

Flowmeter Tutorial

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Flowmeters are used to measure the rate of flow of liquids or gases. They do not control the rate of flow unless they are equipped with a control valve or flow controller. There are two basic types of flowmeters; rotameters and electronic mass flowmeters.

ROTAMETERS

Rotameters are a simple, precise and economical way to measure flow rates. They consist of a precision tapered glass tube containing one or more spherical floats. A measuring scale is etched on the glass tube. The diameter of the tube at the bottom, or inlet is approximately equal to the diameter of the float.

As fluid enters the tube, the float rises to a point where the area between the float and the tube wall is large enough to permit unrestricted flow, and the float is stationary. This position corresponds to a point on the tube scale and thus permits a reading of the rate of flow.

The capacity, or flow range of a tube can be varied by changing the float material. Materials of a lower density such as pyrex glass or sapphire give a lower flow capacity than materials of a higher density like tantalum or stainless steel (see Figure 1).

Rotameters, unlike mass flowmeters, are affected by temperature and pressure variation (see Figure 2.) When equipped with a control valve on the inlet, readings are correct as long as the outlet pressure is equal to the pressure at which the tube was calibrated. When a valve is installed on the outlet, the tube calibration pressure must match the inlet pressure to the flowmeter unit.

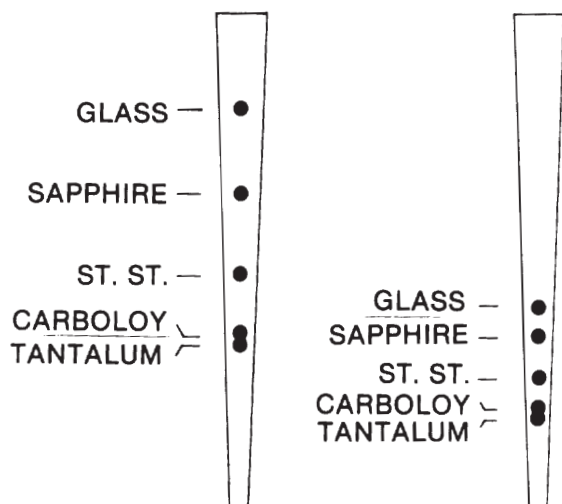


Figure 1

Relative positions of floats of various densities for the same rate of flow with 1 atmosphere outlet pressure.

Figure 2

Effect of float position for the same rate of flow in Figure 1, but with increased pressure at the flowmeter outlet.

high resolution flowmeter

Series 7920

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Description

The 7920 flowmeters provide the most accurate indication and precise control of fluids available for a wide range of applications. This versatile meter is functionally and dimensionally interchangeable with other current designs while incorporating many innovative features.

All 7920 glass metering tubes have integral float guides to assure the accuracy of $\pm 5\%$ of full scale. Glass and stainless steel floats are standard. The meters are available in a wide range of flows.

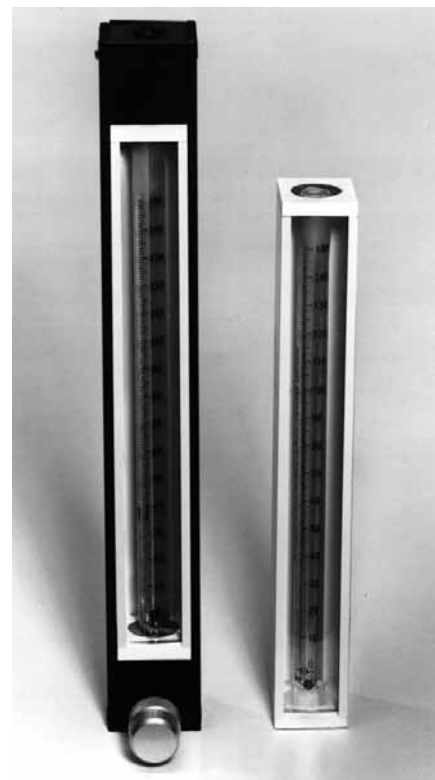
Standard with this series is the TUBE-CUBE™, a unique, design concept. The “cube”, a unitized tube holder, aligns the tube quickly and easily for a simple tube installation or replacement, reduces chipped tube ends, broken tubes, and misalignment. The TUBE-CUBE™ also provides tube protection during handling and storage and affords a 1.5 X scale magnification factor for more accurate tube reading. End seals in the design are direct-acting and non-rotating for fast alignment and convenient service access.

Design Features

- High resolution 150mm scale length
- Many standard direct reading scales available
- Precision taper, fluted metering tube
- Lowest available pressure drop via maximum flow path area increases available flow rates at low feed pressures
- Standard front panel mounting requires minimum hardware - easy installation, quick access.
- Available utility and high precision metering valves do not require special fittings
- Simplified; direct acting non-rotating compression seal

Applications

- Carrier and fuel gas chromatography
- Atomic absorption
- Semiconductor manufacture
- Chemical processing
- General research and industrial uses



Materials

End Blocks
Chrome plated brass, 316 stainless, or Monel®

“O” Rings & packing
Viton® - standard
Buna-N, EPR rubber and Teflon are available options

Side Plates
Anodized Aluminum

Specifications

Maximum Pressure
250 psig

Temperature Range
-20°F to +250°F
-30°C to 120°C

Accuracy
 $\pm 5\%$ of full scale

Repeatability
 $\pm 0.25\%$ of scale reading

Series 7920 (cont.)

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Model	Material	Valve Type
B7920*	Brass	None
B7920V*	Brass	Standard
B7920HA*	Brass	High Accuracy
S7920	316 Stainless Steel	None
S7920V*	316 Stainless Steel	Standard
S7920HA*	316 Stainless Steel	High Accuracy
M7920*	Monel®	None
M7920V*	Monel®	Standard

* Each model includes one tube from the table below; specify your choice when ordering.

Options	P/N Suffix
· 1/4" NPT female inlet & outlet	P4FF
· 1/4" hose barbs inlet and outlet - add suffix "HB"	HB
· 1/4" compression tube fittings inlet and outlet	T4FF
· 1/8" compression tube fittings inlet and outlet	T2FF
Bench stand - Model 7920B	
Eagle Eye Alarm - Model 7926-AVA** (Requires special modified unit - add prefix "EE" to model number)	

Ordering Information

Model - X - Y	
X=tube required Y=optional fittings	1, 2, 3, 4, 5, 6, 7, 8, 10 HB=hose barbs P4FF=1/4" NPT female T4FF=1/4" compression T2FF=1/8" compression
Example:	B7920V-2-T4FF is a brass unit with a 7920-2 flow tube and 1/4" compression fittings on inlet and outlet.

Flowmeter Tubes in TUBE-CUBE®

Model	Typical Flow Range*		
	Float	Air scc/min.	Water cc./min.
7920-1	Glass	3 - 56	0.04 - 0.66
	St. Steel	11 - 158	0.12 - 3.18
7920-2	Glass	6 - 91	0.08 - 1.0
	St. Steel	16 - 271	0.17 - 5.5
7920-3	Glass	22 - 388	0.24 - 7.8
	St. Steel	63 - 845	0.68 - 17
7920-4	Glass	64 - 847	1 - 17
	St. Steel	217 - 1707	2 - 46
7920-5	Glass	550 - 2560	6 - 54
	St. Steel	1070 - 5080	21 - 135
7920-6	Glass	610 - 3830	9 - 89
	St. Steel	1330 - 7670	30 - 217
7920-7	Glass	820 - 8610	14 - 200
	St. Steel	2090 - 16580	53 - 482
7920-8	Glass	2220 - 24920	47 - 568
	St. Steel	4190 - 45940	102 - 1319
7920-10	Glass	1.0 - 100	

*Actual flow rates will vary from one manufacturing lot to another. Calibration data is supplied for each tube shipped.

Selected Correction Factors	
flow = air flow x correction factor	
Gas	Correction Factors
air	1.00
acetylene	1.054
ammonia	1.304
argon	0.851
n-butane	0.706
carbon dioxide	0.811
carbon monoxide	1.017
ethane	0.981
ethylene	1.016
helium	2.689
hydrogen	3.810
methane	1.343
nitrogen	1.017
nitrous oxide	0.811
oxygen	0.951
propane	0.810

Description

The gas proportioner meters the flow of each of two gases and mixes them thoroughly in a special mixing tube to produce homogeneous two-component mixtures.

Concentration accuracies of 10% of component value are maintained with a standard unit using typical calibration curves. (In a desired mixture of 1% gas A and 99% of gas B, a concentration between .9% and 1.1% is maintained.) Individual units can be calibrated for non-corrosive gases to attain an accuracy of 5% of the component value. Individual calibration curves are supplied with these specially calibrated units.

The control valves are installed at the outlets making these gas proportioners back pressure compensated. The readings on the tubes are accurate regardless of the down-stream pressure, so long as the inlet pressures are maintained at the levels for which the tubes were calibrated.

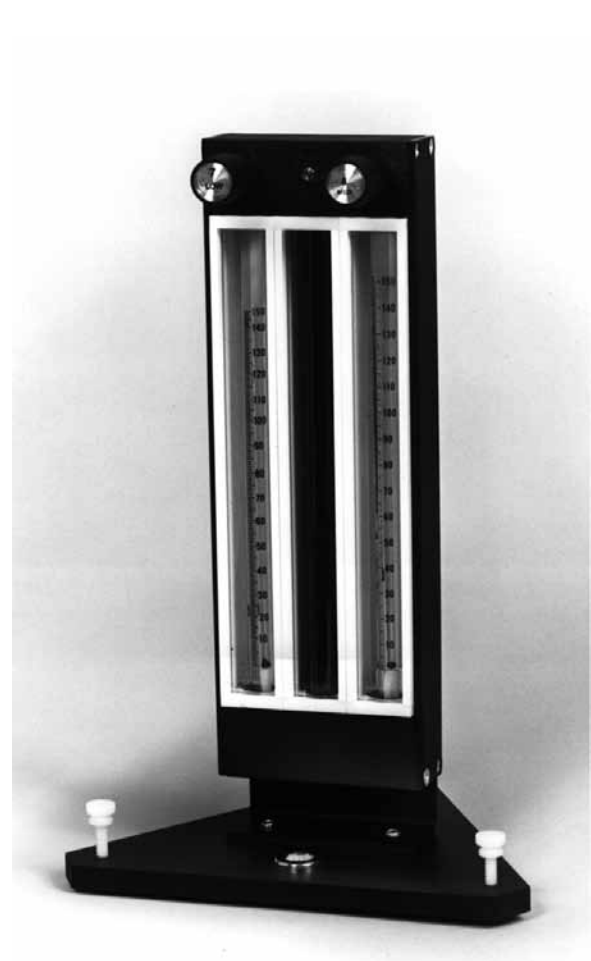
The unit is recommended for 50 psig pressure but can be used at any pressure between 10 and 200 psi.*

These proportioners are available in both aluminum and stainless steel construction. When ordering a gas proportioner, specify the composition of the desired mixture, the gases, the discharge rate, and inlet pressure in addition to the model number.

*For best performance, it is recommended that tubes have only one float.

How to order

All models include baseplate, mixing tube and two flowmeter tubes of your choice. If unsure of correct tubes, provide the composition range of intended mixtures, total outlet flow and operating inlet pressure. We will select the tubes.



Model	Material	Valve	Connections
7951	Aluminum	Standard	1/8" NPT female
7951H	Aluminum	Standard	1/4" hose barb
7951T	Aluminum	Standard	1/4" compression
7952	Aluminum	High Accuracy	1/8" NPT female
7952H	Aluminum	High Accuracy	1/4" hose barb
7952T	Aluminum	High Accuracy	1/4" compression
7953	Stainless Steel	Standard	1/8" NPT female
7953H	Stainless Steel	Standard	1/4" hose barb
7953T	Stainless Steel	Standard	1/4" compression
7954	Stainless Steel	High Accuracy	1/8" NPT female
7954H	Stainless Steel	High Accuracy	1/4" hose barb
7954T	Stainless Steel	High Accuracy	1/4" compression

Series 7974 & 7975

large flow acrylic flowmeters

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Description

The Series 7974 and 7975 acrylic flowmeters are useful in a wide variety of applications involving non-corrosive gases where flow rates exceed those of traditional laboratory models. All units have direct reading scales in either liters/minute or cubic feet/minute of air. Correction factors for other gases can be provided.



Series 7974



Series 7975

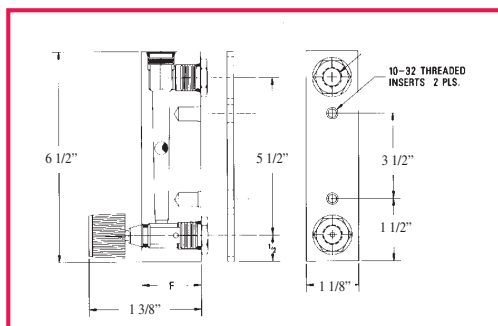
Features	Materials	Specifications
<ul style="list-style-type: none"> Easy to read scales. Air ranges from 14 lpm to 3400 lpm (0.5 to 100 scfm) Durable one-piece clear acrylic construction Optional built-in cartridge type valve available 	<p><i>Body</i> clear acrylic</p> <p><i>Fittings</i> 7974 series - brass 7975 series - PVC</p> <p><i>Valve</i> brass</p> <p><i>Seals</i> Buna-N</p>	<p><i>Max. Operating Pressure</i> 100 psig</p> <p><i>Operating Temperature Range</i> 0° to +150°F</p> <p><i>Body Inlet and Outlet</i> 7974 - 1/4" NPT female 7975 - 1" NPT female</p> <p><i>Accuracy</i> 7974 Series - +3% of full scale 7975 Series - +2% of full scale</p>

Ordering Information

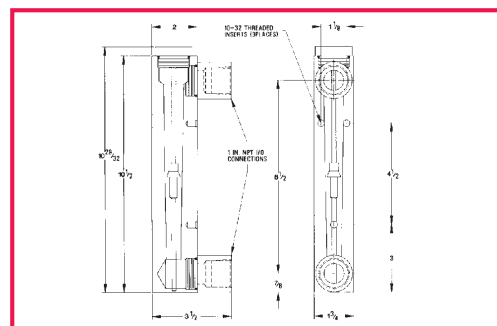
Model Number	Flow Range	Model Number	Flow Range
B7974-1	0.5 - 5.0 SCFM	7975-1	3 - 25 SCFM
B7974-2	1 - 10 SCFM	7975-2	4 - 50 SCFM
B7974-3	2 - 20 SCFM	7975-3	10 - 100 SCFM
B7974-4	14 - 140 lpm	7975-4	100 - 700 lpm
B7974-5	30 - 280 lpm	7975-5	100 - 1400 lpm
B7974-6	60 - 560 lpm	7975-6	400 - 3400 lpm

Option: Inlet needle valve - add suffix "V" to model number, i.e. 7974V-1

Option: Inlet needle valve - add suffix "V" to model number, i.e. 7975V-1



Series 7974



Series 7975

economic acrylic flowmeter

Series 7923

Description

The Series 7923 acrylic flowmeters are an ideal low cost tool for measuring flow rates of inert and non-reactive gases. The 1/8" female standard inlet and outlet connections are contained in brass inserts to ensure a secure leak-free connection to prevent cracking of the acrylic body. A needle valve to control the flow rate is included.

Specifications

Maximum inlet pressure
100 psig

Maximum operating temperature
150°F

Dimensions
1" wide x 4" high x 2 1/8" deep

Accuracy
+5% full scale

Repeatability
+1% of scale reading

Inlet and Outlet
1/8" NPT female standard on 3" centers

Seals
Buna-N



Options

- 1/4" hose barbs inlet and outlet - add suffix "HB"
- 1/4" compression tube fittings inlet and outlet - add suffix "T4FF"
- 1/8" compression tube fittings inlet and outlet - add suffix "T2FF"
- 7923-AVA alarm

Model	Flow Range (SCFH Air)	Float
7923-2A00	0.1 - 1 SCFH	glass
7923-2A01	0.2 - 2 SCFH	SS
7923-2A02	0.5 - 5 SCFH	glass
7923-2A03	0.5 - 10 SCFH	glass
7923-2A04	2 - 20 SCFH	SS
7923-2A05	3 - 30 SCFH	SS
7923-2A06	4 - 50 SCFH	glass
7923-2A07	10 - 100 SCFH	SS
7923-2A08	20 - 200 SCFH	SS
7923-2A12	0.04 - 0.5 slpm	glass
7923-2A13	0.1 - 1.0 slpm	SS
7923-2A29	0.2 - 2.5 slpm	glass
7923-2A14	0.4 - 5.0 slpm	glass
7923-2A15	1 - 10.0 slpm	SS
7923-2A16	2 - 25 slpm	glass
7923-2A17	4 - 50 slpm	SS
7923-2A18	10 - 100 slpm	SS