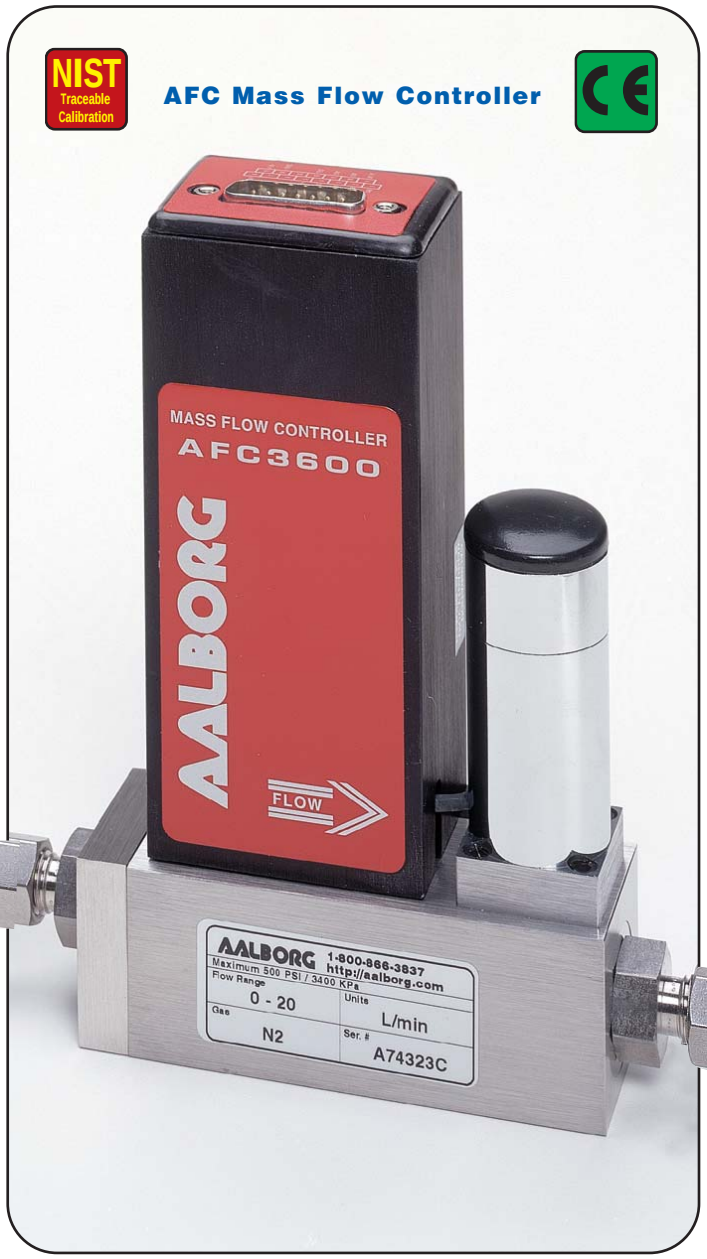
Mass Flow Meters and Controllers

AFC AFM

Model **AF** mass flow meters and controllers are designed to indicate flow rates and control set flow rates of gases.

Each of these units incorporates an advanced straight tube sensor in conjunction with flow passage elements constructed of stainless steel.

LED readouts of command modules are supplied with 0 to 100 percent calibrations. Zero and span adjustments are conveniently accessible from outside of the transmitters.



Design Features

- Rigid metallic construction.
- Maximum pressure of 1000 psig (70 bars).
- 0-5 Vdc or 4-20mA signals.
- Leak integrity 1 x 10^{-9} smL/sec of helium.
- Accuracy of ±1% F.S.
- Totalizer option.
- Circuit protection.

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 or 4 to 20mA are generated indicating mass molecular based flow rates of the metered gas.

In AFC mass flow controllers 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.

Mass Flow Meters and Controllers

AFC **AFM**

AFC mass flow controllers include an electromagnetic control valve that 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.

AF mass flow meters and controllers are designed to meter and control flow rates of gases.

AF mass flow meters and controllers are available with flow ranges from 10 sccm to 100LPM [N_2]. Gases are connected by means of 1/4", 3/8", or optional 1/8"compression fittings. 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} smL/sec of helium max to outside environment.

Mass Flow Systems

Complete Mass Flow Systems include Command Modules, transducers and cables. Command modules contain appropriate power supplies, digital panel meters with 3-1/2" digit LED readouts and high precision potentiometers.External RS-232 or RS-485 are optional.

Switches in the front panels of Command Modules select LOCAL or REMOTE reference signals, analog outputs are accessible through convenient 9 pin D-connectors.

AFC and PROC Mass Flow Controllers

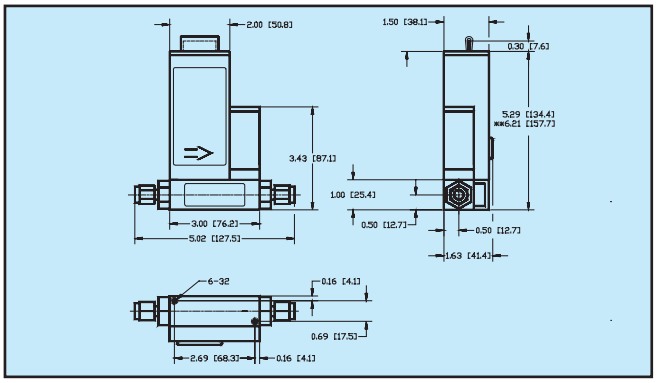
Specifications

Accuracy :	±1% of full scale, including linearity for gas temperatures ranging from 59°F to 77°F (15°C to 25°C) and pressures of 10 to 60 psia (0.7 to 4.1 bars); ±2% of full scale including linearity ranging from 41°F to 122°F (5°C to 50°C) and pressures of 5 to 150 psia (0.35 to 10.3 bars).
Repeatability :	±0.2% of full scale.
Time Constant :	AFM Series - 300 ms AFC2600 (Qmax = 15 sL/min) - 300 ms AFC3600 (Qmax = 50 sL/min) - 600 ms AFC4600 (Qmax = 100 sL/min) - 600 ms
Response Time :	AFM Series - Approximately 1 second to within ±2% of set flow rate for 25% to 100% of full scale flow. AFC2600 (Qmax = 15 sL/min) - Approximately 1 second to within ±2% of set flow rate for 25% to 100% of full scale flow. AFC3600 (Qmax = 50 sL/min) and AFC4600 (Qmax = 100 sL/min) - Approximately 2 second to within ±2% of set flow rate for 25% to 100% of full scale flow.
Temperature Coefficient :	0.1% of full scale/°C.
Pressure Coefficient :	0.01% of full scale/psi (0.07 bar).
Optimum Gas Pressure :	25 psig (1.73 bars).
Maximum Gas Pressure :	1000 psig (70 bars) maximum. Standard calibration is at 20 psig (1.4 bars) inlet pressure.
Max. Pressure Drop [cm H2O](at full scale flow) :	Refer to Table 4 and Table 5.
Gas and Ambient Temp :	41°F to 122°F (5°C to 50°C).
Leak Integrity :	1 x 10^{-9} smL/sec of helium maximum, to the outside environment.
Materials in Fluid Contact :	316 stainless steel, 416 stainless steel, Viton®, O-rings. Optional o-rings, Neoprene®, or 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 (2000Ω min. load impedance); 4 - 20 mA optional (0 - 500Ω loop resistance); maximum noise 20 mV peak to peak.
Connections :	AFM/AFC2600,AFM/AFC3600 -1/4" compression fittings, AFM/AFC4600 - 3/8" compression fittings. Optional - 1/8" or 3/8" compression fittings or 1/4" VCR® fittings.
Transducer Input Power :	AFM/AFC2600 +15 ± 5% Vdc, 80 mA max,1.2W; -15 ± 5% Vdc, 200 mA max, 3W; AFC3600/AFC4600 +15 ± 5% Vdc, 220 mA max, 3.3W; -15 ±5% Vdc, 600 mA max, 9W.
Circuit Protection :	Circuit boards have built-in polarity reversal protection. Replaceable fuses provide power input protection.

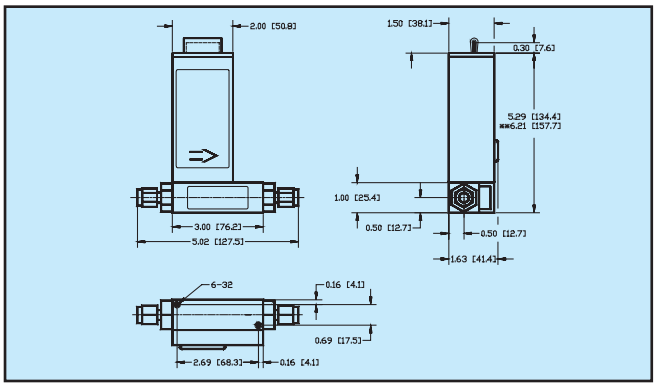
BULLETIN FM200408 AFC / AFM

Dimensions*

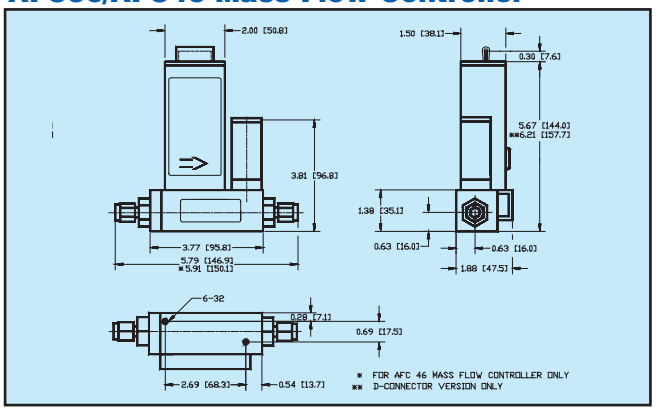
AFC26 Mass Flow Controller



AFM26 Mass Flow Meter



AFC36/AFC46 Mass Flow Controller



AFM36/AFM46 Mass Flow Meter

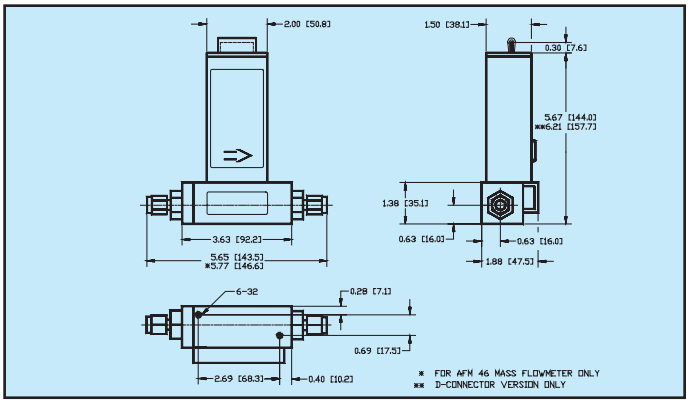


TABLE 26 - Maximum Pressure Drops

Flow Rate [sL/min]	AFC Series		AFM Series	
	[psid]	[bars]	[psid]	[bars]
up to 10	1.06	0.072	0.04	0.003
up to 15	3.87	0.26	0.09	0.006
up to 20	2.0	0.136	0.44	0.030
up to 30	3.5	0.238	1.18	0.080
up to 40	5.5	0.374	2.18	0.148
up to 50	8	0.544	3.23	0.220
up to 100	18.9	1.302	8.08	0.557

FLOW RANGES			
Code	Units [Nitrogen]	Code	Units [Nitrogen]
AFC2600 / AFM2600			
-01	0 to 10 smL/min	-06	0 to 500 smL/min
-02	0 to 20 smL/min	-07	0 to 1 sL/min
-03	0 to 50 smL/min	-08	0 to 2 sL/min
-04	0 to 100 smL/min	-09	0 to 5 sL/min
-05	0 to 200 smL/min	-10	0 to 10 sL/min
AFC3600 / AFM3600			
-11	0 to 15 sL/min	-32	0 to 40 sL/min
-30	0 to 20 sL/min	-33	0 to 50 sL/min
-31	0 to 30 sL/min		
AFC4600 / AFM4600			
-40	0 to 60 sL/min	-42	0 to 100 sL/min
-41	0 to 80 sL/min		

MODEL	SERIES	MAXIMUM FLOW (N_2)
AFC	26	15 L/min
AFM	36	50 L/min
	46	100 L/min

MATERIAL	
S	Stainless

SEALS	
V	Viton
B	Buna
E	EPR
T	PTFE/ Kalrez

FITTINGS	
A	1/4" Compression
B	1/8" Compression
C	VCR
D	3/8" Compression

CONNECTOR	
D	D Connector

DISPLAY	
N	No display

POWER	
5	±15 Vdc

INPUT/OUTPUT SIGNAL AFM ONLY	
A	*n.a./0-5 Vdc
B	*n.a./4-20mA

INPUT/OUTPUT SIGNAL AFC ONLY	
C	0-5Vdc/0-5Vdc
D	0-5Vdc/4-20mA

DIGITAL INTERFACE	
0	None

*n.a. = not applicable

AFM 36 S – V A D N 5 – A 0

EXAMPLE: AFM36S-VADN5-A0 **50 sL/min [N_2] 20 psig** PLEASE SPECIFY: Gas, Flow Range and Pressure.
AFM36 Stainless, Viton seals with 1/4" compression D connector without a display, +15 Vdc, *n.a./0-5Vdc Input/Output signal, and No Digital Interface

ORDERING INFORMATION FOR AFM AND AFC