Siargo Ltd.

Gas Mass Flow Controller VA.0.01

Model MF6600

www.Siargo.com

Gas Mass Flow Controller

With the proprietary Thermal-D MEMS sensing technology

MF6600 Series

User Manual

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Attention!

- Please carefully read this manual before operating this product.
- Do not open or modify any hardware that may lead to irrecoverable damage.
- Do not use this product if you suspect any malfunctions or defects.
- Do not use this product for corrosive media or in a strong vibrational 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 of electrical safety, even if it operates at a low voltage; any electrical shock might lead to some unexpected damage.
- The gas to be measured should be clean and free of particles. Do not apply this meter to a liquid medium.
- Do not apply for any unknown or non-specified gases that may damage the product.
- For remote data, please be sure the meter is configured correctly.

Table of Contents

1. Overview

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

This manual provides essential information for operating the MF6600 series of gas mass flow meters with a manual control valve for general-purpose gas flow monitor and control applications. The product performance, maintenance, and troubleshooting, along with information on product orders, technical support, and repair, are also included.

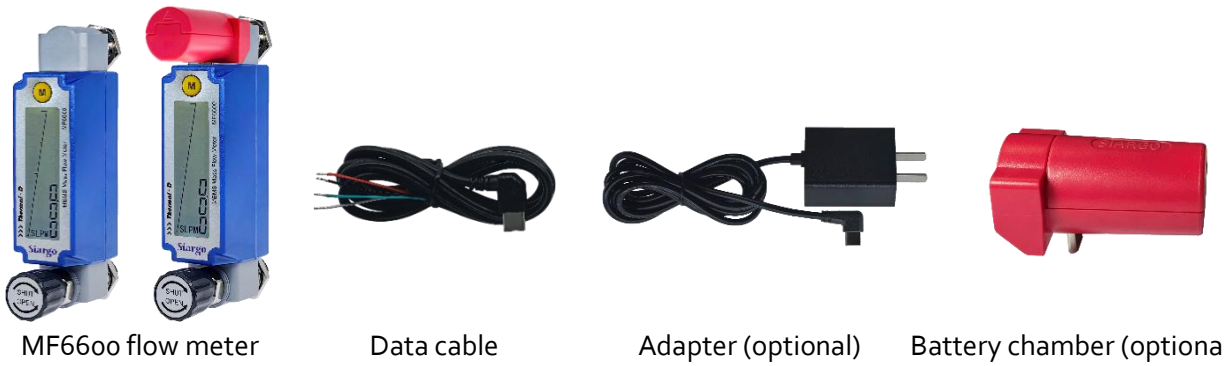
Inaccurate mechanical process monitoring has increasingly been a challenge for today's manufacturing. On the other hand, mass flow sensing products have substantially higher costs and require an external power supply. MF6600 mass flow meters are designed to replace mechanical rotameters for process control and monitoring. The micro-electro-mechanical system (MEMS) and Industrial Internet of Things (IIoT) enabled MF6600 to offer unprecedented performance with a battery power option at a cost comparable to those of its mechanical counterparts. With the same installation options, the products deliver mass flow and can be programmed to alert when the process deviates from high and low-flow limits. Process line leakage detections, gas temperature, and gas auto-detections are among the options. The meter series covers a wide dynamic flow range with a working pressure rating of up to 1.0 MPa, and a temperature ranging from -10 to 55°C.

The meters are operated with Siargo's proprietary MEMS Thermal-D mass flow sensing technology and smart control electronics. The sensor surface is passivated with silicon nitride ceramic materials and water/oilproof nano-coating for performance and reliability. The meter body is made of PC + ABS, which is available for most gas applications.

2. Receipt / Unpack of the Products

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

If the packing box is intact, open it to find the product (either the meter or the meter with the valve, as specified in the actual order). The power adapter and/or data cable, as shown below, may also be found according to your exact order.



MF6600 flow meter Data cable Adapter (optional) Battery chamber (optional)

Figure 2.1: MF6600 flow meter and accessories

Please check immediately for the integrity of the product as well as the power and data cable. If any abnormalities are 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 LCD shall not be lighted until the power cable is plugged in.) This user manual shall also be included in the packing box or made available upon request via an online electronic version. In most cases, this manual shall be made available to the customer before the actual order is placed.

The standard cable (part number USB-C-L-100) has a USB Type-C connector with a length of 1.0 meters. A power adapter must have a safety certification for use with this meter.

The product is also operated with a lithium-ion battery ER14250; the battery chamber is required.

3. Knowing the Products

3.1 Product Description

Figure 3.1: MF6600 parts description

Note: The battery chamber is optional. The lithium-ion battery is ER14250.

3.2 Power and Data Cable Description

Figure 3.2: MF6600 cable (USB-C-L-100)

Table 3.1: MF6600 pin/wire assignments.

Wire	Color	Definition
1	Red	Power supply, 3.6 ~ 24 Vdc
2	Black	GND, ground
3	Green	RS485A (+)
4	White	RS485B (-)

3.3 Mechanical Dimensions

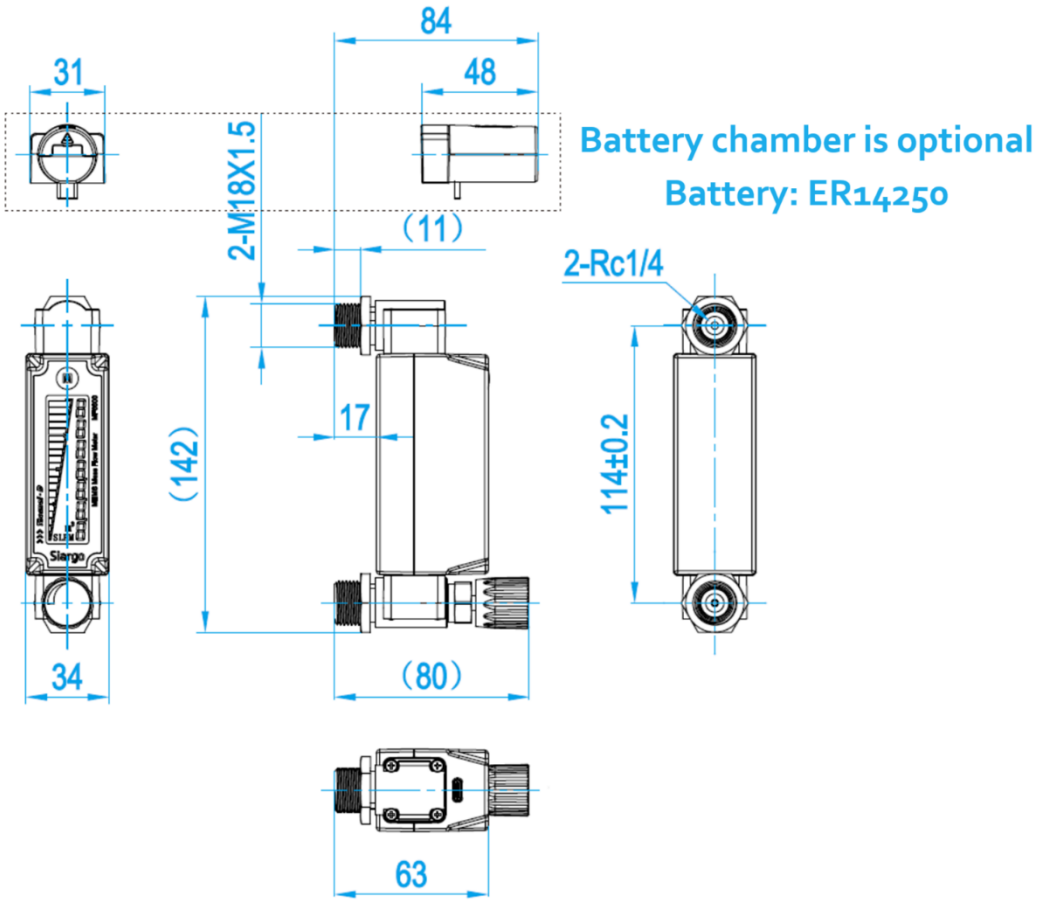


Figure 3.3: MF6600 dimensions

4. Installation

Do not open or alter any part of the product that would lead to malfunction and irrecoverable damage. It will also forfeit the terms of the warranty and cause liability.

The product at the time of shipment is fully inspected for its quality and meets all safety requirements. Additional safety measures during the installation should be applied. This includes, but is not limited to, the leakage verification procedures, standard EDS (electrostatic discharge) precautions, and DC voltage precautions. Other tasks, such as calibration, part replacement, repair, and maintenance, must only be performed by trained personnel. Upon request, the manufacturer will provide necessary technical support and/or training for the personnel.

There are no preferred directions for the installation. The flow direction should be aligned with the arrow mark on the meter body. If the flowing fluid may have particles or debris, it is strongly recommended to install a filter upstream of the meter.

Please follow the following steps to complete the installation:

a) Upon opening the package, the product's physical integrity should be inspected to ensure no visual damage.

b) Before installation of the product, please ensure that the pipe is free from debris, particles, or any other foreign materials.

c) Close the meter valve completely.

d) During installation, please make sure no foreign materials (such as water, oil, dirt, particles, etc.) enter the installation pipeline.

e) Connect electrical wires per the wire definition in Table 3.1. Please be sure of the power supply range (i.e., 3.6 ~ 24 Vdc) and power supply polarization. If an adapter is other than the one supplied by the manufacturer, make sure the adapter meets industrial standards and has all safety certifications.

f) For the data communication wire connection, please follow the description in Table 3.1 and make sure that the wires are correctly connected to the proper ports on your data device/equipment. Please make sure the data cable meets industrial standards with appropriate shielding.

g) Once the external power is successfully connected, the LCD should be lit up with the proper information displayed.

h) Slowly open the valve(s) of the gas supply, if any, upstream or downstream, or both of the pipeline. Next, slowly open the valve of the meter, and it should start to measure the flow in the pipeline. Note: because the meter has an extensive dynamic measurement range, it is normal to see a small instant flow rate even if there is no flow in the pipeline. If the value is consistently

present, double-check the pipe leakage and then reset the offset if you are sure there is no leakage or flow.

h) This will conclude the installation.

Cautions

a) Don't alter any parts of the product.

b) Ensure the electrical connection is done correctly per the instructions.

c) Make sure no mechanical stresses in the connections.

d) The strong electromagnetic interference sources close by or any mechanical shocks at the pipeline may also create malfunctioning of the product.

e) Slowly open/close valves to prevent abrupt pulse flow impact.

5. Operation and MENU Description

5.1 Check the Product Specifications

Before starting to use this product, check the product specifications that can be found in this manual or the basic information from the datasheet on the company's website www.Siargo.com.

The detailed product technical specifications can be found in Section 7. For a specific application, the pressure rating must not exceed the system pressure to be measured, and the flow range should be within the specified limits. In most cases, using a high full-scale range meter for measuring very low flow rates often results in erroneous data. The gas 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.

For optimal product performance, it is recommended that the gas to be measured be clean and free of particles or other foreign materials.

5.2 Check the Leakage

Check for gas leakage before any measurement. If necessary, pressurized nitrogen or air can be used for the leakage check.

5.3 Power the Meter and Digital Data Connection

Although this product complies with the CE-required EMC regulations, it also requires use according to standard electrical device practice. Before connecting the meter with external DC power or an AC-DC adapter, make sure the supply voltage is within the range specified in Section 7. Be cautious that standard electrical device precautions, such as ESD (electrostatic discharge) and DC voltage, are observed. Excessive electrostatic discharge may damage the product.

The manufacturer-supplied power and data cable has a locking fixture. Lock the cable and ensure it is properly engaged to prevent accidental unplugging.

Half-duplex RS485 Modbus is used for digital data communication. Make sure the wires are appropriately connected to the receiver side.

5.4 Meter Display and MENU Descriptions

5.4.1 Display Contents

The meter features a function key that allows users to switch between instant flow rate, accumulated or totalized flow rate, time counter, and auto switch. The instant flow rate unit is SLPM with four digits, and 1 or 2 of the digits are decimals. The totalized or accumulated flow unit is m^3 with seven digits, one of which is a decimal.

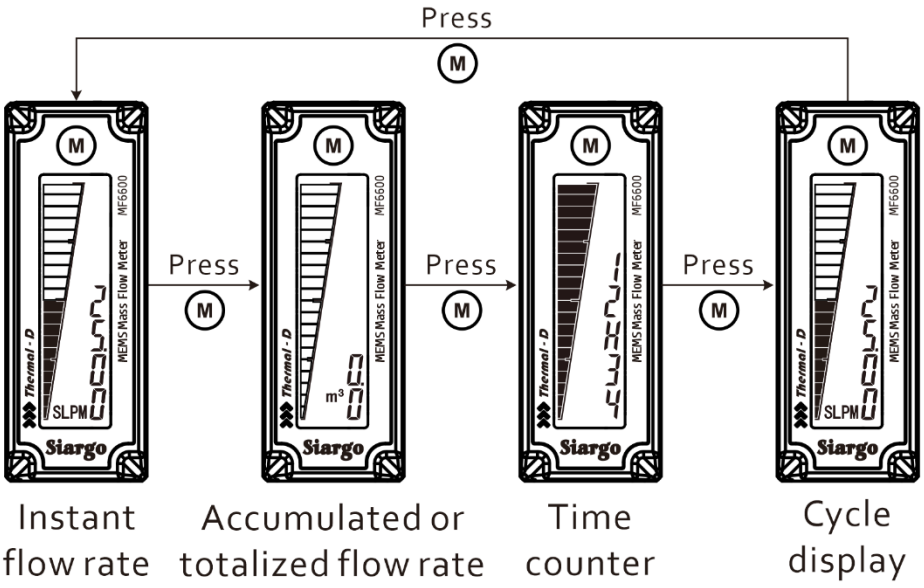


Figure 5.1: MF6600 display and function key

The bar chart indicates the instant flow rate as follows.

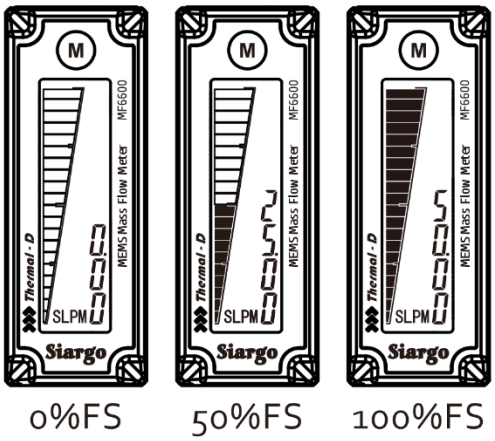


Figure 5.2: Instant flow rate

5.4.2 Offset Calibration

Press the function key > 5 sec to perform the offset calibration.

Note: Before performing the task, ensure there is no flow in the flow channel; otherwise, it will lead to even more erroneous measurement results.

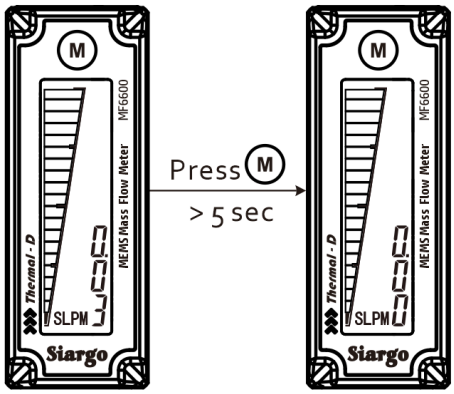


Figure 5.3: offset calibration

5.4.3 Alarm

(1) When the flow rate is above the specified flow range (out-of-flow measurement range), E4 will be shown, and the whole display will flash.

(2) When the battery is low, E5 will be shown, and the whole display will flash.

(3) When the flow rate is higher than the upper limited flow rate, E6 will be shown, and the whole display will flash.

(4) When the flow rate is lower than the lower limited flow rate, E7 will be shown, and the whole display will flash.

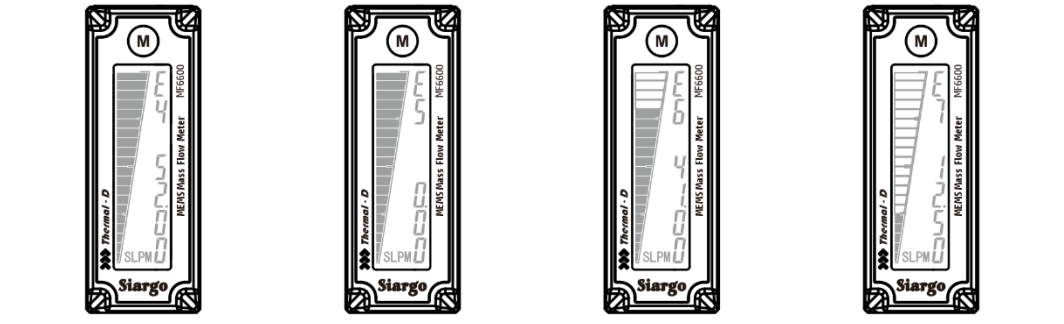


Figure 5.4: MF6600 alarm information

5.5 RS485 Modbus Communication Protocol

The digital communication protocol is based on the standard Modbus RTU Half-duplex mode communication protocol. A master (PC or PLC) can communicate with multiple slaves (the current product) for data exchange and configuration of communication parameters. Refer to Table 3.1 for the cable connection.

5.5.1 Hardware Connection

The RS485 hardware layer is TIA/EIA-485-A, as illustrated below. In this configuration, the product (MF6600) is a slave.

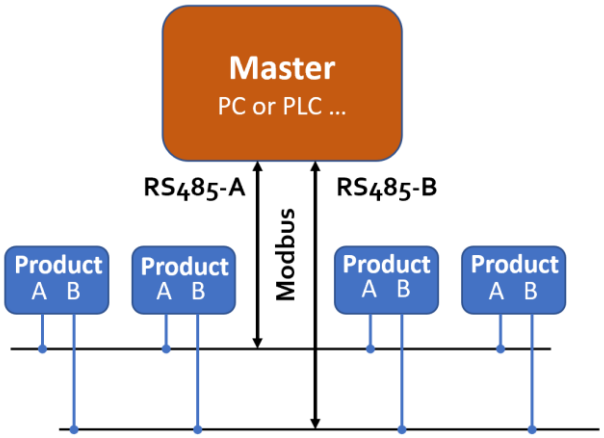


Figure 5.5: RS485 hardware

5.5.2 Communication Parameters

The PC UART communication parameters are listed in Table 5.1.

Table 5.1: PC UART communication parameters

Parameters	Protocol
	RTU
Baud rate (Bits per second)	38400 bps
Start bits	1
Data bits	8
Stop bits	1
Even/Odd parity	None
Bits period	104.2 µsec
Bytes period	1.1458 msec
Maximum data length	20
Maximum nodes	247

5.5.3 Frame

The frame function is based on the standard Modbus RTU framing:

Table 5.2: frame function

Start_bits	Address	Function codes	Data	CRC	Stop_bits
T1-T2-T3-T4	8 bit	8 bit	N 8 bit (20≥n≥0)	16 bit	T1-T2-T3-T4

Start_bits: 4 periods bit time, for a new frame.

Address: The address can be set from 1 to 247, except for 157 (0x9d). 0 is the broadcast address.

Function codes: Define the product (MF6600)'s functions/actions (slaves), either execution or response.

Data: The address of the register, the length of data, and the data itself.

CRC: CRC verification code. The low byte is followed by the high byte. For example, a 16-bit CRC is divided into BYTE_H and BYTE_L. In the framing, the BYTE_L will come first, followed by the BYTE_H. The last one is the STOP signal.

Stop_bits: 4 periods bit time, for ending the current frame.

5.5.4 Function Codes

The Modbus function codes applied for the product are a subclass of the standard Modbus function codes. These codes are used to set or read the registers of the product:

Table 5.3: function codes

Code	Name	Functions
0x03	Read register	Read register(s)
0x06	Set a single register	Write one single 16-bit register
0x10	Set multiple registers	Write multiple registers

5.5.5 Registers

The product (MF6600) features multiple registers for assigning various functions. With these functions, the user can obtain data from products, such as product addresses and flow rates from the registers, or set product functions by writing the corresponding parameters.

The currently available registers are listed in the following table. The registers can be customized upon contacting the manufacturer. Where R: read; W: write-only; W/R: read and write.

Note: At the time of shipping, the write protection function is enabled except for the address and baud rate. Once the user completes the register value change, the write protection will be automatically re-enabled to prevent incidental data loss.

Table 5.4: Registers

Functions	Description	Register	Modbus
Address	Product address (R/W)	0x0081	40130 (0x0081)
Serial number	Serial number of the product (R)	0x0030 ~ 0x0035	40049 (0x0030)
Flow rate	Current flow rate (R)	0x003A ~ 0x003B	40059 (0x003A)
Accumulated flow	Accumulated or totalized flow rate (R)	0x003C ~ 0x003E	40061 (0x003C)
Time counter	Time counter (R)	0x0050 ~ 0x0052	40081 (0x0050)
Baud rate	Communication baud rate (R/W)	0x0082	40131 (0x0082)
GCF *	Gas conversion factor (R/W)	0x008B	40140 (0x008B)
Digital filter depth *	Response time or sampling time (R/W)	0x008C	40141 (0x008C)
Upper flow alarm *	Upper flow rate limit alarm (R/W)	0x0098 ~ 0x0099	40153 (0x0098)
Lower flow alarm *	Lower flow rate limit alarm (R/W)	0x009A ~ 0x009B	40155 (0x009A)
Offset calibration	Offset reset or calibration (W)	0x00F0	40241 (0x00F0)
Reset totalizer and time counter*	Reset accumulated or totalized flow rate, reset time counter (W)	0x00F2	40243 (0x00F2)
Write protection	Write protection of selected parameters (W)	0x00FF	40256 (0x00FF)

Notes: 1, R – Read-only, W – Write only, R/W – Read and write.

2, For the * marked functions, please disable the write protection before executing the command.

The detailed information for each register is described below: Y: enabled; N: disabled.

Address	**0x0081**	**Write**	Y
		Read	Y
Description	Address of the product		
Value type	UINT 16		
Notes	Values range from 1 to 247, excluding 157 (0x9d). The broadcast address is not enabled, and the default address is 1.		

SN, Serial number	**0x0030 ~ 0x0035**	**Write**	N
		Read	Y
Description	Series Number of the product, SN		
Value type	ASCII (12 bits)		
Notes	SN= value(0x0030), value(0x0031),….,value (0x0035); **e.g.,** receiving 12 bits as: 2A 41 31 42 32 33 34 35 36 2A , the corresponding Serial Number is **A1B23456**.		

Flow rate	**0x003A ~ 0x003B**	**Write**	N
		Read	Y
Description	Current flow rate		
Value type	UINT 32		
Notes	Flow rate = [Value (0x003A) * 65536 + value (0x003B)] / 1000 **e.g.,** when the user reads "0" from register 0x003A and "20340" from register 0x003B, current flow rate = (0 * 65536 + 20340) / 1000 = 20.340 SLPM		

Accumulated flow	0x003C ~ 0x003E	Write	Y
		Read	Y
Description	Accumulated or totalized flow rate		
Value type	UINT 32 + UINT 16		
Notes	Accumulated flow = value (0x003C) * 65536 + value (0x003D) + value (0x003E) /1000 **e.g.,** for a totalizer or accumulated flow rate of 3452.245 m^3, the user will read "0 (0x0000)" from register 0x0004; "3452(0x0D7C)" from register 0x0005, and "245(0x00F5)" from register 0x0006. Then, the totalizer or accumulated flow rate = 0*65536 + 3452 + 245/ 1000 = 3452.245 m^3. **Notes: Please disable the write protection before executing this command.**		

Time counter	0x0050 ~ 0x0052	Write	N
		Read	Y
Description	Time counter		
Value type	UINT 16 + UNIT 32		
Notes	Time counter (minute) = Value (0x0050) Time counter (hour) = Value (0x0051) * 65536 + Value (0x0052) **e.g.,** For a time counter of 12 hours and 10 minutes (12:10), the user will read "10 (0x000A)" from register 0x0050; "0 (0x00000)" from register 0x0051, and "12 (0x000C)" from register 0x0052. Then, the time counter = (0*65536 + 12) hour and 10 minutes = 12:10		

Baud rate	0x0082	Write	Y
		Read	Y
Description	Communication baud rate		
Value type	UINT 16		
Notes	0: baud rate=4800; 1: baud rate=9600; 2: baud rate=19200; 3: baud rate=38400. 4: baud rate=57600. 5: baud rate=115200. The default value is 3. **e.g.,** when the user reads "3" from register 0x0082, the baud rate is 38400.		

GCF	0x008B	Write	Y
		Read	Y
Description	The gas conversion factor for the applicable gas differs from that of the calibration gas.		
Value type	UINT 16		
Notes	The GCF of air is 1000 (default), usually read from register 0x008B. **Notes: The product will disable this function with write protection once the metering gas is confirmed with the proper GCF. For a specific GCF value, please contact the manufacturer.**		

Digital filter depth	0x008C	Write	Y
		Read	Y
Description	Data sampling setting in the software filter		
Value type	UINT 16		
Notes	0 ~ 9 programmable, corresponding to 2^0 ~ 2^9 data sampling in the software filter. The default value is 3, corresponding to 2^3 data samples. **Notes: Please disable the write protection before executing this command.**		

Alarm: Flow rate upper limited	0x0098 ~ 0x0099	Write	Y
		Read	Y
Description	Set an alarm value for an upper flow rate limit.		
Value type	UINT 32		
Notes	Alarm values = Value (0x0098)*65536 + Value (0x0099) When the flow rate is above a set value, an alarm will be triggered. **Notes: Please disable the write protection before executing this command.**		

Alarm: Flow rate lower limit	0x009A ~ 0x009B	Write	Y
		Read	Y
Description	Set an alarm value for a lower flow rate limit.		
Value type	UINT 32		
Notes	Alarm values = Value (0x009A)*65536 + Value (0x009B) When the flow rate is below a set value, an alarm will be triggered. **Notes: Please disable the write protection before executing this command.**		

Offset calibration	0x00F0	Write	Y
		Read	N
Description	Reset or calibrate the offset.		
Value type	UINT 16, Fixed value 0xAA55		
Notes	To reset or calibrate the offset, write 0xAA55 to register 0x00F0. **Notes: When you execute this command, make sure there is NO flow in the flow channel.**		

Reset the accumulated flow rate and time counter	0x00F2	Write	Y
		Read	N
Description	Reset the accumulated or totalized flow rate value, and reset the time counter.		
Value type	UINT 16, Fixed value 0x0001 or 0x0003		
Notes	➢ To reset the accumulated or totalized flow rate value, write 0x0001 to register 0x00F2. ➢ To reset the time counter value, write 0x0003 to register 0x00F2. **Notes: Please disable the write protection before executing this command.**		

Write protection	**0x00FF**	**Write**	Y
		Read	N
Description	Write protection disabler for a set value to a specific register.		
Value type	UINT 16, Fixed value 0xAA55		
Notes	This function is enabled at the time of product shipment. To enable the write function of a specific parameter, such as GCF or offset, the user must send 0xAA55 to register 0x00FF, and then the write function will be enabled (write protection is disabled). After the write execution is completed, the firmware will automatically re-enable the write protection.		

6. Product Selection

The product part number consists of the product model number and suffixes that indicate the full-scale flow rate. Refer to the following for details.

Full-scale flow rate, as well as the other parameters. Refer to the following for details.

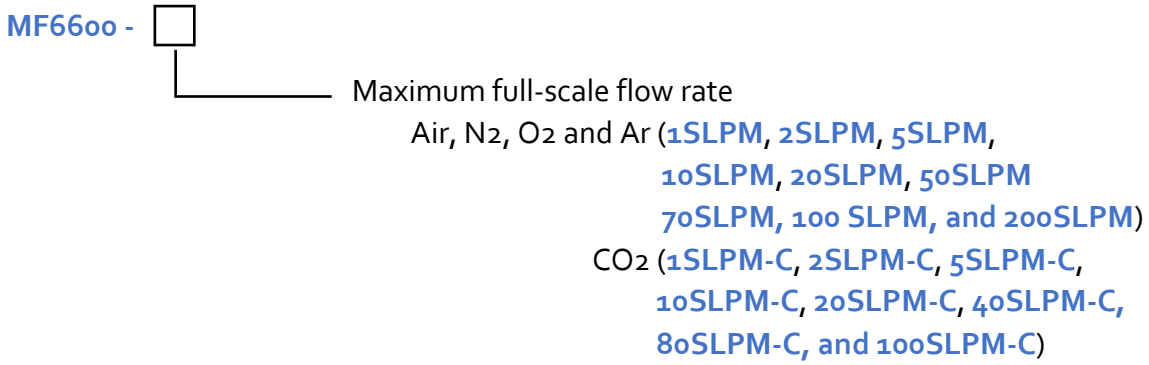


Table 6.1: Units conversion table

sccm	**SLPM**	SCFH	NCMH
1000	**1**	2.12	0.06
2000	**2**	4.24	0.12
5000	**5**	10.59	0.30
	10	21.19	0.60
	20	42.38	1.20
	40	84.76	2.40
	50	105.9	3.00
	70	148.3	4.20

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 air. The product is horizontally mounted during calibration.

	Value	Unit
Full-scale flow range	Air, N_2, O_2, and Ar: 1, 2, 5, 10, 20, 50, 70, 100, 200 CO_2: 1, 2, 5, 10, 20, 40, 80, 100	SLPM
Turn-down ratio	30:1	
Accuracy	±2.0	%FS
Repeatability	0.5	%FS
Working temperature	-10 ~ +55	°C
Maximum pressure	1.0	MPa
Humidity	<95, no condensation	%RH
Power supply	3.6 ~ 24 (50 mA) / lithium-ion battery ER14250	Vdc
Digital output	RS485 Modbus half-duplex	
Electrical connector	USB Type-C	
MENU access	1 function key/digital	
Display	Instant flow rate, accumulated or totalized flow rate	
Control	Manual	
Mechanical connection	BSPT 1/4-Female	
Protection	IP40	
Storage temperature	-20 ~ +65	°C
Reference conditions	20°C, 101.325 kPa, air	
Fluid compatibility	Non-corrosive	
CE	EN61326-1; -2; -3	

Note: 1. For other features or specifications not listed, please get in touch with the manufacturer.

7.1 Wetted materials and compatibility

The product flow channel is made of polybutylene terephthalate. The sensing element comprises silicon, silicon nitride, and silicon dioxide. The sensor chip surfaces are passivated with silicon nitride and silicon dioxide. The electronic sealing is provided by LOCTITE Ablestik 84-3J. Another wetted material that may be exposed is FR-4.

8. Technical Notes for the Product Performance

8.1 Measurement Principle

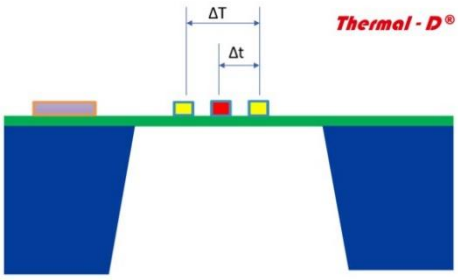


Figure 8.1: Measurement approach illustration.

The products utilize the Company's proprietary micro-machined (MEMS) thermal calorimetric sensing with time-domain data and data processing technology. A thermal signal generator features a pair of sensing elements positioned upstream and downstream of the microheater. These elements are precisely manufactured and separated at predefined micrometer distances on the chip surface, ensuring excellent thermal isolation. When a fluid flows through the sensing chip, it carries the thermal signal downstream. The sensing elements register the amplitude, time, and temperature differences, calculate the thermal diffusivity, and then correlate it with the fluid mass flow rate through the calibration process.

This unique thermal sensing approach offers a large dynamic range with better performance against environmental parameter alternations. It is the first of its kind in the industry to provide gas property-independent mass flow measurements for gases with similar thermal diffusivities. It significantly simplifies process control with high precision and easy maintenance. Please refer to the company's U.S. patents and other publicly available publications for additional information.

8.2 Precautions for the Best Performance of the Product

8.2.1 Comparison with a Third-Party Reference Meter

It is common for users to compare product data with a third-party reference meter, and in many cases, discrepancies may arise.

When performing such a comparison, please note that the reference meter should have a better-specified accuracy (approximately one-third of the product's accuracy). Pay special attention to the differences in reading accuracy and full-scale accuracy.

A full-scale accuracy = reading accuracy x (full-scale flow rate/ set point (current) flow rate)

Another key point to comparing the different flow meters is that as long as the fluidic flow is a continuous flow without pulsation, then the fluid dynamics will have the system following the Bernoulli equation:

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

Where ρ is the fluid density, g is the acceleration due to gravity, P1 is the pressure of the reference meter, P2 is the pressure at the test meter, v1 is the velocity of the reference meter, and v2 is the velocity of the test meter. h1 and h2 are the corresponding heights for the meters, which are generally the same in the system. Therefore, the system must have no pressure variation. (This explains our recommendations for the installations in Section 4). Additionally, the meter measurement principle is often crucial for understanding any discrepancies.

Please note that when comparing with a rotameter, the reading may have large deviations due to different measurement principles, particularly since a rotameter is sensitive to pressure and temperature variations.

8.2.2 Control Flow with a Manual Valve

The precision of the control will be heavily dependent on the valve characteristics. The valve is specified by its turns, ranging from completely closed to open fully. The current product is shipped with a 12-turn valve for the full scale, but can be configured with high-precision valves that offer up to 16 turns. Contact the manufacturer for additional information.

8.2.3 Particle Contamination and Fluidic Cleanness

Any contamination, including particles and liquid vapors, would be detrimental to both the accuracy of the flow measurement and the meter's functionality. It is essential to ensure that the applied flow medium is clean and dry. If any contamination is suspected, please allow experienced technical personnel to inspect and recondition it. Do not use a foreign cleanser or other fluids to clean the flow path, as this could cause irreparable damage.

8.2.4 Apply to a Different Gas Medium

The product is calibrated using a high-precision NIST-traceable metrological standard with clean and dry air. If the meter is to be used for measuring another clean and dry gas, a correct gas conversion factor must be registered in the meter before the measurement.

The meter operates similarly to the principle described in the international standard for thermal mass flow meters (ISO 14511:2001 - Measurement of fluid flow in closed conduits — Thermal mass flowmeters). Due to the meter assembly procedure, the head loss value from the meter to the meter would not be 100% identical. Within the extensive dynamic measurement range, the thermal response also exhibits deviations and nonlinearity from gas to gas. Therefore, measuring a gas

medium other than the calibration gas by the meter would result in larger measurement errors, particularly in the low Reynolds number range, where the laminar flow has a sensitive flow profile.

9. Troubleshooting

Phenomena	Possible causes	Actions
No signal/display	The power is not connected; the battery is empty	Connect the power, check the cable
	Cable connection incorrect	Check cable
	No flow or clogging	Check flow and contamination.
	Power regulator failure	Return to factory
	Sensor failure	Return to factory
Significant errors or unexpected flow rate	Particles, fluid type	Check system
Erroneous or large noise	Vibration, unstable flow	Check system
Valve not work	Valve installation	Return to factory
Offset unstable	Circuitry instability	Check the system, power off
No digital interface	Wrong address, software	Check commands, connection
The screen is flashing with the battery	Wrong battery type or chamber engagement	Check the battery type, capacity, and push the chamber installation

10.Warranty and Liability

(Effective January 2018)

Siargo warrants that the products sold hereunder will be used appropriately and installed correctly under normal circumstances and service conditions. 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 of a serviced product shall be subject to the same terms outlined 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 fully responsible for validating the performance and suitability of the products for their particular design and applications. For any misuse of the products beyond 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, expenses, or reasonable attorney fees 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., 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, 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. Products returned under warranty to Siargo shall be at the user's 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 or when 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, as 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 damage;
(3) Products that have been opened or dismantled for whatever reason;
(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 unauthorized dealers or any third parties resell.

11. Service/order Contact and Other Information

Siargo Ltd. is making every effort to ensure the quality of its products. For questions or product support, please get in touch with your direct sales representative. If you need additional assistance, please reach out to customer service at the address listed below. We will respond to your request promptly and work with you to ensure your complete satisfaction.

For sales or product orders, please get in touch with the local sales representatives or distributors listed on the company's webpage: www.Siargo.com.

For any returns, please get in touch with your direct sales representative to obtain a Return Materials Authorization (RMA). Alternatively, you can contact info@siargo.com for additional information or to request an RMA before shipping the product back to the factory for services such as calibration. Please specify in your email message that you intend to return the product to the factory and include your shipping address. Be sure to write the RMA on the returned package or include a letter with the RMA information.

Direct customer service request(s) should be addressed to

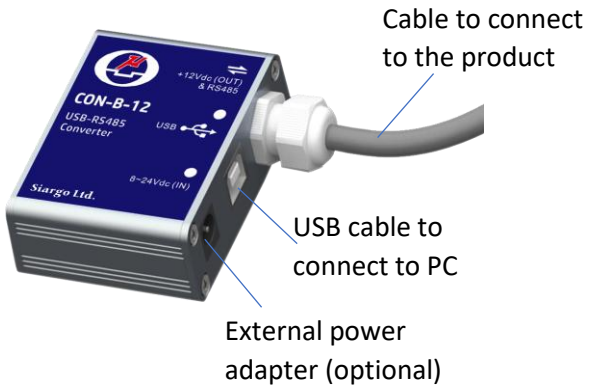
Siargo Ltd.
4677 Old Ironsides Drive, Suite 310,
Santa Clara, California 95054-1857, USA
Tel: +1(408)969-0368
Email: Info@Siargo.com

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

Appendix I: Product Evaluation Kit

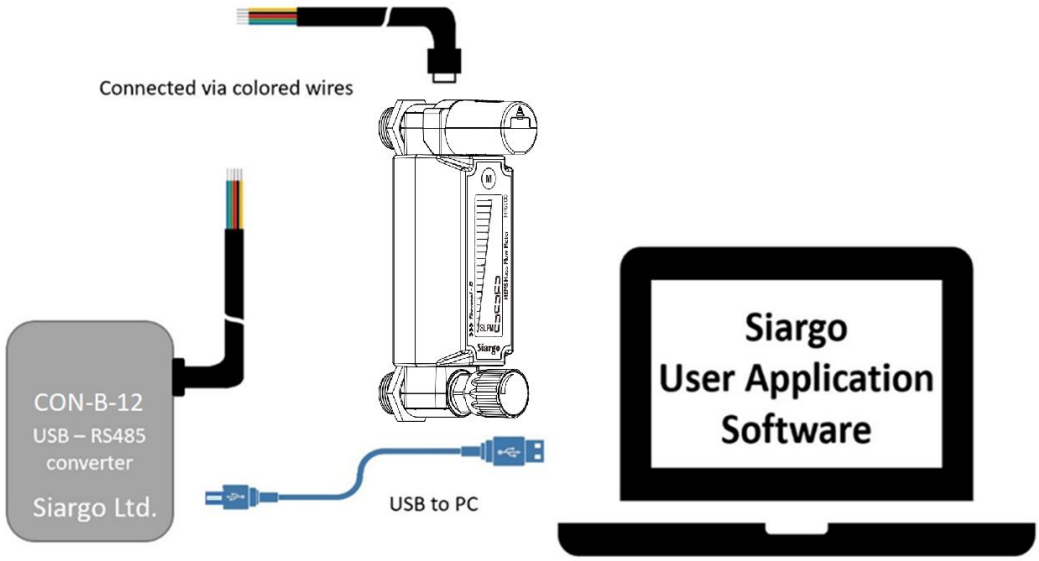
Siargo offers a product evaluation kit that includes a digital data converter, USB data cable, and User Application software, allowing the user to evaluate the product's performance on a Microsoft Windows-based computer. This kit could serve applications requiring digital data transfer. Users can read and visualize the product's flow rate, obtain totalizer or accumulated flow rate values, and save the data for further analysis. It can read from up to 128 sensors via the RS485 serial interface.

For further information and purchase of the evaluation kit, please get in touch with the manufacturer or the sales representative.



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 products, the power from the PC via the USB cable will be sufficient to power the sensor; 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 necessary.



Appendix II: Document History

Revision VA.0.02 (October 2025)

- Update the full-scale range.

Revision VA.0.01 (August 2025)

- Corrections.

Revision VA.0 (June 2024)

- Initial release.