Siargo Ltd.

LF6000 series

Microfluidic Flow Meters

User Manual VA.1

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Microfluidic Flow Meters

with thermal time-of-flight technology

LF6000 Series

User Manual

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Attention !

- Please carefully read this manual prior to operating this product.
- Do not open or modify any hardware which may lead to irrecoverable damage.
- Do not use this product if you suspect any malfunctions or defection.
- Do not use this product for corrosive media or in a strong vibration environment.
- Use this product according to the specified parameters.
- Only the trained or qualified personnel shall be allowed to perform product services.

Use with caution !

- Be cautious for electrical safety, and even it operates at a low voltage, any electrical shock might lead to some unexpected damages.
- The liquid to be measured should be clean and free of particles, as even light particles may be accumulated inside the tiny flow channel that may result in inaccuracy in metrology, clogging, or other irrecoverable damage.
- Do not apply for any unknown or non-specified liquids that may damage the product.
- Be cautious for the bubbles or cavitation inside the fluid, visible or invisible that may lead to inaccuracy or erroneous outputs.

Table of Contents

1. Overview

All contact information can be found at the end of this manual.

This manual provides essential information for the LF6000 series of flow meters and sensors for microfluidic metering applications. The product performance, maintenance, and troubleshooting, as well as the information for product order, technical support, and repair, are also included.

The LF6000 microfluidic flow meters and sensors are manufactured with the company's proprietary MEMS (micro-electro-mechanical systems) thermal time-of-flight technology that offers very high precision at large dynamic ranges starting from 50µL/min up to 400 mL/min, water equivalent. The technology particularly merits for its temperature performance. The flow channel is readily connected with the standard 1/4"-28 pipes. The channel's wetted materials are tailored by Polyetheretherketone (PEEK), Polyphenylsulfone, and silicon nitride only, which allows excellent chemical and bio-compatibility.

The thermal time-of-flight sensing is achieved by modulating a thermal transmitter and acquiring the receiver's modulated signals at a precise distance downstream via the micro-machined process. The predefined precise distance, together with the measured time that the thermal signals travel between the transmitter and receiver, allows the accurate measurement of the flow rate for the interested fluid moving inside the confined flow channel.

The products are packaged with either stainless steel (meters) house or aluminum alloy (sensors) in a miniaturized footprint for durability and easy installation that is good for instrumentation or manifold applications. The MEMS sensor chip is molded inside the channel, eliminating the dead volume and allowing a pressure rating to 0.8MPa for wider pressure rated applications.

While the current packages are best for instrumentation, equipment, OEM, and/or laboratory applications, the manufacturer also offers alternative customized packages, including those for disposable formality. Some medical or cross-contamination sensitive applications would have a disposable approach as the only practical path. For any other forms of packages that are not described in this manual, please contact the manufacturer.

The default data interfaces include I2C and analog with Bluetooth LE 4.2 enabled. Other options include Rs485 Modbus, IO-Link, NB-IoT, and LoRa. This variety of communication options cover most of the current and near-future application requirements, and each or multiple can be requested upon order from the manufacturer.

For the wireless/Bluetooth applications, please download the APP from Apple Store for iOS devices or Google Play Store for Android devices, looking for the APP name: "Siargo McWay."

2. Receipt / unpack of the products

Upon receipt of the products, please check the packing box before the dismantlement of the packing materials. Ensure no damages during shipping. If any abnormality is observed, please contact and notify the carrier who shipped the product and inform the distributors or sales representatives if the order is not placed directly with the manufacturer; otherwise, the manufacturer should be informed. For any further actions, please refer to the return and repair section in this manual.

If the packing box is intact, proceed to open the packing box, and you shall find the product (either the meter or the sensor formality per the actual order), together with the power and data cable as shown below.

Flowmeter

Flow sensor

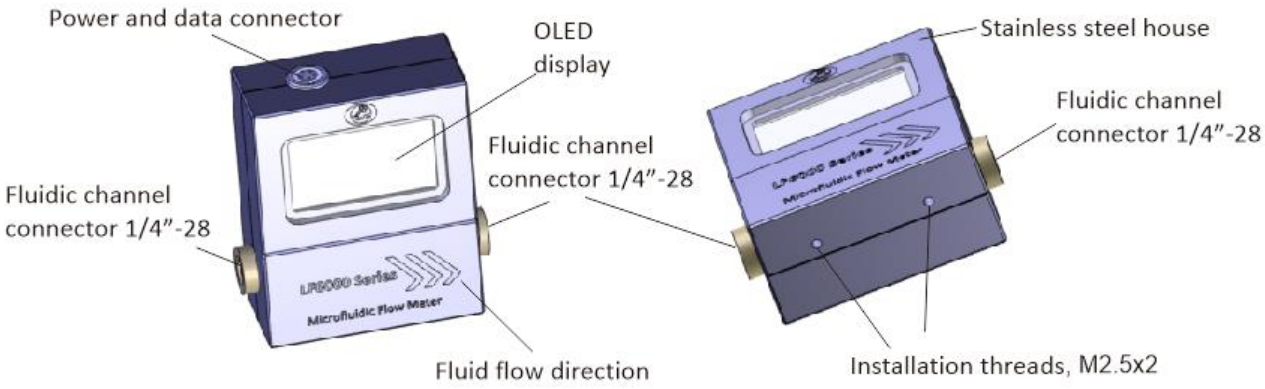
Power and data cable

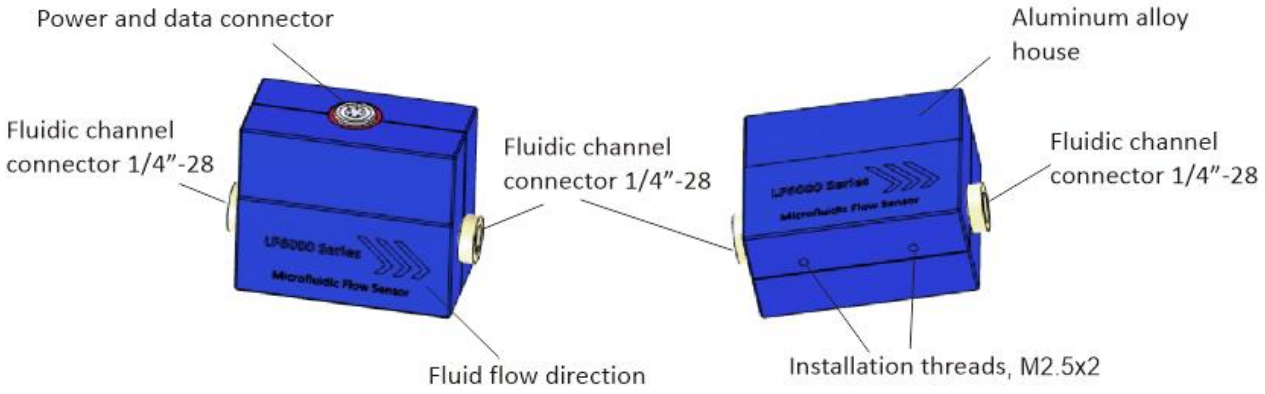
Please check immediately for the integrity of the product and the power and data cable; if any abnormality is identified, please notify the distributor/sales representative or manufacturer as soon as you can. If any defects are confirmed, an exchange shall be arranged immediately via the original sales channel. (Note: the OLED screen shall not be lighted until the power cable is plugged in). This user manual shall also be included in the packing box or via an online request for an electronic version. In most cases, this manual shall be made available to the customer before the actual order.

Important: The basic specifications of the product are written in the 2D code at the back of the product. Use a smartphone to read the information and verify your order before further process. If there are any questions or doubts, please contact the manufacturer or your sales agent.

3. Knowing the products

3.1 Product description





Note: For a full-scale flow rate over 50mL/min, the fluidic channel connector can be fully customized, the default will be NPT.

3.2 Power and data cable description

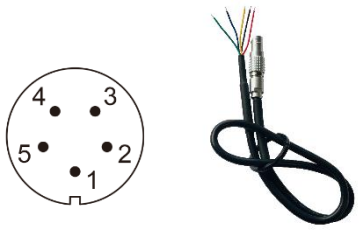


Table 3.2: LF6000 pin assignment.

Pin	Color	Definition
1	Yellow	SCL, I²C clock
2	Black	GND, ground
3	Red	VCC, power supply (8~15 Vdc)
4	Green	Vout, analog output
5	Blue	SDA, I²C data

3.3 Mechanical dimensions

Note: For a full-scale flow rate over 50mL/min, the fluidic channel connector can be fully customized.

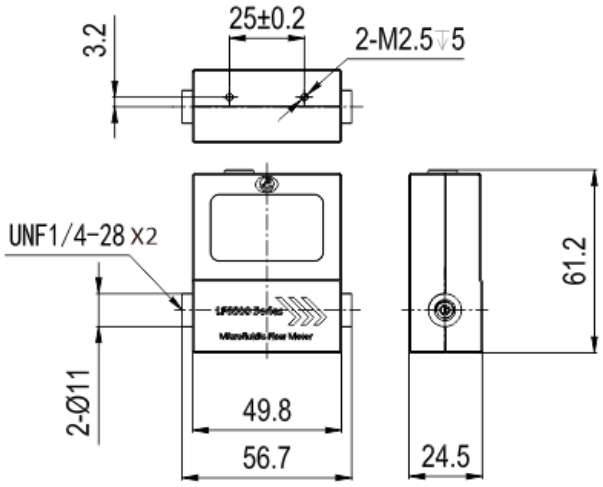


Figure 3.3.1. LF6000 meter dimensions

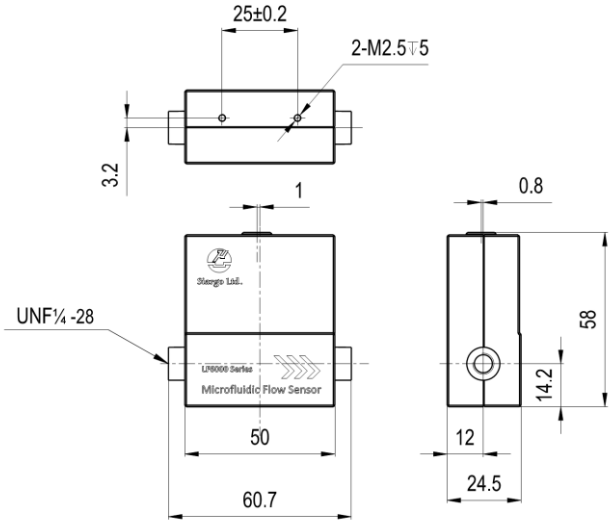


Figure 3.3.2. LF6000 sensor dimensions

4. Installation

Do not open or alter any part of the product, which would lead to malfunction and irrecoverable damage.

To ensure the best performance of the products, it is suggested that the products should be installed at a base that eliminates environmental vibration as much as possible. There are two pre-threaded M2.5 ports at the bottom of the product, as described in Section 3.1. A flat metal plate is suggested to be used as the holder before being fixed onto a solid base.

The product is preferable to be installed horizontally. If the vertical installation is a must, the fluid in the tubing must be required to be filled, in particular at the measurement position.

After the product is properly fixed to a vibration-free base, the flow channel can be connected with the standard UNF 1/4"-28 connectors. Before connection, the tubing should be carefully checked for its integrity and cleanness. There must be no particles, dirt, greases, or other foreign materials inside the tubing. The connectors should also be free of any physical damages and be in a clean condition

without any visible contamination. After the connection, the tubing should not be twisted, and it is preferable to be kept straight or with fewer turns. If any turns must be present, each of the turns should be smooth without sharp bending.

For models with a flow rate higher than 50mL/min, the default will be NPT threaded ports, or the other connections with full customization can be requested at the time of order. Make sure the flow direction on the meter/sensor is observed. A bi-directional version of the product is possible upon request from the manufacturer.

It is important to make sure there are no bubbles inside the fluid for the product's best performance. It is highly recommended a de-bubbler should be installed before the flow meter/sensor.

The proposed installation schematics are shown in Figure 4.

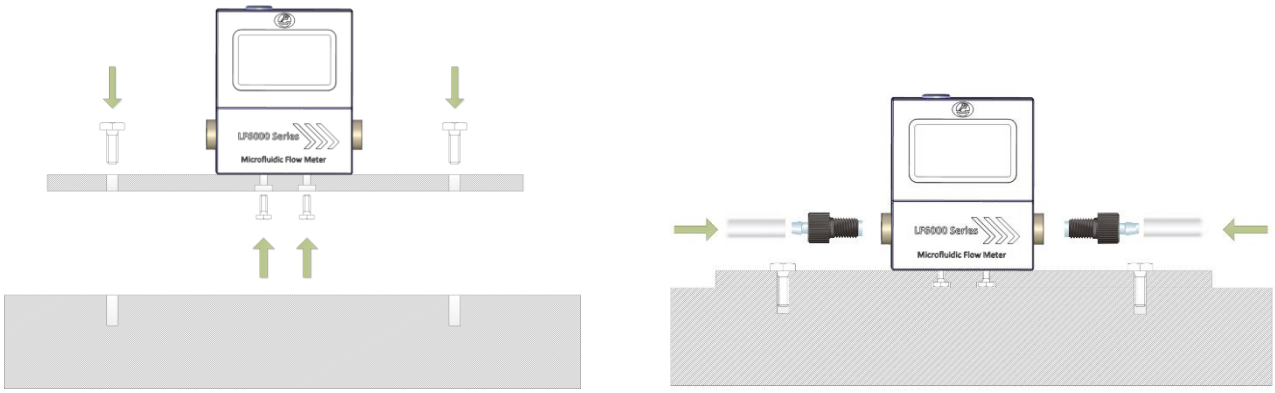


Figure 4. Suggested installation

Note: Recommended connectors

1. IDEX-HS P-647: Adapter, Barbed to Threaded Male, Tefzel™ (ETFE), for use with Soft-Walled Tubing, Each 1/4-28 Flat-Bottom Male, Tefzel™ (ETFE), for 1/8
2. IDEX-HS: D-648: Swivel Barb Adapter, for use with Soft-Walled Tubing, Polypropylene, Each For 1/8

P647 D648

5. Basic operation

5.1. Check the product specifications

Before starting to use this product, check the product specifications found in this manual or the basic information located on the back panel of the product.

One can find the product information from this manual according to the model as defined in Section 6. Or use any optical scanner such as those with a smart mobile device to read the 2D code on the label's basic product specifications. In particular, the pressure rating must not be higher than the system pressure of the fluid to be measured, and the flow range should also be within the specified ones. In most cases, a high full-scale ranged meter for the low flow rate measurement often results in erroneous data. The fluid to be measured must also be consistent with that specified by the product. Be particularly cautious about the supplied voltage indicated in the specification. A higher voltage may lead to irrecoverable damage, and a lower voltage will not power the product for any desired functions.

5.2. Check the microfluidic system

For the product's best performance, it is advised that the fluid to be measured must be clean and free of particles or other foreign materials. An upstream filter of 2μm pore size would be an example for safe usage of the product from particle contamination. Before releasing the fluid to pass through the product, check the tubing again to avoid any twist or sharp bending, tighten the tubing fittings, and verify the measurement fluid flow direction.

We recommend barbed connectors with flat-bottom to measure fluid flow rate less than 50mL/min, allowing the tight engagement with the flow channel with minimal dead space. Make sure the tubing is correct before releasing the fluid into the system.

5.3. Check the leakage

Check leakage before any measurement. If it is needed, the pressurized nitrogen or air can be used for the leakage check, in particular, if the fluid is non-conventional.

5.4. Connect the power supply

Although this product complies with the CE required EMC regulations, it also requires the product to be used according to the standard electrical device practice. Before connecting the product with the external power, ensure the standard electrical device precautions such as EDS (electrostatic discharge) and DC voltage shall be observed. Excessive electrostatic discharge may damage the product. Use only the power and data cable shipped together with the product. The cable comes with a high-quality connector at one end to be plugged into the product, and the other end is with wires for connections with options. Other manufacturer shipped cables may lead to malfunctions if not being properly made.

Pin	Color	Definition
1	Yellow	SCL, I²C clock
2	Black	GND, ground
3	Red	VCC, power supply (8~15 Vdc)
4	Green	Vout, analog output
5	Blue	SDA, I²C data

Plug the manufacturer supplied cable into the meter or sensor connector with the red dot aligned, as shown in Figure 5.4. Do not force the plug, or it may create damage to the product.

The other end of the cable has 5 pre-soldered wire terminals with different colors; refer to the above table for the connection information (the same as Table 3.2).

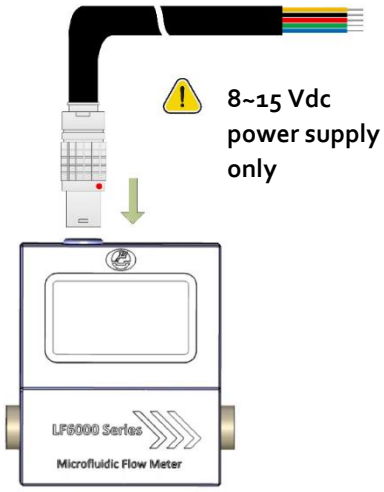


Figure 5.4 Power and data cable connection.

Take special care, connect ONLY the power to the RED power cord/wire, and ensure the power supply is within the specified 8~24Vdc before switching the power on. In addition, the power supply should be properly grounded, connecting the BLACK wire terminal to the ground on the power supply or other safe system ground.

The product's power terminal has the incoming voltage internally filtered and regulated to power the product circuitry. The product operates at a maximum current of less than 25mA, which is normally available for most of the power supply.

The terminal Vout (Green in color) is for analog data output from 0.5 to 4.50 Vdc, corresponding to the specified flow range from zero to full-scale flow rate.

SDA (Blue) and SCL (Yellow) terminals are used for the I²C serial data line and serial clock line, which provides the digital data communication and the remote control of the product.

Upon switching on the power supply, the meter OLED screen will be lighted up, and for the sensor product, the status can be checked with the analog or digital interface.

5.5. Analog interface/measurement

After switching on the power supply, the OLED display screen will show two rows of data. The upper row is the instant flow rate in ccm (mL/min), and the lower row is the totalized or accumulated flow volume. The data are referred back to the calibration condition at 20°C and 101.325 kPa. However, the temperature effects are not measurable within the specified working conditions, and the fluid is normally non-compressible.

Figure 5.5.1 The OLED display

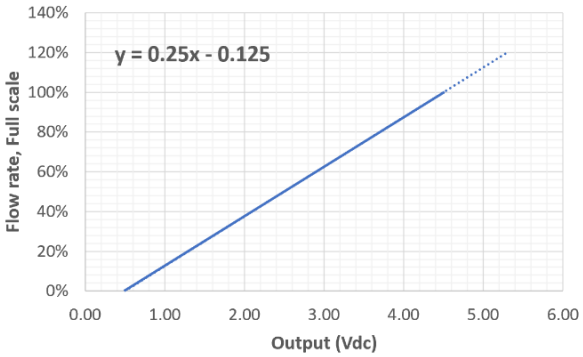


Figure 5.5.2. Analog output.

Unlike most traditional thermal flow meters, the current product does not require a warm up time. But for the best performance, wait for few seconds for electronics to get stabled. The analog data can be acquired by connecting the analog terminal 4 (Green wire). Figure 5.5.2 shows the correlation of the analog reading with the flow rate. For example, if one orders a model of the full-scale flow rate of 50mL/min, then 0.50 Vdc corresponds to a zero flow rate, and 4.50Vdc corresponds to 50mL/min. For any given voltage output x (Vdc), the flow rate shall be (0.25x-0.125)*50mL/min. Beyond this specified range, the voltage could also be read, but the accuracy is not guaranteed, as those are obtained by extrapolation (blue dashed line, maximum calibration to 110% full scale).

Another analog interface such as 4~20mA is also optional and can be requested by directly contacting the manufacturer.

5.6. Digital interface/measurement

The default digital interface for the current product is I2C. Another standard digital interface such as RS485 (Modbus) or IO-Link is also available by request.

For each of the specified digital interface, the corresponding protocol and a special cable for each shall be required. Please contact the manufacture for detailed information.

For the default I²C digital interface, the manufacturer also provides a Microsoft Windows-based evaluation software for simple operation and measurement tasks. Please contact the manufacturer for detailed information.

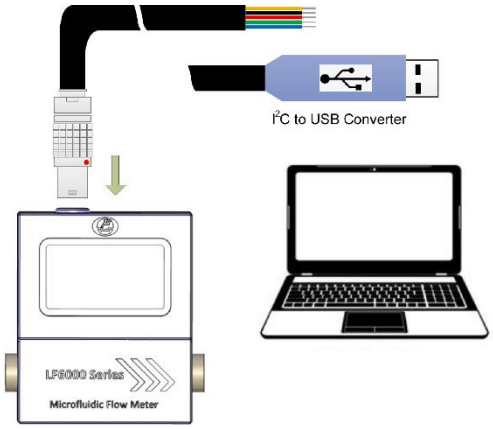


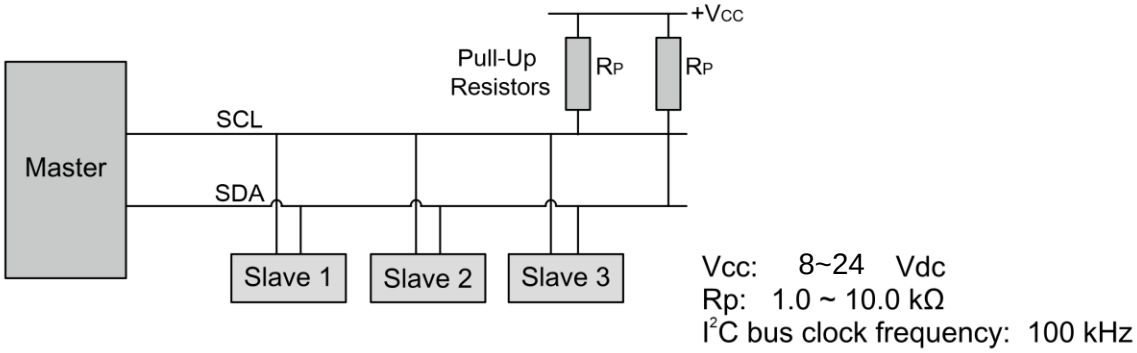
Figure 5.5.1 I²C interface connection.

For the default I²C digital interface, one can connect the SCL (Yellow, clock) and SDA(Blue, data) terminals of the provided cable to the corresponding port of an I2C bus interface on the user's electronics and proceed with tasks of desire.

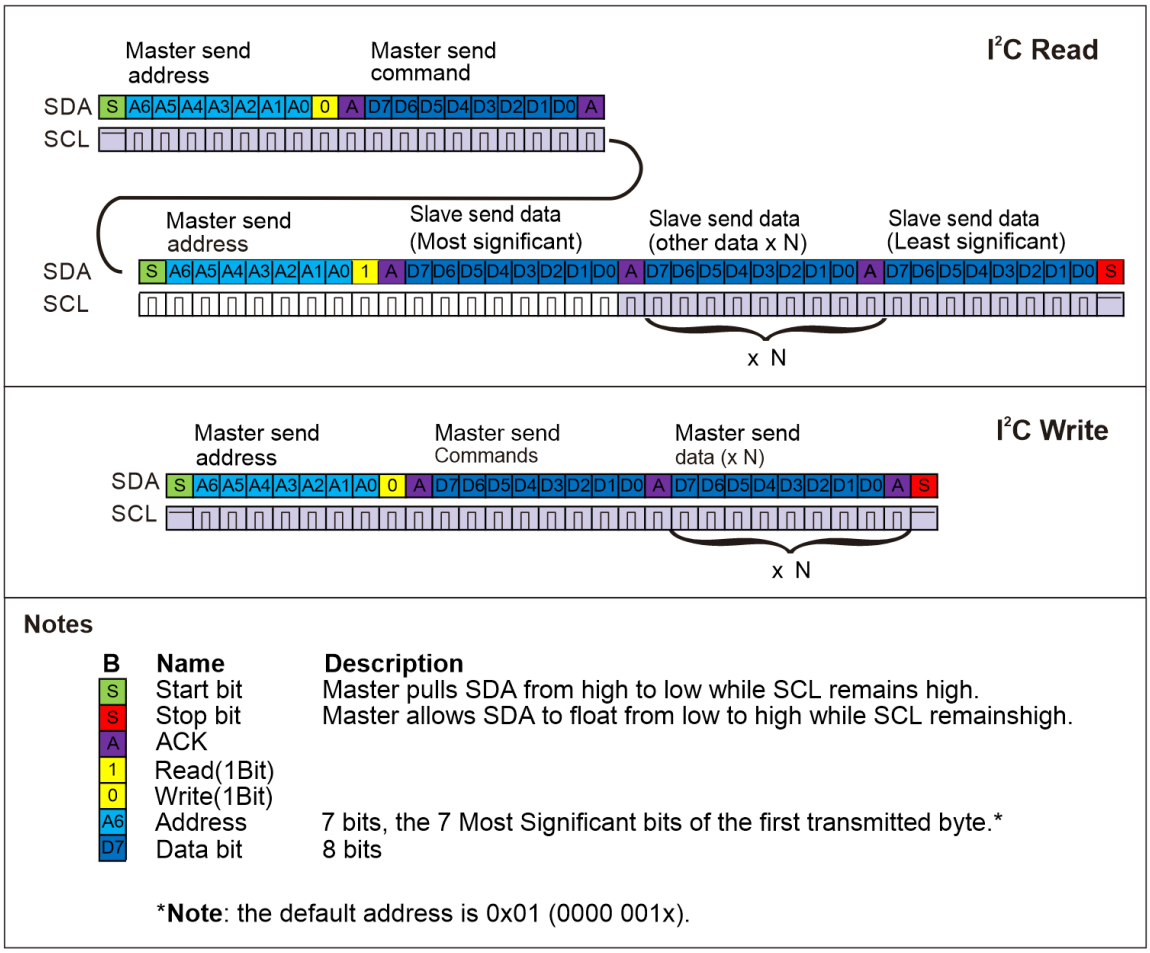
Alternatively, one can order the special cable by the manufacturer in which an I²C to USB port converter is integrated, and therefore it can be plugged into the computer for programming.

The detailed instruction of coding and/or commands of the I²C protocol is described and listed below for reference.

5.6.1. I²C connection diagram



5.6.2. I²C read and write sequences



5.6.3. I²C commands description

Command Byte (Hex)	Length	Command Name	Read/Write	Notes
05H	2	Filter depth	Write	Int 16, 0~10, default is 10
08H	2	I²C address	Write	Bit 15~Bit 1, set value*
81H	4	Flowrate	Read	Int 32/1000 mL/min
82H	4	Forward flowrate	Read	Int 32/1000 mL/min
83H	4	Reverse flowrate	Read	Int 32/1000 mL/min
85H	2	Filter depth	Read	Int 16, 0~10
86H	12	Sensor SN	Read	ASCII
88H	2	I²C address	Read	Bit 15~Bit 1 (Bit 15~Bit 8 =0)

Note: The address is set with Bit7~Bit1. For instance, sensor I2C address 4, write address will be 0x08 (0000 1000) , while read address will be 0x09 (0000 1001).

5.7. Wireless interface

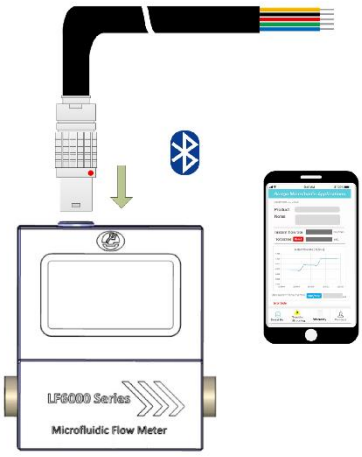


Figure 5.7. Wireless connection.

The product has built-in Bluetooth LE 4.2 wireless data transmission capability.

An application APP named "Siargo McWay" can be downloaded from either Apple Store for smart devices based on the iOS system or Google Play Store for smart devices based on the Android system.

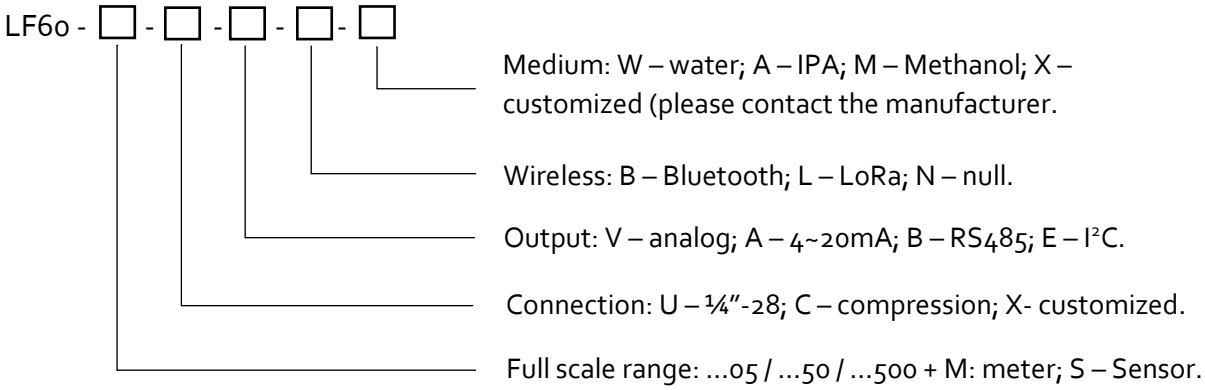
The APP provides the basic functions to access the meter/sensor data, plot an instant flow rate chart, calculate totalized or accumulated flow volume at a specific time defined by the user. It allows the user to instantly send the local data to a remote destination when the wired connection is not an option. Also, the interface provides the readout of the product information as well as technical support information.

Alternatively, NB-IoT, LoRa, and other interfaces can be offered, if requested.

6. Product selection and order information

6.1. Product selection

The product part number is composed of the product model number and suffixes, indicating the full-scale flow rate and the other parameters. Refer to the following for details.



Note: *: Compression fitting is for a soft tube with ¼" OD.

6.2. Order contact and customer support

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

7. Technical specifications

All specifications listed in the following table, unless otherwise noted, apply for calibration conditions at 20°C and 101.325 kPa absolute pressure with de-ionized water. The product is horizontally mounted at calibration.

	Value	Unit
Full-scale flow range	2 ...50 / 100 ... 400	mL/min
Minimal flowrate	20.0	µL/min
Turn-down ratio	100:1	
Accuracy	±(2.0+0.5FS)	%
Response time	200 (others programmable)	msec
Working temperature	5~50	°C
Temperature effects	< 0.02	%/°C
Working pressure	0.8	MPa
Maximum pressure	1.0	MPa
Dead volume	< 7.0	µL
Power supply	8~15	Vdc
Electrical interface	I^2C / 0.5~4.5 Vdc / RS485 / 4~20mA	
Wireless interface	BT LE 4.2 with APP; LoRa	
Display (meter only)	OLED, instant, and totalized flowrate	
Mechanical connection	¼" -28 (0~50 mL/min); NPT or customized	
Wetted materials	PEEK, SiNx, Stainless steel	
Reference conditions	20°C, 101.325 kPa, DI water	
Storage temperature	-10 ~ 70	°C
Weight	230 (meter); 75 (sensor)	Gram
Protection	IP50	
Fluid compatibility	Non-corrosive	
CE	EN61326-1; -2; -3	

*__Note:__ IO-Link is an optional for electrical interface.

8. Technical notes for the product performance

8.1. Measurement principle

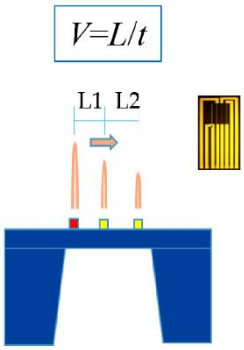


Figure 8.1. Measurement approach illustration.

The products utilize the Company's proprietary micro-machined (MEMS) thermal time-of-flight sensing technology. A thermal signal generator with a plural set of receivers is precisely manufactured and separated at predefined micrometer distances on a chip surface with thermal isolation. When a fluid flows through the sensing chip, the fluid carries the modulated thermal signal downstream. The downstream receivers record a precise period of the fluid traveling from the generator to the receiver. The predefined distances and the measured period allow the sensor to register the fluid's precise flow speed in the sensing regime. By calibrating out any mechanical alignment and other assembly-related factors, the fluid flow rate can be determined.

The thermal time-of-flight sensing technology is particularly effective in metering the microfluidic flow where the tiny channel makes it difficult for other flow measurement techniques to register the data. Please refer to the company's US patents and other publications made available to the public for additional information.

8.2. Precautions for the best performance of the product

8.2.1. Particle contamination

It is critical to have the measured fluid free of particle contamination. Since the fluidic channel is small, any particle's presence may create a deformed channel leading to large measurement errors. The particle deposition may also clog the channel, creating unstable flow and other instability, resulting in unpredictable measurement circumstances.

8.2.2. Presence of bubbles or cavitation

As the measurement principle is via thermal transportation, the presence of the bubbles or cavitation shall significantly alter the thermal property of the fluid. In most cases, the bubble inclusion inside the fluid would lead to a negative deviation of the measurement. Therefore, it is recommended to

flush the flow channel before the measurement if the presence of bubbles is suspected. A degasser is highly recommended for the testing. On the other hand, if the measurement's accuracy is in question, the channel could be first dried with a clean gas such as nitrogen and then flush the channel with degassed fluid before a new measurement.

8.2.3. Pressurized flow delivery

Although the product can be subject to rated pressure, it is recommended to ensure no abrupt changes in pressure inside the flow channel; the pressure shock may lead to an impact on the electronics and the control scheme resulting in a malfunction of the system.

8.2.4. Continuous operation

It is recommended that the product be powered off when it is not in a measurement status. Constant power might risk an overheat for the tiny channel, which may detrimentally create small bubbles or other instability if such phenomena are observed, power off the product and dry the system with a clean gas before reuse.

8.2.5. Measurement of non-conventional fluid

By default, the product is calibrated with de-ionized water; if other fluid is to be measured, there could result in large errors. If the product is to measure the clean water, after foreign fluid had been passed or presented in the channel, purge the product with dry and clean gas such as nitrogen and then flush the channel with de-ionized water before a new measurement.

The flow channel's wetted materials ensure it is inert to most of the conventional fluid, but precaution should be applied for any possible damages.

8.2.6. Product calibration

The product is calibrated with a high precision reference syringe that is traceable to NIST standard. Additional verification with a high precision balance of the system for calibration is also periodically performed. In normal operation, the product should maintain its status as that at the shipment. However, it is recommended that the product be re-calibrated at least once a year for heavy usage.

8.2.7. Verification of the product accuracy or reproducibility

Measurement reproducibility with the microfluidic sensors requires the consideration of the testing setups. The reference meter should have higher accuracy in comparison with the specified one of the current product.

In the microfluidic regime, the surface tension or the Capillary number, which is the ratio between viscosity and capillary force, plays a more important role than the Reynold number. The product has been uniquely designed to handle the surface tension variation in the flow channel. However, for the verification process, additional precautions should apply. The system is required to be cavitation free, and fluid flow to be continuous, therefore a degasser is strongly recommended during the verification process. If the continuous flow is guaranteed, Bernoulli's equation will still govern. There should not be any sections in the system that will create a substantial pressure difference, otherwise, the measured flow speed differences will be inevitable.

9. Troubleshooting

Phenomena	Possible causes	Actions
No signal / display	Power not connected	Connect the power, check the cable.
	Cable connection incorrect	Check cable
	No flow or clogging	Check flow and cavitation.
	Power regulator failure	Return to factory
	Sensor failure	Return to factory
Large errors or unexpected flowrate	Bubbles, clogging, fluid type.	Check system, dry, and flush.
Erroneous or large noise	Vibration, unstable flow	Check system
Offset unstable	Vibration, overheat	Check system, power off.
No digital interface	Wrong address, software	Check commands, connection.
No wireless, BT cannot pair.	Wrong model, data jam	Check model, power off/on.

10. Warranty and Liability

(Effective January 2018)

Siargo warrants the products sold hereunder, properly used, and properly installed under normal circumstances and service. As described in this user manual, it 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 warranty, representation, or guarantee and shall not assume any liability regarding the suitability of the products described in this manual for any purposes that are not specified in this manual. The users shall be held for full responsibility for validating the performance and suitability of the products for their particular design and applications. For any of the misusage of the products out of the scope described herein, the user shall indemnify and hold Siargo and its officers, employees, subsidiaries, affiliates, and sales channels harmless against all claims, costs, damages, and expense or reasonable attorney fee from direct or indirect sources.

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, etc. 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, strict 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. Regardless of form, no action 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 the 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. It shall not be amended, modified, or its terms waived except by Siargo's sole action.

This manual's product information is believed to be accurate and reliable at the time of release to or made available to the users. However, Siargo shall assume no responsibility for any inaccuracies and/or errors and reserves the right to make changes without further notice for the relevant information herein.

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) Products that have been subject to chemical attacks, including exposure to corrosive substances or contaminants. In the case of battery usage, long term discharge or leakage induced damages;
(3) Products that have been opened or dismantled for whatever reasons;
(4) Products that have been subject to working conditions beyond the technical specification as described by this manual or related datasheet published by the manufacturer;
(5) Any damages incurred by the incorrect usage of the products;
(6) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies;
(7) Products that are re-sold by unauthorized dealers or any third parties.

11. Service contact and information

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

Customer service and all orders should be addressed to

Siargo Ltd.
3100 De La Cruz Boulevard, Suite 210,
Santa Clara, California 95054, USA
Phone: +01(408)969-0368
Email: info@Siargo.com

For orders, please provide an accurate and full postal address. Siargo will not ship to P.O. Boxes or via a third party.

Please contact info@siargo.com to obtain a Return Materials Authorization (RMA) before shipping the product back to the factory for returns or factory services such as calibration. Please specify as clear and detailed as possible in your email message the product's status that you intend to ship back to the factory. Be sure to write the RMA on the returned package or include a letter with the RMA information.

For further information and updates, please visit www.Siargo.com.

Appendix I: Product evaluation kit

Siargo offers a sensor evaluation kit, including a digital data converter, USB data cable, and a User Application software, that allows the user to evaluate the product performance on a Microsoft Windows-based computer. The user can read and visualize the flow rate of the product, obtain the totalized values, and save the data for further analysis. It can read from up to 128 sensors with the I^2C interface in serial.

For further information and purchase of the evaluation kit, please contact the manufacturer or the sales representative.

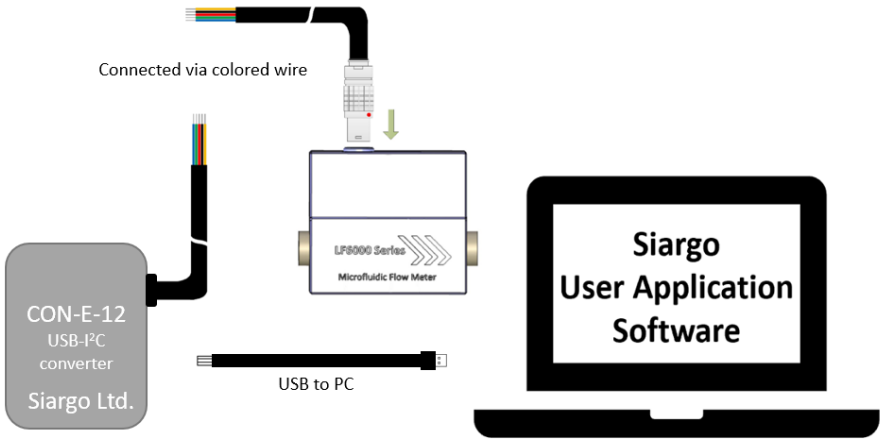
Cable to connect to the product

USB cable to connect to PC

External power adapter (optional)

Each converter has a fixed cable that can be directly connected to the product. The USB cable connected to the PC is also included.

For most of the product, the power from the PC via the USB cable will be sufficient to power the sensor product, no external power will be required. However, for multiple sensors in serial, the power via the USB cable may not be enough, an external power adapter with 8~24Vdc will be required.



Appendix II: Document history

06.2019	VA.0 - First release
01.2020	VA.1 – Formal release