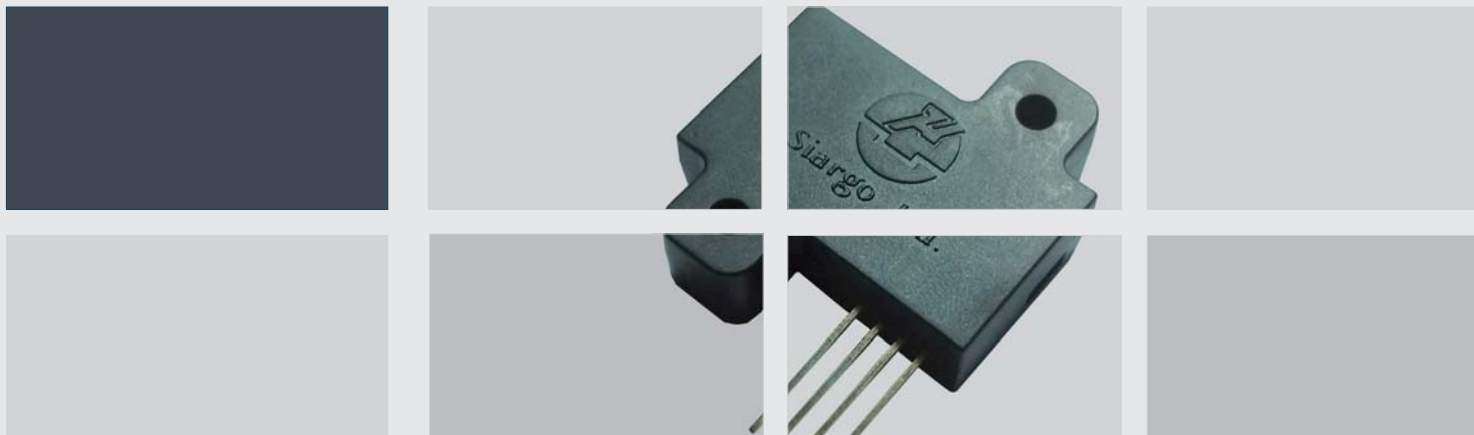




Siargo Ltd.



Model FS7002L

SIARGO MEMS FLOW SENSING PRODUCTS
MEMS Mass Flow/Clog Sensors

VA.0



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MEMS Mass Flow Sensors

FS7002L Series

User Manual

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MEMS Mass Flow/Clog Sensors



Siargo Ltd.

Model FS7002L

Features

- Mass flow range up to 0 ~ 10 m/s
- Fast response time
- High sensitivity
- Cost effective
- Small form factor, easy installation
- Fully customizable



Description

The FS7002L mass flow/clog sensors are designed and manufactured using Siargo's proprietary MEMS flow sensor and package technology. The sensors with a fast response time of 20 msec are specially designed for the applications in open space air mass flow measurement or for monitoring the air flow status behind any air filters preventing clogging of the same. The air flow passing through the sensor via a specially designed venturi channel to provide the stability of the air flow for the measurement.

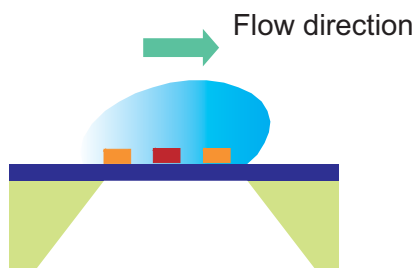
The packaging enclosure is made of the chemically inert and thermally stable polycarbonate material. The compact design of the sensors also provide easy installation and minimum blockage in the air pathway where it is to be installed. Typical applications include but not limited to clog sensing in an intelligent air filter

in an LCD projector, a filter clog monitoring in an air fresher, a ventilation duct flow profile, or a fan motor status.

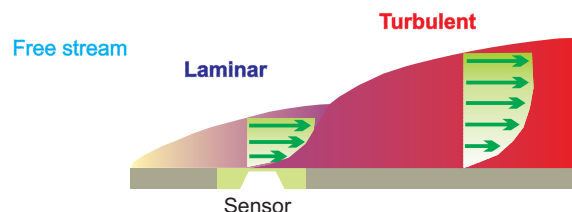
The FS7002L requires a power supply of 3~3.6 Vdc and provides an I²C output corresponding to the flow velocity from 0 to full scale.

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	FS7002L-B	FS7002L-C	
Flow range	0 ~ 5	0 ~ 10	m/s
Repeatability	± 3	± 2	%FS
Response Time	20		ms
Output	Linear, I ² C		
Power Supply	3.0~3.6		Vdc
Operating Current ²	< 10		mA
Power Consumption	< 50		mW
Pins Out	4 Pin, 1.27 mm centers, 0.5 mm square		
Working Temperature	-10 ~ +70		°C
Storage Temperature	-20 ~ +80		°C
Humidity	< 95 %RH (No icing or condensation)		

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

2 The operating current is measured at 5.0 V supply without output load.

1.2 Flow Characteristics

The FS7002L provides flow velocity I²C output corresponding with 0 ~ full scale flow velocity. The typical output characteristics of FS7002L-B illustrated in Figure 1.1, of FS7002L-C illustrated in Figure 1.2. The data are obtained at 3~3.6 Vdc supply.

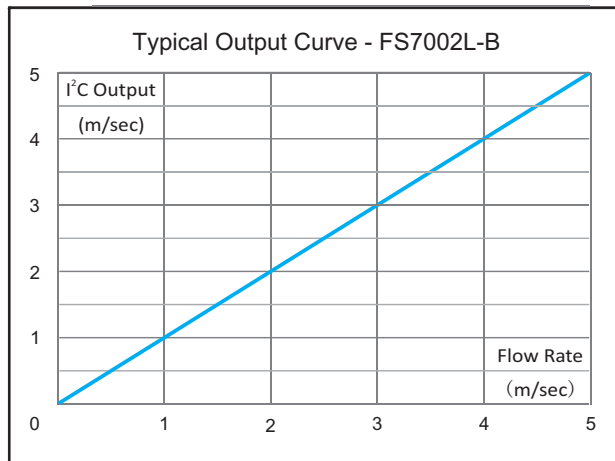


Figure 1.1: The typical output curve of FS7002L-B.

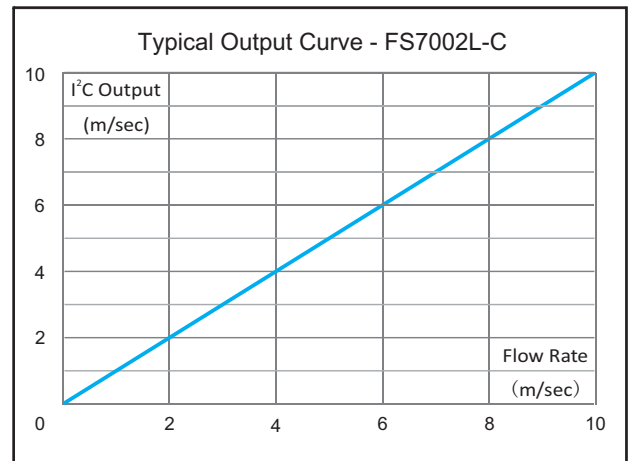


Figure 1.2: The typical output curve of FS7002L-C.

2. Electrical Interface

2.1 Pin Definition

The FS7002L provides a 4-pin electrical interface. The sensor pin configuration is shown in Figure 2.1.

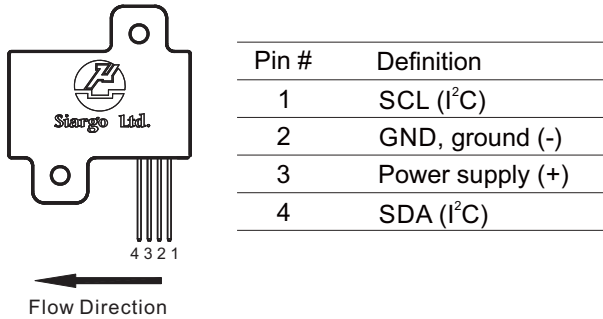


Figure 2.1: FS7002L pin configuration.

2.2 Pin Description

VCC and GND: The FS7002L requires a power supply of 3~3.6Vdc. The voltage is internally filtered and regulated to power the circuit. The sensor consumes less than 10 mA normally but the minimum supply current must be larger than 10 mA for stable performance.

SDA and SCL: I²C protocol is list in section 6.

3. Mechanical Dimensions and Mountings

The FS7002L provides two mounting holes for easy installation. 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.

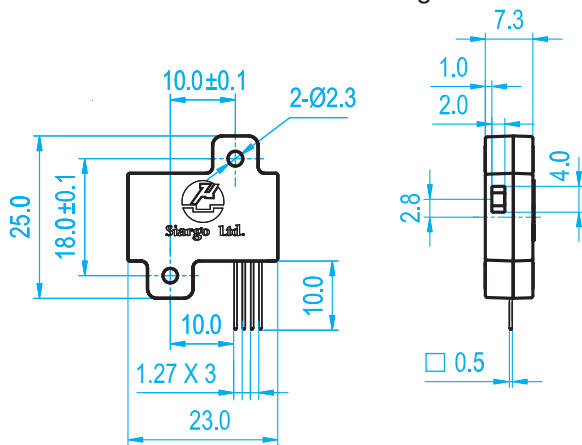


Figure 3.1: The FS7002L mechanical dimensions.

4. Application Notes

- (1) The typical output curves are obtained from the measurement of the sensor for air flow at 20 °C, 101.325 kPa in a flow channel of 8mm in diameter. For applications deviated from these conditions, the performance may vary depending on the specific installation and environments;
- (2) For applications where the sensor is placed in an open air space, the sensor measures the air flow passing through the channel inside the sensor, which is best used as a flow switch or local flow velocity indicator;
- (3) Temperature variations may lead to accuracy deviation from the original manufacture specifications when no temperature compensation is implemented in the electronics. In the worst case, the deviation could be as much as 0.3 %/°C;
- (4) Pressure variations would usually not result in any change for the sensor performance;
- (5) Humidity variations would usually not deteriorate the sensor performance unless condensation occurs.

5. Ordering Contact and Customer Support

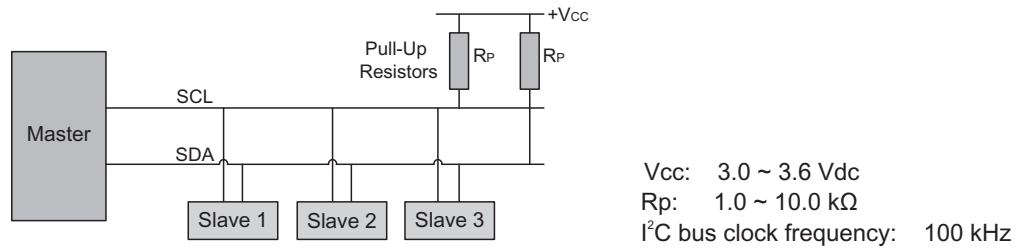
The sales offices are listed at the end of this document. For small quantities, the order can be placed either through website: www.siargo.com or the convenient sales office. For large quantities, please contact the sales office or distributors or sales representatives.

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.

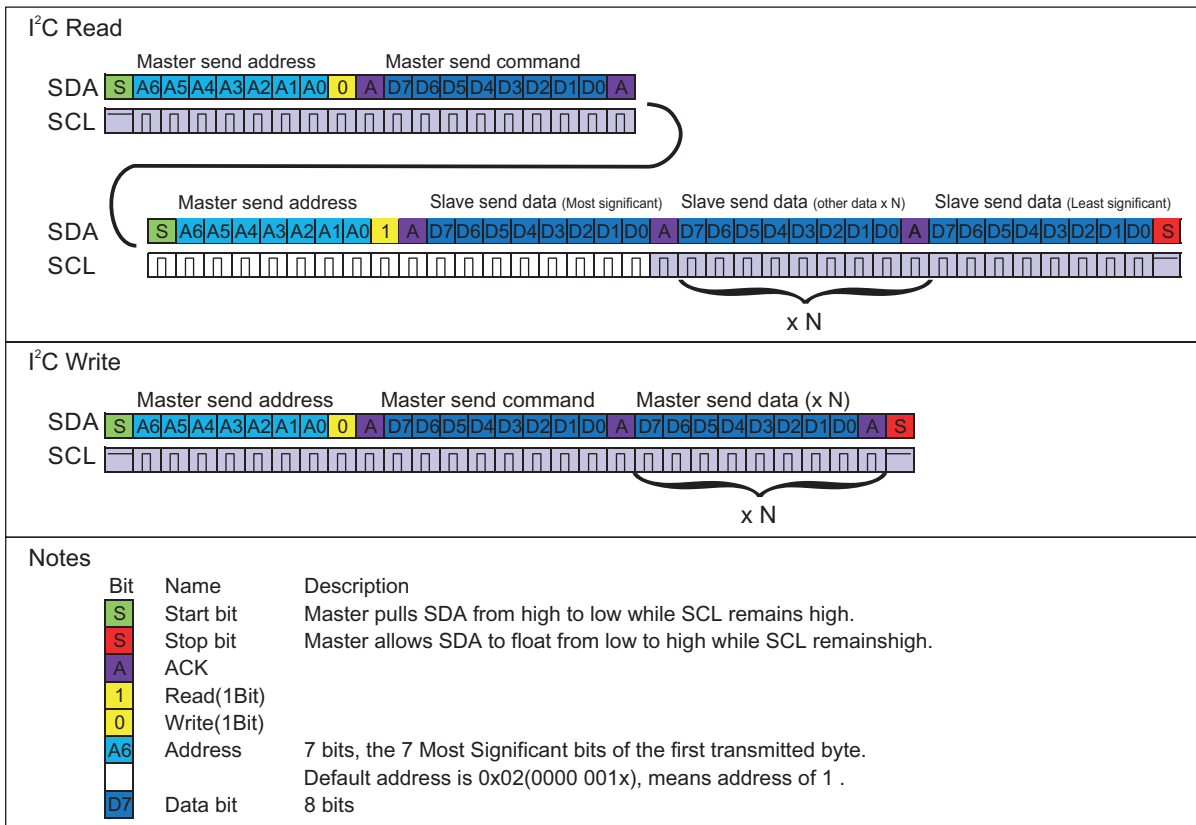


6. I²C Communication

6.1 I²C Connection



6.2 I²C Read and Write Sequences



6.3 I²C Commands description

Command Byte (Hex)	Length	Command Name	Read / Write	Notes
05H	1	Write the I ² C address	W	Bit7 ~ Bit1 can be set *
0BH	1	Write the filter depth	W	Int8, 0~254
1CH	1	Calibration the offset of flow rate	W	1 byte, ensure NO flow in the pipe
82H	12	Read the sensor SN	R	ASCII
83H	4	Read the flow velocity	R	(Int32/1000) m/sec
85H	1	Read the I ² C address	R	Bit7 ~ Bit1
8BH	1	Read the filter depth	R	Int8, 0~254

* The address is set with Bit7~Bit1, For instance, 0x08 (0000 100x) means address of 4 .



Important Notices

Wetted Materials and Compatibility

The sensor body is made of medical compatible plastics. 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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Appendix: Revision History

Revision A.0 (August 2018):

 First released.