GAS FLOW METER 2.0

Instrument Manual

Direct Measurement Method

of Natural Gas Fugitives

Guidelines PR 26 - 06.01

Operation and Maintenance Version 1.2.4

06.01.2026

The GFM 2.0 is UL Certified Class I, Div. 2, ensuring it meets rigorous safety standards for hazardous environments. Fully EPA-compliant, this portable device delivers precise gas leak rate measurements, making it ideal for environmental monitoring and industrial applications. Additionally, the GFM 2.0 is ATEX certified, verifying its suitability for use in explosive atmospheres, and CAD certified, ensuring compliance for use in Australia and New Zealand. These certifications further expand its global reliability for accurate and safe performance.

AddGlobe, LLC
www.addglobe.com
info@addglobe.com

1650 Arabian Drive
Loxahatchee, FL 33470

GAS FLOW METER 2.0

Instrument Manual

About AddGlobe, LLC

AddGlobe, LLC is the leading Gas Flow Meter 2.0 manufacturer, the next-generation high-volume sampler. Our exclusive focus is on researching, designing, developing, and manufacturing the best direct measurement tool for the natural gas industry. Addglobe has over 20 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 use with the US EPA Greenhouse Gas Reporting rule for Oil & Gas, Subpart W, and OOOOb compliance. It is also compliant for use with the US Department of the Interior methane quantification measurement of abandoned/orphaned wells. It meets the stringent regulatory standards for Canada, the European Union, the UK, and OGMP 2.0. Our customers can depend on 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.

AddGlobe, LLC

Customer Service: 561-985-7523

1650 Arabian Drive, Loxahatchee, FL 33470

Customer Support: info@addglobe.com

Website: www.addglobe.com

Contents

0. Bringing the device into operational state

GFM 2.0 is a metrological instrument. It does not operate correctly “out of the box” without stabilization and calibration. Like any precision measurement system, it must be brought into a defined working condition before valid measurements begin.

This is particularly important:

- **after installing new firmware,**
- **after powering the device on and before powering the device off,**
- **after transportation,**
- **after significant changes in altitude, pressure, or temperature.**

The required sequence is (will be explained in several places in the Manual):

1. Purge (3.8.6 Manual Item)
2. Calibration (4 Manual Item)
3. Gas Test (3.8.4 Manual Item “Test”)

Only after completing this sequence is the device considered stabilized and ready for valid measurements.

The Purge and the Calibration steps are critical. It adapts the sensors behavior to the specific environmental conditions (temperature, pressure, altitude) of the current location. This is not optional. It defines the reference state for the day’s measurements and should be performed at the beginning of each working session.

Skipping or shortening this initialization can produce systematic deviations.

1. Introduction

1.1 General Description

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.

The GFM can essentially quantify 98-99% of fugitive methane emissions at a common natural gas compressor station or similar facility. The 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 a sensor 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.

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

Where:

Leakage – The rate of gas leakage from a 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 an 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 the Oxygen Displacement Method© and 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.

IT IS NOT RECOMMENDED TO CHANGE THIS COEFFICIENT WITHOUT CONSENT FROM THE MANUFACTURER.

To control and correct oxygen readings, the GFM has an electrochemical sensor that measures the oxygen concentration (O2) 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.

IMPORTANT!!!

For correct operation with oxygen, the 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. During its service life, periodic calibration of the sensor on gas mixtures is necessary.

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 that 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 CH4 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
- Accessory Kit Bag
- Charging Adapter
- Range of accessories:
- Capture bag 35" x 35" (90cm x 90cm) (2.95 CFM)
- Corrugated nozzle
- Coarse filter
- Grounding cable

1.3 Benefits of Using a Gas Flow Meter

- Greenhouse Gas Regulatory Compliance for US EPA Subpart W and OOOOb regulatory reporting.
- Department of the Interior Compliance for Quantification of abandoned/orphaned wells.
- Canada, European Union, and OGMP 2.0 Compliance.
- 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.
- Best Practice for EPA Directed Inspection and Maintenance Programs at Natural Gas Facilities.

1.4 Description

The front panel (Figure 1) contains the following elements:

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

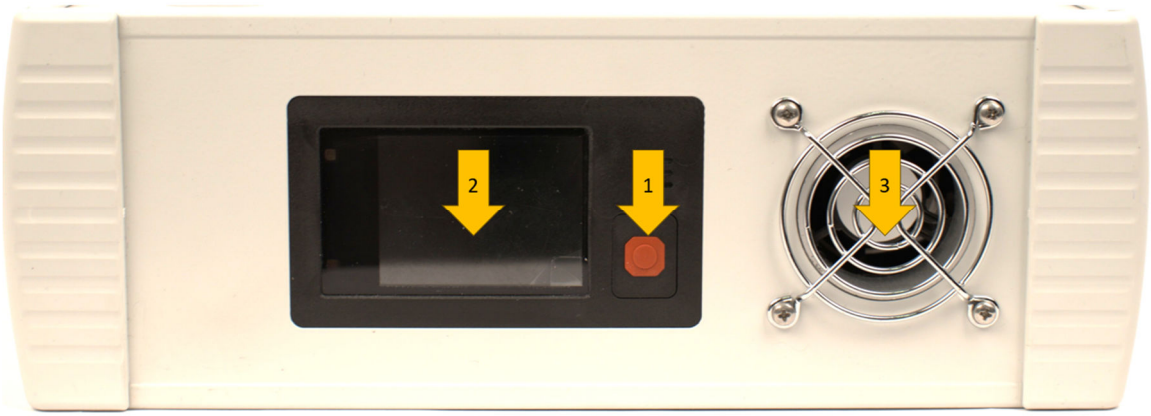


Figure 1 – Front panel

The rear panel (Figure 2) contains the following elements:

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

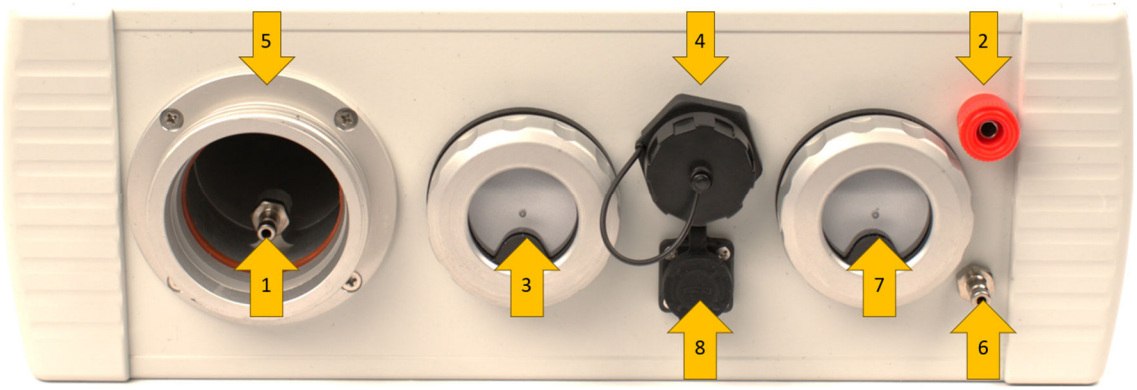


Figure 2 – Rear panel

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 Operations and Calibration are 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.
Variable Speed Blower Fan Intake Capacity	0.01 CFM to 12.36 CFM; 0.28 to 350.0 l/min; 0.01 to 14.2 kg/hr*
Measured Sampling Flow Rate	0.01 CFM to >22.0 CFM; 0.28 to >623 l/min; 0.01 to >26.6 kg/hr+
Minimum Detectable Leak Rate	0.008 CFM; 0.22 l/min;10.00 g/h
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)
Pre-installed Sample Flow Rates	Maximum: 12.36 CFM; 350 l/ min; Medium: 8.82 CFM; 250 l/ min; Low: 5.29 CFM; 150 l/min;
Method of measurement	Pressure drop across the Venturi tube
Natural Gas Sensor / Accuracy	Optical method. The range is from 0 to 100% methane by volume. Accuracy is ±5% of reading or 0.1% methane, whichever it is greater.
Oxygen Correction Method Sensor	The electrochemical O2 sensor is 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: 10.0 Ah; Charging time: Up to 10 hours; Duration of work: 8+ hours (cyclic mode).
Sampler memory	Cyclic - 50 hours of work
Measuring memory, photographs of the object	Limited by phone memory
Dimensions	11.4” x 11.2” x 4” 29cm x 28.5cm x 10cm
Weight	9.4 lbs (4.2 kg)
Certifications	UL Certified Class 1, Division 2; Ex II 2G Ex ib IIB T3 Gb

*12.36 CFM is the nominal blower intake capacity rated under standard test conditions; it doesn’t represent the upper measurement limit of the instrument. .

+ Field validation has demonstrated stable quantification performance up to approximately 22 CFM total flow under real operating conditions, verified against calibrated bag measurements. .

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3. Operation

3.1 Important Safety Precautions

When using the sampler, it is prohibited to:

1. Break the seal and unscrew the screws. Doing so without prior authorization will void the warranty.
2. Troubleshoot outside an authorized service center.
3. Do not operate a sampler that has mechanical damage or broken seals.

Urgency of work or other reasons are not grounds for violating safety rules.

ATTENTION! Conditions for safe use of the sampler:

1. The battery must be charged outside hazardous areas using the manufacturer's network adapter included in the delivery set.

2. The battery must be replaced outside hazardous areas.

Before starting work with the sampler in a hazardous area, it is necessary to check:

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

IMPORTANT! For correct operation, it is necessary to 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.

IMPORTANT! To ensure the operational lifespan of the power supply unit, we recommend maintaining a battery charge of at least 20%, even when the device is not in use.

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).

EPA recommends a pre- and post-test calibration verification every day the measurements are taken 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. Purging can be done manually or automatically if the "auto-purge" mode is enabled in the Global settings (Section 3.8.2).

3.2 Connecting the 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;

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3. Quick-release connector for connection to the input of the background channel;
4. Background gas intake.

Figure 3 – Hose

3.3 Grounding

CAUTION: 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 grounding cable to the nearest earth ground. (Figure 4)

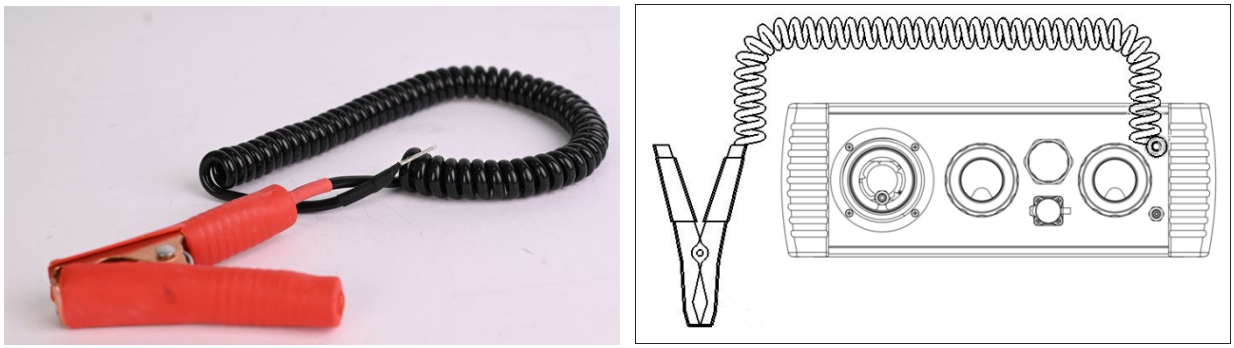


Figure 4 – Grounding

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3. 4 Accessories

A variety of GFM accessories are available to capture leaking gas. Select one of the following accessories that match 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. An oversized capture bag (47x69 inches, 120x175 cm) is available for measuring bulky components (see Section 6.3).

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.

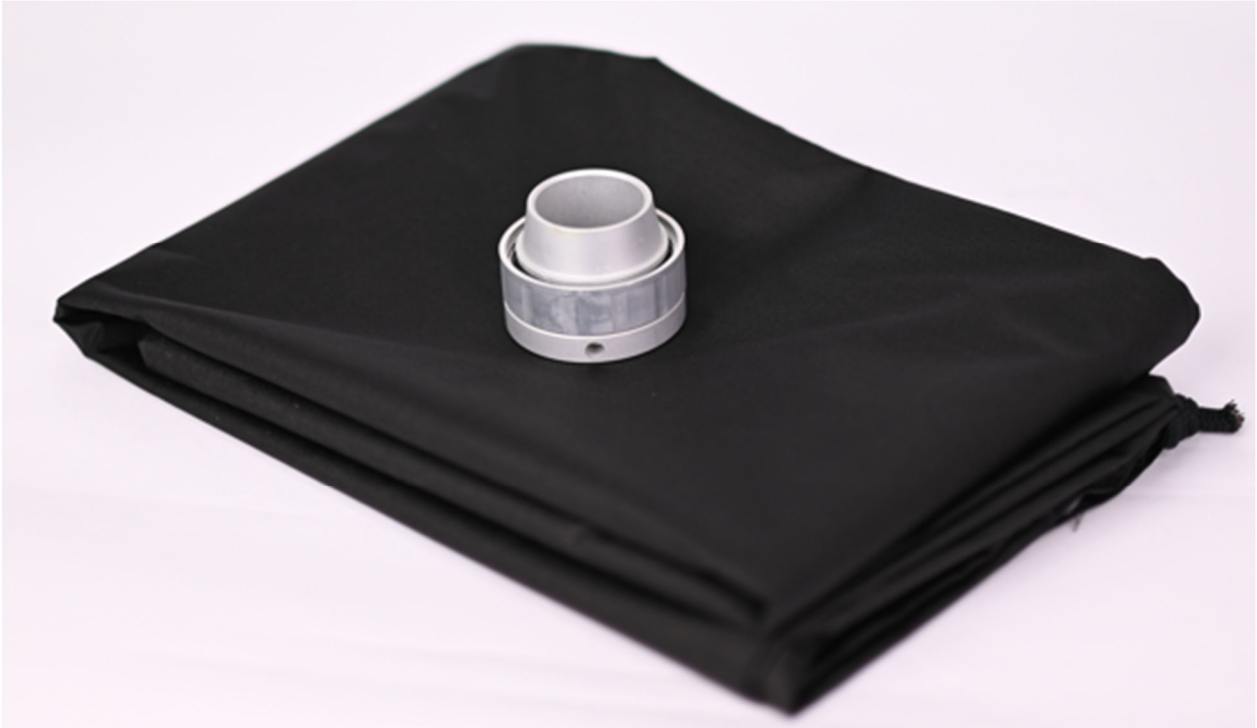


Figure 5 – Capture bag

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.4.2 Corrugated Nozzle

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

Figure 6 – Corrugated nozzle

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.

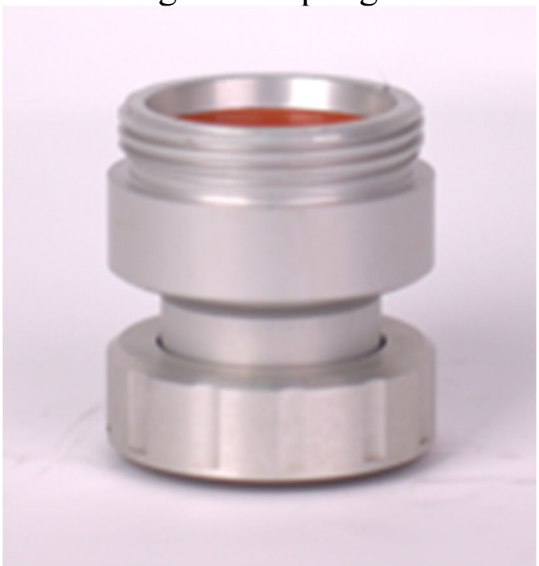


Figure 7 – Coarse filter

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

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 it 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**

Completely purge the unit before shutting down. Switching off is done by pressing and holding the (On/Off) button until the sound signal turns off.

3.7 Pairing the Phone to the GFM 2.0

3.7.1 Installing App on Android Phone

Important: Before installing the new software, you must uninstall the old application from your phone.

Figure 9 – Home Page

Download the application from the website https://addglobe.com/software to your personal computer. You can also contact customer service or sales by phone or email, providing the device's serial number, to receive a link to the current apps.

Below is how to copy the downloaded data to your phone.

1. Connect your phone to your personal computer using a USB cable,
2. Unlock your phone,
3. On the home page, swipe down from the top of the screen (Figure 9),
4. Click on the item "Charging the device via USB", Figure 10;

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

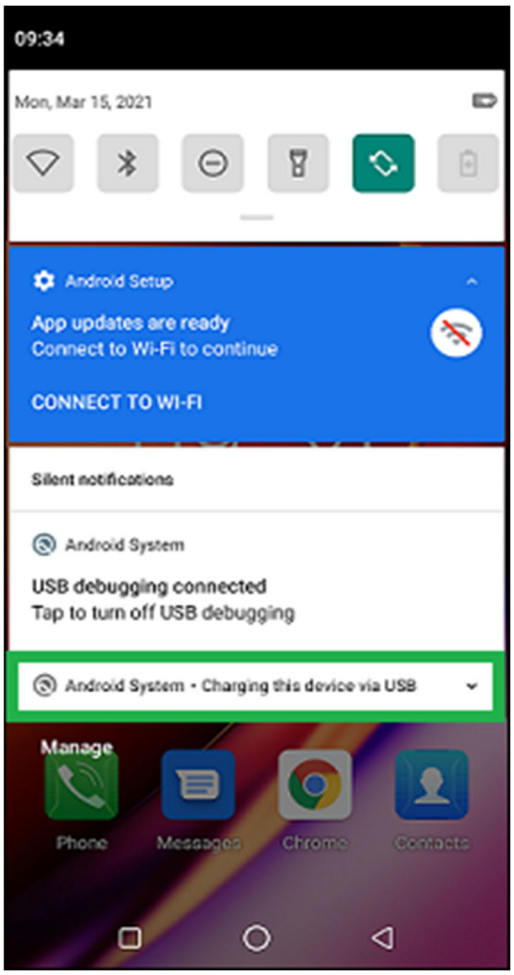


Figure 10 – Notification

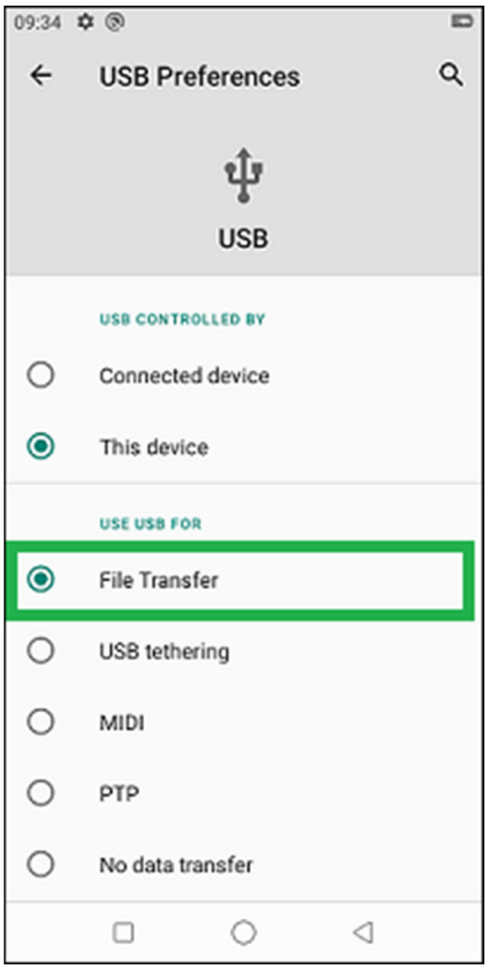


Figure 11 – USB connection settings

5. Click on the "File Transfer" item (Figure 11),
6. Open Explorer on your personal computer,
7. Select the connected phone,
8. Select "Internal memory",
9. Open the "Download" folder,
10. 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 disconnect the USB cable;
11. On the home page, swipe up from the bottom of the screen (Figure 12).
12. In the menu, select the "Files" item (Figure 13).
13. Go to the " Download " folder, select the application, and start the installation.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 12 – Home page

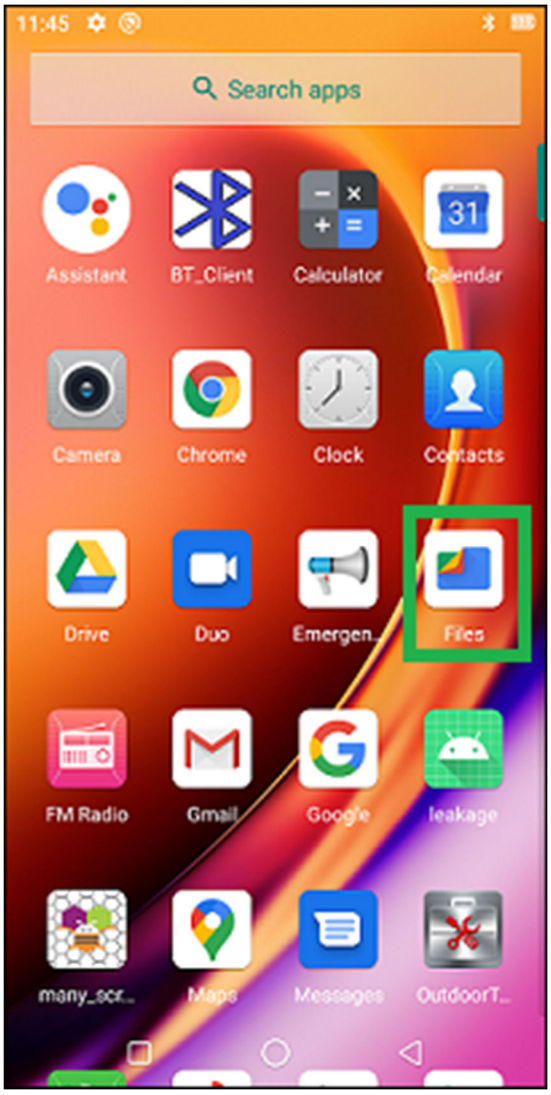


Figure 13 – Menu

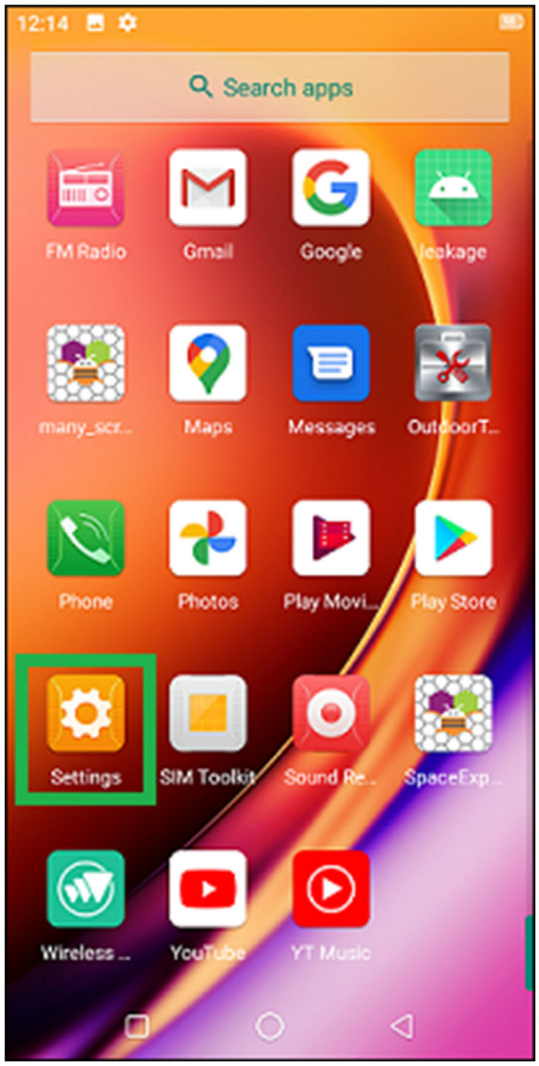
IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.7.2 Connecting GFM to a Phone

Screenshots are provided for Android 10.0. For other Android versions and themes, images may differ. Make sure the Gas Flow Meter is turned on.

On the home page, swipe up from the bottom of the screen (Figure 14).

Figure 14 – Home page



tem (Figure 15).

Figure 15 - Menu

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

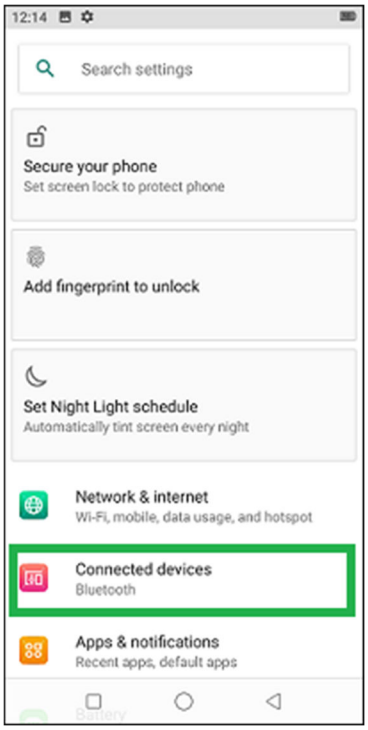


Figure 16 – Settings

Figure 17 – Connected devices

In the settings, select the item "Connected Bluetooth devices" (Figure 16).

Click on the "Pair new device" button (Figure 17). 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.

In the dialog box that opens, enter 1234 in the password entry field (Figure 19). Click OK.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

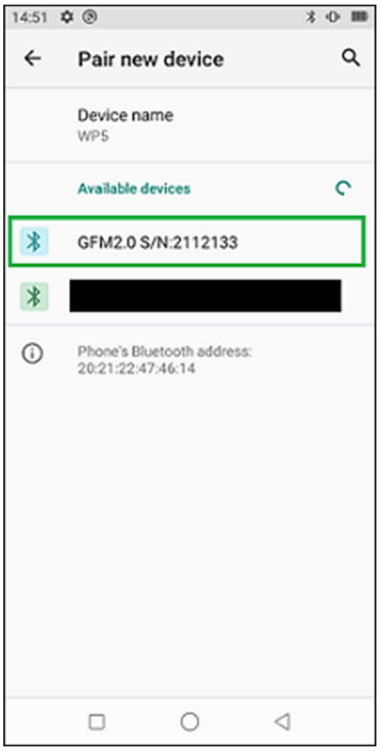


Figure 18 – List of available Bluetooth devices.

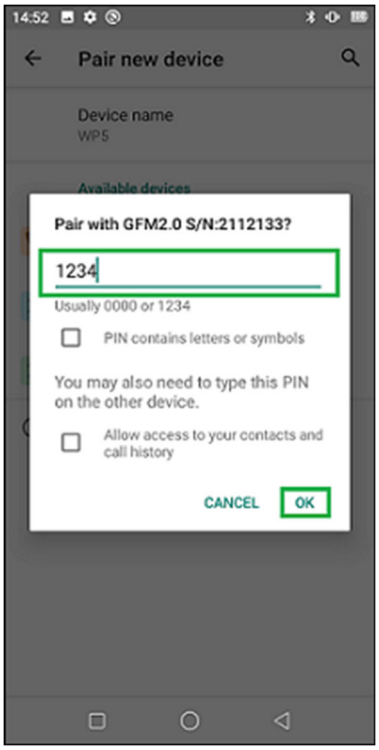


Figure 19 – Dialog box

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

The device should appear in the connected ones (Figure 20).

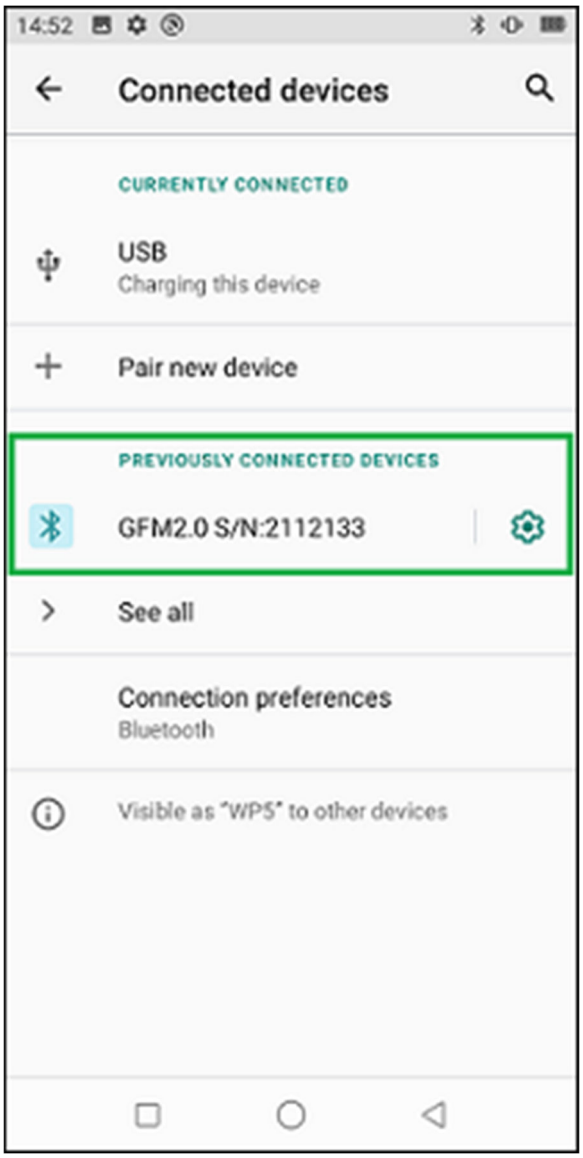


Figure 20 – List of previously connected Bluetooth devices.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

3.8 Operating Procedure

Note: All figures in this manual displaying leakage graphs use the unit of measurement in lpm (liters per minute).

3.8.1 Opening the App, Connecting to GFM

When you open the app, a loading window will appear (Figure 21). The app version is displayed at the bottom of the loading screen (Example: V 1.2.1).

When the app is launched for the first time, you’ll be prompted to choose a folder for saving data. You need to create a folder by tapping the "Create new folder" button (Figure 22); the folder can be given any name (for example, GFM data) (Figure 23).

Figure 21 – Start application

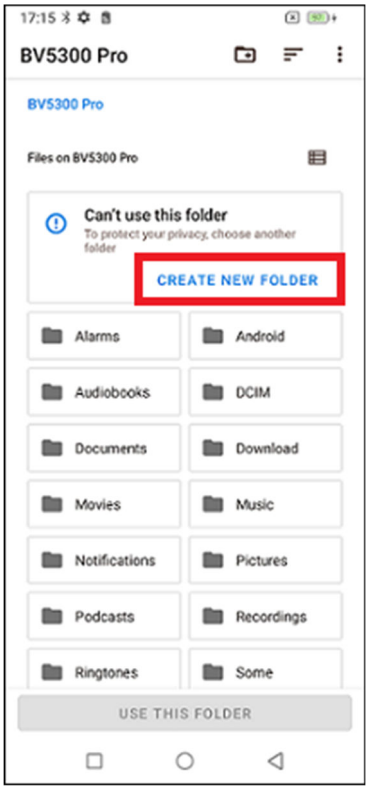


Figure 22 – Create a new folder

Figure 23 – Set folder name

Next, you need to select the folder you just created (Figure 24) using the "USE THIS FOLDER" button. Pay close attention to the full path of the selected

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

folder (Figure 24), as all app files will be stored there. Once the folder is selected, the remaining directory structure will be created automatically.

Then, you need to grant permission to use this folder for reading and recording files (Figure 25) by tapping the "Allow" button.

Thereafter, you need to grant all necessary permissions for the app to function properly (Figure 26).

Figure 24 – Select folder

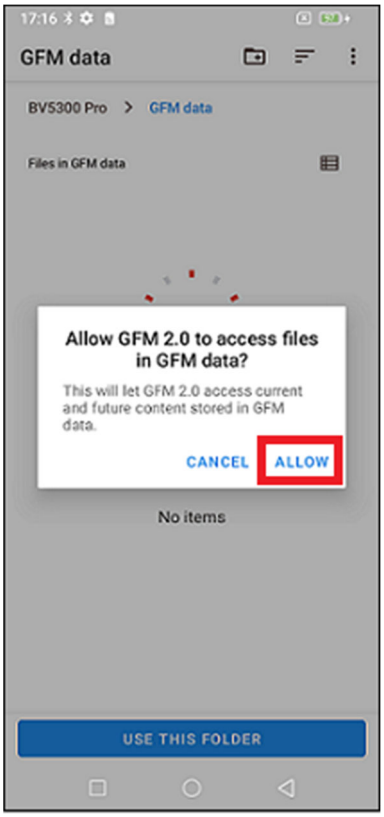


Figure 25 – Allow access

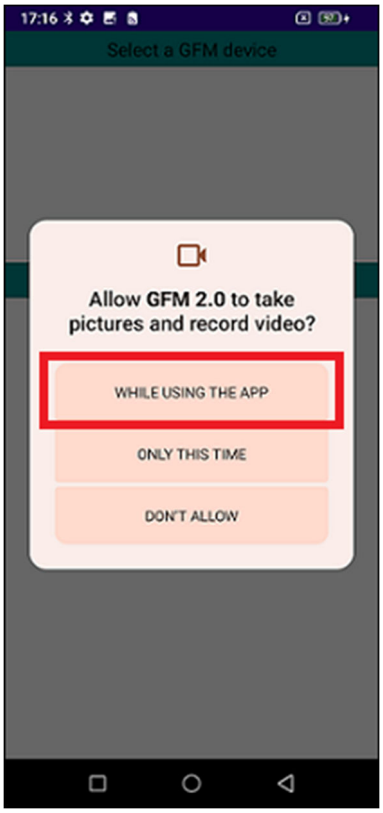


Figure 26 – Grant permissions

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

The steps described above only need to be performed once during the app installation.

The following section outlines how to launch the app for daily use:

Figure 27 – App Home page

Figure 28 – Established connection with a sampler

1. Open the GFM 2.0 app on the phone. Select the previously paired GFM from the start page. (Figure 27).

This page presents the previously paired GFM and GFM_Laser devices. GFM_Laser is used for low leakage measurements. The GFM_Laser operating instructions are described in the GFM_Laser user manual. For more information, please contact the manufacturer.

It is necessary to connect to the GFM sampler. Click on the required device.

2. As a result, synchronization (setting the current time and date) with the sampler will be performed (Figure 28). The time in the device is set in accordance with the time on the phone.

As a result of connecting to the device, additional elements will be displayed in the form of a check mark and a cross. The check mark indicates an existing connection, and the cross allows you to close the connection by clicking on it. The button "Go to GFM" and the button "Global Settings GFM" appear.

When you click on the "Go to GFM" button, you can go to the GFM menu, and by clicking on the "Global settings GFM" button, you can go to the global GFM settings.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Note: Exiting the application by pressing the "Back" button closes all existing connections. When the application is minimized, all existing connections remain open, and data is exchanged with connected devices.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.8.2 Global Settings GFM

Figure 29 – Home page

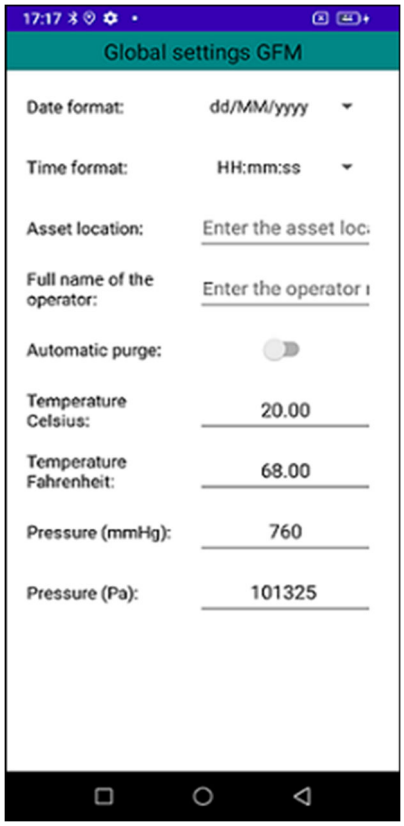


Figure 30 – Global settings GFM

Click on the button "Global settings GFM" (Figure 29).

This will open the "Global settings GFM" page (Figure 30).

On this page, the operator can set the required date and time formats, which will be reflected in the log file (Figure 31) and in the file when saving manually.

The operator also has the option to enter the name of the measurement or company asset and their personal data: name or employee identification number.

The data in the "Asset location" field is text-based, allowing for any information to be entered that identifies the measurement object (there is no possibility to enter special characters prohibited in file names). Similarly, the data in the "Full name of the operator" field is text-based, so entering the employee's Personnel number/Employee ID or other identifying details is permitted. The Asset name and the operator's personal information will be recorded in the log file (Figure 25).

Note: The asset location and the operator's personal data will be recorded in the log file when navigating to the GFM menu. It is also important to note that when switching to another Company asset or changing the operator, this information should be updated for proper logging and further analysis.

Note: The asset location data is also involved when saving the log file and manually recorded files, which are saved in a folder by the object name. If the asset location is not specified, the data will be saved in the folder named "unknown_object".

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

Note: Do not use the # symbol in either the asset location or the full name of the operator. This will prevent the data from formatting correctly when converting to a spreadsheet**.**

The "Automatic purge" switch is used to enable or disable automatic purging. When automatic purging is enabled, purging will be activated upon entering the GFM menu and will remain active for the entire time between measurements, turning off when returning to the application's main page. Using this mode reduces the battery's operating time without recharging.

The dialog boxes "Temperature Celsius" and "Temperature Fahrenheit" are used by the operator to enter the current temperature in either Celsius or Fahrenheit.

When a value is entered in Celsius, the corresponding Fahrenheit value is automatically calculated, so there’s no need to edit the "Temperature Fahrenheit" field manually.

Likewise, entering a temperature in Fahrenheit will automatically convert it to Celsius, and the "Temperature Celsius" field does not need to be changed.

The "Pressure (mmHg)" and "Pressure (Pa)" dialog boxes are used by the operator to enter the current pressure in either millimeters of mercury or Pascals.

When a value is entered in millimeters of mercury, the pressure is automatically converted to Pascals, so there’s no need to change the "Pressure (Pa)" field manually.

Likewise, entering a value in Pascals will automatically convert the pressure to millimeters of mercury, and the "Pressure (mmHg)" dialog box does not need to be edited.

Note: Temperature and pressure data are used to generate a PDF report in the "EPA Automatic" mode. For more details, refer to Section 3.8.9, Menu Item "EPA Automatic."

	A	B	C	D	E	F	G	H	I	J
1	Date	Time	Latitude	Longitude	Object name	Operator name	Battery	Measurement type	Active	Photo nar
2	2024-08-20	11:16:44			New York	John Wick	95	NONE	STOPPED	
3	2024-08-20	11:16:45			New York	John Wick	95	NONE	STOPPED	
4	2024-08-20	11:16:46			New York	John Wick	95	NONE	STOPPED	
5	2024-08-20	11:16:47			New York	John Wick	95	NONE	STOPPED	
6	2024-08-20	11:16:48			New York	John Wick	95	NONE	STOPPED	
7	2024-08-20	11:16:49			New York	John Wick	95	NONE	STOPPED	
8										
9										
10										

Figure 31 – Log file

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

When you click the "Back" button, the global settings data will be saved and will not need to be re-entered when you reopen the application, unless the measurement object or the operator performing the measurements has changed.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.8.3 GFM Menu

Click on the "Go to GFM" (Figure 32)
This will open the GFM menu page (Figure 33).

Figure 32 – Home page

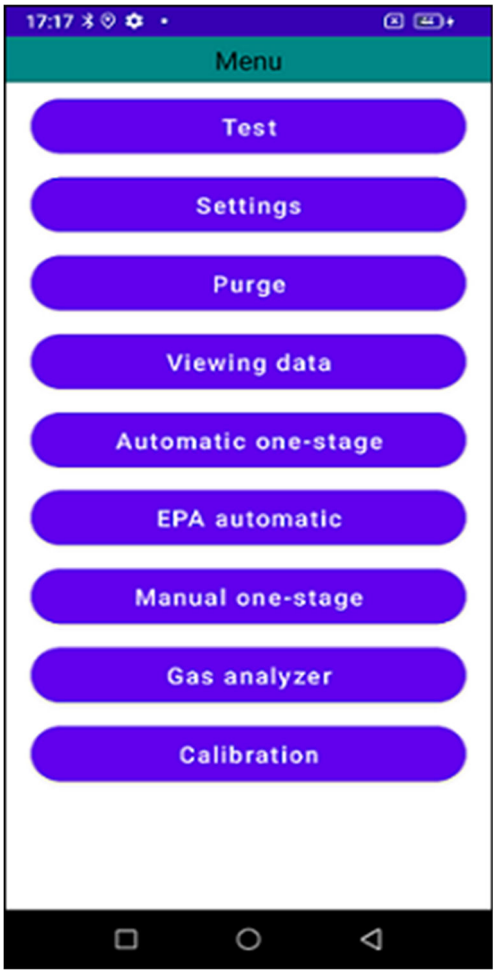


Figure 33 – GFM Menu

3.8.4 Menu Item "Test"

ATTENTION! Perform the "Purge" procedure according to 3.8.6 "Purge" each time before performing testing instructions below

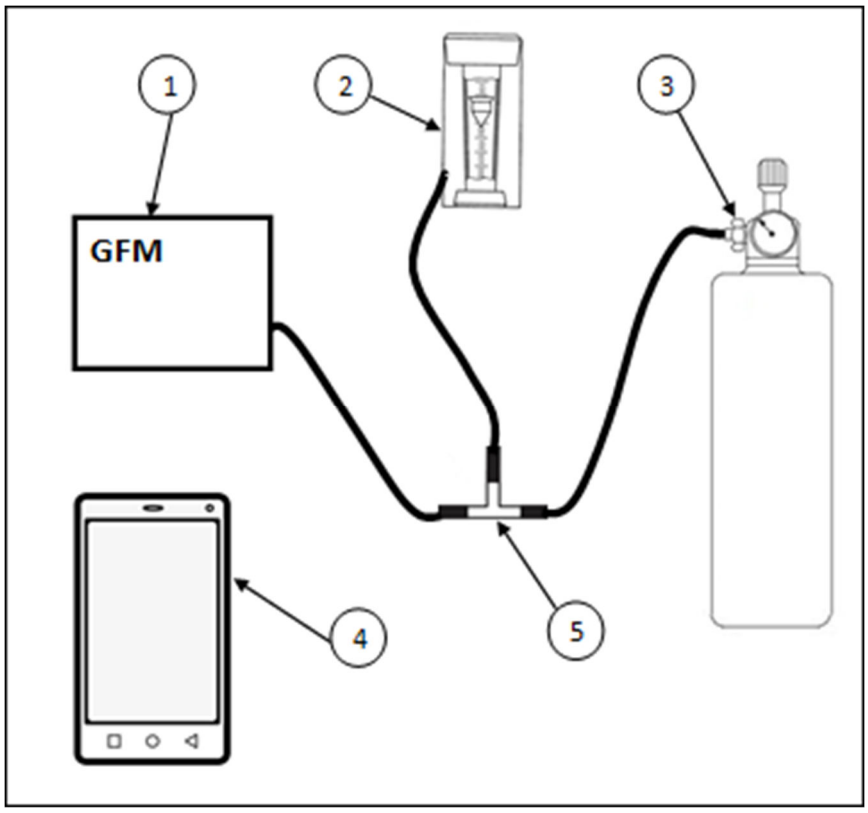
The Test mode is required to check the operability of the device, the correctness of the determination of methane concentrations and the correctness of the calculation of the volumes of leaks.In the "Test" mode, the instrument is tested using gas mixtures of known concentrations. The device is tested in the low and high concentration ranges. The lower concentration range is from 1.5% to 3.0%, inclusive. The upper concentration range is from 40.0% to 100.0%, inclusive. To

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

check the accuracy of methane concentration measurements, methane gas mixtures with concentrations of 2.5% (for the low range) and 50% (for the high range) must be used.

We do not recommend connecting the calibration gas cylinder directly to the instrument's calibration ports. Always use the supplied rotameter to ensure a constant flow of testing gas. The connection diagram for the components is shown in Figure 34.

The scheme includes:



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

Figure 34 – Connection diagram

Assemble the testing bench to the connection diagram (Figure 34), following the exact sequence of steps:

1.1 Ensure that the cylinder valve is closed, Open the regulator on the reducer to release any residual gas pressure and prevent damage to the device from a sudden pressure surge at the inlet.

1.2 Close the pressure regulator and verify that the pressure gauge on the reducer reads 0.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

1.3 Open the cylinder valve and confirm that the pressure on the reducer's pressure gauge increases and stabilizes.

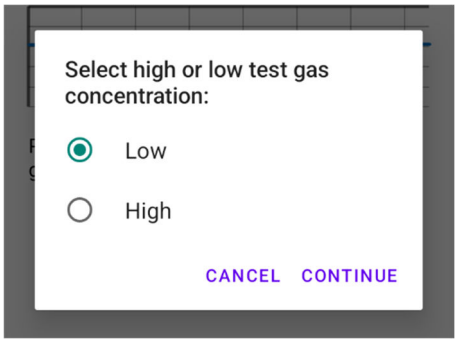
1.4 Connect the rotameter to the cylinder reducer as shown in Figure 34, using the tee and tubing from the rotameter kit. Secure the rotameter in an upright position. **Do not** connect the device to the tee at this stage.

2. Open the reducer regulator and adjust the rotameter reading in the middle of the scale.

3. Connect the addition inlet of the instrument (1) to the tee of the testing bench (5) according to the diagram in Figure 34.

4. Press the button ▶ and select the Low or High concentration mode according to the gas mixture selected for the test (Figure 35)

5. Press the "Continue" button, set the concentration of the gas mixture selected for the test, and press "Start" (Figure 36).



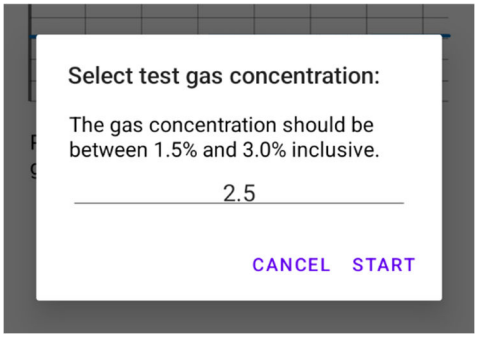


Figure 35 – Select concentration Figure 36 – Set concentration

6. Wait for 20 seconds the Leak reading to stabilize.

7. Make sure the "Percentage difference test gas/leak channel" reading is stabilized within 5% for at least 10 seconds. If the "Percentage difference test gas/leak channel" reading deviates from the test mixture by more than 5%, calibrate the instrument according to Section 4 "Calibration".

8. Click the 💾 button to save the test result. When you click the record button, the message "DATA SAVED" will appear at the bottom. Then click the ■ button. Saving data is not available after clicking the ■ button.

9. Disconnect the background channel of the instrument from the test setup, close the cylinder valve first, then close the reducer.

10. Exit the Test menu, select the Purge menu item and perform the Purge procedure for 2 minutes with the buttons ▶ and ■ .

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

11. Repeat the procedure to test on mixtures of other concentrations.
12. Pressing the "Back" ◁ button will return you to the application menu.

Note: The verified data is saved to a file, which makes it possible to confirm whether a check was performed at the beginning or end of the working day and to verify the accuracy of the GFM 2.0 sampler measurements (Figure 37).

	A	B	C	D	E	F	G	H
1	Date	Time	Channel	Test gas concentration	Concentration back	Concentration leak	Difference back channel	Difference leak channel
2	20.08.2024	12:18:34	Back	2.5	0.00	---	100.00	---
3	20.08.2024	12:18:49	Back	50.0	0.00	---	100.00	---
4	20.08.2024	12:18:57	Leak	2.5	---	0.00	---	100.00
5	20.08.2024	12:19:07	Leak	50.0	---	0.00	---	100.00
6								
7								

Figure 37 – Test data

Table 2

No.	Name	Description
1	Date	Date of verification
2	Time	Test execution time
3	Channel	The channel through which the check was performed (Back / Leak)
4	Test gas concentration	Concentration of the reference gas mixture
5	Background channel concentration	Actual concentration of the background channel methane sensor
6	Leak channel concentration	Actual concentration of the methane leak channel sensor
7	Difference channel background	The percentage difference between the concentration of the reference gas mixture and the actual concentration of the background channel methane sensor
8	Difference leak channel	The percentage difference between the concentration of the reference gas mixture and the actual concentration of the leak channel methane sensor
Note:		

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

If the measurement is performed for the background channel, the values of “Leak Channel Concentration” and “Leak Channel Difference” will be presented as “---" since the test is performed for the background channel.
If the measurement is performed for a leak channel, the values of "Background Channel Concentration" and "Background Channel Difference" will be presented as "---" since the test is performed for a leak channel.

Recommendation:

If the percentage difference for any of the channels is more than 5%, then GFM calibration must be performed. If the test was performed at the end of the working day and the percentage difference was more than 5% for any channel, then the measurement data for that day cannot be considered valid, and calibration must be performed.

The file with the test data can be downloaded to a personal computer and imported into dynamic tables for further analysis. The file with the test data is located at the following path: Previously selected folder for data saving (Section 3.8.1 Opening the App, Connecting to GFM) → GFM 2.0 → files → <device serial number> → tests → tests.txt. The separator of single values for this file is ";".

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.8.5 Menu Item "Settings"

Click on the item "Settings" (Figure 38). This will open the settings page (Figure 39).

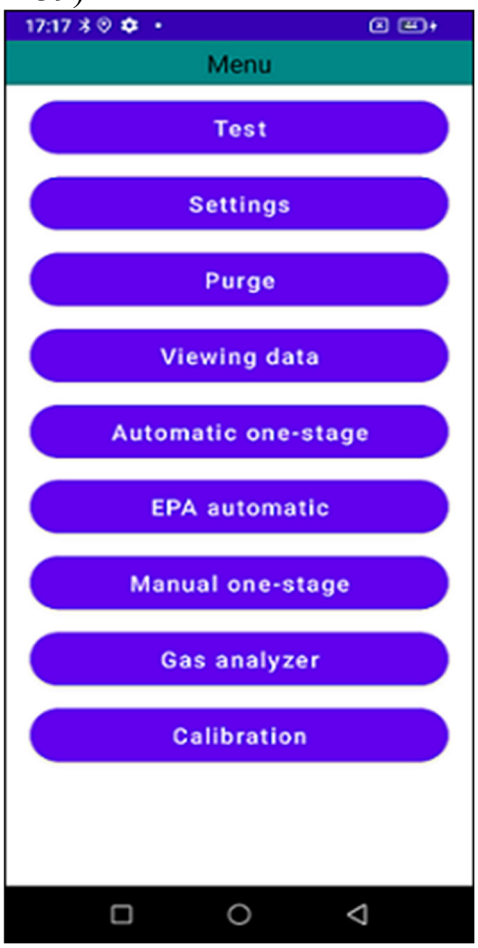


Figure 38 – Main Menu

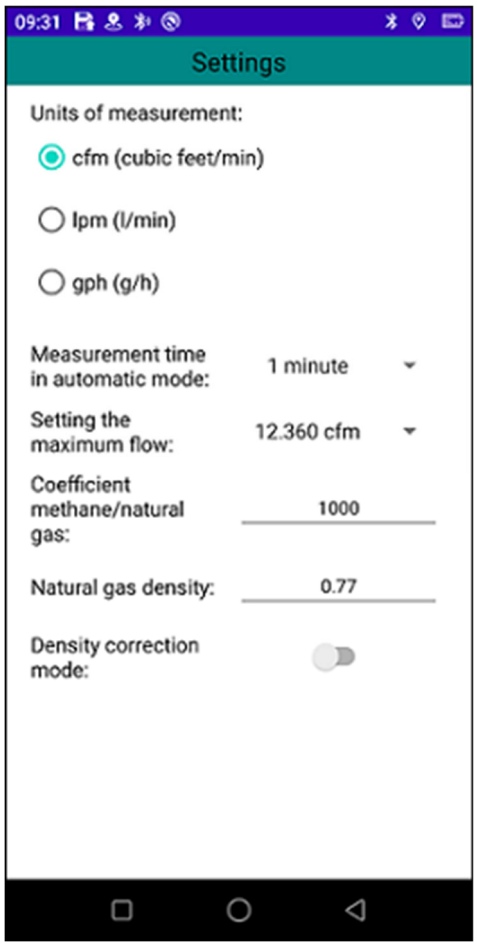


Figure 39 – Settings

The settings page allows you to select the required units of measurement, such as:

– cfm (cubic feet/min);
– lpm (l/min);
– gph (g/h).

It is possible to select the measurement time in automatic mode with the following values:

– 1 minute;
– 1.5 minutes;
– 2 minutes;
– 2.5 minutes;

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

– 3 minutes.

You can set the maximum flow rate for Manual mode one-stage with values that depend on the selected units of measurement (Table 3).

Table 3

Units of measurement	Meaning
cfm (cubic feet/min)	12,360 cfm
	8,829 cfm
	5,297 cfm
lpm (l/min)	350 lpm
	250 lpm
	150 lpm
gph (g/h)	350 lpm
	250 lpm
	150 lpm

It is possible to set the values of the coefficient methane/natural gas in the range from 100 to 1000.

It is possible to set the density of natural gas in the range from 0.6 to 1.22.

The density correction mode switch is designed to enable/disable taking into account gas density in calculations.

Note: The parameters you set are saved in the configuration file, which allows you to avoid making adjustments every time you turn on the device.

Pressing the "Back" button  will return you to the application menu.

Table 4 presents the data displayed on the data viewing screens corresponding to the different measurement modes.

Table 4

Count	Description
Date	Date of measurement taken
Time	Time of measurement taken
Battery charge	The remaining battery charge of the sampler in %
Flow rate	Flow rate in cfm or lpm (depending on the units selected)
Background concentration	Background gas concentration in %
Leak concentration	Gas concentration in the flow in %
Background channel pump load*	V %
Measuring channel pump load*	V %
Latitude	Latitude of the device in degrees

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Longitude	Longitude of the device location in degrees
Leakage intensity	in cfm, lpm, or gph (depending on the units selected)
Barcode	Scanned barcode data

*With the readings at 70% or more at a temperature of 68°±50°F (20°C±10°C), and the 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%.

ATTENTION: If the background of the graphs and headings on the application pages is displayed in red, this indicates a malfunction of the sampler units. If the background of the graphs and headings is displayed in yellow, the sampler must be purged. The short-term appearance of "red" and "yellow" indicators is not a sign of a malfunction and does not indicate the need to purge the device.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.8.6 Menu Item "Purge"

Click on the item "Purge" (Figure 23). This will open the purge page (Figure 40).

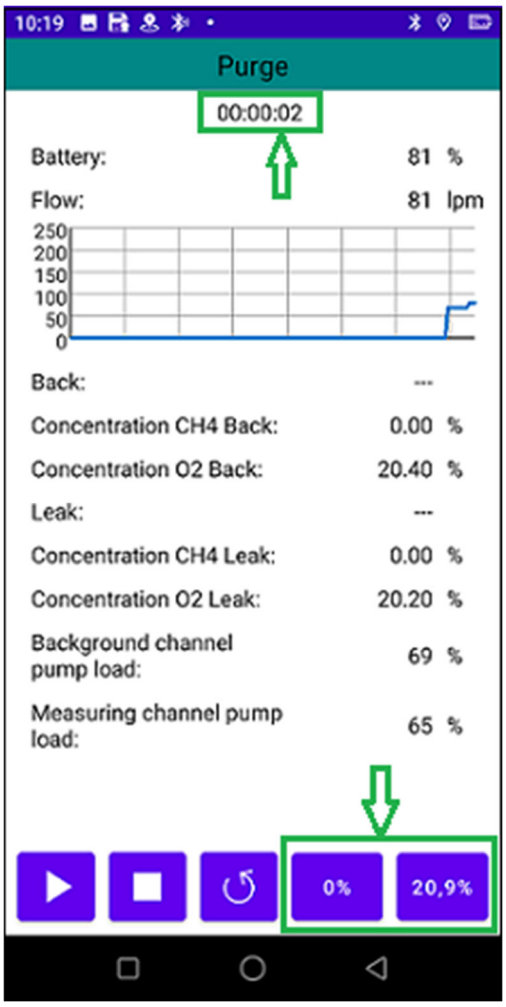


Figure 40 – Purge

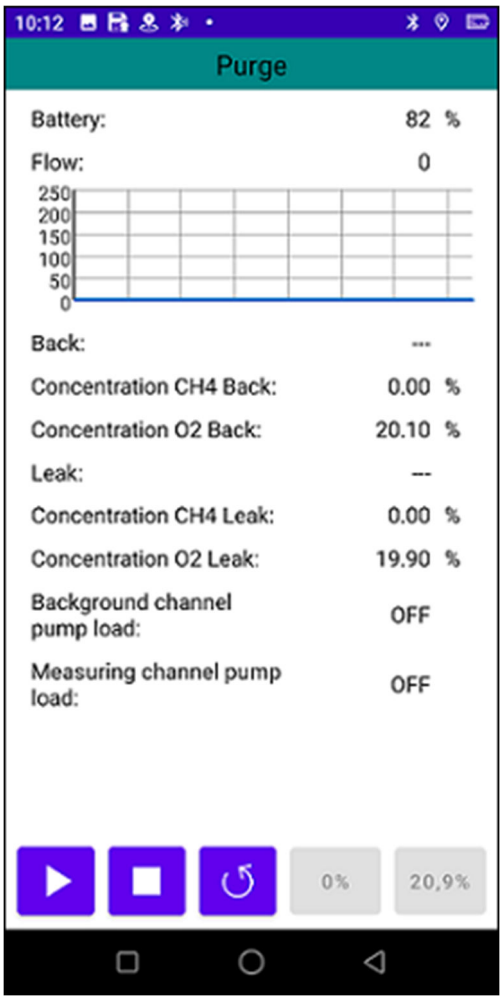


Figure 41 – Manual purge

The "Start" ▶ and ■ "Stop" buttons are used to start and stop the sampler purge. When you press the "Start" button, the manual purge process will start, and the "0%" and "20.9%" buttons will become available (Figure 34), which are used to set the zero value for methane sensors and set the value of 20.9% for oxygen sensors. Also, when the purge process starts, a timer will be displayed, signaling the time elapsed since the start of the process (Figure 41).

Oxygen sensor adjustment. Before starting the purge process in the Purge screen mode, the oxygen readings may be overestimated or underestimated. The

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

actual oxygen levels are only displayed in purge mode (after the purge is started) once the flow stabilizes (approximately 20 seconds). If the value stabilizes at 20.9%, no adjustment is needed. If the values differ, press the 20.9% button once and wait about 20 seconds. The readings should stabilize at this level. Methane adjustment is carried out by a single press of the 0% button. The sensor response time is about 20 seconds.

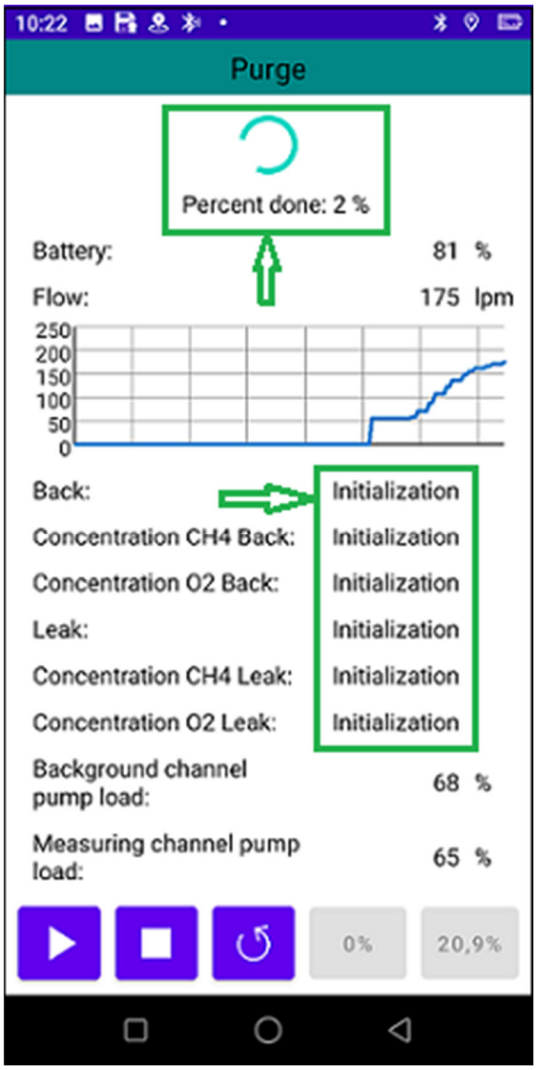


Figure 42 – Complete sensors reset

If the manual reset mode of the methane sensors does not produce results, then it is necessary to reset to zero values in automatic mode.

"Reset to zero" allows you to set zero gas concentration readings. When you press the "Complete sensors reset" button, the purge process will start for 5 minutes, and the sensors will be automatically initialized (Figure 42). The progress of the process is displayed as a percentage (Figure 42).

After the automatic purge process is completed, the methane sensor readings should be 0.00±0.03. In case of other readings, it is necessary to adjust the zero readings of the methane sensors manually.

The "Back" button serves to return to the application menu and stops the blowing process in the same way as the "Stop" button.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

3.8.7 Menu Item "Viewing Data"

Figure 43 – Viewing a file

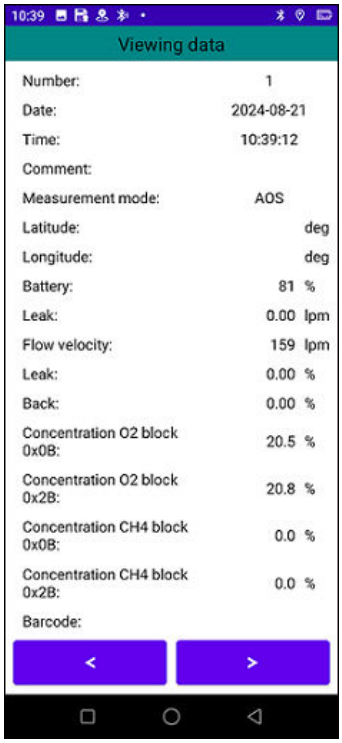
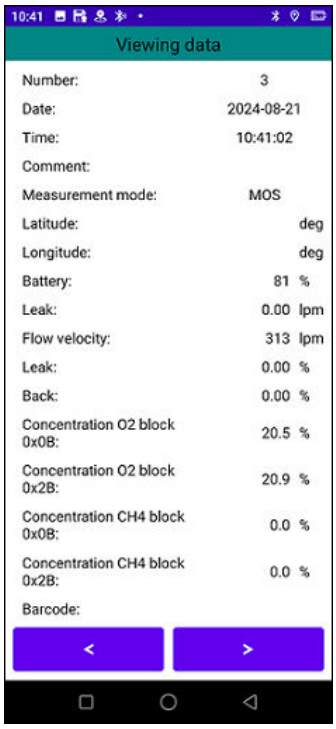


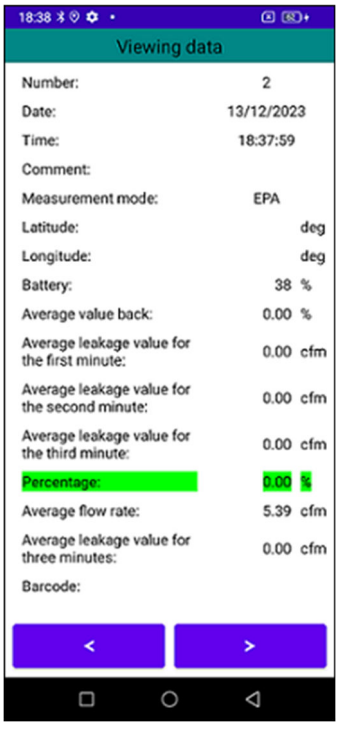
Figure 44 – Viewing recording data in AOS mode

This mode is used to view measurements taken and saved on the phone screen in Automatic one-stage (AOS), EPA automatic, and Manual one-stage (MOS) modes. Click on the item "Viewing Data" (Figure 33). As a result, the file selection page will open (Figure 43).

The "Back" button is used to return to the application menu.

The button in the center of the screen labeled "Back" in the application is used to return to the main directory.





Select the necessary folders until the document opens (the folder names match the object names set in the global settings mode). The displayed data depends on the measurement mode in which the manual save was performed.

If the percentage difference between the maximum and minimum leakage value in EPA mode is less than 10%, then the data will be highlighted in green, otherwise in red.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 45 – Viewing recording data in MOS mode

Figure 46 – Viewing recording data in EPA automatic mode

Note: If the operator has set the density adjustment mode, the "Measurement mode" cell will display AOSC <density value>, MOSC <density value>, or EPAC <density value>. Here, the "density value" represents the gas density set by the operator, which defaults to 0,77.

The "Back" button is used to return to the file selection page.

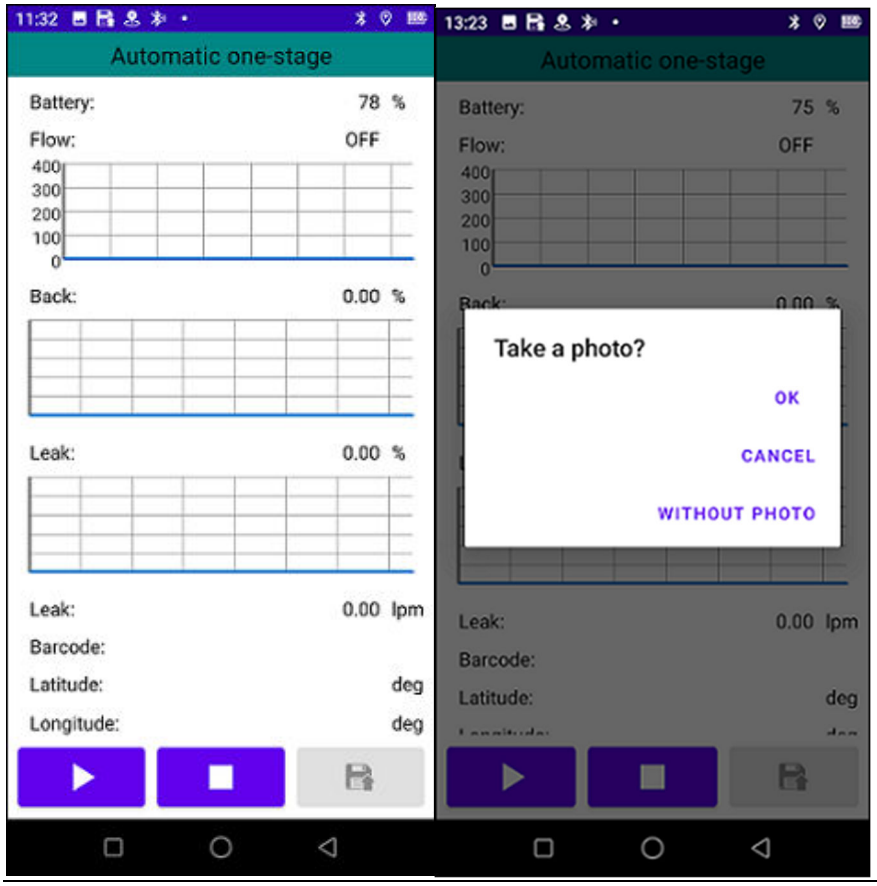
When you open a file, the first entry in the text document is displayed by default; to navigate through the entries, use the "Previous" and "Next" buttons. You can also swipe right or left to navigate through the entries.

Note: The data is presented in the form of a table that can be scrolled (up and down).

3.8.8 Menu Item "Automatic one-stage"

Click on the item "Automatic one-stage" (Figure 33) to open the "Automatic one-stage" page (Figure 47).

The "Start" and "Stop" buttons allow you to start or stop measuring, respectively.



When you click the "Start" button, a dialog box will open (Figure 48).

The "CANCEL" button is required to cancel the start of the measurement process.

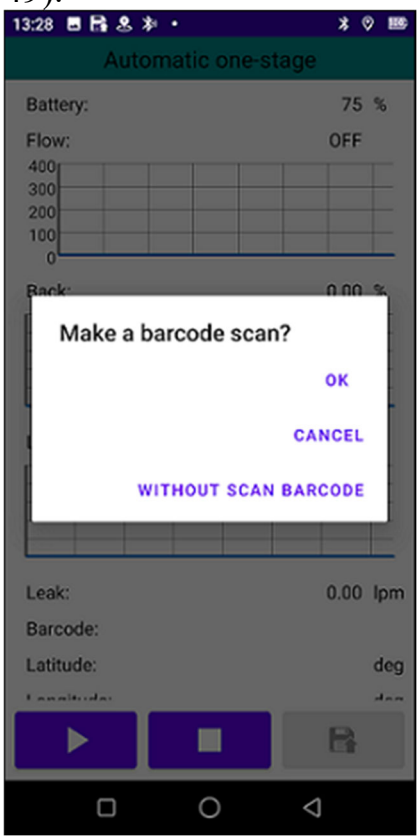
Pressing the "OK" button will open the "CAMERA" application to take a picture of the measured component. If the operator has taken a picture, the name of the picture will be recorded in the log file throughout

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 47 – Automatic one-stage mode

Figure 48 – "Take a photo" dialog box

the measurement process. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 49).



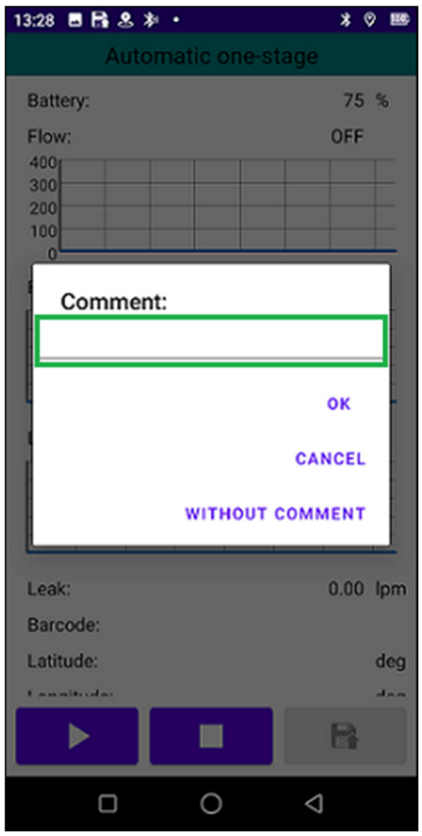


Figure 49 – "Scan a barcode" dialog box

Figure 50 – "Comment" dialog box

Clicking on the button "WITHOUT SCAN BARCODE" will cause the dialog box (Figure 50) to open and empty values to be written throughout the measurement.

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will open the "CAMERA" application to scan the barcode. If the barcode was scanned by the operator, the barcode data will be recorded throughout the measurement process in the log file. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 50).

Clicking on the button "WITHOUT COMMENT" will start the measurement process and a timer will be displayed indicating the time elapsed since the start of the measurement (Figure 51), as well as recording empty values throughout the measurement.

Pressing the "OK" button will start the measurement process, and a timer will be displayed indicating the time elapsed since the start of the measurement (Figure

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements be[illegible].

51) and will also record the data from the input field (highlighted in green) into the log file throughout the measurement process.

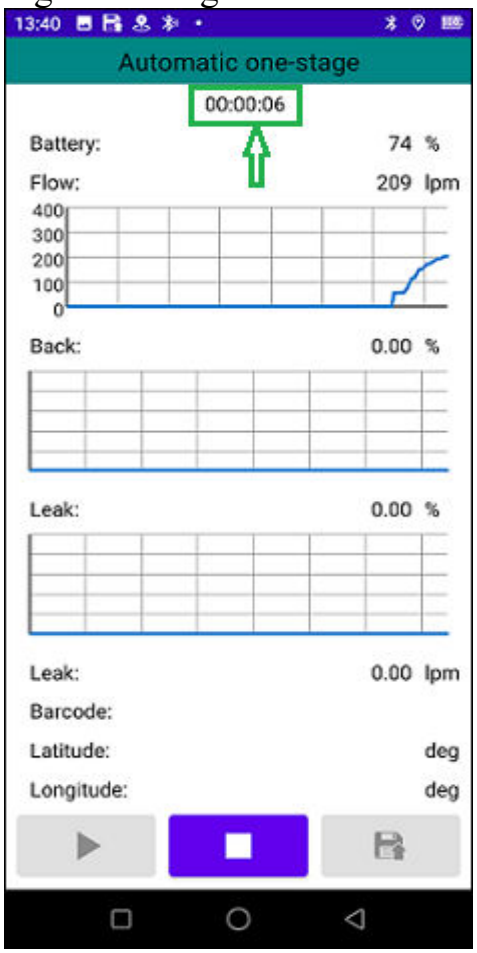


Figure 51 – Automatic one-stage mode – running process

After the measurement process is complete, the "Write to file" button will become available. Pressing this button performs a manual data recording, and a corresponding notification will appear.

Figure 52 shows the data, including the photo name, barcode data, and the comment provided by the operator.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	Time	Latitude	Longitude	Object name	Operator name	Battery	Measurement type	Active	Photo name	Barcode data	Comment	Leak rate units	Flow rate
32	2024-08-21	14:13:20					73	AOS	STOPPED				lpm	0.0
33	2024-08-21	14:13:21					73	AOS	STOPPED				lpm	0.0
34	2024-08-21	14:13:22					73	AOS	STOPPED				lpm	0.0
35	2024-08-21	14:13:23					73	AOS	STOPPED				lpm	0.0
36	2024-08-21	14:13:24					73	AOS	STOPPED				lpm	0.0
37	2024-08-21	14:13:25					73	AOS	STOPPED				lpm	0.0
38	2024-08-21	14:13:26					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	0.0
39	2024-08-21	14:13:27					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	56.0
40	2024-08-21	14:13:28					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	74.0
41	2024-08-21	14:13:29					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	144.0
42	2024-08-21	14:13:30					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	174.0
43	2024-08-21	14:13:31					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	198.0
44	2024-08-21	14:13:32					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	210.0
45	2024-08-21	14:13:33					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	222.0
46	2024-08-21	14:13:34					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	229.0
47	2024-08-21	14:13:35					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	234.0
48	2024-08-21	14:13:36					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	239.0
49	2024-08-21	14:13:37					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	240.0
50	2024-08-21	14:13:38					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	243.0
51	2024-08-21	14:13:39					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	244.0
52	2024-08-21	14:13:40					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	246.0
53	2024-08-21	14:13:41					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	247.0
54	2024-08-21	14:13:42					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	247.0
55	2024-08-21	14:13:43					73	AOS	RUNNING	jpg_20240821_141254_5941296709620548600.jpg	001234567895	comment aos for instruction	lpm	247.0
56	2024-08-21	14:13:44					73	AOS	STOPPED				lpm	248.0
57	2024-08-21	14:13:45					73	NONE	STOPPED				lpm	0.0
58	2024-08-21	14:13:46					73	NONE	STOPPED				lpm	0.0
59														
60														
61														

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 52 – Log file data

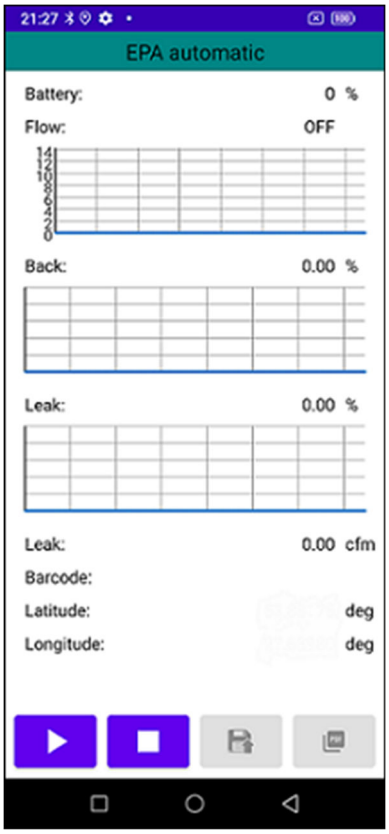
The measurement process in automatic one-stage mode follows this algorithm: for 30 seconds, the concentration is measured at a flow rate of 250 lpm. Based on concentration, the flow rate is automatically adjusted to one of the values (150 lpm, 250 lpm, or 350 lpm) to reduce measurement error. The measurement process then continues for the time set in the "Settings" menu, defaulting to 1 minute.

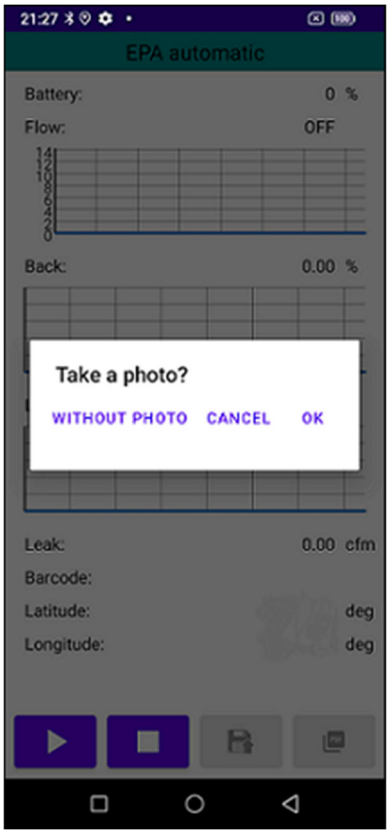
The "Back" button is used to return to the application menu and stop the measurement, similar to the "Stop" button.

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

3.8.9 Menu Item "EPA automatic"

This test feature is designed to follow the procedure and protocol to perform an exact EPA-compliant OOOOb 4-minute test for Rod Packings of Reciprocating Compressors or Wet/Dry Seals off Turbine Compressors.





Click on the item "EPA automatic" (Figure 33). As a result, the "EPA automatic" mode page will open (Figure 53).

The "Start" and "Stop" buttons allow you to start or stop measuring, respectively.

When you click on the "Start" button, a dialog box will open (Figure 54).

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 53 – EPA automatic mode

Figure 54 – "Take a photo" dialog box

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will open the "CAMERA" application to take a picture of the measured component. If the operator has taken a picture, the name of the picture will be recorded in the log file throughout the measurement process. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 55).

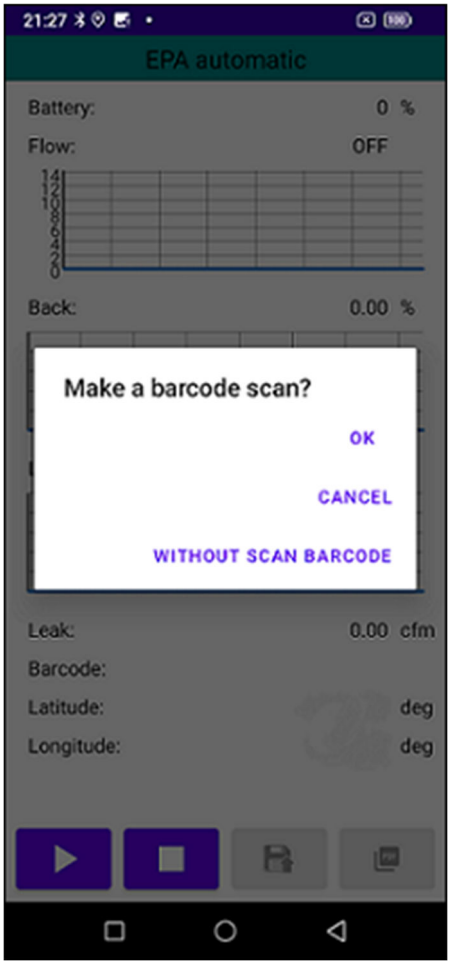


Figure 55 – "Scan a barcode" dialog box

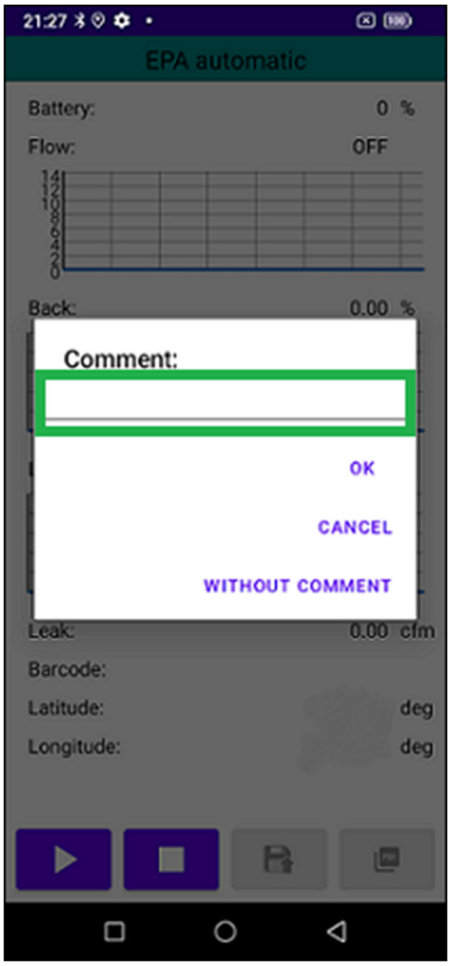


Figure 56 – "Comment" dialog box

Clicking on the button "WITHOUT PHOTO" will cause the dialog box (Figure 55) to open and empty values to be written throughout the measurement. The "CANCEL" button is required to cancel the start of the measurement process.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Pressing the "OK" button will open the "CAMERA" application to scan the barcode. If the barcode was scanned by the operator, the barcode data will be recorded throughout measurement process in the log file. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 56).

Clicking on the button "WITHOUT SCAN BARCODE" will open a dialog box (Figure 56) and record empty values throughout the measurement.

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will start the measurement process, and a timer will be displayed indicating the time elapsed since the start of the measurement, and will also record the data from the input field (highlighted in green) into the log file throughout the measurement process.

Clicking on the button "WITHOUT COMMENT" will start the measurement process, and a timer will be displayed indicating the time elapsed since the start of the measurement, as well as recording empty values throughout the measurement.

The measurement process in the "EPA automatic" mode is performed according to the following algorithm:

- For 1 minute, the background concentration is measured, and the concentration through the leak channel is measured at a flow rate of 250 lpm.

- At the end of the first minute, the average background leak value in % is calculated and displayed on the screen in the top line (field "Average value back").

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

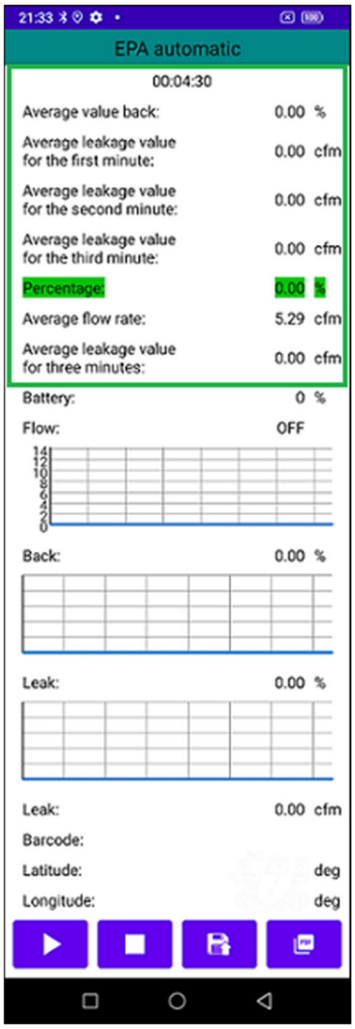


Figure 57 – Completed “EPA automatic” process

- After this, based on the concentration through the leak channel, the flow rate is determined and automatically set. The flow rate is selected from the set values of 150 lpm, 250 lpm, and 350 lpm.

- The measurement process continues for 3 minutes. Throughout the measurement, the current leak value is displayed in the “Leak” field.

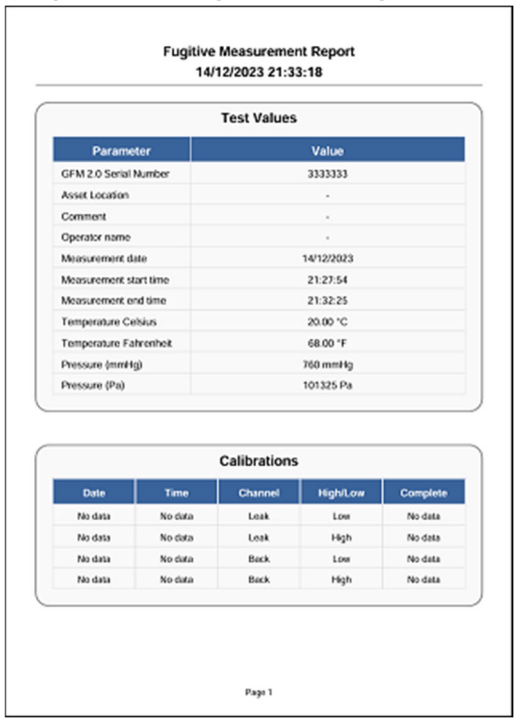
- At the end of each of the three minutes, the average leak rate for that minute is displayed (fields “Average leakage value” for the first/second/third minute).

Thus, after the measurement process is complete in EPA automatic mode, the screen will show (Figure 57): the average background leak, average leak for the first minute, average leak for the second minute, average leak for the third minute, and the percentage difference between the maximum and minimum leak rate values from the three minutes (field “Percentage”). If the percentage difference is less than 10%, the Percentage field is highlighted in green; otherwise, it is highlighted in red. The average leak rate for the 3 minutes is also displayed (field “Average leakage value for three minutes”).

- The measurement process automatically ends, and the "Write to file button becomes available for manual data recording by the operator.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Once the measurement process is complete, the "Generate PDF report" button will become available; clicking it allows you to generate a PDF report. (Figure 58, Figure 59, Figure 60, Figure 61).



Fugitive Measurement Report
14/12/2023 21:33:18

Test Values

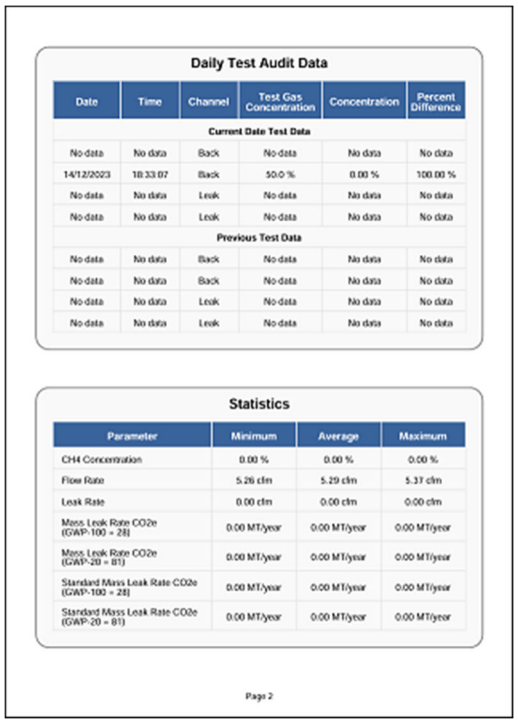
Parameter	Value
GFM 2.0 Serial Number	333333
Asset Location	-
Comment	-
Operator name	-
Measurement date	14/12/2023
Measurement start time	21:27:54
Measurement end time	21:32:25
Temperature Celsius	20.00 °C
Temperature Fahrenheit	68.00 °F
Pressure (mmHg)	760 mmHg
Pressure (Pa)	101325 Pa

Calibrations

Date	Time	Channel	High/Low	Complete
No data	No data	Leak	Low	No data
No data	No data	Leak	High	No data
No data	No data	Back	Low	No data
No data	No data	Back	High	No data

Page 1

Figure 58 – Fugitive Measurement Report (Page 1)



Daily Test Audit Data

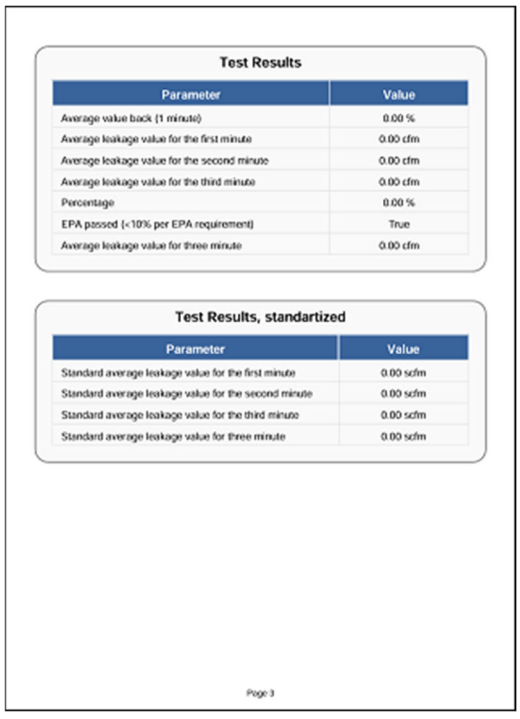
Date	Time	Channel	Test Gas Concentration	Concentration	Percent Difference
Current Date Test Data					
No data	No data	Back	No data	No data	No data
14/12/2023	18:33:07	Back	50.0 %	0.00 %	100.00 %
No data	No data	Leak	No data	No data	No data
No data	No data	Leak	No data	No data	No data
Previous Test Data					
No data	No data	Back	No data	No data	No data
No data	No data	Back	No data	No data	No data
No data	No data	Leak	No data	No data	No data
No data	No data	Leak	No data	No data	No data

Statistics

Parameter	Minimum	Average	Maximum
CH4 Concentration	0.00 %	0.00 %	0.00 %
Flow Rate	5.26 cfm	5.29 cfm	5.37 cfm
Leak Rate	0.00 cfm	0.00 cfm	0.00 cfm
Mass Leak Rate CO2e (GWP-100 = 28)	0.00 MT/year	0.00 MT/year	0.00 MT/year
Mass Leak Rate CO2e (GWP-20 = 81)	0.00 MT/year	0.00 MT/year	0.00 MT/year
Standard Mass Leak Rate CO2e (GWP-100 = 28)	0.00 MT/year	0.00 MT/year	0.00 MT/year
Standard Mass Leak Rate CO2e (GWP-20 = 81)	0.00 MT/year	0.00 MT/year	0.00 MT/year

Page 2

Figure 59 – Fugitive Measurement Report (Page 2)



Test Results

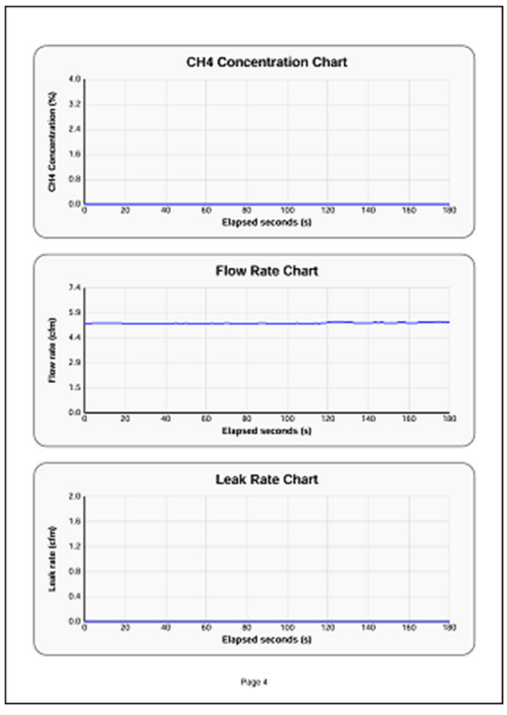
Parameter	Value
Average value back (1 minute)	0.00 %
Average leakage value for the first minute	0.00 cfm
Average leakage value for the second minute	0.00 cfm
Average leakage value for the third minute	0.00 cfm
Percentage	0.00 %
EPA passed (<10% per EPA requirement)	True
Average leakage value for three minute	0.00 cfm

Test Results, standartized

Parameter	Value
Standard average leakage value for the first minute	0.00 scfm
Standard average leakage value for the second minute	0.00 scfm
Standard average leakage value for the third minute	0.00 scfm
Standard average leakage value for three minute	0.00 scfm

Page 3

Figure 60 – Fugitive Measurement Report (Page 3)



Page 4

Figure 61 – Fugitive Measurement Report (Page 4)

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Figure 60 – Fugitive Measurement Report (Page 3)

Figure 61 – Fugitive Measurement Report (Page 4)

In the Fugitive Measurement Report (Figure 59), the Mass Leak Rate CO_2e value in the "Statistics" table is calculated using Formula 6.

$$CO2e = Mass\ CH_4 \times GWP(CH_4) \quad [Formula\ 6]$$

Where:

GWP over 100 years = 28 (according to IPCC AR6, 2021)

GWP over 20 years = 81

For standardized Mass Leak Rate CO_2e values, pressure and temperature are used. The formula for gas density is provided in Formula 7.

$$\rho = \frac{P \times M}{Z \times R \times T} \quad [Formula\ 7]$$

Where:
P – absolute pressure (Pa)
M – molar mass CH4 (16.04 g/mol)
Z – compressibility factor of CH_4 (Z = 0.998 indicates an almost ideal gas. At 1 atm pressure, this factor can be neglected; typical range: Z = 0.8 to 1.2)
R – universal gas constant (8.324 J/(mol·K))
T – temperature in kelvins (K = °C + 273.15)

The mass of CH_4 is calculated using Formula 8:

$$Mass\ CH4 = Volume\ \times \rho \quad [Formula\ 8]$$

In the Fugitive Measurement Report (Figure 60), in the table "Test Results, standardized," the conversion of values to standardized units is performed using Formula 9.

$$SCFM = CFM \times \left(\frac{P_{actual}}{P_{standard}}\right) \times \left(\frac{T_{standard}}{T_{actual}}\right) \quad [Formula\ 9]$$

Where:
Pactual – absolute pressure under operating conditions
Pstandard – standard pressure
Tactual – absolute temperature under operating conditions

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Tstandard – standard temperature Figure 52 ("Log file data") shows the photo name, barcode data, and the comment specified by the operator.

The "Back" button is used to return to the application menu and stops the measurement in the same way as the "Stop" button

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

3.8.10 Menu Item "Manual one-stage"

Click on the item "Manual one-stage" (Figure 33). This will open the manual one-stage mode page (Figure 62).

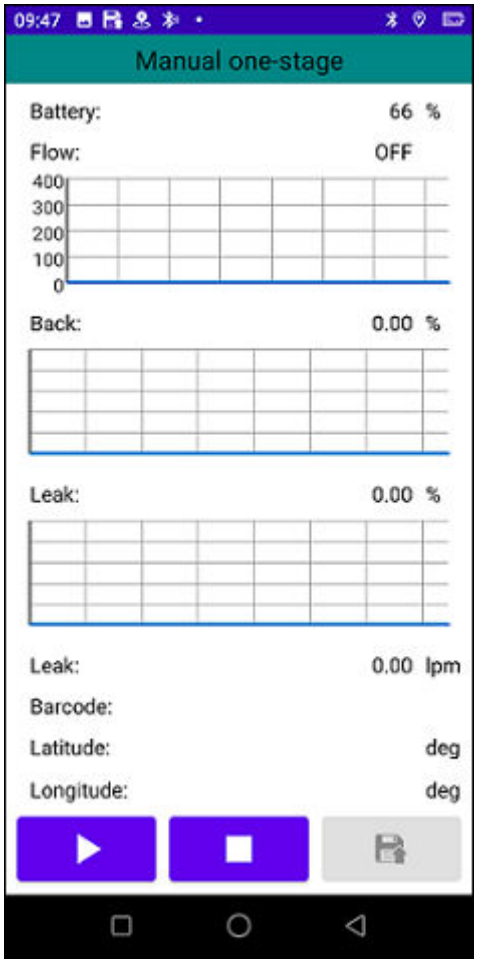


Figure 62 – Manual one-stage mode

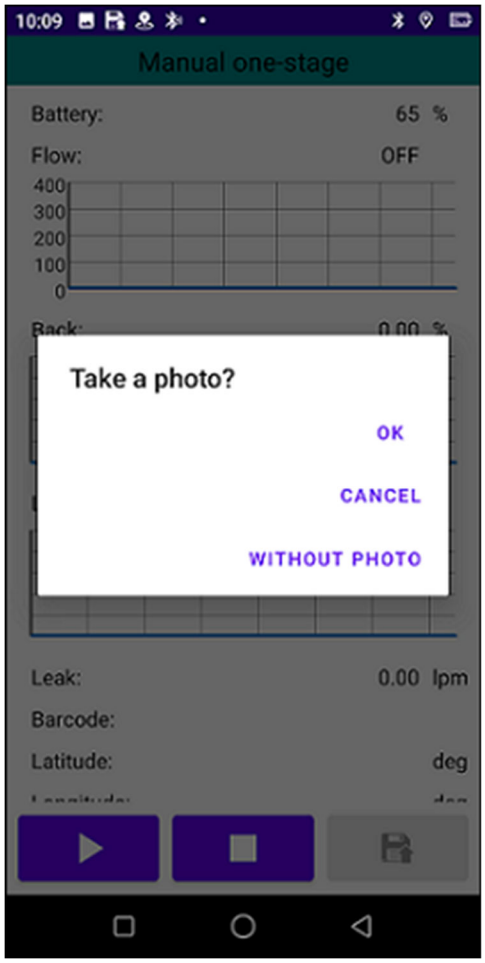


Figure 63 – "Take a photo" dialog box

The "Start" and "Stop" buttons allow you to start or stop measuring, respectively.

When you click the "Start" button, a dialog box will open (Figure 63).

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will open the "CAMERA" application to take a picture of the measured component. If the operator has taken a picture, the name of

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

the picture will be recorded in the log file throughout the measurement process. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 64).

Clicking on the button "WITHOUT PHOTO" will cause the dialog box (Figure 64) to open and empty values to be written throughout the measurement.

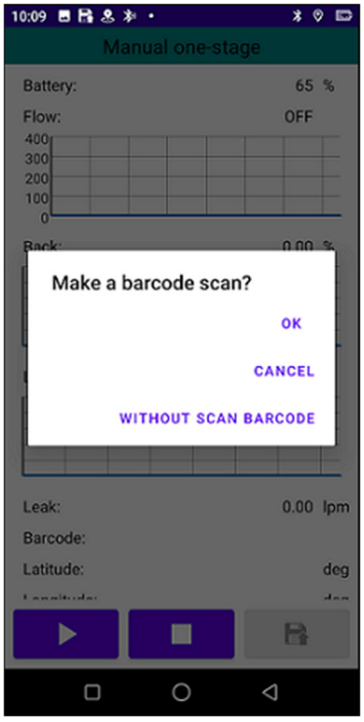


Figure 64 – "Scan a barcode" dialog box

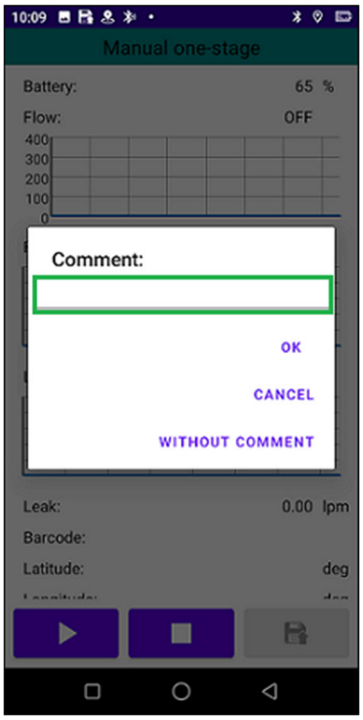


Figure 65 – "Comment" dialog box

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will open the "CAMERA" application to scan the barcode. If the barcode was scanned by the operator, the barcode data will be recorded throughout the measurement process in the log file. If the operator exits the "CAMERA" application, the log file will be recorded with an empty value. After that, a dialog box will open (Figure 65).

Clicking on the button "WITHOUT SCAN BARCODE" will open a dialog box (Figure 65) and record empty values throughout the measurement.

The "CANCEL" button is required to cancel the start of the measurement process.

Pressing the "OK" button will start the measurement process, and a timer will be displayed indicating the time elapsed since the start of the measurement (Figure 66) and will also record the data from the input field (highlighted in green) into the log file throughout the measurement process.

Clicking on the button "WITHOUT COMMENT" will start the measurement process, and a timer will be displayed indicating the time elapsed since the start of

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

the measurement (Figure 66), as well as recording empty values throughout the measurement.

After the measurement process starts, the "Write to file" button (Figure 66) will become available, pressing which performs a manual data recording.

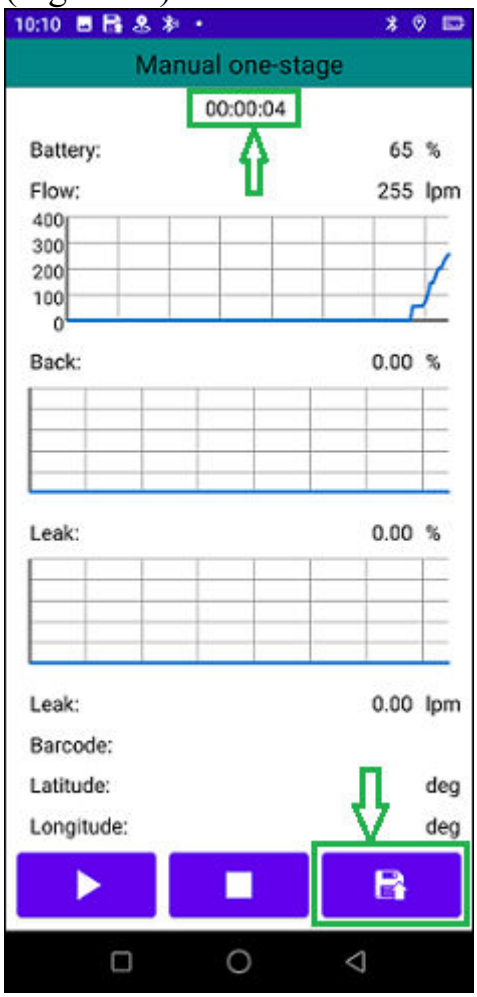


Figure 66 – Manual one-stage mode running process

Figure 52 ("Log file data") displays the photo name, barcode data, and comments set by the operator.

In the manual one-stage mode, the operator starts the measurement at the flow rate set in the "Settings" menu and waits until stable leakage readings appear.

Once stable readings are reached, the operator can manually save all measured and calculated data to memory using the "Write to file" button. Recording in this mode can be done any number of times, depending on the operator's measurement plan. This mode is used when the leakage rate measurement process requires more careful control.

The "Back" button is used to return to the application menu and also stops the measurement, similar to the "Stop" button.

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

3.8.11 Menu Item "Gas analyzer"

When selected, the GFM enables the background channel to draw in a sample, which is then analyzed and displayed as a percentage of Volume Gas. This can be useful to determine the concentration of gas in an area, vent stack, or separate bag measurement, and by using the background tubing off the main sample hose. It is only a gas-by-volume reading of the gas concentration.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

Click on the item "Gas analyzer" (Figure 33). This will open the manual one-stage mode page (Figure 67).

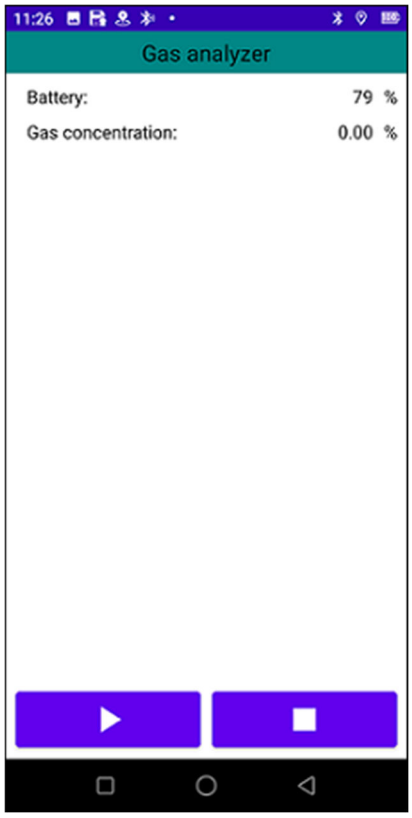


Figure 67 – Gas analyzer

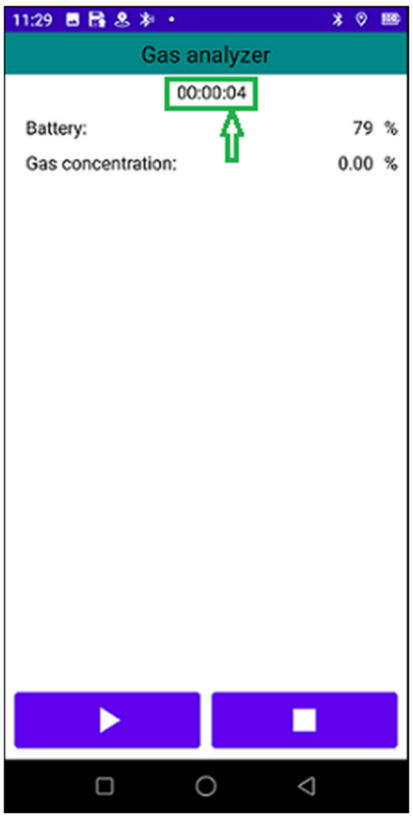


Figure 68 – Gas analyzer

Buttons "Start" and "Stop" allow you to start or stop measuring gas concentration, respectively.

When you click on the "Start" button, the measurement process will start, and a timer will be displayed indicating the time elapsed since the start of the measurement process (Figure 68).

The "Back" button returns to the application menu and stops the Gas analyzer, similar to the "Stop" button.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

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, where single values are 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.

Figure 69 – Home Page

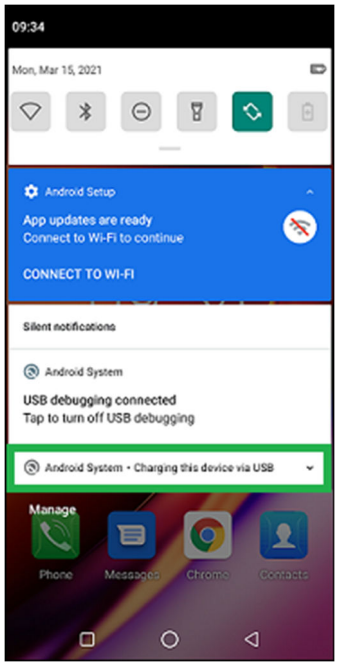
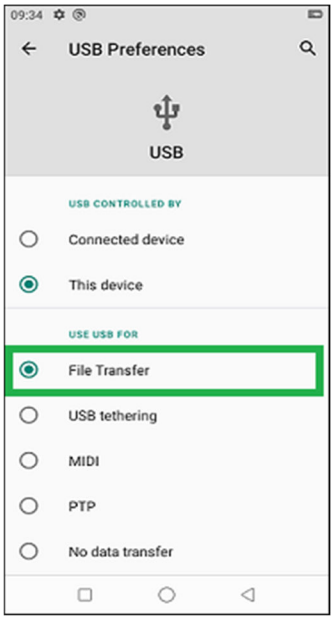


Figure 70 – Notifications

1. Connect your phone to your personal computer using a USB cable;
2. Unlock your phone;
3. On the home page, swipe down from the top of the screen (Figure 69);
4. Click on the item “Charging the device via USB ” (Figure 70);
5. Click on the item "File Transfer" (Figure 71) and open File Explorer on your personal computer.
6. Select the connected phone
7. Select "Internal storage".

All folders in the phone's internal storage will appear.



Select the previously chosen folder for saving. (section 3.8.1 Opening the App, Connecting to GFM).

8. Select the "GFM 2.0" folder.
9. Select the "files" folder.
10. Select the <device serial number> folder.
11. Select the "data" folder.
12. Select the "GFM_data" folder.
13. Select the folder with the required date (example: 22_08_2024).
14. Select the folder named after the measurement object. If the measurement object name was not set in the global settings, select the "unknown_object" folder. Folders with files will be displayed. The "TextFiles" folder contains text files of saved measurements. The "Pictures" folder contains photos if the operator took any.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

Figure 71 – USB connection

If no photos were taken, the "Pictures" folder will be absent.

15. Copy the necessary folders to your personal computer.

settings

3.10 Clearing Phone Memory

It is recommended to clean the phone memory, which includes deleting the folders "Measurement date (example: 23_08_2024)", "Measurement object (example: unknown_object)", "TextFiles", and "Pictures". The number of entries is limited by the internal memory of the phone.

4. Calibration

The excess flow method is used for calibration.

We do not recommend applying a direct connection of the calibration gas bottle to the calibration ports of the instrument. Always use a supplied rotameter to provide a constant flow of the calibration gas. The rotameter indicator should 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 72.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

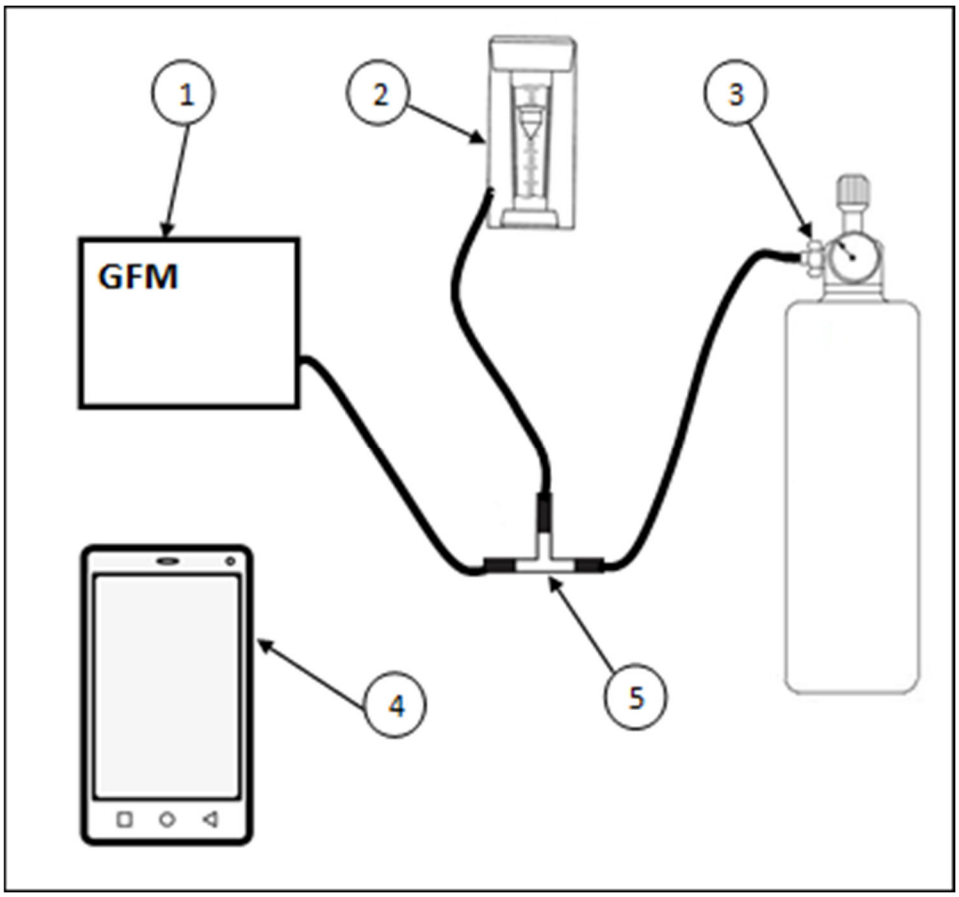


Figure 72 – Connection diagram

The scheme includes:
1. GFM 2.0 device.
2. Rotameter.
3. Reducer.
4. Telephone.
5. Tee.

To perform calibration, follow these steps.

1. Assemble the gas mixture supply system (Figure 72).
2. Turn on the device.
3. Launch the GFM 2.0 app on your phone.
4. Establish a connection with the sampling device.
5. Click on "Go to GFM".
6. Go to the "Purge" menu.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

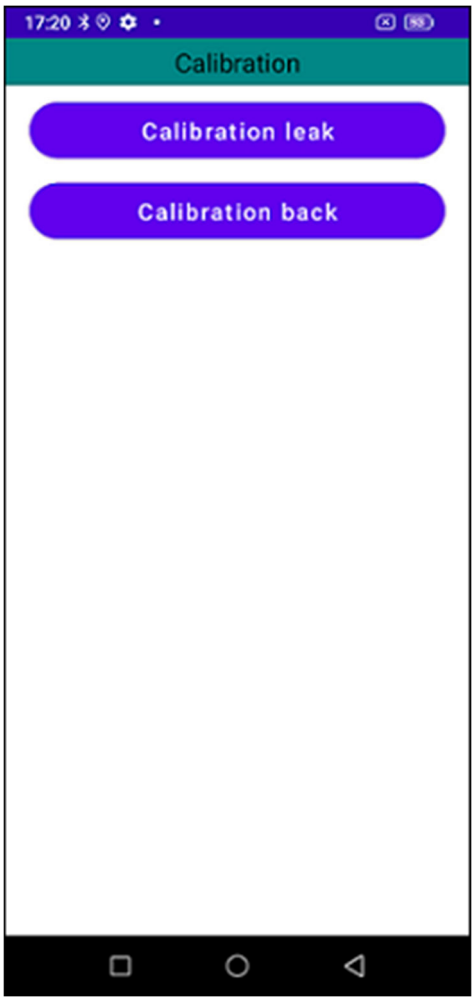


Figure 73 – Calibration Menu

Figure 74 – Calibration Leak

7. Perform the purge.
8. Return to the application menu.
9. Go to the "Calibration" menu (Figure 73).
10. Go to the "Calibration leak" (Figure 74).
11. If zero offset is observed (the detector signal is not equal to 10000±10), set the methane sensor to zero by pressing the "Zero" button.
12. In the "SET LOW" field, enter the value of the methane concentration being used. Introduce gas into the working channel (ensure excess gas is present on the rotameter). Wait for the readings to stabilize. The channel layout is shown in Figure 63.
13. Press the "SET LOW" button.
14. In the "SET HIGH" field, enter the value of the methane concentration being used.
15. Introduce gas into the working channel (ensure excess gas is present on the rotameter). Wait for the readings to stabilize. The channel layout is shown in Figure 63.
16. Press the "SET HIGH" button.
17. If the entered concentration differs from the current reading by more than 20 times, the calibration will not be completed. Press the "INIT" button to initialize the calibration coefficient and zeroing coefficient, and then repeat the calibration procedure.

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

18. To return to the menu, press the "Back" button.

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

Note:

It is permissible to use other equipment that does not compromise the results of calibration and testing. For example, gas mixtures can be supplied directly from cylinder flow regulators, with a set flow rate of 1 liter per minute.

Repeat steps 9-16 for the comparative channel by going to the "Calibration back" menu.

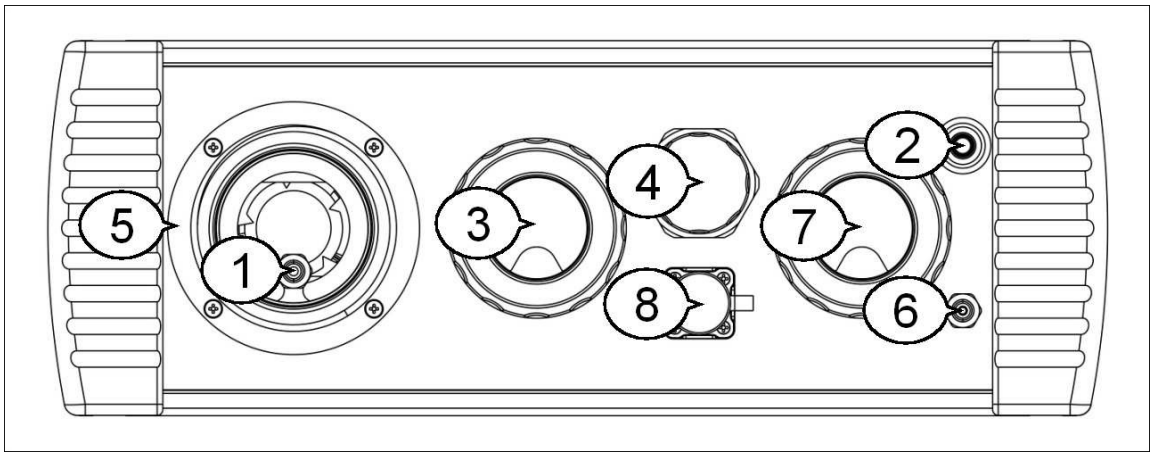
For calibration, methane gas mixtures should be used containing methane at:

- Low range: from 1.5% to 3.0%;
- High range: from 40.0% to 100.0%.

All calibration data is automatically saved in a comma-separated text file, which can then be uploaded into dynamic tables (Excel). The full path to the file is: Internal storage → Select the previously chosen save folder (see Section 3.8.1 Opening the App, Connecting to GFM) → GFM 2.0 → files → <device serial number> → calibrations → calibrations.txt using the same steps as described in section 3.9.

The rear panel (Figure 75) contains the following elements:

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.



IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the “0. Bringing the device into operational state” before valid measurements begin.

Figure 75

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

5. Maintenance

Preventive maintenance of the GFM 2.0 consists of the following:

1. Charging the battery;
2. Replacement or cleaning of external filters;
3. Checking the accuracy of methane concentration measurements;
4. Calibration of GFM on methane mixtures.
5. If necessary and periodically, wipe down connectors, venturi tube, and sample hose to remove oil residue.

5.1 Charging the Battery

The rechargeable battery must be charged in a gas-free environment using the manufacturer's provided charging adapter. To ensure maximum battery life, we recommend maintaining a battery charge of at least 20% and fully charging the battery every three months while the unit is in storage.

5.2 Replacing External Filters

The external filter (Figures 76 and 77) contains the following elements:

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

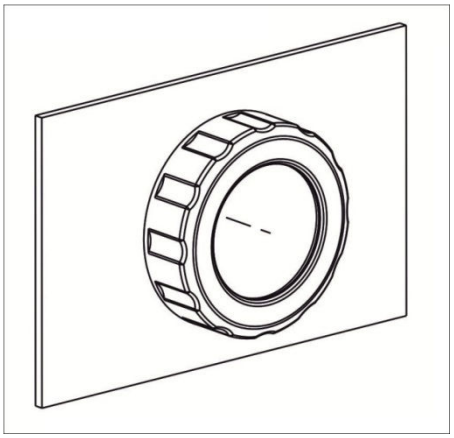


Figure 76 – Assembled outer filter

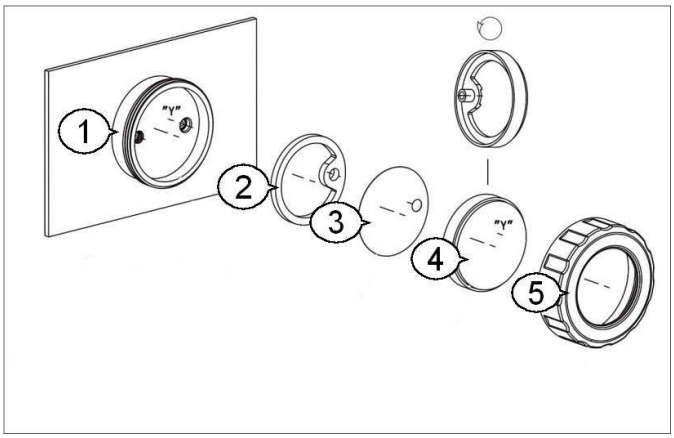


Figure 77 – Disassembled outer filter

The procedure for disassembling the external filter to replace or clean the filter element consists of the following steps:

1. Unscrew the washer (5) counterclockwise;

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

2. Remove the clip (4) from the filter base;
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. You can clean the hydrophobic filters with a mild dish-washing liquid detergent, lay them out to dry, and then reuse.
6. Install the filter element into the clip. The "smooth" side of the filter element should face the clip as shown in Figure 65;
7. Install the sealing ring into 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 77;
9. Screw the washer clockwise with as much hand force as possible.

5.3 Checking the Accuracy of Methane Concentration Measurement

The excess flow method is used to verify measurement accuracy.

It is not recommended to supply gas under high pressure to the calibration ports of the device. The pumps that draw in the gas create negative (rarefied) pressure at the calibration port inlets, pulling the gas inside.

The connection diagram for the components is shown in Figure 78.

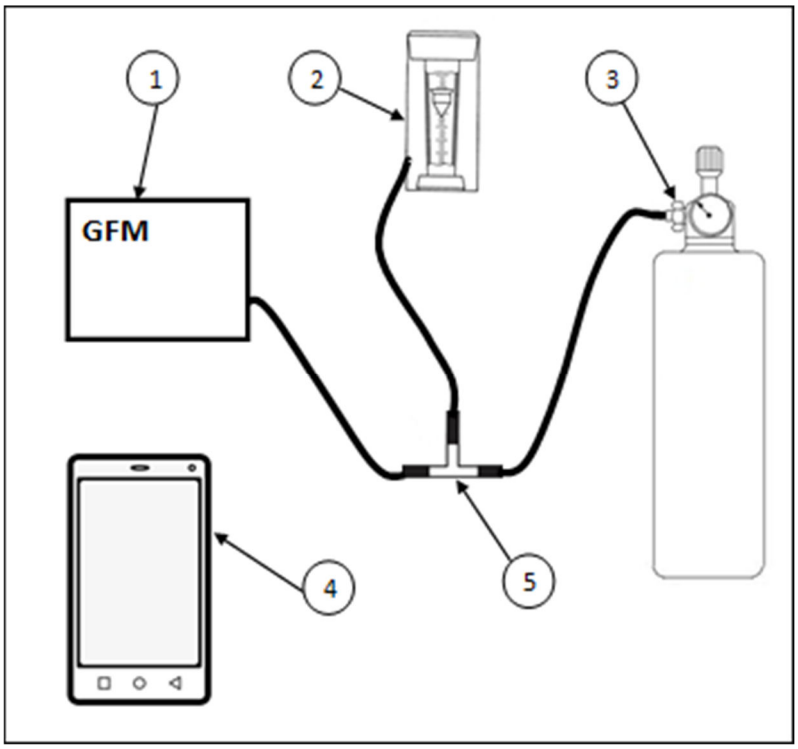


Figure 78 – Connection diagram

The scheme includes:
1. GFM 2.0 device.
2. Rotameter.
3. Reducer.
4. Telephone.
5. Tee.

To perform the check, follow these steps:

1. Assemble the gas mixture supply system (Figure 66);
2. Turn on the GFM 2.0 device;
3. Launch the GFM 2.0 app on your phone;
4. Connect to the sampling device;

IMPORTANT! GFM 2.0 is a metrological instrument. It must be brought into a defined working condition according the "0. Bringing the device into operational state" before valid measurements begin.

5. Go to the GFM menu;
6. Go to the menu item "Test";
7. Press the "Start" button;
8. Select a channel for testing;
9. Select the concentration of the reference gas mixture;
10. Supply gas to the background channel (monitor the presence of excess gas on the rotameter). Wait until the readings on the graph of the channel to which the gas mixture was applied are aligned;
11. Click the "Save" button;
12. Repeat steps 6 and 7 for the leak channel.

When conducting the test, it is necessary to use methane gas mixtures with concentrations of 2.5% and 50%.

Note:
It is permissible to use other equipment that does not compromise the calibration and verification results. For example, gas mixtures can be supplied directly from cylinder flow regulators (with a set flow rate of 1 liter per minute).

5.4 Warranty and Repair

The Gas Flow Meter 2.0 comes with a one (1) year warranty 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 responsibility 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

6. Optional Gas Flow Meter Accessories

6.1 Collapsible Sampling Cone (Part # 70723)

Sampling Cone Accessory for leak quantification of Open-Ended Lines and Blow Down Systems. Ideal for vertical OELs up to 8-inch (20 CM) diameter. Collapsible for easy storage and portability. Lightweight and bright orange with reflective stripes.

6.2 12-Foot Sampling Hose with Mounting Ends (Part # 70721)

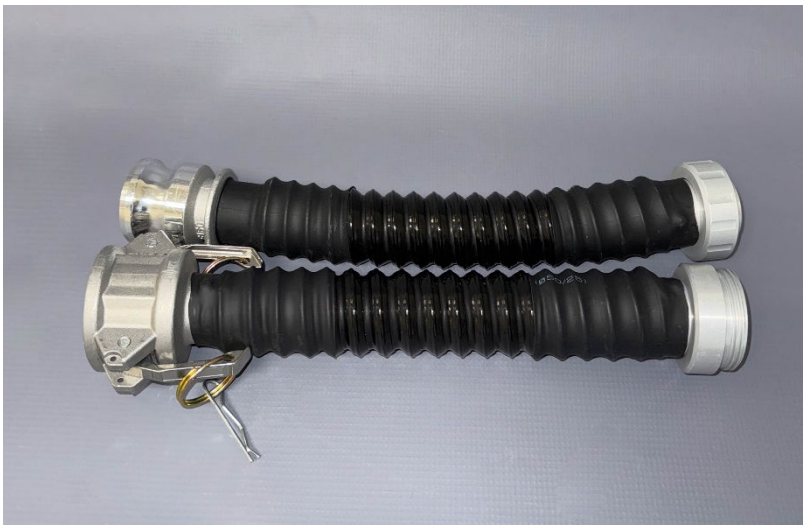
12-foot sampling hose accessory that attaches to the original 6-foot GFM sampling hose to allow for 18 feet of hose extension.

6.3 Large Capture Bag (Part # 70713)

Oversized Capture Bag for measurement of bulky components, including storage tank vent systems, valve actuators, and Christmas Tree structures on production well pad sites. Adaptable thread fitting to GFM sampling hose. 47x69 inches.

6.4 GFM Adapter Hose Pair (Part # 70719)

Transitional hose connections for compatibility with the Bacharach Hi-Flow Sampler



Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

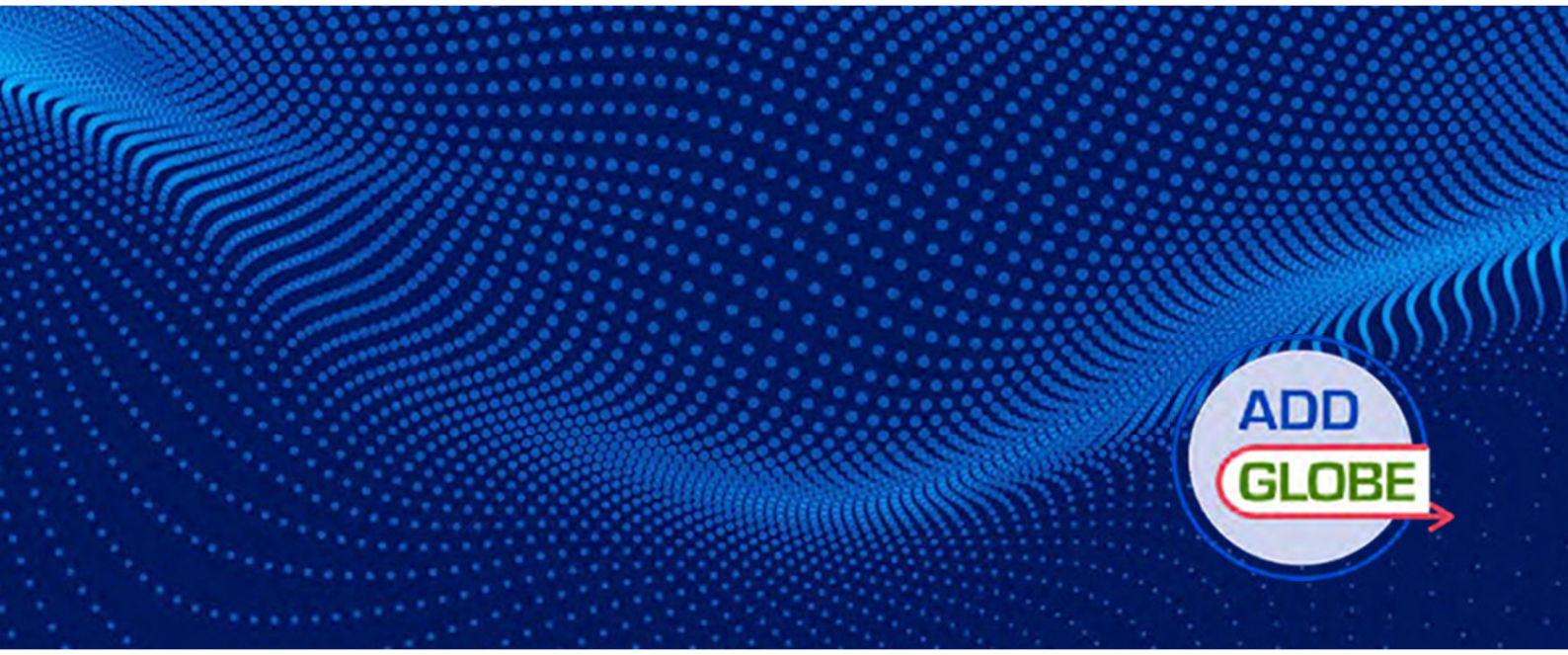
Notes

Notes

Notes

Notes

Notes


ADD
GLOBE