User Guide

Automatic Film Gas Flowmeter

Model GD03_xxx_Auto_Manual

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Contents

1 Introduction

This guide is intended to gain a thorough understanding of the device operation. It is strongly recommended to read this manual completely before placing the device in service.

Although the flow meters are designed to be reliable in operation, there is always the possibility of a malfunction. If any problem persists, call or e-mail the producer for technical support and assistance.

For EU customers, if necessary, the producer can provide the complete service with regard to the device commissioning, personal training and on-site support.

The text and illustrations reflect the state of the art at the time of printing and are subject to change. The manufacturer is constantly improving its products and reserves the right to change product specifications, spare parts, schematics, and software without notice.

We welcome suggestions for improvement and any information regarding inconsistencies in the manual.

The measuring principle is similar to the conventional soap bubble flowmeters with a rubber bulb filled with soap solution, which are widely used in various laboratory applications. In contrast to these flowmeters, the GD03 devices do all the measurement procedures automatically.

The device creates a film from a special tenside solution and measures the time it takes for the film to travel through a certain volume in a graduated cylinder.

The flow rate is calculated as the volume divided by the time and is shown on the display, where the ambient temperature and air pressure are also indicated.

For continuous data recording, extended data can be transmitted via the device's USB port and can be called up by any suitable program and recorded, for example, in MS Excel.

Apart from the ambient temperature and pressure, these extended data include four values for the flow rate:

(i) the actual flow rate as shown on the instrument display,
(ii) the flow rate as in (i) but normalized to the standard reference conditions 0°C and 1 bar,
(iii) the flow rate (when the dry gas is measured) with the consideration to water evaporation from the surfactant solution at the ambient temperature and pressure and
(iv) the value as in (iii) normalized to the standard reference conditions 0°C and 1 bar.

There are two modes of device operation that can be selected by the operator: AUTO or MANUAL. In the AUTO mode, the device automatically and continuously reiterates the measuring procedure, while, in the MANUAL mode, the measuring process starts only after pressing the corresponding button.

In both modes, the device analyzes and monitors its functionality and performs its internal diagnosis and optimization if necessary.

2 General safety instructions - WARNINGS!

Before installing, operating, or maintaining these devices, it is imperative that all hazards and preventive measures are fully understood. While specific hazards may vary according to location and application, take heed to the following general operation conditions.

Do not operate the device if its embodiment does not correspond to the local institution safety instructions.

Do not disassemble the device. Hazard of injury.

2.1 Requirements for flowmeter placement and gas measurement

The device does not comply with the standards for explosion protection according to ATEX directives. That implies the stringent conditions imposed on the device's placement:

(I) Never place the device where potentially explosive atmospheres exist or may arise.

(ii) Never use the device to measure the flow rate of the explosive gaseous and / or hypergolic gaseous mixtures or the gases prone to spontaneous polymerization.

Due to the possibility of leakage of surfactant solution in case of improper use or malfunction of the flowmeter, never place the device in a location where leaked liquid may damage other equipment.

2.2 Requirements for environmental conditions at the device location

Do not operate the device at temperatures below +10°C or above +30°C. Avoid using the device in places with high humidity and / or dust. Do not use the device in corrosive or other chemically aggressive environments.

2.3 Cable and power requirements

The DC power supplier, its cord and the USB cable should be intact. Do not use them if any of their parts are faulty. Employ only the power supply designed for microprocessors with stabilized DC voltage of 9-12V and current of 1A with a correct jack plug.

2.4 Requirements for connecting the gas inlet and the gas outlet

To prevent gas lines inside the appliance from bursting, never block the gas outlet fitting or the hose connected to it.

Be careful when directing the measured gas flow into the instrument. The excessive flow rate or inlet pressure can damage the device by breaking the internal parts.

By measuring the flow rate of the flammable gases or their mixture, always direct the outlet flow to the special (e.g. ventilation) system according to the institution's safety instructions.

Be aware that flammable gases or gases that can form a flammable or explosive mixture with air may accumulate inside the enclosed space. Bear in mind that in typical laboratory facilities, gases of less density than air (e.g. hydrogen, methane, etc.) tend to collect at the top, while gases denser than air (e.g. butane, propane, etc.) tend to collect at the bottom.

3 Device description – an overview

3.1 Control elements and connections

Figure 1 shows the common view of model GD03_20 cm³_Manual_Auto. The only difference from other GD03_xxx_Manual_Auto models is the size of the measuring cylinder. All other parts are identical.

Fig. 1. Common view of GD03_20 cm³

1. Graduated or calibrated cylinder
2. Center-positive jack socket (on the opposite side) DC 9-12V / 1A, 5.5x2.1mm
3. F-Button
4. LCD display
5. Micro USB type B socket
6. Fitting for tenside solution filling / device flushing
7. Valve
8. Gas outlet fitting
9. Gas inlet fitting
10. Tenside solution

The instrument consists of the case with the mounted graduated or calibrated cylinder **1**. The graduated cylinder is transparent to allow the operator to observe the operation of the device.

Multifunction **F**-button **3** on the case top is designated for the following purposes:

(i) It allows for selecting either MANUAL or AUTO operating mode (Section 7.2).

(ii) In MANUAL mode, pressing the **F**-button launches a single flow rate measurement (see Section 7.4).

(iii) When flushing the device, pressing the **F** button makes it easier to clean the internal lines of the flow meter. (see Section 10.2).

(iv) If necessary, the **F**-button performs the quick wetting procedure of the inner surface of measuring cylinder **1** (Section 6.6).

LCD display 4 reflects the measurement results, ambient temperature and pressure and other information depending on the operating state.

Center-positive jack socket **2** is intended for the power supply of the device with stabilized DC 9-12V and 1A.

In the hole of the case, USB micro connector **5** is situated for connecting a computer to record measurement results (Section 9).

Fitting **6** is used to fill the device with the tenside solution or water (Sections 6.1 and 10.2).

The appropriate position of the handle of valve **7** optionally allows for the external supply of the device with the tenside solution (Section 7.1) as well as the filling or flushing of the device (Sections 6.1 or 10.2).

Fitting **8** on the device rear is the gas outlet designed to connect a hose to direct the gas coming out of the device to the designated place.

Fitting **9** on the back of the device is the inlet for the gas whose flow rate needs to be measured (Section 6.3).

3.2 Short description of operation

The flowmeter filled with the tenside solution (see Section 6.1) and connected to gas lines starts the operation after the power supply is applied.

IMPORTANT
Do not connect the USB cable to the device before power is applied. If the USB cable is connected to the flowmeter, it will not result in measurement, although the LCD display will show information as if the device is on.

During the first ten seconds, there is a possibility to choose the MANUAL operating mode. If **F**-button **3** (Fig. 1) is briefly pressed during the first ten seconds, the unit will switch to the MANUAL mode (see Section 7.4). Otherwise, the device starts to operate in the AUTO mode.

In the MANUAL mode, the moving film formed by a surfactant solution is generated by pressing **F**-Button **3** (Fig. 1) briefly. The push duration defines the quality of the film, and it requires a certain operator's skill.

If there is a gas flow through the device and the internal cylinder wall is completely wet (see Section 6.6), the operator can observe the film displaced by the gas and moving downwards.

Two sensors register the passage of the film center along the graduated cylinder, which is reflected on the LCD. If the device does not discover any malfunction (e.g. multiple films, incorrect film form, film burst, flow rate beyond specified flow range, disturbance through electromagnetic impact, etc.), the measurement outcome is displayed and can be transmitted to the computer.

It should be noted that proper operation is only possible when the internal surface of the graduated cylinder is completely wet. In the MANUAL mode, the wetting of the cylinder wall should be performed by an operator (see Section 6.6).

If **F**-Button **3** is not pressed during the first ten seconds, the device goes into the AUTO mode by default.

In the AUTO mode, the device starts the wetting process from the very beginning. If the gas flows through the device, the flowmeter itself determines the moment when the cylinder internal surface gets wet and then begins the measurement of the flow rate.

IMPORTANT
The internal surface of the cylinder can only be wetted when gas is flowing through the instrument.

The measurement results are displayed on LCD and can be transferred to the computer. The next measurement begins after the previous is finished. In the AUTO mode (as well as in the MANUAL mode), the flowmeter carries out self-diagnosis and, if necessary, performs the optimization, which is reflected on the display. (The displays readings and messages are described in Section 8 in detail.)

4 Technical specifications

1	**Model**	GD03F_160 cm³_Manual_Auto	GD03F_20 cm³_Manual_Auto
2	**Graduated cylinder class**	A or B	A or B
3	**Flow range, dm³/h**	8 – 60	1 – 12
4	**Operating mode**	Fully automatic (or manual if desired)	Fully automatic (or manual if desired)
5	**Relative standard deviation, %**	<0.5	<0.5
6	**Gas hose fitting diameter, mm**	9	9
7	**Recommended gas connection hose**	Silicone or PVC tube Ø10x1.5	Silicone or PVC tube Ø10x1.5
8	**Filling fitting diameter, mm**	4	4
9	**Recommended hose for filling /flushing fitting**	Silicone tube ∅5x1	Silicone tube ∅5x1
10	**Power supply**	Stabilized DC 9-12V, 1A	Stabilized DC 9-12V, 1A
11	**Power supply adapter cable**	Center-positive 5.5x2.1mm	Center-positive 5.5x2.1mm
12	**USB socket**	Micro USB type B	Micro USB type B
13	**Gases permissible to be measured**	Gases or thereof mixtures that are: (i) not explosive, (ii) not hypergolic, (iii) not prone to spontaneous polymerization, (iv) not condensable under measurement conditions, (v) not corrosive (e.g. chlorine, fluorine, etc.), (vi) not containing dust and / or aerosol, (vii) not reacting with water (e.g. NH_3) See also Section 2.1	
14	**Maximum allowable inlet pressure, mbar (cm H_2O)**	40	40
15	**Pressure drop, mbar (cm H_2O)**	<10	<2
16	**Device dimensions LxBxH, mm**	~190x110x460	~190x110x460
17	**Mass, g**	~700	

18	**Remarks**	At the customer's request, the measurement range can be adjusted to suit the required conditions on site.

5 Scope of delivery

No.	Item	Quantity
1	Flowmeter	1
2	Concentrated tenside solution, 500 ml	1
3	Syringe 20 ml	1
4	Silicone or PVC tube ∅10x1.5 mm or 8x1.5 mm, 10 cm	2
5	Silicone or PVC tube ∅5x1 mm (or ∅6x1 mm), 10 cm	1
6	Power supplier, stabilized DC 9V or 12V, 1A	1
7	USB-A to Micro-USB Cable type B	1
8	User guide	1
9	Test protocol	1
10	Declaration of conformity	1

6 Flowmeter commissioning

6.1 Filling the tenside solution

IMPOTANT

- Do not use any tenside concentrate other than the one supplied with the flowmeter. Any other surfactant may not only cause malfunctions but may also damage the device.
- Never turn the device filled with the tenside solution upside down.

Prepare the surfactant solution from the supplied concentrate by adding clean tap water to the concentrate in the ratio indicated on the label.

Fill the syringe provided with the prepared tenside solution and connect it to fitting **6** (Fig. 1) using the silicone tube.

Turn the central finger of the valve **7** handle (Fig. 2) to the position marked "**b**". Squeeze the tenside solution out of the syringe into the flowmeter so that the solution level is between the "**min**" and "**max**" marks. If necessary, repeat the procedure.

Turn the valve handle to the position "**Loop**" (see Fig. 3).

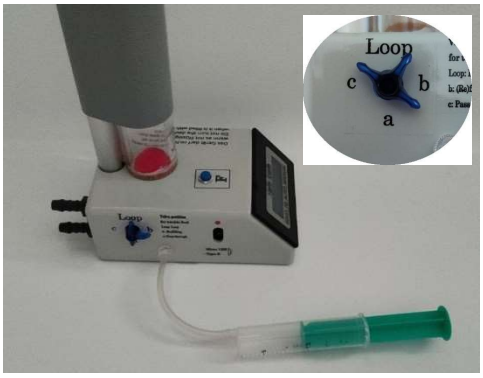


Fig. 2
Filling the tenside solution

6.2 Flowmeter placement

Place the device on a flat surface next to the gas flow source. A strictly horizontal surface is not required. An inclination of up to 20° does not affect the device functionality. The device can be applied in a vehicle moving with an acceleration not more than 0.3 g (~3 m/s²).

6.3 Connecting gas lines

Connect the gas outlet fitting **8** (Fig. 1) to the hose intended for the gas leaving the flowmeter after measurement.

Connect the gas inlet fitting **9** (Fig. 1) to the line of the gas to be measured.

IMPORTANT

Make sure that the outlet hose is not blocked. Otherwise, the blocked gas outlet may cause the pressure inside the flowmeter to increase, resulting in damage to the flowmeter. Always comply with local safety regulations (see also Section 2).

NOTE

(i) To monitor gas flow through the flowmeter, it is recommended that a bubbler be installed somewhere on the outlet or inlet hose.

(ii) The gas flowmeters are not equipped with a safety valve. It is recommended that a pressure relief valve be installed in the connected gas pipework to prevent the permissible operating pressure (indicated on the instrument label and in the data sheet of this manual) from being exceeded.

6.4 Connecting to power supply

Plug the power supplier into the AC 230V socket and connect its cord to socket **2** (Fig. 1).

When the flowmeter is connected to the power source, LCD display **4** (Fig. 1) begins to reflect the information.

IMPORTANT

When the device is not used, the power supply must be disconnected!

6.5 Connecting the USB cable to the computer

Insert the Micro-USB type B plug into device's socket **5** (Fig. 1) and another part of the cable into the computer socket. Use only a USB cable designed for data transfer.

NOTE

(i) It is recommended to connect the device to the computer only when the 9-12V voltage is already applied.

(ii) If the device is not connected to the power supply whereas the flowmeter is coupled to the computer, the device will not perform any measurement although the LCD monitor will display some information.

(iii) Disconnecting the USB cable from the flowmeter during operation will cause the flowmeter to restart.

6.6 Cylinder wetting procedure

To form a sustainable film moving along the calibrated cylinder **1** (Fig. 1), its inner surface should be wet.

IMPORTANT
Wetting is only possible if two conditions are met:
(i) The surfactant solution is filled (see Section 6.1) and
(ii) There is a gas flow through the instrument.

In the AUTO mode, the flowmeter automatically performs the wetting procedure. The instrument itself detects the end of the wetting process and then begins to determine the flow rate.

In the MANUAL mode, the operator should execute the wetting procedure by pressing **F**-button **3** (Fig. 1) for an extended period of time in order to form the moving foam. Wetting is considered complete when the operator observes the foam reaching the cylinder bottom.

In both modes of operation, the movement of foam (or film bundle) can be seen during the wetting.

When the unit is first delivered or returned from long-term storage, the internal lines are not filled with the surfactant solution. In this case, wetting will take longer in both modes and can be accelerated by pressing **F**-button **3** (Fig. 1).

7 Flow rate measurements

7.1 Selecting the way of the tenside solution feed

Two regimes of the tenside solution feeding can be utilized: (i) looped and (ii) pass-through.

In the loop regime, the device uses the surfactant solution enclosed in it. The advantage of this regime lies in simplicity, i.e. no additional embodiments are required. The drawback is caused by the evaporation of water, which leads to a decrease in the tenside solution or its deterioration in case an inappropriate gas being measured (e.g. gas includes dust, vapor or reacts with the surfactant solution).

The potential disadvantages inherent in the loop regime at ceaseless operation over sustained periods can be circumvented by the through-pass regime. In this regime, the device is perpetually replenished with a fresh solution from an external source. The solution traverses the device and exits it along with the outlet gas flow.

NOTE
If necessary, the entrance of the solution into the institution ventilation system should be prevented.

7.1.1 Loop regime

The device is filled with the surfactant solution (see Section 6.1) and the valve **7** handle (Fig. 2) is in the position "**Loop**".

Fig. 3
Valve **7** in "**Loop**" position

7.1.2 Pass-through regime

(1) Fitting **6** for the tenside solution (see Fig. 1) should be connected to a container with the fresh tenside solution,

(2) The central handle finger of valve **7** (Fig. 2) should be in the position "**c**" (Fig. 4).

Fig. 4
The tenside solution feed in the regime
“Pass-through “.
The central handle finger of valve **7** (Fig. 1)
is in the position “**c**”

NOTE
(i) The container is not in the delivery scope.
(ii) If there are gas bubbles in the hose, press **F**-Button **3** (Fig. 1) some time until all bubbles have disappeared.
(iii) In the “pass-through” regime, the level of the tenside solution may rise above the “MAX” mark, which does not affect the device’s functionality.

7.2 Selecting the operation mode

When power is applied to the instrument, LCD **4** (Fig. 1) will display the command "Press **F** for MANUAL OPERATION".

If **F**-button **3** (Fig. 1) is pressed within the first ten seconds, MANUAL mode will be selected and the message "MANUAL - OK Briefly press **F**" will appear on the LCD display. Otherwise, the flow meter will default to AUTO mode and the message "AUTO MODE" will appear on the display.

NOTE
The operator always has the possibility to check the obtained value of the flow rate by simultaneously measuring the passage of the film through the cylinder with the help of the stopwatch.

7.3 AUTO mode

When the flowmeter switches over to the AUTO mode, it will start the wetting procedure (see Section 6.6).

Once the flowmeter has completed the wetting process, the device will start self-diagnosis and initialization, which will take about 2 minutes. Afterwards, it will begin measuring the flow rate.

The operator can clearly see the film moving through the graduated cylinder and the detection of the film by sensors is reflected in the right top segment of the LCD display.

NOTE

Imperfect film shape, such as small bubbles at film peripheral edge, does not affect the measurement accuracy.

Once the film reaches the bottom of the cylinder, the measurement results (actual flow rate, ambient temperature and atmospheric pressure) are displayed, and a new measurement then begins.

The extended data are also available via the meter's USB port for logging into a computer. Apart from the temperature and pressure, they include four values for the flow rate (all in dm^3/h):

(i) the actual flow rate as shown on the instrument display,

(ii) the flow rate (as in (i)) but normalized to the standard reference conditions (0°C and 1 bar),

(iii) the flow rate (when the dry gas is measured) with the consideration to water evaporation from the surfactant solution at the ambient temperature and pressure, and

(iv) the value as in (iii) normalized to the standard reference conditions (0°C and 1 bar).

The flowmeter monitors its own operation continuously and, when necessary, optimizes it, which is reflected on the display. Should the device detect an internal fault (e.g. inappropriate film generation, multiple films, film burst, etc.), it will automatically restore the measurement after several minutes.

When the message “Check gas flow / Check level” appears on the LCD display, the operator should check whether there is the gas flow through the flowmeter, and the tenside solution is in the device. If the surfactant and the gas flow are present, but the message appears mistakenly, the device restores the measurement after some time automatically

During prolonged operation at the loop regime of the tenside solution feed (see section 7.1.1), the surfactant solution level decreases due to water evaporation. When the level reaches the “**min**” mark, fresh tap water should be added to the device in the same way as it is described for the surfactant solution in Section 6.1. During long term continuous operation, it is recommended to refill the surfactant solution after a week of operation in accordance with Sections 10.1 and 10.2.

The tenside solution should be immediately changed if there is any residue in the solution or color alteration.

To avoid the periodical refilling of the surfactant solution (or tap water) during continuous operation, the pass-through feed of the fresh tenside solution can be carried out as it is described in Section 7.1.2. In this case, the fresh tenside solution is always directed to the device and removed out of the device with the gas escaping the flowmeter.

IMPORTANT

If the flow rates are significantly less than the minimum flow rate according to the technical specifications, the flowmeter may not perform self-diagnosis and optimization, which may result in incorrect flow rate indication.

In order to monitor the presence of low gas flows, it is recommended that a bubbler be applied to the device outlet.

7.4 MANUAL mode

When power is applied to the instrument, LCD **3** (Fig. 1) will display the command "Press F for MANUAL OPERATION".

By pressing **F**-button **3** (Fig. 1) within the first ten seconds, the MANUAL mode will be selected and the message "MANUAL - OK Briefly press F" will appear on the LCD display. Pressing **F**-button **3** (Abb. 1), the operator forces the film to be generated.

If the device is not in use for an extended period, resulting in the internal cylinder wall becoming desiccated and the generated film failing to reach the cylinder bottom, the operator is required to undertake the wetting procedure manually, in accordance with the instructions set out in Section 6.6.

The results of each measurement are reflected on the device display and can be transmitted to a computer for further analysis.

The flowmeter carries out self-diagnosis as is described in the previous Section 7.3. However, subsequent restoration of the measurement is not automatically initiated. It is the responsibility of the operator to perform this action.

8 Display readings and messages

The readings and messages appearing during the flowmeter function are illustrated in the following figures.

This message appears when power is applied. If the **F**-button **3** (Fig. 1) is pressed within the first ten seconds, the device will switch to MANUAL mode. Otherwise, it will switch to AUTO mode.

The **F**-button **3** (Fig. 1) was pressed within the first ten seconds after the power was on.

The unit is ready for MANUAL operation and is waiting for the operator to press the **F**-button **3** (Fig. 1).

The flowmeter operates in AUTO mode since the **F**-button **3** (Fig. 1) was not pressed during the first ten seconds.

Example of measurement readings:
31.35 dm³/h – actual flow rate,
Operating state of the flowmeter (1, 2, F or W),
20.2 oC – ambient temperature in °C,
0.97 bar – atmospheric pressure.

The flow rate is out of the measurement range.
Operating state of the flowmeter (can be 1, 2, F or W)
NOTE: This message may also appear during the wetting process.

Some errors are detected, and correction is running.
Note: Operating state of the flowmeter (can be 1, 2, F or W)

Device optimization is in progress. Wait" indicates the time until the optimization is finished.

This indication may be caused by either a lack of gas flow or an absence of surfactant solution in the flowmeter. If the indication appears by mistake, the flowmeter will automatically resume normal measurement.
Note: The operating state of the flowmeter can be 1, 2, F, or W.

This message appears when the initialization is required at the start of AUTO mode.
Note: The operating state of the flowmeter can be 1, 2, F, or W.

9 Computer data logging

For logging onto a computer, the extended data transmitted with baud rate of 9600 are available via the flowmeter's USB serial port.

They include four values for the flow rate (all in dm^3/h) and two for the ambient temperature and pressure:

(i) the actual flow rate as shown on the instrument display,
(ii) the flow rate (as in (i)) but normalized to the standard reference conditions (0°C and 1 bar),
(iii) the flow rate (when the dry gas is measured) with the consideration to water evaporation from the surfactant solution at the ambient temperature and pressure,
(iv) the value as in (iii) normalized to the standard reference conditions (0°C and 1 bar)
as well as
(v) ambient temperature (in °C) and
(vi) air pressure (in bar).

At the USB serial port, the data represent the above values (i) – (vi) after “DATA,TIME” separated by “,” as follows:

DATA,TIME,35.70,32.26,34.79,31.44,20.99,0.9931.

This data format is mainly intended for MS Excel (Parallax Data Acquisition tool PLX-DAQ software add-in for Microsoft Excel produced by Parallax Inc), but it can also be used by other tools for reading the USB serial port.

9.1 Windows

For logging the data from the device via USB port, FTDI drivers should be installed on the computer.

As a rule, FTDI drivers will be automatically installed by Windows when the flowmeter is first connected to PC. But if this does not happen, they can be loaded from the FTDI webpage: https://ftdichip.com/drivers/d2xx-drivers.

If the FTDI drivers are already installed, but there is no connection to the flowmeter because they are outdated or corrupted, the drivers should be reinstalled as follows.

On the above-mentioned webpage, select “VCP Drivers”, choose “setup executable” for “Windows (Desktop)” and follow the commands of Installation Wizard.

Any appropriate software can be used to log data e.g. PLX-DAQ, Excel Streamer, Excel serial data writer plugin (https://www.aggsoft.com/serial-data-logger/plugins/excel.htm), etc..

The following describes two ways to record data using MS Excel (PLX-DAQ and Data Streamer Add-in).

9.1.1 PLX-DAQ for MS Excel

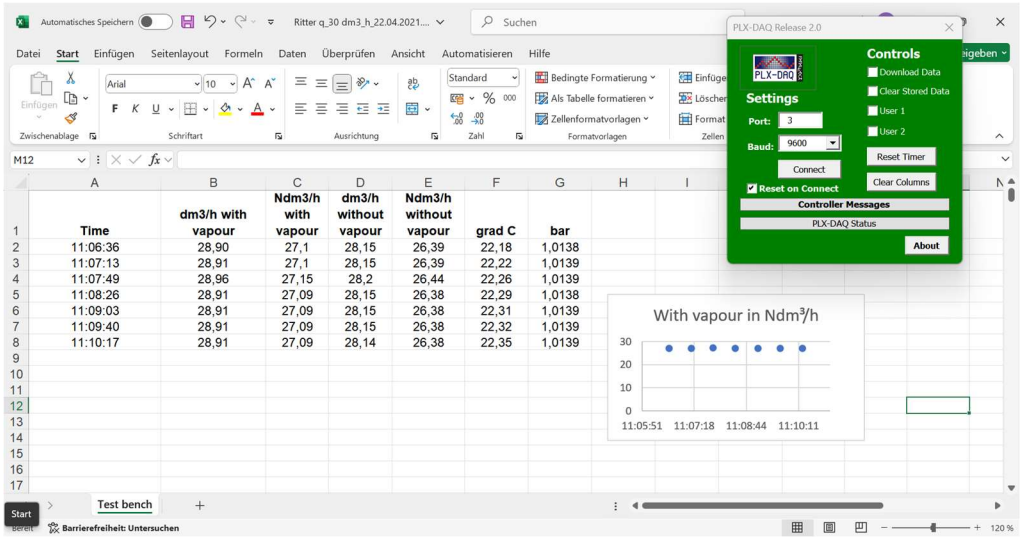
The software PLX-DAQ can be downloaded from https://www.parallax.com/package/plx-daq and then tuned by a user for data logging. Alternatively, the PLX-DAQ_GD_03 software (especially adopted to the GD03 devices) can be directly downloaded from our Webpage.

NOTE
To use this program, macros should be allowed.

In the pop-up window, the corresponding COM Port should be selected and 9600 baud rate should be set. After the button “Connect” on the control panel is on, the flowmeter starts the measurement.

NOTE
(i) The COM Port number can be found in Windows Device Manager.
(ii) Clicking the Connect button restarts the flowmeter from the beginning.

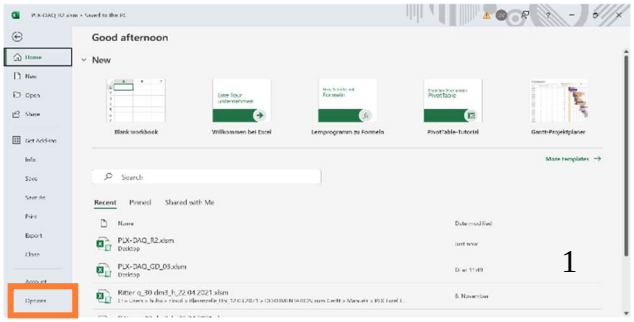
The real-time readings appear in the Table as shown below. The first column represents the time at which the measurement result was obtained, followed by the values (i) – (vi) listed above.



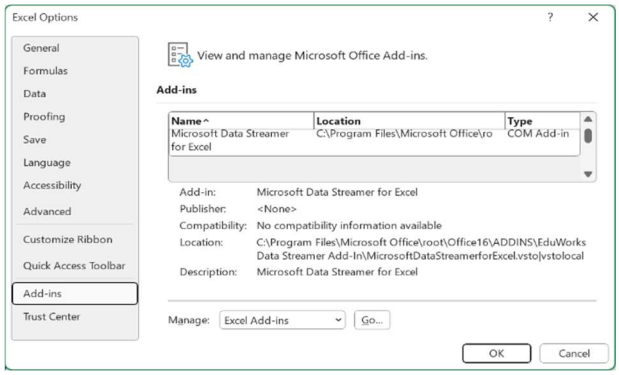
	A	B	C	D	E	F	G
1	Time	dm3/h with vapour	Ndm3/h with vapour	dm3/h without vapour	Ndm3/h without vapour	grad C	bar
2	11:06:36	28,90	27,1	28,15	26,39	22,18	1,0138
3	11:07:13	28,91	27,1	28,15	26,39	22,22	1,0139
4	11:07:49	28,96	27,15	28,2	26,44	22,26	1,0139
5	11:08:26	28,91	27,09	28,15	26,38	22,29	1,0138
6	11:09:03	28,91	27,09	28,15	26,38	22,31	1,0139
7	11:09:40	28,91	27,09	28,15	26,38	22,32	1,0139
8	11:10:17	28,91	27,09	28,14	26,38	22,35	1,0139

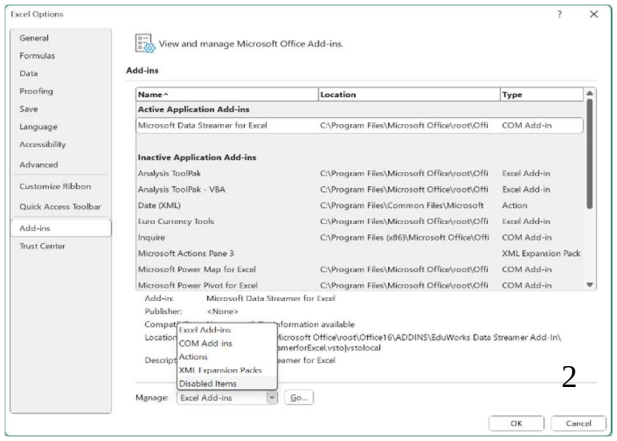
9.1.2 Data Streamer Add-in

To install and use the Excel Data Streamer Add-in, please follow these steps:
(1) From the Excel menu bar “File”, choose “Options”

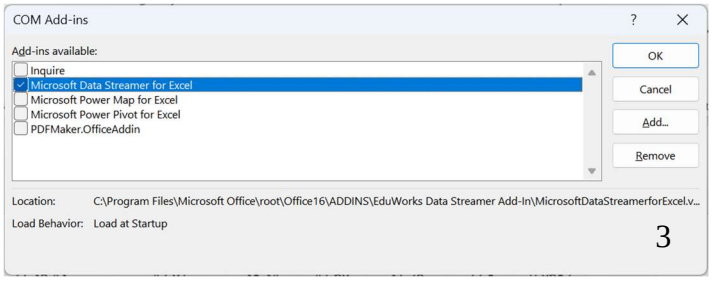


(2) In the new menu, click on bar “Add-ins” and then in bar “Manage: Excel Add-ins” select “COM Add-ins” and click on “Go…”

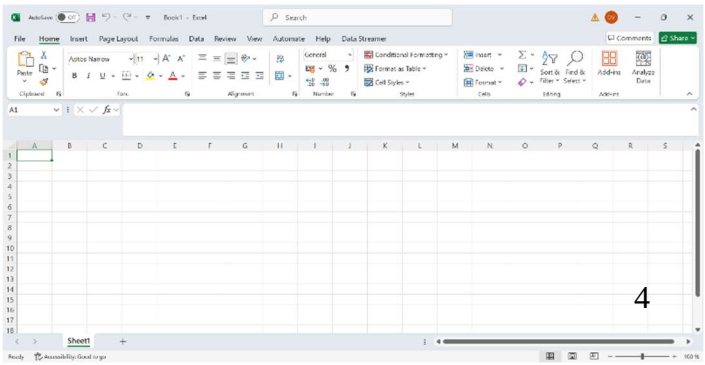




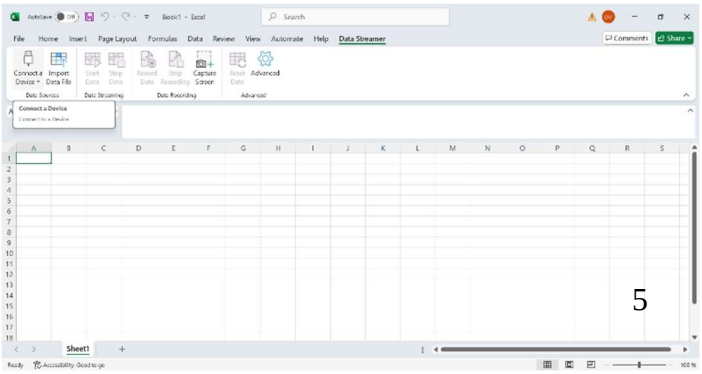
(3) Select "Microsoft Data Streamer for Excel" from the new menu by clicking "OK".



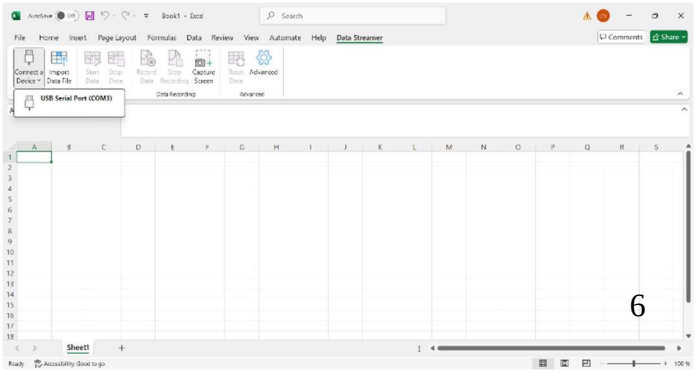
(4) In EXCEL, a new menu bar “Data Streamer” appears. Click on the "Data Streamer" bar.



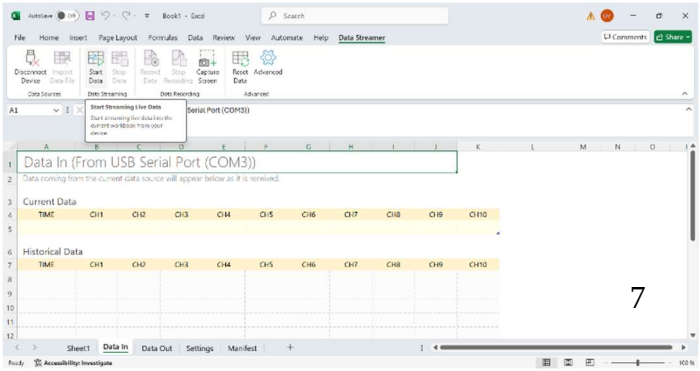
(5) In the opened menu click on "Connect a Device".



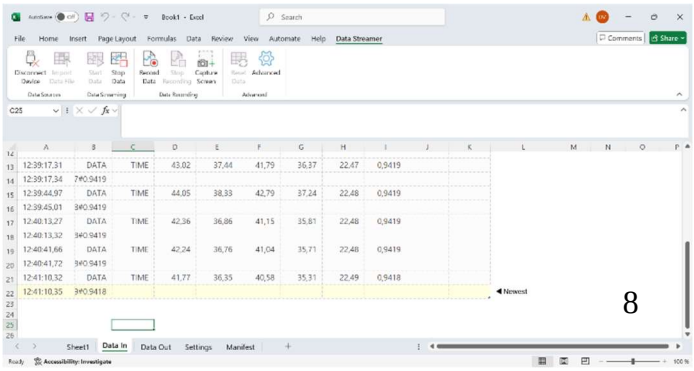
(6) Choose an appropriate COM Port



(7) Start data logging by clicking on “Start Data”

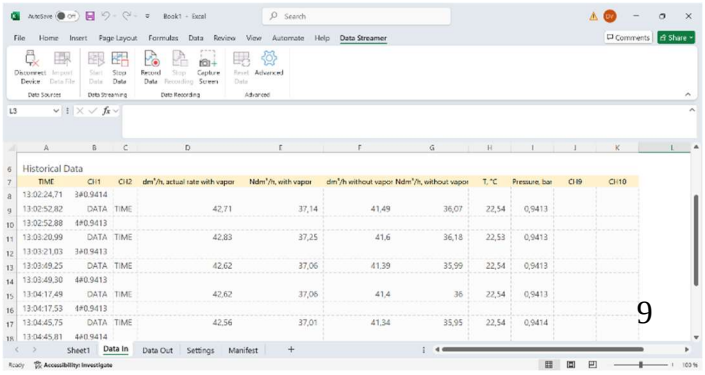


(8) Data are logged in Excel Table.



(9) The values in the row after the "DATA" and "TIME" tags correspond to the sequence of flow rates listed in this section.

The column headings "CH3" - "CH 8" can be renamed, e.g. as follows.



9

9.2 Linux

Detailed instructions for data recording under the Linux operating system can be found on the website gasflowmeter.de.

10 Maintenance

10.1 Refilling the surfactant solution

Under real conditions when the loop feeding (Section 7.1.1) is employed, especially during the continuous day and night operation, the tenside solution may undergo deterioration and ageing processes. It can be identified by comparing the solution with a fresh one. For instance, the solution may become opaque, its color may change, or the film formation may become unstable.

In this instance, the surfactant solution should be replenished as follows:

(i) Connect the empty syringe to fitting **6** (Fig. 1 and Fig. 2),

(ii) Turn the central finger of the valve **7** handle (Fig. 2) to the position marked "**b**",

(iii) Suck out the tenside solution from the device with the syringe,

(iv) Press **F**-button **3** (Fig. 1) in order to empty the lines inside the flow meter filled with the tenside solution (the device must be powered on),

(v) Subsequently, fill in the fresh tenside solution in accordance with the instructions set out in Section 6.1.

In the event of severe deterioration of the tenside solution, it is advised that the device lines should be cleaned in accordance with the instructions outlined in Section 10.2.

10.2 Cleaning procedure

In order to remove the surfactant solution, the flowmeter should be flushed with clean tap water. The following steps should be carried out:

(i) Connect the empty syringe to fitting **6** (Fig. 1 and Fig. 2),

(ii) Turn the central finger of the valve **7** handle (Fig. 2) to the position marked "**b**",

(iii) Suck out the liquid from the device with the syringe,

(iv) Take the clean tap water into the syringe and fill the water in the device, connecting the syringe to fitting **6** (Fig. 1 and Fig. 2),

(v) Shake the device, dispersing the water over the cylinder wall,

(vi) Repeat the aforementioned steps (i) – (v) until the liquid is relatively free of contamination,

(vii) Fill the device with water and press **F**-button **3** (Fig. 1) to clean the flow meter lines of the remaining tenside solution (the device must be powered on),

(viii) Extract the water from the device with the syringe.

10.3 Long-term storage

Is the flowmeter not going to be used longer than 6 months, it should be emptied from the tenside solution and rinsed. For this purpose, conduct steps (i) –(vi) of cleaning procedure (Section 10.2).

The flowmeter should be stored indoors at a temperature of 10°C to 30°C, avoiding exposure to direct sunlight.

IMPORTANT
Drying the flow meter is not required. **Never try to dry it with compressed air**.

11 Troubleshooting

No.	Problem	Cause	Action	Remarks
1	Dark LCD display	(i) No power supply (ii) internal circuit break due to fall or impact	(i) Check the power unit and replace it (ii) Send the device to the manufacturer for repair or use a new one.	(i) Use only a stabilized DC 9V or 12V, 1A designated for microprocessors
2	(i) Flickering of LCD display	(i) Inappropriate DC-power supplier (ii) The flowmeter is connected to a computer without being connected to the power supply	(i) Replace the power unit (i) Connect the power supply	Use only a stabilized DC 9V or 12V, 1A designated for microprocessors
3	Unreadable symbols on LCD	(i) Inappropriate DC-power supplier (ii) Failure due to strong electromagnetic impact	(i) Replace the power unit (ii) Restart the flowmeter by disconnecting the power and USB cables or by command from a computer	(i) Use only a stabilized DC 9V or 12V, 1A designated for microprocessors
4	No film formation for a longer period of time, message “Check gas flow / Check fill level” on the LCD	(i) Absence of gas flow (ii) No tenside solution in the device	(i) Check the presence of gas flow and resume it (ii) Check the tenside solution level and refill it	
5	Dirty, opaque tenside solution in the flowmeter	Contaminated or unsuitable gas or	Refill the tenside solution	Do not use any tenside solution

		too long operating time of the device		other than the one supplied
6	Poor film formation with frequent skips	Deterioration of the tenside solution due to long device duty or inappropriate gas	Refill the tenside solution	
7	“Range!” message on LCD	The gas flow rate beyond the measurement range	Check the flow rate by other means. If the flow rate is within the instrument specification, restart operation by disconnecting the power and USB cables or by command from the computer	Depending on the gas to be measured, the measurement range can be adjusted to suit the required conditions on site at the customer's request
8	Multiple moving films. Inadequate readings on LCD	(i) Disturbance due to electromagnetic impact or internal failure (ii) Inappropriate DC-power supplier	(i) Restart operation by disconnecting the power and USB cables or by command from the computer (ii) Replace the power unit	(ii) Use only a stabilized DC 9V or 12V, 1A designated for microprocessors
9	Constant, non-stop noises	(i) Software failure (ii) Internal defect	(i) Restart operation by disconnecting the power and USB cables or by command from the computer (ii) Unplug the power cord and USB cable and switch off the device	(ii) Upon request, the flowmeter can be returned to the manufacturer for troubleshooting

10	Leakage of liquid or gas	Burst of internal lines because of excessive pressure	Disconnect the power supply and withdraw from operation	Upon request, the flowmeter can be returned to the manufacturer for troubleshooting

NOTE

(i) If only the USB cable is connected to the computer (power supply is disconnected), the device display is on. However, the flowmeter does not run.

(ii) Imperfect film shape, such as small bubbles along its peripheral edge, does not affect the measurement accuracy.

(iii) By pressing **F** button **3** (Fig. 1), it is possible to check the film formation and, therefore, the existence of the gas flow.

(iv) If the 'OFF/ON USB&POWER' notice appears on the LCD display, the actual flow rate is shown on the instrument display as usual. However, the other normalized values (see Section 9) will not be transmitted to the PC for logging.
To restore the readings of all values, disconnect the device from the power supply (9-12 V) and the USB port, then reconnect it.

12 Recycling

The flowmeter does not contain batteries / accumulators or any hazardous materials and can be recycled as normal electrical and electronic equipment.

It can be taken to a designated collection point, usually a special recycling container or a certified collection point.

Always follow the rules in force in your institution and country.

13 Software

The flowmeter software uses the following open-source libraries:

- LiquidCrystal (https://github.com/arduino-libraries/LiquidCrystal/tree/master),
- Wire (https://github.com/arduino/ArduinoCore-avr/blob/master/libraries/Wire/src/Wire.h),
- SPI (https://github.com/arduino/ArduinoCore-avr/blob/master/libraries/SPI/src/SPI.h),
- Adafruit_Sensor (https://github.com/adafruit/Adafruit_Sensor),
- Adafruit_BMP280 (https://github.com/adafruit/Adafruit_BMP280_Library).

The contribution of their developers is highly valued.

14 Warranty

Warranty claims are excluded if they are due to one or more of the following causes:

- Improper use of the flowmeter.
- Improper connection, commissioning, operation and maintenance of the device.
- Failure to follow the instructions in this manual regarding storage, installation, commissioning, operation and maintenance of the flowmeter.
- Unauthorized structural modifications to the flowmeter.
- Inadequate monitoring of accessories subject to wear.
- Tampering with the integrity of the flowmeter or attempting to disassemble the flowmeter for repair purposes when this has not been done by the manufacturer.
- Damages caused by external influences and force majeure.