterned fluctuations, while the average sampled signal over a period is close to the reference instrument	Periodic pulsation characteristics in the airflow	Increase the signal integration time or refer to Section 5.3 to adjust rectification (e.g., by adding filter layers or increasing mesh count).

8 Disclaimer

Our company shall not be held liable for damages caused under the following circumstances:

(1) Force majeure, including natural disasters, etc.

(2) Failure to install, use, or operate the product in accordance with the instruction manual.

(3) Operation or storage in unsuitable or harsh environments.

(4) Unauthorized modifications, alterations, disassembly, reassembly, or repairs by the user or any third party, resulting in product damage, personal injury, property loss, infringement of intellectual property rights, or other harmful consequences.

(5) Our company reserves the final right to interpret this disclaimer.

(6) This disclaimer shall be interpreted in accordance with the laws of Mainland China

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