ANALYT MESSTECHNIK



OPERATING MANUAL

GFM Mass Flow Meter

Installation, wiring, operation, calibration and maintenance of GFM17, GFM37, GFM47, GFM57, GFM67 and GFM77 thermal mass flow meters.

AMTC-MN-0012

Rev. 2 · October 2026

About this manual

This manual explains how to install, wire, operate, calibrate and maintain GFM thermal mass flow meters. It covers all six models, GFM17, GFM37, GFM47, GFM57, GFM67 and GFM77, with an aluminium body or in stainless steel, with a built-in display or without one.

Read Safety (p. 6) before you install the meter. To set up a new meter, work through Installation (p. 10) with its Electrical connections (p. 11), then Commissioning (p. 14) and Operation (p. 15), in that order. The Specifications (p. 25) and the gas conversion factors in Appendix A (p. 31) are reference material for later.

For service, calibration, repairs and technical questions, contact Analyt-MTC. The contact details are in Service, warranty and contacts (p. 29) and on the back cover.

Keep this manual for the lifetime of the product. The current revision is on the product page at analyt-mtc.com.

Safety notices in this manual

⚠ WARNING

A hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

Practices not related to personal injury — damage to the product, the process or the sample.

Note

Information that helps understanding; never a hazard.

Conventions

- **FS** stands for full scale: the highest flow of the range your meter is calibrated for. Accuracies given as “% FS” are a percentage of that value.
- Flows are standard flows of nitrogen at 21.11 °C, 1013.25 mbar unless stated otherwise. For other gases, see Gas conversion factors (p. 18).
- Pressures are gauge pressures in bar; where useful, the value in psi follows in brackets.
- Pin numbers, such as “pin 2”, refer to the 9-pin D connector (pin assignment (p. 12)).
- Potentiometers and jumpers are named as printed on the circuit board: R34, R33, J1A and so on (adjustment points (p. 8)).

Abbreviations

Abbreviation	Meaning
EMC	Electromagnetic compatibility
EPR	Ethylene propylene rubber
FFKM	Perfluoroelastomer

Abbreviation	Meaning
FKM	Fluoroelastomer
LCD	Liquid-crystal display
NPT	National Pipe Thread: tapered US pipe thread
OEM	Original equipment manufacturer
WEEE	Waste electrical and electronic equipment

Document information

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2	October 2026	Quality programme: new document type, number and identity pages.
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CHAPTER 1

Safety

Read this chapter before you install, wire or operate the meter. Each point is repeated, with its context, at the step where it applies.

Intended use

The GFM measures the mass flow of clean gases. It cannot measure liquids, and no liquid may ever enter it. Filter any gas that may carry particles before it reaches the meter: the sensor is a fine capillary tube that blocks easily.

The meter is safe only when it is installed and operated as this manual describes. Any other use can defeat the protection built into it; agree such a use in writing with Analyt-MTC first.

⚠ WARNING

The GFM is not intended for life-support applications. A failure or a wrong reading in such an application could endanger a person's life or health. Do not use the GFM where a failure or a wrong reading could endanger a person.

Before you start

These points apply whenever you install, wire, adjust or service the meter.

NOTICE

Wiring the meter with the power on can damage the electronics. Switch the power off before you connect or disconnect any cable.

NOTICE

Exceeding the maximum supply voltage damages the meter permanently. Before you connect a supply, check the serial number and the power label on the back cover. Never connect more than 15 V DC to a meter labelled 12 V DC, and never connect 24 V DC to a meter that was not ordered and configured for 24 V DC.

NOTICE

Some components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you wire, adjust or service the meter. While the D connector is not in use, leave its protective cover in place.

- **Gas compatibility.** Choosing a model whose wetted materials suit your gas is your responsibility. The materials are listed in Materials and connections (p. 25).
- **Oxygen.** You decide whether the meter is suitable for your oxygen application. If it needs oxygen cleaning, specify this when you order.
- **Decontamination.** Purge any meter that has carried toxic, corrosive, infectious or radioactive media before you open it or send it for service.
- **Qualified staff.** Have calibration, adjustment and repair done by qualified staff with suitable equipment (Calibration and verification (p. 16)).

CHAPTER 2

Product description

The GFM models

The GFM is a thermal mass flow meter: it measures the mass flow of a gas and gives it as an analogue signal and, on models with a display, as a reading in engineering units. The six models differ in flow range and size. Each comes with an anodized aluminium and brass body or, with the suffix S (GFM17S … GFM77S), in 316 stainless steel. Models with a built-in display carry a 1 after the model number (GFM171 … GFM771); meters without a display suit OEM installations.

Model	Full-scale flow (N_2)
GFM17	10 smL/min–10 sL/min
GFM37	15–50 sL/min
GFM47	60–100 sL/min
GFM57	200 sL/min
GFM67	500 sL/min
GFM77	1000 sL/min

The full list of ranges and their codes is in Flow ranges (p. 26). The range and the gas your meter is calibrated for are printed on its front label.

How the GFM measures

Inside the flow body, the gas stream divides. A small, fixed share flows through a thin stainless-steel sensor tube; the rest passes through the main channel. Both paths are shaped so that the flow in them stays laminar, which keeps the share in the sensor tube in a constant proportion to the total flow. A restrictor flow element (RFE) in the main channel sets that proportion; which RFE a meter has depends on its gas and range.

Two precision-wound coils heat the sensor tube at two points. Flowing gas carries heat from the upstream coil to the downstream coil, and the resulting temperature difference changes the resistance of the coils. The electronics measure this difference, which is linearly proportional to the mass flow, and turn it into the flow signal.

Parts of the meter

The display on top of the meter tilts through 90° for easy reading. It plugs into the meter with a modular connector and can be removed for remote reading (Remote and panel-mounted display (p. 11)). The connections are on the inlet side, the zero and span adjustments on the outlet side:

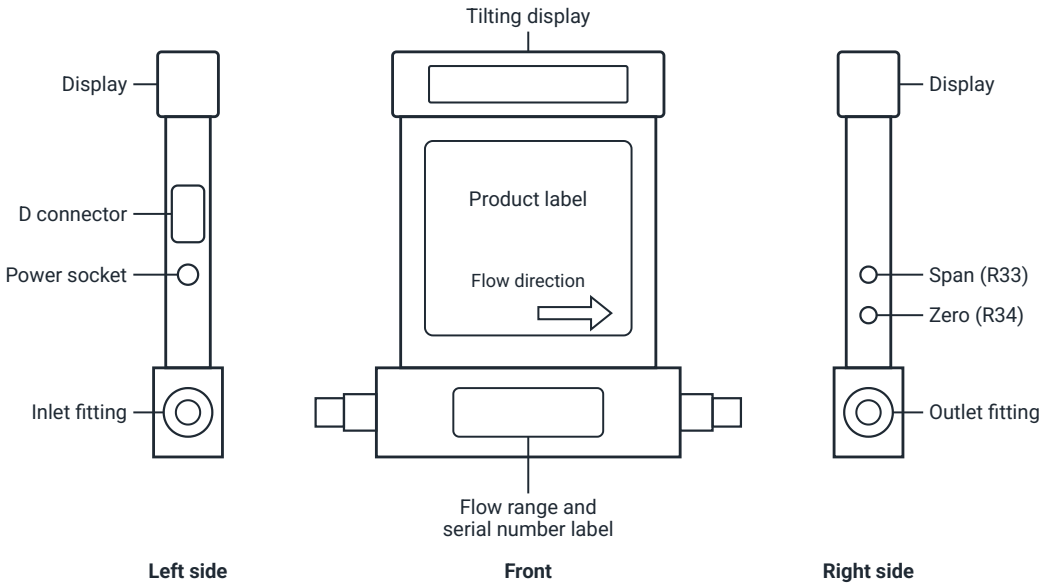


Figure 2-1. Parts of the GFM. The flow arrow on the front label shows the flow direction.

Adjustment points

All calibration settings are made with an insulated screwdriver through the access window; you do not need to open the meter. The potentiometers and jumpers on the circuit board are:

Item	Function	Used in
R34	Zero	Warm-up and zero check (p. 14), calibration
R33	Span (calibration at 25 or 10 %)	Checking zero and span (p. 17), linearity
R52	25 % linearity point, when enabled	Linearity adjustment (p. 17)
R38, R39, R40	50 %, 75 % and 100 % linearity points	Linearity adjustment (p. 17)
J1A … J1D	Linearizer jumpers for R52, R38, R39 and R40	Linearity adjustment (p. 17)
R1	Not used in the procedures of this manual	—
R3 (display board)	Display full-scale reading	Display scaling (p. 18)

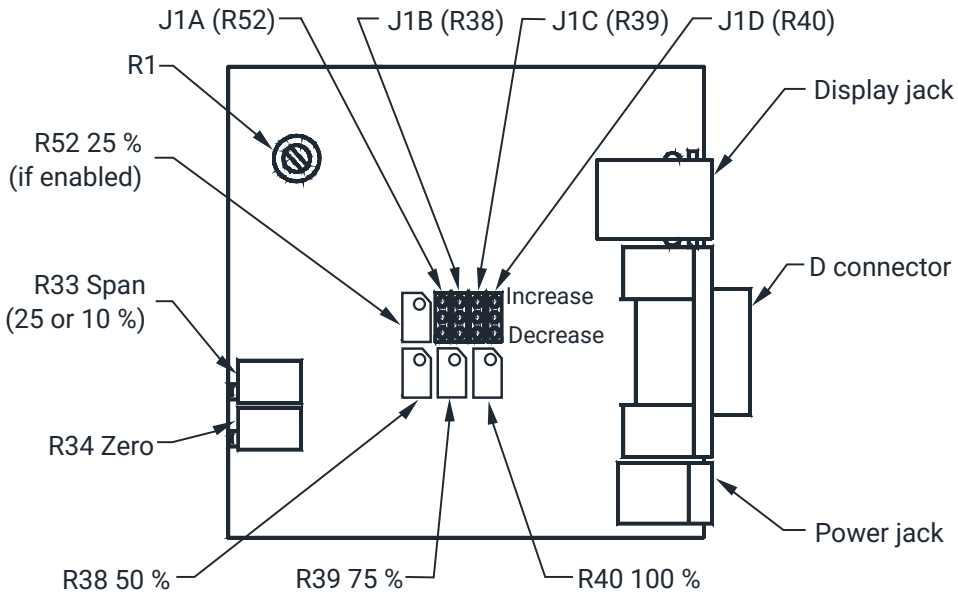


Figure 2-2. Circuit board of the GFM with the calibration potentiometers and the linearizer jumpers. Each jumper J1A … J1D has an increase and a decrease position.

Supplied items and accessories

The meter is delivered with the items on its packing list. Check them when you unpack it (Unpacking and inspection (p. 10)). Accessories include a remote display, shielded interface cables, power supplies, a battery pack, the totaliser I/O monitor (TIO) with its mounting kit, a universal baseplate and a transport case (Ordering information (p. 27)).

CHAPTER 3

Installation

Unpacking and inspection

The meter is shipped in a sturdy carton with anti-static cushioning. When it arrives:

1. Inspect the outside of the carton. If it is damaged, report the damage to the carrier immediately.
2. Open the carton carefully from the top and check the meter for hidden transport damage. If you find any, report it to the carrier and send a copy of the damage report to Analyt-MTC.
3. Check the contents against the packing list and report anything missing to Analyt-MTC straight away.
4. Leave the protective cover on the 9-pin D connector until you wire the meter.

To send a meter back to Analyt-MTC for repair or calibration, follow Sending in a meter (p. 29).

Gas quality

Only clean gases may enter the meter. Particles, condensate or gas components that crystallize block the capillary sensor tube and the narrow flow passages. Filter any gas that may carry contaminants, and never let liquid into the meter. The inlet filter screen of the GFM17 (50 µm) and of the GFM37 and GFM47 (60 µm) is a last line of defence, not a substitute for a clean gas supply.

⚠ WARNING

Oxygen service: a meter that is not suitable or not cleaned for oxygen is a hazard in oxygen applications. Using it with oxygen can cause damage or personal injury. You are responsible for deciding whether the meter suits your oxygen application. If your application requires oxygen cleaning, specify it when you order.

Location and orientation

Mount the meter with its flow path horizontal. It is calibrated in this position and keeps its calibration accuracy within a tilt of ±15°. If it has to be mounted in another orientation, it may need to be recalibrated for that position.

Choose a stable location, free from sudden or frequent temperature changes, high humidity and draughts. Keep the meter away from vibration, heat, corrosive atmospheres and strong radio-frequency or magnetic fields. The meter can stand on a bench or be fixed with screws through the mounting holes in its base (Appendix B (p. 34)).

Connecting the gas lines

1. Inspect the pipework, fittings and ferrules and remove any dust or other contamination.
2. Find the flow-direction arrow on the front of the meter and connect the gas supply to the inlet side.
3. Push the tubing into each compression fitting until the tube end sits against the shoulder of the fitting. The GFM77 has female NPT threads unless compression fittings were ordered.

NOTICE

Excessive force on the fittings seriously damages the restrictor flow elements (RFEs) inside the flow body. Do not over-tighten.

4. Tighten each compression fitting by one and a quarter turns, following the fitting manufacturer's instructions.
5. Leak-test the whole installation with a helium leak detector or an equivalent method. Every meter is leak-tested before shipment to the limit in Performance (p. 25).

Remote and panel-mounted display

Instead of the display on top of the meter, there are two remote options:

- **Remote display.** The display comes on a 3 ft cable, together with the upper block that serves as its mounting. For cables up to 9.5 ft (3 m), ask Analyt-MTC.
- **Panel-mount display.** The display comes without the aluminium housing, on a 3 ft cable, with a bezel that holds it in a rectangular panel cut-out with two plastic screws. Cut the panel as shown in Figure 3-1.

Keep the display cable, like the cable of the 0–5 V DC output, no longer than 9.5 ft (3 m). With longer cables the meter no longer meets its specifications.

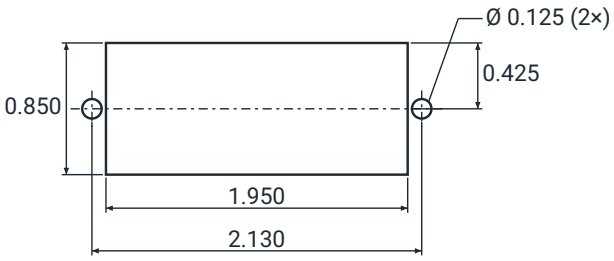


Figure 3-1. Panel cut-out for the panel-mount display. Dimensions in inches; the two fixing holes are centred on the cut-out's height.

Electrical connections

Before you wire

The meter takes its power either through the DC power jack or through the 9-pin D connector, both on the inlet side of the enclosure (Parts of the meter (p. 7)). The analogue flow signals are on the D connector. A meter without a display needs a panel meter, a digital multimeter or a similar instrument on its output to show the flow.

NOTICE

Wiring the meter with the power on can damage the electronics. Switch the power off before you connect or disconnect any cable.

NOTICE

Some components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you wire, adjust or service the meter. While the D connector is not in use, leave its protective cover in place.

Power supply

Which supply voltage your meter needs depends on its serial number:

Serial number	Supply voltage	Current, max.	Fuse
Above 340621-1	Universal: any voltage, 12–26 V DC	200 mA	300 mA

Serial number	Supply voltage	Current, max.	Fuse
Below 340621-1	12 V DC or 24 V DC, as stated on the power label	200 mA	750 mA

Use a supply rated for at least 200 mA per meter. If one supply feeds several meters, choose one whose current rating covers all of them.

If the meter must run on a battery, use only the optional battery pack and its charger (ask Analyt-MTC).

NOTICE

Exceeding the maximum supply voltage damages the meter permanently. Before you connect a supply, check the serial number and the power label on the back cover. Never connect more than 15 V DC to a meter labelled 12 V DC, and never connect 24 V DC to a meter that was not ordered and configured for 24 V DC.

Connect the supply in one of two ways, never both:

- **DC power jack** — the centre contact is positive.
- **D connector** — pin 4 (+) and pin 5 (−).

NOTICE

Power on the power jack and the D connector at the same time damages the meter. When the meter is powered through the power jack, do not connect a supply to the D connector as well.

Pin assignment

Pin	Function
1	Remote display signal
2	0–5 V DC flow signal output (+)
3	0–5 V DC flow signal common (−)
4	Power supply, positive
5	Power supply, common
6	Remote display reference
7	Not connected
8	4–20 mA flow signal output (+); self-powered, sourcing, not isolated
9	4–20 mA flow signal return (−)

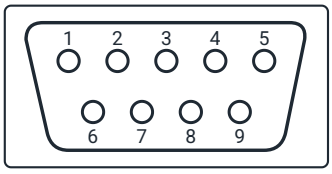


Figure 3-2. Pin numbering of the 9-pin D connector on the meter.

Note

Most D connectors share the same pin numbering, but some mating connectors are numbered differently. Wire by function, as in the table above, whatever numbers your mating connector shows. Take the same care when you use cables made for other manufacturers' instruments.

Keep the cable of the 0–5 V DC output, and that of a remote display, no longer than 9.5 ft (3 m). The 0–5 V DC output needs a load of at least 1000 Ω; the 4–20 mA loop resistance must not exceed 500 Ω.

Fuse protection

The power input is protected by a resettable, medium time-lag fuse (300 mA or 750 mA, see Power supply (p. 11)) and by a diode against reversed polarity. A short circuit or reversed polarity trips the

fuse and cuts the power to the meter. To reset it, disconnect the power, remove the fault and reconnect the power.

NOTICE

The fuse does not protect the meter against a supply voltage above the maximum for its model. Such a voltage damages the meter permanently. Never exceed the maximum supply voltage of your model (Power supply).

CHAPTER 4

Commissioning

Warm-up and zero check

Start with a meter that is installed and leak-tested as described in Installation (p. 10).

1. Shut off the gas supply to the meter.
2. Check the power label, then connect the power supply to the DC power jack or to the D connector, not to both (Power supply (p. 11)).
3. Let the meter warm up for at least 15 minutes. Right after power-on the flow signal reads higher than normal, because the sensor has not yet reached its operating temperature. Within a few minutes the reading settles back to zero.

   NOTICE

   Moving the zero by more than ±3.0 % FS from the factory setting can affect the calibration. If the offset is larger, have the meter recalibrated instead of compensating with R34.

4. After the warm-up, check that the display (or the output) reads zero. If a small offset remains, within ±3.0 % FS, disconnect the gas supply so that no gas can seep in, then turn the zero potentiometer R34 through the access hole until the reading is zero.

CHAPTER 5

Operation

Reading the flow

Start a controlled gas flow once the meter has warmed up. The flow signal is linearly proportional to the mass flow. Read it on the built-in or remote display, or on an instrument connected to the analogue outputs (Pin assignment (p. 12)):

- **Display** — reads directly in engineering units of the calibrated gas, for example smL/min, sL/min or scfh. For a 0–100 % display, ask Analyt-MTC.
- **0–5 V DC output** — pins 2 (+) and 3 (−).
- **4–20 mA output** — pins 8 (+) and 9 (−).

The full-scale range and the gas your meter is calibrated for are printed on its front label. After a change in flow, the reading settles within ±2 % of the new flow in about 2 seconds, for flows between 25 and 100 % FS.

Meters are calibrated on the 0–5 V DC output unless you order otherwise. If you read the 4–20 mA output of such a meter, the total uncertainty of the reading can grow to 2.5 % FS. For a calibration on the 4–20 mA output, ask Analyt-MTC.

Flow above full scale

Keep the flow below 110 % of full scale. Above that, the sensor saturates (“swamping”): the readings are no longer accurate or linear. They return to normal on their own once the flow is back in the calibrated range, but the longer the meter runs above 110 %, the longer the sensor may take to recover.

CHAPTER 6

Calibration and verification

Meters are calibrated with dry nitrogen. This chapter shows how to check that calibration, how to adjust it in the field and how to convert it to other gases.

Before you start

Analyt-MTC calibrates GFM meters, including calibrations for a specific non-toxic, non-corrosive gas and for specific operating conditions. A calibration as close as possible to your real operating conditions gives the best accuracy. Contact Analyt-MTC for a calibration or for advice before you start (Service, warranty and contacts (p. 29)).

If you calibrate yourself, have the work done by qualified staff with suitable equipment. In the field you can only recalibrate a meter for the range it was originally calibrated for; a new flow range may need a different restrictor flow element (RFE).

Note
Every adjustment described in this chapter changes the calibration of the meter. Ask Analyt-MTC before you start.

NOTICE

Some electronic components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you adjust or service the meter.

Equipment

- A flow calibration standard at least four times more accurate than the meter.
- A certified high-resolution digital multimeter. Together with the flow standard it must reach an accuracy of ±0.25 % or better.
- An insulated (plastic) screwdriver.
- A flow regulator, for example a metering needle valve, upstream of the meter.
- A pressure-regulated supply of dry, filtered nitrogen, or of another suitable reference gas.

Set the gas and ambient temperature and the inlet and outlet pressures to match your operating conditions. Factory calibrations use dry nitrogen at 21.1 °C (70 °F), 1.4 bar g (20 psig) at the inlet and 0 bar g at the outlet.

Connections and warm-up

1. Connect the multimeter to the flow signal output: pins 2 (+) and 3 (−) for 0–5 V DC, or pins 8 (+) and 9 (−) for 4–20 mA.
2. Power the meter for at least 30 minutes before you begin.

The potentiometers are shown in Adjustment points (p. 8). All adjustments are made through the access window; you do not need to open the meter.

Checking zero and span

> **Note**
> At zero flow the 0–5 V DC output may not fall below 7 to 25 mV. Turning R34 further after it stops falling in that range creates a negative zero shift, which you cannot see on a meter without a display. Stop turning R34 as soon as the output stops falling in that range.

1. **Zero.** Shut off the gas and disconnect the gas supply so that nothing can seep in. Turn R34 until the output reads 0 V DC (4 mA).
2. **Span.** Reconnect the gas supply and set 100 % of full scale with the flow regulator. Compare the reading with the flow standard. If it deviates by less than ±10 % of full scale, turn R33 until the deviation disappears.
3. If it deviates by more than ±10 %, the meter probably has a fault. Common causes are a blocked or contaminated sensor tube, a leak in the meter or in the gas lines, a wrong K factor (for gases other than nitrogen) and errors in the temperature or pressure correction. Remove the cause (Troubleshooting (p. 22)); if the deviation persists, return the meter to Analyt-MTC.
4. The calibration is now complete. Analyt-MTC recommends checking a few points in between as well, for example 25 %, 50 % and 75 %. If they are off, adjust the linearity as described below.

Linearity adjustment

The linearity is set at up to five points with the potentiometers and linearizer jumpers of Table 6-1. Each jumper J1A … J1D can sit in its increase or its decrease position (Figure 2-2 (p. 9)); choose the one that moves the output in the direction you need.

1. Connect the multimeter and warm up the meter (Connections and warm-up (p. 16)). If you are calibrating for a new range or a different gas, first remove any jumpers from J1A, J1B, J1C and J1D.
2. **Zero.** Shut off and disconnect the gas supply. Turn R34 until the output reads 0 V DC (4 mA). Observe the 7 to 25 mV limit given above.
3. **25 % with R33.** Reconnect the gas. With the flow regulator, set 25 % of full scale on the flow standard. Turn R33 until the output reads 1.25 V DC ±63 mV (8.0 mA ±0.25 mA).
4. **Check 10 %.** With the regulator, reduce the flow until the output reads 0.50 V DC (5.6 mA). If the flow standard now reads 10 % ±1.5 % of full scale, skip steps 5 and 6 and go to step 7.
5. **10 % with R33.** Set 10 % of full scale on the flow standard. Turn R33 until the output reads 0.50 V DC ±63 mV (5.6 mA ±0.25 mA).
6. **25 % with R52.** Set 25 % of full scale on the flow standard. The output should read 1.25 V DC ±63 mV (8.0 mA ±0.25 mA). If it does not, fit jumper J1A in the increase or decrease position as needed and turn R52 until the reading is within tolerance.
7. **50 %, 75 % and 100 %.** Raise the flow to each point of Table 6-1 in turn. If the output is outside the tolerance, fit the jumper listed in the increase or decrease position and turn the potentiometer listed until the output is within tolerance.
8. Repeat steps 3 to 7 at least once more.

Table 6-1 Linearity points

Flow	0–5 V DC	4–20 mA	Jumper	Adjust
10 %	0.50 V	5.6 mA	—	R33

Flow	0–5 V DC	4–20 mA	Jumper	Adjust
25 %	1.25 V	8.0 mA	J1A	R52 (or R33, step 3)
50 %	2.50 V	12.0 mA	J1B	R38
75 %	3.75 V	16.0 mA	J1C	R39
100 %	5.00 V	20.0 mA	J1D	R40

Tolerance at every point: ±63 mV or ±0.25 mA.

Display scaling

After a recalibration for a new range, or to show different engineering units, you may need to rescale the display.

NOTICE

Unplugging or reconnecting the display with the power on, or an electrostatic discharge, can damage the electronics. Switch the power off before you unplug or reconnect the display. Wear a grounded wrist strap when you open the display or touch its board.

1. Carefully remove the display from the meter or from the panel. Remove the aluminium housing on the cable side and slide the display assembly out.
2. Connect the multimeter to the 0–5 V DC or the 4–20 mA output and set the flow to full scale (5.00 V DC or 20 mA).
3. Keep the flow at full scale and turn the potentiometer R3 on the display circuit board until the display shows the full-scale value you want.
4. To move the decimal point, move the jumper on the 8-pin header of the display board to the position for the highest reading you need (Table 6-2). The positions are printed next to the pins. Never fit more than one decimal-point jumper.

Table 6-2 Decimal point jumper

Jumper position	Highest reading
0	1999
3	199.9
2	19.99
1	1.999

Gas conversion factors

A meter calibrated with nitrogen can measure other gases if you correct its reading with a conversion factor, the K factor. The K factor of a gas depends on its density and its specific heat; Appendix A (p. 31) lists it for many gases, relative to nitrogen. For a diatomic gas:

$$K = 1 / (d \times c_p)$$

where d is the density of the gas in g/L and c_p its specific heat in cal/g, both taken at the same temperature and pressure.

As long as the flow range stays the same, the ratio of the K factors links the flow of the actual gas to the flow of the reference gas:

$$Q_a \;/\; Q_r = K_a \;/\; K_r$$

with Q_a and Q_r the mass flows of the actual and the reference gas, and K_a and K_r their K factors.

Example. A meter calibrated with nitrogen reads 1000 smL/min while oxygen flows through it. The K factor of oxygen relative to nitrogen is 0.9926, so the actual oxygen flow is 1000 × 0.9926 = 992.6 smL/min.

Some process gases behave quite differently from nitrogen. If a reference gas with thermodynamic properties close to your process gas is available, calibrating with it and recalculating the factor relative to it with the formula above gives a more accurate conversion.

Note
K factors are approximations at best. Do not rely on them where you need an accuracy better than ±5 to 10 %. For better accuracy, have the meter calibrated with the actual gas.

CHAPTER 7

Maintenance

What needs maintenance

Apart from occasional cleaning of the inlet filter screen and the flow paths, the GFM needs no routine maintenance. The sensor is a fine capillary tube, and the other flow passages are narrow too: particles, condensate or crystallizing gas components block them easily. Clean, filtered gas is therefore the best maintenance (Gas quality (p. 10)).

Have the calibration checked at the intervals your quality system requires, by qualified staff with suitable equipment (Calibration and verification (p. 16)). For repair and calibration, return meters to Analyt-MTC.

⚠ WARNING

A meter that has carried toxic, corrosive, infectious or radioactive media can hold hazardous residues. These residues endanger the people who open or service it. Purge the meter and neutralize all residues before you open it or send it for service.

Cleaning the flow path

NOTICE

Any disassembly of the sensor can upset the calibration. Never take the sensor apart. Do not dismantle or repair the GFM37, GFM47, GFM57, GFM67 or GFM77 yourself: once opened, they have to be recalibrated.

NOTICE

Some electronic components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you adjust or service the meter.

1. Remove the meter from the gas line and look into the inlet and the outlet for debris that may block the flow.
2. Remove any debris you find.
3. If the flow path is still blocked, clean the inlet filter of a GFM17 as described below. A sensor tube that stays blocked after flushing with a cleaning fluid has to be cleared by Analyt-MTC: return the meter.

Cleaning the inlet filter (GFM17)

The GFM17 has a 50 µm filter screen in its inlet, held in the RFE sub-assembly together with the restrictor flow element. You need an 11/16 in open-ended wrench, a 1/2 in wide flat screwdriver, a pin or small screwdriver of 3/32 to 1/8 in diameter, and hex keys of 1/4 in and 5/32 in.

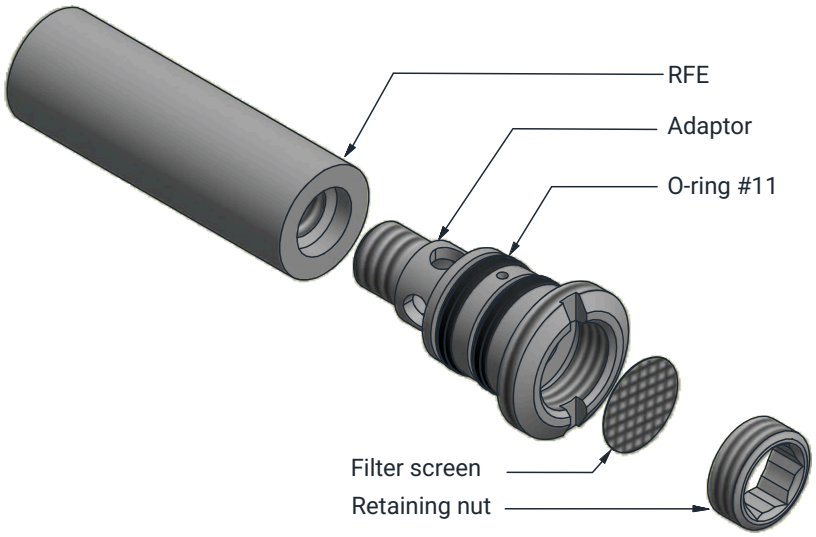


Figure 7-1. RFE sub-assembly of the GFM17 with the inlet filter screen.

1. Unscrew the inlet and outlet compression fittings from the meter with the 11/16 in wrench.
2. Unscrew the RFE sub-assembly from the inlet side with the flat screwdriver.
3. Push the pin through the holes of the adaptor to hold it, and unscrew the retaining nut with the 1/4 in hex key. The filter screen is now accessible.
4. Separate the RFE from the adaptor with the 5/32 in hex key.
5. Clean or replace the parts as necessary. If you clean them with alcohol, let them dry completely.
6. Inspect the flow path inside the meter for contamination. If necessary, flush it with alcohol and dry it thoroughly with a flow of clean, dry gas.

   NOTICE

   Too much force deforms the RFE and makes it unusable. The RFE sub-assembly belongs in the inlet side only. Never install it in the outlet side, and do not over-tighten it.

7. Check that there is no dust on the O-ring, then reassemble the RFE sub-assembly and screw it carefully into the inlet side.
8. Screw the compression fittings back in.
9. Check at least one calibration point (Checking zero and span (p. 17)).

CHAPTER 8

Troubleshooting

First checks

Each meter is tested during manufacture and calibrated for the gas and conditions on your order, so most faults in the field come from the installation. Before you look at the fault table, rule out these causes:

- Wiring: compare the cable with the pin assignment (p. 12). A cable taken from another make of instrument is the most frequent culprit, because the pins rarely match.
- Supply: the voltage must match the power label, and the supply must deliver the current of every meter connected to it.
- Gas side: test the connections for leaks and check that there is enough pressure difference across the meter.

Fault finding

Where a remedy says “open the display”, remove the display from the meter, take off the aluminium housing on the cable side and slide the display assembly out, as in Display scaling (p. 18).

NOTICE

Unplugging or reconnecting the display with the power on, or an electrostatic discharge, can damage the electronics. Switch the power off before you unplug or reconnect the display. Wear a grounded wrist strap when you open the display or touch its board.

Likely cause	Remedy
NO READING OR NO OUTPUT	
Power supply off	Check the power supply and its connection.
Fuse tripped	Disconnect the power, remove the short circuit or correct the polarity; the fuse resets itself (Fuse protection (p. 12)).
Inlet filter screen blocked	Flush it clean, or dismantle and clean or replace it (Cleaning the inlet filter (p. 20)).
Sensor tube blocked	Flush it clean (Cleaning the flow path (p. 20)), or return the meter.
Circuit board defective	Return the meter.
DISPLAY BLANK AFTER POWER-ON	
Display connector loose or not plugged in (flow still visible on the 0–5 V DC output, pins 2 and 3)	Unplug the display connector and plug it in again.
Wire disconnected inside the display (flow still visible on the 0–5 V DC output)	Open the display, check all four wires and reconnect any loose one.
Power supply faulty or polarity reversed (0–5 V DC output below 15 mV)	Measure the voltage between pins 4 and 5. Below 11.0 V DC, replace the supply. If the reading is negative, correct the polarity.
Circuit board defective	Return the meter.
UNSTABLE ZERO, OR NO ZERO READING	
Power supply problem	Check that the supply delivers the correct voltage.
Gas leak	Find and repair the leak.
Circuit board defective	Return the meter.

Likely cause	Remedy
NOT AT ZERO AFTER 15 MINUTES OF WARM-UP WITH NO FLOW	
Internal temperature of the meter has changed	Readjust the zero with R34 (Warm-up and zero check (p. 14)).
Supply voltage below 11.0 V DC (the display does not respond to R34)	Measure the voltage between pins 4 and 5. Below 11.0 V DC, replace the supply; a regulated 12.0 V DC supply of at least 250 mA is recommended.
Wire disconnected inside the display (the display does not respond to R34, but R34 moves the 0–5 V DC output between 10 mV and 0.5 V DC)	Open the display, check all four wires and reconnect any loose one. Then disconnect the gas supply and readjust the zero with R34.
FULL-SCALE READING WITH NO FLOW	
Sensor defective	Return the meter.
Gas leak	Find and repair the leak.
READING ABOVE FULL SCALE (0–5 V DC OUTPUT ABOVE 5.5 V DC)	
Flow more than 10 % above full scale	Reduce the flow into the calibrated range, or shut it off. The reading recovers by itself (Flow above full scale (p. 15)).
Circuit board defective	Return the meter.
GAS FLOWS, BUT NEITHER DISPLAY NOR OUTPUT RESPONDS	
Flow too low for this model	Check the range on the front label and adjust the flow.
GFM17: RFE not seated properly against the inlet fitting	Unscrew the inlet fitting and refit the RFE (Cleaning the inlet filter (p. 20)). This can affect the calibration.
Sensor or circuit board defective	Return the meter.
NO GAS FLOWS ALTHOUGH THERE IS PRESSURE AT THE INLET	
Inlet filter screen blocked	Flush it clean, or dismantle and clean or replace it (Cleaning the inlet filter (p. 20)). This can affect the calibration.
GAS FLOWS, THE DISPLAY IS NEGATIVE AND THE OUTPUT STAYS NEAR 10 MV	
Flow direction reversed	Check the flow arrow on the front of the meter and reconnect the gas lines.
Back pressure in the installation combined with a leak	Find and repair the leak. If the meter itself leaks, return it.
CALIBRATION OFF	
Off by no more than 3.0 % FS: zero has shifted	Shut off and disconnect the gas supply, wait 15 minutes with no flow and readjust the zero with R34.
Gas differs from the calibration gas	Use a meter calibrated for this gas.
Gas composition has changed	Correct with the K factors (Gas conversion factors (p. 18)).
Gas leak	Find and repair the leak.
Circuit board defective	Return the meter.
RFE dirty	Flush it clean, or dismantle and clean it.
Sensor tube blocked	Flush it clean, or return the meter.
Inlet filter screen blocked	Flush it clean, or dismantle and clean or replace it.
Meter not mounted correctly	Check for tilt or a changed mounting position. Meters are calibrated with the sensor horizontal (Location and orientation (p. 10)).
DISPLAY DOES NOT AGREE WITH THE 0–5 V DC OUTPUT	
Display scaled for another range or unit	Rescale the display (Display scaling (p. 18)).
Decimal-point jumper in the wrong position (reading 10 or 100 times too high or too low)	Open the display and move the jumper to the right position (Table 6-2 (p. 18)).
Reference wire (green, 5.00 V DC) disconnected inside the display (display negative and does not follow the flow)	Open the display and reconnect the green wire.

Likely cause	Remedy
OUTPUT SIGNAL FAULTS	
0–5 V DC output shorted to ground or overloaded (display and output fluctuate widely while gas flows)	Check the wiring on pins 2 and 3. The load must be more than 1000 Ω.
0–5 V DC output circuit damaged (display correct, output fixed or near zero)	Return the meter.
4–20 mA loop open or above 500 Ω (output fixed, around 4.0 mA)	Check the wiring on pins 8 and 9. The loop resistance must be below 500 Ω.
4–20 mA output circuit damaged	Return the meter.
READING FLUCTUATES WIDELY WITH NO GAS CONNECTED, ON A STABLE SUPPLY	
Sensor or circuit board defective	Return the meter.

For the best result, Analyt-MTC recommends returning a faulty meter to Analyt-MTC (Sending in a meter (p. 29)).

Technical support

Analyt-MTC gives technical support to qualified personnel. Have the model number and the serial number of the meter ready; both are on its labels. The contact details are in Service, warranty and contacts (p. 29).

CHAPTER 9

Specifications

Performance

Flow medium	Clean gases only; not for liquids
Calibration conditions	Standard conditions, 21.11 °C, 1013.25 mbar, unless otherwise ordered
Accuracy	GFM17, GFM37, GFM47: ±1.0 % of full scale GFM57, GFM67, GFM77: ±1.5 % of full scale
Repeatability	±0.25 % FS
Temperature coefficient	0.15 % FS per °C
Pressure coefficient	0.01 % FS per psi (0.07 bar)
Response time	Time constant 800 ms; about 2 s to within ±2 % of the flow, for flows of 25–100 % FS
Maximum gas pressure	GFM17, GFM37, GFM47: 69 bar g (1000 psig) GFM57, GFM67, GFM77: 34.5 bar g (500 psig) Optimum pressure: 1.4 bar g (20 psig)
Gas and ambient temperature	0–50 °C (32–122 °F); −10 to 50 °C (14–122 °F) with dry gases only
Gas relative humidity	Up to 70 %
Leak integrity	1×10^{-9} scc/s helium maximum, to the outside
Attitude sensitivity	±15° from horizontal; calibrated in the horizontal position
Environment	Installation category II, pollution degree 2 (IEC 664)

Electrical

Power supply	Serial numbers above 340621-1: universal, 12–26 V DC, 200 mA maximum Serial numbers below 340621-1: 12 V DC or 24 V DC, 200 mA maximum
Protection	Resettable fuse, medium time-lag: 300 mA (universal input) or 750 mA (12 or 24 V DC input); diode against reversed polarity
Flow signal outputs	0–5 V DC, linear, minimum load 1000 Ω 4–20 mA, linear, self-powered (sourcing), not isolated, loop resistance 0–500 Ω Noise: 20 mV peak-to-peak maximum
Connections	9-pin D connector (Pin assignment (p. 12)); DC power jack, centre positive; optional shielded interface cable. Cables for the 0–5 V DC output and the remote display 9.5 ft (3 m) maximum
Display	3½-digit LCD, highest reading 1999, 0.5 in characters; built into the top of the meter on models GFM171 … GFM771 and tilts over 90°; remote or panel-mount display optional. Reads in engineering units (for example smL/min, sL/min); 0–100 % scaling: ask Analyt-MTC
CE marking	The meter carries the CE marking: EMC Directive 89/336/EEC as amended; emission EN 55011:1991, Group 1, Class B; immunity EN 55082-2:1992. For the EU declaration of conformity, ask Analyt-MTC.

Materials and connections

Wetted materials	Aluminium models: anodized aluminium, brass, 316 stainless steel, FKM O-rings Stainless-steel models (suffix S): 316 stainless steel, FKM O-rings Optional O-rings: Buna-N, EPR or FFKM

Process connections	GFM17, GFM37: 1/4 in compression; optional 6 mm or 3/8 in compression or 1/4 in VCR; GFM17 also 1/8 in compression GFM47, GFM57: 3/8 in compression GFM67: 1/2 in compression GFM77: 3/4 in female NPT or 3/4 in compression
Inlet filter screen	GFM17: 50 µm; GFM37, GFM47: 60 µm

You are responsible for choosing a model whose wetted materials are compatible with your gas. If in doubt, ask Analyt-MTC before you order. Dimensions are in Appendix B (p. 34).

Flow ranges

Full-scale flows of nitrogen at 21.11 °C, 1013.25 mbar. For other gases, multiply by the K factor (Appendix A (p. 31)).

Table 9-1 GFM17

Code	Full scale	Code	Full scale
01	10 smL/min	07	1 sL/min
02	20 smL/min	08	2 sL/min
03	50 smL/min	09	5 sL/min
04	100 smL/min	10	10 sL/min
05	200 smL/min		
06	500 smL/min		

Table 9-2 GFM37 to GFM77

Model	Code	Full scale
GFM37	11	15 sL/min
	30	20 sL/min
	31	30 sL/min
	32	40 sL/min
	33	50 sL/min
GFM47	40	60 sL/min
	41	80 sL/min
	42	100 sL/min
GFM57	50	200 sL/min
GFM67	60	500 sL/min
GFM77	70	1000 sL/min

Pressure drop

Table 9-3 Maximum pressure drop at full scale (N_2)

Model	Flow	mm H_2O	mbar	psid
GFM17	up to 10 sL/min	58	5.7	0.083
GFM37	15 sL/min	63	6.4	0.09
	20 sL/min	300	30	0.44
	30 sL/min	800	81	1.18
	40 sL/min	1480	150	2.18
	50 sL/min	2200	223	3.23
GFM47	60 sL/min	3100	314	4.56
	100 sL/min	5500	557	8.08
GFM57	200 sL/min	2720	280	4.0
GFM67	500 sL/min	3400	340	5.0
GFM77	1000 sL/min	6120	620	9.0

CHAPTER 10

Ordering information

Order from Analyt-MTC with the order codes. The meters below are the standard versions; for any other version, contact Analyt-MTC. Full-scale flows are for air at standard conditions (21.11 °C, 1013.25 mbar).

Accessory	Order code
Remote display with 3 ft cable	17/R
Cable for the remote display, 3 ft	ask Analyt-MTC
Shielded interface cable for the 9-pin D connector	CBL-D4 (4–20 mA) CBL-D5 (0–5 V DC)
Power supply 240 V AC / 12 V DC, UK plug	PS-GFM-240UK-2
Other power supplies, 110–240 V AC, 12 or 24 V DC	PS-USA (North America, 12 V DC) other regions and voltages: ask Analyt-MTC
Battery pack, 110 V or 220 V, with case	ask Analyt-MTC
Totaliser I/O monitor (TIO), RS-232 or RS-485 interface	TIO-LAA2 (RS-232) TIO-LAA5 (RS-485)
Mounting kit for the TIO, two 9-pin D connectors	KIT-TM-DD
Universal baseplate, a bench-top stand	35780
Transport case	1200-000-110E

For digital communication, a totaliser and other engineering units, the GFM can be upgraded with the TIO totaliser and input/output module. Ask Analyt-MTC.

Meters

	Aluminium body, order code		Stainless steel body, order code	
Full scale	without display	with display	without display	with display
GFM17				
10 smL/min	35300N	35300L	35603N	35603L
20 smL/min	35301N	35301L	35604N	35604L
50 smL/min	35302N	35302L	35605N	35605L
100 smL/min	35303N	35303L	35606N	35606L
200 smL/min	35304N	35304L	35607N	35607L
500 smL/min	35305N	35305L	35608N	35608L
1 sL/min	35306N	35306L	35609N	35609L
2 sL/min	35307N	35307L	35610N	35610L
5 sL/min	35308N	35308L	35611N	35611L
10 sL/min	35309N	35309L	35612N	35612L
GFM37				
15 sL/min	35310N	35310L	35613N	35613L
20 sL/min	35317N	35317L	35614N	35614L
30 sL/min	35318N	35318L	35626N	35626L
40 sL/min	35319N	35319L	35625N	35625L

	Aluminium body, order code		Stainless steel body, order code	
Full scale	without display	with display	without display	with display
50 sL/min	35320N	35320L	35615N	35615L
GFM47				
60 sL/min	35321N	35321L	35616N	35616L
80 sL/min	35322N	35322L	35617N	35617L
100 sL/min	35323N	35323L	35618N	35618L
GFM57				
200 sL/min	35600N	35600L	35619N	35619L
GFM67				
300 sL/min	35599N	35599L	35620N	35620L
500 sL/min	35601N	35601L	35621N	35621L
GFM77				
1000 sL/min	35602N	35602L	35622N	35622L

CHAPTER 11

Service, warranty and contacts

Calibration, repair, cleaning, spare parts and technical support for your meter come from Analyt-MTC. Talk to Analyt-MTC before you send anything: many faults can be traced on the phone.

Contact

ANALYT-MTC Messtechnik GmbH

German Headquarters

Klosterrunsstraße 18, 79379 Müllheim
Germany

+49 7631 5545

info@analyt-mtc.de

French Subsidiary

175 Avenue d'Alsace, 68000 Colmar
France

+33 3 89 41 47 78

info@analyt-mtc.fr

www.analyt-mtc.com

Before you contact Analyt-MTC

Have the following at hand so that Analyt-MTC can help you quickly:

- the model number and serial number from the labels on the meter;
- the gas and the flow range on the front label;
- a description of the fault and of what you have already checked (Troubleshooting (p. 22)).

Open and follow every service request in the Analyt-MTC customer portal at portal.analyt-mtc.com: where your meter is and, once the work is done, its digitally signed certificates.

Sending in a meter

1. **Open a service request.** Open it online in the Analyt-MTC customer portal, portal.analyt-mtc.com, with the model, the serial number and the reason for service: calibration, repair or cleaning. Do not put paper forms in the box: the service request carries everything Analyt-MTC needs.

   ⚠ WARNING

   A meter that has carried hazardous media can hold residues. Residues endanger the people who unpack and service it. Never ship such a meter without purging and neutralizing it.

2. **Decontaminate.** Purge the meter and neutralize all residues of toxic, corrosive, infectious or radioactive media. In the service request, state the substances the meter has been in contact with and their hazards, and confirm the safety declaration online. If you are not sure, do not send it.

3. **Pack the meter alone.** Send the meter without power supply, cables, fittings or case unless they are part of the problem; Analyt-MTC is not responsible for accessories sent. Fit the protective cover on the 9-pin D connector. Close the process ports so that nothing enters the flow path, protect the connectors against electrostatic discharge, and pack each meter individually for transport.

4. **Ship it to Müllheim.** Send the parcel to the Analyt-MTC service centre in Müllheim, Germany, never to the Colmar address.

When the meter arrives, it is registered and assessed, and you receive a quote before any work begins: no work is done without your agreement. If you decline the quote, a bench fee and return transport are charged. Every instrument passes a final check before it is returned with its documentation. A standard service typically takes one to two weeks from arrival to dispatch; this lead time is indicative. Express service can be requested in the service request.

Warranty

The warranty terms for your meter are those agreed in your order confirmation. Warranty claims are handled by Analyt-MTC: give it the serial number and a description of the fault before you return the meter.

Disposal

Do not dispose of the meter with household waste. Dispose of it as electrical and electronic equipment under local regulations (WEEE). Remove batteries first where fitted and dispose of them separately.

APPENDIX A

Gas conversion factors

K factors relative to nitrogen, with the specific heat c_p and the density d from which they are derived. For a meter calibrated with nitrogen, multiply the reading by the K factor of the gas you are using (Gas conversion factors (p. 18)). For argon, carbon dioxide, helium, hydrogen and methane the factor depends on the full-scale flow of the meter.

Note
K factors are approximations at best, accurate to no better than about ±5 to 10 %. Do not rely on them where you need a better accuracy.

Gas	K	c_p cal/g	d g/L
A			
Acetylene C_2H_2	**0.5829**	0.4036	1.162
Air	**1.0000**	0.240	1.293
Allene (propadiene) C_3H_4	**0.4346**	0.352	1.787
Ammonia NH_3	**0.7310**	0.492	0.760
Argon, up to 10 sL/min Ar	**1.4573**	0.1244	1.782
Argon, above 10 sL/min Ar	**1.205**	0.1244	1.782
Arsine AsH_3	**0.6735**	0.1167	3.478
B			
Boron tribromide BBr_3	**0.38**	0.0647	11.18
Boron trichloride BCl_3	**0.4089**	0.1279	5.227
Boron trifluoride BF_3	**0.5082**	0.1778	3.025
Bromine Br_2	**0.8083**	0.0539	7.130
Bromine pentafluoride BrF_5	**0.26**	0.1369	7.803
Bromine trifluoride BrF_3	**0.3855**	0.1161	6.108
Bromotrifluoromethane (Freon-13B1) $CBrF_3$	**0.3697**	0.1113	6.644
1,3-Butadiene C_4H_6	**0.3224**	0.3514	2.413
Butane C_4H_{10}	**0.2631**	0.4007	2.593
1-Butene C_4H_8	**0.2994**	0.3648	2.503
cis-2-Butene C_4H_8	**0.324**	0.336	2.503
trans-2-Butene C_4H_8	**0.291**	0.374	2.503
C			
Carbon dioxide, up to 10 sL/min CO_2	**0.7382**	0.2016	1.964
Carbon dioxide, above 10 sL/min CO_2	**0.658**	0.2016	1.964
Carbon disulfide CS_2	**0.6026**	0.1428	3.397
Carbon monoxide CO	**1.00**	0.2488	1.250
Carbon tetrachloride CCl_4	**0.31**	0.1655	6.860
Carbon tetrafluoride (Freon-14) CF_4	**0.4210**	0.1654	3.926
Carbonyl fluoride COF_2	**0.5428**	0.1710	2.945
Carbonyl sulfide COS	**0.6606**	0.1651	2.680
Chlorine Cl_2	**0.86**	0.114	3.163
Chlorine trifluoride ClF_3	**0.4016**	0.1650	4.125
Chlorodifluoromethane (Freon-22) $CHClF_2$	**0.4589**	0.1544	3.858
Chloroform $CHCl_3$	**0.3912**	0.1309	5.326
Chloropentafluoroethane (Freon-115) C_2ClF_5	**0.2418**	0.164	6.892
Chlorotrifluoromethane (Freon-13) $CClF_3$	**0.3834**	0.153	4.660
Cyanogen C_2N_2	**0.61**	0.2613	2.322
Cyanogen chloride ClCN	**0.6130**	0.1739	2.742
Cyclopropane C_3H_6	**0.4584**	0.3177	1.877
D			
Deuterium D_2	**1.00**	1.722	1.799
Diborane B_2H_6	**0.4357**	0.508	1.235
Dibromodifluoromethane CBr_2F_2	**0.1947**	0.15	9.362
Dichlorodifluoromethane (Freon-12) CCl_2F_2	**0.3538**	0.1432	5.395
Dichlorofluoromethane (Freon-21) $CHCl_2F$	**0.4252**	0.140	4.592
Dichloromethylsilane $(CH_3)_2SiCl_2$	**0.2522**	0.1882	5.758
Dichlorosilane SiH_2Cl_2	**0.4044**	0.150	4.506
Dichlorotetrafluoroethane (Freon-114) $C_2Cl_2F_4$	**0.2235**	0.1604	7.626
1,1-Difluoroethylene (Freon-1132A) $C_2H_2F_2$	**0.4271**	0.224	2.857
Dimethyl ether $(CH_3)_2O$	**0.3896**	0.3414	2.055
Dimethylamine $(CH_3)_2NH$	**0.3714**	0.366	2.011
2,2-Dimethylpropane C_5H_{12}	**0.2170**	0.3914	3.219

Gas	K	c_p cal/g	d g/L
E			
Ethane C_2H_6	**0.50**	0.420	1.342
Ethanol C_2H_6O	**0.3918**	0.3395	2.055
Ethyl acetylene C_4H_6	**0.3225**	0.3513	2.413
Ethyl chloride C_2H_5Cl	**0.3891**	0.244	2.879
Ethylene C_2H_4	**0.60**	0.365	1.251
Ethylene oxide C_2H_4O	**0.5191**	0.268	1.965
F			
Fluorine F_2	**0.9784**	0.1873	1.695
Fluoroform (Freon-23) CHF_3	**0.4967**	0.176	3.127
Freon refrigerants are listed under their chemical names, with the Freon number in brackets: Freon-14, for example, under Carbon tetrafluoride.			
G			
Germane GeH_4	**0.5696**	0.1404	3.418
Germanium tetrachloride $GeCl_4$	**0.2668**	0.1071	9.565
H			
Helium, up to 10 sL/min He	**1.454**	1.241	0.1786
Helium, above 10–50 sL/min He	**2.05**	1.241	0.1786
Helium, above 50 sL/min He	**2.43**	1.241	0.1786
Hexafluoroethane (Freon-116) C_2F_6	**0.2421**	0.1834	6.157
Hexane C_6H_{14}	**0.1792**	0.3968	3.845
Hydrogen bromide HBr	**1.000**	0.0861	3.610
Hydrogen chloride HCl	**1.000**	0.1912	1.627
Hydrogen cyanide HCN	**0.764**	0.3171	1.206
Hydrogen fluoride HF	**0.9998**	0.3479	0.893
Hydrogen iodide HI	**0.9987**	0.0545	5.707
Hydrogen selenide H_2Se	**0.7893**	0.1025	3.613
Hydrogen sulfide H_2S	**0.80**	0.2397	1.520
Hydrogen, up to 10 sL/min H_2	**1.0106**	3.419	0.0899
Hydrogen, above 10–100 sL/min H_2	**1.35**	3.419	0.0899
Hydrogen, above 100 sL/min H_2	**1.9**	3.419	0.0899
I			
Iodine pentafluoride IF_5	**0.2492**	0.1108	9.90
Isobutane $CH(CH_3)_3$	**0.27**	0.3872	3.593
Isobutylene C_4H_8	**0.2951**	0.3701	2.503
K			
Krypton Kr	**1.453**	0.0593	3.739
M			
Methane, up to 10 sL/min CH_4	**0.7175**	0.5328	0.715
Methane, above 10 sL/min CH_4	**0.75**	0.5328	0.715
Methanol CH_3OH	**0.5843**	0.3274	1.429
Methyl acetylene C_3H_4	**0.4313**	0.3547	1.787
Methyl bromide CH_3Br	**0.5835**	0.1106	4.236
Methyl chloride CH_3Cl	**0.6299**	0.1926	2.253
Methyl fluoride CH_3F	**0.68**	0.3221	1.518
Methyl mercaptan CH_3SH	**0.5180**	0.2459	2.146
Methyltrichlorosilane $(CH_3)SiCl_3$	**0.2499**	0.164	6.669
Molybdenum hexafluoride MoF_6	**0.2126**	0.1373	9.366
Monoethylamine $C_2H_5NH_2$	**0.3512**	0.387	2.011
Monomethylamine CH_3NH_2	**0.51**	0.4343	1.386
N			
Neon Ne	**1.46**	0.246	0.900
Nitric oxide NO	**0.990**	0.2328	1.339
Nitrogen N_2	**1.000**	0.2485	1.25
Nitrogen dioxide NO_2	**0.737**	0.1933	2.052
Nitrogen trifluoride NF_3	**0.4802**	0.1797	3.168
Nitrosyl chloride NOCl	**0.6134**	0.1632	2.920
Nitrous oxide N_2O	**0.7128**	0.2088	1.964
O			
Octafluorocyclobutane (Freon-C318) C_4F_8	**0.176**	0.185	8.397
Oxygen O_2	**0.9926**	0.2193	1.427
Oxygen difluoride OF_2	**0.6337**	0.1917	2.406
Ozone O_3	**0.446**	0.195	2.144
P			
Pentaborane B_5H_9	**0.2554**	0.38	2.816
Pentane C_5H_{12}	**0.2134**	0.398	3.219
Perchloryl fluoride ClO_3F	**0.3950**	0.1514	4.571
Perfluoropropane C_3F_8	**0.174**	0.197	8.388
Phosgene $COCl_2$	**0.4438**	0.1394	4.418
Phosphine PH_3	**0.759**	0.2374	1.517
Phosphorus oxychloride $POCl_3$	**0.36**	0.1324	6.843
Phosphorus pentafluoride PF_5	**0.3021**	0.1610	5.620
Phosphorus trichloride PCl_3	**0.30**	0.1250	6.127
Propane C_3H_8	**0.35**	0.399	1.967
Propylene C_3H_6	**0.40**	0.366	1.877
S			
Silane SiH_4	**0.5982**	0.3189	1.433
Silicon tetrachloride $SiCl_4$	**0.284**	0.1270	7.580
Silicon tetrafluoride SiF_4	**0.3482**	0.1691	4.643
Sulfur dioxide SO_2	**0.69**	0.1488	2.858
Sulfur hexafluoride SF_6	**0.2635**	0.1592	6.516
Sulfuryl fluoride SO_2F_2	**0.3883**	0.1543	4.562

Gas	K	c_p cal/g	d g/L
T			
Tetrafluoroethane (R-134a) CF_3CH_2F	**0.5096**	0.127	4.224
Tetrafluorohydrazine N_2F_4	**0.3237**	0.182	4.64
Titanium tetrachloride $TiCl_4$	**0.2691**	0.120	8.465
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) CCl_2FCClF_2	**0.2031**	0.161	8.36
Trichloroethylene C_2HCl_3	**0.32**	0.163	5.95
Trichlorofluoromethane (Freon-11) CCl_3F	**0.3287**	0.1357	6.129
Trichlorosilane $SiHCl_3$	**0.3278**	0.1380	6.043
Triisobutylaluminium $(C_4H_9)_3Al$	**0.0608**	0.508	8.848
Trimethylamine $(CH_3)_3N$	**0.2792**	0.3710	2.639
Tungsten hexafluoride WF_6	**0.2541**	0.0810	13.28
V			
Vinyl bromide CH_2CHBr	**0.4616**	0.1241	4.772
Vinyl chloride CH_2CHCl	**0.48**	0.12054	2.788
X			
Xenon Xe	**1.44**	0.0378	5.858

APPENDIX B

Dimensions

The drawings show what each letter measures; the tables give the values in millimetres, with inches in brackets. The drawings are not to scale. Designs and dimensions can change; for certified drawings of your configuration, ask Analyt-MTC.

GFM17, GFM37 and GFM47

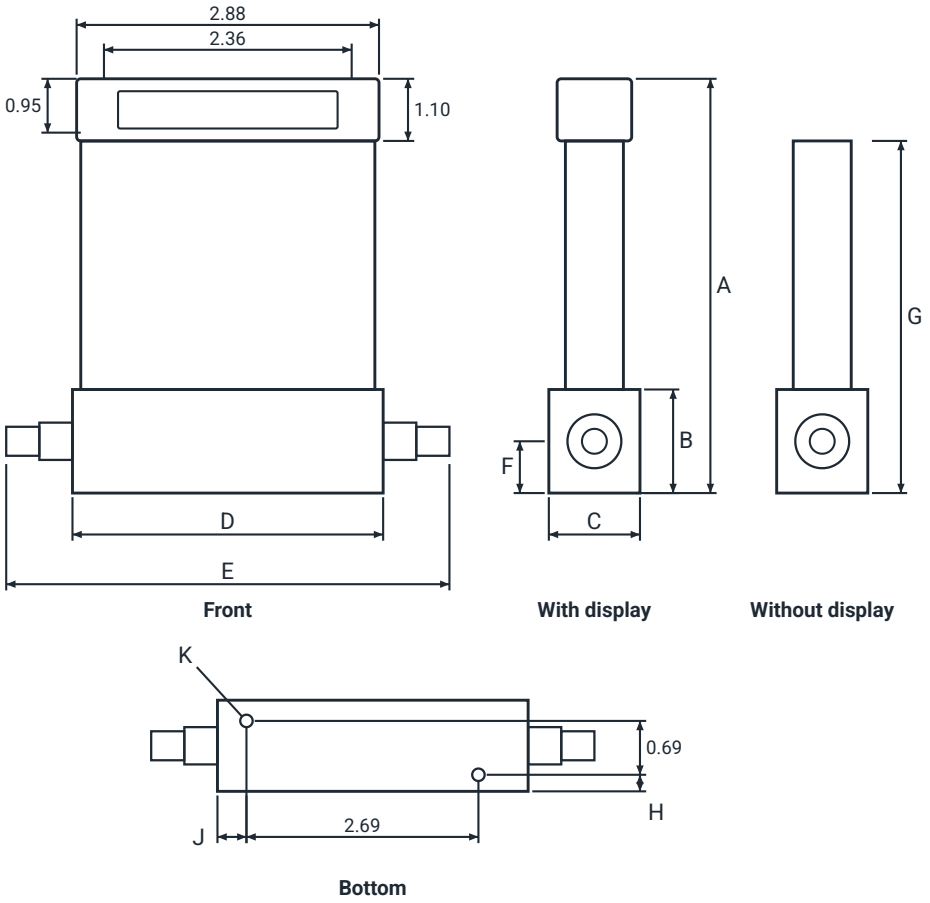


Figure B-1. GFM17, GFM37 and GFM47: front, side and bottom views. Values on the drawing in inches.

Table B-1 Dimensions of the GFM17, GFM37 and GFM47, mm (in)

Dimension	GFM17	GFM37	GFM47
Process connections, compression	1/4 in tube	1/4 in tube	3/8 in tube
A Height with display	145.3 (5.72)	154.9 (6.10)	154.9 (6.10)
B Height of the base block	25.4 (1.00)	34.9 (1.38)	34.9 (1.38)
C Width of the base block	28.6 (1.13)	31.8 (1.25)	31.8 (1.25)
D Length of the base block	78.6 (3.09)	104.8 (4.13)	104.8 (4.13)
E Length over the fittings	129.6 (5.10)	155.8 (6.13)	158.7 (6.25)
F Height of the fitting centre	12.7 (0.5)	15.9 (0.63)	15.9 (0.63)
G Height without display	117.1 (4.61)	126.7 (4.99)	126.7 (4.99)
H Mounting hole from the side	4.0 (0.16)	7.1 (0.28)	7.1 (0.28)

Dimension	GFM17	GFM37	GFM47
J Mounting hole from the inlet end	4.0 (0.16)	27.3 (1.08)	27.3 (1.08)
K Mounting thread and depth	6-32, 0.13 in deep	6-32, 0.10 in deep	6-32, 0.10 in deep

GFM57, GFM67 and GFM77

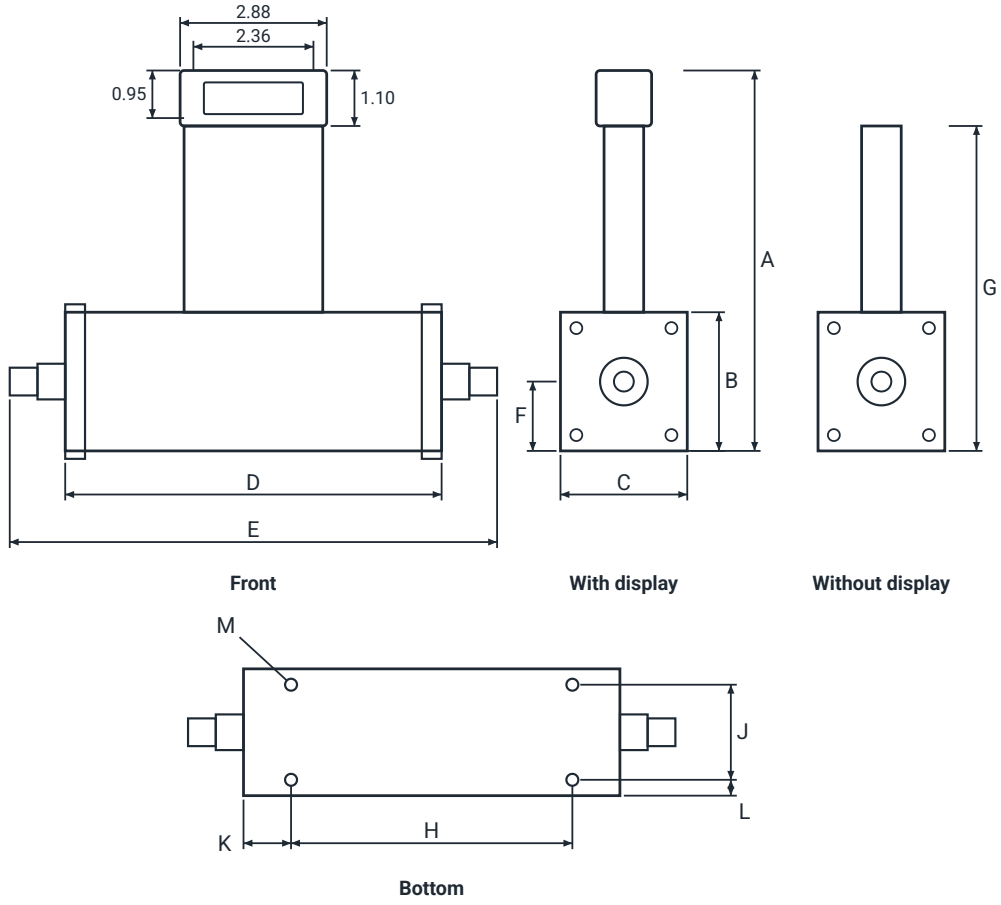


Figure B-2. GFM57, GFM67 and GFM77: front, side and bottom views. Values on the drawing in inches.

Table B-2 Dimensions of the GFM57, GFM67 and GFM77, mm (in)

Dimension	GFM57	GFM67	GFM77
Process connections	3/8 in tube, compression	1/2 in tube, compression	3/4 in NPT female
A Height with display	170.8 (6.73)	194.0 (7.64)	220.0 (8.66)
B Height of the flow body	2.00 in	76.2 (3.00)	101.6 (4.00)
C Width of the flow body	44.5 (1.75)	76.2 (3.00)	101.6 (4.00)
D Length of the flow body	169.8 (6.69)	184.2 (7.25)	185.4 (7.30)
E Length over the fittings	223.7 (8.81)	245.1 (9.65)	—
F Height of the fitting centre	22.2 (0.88)	38.1 (1.5)	50.8 (2.00)
G Height without display	142.6 (5.62)	165.8 (6.53)	191.8 (7.55)
H Mounting hole spacing, lengthwise	119.0 (4.69)	171.5 (6.75)	172.7 (6.80)
J Mounting hole spacing, across	35.3 (1.39)	57.2 (2.25)	76.2 (3.00)
K Mounting hole from the end	25.4 (1.00)	6.4 (0.25)	6.4 (0.25)
L Mounting hole from the side	4.6 (0.18)	9.5 (0.38)	12.7 (0.50)
M Mounting thread and depth	10-24, 0.25 in deep	1/4-20, 0.35 in deep	1/4-20, 0.35 in deep

APPENDIX C

Circuit board layout

The component layout of the GFM circuit board. The designators are those printed on the board; the adjustment points you use are described in Adjustment points (p. 8).

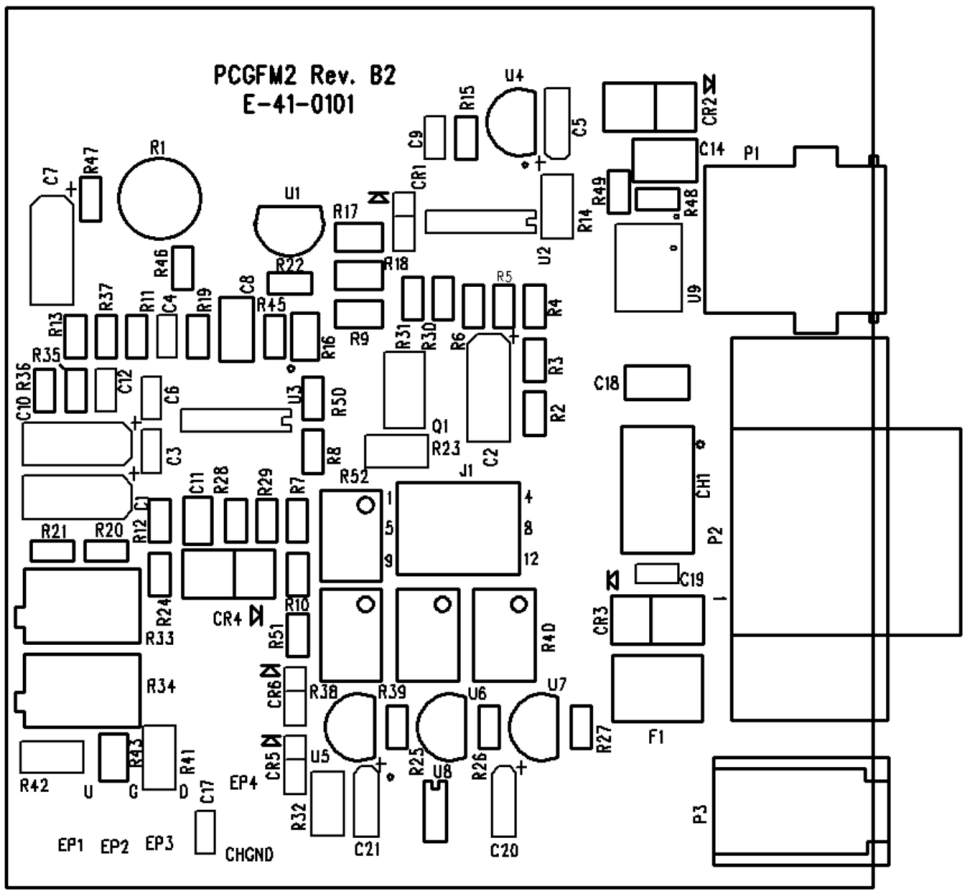


Figure C-1. GFM circuit board.

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