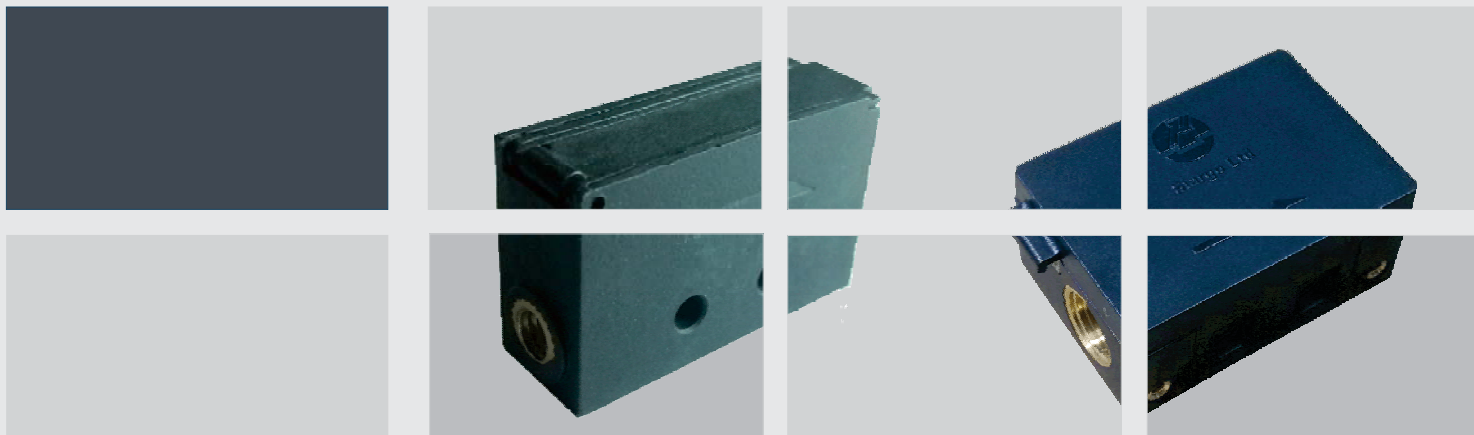




Siargo Ltd.



Model FS8000

SIARGO MEMS FLOW SENSING PRODUCTS
MEMS Mass Flow Sensors

VA.1





MEMS Mass Flow Sensors

FS8000 Series

User Manual

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MEMS Mass Flow Sensors



Siargo Ltd.

Model FS8000

Features

- Fast response time
- High sensitivity and accuracy
- Small form factor
- Linearized analog and digital output
- Easy for manifold configuration



Description

The FS8000 mass flow sensors are designed and manufactured using Siargo's proprietary MEMS flow sensing and package technology.

The small form factor of FS8000 mass flow sensors with manifold configuration enables its applications in various gas flow control equipment in process automation.

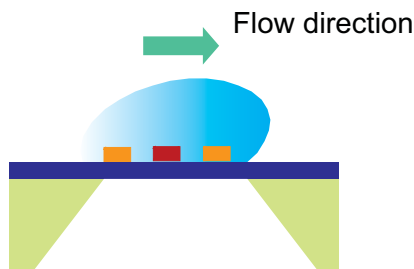
•The packaging enclosure is made of the chemically inert and thermally stable polyphenylene sulfite (PPS, FS8001) or polycarbonate (PC, FS8003) material and silicon nitride for the additional wetted materials.

Applications

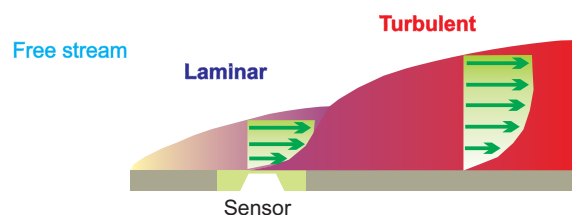
- Air sensitive pick and place automation
- Vacuum equipment
- Leak detection
- Handheld air sampler and analyzer
- Wire-binder and automation
- Medical device and equipment with gas control

Working Principle

The MEMS sensor chip utilizes the calorimetric principle. It is packaged on a plate installed inside the flow channel, which provides additional flow conditioning from the boundary layer configuration resulting in a laminar flow. The mass flow measurement is established as the gas carries heat away from the heater leading to the redistribution of the temperature field. Accurate flow rate is obtained by calibration with standard gas at preset conditions.



Time-averaged velocity profile boundary layer





1. Sensor Performance

1.1 Performance Specifications

All data unless otherwise noted apply for measurement conditions: air, 20 °C, 101.325 kPa absolute pressure, in a fixed flow channel of 8mm in diameter.

Model	FS8001	FS8003
Flow range	(0~500) sccm	(0~6) (0 ~ 25) SLPM
Accuracy ¹	$\pm (2.0+0.5FS)$ %	
Repeatability	± 1.0 %FS	
Output	Linear, analog, I ² C	
Analog Output Range	0.5 ~ 4.5 Vdc	
Null Shift	<30 mVdc	
Output Shift	< ± 0.12 %/°C	
Response Time	10 msec	
Power Supply	8~24 Vdc	
Max. Working Pressure	0.5 MPa	
Working Temperature	0 ~ 55 °C	
Storage Temperature	-20 ~ 65 °C	
Humidity	< 95 %RH (No icing or condensation)	
Mechanical Connection ²	M5	Rc 1/8 (Inlet) , M5 (Outlet)
Connector	SM05B-SRSS-TB (JST)	
Calibration	Air (@ 20°C , 101.325kPa)	

¹ To obtain accurate flow measurement, let the sensor warm up 1 minute at power up.

² For best performance, both inlet and outlet's connecting pipe diameters should not be smaller than the specified mechanical sizes of the products.

1.2 Flow Characteristics

The FS8000 provides a linear analog output corresponding with 0 ~ full scale. The typical output characteristics of FS8000 is illustrated in Figure 1.1. The data are obtained with a 12 Vdc supply.

Mass flow sccm	Typical analog output mV
0	500
20%	1300
40%	2100
60%	2900
80%	3700
100%	4500

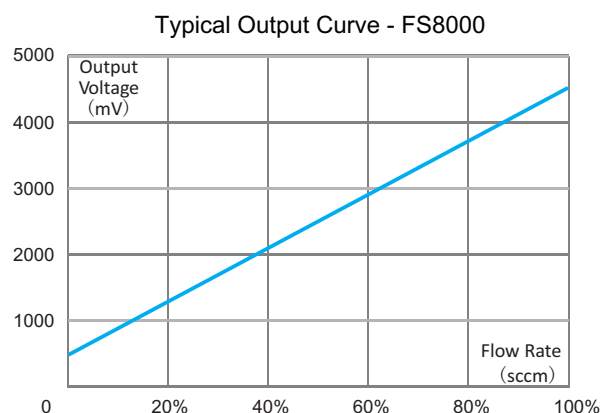


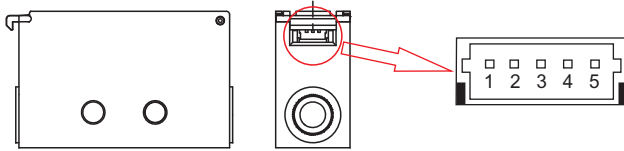
Figure 1.1: The typical analog output curve of FS8000.

2. Electrical Interface

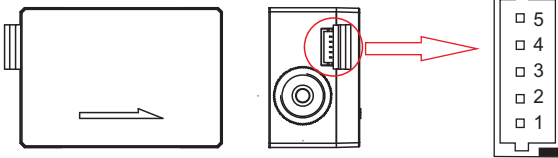
2.1 Pin Definition

The FS8000 series have a 5-pin electrical interface. The sensor pin configuration is shown in Figure 2.1.

FS8001



FS8003



Pin	Definition
1	SCL (I ² C)
2	GND (Ground)
3	VCC (Power supply)
4	Vout (Analog output)
5	SDA (I ² C)

Figure 2.1: FS8000 pin configuration.

2.2 Pin Description

VCC and GND: The FS8000 requires a power supply of 8~24 Vdc. The voltage is internally filtered and regulated to power the circuit. The sensor output is dependent on the accuracy of the power supply and the $\pm 5\%$ power accuracy will ensure the performance. The sensor consumes less than 10 mA normally but the minimum supply current must be larger than 10 mA for stable performance.

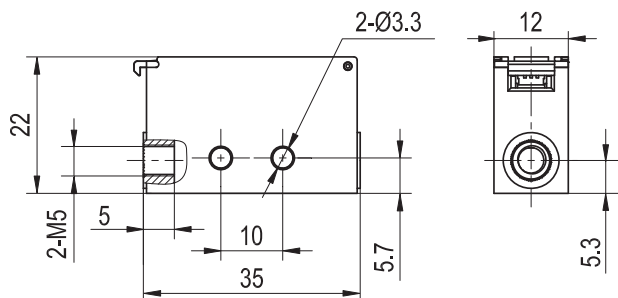
Vout: The analog output pin.

SDA and SCL: For I²C, please contact Siargo for protocol.

3. Mechanical Dimensions and Mountings

The Fs8000 series have two mounting holes for easy installation and manifold configuration. Be sure to align the arrow mark (on the sensor body) with the measurement flow direction. The sensor dimensions are shown in Figure 3.1.

FS8001



FS8003

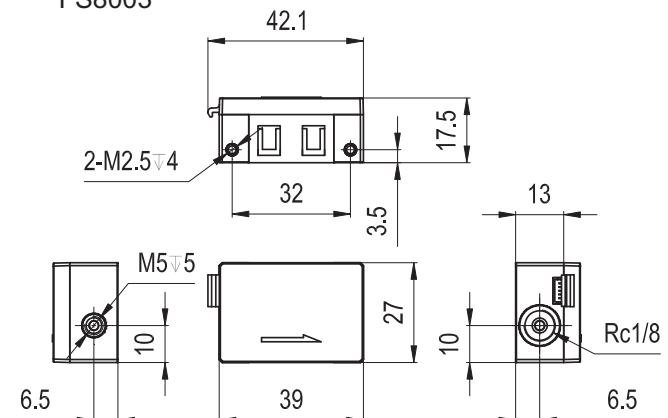
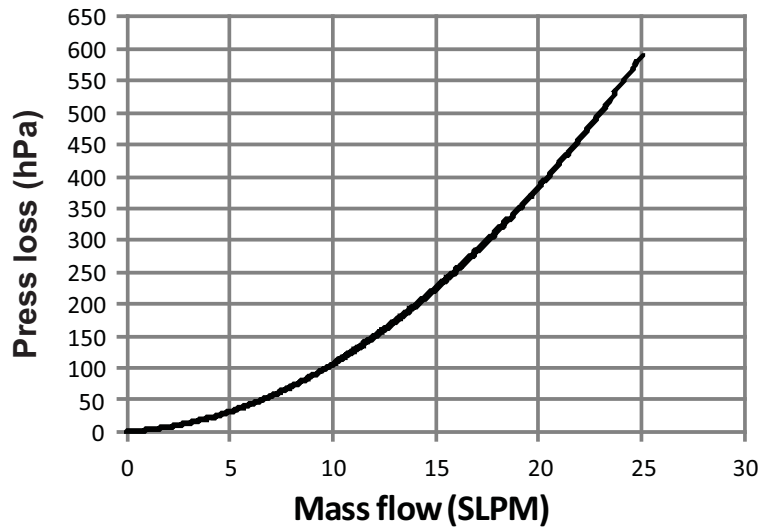


Figure 3.1: The FS8000 mechanical dimensions.

4. Pressure loss

The FS8000 series mass flow sensors have very low pressure drop at the full scale less than 50Pa for both FS8001-500 and FS8001-1000 (max configurable to 1000 sccm). The same value holds for FS8003-6.

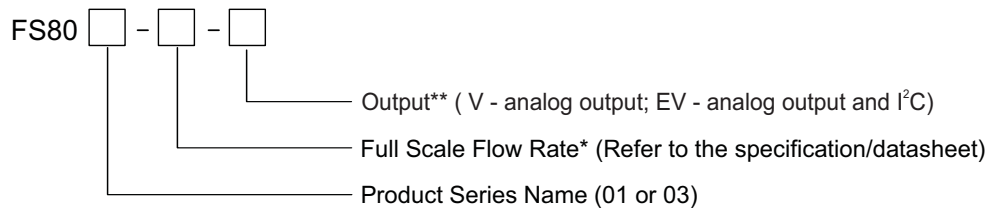
The pressure loss for high flow mode of FS8003-25 is shown in Figure 4.1.



4. Ordering Guide

4.1 Sensor Selection

The sensor part number is composed of the model number and output format. Refer to the followings for details.



* Flow rate: number only, without unit. The default unit of FS8001 is sccm, of FS8003 is SLPM;

** The sensor standard output is analog, while digital output is optional.

4.3 Order Contact and Customer Support

The sales offices are listed at the end of this document. For small quantities, the order can be placed either through Siargo website: www.siargo.com or the sales office. For large quantities, please contact the sales office or distributors or sales representatives.

Siargo is making every effort to ensure the quality of the products. In case of questions and/or product supports, please contact customer service listed at the end of the document. We will respond your request in a timely fashion and will work with you toward your complete satisfaction.



Important Notices

Wetted Materials and Compatibility

The sensor body is made of polyphenylene sulfite (FS8001) or polycarbonate (FS8003). The sensor chip comprises of silicon, silicon nitride and silicon dioxide and the sensor chip surfaces are passivated with silicon nitride and silicon dioxide. The electronic sealing is provided by RTV (room temperature vulcanizing) silicone sealant WR-704 composed of $\text{HOCH}_3(\text{SiO})_n\text{CH}_3\text{H}$.

Cautions for Handling and Installations

The product at the time of shipment is fully inspected for product quality and meets all safety requirements. Additional safety measures during handling and installation should be applied. To prevent ESD (electrostatic discharge) damage and /or degradation, take customary and statutory ESD precautions when handling. Do power the product with the correct polarity, voltage and amperage. All precautions and measures for electrical voltage handling must apply.

This product contains no user serviceable components. Do not attempt to disassemble, substitute parts or perform unauthorized modifications to the product. Doing so will forfeit the terms of the warranty and cause the liability to any damages thereafter. It should only be serviced by authorized personnel. Upon requests, Siargo will provide necessary technical support and/or training of the personnel.

Cautions for Product Applications

The product is designed for use with general purpose gases such as air and nitrogen. It is advised that the products are best used for non-explosive clean gases. The sensors cannot be used for gas metrology of fluoride or fluoride-containing gases. For updates of the product certification information, please contact the manufacturer. Use for other gases such as extreme corrosive and toxic gases may cause the product malfunctioning or even severe damages.

Don't expose the product's outer surface to any liquids, the unit does not have a water resistive electronics package.

Don't flow gas in conditions that can cause condensing water vapor to be trapped inside the unit as the accuracy could be significantly altered.

It is suggested to design your application so that nominal flow rate is approximately 70% of the full scale flow rate of the sensor. Don't use a sensor with an extreme flow range, for instance, don't use a 10 m/s sensor for a 0.2 m/s application.

Warranty and Liability

(effective June 2009)

Siargo warrants the products sold hereunder, properly used and properly installed under normal circumstances and service as described in the user manual, shall be free from faulty materials or workmanship for 180 days for OEM products, and 365 days for non-OEM products from the date of shipment. This warranty period is inclusive of any statutory warranty. Any repair or replacement serviced product shall bear the same terms in this warranty.

Siargo makes no other warranty, express or implied and assumes no liability for any special or incidental damage or charges, including but not limited to any damages or charges due to installation, dismantling, reinstallation or any other consequential or indirect damages of any kind. To the extent permitted by law, the exclusive remedy of the user or purchaser, and the limit of Siargo's liability for any and all losses, injuries or damages concerning the products including claims based on contract, negligence, tort, strictly liability or otherwise shall be the return of products to Siargo, and upon verification of Siargo to prove to be defective, at its sole option, to refund, repair or replacement of the products. No action, regardless of form, may be brought against Siargo more than 365 days after a cause of action has accrued. The products returned under warranty to Siargo shall be at user or purchaser's risk of loss, and will be returned, if at all, at Siargo's risk of loss. Purchasers or users are deemed to have accepted this limitation of warranty and liability, which contains the complete and exclusive limited warranty of Siargo, and it shall not be amended, modified or its terms waived except by Siargo's sole action.

This warranty is subject to the following exclusions

- (1) Products that have been altered, modified or have been subject to unusual physical or electrical circumstances indicated but not limited to those stated in this document or any other actions which cannot be deemed as proper use of the products;
- (2) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies;
- (3) Products re-sold to the third parties.



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