Siargo Ltd.



Gas Mass Flow Meter VC.0.02

Model MF2000

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Gas Mass Flow Meter

with MEMS calorimetric sensing technology

MF2000 Series

User Manual

Document No. 11-2025-MF20 EN
Issue date: 2025.11
Revision: VC.0.02

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Attention!

- Please ensure that each specification in this manual is fully understood for its application in a specific application. Please consult the manufacturer before applying it in working conditions beyond the specifications. Otherwise, the product may not function properly, may be damaged, or cause other irreversible consequences.
- Before starting the application of this product, a leakage test must be performed as a safety precaution after installation.
- All local regulatory requests should be observed and verified for additional safety precautions.
- The product performance requires pre-calibration that would best be applied to the necessary conditions. Use of the product in other conditions may lead to unexpected results or even to irreparable damage.
- Operation, installation, storage, and maintenance of the product must strictly follow the instructions detailed in this user manual. It is highly recommended that the maintenance be performed by skilled personnel or trained operators. Unpredicted consequences may otherwise be caused. Qualified operators must handle all the installation, storage, and maintenance of the product. This user manual should be placed near the product for easy access.
- Before using the product, the user should read this user manual carefully and thoroughly.
- It is recommended that the product be recalibrated and maintained every two years or at a specific time period if deemed necessary.

Use with caution!

- Do not apply this product to any gas medium that contains excessive liquid or solid debris, which may lead to malfunction or unrecoverable damage of the product.
- Do not change any software or hardware of the product. All software and hardware of the product have been certified at the time of manufacture.
- Do not use any unit of the product if there is a suspicion of a malfunction.
- Do not use this product in any excessive radiation or vibration environment.
- Only qualified or accredited personnel by Siargo can perform repair services. Siargo shall not be liable for any products that have been altered or damaged before shipping for product verification and services.
- When communicating with the meter via the communication port, such as downloading the historical data from the meter, it is highly recommended that a Siargo handheld accessory be used to avoid a direct, unsafe electrical connection.
- The product body is made of aluminum alloy. Do not hammer or use sharp tooling during installation.
- The meter connections are threaded with NPT standard. Please make sure the pipe connectors have the same thread. Force connection would cause unpredictable damage and/or irrecoverable malfunction.
- Read the manual carefully before performing any maintenance or troubleshooting.

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1. Overview

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

MF2000 series MEMS mass flow meters are designed for industrial gas process metering, control, and management. The products directly measure the gas mass flow rate, data safety, and process. They are also ready for remote data management via RS485 Modbus or 4~20mA protocol. The products can be selected for pipe diameter from 25 to 50 mm with standard accuracy of ±(2.0+0.5FS)%.

The products are manufactured with reference to ISO-14511.

The products have the following features:

- Proprietary low-power MEMS mass flow sensing technology
- Direct mass flow metering without additional temperature and pressure compensation
- Pressure output selectable
- A stainless steel enclosure is suitable for various gases
- In meter data storage for data safety, and downloadable for further processing
- RS485 Modbus or 4~20mA remote data protocol
- Large dynamic measurement range

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, and 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 inside. The power adapter and/or data cable, as shown below, may also be found according to your actual order.



Figure 2.1: MF2000 flow meter

Please check immediately for the integrity of the product. 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 LED screen will not be lit until powered up. This user manual shall also either be included in the packing box or be available via an online request for an electronic version. In most cases, this manual shall be made available to the customer before the actual order.

3. Knowing the products

3.1 Product description

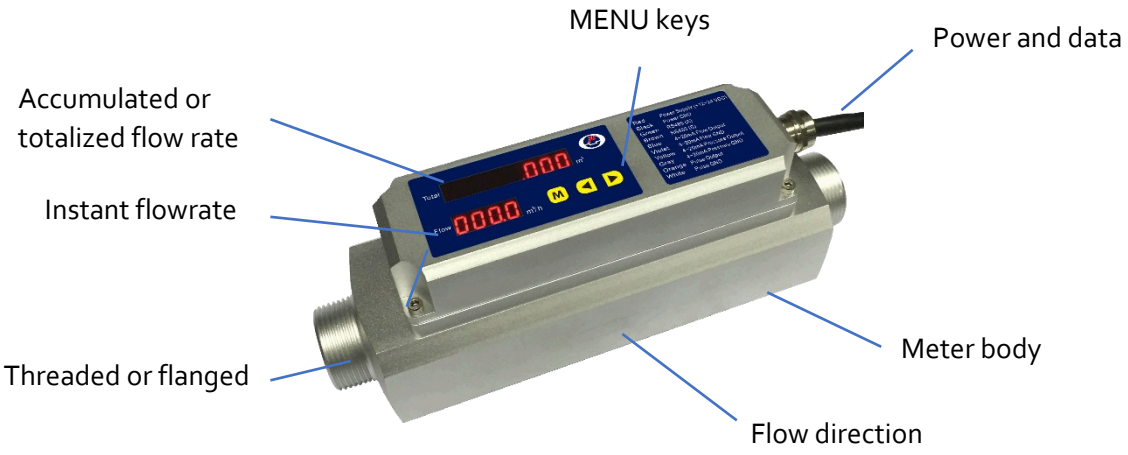


Figure 3.1: MF2000 parts description

3.2 LED description

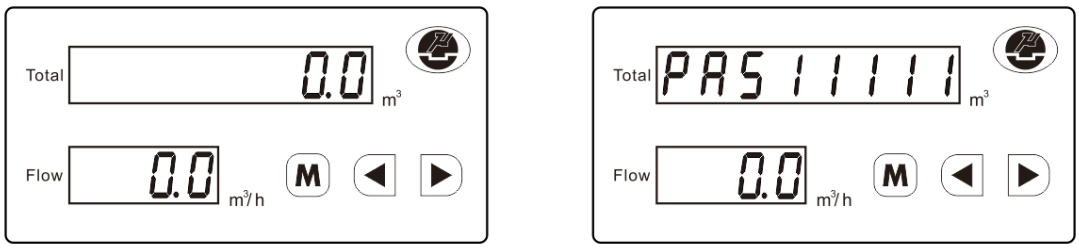


Figure 3.2: LED symbol illustration

The LED provides all the information that the product measures. Some symbols are reserved for future upgrades and will not be lit during the operation. The following table details the meaning of each of the symbols.

When there is an error, the lower row will display the error code E1 through E4.

Table 3.1: Symbols description

Flow	The upper row displays the instant flow rate, which can be selected from two units (NL/min or Nm^3/h) via the MENU key or Modbus.
Total	The lower row displays the accumulated or totalized flow rate, or the instant pressure value if a pressure sensor is integrated—the accumulated or totalized flow rate in Nm^3 (Normalized cubic meters). Here, the standard (normalized) conditions refer to 20°C, 101.325kPa.
LoRaWAN	When the LoRaWAN is connected, the light will be on.
E1	Error 1 – Sensor error
E2	Error 2 – Sensor contaminated or reverse flow
E3	Error 3 – Hardware errors
E4	Error 4 – Overflow
P	Pressure, for models with a pressure measurement option

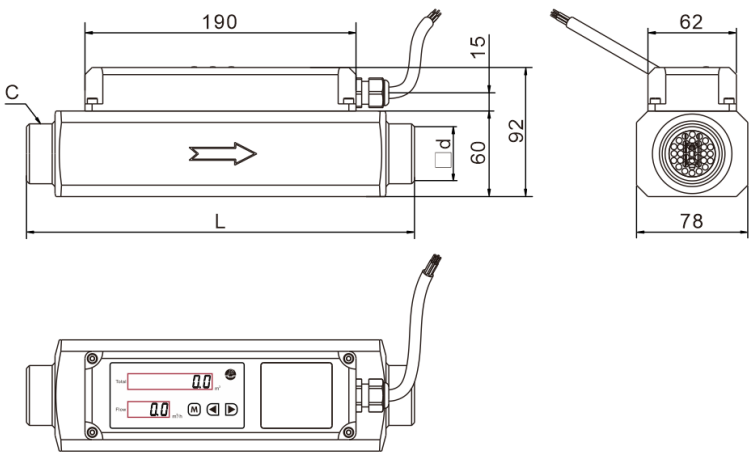
***Note:** Pressure sensors can be integrated with the current product, but not with the default models. Temperature data can only be accessed via a digital interface. Please get in touch with the manufacturer for further information.

3.3 Power and data cable description

Table 3.2: MF2000 wire assignments

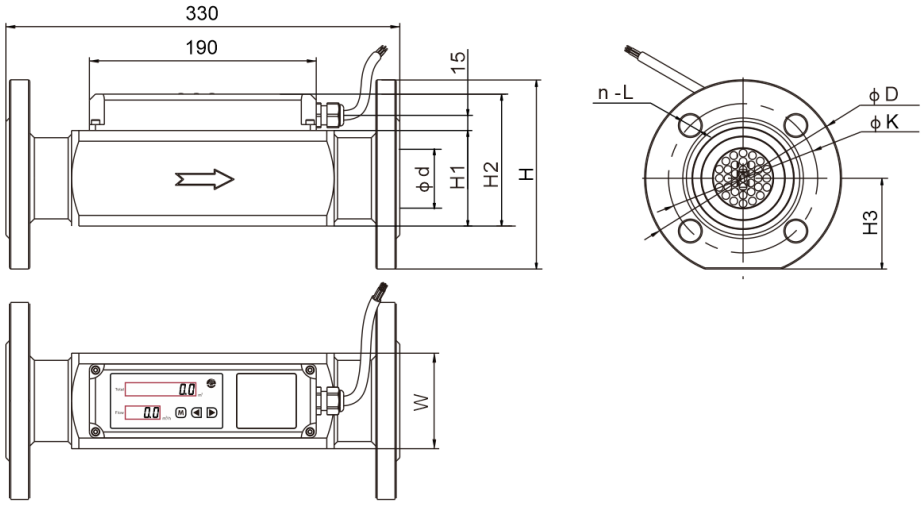
Color	Definition
Red	Power supply (+12 ~ +24VDC)
Black	Power GND
Green	RS485(A)
Brown	RS485(B)
Blue	4~20mA flow signal output
Violet	4~20mA flow signal GND
Yellow	4~20mA pressure signal output
Gray	4~20mA pressure signal GND
Orange	Pulse signal output
White	Pulse GND

3.4 Mechanical dimensions



Model	L	C	d
MF2025	270	BSPT 1	25
MF2032	272	BSPT 1 1/4	32

Figure 3.3: MF2025/MF2032 dimensions with thread



Model	W	H	H1	H2	H3	D	d	K	n-L
MF2025	78	115	60	92	53	115	25	85	4 - ϕ 14
MF2032	78	134	60	92	64	140	32	100	4 - ϕ 18
MF2050	84	159	70	102	76	165	50	125	4 - ϕ 18

Figure 3.4: MF2000 dimension with flange

4. Installation

Cautions

(1) The meter can be either installed horizontally or perpendicularly. A horizontal installation is recommended for easier meter reading.

(2) After the installation pipe is prepared, make sure there are no metal particles or other harmful debris present inside the flow channel. Avoid strong vibration sources, fire sources, direct exposure to rain, or sun, or other sources that may lead to safety issues.

(3) Ensure the product is free of visible damage. Check the meter's power status and ensure there are no abnormalities in the display or other indications.

(4) Engage the meter with the prepared installation pipe, making sure the thread or flange can properly seal. Check the meter position and make sure there are no twists or other mechanical faults.

(5) The flow measurement direction marked on the meter should be aligned with the flow direction in the flow channel.

(6) It is recommended that a highly efficient filter be installed before the meter.

(7) To ensure the proper operation of the meter, make sure that there is no presence of foreign gases other than the designated ones.

(8) The meter should be installed, avoiding valves, sharp turns, and other obstacles close to the meter.

Recommended installation steps:

(1) Check the meter and make sure there is no physical damage.

(2) Connect the meter with the clean pipelines. Use the pipe gas to clean up the debris or other foreign materials. Ensure the pipeline is clean before installation.

Note: (a) a high-efficiency filter should be installed upstream to avoid direct particle impact;

(b) At least 10XDN straight pipeline should be kept in front of the meter, and 5XDN straight pipeline should be installed at the exit of the meter.

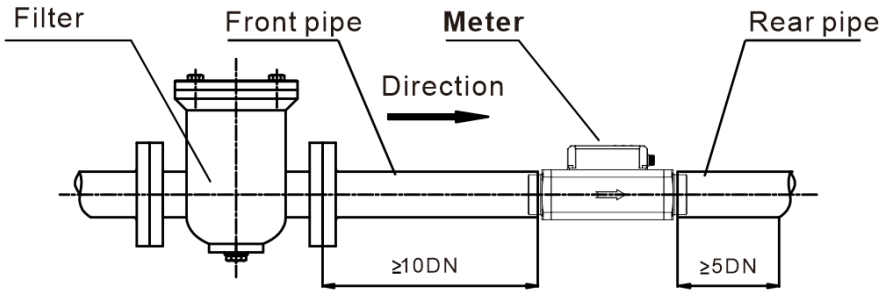
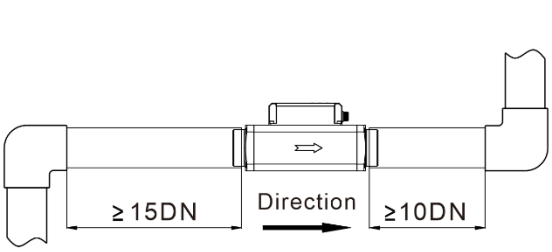
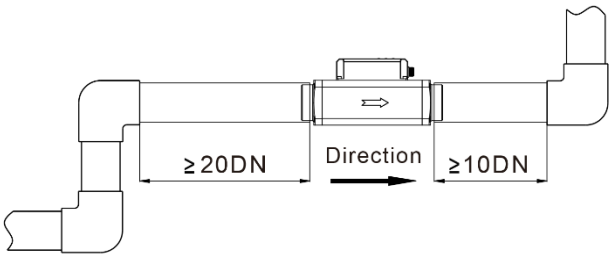


Figure 4.1: MF2000 installation

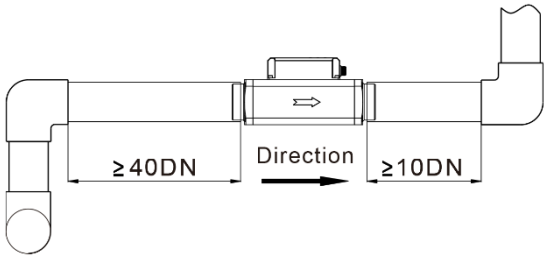
In the following field cases, the straight pipelines before and after the meter should be extended as shown below:



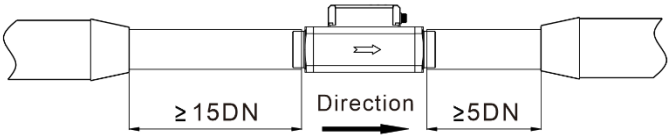
(a) 90-degree elbow or T-piece



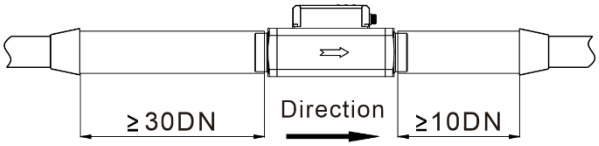
(b) 2x90-degree elbow



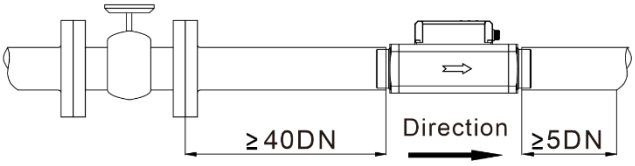
(c) 2x90-degree elbow, 3D



(d) Pipe size-reduction



(e) Pipe size expansion



(f) Control valve at upstream or downstream

Figure 4.2: MF2000 installation

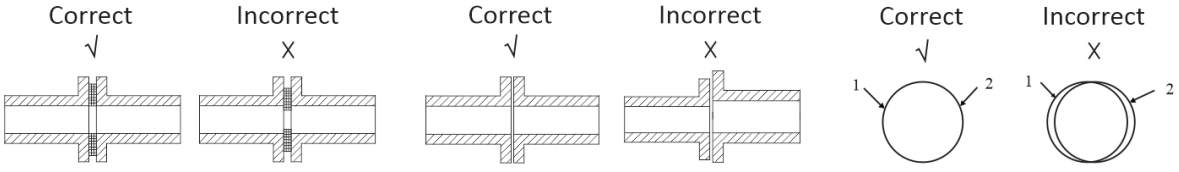
(3) Engage the meter to the pipeline and start the installation.

a) It is recommended to start the connection of the upstream of the meter

b) The seal gasket should not intrude into the flow channel. The size of the gasket should not be smaller than the inner diameter of the flow channel. Avoid liquid penetration into the channel.

c) The inner diameter of the meter pipe should be identical to that of the pipeline.

d) Graphs below refer to the ISO14511 installation guidance.



(4) If the remote data cable needs to be connected, make sure the user interface wiring instructions are read before starting the wiring.

(5) Before opening the valves connected to the pipes, check the meter. If the meter is measuring a trace flow, check the leakage of the pipeline, including the possibility of valve leakage.

(6) After completing the installation, open the valves at upstream and downstream. The meter should start the reading.



Additional cautions

(1) The welding of the pipelines while the meter is running is prohibited.

(2) The pipeline must be ensured to be clean before installation of the meter(s);

(3) The sealing gasket must not be intruded into the flow channel; The alignment must be done appropriately before engagement of the meter.

(4) A highly efficient particle filter (<50 μ) is strongly recommended at the upstream of the meter;

(5) After the installation, the pipeline should be free of stress.

(6) It should avoid the presence of a strong magnetic or vibrational field;

(7) It should avoid abruptly opening or closing the valve that may create strong pulse flow, causing the instability of the system.

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 located on the back panel of the product.

The detailed product technical specifications can be found in Section 7. For a specific application, the pressure rating must not be higher than the system pressure to be measured, and the flow range should also be within the specified range. In most cases, the use of a high full-scale range meter for the very low flow rate measurement 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 the product to be used according to the 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 of the specified ones 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 correctly connected to the receiver side.

5.4 Meter MENU descriptions

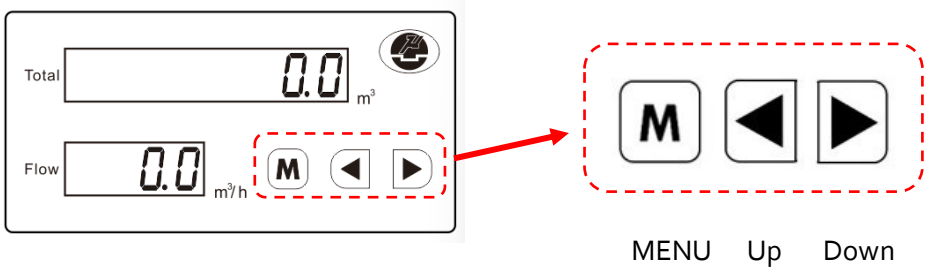


Figure 5.1: MF2000 keys description

The meter features a front 3-key board, allowing users to set desired functions, access data, and check the status. The Menu key (M) is in the left position, allowing the user to select a function and perform confirmation or other related actions, which will be detailed below. Two keys ("Up" and "Down") to select the menu and sub-menu.

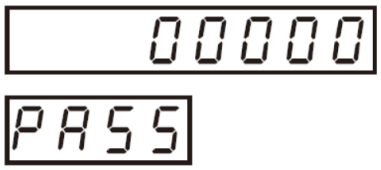
5.4.1 Starting the measurement

Once the power is supplied and no abnormal issues are observed, the meter is ready to perform the measurements. The default display is for the mass flow measurement, having two numerical lines on the LED. The upper line is the instant flow rate, and the lower line is the accumulated or totalized flow rate. The lower line will light up when the pressure option is selected.

The LED capability limits the display characters; the following table is an illustration.

A/a	B/b	C/c	D/d	E/e	F/f	G/g	H/h	I/i	J/j	K/k	L/l	M/m	N/n	O/o	P/p	Q/q	R/r
S/s	T/t	U/u	V/v	W/w	X/x	Y/y	Z/z	1	2	3	4	5	6	7	8	9	0

5.4.2 MENU entry with a verified password



At the flow measurement (primary) display, press the central "M" MENU key for three seconds, and it will enter the password setting and verification MENU. The default password is "11111". If the password is incorrect, the display will return to the main display.

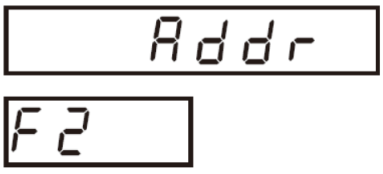
To enter a new password, press the "Up" or "Down" key to change the digit that flashes, and press the "M" key to confirm. Repeat this process for all five digits, and the meter will enter the menu setting interface/screen.

Subsequently, the MENU allows the user to:

- Set Modbus address — F2 - Addr
- Change communication baud rate — F3 - bPS
- Reset or calibrate the offset — F11 - oFFST
- Enter the gas correction factor (GCF) — F12 - GCF
- Set the 2nd-correction factor — F14 - Corr
- Change the response time — F16 - rESPS
- Set the pulse — F41 – PULSE
- Change the default password — F91 - PASS
- Clear or reset the accumulated or totalized flow rate — F92 - CLr-A
- Reset the 2nd-correction factor — F94 - rS2nd
- Exit from the MENU — F99 - qUIT

Note: During this process, the meter will continue to measure the flow without being interrupted.

5.4.3 Set the RS485 Modbus address



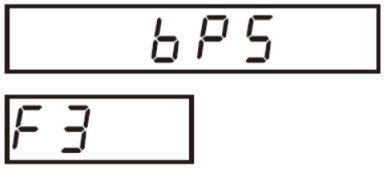
After the password is verified and entered into the MENU settings, press the "Up" or "Down" key until the screen shows the F2-Addr as indicated to the left.

The Modbus address has 3 digits, which can be any number between 001 and 247. Press the "M" key to enter the change address screen. Press the "Up" or "Down" key to change the flashing digits, and then press the "M" key to confirm. After the address is set, the display will return to F2 - Addr, which indicates the task is completed. Press the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

Note: The default address is 1.



5.4.4 Set the RS485 communication baud rate

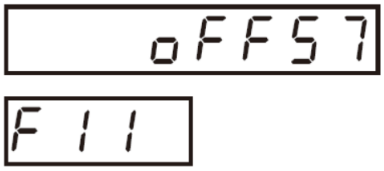


Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F3-bPS and then press the "M" key to set the RS485 communication baud rate.

There are six baud rates selectable, depending on your system requirements: 4800, 9600, 19200, 38400, and 57600. The default baud rate is 9600. Use the "Up" or "Down" key to select the desired one and press the "M" key to confirm. The display will then return to the F3-bPS screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



5.4.5 Reset or calibrate the offset



After a certain period of usage, the meter's offset (zero flow rate) may exhibit a slight shift. When applying the meter to different gases, the offset might shift. To ensure measurement accuracy, it is necessary to reset or calibrate the offset. Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F11 - oFFST. Before performing the task, ensure there is no flow in the flow channel; otherwise, it will lead to even more erroneous measurement results.

Press the "M" key to confirm the task, and it will open the sub-MENU asking you to confirm. Use the "Up" or "Down" key to select the desired one and press the "M" key to confirm. The display will then return to the F11 - oFFST screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



5.4.6 Gas conversion factor (GCF) for different gas measurements

For the general purpose of the application, a gas conversion factor (GCF) can be applied to measure the gas differently from the default one or the one used for calibration. The GCF is determined by the thermal calorimetric sensing principle, as well as the meter fluidic dynamic design and the control circuitry. Contact the manufacturer to obtain the values corresponding to the correct models.

The GCF for air is 1000.

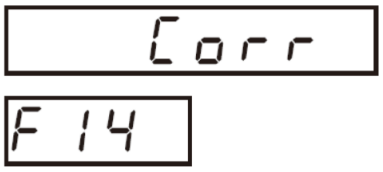
Note: If the meter is ordered for a special real gas calibration during purchase, contact the manufacturer before proceeding further.



Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F12 - GCF. Press the "M" key to confirm, and it will open the sub-MENU showing the current gas conversion value. Use the "Up" or "Down" and the "M" confirming key to input the desired value, and press the "M" key again to complete the task. The display will then return to the F12 - GCF screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

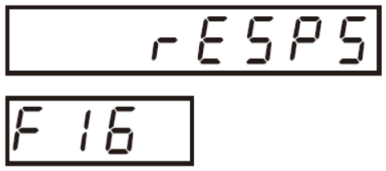


5.4.7 Set the 2nd-correction factor



Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F14 - Corr and then press the "M" key to set the 2nd correction factor.

5.4.8 Set the Response time

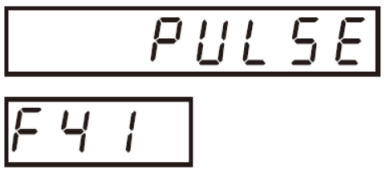


Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F16 - rESPS and then press the "M" key to set the response time.

There are six selectable response times: 125, 250, 500, 1000, 2000, and 5000 milliseconds. The default response time is 125 msec. Use the "Up" or "Down" key to select the desired one and press the "M" key to confirm. The display will then return to the F16 - rESPS screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



5.4.9 Set the pulse



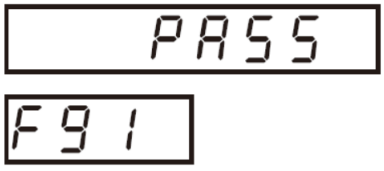
Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F41 - PULSE and then press the "M" key to set the pulse output for the accumulated or totalized flow rate.

There are five pulse outputs selectable: 0.001 SL/pulse (display shows: 10-3), 0.01 SL/pulse (display shows: 10-2), 0.1 SL/pulse (display shows: 10-1), 1 SL/pulse (display shows: 1) and 10 SL/pulse (display shows: 10). The default pulse output is 1 SL/pulse (display shows: 1). Use the "Up" or "Down" key to select the desired one and press the "M" key to confirm. The display will then return to the F41 - PULSE screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



5.4.10 Change the default password

For data safety, it is recommended that the default password of 11111 be changed when using this product for the first time.

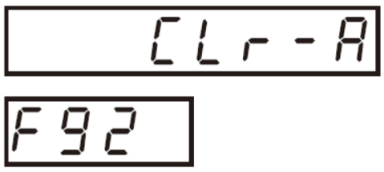


Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F91 - PASS. Press the "M" key to confirm, and it will open the sub-MENU showing the default password of 11111. Use the "Up" or "Down" keys and the "M" confirming key to select the desired option, and press the "M" key again to complete the task. The display will then return to the F91 - PASS screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

Please keep the changed password in a safe yet accessible place. In case it is unrecoverable, please get in touch with the manufacturer to obtain a special password to access the meter MENU.



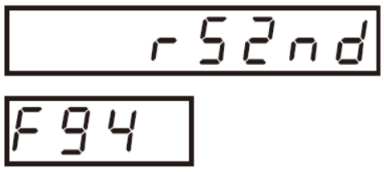
5.4.11 Reset the accumulated or totalized flow rate



As the maximum value of the accumulated or totalized flow rate that the internal register can have is 9999999, the register will stop accumulating once the value is reached. At this time, it is necessary to reset this register. Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F92 - CLr-A. Press the "M" key to confirm, and it will open the sub-MENU for resetting the value. Use the "Up" or "Down" keys to select, and the "M" key to confirm and execute. Press the "M" key again to complete the task. The display will then return to the F92-Clr-A screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

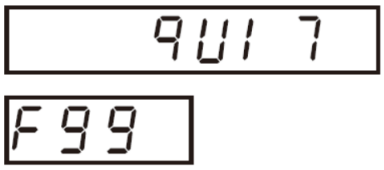


5.4.12 Reset the 2nd-correction factor



Following the above-mentioned steps, at the MENU setting screen, use the "Up" or "Down" key to select F14 - Corr and then press the "M" key to set the 2nd correction factor.

5.4.13 Exit the MENU



At the MENU settings, use the "Up" or "Down" key to select the F99 - qUIT option and press the "M" confirming key to exit the MENU settings and return to the Main Display screen.



5.4.14 MENU key sequence for the settings

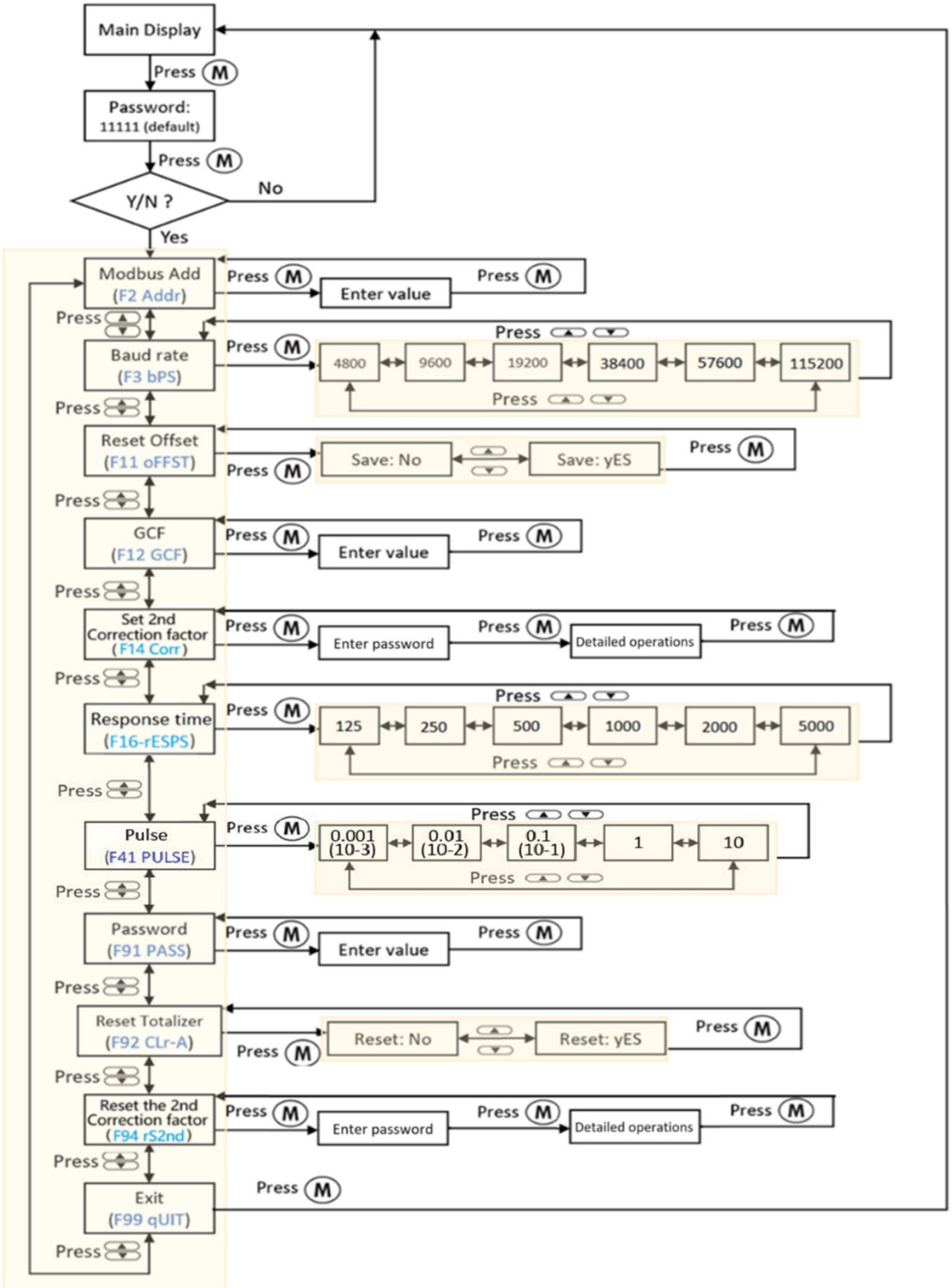


Figure 5.2: MF2000 MENU key sequence

5.5 RS485 Modbus communication protocol

The digital communication protocol Mode P2 is based on the standard Modbus RTU Half-plex mode. A master (PC or PLC) can communicate with multiple slaves (the current product) for data exchange and configuration of communication parameters. Refer to Table 3.2 for the cable connection.

5.5.1 Hardware connection

The hardware layer is TIA/EIA-485-A, as illustrated below. In this configuration, the product (MF2000) is a slave.

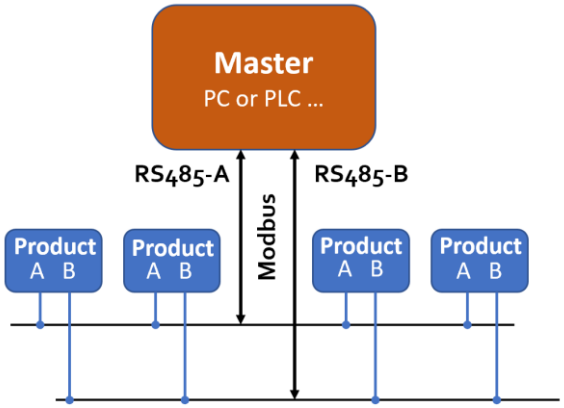


Figure 5.3: RS485 hardware connection

5.5.2 Communication parameters

The PC UART communication parameters are listed in the following table.

Parameters	Protocol
	RTU
Baud rate (Bits per second)	9600 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:

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 (MF2000)'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 the sub-class of the standard Modbus function codes. These codes are used to set or read the registers of the product:

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 (MF2000) has multiple registers available for the assignment of the 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, and the registers may be customized upon contacting the manufacturer.

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.

Functions	Description	Register	Modbus reference
Address	Product address (R/W)	0x0081	40130 (0x0081)
Serial number	Serial number of the product	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)
Pressure	Gas pressure (R)	0x0045 ~ 0x0046	40070 (0x0045)
Baud rate	Communication (R/W)	0x0082	40131 (0x0082)
GCF*	Gas correction factor (R/W)	0x008B	40140 (0x008B)
Password*	Password change (R/W)	0x00AE ~ 0x00AF	40175 (0x00AE)
Offset calibration	Reset or calibrate the offset (W)	0x00F0	40241 (0x00F0)
Reset accumulated flow *	Reset accumulated or totalized flow rate (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, you need to disable the write protection before setting.

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

Address	**0x0081**	**Write**	Y
		Read	Y
Description	RS485 Modbus address of the flow meter		
Value type	UINT 16		
Notes	Values range from 1 to 247, excluding 157 (0x9d). Broadcast address 0 is not enabled. **The default address is 1.**		

SN, Serial number	**0x0030 ~ 0x0035**	**Write**	N
		Read	Y
Description	Series Number of the product, SN		
Value type	ASCII		
Notes	SN= value(0x0030), value(0x0031),….,value (0x0035); **e.g.:** Receiving 12 bits as: 0x2A47, 0x3741, 0x4549, 0x3032, 0x3035, 0x382A, the corresponding Serial Number is **G7AEI02058**.		

Instant flow rate	**0x003A ~ 0x003B**	**Write**	N
		Read	Y
Description	Instant flow rate		
Value type	UINT 32		
Notes	Flow rate = [Value (0x003A)*65536 + value (0x003B)]/1000 **e.g.:** For a flow rate of 20.340 Nm^3/h, the user will read "0 (0x0000)" from register 0x003A and "20340 (0x4F74)" from register 0x003B, therefore Instant flow rate = (0*65536+20340)/1000 = 20.340 Nm^3/h		

Accumulated flow rate	0x003C ~ 0x003E	Write	N
		Read	Y
Description	Accumulated or totalized flow rate		
Value type	UINT 32 + UNIT 16		
Notes	Accumulated flow rate = Value (0x003C) * 65536 + Value (0x003D) + Value (0x003E)/1000 **e.g.:** For an accumulated flow rate of 3452.245 m^3, the user will read "0 (0x0000)" from register 0x003C; "3452 (0x0D7C)" from register 0x003D, and "245 (0x00F5)" from register 0x003E. Then, the accumulated flow rate = 0 + 3425 + 245/1000=3425.245.		

Pressure	0x0045 ~ 0x0046	Write	N
		Read	Y
Description	Gas pressure		
Value type	UINT 32		
Notes	Gas pressure = [Value (0x0045)*65536 + value (0x0046)]/1000 **e.g.:** For a gas pressure of 300.000 kPa, the user will read "0 (0x0004)" from register 0x0045 and "3452 (0x93E0)" from register 0x0046, therefore Gas pressure = (4*65536+37856)/1000 = 300.000 kP.		

Baud rate	0x0082	Write	Y
		Read	Y
Description	Communication baud rate with a PC		
Value type	UINT 16		
Notes	0 - 4800; 1 - 9600; 2 - 19200; 3 - 38400; 4 - 57600; 5 - 115200. **The default value is 1, and the baud rate is 9600.** **For example, when** the user reads "1" from register 0x0082, the baud rate is 9600.		

GCF	0x008B	Write	Y
		Read	Y
Description	The gas conversion factor for a gas is different from the calibration gas.		
Value type	UINT 16		
Notes	The air (default) is 1000, usually read from register 0x008B. **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. **Notes: Please disable the write protection before executing this function.**		

Change password	0x00AE ~ 0x00AF	Write	Y
		Read	Y
Description	Change the default password		
Value type	UINT 32		
Notes	Password values = Value (0x00AE)*65536 + Value (0x00AF) Available: 00000 ~ 99999 **Notes: Please disable the write protection before executing this function.**		

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. **When you execute this function, make sure there is NO flow in the flow channel.** **Notes: Please disable the write protection before executing this function.**		

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

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, the user needs to send 0xAA55 to the 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 and order information

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

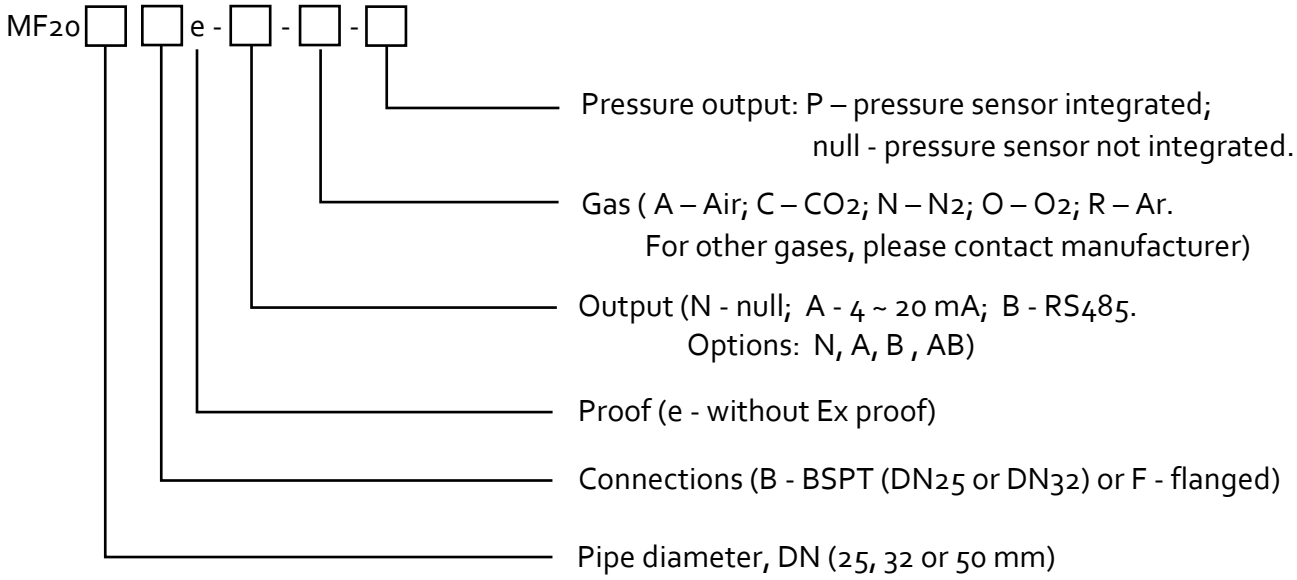


Table 6.1: The Product models and Flow ranges.

Model	Pipe size (mm)	Maximum flow rate (Nm^3/h)	Minimal flow rate (Nm^3/h)
MF2025	25	100	2.0
MF2032	32	160	3.0
MF2050	50	400	10.0

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	See Table 6.1	
Accuracy	±(2.0+0.5FS)	%
Repeatability	(0.5+0.15FS)	%
Turn-down ratio	50:1	
Pressure range (Optional)	15 ~ 700	kPa
Pressure accuracy	±2.5	%
Working temperature	-10 ~ +55	°C
Maximum pressure	1.0	MPa
Humidity	(10 ~ 90) %RH, no condensation	
Power supply	12 ~ 24 (50 mA)	Vdc
Digital output	RS485 Modbus half-duplex, 4 ~ 20 mA	
MENU access	3 key – front face keyboard/digital	
Display	LED: instant flow rate, accumulated or totalized flow rate	
Mechanical connection	BSPT of flange	
Storage temperature	-20 ~ +70	°C
Reference conditions	20°C, 101.325 kPa, air	
Fluid compatibility	Non-corrosive	

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

8. Technical notes for the product performance

8.1 Measurement principle

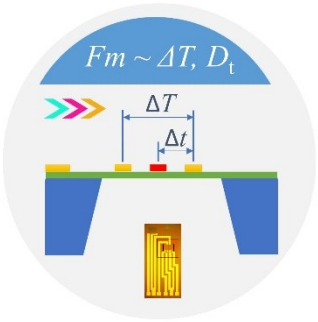


Figure 8.1: Illustration of the measurement principle.

The products utilize the Company's proprietary micro-machined (MEMS) calorimetric sensing technology with thermal diffusivity detection and data processing technology. A thermal signal generator with a pair of sensing elements upstream and downstream of the microheater is precisely manufactured and separated at predefined micrometer distances on a chip surface with excellent thermal isolation. When fluid flows through the sensing chip, the fluid carries the thermal signal downstream. The sensing elements register the temperature differences and measure the fluidic thermal diffusivity, further correlated to the fluid mass flow rate via the calibration process.

Compared to the calorimetric sensing products offered by other manufacturers, the proprietary sensing approach provides an extensive dynamic range with better performance against environmental parameter alternations. It removes some gas sensitivities for gases with the same diffusivity and improves the linearity when a gas conversion factor is used for the metering of the non-calibration gases. 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 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 (about 1/3 of the product), and pay special attention to the differences in the 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, it would be very critical to have the system with a pressure variation as minimal as possible. (This explains our recommendations for the installations in Section 4). Also, the meter measurement principle is often very important for the understanding of any discrepancies.

8.2.2 Particle contamination and fluidic cleanness

Any contamination, including particles and liquid vapors, would be detrimental to the accuracy of the flow measurement and also to the meter functionality. It is important to ensure the applied flow medium will be clean and dry. If any contamination is suspected, please allow experienced technical personnel to have it checked and reconditioned. Do not use a foreign cleanser or other fluids to clean the flow path, which could bring irrecoverable damage.

8.2.3 Apply to a different gas medium

The product is calibrated with a high-precision NIST traceable metrological standard with clean and dry air. In case the meter is applied to meter the other clean and dry gas, a correct gas conversion factor needs to 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. At the extensive dynamic measurement range, the thermal response would also exhibit some deviations and nonlinearity from gas to gas. Therefore, measurement by the meter for a gas medium other than the calibration gas would bear larger measurement errors, particularly at 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.	Connect the power and then check the cable.
	Cable connection incorrect.	Check the cable.
	No flow or clogging.	Check flow and contamination.
	Power regulator failure.	Return to the factory.
	Sensor failure.	Return to the factory.
Significant errors or unexpected flow rate.	Particles, fluid type.	Check the system.
Erroneous or large noise.	Vibration, unstable flow.	Check the system.
Valve not work.	Wire connection, valve.	Return to the factory.
Offset unstable.	Circuitry instability.	Check the 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.
E1 code in LCD display.	Error 1 – Sensor error.	Return to the factory.
E2 code in LCD display.	Error 2 – Sensor contaminated or reverse flow.	Return to the factory.
E3 code in LCD display.	Error 3 – Hardware errors.	Return to the factory.
E4 code in LCD display.	Error 4 – Overflow.	Turn down the flow rate.

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 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 fully responsible for validating the performance and suitability of the products for their particular design and applications. For any misuse 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 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 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 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;

(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 get in touch with 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.

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 an RMA. If you require further assistance, please get in touch with info@siargo.com for additional information or a Return Materials Authorization (RMA) before returning the product to the factory for servicing, including calibration. Please specify in your email message the product's status as clearly as possible, indicating your intention to return it 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

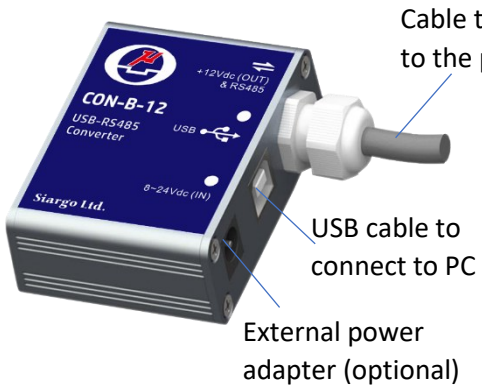
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Email: Info@Siargo.com

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

Appendix I: Product Evaluation Kit

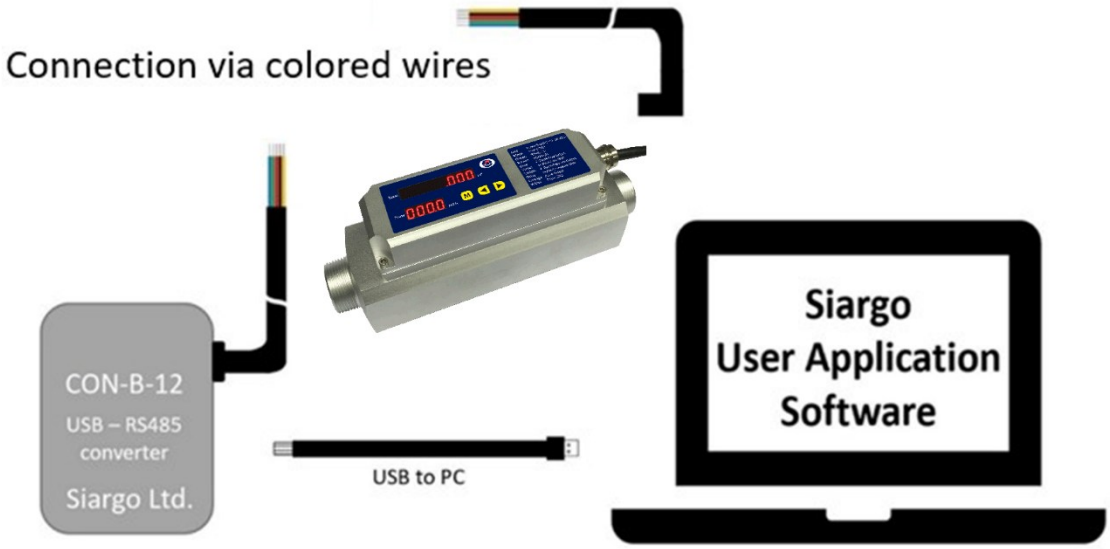
Siargo offers a product evaluation kit, including a digital data converter, USB data cable, and User Application software, that allows the user to evaluate the product performance on a Microsoft Windows-based computer. For some simple applications with digital data transfer, this kit could serve the purpose. The user can read and visualize the product's flow rate, obtain accumulated totalized or 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 of the products, 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 necessary.



Appendix II: Document history

Revision VC.0.02 (November 2025)

- Revised the troubleshooting.

Revision VC.0.01 (August 2025)

- Corrections.

Revision VC.0 (June 2024)

- Format, addition, and modifications.