Flow Sensor

FR03

Version ：1.2

Issue Date：2023.11.10

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.Profile：

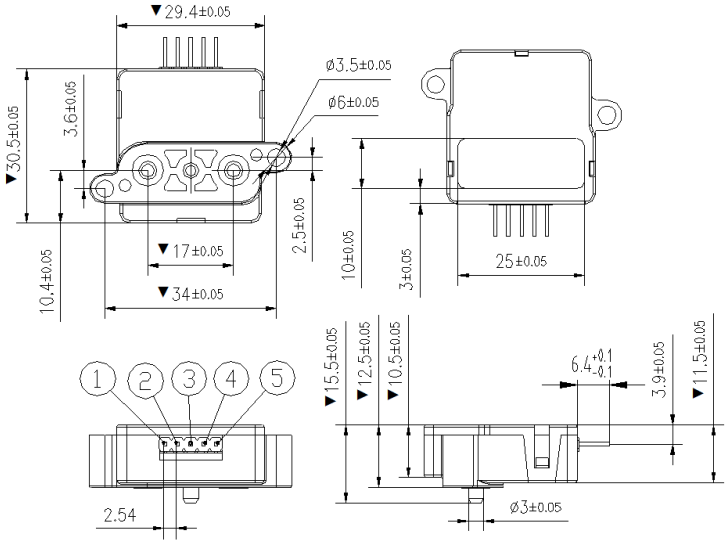
FR03 flow sensor adopts MEMS Thermal principle to monitor the flow of pipeline gas medium. This product adopts low pressure loss design and is widely used for all kinds of gas measurement.

2. Features：

- ✧ High sensitivity;
- ✧ Very low pickup flow;
- ✧ High Accuracy;
- ✧ Low voltage loss;
- ✧ Modular design;
- ✧ High measurement repeatability;
- ✧ Surface mount structure

3.Technical Parameters：

3.1Structure Parameters



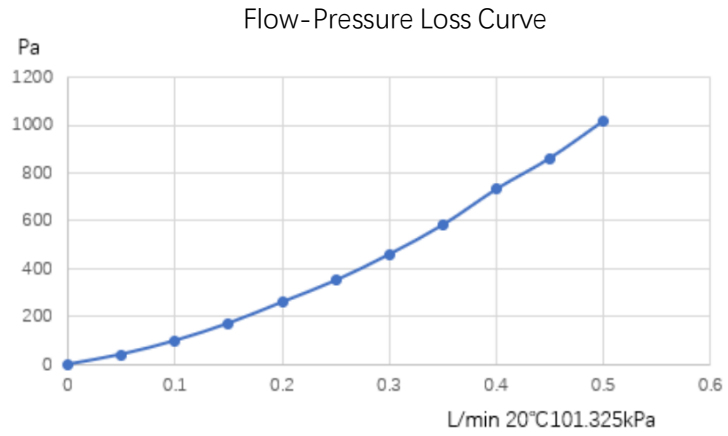
3.2Electrical Index

Model No.		FR03
Flow measurement	Maximum flow	500L/min @20℃ 101.325kPa
	Measurement accuracy	[25 , 500]mL/min： ±2.5% [0, 25) mL/min： ±0.5%FS
	Repeatability	0.50%
	Working Pressure	≤200kPa
	Burst pressure	≥0.7MPa
	Working Temperature	0℃ ~ 50℃
Output signal	Output method	Digital IIC or analog voltage
	Analog signal	Linearity 0.5V ~ 4.5V
	IIC communication rate	100kHz
	Signal refresh time	≤1ms
	Signal response time	≤3ms
	Electrical interface	PH2.0-5P plug-in connector
Other	Working Voltage	DC5V ~ 14V
	Working Current	≤30mA
	Storage Temperature	-20℃ ~ 80℃
	Measurement Medium	Dry and clean non-corrosive gas
	△Pmax	≤2000Pa

* Our company's flow sensor adopts 20℃ 101.325kPa and air calibration by default. The production conditions are temperature 22±2℃, purification, (30%~35%) RH environment. If the user has special requirements, calibration will be carried out according to the customer's requirements.

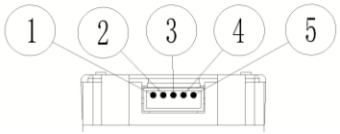
*·· %FS refers to the full-scale accuracy, and % is the reading accuracy.

3.3 Flow Pressure Loss Curve



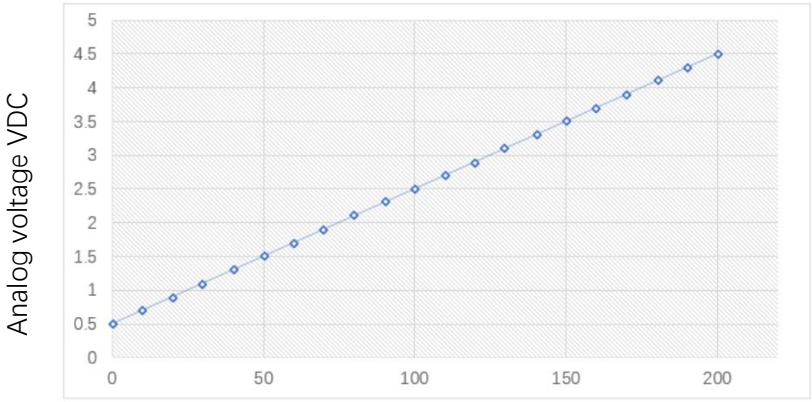
3.4 Interface Definition

The built-in connector model of the sensor is PH2.0-5P. The specific signal definitions are as follows:



PIN1	SDA
PIN2	SCL
PIN3	GND
PIN4	VCC
PIN5	Vout

3.5 Analog Signal Output & Flow Calculation



Mass flow L/min 20℃ 101.325kPa

4 IIC Communications

4.1 IIC connection

This sensor adopts the standard IIC communication protocol, using the serial data bus (SDA) and serial time bus (SCL). The recommended pull-up resistor is 10kΩ.

4.2 IIC address

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

4.3 IIC communications

Transmission start signal (S) - When the clock line SCL is high, the data line SDA has a falling edge from high to low.

Transmission stop signal (P) - When the clock line SCL is high, the data line SDA has a rising edge from low to high.

Acknowledge (ACK) - SCL sends a positive pulse while SDA is low.

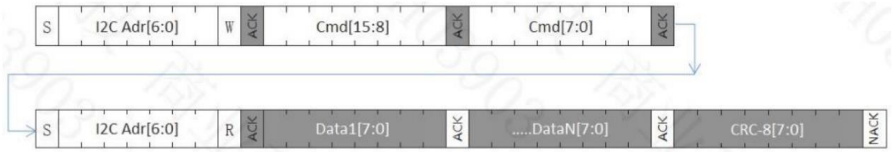
Non-Acknowledge (NACK) - SCL sends a positive pulse while SDA is high.

4.4 Command set and data transfer sequence

Command code	Return/Write Number of bytes (bytes)	Command description	Remark
0x1000	5	traffic collection	read instantaneous flow value

4.5 Communication timing

Traffic collection



Datasheets:

Data1	current flow measurement value	HEX, high byte first
Data2		
Data3	reserved	-
Data4		
Data5	CRC-8	Check value

Conversion factor table:

Media type	Conversion factor	Offset
Air	140	20000
Oxygen	142	20000
Other gases		

4.6 Digital flow calculation

$$\text{Flow rate(L/min)} = \frac{\text{Flow measurement value} - \text{offset}}{Conversion\ \ factor}$$

4.7 CRC check

CRC check uses CRC-8, the initial value is 0x00, and the polynomial is 0x131(x8 + x5 + x4 + 1). The sample code is as follows:

```
//*************************************
// Function name：Calc_CRC8
// Function ：CRC8 calculation, initial value: 0x00, polynomial: 0x131(x8 + x5 + x4 + 1)
// Parameter ：unsigned char *data：CRC Check array pointer
//                unsigned char num：CRC Check data length
// 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;
}
```

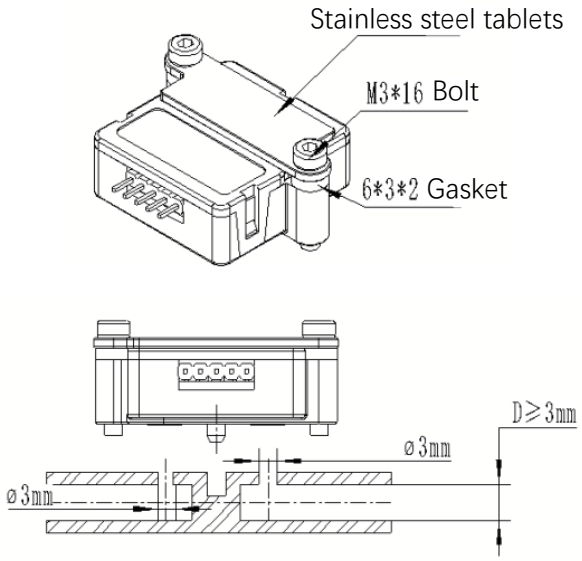
5. Install and use

Due to the low pressure drop across the sensor, the flow is not fully regulated by the sensor itself. The piping leading to the sensor will also affect the airflow distribution through the sensor, and the measurement results will be affected accordingly. In order to obtain the best measurement performance, it is recommended to configure laminar flow as much as possible. Details as follows:

5.1 The gas used must be purified to avoid dust, liquid, and oil. If necessary, a filter device can be installed in the air inlet end of the gas path.

5.2 The operating pressure of the medium should not exceed 2 times the maximum operating pressure of the product.

5.3 In order to ensure the measurement accuracy of the sensor in the application scenario, it is recommended to install it as follows.



6.Fault Diagnosis

6.1 Preliminary inspection

6.1.1 Check the opening of air source and inlet.

6.1.2 Ensure the correct connection of communication lines.

6.1.3 Check whether the medium pressure and ambient temperature meet the product technical indicators.

6.2 Fault Check

No.	Symptoms	Possible Causes	Solutions
1	When there is no ventilation, there is no signal output or a non-zero fixed value is output.	Sensor damaged Wire sequence error	Return to factory for repair 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	Increase the signal integration time or refer to 5.3 Optimizing the Pipeline

	The sensor responds normally during ventilation, but there is a large negative deviation	Sensor or assembly leaking	The elimination method gives priority to checking the reliability of the assembly, and secondly checks the air tightness of the sensor
	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	Increase signal integration time

7. Product selection

Model	Illustrate
FR03-H0D	Output digital signal
FR03-H0A	Output linear analog signal

8. Disclaimer

Our company is not responsible for the damage caused by the following circumstances:

- Natural disasters.
- Misoperation or unreasonable use.
- Operate or store in unsuitable or harsh environment.
- Unauthorized modification or disassembly of products.
- Violent means lead to product damage.