ANALYT MESSTECHNIK



OPERATING MANUAL

GFC Mass Flow Controller

Installation, wiring, operation, calibration and maintenance of GFC17, GFC37, GFC47, GFC57, GFC67 and GFC77 thermal mass flow controllers.

AMTC-MN-0011

Rev. 2 · October 2026

About this manual

This manual explains how to install, wire, operate, calibrate and maintain GFC mass flow controllers. It covers all six models: the GFC17, GFC37 and GFC47 with a proportional solenoid valve, and the GFC57, GFC67 and GFC77 with a motorized valve, in aluminium and in stainless steel.

Read Safety (p. 6) before you install the controller. If you are setting up a new controller, follow the chapters in order: Installation (p. 11), Commissioning (p. 15), then Operation (p. 16). The Specifications (p. 32) and the gas conversion factors in Appendix A (p. 39) are reference material you can turn to at any time.

For service, calibration, repairs and technical questions, contact Analyt-MTC. The contact details are in Service, warranty and contacts (p. 37) 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.

⚠ CAUTION

A hazardous situation which, if not avoided, could result in minor or moderate 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 controller 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. 23).
- Pressures are gauge pressures in bar unless marked absolute; where useful, the value in psi follows in brackets.
- Pin numbers, such as “pin 12”, refer to the 15-pin D connector (pin assignment (p. 13)).
- Potentiometers and jumpers are named as printed on the circuit boards: R34, R33, NJ1 and so on (adjustment points (p. 9)).

Abbreviations

Abbreviation	Meaning
EPR	Ethylene propylene rubber
FFKM	Perfluoroelastomer
FKM	Fluoroelastomer
LCD	Liquid-crystal display
NBR	Nitrile rubber

Document information

Title	GFC Mass Flow Controller — Operating manual
Document number	AMTC-MN-0011
Revision	Rev. 2 — October 2026
Applies to	GFC17, GFC37, GFC47, GFC57, GFC67, GFC77 and their stainless-steel versions (suffix S)
Language	English

Revision history

Rev.	Date	Change
2	October 2026	Quality programme: new document type, number and identity pages.
1	October 2026	First issue.

Information in this manual is subject to change without notice. VCR® is a registered trademark of its owner. © 2026 ANALYT-MTC Messtechnik GmbH. All rights reserved.

Contents

1 Safety 6
Intended use 6
Before you start 6

2 Product description 8
The GFC models 8
How the GFC measures and controls 8
Display and indicators 8
Adjustment points 9
Supplied items and accessories 10

3 Installation 11
Unpacking and inspection 11
Gas quality 11
Location and orientation 11
Connecting the gas lines 11
Remote and panel-mounted display 12
Electrical connections 12
Before you wire 12
Power supply 12
Pin assignment 13
Fuse protection 14
Valve control configuration 14

4 Commissioning 15
Warm-up and zero check 15

5 Operation 16
Reading the flow 16
Flow above full scale 16
Setting the flow 16
Closing the valve: valve off 17
Opening the valve fully: purge 17
Motorized valve behaviour (GFC57, GFC67, GFC77) 18

6 Calibration and verification 19
Before you start 19
Checking zero and span 20
Linearity adjustment, GFC17/37/47 20
Linearity adjustment, GFC57/67/77 22
Display scaling 23
Gas conversion factors 23

7 **Maintenance** 25
What needs maintenance 25
Cleaning the flow path 25
Cleaning the inlet filter (GFC17) 25
Solenoid valve (GFC17, GFC37, GFC47) 26

8 **Troubleshooting** 28
First checks 28
Fault finding 28
Valve adjustment procedures (GFC17, GFC37, GFC47) 29
Technical support 31

9 **Specifications** 32
Performance 32
Electrical 32
Materials and connections 33
Flow ranges 33
Pressure drop 34

10 **Ordering information** 35
Accessories 35
Controllers 35

11 **Service, warranty and contacts** 37
Contact 37
Sending in a controller 37
Warranty 38
Disposal 38

A **Gas conversion factors** 39

B **Dimensions** 42
GFC17 42
GFC37 and GFC47 43
GFC57 44
GFC67 and GFC77 44

C **Circuit board layout** 46

CHAPTER 1

Safety

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

Intended use

The GFC measures and controls the mass flow of clean, dry gases. It is not designed for liquids: never let liquid enter the controller. Contaminated gases must be filtered before they reach it, because particles block the sensor tube and the flow passages.

The protection built into the controller works only when it is installed and operated the way this manual describes. If your application calls for anything else, agree it in writing with Analyt-MTC first.

⚠ WARNING

The GFC is not intended for life-support applications. There, a failure or a wrong flow could endanger a person's life or health. Do not use the GFC where its failure or a wrong flow could endanger anyone.

Before you start

Keep these points in mind whenever you install, wire, adjust or service the controller.

⚠ CAUTION

On the GFC17, GFC37 and GFC47, the solenoid valve can become hot when it controls or stays open (purge) for a long time. Touching it then can burn you. Avoid touching the valve during operation.

NOTICE

Wiring the controller or changing jumpers with the power on can damage the electronics. Switch the power off before you connect or disconnect any cable, and before you move an NJ1 jumper.

NOTICE

Exceeding the maximum supply voltage damages the controller permanently. Never connect more than 15 V DC to a controller labelled 12 V DC. Never connect 24 V DC to a controller that was not ordered and configured for 24 V DC.

NOTICE

Some components are sensitive to electrostatic discharge, which can damage them. Wear a grounded wrist strap when you wire, adjust or service the controller. While the 15-pin connector is not in use, leave its protective cover in place.

- **Gas compatibility.** You choose the model and its wetted materials (body, seals, valve seat) for your gas. Check that they are compatible before you start; the materials are listed in Materials and connections (p. 33).
- **Oxygen.** You decide whether the instrument is suitable for your oxygen application. If oxygen cleaning is required, specify it when you order.
- **Decontamination.** Purge any controller 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. 19)).

CHAPTER 2

Product description

The GFC models

The GFC is a thermal mass flow controller: it measures the mass flow of a gas and drives a built-in valve to hold that flow at the set point you choose. The six models differ in flow range and valve type. Each comes with an anodized aluminium body or, with the suffix S (GFC17S … GFC77S), in stainless steel. Models with a built-in display carry a 1 after the model number (GFC171 … GFC771).

Model	Full-scale flow (N_2)	Control valve
GFC17	10 smL/min–10 sL/min	Proportional solenoid valve, normally closed
GFC37	15–50 sL/min	
GFC47	60–100 sL/min	
GFC57	200 sL/min	Motorized valve
GFC67	500 sL/min	
GFC77	1000 sL/min	

The full list of ranges and their codes is in Flow ranges (p. 33). The range and the gas your controller is calibrated for are printed on its front label.

How the GFC measures and controls

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.

Two precision-wound coils on the sensor tube heat it. 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.

The control circuit compares this flow signal with the set point all the time and opens or closes the valve to remove any difference. The GFC17, GFC37 and GFC47 use a proportional solenoid valve, which closes when it has no power. The GFC57, GFC67 and GFC77 use a motorized valve, which stays where it is when the power fails (see Motorized valve behaviour (p. 18)).

Display and indicators

On the models with a built-in display (GFC171 … GFC771), a 3½-digit LCD sits in the upper block of the controller and tilts through 90 degrees for easier reading. A remote or panel-mounted display is optional (Remote and panel-mounted display (p. 12)). The display reads the actual flow in engineering units and does not show the set point (Reading the flow (p. 16)).

On the GFC57, GFC67 and GFC77, two lights on top of the controller show the state of the valve: green when the valve is commanded to close, red when it is open in purge (Opening the valve fully: purge (p. 17)).

Adjustment points

All settings are made from the back of the controller, through access windows, with an insulated screwdriver. You do not need to open the instrument. The potentiometers and jumpers are:

Item	Function	Used in
NR7	Local set point potentiometer	Local set point (p. 16)
R34	Zero	Warm-up and zero check (p. 15), calibration
R33	Span (calibration at 10 or 25 % on GFC17/37/47, 25 % on GFC57/67/77)	Checking zero and span (p. 20), linearity
R52	25 % linearity point (GFC17/37/47, when enabled)	Linearity adjustment, GFC17/37/47 (p. 20)
R38, R39, R40	50 %, 75 % and 100 % linearity points	Linearity adjustment
R1	Response time (no field procedure in this manual)	—
NJ1	Control-circuit jumpers: local or remote set point, signal type, 2 % cut-off	Valve control configuration (p. 14)
J1A … J1D	Linearizer jumpers	Linearity adjustment

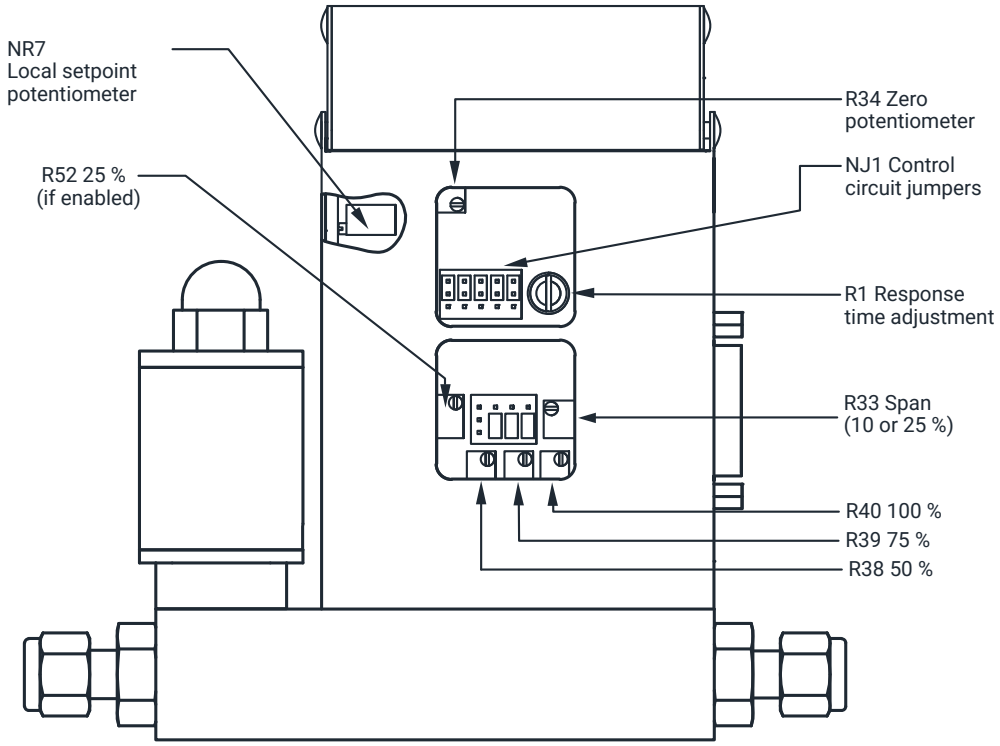


Figure 2-1. Adjustment points of the GFC17, GFC37 and GFC47 (back of the controller).

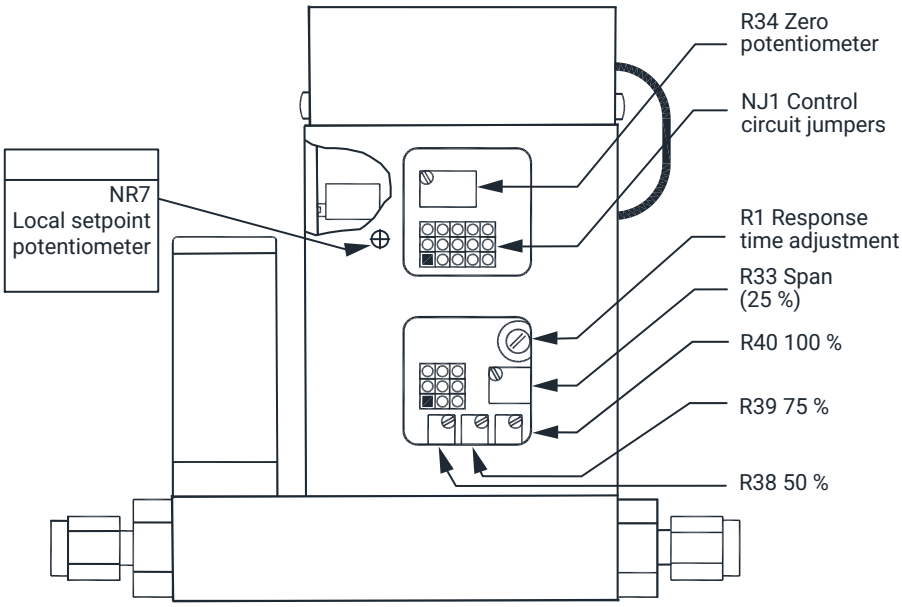


Figure 2-2. Adjustment points of the GFC57, GFC67 and GFC77 (back of the controller).

Supplied items and accessories

The controller is delivered with the items on its packing list. Check them when you unpack it (Unpacking and inspection (p. 11)). Accessories include a remote or panel-mounted display, a shielded interface cable, power supplies, the totaliser and I/O module (TIO), a universal baseplate and a transport case (Accessories (p. 35)).

CHAPTER 3

Installation

Unpacking and inspection

The controller 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 controller 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. Keep the protective cover on the 15-pin connector until you wire the controller.

To send a controller back to Analyt-MTC for repair or calibration, follow Sending in a controller (p. 37).

Gas quality

Only clean gases may enter the controller. The sensor is a fine capillary tube that particles, condensate or crystallizing gas components block easily. Filter any gas that may carry contaminants, and never let liquid into the controller. An inlet filter screen protects the GFC17 (50 µm), GFC37 and GFC47 (60 µm), but it is a last line of defence, not a substitute for a clean gas supply.

⚠ WARNING

A controller that is not suitable or not cleaned for oxygen service can cause damage or personal injury when it is used with oxygen. It is your responsibility to decide whether the controller is suitable for your oxygen application. Do not use the controller with oxygen until you have confirmed that it is suitable. If your application requires it, specify oxygen cleaning when you order.

Location and orientation

Mount the controller with its flow path horizontal. It is calibrated in this position and tolerates a tilt of up to ±15°. If you have to mount it 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 controller away from vibration, heat, corrosive atmospheres and strong radio-frequency or magnetic fields.

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 controller 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.

NOTICE

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

4. Tighten each 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 controller is leak-tested before shipment to the limits in Performance (p. 32).

Leave the compression fittings on the controller once they are installed. Remove them only to clean the flow path or to recalibrate the controller for a new flow range.

Remote and panel-mounted display

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

- **Remote display.** The display sits in its own housing, which also serves as its mounting block, on a 3 ft cable. For longer 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 fixes it in a rectangular panel cut-out with two plastic screws. Cut the panel as shown in Figure 3-1.

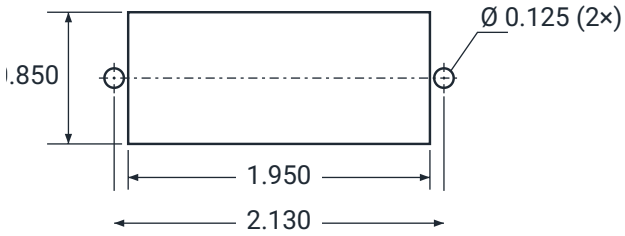


Figure 3-1. Panel cut-out for the panel-mount display. Dimensions in inches; the two fixing holes are centred on the cut-out's height.

Electrical connections

Before you wire

Power, the analogue signals and the valve commands all pass through the 15-pin D connector on the side of the controller. A controller without a built-in display needs a panel meter, a digital multimeter or a similar instrument connected to its output to show the flow.

NOTICE

Wiring the controller or changing jumpers with the power on can damage the electronics. Switch the power off before you connect or disconnect any cable, and before you move an NJ1 jumper.

NOTICE

Some components are sensitive to electrostatic discharge, which can damage them. Wear a grounded wrist strap when you wire, adjust or service the controller. While the 15-pin connector is not in use, leave its protective cover in place.

Power supply

Depending on the model you ordered, the controller runs on 12 V DC, on 24 V DC, or (GFC17, GFC37 and GFC47 only) on any voltage from 12 to 26 V DC. The power label on the back cover states which. Read it before you connect a supply.

Models	Supply voltage	Current, max.
GFC17, GFC37, GFC47	12 V DC, 24 V DC or universal 12–26 V DC	650 mA
GFC57, GFC67, GFC77	12 V DC or 24 V DC	800 mA

NOTICE

Exceeding the maximum supply voltage damages the controller permanently. Never connect more than 15 V DC to a controller labelled 12 V DC. Never connect 24 V DC to a controller that was not ordered and configured for 24 V DC.

If one power supply feeds several controllers, choose one whose current rating covers all of them.

Pin assignment

Pin	Function
1	Common, 0–5 V DC flow signal
2	0–5 V DC flow signal output
3	Common
4	Valve open (purge)
5	Common, power supply
6	Unassigned
7	Power supply +12 V DC (+24 V DC on 24 V DC models)
8	Remote set point input
9	4–20 mA flow signal return (–), use with pin 14
10	Remote set point common, use with pin 8
11	+5 V DC reference output for a remote set point
12	Valve off
13	Auxiliary power output +12 V DC (+24 V DC on 24 V DC models), loads below 100 mA
14	4–20 mA flow signal output (+)
15	Chassis ground

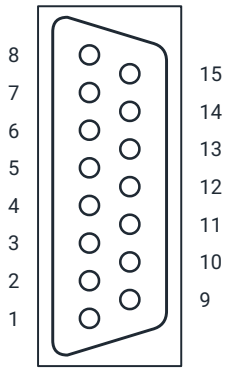


Figure 3-2. Pin numbering of the 15-pin D connector on the controller.

Table 3-1 Connections by function

Pins	Function
7 (+) and 5 (–)	Power supply
2 (+) and 1 (–)	0–5 V DC flow signal output
14 (+) and 9 (–)	4–20 mA flow signal output; sourcing, for passive loads only
8 (+) and 10 (–)	Remote set point, 0–5 V DC or 4–20 mA (from a 3-wire loop-sourcing device)
11 (+) and 10 (–)	+5 V DC reference for a remote set point potentiometer
4 and 3	Purge: connect to open the valve fully
12 and 3	Valve off: connect to close the valve
13 (+) and 5 (–)	Auxiliary power output, loads below 100 mA

NOTICE

Most D connectors share the same pin numbering, but some mating connectors are numbered differently. A cable wired by those numbers connects signals to the wrong pins, and the controller does not work correctly. Wire by function, matching the table above, whatever numbers your mating connector shows. Take the same care when you connect cables made for other manufacturers' instruments.

Keep the signal common and the power-supply common at the same potential. Different commons create a ground loop, and the flow reading then no longer matches the set point.

Fuse protection

The power input is protected by a resettable, medium time-lag fuse: 900 mA on the GFC17, GFC37 and GFC47, 1600 mA on the GFC57, GFC67 and GFC77. A short circuit or reversed polarity trips it and cuts the power to the controller. To reset it, disconnect the power, remove the fault and reconnect the power.

NOTICE

The fuse does not protect the controller against a supply voltage above the maximum for its model, and such a voltage damages the controller permanently. Never connect a supply voltage above the maximum for your model.

Valve control configuration

The NJ1 jumpers on the back of the controller (Figure 2-1 (p. 9) and Figure 2-2 (p. 10)) set three options:

- **Local or remote set point** — the built-in potentiometer or an external signal.
- **Set point signal** — 0–5 V DC or 4–20 mA; remote set point only.
- **2 % cut-off** — when it is on, the valve loses power, and so closes, whenever the set point is below 2 % of full scale. The cut-off is not available on the GFC57, GFC67 and GFC77.

Controllers leave the factory set for a local set point with the 2 % cut-off off.

Table 3-2 NJ1 jumper positions

Set point	Cut-off	NJ1A	NJ1B	NJ1C	NJ1D	NJ1E
Remote, 0–5 V DC	On	2–3	5–6	8–9	10–11	13–14
	Off	2–3	5–6	8–9	10–11	14–15
Remote, 4–20 mA	On	1–2	4–5	7–8	10–11	13–14
	Off	1–2	4–5	7–8	10–11	14–15
Local	On	2–3	5–6	8–9	11–12	13–14
	Off (default)	2–3	5–6	8–9	11–12	14–15

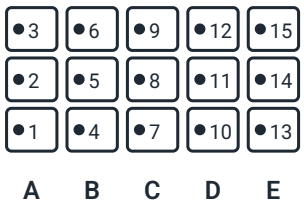


Figure 3-3. NJ1 header: five jumper positions, A to E, each with three pins. "2–3" means the jumper links pins 2 and 3.

NOTICE

Changing jumpers with the power on can damage the electronics. Change jumpers only with the power off. After changing to a remote set point, apply the signal type the jumpers are set for.

CHAPTER 4

Commissioning

Warm-up and zero check

Start with a controller that is installed and leak-tested as described in Installation (p. 11).

1. Shut off the gas supply to the controller.
2. Check the power label on the back cover, then switch on the power supply connected to the 15-pin connector (Power supply (p. 12)).
3. Let the controller 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. The reading falls back to zero within a few minutes.

   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 controller 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 its access window until the reading is zero.

CHAPTER 5

Operation

Reading the flow

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. 13)):

- **Display** — reads directly in engineering units, for example 0–10 smL/min or 0–100 sL/min. For a 0–100 % display, ask Analyt-MTC. The display shows the actual flow only; there is no separate set point display.
- **0–5 V DC output** — pins 2 (+) and 1 (−).
- **4–20 mA output** — pins 14 (+) and 9 (−).

The full-scale range and the gas your controller is calibrated for are printed on its front label.

Controllers are calibrated on the 0–5 V DC signals unless you order otherwise. If you use the 4–20 mA output of such a controller, the flow itself is still controlled within the specified accuracy (±1.0 % of full scale on the GFC17/37/47, ±1.5 % of full scale on the GFC57/67/77), but the output reading can deviate by up to ±2.5 % of full scale. For a calibration on the 4–20 mA signals, ask Analyt-MTC.

Flow above full scale

When the flow exceeds 110 % of full scale, the sensor can saturate, a temporary condition called swamping: readings are then no longer accurate or linear. Reduce the flow to the calibrated range and the readings return to normal. The longer the controller runs above 110 %, the longer the sensor may take to recover.

Setting the flow

The set point can be any value within the controller's range. It is linear: 0–5 V DC (or 4–20 mA) corresponds to 0–100 % of the full-scale flow. After a set point change between 25 and 100 % FS, the flow settles within 2 % of its final value in about 1 second on the GFC17, 2 seconds on the GFC37 and GFC47, and 5 seconds on the GFC57, GFC67 and GFC77.

The NJ1 jumpers decide whether the set point comes from the built-in potentiometer or from an external signal (Valve control configuration (p. 14)). The factory setting is the local set point.

Local set point

The local set point potentiometer NR7 is on the same side of the controller as the valve. With gas flowing, turn it with an insulated screwdriver until the display or output shows the flow you want.

Remote set point

NOTICE

Wiring the controller or changing jumpers with the power on can damage the electronics. Switch the power off before you move the NJ1 jumpers and before you connect the set point signal or potentiometer.

For a remote set point, set the NJ1 jumpers to remote and connect one of the following:

- **An analogue signal** of 0–5 V DC or 4–20 mA, whichever the jumpers are set for, to pins 8 (+) and 10 (–).
- **An external potentiometer** of 5 to 10 kΩ, with at least 10 turns, supplied from the controller's regulated +5 V DC reference on pin 11, as shown in Figure 5-1. Turning it clockwise raises the set point.

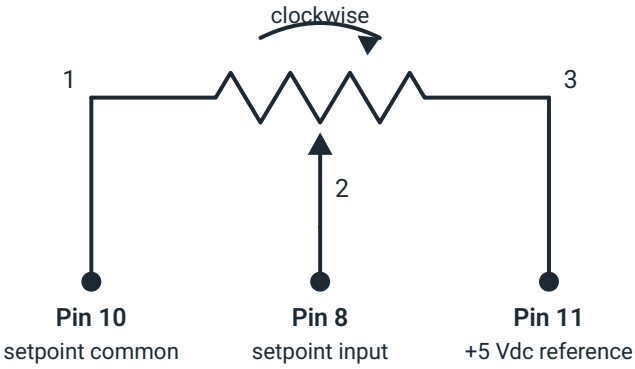


Figure 5-1. Wiring an external set point potentiometer.

Closing the valve: valve off

You can close the valve, and open it again, without touching the set point. Connect pin 12 (valve off) to pin 3 (common):

- On the GFC17, GFC37 and GFC47 the solenoid valve loses power and closes, whatever the set point.
- On the GFC57, GFC67 and GFC77 the motorized valve is commanded to close; a green light on top of the controller shows the close command.

A toggle switch between pins 12 and 3 is all you need for manual control. For automatic control, drive pin 12 from an open-collector NPN output, for example a DC output of a programmable logic controller (PLC). When nothing pulls pin 12 to common, the valve follows the set point again.

Opening the valve fully: purge

⚠ CAUTION

On the GFC17, GFC37 and GFC47, the solenoid valve can become hot when it controls or stays open (purge) for a long time. Touching it then can burn you. Avoid touching the valve during operation.

NOTICE

On the GFC17, GFC37 and GFC47, leaving the valve controlling or in purge for long periods without gas flow can shift the calibration by up to 2 % FS. Even a small set point (2 %, for example) with the inlet pressure disconnected overheats the valve within 15 minutes, and its seat and spring lose their adjustment (Valve adjustment procedures (p. 29)). Do not leave the valve controlling or in purge without gas flowing through the controller.

To purge the gas system, for example with clean, dry nitrogen, the valve can be opened fully whatever the set point. Connect pin 4 (purge) to pin 3 (common). On the GFC57, GFC67 and GFC77 a red light on top of the controller shows that the valve is open.

Motorized valve behaviour (GFC57, GFC67, GFC77)

Unlike the solenoid valve, the motorized valve does not close when it loses power: it stays in the position it had when the power went off. When the power returns, the valve closes within the first 10 seconds, regardless of the set point and of the purge and valve-off inputs. To close a motorized valve that was left open in purge, connect pins 3 and 12.

NOTICE

After a power failure, a motorized valve can remain open and gas keeps flowing. It is your responsibility to provide a way of shutting off the gas when the power fails, for example a separate valve that closes on power loss.

CHAPTER 6

Calibration and verification

Controllers 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 GFC controllers, including calibrations for a specific gas and 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. 37)).

If you calibrate yourself, have the work done by qualified staff with suitable equipment. In the field you can only recalibrate a controller for the range it was originally calibrated for. A new flow range may need a different restrictor flow element (RFE) and, on the GFC17, GFC37 and GFC47, a different valve orifice (Valve orifices (p. 34)).

Note
Every adjustment described in this chapter changes the calibration of the controller. Breaking the factory calibration seals or adjusting the controller can affect the calibration warranty, and the Analyt-MTC terms apply (Warranty (p. 38)). Ask Analyt-MTC before you start.

NOTICE

Some components are sensitive to electrostatic discharge, which can damage them. Wear a grounded wrist strap when you adjust or service the controller.

Equipment

- A flow calibration standard at least four times more accurate than the controller.
- 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 controller.
- 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.

Connections and warm-up

1. Connect the multimeter to the flow signal output: pins 2 (+) and 1 (−) for 0–5 V DC, or pins 14 (+) and 9 (−) for 4–20 mA.
2. If you use a remote set point, connect it to pins 8 (+) and 10 (−).
3. Power the controller for at least 30 minutes before you begin.

The potentiometers are shown in Adjustment points (p. 9). All adjustments are made through the access windows; you do not need to open the controller.

Checking zero and span

This check is the same on all models.

1. **Zero.** Shut off the gas and disconnect the gas supply so that nothing can seep in.
2. Turn R34 until the output reads 0 V DC (4 mA).
3. **Span.** Reconnect the gas supply and set the set point to 100 %.
4. Compare the flow with the flow standard.
5. If it deviates by less than ±10 % of full scale, turn R33 until the deviation disappears.
6. If it deviates by more than ±10 %, the controller probably has a fault. Common causes are a blocked or contaminated sensor tube, a leak in the controller 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. 28)).
7. If the deviation persists, return the controller to Analyt-MTC.
8. 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 for your model.

Linearity adjustment, GFC17/37/47

The linearity is adjusted in two passes. First the controller works as a flow meter with its valve held open, and you set the flow with the upstream regulator. Then you check the result in control mode.

Pass 1: flow meter mode

> **⚠ CAUTION**
>
> The solenoid valve can become hot when it stays open for a long time. Touching it then can burn you. Avoid touching the valve.

1. Put the valve in purge (connect pins 4 and 3). The controller now measures without controlling.
2. Connect the multimeter and warm up the controller (Connections and warm-up (p. 19)).
3. If you are calibrating for a new range or a different gas, first remove any jumpers from J1A, J1B, J1C and J1D.
4. **Zero.** Shut off and disconnect the gas supply.

> **NOTICE**
>
> At zero flow the 0–5 V DC output may not fall below 7 to 25 mV. Turning R34 further creates a negative zero shift, which you cannot see on a controller without a display. If the output stops falling in that range, stop turning R34.

5. Turn R34 until the display and the output read zero: 0 V DC (4 mA).
6. **25 % with R33.** Reconnect the gas.
7. With the flow regulator, set 25 % of full scale on the flow standard.
8. Turn R33 until the output reads 1.25 V DC ±63 mV (8.0 mA ±0.25 mA).
9. **Check 10 %.** With the regulator, reduce the flow until the output reads 0.50 V DC (5.6 mA).
10. If the flow standard now reads 10 % ±1.0 % of full scale, skip steps 11 to 14 and go to step 15.

11. **10 % with R33.** Set 10 % of full scale on the flow standard.
12. Turn R33 until the output reads 0.50 V DC ±63 mV (5.6 mA ±0.25 mA).
13. **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).
14. If it does not, fit the J1A jumper in the increase or decrease position as needed (Table 6-2) and turn R52 until the reading is within tolerance.
15. **50 %, 75 % and 100 %.** Raise the flow to each point of Table 6-1 in turn.
16. 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.
17. Repeat steps 6 to 16 at least once more.

Table 6-1 Linearity points, GFC17/37/47

Flow	0–5 V DC	4–20 mA	Jumper	Adjust
10 %	0.50 V	5.6 mA	—	R33
25 %	1.25 V	8.0 mA	J1A	R52 (or R33)
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 in pass 1: ±63 mV or ±0.25 mA.

Table 6-2 Linearizer jumpers, GFC17/37/47

Jumper	Decrease	Increase
J1A (10 or 25 %)	1–2	2–3
J1B (50 %)	4–5	5–6
J1C (75 %)	7–8	8–9
J1D (100 %)	10–11	11–12

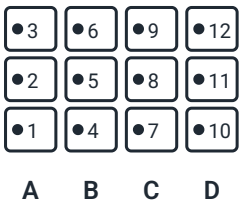


Figure 6-1. J1 header, GFC17/37/47: four jumper positions, A to D, each with three pins.

Valve adjustment

1. End the purge (disconnect pins 4 and 3) so that the valve is closed.
2. Apply an inlet pressure of 5 psig, with the outlet open to atmosphere.
3. If gas still flows, turn the adjusting screw on top of the solenoid valve clockwise until the flow just stops.

Pass 2: control mode

1. Open the upstream flow regulator fully.
2. Raise the inlet pressure to 20 psig; on the GFC47, to 25 psig.
3. **Full scale.** Apply a set point of 5.00 V DC (100 %).
4. Check the flow on the flow standard and, if needed, turn R33 until it matches the full-scale flow. In control mode, turning R33 clockwise reduces the flow; counter-clockwise increases it.
5. **10 % and 25 % with R33 and R52.** Only if you adjusted the 10 % point in pass 1 (steps 11 to 14); otherwise go to step 7.
6. Apply 0.50 V DC (10 %) and adjust R33, then apply 1.25 V DC (25 %) and adjust R52.

7. **25 % with R33.** Apply 1.25 V DC (25 %) and adjust R33.
8. **50 %, 75 % and 100 %.** Apply 2.50 V DC and adjust R38, 3.75 V DC and adjust R39, then 5.00 V DC and adjust R40.
9. At each point, the flow must be within ±0.75 % of full scale of the set point. Repeat steps 5 to 8 at least once more.

Linearity adjustment, GFC57/67/77

The procedure follows the same two passes as for the GFC17/37/47, with three linearizer jumpers and without a 10 % point.

Pass 1: flow meter mode

1. Put the motorized valve in purge by connecting pin 4 to pin 3.
2. Connect the multimeter and warm up the controller (Connections and warm-up (p. 19)).
3. If you are calibrating for a new range or a different gas, first remove any jumpers from J1A, J1B and J1C.
4. **Zero.** Shut off and disconnect the gas supply.
5. Turn R34 until the output reads 0 V DC (4 mA).
6. **25 % with R33.** Reconnect the gas.
7. With the flow regulator, set 25 % of full scale on the flow standard.
8. Turn R33 until the output reads 1.25 V DC ±63 mV (8.0 mA ±0.25 mA).
9. **50 %, 75 % and 100 %.** Raise the flow to each point of Table 6-3 in turn.
10. If the output is outside ±63 mV (±0.25 mA), fit the jumper listed in the increase or decrease position (Table 6-4) and turn the potentiometer listed until it is within tolerance.
11. Repeat steps 6 to 10 at least once more.

Table 6-3 Linearity points, GFC57/67/77

Flow	0–5 V DC	4–20 mA	Jumper	Adjust
25 %	1.25 V	8.0 mA	—	R33
50 %	2.50 V	12.0 mA	J1A	R38
75 %	3.75 V	16.0 mA	J1B	R39
100 %	5.00 V	20.0 mA	J1C	R40

Table 6-4 Linearizer jumpers, GFC57/67/77

Jumper	Decrease	Increase
J1A (50 %)	1–2	2–3
J1B (75 %)	4–5	5–6
J1C (100 %)	7–8	8–9

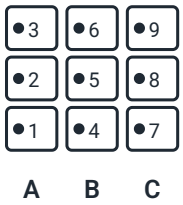


Figure 6-2. J1 header, GFC57/67/77: three jumper positions, A to C, each with three pins.

Note
Do not adjust the motorized valve. It is adjusted at the factory. When pass 1 is complete, simply end the purge (disconnect pins 4 and 3) so that the valve returns to automatic control.

Pass 2: control mode

1. Open the upstream flow regulator fully and raise the inlet pressure to 20 psig.
2. **Full scale.** Apply 5.00 V DC (100 %) and, if needed, turn R33 until the flow matches the full-scale flow. Clockwise reduces the flow; counter-clockwise increases it.
3. **Points.** Apply 1.25 V DC and adjust R33, 2.50 V DC and adjust R38, 3.75 V DC and adjust R39, then 5.00 V DC and adjust R40. At each point the flow must be within ±0.75 % of full scale of the set point.
4. Repeat step 3 at least once more.

Display scaling

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

1. Carefully remove the display from the controller or from the panel.
2. Remove the aluminium housing on the cable side and slide the display assembly out.
3. 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).
4. 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.
5. 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 6-5). The positions are printed next to the pins.
6. Never fit more than one decimal-point jumper.

Table 6-5 Decimal point jumper

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

Gas conversion factors

A controller calibrated with nitrogen can measure and control 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. 39) 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 at the same temperature and pressure.

If the flow range stays the same, the ratio of the K factors relates 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 controller calibrated with nitrogen reads 1000 smL/min. The gas is oxygen, whose K factor relative to nitrogen is 0.9926. The actual oxygen flow is 1000 × 0.9926 = 992.6 smL/min.

Nitrogen is not the only possible reference. If you can calibrate with a gas whose thermodynamic properties are close to those of your process gas, the conversion becomes more accurate. Use the formula above to work out the factor relative to that reference gas.

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. For better accuracy, have the controller 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 GFC 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. 11)).

Have the calibration checked at the intervals your quality system requires (Calibration and verification (p. 19)). For repair and calibration, return controllers to Analyt-MTC.

⚠ WARNING

A controller that has carried toxic, corrosive, infectious or radioactive media holds residues that endanger the people who service it. Before you open such a controller or send it for service, purge it and neutralise all residues.

Cleaning the flow path

NOTICE

Taking the sensor apart destroys its calibration, and any disassembly of the GFC37, GFC47, GFC57, GFC67 or GFC77 makes a recalibration necessary. Never take the sensor apart. Do not dismantle or repair these controllers yourself.

NOTICE

Some components are sensitive to electrostatic discharge, which can damage them. Wear a grounded wrist strap when you adjust or service the controller.

1. Remove the controller from the gas line and inspect the flow paths at the inlet and the outlet for debris.
2. Remove any debris carefully with tweezers, then blow clean, low-pressure air or nitrogen through from the inlet side.
3. If the flow path is still blocked, return the controller to Analyt-MTC.

Cleaning the inlet filter (GFC17)

The GFC17 has a 50 µm filter screen in its inlet, held in the RFE sub-assembly together with the restrictor flow element (Figure 7-1). 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.

1. Unscrew the inlet and outlet compression fittings from the controller 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 controller for contamination. If necessary, flush it with alcohol and dry it thoroughly with a flow of clean, dry gas.

> **Note**
> The RFE sub-assembly belongs in the inlet side only. Never install it in the outlet side.

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. 20)).

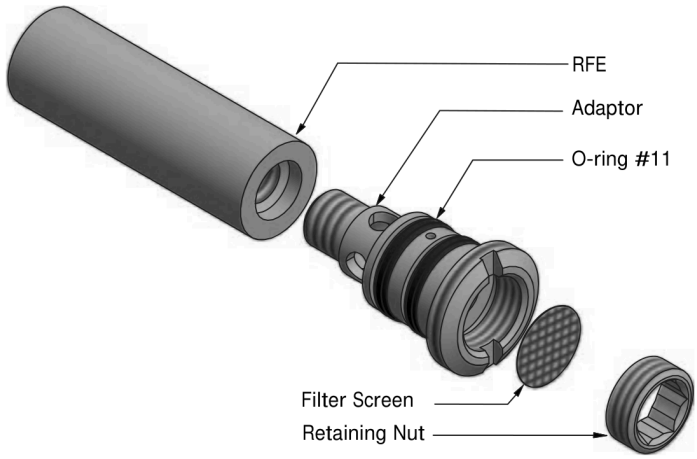


Figure 7-1. RFE sub-assembly of the GFC17 with the inlet filter screen.

Solenoid valve (GFC17, GFC37, GFC47)

The solenoid valve is made of 316 and 416 stainless steel, with O-rings and seals of FKM, or optionally EPR or FFKM. Apart from periodic cleaning it needs no maintenance. Corrosive gases can make it necessary to replace the O-rings and seals more often; make sure the elastomer suits your gas. Analyt-MTC supplies the optional sealing materials.

To clean the valve, put the controller in purge (Opening the valve fully (p. 17)) and flush it with a clean, filtered, neutral gas such as nitrogen. Alternatively, open the valve fully by removing the plastic cap on top and turning the adjusting screw counter-clockwise until it stops; the valve must then be readjusted before use (Valve adjustment (p. 21)).

After you reinstall the inlet fitting, check at least one calibration point.

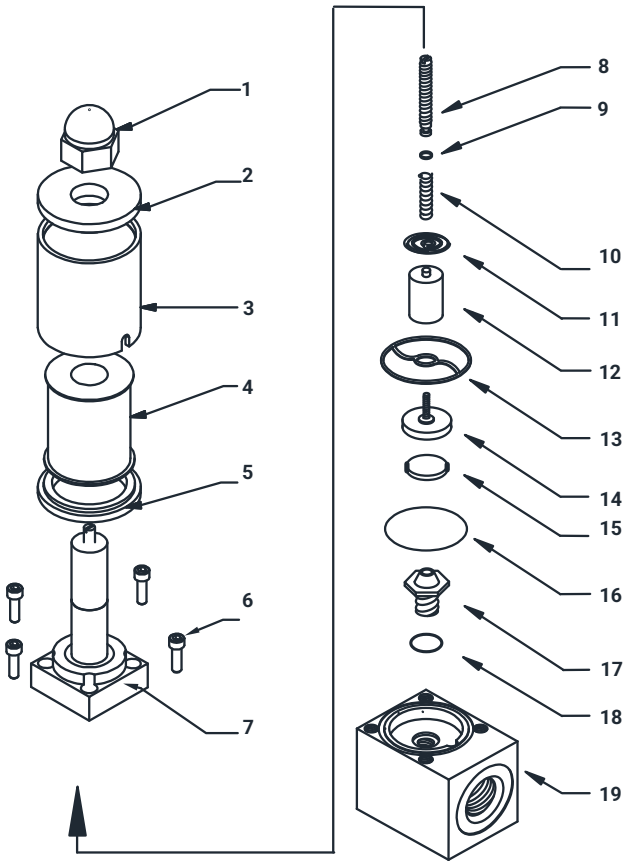


Figure 7-2. Proportional solenoid valve of the GFC17, GFC37 and GFC47, exploded view.

No.	Part	No.	Part
1	Nut	11	Spiral spring
2	Guard top	12	Core
3	Guard	13	Spider spring
4	Coil	14	Stem
5	Guard base	15	Seat insert (FKM)
6	4-40 socket screws	16	O-ring
7	Valve body	17	Orifice
8	Adjusting screw	18	O-ring
9	O-ring	19	Block
10	Compression spring		

CHAPTER 8

Troubleshooting

First checks

Each controller 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. 13). 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 controller connected to it.
- Gas side: test the connections for leaks and check that the inlet pressure gives enough pressure difference across the controller.

Fault finding

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. 14)).
Inlet filter screen blocked	Flush it clean. On the GFC17 you can also dismantle, clean or replace the screen (Cleaning the inlet filter (p. 25)); on the other models, return the controller to Analyt-MTC.
Sensor tube blocked	Flush it clean (Cleaning the flow path (p. 25)), or return the controller.
Circuit board defective	Return the controller.
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure C (p. 30)).
FLOW DOES NOT MATCH THE SET POINT	
Gas pressure too low	Apply the correct gas pressure.
Inlet filter screen blocked	Flush it clean. On the GFC17 you can also dismantle, clean or replace the screen (Cleaning the inlet filter (p. 25)); on the other models, return the controller to Analyt-MTC.
Ground loop	Signal common and power-supply common are at different potentials; connect them to the same common.
NO RESPONSE TO THE SET POINT	
Gas pressure too low	Apply the correct gas pressure.
Cable or connector fault	Check all cables and connections; replace if necessary.
Set point below 2 % of full scale	Raise the set point, or switch off the 2 % cut-off (Valve control configuration (p. 14)).
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure C (p. 30)).
UNSTABLE ZERO, OR NO ZERO READING	
Gas leak	Find and repair the leak.
Circuit board defective	Return the controller.
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure B (p. 30)).
FULL-SCALE READING WITH NO FLOW OR WITH THE VALVE CLOSED	
Sensor defective	Return the controller.

Likely cause	Remedy
Gas leak	Find and repair the leak.
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure A (p. 30)).
CALIBRATION OFF	
Gas differs from the calibration gas	Use a controller calibrated for this gas.
Gas composition has changed	Correct with the K factors (Gas conversion factors (p. 23)).
Gas leak	Find and repair the leak.
Circuit board defective	Return the controller.
RFE dirty	Flush it clean. On the GFC17 you can also dismantle and clean it (Cleaning the inlet filter (p. 25)); on the other models, return the controller to Analyt-MTC.
Sensor tube blocked	Flush it clean, or return the controller.
Inlet filter screen blocked	Flush it clean. On the GFC17 you can also dismantle, clean or replace the screen (Cleaning the inlet filter (p. 25)); on the other models, return the controller to Analyt-MTC.
Controller not mounted correctly	Check for tilt or a changed mounting position. Controllers are calibrated with the sensor horizontal (Location and orientation (p. 11)).
VALVE DOES NOT OPEN	
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure C (p. 30)).
Circuit board defective	Return the controller.
Cable or connector fault	Check the cable and connectors; replace if necessary.
Pressure difference too high	Reduce the pressure to the correct level (Performance (p. 32)).
Inlet pressure too low	Raise it to the correct level.
VALVE DOES NOT CLOSE	
Solenoid valve misadjusted (GFC17/37/47)	Readjust it (procedure A (p. 30)).
Circuit board defective	Return the controller.
Cable or connector fault	Check the cable and connectors; replace if necessary.
Valve orifice obstructed	Dismantle the valve (not the sensor or flow body) and clean the orifice (Figure 7-2 (p. 27)), or return the controller.

Valve adjustment procedures (GFC17, GFC37, GFC47)

The proportional solenoid valve is set with the adjusting screw under the hex nut cover on top of the valve (Figure 7-2 (p. 27)). Three faults are corrected there. Work patiently: the sensor needs time to respond after every turn.

NOTICE

An over-adjusted valve leaks. Do not over-adjust the valve: turn the screw by no more than 15° at a time and wait as instructed before the next turn. This valve is not a shut-off valve: a leakage of up to 0.5 % FS with the valve closed is normal.

NOTICE

Valves are often found misadjusted after being left powered with no gas: a low set point, around 2 %, with the inlet pressure shut off. Within about 15 minutes the valve overheats, which changes the properties of its seat insert and compression spring. Do not leave a set point applied while the gas is shut off.

A — Valve leaks when closed

Symptom	With the gas lines disconnected and the valve closed (pins 3 and 12 connected), the display reads zero, but with 20 psig at the inlet it reads more than 0.5 % FS.
Cause	The valve is out of adjustment and leaks.

1. Set the set point to zero and close the valve by connecting pins 3 and 12. This step is essential.
2. Apply 20 psig to the inlet.
3. Unscrew the hex nut cover on top of the solenoid valve.
4. Turn the adjusting screw clockwise, 15° at a time, waiting one minute after each turn, until the display reads zero.
5. If the leak persists after five full turns (360° each), stop and return the controller to Analyt-MTC.
6. Refit the hex nut cover.
7. Disconnect pins 3 and 12, apply a 100 % set point and check that the flow reaches 100 %.

B — Flow oscillates

Symptom	The pressure difference across the controller is within specification, but the reading and the flow oscillate one to four times per second.
Cause	The valve's compression spring is set too tight and the control loop cannot hold the flow steady.

1. Make sure the pressure difference across the controller is within specification.
2. Set the set point to 100 % FS. This should stop the oscillation.
3. Unscrew the hex nut cover on top of the solenoid valve.
4. Turn the adjusting screw counter-clockwise, 15° at a time, waiting about 15 seconds after each turn, until the reading is stable.
5. If the flow stays constant above 105 % FS, the valve is now set too loose and leaks: turn the screw clockwise until the reading is back at 100 %.
6. Set the set point to zero (or close the valve with pins 3 and 12), wait about 3 minutes and check that the valve closes.
7. Refit the hex nut cover.

C — Flow stays below a 100 % set point

Symptom	The pressure difference is within specification, but with a 100 % set point the flow stays more than 1 % FS below the set point.
Cause	The compression spring is set too tight and the controller cannot open the valve far enough.

1. Make sure the pressure difference across the controller is within specification.
2. Set the set point to 100 % FS.
3. Unscrew the hex nut cover on top of the solenoid valve.
4. Turn the adjusting screw counter-clockwise, 15° at a time, waiting about 15 seconds after each turn, until the reading equals the set point.
5. If the flow stays constant above 105 % FS, the valve is now set too loose and leaks: turn the screw clockwise until the reading is back at 100 %.
6. Set the set point to zero (or close the valve with pins 3 and 12), wait about 3 minutes and check that the valve closes.

7. Refit the hex nut cover.

For the best result, Analyt-MTC recommends returning the controller to Analyt-MTC for this work (Sending in a controller (p. 37)).

Technical support

Analyt-MTC gives technical support to qualified personnel. Have the model number and the serial number of the controller ready; both are on its labels. The contact details are in Service, warranty and contacts (p. 37).

CHAPTER 9

Specifications

Performance

Flow medium	Clean gases only; not for liquids
Calibration conditions	Standard conditions, 21.11 °C, 1013.25 mbar, or normal conditions, 0 °C, 1013.25 mbar, unless otherwise ordered
Accuracy	GFC17, GFC37, GFC47: ±1.0 % of full scale GFC57, GFC67, GFC77: ±1.5 % of full scale from 20 to 100 % of full scale, ±3 % of full scale below 20 % of full scale GFC57, GFC67, GFC77 with optional enhanced accuracy: ±1 % of full scale from 20 to 100 % of full scale; below 20 % of full scale, reference data with ±1 % of full scale
Repeatability	±0.5 % FS
Temperature coefficient	0.15 % FS per °C
Pressure coefficient	0.01 % FS per psi (0.07 bar)
Response time	GFC17: time constant 300 ms; about 1 s to within ±2 % of set point GFC37, GFC47: time constant 600 ms; about 2 s GFC57, GFC67, GFC77: time constant 1800 ms; about 5 s Settling times for set points between 25 and 100 % FS.
Turndown ratio	40:1
Maximum gas pressure	GFC17, GFC37, GFC47: 69 bar (1000 psig) GFC57, GFC67, GFC77: 34.5 bar (500 psig) Optimum inlet pressure: 1.4 bar (20 psig)
Maximum pressure difference	50 psid (345 kPa); GFC47: 40 psid (276 kPa)
Gas temperature	0–50 °C (32–122 °F)
Ambient temperature	−10 to 50 °C (14–122 °F)
Gas relative humidity	Up to 70 %
Internal leakage of the valve	0.5 % FS maximum
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	GFC17, GFC37, GFC47: 12 V DC, 24 V DC or universal 12–26 V DC, 650 mA maximum GFC57, GFC67, GFC77: 12 V DC or 24 V DC, 800 mA maximum
Fuse	Resettable, medium time-lag; 900 mA (GFC17/37/47), 1600 mA (GFC57/67/77)
Flow signal outputs	0–5 V DC, linear, minimum load 1000 Ω 4–20 mA, linear, loop resistance 0–500 Ω, sourcing, for passive loads only Noise: 20 mV peak-to-peak maximum (GFC17/37/47), 100 mV peak-to-peak maximum (GFC57/67/77)
Set point input	0–5 V DC, input impedance 100 kΩ minimum, or 4–20 mA, input impedance 250 Ω, from a 3-wire loop-sourcing device only
Digital interface	RS-232 or RS-485: optional, ask Analyt-MTC
Connector	15-pin D (Pin assignment (p. 13)); optional shielded interface cable

Display	3½-digit LCD, highest reading 1999, 0.5 in characters; built into the top of the controller on models GFC171 … GFC771 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 controller carries the CE marking: EMC Directive 89/336/EEC as amended; emission EN 55011:1991, Group 1, Class B; immunity EN 55082-1:1992. For the EU declaration of conformity, ask Analyt-MTC.

Materials and connections

Wetted materials	Aluminium models: anodized aluminium, brass, 416 and 316 stainless steel, FKM O-rings Stainless-steel models (suffix S): 416 and 316 stainless steel, FKM O-rings Optional O-rings: NBR, EPR or FFKM
Process connections	GFC17, GFC37: 1/4 in compression; optional 6 mm compression, 1/4 in VCR, 3/8 in or 1/8 in compression GFC47, GFC57: 3/8 in compression GFC67: 1/2 in compression GFC77: 3/4 in female NPT; optional 3/4 in compression

You are responsible for choosing a model whose wetted materials are compatible with your gas. If in doubt, ask Analyt-MTC before you order.

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. 39)).

Table 9-1 GFC17

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 GFC37 to GFC77

Model	Code	Full scale
GFC37	11	15 sL/min
	30	20 sL/min
	31	30 sL/min
	32	40 sL/min
	33	50 sL/min
GFC47	40	60 sL/min
	41	80 sL/min
	42	100 sL/min
GFC57	50	200 sL/min
GFC67	60	500 sL/min
GFC77	70	1000 sL/min

Pressure drop

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

Model	Flow	mm H_2O	mbar	psid
GFC17	up to 10 sL/min	720	75	1.06
GFC37	15 sL/min	2630	266	3.87
	20 sL/min	1360	138	2.00
	30 sL/min	2380	241	3.50
	40 sL/min	3740	379	5.50
	50 sL/min	5440	551	8.00
GFC47	60 sL/min	7480	758	11.00
	100 sL/min	12850	1302	18.89
GFC57	200 sL/min	7031	690	10.00
GFC67	500 sL/min	8437	827	12.00
GFC77	1000 sL/min	10547	1034	15.00

Dimensions are in Appendix B (p. 42).

Table 9-4 Valve orifices (GFC17/37/47)

Orifice	Flow range (N_2)
OR.020	10–1000 smL/min
OR.040	1–5 sL/min
OR.055	5–10 sL/min
OR.063	10–15 sL/min
OR.094	20–50 sL/min
OR.125	50–100 sL/min

A change of flow range can require a different orifice; ask Analyt-MTC.

CHAPTER 10

Ordering information

Order from Analyt-MTC with the order codes. The controllers 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).

Accessories

Accessory	Order code
Remote display with 3 ft cable	17/R
Cable for the remote display, 3 ft	ask Analyt-MTC
Power supply 230 V AC / 12 V DC, EU plug (power only; does not carry the analogue signals)	PSGFC-12V
Power supply 230 V AC / 24 V DC, EU plug (power only; does not carry the analogue signals)	PSGFC-24V
Shielded interface cable for the 15-pin D connector	CBL-DGS
Power supply 110 V AC, North America, 12 or 24 V DC	ask Analyt-MTC
Power supply 240 V AC, UK plug, 12 or 24 V DC	ask Analyt-MTC
Power supply 240 V AC, Australia, 12 or 24 V DC	ask Analyt-MTC
Totaliser and I/O module (TIO): digital interface, programmable set point	ask Analyt-MTC
RS-232 or RS-485 digital interface, optional	ask Analyt-MTC
Universal baseplate, a bench-top stand	35780
Transport case	1200-000-110E

Controllers

	Aluminium body, order code		Stainless steel body, order code	
Full scale	without display	with display	without display	with display
GFC17				
10 smL/min	35360N	35360L	35631N	35631L
20 smL/min	35361N	35361L	35632N	35632L
50 smL/min	35362N	35362L	35633N	35633L
100 smL/min	35363N	35363L	35634N	35634L
200 smL/min	35364N	35364L	35635N	35635L
500 smL/min	35365N	35365L	35636N	35636L
1 sL/min	35366N	35366L	35637N	35637L
2 sL/min	35367N	35367L	35638N	35638L
5 sL/min	35368N	35368L	35639N	35639L
10 sL/min	35369N	35369L	35640N	35640L
GFC37				
15 sL/min	35370N	35370L	35641N	35641L
20 sL/min	35371N	35371L	35642N	35642L
30 sL/min	35672N	35672L	35643N	35643L
40 sL/min	35373N	35373L	35644N	35644L

	Aluminium body, order code		Stainless steel body, order code	
Full scale	without display	with display	without display	with display
50 sL/min	35374N	35374L	35380N	35380L
GFC47				
60 sL/min	35375N	35375L	35645N	35645L
80 sL/min	35376N	35376L	35646N	35646L
100 sL/min	35377N	35377L	35647N	35647L
GFC57				
200 sL/min	35627N	35627L	35648N	35648L
GFC67				
300 sL/min	35628N	35628L	35649N	35649L
500 sL/min	35629N	35629L	35650N	35650L
GFC77				
1000 sL/min	35630N	35630L	35651N	35651L

CHAPTER 11

Service, warranty and contacts

Calibration, repair, cleaning, spare parts and technical support for your controller 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 controller;
- the gas and the flow range on the front label;
- a description of the fault and of what you have already checked (Troubleshooting (p. 28)).

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

Sending in a controller

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 controller that has carried hazardous media holds residues. Residues endanger the people who unpack and service it. Never ship such a controller without purging and neutralising it.

2. **Decontaminate.** Purge the controller and neutralize all residues of toxic, corrosive, infectious or radioactive media. In the service request, state the substances the controller 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 controller alone.** Send the controller 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 15-pin connector. Close the process ports so that nothing enters the flow path, protect the connectors against electrostatic discharge, and pack each controller 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 controller 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 controller 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 controller.

Disposal

Do not dispose of the controller 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 controller calibrated with nitrogen, multiply the reading by the K factor of the gas you are using (Gas conversion factors (p. 23)). For argon, carbon dioxide, helium, hydrogen and methane the factor depends on the full-scale flow of the controller.

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

Dimensions are given in millimetres and inches; each caption says which unit comes first. Designs and dimensions can change; for certified drawings of your configuration, ask Analyt-MTC.

GFC17

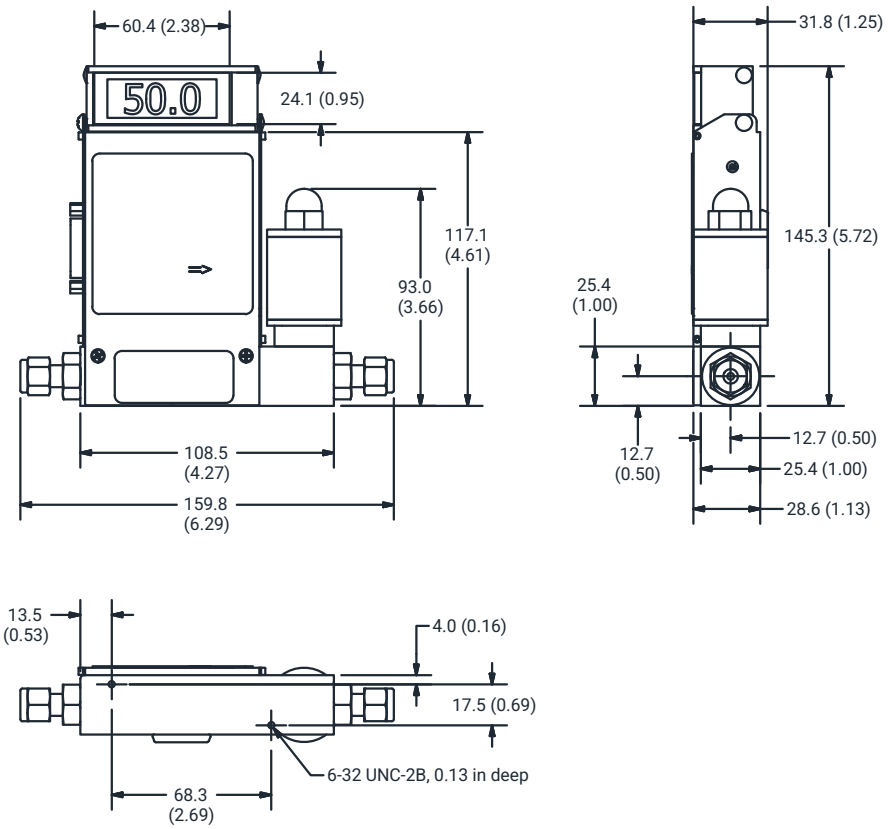


Figure B-1. GFC17, front, side and bottom views. Dimensions in mm (inches).

GFC37 and GFC47

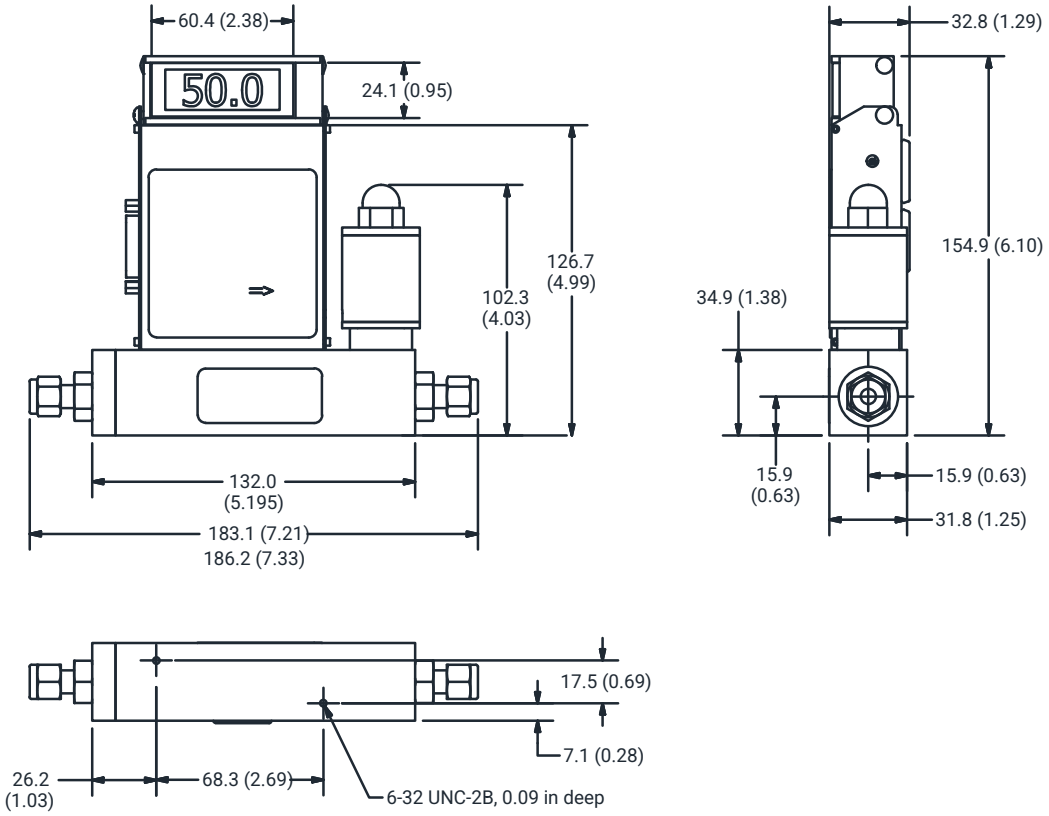


Figure B-2. GFC37 and GFC47, front, side and bottom views. Dimensions in mm (inches). Two overall lengths are given, 183.1 mm and 186.2 mm; ask Analyt-MTC for the value that applies to your controller.

GFC57

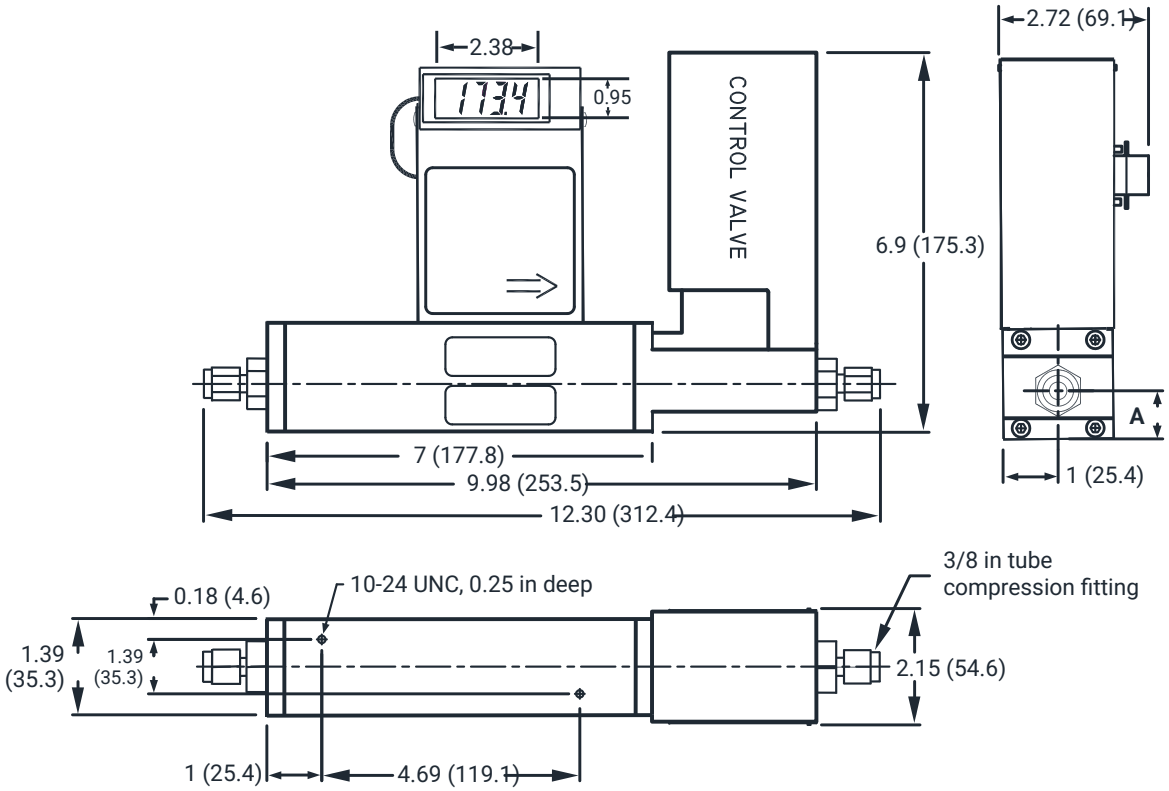


Figure B-3. GFC57, front, side and bottom views. Dimensions in inches (mm); A = 0.875 (22.2).

GFC67 and GFC77

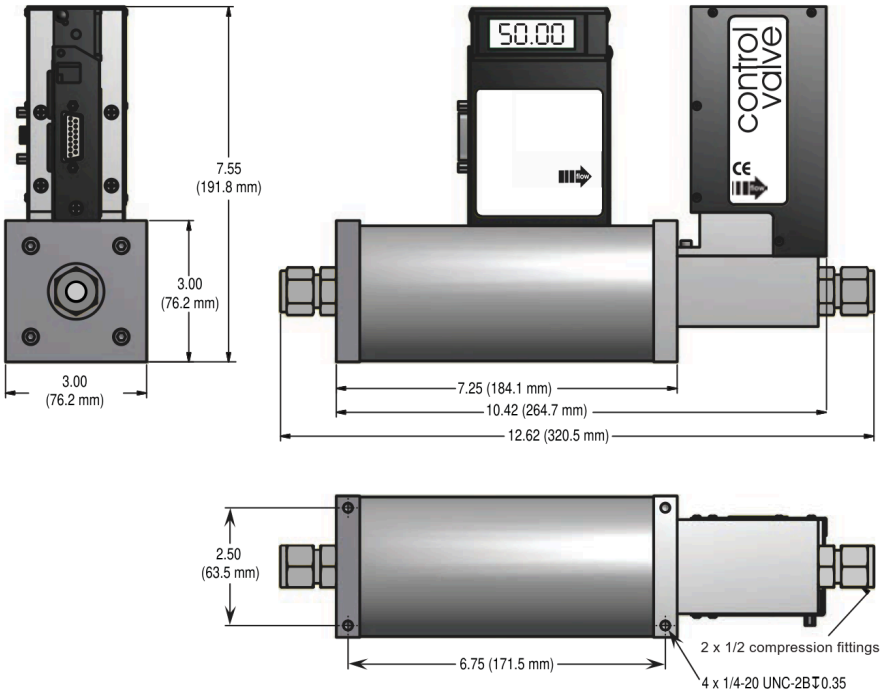


Figure B-4. GFC67, front, side and bottom views. Dimensions in inches (mm).

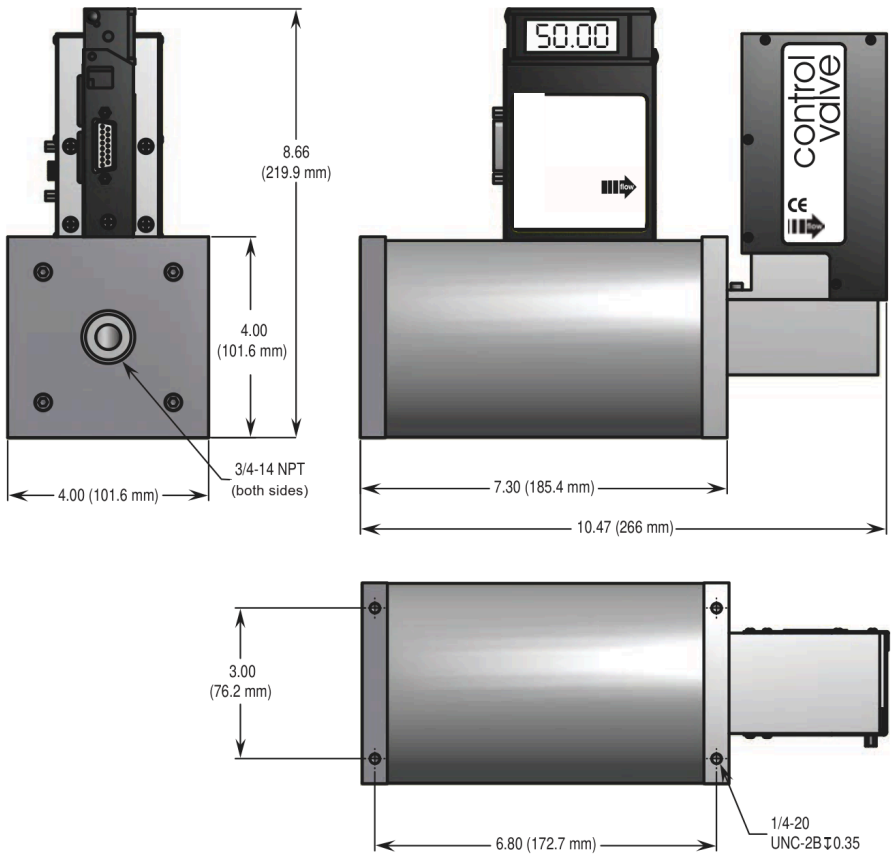


Figure B-5. GFC77, front, side and bottom views. Dimensions in inches (mm).

Dimension	GFC67	GFC77
Height	191.8 (7.55)	219.9 (8.66)
Flow body, end face	76.2 × 76.2 (3.00 × 3.00)	101.6 × 101.6 (4.00 × 4.00)
Flow body, length	184.1 (7.25)	185.4 (7.30)
Length of flow body and valve	264.7 (10.42)	266 (10.47)
Length over the fittings	320.5 (12.62)	—
Process connections	2 × 1/2 in compression fittings	3/4-14 NPT female, both sides
Mounting holes, bottom	4 × 1/4-20 UNC-2B, 0.35 in deep	1/4-20 UNC-2B, 0.35 in deep
Mounting hole spacing	171.5 × 63.5 (6.75 × 2.50)	172.7 × 76.2 (6.80 × 3.00)

APPENDIX C

Circuit board layout

The component layout of the controller board of the GFC17, GFC37 and GFC47, top and bottom side. The designators are those printed on the board; the adjustment points you use are described in Adjustment points (p. 9).

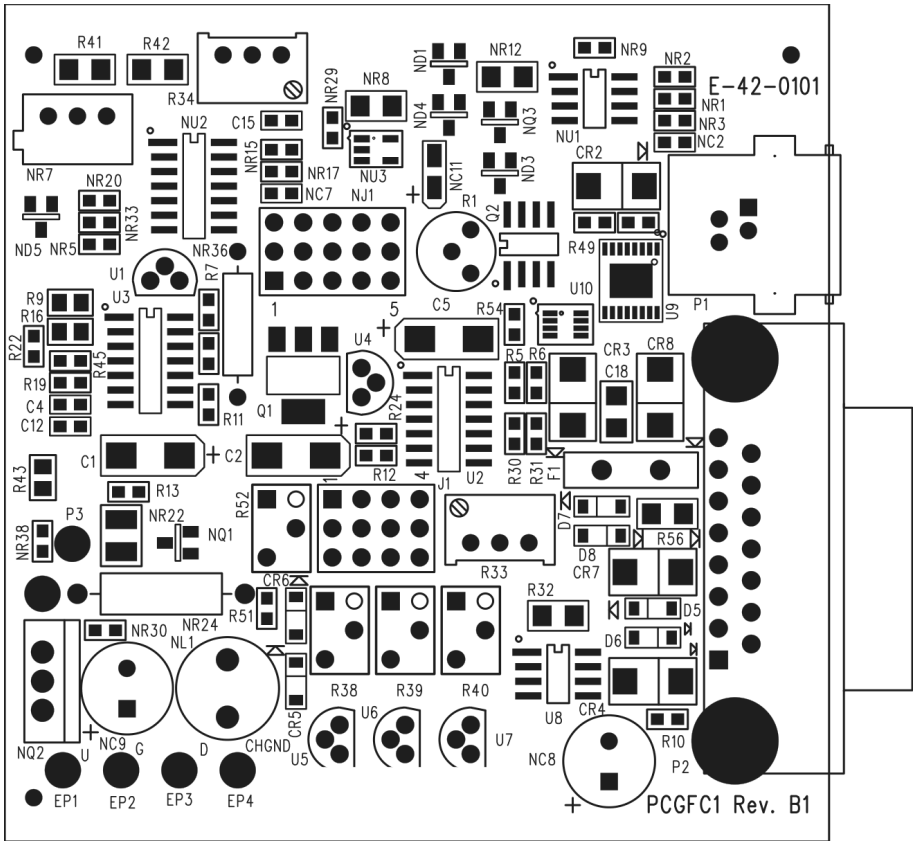


Figure C-1. GFC17/37/47 controller board, top side.

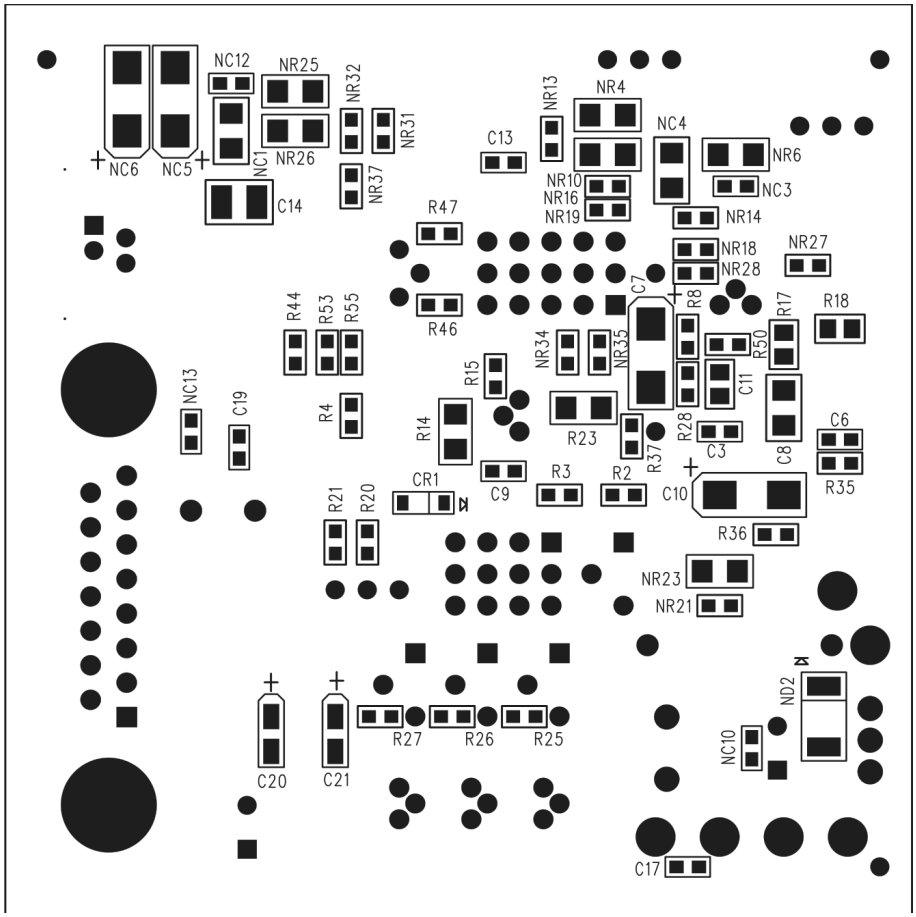


Figure C-2. GFC17/37/47 controller board, bottom side.

ANALYT-MTC Messtechnik GmbH

Sales, service and calibration

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

AMTC-MN-0011 · Rev. 2 · 2026-10

© 2026 ANALYT-MTC Messtechnik GmbH. All rights reserved. Subject to technical changes without notice.