Variable Area Flowmeters

G Series and M Series

- Glass and metal (armored) tube models, including miniature armored model
- Highly accurate measurement with individually calibrated scales based on flow tests
- Flexible and adaptable to specific system requirements
- High quality, durability, and repeatability
- 1/8 to 1 1/4 in. process end connections

Contents

Variable Area Flowmeters

Swagelok® variable area flowmeters measure the flow rate of liquids and gases by means of a tapered tube and float. The float is pushed up by increasing fluid flow and pulled down by gravity as fluid flow decreases, except for the spring-loaded MH model. Variable area flowmeters do not require external power, but may be ordered with electrical or electronic options.

Most Swagelok models contain integral needle valves at the bottom (inlet) process connection; top mounting is available as an option.

Features

- Simple installation
- Easy to read
- No wearing parts
- Limit switches available
- 10-to-1 turndown ratio (the lowest measurement is one tenth of the full-scale reading).
- Meters are marked with the fluid media and unit of measure for which they are calibrated.

Calibration and Testing

Every Swagelok variable area flowmeter is factory calibrated to its media, flow range, and accuracy class using clean, dry air for air-flow range models and water for water-flow range models.

- G1, G2, G3, GM, and GP models are calibrated to 17.4 psia (1.2 bar) and 68°F (20°C).
- G4, M1, M2, M3, and MH models are calibrated to 14.7 psia (1.013 bar) and and 68°F (20°C).

Meters can be calibrated to user-specific applications.

Cleaning and Packaging

All Swagelok variable area flowmeters are cleaned to remove dirt, debris, and burrs and are individually boxed. Oil- and grease-free cleaning are available on request.

Installation

Variable area flowmeters must be oriented vertically, except for the MH model, which is mounted horizontally. For complete installation information, see the Swagelok *Variable Area Flowmeters Installation Instructions, G Series and M Series,* MS-CRD-0111, available *only* on your Swagelok website.

Choosing the Right Flowmeter

Variable Area Flowmeter Selection

Model	Process Temperature Rating °F (°C)	Ambient Temperature Rating °F (°C)	Maximum Inlet Pressure at 70°F (20°C) psig (bar)
G1	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	145 (10.0)
G2	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	145 (10.0)
G3	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	145 (10.0)
G4	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	145 (10.0)
GM	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	58.0 (4.0)
GP	23 to 212 (–5 to 100)	–4 to 212 (–20 to 100)	58.0 (4.0)
M1	–4 to 302 (–20 to 150)	–4 to 158 (–20 to 70)	1885 (130)
M2	–4 to 302 (–20 to 150)	–4 to 158 (–20 to 70)	1885 (130)
M3 (1/2 in. dia tube)	–40 to 572 (–40 to 300)	–40 to 248 (–40 to 120)	2888 (199)
M3 (1 in. dia tube)	–40 to 572 (–40 to 300)	–40 to 248 (–40 to 120)	1393 (96.0)
MH (1/2 in. dia tube)	–40 to 572 (–40 to 300)	–40 to 248 (–40 to 120)	2888 (199)
MH (1 in. dia tube)	–40 to 572 (–40 to 300)	–40 to 248 (–40 to 120)	1393 (96.0)

Choosing the Right Flowmeter

Variable area flowmeters are fitted with measuring tubes made of glass or metal.

- Swagelok G series models contain glass measuring tubes, which allow direct viewing of the process fluid and direct reading of the flow.
- Swagelok M series models contain metal measuring tubes, which are used for difficult operating conditions where pressure, temperature, or both are factors. Because direct readings are not possible with metal tubes, these flowmeters are equipped with mechanical or electronic displays.

See the **Variable Area Flowmeter Selection** table below for a wide selection of flowmeters.

- Standard conditions (std ft^3/min and std ft^3/h air flow ranges) are defined as 14.7 psia (1.013 bar) at 59°F (15°C) in accordance with ISO 13443.
- Normal conditions (NL/min and NL/h air flow ranges) are defined as 14.7 psia (1.013 bar) at 32°F (0°C) in accordance with DIN 1343.

Fluids with properties different from those of air or water, as well as systems operating at higher pressures or temperatures, may require custom-calibrated flowmeters.

See **Custom Calibration**, page 1040, for more information.

Variable Area Flowmeter Selection

Air Flow Ranges				Water Flow Ranges				Accuracy Class①	Process End Connections	Page
NL/min	NL/h	std ft^3/min	std ft^3/h	L/min	L/h	U.S. gal/min	U.S. gal/h			
0.011 to 0.11 through 2.0 to 20	0.5 to 5.0 through 120 to 1200	0.0004 to 0.004 through 0.07 to 0.7	0.018 to 0.18 through 4.5 to 45	0.004 to 0.04 through 0.27 to 2.7	0.25 to 2.5 through 16 to 160	0.001 to 0.01 through 0.07 to 0.7	0.065 to 0.65 through 4.2 to 42	4.0	1/4 in. NPT	1023
0.011 to 0.11 through 8.4 to 84	0.5 to 5.0 through 500 to 5000	0.0004 to 0.004 through 0.3 to 3.0	0.018 to 0.18 through 18 to 180	0.004 to 0.04 through 0.28 to 2.8	0.25 to 2.5 through 16 to 160	0.001 to 0.01 through 0.07 to 0.7	0.065 to 0.65 through 4.2 to 42	2.5	1/4 in. NPT	1024
0.027 to 0.27 through 1.3 to 13	1.6 to 16 through 80 to 800	0.001 to 0.01 through 0.05 to 0.5	0.06 to 0.6 through 3.0 to 30	0.008 to 0.08 through 0.17 to 1.7	0.5 to 5.0 through 10 to 100	0.002 to 0.02 through 0.045 to 0.45	0.13 to 1.3 through 2.5 to 25	2.5	1/4 in. NPT	1025
0.027 to 0.27 through 5.0 to 50	1.6 to 16 through 300 to 3000	0.001 to 0.01 through 0.18 to 18	0.06 to 0.6 through 11 to 110	0.0007 to 0.007 through 0.17 to 1.7	0.04 to 0.4 through 10 to 100	0.00019 to 0.0019 through 0.045 to 0.45	0.01 to 0.1 through 2.5 to 25	1.0	1/4 in. NPT	1026
0.011 to 0.11 through 1.3 to 13	0.5 to 5.0 through 80 to 800	0.0004 to 0.004 through 0.05 to 0.5	0.018 to 0.18 through 3.0 to 30	0.004 to 0.04 through 0.065 to 0.65	0.25 to 2.5 through 4.0 to 40	0.001 to 0.01 through 0.017 to 0.17	0.065 to 0.65 through 1.1 to 11	4.0	G 1/8 (ISO 228)	1027
0.011 to 0.11 through 8.4 to 84	0.5 to 5.0 through 500 to 5000	0.0004 to 0.004 through 0.3 to 3.0	0.018 to 0.18 through 18 to 180	0.004 to 0.04 through 0.28 to 2.8	0.25 to 2.5 through 16 to 160	0.001 to 0.01 through 0.07 to 0.7	0.065 to 0.65 through 4.2 to 42	2.5	G 1/4 (ISO 228)	1028
0.08 to 0.8 through 6.0 to 60	5.0 to 50 through 340 to 3400	0.003 to 0.03 through 0.2 to 2.0	0.18 to 1.8 through 13 to 130	0.005 to 0.05 through 0.17 to 1.7	0.3 to 3.0 through 10 to 100	0.0013 to 0.013 through 0.045 to 0.45	0.08 to 0.8 through 2.5 to 25	4.0	1/4 in. NPT	1030
0.08 to 0.8 through 6.0 to 60	5.0 to 50 through 340 to 3400	0.003 to 0.03 through 0.2 to 2.0	0.18 to 1.8 through 13 to 130	0.005 to 0.05 through 0.17 to 1.7	0.3 to 3.0 through 10 to 100	0.0013 to 0.013 through 0.045 to 0.45	0.08 to 0.8 through 2.5 to 25	2.5	1/4 in. NPT	1032
1.1 to 11 through 50 to 500	70 to 700 through 2800 to 28 000	0.04 to 0.4 through 1.6 to 16	2.5 to 25 through 100 to 1000	0.03 to 0.3 through 1.7 to 17	1.8 to 18 through 100 to 1000	0.008 to 0.08 through 0.45 to 4.5	0.48 to 4.8 through 25 to 250	1.6	1/2 and 3/4 in. NPT; 1/2, 3/4, and 1 in. ASME flange	1034
25 to 250 through 300 to 3000	1400 to 14 000 through 18 000 to 180 000	1.0 to 10 through 10 to 1000	52 to 520 through 670 to 6700	0.8 to 8.0 through 10 to 100	48 to 480 through 630 to 6300	0.2 to 2.0 through 3.0 to 30	13 to 130 through 160 to 1600	1.6	3/4 and 1 in. NPT; 3/4 and 1 in. ASME flange	1034
—	—	—	—	0.11 to 1.1 through 4.0 to 40	7.0 to 70 through 240 to 2400	0.03 to 0.3 through 1.07 to 10.7	2.0 to 20 through 64 to 640	1.6	3/4 in. NPT; 1/2, 3/4, and 1 in. ASME flange	1036
—	—	—	—	2.0 to 20 through 17 to 170	130 to 1300 through 1000 to 10 000	0.6 to 6.0 through 4.5 to 45	35 to 350 through 270 to 2700	1.6	1 1/4 in. NPT; 1 in. ASME flange	1036

① In accordance with VDI/VDE 3513 Sheet 2: 2008, accuracy class is effectively equivalent to permissible error above q_G = 50 %.

where:

G = Constant permissible error in percent of measured value above q_G

q_G = Flow limit value in percent of full scale

Above q_G, the permissible error is constant. Below q_G, the permissible error increases toward lower flow rates inversely proportional.

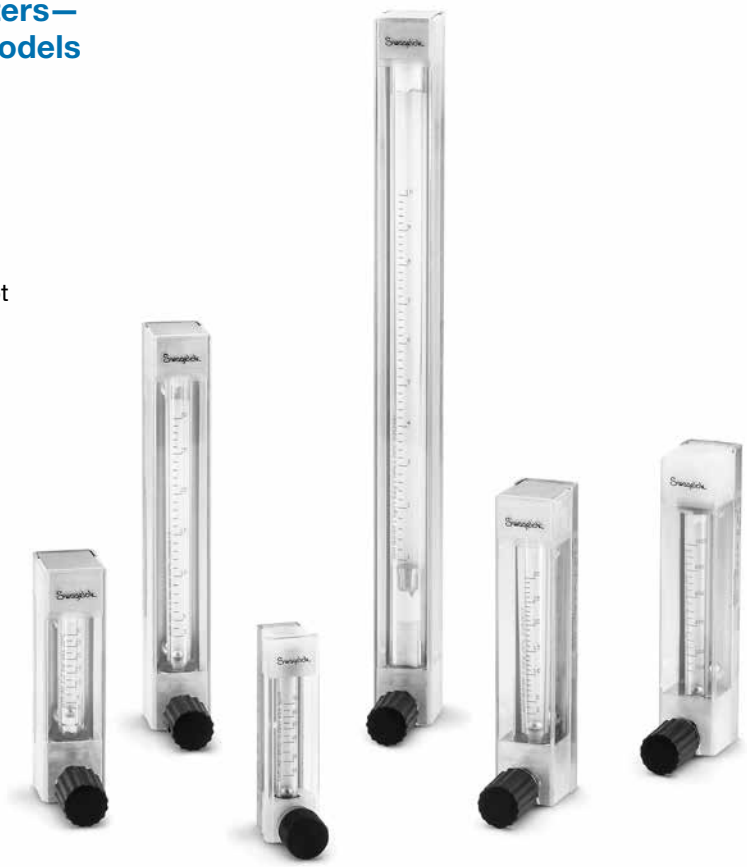
In sizing a flowmeter, q_G = 50 % allows for the greatest accuracy above 50 % of the full scale. For assistance with variable area flowmeter selection, contact your authorized Swagelok sales and service representative.

Fluid media, temperature, pressure, viscosity, and density also must be considered in selecting a variable area flowmeter. See **Custom Calibration,** page 1040.

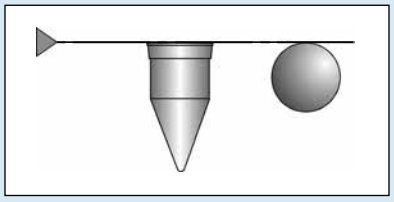
G Series (Glass Tube) Flowmeters—G1, G2, G3, G4, GM, and GP Models

Features

- Glass tube design
- Low maintenance
- Optional factory-installed limit switches
- Polycarbonate cover for protection
- Integral needle valve for fine metering, not intended for shutoff



Reading Glass-Tube Flowmeters



Glass-tube flowmeters are read by the position of the float or ball within the flowmeter tube. The flow rate is read at the top edge of the float or ball.

Materials of Construction

G1, G2, G3, and G4 Models

Component	Material / Specification
Flowmeter	
Head piece, foot piece	*316L stainless steel / EN 1.4404*
Float (G1, G2, G3)	*316 stainless steel / EN 1.4401*
Float (G4)	*316Ti stainless steel / EN 1.4571*
Measuring tube	*Borosilicate glass*
Float stops	*PFA with fluorocarbon (FKM) gaskets or PTFE with perfluorocarbon (FFKM) gaskets*
Head piece gasket, foot piece gasket	*Fluorocarbon (FKM), perfluorocarbon (FFKM), or EPDM*
Protective cover	Polycarbonate
Mounting rail	304 stainless steel / EN 1.4301
Needle Valve	
Needle	*316L stainless steel / EN 1.4404*
Gaskets	*PTFE*
O-rings	*Fluorocarbon (FKM), perfluorocarbon (FFKM), or EPDM*
Housing, spring	*316Ti stainless steel / EN 1.4571*
Spindle	316L stainless steel / EN 1.4404
Spindle lubricant	PTFE-based
Knob handle	Plastic
Knob handle insert	Brass
Knob handle set screw	A2 stainless steel

Wetted components listed in *italics*.

G1 Model

This G1 model is suitable for low flow rates in fine-metering applications such as gas chromatography.

Technical Data

See **Variable Area Flowmeter Selection**, page 1020.

Ordering Information

Build a G1 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

				4		5	6		7	
VAF	-	G1	-	**01M**	-	**1**	**1**	-	**A**	

4 Measured Flow Range

Air, NL/min	*Air, NL/h*
01L = 0.011 to 0.11	**01M** = 0.5 to 5.0
02L = 0.013 to 0.13	**02M** = 0.8 to 8.0
03L = 0.027 to 0.27	**03M** = 1.6 to 16
04L = 0.07 to 0.7	**04M** = 4.0 to 40
05L = 0.1 to 1.0	**05M** = 6.0 to 60
06L = 0.17 to 1.7	**06M** = 10 to 100
07L = 0.42 to 4.2	**07M** = 25 to 250
08L = 0.83 to 8.3	**08M** = 50 to 500
09L = 1.3 to 13	**09M** = 80 to 800
10L = 2.0 to 20	**10M** = 120 to 1200
Air, std ft³/min	***Air, std ft³/h***
01R = 0.0004 to 0.004	**01S** = 0.022 to 0.22
02R = 0.0005 to 0.005	**02S** = 0.03 to 0.3
03R = 0.001 to 0.01	**03S** = 0.06 to 0.6
04R = 0.002 to 0.02	**04S** = 0.15 to 1.5
05R = 0.0035 to 0.035	**05S** = 0.22 to 2.2
06R = 0.006 to 0.06	**06S** = 0.38 to 3.8
07R = 0.015 to 0.15	**07S** = 0.95 to 9.5
08R = 0.03 to 0.3	**08S** = 1.9 to 19
09R = 0.05 to 0.5	**09S** = 3.0 to 30
10R = 0.07 to 0.7	**10S** = 4.5 to 45
Water, L/min	***Water, L/h***
A1L = 0.004 to 0.04	**A1M** = 0.25 to 2.5
A2L = 0.008 to 0.08	**A2M** = 0.50 to 5.0
A3L = 0.02 to 0.2	**A3M** = 1.2 to 12
A4L = 0.04 to 0.4	**A4M** = 2.5 to 25
A5L = 0.065 to 0.65	**A5M** = 4.0 to 40
A6L = 0.1 to 1.0	**A6M** = 6.0 to 60
A7L = 0.17 to 1.7	**A7M** = 10 to 100
A8L = 0.2 to 2.0	**A8M** = 12 to 120
A9L = 0.27 to 2.7	**A9M** = 16 to 160
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.001 to 0.01	**A1S** = 0.065 to 0.65
A2R = 0.002 to 0.02	**A2S** = 0.13 to 1.3
A3R = 0.005 to 0.05	**A3S** = 0.30 to 3.0
A4R = 0.01 to 0.1	**A4S** = 0.65 to 6.5
A5R = 0.017 to 0.17	**A5S** = 1.1 to 11
A6R = 0.025 to 0.25	**A6S** = 1.6 to 16
A7R = 0.045 to 0.45	**A7S** = 2.5 to 25
A8R = 0.055 to 0.55	**A8S** = 3.0 to 30
A9R = 0.07 to 0.7	**A9S** = 4.2 to 42

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)
3 = EPDM

6 Limit Switches (See page 1040.)

*The maximum process and ambient temperatures are reduced to 149°F (65°C) if limit switches are selected. Most G1 model flowmeters can accept up to two limit switches; models with measured water flow ranges **A8L, A9L, A8M, A9M, A8R, A9R, A8S,** and **A9S** cannot accept limit switches; also see footnote below.*

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = One switch
2 = Two switches①
3 = One switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
4 = Two switches and a two-channel isolated switch amplifier with relay output, 115 V (ac)①
5 = One switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
6 = Two switches and a two-channel isolated switch amplifier with relay output, 230 V (ac)①
A = One switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Two switches and a two-channel isolated switch amplifier with relay output, 24 V (dc)

① Not available with measured air flow ranges **10L, 10M, 10R,** and **10S,** or with measured water flow ranges **A7L, A7M, A7R,** and **A7S.**

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

A = Limit switch junction box
G = 5-point calibration record
H = Pressure test, certificate
J = Material certification
T = Wall mounting
W = Panel mounting
X = Oil- and grease-free cleaning (**required** for oxygen service)
Y = No needle valve
Z = Top-mounted needle valve

Dimensions

See page 1038 for G1 model dimensions.

G2 Model

Commonly used in analytical instrumentation applications, the G2 model is appropriate for low to medium flow rates.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build a G2 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

				4		5	6		7	
VAF	-	G2	-	**01M**	-	**1**	-	**1**	-	**A**

4 Measured Flow Range

Air, NL/min	*Air, NL/h*
01L = 0.011 to 0.11	**01M** = 0.5 to 5.0
02L = 0.013 to 0.13	**02M** = 0.8 to 8.0
03L = 0.027 to 0.27	**03M** = 1.6 to 16
04L = 0.07 to 0.7	**04M** = 4.0 to 40
05L = 0.1 to 1.0	**05M** = 6.0 to 60
06L = 0.17 to 1.7	**06M** = 10 to 100
07L = 0.42 to 4.2	**07M** = 25 to 250
08L = 0.83 to 8.3	**08M** = 50 to 500
09L = 1.3 to 13	**09M** = 80 to 800
10L = 1.7 to 17	**10M** = 100 to 1000
11L = 3.0 to 30	**11M** = 180 to 1800
12L = 4.0 to 40	**12M** = 240 to 2400
13L = 5.0 to 50	**13M** = 300 to 3000
14L = 6.8 to 68	**14M** = 400 to 4000
15L = 8.4 to 84	**15M** = 500 to 5000
Air, std ft³/min	*Air, std ft³/h*
01R = 0.0004 to 0.004	**01S** = 0.018 to 0.18
02R = 0.0005 to 0.005	**02S** = 0.03 to 0.3
03R = 0.001 to 0.01	**03S** = 0.06 to 0.6
04R = 0.002 to 0.02	**04S** = 0.15 to 1.5
05R = 0.0035 to 0.035	**05S** = 0.22 to 2.2
06R = 0.006 to 0.06	**06S** = 0.38 to 3.8
07R = 0.015 to 0.15	**07S** = 0.95 to 9.5
08R = 0.03 to 0.3	**08S** = 1.9 to 19
09R = 0.05 to 0.5	**09S** = 3.0 to 30
10R = 0.06 to 0.6	**10S** = 4.5 to 45
11R = 0.1 to 1.0	**11S** = 6.5 to 65
12R = 0.14 to 1.4	**12S** = 9.0 to 90
13R = 0.18 to 1.8	**13S** = 11 to 110
14R = 0.24 to 2.4	**14S** = 14 to 140
15R = 0.3 to 3.0	**15S** = 18 to 180

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

Water, L/min	*Water, L/h*
A1L = 0.004 to 0.04	**A1M** = 0.25 to 2.5
A2L = 0.008 to 0.08	**A2M** = 0.50 to 5.0
A3L = 0.02 to 0.2	**A3M** = 1.2 to 12
A4L = 0.04 to 0.4	**A4M** = 2.5 to 25
A5L = 0.065 to 0.65	**A5M** = 4.0 to 40
A6L = 0.1 to 1.0	**A6M** = 6.0 to 60
A7L = 0.17 to 1.7	**A7M** = 10 to 100
A8L = 0.2 to 2.0	**A8M** = 12 to 120
A9L = 0.28 to 2.8	**A9M** = 16 to 160
Water, U.S. gal/min	*Water, U.S. gal/h*
A1R = 0.001 to 0.01	**A1S** = 0.065 to 0.65
A2R = 0.002 to 0.02	**A2S** = 0.13 to 1.3
A3R = 0.005 to 0.05	**A3S** = 0.30 to 3.0
A4R = 0.01 to 0.1	**A4S** = 0.65 to 6.5
A5R = 0.017 to 0.17	**A5S** = 1.1 to 11
A6R = 0.025 to 0.25	**A6S** = 1.6 to 16
A7R = 0.045 to 0.45	**A7S** = 2.5 to 25
A8R = 0.054 to 0.54	**A8S** = 3.0 to 30
A9R = 0.07 to 0.7	**A9S** = 4.2 to 42

5 Flowmeter Gasket, Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)
3 = EPDM

Dimensions

See page 1038 for G2 model dimensions.

6 Limit Switches (See page 1040.)

The maximum process and ambient temperatures are reduced to 149°F (65°C) if limit switches are selected.

Most G2 model flowmeters can accept up to two limit switches; see footnote below.

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = One switch
2 = Two switches①
3 = One switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
4 = Two switches and a two-channel isolated switch amplifier with relay output, 115 V (ac)①
5 = One switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
6 = Two switches and a two-channel isolated switch amplifier with relay output, 230 V (ac)①
A = One switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Two switches and a two-channel isolated switch amplifier with relay output, 24 V (dc)

① Not available with measured air flow ranges **13L, 14L, 15L, 13S, 14S, 15S, 13M, 14M, 15M, 13R, 14R,** and **15R,** or with measured water flow ranges **A7L, A8L, A9L, A7M, A8M, A9M, A7R, A8R, A9R, A7S, A8S,** and **A9S.**

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

A = Limit switch junction box
G = 5-point calibration record
H = Pressure test, certificate
J = Material certification
T = Wall mounting
W = Panel mounting
X = Oil- and grease-free cleaning (**required** for oxygen service)
Y = No needle valve
Z = Top-mounted needle valve

G3 Model

The G3 model provides reliable, accurate measurement over the mid ranges of air or water flow.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build a G3 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

			4		5		6		7	
VAF	-	G3	-	**01M**	-	**1**	-	**1**	-	**A**

4 Measured Flow Range

Air, NL/min	*Air, NL/h*
01L = 0.027 to 0.27	**01M** = 1.6 to 16
02L = 0.07 to 0.7	**02M** = 4.0 to 40
03L = 0.1 to 1.0	**03M** = 6.0 to 60
04L = 0.17 to 1.7	**04M** = 10 to 100
05L = 0.42 to 4.2	**05M** = 25 to 250
06L = 0.83 to 8.3	**06M** = 50 to 500
07L = 1.3 to 13	**07M** = 80 to 800
Air, std ft³/min	***Air, std ft³/h***
01R = 0.001 to 0.01	**01S** = 0.06 to 0.6
02R = 0.002 to 0.02	**02S** = 0.15 to 1.5
03R = 0.0035 to 0.035	**03S** = 0.21 to 2.1
04R = 0.006 to 0.06	**04S** = 0.38 to 3.8
05R = 0.015 to 0.15	**05S** = 0.95 to 9.5
06R = 0.03 to 0.3	**06S** = 1.9 to 19
07R = 0.05 to 0.5	**07S** = 3.0 to 30
Water, L/min	***Water, L/h***
A1L = 0.008 to 0.08	**A1M** = 0.5 to 5.0
A2L = 0.02 to 0.2	**A2M** = 1.2 to 12
A3L = 0.04 to 0.4	**A3M** = 2.5 to 25
A4L = 0.065 to 0.65	**A4M** = 4.0 to 40
A5L = 0.1 to 1.0	**A5M** = 6.0 to 60
A6L = 0.17 to 1.7	**A6M** = 10 to 100
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.002 to 0.02	**A1S** = 0.13 to 1.3
A2R = 0.005 to 0.05	**A2S** = 0.25 to 2.5
A3R = 0.01 to 0.1	**A3S** = 0.65 to 6.5
A4R = 0.017 to 0.17	**A4S** = 1.1 to 11
A5R = 0.025 to 0.25	**A5S** = 1.6 to 16
A6R = 0.045 to 0.45	**A6S** = 2.5 to 25

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)
3 = EPDM

6 Limit Switches (See page 1040.)

The maximum process and ambient temperatures are reduced to 149°F (65°C) if limit switches are selected. Most G3 model flowmeters can accept up to two limit switches; see footnote below.

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = One switch
2 = Two switches①
3 = One switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
4 = Two switches and a two-channel isolated switch amplifier with relay output, 115 V (ac)①
5 = One switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
6 = Two switches and a two-channel isolated switch amplifier with relay output, 230 V (ac)①
A = One switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Two switches and a two-channel isolated switch amplifier with relay output, 24 V (dc)

① Not available with measured flow ranges **A6L, A6M, A6R,** and **A6S.**

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

A = Limit switch junction box
G = 5-point calibration record
H = Pressure test, certificate
J = Material certification
T = Wall mounting
W = Panel mounting
X = Oil- and grease-free cleaning (**required** for oxygen service)
Y = No needle valve
Z = Top-mounted needle valve

Dimensions

See page 1038 for G3 model dimensions.

G4 Model

Suitable for laboratory applications, the large-size G4 model is highly accurate over its full measured flow range.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build a G4 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

			4		**5**	**6**	**7**			
VAF	-	G4	-	**05M**	-	**1**	-	**1**	-	**A**

4 Measured Flow Range

Air, NL/min	*Air, NL/h*
01L = 0.027 to 0.27	**01M** = 1.6 to 16
02L = 0.042 to 0.42	**02M** = 2.5 to 25
03L = 0.068 to 0.68	**03M** = 4.0 to 40
04L = 0.1 to 1.0	**04M** = 6.0 to 60
05L = 0.15 to 1.5	**05M** = 9.0 to 90
06L = 0.23 to 2.3	**06M** = 14 to 140
07L = 0.33 to 3.3	**07M** = 20 to 200
08L = 0.5 to 5.0	**08M** = 30 to 300
09L = 0.83 to 8.3	**09M** = 50 to 500
10L = 1.33 to 13.3	**10M** = 80 to 800
11L = 2.0 to 20	**11M** = 120 to 1200
12L = 3.33 to 33.3	**12M** = 200 to 2000
13L = 5.0 to 50	**13M** = 300 to 3000
Air, std ft³/min	***Air, std ft³/h***
01R = 0.001 to 0.01	**01S** = 0.06 to 0.6
02R = 0.0015 to 0.015	**02S** = 0.095 to 0.95
03R = 0.0023 to 0.023	**03S** = 0.15 to 1.5
04R = 0.0035 to 0.035	**04S** = 0.22 to 2.2
05R = 0.0051 to 0.051	**05S** = 0.35 to 3.5
06R = 0.0082 to 0.082	**06S** = 0.50 to 5.0
07R = 0.012 to 0.12	**07S** = 0.75 to 7.5
08R = 0.018 to 0.18	**08S** = 1.1 to 11
09R = 0.03 to 0.3	**09S** = 1.9 to 19
10R = 0.05 to 0.5	**10S** = 3.0 to 30
11R = 0.072 to 0.72	**11S** = 4.5 to 45
12R = 0.12 to 1.2	**12S** = 7.5 to 75
13R = 0.18 to 1.8	**13S** = 11 to 110
Water, L/min	***Water, L/h***
A1L = 0.0007 to 0.007	**A1M** = 0.04 to 0.4
A2L = 0.001 to 0.01	**A2M** = 0.063 to 0.63
A3L = 0.0017 to 0.017	**A3M** = 0.1 to 1.0
A4L = 0.0025 to 0.025	**A4M** = 0.16 to 1.6
A5L = 0.004 to 0.04	**A5M** = 0.25 to 2.5
A6L = 0.007 to 0.07	**A6M** = 0.4 to 4.0
A7L = 0.01 to 0.1	**A7M** = 0.6 to 6.0
A8L = 0.017 to 0.17	**A8M** = 1.0 to 10
A9L = 0.025 to 0.25	**A9M** = 1.6 to 16
B1L = 0.04 to 0.4	**B1M** = 2.5 to 25
B2L = 0.065 to 0.65	**B2M** = 4.0 to 40
B3L = 0.1 to 1.0	**B3M** = 6.3 to 63
B4L = 0.17 to 1.7	**B4M** = 10 to 100

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

Water, U.S. gal/min	*Water, U.S. gal/h*
A1R = 0.00019 to 0.0019	**A1S** = 0.01 to 0.1
A2R = 0.0003 to 0.003	**A2S** = 0.016 to 0.16
A3R = 0.00045 to 0.0045	**A3S** = 0.025 to 0.25
A4R = 0.0007 to 0.007	**A4S** = 0.04 to 0.4
A5R = 0.001 to 0.01	**A5S** = 0.065 to 0.65
A6R = 0.0019 to 0.019	**A6S** = 0.1 to 1.0
A7R = 0.0025 to 0.025	**A7S** = 0.16 to 1.6
A8R = 0.0045 to 0.045	**A8S** = 0.25 to 2.5
A9R = 0.007 to 0.07	**A9S** = 0.4 to 4.0
B1R = 0.01 to 0.1	**B1S** = 0.65 to 6.5
B2R = 0.017 to 0.17	**B2S** = 1.0 to 10
B3R = 0.03 to 0.3	**B3S** = 1.6 to 16
B4R = 0.045 to 0.45	**B4S** = 2.5 to 25

5 Flowmeter Gasket, Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)
3 = EPDM

Dimensions

See page 1038 for G4 model dimensions.

6 Limit Switches (See page 1040.)

The maximum process and ambient temperatures are reduced to 149°F (65°C) if limit switches are selected.

*Most G4 model flowmeters can accept up to two limit switches; models with measured air flow ranges **01L, 02L, 03L, 11L, 12L, 13L, 01M, 02M, 03M, 11M, 12M, 13M, 01R, 02R, 03R, 11R, 12R, 13R, 01S, 02S, 03S, 11S, 12S,** and **13S,** or with measured water flow ranges **A1L, A2L, A3L, B2L, B3L, B4L, A1M, A2M, A3M, B2M, B3M, B4M, A1R, A2R, A3R, B2R, B3R, B4R, A1S, A2S, A3S, B2S, B3S,** and **B4S** cannot accept limit switches.*

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = One switch
2 = Two switches
3 = One switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
4 = Two switches and a two-channel isolated switch amplifier with relay output, 115 V (ac)
5 = One switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
6 = Two switches and a two-channel isolated switch amplifier with relay output, 230 V (ac)
A = One switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Two switches and a two-channel isolated switch amplifier with relay output, 24 V (dc)

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

A = Limit switch junction box
G = 5-point calibration record
H = Pressure test, certificate
J = Material certification
W = Panel mounting
X = Oil- and grease-free cleaning (**required** for oxygen service)
Y = No needle valve
Z = Top-mounted needle valve

GM Model

This miniature glass-tube model has a plastic head and foot piece and can be panel mounted easily.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Materials of Construction

Component	Material / Specification
Flowmeter	
Head piece, foot piece	*PVDF*
Float	*316 stainless steel / EN 1.4401*
Measuring tube	*Borosilicate glass*
Float stops	*PFA with fluorocarbon (FKM) gaskets or PTFE with perfluorocarbon (FFKM) gaskets*
Head piece gasket, foot piece gasket	*Fluorocarbon (FKM)*
Protective cover	Polycarbonate
Mounting rail	Aluminum 6060
Needle Valve	
Needle	*316L stainless steel / EN 1.4404*
Gaskets	*PTFE*
O-rings	*Fluorocarbon (FKM)*
Housing, spring	*316Ti stainless steel / EN 1.4571*
Spindle	316L stainless steel / EN 1.4404
Spindle lubricant	PTFE-based
Knob handle	Aluminum 6060
Knob handle insert	Brass
Knob handle set screw	A2 stainless steel

Wetted components listed in *italics*.

Ordering Information

Build a GM model variable area flowmeter ordering number by combining the designators in the sequence shown below.

VAF - GM - **4** **01M** - **5** **Z**

4 Measured Flow Range

Air, NL/min

01L = 0.011 to 0.11
02L = 0.013 to 0.13
03L = 0.027 to 0.27
04L = 0.07 to 0.7
05L = 0.1 to 1.0
06L = 0.17 to 1.7
07L = 0.42 to 4.2
08L = 0.83 to 8.3
09L = 1.3 to 13

Air, NL/h

01M = 0.5 to 5.0
02M = 0.8 to 8.0
03M = 1.6 to 16
04M = 4.0 to 40
05M = 6.0 to 60
06M = 10 to 100
07M = 25 to 250
08M = 50 to 500
09M = 80 to 800

Air, std ft^3/min

01R = 0.0004 to 0.004
02R = 0.0005 to 0.005
03R = 0.001 to 0.01
04R = 0.002 to 0.02
05R = 0.0035 to 0.035
06R = 0.006 to 0.06
07R = 0.015 to 0.15
08R = 0.03 to 0.3
09R = 0.05 to 0.5

Air, std ft^3/h

01S = 0.018 to 0.18
02S = 0.03 to 0.3
03S = 0.06 to 0.6
04S = 0.15 to 1.5
05S = 0.22 to 2.2
06S = 0.38 to 3.8
07S = 0.95 to 9.5
08S = 1.9 to 19
09S = 3.0 to 30

Water, L/min

A1L = 0.004 to 0.04
A2L = 0.008 to 0.08
A3L = 0.02 to 0.2
A4L = 0.04 to 0.4
A5L = 0.065 to 0.65

Water, L/h

A1M = 0.25 to 2.5
A2M = 0.50 to 5.0
A3M = 1.2 to 12
A4M = 2.5 to 25
A5M = 4.0 to 40

Water, U.S. gal/min

A1R = 0.001 to 0.01
A2R = 0.002 to 0.02
A3R = 0.005 to 0.05
A4R = 0.01 to 0.1
A5R = 0.017 to 0.17

Water, U.S. gal/h

A1S = 0.065 to 0.65
A2S = 0.13 to 1.3
A3S = 0.30 to 3.0
A4S = 0.65 to 6.5
A5S = 1.1 to 11

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

5 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

W = Panel mounting
Z = Top-mounted needle valve

Dimensions

See page 1038 for GM model dimensions.

GP Model

The GP model offers a plastic head and foot piece, including end connections.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build a GP model variable area flowmeter ordering number by combining the designators in the sequence shown below.

4	5	6	7
01M	1	1	A

VAF - GP - **01M - 1 - 1 - A**

4 Measured Flow Range

Air, NL/min	*Air, NL/h*
01L = 0.011 to 0.11	**01M** = 0.5 to 5.0
02L = 0.013 to 0.13	**02M** = 0.8 to 8.0
03L = 0.027 to 0.27	**03M** = 1.6 to 16
04L = 0.07 to 0.7	**04M** = 4.0 to 40
05L = 0.1 to 1.0	**05M** = 6.0 to 60
06L = 0.17 to 1.7	**06M** = 10 to 100
07L = 0.42 to 4.2	**07M** = 25 to 250
08L = 0.83 to 8.3	**08M** = 50 to 500
09L = 1.3 to 13	**09M** = 80 to 800
10L = 1.7 to 17	**10M** = 100 to 1000
11L = 3.0 to 30	**11M** = 180 to 1800
12L = 4.0 to 40	**12M** = 240 to 2400
13L = 5 to 50	**13M** = 300 to 3000
14L = 6.8 to 68	**14M** = 400 to 4000
15L = 8.4 to 84	**15M** = 500 to 5000
Air, std ft³/min	***Air, std ft³/h***
01R = 0.0004 to 0.004	**01S** = 0.018 to 0.18
02R = 0.0005 to 0.005	**02S** = 0.03 to 0.3
03R = 0.001 to 0.01	**03S** = 0.06 to 0.6
04R = 0.002 to 0.02	**04S** = 0.15 to 1.5
05R = 0.0035 to 0.035	**05S** = 0.22 to 2.2
06R = 0.006 to 0.06	**06S** = 0.38 to 3.8
07R = 0.015 to 0.15	**07S** = 0.95 to 9.5
08R = 0.03 to 0.3	**08S** = 1.9 to 19
09R = 0.05 to 0.5	**09S** = 3.0 to 30
10R = 0.06 to 0.6	**10S** = 4.5 to 45
11R = 0.1 to 1.0	**11S** = 6.5 to 65
12R = 0.14 to 1.4	**12S** = 9.0 to 90
13R = 0.18 to 1.8	**13S** = 11 to 110
14R = 0.24 to 2.4	**14S** = 14 to 140
15R = 0.3 to 3.0	**15S** = 18 to 180

Water, L/min	*Water, L/h*
A1L = 0.004 to 0.04	**A1M** = 0.25 to 2.5
A2L = 0.008 to 0.08	**A2M** = 0.50 to 5.0
A3L = 0.02 to 0.2	**A3M** = 1.2 to 12
A4L = 0.04 to 0.4	**A4M** = 2.5 to 25
A5L = 0.065 to 0.65	**A5M** = 4.0 to 40
A6L = 0.1 to 1.0	**A6M** = 6.0 to 60
A7L = 0.17 to 1.7	**A7M** = 10 to 100
A8L = 0.2 to 2.0	**A8M** = 12 to 120
A9L = 0.28 to 2.8	**A9M** = 16 to 160
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.001 to 0.01	**A1S** = 0.065 to 0.65
A2R = 0.002 to 0.02	**A2S** = 0.13 to 1.3
A3R = 0.005 to 0.05	**A3S** = 0.30 to 3.0
A4R = 0.01 to 0.1	**A4S** = 0.65 to 6.5
A5R = 0.017 to 0.17	**A5S** = 1.1 to 11
A6R = 0.025 to 0.25	**A6S** = 1.6 to 16
A7R = 0.045 to 0.45	**A7S** = 2.5 to 25
A8R = 0.054 to 0.54	**A8S** = 3.0 to 30
A9R = 0.07 to 0.7	**A9S** = 4.2 to 42

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)
3 = EPDM

Dimensions

See page 1038 for GP model dimensions.

6 Limit Switches (See page 1040.)

The maximum process and ambient temperatures are reduced to 149°F (65°C) if limit switches are selected.

Most GP model flowmeters can accept up to two limit switches; see footnote below.

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = One switch
2 = Two switches①
3 = One switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
4 = Two switches and a two-channel isolated switch amplifier with relay output, 115 V (ac)①
5 = One switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
6 = Two switches and a two-channel isolated switch amplifier with relay output, 230 V (ac)①
A = One switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Two switches and a two-channel isolated switch amplifier with relay output, 24 V (dc)

① Not available with measured air flow ranges **13L, 14L, 15L, 13M, 14M, 15M, 13R, 14R, 15R, 13S, 14S,** and **15S** or with measured° water flow ranges **A7L, A8L, A9L, A7M, A8M, A9M, A7R, A8R, A9R, A7S, A8S,** and **A9S.**

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

A = Limit switch junction box
G = 5-point calibration record
H = Pressure test, certificate
T = Wall mounting
W = Panel mounting
X = Oil- and grease-free cleaning (**required** for oxygen service)
Y = No needle valve
Z = Top-mounted needle valve

GP Model

Materials of Construction

Component	Material / Specification
Flowmeter	
Head piece, foot piece	*PVDF*
Float	*316 stainless steel / EN 1.4401*
Measuring tube	*Borosilicate glass*
Float stops	*PFA with fluorocarbon (FKM) gaskets, PTFE with perfluorocarbon (FFKM) gaskets, or EPDM*
Head piece gasket, foot piece gasket	*Fluorocarbon (FKM) or Perfluorocarbon (FFKM)*
Protective cover	Polycarbonate
Mounting rail	304 stainless steel / EN 1.4301
Needle Valve	
Needle	*316L stainless steel / EN 1.4404*
Gaskets	*PTFE*
O-rings	*Fluorocarbon (FKM), perfluorocarbon (FFKM), or EPDM*
Housing, spring	*316Ti stainless steel / EN 1.4571*
Spindle	316L stainless steel / EN 1.4404
Spindle lubricant	PTFE-based
Knob handle	Plastic
Knob handle insert	Brass
Knob handle set screw	A2 stainless steel

Wetted components listed in *italics*.

M Series (Metal Tube) Flowmeters—M1, M2, M3, and MH Models

Features

- Armored design for extreme operating conditions
- Measurement in multiple flow directions
- Ideal for industrial sector applications
- Metal measuring tube for increased durability
- Horizontal mounting (MH model) available

Materials of Construction

M1 and M2 Models

Component	Material / Specification
Flowmeter	
Head piece, foot piece, float, measuring tube, upper plug	*316L stainless steel / EN 1.4404 / Alloy C-276 / Alloy K-500*
Upper float stop (spring)	*316Ti stainless steel / EN 1.4571*
Plug gasket, lower float stop	*PTFE*
Indicator housing	Painted aluminum
Needle Valve	
Needle	*316L stainless steel / EN 1.4404*
Gaskets	*PTFE*
O-rings	*Fluorocarbon (FKM) or Perfluorocarbon (FFKM)*
Housing, spring	*316Ti stainless steel / EN 1.4571*
Spindle	316L stainless steel / EN 1.4404
Spindle lubricant	PTFE-based
Knob handle	Plastic
Knob handle insert	Brass
Knob handle set screw	A2 stainless steel

Wetted components listed in *italics*.

M3 and MH Models

Component	Material / Specification
Measuring tube, float, float stops, receiver, guide	*316L stainless steel / EN 1.4404 / Alloy C-276 / Alloy K-500*
Flange or NPT end connections	*316L stainless steel / EN 1.4404 / Alloy C-276 / Alloy K-500*
Indicator housing	Painted aluminum

Wetted components listed in *italics*.

M1 Model

The miniature M1 model is compact, yet offers protection against harsh environments and higher pressures with an armored measuring tube.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build an M1 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

				4		5	6		7	
VAF	-	M1	-	**01M**	-	**1**	-	**1**	-	**F**

4 Measured Flow Range

Air, NL/min	*Air, NL/h*	*Water, L/min*	*Water, L/h*
01L = 0.08 to 0.8	**01M** = 5.0 to 50	**A1L** = 0.005 to 0.05	**A1M** = 0.3 to 3.0
02L = 0.17 to 1.7	**02M** = 10 to 100	**A2L** = 0.008 to 0.08	**A2M** = 0.5 to 5.0
03L = 0.25 to 2.5	**03M** = 15 to 150	**A3L** = 0.018 to 0.18	**A3M** = 1.0 to 10
04L = 0.67 to 6.7	**04M** = 40 to 400	**A4L** = 0.04 to 0.4	**A4M** = 2.5 to 25
05L = 1.3 to 13	**05M** = 80 to 800	**A5L** = 0.07 to 0.7	**A5M** = 4.0 to 40
06L = 2.0 to 20	**06M** = 125 to 1250	**A6L** = 0.1 to 1.0	**A6M** = 6.0 to 60
07L = 3.33 to 33.3	**07M** = 200 to 2000	**A7L** = 0.13 to 1.3	**A7M** = 8.0 to 80
08L = 4.2 to 42	**08M** = 250 to 2500	**A8L** = 0.17 to 1.7	**A8M** = 10 to 100
09L = 6.0 to 60	**09M** = 340 to 3400	*Water, U.S. gal/min*	*Water, U.S. gal/h*
Air, std ft³/min	*Air, std ft³/h*	**A1R** = 0.0013 to 0.013	**A1S** = 0.08 to 0.8
01R = 0.003 to 0.03	**01S** = 0.18 to 1.8	**A2R** = 0.0022 to 0.022	**A2S** = 0.13 to 1.3
02R = 0.006 to 0.06	**02S** = 0.37 to 3.7	**A3R** = 0.0045 to 0.045	**A3S** = 0.25 to 2.5
03R = 0.01 to 0.1	**03S** = 0.55 to 5.5	**A4R** = 0.01 to 0.1	**A4S** = 0.65 to 6.5
04R = 0.025 to 0.25	**04S** = 1.5 to 15	**A5R** = 0.018 to 0.18	**A5S** = 1.1 to 11
05R = 0.05 to 0.5	**05S** = 3.0 to 30	**A6R** = 0.025 to 0.25	**A6S** = 1.6 to 16
06R = 0.075 to 0.75	**06S** = 4.5 to 45	**A7R** = 0.035 to 0.35	**A7S** = 2.0 to 20
07R = 0.12 to 1.2	**07S** = 7.5 to 75	**A8R** = 0.045 to 0.45	**A8S** = 2.5 to 25
08R = 0.15 to 1.5	**08S** = 9.5 to 95		
09R = 0.2 to 2.0	**09S** = 13 to 130		

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

5 Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)

M1 Model

Electrical Connections

- Up to two limit switches; junction box included

Temperature Ranges With Limit Switches

- As ambient temperature increases, the process temperature maximum is reduced.

Process °F (°C)	Ambient °F (°C)
293 (145)	104 (40)
275 (135)	122 (50)
257 (125)	140 (60)

6 Limit Switches with Junction Box (See page 1040.)

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

- **0** = None
- **1** = Minimum switch
- **2** = Maximum switch
- **3** = Minimum and maximum switch
- **4** = Minimum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
- **5** = Maximum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
- **6** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 115 V (ac)
- **7** = Minimum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
- **8** = Maximum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
- **9** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 230 V (ac)
- **A** = Minimum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
- **B** = Maximum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
- **C** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 24 V (dc)

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

- **B** = FM Approval certificate
- **F** = Certificate of compliance
- **G** = 5-point calibration record
- **H** = Pressure test, certificate
- **I** = Silconert Coating
- **J** = Material certification
- **X** = Oil- and grease-free cleaning (**required** for oxygen service)
- **Y** = No needle valve
- **Z** = Top-mounted needle valve

Note: For non stainless steel Alloys add the prefix HC and M.

Non Stainless Steel Options

M = Alloy K-500 **HC** = Alloy C-276

Example: **M**-VAF-M1-02M-1-0

Dimensions

See page 1038 for M1 model dimensions.

M2 Model

The M2 model offers versatility, with an integral junction box and choice of mechanical or electronic display.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build an M2 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

				4		5	6		7	
VAF	-	M2	-	**01M**	-	**1**	**1**	-	**F**	

4 Measured Flow Range

Air, NL/min

01L = 0.08 to 0.8
02L = 0.17 to 1.7
03L = 0.25 to 2.5
04L = 0.67 to 6.7
05L = 1.3 to 13
06L = 2.0 to 20
07L = 3.33 to 33.3
08L = 4.2 to 42
09L = 6.0 to 60

Air, NL/h

01M = 5.0 to 50
02M = 10 to 100
03M = 15 to 150
04M = 40 to 400
05M = 80 to 800
06M = 125 to 1250
07M = 200 to 2000
08M = 250 to 2500
09M = 340 to 3400

Air, std ft³/min

01R = 0.003 to 0.03
02R = 0.006 to 0.06
03R = 0.01 to 0.1
04R = 0.025 to 0.25
05R = 0.05 to 0.5
06R = 0.075 to 0.75
07R = 0.12 to 1.2
08R = 0.15 to 1.5
09R = 0.2 to 2.0

Air, std ft³/h

01S = 0.18 to 1.8
02S = 0.37 to 3.7
03S = 0.55 to 5.5
04S = 1.5 to 15
05S = 3.0 to 30
06S = 4.5 to 45
07S = 7.5 to 75
08S = 9.5 to 95
09S = 13 to 130

Water, L/min

A1L = 0.005 to 0.05
A2L = 0.008 to 0.08
A3L = 0.018 to 0.18
A4L = 0.04 to 0.4
A5L = 0.07 to 0.7
A6L = 0.1 to 1.0
A7L = 0.13 to 1.3
A8L = 0.17 to 1.7

Water, L/h

A1M = 0.3 to 3.0
A2M = 0.5 to 5.0
A3M = 1.0 to 10
A4M = 2.5 to 25
A5M = 4.0 to 40
A6M = 6.0 to 60
A7M = 8.0 to 80
A8M = 10 to 100

Water, U.S. gal/min

A1R = 0.0013 to 0.013
A2R = 0.0022 to 0.022
A3R = 0.0045 to 0.045
A4R = 0.01 to 0.1
A5R = 0.018 to 0.18
A6R = 0.025 to 0.25
A7R = 0.035 to 0.35
A8R = 0.045 to 0.45

Water, U.S. gal/h

A1S = 0.08 to 0.8
A2S = 0.13 to 1.3
A3S = 0.25 to 2.5
A4S = 0.65 to 6.5
A5S = 1.1 to 11
A6S = 1.6 to 16
A7S = 2.0 to 20
A8S = 2.5 to 25

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas
LIQ = Liquid

5 Valve O-Ring Material

1 = Fluorocarbon (FKM) (standard)
2 = Perfluorocarbon (FFKM)

M2 Model

Electrical Connections

- Up to two limit switches
- 2-wire, 4 to 20 mA output signal with LED display available

Temperature Ranges

- As ambient temperature increases, the process temperature maximum is reduced.

With Limit Switches

Process °F (°C)	Ambient °F (°C)
302 (150)	104 (40)
257 (125)	122 (50)
212 (100)	140 (60)

With 4 to 20 mA Output Signal

Process °F (°C)	Ambient °F (°C)
275 (135)	104 (40)
230 (110)	122 (50)
182 (85)	140 (60)

6 Limit Switches or Electronic Display (See page 1040.)

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

- **0** = None
- **1** = Minimum switch
- **2** = Maximum switch
- **3** = Minimum and maximum switch
- **4** = Minimum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
- **5** = Maximum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
- **6** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 115 V (ac)
- **7** = Minimum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
- **8** = Maximum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
- **9** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 230 V (ac)
- **A** = Minimum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
- **B** = Maximum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
- **C** = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 24 V (dc)
- **E** = LED display of measured flow with 4 to 20 mA output signal

7 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

- **F** = Certificate of compliance
- **G** = 5-point calibration record
- **H** = Pressure test, certificate
- **I** = Silconert Coating
- **J** = Material certification
- **X** = Oil- and grease-free cleaning (**required** for oxygen service)
- **Y** = No needle valve
- **Z** = Top-mounted needle valve

Note: For non stainless steel Alloys add the prefix HC and M.

Non Stainless Steel Options

M = Alloy K-500 **HC** = Alloy C-276

Example: **HC**-VAF-M2-05R-1-0

Dimensions

See page 1038 for M2 model dimensions.

M3 Model

This metal-tube flowmeter, with rugged design, is suited for extreme operating conditions and high flow rates.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build an M3 model variable area flowmeter ordering number by combining the designators in the sequence shown below. **Choose end connections and measured flow range designators based on measuring tube size.**

				4	5		6		7	8	9
VAF	-	M3	-	**1**	-	**1**	-	**01M**	-	**1**	**A**	-	**F**

4 Measuring Tube Size

1 = 1/2 in.
2 = 1 in.

5 End Connections

1/2 in. Measuring Tube

1 = 1/2 in. NPT
2 = 3/4 in. NPT
3 = 1/2 in. ASME class 150 flange
4 = 3/4 in. ASME class 150 flange
5 = 1 in. ASME class 150 flange

1 in. Measuring Tube

1 = 3/4 in. NPT
2 = 1 in. NPT
3 = 3/4 in. ASME class 150 flange
4 = 1 in. ASME class 150 flange

6 Measured Flow Range

1/2 in. Measuring Tube

Air, NL/min	*Air, NL/h*
01L = 1.1 to 11	**01M** = 70 to 700
02L = 1.7 to 17	**02M** = 100 to 1000
03L = 2.6 to 26	**03M** = 160 to 1600
04L = 4.0 to 40	**04M** = 220 to 2200
05L = 6.0 to 60	**05M** = 360 to 3600
06L = 10 to 100	**06M** = 550 to 5500
07L = 17 to 170	**07M** = 1000 to 10 000
08L = 25 to 250	**08M** = 1400 to 14 000
09L = 30 to 300	**09M** = 1800 to 18 000
10L = 50 to 500	**10M** = 2800 to 28 000
Air, std ft³/min	***Air, std ft³/h***
01R = 0.04 to 0.4	**01S** = 2.5 to 25
02R = 0.06 to 0.6	**02S** = 4.0 to 40
03R = 0.1 to 0.10	**03S** = 5.8 to 58
04R = 0.14 to 1.4	**04S** = 8.0 to 80
05R = 0.2 to 2.0	**05S** = 13 to 130
06R = 0.35 to 3.5	**06S** = 20 to 200
07R = 0.6 to 6.0	**07S** = 38 to 380
08R = 0.8 to 8.0	**08S** = 52 to 520
09R = 1.0 to 10	**09S** = 65 to 650
10R = 1.6 to 16	**10S** = 100 to 1000

1/2 in. Measuring Tube

Water, L/min	*Water, L/h*
A1L = 0.03 to 0.3	**A1M** = 1.8 to 18
A2L = 0.04 to 0.4	**A2M** = 2.5 to 25
A3L = 0.05 to 0.5	**A3M** = 3.0 to 30
A4L = 0.07 to 0.7	**A4M** = 4.0 to 40
A5L = 0.095 to 0.95	**A5M** = 5.5 to 55
A6L = 0.105 to 1.05	**A6M** = 6.3 to 63
A7L = 0.13 to 1.3	**A7M** = 8.0 to 80
A8L = 0.17 to 1.7	**A8M** = 10 to 100
A9L =0.2 to 2.0	**A9M** = 12 to 120
B1L = 0.27 to 2.7	**B1M** = 16 to 160
B2L = 0.35 to 3.5	**B2M** = 20 to 200
B3L = 0.4 to 4.0	**B3M** = 25 to 250
B4L = 0.6 to 6.0	**B4M** = 35 to 350
B5L = 0.7 to 7.0	**B5M** = 40 to 400
B6L = 0.85 to 8.5	**B6M** = 50 to 500
B7L = 1.05 to 10.5	**B7M** = 63 to 630
B8L = 1.2 to 12	**B8M** = 70 to 700
B9L = 1.7 to 17	**B9M** = 100 to 1000
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.008 to 0.08	**A1S** = 0.48 to 4.8
A2R = 0.01 to 0.1	**A2S** = 0.65 to 6.5
A3R = 0.015 to 0.15	**A3S** = 0.8 to 8.0
A4R = 0.018 to 0.18	**A4S** = 1.1 to 11
A5R = 0.025 to 0.25	**A5S** = 1.5 to 15
A6R = 0.03 to 0.3	**A6S** = 1.6 to 16
A7R = 0.035 to 0.35	**A7S** = 2.0 to 20
A8R = 0.045 to 0.45	**A8S** = 2.5 to 25
A9R = 0.05 to 0.5	**A9S** = 3.0 to 30
B1R = 0.07 to 0.7	**B1S** = 4.2 to 42
B2R = 0.09 to 0.9	**B2S** = 5.0 to 50
B3R = 0.11 to 1.1	**B3S** = 6.5 to 65
B4R = 0.15 to 1.5	**B4S** = 9.0 to 90
B5R = 0.18 to 1.8	**B5S** = 10 to 100
B6R = 0.22 to 2.2	**B6S** = 13 to 130
B7R = 0.28 to 2.8	**B7S** = 16 to 160
B8R = 0.3 to 3.0	**B8S** = 18 to 180
B9R = 0.45 to 4.5	**B9S** = 25 to 250

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

M3 Model

Electrical Connections

- Up to two limit switches (M16 × 1.5 cable glands standard)
- 2-wire 4 to 20 mA output signal available

Temperature Ranges With Limit Switches or 4 to 20 mA Output Signal

- Ambient low temperature is limited to –13°F (–25°C) with limit switches.
- As ambient temperature increases, the process temperature maximum is reduced.

Process °F (°C)	Ambient °F (°C)
392 (200)	104 (40)
356 (180)	140 (60)

6 Measured Flow Range

1 in. Measuring Tube

Air, NL/min

01L = 25 to 250
02L = 40 to 400
03L = 60 to 600
04L = 100 to 1000
05L = 200 to 2000
06L = 300 to 3000

Air, NL/h

01M = 1400 to 14 000
02M = 2300 to 23 000
03M = 3500 to 35 000
04M = 5000 to 50 000
05M = 11 000 to 110 000
06M = 18 000 to 180 000

Air, std ft³/min

01R = 1.0 to 10
02R = 1.5 to 15
03R = 2.0 to 20
04R = 3.0 to 30
05R = 6.5 to 65
06R = 10 to 100

Air, std ft³/h

01S = 52 to 520
02S = 85 to 850
03S = 130 to 1300
04S = 190 to 1900
05S = 400 to 4000
06S = 670 to 6700

Water, L/min

A1L = 0.8 to 8.0
A2L = 1.05 to 10.5
A3L = 1.5 to 15
A4L = 1.7 to 17
A5L = 2.0 to 20
A6L = 2.7 to 27
A7L = 3.0 to 30
A8L = 4.2 to 42
A9L = 5.5 to 55
B1L = 7.0 to 70
B2L = 10 to 100

Water, L/h

A1M = 48 to 480
A2M = 63 to 630
A3M = 82 to 820
A4M = 100 to 1000
A5M = 120 to 1200
A6M = 160 to 1600
A7M = 170 to 1700
A8M = 250 to 2500
A9M = 320 to 3200
B1M = 400 to 4000
B2M = 630 to 6300

Water, U.S. gal/min

A1R = 0.2 to 2.0
A2R = 0.28 to 2.8
A3R = 0.35 to 3.5
A4R = 0.45 to 4.5
A5R = 0.5 to 5.0
A6R = 0.7 to 7.0
A7R = 0.75 to 7.5
A8R = 1.0 to 10
A9R = 1.5 to 15
B1R = 1.8 to 18
B2R = 3.0 to 30

Water, U.S. gal/h

A1S = 13 to 130
A2S = 16 to 160
A3S = 22 to 220
A4S = 25 to 250
A5S = 32 to 320
A6S = 42 to 420
A7S = 45 to 450
A8S = 65 to 650
A9S = 85 to 850
B1S = 110 to 1100
B2S = 160 to 1600

Custom

*See **Custom Calibration,** page 1040.*

GAS = Gas **LIQ** = Liquid

7 Limit Switches (See page 1040.)

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = Minimum switch
2 = Maximum switch
3 = Minimum and maximum switch
4 = Minimum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
5 = Maximum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
6 = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 115 V (ac)
7 = Minimum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
8 = Maximum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
9 = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 230 V (ac)
A = Minimum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Maximum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
C = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 24 V (dc)

8 Output Signal

Omit designator if output signal not ordered.

A = 4 to 20 mA

9 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

B = FM Approval certificate
F = Certificate of compliance
G = 5-point calibration record
H = Pressure test, certificate
I = Silconert Coating
J = Material certification
L = Dye penetration test, certificate
N = X-ray test, report
P = Hardness test, report
R = 1/2 in. female NPT conduit gland
S = M20 × 1.5 cable gland
X = Oil- and grease-free cleaning (**required** for oxygen service)

Note: For non stainless steel Alloys add the prefix HC and M.

Non Stainless Steel Options

M = Alloy K-500 **HC** = Alloy C-276

Example: **M**-VAF-M3-1-1-01L-0

Dimensions

See page 1038 for M3 model dimensions.

MH Model

This horizontal model offers liquid flow reading left-to-right or right-to-left to meet system requirements.

Technical Data

See **Variable Area Flowmeter Selection,** page 1020.

Ordering Information

Build an MH model variable area flowmeter ordering number by combining the designators in the sequence shown below. **Choose end connections and measured flow range designators based on measuring tube size.**

			4	5	6	7	8	9	10	
VAF	-	MH	- **1**	- **1**	- **A1M**	- **1**	**A**	- **RL**	- **F**	

4 Measuring Tube Size

1 = 1/2 in.
2 = 1 in.

5 End Connections

1/2 in. Measuring Tube

1 = 3/4 in. NPT
2 = 1/2 in. ASME class 150 flange
3 = 3/4 in. ASME class 150 flange
4 = 1 in. ASME class 150 flange

1 in. Measuring Tube

1 = 1 1/4 in. NPT
2 = 1 in. ASME class 150 flange

6 Measured Flow Range

1/2 in. Measuring Tube

Water, L/min	*Water, L/h*
A1L = 0.11 to 1.1	**A1M** = 7.0 to 70
A2L = 0.2 to 2.0	**A2M** = 12 to 120
A3L = 0.3 to 3.0	**A3M** = 18 to 180
A4L = 0.5 to 5.0	**A4M** = 28 to 280
A5L = 0.75 to 7.5	**A5M** = 45 to 450
A6L = 1.2 to 12	**A6M** = 70 to 700
A7L = 2.0 to 20	**A7M** = 120 to 1200
A8L = 2.5 to 25	**A8M** = 160 to 1600
A9L = 4.0 to 40	**A9M** = 240 to 2400
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.03 to 0.3	**A1S** = 2.0 to 20
A2R = 0.05 to 0.5	**A2S** = 3.0 to 30
A3R = 0.08 to 0.8	**A3S** = 5.0 to 50
A4R = 0.12 to 1.2	**A4S** = 8.0 to 80
A5R = 0.2 to 2.0	**A5S** = 12 to 120
A6R = 0.3 to 3.0	**A6S** = 20 to 200
A7R = 0.5 to 5.0	**A7S** = 32 to 320
A8R = 0.7 to 7.0	**A8S** = 43 to 430
A9R = 1.07 to 10.7	**A9S** = 64 to 640

1 in. Measuring Tube

Water, L/min	*Water, L/h*
A1L = 2.0 to 20	**A1M** = 130 to 1300
A2L = 3.0 to 30	**A2M** = 200 to 2000
A3L = 5.0 to 50	**A3M** = 300 to 3000
A4L = 8.0 to 80	**A4M** = 500 to 5000
A5L = 15 to 150	**A5M** = 850 to 8500
A6L = 17 to 170	**A6M** = 1000 to 10 000
Water, U.S. gal/min	***Water, U.S. gal/h***
A1R = 0.6 to 6.0	**A1S** = 35 to 350
A2R = 0.9 to 9.0	**A2S** = 55 to 550
A3R = 1.4 to 14	**A3S** = 80 to 800
A4R = 2.2 to 22	**A4S** = 130 to 1300
A5R = 4.0 to 40	**A5S** = 230 to 2300
A6R = 4.5 to 45	**A6S** = 270 to 2700

Custom

*See **Custom Calibration,** page 1040.*

LIQ = Liquid

7 Limit Switches (See page 1040.)

Limit switch amplifiers are required. Amplifiers can be ordered with the flowmeter or customer supplied.

0 = None
1 = Minimum switch
2 = Maximum switch
3 = Minimum and maximum switch
4 = Minimum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
5 = Maximum switch and a one-channel isolated switch amplifier with relay output, 115 V (ac)
6 = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 115 V (ac)
7 = Minimum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
8 = Maximum switch and a one-channel isolated switch amplifier with relay output, 230 V (ac)
9 = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 230 V (ac)
A = Minimum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
B = Maximum switch and a one-channel isolated switch amplifier with relay output, 24 V (dc)
C = Minimum and maximum switch and a two-channel isolated switch amplifier with relay output, 24 V (dc)

MH Model

Electrical Connections

- Up to two limit switches (M16 × 1.5 cable glands standard)
- 2-wire 4 to 20 mA output signal available

Temperature Ranges With Limit Switches or 4 to 20 mA Ouput Signal

- Ambient low temperature is limited to –13°F (–25°C) with limit switches.
- As ambient temperature increases, the process temperature maximum is reduced.

Process °F (°C)	Ambient °F (°C)
392 (200)	104 (40)
356 (180)	140 (60)

8 Output Signal

Omit designator if output signal not ordered.

A = 4 to 20 mA

9 Flow Direction

RL = Right-to-left
LR = Left-to-right

10 Options (See page 1040.)

Add multiple designators in alphabetical order; omit final dash (-) if no options are ordered.

F = Certificate of compliance
G = 5-point calibration record
H = Pressure test, certificate
J = Material certification
L = Dye penetration test, certificate
N = X-ray test, report
P = Hardness test, report
R = 1/2 in. female NPT conduit gland
S = M20 × 1.5 cable gland
X = Oil- and grease-free cleaning (**required** for oxygen service)

Note: For non stainless steel Alloys add the prefix HC and M.

Non Stainless Steel Options

HC = Alloy C-276
Example: **HC**-VAF-MH-2-2-A4R-0-LR

Dimensions

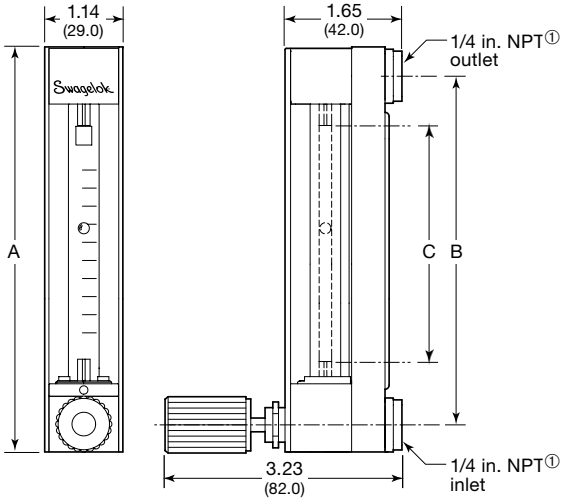
See page 1039 for MH model dimensions.

Left-to-Right Flow Model

Dimensions

Dimensions, in inches and (millimeters), are for reference only and are subject to change.

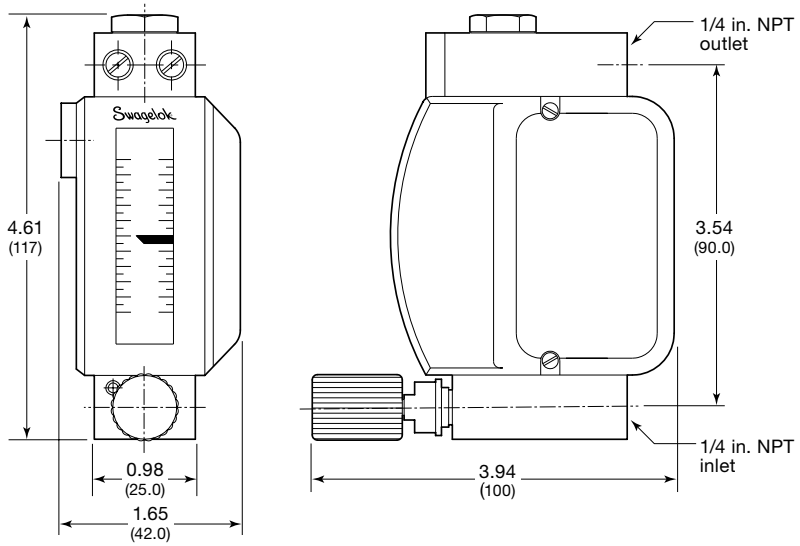
G1, G2, G3, G4, and GP Models



① GP model: G 1/4.

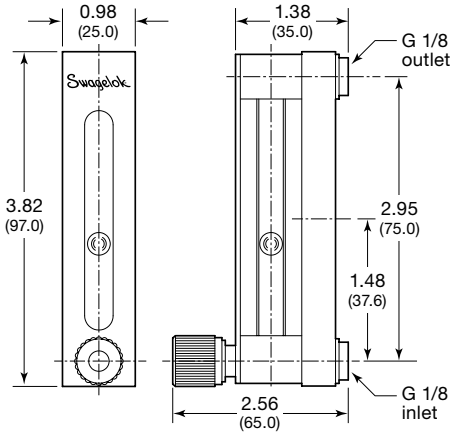
Model	Dimensions, in. (mm)			Weight lb (kg)
	A	B	C	
G1	4.37 (111)	3.54 (90.0)	1.77 (45.0)	0.80 (0.36)
G2	5.75 (146)	4.92 (125)	3.15 (80.0)	0.89 (0.40)
G3	7.72 (196)	6.89 (175)	5.12 (130)	0.98 (0.44)
G4	13.6 (346)	12.8 (325)	11.0 (280)	1.35 (0.61)
GP	5.75 (146)	4.92 (125)	3.15 (80.0)	0.44 (0.20)

M1 Model



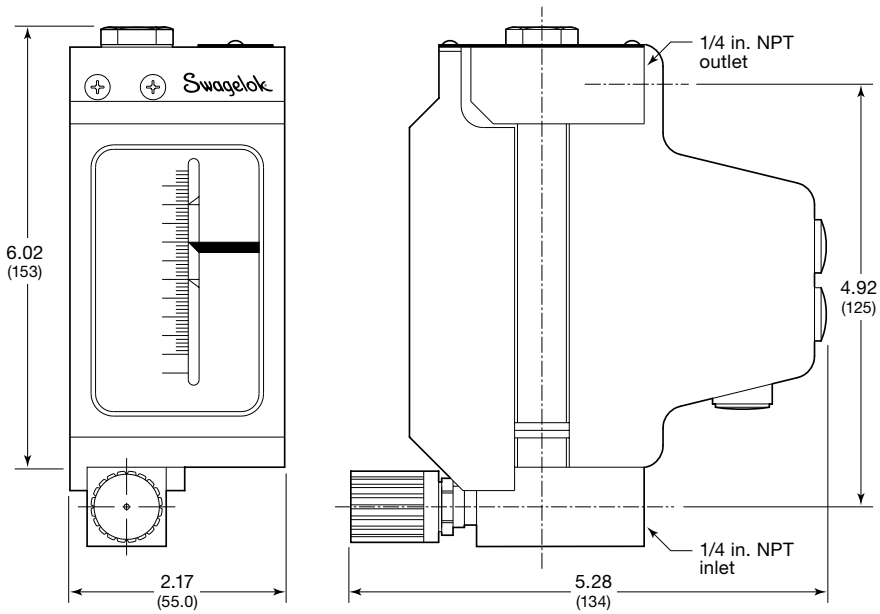
Weight: 1.53 lb (0.7 kg)

GM Model



Weight: 0.18 lb (0.08 kg)

M2 Model

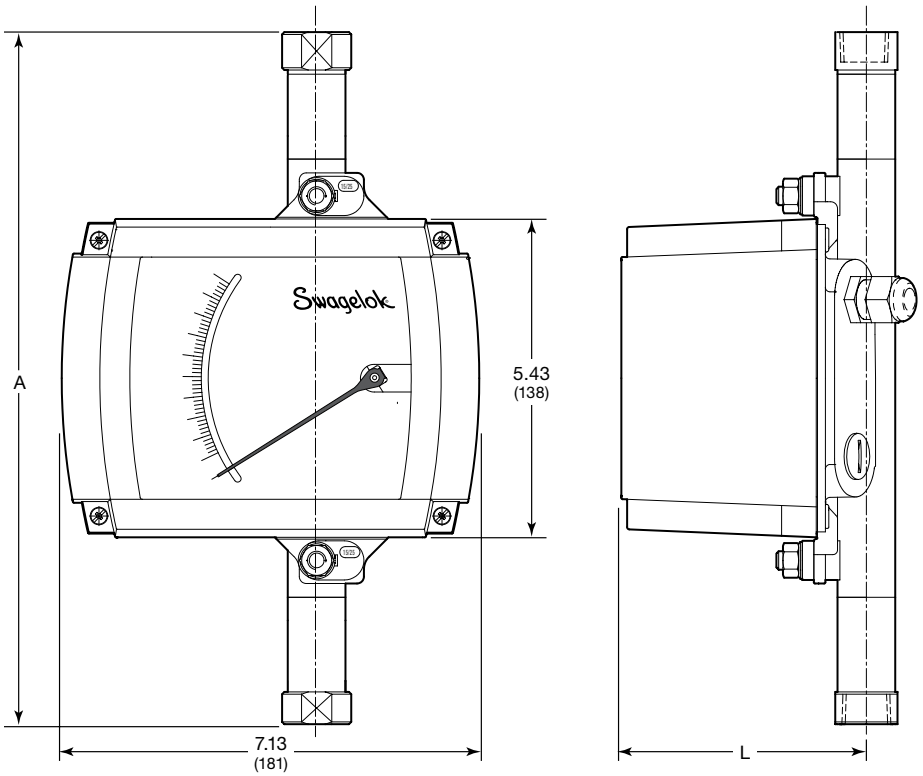


Weight: 2.2 lb (1.0 kg)

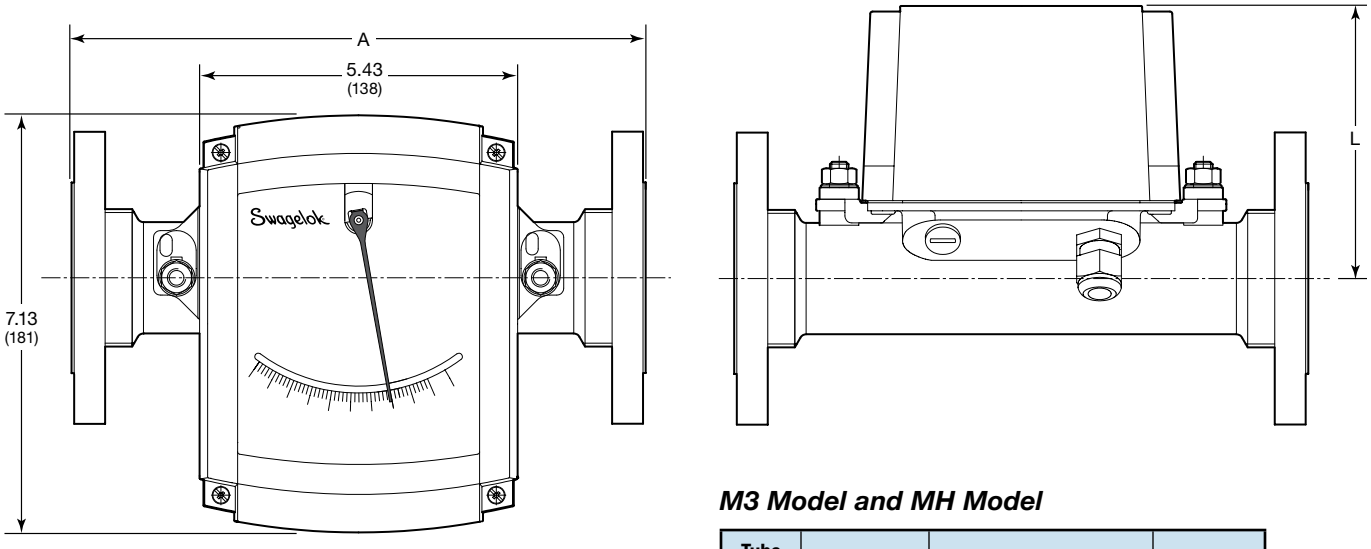
Dimensions

Dimensions, in inches and (millimeters), are for reference only and are subject to change.

M3 Model



MH Model



Right-to-Left Flow Model

M3 Model and MH Model

Tube Size in.	Process End Connection	Dimensions, in. (mm)		Weight lb (kg)
		A	L	
1/2	NPT	11.8 (300)	4.21 (107)	4.4 (2.0)
	Flange	9.84 (250)	4.21 (107)	7.1 (3.2)
1	NPT	11.8 (300)	4.69 (119)	7.7 (3.5)
	Flange	9.84 (250)	4.69 (119)	11.5 (5.2)

Custom Calibration

Standard Swagelok variable area flowmeters are factory calibrated to their media, flow range, and accuracy class using clean, dry air for air-flow range models and water for water-flow range models. Standard units of measure marked on the scale are calibrated to:

- 17.4 psia (1.2 bar) and 68°F (20°C) for G1, G2, G3, GM, and GP models.
- 14.7 psia (1.013 bar) and and 68°F (20°C) for G4, M1, M2, M3, and MH models.

Custom-calibrated flowmeters are available for fluids with properties substantially different from those of air or water, as well as systems operating at higher pressures or temperatures.

Flowmeters calibrated for one fluid at a specific pressure and temperature can be used to measure other fluids and different pressures and temperatures by using a conversion factor. See the Swagelok *Variable Area Flowmeters Installation Instructions, G Series and M Series,* MS-CRD-0111, for more information.

In liquids, higher temperature can reduce viscosity and density, resulting in lower readings. In gases, higher fluid temperature can increase volume and result in higher readings. Knowing the specific fluid temperature enables us to calibrate the scale more accurately.

Increased pressure can compress gases and lead to lower meter readings. Knowing the system pressure enables us to calibrate the scale properly for your application.

To order a custom Swagelok variable area flowmeter calibrated to meet your requirements as shown below, use **GAS** or **LIQ** as the flow range designator in the desired model ordering number and contact your authorized Swagelok representative. You will need to specify:

1. Fluid to be measured
2. Fluid dynamic viscosity, typically in cP or mPa·s, or kinetic viscosity, typically in cSt or m^2/s, at operating pressure and temperature
3. Fluid density in lb/ft^3 or kg/m^3 at operating pressure and temperature
4. Fluid temperature at operating conditions, with unit of measure
5. Fluid pressure at operating conditions, with unit of measure
6. Flow measurement range and unit of measure.

Swagelok custom-calibrated variable area flowmeters must maintain a 10-to-1 turndown ratio and are matched as closely as possible to the desired flow measurement range. Custom-calibrated flowmeters are marked with the fluid media and unit of measure for which they are calibrated.

Options

Options are specified in variable area flowmeter ordering numbers as shown in **Ordering Information** for each model.

Electrical Options

Two electrical options are available with select Swagelok variable area flowmeter models:

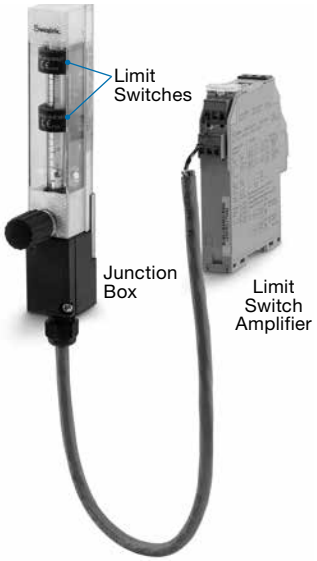
- discrete limit switch outputs for indicating high/low flow
- 4 to 20 mA output signal.

Limit Switches

Optional minimum or maximum limit switches available for most models are compliant with NAMUR IEC 60947-5-6 (EN 60947-5-6).

Output Signal

Some variable area flowmeter models are available with a separate two-wire 4 to 20 mA output signal. These models require auxiliary power of 14.8 to 30 V (dc).



G Series Flowmeter with Limit Switches, Junction Box, and Isolated Switch Amplifier with Relay Output

For more information about electrical options, see the Swagelok *Variable Area Flowmeters Installation Instructions, G Series and M Series,* MS-CRD-0111, available *only* on your Swagelok website.

Junction Boxes

Junction boxes, available on select Swagelok variable area flowmeter models, can be mounted to the flowmeter to facilitate electrical connections between the flowmeter and the control system. Junction boxes are suggested when limit switches are ordered.

Threaded Conduit Gland and M20 × 1.5 Cable Gland (M3 and MH Models)

The standard cable gland assembled onto the flowmeter casing to guide the wiring for electronic options is M16 × 1.5 thread. Available options are a 1/2 in. female NPT end connection and an M20 × 1.5 end connection.

Valve Position

An integral needle valve for fine metering is provided on some products, on the bottom (inlet) side of the flowmeter. Upon request, the valve can be mounted on the top (outlet) side or omitted from the assembly.

For gas applications, the valve is typically on the top (behind the measuring cone) to help maintain constant pressure in the measuring cone despite changes in density caused by gas compression or decompression. For liquids, the valve can be on the bottom or the top, because pressure changes do not affect liquid density.

Options

Options are specified in variable area flowmeter ordering numbers as shown in **Ordering Information** for each model.

Certificates and Test Reports

FM Approvals Certificate

Swagelok M1 and M3 models are available with FM Approvals certificates of compliance.

M1 Model

- Intrinsically safe for Class I, II, and III, Division 1, Groups A, B, C, D, E, F, and G
- Nonincendive for Class I, Division 2, Groups A, B, C, and D
- Suitable for Class II and III, Division 2, Groups F and G
- Associated apparatus nonincendive for Class I, II, and III, Division 2, Groups A, B, C, D, F, and G
- Temperature class T5 at ambient 140°F (60°C)
- Type 4X

M3 Model

- Intrinsically safe for Class I, Division 1, Groups A, B, C, and D
- Associated apparatus nonincendive for Class I, Division 2, Groups A, B, C, and D
- Nonincendive for Class I, Division 2, Groups A, B, C, and D
- Type 4X

Certificate of Compliance

This document certifies that the products supplied to the customer by the manufacturer are in compliance with the requirements of the order, in accordance with EN 10204.

5-Point Calibration Record

The calibration record shows actual flow performance, theoretical performance, and error over the measurement range.

Pressure Test and Certificate

A hydrostatic pressure test based on EN 10204 is available.

Material Certification

This inspection certificate, in accordance with EN 10204, shows the material and heat numbers of the pressure-bearing and wetted materials, as well as the original mill material certifications of the wetted materials.

Dye Penetration Test and Certificate

A dye penetration test is available for wetted welds. For acceptance criteria, the related material standard is used.

X-Ray Test and Report

An X-ray test is available for wetted welds. The test procedure follows EN 1435-1 Class B. Acceptance criteria are in accordance with ISO 5817 group.

Hardness Test and Report

A hardness test on wetted metal components, based on ASTM A956, is available.

Oil- and Grease-Free Cleaning

An additional degreasing operation is available that meets the requirements of DIN 25410 and KWU-AVS 8/0 D. This option must be selected on flowmeters calibrated for oxygen service.

Oxygen Service Hazards

For information about hazards and risks of oxygen-enriched systems, see the Swagelok *Oxygen System Safety* technical report, (MS-06-13), page 1184.

Options

Options are specified in variable area flowmeter ordering numbers as shown in **Ordering Information** for each model.

Mounting Brackets

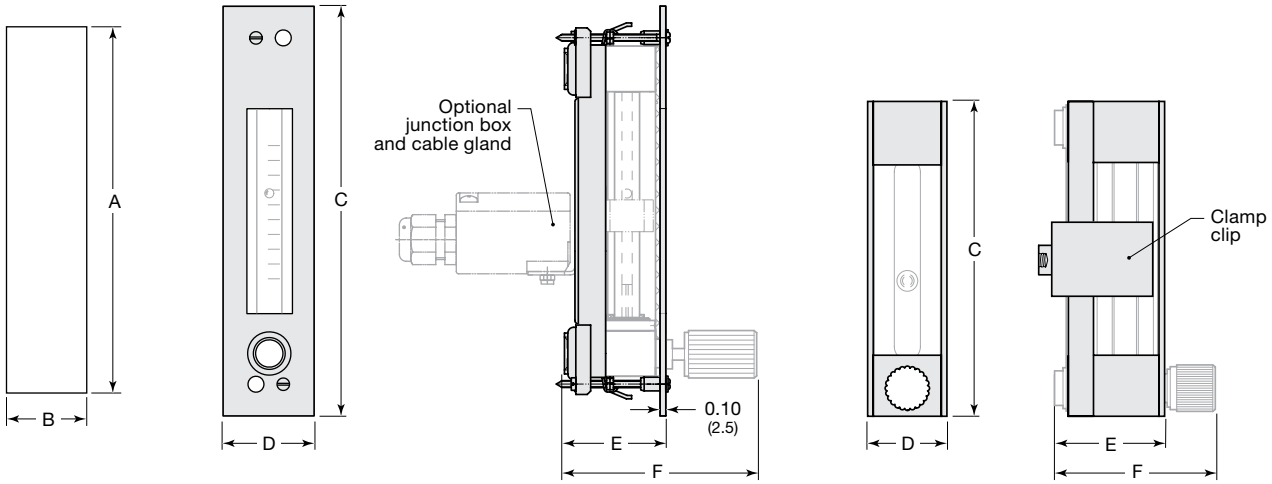
Panel Mounting

Panel mounting is available for G1, G2, G3, G4, GM, and GP model flowmeters. The face plate is aluminum, and the rear brackets are steel.

G1, G2, G3, G4, and GP models are mounted with four nickel-plated steel fasteners, included; GM models are mounted with an anodized aluminum clamp clip and 4 mm stainless steel Allen screw.

Dimensions, in inches (millimeters) are for reference only and are subect to change.

Model	Dimensions, in. (mm)					
	A	B	C	D	E	F
G1	5.04 (128)	1.26 (32.0)	5.71 (145)	1.58 (40.0)	1.75 (44.5)	3.23 (82.0)
G2, GP	6.42 (163)	1.26 (32.0)	7.09 (180)	1.58 (40.0)	1.75 (44.5)	3.23 (82.0)
G3	8.39 (213)	1.26 (32.0)	9.06 (230)	1.58 (40.0)	1.75 (44.5)	3.23 (82.0)
G4	14.3 (363)	1.26 (32.0)	15.0 (380)	1.58 (40.0)	1.75 (44.5)	3.23 (82.0)
GM	3.70 (94.0)	0.91 (23.0)	3.82 (97.0)	0.98 (25.0)	1.38 (35.0)	2.56 (65.0)



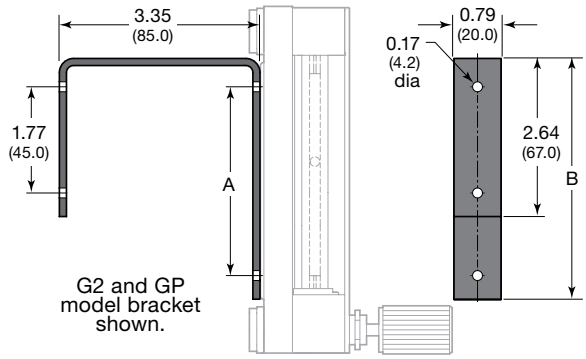
Panel Cutout | **G1, G2, G3, G4, GP Model Face Plate** | **G1, G2, G3, G4, GP Model Side** | **GM Model Face Plate** | **GM Model Side**

Wall Mounting

Black anodized aluminum wall mounting brackets are available for G1, G2, G3, and GP model flowmeters.

Dimensions, in inches (millimeters) are for reference only and are subect to change.

Model	Dimensions, in. (mm)	
	A	B
G1	1.77 (45.0)	2.64 (97.0)
G2, GP	3.15 (80.0)	4.02 (102)
G3	5.12 (130)	5.98 (152)



Accessories

Damping Device

For unstable flows or low operating (inlet) pressures, particularly with gas applications, the measuring section can be fitted with a float damping device on some M3 and MH models. This device is self-locating, with working parts of high-tech ceramic to ensure a long service life.

For more information, contact your authorized Swagelok representative.

Additional Products

Pressure Regulators

Swagelok offers a variety of pressure regulators.

- Spring-, dome-, and air-loaded models
- Pressure-reducing regulators
- Back-pressure regulators
- Gas cylinder changeover manifolds
- Electrically heated and steam-heated vaporizing regulators.

For more information, see the Swagelok *Pressure Regulators* catalog, MS-02-230, and the Swagelok *Pressure Regulators, RHPS Series* catalog, MS-02-430.

Metering Valves

Swagelok metering valves offer:

- Low- and high-pressure service
- Repeatable vernier handles
- Brass and 316 stainless steel materials.

For more information, see the Swagelok *Metering Valves* catalog, MS-01-142.

Caution: Do not mix or interchange parts with those of other manufacturers.

About this document

Thank you for downloading this electronic catalog, which is part of General Product catalog Swagelok published in print. This type of electronic catalog is updated as new information arises or revisions, which may be more current than the printed version.

Swagelok Company is a major developer and provider of fluid system solutions, including products, integration solutions and services for industry research, instrumentation, pharmaceutical, oil and gas, power, petrochemical, alternative fuels, and semiconductor. Our manufacturing facilities, research, service and distribution facilities support a global network of more than 200 authorized sales and service centers in 57 countries.

Visit www.swagelok.com to locate your Swagelok representative and obtain any information on features, technical information and product references, or to learn about the variety of services available only through authorized sales centers and service Swagelok.

Safe Product Selection

When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit your Swagelok Web site or contact your authorized Swagelok representative.