Model GFC thermal Mass Flow Controllers are designed to indicate and control set flow rates of gases.

The GFC combines the characteristics and accuracy of conventional mass flow devices into a unique compact design at low costs previously unattainable.

Each of these controllers incorporates an advanced straight tube sensor in conjunction with flow passage elements constructed of aluminum and brass for non-corrosive gases or 316 stainless steel for corrosive applications. Zero and span adjustments are accessible from the outside of transmitters.

## Principles of Operation

Metered gases are divided into two laminar flow paths, one through the primary flow conduit, and the other through a capillary sensor tube. Both flow conduits are designed to ensure laminar flows and therefore the ratio of their flow rates is constant.

Two precision temperature sensing windings on the sensor tube are heated, and when flow takes place, gas carries heat from the upstream to the downstream windings. The resultant temperature differential is proportional to the change in resistance of the sensor windings.

A Wheatstone bridge design is used to monitor the temperature dependent resistance gradient on the sensor windings which is linearly proportional to the instantaneous rate of flow.

Output signals of 0 to 5Vdc and 4 to 20mA are generated indicating mass molecular based flow rates of the metered gas. The combined gas streams flow through a proportionating electromagnetic valve with an appropriately selected orifice.The closed loop control circuit continuously monitors the mass flow output and maintains it at the set flow rate.

Flow rates are unaffected by temperature and pressure variations within stated limitations.

## Design Features

- Rigid metallic construction.
- Maximum pressure of 1000 psig (70 bars).
- Leak integrity 1 x $10^{-9}$ smL/sec of helium.
- NIST traceable certification.
- Built-in tiltable LCD readout.
- Local or remote setpoint control.
- 0-5 Vdc and 4-20 mA signals.
- Circuit protection.
- TIO Totalizer option.

## General Description

Compact, self-contained GFC mass flow controllers are designed to indicate and control flow rates of gases. The rugged design coupled with instrumentation grade accuracy provides versatile and economical means of flow control. Aluminum or stainless steel models with readout options of either engineering units (standard) or 0 to 100 percent displays are available. The built-in electromagnetic valve allows the flow to be set to any desired flow rate within the range of the particular model.


Typical Stainless Steel GFC Mass Flow Controller

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Setpoints are controlled either locally or remotely. The valve is normally closed as a safety feature to ensure that gas flow is shut off in case of a power outage. The LCD readout built into the top of the transducer is tiltable over 90 degrees to provide optimal reading comfort. It is connected to the transducer by a standard modular plug, and is readily removable for remote reading installations. Transducers without LCD readout are offered for OEM applications. GFC mass flow controllers are available with flow ranges from 10 mL/min to 1000 L/min $N_2$.Gases are connected by means of 1/4", 3/8", or optional 1/8" compression fittings and 3/4" FNPT fittings. Optional fittings are available. These controllers may be used as bench top units or mounted by means of screws in the base.Transducer power supply ports are fuse and polarity protected.

## Leak Integrity

1 x $10^{-9}$ mL/sec of helium maximum to the outside environment.

**TABLE 12 - SPECIFICATIONS**

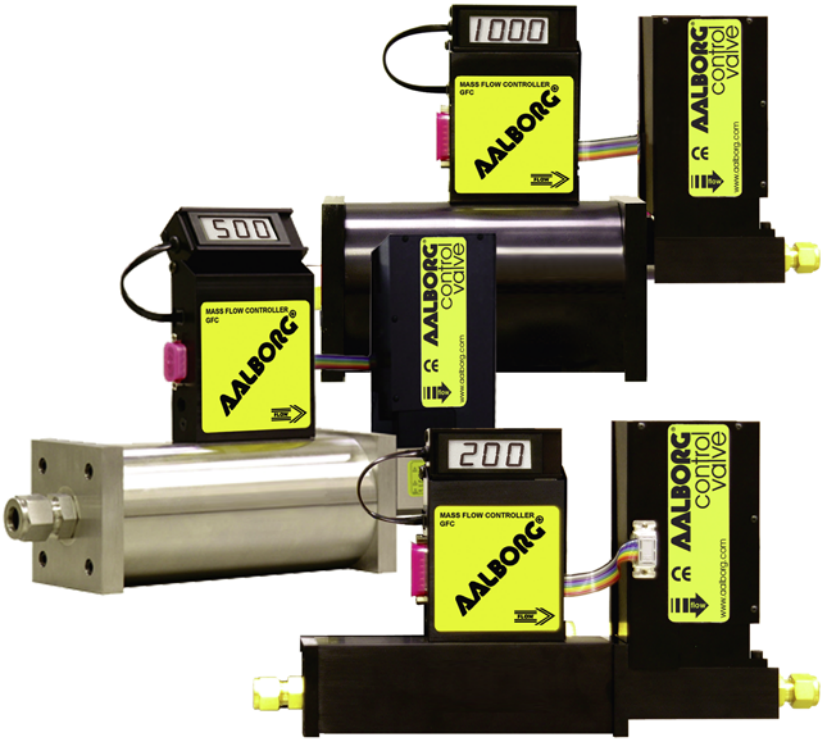
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ACCURACY:** | **ACCURACY %FS** | | | | **OPTIONAL ENHANCED ACCURACY %FS** | | | |
| | **MODEL:** | GFC 17, 37 | GFC 47, 57, 67, 77 | | **MODEL:** | GFC 17 | GFC 37, 47, 57, 67, 77 | |
| | **FLOW RANGE:** | 0-100% | 20-100% | 0-20% | **FLOW RANGE:** | 0-100% | 20-100% | 0-20% |
| | **ACCURACY:** | ±1.5% | ±1.5% | ±3% | **ACCURACY:** | ±1% | ±1% | REF DATA with ±1% |
| **CALIBRATIONS:** | Performed at standard conditions [14.7 psia (101.4 kPa) and 70 °F (21.1°C)] unless otherwise requested. | | | | | | | |
| **REPEATABILITY:** | ±0.25% of full scale. | | | | | | | |
| **RESPONSE TIME:** | Generally 2 seconds to within ±2% of actual flow rate over 25 to 100% of full scale. | | | | | | | |
| **TEMPERATURE COEFFICIENT:** | 0.15% of full scale / °C. | | | | | | | |
| **PRESSURE COEFFICIENT:** | 0.01% of full scale / psi (0.07 bar). | | | | | | | |
| **PRESSURE DROP:** | See Table 14. | | | | | | | |
| **OPTIMUM GAS PRESSURE:** | 25 psig (1.73 bars). | | | | | | | |
| **MAX. GAS PRESSURE:** | 1000 psig (70 bars) maximum GFC 17, 37, 47. 500 psig (34.5 bars) GFC 57, 67, 77. | | | | | | | |
| **TURN DOWN RATIO:** | 40:1. | | | | | | | |
| **MAX. DIFF. PRESSURE:** | 50 psi for GFC 17/37/57/67 and 77 (3.4 bars), 40 psi for 47 (2.7 bars). | | | | | | | |
| **GAS and AMBIENT TEMP:** | 32 °F to 122 °F (0 °C to 50 °C). 14 °F to 122 °F (-10 °C to 50 °C) - Dry gases only. | | | | | | | |
| ****MATERIALS FLUID CONTACT:** | **a.** Aluminum models GFC Series: anodized aluminum, 316 stainless steel, brass and Viton® O-rings. | | | | | | | |
| | **b**. Stainless steel models GFC17S, 37S, 47S, 57S, 67S and 77S: 316 stainless steel and Viton® O-rings. Optional O-rings: Buna®, EPR and Kalrez®. | | | | | | | |
| **ATTITUDE SENSITIVITY:** | No greater than ±15 degree rotation from horizontal to vertical; standard calibration is in horizontal position. | | | | | | | |
| **OUTPUT SIGNALS:** | Linear 0-5 Vdc. (1000 ohms min. load impedance); 4-20 mA (0-500 ohms loop resistance) Max noise ±20mV. | | | | | | | |
| **COMMAND SIGNALS:** | Analog 0-5 Vdc or 4-20 mA for remote set point mode; NPN compatible purge /valve off. | | | | | | | |
| **CONNECTIONS:** | **GFC 17 and 37**: 1/4" compression fittings.<br>**Optional:** 6mm compression, 1/4" VCR®, 3/8" or 1/8" compression fittings. | | | | | | | |
| | **GFC 47:** 3/8" compression fittings. | | | | | | | |
| | **GFC 57:** 3/8" compression fittings. | | | | | | | |
| | **GFC 67:** 1/2" compression fittings. | | | | | | | |
| | **GFC 77:** 3/4" FNPT fittings. Optional: 3/4" compression fittings. | | | | | | | |
| **LEAK INTEGRITY**: | 1 x $10^{-9}$ smL/sec of helium maximum to the outside environment. | | | | | | | |
| **TRANSDUCER INPUT POWER:** | +12 Vdc, 800 mA; +24 Vdc, 650 mA optional. | | | | | | | |
| **CIRCUIT PROTECTION:** | Circuit boards have built-in polarity reversal protection. Resettable fuses provide power input protection. | | | | | | | |
| **DISPLAY:** | 3-1/2 digit LCD, 0.5" high characters. | | | | | | | |
| **CE COMPLIANT:** | EN 55011 class 1, class B; EN50082-1. | | | | | | | |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

| TABLE 13 - FLOW RANGES FOR GFC | |
|---|---|
| **GFC 17 LOW FLOW MASS FLOW CONTROLLER** | |
| **CODE** | **mL / min [$N_2$]** |
| **01** | 0 to 10 |
| **02** | 0 to 20 |
| **03** | 0 to 50 |
| **04** | 0 to 100 |
| **05** | 0 to 200 |
| **06** | 0 to 500 |
| **CODE** | **liters / min [$N_2$]** |
| **07** | 0 to 1 |
| **08** | 0 to 2 |
| **09** | 0 to 5 |
| **10** | 0 to 10 |
| **GFC 37 MEDIUM FLOW MASS FLOW CONTROLLER** | |
| **11** | 0 to 15 |
| **30** | 20 |
| **31** | 30 |
| **32** | 40 |
| **33** | 50 |
| **GFC 47 /57 /67 /77 HIGH FLOW MASS FLOW CONTROLLER** | |
| **40** | 60 |
| **41** | 80 |
| **42** | 100 |
| **50** | 200 |
| **60** | 500 |
| **70** | 1000 |

**TABLE 14 - MAXIMUM PRESSURE DROP FOR GFC**

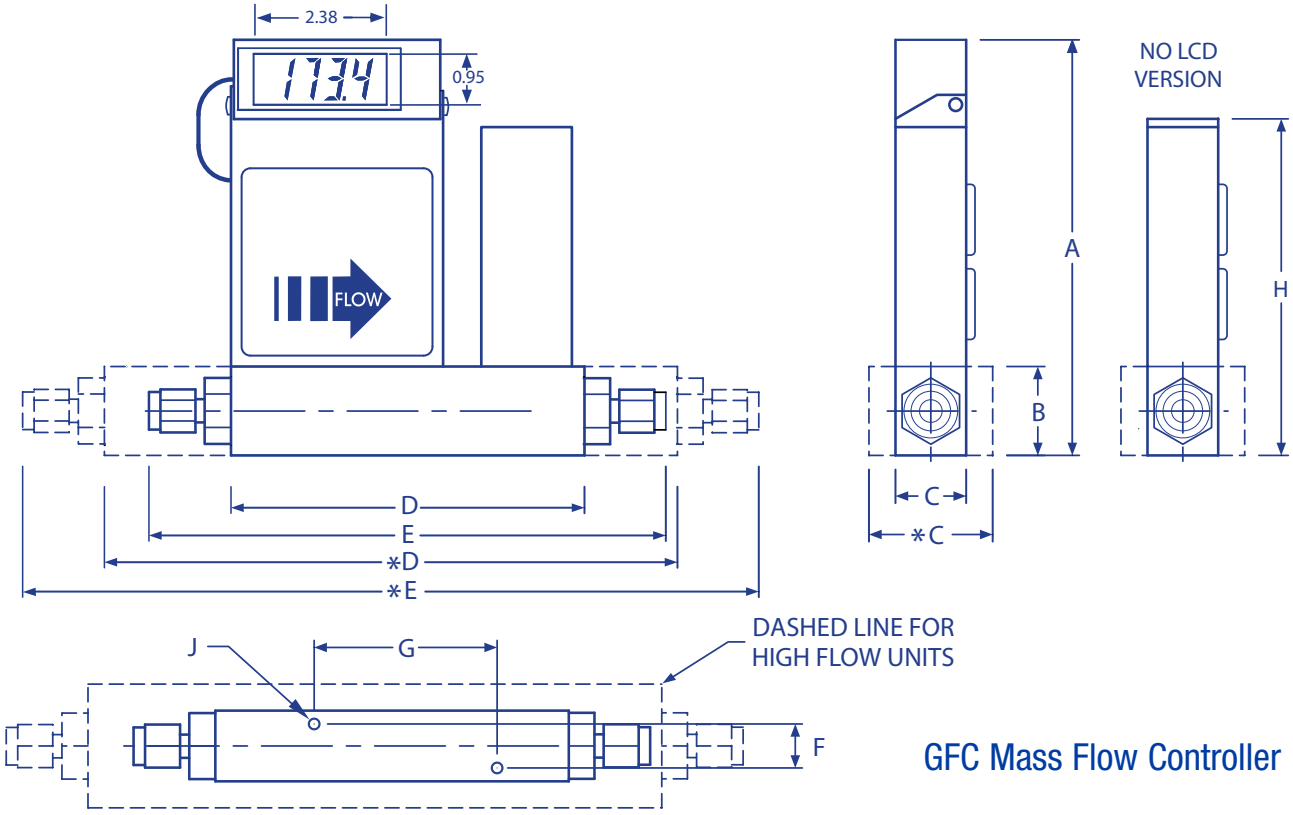
| MODEL | FLOW RATE [liters/min] | MAXIMUM PRESSURE DROP | | |
|---|---|---|---|---|
| | | [mm $H_2O$] | [psid] | [mbar] |
| **GFC 17** | UP to 10 | 720 | 1.06 | 75 |
| **GFC 37** | 15 | 2630 | 3.87 | 266 |
| | 20 | 1360 | 2.00 | 138 |
| | 30 | 2380 | 3.50 | 241 |
| | 40 | 3740 | 5.50 | 379 |
| | 50 | 5440 | 8.00 | 551 |
| **GFC 47** | 60 | 7480 | 11.00 | 758 |
| | 100 | 12850 | 18.89 | 1302 |
| **GFC 57** | 200 | 7031 | 10.00 | 690 |
| **GFC 67** | 500 | 8437 | 12.00 | 827 |
| **GFC 77** | 1000 | 10547 | 15.00 | 1034 |




GFC 57, 67 and 77 Series Aluminum and Stainless Mass Flow Controllers

| TABLE 15 - ACCESSORIES FOR GFC | |
|---|---|
| **POWER SUPPLY - BATTERY PACK - CABLES** | |
| **PS-GFC-110NA-2** | Power Supply, 110 V/12 Vdc /North America |
| **PS-GFC-110NA-4** | Power Supply, 110 V/24 Vdc /North America |
| **PS-GFC-230EU-2** | Power Supply, 220 V/12 Vdc /Europe |
| **PS-GFC-230EU-4** | Power Supply, 220 V/24 Vdc /Europe |
| **PS-GFC-240UK-2** | Power Supply 240 V/12 Vdc /United Kingdom |
| **PS-GFC-240UK-4** | Power Supply 240 V/24 Vdc /United Kingdom |
| **PS-GFC-240AU-2** | Power Supply 240 V/12 Vdc /Australia |
| **PS-GFC-240AU-4** | Power Supply 240 V/24 Vdc /Australia |
| **CBL-DGS** | Cable, Shielded 15-pin D-connector /end terminated |
| **17/ 3RC** | Remote Cable, 3 feet long |
| **17/ R** | Remote LCD readout with 3 feet long cable |

***For Totalizer Input/Output Flow Monitor/ Controller options see page 18.***




GFC Mass Flow Controller

**TABLE 16 - DIMENSION FOR GFC**

| MODEL | CONNECTION COMPRESSION FITTING (except model GFC 77) | DIMENSION (INCH) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | LCD VERSION | | | | | | | NO LCD | MOUNTING HOLE |
| | | A | B | C/*C | D/*D | E/*E | F | G | H | J |
| **GFC 17** | 1/4" Tube O Diameter | 5.60 | 1.00 | 1.00 | 4.27 | 6.29 | 0.69 | 2.69 | 4.50 | 6-32 |
| **GFC 37** | 1/4" Tube O Diameter | 5.98 | 1.37 | 1.25 | 5.19 | 7.21 | 0.69 | 2.69 | 4.88 | 6-32 |
| **GFC 47** | 3/8" Tube O Diameter | 5.98 | 1.37 | 1.25 | 5.19 | 7.33 | 0.69 | 2.69 | 4.88 | 6-32 |
| **GFC 57** | 3/8" Tube O Diameter | 6.60 | 2.00 | 1.75 | 10.2 | 12.3 | 1.39 | 4.69 | 6.60 | 10-24 |
| **GFC 67** | 1/2" Tube O Diameter | 7.56 | 3.00 | 3.00 | 10.24 | 12.4 | 2.5 | 6.80 | 7.56 | 1/4-20 |
| **GFC 77** | 3/4" NPT Female | 8.56 | 4.00 | 4.00 | 10.5 | — | 3.0 | 6.80 | 8.56 | 1/4-20 |

*NOTE: Only 12Vdc for models GFC 57, 67 and 77. For Specific Flow Ranges Contact Aalborg Customer Service Department.*

GFC

| GFC | MODEL |
|---|---|

| MAX. FLOW ($N_2$) | |
|---|---|
| 17 | 10 L/min |
| 37 | 50 L/min |
| 47 | 100 L/min |
| 57 | 200 L/min |
| 67 | 500 L/min |
| 77 | 1000 L/min |

| MATERIAL | |
|---|---|
| A | Aluminum |
| S | Stainless Steel |

| SEALS | |
|---|---|
| V | Viton® |
| B | Buna® |
| E | EPR |
| T | PTFE/ Kalrez® |

| FITTINGS | | MODEL |
|---|---|---|
| A | 1/4" Compression | GFC 17, 37 |
| B | 1/8" Compression | GFC 17 |
| C | 1/4" VCR® | GFC 17, 37 |
| D | 3/8" Compression | GFC 17, 37, 47, 57 |
| E | 1/2" Compression | GFC 67 |
| F | 3/4" FNPT | GFC 77 |
| G | 3/4" Compression | GFC 77 |
| H | 6mm Compression | GFC 17, 37 |

| CONNECTOR | |
|---|---|
| D | D Connector |

| DISPLAY | |
|---|---|
| N | No display |
| L | LCD readout |

| POWER | |
|---|---|
| 2 | 12 Vdc |
| 4 | 24 Vdc |

| INPUT/OUTPUT SIGNAL | |
|---|---|
| A | Local 0-5 Vdc |
| B | Local 4-20mA |
| C | 0-5Vdc/0-5Vdc |
| D | 0-5Vdc/4-20mA |
| E | 4-20mA/4-20mA |
| F | 4-20mA/0-5Vdc |

| DIGITAL INTERFACE | |
|---|---|
| 0 | None |

| GFC | 17 | S | — | V | A | D | L | 2 | — | C | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|

**EXAMPLE: GFC17S-VADL2-C0** 10 L/min [$N_2$] 20 psig

***SPECIFY:*** *FLOW RANGE, GAS and PRESSURE*

GFC17 stainless steel, Viton® seals, 1/4" compression fittings, D connector with display, 12Vdc, 0-5 Vdc. Out put signal, No digital interface



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