

Smart Gas Cylinder Meters with IOT technology

MF5806-G Series

User Manual (VA.4)



Please read this manual for ensuring correct use of
this product. Make the manual available for easy access.

SIARGO LTD.



Siargo Ltd.

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MF5806-G Series

User Manual

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RESTRICTION ON USE

1. This meter is designed and manufactured specially for gas usage of the cylinders and connectivity. Do not alter any hardware and software of the product. Any modifications might cause damage and unexpected events.
2. All practices for electronic device safety should apply.
3. Do not use this product in any environments where safety may be a concern.
4. Only a qualified person from Siargo or a person who is accredited by Siargo can perform troubleshooting services to the product, Siargo is otherwise not liable for any consequences thereafter.

SAFETY PRECAUTION

1. The product can be utilized to measure and/or monitor gas mass flow rate of the cylinders and connectivity. For other special gases or variable concentration gases, the product may not function properly or even can be damaged. Please contact Siargo for further information.
2. The operational environments of the product are illustrated in the section of product specifications. If the product is used for other circumstances, the product may not function properly or even can be damaged.
3. Operation, installation, storage, and maintenance of the product must strictly follow the instructions described in this user manual. Otherwise, unpredicted damage and even injuries or other severe situations could be induced. All the installation, storage, and maintenance of the product must be performed by skilled workers. This user manual should be placed near the product for easy access.
4. Before using the product, the user should read this user manual completely and in details so that the user well understands all the important instructions.

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Overview

Management of a gas cylinder is often difficult as the current mechanical pressure transducer cannot provide the information for gas consumption, the possible leakage as well as the identification, which makes cylinder inventory, manufacture and in particular safety all at large. The unexpected consumption or leakage may also lead to significant impact to the efficiency of the process where gas supply is a must. For medical applications, the preventive measures often lead to excessive inventory and labor extensive tasks. The MF5806-G smart cylinder meter utilizes the company's proprietary mass flow technology enabled with the state-of-the-art mobile network technology as well as the IOT (internet of things) technology that transmits all the desired information of a gas cylinders to you and also let you be able to access the information at anytime. The programmable smart cylinder meter will also alarm you whenever there is a possible safety issue.

Features

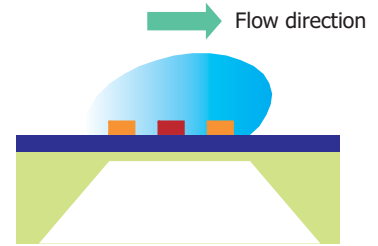
- ◆ Gas consumption and instant flowrate
- ◆ Battery powered BT LE or GPRS data transmission
- ◆ User friendly APP provides interactions and data
- ◆ Gas consumption high/low alarm
- ◆ Cloud computing eases the inventory, dispatch & production

Applications

- ◆ Medical oxygen cylinder for homecare
- ◆ Welding gas cylinder management
- ◆ Consumer (BBQ) gas cylinder
- ◆ Laboratory gas cylinder management
- ◆ Smart gas data
- ◆ Gas cylinder manufacture production, inventory and dispatch management

Working Principle

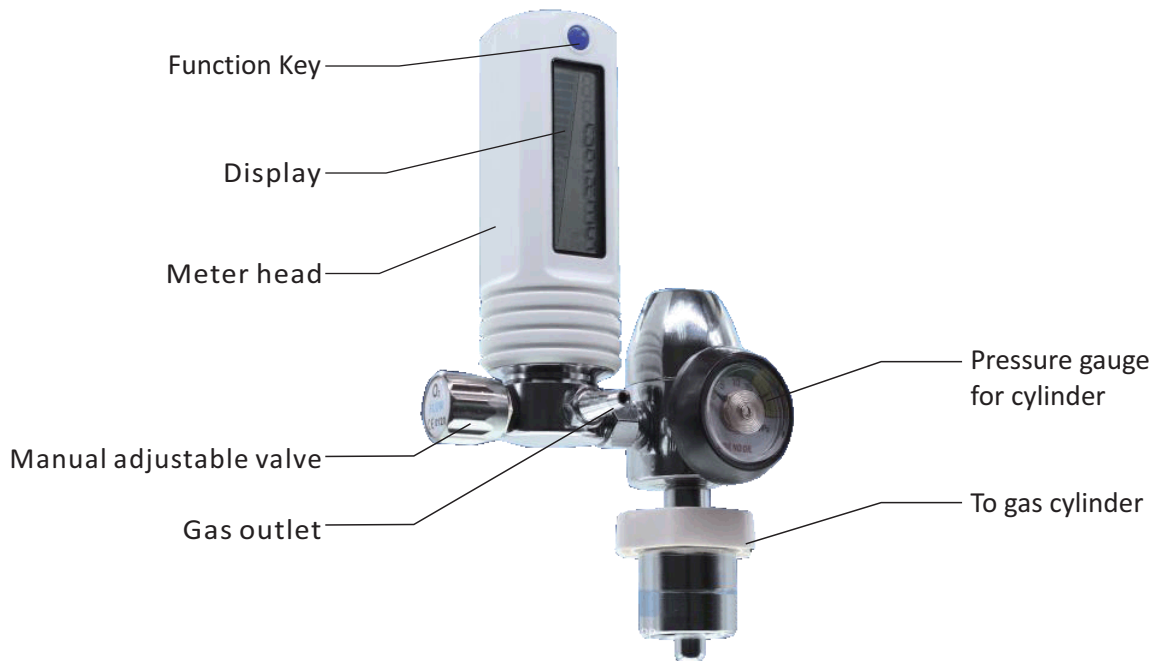
The MF5806-G smart cylinder meter measures flow using Siargo's proprietary MEMS calorimetric mass flow sensor that is installed in the flow channel forming a plate which serves as an additional flow conditioner from the boundary layer configuration resulting in a laminar flow. The mass flow measurement is established as the fluid carries heat away from the heater causing the redistribution of the temperature field. Accurate flow rate is obtained by calibration with the standard fluid at the preset conditions.



The wetted materials of the MEMS sensor is silicon nitride and the flow channel of the meter is made of polycarbonate that are compatible with the most common gases. As each of a specific gas has a unique specific heat, the MEMS sensor can also measure such values and hence provide the gas identification capability which could be critical in applications where mixed or incorrect gas flow may lead to unrecoverable damage.

The data are readily transmitted via the Bluetooth LE embedded inside the meter head to a smart device with the manufacturer provided APP and further the information can be relied to the cloud for data processing. Alternatively, GPRS or WIFI option can be requested. A land line option with RS485 Modbus can also be requested.

Description



Specifications

Model	MF5806-G-20/50	Unit
Flow range	0 ~ 20 SLPM / 0 ~ 50 SLPM	
Accuracy	$\pm(2.0+0.5FS)$	%
Repeatability	0.5	%
Response time	≤ 2	sec
Power supply	2 x AA batteries(LR6) or AC adapter (6 ~ 24 Vdc)	
Power consumption	≤ 0.5	mW
Digital output	Linear, 1°C	
Wireless output	Bluetooth LE 4.2; GPRS (optional); WIFI (optional)	
Display	LCD	
Display information	Instant flow: SLPM; Totalized flow: m ³ ; Time: hhHmm	
Flow resolution	Instant flow: 0.01 SLPM; Totalized flow: 0.001 m ³ ; Time: 00H01	
Keyboard	1 key	
User function	Password; alarm limit; totalized flow; offset reset	
Max. pressure	0.5	MPa
Working temperature	-10 ~ +55	°C
Pressure loss	≤ 500	Pa
Battery life	800 hrs - continuous operation; 2300 hrs - meter continuous operation with BT off	
Calibration	Air @ 20°C, 101.325 kPa	
Pin out	miniUSB (optional)	
Mech. connection	Gas cylinder connection (customizable)	
Weight	~ 350	g

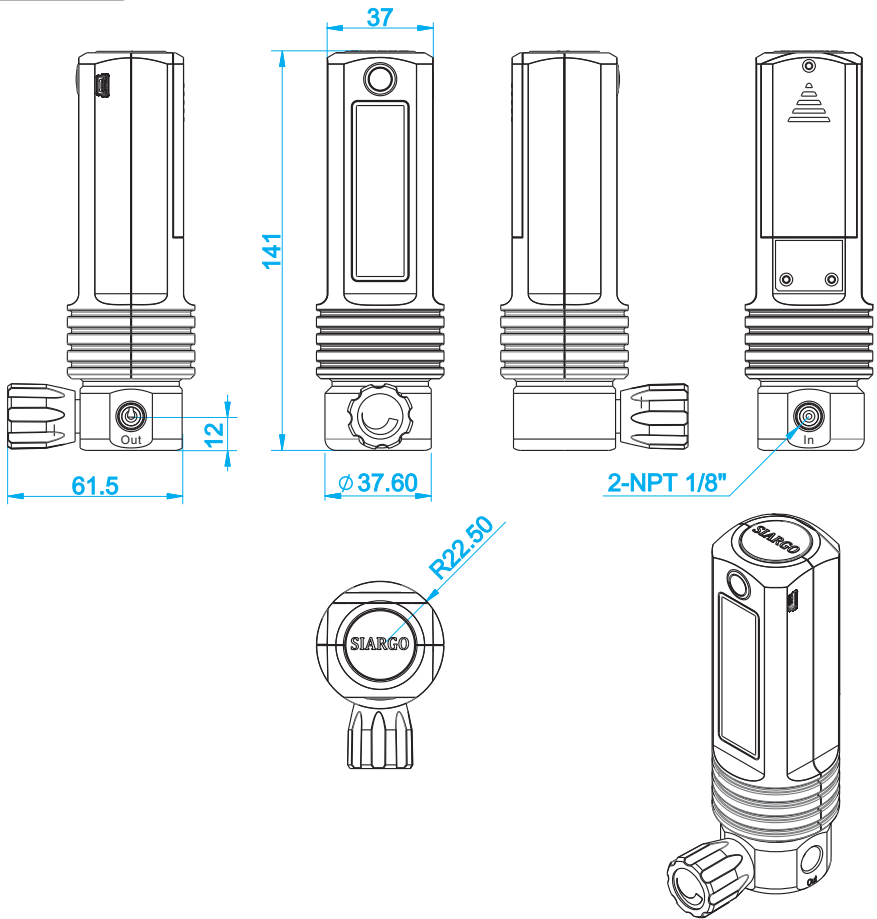
Notes: * The above parameters are applicable at 20°C and 101.325kPa.

** Meter head can be rotated 180 degree for convenience at installation and reading.

The smart cylinder meter can be combined with any types of the cylinder regulators. If required, pressure sensor can also be integrated with the smart cylinder meter.

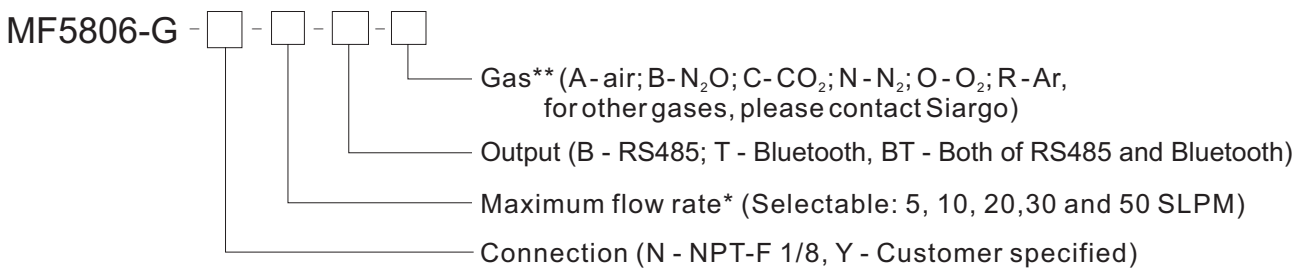
Siargo can also supply the cylinder regulators and assembly with the smart cylinder meter, customer is required to provide desired regulator standard for reference.

Dimensions



Note:
For gas regulators, customer needs to specify the relevant standard such that the mechanical connections can be matched at manufacture.

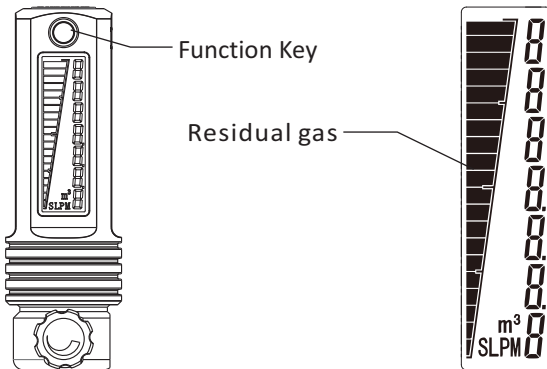
Product Selection



* There is flow rate number only.
For CO₂ and N₂O, selectable: 5, 10, 20 or 30 SLPM (without 50 SLPM).

Menu Illustration

1. Interface illustration



Interface includes *instant flow, totalized flow, time counter, bar-chart indicates instant flow rate (cylinder gas remaining volume optional), menu and other process data for Setup*. See the graph at the left for details.

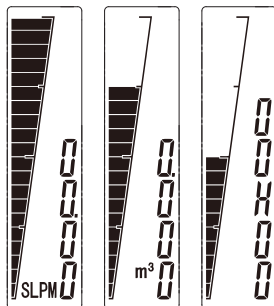
One function key located on the upper front of the meter head.

2. Operation

The followings describe the details for each menu step. Please read carefully before use.

2.1 Display at normal operation

Upon power on, the meter will go through a self-check, and the meter then will display the normal operation menu: instant flow mode, totalized mode or time counter mode. Press the *function key* (for less than 0.5sec), one can switch the mode from one to another.



- a. Instant flow: SLPM;
- b. Totalized or accumulated flow: m³;
- c. Time counter: hhHmm (for instance, 03H25 means 3 hours and 25 minutes);
- d. Bar-chart: instant flow; (Optional: cylinder remaining gas volume. The initial volume must be input with the APP provided by the manufacturer, see Appendix A).

2.2 Password verification

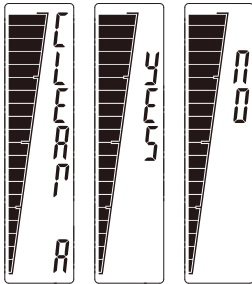
At the normal operation display, press & hold *the function key* (press for more than 1 sec), it will enter into the password interface. Input the correct password, then the *Setup Menu* will display. If the password is incorrect, the display will return to normal operation modes. The default password is 1111.



To enter the password, **briefly press (less than 1 sec) the function key** to change the digit. When it flashes, then **press & hold the function key (press for more than 3 sec)** to confirm the entry. Repeat this process for all 4 digits and the meter will proceed to the menu interface.

Note: while performing the password input, the flow measurement will not be interrupted.

2.3 Reset the totalized flow

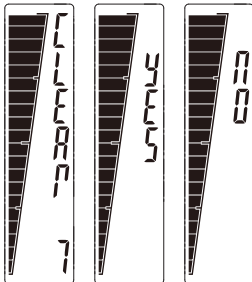


When the meter completed the “password verification”, the following menu can be accessed: **CLEAR A, CLEAR T, OFFSET, ACC dIS, EXIT**.

For the “**CLEAR A**” mode, press & hold the *function key*, the screen will show “**YES**” or “**nO**”, briefly press the *function key* to choose “**YES**”, press & hold *function key*, the totalized flow will be reset or be cleared.

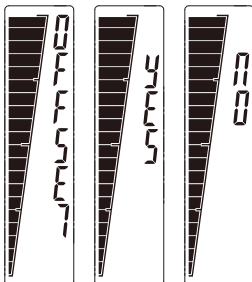
Note: while “**UnUSED**” is chosen in the “**ACC dIS**”, there is no “**CLEAR A**”.

2.4 Reset the time counter



For the “**CLEAR T**” mode, press & hold the *function key*, the screen will show “**YES**” or “**nO**”, briefly press the *function key* to choose “**YES**”, press & hold *function key*, the time counter will be reset or be cleared.

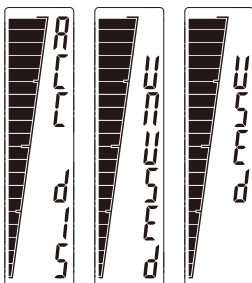
2.5 Offset calibration



For the “**OFFSET**” mode, press & hold the *function key*, the screen will show “**YES**” or “**nO**”, briefly press the *function key* to choose “**YES**”, press & hold *function key*, the meter will calibration offset.

Note: Please ensure that there is **NO FLOW** in the offset calibration.

2.6 Accumulated flow modes (increasing/decreasing)



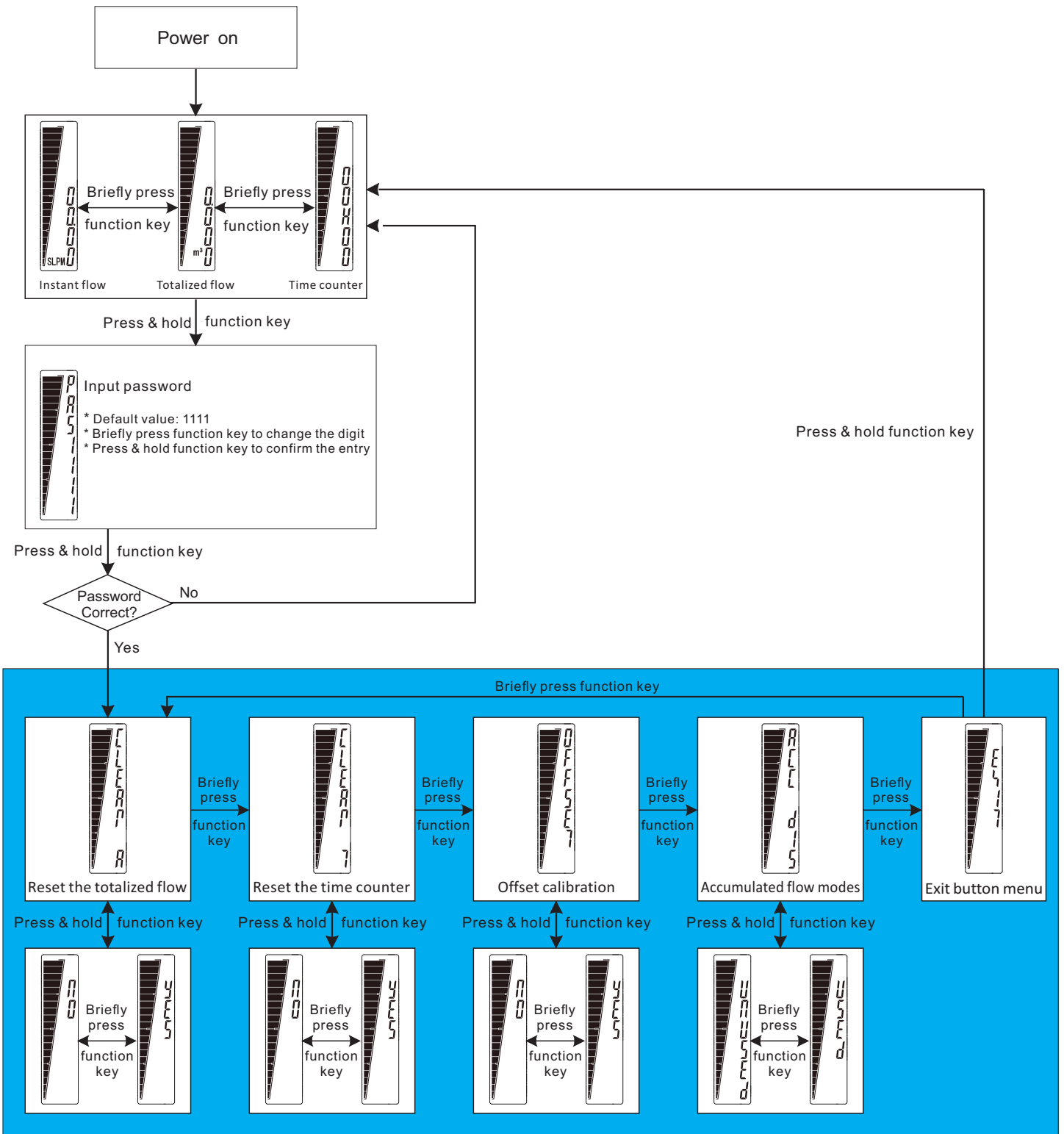
For the “**ACC dIS**” mode, press & hold the *function key*, the screen will show “**UnUSED**” or “**USED**”, briefly press the *function key* to choose “**UnUSED**” or “**USED**”, press & hold *function key*, the mode will be chosen. “**UnUSED**” means of decreasing, while “**USED**” means of increasing.

2.7 Exit



Briefly press the function key, the screen will switch to “**EXIT**” mode.

At “**EXIT**” mode, press & hold the *function key*, the meter will return to normal operation mode.

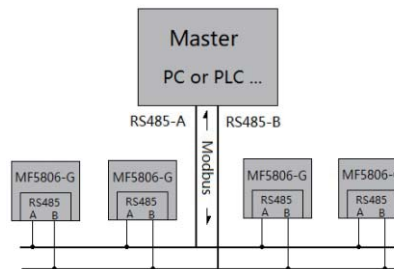


RS485 Communication Protocol

RS485 is based on the standard Modbus communication protocol. It supports either single meter communication or multi-meter networking.

1. Interface illustration

Based on standard Modbus RTU mode, a master (PC or PLC) can communicate with several slaves (MF5806-G), setting parameter or getting data. The hardware layer is TIA/EIA-485-A. The connection is as below:



2. Communication parameter

The UART parameter is shown as below table:

Communication parameter	Protocol
	RTU
Baud rate(Bits per second)	9600 bps
Start bits	1
Data bits	8
Stop bits	1
Even/Odd parity	None
Bits period	104.2μs
Bytes period	1.1458ms
Maximum data length	20
Maximum Nodes	247

3. Frame

The framing function is accord with The Standard Modbus RTU framing, which is shown as below:

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

Start_bits: 4 periods bit time, to indicate a new frame.

Address: The Modbus address, can be set as 0 to 255 except 157. 0 is broadcast address.

Function code : Define the action that MF5806-G should takes, or indicate that which code the MF5806-G is responding.

Data: Including the address of register, length of data and the data.

CRC: CRC verify code , the low byte is flowed by high byte. For example, the 16bit CRC code is divide as BYTE_H BYTE_L , in the frame, the BYTE_L goes first ,then the BYTE_H, at last ,is the stop signal .

Stop_bits: 4 periods bit time , to indicate that the current framing is over.

4. Function code

MF5806-G Modbus Function-code is a subclass of Standard Modbus Function-code. By using these function-code, We can set or read the registers of MF5806-G.

They are shown as below table:

Code	Name	Action
0x03	Read register	Read register (one or more)
0x06	Set single register	Write one single 16bit register
0x10	Set multi registers	Write multi registers

5. Registers

MF5806-G has several registers. We can get the information (such as “address”, “flow rate” and so on) form reading these registers, or we can write into some of the registers for setting parameters of MF5806-G.

Name	Description	Register	Modbus
Address	The modbus address (RW)	0x0001	40002(0x0001)
Flow Rate	The Instant flow (R)	0x0002 ~ 0x0003	40003(0x0002)
Total	The totalized flow (RW)	0x0004 ~ 0x0006	40005(0x0004)
Time Counter	The time counter (RW)	0x0017 ~ 0x0018	40024(0x0017)
Leakage Alarm	The leakage alarm flow rate (RW)	0x0019	40026(0x0019)
GCF	The gas correction factor (RW)	0x001A	40027(0x001A)

* R-read only, RW-read and write.

Flow meter Address	0x0001	WRITE	A
		READ	A
Description	The modbus address		
Value type	UINT16		
Detail	Value from 1 to 255 except 157 (0x9d). Default value is 255.		
Flow Rate	0x0002 ~ 0x0003	WRITE	N
		READ	A
Description	The instant flow		
Value type	UINT32		
Detail	Flowrate = [value(0x0002) * 65536 + value(0x0003)] /1000 Example: When the LCD shows 20.34 SLPM, we can get “0” form register 0x0002 and “20340” form register 0x0003. Thus, flowrate = (0*65536 + 20340)/1000= 20.340		

Total	0x0004 ~ 0x0006	WRITE	A
		READ	A
Description	The totalized flow		
Value type	UINT32 + UINT16		
Detail	<p>V1 = value (0x0004) * 65536 + value (0x0005); V2 = value (0x0006) Total = (V1 *1000 + V2)/1000. Example: When the LCD shows 3452.245NCM, we can get “0” from register 0x0004, “3452” from register 0x0005, “245” from register 0x0006. Then, V1 = 0*65536 + 3452; V2 = 245 Total =(3452*1000+245) /1000 = 3452.245</p>		
Time Counter	0x0017 ~ 0x0018	WRITE	A
		READ	A
Description	The time counter		
Value type	UINT32		
Detail	<p>The time counter (Minutes) = value(0x0017). The time counter (Hours) = value(0x0018). Example: When the LCD shows 3:25 (3 hours and 25 minutes), we can get “3” from register 0x0017 and “25” from register 0x0018.</p>		
Leakage Alarm	0x0019	WRITE	A
		READ	A
Description	The leakage alarm flow rate		
Value type	UINT16		
Detail	<p>The leakage alarm flow rate = value(0x0019) /1000. Example: When the leakage alarm is 0.1 SLPM, we can get “100” from register 0x0019.</p>		
GCF	0x001A	WRITE	A
		READ	A
Description	The gas correction factor		
Value type	UINT16		
Detail	<p>GCF = value(0x001A) /1000. Example: When GCF is 0.67, we can get “670” from register 0x001A.</p>		

Parts in Package

MF5806-G gas usage meter	1
User manual	1
QC certificate	1

Safety and Maintenance

1. Safety Precautions

The product is designed for use with general purpose gases such as air and nitrogen. It is advised that the products are best used for non-explosive clean gases. The meters cannot be used for gas metrology of fluoride or fluoride containing gases. For updates of the product certification information, please contact manufacturer or visit www.Siargo.com. Use for other gases such as extreme corrosive and toxic agents may cause the product malfunctioning or even severe damages. The product sealing is ensured to work under working pressure of 0.8MPa and is leakage proof before the shipment. But cautions and further leakage test are important at installation as well since any leakage could cause severe safety issue. The power supply for this product is 4-AA batteries or external adapter, all precautions and measures for electrical voltage handling must apply.

Attention: any alternation and/or improper use of the product without the permission of the manufacturer can cause unpredicted damages and even injuries or other severe situations. Siargo or any of its employees, subsidiaries shall not be hold and indemnified against such consequences due to such circumstances via improper use of the product.

2. Cautions for change of batteries

When the battery life indicator on LCD shows low, batteries should be changed immediately or switch to AC power. Do not allow battery leakage inside the meter.

3. Maintenance

Attention: without prior permission of the manufacturer, please do not attempt to alter any parts of the product as it may cause unrecoverable damages. If there are questions or doubts, please contact manufacturer immediately before further actions.

All maintenance of the sensor should be performed by trained and certified personnel by Siargo.

Customer Service

Siargo Ltd. is making every effort to ensure the quality of the products. In case of questions, and or product supports, please contact customer service at the address listed below. We will respond your request in a timely fashion and will work with you toward your complete satisfaction.

Customer service and all orders should be addressed to

Headquarters

Siargo Ltd.
3100 De La Cruz Boulevard, Suite 210,
Santa Clara, California 95054,USA
Phone: +01(408)969-0368
Email: info@Siargo.com

For orders, please provide accurate and full post address. Siargo will not ship to P.O. Boxes or via a third party.

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

Warranty and Liability

(Effective January 2010)

Siargo warrants the products sold hereunder, properly used and properly installed under normal circumstances and service as described in this user manual, 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 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 for full responsibility for validating the performance and suitability of the products for their particular design and applications. For any of the 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 expense or reasonable attorney fee 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 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, strictly 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. No action, regardless of form, 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 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, and it shall not be amended, modified or its terms waived except by Siargo's sole action.

The product information provided in this manual is believed to be accurate and reliable at the time of release to or made available to the users. However, Siargo shall assume no responsibility for any inaccuracies and/or errors and reserves the rights 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 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) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies;
- (3) Products re-sold to the third parties.

Appendix: Revision History

Revision A.4 (July 2019):

- ✎ Added the RS485 communication protocol.

Revision A.3 (January 2019):

- ✎ Revised the buttons operations.

Revision A.2 (April 2018):

- ✎ Corrected some specs.

Revision A.1 (March 2018):

- ✎ Update the button operation.

Revision A.0 (September 2017):

- ✎ First released.