Flow Sensors

FR03H

Version number: 1.3

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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

FR03H flow sensor uses the MEMS thermal principle to monitor the flow of pipeline gas media. This product adopts low pressure loss design and is widely used in various types of gas flow measurement.

2. Product features

- ✧ High sensitivity.
- ✧ Extremely low initial flow rate.
- ✧ High precision.
- ✧ High measurement repeatability.
- ✧ Low pressure loss.
- ✧ Modular design.
- ✧ Digital IIC or linear analog voltage output.

3.Technical indicators _

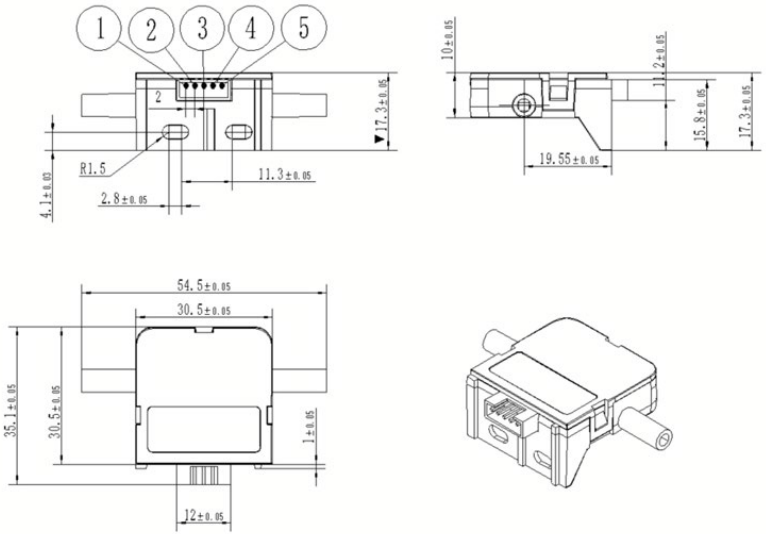
3.1Technical parameters _

Product number		FR03H
Diameter D		⌀ 3mm
Flow measurement	Maximum flow	5L/ min @20℃ 101.325kPa
	measurement accuracy	[0.15, 5]L/min ± 2.5 % [0 , 0.15)L/min ± 0.5%FS
	Repeatability	0.5%
	work pressure	⩽200kPa
	Burst pressure	⩾0.3MPa _
	Operating temperature	0 ℃ ~50 ℃
output signal	output method	Digital I IC or linear analog voltage
	Simulate traffic	Linear 0.5V ~ 4.5V
	I IC communication rate	100kHz _ _
	Signal refresh time	⩽1m s _
	Signal response time	⩽3 ms
Electrical parameters	Operating Voltage	D C4.9V ~1 4V
	Working current	⩽ 30mA _
	Electrical Interface	P H2.0-5P plug-in connector or 2.54mm-5P pin
other	Storage temperature	-20 ℃ ~80 ℃
	△ Pmax	⩽ 10 00Pa
	Measuring medium	Dry, clean, non-corrosive gas

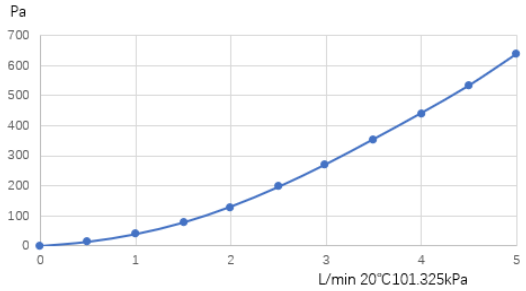
* The flow sensor of our company adopts 20℃ 101.325kPa and air calibration by default. The production conditions are temperature 22 ±2 ℃, purification, (30 % ~ 35 %) RH environment. If the user has special requirements, calibration will be carried out according to the customer's requirements.

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

3.2 Structural parameters _

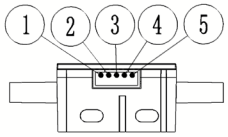


3.3Flow pressure loss curve



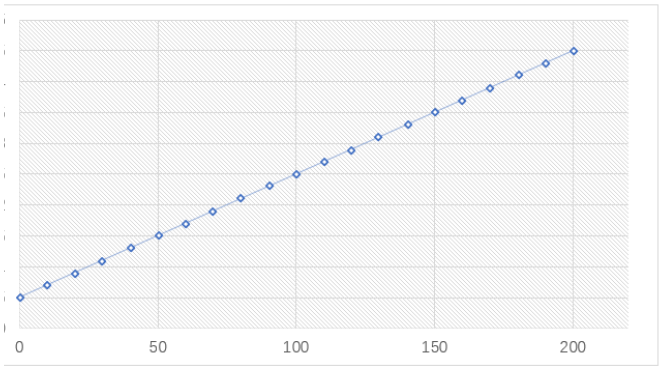
3. 4Interface definition

The sensor wiring definition is as follows:



PIN 1	SCL
PIN 2	VOUT
PIN 3	VCC
PIN 4	GND
PIN 5	SDA

3. 5 Analog signal output and flow calculation



$$\text{Flow rate (L /min)} = \frac{\text{Output voltage} - \text{Zero point voltage}}{\text{full-scale voltage} - \text{Zero point voltage}} \times \text{Maximum flow}$$

4 I IC communication

4.1 IC connection _

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

4.2 I I C address

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

4.3 II C Communication

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

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

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

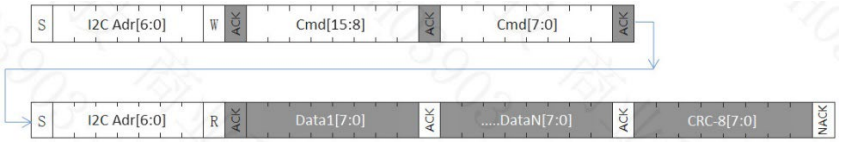
Non-responds (NACK) - SCL sends a positive pulse while SDA is high.

4. 4 Command set and data transmission 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 traffic Measurements	HEX, High byte first
Data2		
Data3	reserved	-
Data4		
Data 5	CRC-8	Check value

Conversion factor table:

media type	Conversion factor	Offset
Air	1 40	20000
oxygen	1 42	20000
Other gases		

4.6 Digital flow calculation

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

4.7 CRC check

The 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)
//Parameters: 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．Installation 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 pressure of the medium used should not exceed 2 times the maximum pressure of the product .

5.3 In order to ensure the measurement accuracy of the sensor in the application scenario, it is recommended that the inlet and outlet pipes be connected with silicone hoses with an inner diameter of ⌀ 3mm .

5.4 In principle, the thermal flow sensor is not suitable for pulsating air flow measurement. This sensor has 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:

5.4.1 The sensor installation location should be as far away from the pulsation source as possible.

5.4.2 Try to add an adjustment device in the pipeline between the pulsation source and the sensor to isolate the pulsation (such as a regulating valve, buffer container, etc.);

5.4.3 According to the actual application situation, try to use the WS flow sensor debugging tool to modify the filter parameters.

5.4.4 The application end attempts to adjust the sampling speed and filtering depth according to actual application requirements.

6. Troubleshooting

6.1 Preliminary inspection

6.1.1 Check that the air source and inlet air path are open.

6.1.2 Ensure that the communication lines are correctly connected.

6.1.3 Check the medium pressure and ambient temperature to see if they meet the product technical specifications.

6.2 Troubleshooting

serial number	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	There is turbulence in the installation pipeline	Refer to 5.4 to increase the signal integration time

	value of the sampling signal within a period of time is close to the reference instrument.		
	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 5.3 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 5.4 to increase the signal integration time

7．Product selection

model	illustrate
F R03H-H0D	Output digital signal
F R03H-H0A	Output linear analog signal

8．Disclaimer _

Our company is not responsible for damage caused by:

(1) natural disaster.
(2) Misoperation or improper use.
(3) Operated or stored in unsuitable or harsh environments.
(4) Unauthorized modification or disassembly of the product.
(5) Violent means result in damage to the product.

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