

# Mass Flow Controllers

## Model GFC

Model GFC Thermal Mass Flow Controllers are compact, self-contained flow controllers 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. Zero and span adjustments are accessible from the outside of transmitters.

### 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 5 VDC 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.

Model GFC Mass Flow Controller 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 nitrogen. Gases are connected by means of 1/4", 3/8", or optional 1/8" compression fittings and 3/4" NPT Female 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.



Typical Stainless Steel GFC Mass Flow Controller



### Benefits/Features

- Rigid metallic construction
- Maximum pressure of 1000 psig (70 bar)
- Leak integrity  $1 \times 10^{-9}$  sml/sec of helium
- NIST-traceable certification
- Built-in tiltable LCD readout
- Local or remote setpoint control
- 0-5 VDC and 4-20mA signals
- Circuit protection
- Engineering units or 0-100% displays
- TIO Totalizer option

Models GFC 57, 67 and 77 Mass Flow Controllers





# Mass Flow Controllers (cont'd.)

## Model GFC

### Specifications

**Accuracy:**

17, 37, 47: ±1% of full scale (0-100% flow range)  
 57, 67, 77: ±1.5% of full scale (20-100% flow range), ±3% (0-20% flow range). Optional enhanced accuracy is available: ±1% of full scale (20-100% flow range), REF DATA with ±1% of full scale (0-20% flow range)

**Calibration:** 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

**Pressure Drop:** See Table 2

**Maximum Gas Pressure:**

17, 37, 47: 1000 psig (70 bar) maximum, 25 psig (1.73 bar) optimum  
 57, 67, 77: 500 psig (34.5 bar) maximum, 25 psig (1.73 bar) optimum

**Turn Down Ratio:** 40:1

**Differential Pressure (maximum):**

17, 37, 57, 67, 77: 50 psi (3.4 bar)  
 47: 40 psi (2.7 bar)

**Gas and Ambient Temperature:**

32°F to 122°F (0°C to 50°C)  
 Dry gases: 14°F to 122°F (-10°C to 50°C)

**Materials in Fluid Contact:**

Aluminum Models: Anodized aluminum, 316 Stainless Steel, brass and Viton® O-rings  
 Stainless Steel Models: 316 Stainless Steel and Viton® O-rings (optional O-rings: Buna®, EPR and Kalrez®)

**Attitude Sensitivity:** No greater than ±15° rotation from horizontal to vertical; standard calibration is in horizontal position

**Output Signals:** Linear 0-5 VDC (1000 ohms min. load impedance) and 4-20mA (0-500 ohms loop resistance), max noise is ±20mV

**Command Signals:** Analog 0-5 VDC or 4-20mA for remote set point mode, NPN compatible purge/valve off

**Connections:**

17: 1/4" compression fittings, optional 6mm, 3/8" and 1/8" compression fittings or 1/4" VCR  
 37: 1/4" compression fittings, optional 6mm and 3/8" compression fittings or 1/4" VCR  
 47, 57: 3/8" compression fittings  
 67: 1/2" compression fittings  
 77: 3/4" NPT Female fittings, optional 3/4" compression fittings

**Leak Integrity:** 1 x 10<sup>-9</sup> smL/sec of helium maximum to the outside environment

**Transducer Input Power:**

17, 37, 47: Universal +12 VDC to +26 VDC, 200mA maximum  
 57, 67, 77: +12 VDC, 800mA, optional +24 VDC, 650mA

**Circuit Protection:** Circuit boards have built-in polarity reversal protection, resettable fuses provide power input protection

**Display:** 3-1/2 digit LCD, 0.5"(H) characters

**CE Compliant:** EN 55011 Class 1, Class B; EN50082-1

**Table 1 Flow Ranges**

GFC Model	Code	Flow Range	
		mL/min (N2)	L/min (N2)
17   Low-Flow	01	0 – 10	—
	02	0 – 20	—
	03	0 – 50	—
	04	0 – 100	—
	05	0 – 200	—
	06	0 – 500	—
	07	—	0 – 1
	08	—	0 – 2
	09	—	0 – 5
	10	—	0 – 10
37   Medium-Flow	11	—	0 – 15
	30	—	0 – 20
	31	—	0 – 30
	32	—	0 – 40
	33	—	0 – 50
47   High-Flow	40	—	0 – 60
	41	—	0 – 80
	42	—	0 – 100
57   High-Flow	50	—	0 – 200
67   High-Flow	60	—	0 – 500
77   High-Flow	70	—	0 – 1000

**Table 2 Pressure Drop**

GFC Model	Flow Rate	Maximum Pressure Drop		
		L/min	mm H2O	psid
17 37	up to 10	720	1.06	75
	15	2630	3.87	266
	20	1360	2.00	138
	30	2380	3.50	241
	40	3740	5.50	379
47	50	5440	8.00	551
	60	7480	11.00	758
	100	12850	18.89	1302
57	200	7031	10.00	690
67	500	8437	12.00	827
77	1000	10547	15.00	1034

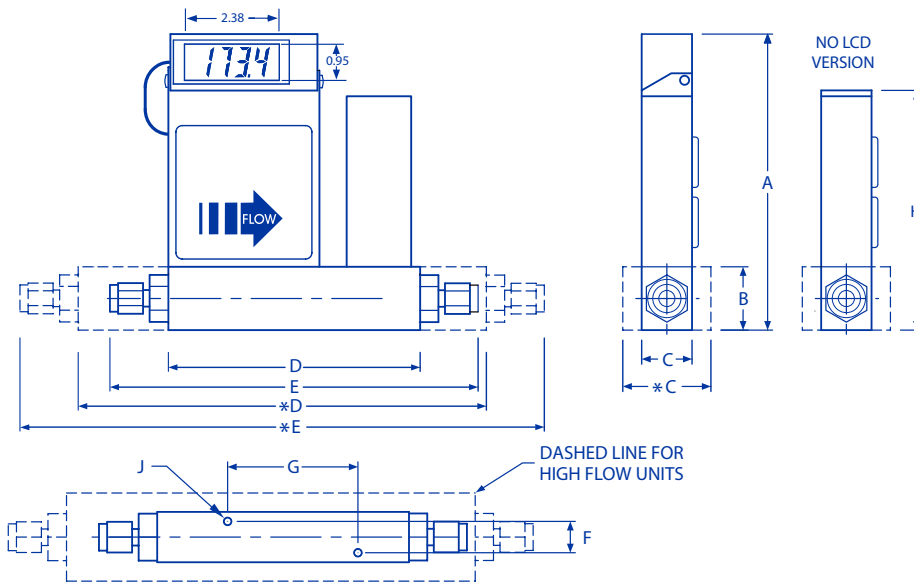
## Mass Flow Controllers (cont'd.)

Model GFC

Table 3 Dimensions

GFC Model	Inlet and Outlet Connections	Dimension (inches)								Size	
		LCD Version								No LCD	Mounting Hole
		A	B	C/C	D/D	E/E	F	G	H	J	
17	1/4" Compression	5.60	1.00	1.00	4.27	6.29	0.69	2.69	4.50	6-32	
37	1/4" Compression	5.98	1.37	1.25	5.19	7.21	0.69	2.69	4.88	6-32	
47	3/8" Compression	5.98	1.37	1.25	5.19	7.33	0.69	2.69	4.88	6-32	
57	3/8" Compression	6.60	2.00	1.75	10.20	12.30	1.39	4.69	6.60	10-24	
67	1/2" Compression	7.56	3.00	3.00	10.24	12.40	2.50	6.80	7.56	1/4-20	
77	3/4" NPT Female	8.56	4.00	4.00	10.50	—	3.00	6.80	8.56	1/4-20	

Table 4 Accessories: Power Supply and Cables



Part Number	Description
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

# Mass Flow Controllers (cont'd.)

## Model GFC Ordering Information

GFC		Maximum Flow N <sub>2</sub>		
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		GFC Model		
A	1/4" Compression	17, 37		
B	1/8" Compression	17		
C	1/4" VCR®	17, 37		
D	3/8" Compression	17, 37, 47, 57		
E	1/2" Compression	67		
F	3/4" NPT Female	77		
G	3/4" Compression	77		
H	6mm Compression	17, 37		
Display				
N	No display			
L	LCD readout			
Power			GFC Model	
6	Universal +12 VDC to +26 VDC		17, 37, 47	
2	12 VDC		57, 67, 77	
4	24 VDC		57, 67, 77	
Input/Output Signals			Digital Interface	
A	Local 0 – 5 VDC		0	None
B	Local 4-20mA			
C	0 – 5 VDC/0 – 5 VDC			
D	0 – 5 VDC/4-20mA			
E	4-20mA/4-20mA			
F	4-20mA/0 – 5 VDC			

**Example: GFC17S-VAL6-C0**  
10 L/min (N<sub>2</sub>) 20 psig

Specify flow range, gas and pressure  
GFC17 with stainless steel, Viton® seals,  
1/4" compression fittings, display, 12  
VDC, 0-5 VDC output signal, no digital  
interface

GFC	17	S	V	A	L	2	C	0
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