Flow Sensor

FRn06

Version：1.0

Issue Date：2025.08.20

Zhengzhou Winsen Electronic Technology Co., Ltd

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 Electronics Technology CO., LTD

1.Product Overview

The FRn06 series micro-flow gas mass flow sensors are specifically designed for precision micro-flow process control applications. An upgraded version of the FR06, this product offers significantly improved zero-point stability and full-range signal consistency. It is widely used in various gas measurement application.

2. Features

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

3. Model Selection:

FR$_n$06-H0□-□□

- Unit——SLM（SLM——0℃ standard condition L/min）
- Range—— 5/10/15/20L/min optional
- Output signal—— D or A

（D: I2C output, A: Analog voltage output）

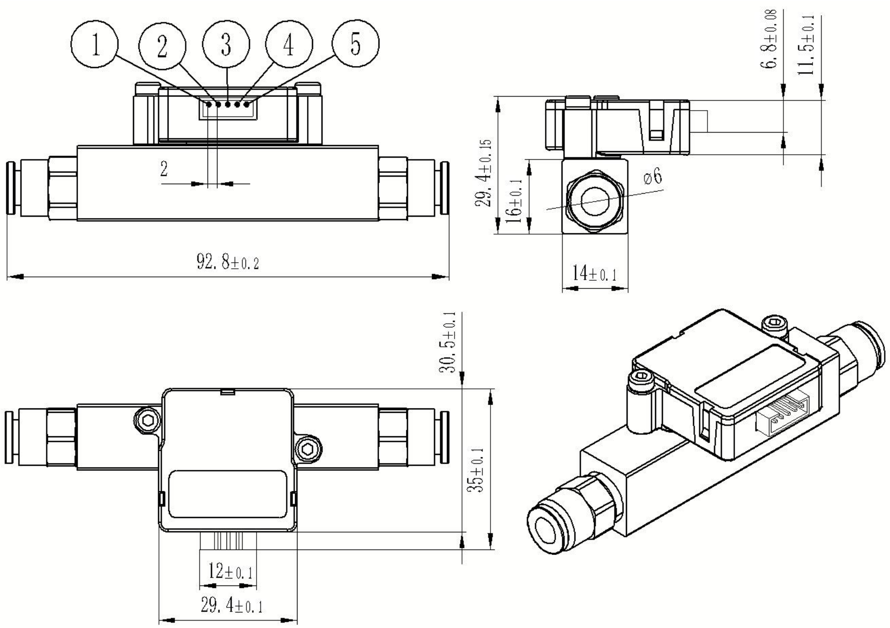
4. Technical Specifications

4.1 Technical Parameters

	Data	Specification	Unit
Flow measurement	Bore	6	mm
	Max Range	5/10/15/20	SLM
	Accuracy	±（2+0.5FS）	%
	Repeatability	0.50%	%
	Max Working Pressure	400	kPa
	Working Temperature	0～50	℃
Output	Output method	Digital output I²C or Analog output 0.5V～4.5VDC	
	I²C Communication rate	100	kHz
	Response Time	≤50	ms
Electrical parameters	Working Voltage	5～15	VDC
	Working Current	≤30	mA
	Electrical interface	PH2.0-5P plug-in connector	
Other Information	Storage Temperature	-20～65	℃
	Mechanical interface	Dry and clean non-corrosive gas	
	Measuring medium	⌀ 6-G1/8 Pneumatic Quick-Connect Coupling	

Note: Our flow sensors are calibrated under conditions of 20°C and 101.325 kPa using air as the reference medium. Production is carried out in a controlled environment with temperature maintained at 22±2°C, purified air, and 30%–35% relative humidity. Custom calibration is available upon request to meet specific customer requirements.

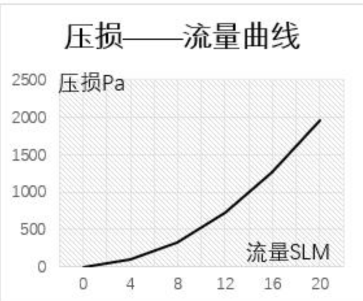
4.2 Structural Parameter



4.3 Flow pressure loss curve

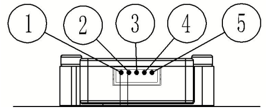
15/10/15/20SLM

流量 SLM	压损 Pa
0	0
4	88
8	324
12	717
16	1255
20	1966



4.4 Pin Definition

The built-in connector model No. is PH2.0-5P.

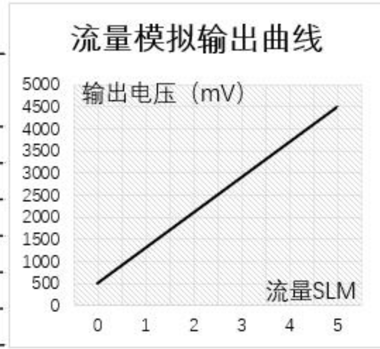


PIN1	SDA
PIN2	SCL
PIN3	GND
PIN4	VCC
PIN5	Vout

4.5 Analog signal output curve

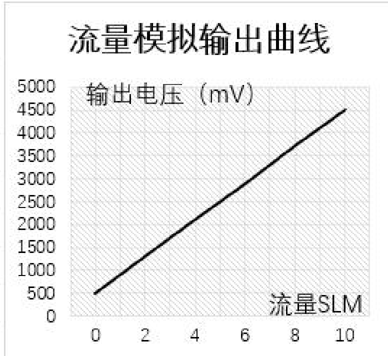
FRn06-H0D-5SLM

流量 SLM	模拟电压 mV
0	500
1	1300
2	2100
3	2900
4	3700
5	4500



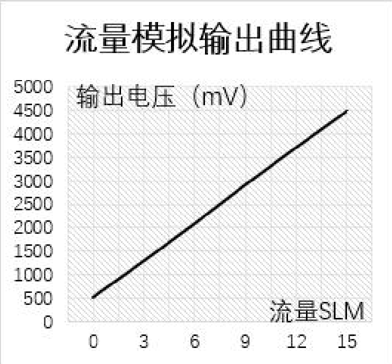
FRn06-H0D-10SLM

流量 SLM	模拟电压 mV
0	500
2	1300
4	2100
6	2900
8	3700
10	4500



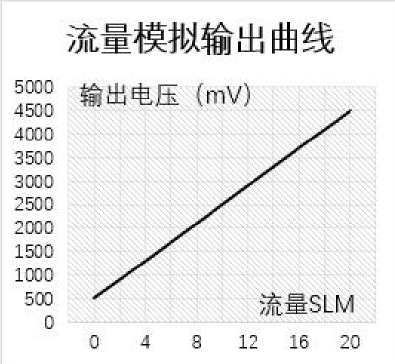
FRn06-H0D-15SLM

流量 SLM	模拟电压 mV
0	500
3	1300
6	2100
9	2900
12	3700
15	4500



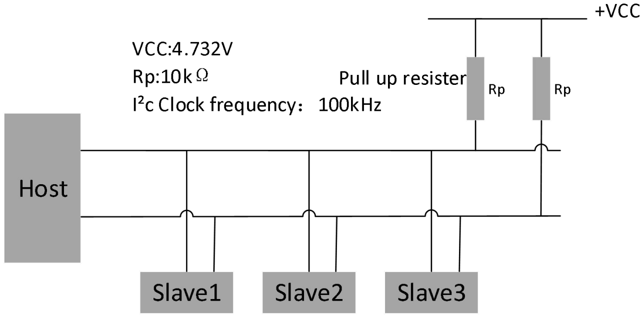
FRn06-H0D-20SLM

流量 SLM	模拟电压 mV
0	500
4	1300
8	2100
12	2900
16	3700
20	4500



5. I2C communication

5.1 I²C connection



5.2 I²C Address

The default address is 0x40, followed by 1 bit indicating Read (1) or Write (0).

5.3 I²C Communication

- Start Condition (S): Generated when SDA transitions from HIGH to LOW while SCL is HIGH.
- Stop Condition (P): Generated when SDA transitions from LOW to HIGH while SCL is HIGH.
- Acknowledge (ACK): A positive pulse on SCL while SDA is held LOW.
- Not Acknowledge (NACK): A positive pulse on SCL while SDA is held HIGH.

5.4 I²C Command Codes

Command Code	Number of bytes returned (bytes)	**Command Description**	**Remark**
0x1000	5	Read the flow value	Read the instantaneous flow value
0xCCDD	41	Read sensor parameters	Read the sensor configuration parameters

5.5 I²C Communication Timing and Protocol

5.5.1 I²C Timing

5.5.2 Reading Flow Data Sequence:

Data1	Current flow measurement value	HEX High byte in the front
Data2		
Data3	/	/-
Data4		
Data5	CRC-8	Value of check

5.5.3 Read the sensor parameter data list::

Data1- Data4	/	/	
Data5 Data6	Unit	HEX High byte in the front 0x15--mL/min 0x16--L/min	
Data7 Data8	Range	HEX High byte in the front	
Data9 Data10	Offset	HEX High byte in the front	
Data11 Data12	Conversion Factor		
Data13- Data16	/	/	
Data17- Data20	Lower limit of output voltage—mV	HEX High byte in the front	
Data21- Data24	Upper limit of output voltage —mV		
Data25- Data29	/	/	
Data30- Data33	Product ID	ASCII code format	
Data34- Data40	/	/	
Data41	CRC-8	Check value	

5.5.4 Offset and Medium Coefficient Table;

Range	Unit	Offset	Medium coefficient
5～10	SLM	30000	2500
15～20	SLM	30000	500

5.6 Digital Flow Calculation

$$\text{Mass Flow}=\frac{\text{Flow Measurement Value}-\text{offset}}{\text{Conversion Factor}}$$

5.7 CRC Checksum

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

```
// Function Name: Calc_CRC8
// Function: CRC8 calculation. Initial value: 0x00, Polynomial: 0x131 (x^8 + x^5 + x^4 + 1)
// Parameters: unsigned char *data: Pointer to the CRC data array
// unsigned char num: Length of CRC 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 fully regulated by the sensor itself. The piping connected to the sensor may also affect the distribution of airflow passing through the sensor, thereby influencing measurement results. To achieve optimal measurement performance, a laminar flow configuration is recommended whenever possible. Details are as follows:

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

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

6.3 To ensure measurement accuracy in application scenarios, 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 at the outlet. The installation shall be implemented as follows:

6.3.1 G1/8-∅ 6mm pneumatic connectors should be used on both sides of the sensor, connected with PU tubing (outer diameter ∅ 6mm/inner diameter ∅ 4mm) or stainless steel tubing of the same specification.

6.3.2 The requirements in section 6.3.1 shall be followed as a general rule. If the actual application differs, consult the manufacturer for evaluation.

7. **Fault Diagnosis**

7.1 Preliminary Checks

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

7.1.2 Ensure communication lines are correctly connected.

7.1.3 Verify that medium pressure and ambient temperature comply with product specifications.

7.2 Troubleshooting

No.	Fault phenomenon	Possible Causes	Approach
1	When there is no ventilation, there is no signal output, or a non-zero fixed value is output.	Sensor damaged	Return to factory for repair
		Wire sequence error	Check whether the terminals are plugged in correctly
2	No signal changes during ventilation	Sensor installed backwards	Change installation direction
		Wire sequence error	Check whether the terminals are plugged in correctly
		Sensor damaged	Return to factory for repair
3	The sensor responds normally during ventilation, but there is a specific regular deviation from the reference instrument.	Reference standards are inconsistent	Check the measurement units used by reference meters and sensors and convert them
	During ventilation, the sensor responds normally, and the signal has large and irregular beats, but the average value of the sampling signal within a period of time is close to the reference instrument.	There is turbulence in the installation pipeline	Refer to 6.4 to increase the signal integration time
	The sensor responds normally during ventilation, but there is a large negative deviation	There is a jet flow in the pipeline entering the sensor.	Refer to 6.3 Optimizing pipelines Or ask the manufacturer to jointly analyze solutions
	During ventilation, the sensor responds normally and the signal beats in a specific pattern, but the average value of the sampling signal within a period of time is close to the reference instrument.	The air flow has periodic pulsation characteristics	Refer to 6.4 to increase the signal integration time

8.Disclaimer

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

(1) Force majeure, including natural disasters.

(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 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 statement shall be interpreted in accordance with the laws of Mainland China.

Zhengzhou Winsen Electronics Technology Co., Ltd
Add: No.299, Jinsuo Road, National Hi-Tech Zone, Zhengzhou 450001 China
Tel: +86-371-67169097/67169670
Fax: +86-371-60932988
E-mail: sales@winsensor.com
Website: www.winsen-sensor.com