GAS FLOW METER 2.0
Instrument Manual

Direct Measurement Method
of Natural Gas Fugutives

Guidelines PR 21 - 03.00

Operation and Maintenance Version 2.0.4
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GAS FLOW METER 2.0
Instrument Manual

ABOUT ADDGLOBE, LLC

AddGlobe, LLC is the leading manufacturer of the Gas Flow Meter 2.0, the next generation high volume sampler. Our exclusive focus is researching, designing, developing and manufacturing the best direct measurement tool for the natural gas industry. Addglobe has over 17 years of experience as the largest supplier of high volume samplers across Europe, Asia and Africa with over 35 international methane reduction projects.

The GFM 2.0 is 100% assembled in the USA. It is designed for EPA, 0000b, Subpart W and OGMP 2.0 Compliance. Our customers can depend on the GFM 2.0 to set the standard for quality, reliability, accuracy, portability, ease of operation and performance.

Thank you for your business and continued support.

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1. INTRODUCTION

1.1. GENERAL DESCRIPTION

AddGlobe's Gas Flow Meter 2.0 is a portable, explosion-proof, battery powered instrument designed to determine the volumetric leak rate from various pipe fittings, compressor rod packing, wet/dry seals (off turbine compressors), main line suction and discharge valves, blow down valves, pressure relief valves, emergency shutdown valves, storage tanks, vents and all other pipe connectors typically found at natural gas facilities.

Leak rate is measured by sampling at high speed in order to capture all gas escaping from the object while diluting with ambient air. Accurate measurement of the sample flow rate and natural gas concentration allows the calculation of the leakage rate according to Formula 1. The instrument automatically compensates for the difference in gas content between the sample and the ambient air, thus ensuring the accuracy of the calculation of the leakage rate.

A small-sized optical sensor (form factor 20mm) with a wide temperature range of -40 to 140 °F (-40 to 60 °C) was chosen as sensors for measuring the concentration of natural gas.

The measuring system has an additional sensor that indicates the volumetric oxygen content. While purging the system with fresh air, it must be adjusted to 20.9%. During the measurement, according to its indications, the content of natural gas in the stream is corrected, and thus the influence of high-order hydrocarbon impurities is eliminated.

$$Leakage = Flow\,(Gas_{sample} - Gas_{background}) \quad \text{(Formula 1)}$$

Where:

Leakage = Rate of gas leakage from the source;
Flow = Sample flow rate;
Gas_{sample} = Concentration of gas from the source of the leak;
$Gas_{background}$ = Background gas concentration.

Natural gas contains about 85 - 95 vol. % methane and unspecified balance of other gases. In addition to nitrogen and carbon dioxide, these gases contain other hydrocarbons, mainly ethane, propane, butane, etc. The presence of high-order hydrocarbons leads to a significant increase in the readings of the optical sensor and beyond the stated measurement error limits.

To eliminate the influence of high-order hydrocarbons on the measured values of natural gas leakage, the GFM instrument corrects the leakage

readings by using Oxygen Displacement Method© and using the Methane/Natural Gas Coefficient. The Methane /Natural Gas Ratio by default is set up at 1000, which is a universal average parameter for most real gas mixtures. Changing this coefficient may have a small effect on measurements in the range below 3% concentration. If you require precise measurements below 1%, please send us your gas composition, and we will calculate the exact coefficient using those values. This coefficient is unique for each gas field and is calculated individually based on preliminary measurements. The value of this coefficient for each device may differ. This is due to the spread in the characteristics of the optical sensor.

WE DO NOT RECOMMEND CHANGING
THIS COEFFICIENT WITHOUT PRIOR APPROVAL.

To control and correct oxygen readings, the GFM has an electrochemical sensor that measures the oxygen concentration (O_2) in the range from 0% to 25% vol.

The principle of control and correction for oxygen is based on the following factor: If the concentration of natural gas in the flow increases, then the content of air and, consequently oxygen, decreases proportionally. Thus, the calculated CH_4 oxygen content in the flow generated by GFM is determined by the formula:

$$O_2 = 20.9 - \frac{20.9}{100\%} * CH_4$$

where CH_4 is the reading of the optical methane sensor.

Similarly, in the opposite direction, the calculated content of natural gas in terms of O_2 in the stream created by GFM 2.0 is given by the formula:

$$C_xH_y = \frac{20.9 - O_2}{20.9} * 100\%,$$

where O_2 – readings of the electrochemical oxygen sensor

IMPORTANT:
For correct operation with oxygen, operator must purge the device in clean air before measurement. If the oxygen concentration reading deviates from 20.9%, the operator must adjust the oxygen concentration value.

The electrochemical oxygen sensor has a service life of about three (3) years in normal ambient conditions.

The flow measuring device is calibrated against air under normal conditions. At included mechanism flow recalculation produced by the formula:

$$Q_g = \sqrt{\frac{1.22 * Q^2_{GFM}}{P_g}}$$

where: Q_g = recalculated flow;

1.22 = average air density;

Q_{GFM} = flow measured by GFM;

P_g = density of the mixture.

The density of the mixture is calculated by the formula:

$$P_g = \left(\frac{100 - C_g}{100} * 1.22\right) + \left(\frac{C_g}{100} * 0.77\right)$$

where:

P_g = the density of the mixture;

C_g = measured gas concentration, %;

1.22 = air density;

0.77 = average density of natural gas (depends on the field and can be changed in settings to the number provided by Gas Distribution Network.)

At low gas concentrations in the sample, it is possible to reduce the sampling rate to ensure higher measurement accuracy.

The sampler is installed in a case attached to the harness, leaving the operator's hands free for use when climbing ladders and descending into confined spaces. The sampler can also be used without the harness.

The sampler is controlled wirelessly using an Android phone (version 6.0 or later) which displays technical information and controls for the GFM. Its range is up to 15 ft.

The sample is captured into the instrument through a flexible hose with an inner diameter of 40mm. The end of the sampling hose is equipped with a variety of attachments which ensure that all escaping gas from the test object is captured.

The metering unit consists of a structurally safe high-performance fan which draws air from the leakage area through a flexible hose into a gas

manifold located inside the unit. The sample flow rate is determined by a flow meter that measures the differential pressure. A small portion of the sample from the collection chamber enters the sensor, which measures the CH_4 content in the range from 0.25% to 100% by volume. The second identical sensor measures the background content of CH_4.

Based on the measured flow rate and the measured CH_4 concentrations (leakage and background), the leakage rate from the tested component is calculated and all measured and calculated values are displayed on the connected phone.

The GFM's graphic display shows the data required ONLY for diagnostics, maintenance and adjustment of the device by the manufacturer. They cannot be used as measurement results.

1.2. CONTENTS

Gas Flow Meter (in case)

40mm hose, 6 ft long

Harness/Backpack

Carrying Case Kit Bag

Charging Adapter

Accessories:

- Capture bag 35" x 35" (90cm x 90cm) (2.95 CFM)
- Corrugated tip
- Coarse filter

1.3. BENEFITS OF USING A GAS FLOW METER

Compliance with EPA Subpart W and 0000b;

Ability to classify leaks in order of intensity;

Allows users to evaluate potential savings by eliminating a gas leak;

Easily determine the payback period for particularly costly repairs;

Enables more efficient use of the repair budget;

Determines the initial level of leaks;

Provides permanent registration of leaks and repairs;

Greenhouse Gas Regulations;

Best EPA Practice Directed Inspection and Maintenance.

1.4. DESCRIPTION

Figure 1 - Front panel

1. On/Off button;
2. Graphic display;
3. Sampler outlet.

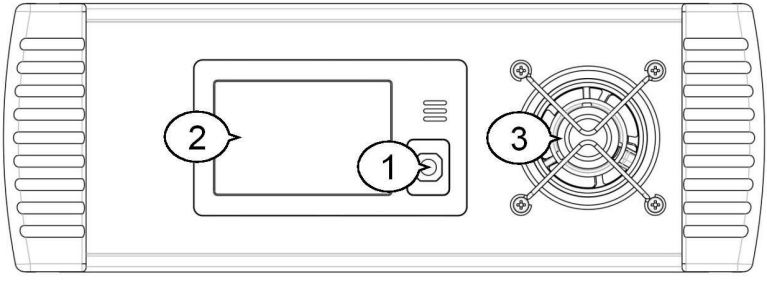
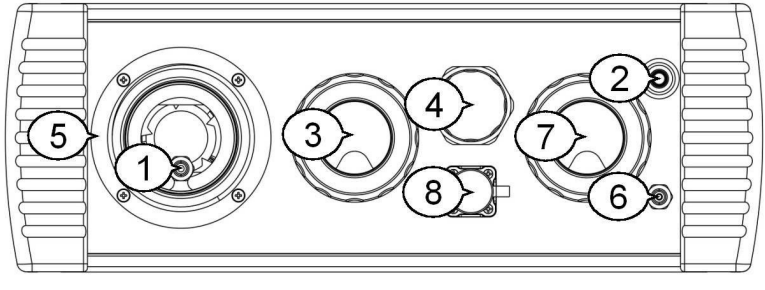


Figure 2 - Rear panel

1. Input of the working leak channel;
2. Ground connector;
3. Working leak channel filter;
4. USB connector;
5. Main Suction Intake;
6. Background channel input;
7. Background channel filter;
8. Battery charge connector.



2. TECHNICAL DATA

Display	Graphic TFT display
Control Buttons	On/Off
Connection	Bluetooth, USB
Software	Android (OS version 6.0 or higher) Applications for GFM Operation and Calibration preinstalled
Graphic TFT Display Measured Values	Sample flow rate Background gas concentration Gas concentration in the sample Battery capacity
Estimated Values	Leakage concentration taking into account the background gas level Leak intensity
Measured Leakage Rate	0.01 CFM to 12.36 CFM; 0.28 to 350.0 l/min; 0.01 to 14.2 kg/hr
Minimum Detectable Leak Rate	0.008 CFM; 0.22 l/min; 0.009 kg/hr
Leak Rate Measurement Error	±5% of reading
Temperature	Operational: -4° to 122° F (-20° to 50° C) Storage: -40° to 140° F (-40° to 60° C)
Humidity	5 to 95% RH (Non-condensing)
Sample Flow Rate	Maximum: 12.36 CFM; 350 l/min; 14.2 kg/hr Medium: 8.82 CFM; 250 l/min; 10.2 kg/hr Low: 5.29 CFM; 150 l/min; 6.10 kg/hr
Method of Measurement	Pressure drop across the Venturi tube
Natural Gas Sensor/ Accuracy	Optical method Range from 0 to 100% methane by volume Accuracy is ±5% of reading or 0.1% methane, whichever is greater
Oxygen Correction Method Sensor	Electro-chemical O_2 sensor engaged when the leakage range is from 3 to 100% natural gas by volume Accuracy is ±2.5% natural gas by volume
Battery	Type: Intrinsically Safe, low- temperature rechargeable LiPo Rated voltage: 3.7 V Capacity: 11.0 Ah Charging time: Up to 10 hours Duration of work: 8+ hours (cyclic mode)
Sampler memory	Last 50 hours of work stored
Memory for data, images, video	Limited by phone memory
Dimensions	11.4" x 11.2" x 4" 29cm x 28.5cm x 10cm
Weight	9.4 lb (4.2 kg)
UL Certification	Class I, Division 2

3. OPERATION

3.1. IMPORTANT SAFETY PRECAUTIONS

OPERATION:

When operating the GFM 2.0, please do not:

- Break the seal or remove the back-panel screws;
- Operate a GFM that has mechanical damage or broken seals.
- Attempt to repair. Please see page 37 for warranty and repair service.

BATTERY:

1. The rechargeable battery must be charged in a gas-free environment with the manufacturer's charging adapter (included.)
2. Battery replacement must be performed by AddGlobe. See page 37.

Before working with the sampler in an explosive area, please check:

1. Integrity of the instrument case;
2. The presence and integrity of all fasteners and assemblies;

To ensure the instrument is properly reset at start-up, be sure to turn the GFM on in clean air (free from combustible gases or vapors.)

Verify calibration of the sampler at least once weekly to ensure reliable readings. Always purge the instrument with clean air after measurements. This removes combustible substances from the sensor chambers and extends the life of the sensors.

3.2. CONNECTING HOSE AND ACCESSORIES

The hose (Figure 3) can connect several attachments as needed. The hose contains the following elements:

1. Adapter for connecting the hose to the device;
2. Adapter for connecting accessories;
3. Quick-release connector for connection to the input of the background channel;
4. Background gas intake

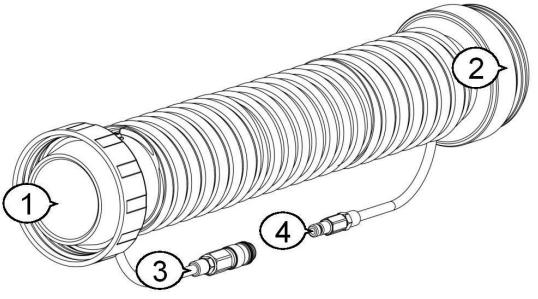


Figure 3 - Hose

3.3. GROUNDING

The GFM 2.0 must be grounded to reduce the possibility of static discharge. We recommend grounding the GFM 2.0 when performing man-lift operations on vent stacks and large emission sources. Connect the instrument ground clamp to the nearest earth ground. (Figure 4)

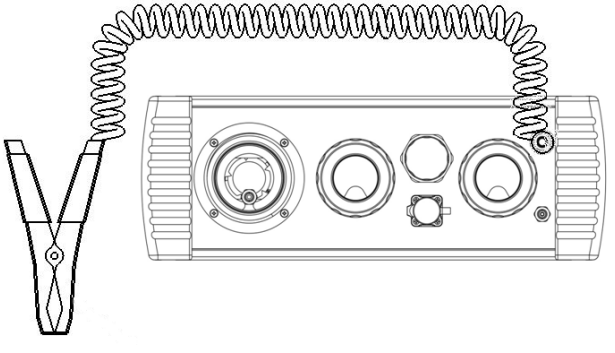


Figure 4 - Grounding

3.4. ACCESSORIES

A variety of GFM accessories are available to capture leaking gas. Select one of the following accessories that matches the type of object being examined and attach it to the end of the main sampling hose.

3.4.1. CAPTURE BAG

The 35" x 35" (90cm x 90cm) (2.95 CFM) capture bag (Figure 5) is reusable and can completely cover a component that may have multiple sources of leakage or that has a source of leakage that is difficult to find or reach.

To use, close the bag with a drawstring, but DO NOT seal the bag completely. Allow fresh air to sweep through the enclosure while sampling. Ideal for valve actuators, compressor unloaders, regulators, pneumatic controllers, Enardo valves, storage tanks and blow down systems.

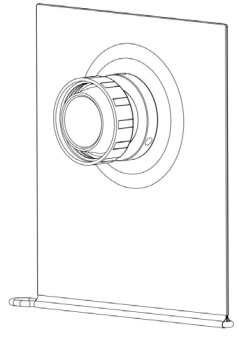


Figure 5 - Capture Bag

3.4.2. CORRUGATED TIP

The corrugated tip (Figure 6) is useful for catching leaks on valve stems, small pipe connector fittings and rod packing compressor seal vents.

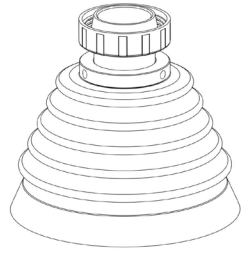


Figure 6 - Corrugated Tip

3.4.3. COARSE FILTER

The coarse filter (Figure 7) is a stainless steel mesh filter that is used to prevent coarse debris from entering the sampling channel.

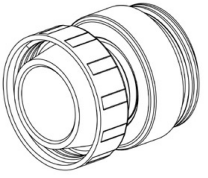


Figure 7 - Coarse Filter

3.4.4. ROD (upon request)

The rod (Figure 8) is used to measure the gas concentration at potential leaks. It is connected to the input of the comparison channel when using the sampler as a gas analyzer.

Figure 8 - Rod

3.5. POWERING ON THE GFM 2.0 System

Take the GFM to an area with clean air (where no combustible gases or vapors are present.) Press and hold the button (On / Off) until the beep stops. After turning on, the sampler will enter standby mode for connection with the phone. When the phone is connected to the sampler, the green light on the graphical screen will turn on.

3.6. POWERING OFF THE GFM 2.0

Press and hold the button (On / Off) until the sound signal is turned off.

3.7. PAIRING PHONE TO THE GFM 2.0

3.7.1 INSTALLING APP ON ANDROID PHONE

Download the application from the site [1] to your personal computer.

The following describes how to copy the downloaded data to your phone.

1. Connect your phone to a PC using a USB cable;
2. Unlock the phone;
3. On the home page, swipe down from the top of the screen (swipe), Figure 10;

Figure 10 Home page

1. Click on “Charging the device via USB,” Figure 11;

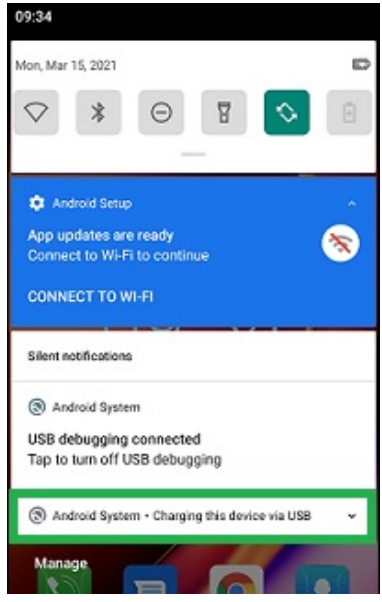


Figure 11 – Notifications

1. Click on “File Transfer,” Figure 12;

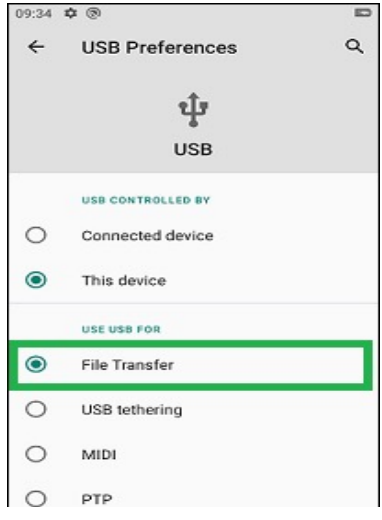


Figure 12 - USB connection settings

1. Open Explorer on a personal computer;

2. Select the connected phone;

3. Select “Internal Memory”;

4. Open the “Download” folder;

5. Move the previously downloaded application file from your personal computer to the “Download” folder on your phone. After moving the file to your phone, you can unplug the USB cable;

6. On the home page, swipe up from the bottom of the screen (swipe), Figure 13.

7. In the menu, select the “Files” item, Figure 14.

Figure 13 – Home page

Figure 14 – Menu

8. Go to the Download folder, select the application and start the installation. When updating the software on the phone, you need to copy the measurement data to the computer, delete the old version of the software, and then install the new version of the software.

3.7.2. CONNECTING GFM TO PHONE

Screenshots are for Android 10.0. Images may vary for other Android versions and themes.

Make sure the Gas Flow Meter is turned on.

On the home page, swipe up from the bottom of the screen (swipe), Figure 15.

Figure 15 - Home page

In the menu, select the "Settings" item, Figure 16.

Figure 16 - Menu

In Settings, select "Connected Bluetooth devices," Figure 17.

Figure 17 – Settings

Click on the "Add device" button, Figure 18.

Figure 18 - Connected devices

Wait until the search for Bluetooth devices is completed. Devices found should be in the list. Press on GFM 2.0 S / N: XXXXXXX, where XXXXXXX is the serial number of the Gas Flow Meter;

Figure 19 - List of available Bluetooth devices

In the dialog box that opens, enter 1234 in the password field. Click OK;

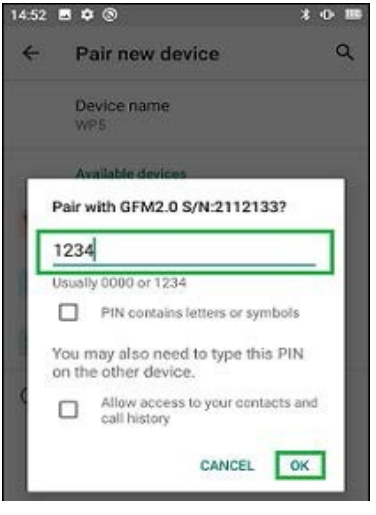


Figure 20 - Dialog box

The device should show up in Connected.

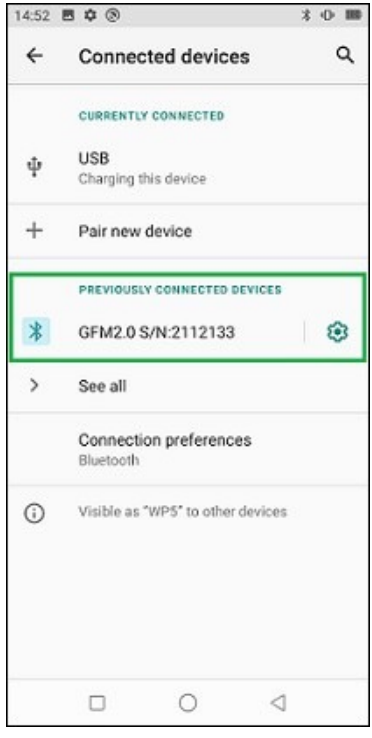


Figure 21 - List of previously connected Bluetooth devices

3.8. OPERATION

3.8.1. OPENING THE APP, CONNECTING TO GFM

1. Open the GFM 2.0 app on the phone. Select the previously paired GFM from the start page. (Figure 22.)

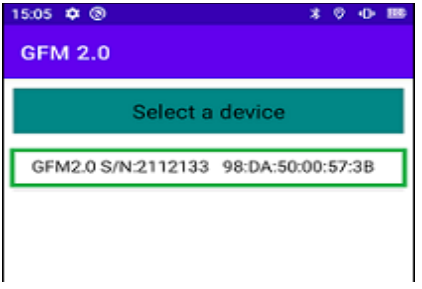


Figure 22 - The initial page of the application

2. Syncing current time and date will happen automatically and the application menu will open (Figure 23.)

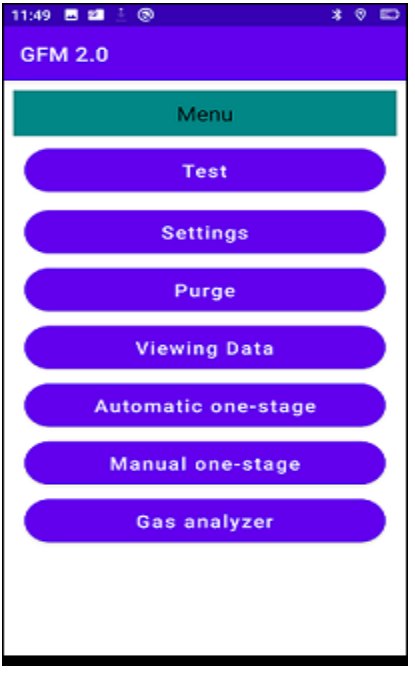


Figure 23 - Application menu

3.8.2. MENU ITEM "TEST"

Click "Test" (Figure 23) on the Start menu. The verification page will open (Figure 24.) Use the Back button to return to the application menu.

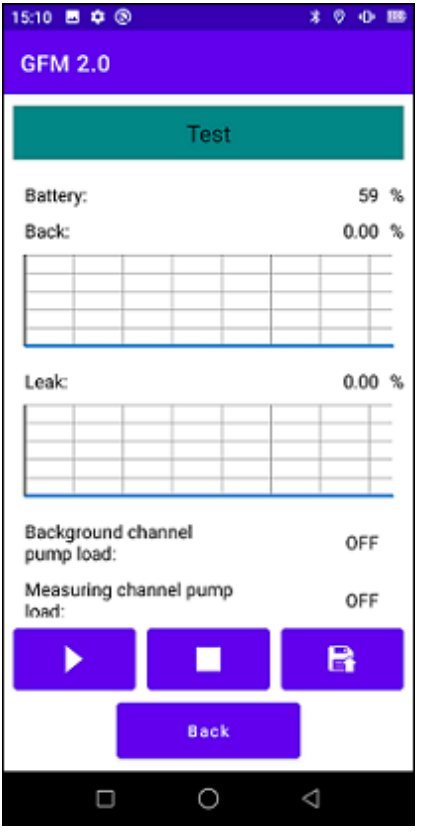


Figure 24 - Test

The test page allows you to test the GFM at the start of the day using a reference gas mixture (2.5% methane.)

NOTE: Checked data is saved to a file, in order to determine the presence or absence of a check performed at the beginning of the workday and as proof of the correct measurements of the GFM.

Check to be carried out in accordance with paragraph 3.8.9

3.8.3. MENU ITEM "SETTINGS"

Click on "Settings" (Figure 23) to open the settings page (Figure 25.) Use the Back button to return to the application menu.

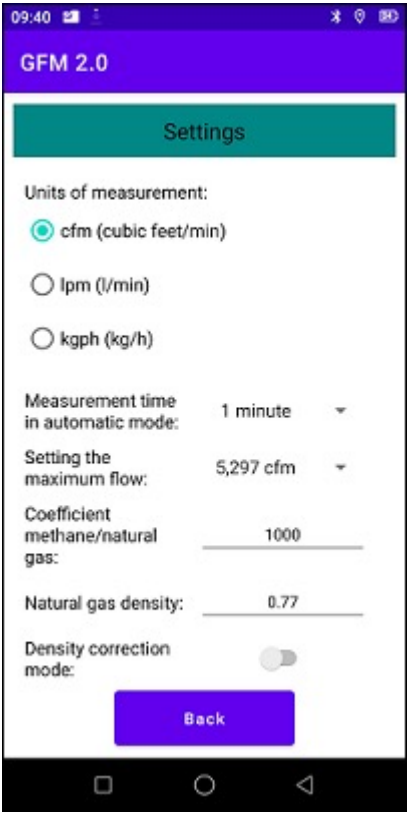


Figure 25 - Settings

The settings page allows you to select the required units of measurement, the measurement time in automatic mode and configure the maximum flow.

You may also change the values of methane/natural gas coefficient and natural gas density (Clause 1.1)

NOTE: The parameters you set are saved to the configuration file, which gives you the opportunity not to make settings every time you turn it on.

Table 1 shows the data displayed on the pages.

Table 1 - Displayed Data

COUNT	DESCRIPTION
Date	Date of measurement
Time	Measurement time
Battery charge	Sampler battery remaining in %
Flow rate	Flow rate in cfm, lpm or kghr (depending on selected unit)
Background concentration	Background gas concentration in %
Leak concentration	Gas concentration in the stream in %
Background channel pump load*	in %
Measuring channel pump load*	in %
Latitude	Instrument location latitude in degrees
Longitude	Longitude of instrument location in degrees
Leak Rate	in cfm, lpm or Kg/hr (depending on the chosen units)
Barcode	Scanned barcode data

*With the readings at 70% or more at a temperature of 68°±50° (20°C±10 °C), and background channel fitting disconnected, we recommend replacing or cleaning the filters. To check the tightness of the gas paths, close the inlet fittings of the measurement channels one by one. Readings must be over 90%.

NOTE: When the background of the graph and headings on app pages is RED, there is a malfunction of the sampler blocks.

When the background of the graph and headings on app pages is YELLOW, it is time to purge the sampler.

3.8.4. MENU ITEM "PURGE"

Click on Purge (Figure 23.) This will open the purge page (Figure 26.)

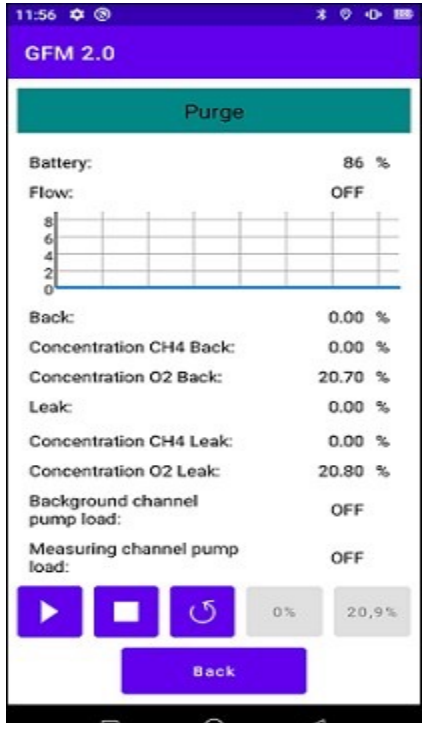


Figure 26 - Purge

The start button  is used to start purging the sampler.

The reset button  allows you to start the purge with the reset of the sensors (highly recommended).

The stop button  is used to stop the purge. The back button returns to the application menu and stops the purge - similar to the stop button.

After activating the buttons "0%" and "20.9%" (if necessary), adjust the zero values of the methane sensors and/or the values of 20.9% of the oxygen sensors. Perform these actions in clean air.

3.8.5. MENU ITEM "VIEWING DATA"

Click Viewing Data (Figure 23) to open the Viewing Data page (Figure 27). Use the Back button to return to the application menu.

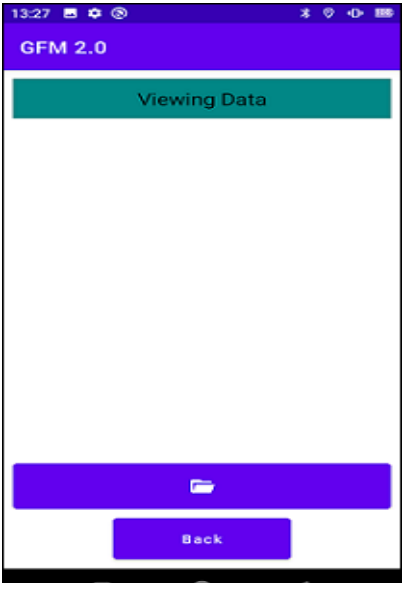


Figure 27 - Viewing data

Click on the file icon to open the file selection menu (Figure 28).

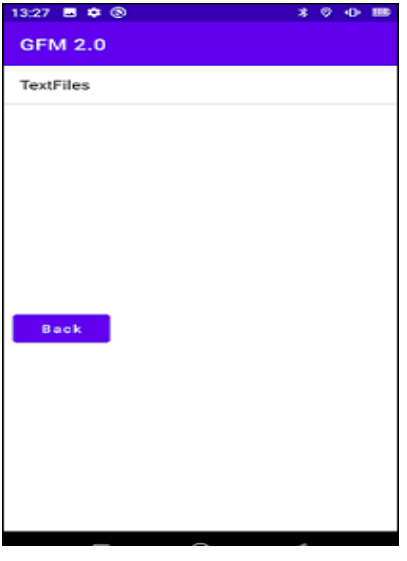


Figure 28 - File selection menu

Select the folders you need until the document opens (Figure 29.) Use the Back button to return to the application menu.

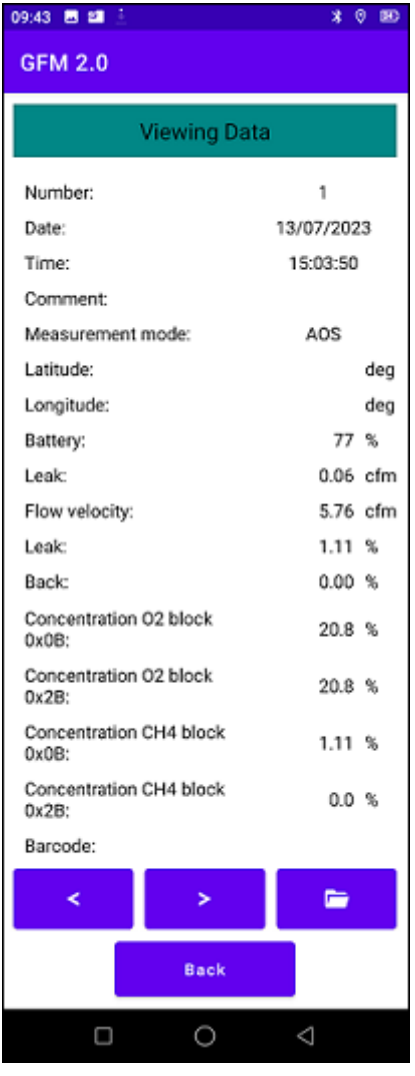


Figure 29 - Viewing data

When opening a file, the first entry in a text document is displayed by default. To navigate through the entries, use the “Previous” and “Next” arrow buttons.

NOTE: The data is presented in table form that can be scrolled through.

3.8.6. MENU ITEM "AUTOMATIC ONE-STAGE"

Click on Automatic one-stage" (Figure 23) to open the Automatic one-stage page (Figure 30.)

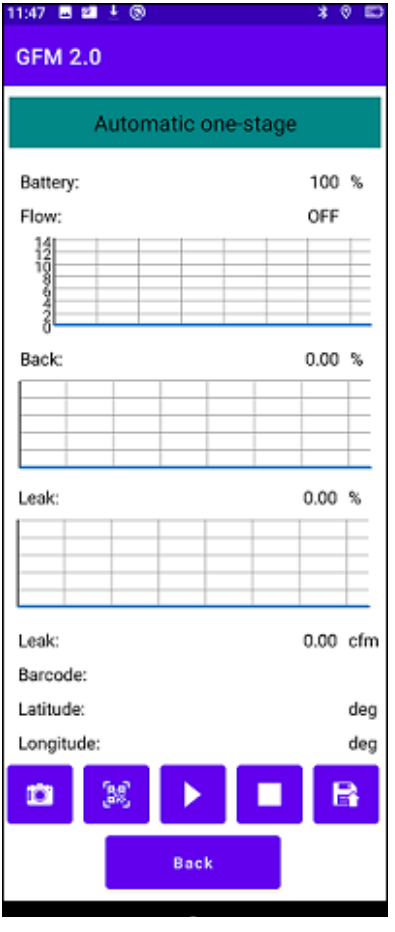


Figure 30 - Automatic one-stage mode

"Make photo" button allows you to take a photo of the measured component. "Scan barcode" button allows you to scan a barcode. The "Start" and "Stop" buttons allow you to start or stop the measurement, respectively. "Write to file" button is used to write data to a file. The "Back" button is used to return to the application menu, and also stops the measurement in the same way as the "Stop" button.

NOTE: The data is presented in table form that can be scrolled through.

In Automatic one-stage mode, the instrument starts measuring at the speed of 250 lpm for 30 seconds, then, depending on the concentration value, the flow rate adjusts. Further measurement takes place during the time that is selected in Settings. The final measured and calculated values can be written to the memory after activating "Write to file."

After clicking "Write to file," a comments window is displayed. Use this field to enter information regarding the object or location of the measurement.

This mode is used in cases of obvious and easily caught leaks.

REMINDER: Purge the instrument and adjust the sensor readings before beginning measurements.

3.8.7. MENU ITEM "MANUAL ONE-STAGE"

Click on "Manual one stage" (Figure 23) to open the Manual one-stage page (Figure 31.)

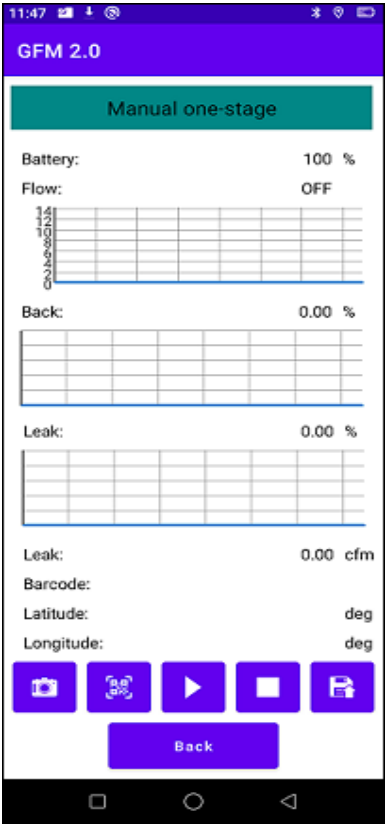


Figure 31 - Manual one-stage mode

The Camera button allows you to take a photo of the measured component. Scan barcode allows you to scan a barcode. Start and Stop buttons start or stop the measurement. Write to File button writes data to a file. The Back button is used to return to the application menu, and also stops the measurement in the same way as the Stop button.

NOTE: The data is in a table that can be scrolled (up and down).

In Manual one-step mode, the operator starts the measurement at the flow rate set in the Settings menu, and waits until a steady leak reading appears. Once stable readings are reached, the operator can manually write all measured and calculated readings to memory using the Write to file. When writing to file, a comment window is displayed. This field is used to enter any information regarding the object or location of the measurement.

This mode is used when the leakage rate measurement process needs more supervision.

3.8.8. MENU ITEM "GAS ANALYZER"

Click on Gas analyzer (Figure 23) to open Gas analyzer mode (Figure 32.)

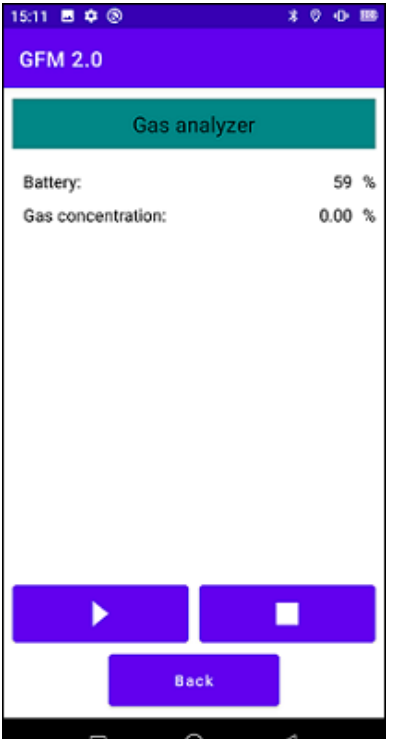


Figure 32 - Gas analyzer

Start and Stop allow you to start or stop the measurement of gas concentration, respectively. Use the Back button to return to the application menu.

3.8.9. CALIBRATION OF THE GFM FOR METHANE

For calibration, the excess flow method is used.

We do not recommend applying direct connection of the calibration gas bottle to the calibration ports of the instrument. Always use a supplied rotameter to provide constant flow of the calibration gas. Rotameter indicator should to be steady around number 1. Gas suction pumps create negative (rarefied) pressure at the inlet of the calibration ports and draw the gas in.

The connection diagram of the elements is shown in Figure 33.

1. GFM 2.0
2. Rotameter
3. Reducer
4. Telephone
5. Tee

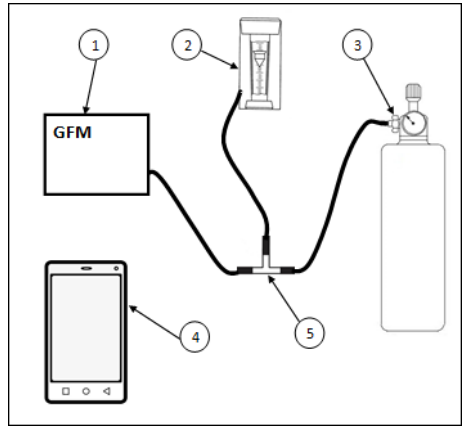
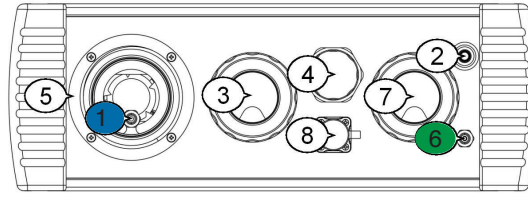


Figure 33

Figure 2 - Rear panel

1. Input of the working leak channel;
2. Ground connector;
3. Working leak channel filter;
4. USB connector;
5. Main Suction Intake;
6. Background channel input;
7. Background channel filter;
8. Battery charge connector.



To perform calibration, follow these steps:

1. Assemble the gas mixture supply scheme, (Figure 33);

2. Turn on the device;

3. Launch GFM Application Calibration on the phone;

4. Purge the instrument for at least five minutes;

5. Go to the menu item Leak calibration, (Figure 34);

6. If a zero offset is observed (detector signal is not equal to 10000±10), adjust the zero readings of the methane sensor by pressing the Zero button;

7. In the Set Low field, enter the value of the methane concentration used;

8. Supply gas to the working channel (monitor the presence of excess gas on the rotameter.) Wait for the readings to stabilize;

9. Press Set Low;

10. In the field Set High, enter the value of the methane concentration used;

11. Supply gas to the working channel (monitor the presence of excess gas on the rotameter.) Wait for the readings to stabilize;

12. Press Set High;

13. If the entered concentration value differs from the current reading by more than 20 times, the GGM will not be calibrated. Press the INIT button to initialize the calibration coefficient and the zeroing coefficient and perform the calibration procedure again;

14. Press Back to exit the menu.

If, after completing the calibration procedure, the sensor error does not meet the requirements, it is necessary to repeat the procedure. If the readings do not match again, the sensor unit must be replaced and sent to the manufacturer for repair.

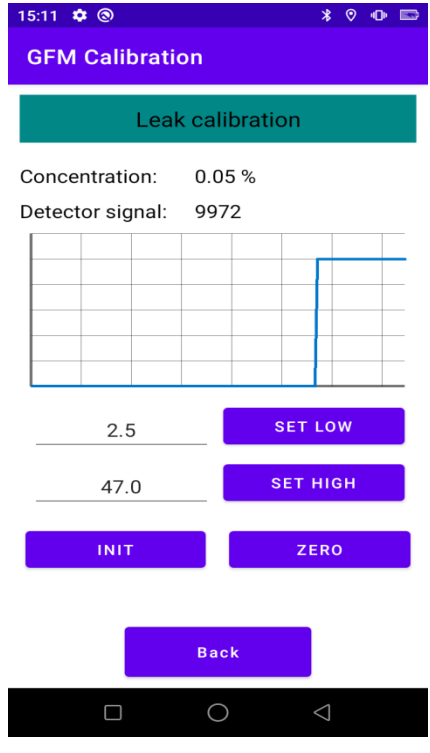


Figure 34

Steps 6-13 are repeated for the comparative channel by going to the menu item “Back calibration.”

Calibration requires the use of methane gas mixtures containing methane:

- for low range 2.0% to 3.0%;
- for high range from 40.0% to 60.0%;

All calibration data is automatically saved to a text comma separated file, which can then be loaded into dynamic spreadsheets (Excel).

Full path to the file:

Internal Memory -> Android -> data -> com.flow.gasflowmetercalibration -> files -> TextFiles -> TextData.txt, using the same steps as in 3.9.

Recommend full calibration of GFM 2.0 Monthly.

3.8.9. RECOMMEND VERIFICATION OF GFM WEEKLY

This is very simple, whereby you introduce the calibration gas to verify that the sensors respond to the specific gas amount and remain within 5% of the specified gas. If they are within 5%, there is no need to perform full calibration. If they exceed 5% +/-, then perform full calibration.

3.9. TRANSFERRING DATA TO A PC

All measured and calculated data stored in memory can be copied to a personal computer as an ASCII file separated by "#", which can then be entered into any spreadsheet program for analysis. The following describes how to copy the recorded data to a personal computer.

1. Connect the phone to a personal computer using a USB cable;
2. Unlock phone;
3. From home page, swipe down from the top of the screen (swipe), Figure 35;

Figure 35 - Home page

4. Click on the item “Charging the device via USB,” Figure 36;

5. Click on File Transfer, Figure 37;

6. Open the explorer on a personal computer;

7. Select the connected phone;

8. Select “Internal Memory”;

9. All folders that are in the internal memory of the phone will appear. Select the Android folder;

10. Select the “data” folder;

11. Select the folder “com.flow.gas-flowmeter2”;

12. Select the “files” folder;

13. File folders will be displayed. The TextFile folder contains folders broken down by dates with text files of saved measurements located inside. The “Pictures” folder contains folders organized by date with photos inside.

14. Copy the necessary folders to your personal computer.

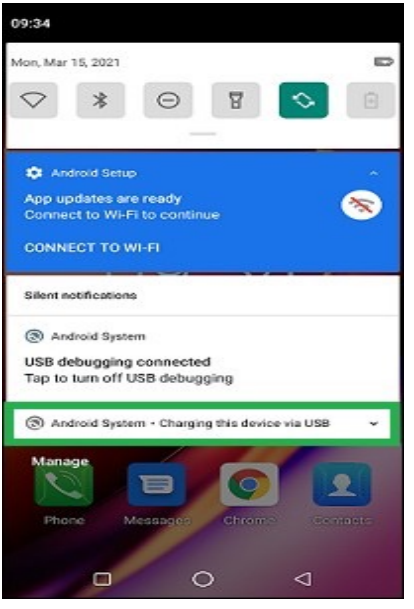


Figure 36 - Notifications

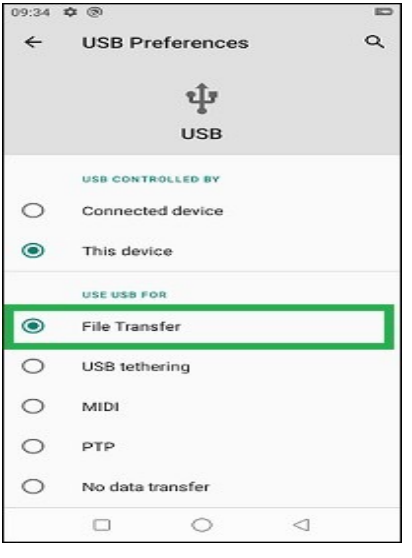


Figure 37 - USB connection settings

3.10. VIEWING DATA DURING OPERATION OF GFM

Data is recorded in the phone's memory throughout the entire operation time (data is recorded if the device is on) with a frequency of one (1) time every 1-2 seconds.

To obtain data for a specific day of work, it is necessary to perform the actions indicated in Section 3.9.

Full path to the file : Internal Memory -> Android -> data -> com.flow.gas-flowmeter2 -> files -> TextFiles -> TextDataFull.txt

Data written to memory can be copied to a personal computer as an ASCII file separated by "#", which can then be entered into any spreadsheet program for analysis. This file has the form shown Table 2.

TABLE 2

No.	Name	Description
1	Date	Recording date
2	Time	Recording time
3	Latitude	Latitude for this entry
4	longitude	Longitude for this entry
5	Battery	Battery charge level
6	measurement type *	Measurement type
7	Leak rate units	Leak units. Can be rendered in cfm, lpm or kghr
8	flow rate	Flow rate
9	Selected flow rate	Selected flow rate
10	Selected density value	Density set value
11	Recalculated density value	Recalculated density value
12	Recalculated flow rate	Recalculated flow rate
13	Flag O2/CH4	Measurement mode flag (O2 or CH4)
14	Recalculated concentration CH4 leak	Calculated CH4 concentration for working channel
15	Recalculated concentration of CH4 back	Calculated CH4 concentration for the background channel
16	Leakage rate	Estimated leakage
17	Concentration CH4 leak	CH4 concentration for working channel
18	Concentration O2 leak	O2 concentration for working channel
19	MCPL	Working channel pump load
20	Concentration CH4 back	CH4 concentration for the background channel
21	Concentration O2 back	O2 concentration for the background channel
22	BCPL	Background channel pump load

*Measurement type: This field can have one of several values:

TEST: Data was recorded when the Test window was active in the application on the smartphone;

PURGE: Data was recorded when the Purge window was active in the application on the smartphone;

AOS: Data was written while the Automatic window was active one stage in the application on the smartphone;

MOS: Data was written while the Manual window was active one stage in the application on the smartphone;

NONE: Data was written when one of the following windows was active: Menu, Settings, Viewing data, Gas analyzer.

We recommend cleaning up phone's memory periodically, including deleting the Text Files and Pictures folders. The number of entries is limited by the phone's external memory.

3.11. IMPORTING SAVED DATA INTO A DYNAMIC TABLE

Measurement data copied to a computer according to Section 3.9 can be imported into spreadsheet programs that are capable of accepting comma-separated files. Please note that some of the previously recorded fields may be empty because some features are not installed.

The method for creating spreadsheets from comma-separated text files using Microsoft® Excel 2010 is described below.

1. Launch Microsoft Excel;

2. Click on the "Data" tab;

3. Click on the "From text" button, a dialog box will open;

4. Select the text file that was previously copied from the phone to the personal computer and click the "Import" button;

5. In the "specify data format" field, select "delimited" and click the "Next" button;

6. In the "separator character is:" field, check the "other" box and put the "#" symbol, all other checkboxes must be unchecked, click the "Finish" button;

7. Select the cell where you want to start inserting the table and click the OK button.

4. MAINTENANCE

Regular GFM 2.0 Maintenance consists of the following:

1. Battery Charging;
2. Replacement or cleaning of external filters;
3. Calibration of the GFM 2.0 for methane (3.8.9.)

4.1. CHARGING THE BATTERY

The rechargeable battery must be charged in a gas free environment using the manufacturer's provided charging adapter. To insure maximum battery life, we recommend fully charging the battery every three months while the unit is in storage.

4.2. REPLACING THE EXTERNAL FILTERS

The external filter (Figure 38 and 39) contains the following elements:

1. Filter base
2. Sealing ring
3. Filter element
4. Clip
5. Washer

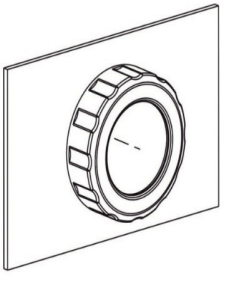


Figure 38 -
Outer filter assembly

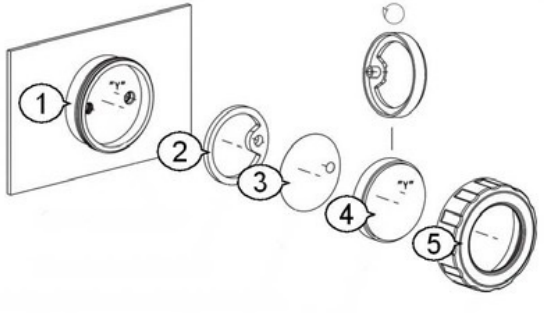


Figure 39 -
Outer filter disassembled

How to disassemble the external filter for replacement or cleaning:

1. Unscrew the washer (5) counterclockwise;
2. Remove the clip (4) from the base of the filter;
3. Remove the sealing ring (2) from the holder;
4. Carefully remove the filter element (3), avoiding surface creases;
5. Clean or replace the filter element;
6. Install the filter element into the clip. The “smooth” side of the filter element should face the clip as shown in Figure 38;
7. Install the sealing ring in the holder;
8. Install the assembled cartridge into the filter base (1), ensuring the correct positioning of the elements by aligning the “Y” axes as shown in Figure 39;
9. Screw the washer clockwise with as much hand force as possible.

4.3. WARRANTY AND REPAIR

The Gas Flow Meter 2.0 is warranteed for one (1) year from the date of shipment. The warranty covers failures due to defective materials or workmanship occurring during normal use. Damage from improper use, accident or misapplication is not covered under this warranty and will be determined upon inspection. Damage caused by neglect of proper filter and battery maintenance is excluded and will be assessed upon inspection for replacement of individual parts. AddGlobe’s responsiblity shall be limited to repairing or replacing any defective part, provided the product is returned to our repair department in Florida. Return shipping charges and insurance will be paid by AddGlobe, LLC.

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