Siargo Ltd.

Gas Mass Flow Meter VF.3.01

Model MFGD

www.Siargo.com

Gas Mass Flow Meter

with MEMS calorimetric sensing technology

MF-GD Series

User Manual

Document No. 08-2025-MFGD EN
Issue date: 2025.08
Revision: VF.3.01

Siargo Ltd.
4677 Old Ironsides Drive, Suite 310
Santa Clara, California 95054-1857
USA

Tel: +1(408)969-0368
Email: Info@Siargo.com

Attention!

- This product is designed for low-pressure gas mass flow metering and control with a safety rating of Ex ib IIC T4. All standard hazardous gas handling procedures must be observed during installation and usage.

- This product can be powered with a lithium-ion battery or an external DC power. For digital data communication, external power is recommended, but the intrinsic device safety procedure must be observed.

- The detailed operational conditions of the product are described in this manual. Please ensure each of the specifications is fully understood. Knowledge of the field where the product will be installed is required. Please do not apply the products outside their working conditions. Otherwise, the product may not function properly. In cases, it may be damaged, or it may cause other irreversible consequences.

- Before the operation, a leakage test must be performed after installation for safety assurance.

- Operation, installation, storage, and maintenance of the product must strictly follow the instructions 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. Installation, storage, and maintenance must be handled by qualified personnel. 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 time when 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 irreparable damage.
- 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 the product if any doubt about its operational status.
- Do not use this product in any excessive radiation or vibration environment.
- Only qualified or accredited personnel by Siargo can perform the repair services. Siargo shall not be liable for any products that have been altered or damaged before returning for product verification and services.
- Before digitally communicating with the product, it is highly recommended to read carefully the user interface requirements described in this manual.
- The product body is made of aluminum alloy; do not hammer or use sharp tooling during installation.
- The battery pack must be assembled with safety-certified lithium-ion batteries. Consult the manufacturer for battery requirements or obtain a replacement.
- Read the manual carefully before processing any maintenance or troubleshooting.

Table of Contents

1. Overview

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

This manual provides essential information for the MF-GD series of gas mass flow meters. The product performance, maintenance, troubleshooting, product order, technical support, and repair are also included.

The MF-GD series gas flow meters are designed specially for city utility gas metering applications, but they can also be used as general-purpose gas metering at low pressure. Based on Siargo's proprietary MEMS calorimetric flow sensing technology and control technology, the meters can identify gas thermal properties at dynamic flowing conditions. Unlike most conventional thermal mass flow metering, this product does not require manual input of gas conversion factors. It can be adjusted automatically between air and natural gases. The product offers a wide dynamic range while maintaining high sensitivity at the low flow for gas tariff and monitoring. The product is fully temperature-compensated. It operates with either battery power or external DC power and a safety barrier. The sensing elements are at the center of the flow channel, which is designed for a semi-Venturi configuration. The sensors are packaged using boundary layer technology, which ensures a time-averaged velocity profile across the sensing elements. The design would force the flow to redistribute at the sensor assembly, forming a laminar flow.

This product is equipped with a standard half-duplex RS485 Modbus communication interface. It is ready for remote data logging or networking. The storage in the control circuitry enhances the data safety. It enables users to program flow status records, which can be transmitted over the network or downloaded using a handheld or personal computer with the manufacturer-provided software.

The products are best for clean and dry gas flow measurements for gas mass flow applications. Other gases with excessive moisture may cause instability due to condensation. The meters also come with options for GPRS data transmission, and a pre-paid IC card reader attachment with a shut-off valve. Other convenient features include compact logistics and well-isolated standalone units for the prevention of foreign tampering.

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 also 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 it. The box will contain 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 if the order includes them.

The product Battery pack assembly, Data cable (optional)

Figure 2.1: MF-GD flow meter, battery, and data cable

Please immediately check the integrity of the product, as well as the battery pack assembly parts and the optional 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 LCD screen shall not be lighted until the battery is installed or the power cable is plugged in.) Due to the restriction on battery freight, the user is required to assemble the battery pack by following the instructions in Sec 5.3. This user manual will either be included in the packing box. It can also be obtained by request online for an electronic version. In most cases, this manual will be made available to the customer before the actual order.

3. Knowing the products

3.1. Product description

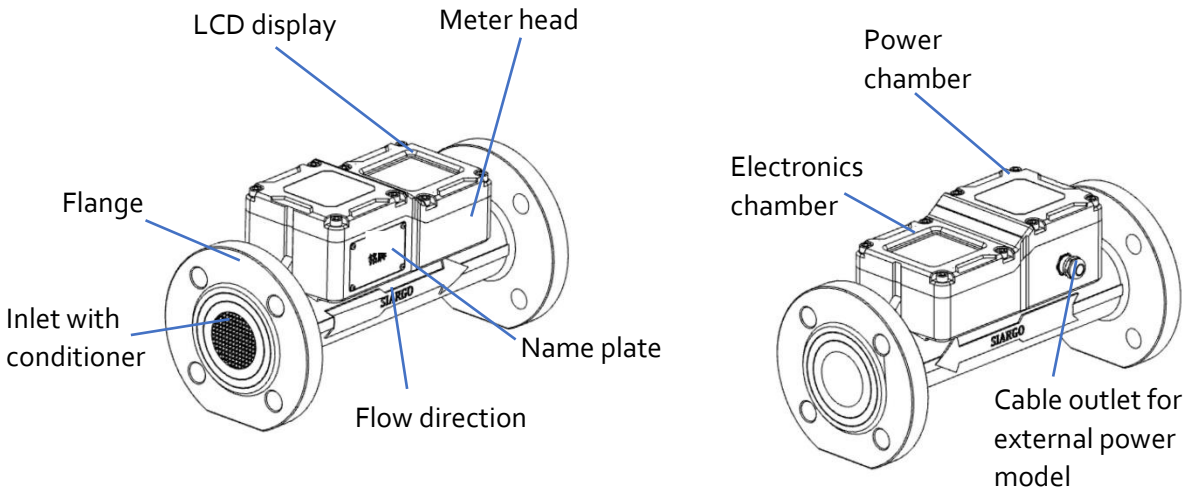
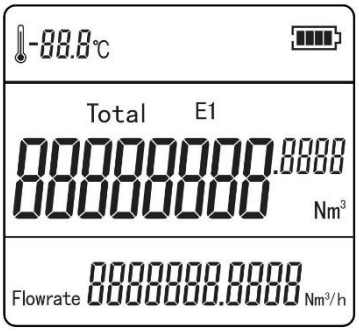


Figure 3.1: MF-GD meter parts description

3.2. LCD description



The LCD displays all the information measured by the product. Some symbols are reserved for future upgrades and will not be lit during the operation. The following table explains each symbol.

Figure 3.2: LCD symbol illustration.

Table 3.1: Symbol descriptions

Total	The middle row. The default display shows the totalizer or accumulated flow rate in Nm^3 (cubic meters at normalized conditions: 20°C, 101.325 kPa). The maximum value is 99,999,999.999 Nm^3.
Flowrate	The bottom row. Displays instant flow rate in Nm^3/h (normal cubic meters per hour).
	Battery or power status is displayed in the upper row to the right.
	Temperature is displayed in the upper row to the left.

E1	One of the five error codes (the sign will be flashing): E1 – Sensor error. In most cases, E1 is often an indication of sensor damage.
E2	E2 – Sensor contamination, an indication of changes in surface thermal sensitivity.
E3	E3 – Electronic hardware errors.
E4	E4 – Out-of-flow measurement range.
E5	E5 – Battery low.

3.3. Interface terminal descriptions

For products with the external power option, the interface can be accessed by opening the battery (power) chamber cover, and the interface terminal is inside the chamber. The description of the terminal is as follows:

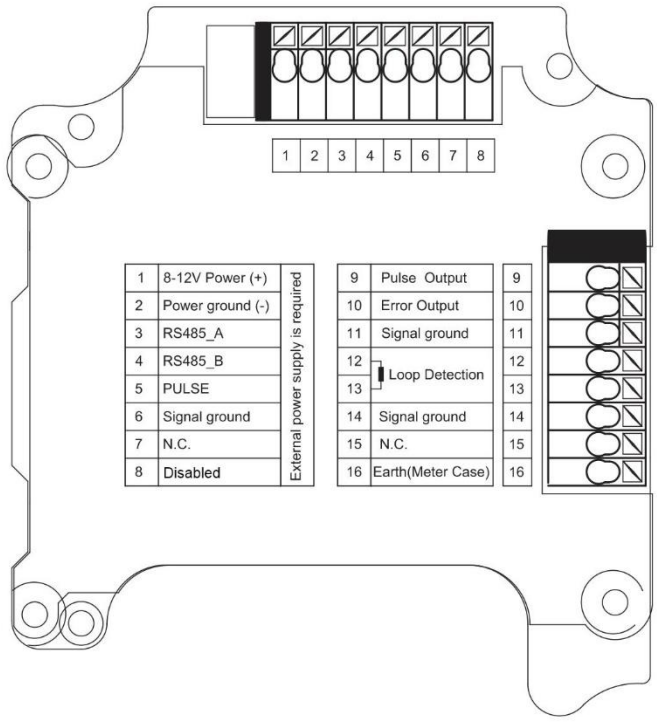


Figure 3.3: MF-GD meter interface terminal

Note: Terminals 1 through 6 are isolated for use with external power. Communication is strongly recommended to have an external power supply.

Table 3.2: Interface terminal assignment

Wire	Definition
1	Power supply (8~12Vdc)
2	Ground, power
3	RS485A (+)
4	RS485B (-)
5	Pulse output, (5.0 Vdc)
6	Ground, pulse
7	N.C.
8	Disabled
9	Pulse output (3.0 Vdc)
10	Error output
11	Ground, error output
12	Loop detection, fixed
13	Loop detection, fixed
14	Ground, pulse (3.0 Vdc)
15	N.C.
16	Earth (to meter case)

3.4. Mechanical dimensions

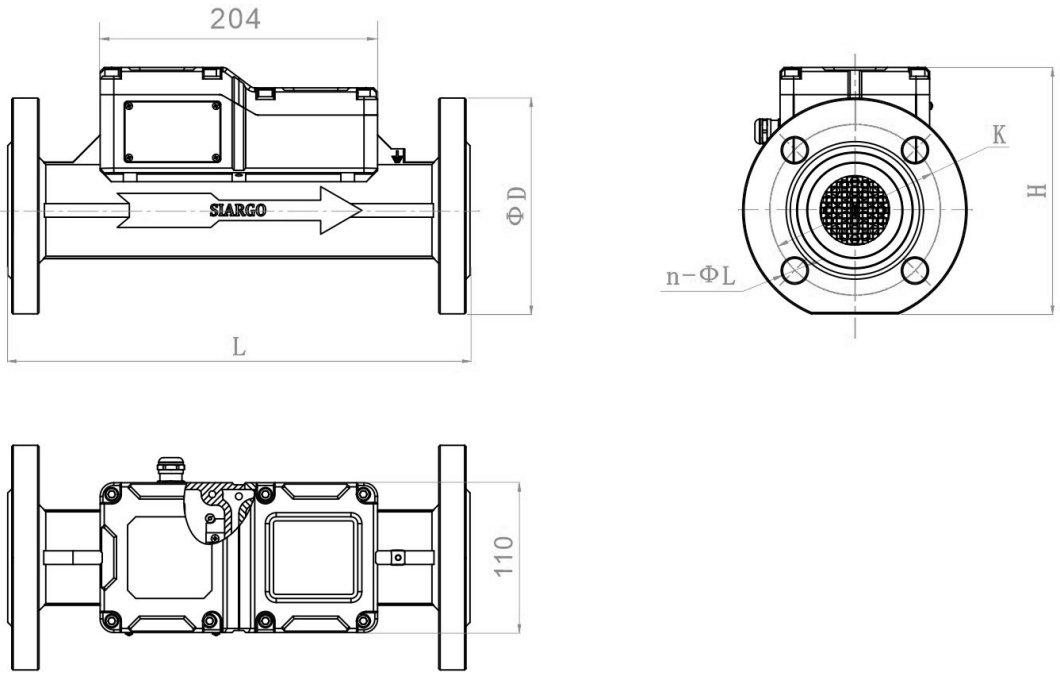


Figure 3.4: MF-GD meter dimensions

Table 3.3: Meter dimensions (mm)

Model	L	H	ΦD	n-ΦL	ΦK
MF25GD	300.0	156.0	115.0	4-14.0	85.0
MF40GD	320.0	175.0	150.0	4-18.0	110.0
MF50GD	340.0	181.0	165.0	4-18.0	125.0
MF80GD	340.0	215.0	200.0	8-18.0	160.0

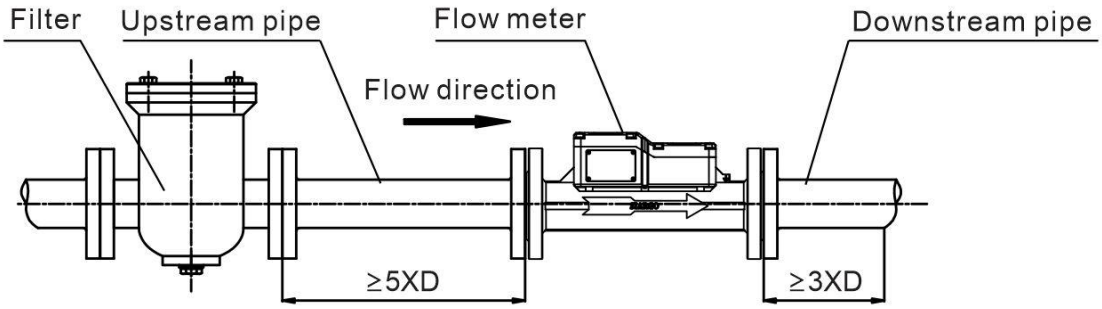
4. Installation

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

The product at the time of shipment is fully inspected for quality and meets all safety requirements. Additional safety measures should be applied during the installation. 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.

The product is preferably installed horizontally. The flow direction should be aligned with the arrow mark on the meter body. If the flowing fluid may have particles or debris, a filter is strongly recommended to be installed upstream of the meter.

Please follow the following steps to complete the installation:

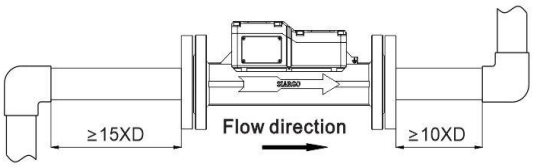


a) Upon opening the package, the product's physical integrity should be inspected to ensure no visual damage.

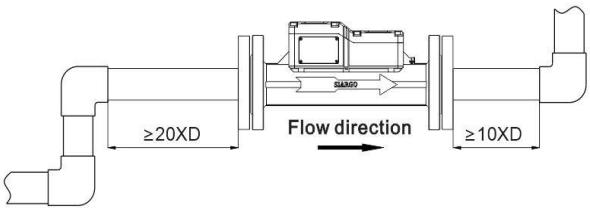
b) Before installation of the product, please ensure that the pipe debris or particles, or any other foreign materials, are completely removed.

c) Cautions during installation:

   i) It is preferable to install/connect the meter inlet first and then the outlet end of the meter. To ensure measurement accuracy, an upstream straight pipe of length no less than 10DN and a downstream straight pipe of length no less than 5DN should be in place. Please refer to the recommended installation configuration in the following illustrations.

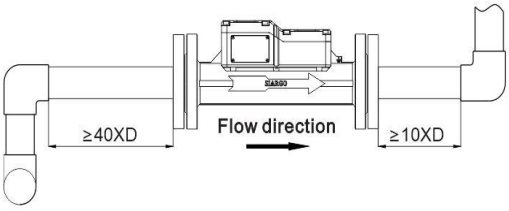


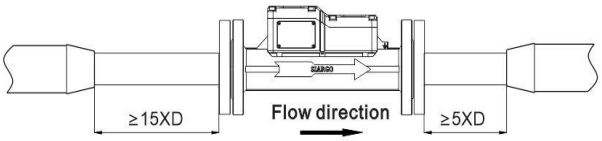
(a) 90-degree elbow or T-piece



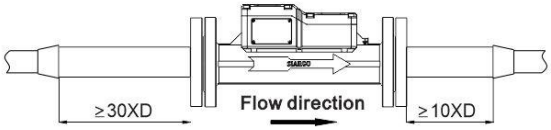
(b) 2x90-degree elbow

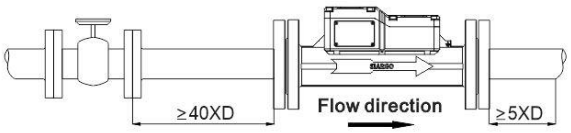
ii) If the upstream or downstream pipe size is different from that of the product, the size of the installation line pipe diameter(s) should be larger than the flow channel (pipe) size of the meters to be installed. For some typical situations, please follow the installation recommendations detailed in the following sketches.





(c) 2x90-degree elbow, 3D (d) Pipe size-reduction

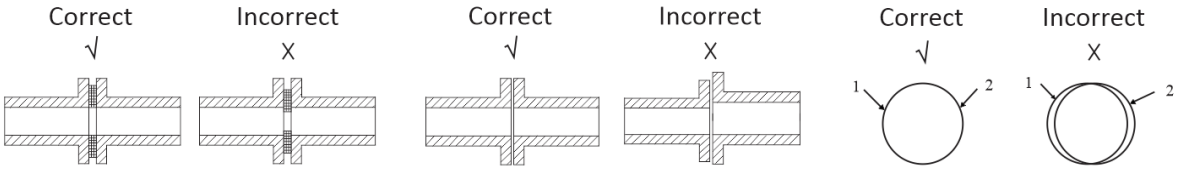




(e) Pipe size expansion

(f) Control valve at upstream or downstream

It is also essential to ensure mechanical alignment for the connections to the meters. The following illustrations indicate some frequently mistaken connections:



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

d) Connect electrical wires per the wire definition in Table 3.2. Please ensure the power supply range (i.e., 8~12 Vdc) and power supply polarization. Any third-party adapter must meet industrial standards and carry all safety certifications.

e) For the data communication wire connection, please follow the description in Table 3.2 and make sure that the wires are correctly connected to the proper ports on your data device/equipment. Please ensure the data cable meets industrial standards and has correct connections.

f) Once the external power is successfully connected, the LCD should be lit up with the proper information displayed to work correctly.

g) Slowly open the valve(s) if any, upstream or downstream, or both of the pipeline, and the meter should then start to measure the flow in the pipeline. Note: The meter has an extensive dynamic measurement range. It is normal for a small instant flow rate to be present before opening the valve, as this may indicate some leakage. However, the meter should read null when there is no flow present in the pipeline.

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 cause malfunctioning of the product.

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

5. Operation

5.1 Check the product specifications

Before using this product, verify the product specifications, which can be found in this manual or the basic information on 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 be lower than the system pressure, and the flow range should also be within the specified range. In most cases, a large full-scale meter will result in errors when applied to a very low-flow measurement. 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 irreparable damage. A low voltage will not power the product for any desired functions.

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

5.2 Check the leakage

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

5.3 Power the meter and data connection

Although this product complies with the CE-required EMC regulations, standard electrical device practice must be applied during usage. Before connecting the product to external DC power or an AC-DC adapter, ensure the supply voltage is within the specified range in Section 7. Be cautious to observe standard electrical device precautions, such as ESD (electrostatic discharge) and DC voltage. Excessive electrostatic discharge may damage the product.

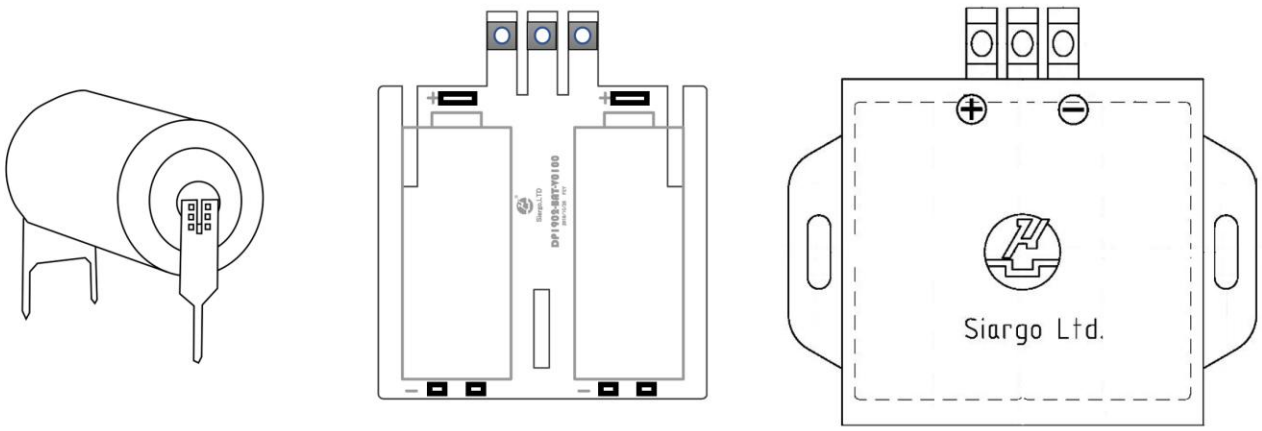
The products offer two power options. The battery option is favored for utility gas metering, while the external power option is mainly used when remote data communication is required. Due to transportation restrictions, the user must acquire batteries and assemble the battery pack for battery power. Please follow the instructions in 5.3.1 to complete the battery pack assembly. For external power users, refer to Section 3.3 for a detailed description of the cable wire definition, and 5.3.2 for cable installation and terminal connections.

Half-duplex RS485 Modbus is used for digital data communication. Make sure the wires are correctly connected and configured on the receiver side.

5.3.1 Battery power and battery pack

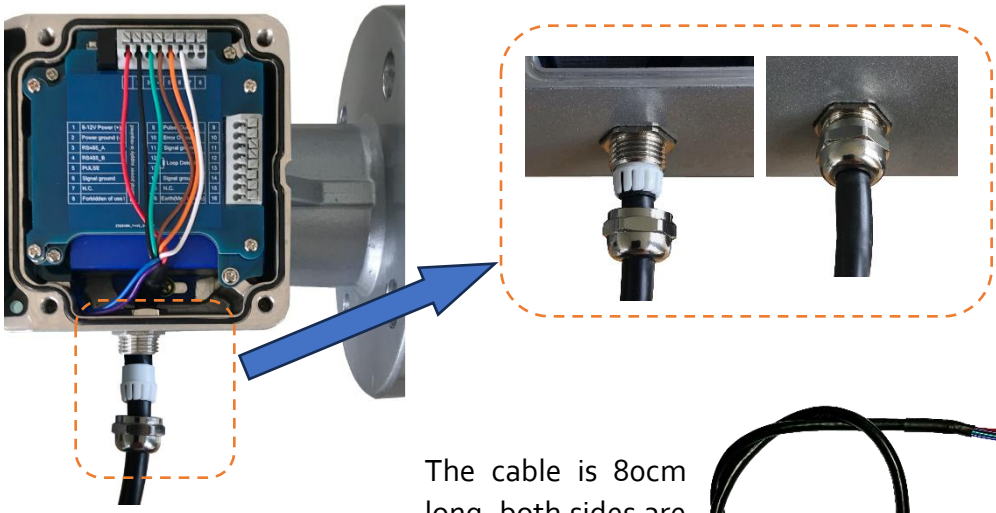
The meter is designed for city utility gas metering powered by lithium-ion batteries. Two 3.6 Vdc 19Ah D-Cell lithium-ion batteries in normal usage can offer up to 5+ years of operation. Due to the restriction on battery freight, the user must acquire the proper batteries and do a simple assembly. For fuel gas applications, the battery must meet the required safety regulations, and a safety certificate for the battery should be ensured before acquiring it for the battery pack.

The necessary parts for battery pack assembly are shipped together with the product (see Sec. 2). These are the battery pack box, battery PCB, and cover. Follow the steps below to complete the battery pack assembly.

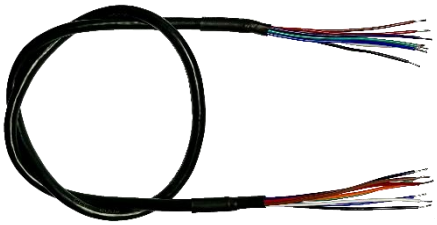


For simplicity, the D-Cell lithium-ion battery with terminal option TP should be purchased from the local dealer. This terminal option is readily available from the battery suppliers such as Tadiran (www.tadiranbat.com). The pre-installed terminal can be easily fitted into position on the PCB. After that, it can be soldered. After the two batteries are installed onto the PCB, the PCB can then be placed into the battery pack enclosure and filled with epoxy (for example, Araldite CW 177 CI by Vantico). Finally, close and seal the pack with the battery pack cover.

5.3.2 External power option and cable installation



The cable is 80cm long, both sides are color-coded wires.



The terminal interface PCB is located inside the battery chamber. Open the battery chamber cover. If the model is external power only, there will be only the terminal PCB. Otherwise, one needs to install the battery pack first. Then, install the terminal PCB and the connections. The above illustration and Table 3.3 show the process of connecting the wires to the power source. Finally, the cable must be tightly engaged from outside the battery chamber, which ensures protection of the batteries.

5.4 Meter MENU descriptions

Figure 5.1: MF-GD keys description

The front 3-key board of the meter is used to set the desired functions, access data, and check the status. The Menu key (M) is in a central position. It allows the user to select a function, confirm the selection, or perform other related actions. See the details below. Two keys ("Up" and "Down") are used to select the menu and submenu.

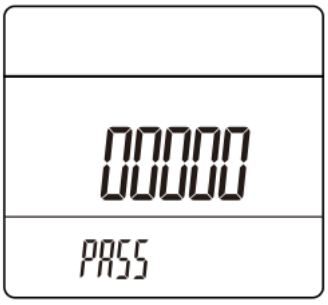
5.4.1 Starting the measurement

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 LCD. The middle line displays the accumulated or totalized flow rate; the lower line shows the instant flow rate. The upper line will light up when the pressure or temperature option is selected.

The display characters are limited by the LCD capability, as shown in the table.

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, which 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
- Reset or calibrate the offset — F11 - oFFST
- Enter the gas conversion factor (GCF) — F12 - GCF
- Change the meter factor — F13 - FACTr
- Set the 2nd-correction factor — F14 - Corr
- Set the full scale — F15 - FS
- Set the pulse — F41 - PULSE
- Change the default password — F91 - PASS
- Reset the 2nd-correction factor — F94 - rS2nd
- Exit from the MENU — F99 - qUIT

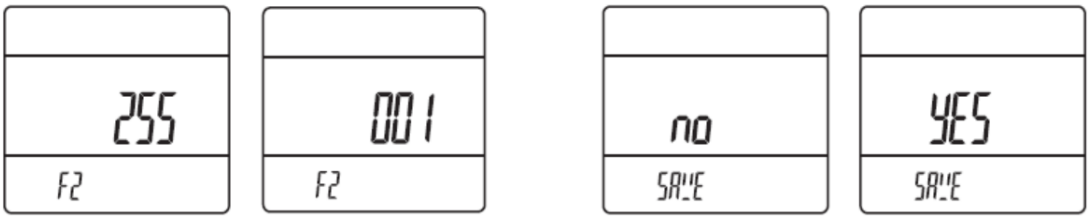
Note: During this process, the meter will continue to measure the flow without being interrupted.

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.

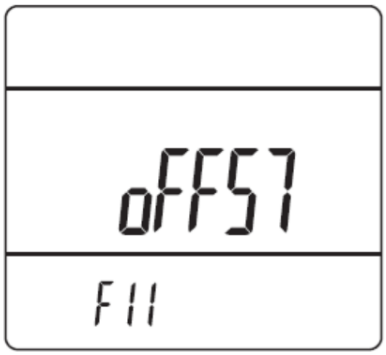
The Modbus address has three digits, which can be any number between 001 and 255. Press the "M" key to enter the change address screen. Press the "Up" or "Down" key to change the flashing digits, and then press the "M" key to confirm. After the address is set, the display will return to F2-Addr, which 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 255.

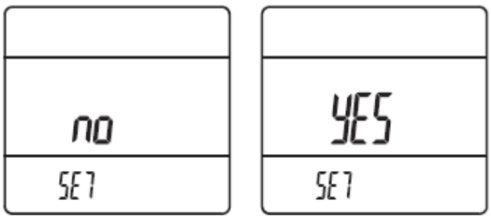


5.4.4 Reset or calibrate the offset

After a specific usage, the meter's offset (zero flow rate) might have a slight shift. Or when you apply the meter to different gases, the offset might be shifted. To ensure measurement accuracy, it is necessary to reset or calibrate the offset. Following the above steps, at the MENU setting screen, use the "Up" or "Down" key to select F11 - oFFST. Before performing the task, ensure no gas flow is in the flow channel. Otherwise, it can create 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.

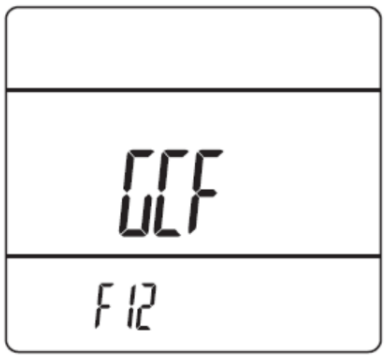


5.4.5 Gas conversion factor (GCF) for different gas measurements

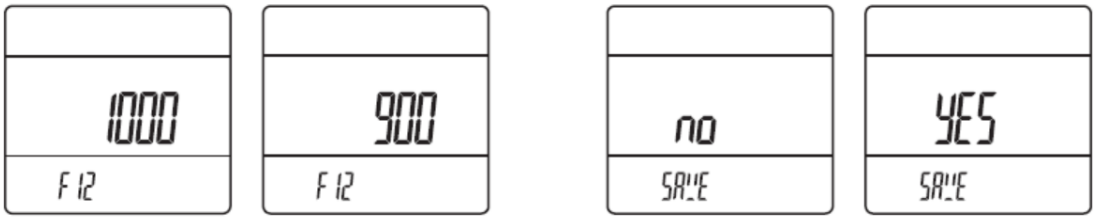
For general-purpose applications, a gas conversion factor (GCF) can be applied to measure gases other than the calibration gas. The GCF is determined by the thermal calorimetric sensing principle, as well as the meter's fluidic dynamic design and the control circuitry. Contact the manufacturer to obtain the values.

The GCF for air is 1000.

Note: If the meter is ordered for a special real gas calibration, contact the manufacturer before issuing the purchase order.

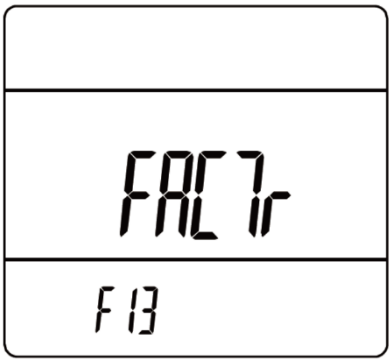


Following the above steps, at the MENU setting screen, use the "Up" or "Down" key to select F12 - GCF. Press the "M" key to confirm, and it will open the sub-MENU showing the current gas conversion value. Use the "Up" or "Down" and the "M" confirming key to input the desired value, and press the "M" 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.

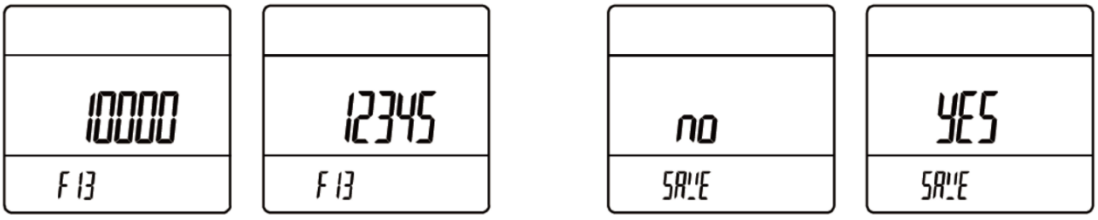


5.4.6 Meter factor

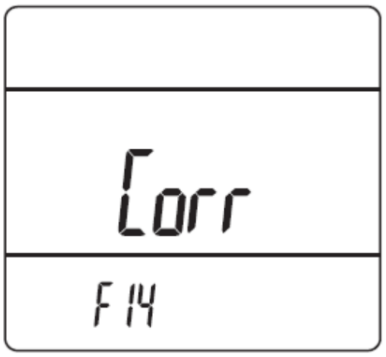
The meter factor is used to correct the systematic deviation in different devices. The default value is 10000.



Following the above 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.

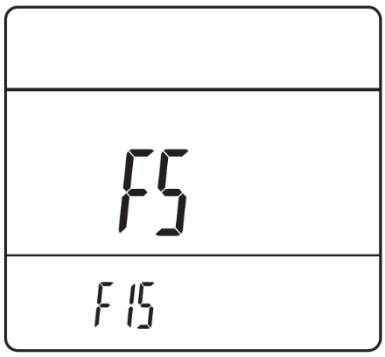


5.4.7 Set the 2nd-correction factor

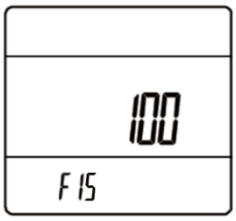


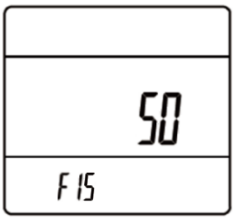
Following the above steps, at the MENU setting screen, use the "Up" or "Down" key to select F14 - Corr and then press the "M" key to set the 2nd correction factor.

5.4.8 Set the full scale

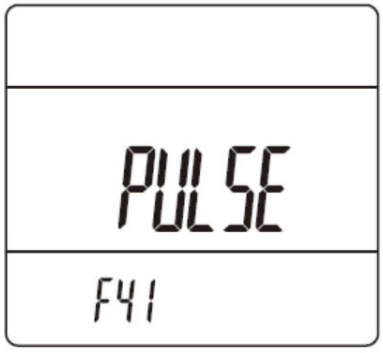


Following the above steps, at the MENU setting screen, use the "Up" or "Down" key to select F15 - FS. Press the "M" key to confirm, and it will open the sub-MENU showing the current full scale. Use the "Up" or "Down" and the "M" confirming key to input the desired value, and press the "M" key again to complete the task. The display will then return to the F15-FS 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.

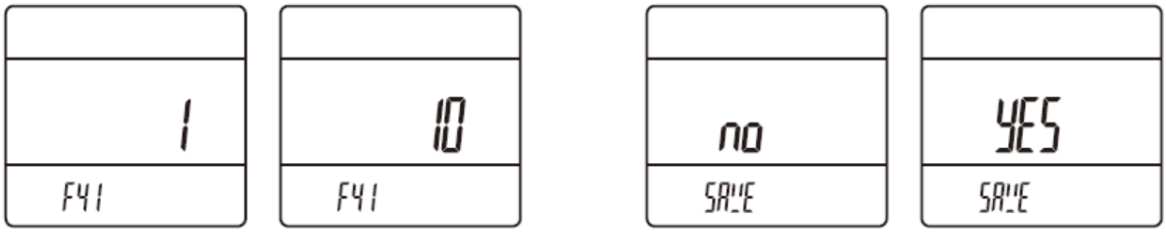




5.4.9 Set the pulse

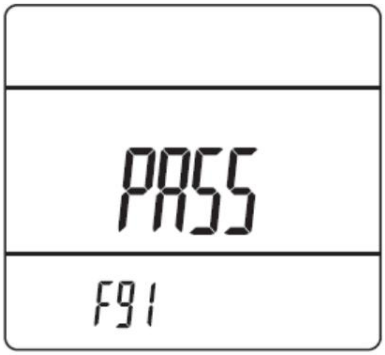


Following the above steps, at the MENU setting screen, use the "Up" or "Down" key to select F41 - PULSE and then press the "M" key to set the pulse output for the accumulated or totalized flow rate.
There are five pulse outputs selectable:0.1 SL/pulse (display shows: 10-1), 1 SL/pulse (display shows: 1), 10 SL/pulse (display shows: 10), 100 SL/pulse (0.1 Nm^3, display shows: 100), and 1000 SL/pulse (1 Nm^3, display shows: 1000). The default pulse output is 1000 SL/pulse (1 Nm^3, display shows: 1000). 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.



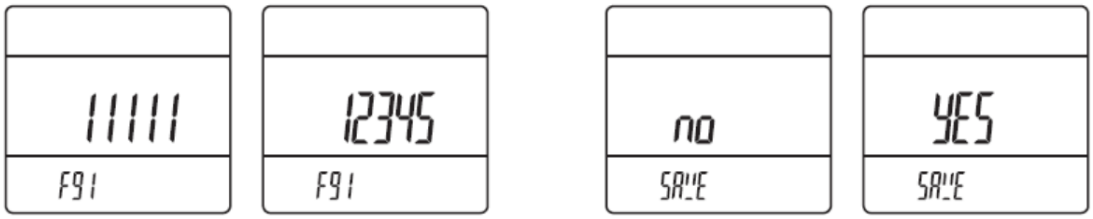
5.4.10 Change the default password

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



Following the above 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" key to confirm your selection. 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.

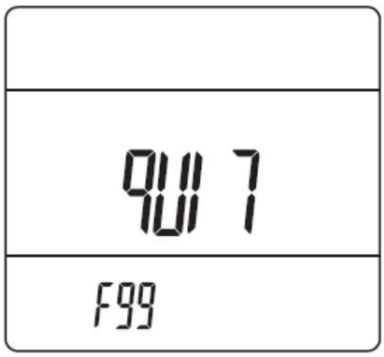
Please keep the changed password in a safe yet accessible place. If it is unrecoverable, contact the manufacturer to obtain a special password to access the meter MENU.



5.4.11 Reset the 2nd-correction factor

Following the above 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.

5.4.12 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.

5.4.13 MENU key sequence for the settings

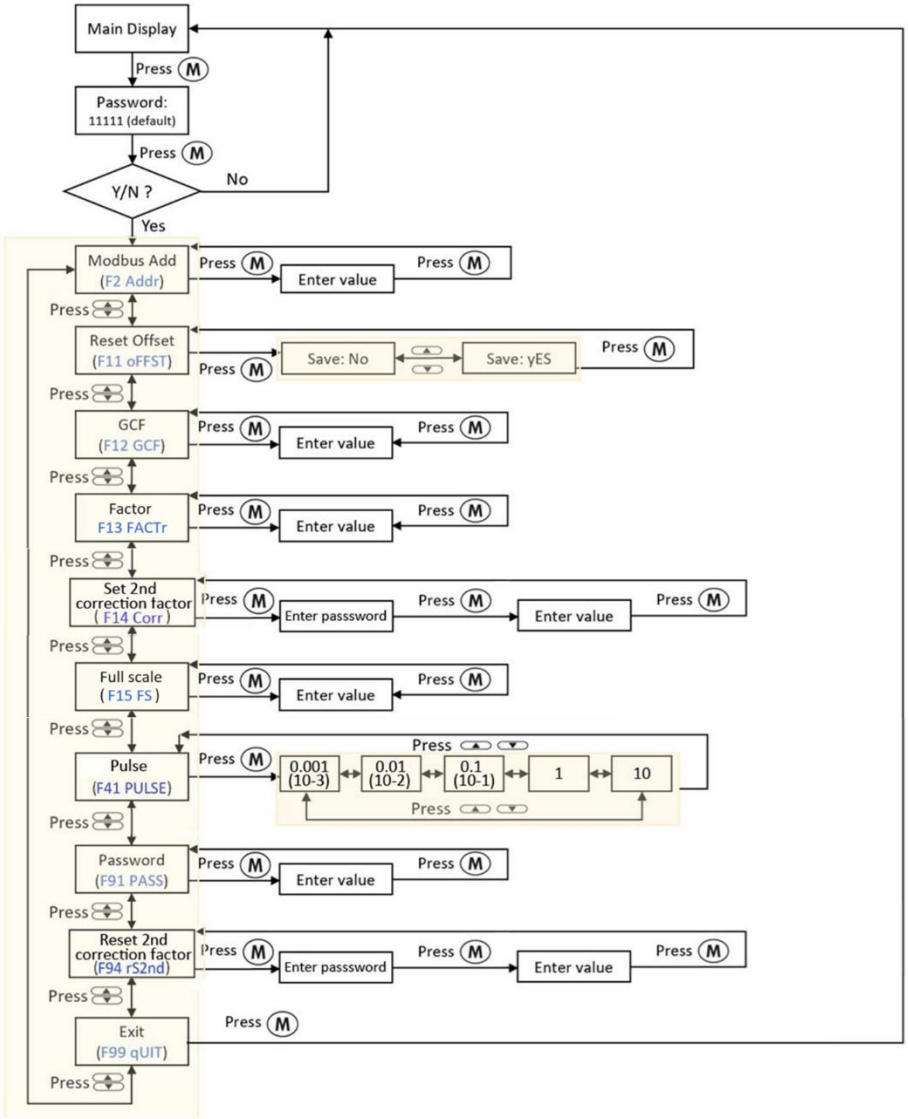
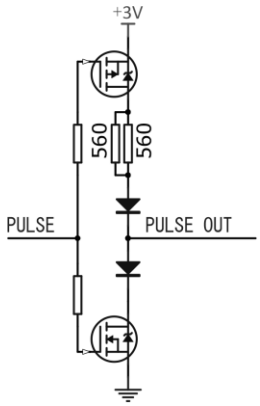
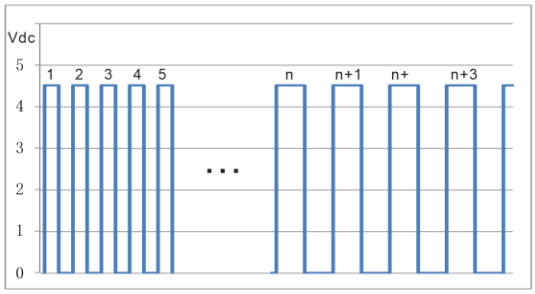


Figure 5.2: MF-GD MENU key sequence

5.5 Analog (pulse) data communication

The pulse outputs are the square waves of a 3Vdc signal high and a 0Vdc signal low. The pulse can be programmed to 0.1 SL, 1 SL, 10 SL, 100 SL (0.1 Nm3), or 1000 SL (1 Nm³); the default is 1000 SL (1 Nm³). The pulse level can be converted to other values. Use the circuitry below as the reference.



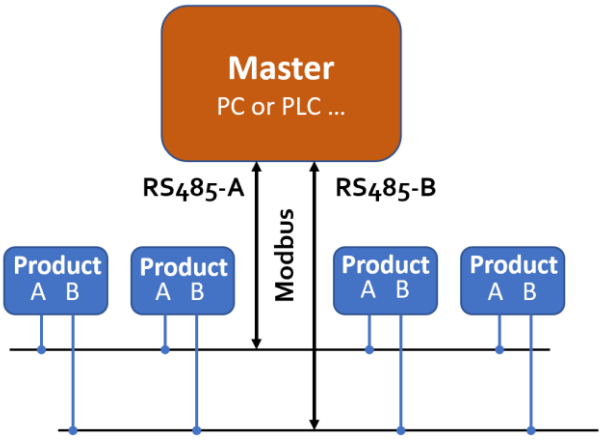


5.6 RS485 Modbus communication protocol

The digital communication protocol is based on 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 3.3 for the cable connection.

5.6.1 Hardware connection

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



5.6.2 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

5.6.3 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 (MF-GD)'s functions/actions (slaves), either execution or response.

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

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 of bit time, for ending the current frame.

5.6.4 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:

Code	Name	Functions
0x03	Read register	Read register(s)
0x06	Set a single register	Write one single 16-bit register
0x08	CRC verification	Communication verification
0x10	Set multiple registers	Write multiple registers

5.6.5 Registers

The product (MF-GD) 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. 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.

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)
Totalizer	Totalizer or accumulated flow rate (R)	0x003C~0x003E	40061 (0x003C)
GCF*	Gas correction factor (R/W)	0x008B	40140 (0x008B)
Pulse*	Set the pulse output (R/W)	0x0093	40148 (0x0093)
Reset offset	Reset or calibrate the offset (W)	0x00F0	40241 (0x00F0)
Reset totalizer*	Reset totalizer or accumulated 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	Address of the product		
Value type	UINT 16		
Notes	Values range from 1 to 247, excluding 157 (0x9d). 0 is the broadcast address.		

Serial number, SN	**0x0030 ~ 0x0035**	**Write**	N
		Read	Y
Description	Series Number of the product, SN		
Value type	ASCII		
Notes	SN= value(0x0030), value(0x0031),….,value (0x0035); Receiving 12 bytes as: 2A 47 37 41 45 49 30 32 30 35 38 2A, the corresponding Serial Number is **G7AEI02058**.		

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.: for a flow rate of 123.456 Nm^3/h, the user will read "1 (0x0001)" from register 0x003A and "57920 (0xE240)" from register 0x003B, therefore Current flow rate = (1*65536+57920)/1000 = 123.456 Nm^3/h.		

Totalizer	**0x003C ~ 0x003E**	**Write**	N
		Read	Y
Description	Totalizer or accumulated flow rate		
Value type	UINT 32 + UNIT 16		
Notes	A1 = Value (0x003C) * 65536 + Value (0x003D) A2 = Value (0x003E) Totalizer or accumulated flow rate = (A1 * 1000 + A2)/1000 For a totalizer or accumulated flow rate of 3452.245 m3, the user will read "0 (0x0000)" from register 0x003C; "3452(0x0D7C)" from register 0x003D, and "245(0x00F5)" from register 0x003E. Then, the totalizer or accumulated flow rate = ((0 + 3452)*1000 + 245)/1000=3452.245.		

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. **The default value is 1, and the baud rate is 9600.** **e.g.,** when the user reads "2" from register 0x0082, the baud rate is 19200.		

GCF	0x008B	Write	Y
		Read	Y
Description	The gas conversion factor applies to a gas that differs 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 get in touch with the manufacturer. **Notes: Please disable the write protection before executing this function.**		

Pulse	0x0093	Write	Y
		Read	Y
Description	Set the pulse		
Value type	UINT 16		
Notes	Value -1, 0, 1, 2, or 3. -1 (0xFFFF): 0.1 (10^{-1}) SL/pulse; 0 (0x0000): 1 (10^{0}) SL/pulse; 1 (0x0001): 10 (10^{1}) SL/pulse; 2 (0x0002): 100 (10^{2}) SL/pulse (0.1 m^3/pulse) ; 3 (0x0003): 1, 000 (10^{3}) SL/pulse (1 m^3/pulse); **The default value is 3, the pulse is 1,000 SL/pulse (1 m^3/pulse).** **For example, when** the user reads "2 (0x0003)" from register 0x0093, the pulse is 100 (10^{2}) SL/pulse (0.1 m^3/pulse). **Notes: Please disable the write protection before executing this function.**		

Offset calibration	0x00Fo	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 0x00Fo. **Notes: When you execute this function, make sure there is NO flow in the flow channel.**		

Reset totalizer	**0x00F2**	**Write**	Y
		Read	N
Description	Reset the totalizer or accumulated flow rate value.		
Value type	UINT 16, Fixed value 0x0001		
Notes	To reset the totalizer or accumulated 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, offset, or totalizer, send 0xAA55 to register 0x00FF. The write function will be enabled, and write protection is disabled. After the write execution is completed, the firmware will automatically re-enable the write protection. **Only the Address and Baud rate will not be write-protected.**		

6. Product selection

The product part number is defined by the flow pipe diameter (mm), and its flow ranges are listed in the following table.

Table 6.1: The Product Models and Flow Ranges.

Model	**DN (mm)**	**Max. flowrate (Nm^3/h)**	**Min. flowrate (Nm^3/h)**
MF25GD10/16/25/40	25.0 (1")	10 / 16 / 25 / 40	0.10 / 0.16 / 0.25 / 0.40
MF40GD25/40/65	40.0 (1-1/2")	25 / 40 / 65	0.25 / 0.40 / 0.65
MF50GD40/65/80	50.0 (2")	40 / 65 / 80	0.40 / 0.65 / 0.80
MF80GD100/160	80.0 (3")	100 / 160	1.0 / 1.6

7. Technical specifications

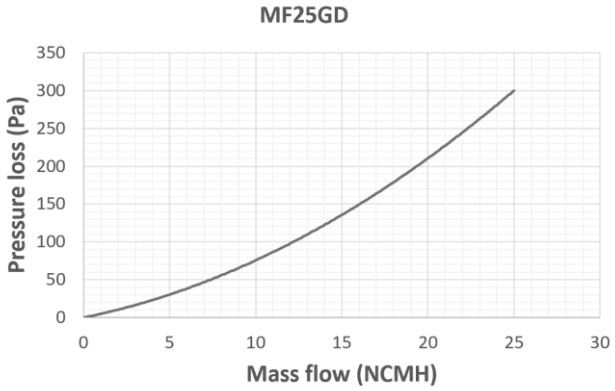
7.1 Technical parameters

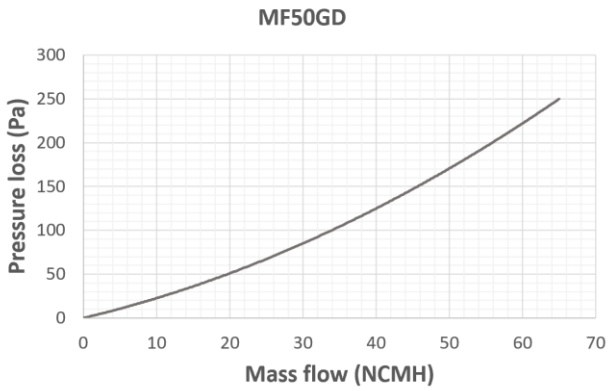
All specifications listed in the following table, unless otherwise noted, apply for calibration conditions at 20°C and 101.325 kPa absolute pressure with air. The product is horizontally mounted during calibration.

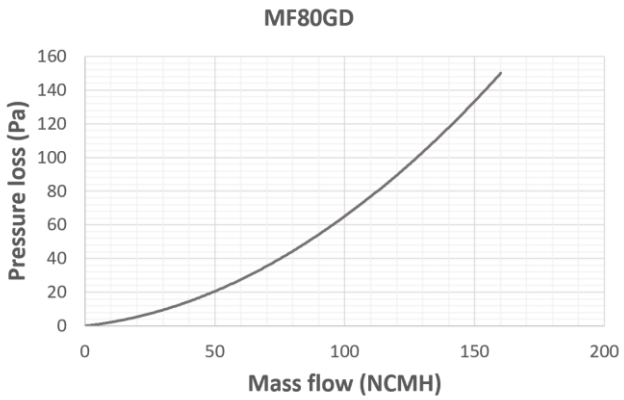
	Value	Unit
Full-scale flow range	See Table 6.1	
Accuracy	±(1.5+0.25FS)	%
Repeatability	(0.5+0.08FS)	%
Turn-down ratio	100:1	
Working temperature	-20 ~ +55	°C
Maximum pressure	0.6	MPa
Humidity	<95, no condensation	%RH
Power supply	2x D-Cell 19 Ah lithium-ion or 8 ~ 12Vdc	
Battery life	>36	Months
Real-time clock life	>10	Years
Digital output	RS485 Modbus half-duplex / Pulse	
MENU access	3 key – front face keyboard/digital	
Display	LCD, instant flow rate, totalizer, or accumulated flow rate	
Storage temperature	-20 ~ +70	°C
Reference conditions	20°C, 101.325 kPa, air	
Protection	IP66 (NEMA 4x)	
Fluid compatibility	Non-corrosive	
Ex Proof	Ex ia IIC T4 Gb	

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

7.2 Pressure loss







7.3 Wetted materials and compatibility

The product flow channel is made of anodized aluminum alloy. 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

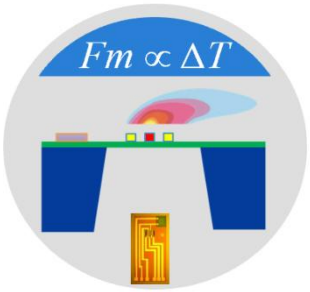


Figure 8.1: Measurement approach illustration.

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

Our proprietary calorimetric sensing technology offers an extensive dynamic range with improved performance against environmental parameter alternations. It provides a unique gas identification algorithm via the direct measurement of the gas thermal conductivity and capacitance. For any gases with distinct thermal properties and pre-registered, the meter can identify them and make an automatic adjustment to the original calibration values, making measurement via thermal mass sensing an easy task. Please refer to the company's patents and 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 a general practice to compare the data from the product with a third-party reference meter, and in many cases, discrepancies can occur.

When performing such a comparison, please note that the reference meter should have a better-specified accuracy (approximately one-third of that specified by 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 often the same in the system. Therefore, it will be essential to ensure the system has no pressure variation. (This explains our recommendations for the installations in Section 4). In addition, the meter measurement principle is often the key to understanding any discrepancies.

Please note that for comparison with a rotameter, the reading can have large deviations due to differences in measurement principles. Particularly, a rotameter is sensitive to pressure and temperature variations.

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 the meter's functionality. It is critical to ensure that the applied flow medium is clean and dry. If contamination is suspected, please allow experienced technical personnel to check and recondition it. Do not use foreign cleansers or other fluids to clean the flow path, as they could cause irreparable damage.

8.2.3 Apply to a different gas medium

The product is calibrated using a high-precision NIST-traceable metrological standard and clean and dry air. Thanks to its unique thermal sensing technology, the product can be applied to meters and control other clean and dry gases with similar thermal diffusivities without compromising accuracy. It has effectively resolved the nonlinearity issues when applying to a gas conversion factor in calorimetric sensing, making the measurement highly accurate with an extensive dynamic range. Applicable gases include air, N_2, O_2, Ar, CH_4, and CO.

This innovative product also follows the basic sensing principle described in the international standard for thermal mass flow meters (ISO 14511:2001 - Measurement of fluid flow in closed conduits — Thermal mass flowmeters). For gases with different diffusivities, a gas conversion factor could be applied. For more information, contact your sales representative or manufacturer.

Under normal operation conditions, the wetted materials are fully compatible with common gases, such as air, oxygen, nitrogen, argon, and carbon dioxide. If a special gas is applied, please check the

gas compatibility data with the manufacturer. In some cases, packing materials may need to be changed for gas compatibility, or additional hazardous zone certification will be required before the products can be used.

8.2.4 Recalibration and maintenance

The recalibration of the controller depends on usage and application requirements. Therefore, it is a decision by the applications.

If preferred, Siargo can offer free calibration software or a user application kit to facilitate the customer's calibration requirements. Alternatively, contact your sales representative or contact the manufacturer for assistance. Siargo calibrates all products with NIST (National Institute of Standards and Technology, USA) traceable calibrators.

For maintenance, the services must be performed by trained or certified technicians by Siargo. Any changes to the products will void the product warranty. It could lead to irreparable damage to the products and could result in unexpected injuries.

The products do not require regular maintenance if the specified application conditions are exactly observed. Maintenance is required if indications of contamination or malfunctions are verified. In this case, contact your sales representative or directly contact customer support (information available on the Company's webpage) to obtain an RMA (Return Material Authorization) before shipping the products back to the Company's support center. Siargo commits to responding as fast as possible. Regular service will be performed within five business days if no major parts change is required.

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.
	LCD error	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
Readings without flow rate	Sensor error	Return to factory
	Power failure	Check power status
Offset unstable	Circuitry instability	Check the system, power off
No digital interface	Wrong address, software	Check commands, connection
	Incorrect baud rate	Check the settings
	Pin contact or connection	Check hardware
No pulse output	Incorrect wiring	Reconnect the wire

10.Warranty and Liability

(Effective January 2018)

Siargo warrants that the products sold hereunder, when used and installed properly under normal circumstances and services, will be free from defects. 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 repairs or replacement product shall bear the exact terms of 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. 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, its officers, employees, subsidiaries, affiliates, and sales channels harmless against all claims, costs, damages, expenses, and 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 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.

The product information in this manual is believed to be accurate and reliable at the time of release. They are made available to 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, but not limited to those stated in this document or any other actions that 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 resold by unauthorized dealers or any third parties.

11. Service/order contact and other information

Siargo Ltd. is making every effort to ensure the quality of its products. For any questions or product support, contact your direct sales representative. If you require additional assistance, contact the customer service at the address listed below. We will respond quickly to your requests and work with you to your complete satisfaction.

For sales or product orders, contact the local sales representatives or distributors listed on the company's webpage www.Siargo.com.

For any returns, contact your direct sales representative to obtain an RMA. For any further assistance, contact info@siargo.com to obtain additional information or a Return Materials Authorization (RMA) before shipping the product back to the factory for factory services such as calibration. In your email messages, please specify the status of the product you intend to return 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

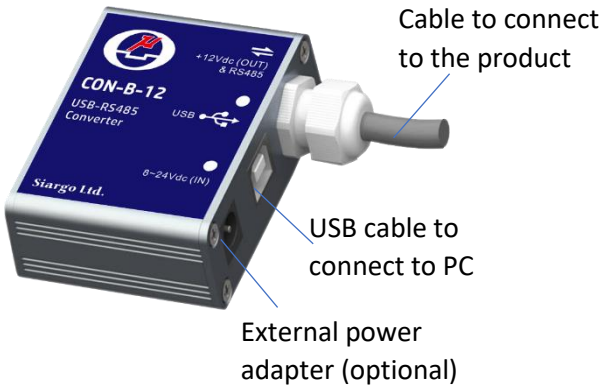
Siargo Ltd.
4677 Old Ironsides Drive, Suite 310,
Santa Clara, California 95054-1857, USA
Tel: +1(408)969-0368
Email: Info@Siargo.com

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

Appendix I: Product evaluation kit

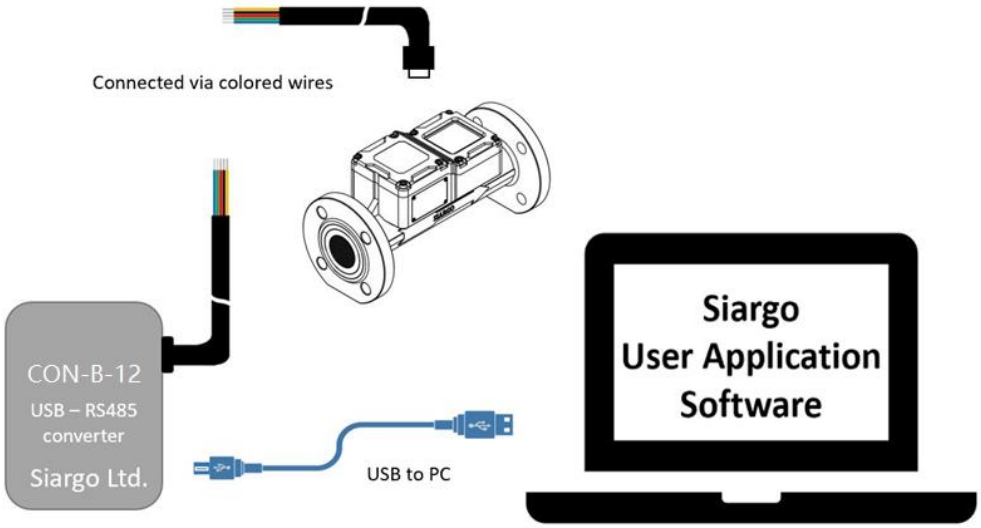
Siargo offers a product evaluation kit that includes a digital data converter, a USB data cable, and a user application software. This kit is to evaluate the product's performance on a Microsoft Windows-based computer. For some simple applications with digital data transfer, this kit could serve the purpose. The user can read and visualize the flow rate, obtain the totalizer or accumulated flow rate values, and save the data for further analysis. It can read from up to 128 meters from the RS485 interface in serial.

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



Each converter has a fixed cable that can be directly connected to the product. The USB cable 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 products. No external power will be required. However, for multiple meters in a single system, the power from the USB cable may not be enough. An external power adapter with an 8~24 Vdc voltage will be required.



Appendix II: Document history

Revision VF.3.01 (August 2025)

- Corrections.

Revision VF.3 (July 2024)

- Corrections.

Revision VF.2.04 (March 2024)

- Correct the cable.

Revision VF.2.03 (June 2023)

- Update contact address.

Revision VF.2.02 (October 2022)

- Minor corrections.

Revision VF.2.01 (August 2022)

- Minor corrections.

Revision VF.2 (July 2022)

- Corrections;
- Update service contact information.

Revision VF.1 (July 2021)

- Corrections.

Revision VF.0 (March 2021)

- Format, addition, and modifications.

Revision VE.1 (July 2020)

- Revision for flanged mechanical modification release.

Revision VD.5 (April 2019)

- Addition of a gas recognition function.

….

Revision VA.0 (May 2009)

- First release.