



Gas Cylinder Mass Flow Meter VB.0.04

Model MF5806-G

Gas Cylinder Mass Flow Meter

with MEMS thermal sensing technology and enabled by IoT

MF5806-G Series

User Manual

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Attention!

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



Use with caution!

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

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1. Overview

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

This manual provides essential information for the operation of the MF580G series of gas mass flow meters for gas cylinder management applications. The product performance, maintenance, and troubleshooting, as well as the information for product order, technical support, and repair, are also included.

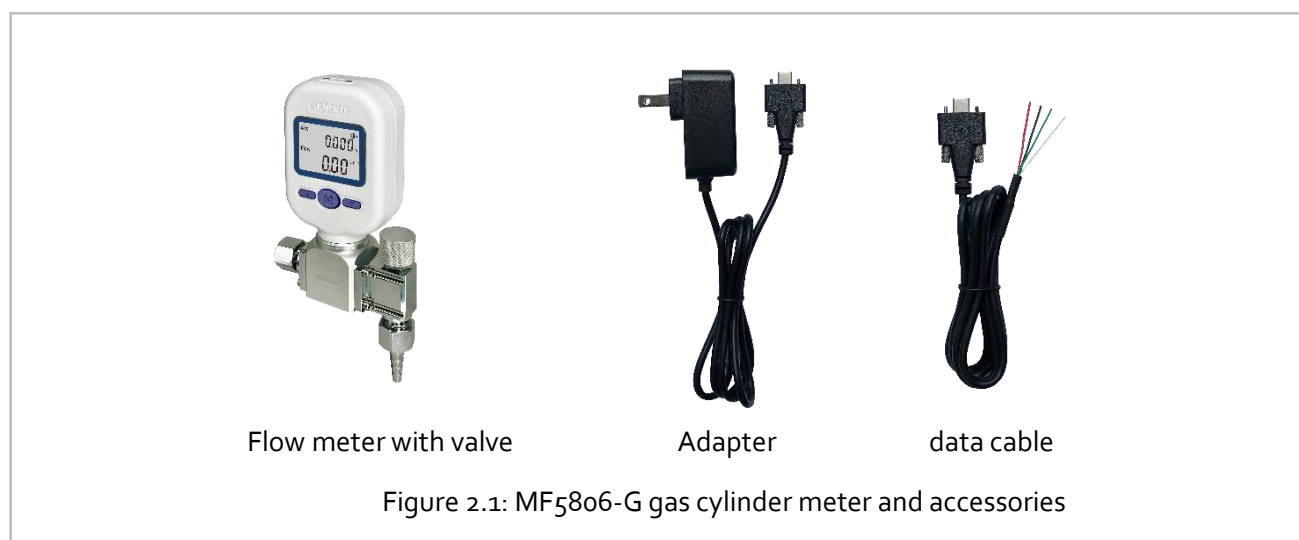
The MF5806-G is designed for gas cylinder management, including its consumption, instant supplied flow, location, and various usage alarms. The product is a mass flow meter re-engineered from one of the company's best-selling mass flow meter products on the market, due to its performance and cost-effective design enabled by the company's proprietary MEMS (micro-electro-mechanical systems) thermal sensing technology and the full spectrum of wireless data options for IoT applications. The current model is the 3rd generation of the product, having significantly upgraded features since its first release in 2010. The upgrade includes much-improved accuracy, an additional model to cover flow range and channel size compatibility; significantly extended measurement dynamic range, and valve options. Siargo is committed to continuous product innovation while offering the best value to our customers.

The wetted materials of the products are compatible with most common gases, including oxygen, nitrogen, air, argon, and carbon dioxide. Siargo also offers a broad spectrum of off-the-shelf and customized flow, pressure, temperature/humidity, and gas concentration sensing products and provides integration and turn-key solutions to our customers. Please get in touch with the manufacturer for additional information.

2. Receipt / unpack of the products

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

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

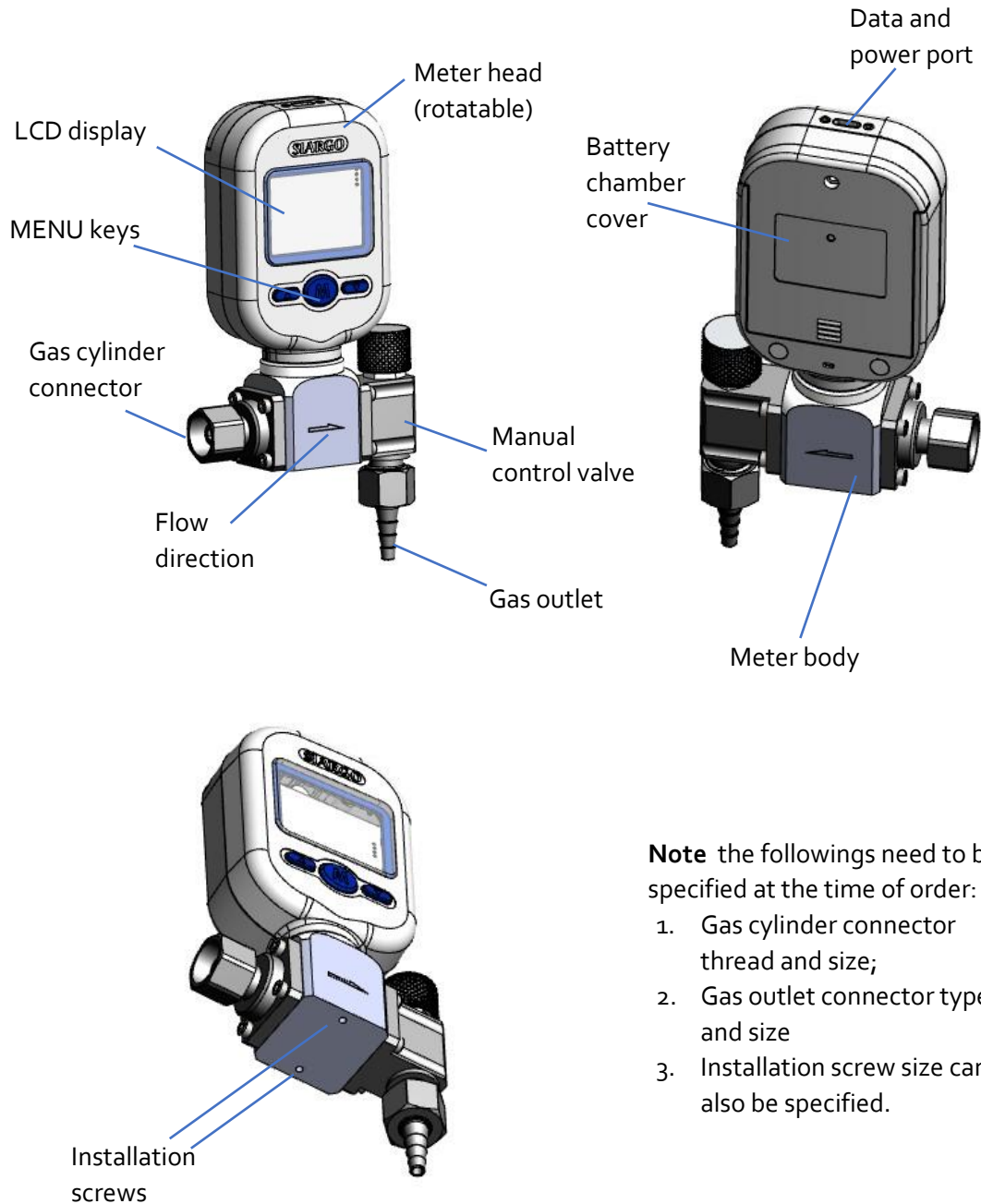


Please check immediately for the integrity of the product as well as the power and data cable. If any abnormalities are identified, please notify the distributor/sales representative or manufacturer as soon as you can. If any defects are confirmed, an exchange shall be arranged immediately via the original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

The meter is designed to operate on low power, utilizing 4 AA batteries (LR6). If you prefer to use an external power adapter, the power adapter must have a safety certification for use with this meter. The external power/data connector is a Type-C USB. See the detailed requirements in the operation section.

3. Knowing the products

3.1 Product description



Note the followings need to be specified at the time of order:

1. Gas cylinder connector thread and size;
2. Gas outlet connector type and size
3. Installation screw size can also be specified.

Figure 3.1: MF5806-G product description

3.2 LCD description

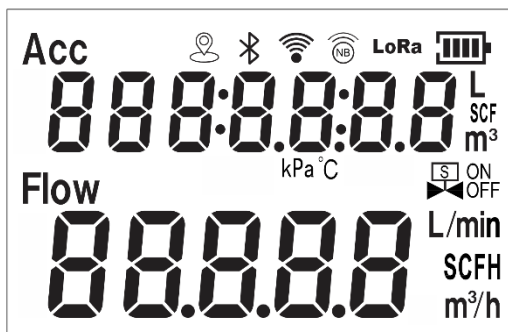


Figure 3.2: LCD symbol illustration.

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 details the meaning of each of the symbols.

Table 3.1: Symbol descriptions

ACC	The top row. The default displays the totalized flow rate in L (liters), m ³ (cubic meters), or SCF (standard cubic feet). It also displays pressure (if kPa lights up) or temperature (if °C lights up)*.
Flow	The 2 nd row. Displays instant flow rate in L/min (Liters per minute) or SCFH (standard cubic feet per hour) or m ³ /h (cubic meters per hour).
	Battery status.
	Valve status – this is applicable only when an external valve is installed.
LoRa	The LoRa or LoRaWAN wireless protocol is enabled when it lights up.
	NB-IoT wireless protocol is enabled when the lights are up.
	The Wi-Fi wireless protocol is enabled when the Wi-Fi light turns on.
	Bluetooth LE 4.2 wireless protocol is enabled when the lights are turned on.
	Reserved for future upgrade of GPRS inclusion.

***Note:** Both the pressure and temperature sensors can be integrated with the current product, but not with the default models. Please get in touch with the manufacturer for further information.

3.3 Power and data cable description

Table 3.2: MF5806-G wire assignment.



Wire	Color	Definition
1	Red	Power supply (5 ~ 24 Vdc)
2	Black	GND, ground
3	Green	RS485A (+)
4	White	RS485B (-)

Figure 3.3: MF5806-G cable (USB-C-100)

3.4 Mechanical dimensions

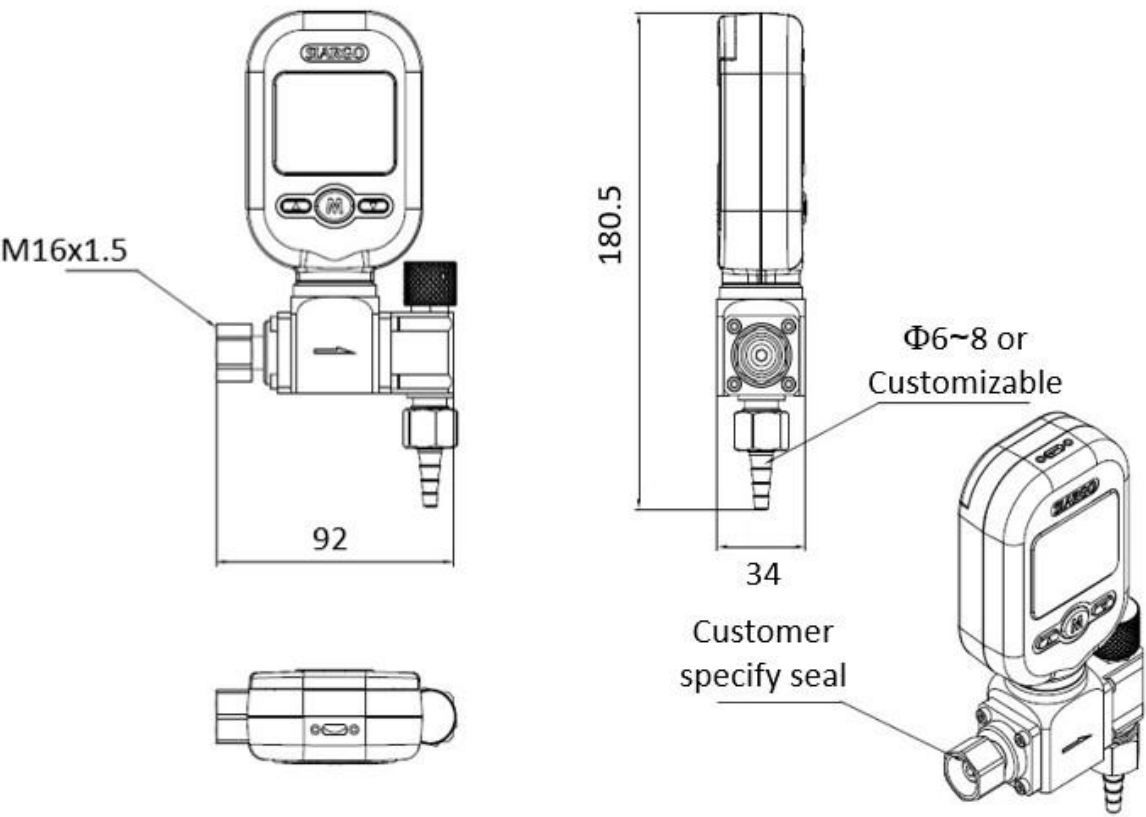


Figure 3.4: MF5806-G meter mechanical dimensions

4. Installation

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

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

The product is preferably installed horizontally. The flow direction should be aligned with the arrow mark on the meter body.

Please follow the following steps to complete the installation:

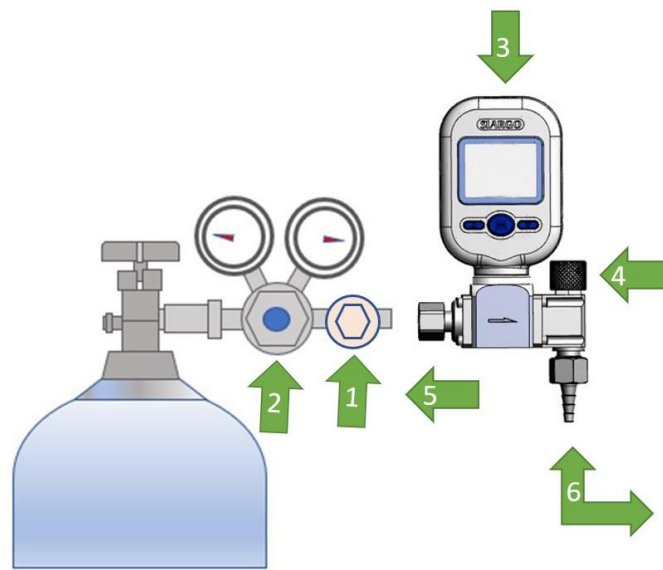


Figure 4.1: MF5806-G meter installation

- 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) Refer to the graph above,
 - (i) The meter should be installed after the gas cylinder pressure regulator. Before the installation, please check first that the valve of the regulator outlet is closed tightly.

- (ii) Adjust the gas cylinder regulator for the desired gas delivery pressure. Please note that the meter is suitable for a gas delivery pressure of less than 8 bar (0.8 MPa or 120 psi). In most cases, the gas pressure should be set to below 5 bar (0.5 MPa or 75 psi).
 - (iii) Make sure the meter has power. Either 4-AA batteries have been installed or an external power adapter is plugged in. In case the external power supply is desired, connect electrical wires per the wire definition in Table 3.2. Please be sure of the power supply range (i.e., 5 ~ 24 Vdc) and power supply polarization. If an adapter is other than the one supplied by the manufacturer, make sure the adapter meets industrial standards and has all safety certifications.
 - (iv) Seal the meter inlet by hand, and there should be no flow data shown on the LCD.
 - (v) Make sure the manual control valve is closed tightly.
 - (vi) Install the meter by connecting the connector to the outlet of the gas cylinder pressure regulator.
 - (vii) Connect the flexible tube to the outlet of the meter. If a threaded outlet is ordered, a corresponding-sized pipe should be connected properly.
 - (viii) After the connection is done correctly, open valve one and slowly open valve 4.
 - (ix) Check the leakage before starting any gas usage.
- d) For the 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 make sure the data cable meets industrial standards with appropriate shielding.
- 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.
- e) This will conclude the installation.



Cautions

- a) Don't alter any parts of the product.
- b) Ensure the electrical connection is done correctly per the instructions.
- c) Make sure no mechanical stresses in the connections.
- d) The strong electromagnetic interference sources close by or any mechanical shocks at the pipeline may also create malfunctioning of the product.
- e) Slowly open/close valves to prevent abrupt pulse flow impact.

5. Operation and MENU description

5.1 Check the product specifications

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

The detailed product technical specifications can be found in Section 7. For a specific application, the pressure rating must not be higher than the system pressure to be measured, and the flow range should also be within the specified range. In most cases, the use of a high full-scale range meter for the very low flow rate measurement often results in erroneous data. The gas to be measured must also be consistent with that specified by the product. Be particularly cautious about the supplied voltage indicated in the specification. A higher voltage may lead to irrecoverable damage, and a lower voltage will not power the product for any desired functions.

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

5.2 Check the leakage

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

5.3 Power the meter and digital data connection

Although this product complies with the CE-required EMC regulations, it also requires the product to be used according to the standard electrical device practice. For general-purpose usage, the meter can be powered by 4 AA batteries. Be sure to select batteries with safety features and within their expiration dates. Do not use batteries without a known manufacturer and expiration date. For models with control valves or extensive usage, it is recommended to have the meter powered with external DC power or an AC-DC adapter. Make sure the supply voltage is within the range of the specified ones in Section 7. Before connecting the product to external power, ensure you follow standard electrical device precautions, including ESD (electrostatic discharge) and DC voltage. Excessive electrostatic discharge may damage the product.

The power and data are connected via a standard Type-C USB port. The manufacturer-supplied Type-C USB cable has a screw-locking fixture. It is recommended to use this feature to ensure the cable is properly engaged and will not accidentally get unplugged.

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

5.4 Wireless data communication

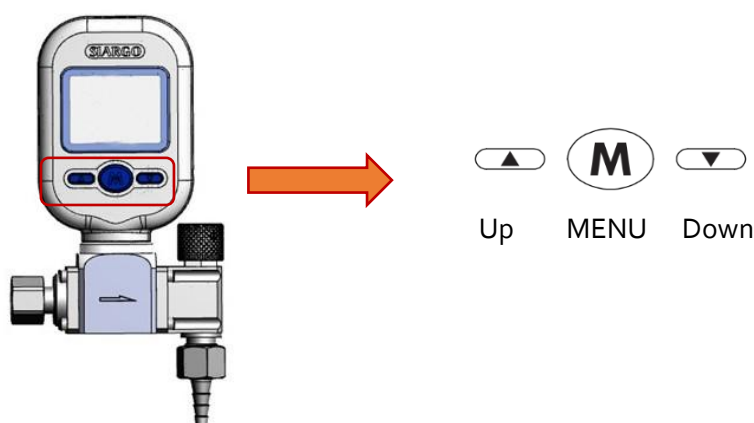
The product offers optional wireless data transmission via Bluetooth LE 4.2, LoRa, Wi-Fi, and NB-IoT.

An application "APP" named "Siargo Smart Meter 2.0" can be downloaded from either the Apple Store for smart devices based on the iOS system or from the Google Play Store for smart devices based on the Android system.

The APP provides the basic functions to access the meter/sensor data, plot an instant flow rate chart, and calculate totalized or accumulated flow volume at a specific time defined by the user. It enables users to send local data instantly to a remote destination when a wired connection is unavailable. Also, the interface provides the readout of the product information as well as technical support information.

For the detailed protocols of LoRa, WIFI, and NB-IoT, please contact the manufacturer for further information.

5.5 Meter MENU 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 located at the central position, allowing the user to select a

function and perform confirmation or other related actions, which will be detailed below. Two keys (“Up” and “Down”) to select the menu and sub-menu.

5.5.1 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 upper line is the accumulated or totalized flow rate, and the lower line is the instant flow rate. If the battery symbol turns on,  proceed to change the battery or plug in the external power cord.

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

A	b	C	d	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
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
5	7	U	‘	4	4	2	1	2	3	4	5	6	7	8	9	0	
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

5.5.2 MENU entry with a verified password



At the flow measurement (main) 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 5 digits, and the meter will enter into the menu setting interfaces/screen.

Subsequently, the MENU allows the user to:

- Set Modbus address
 - Change communication baud rate
- F2 - Addr

F3 - bPS

- | | |
|---|-------------|
| ➤ Reset or calibrate the offset | F11 - oFFST |
| ➤ Enter the gas conversion factor (GCF) | F12 - GCF |
| ➤ Change the response time | F16 - rESPS |
| ➤ Select the totalizer or accumulated flow rate unit | F31 - UnT-A |
| ➤ Select the instant flow rate unit | F32 - UnT-F |
| ➤ Change the display mode | F38 - dISP |
| ➤ Change the display language | F39 - LAnG |
| ➤ Open/Close the valve | F43 - VALVE |
| ➤ Set upper flow rate limit alarm | F51 - ALM-H |
| ➤ Set lower flow rate limit alarm | F52 - ALM-L |
| ➤ Set totalized or accumulated flow rate alarm | F53 - ALM-A |
| ➤ Change the default password | F91 - PASS |
| ➤ Clear or reset the totalizer or accumulated flow rate | F92 - CLr-A |
| ➤ Exit from the MENU | F99 - qUIT |

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

5.5.3 Set the RS485 Modbus address



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

The Modbus address has 3 digits, which can be any number between 001 and 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.

5.5.4 Set the RS485 communication baud rate



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

There are six baud rates selectable, depending on your system requirements: 4800, 9600, 19200, 38400, 57600, and 115200. 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 F9g - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

5.5.5 Reset or calibrate the offset



After a certain period of usage, the meter's offset (zero flow rate) may exhibit a small shift. When applying the meter to different gases, the offset might shift. To ensure measurement accuracy, it is necessary to reset or calibrate the offset. Following the 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 F9g - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

5.5.6 Gas conversion factor (GCF) for different gas measurements



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

The GCF for air is 1000.

Note: If the meter is required with a special real gas calibration, contact the manufacturer before placing the order.

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" 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 F9g - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

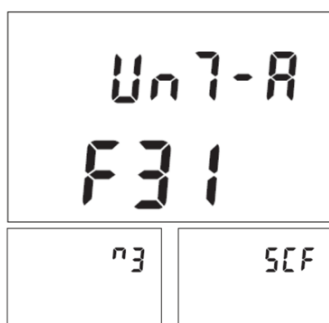
5.5.7 Set the response time



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

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

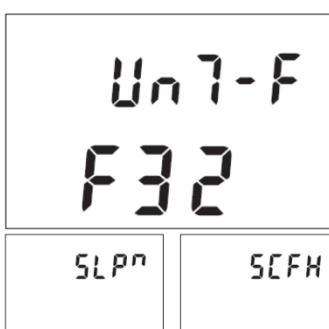
5.5.8 Select the totalizer or accumulated flow rate unit



This function allows the user to select the totalizer or accumulated flow rate units of the cubic meter (m³) or standard cubic feet (SCF). 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. 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.

5.5.9 Select the instant flow rate unit



This function allows the user to select the instant flow rate units of a standard liter per minute (SLPM) or standard cubic feet per hour (SCFH). 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. 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.

5.5.10 Select the display mode



This function allows you to set the display mode, cycle through display modes, or switch to fixed display mode. If one likes to switch between these two display modes, following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F38 - dISP. Press the "M" key to confirm, and it will open the sub-MENU showing the current display mode. 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 F38 - dISP 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.

5.5.11 Select the display language



This function is reserved for future upgrades. The current models are configured to be English or Chinese based on the shipping geographic regions. However, if one likes to switch between these two default languages, following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F39 - LAnG. Press the "M" key to confirm, and it will open the sub-MENU showing the current language. 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

F39 - LAnG 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.

5.5.12 Open/close the valve



This function is to open or close the valve. If one likes to open or close the valve, follow the steps mentioned above. At the MENU setting screen, use the "Up" or "Down" key to select F43 - VALVE. Press the "M" key to confirm, and it will open the sub-MENU showing the current valve status. Use the "Up" or "Down" keys and the "M" key to confirm your selection. Here, "on" means valve open and "off" indicates valve closed. Then press the "M" key again to complete the task. The display will then return to the F43 - VALVE 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.

Note: The valve is configured as a constant-open valve, or its default status is open (on). A constant-close valve can be an option by contacting the manufacturer

5.5.13 Set an alarm: upper instant flow rate limit



This function allows the user to set the instant flow rate above which the meter will trigger the alarm function. The alarm will be a sharp sound every 2 seconds while the screen/display will flash. The triggered alarm will not stop the meter from continuous operation. The alarm will be off once the metering value is below the set value.

The flow rate has two decimal points with a maximum not over the full-scale flow rate at the order. 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 showing a default flow rate of 999.99. 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 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.

5.5.14 Set an alarm: lower the instant flow rate limit



This function allows the user to set the instant flow rate below which the meter will trigger the alarm function. The alarm will be a sharp sound every 2 seconds while the screen/display will flash. The triggered alarm will not stop the meter from continuous operation. The alarm will be off once the metering value is above the set value.

The flow rate has two decimal points with a minimum of 0.00. 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 showing a default flow rate of 0.00. 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 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.

5.5.15 Set an alarm: accumulated flow rate or totalizer limit

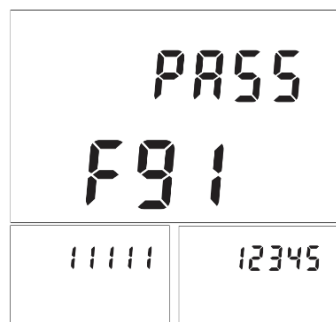


This function allows the user to set the maximum accumulated or totalized flow rate above which the meter will trigger the alarm function. The alarm will be a sharp sound every 2 seconds while the screen/display will flash. The triggered alarm will not stop the meter from continuous operation. The alarm will be off by resetting the setting.

The accumulated or totalized flow rate has seven digits with a maximum of 9999999. Following the steps mentioned above, at the MENU setting screen, use the "Up" or "Down" key to select F53 - ALM-A. Press the "M" key to confirm, and it will open the sub-MENU showing a default flow rate of 9999999. 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 F53 - ALM-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.

5.5.16 Change the default password

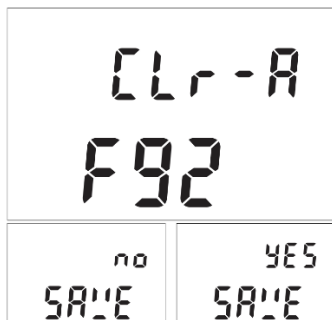
For data safety, it is recommended that the default password of 11111 be changed when using this product for the first time.



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 showing the default password of 11111. Use the "Up" or "Down" keys and the "M" confirming key to select the desired option, and press the "M" key again to complete the task. The display will then return to the F91 - PASS screen, which indicates the task is completed. Use the "Up" or "Down" key to select F99 - qUIT and the "M" key to exit the MENU and return to the Main Display screen.

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

5.5.17 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.

5.5.18 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.

5.5.19 Sleeping mode

When batteries power the meter, it is necessary to enable the sleeping mode for power saving to allow a longer operation time.

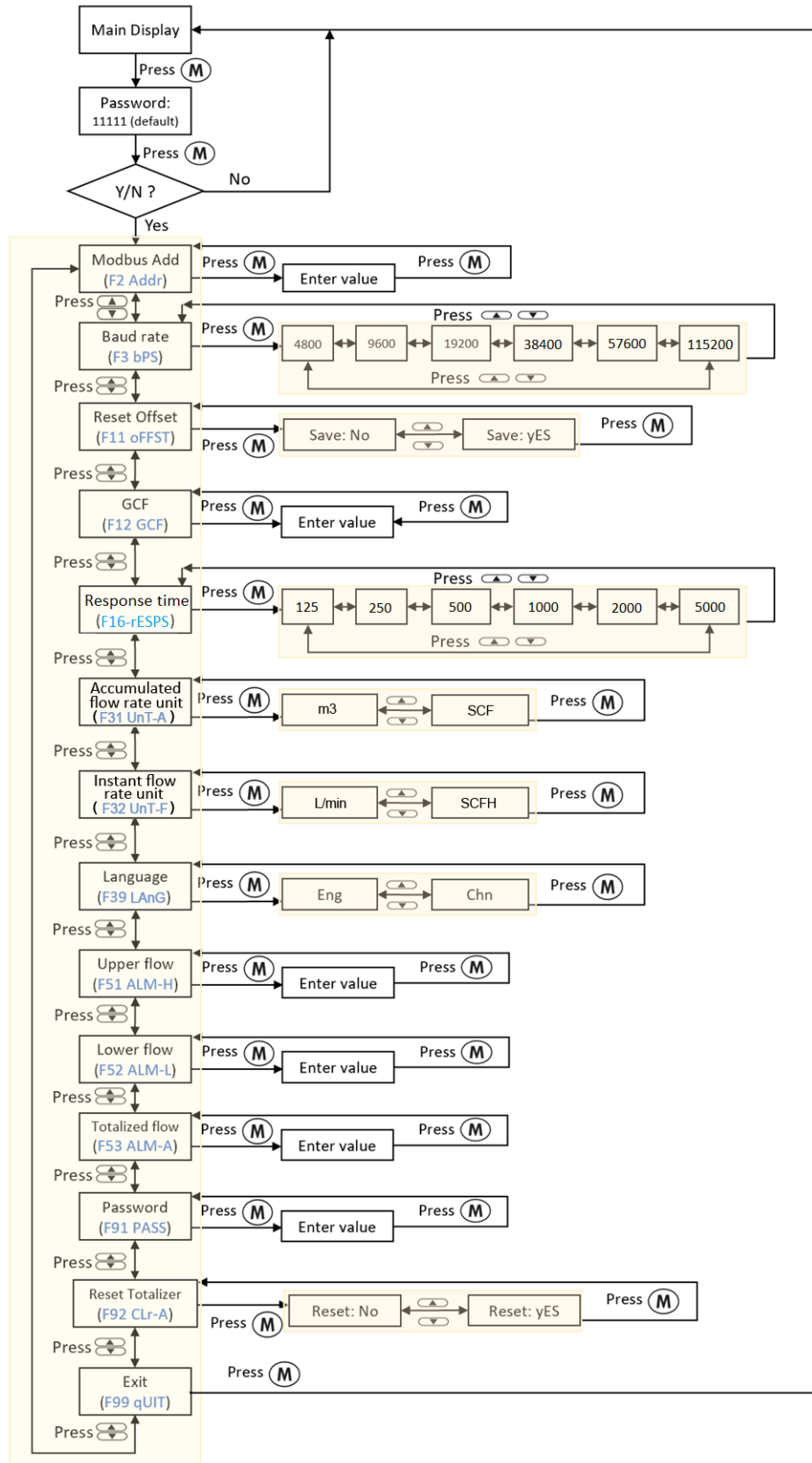
The meter features an automatic sleeping mode that shuts off the display, while the control circuitry operates at minimal power consumption. This mode will be executed when the continuously measured flow rate is zero for 5 minutes.

The meter can also be turned into sleep mode manually by pressing the "Up" key for 3 seconds.

5.5.20 Wake up the meter

When the meter is in sleeping mode, it will automatically wake up if the flow rate in the flow channel is larger than 0.5 L/min (1.1 SCFH or 0.03 m³/h) for 10 seconds. Alternatively, the meter can be manually activated by pressing any of the three keys on the front meter face for five seconds.

5.5.21 MENU key sequence for the settings

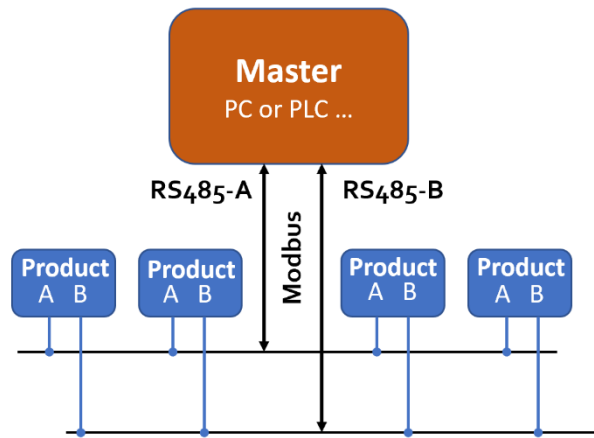


5.6 RS485 Modbus communication protocol

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.

5.6.1 Hardware connection

The hardware layer is TIA/EIA-485-A, as illustrated below. In this configuration, the product (MF5700) 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 μ sec
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
T ₁ -T ₂ -T ₃ -T ₄	8 bit	8 bit	N 8 bit (20≥n≥0)	16 bit	T ₁ -T ₂ -T ₃ -T ₄

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 (MF5806-G)'s functions/actions (slaves), either execution or response.

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

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

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

5.6.4 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
0x10	Set multiple registers	Write multiple registers

5.6.5 Registers

The product (MF5806-G) 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)
Alarm information	Read the alarm information (R)	0x0037	40056 (0x0037)
Flow rate	Current flow rate (R)	0x003A ~ 0x003B	40059 (0x003A)
Accumulated flow	Accumulated or totalized flow rate (R)	0x003C ~ 0x003E	40061 (0x003C)
Temperature	Ambient temperature	0x003F	40064 (0x003F)
Time counter	Time counter (R)	0x0050 ~ 0x0052	40081 (0x0050)
Baud rate	RS485 communication baud rate (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)
Totalizer alarm *	Accumulated/totalized flow rate alarm (R/W)	0x0096 ~ 0x0097	40151 (0x0096)
Upper flow alarm *	Upper flow rate limit alarm (R/W)	0x0098 ~ 0x0099	40153 (0x0098)
Lower flow alarm *	Lower flow rate limit alarm (R/W)	0x009A ~ 0x009B	40155 (0x009A)
Password *	Password change (R/W)	0x00AE ~ 0x00AF	40175 (0x00AE)
Offset calibration	Offset reset or calibration (W)	0x00F0	40241 (0x00F0)
Reset totalizer *	Reset accumulated or totalized flow rate (W)	0x00F2	40243 (0x00F2)
Valve status	Read/check the valve status	0x0037	40056 (0x0037)
Valve control*	Open/close (turn on/off) the valve	0x00F5	40246 (0x00F5)
Write protection	Write protection of selected parameters (W)	0x00FF	40256 (0x00FF)

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

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

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

Flowmeter 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). Broadcast address 0 is not enabled.		

SN, Serial number	0x0030 ~ 0x0035	Write	N
		Read	Y
Description	Series Number of the product, SN		
Value type	ASCII		
Notes	SN= value(0x0007), value(0x0008),...,value (0x000C); e.g., Receiving 12 bits as: 0x2A47, 0x3741, 0x4549, 0x3032, 0x3035, 0x382A, the corresponding Serial Number is *G7AE102058*.		

Alarm information	0x0037	Write	N
		Read	Y
Description	Read the alarm information.		
Value type	UINT 16		
Notes	Bit 13 - Upper flow alarm (0 - alarm not triggered, 1 - alarm triggered); Bit 14 - Lower flow alarm (0 - alarm not triggered, 1 - alarm triggered); Bit 15 - Totalizer alarm (0 - alarm not triggered, 1 - alarm triggered). e.g., when the user reads "0x0012" (Bin: 1010 0000 0000 0001) from register 0x0037. ➤ Upper flow alarm is triggered (bit 13 = 1); ➤ Lower flow alarm is not triggered (bit 14 = 0); ➤ The totalizer alarm is triggered (bit 15 = 1).		

Current 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 20.340 L/min, the user will read "0" from register 0x003A and "20340" from register 0x003B, therefore Current flow rate = (0*65536+20340)/1000 = 20.340		

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 m³, 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.		

Temperature	0x003F	Write	N
		Read	Y
Description	Ambient temperature.		
Value type	UINT 16		
Notes	Ambient temperature = Value (0x003F) / 100 e.g., for an ambient temperature of 23.45 °C, the user will read "2345 (0x0929)" from register 0x003F, therefore Ambient temperature = 2345/100 = 23.45		

Time counter	0x0050 ~ 0x0052	Write	N
		Read	Y
Description	Time counter		
Value type	UINT 16 + UNIT 32		
Notes	Time counter (minute) = Value (0x0050) Time counter (hour) = Value (0x0051) * 65536 + Value (0x0052) e.g., For a time counter of 12 hours and 10 minutes (12:10), the user will read "10 (0x000A)" from register 0x0050; "0 (0x0000)" from register 0x0051, and "12 (0x000C)" from register 0x0052. Then, the time counter = (0*65536 + 12) hour and 10 minutes = 12:10		

Baud rate	0x0082	Write	Y
		Read	Y
Description	Communication baud rate with a PC		
Value type	UINT 16		
Notes	0 - 4800; 1 - 9600; 2 - 19200; 3 - 38400; 4 - 57600; 5 - 115200. The default value is 1, and the baud rate is 9600. For example, when the user reads "2 (0x0002)" from register 0x0082, the baud rate is 19200.		

GCF	0x008B	Write	Y
		Read	Y
Description	The gas conversion factor for a gas is different from the calibration gas.		
Value type	UINT 16		
Notes	The air (default) is 1000, usually read from register 0x008B. The product will disable this function with write protection once the metering gas is confirmed with the proper GCF. For a specific GCF value, please get in touch with the manufacturer. Notes: Please disable the write protection before executing this command.		

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

Alarm: Accumulated flow rate	0x0096 ~ 0x0097	Write	Y
		Read	Y
Description	The alarm is set for the maximum value of an accumulated flow rate.		
Value type	UINT ₃₂		
Notes	Alarm values = Value (0x0096)*65536 + Value (0x0097) When the set value is reached, an alarm will be triggered. Notes: Please disable the write protection before executing this command.		

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

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

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 command.		

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 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 command.		

Valve status	0x0037	Write	N
		Read	Y
Description	Read the valve status.		
Value type	UINT 16		
Notes	Bit 0 - valve status (0 - closed, 1 - open); e.g. , when the user reads "0x0012" (Bin: 1010 0000 0000 0001) from register 0x0037. ➤ The valve is open (bit 0 = 1); ➤ The valve is closed (bit 0 = 0).		

Valve control	0x00F5	Write	Y
		Read	N
Description	Open/close (Turn on/off) the valve		
Value type	UINT 16. Close valve: Fixed value 0x0001; Open valve: Fixed value 0x8001.		
Notes	To close (turn off) the valve, write 0x0001 to register 0x00F5. To open (turn on) the valve, write 0x8001 to register 0x00F5. The valve is configured to be constant-open, i.e., the default status is open. Notes: Please disable the write protection before executing this command.		

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

6. Product selection

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

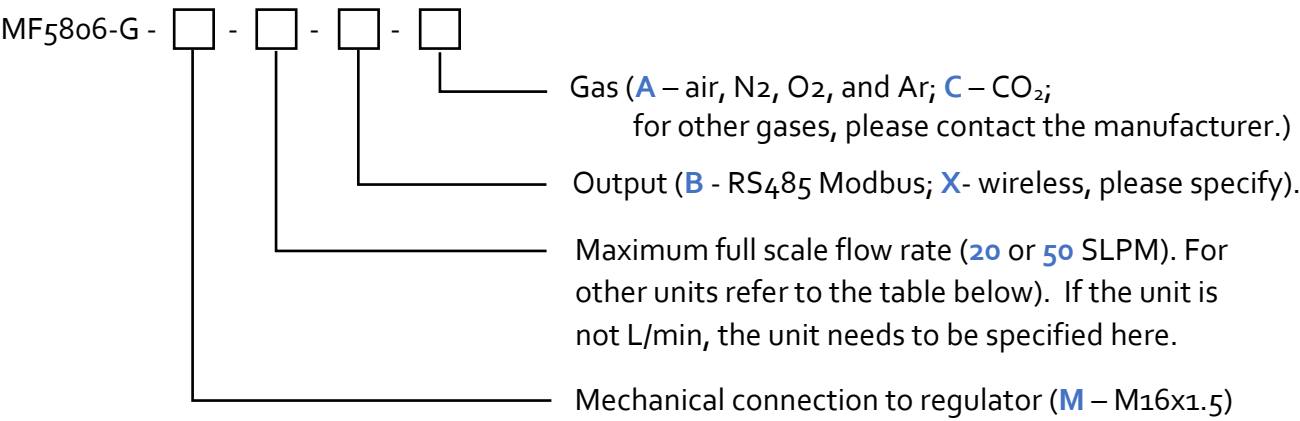


Table 6.1: Units conversion table

L/min	SCFH	NCMH		L/min	SCFH	NCMH
20	42.38	1.20		18.88	40	1.13
50	211.89	6.00		47.19	200	5.66

7. Technical specifications

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

Spec	MF5806-G	Unit
Full-scale flow range	0 ~ 20; 0 ~ 50	L/min
Accuracy	$\pm(2.0+0.5FS)$	%
Repeatability	$(0.5+0.15FS)$	%
Turn-down ratio	80:1	
Response time	<2.0	sec
Working temperature	-10 ~ +55	°C
Maximum pressure	0.8	MPa
Humidity	<95, no condensation	%RH
Maximum overflow	100	L/min
Maximum flow change	15	L/min/sec
Pressure loss @ 50SLPM	2.0	kPa
Power supply	4-AA batteries (LR6) / 5 ~ 24 Vdc	
Power consumption	>60 (on batteries)	day
Power/data interface	USB Type-C	
Digital output	RS485 Modbus half-duplex	
Wireless options	LoRa / WIFI / NB-IoT / BT LE	
Display	LCD	
Resolution	0.01 L/min (instant) / 0.001 m ³ (accumulated)	
Mechanical connection	Gas cylinder connection (customizable)	
Storage temperature	-20 ~ +70	°C
Reference conditions	20°C, 101.325 kPa, air	
Protection	IP50	
Fluid compatibility	Non-corrosive	
CE	EN61326-1; -2; -3	

8. Wetted materials and compatibility

The product flow channel is made of anodized aluminum. Flow conditioner is made of Acrylonitrile Butadiene Styrene (ABS). 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.

9. Technical notes for the product performance

9.1 Measurement principle

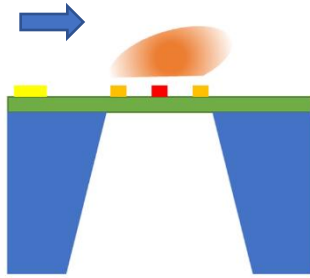


Figure 8.1: Measurement approach illustration.

The products utilize the Company's proprietary micro-machined (MEMS) thermal calorimetric sensing technology. A thermal signal generator (microheater) is placed on a thermally isolated membrane where two thermistors are positioned symmetrically with respect to the microheater. The flowing fluid carries away the heat from the microheater, causing a redistribution of the temperature field, which is registered by the thermistors. The amount of heat carried by the flowing fluid is dependent on the fluid's mass as well as its thermal properties. By precisely gauging the change in the temperature field with a metrological reference standard, the fluid's mass flow rate can be established and reproduced.

Following circuitry temperature compensation and proper MEMS sensing chip design, the addition of a pressure balancer enables the membrane to remain flat under various fluidic pressure conditions. The calorimetric thermal sensing will guarantee a pressure and temperature-independent mass flow data acquisition. The MEMS technology also allows the mass production of the sensing elements, which significantly reduces the cost compared to a traditional thermal mass flow sensing element. It enables the current offer to provide superior value to users. For additional information, please refer to the company's US patents and other publications made available to the public.

9.2 Precautions for the best performance of the product

9.2.1 Comparison with a third-party reference meter

Commonly, a user may compare the data from the product with a third-party reference meter, and in many cases, there could be some discrepancies.

When performing such a comparison, please note that the reference meter should have a better-specified accuracy (about 1/3 of the product), and pay special attention to the differences in the reading accuracy and full-scale accuracy.

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

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

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho gh_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho gh_2$$

Where ρ is the fluid density, g is the acceleration due to gravity, P_1 is the pressure of the reference meter, P_2 is the pressure at the test meter, v_1 is the velocity of the reference meter, and v_2 is the velocity of the test meter. h_1 and h_2 are the corresponding heights for the meters, which are generally the same in the system. Therefore, it would be very critical to have the system with a pressure variation as minimal as possible. (This explains our recommendations for the installations in Section 4). Also, the meter measurement principle is often very important for the understanding of any discrepancies.

9.2.2 Particle contamination and fluidic cleanness

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

9.2.3 Apply to a different gas medium

The product is calibrated with a high-precision NIST traceable metrological standard with clean and dry air. In case the meter is applied to meter the other clean and dry gas, a correct gas conversion factor needs to be registered in the meter before the measurement.

The meter operates similarly to the principle described in the international standard for thermal mass flow meters (ISO 14511:2001 - Measurement of fluid flow in closed conduits — Thermal mass flowmeters). Due to the meter assembly procedure, the head loss value from the meter to the meter would not be 100% identical. At the extensive dynamic measurement range, the thermal response would also have some deviations and nonlinearity from gas to gas. Therefore, measurement by the meter for a gas medium other than the calibration gas would bear larger measurement errors, particularly at the low Reynolds number range, where the laminar flow has a sensitive flow profile.

10. Troubleshooting

Phenomena	Possible causes	Actions
No signal/display	The power is not connected; the battery is empty	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

11. Warranty and Liability

(Effective January 2018)

Siargo warrants that the products sold hereunder will be used appropriately and installed correctly under normal circumstances and service conditions. As described in this user manual, it shall be free from faulty materials or workmanship for 180 days for OEM products and 365 days for non-OEM products from the date of shipment. This warranty period is inclusive of any statutory warranty. Any repair or replacement of a serviced product shall bear the same terms in this warranty.

Siargo makes no warranty, representation, or guarantee and shall not assume any liability regarding the suitability of the products described in this manual for any purposes that are not specified in this manual. The users shall be held fully responsible for validating the performance and suitability of the products for their particular design and applications. For any misuse of the products out of the scope described herein, the user shall indemnify and hold Siargo and its officers, employees, subsidiaries, affiliates, and sales channels harmless against all claims, costs, damages, and expenses or reasonable attorney fees from direct or indirect sources.

Siargo makes no other warranty, express or implied, and assumes no liability for any special or incidental damage or charges, including but not limited to any damages or charges due to installation, dismantling, reinstallation, etc., or consequential or indirect damages of any kind. To the extent permitted by law, the exclusive remedy of the user or purchaser, and the limit of Siargo's liability for any and all losses, injuries, or damages concerning the products, including claims based on contract, negligence, tort, strict liability, or otherwise shall be the return of products to Siargo, and upon verification of Siargo to prove to be defective, at its sole option, to refund, repair or replacement of the products. Regardless of form, no action may be brought against Siargo more than 365 days after a cause of action has accrued. The products returned under warranty to Siargo shall be at the user or purchaser's risk of loss and will be returned, if at all, at Siargo's risk of loss. Purchasers or users are deemed to have accepted this limitation of warranty and liability, which contains the complete and exclusive limited warranty of Siargo. It shall not be amended, modified, or its terms waived except by Siargo's sole action.

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

This warranty is subject to the following exclusions:

- (1) Products that have been altered, modified, or have been subject to unusual physical or electrical circumstances, as indicated, but not limited to those stated in this document or any other actions which cannot be deemed as proper use of the products;

- (2) Products that have been subject to chemical attacks, including exposure to corrosive substances or contaminants. 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.

12. Service/order contact and other information

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

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

For any returns, please get in touch with your direct sales representative to obtain an RMA. In case you need any further assistance, please get in touch with 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. Please specify in your email message that you intend to return the product to the factory and include your shipping address. Be sure to write the RMA on the returned package or include a letter with the RMA information.

Direct customer service request(s) should be addressed to

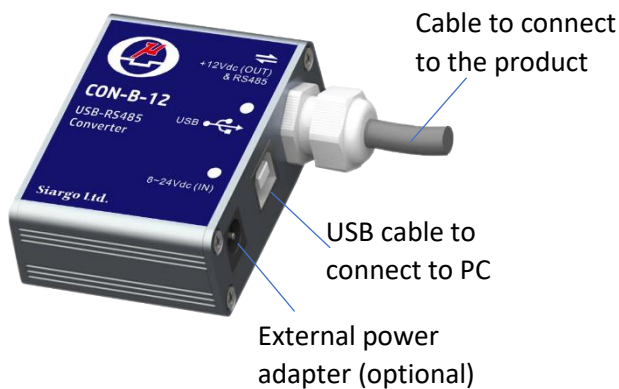
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For further information and updates, please visit www.Siargo.com.

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 flow rate of the product, obtain the totalized values, and save the data for further analysis. It can read from up to 128 sensors via the RS485 serial interface.

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



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

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

Appendix II: Document history

Revision VB.o.04 (August 2025)

- Corrections.

Revision VB.o.03 (October 2024)

- Correct the mechanical connection and gas in product selection.

Revision VB.o.02 (July 2024)

- Corrections.

Revision VB.o.01 (June 2023)

- Update contact address.

Revision VB.o (January 2023)

- Reformatted and updated;
- The first release of the 2nd generation products.

Revision VA.1 (March 2020)

- The formal release of the 1st generation products.

Revision VA.o (September 2018)

- The first release of the 1st generation products.