

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

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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. Variable area flowmeters do not require external power, but may be ordered with electrical or electronic options.

Most Swagelok models contain integral metering 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); measurement ranges are available in U.S. customary and metric scales.
- Meters are marked with the fluid media and unit of measure for which they are calibrated. Meters can be factory calibrated to customer process specifications.

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. 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.

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 with standard air and water flow scale ranges at 60°F (15°C) and 14.7 psig (1.0 bar). 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 20, for more information about selecting and specifying Swagelok variable area flowmeters with custom scale ranges.

Variable Area Flowmeter Selection

Air Flow Ranges		Water Flow Ranges		Process Temperature Rating °F (°C)	Ambient Temperature Rating °F (°C)	Maximum Inlet Pressure at 70°F (20°C) psig (bar)	Accuracy Class ^①	Process End Connections	Model
std ft ³ /h	std L/h	U.S. gal/h	L/h						
0.018 to 0.18 through 4.5 to 45	0.5 to 5.0 through 120 to 1200	0.065 to 0.65 through 4.2 to 42	0.25 to 2.5 through 16 to 160	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	145 (10)	4.0	1/4 in. NPT	G1
0.018 to 0.18 through 18 to 180	0.5 to 5.0 through 500 to 5000	0.065 to 0.65 through 4.2 to 42	0.25 to 2.5 through 16 to 160	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	145 (10)	2.5	1/4 in. NPT	G2
0.06 to 0.6 through 3.0 to 30	1.6 to 16 through 80 to 800	0.13 to 1.3 through 2.5 to 25	0.5 to 5.0 through 10 to 100	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	145 (10)	2.5	1/4 in. NPT	G3
0.06 to 0.6 through 11 to 110	1.6 to 16 through 300 to 3000	0.01 to 0.1 through 2.5 to 25	0.04 to 0.4 through 10 to 100	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	145 (10)	1.0	1/4 in. NPT	G4
0.018 to 0.18 through 4.5 to 45	0.5 to 5.0 through 100 to 1000	0.065 to 0.65 through 1.1 to 11	0.25 to 2.5 through 4.0 to 40	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	58 (4.0)	4.0	G 1/8 (ISO 228)	GM
0.018 to 0.18 through 18 to 180	0.5 to 5.0 through 500 to 5000	0.065 to 0.65 through 4.2 to 42	0.25 to 2.5 through 16 to 160	23 to 212 (-5 to 100)	-4 to 212 (-20 to 100)	58 (4.0)	2.5	G 1/4 (ISO 228)	GP
0.18 to 1.8 through 13 to 130	5.0 to 50 through 340 to 3400	0.08 to 0.8 through 2.5 to 25	0.3 to 3.0 through 10 to 100	-40 to 302 (-40 to 150)	-4 to 158 (-20 to 70)	1885 (130)	4.0	1/4 in. NPT	M1
0.18 to 1.8 through 13 to 130	5.0 to 50 through 340 to 3400	0.08 to 0.8 through 2.5 to 25	0.3 to 3.0 through 10 to 100	-40 to 302 (-40 to 150)	-4 to 158 (-20 to 70)	1885 (130)	2.5	1/4 in. NPT	M2
2.5 to 25 through 100 to 1000	70 to 700 through 2800 to 28 000	0.48 to 4.8 through 25 to 250	1.8 to 18 through 100 to 1000	-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)	2888 (199)	1.6	1/2 in. NPT 3/4 in. NPT 1/2 in. ASME flange 3/4 in. ASME flange 1 in. ASME flange	M3 (1/2 in. diameter tube)
52 to 520 through 670 to 6700	1400 to 14 000 through 18 000 to 180 000	13 to 130 through 160 to 1600	48 to 480 through 630 to 6300	-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)	1393 (96.0)	1.6	3/4 in. NPT 1 in. NPT 3/4 in. ASME flange 1 in. ASME flange	M3 (1 in. diameter tube)
—	—	2.0 to 20 through 64 to 640	7.0 to 70 through 240 to 2400	-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)	2888 (199)	1.6	3/4 in. NPT 1/2 in. ASME flange 3/4 in. ASME flange 1 in. ASME flange	MH (1/2 in. diameter tube)
—	—	35 to 350 through 270 to 2700	130 to 1300 through 1000 to 10 000	-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)	1393 (96.0)	1.6	1 1/4 in. NPT 1 in. ASME flange	MH (1 in. diameter tube)

① Accuracy class and full scale are important components in calculating the maximum allowable error at a given reading. To calculate the maximum allowable error, use the VDI/VDE 3513 equation:

$$E = (0.75M + 0.25F) \times A/100$$

where:

E = Maximum allowable error at the measured flow rate

M = Measured flow rate

F = Full scale of the flowmeter

A = Accuracy class

Examples:

$$A = 1.0; F = 100 \text{ L/h}$$

At 90 L/h

$$E = (0.75 \times 90 + 0.25 \times 100) \times 1.0/100 = 0.925 \text{ L/h}$$

At 20 L/h

$$E = (0.75 \times 20 + 0.25 \times 100) \times 1.0/100 = 0.40 \text{ L/h}$$

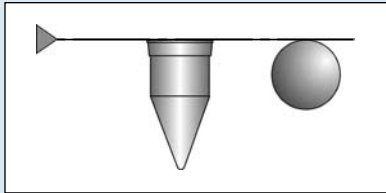
Fluid media, temperature, pressure, viscosity, and specific gravity must be considered in selecting a variable area flowmeter. See **Custom Calibration**, page 20.

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 fine metering valve

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

Measured Flow Ranges

Air

- 0.018 to 0.18 through 4.5 to 45 std ft³/h
- 0.5 to 5.0 through 120 to 1200 std L/h

Water

- 0.065 to 0.65 through 4.2 to 42 U.S. gal/h
- 0.25 to 2.5 through 16 to 160 L/h

Temperature Ranges

Process

- 23 to 212°F (–5 to 100°C); 149°F (65°C) max with limit switches

Ambient

- –4 to 212°F (–20 to 100°C); 149°F (65°C) max with limit switches

Maximum Inlet Pressure

- 145 psig (10 bar)

Accuracy Class

- 4.0

Electrical Connections

- Up to two limit switches

Process End Connections

- 1/4 in. NPT

Weight

- 0.8 lb (0.36 kg)

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, std ft³/h

01S = 0.018 to 0.18	01M = 0.5 to 5.0
02S = 0.03 to 0.3	02M = 0.8 to 8.0
03S = 0.06 to 0.6	03M = 1.6 to 16
04S = 0.15 to 1.5	04M = 4.0 to 40
05S = 0.22 to 2.2	05M = 6.0 to 60
06S = 0.38 to 3.8	06M = 10 to 100
07S = 0.95 to 9.5	07M = 25 to 250
08S = 1.9 to 19	08M = 50 to 500
09S = 3.0 to 30	09M = 80 to 800
10S = 4.5 to 45	10M = 120 to 1200

Water, U.S. gal/h

A1S = 0.065 to 0.65	A1M = 0.25 to 2.5
A2S = 0.13 to 1.3	A2M = 0.50 to 5.0
A3S = 0.30 to 3.0	A3M = 1.2 to 12
A4S = 0.65 to 6.5	A4M = 2.5 to 25
A5S = 1.1 to 11	A5M = 4.0 to 40
A6S = 1.6 to 16	A6M = 6.0 to 60
A7S = 2.5 to 25	A7M = 10 to 100
A8S = 3.0 to 30	A8M = 12 to 120
A9S = 4.2 to 42	A9M = 16 to 160

Custom

See **Custom Calibration**, page 20.

GAS = Gas

LIQ = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

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

6 Limit Switches (See page 20.)

- 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)

7 Options (See page 20.)

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
- X** = Oil- and grease-free cleaning, test report
- Z** = Top-mounted metering valve

Dimensions

See page 18 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

Measured Flow Ranges

Air

- 0.018 to 0.18 through 18 to 180 std ft³/h
- 0.5 to 5.0 through 500 to 5000 std L/h

Water

- 0.065 to 0.65 through 4.2 to 42 U.S. gal/h
- 0.25 to 2.5 through 16 to 160 L/h

Temperature Ranges

Process

- 23 to 212°F (–5 to 100°C); 149°F (65°C) max with limit switches

Ambient

- –4 to 212°F (–20 to 100°C); 149°F (65°C) max with limit switches

Maximum Inlet Pressure

- 145 psig (10 bar)

Accuracy Class

- 2.5

Electrical Connections

- Up to two limit switches

Process End Connections

- 1/4 in. NPT

Weight

- 0.89 lb (0.40 kg)



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, std ft³/h

01S = 0.018 to 0.18	01M = 0.5 to 5.0
02S = 0.03 to 0.3	02M = 0.8 to 8.0
03S = 0.06 to 0.6	03M = 1.6 to 16
04S = 0.15 to 1.5	04M = 4.0 to 40
05S = 0.22 to 2.2	05M = 6.0 to 60
06S = 0.38 to 3.8	06M = 10 to 100
07S = 0.95 to 9.5	07M = 25 to 250
08S = 1.9 to 19	08M = 50 to 500
09S = 3.0 to 30	09M = 80 to 800
10S = 4.5 to 45	10M = 100 to 1000
11S = 6.5 to 65	11M = 180 to 1800
12S = 9.0 to 90	12M = 240 to 2400
13S = 11 to 110	13M = 300 to 3000
14S = 14 to 140	14M = 400 to 4000
15S = 18 to 180	15M = 500 to 5000

Water, U.S. gal/h

A1S = 0.065 to 0.65	A1M = 0.25 to 2.5
A2S = 0.13 to 1.3	A2M = 0.50 to 5.0
A3S = 0.30 to 3.0	A3M = 1.2 to 12
A4S = 0.65 to 6.5	A4M = 2.5 to 25
A5S = 1.1 to 11	A5M = 4.0 to 40
A6S = 1.6 to 16	A6M = 6.0 to 60
A7S = 2.5 to 25	A7M = 10 to 100
A8S = 3.0 to 30	A8M = 12 to 120
A9S = 4.2 to 42	A9M = 16 to 160

Custom

See **Custom Calibration**, page 20.

GAS = Gas

LIQ = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

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

6 Limit Switches (See page 20.)

- 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)

7 Options (See page 20.)

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

X = Oil- and grease-free cleaning, test report

Z = Top-mounted metering valve

Dimensions

See page 18 for G2 model dimensions.



G3 Model

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

Technical Data

Measured Flow Ranges

Air

- 0.06 to 0.6 through 3.0 to 30 std ft³/h
- 1.6 to 16 through 80 to 800 std L/h

Water

- 0.13 to 1.3 through 2.5 to 25 U.S. gal/h
- 0.5 to 5.0 through 10 to 100 L/h

Temperature Ranges

Process

- 23 to 212°F (–5 to 100°C); 149°F (65°C) max with limit switches

Ambient

- –4 to 212°F (–20 to 100°C); 149°F (65°C) max with limit switches

Maximum Inlet Pressure

- 145 psig (10 bar)

Accuracy Class

- 2.5

Electrical Connections

- Up to two limit switches

Process End Connections

- 1/4 in. NPT

Weight

- 0.98 lb (0.44 kg)

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, std ft³/h

- 01S** = 0.06 to 0.6
- 02S** = 0.15 to 1.5
- 03S** = 0.21 to 2.1
- 04S** = 0.38 to 3.8
- 05S** = 0.95 to 9.5
- 06S** = 1.9 to 19
- 07S** = 3.0 to 30

Air, std L/h

- 01M** = 1.6 to 16
- 02M** = 4.0 to 40
- 03M** = 6.0 to 60
- 04M** = 10 to 100
- 05M** = 25 to 250
- 06M** = 50 to 500
- 07M** = 80 to 800

Water, U.S. gal/h

- A1S** = 0.13 to 1.3
- A2S** = 0.25 to 2.5
- A3S** = 0.65 to 6.5
- A4S** = 1.1 to 11
- A5S** = 1.6 to 16
- A6S** = 2.5 to 25

Water, L/h

- A1M** = 0.5 to 5.0
- A2M** = 1.2 to 12
- A3M** = 2.5 to 25
- A4M** = 4.0 to 40
- A5M** = 6.0 to 60
- A6M** = 10 to 100

Custom

See **Custom Calibration**, page 20.

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

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

6 Limit Switches (See page 20.)

- 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)

7 Options (See page 20.)

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
- X** = Oil- and grease-free cleaning, test report
- Z** = Top-mounted metering valve

Dimensions

See page 18 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

Measured Flow Ranges

Air

- 0.06 to 0.6 through 11 to 110 std ft³/h
- 1.6 to 16 through 300 to 3000 std L/h

Water

- 0.01 to 0.1 through 2.5 to 25 U.S. gal/h
- 0.04 to 0.4 through 10 to 100 L/h

Temperature Ranges

Process

- 23 to 212°F (–5 to 100°C); 149°F (65°C) max with limit switches

Ambient

- –4 to 212°F (–20 to 100°C); 149°F (65°C) max with limit switches

Maximum Inlet Pressure

- 145 psig (10 bar)

Accuracy Class

- 1.0

Electrical Connections

- Up to two limit switches

Process End Connections

- 1/4 in. NPT

Weight

- 1.35 lb (0.61 kg)

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 - 01M - 1 - 1 - A

4 Measured Flow Range

Air, std ft³/h

- | | |
|----------------------------|--------------------------|
| 01S = 0.06 to 0.6 | 01M = 1.6 to 16 |
| 02S = 0.095 to 0.95 | 02M = 2.5 to 25 |
| 03S = 0.15 to 1.5 | 03M = 4.0 to 40 |
| 04S = 0.22 to 2.2 | 04M = 6.0 to 60 |
| 05S = 0.35 to 3.5 | 05M = 9.0 to 90 |
| 06S = 0.50 to 5.0 | 06M = 14 to 140 |
| 07S = 0.75 to 7.5 | 07M = 20 to 200 |
| 08S = 1.1 to 11 | 08M = 30 to 300 |
| 09S = 1.9 to 19 | 09M = 50 to 500 |
| 10S = 3.0 to 30 | 10M = 80 to 800 |
| 11S = 4.5 to 45 | 11M = 120 to 1200 |
| 12S = 7.5 to 75 | 12M = 200 to 2000 |
| 13S = 11 to 110 | 13M = 300 to 3000 |

Water, U.S. gal/h

- | | |
|----------------------------|----------------------------|
| A1S = 0.01 to 0.1 | A1M = 0.04 to 0.4 |
| A2S = 0.016 to 0.16 | A2M = 0.063 to 0.63 |
| A3S = 0.025 to 0.25 | A3M = 0.1 to 1.0 |
| A4S = 0.04 to 0.4 | A4M = 0.16 to 1.6 |
| A5S = 0.065 to 0.65 | A5M = 0.25 to 2.5 |
| A6S = 0.1 to 1.0 | A6M = 0.4 to 4.0 |
| A7S = 0.16 to 1.6 | A7M = 0.6 to 6.0 |
| A8S = 0.25 to 2.5 | A8M = 1.0 to 10 |
| A9S = 0.4 to 4.0 | A9M = 1.6 to 16 |
| B1S = 0.65 to 6.5 | B1M = 2.5 to 25 |
| B2S = 1.0 to 10 | B2M = 4.0 to 40 |
| B3S = 1.6 to 16 | B3M = 6.3 to 63 |
| B4S = 2.5 to 25 | B4M = 10 to 100 |

Custom

See **Custom Calibration**, page 20.

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

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

6 Limit Switches (See page 20.)

- 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)

7 Options (See page 20.)

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
- X** = Oil- and grease-free cleaning, test report
- Z** = Top-mounted metering valve



Dimensions

See page 18 for G4 model dimensions.



GM Model

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

Technical Data

Measured Flow Ranges

Air

- 0.018 to 0.18 through 4.5 to 45 std ft³/h
- 0.5 to 5.0 through 100 to 1000 std L/h

Water

- 0.065 to 0.65 through 1.1 to 11 U.S. gal/h
- 0.25 to 2.5 through 4.0 to 40 L/h

Temperature Ranges

Process

- 23 to 212°F (-5 to 100°C)

Ambient

- -4 to 212°F (-20 to 100°C)

Maximum Inlet Pressure

- 58 psig (4.0 bar)

Accuracy Class

- 4.0

Process End Connections

- G 1/8 (ISO 228)

Weight

- 0.18 lb (0.08 kg)

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
Metering 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.

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

4 Measured Flow Range

Air, std ft³/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
- 10S** = 4.5 to 45

Air, std L/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
- 10M** = 100 to 1000

Water, U.S. gal/h

- A1S** = 0.065 to 0.65
- A2S** = 0.13 to 1.3
- A3S** = 0.3 to 3.0
- A4S** = 0.65 to 6.5
- A5S** = 1.1 to 11

Water, L/h

- A1M** = 0.25 to 2.5
- A2M** = 0.5 to 5.0
- A3M** = 1.2 to 12
- A4M** = 2.5 to 25
- A5M** = 4.0 to 40

Custom

See **Custom Calibration**, page 20.

GAS = Gas

LIQ = Liquid

5 Options (See page 20.)

Omit final dash (-) if no options are ordered.

Z = Top-mounted metering valve

Dimensions

See page 18 for GM model dimensions.

GP Model

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

Technical Data

Measured Flow Ranges

Air

- 0.018 to 0.18 through 18 to 180 std ft³/h
- 0.5 to 5.0 through 500 to 5000 std L/h

Water

- 0.065 to 0.65 through 4.2 to 42 U.S. gal/h
- 0.25 to 2.5 through 16 to 160 L/h

Temperature Ranges

Process

- 23 to 212°F (-5 to 100°C); 149°F (65°C) max with limit switches

Ambient

- -4 to 212°F (-20 to 100°C); 149°F (65°C) max with limit switches

Maximum Inlet Pressure

- 58 psig (4.0 bar)

Accuracy Class

- 2.5

Electrical Connections

- Up to two limit switches

Process End Connections

- G 1/4 (ISO 228)

Weight

- 0.44 lb (0.20 kg)



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) or Perfluorocarbon (FFKM)
Protective cover	Polycarbonate
Mounting rail	304 stainless steel / EN 1.4301
Metering 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*.

Dimensions

See page 18 for GP model dimensions.

Ordering Information

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

4 5 6 7
VAF - GP - 01M - 1 - 1 - A

4 Measured Flow Range

<i>Air, std ft³/h</i>	<i>Air, std L/h</i>
01S = 0.018 to 0.18	01M = 0.5 to 5.0
02S = 0.03 to 0.3	02M = 0.8 to 8.0
03S = 0.06 to 0.6	03M = 1.6 to 16
04S = 0.15 to 1.5	04M = 4.0 to 40
05S = 0.22 to 2.2	05M = 6.0 to 60
06S = 0.38 to 3.8	06M = 10 to 100
07S = 0.95 to 9.5	07M = 25 to 250
08S = 1.9 to 19	08M = 50 to 500
09S = 3.0 to 30	09M = 80 to 800
10S = 4.5 to 45	10M = 100 to 1000
11S = 6.5 to 65	11M = 180 to 1800
12S = 9.0 to 90	12M = 240 to 2400
13S = 11 to 110	13M = 300 to 3000
14S = 14 to 140	14M = 400 to 4000
15S = 18 to 180	15M = 500 to 5000

<i>Water, U.S. gal/h</i>	<i>Water, L/h</i>
A1S = 0.065 to 0.65	A1M = 0.25 to 2.5
A2S = 0.13 to 1.3	A2M = 0.5 to 5.0
A3S = 0.3 to 3.0	A3M = 1.2 to 12
A4S = 0.65 to 6.5	A4M = 2.5 to 25
A5S = 1.1 to 11	A5M = 4.0 to 40
A6S = 1.6 to 16	A6M = 6.0 to 60
A7S = 2.5 to 25	A7M = 10 to 100
A8S = 3.0 to 30	A8M = 12 to 120
A9S = 4.2 to 42	A9M = 16 to 160

Custom

See **Custom Calibration**, page 20.

GAS = Gas **LIQ** = Liquid

5 Flowmeter Gasket, Valve O-Ring Material

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

6 Limit Switches (See page 20.)

- 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)

7 Options (See page 20.)

- 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
- X** = Oil- and grease-free cleaning, test report
- Z** = Top-mounted metering valve

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	
<i>Head piece, foot piece, float, measuring tube, upper plug</i>	316L stainless steel / EN 1.4404
<i>Upper float stop (spring)</i>	316Ti stainless steel / EN 1.4571
<i>Plug gasket, lower float stop</i>	PTFE
Indicator housing	Painted aluminum
Metering Valve	
<i>Needle</i>	316L stainless steel / EN 1.4404
<i>Gaskets</i>	PTFE
<i>O-rings</i>	Fluorocarbon (FKM) or Perfluorocarbon (FFKM)
<i>Housing, spring</i>	316Ti stainless steel / EN 1.4571
<i>Spindle</i>	316L stainless steel / EN 1.4404
<i>Spindle lubricant</i>	PTFE-based
<i>Knob handle</i>	Plastic
<i>Knob handle insert</i>	Brass
<i>Knob handle set screw</i>	A2 stainless steel

Wetted components listed in *italics*.

M3 and MH Models

Component	Material / Specification
<i>Measuring tube, float, float stops, receiver, guide</i>	316L stainless steel / EN 1.4404
<i>Flange or NPT end connections</i>	316L stainless steel / EN 1.4404
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

Measured Flow Ranges

Air

- 0.18 to 1.8 through 13 to 130 std ft³/h
- 5.0 to 50 through 340 to 3400 std L/h

Water

- 0.08 to 0.8 through 2.5 to 25 U.S. gal/h
- 0.3 to 3.0 through 10 to 100 L/h

Temperature Ranges

Process °F (°C)	Ambient °F (°C)
-40 to 302 (-40 to 150)	-4 to 158 (-20 to 70)

With Limit Switches

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

Maximum Inlet Pressure

- 1885 psig (130 bar)

Accuracy Class

- 4.0

Electrical Connections

- Up to two limit switches; junction box included

Process End Connections

- 1/4 in. NPT

Weight

- 1.53 lb (0.7 kg)

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

<i>Air, std ft³/h</i>	<i>Air, std L/h</i>
01S = 0.18 to 1.8	01M = 5.0 to 50
02S = 0.37 to 3.7	02M = 10 to 100
03S = 0.55 to 5.5	03M = 15 to 150
04S = 1.5 to 15	04M = 40 to 400
05S = 3.0 to 30	05M = 80 to 800
06S = 4.5 to 45	06M = 125 to 1250
07S = 7.5 to 75	07M = 200 to 2000
08S = 9.5 to 95	08M = 250 to 2500
09S = 13 to 130	09M = 340 to 3400

<i>Water, U.S. gal/h</i>	<i>Water, L/h</i>
A1S = 0.08 to 0.8	A1M = 0.3 to 3.0
A2S = 0.13 to 1.3	A2M = 0.5 to 5.0
A3S = 0.25 to 2.5	A3M = 1.0 to 10
A4S = 0.65 to 6.5	A4M = 2.5 to 25
A5S = 1.1 to 11	A5M = 4.0 to 40
A6S = 1.6 to 16	A6M = 6.0 to 60
A7S = 2.0 to 20	A7M = 8.0 to 80
A8S = 2.5 to 25	A8M = 10 to 100

Custom

See **Custom Calibration**, page 20.

GAS = Gas **LIQ** = Liquid

5 Valve O-Ring Material

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

6 Limit Switches with Junction Box (See page 20.)

- 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)

7 Options (See page 20.)

- 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
 - X** = Oil- and grease-free cleaning, test report
 - Z** = Top-mounted metering valve

Dimensions

See page 18 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

Measured Flow Ranges

Air

- 0.018 to 0.18 through 13 to 130 std ft³/h
- 5.0 to 50 through 340 to 3400 std L/h

Water

- 0.08 to 0.8 through 2.5 to 25 U.S. gal/h
- 0.30 to 3.0 through 10 to 100 L/h

Temperature Ranges

Process °F (°C)	Ambient °F (°C)
-40 to 302 (-40 to 150)	-4 to 158 (-20 to 70)

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)

Maximum Inlet Pressure

- 1885 psig (130 bar)

Accuracy Class

- 2.5

Electrical Connections

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

Process End Connections

- 1/4 in. NPT

Weight

- 2.2 lb (1.0 kg)

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, 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

Air, std L/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

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

Water, L/h

- A1M** = 0.30 to 3.0
- A2M** = 0.50 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

Custom

See **Custom Calibration**, page 20.

GAS = Gas

LIQ = Liquid

Dimensions

See page 18 for M2 model dimensions.

5 Valve O-Ring Material

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

6 Limit Switches or Electronic Display

(See page 20.)

- 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)
- E** = LED display of measured flow with 4 to 20 mA output signal

7 Options (See page 20.)

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
- X** = Oil- and grease-free cleaning, test report
- Z** = Top-mounted metering valve



M2 Model with LED Display



M3 Model

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

Technical Data

Measured Flow Ranges

Air

- 2.5 to 25 through 670 to 6700 std ft³/h
- 70 to 700 through 18 000 to 180 000 std L/h

Water

- 0.48 to 4.8 through 160 to 1600 U.S. gal/h
- 1.8 to 18 through 630 to 6300 L/h

Temperature Ranges

Process °F (°C)	Ambient °F (°C)
-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)

With Limit Switches or 4 to 20 mA Output Signal

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

Ordering Information (M3 Model with 1 in. Measuring Tube)

Build an M3 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

4 5 6 7 8 9
VAF - M3 - 2 - 1 - 01M - 1 A - F

4 Measuring Tube Size

2 = 1 in.

5 End Connections

- 1 = 3/4 in. NPT
- 2 = 1 in. NPT
- 3 = 3/4 in. flange
- 4 = 1 in. flange

6 Measured Flow Range

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

Air, std L/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

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

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

Custom

See **Custom Calibration**, page 20.

- GAS = Gas
- LIQ = Liquid

7 Limit Switches (See page 20.)

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

8 Output Signal

Omit designator if output signal not ordered.

A = 4 to 20 mA

9 Options (See page 20.)

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, test report

Dimensions

See page 19 for M3 model dimensions.

M3 Model

Ordering Information (M3 Model with 1/2 in. Measuring Tube)

Build an M3 model variable area flowmeter ordering number by combining the designators in the sequence shown below.

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

Maximum Inlet Pressure

- 1/2 in. tube: 2888 psig (199 bar)
- 1 in. tube: 1393 psig (96.0 bar)

Accuracy Class

- 1.6

Electrical Connections

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

Process End Connections

- 1/2 to 1 in. NPT or ASME class 150 flanges

Weight

- 1/2 in. NPT process connections:
4.4 lb (2.0 kg)
- 1 in. NPT process connections:
7.7 lb (3.5 kg)
- 1/2 in. flange process connections:
7.1 lb (3.2 kg)
- 1 in. flange process connections:
11.5 lb (5.2 kg)

4 Measuring Tube Size

1 = 1/2 in.

5 End Connections

1 = 1/2 in. NPT
 2 = 3/4 in. NPT
 3 = 1/2 in. flange
 4 = 3/4 in. flange
 5 = 1 in. flange

6 Measured Flow Range

Air, std ft³/h

01S = 2.5 to 25
 02S = 4.0 to 40
 03S = 5.5 to 55
 04S = 8.0 to 80
 05S = 13 to 130
 06S = 20 to 200
 07S = 38 to 380
 08S = 52 to 520
 09S = 65 to 650
 10S = 100 to 1000

Water, U.S. gal/h

A1S = 0.48 to 4.8
 A2S = 0.65 to 6.5
 A3S = 0.8 to 8.0
 A4S = 1.1 to 11
 A5S = 1.5 to 15
 A6S = 1.6 to 16
 A7S = 2.0 to 20
 A8S = 2.5 to 25
 A9S = 3.0 to 30
 B1S = 4.2 to 42
 B2S = 5.0 to 50
 B3S = 6.5 to 65
 B4S = 9.0 to 90
 B5S = 10 to 100
 B6S = 13 to 130
 B7S = 16 to 160
 B8S = 18 to 180
 B9S = 25 to 250

Air, std L/h

01M = 70 to 700
 02M = 100 to 1000
 03M = 150 to 1500
 04M = 220 to 2200
 05M = 360 to 3600
 06M = 550 to 5500
 07M = 1000 to 10 000
 08M = 1400 to 14 000
 09M = 1800 to 18 000
 10M = 2800 to 28 000

Water, L/h

A1M = 1.8 to 18
 A2M = 2.5 to 25
 A3M = 3.0 to 30
 A4M = 4.0 to 40
 A5M = 5.5 to 55
 A6M = 6.3 to 63
 A7M = 8.0 to 80
 A8M = 10 to 100
 A9M = 12 to 120
 B1M = 16 to 160
 B2M = 20 to 200
 B3M = 25 to 250
 B4M = 35 to 350
 B5M = 40 to 400
 B6M = 50 to 500
 B7M = 63 to 630
 B8M = 70 to 700
 B9M = 100 to 1000

Custom

See **Custom Calibration**, page 20.

GAS = Gas

LIQ = Liquid

7 Limit Switches (See page 20.)

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

8 Output Signal

Omit designator if output signal not ordered.

A = 4 to 20 mA

9 Options (See page 20.)

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, test report

Dimensions

See page 19 for M3 model dimensions.

MH Model

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



Left-to-Right Flow Model

Technical Data

Measured Flow Ranges

Water

- 2.0 to 20 through 270 to 2700 U.S. gal/h
- 7.0 to 70 through 1000 to 10 000 L/h

Temperature Ranges

Process °F (°C)	Ambient °F (°C)
-325 to 572 (-200 to 300)	-40 to 248 (-40 to 120)

With Limit Switches or 4 to 20 mA Output Signal

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

Ordering Information (MH Model with 1 in. Measuring Tube)

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

4 5 6 7 8 9 10
VAF - MH - 2 - 1 - A1M - 1 A - RL - F

4 Measuring Tube Size

2 = 1 in.

5 End Connections

- 1 = 1 1/4 in. NPT
- 2 = 1 in. flange

6 Measured Flow Range

<i>Water, U.S. gal/h</i>	<i>Water, L/h</i>
A1S = 35 to 350	A1M = 130 to 1300
A2S = 55 to 550	A2M = 200 to 2000
A3S = 80 to 800	A3M = 300 to 3000
A4S = 130 to 1300	A4M = 500 to 5000
A5S = 230 to 2300	A5M = 850 to 8500
A6S = 270 to 2700	A6M = 1000 to 10 000

Custom

See **Custom Calibration**, page 20.
LIQ = Liquid

7 Limit Switches (See page 20.)

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

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 20.)

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, test report

MH Model

Maximum Inlet Pressure

- 1/2 in. tube: 2888 psig (199 bar)
- 1 in. tube: 1393 psig (96.0 bar)

Accuracy Class

- 1.6

Electrical Connections

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

Process End Connections

- 1/2 to 1 1/4 in. NPT or ASME class 150 flanges

Weight

- 1/2 in. NPT process connections: 4.4 lb (2.0 kg)
- 1 in. NPT process connections: 7.7 lb (3.5 kg)
- 1/2 in. flange process connections: 7.1 lb (3.2 kg)
- 1 in. flange process connections: 11.5 lb (5.2 kg)

Dimensions

See page 19 for MH model dimensions.

Ordering Information (MH Model with 1/2 in. Measuring Tube)

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

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

4 Measuring Tube Size

1 = 1/2 in.

5 End Connections

1 = 3/4 in. NPT
 2 = 1/2 in. flange
 3 = 3/4 in. flange
 4 = 1 in. flange

6 Measured Flow Range

Water, U.S. gal/h	Water, L/h
A1S = 2.0 to 20	A1M = 7.0 to 70
A2S = 3.0 to 30	A2M = 12 to 120
A3S = 5.0 to 50	A3M = 18 to 180
A4S = 8.0 to 80	A4M = 28 to 280
A5S = 12 to 120	A5M = 45 to 450
A6S = 20 to 200	A6M = 70 to 700
A7S = 32 to 320	A7M = 120 to 1200
A8S = 43 to 430	A8M = 160 to 1600
A9S = 64 to 640	A9M = 240 to 2400

Custom

See **Custom Calibration**, page 20.

LIQ = Liquid

7 Limit Switches (See page 20.)

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

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 20.)

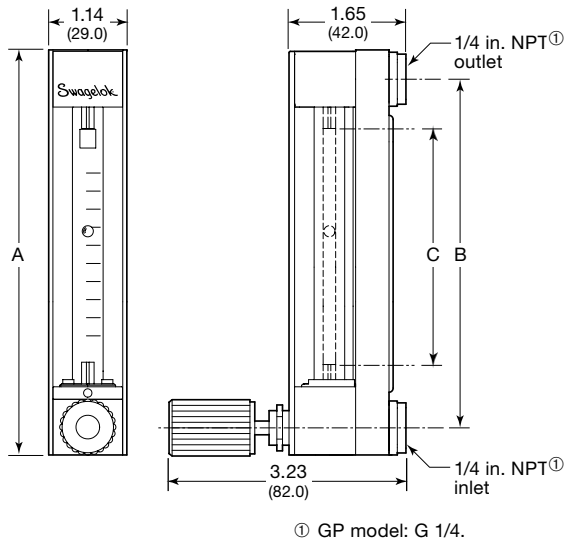
Add multiple designators in *alphabetical* order; omit final dash (-) if no options are ordered.

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, test report

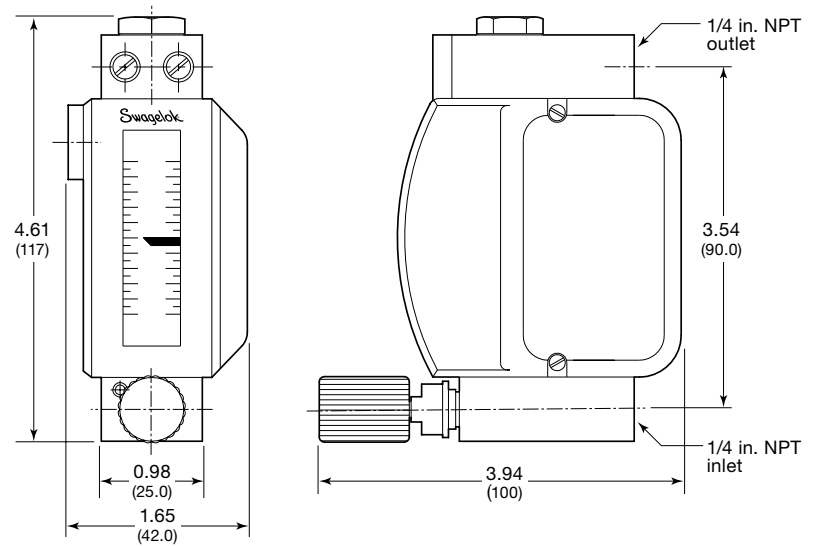
Dimensions

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

G1, G2, G3, G4, and GP Models

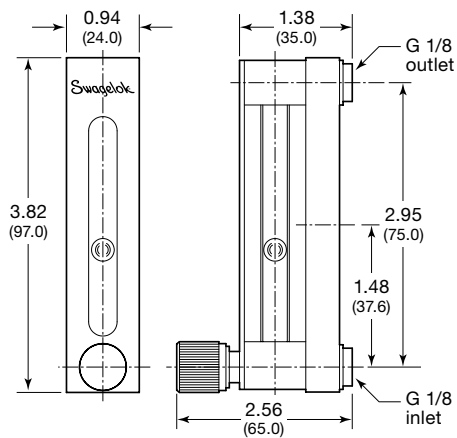


M1 Model

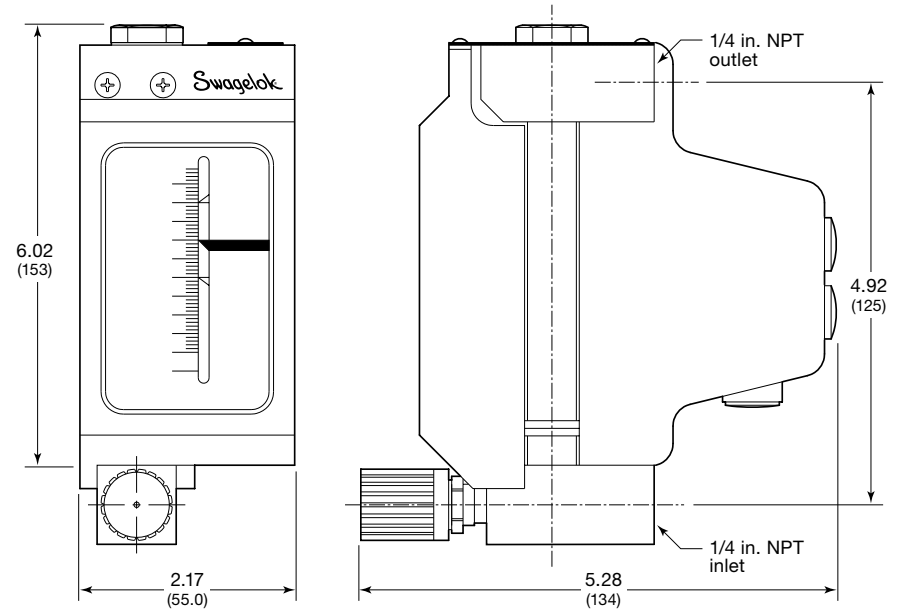


Model	Dimensions, in. (mm)		
	A	B	C
G1	4.37 (111)	3.54 (90.0)	1.77 (45.0)
G2, GP	5.75 (146)	4.92 (125)	3.15 (80.0)
G3	7.72 (196)	6.89 (175)	5.12 (130)
G4	13.6 (346)	12.8 (325)	11.0 (280)

GM Model



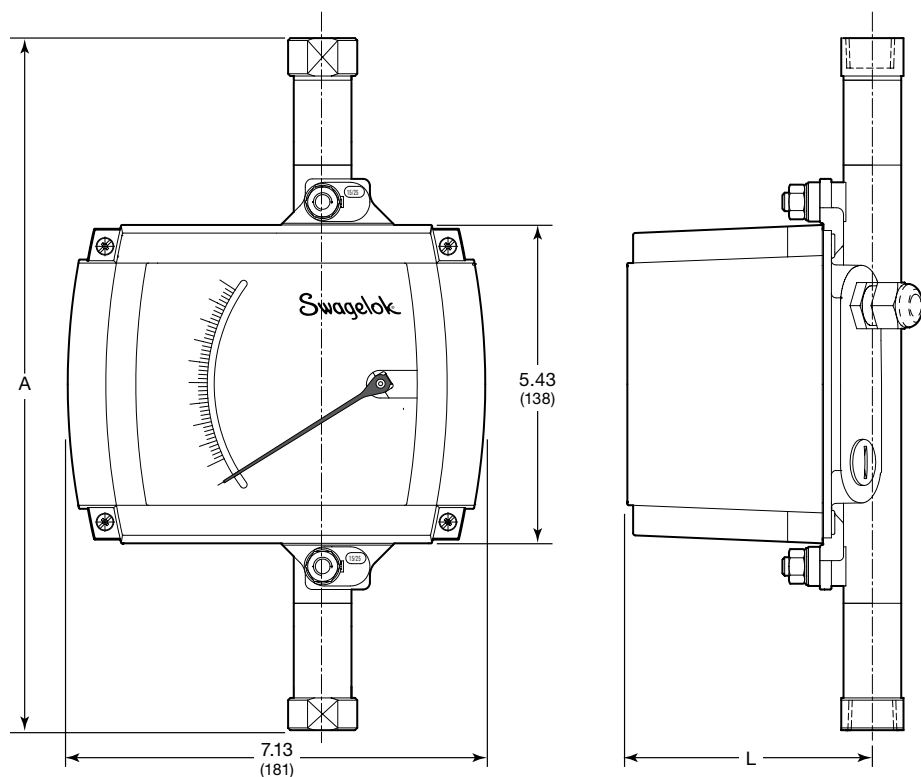
M2 Model



Dimensions

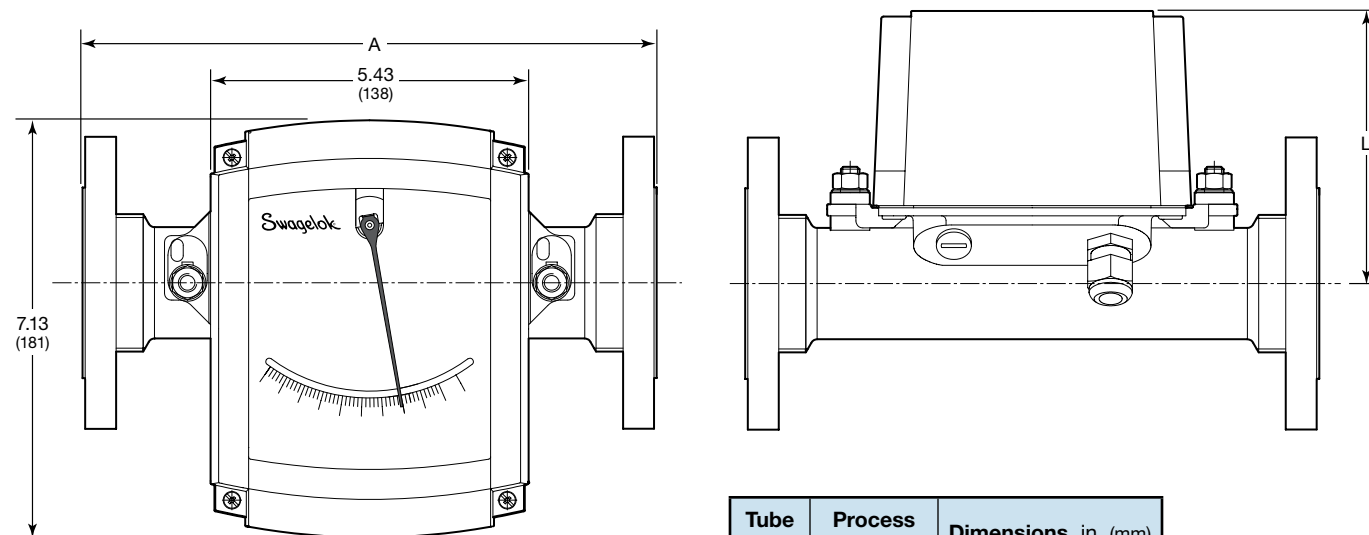
Dimensions, in inches and (millimeters), are for reference only and are subject to change.

M3 Model



Tube Size in.	Process End Connection	Dimensions, in. (mm)	
		A	L
1/2	NPT	11.8 (300)	4.21 (107)
	Flange	9.84 (250)	
1	NPT	11.8 (300)	4.69 (119)
	Flange	9.84 (250)	

MH Model



**Right-to-Left
Flow Model**

Tube Size in.	Process End Connection	Dimensions, in. (mm)	
		A	L
1/2	NPT	11.8 (300)	4.21 (107)
	Flange	9.84 (250)	
1	NPT	11.8 (300)	4.69 (119)
	Flange	9.84 (250)	

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 at 60°F (15°C) and 14.7 psig (1.0 bar).

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 sales and service representative. You will need to specify:

1. Fluid to be measured
2. Fluid viscosity with unit of measure
3. Fluid specific gravity
4. Fluid temperature with unit of measure
5. Fluid pressure with unit of measure
6. Flow measurement range with 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

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 metering valve 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.

Options

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

Certificates and Test Reports

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 and Test Report

An additional degreasing operation is available.

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.

- 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.



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.



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.

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

Warranty Information

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

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