Siargo Ltd.

LoRaWAN®

Thermal - D®



Gas Mass Flow Meter VD.2.01

Model

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Gas Mass Flow Meter

IoT-ready with MEMS *Thermal-D*® sensing technology

MF5200 Series

User Manual

Document No. 11-2025-M11 EN
Issue date: 2025.11
Revision: VD.2.01

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Attention!

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

Use with caution!

- Be cautious of electrical safety, even if it operates at a low voltage; any electrical shock might lead to some unexpected damage.
- The gas to be measured should be clean and free of particles. Do not apply this meter to a liquid medium.
- Do not apply for any unknown or non-specified gases that may damage the product.
- For remote data, please be sure the meter is configured correctly.

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1. Overview

All contact information is at the end of this manual.

This manual provides essential information for operating the MF5200 series of gas mass flow meters for general-purpose gas mass flow measurement applications. Product performance, maintenance, and troubleshooting, as well as information on product ordering, technical support, and repair, are also included.

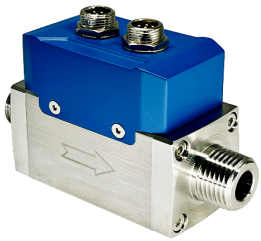
MF5200 mass flow meters are designed with the Company's proprietary *Thermal-D*® (registered trademark) micromachined thermal sensing technology that combines calorimetry and diffusivity sensing. Compared with traditional calorimetric sensing, this proprietary sensing removes gas sensitivities for gases with the same diffusivity, improves the linearity when a gas conversion is applied, and extends the dynamic measurement range for some gases. Various wireless data options make the products ready for plug-and-play IoT applications. Typical applications include hospital gases (air, oxygen, nitrogen, carbon dioxide, argon, and nitrous oxide), industrial processing gas monitoring and management, and other applications. The design is suited to applications where the display must be placed separately from the meter body or flow channel. In addition to gas mass flow, the products can also measure gas pressure and gas temperature.

The current models are ready to connect to 12 mm (1/2") or 19 mm (3/4") lines, while other pipe diameters can be offered as customized models. The meter body is made of stainless steel and has a maximum working pressure of 1 MPa (10 bar).

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 the carrier that shipped the product and notify the distributors or sales representatives if the order was not placed directly with the manufacturer; otherwise, the manufacturer should also be notified. 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 shown below may also be included in your order.



Flow meter



Detachable display



Power & data cable, 12M6-100



Display cable 12M7-100-12M7

Figure 2.1: MF5200 flow meter and accessories

Please check the product's integrity and the power and data cables immediately. If any abnormalities are identified, please notify the distributor/sales representative or manufacturer as soon as possible. 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 the power cable is plugged in.) This user manual shall either be included in the packing box or be available upon request for an electronic version. In most cases, this manual shall be made available to the customer before the order is placed.

The two cables are Accessory Cable 1 for power & data inputs/outputs (Part number: **12M6-100**, Length: 1.0 m) and Accessory Cable 2 for the detachable LED (Display cable, Part number: **12M7-100-12M7**, Length: 1.0 m).

3. Knowing the products

3.1 Product description

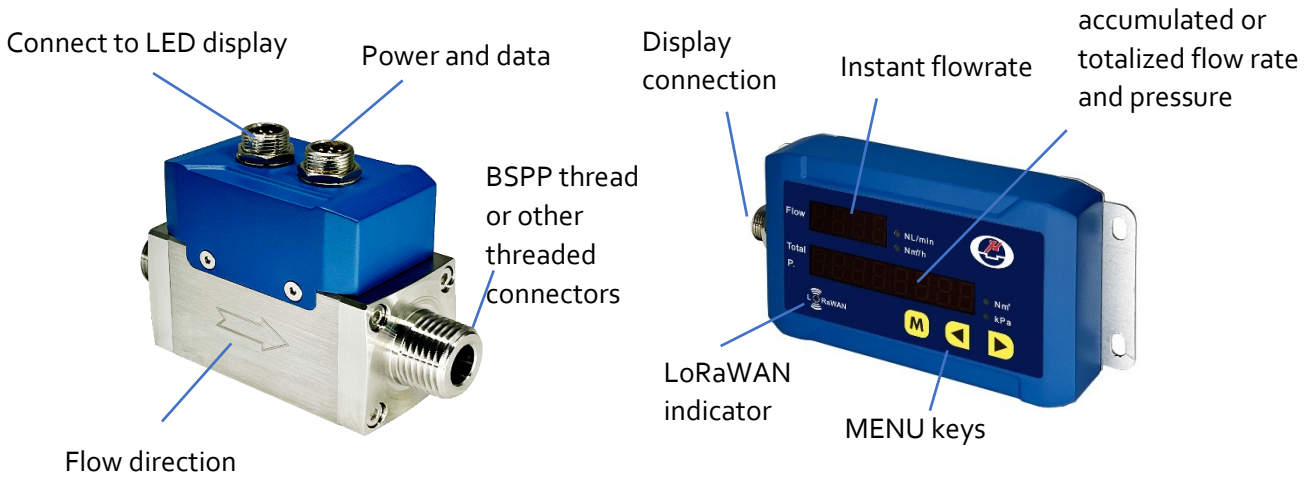


Figure 3.1: MF5200 parts description.

3.2 LED description

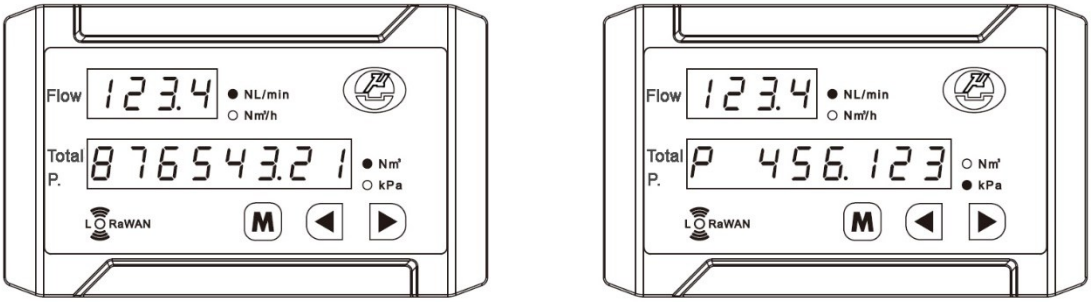


Figure 3.2: LED symbol illustration.

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 explains the meaning of each symbol.

When an error occurs, the lower row displays error codes E1 through E4.

Table 3.1: Symbol descriptions

Flow	The upper row displays the instant flow rate, which can be selected from two units (NL/min or Nm3/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 contact the manufacturer for further information.

3.3 Power and data cable description



Figure 3.3: MF5200 power cable
Part number **12M6-100**

Table 3.2: MF5200 wire assignments.

Wire	Color	Definition
1	Red	Power supply (8~24Vdc)
2	Black	GND, ground
3	Green	RS485A (+)
4	Brown	RS485B (-)
5	White	High flow alarm
6	Yellow	Low flow alarm

The cable connector is the standard 12 M connector. Do not force the plug. After the plug is engaged correctly, use the plug screw to tighten the engagement.

3.4 Mechanical dimensions

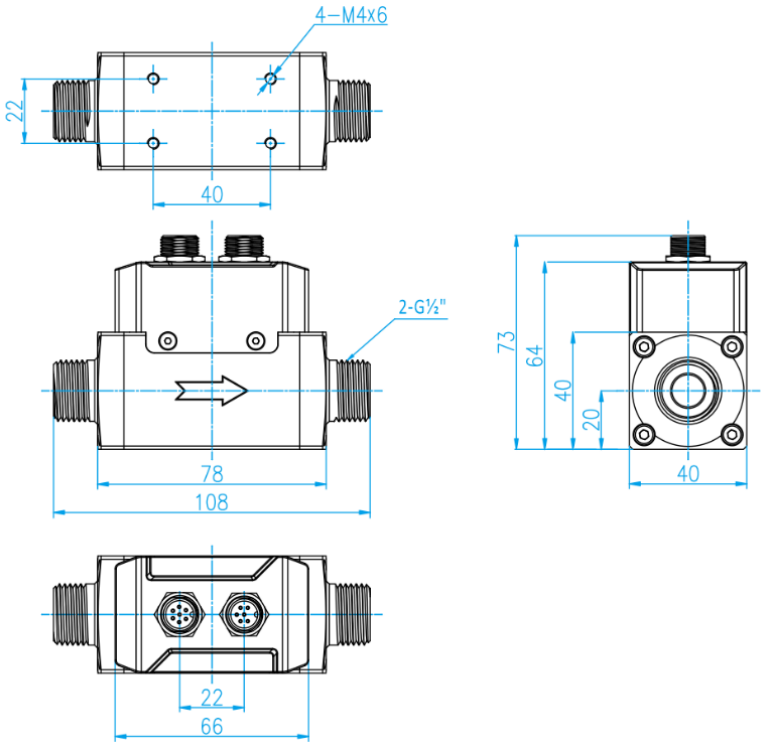


Figure 3.4: MF5200 dimensions – flow meter MF5212

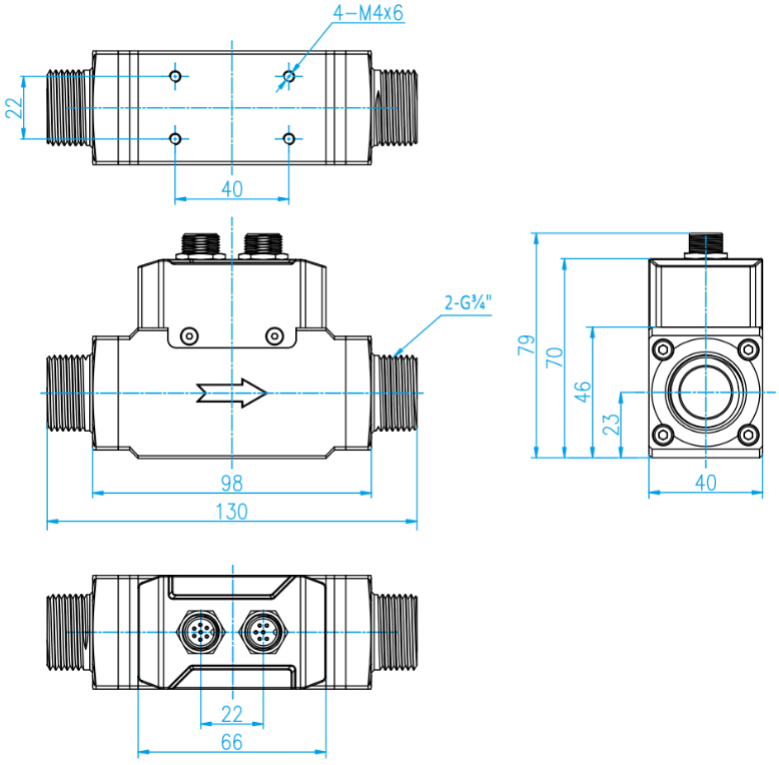


Figure 3.5: MF5200 dimensions – flow meter MF5219

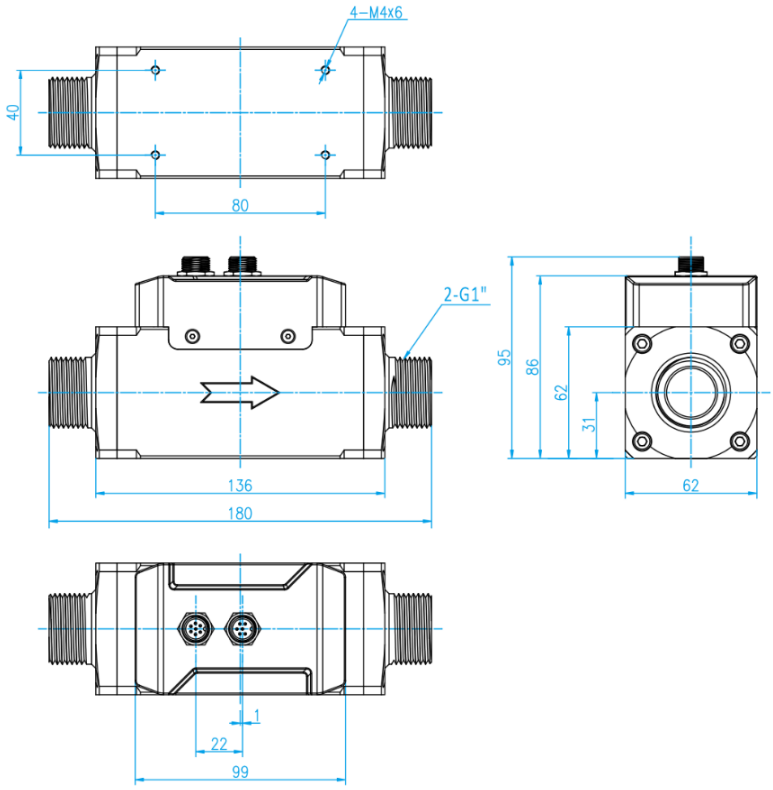


Figure 3.6: MF5200 dimensions – flow meter MF5225

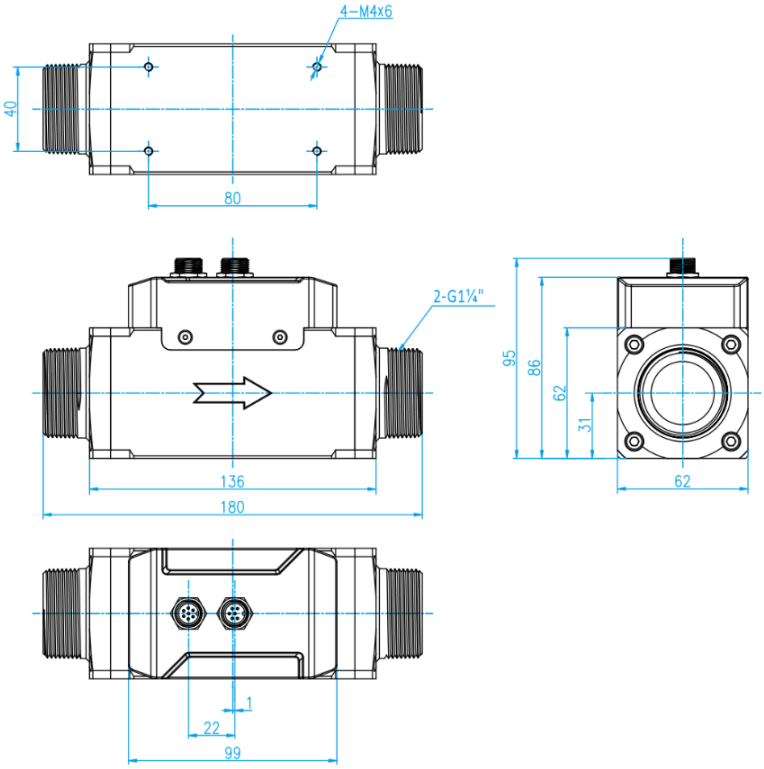


Figure 3.7: MF5200 dimensions – flow meter MF5232

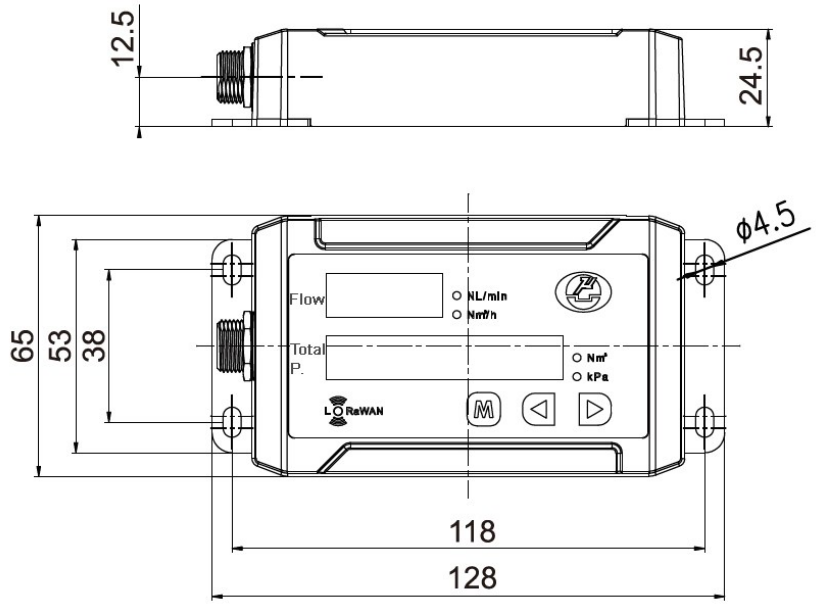


Figure 3.8: MF5200 dimensions – LED display, type C

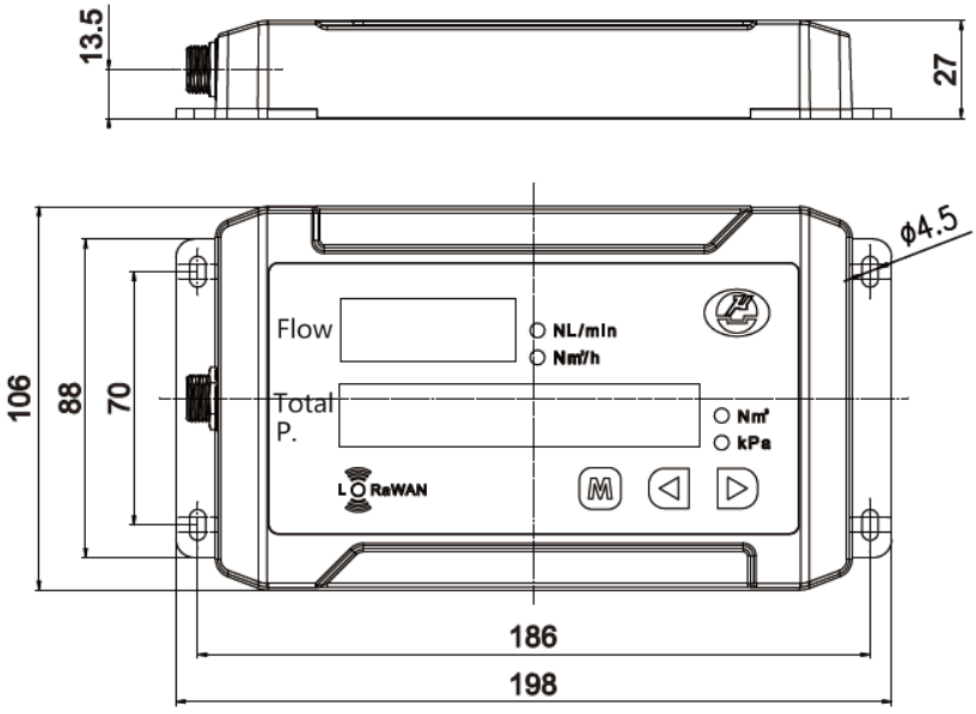


Figure 3.9: MF5200 dimensions – LED display, type D and type E
For type E, the electrical interface is in the back of the LED display.

4. Installation

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

The product at the time of shipment is fully inspected for its quality and meets all safety requirements. Additional safety measures during the installation should be applied. This includes, but is not limited to, the leakage verification procedures, standard ESD (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 contain particles or debris, a filter is strongly recommended for installation upstream of the meter.

Please follow the following steps to complete the installation:

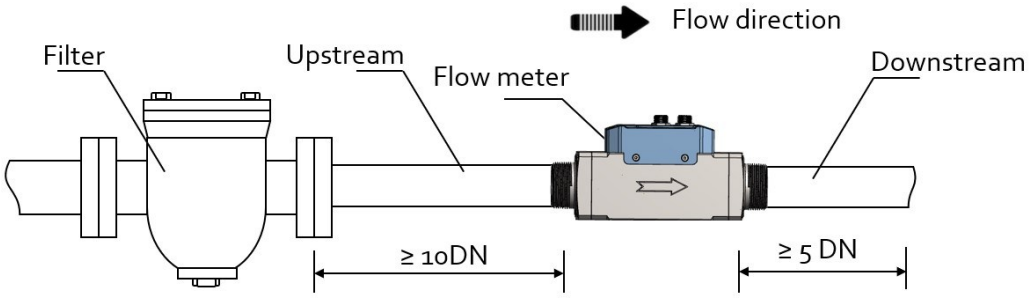


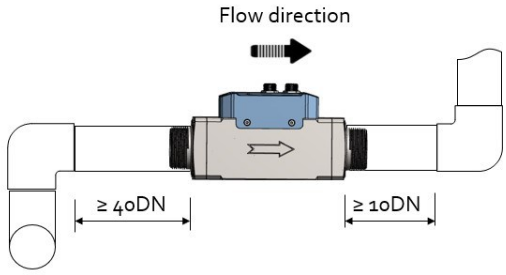
Figure 4.1: MF5200 installation

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

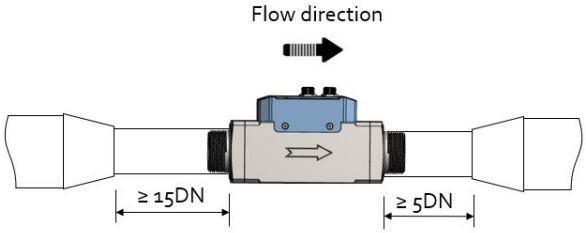
b) Before installation of the product, please ensure that the pipe is free from debris, particles, or any other foreign materials.

c) Cautions during installation:

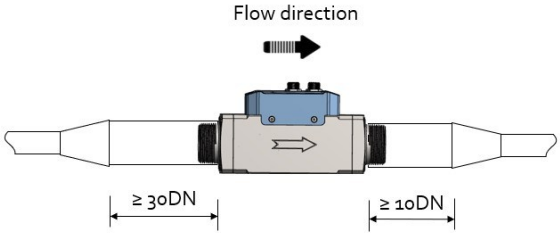
i) It is preferable first to install/connect the meter inlet and then the outlet end of the meter; To ensure measurement accuracy, an upstream straight pipe of length no less than 10DN and a downstream straight pipe of length no less than 5DN should be in place. Please refer to the recommended installation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

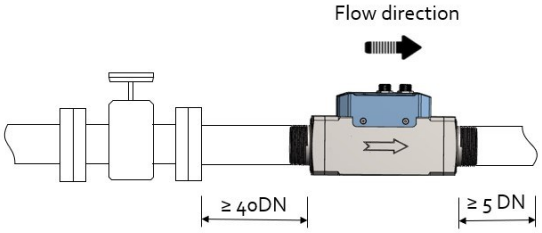


(a) 90-degree elbow or T-piece

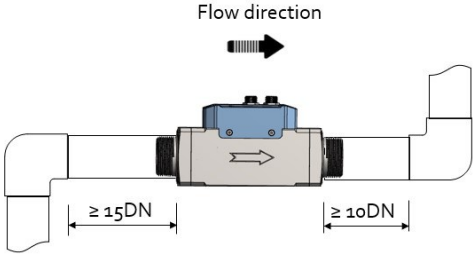


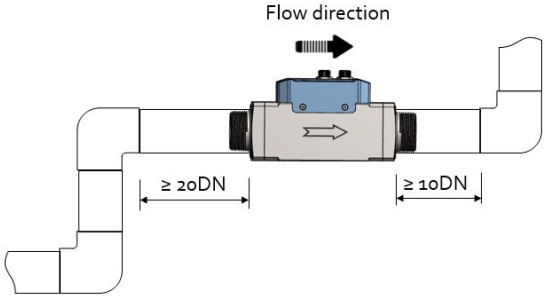
(b) 2x90-degree elbow





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





(e) Pipe size expansion (f) Control valve at upstream or downstream

Figure 4.2: MF5200 installation

(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.

(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 confirm the power supply range (i.e., 8-24 Vdc) and polarity. If an adapter is other than the one supplied by the manufacturer, make sure the adapter meets industrial standards and has 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 appropriate shielding.

f) Once the external power is successfully connected, the LED 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: Because the meter has an extensive dynamic measurement range, it is normal to see a small instant flow rate before opening the valve, as there may be some leakage. However, make sure the meter reads 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 create malfunctioning of the product.

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

5. Operation and MENU description

5.1 Check the product specifications

Before using this product, check the product specifications in this manual or the basic information on the product's back panel.

The detailed product technical specifications are available in Section 7. For a specific application, the pressure rating must not exceed the system pressure to be measured, and the flow range must also be within the specified range. In most cases, using a high full-scale-range meter for very low flow rate measurements 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 cause irreparable 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 must also be used according to standard electrical device practice. Before connecting the meter with external DC power or an AC-DC adapter, make sure the supply voltage is within the range specified in Section 7. Be cautious to ensure 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

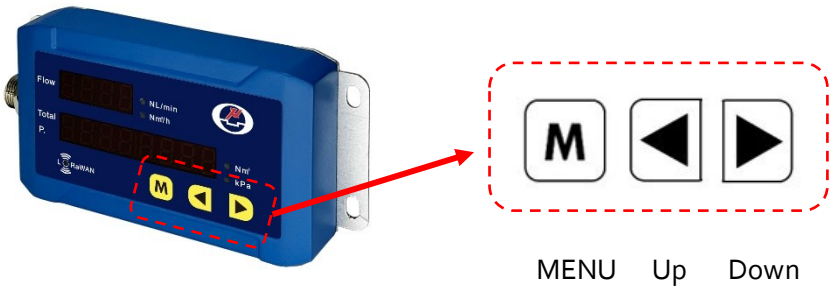


Figure 5.1: MF5200 keys description

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, enabling the user to select a function and perform confirmation or other related actions, as detailed below. Two keys ("Up" and "Down") are used to select the menu and sub-menu.

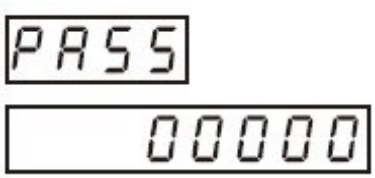
5.4.1 Starting the measurement

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 shows the instantaneous flow rate, and the lower line shows the accumulated or totalized flow rate. The lower line will light up when the pressure option is selected.

The LED capability limits the number of display characters; see the following 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 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 flashing digit, then 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 unit for the accumulated or totalized flow rate	F31 - UnT-A
➢ Set the unit for the instant flow rate	F32 - UnT-F
➢ Set the display mode	F38 - dISP
➢ Set the high flow alarm	F51 - ALm -H
➢ Set the low flow alarm	F52 - ALm -L
➢ 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 flow without interruption.

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 and 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, indicating that the task is complete. 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 steps above, on the MENU setting screen, use the "Up" or "Down" key to select F3-bPS, then press the "M" key to set the RS485 communication baud rate.

There are six selectable baud rates, 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 specific period of use, the meter's offset (zero flow rate) may shift slightly. When applying the meter to different gases, the offset might shift. To ensure measurement accuracy, the offset must be reset or calibrated. Following the steps mentioned above, 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.

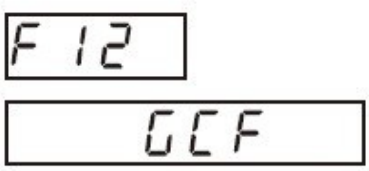


5.4.6 Gas conversion factor (GCF) for different gas measurements

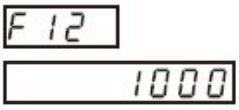
For general applications, a gas conversion factor (GCF) can be used to measure gas differently from the default or calibration value. The GCF is determined by the thermal-calorimetric sensing principle, the meter's fluid-dynamic design, and the control circuitry. Contact the manufacturer to obtain the values corresponding to the correct models.

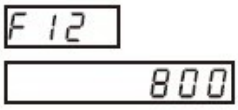
The GCF for air is 1000.

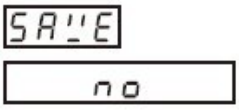
Note: If the meter is ordered with a special real-gas calibration at the time of purchase, contact the manufacturer before proceeding.

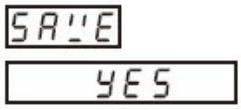


Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F12 - GCF. Press the "M" key to confirm, and it will open the sub-MENU showing the current gas conversion value. Use the "Up" or "Down" keys and the "M" confirming key to enter the desired value, then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

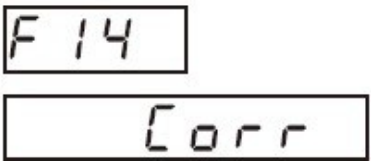






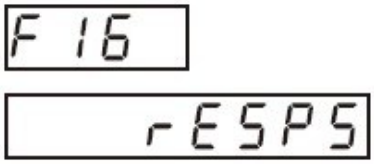


5.4.7 Set the 2nd-correction factor



Following the steps mentioned above, 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



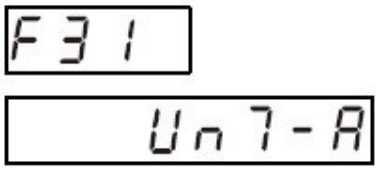
Following the steps above, on the MENU setting screen, use the "Up" or "Down" key to select F16 - rESPS, then press the "M" key to set the response time.

There are six selectable response times: 125, 250, 500, 1000, 2000, and 5000 milliseconds. The default response time is 1000 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

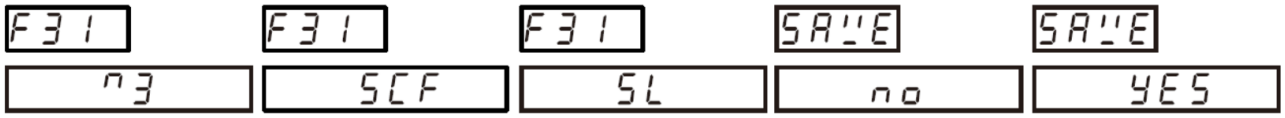
screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



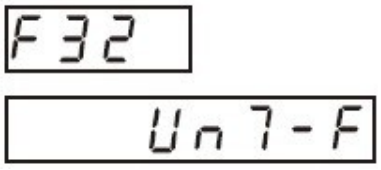
5.4.9 Set the unit for the accumulated or totalized flow rate



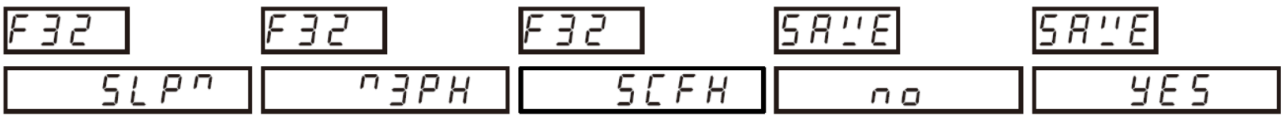
This function sets the unit of accumulated flow. If one likes to switch between m^3 and SL, following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F31 - UnT-A. Press the "M" key to confirm, and it will open the sub-MENU showing the current unit of accumulated flow. 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 F31 – UnT-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.



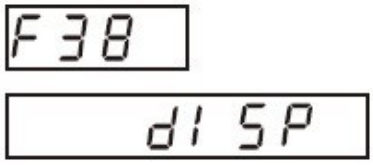
5.4.10 Set the unit for the instant flow rate



This function sets the unit for an instant flow rate. If one likes to switch between SLPM and m3/h, following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F32 - UnT-F. Press the "M" key to confirm, and it will open the sub-MENU showing the current unit of accumulated flow. 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 F32 - UnT-F 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.



5.4.11 Set the display mode



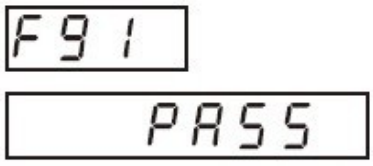
For the models with an integrated pressure sensor, following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F38 - dISP and then press the "M" key to set the display mode for either fixed for the accumulated or totalized flow rate or Cycle mode that will alternatively display the accumulated flow rate and the pressure data.

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.



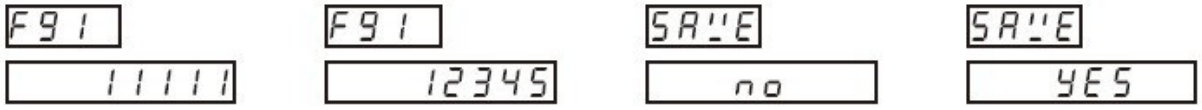
5.4.12 Change the default password

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

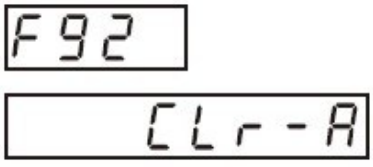


Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F91 - PASS. Press the "M" key to confirm, and it will open the sub-MENU, which shows the default password 11111. Use the "Up" or "Down" keys and the "M" confirming key to select the desired option, and 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. If it is unrecoverable, please get in touch with the manufacturer to obtain a special password to access the meter's MENU.

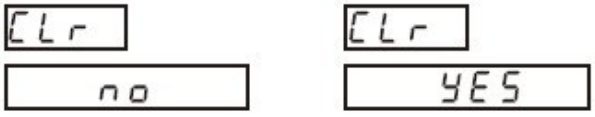


5.4.13 Reset the accumulated or totalized flow rate

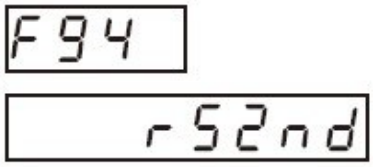


As the maximum value of the accumulated or totalized flow rate that the internal register can have is 9999999, the register will stop accumulating once the value is reached. At this time, it is necessary to reset this register. Following the steps mentioned above, at the MENU setting screen, use the "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.

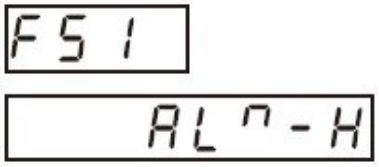


5.4.14 Reset the 2nd-correction factor

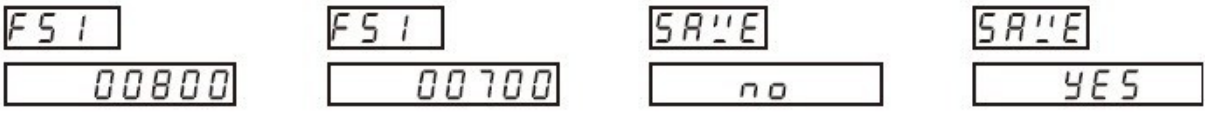


Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F14 - Corr and then press the "M" key to set the 2nd correction factor.

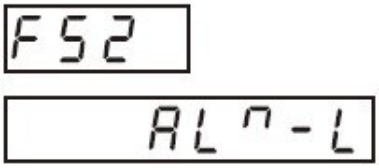
5.4.15 Set high-flow alarm



This function allows the user to set a high-flow rate limit above which the alarm will trigger. The limit range will be 100 to 1000 SLPM. Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F51 – ALm -H. Press the "M" key to confirm, and it will open the sub-MENU for setting 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 F51 – ALm - H 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.

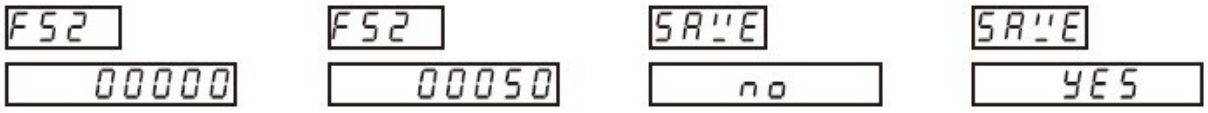


5.4.16 Set low-flow alarm

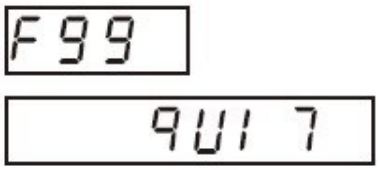


This function allows the user to set a low-flow rate limit below which the alarm will trigger. The limit range will be 0 to 100 SLPM. Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F52 – ALm -L. Press the "M" key to confirm, and it will open the sub-MENU for setting 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 F52 – ALm - L screen, which indicates the

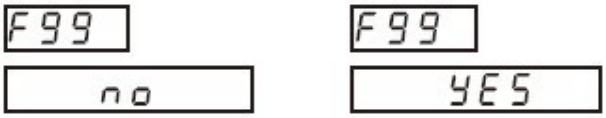
task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.



5.4.17 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.



5.4.18 MENU key sequence for the settings

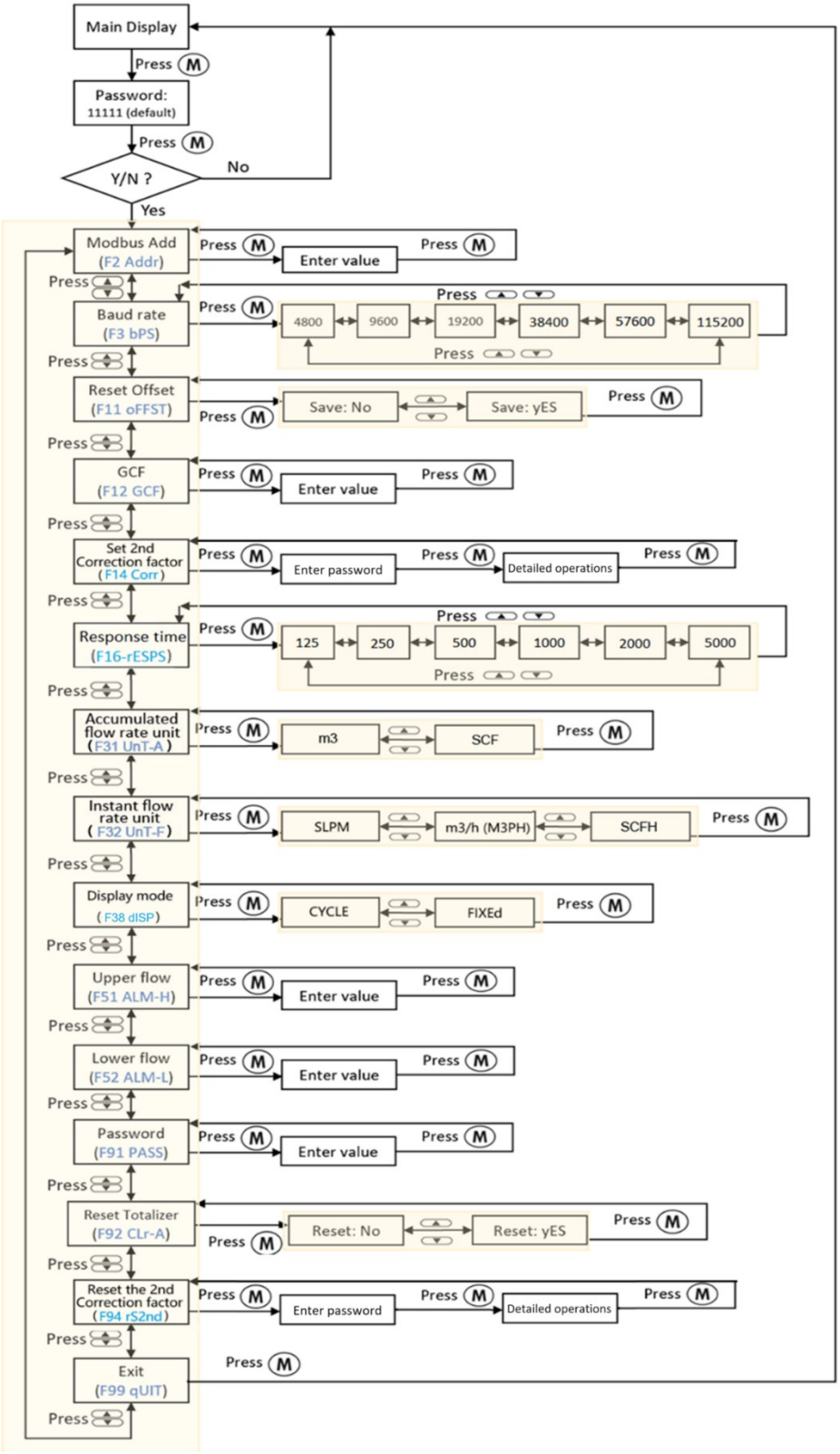


Figure 5.2: MF5200 MENU key sequence

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 (MF5200) is a slave.

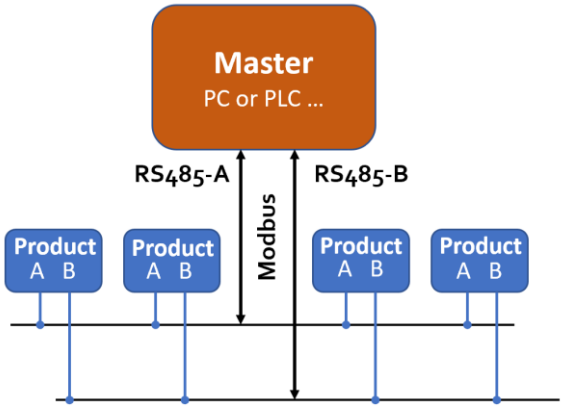


Figure 5.3: RS485 hardware connection

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 to 1-247, except 157 (0x9d). 0 is the broadcast address.

Function codes: Define the product (MF5200)'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 bit time, for ending the current frame.

5.5.4 Function codes

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

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 (MF5200) has multiple registers available for assigning various functions. With these functions, the user can obtain data from products, such as product addresses and flow rates from the registers, or set product functions by writing the corresponding parameters.

The currently available registers are listed in the following table; they 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)
Baud rate	Communication (R/W)	0x0082	40131 (0x0082)
GCF*	Gas correction factor (R/W)	0x008B	40140 (0x008B)
Response time*	Set the response time (R/W)	0x008D	40142 (0x008D)
Units*	Instant and accumulated flow rate units (R/W)	0x0090	40145 (0x0090)
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 turn off the write protection before setting.

The detailed information for 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 SLPM, 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 SLPM		

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.		

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.** **For example, when** the user reads "2" from register 0x0082, the baud rate is 19200.		

GCF	0x008B	Write	Y
		Read	Y
Description	The gas conversion factor for a gas differs from that for 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 to be the proper GCF.** For a specific GCF value, please contact the manufacturer. **Notes: Please disable the write protection before executing this function.**		

Response time	0x008D	Write	Y
		Read	Y
Description	Set response time		
Value type	UINT 16		
Notes	125, 250, 500, 1000, 2000, or 5000, unit is msec. **The default value is 1000 msec.** **For example, when** the user reads "2000 (0x07D0)" from register 0x008D, the response time is 2000 msec (2 sec). **Notes: Please disable the write protection before executing this function.**		

Units	0x0090	Write	Y
		Read	Y
Description	Set the instant flow rate unit and the accumulated or totalized flow rate unit		
Value type	UINT 16		
Notes	1 - instant flow rate unit SLPM, accumulated or totalized flow rate unit Nm^3; 2 - instant flow rate unit Nm^3/h, accumulated or totalized flow rate unit Nm^3; 7 - Instant flow rate unit: SLPM, accumulated or totalized flow rate unit: SL. **The default value is 1.** **For example, when** the user reads "1 (0x0001)" from register 0x0090, the instant flow rate unit is SLPM, and the accumulated or totalized flow rate unit is Nm^3. **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 the 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 specific register to a set value.		
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 write execution completes, the firmware will automatically re-enable write protection.		

5.6 LoRaWAN communication

The default wireless communication is LoRaWAN. Other options can be customized—available options include Wi-Fi, NB-IoT, BT LE, etc. Please contact the manufacturer for further information.

The default LoRaWAN parameters are:

DEVEUI: Unique product ID, printed on the product label. **Please do not modify!**

APPKEY: 2000000000000000000000000000001, printed on the product label

APPEUI: 0000000000000000, printed on the product label

Network access method: OTAA

LoRaWAN MAC version: 1.0.2

LoRaWAN Regional Parameters revision: A

Uplink and Downlink Mode: Same Frequency Mode

The communication is based on the Modbus protocol. At the time of shipping, the auto data transmission function is enabled. Once the product is connected with the LoRaWAN, the data will be sent every 5 minutes, and the data structure is explained as follows:

Data example: 01 03 0E 00 00 00 64 00 00 00 64 00 E6 00 00 00 64 CRC CRC

Register Address	HEX	Parsing	Note
	01	MODBUS address	
	03	Read Command	
	0E	Number of bytes	
58-59	00 00 00 64	Instant Flow Rate	Flow=/1000=0.1 L/min
60-62	00 00 00 64 00 E6	Total Vol: Integer Total Vol: Decimal	Accflow=int+dec/1000 =100+230/1000=100.23m³
69-70	00 00 00 64	pressure	100/1000=0.1bar
	CRC CRC	MODBUS CRC Check	X16 + X15 + X2 + 1

6. Product selection and order information

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

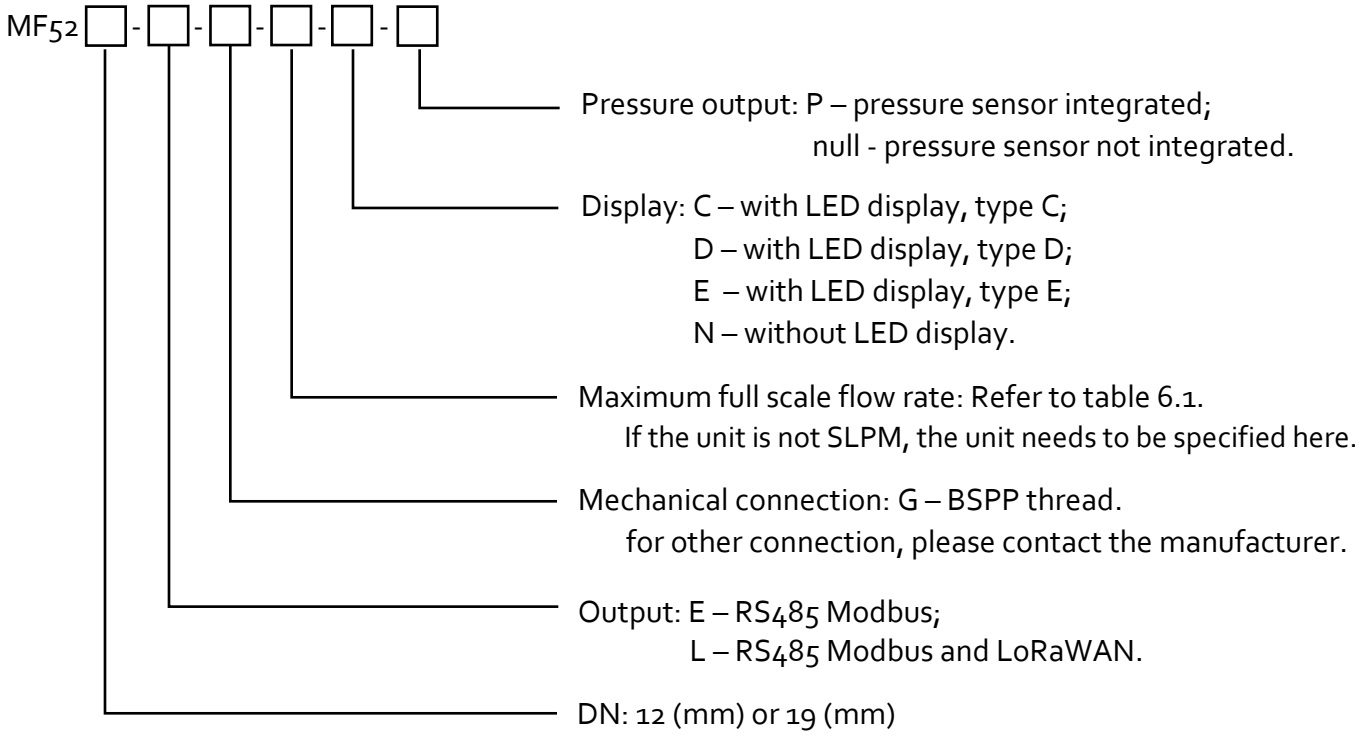


Table 6.1: Connection and maximum full-scale flow rate selection

Model	DN (mm)	Connection	Maximum full-scale flow rate	
			SLPM	NCMH
MF5212	12	G 1/2"	200, 300, 400	12, 18, 24
MF5219	19	G 3/4"	600, 800, 1000	36, 48, 60
MF5225	25	G 1"	1500, 2000	90, 120
MF5232	32	G 1-1/4"	2500, 3000	150, 200

e.g. MF5212-E-Q-200-C-A, MF5219-L-Y-48NCMH-D-R-P

Note: For other IoT / wireless data options, please contact the manufacturer.

7. Technical specifications

7.1 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.

	MF5212	MF5219	MF5225	MF5232	Unit
Full-scale flow range	200 / 300 / 400	600 / 800 / 1000	1500/2000	2500/3000	SLPM
Accuracy	±(1.5+0.5FS)				%
Repeatability	(0.5+0.15FS)				%
Turn-down ratio	30:1				
Response time	1000 (default)				msec
Working temperature	-10 ~ +55				°C
Maximum pressure	1.0				MPa
Humidity	<95, no condensation				%RH
Power supply	8 ~ 24 (50 mA)				Vdc
Cable	Power/data cable 12M6-100; Detachable LED cable 12M7-100-12M7.				
Digital output	RS485 Modbus half-duplex / LoRaWAN				
MENU access	3 key – front face keyboard/digital				
Display	Detachable LED: Instant flow rate, accumulated or totalized flow rate				
Mechanical connection	BSPP thread or customized				
Storage temperature	-20 ~ +70				°C
Reference conditions	20°C, 101.325 kPa, air				
Weight	1.2	1.5	2.1	2.5	kg
Fluid compatibility	Non-corrosive				
CE	EN61326-1; -2; -3				

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

7.2 Wetted materials

The wetted materials are 304 stainless steel. The sensing element comprises silicon, silicon nitride, and silicon dioxide. The sensor chip surfaces are passivated with silicon nitride and silicon dioxide. The electronic sealant is 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

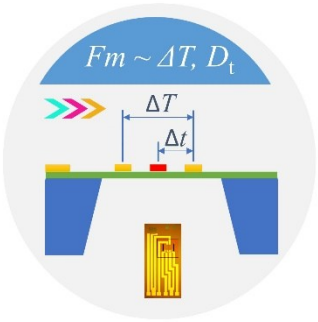


Figure 8.1: Illustration of the measurement principle.

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

Compared to the calorimetric sensing products offered by other manufacturers, the proprietary sensing approach provides a broader dynamic range and better performance under fluctuations in environmental parameters. It reduces some gas-sensitivity issues for gases with the same diffusivity and improves linearity when a gas conversion factor is used for metering 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 more precisely specified accuracy (about 1/3 of the product's accuracy), and pay special attention to differences in reading 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 critical to keep the system's pressure variation as minimal as possible. (This explains our recommendations for the installations in Section 4). Also, the measurement principle is often very important for understanding 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 essential to ensure the applied flow medium will be clean and dry. If any contamination is suspected, please allow experienced technical personnel to check and recondition it. Do not use a foreign cleanser or other fluids to clean the flow path, as this could cause irreparable damage.

8.2.3 Apply to a different gas medium

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

The meter operates according 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 flow meters). Due to the meter assembly procedure, the head loss value from the meter to the meter would not be 100% identical. Within the extensive dynamic measurement range, the thermal response would also exhibit deviations and nonlinearity from gas to gas. Therefore, measurements by the meter for a gas medium other than the calibration gas would exhibit larger measurement errors, particularly at low Reynolds numbers, where the flow profile is sensitive to laminar flow.

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, OEM products shall be free from faulty materials or workmanship for 180 days from the date of shipment, and non-OEM products shall be free from such defects for 365 days from the date of shipment. This warranty period is inclusive of any statutory warranty. Any repair or replacement of a serviced product shall be subject to the same terms 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 fully responsible for validating the performance and suitability of the products for their specific designs and applications. For any misuse of the products outside 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, including reasonable attorney's fees, arising from direct or indirect sources.

Siargo makes no other warranty, express or implied, and assumes no liability for any special or incidental damage or charges, including but not limited to any damages or charges due to installation, dismantling, reinstallation, etc., or any other consequential or indirect damages of any kind. To the extent permitted by law, the exclusive remedy of the user or purchaser, and the limit of Siargo's liability for any and all losses, injuries, or damages concerning the products, including claims based on contract, negligence, tort, strict liability, or otherwise shall be the return of products to Siargo, and upon verification of Siargo to prove to be defective, at its sole option, to refund, repair or replacement of the products. Regardless of form, no action may be brought against Siargo more than 365 days after the cause of action accrues. 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. In the case of battery usage, long-term discharge, or leakage-induced damage;
(3) Products that have been opened or dismantled for whatever reason;
(4) Products that have been subject to working conditions beyond the technical specification as described by this manual or related datasheet published by the manufacturer;
(5) Any damages incurred by the incorrect usage of the products;
(6) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies.
(7) Products that unauthorized dealers or any third parties resell.

11. Service/order contact and other information

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

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

For any returns, please contact 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

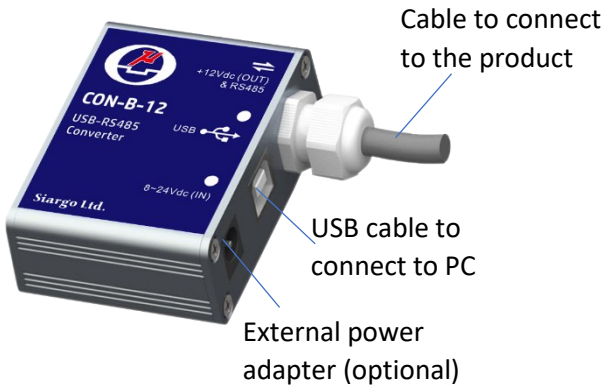
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For further information and updates, please visit www.Siargo.com.

Appendix I: Product Evaluation Kit

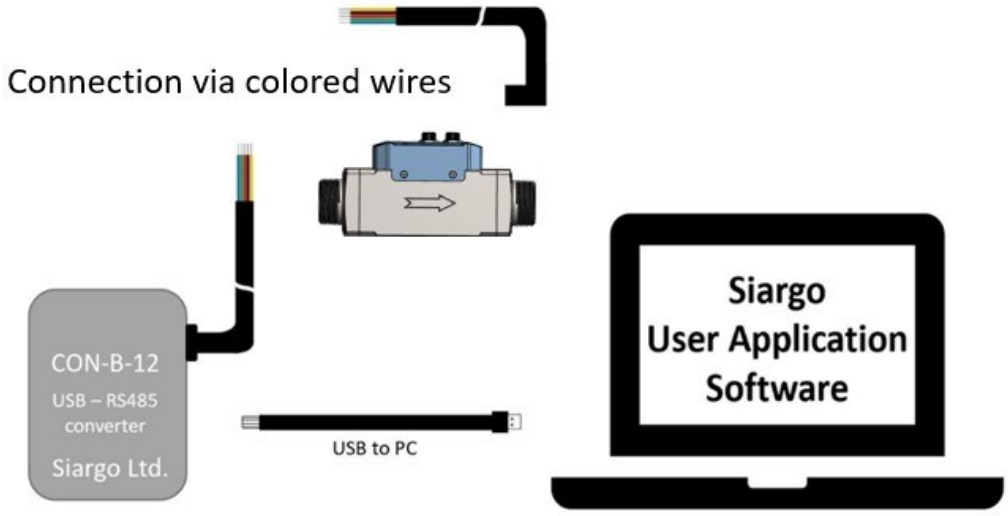
Siargo offers a product evaluation kit, including a digital data converter, USB data cable, and User Application software, that allows the user to evaluate the product performance on a Microsoft Windows-based computer. For some simple applications with digital data transfer, this kit could serve the 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 or to purchase the evaluation kit, please get in touch with the manufacturer or a sales representative.



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

For most products, power from the PC via the USB cable will be sufficient; 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 8~24 Vdc will be required.



Appendix II: Document history

Revision VD.2.01 (November 2025)

- Revised the troubleshooting.

Revision VD.2 (October 2025)

- Add MF5225 and MF5232.

Revision VD.1.03 (August 2025)

- Corrections.

Revision VD.1.02 (October 2024)

- Correct the default response time.

Revision VD.1.01 (July 2024)

- Minor corrections.

Revision VD.1 (March 2024)

- Corrections.

Revision VD.0 (July 2023)

- First release.