Low Cost Mass Flow Controllers

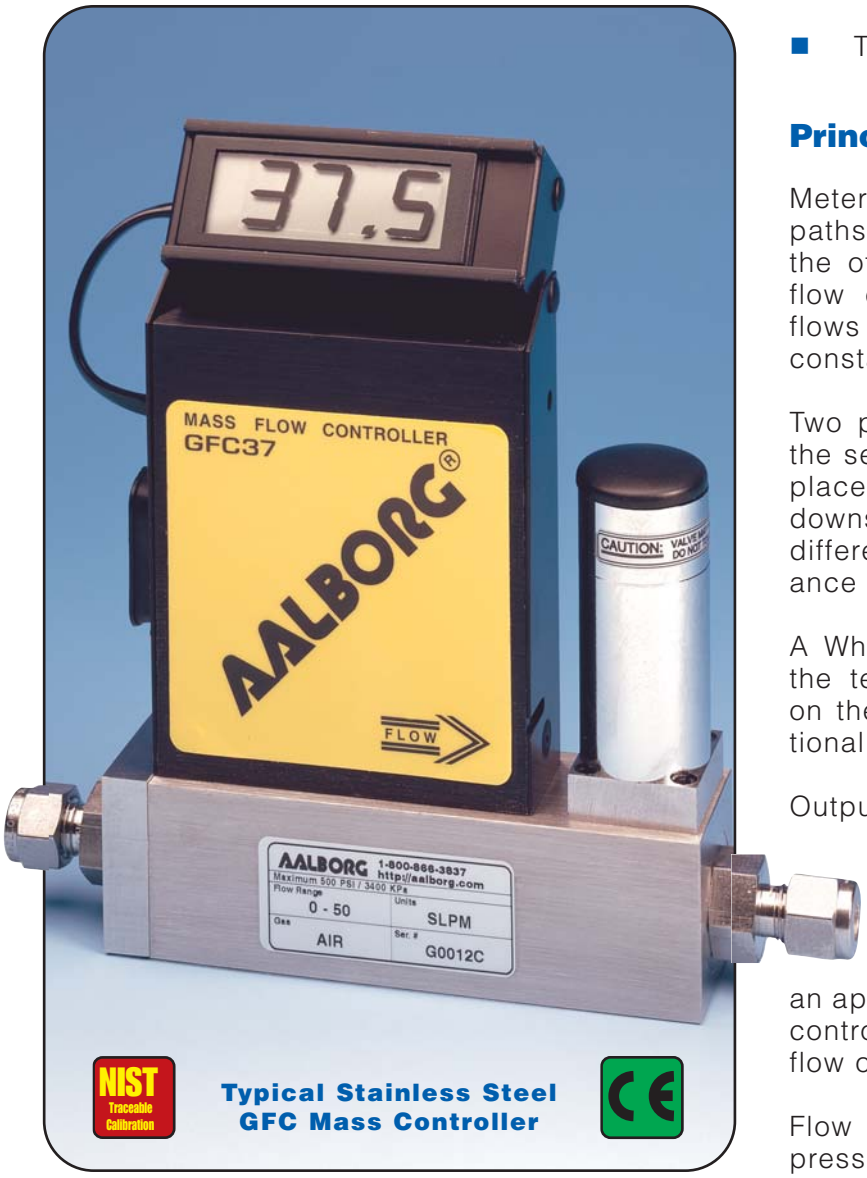
GFC

http://aalborg.com

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.



Typical Stainless Steel GFC Mass Controller

Design Features

- Rigid metallic construction.
- Maximum pressure of 500 psig (34.5 bars).
- Leak integrity 1 x 10^{-7} 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.
- Totalizer option.

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.

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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. The valve is normally closed as a safety feature to ensure that gas flow is shut off in case of a power outage. Setpoints are controlled either locally or remotely.

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 sccm to 1000 sL/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 benchtop units or mounted by means of screws in the base.

Transducer power supply ports are fuse and polarity protected.

GFC 77 Aluminum Mass Flow Controller

Leak Integrity

1 x 10^{-7} smL/sec of helium maximium to the outside environment.

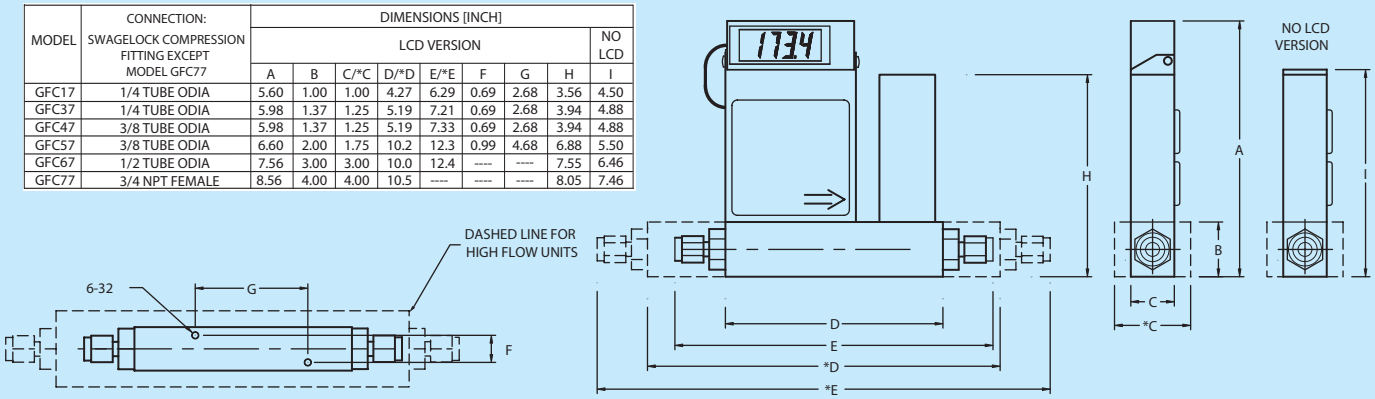
Specifications

Accuracy (including linearity) :	±1.5% of full scale, including linearity for gas temperatures of 59°F to 77°F (15°C to 25°C) and pressures of 5 to 60 psia (0.4 to 4.1 bars).
Repeatability :	±0.5% of full scale.
Response Time :	Generally 2 seconds to within ±2% of actual flow rate over 25 to 100% of full scale.
Temp. Coefficient :	0.15% of full scale / °C.
Pressure Coefficient :	0.01% of full scale / psi (0.07 bar).
Optimum Gas Pressure :	25 psig (1.73 bars).
Max Gas Pressure :	500 psig (34.5 bars) maximum.
Max Diff. Pressure :	GFC17 & GFC37 50psi (3.4bars), GFC47 40psi (2.7bars)
Gas & Ambient Temp :	41°F to 122°F (5°C to 50°C).
Materials In 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 Neoprene® and Kalrez®.
Attitude Sensitivity :	1% shift for a 90° 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 setpoint mode; NPN compatible purge / valve off.
Connections :	GFC 17 and 37 - 1/4"compression fittings. GFC 47 - 3/8" compression fittings. Optional VCR®s or 1/8", 3/8" compression fittings. GFC 57 - 3/8" compression fittings. GFC 67 - 1/2" compression fittings. GFC 77 - 3/4" FNPT fittings. Optional VCR®s 3/4" compression fittings(GFC77).
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

Dimensions*

GFC Mass Flow Controller

MODEL	CONNECTION: SWAGELOCK COMPRESSION FITTING EXCEPT MODEL GFC77	DIMENSIONS [INCH]								
		LCD VERSION								NO LCD
		A	B	C/*C	D/*D	E/*E	F	G	H	I
GFC17	1/4 TUBE ODIA	5.60	1.00	1.00	4.27	6.29	0.69	2.68	3.56	4.50
GFC37	1/4 TUBE ODIA	5.98	1.37	1.25	5.19	7.21	0.69	2.68	3.94	4.88
GFC47	3/8 TUBE ODIA	5.98	1.37	1.25	5.19	7.33	0.69	2.68	3.94	4.88
GFC57	3/8 TUBE ODIA	6.60	2.00	1.75	10.2	12.3	0.99	4.68	6.88	5.50
GFC67	1/2 TUBE ODIA	7.56	3.00	3.00	10.0	12.4	----	----	7.55	6.46
GFC77	3/4 NPT FEMALE	8.56	4.00	4.00	10.5	----	----	----	8.05	7.46



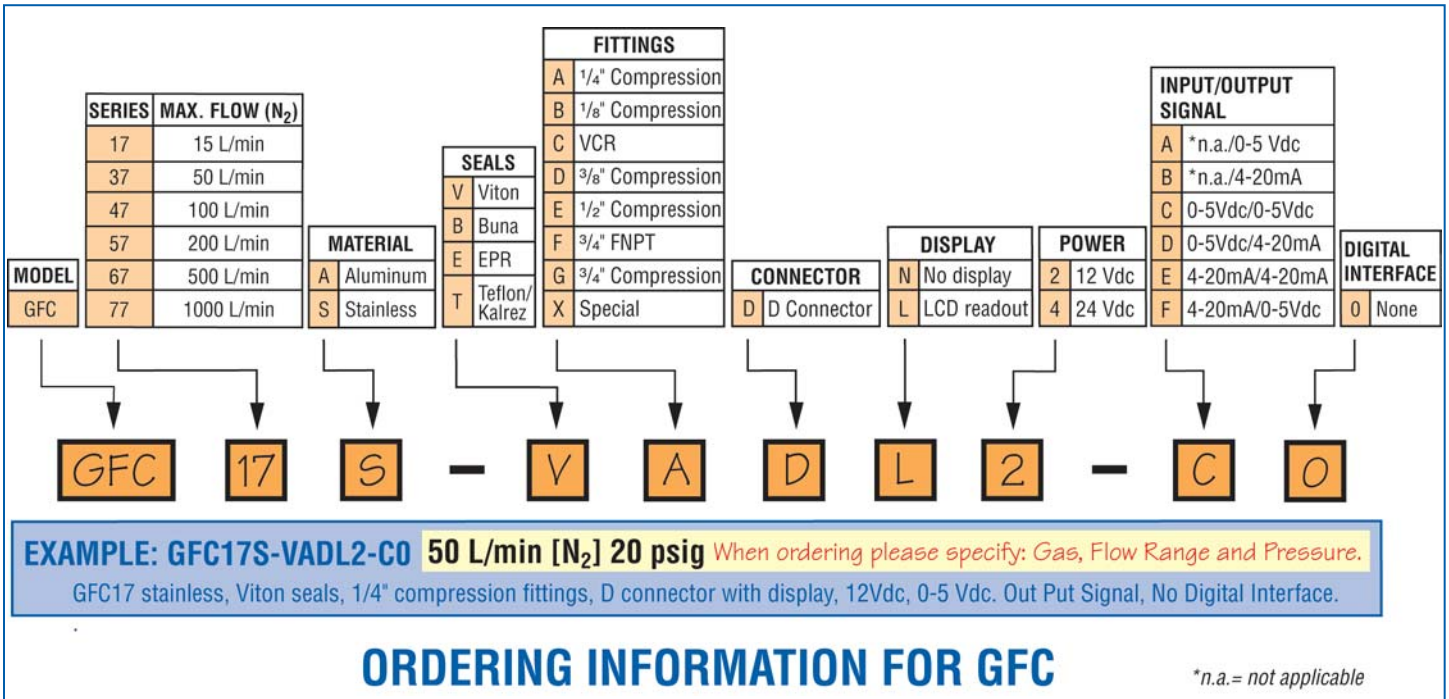


Table 13 - Totalizer	
TOT-10-0C	Totalizer (5Vdc - 10Vdc signals), calibrated.
TOT-10-0N	Totalizer (5Vdc - 10Vdc signals), uncalibrated.
CBLTOT-10	Cable & splitter, used in conjunction w/ display

Table 14 - IO Input/Output	
IO-232-C	Input/output to RS232, 0-5Vdc.
IO-232-E	Input/output to RS232, 4-20mA.
IO-485-C	Input/output to RS485, 0-4Vdc.
IO-485-E	Input/output to RS485, 4-20mA.

***Only 12Vdc for models GFC 57, 67 and 77.**

Table 15 - Accessories for GFC Mass Flow Controllers	
PS-GFC-110NA-2	Power Supply, 110V / 12Vdc /North America
PS-GFC-230EU-2	Power Supply, 220V / 12Vdc /Europe
PS-GFC-240UK-2	Power Supply 240V / 12Vdc /United Kingdom
PS-GFC-240AU-2	Power Supply 240V / 12Vdc /Australia

CBL-DGS	Cable, Shielded 15-pin D-connector /end unterminated
17/3RC	Remote cable, 3 ft long
17/R	Remote LCD readout with 3 ft long cable