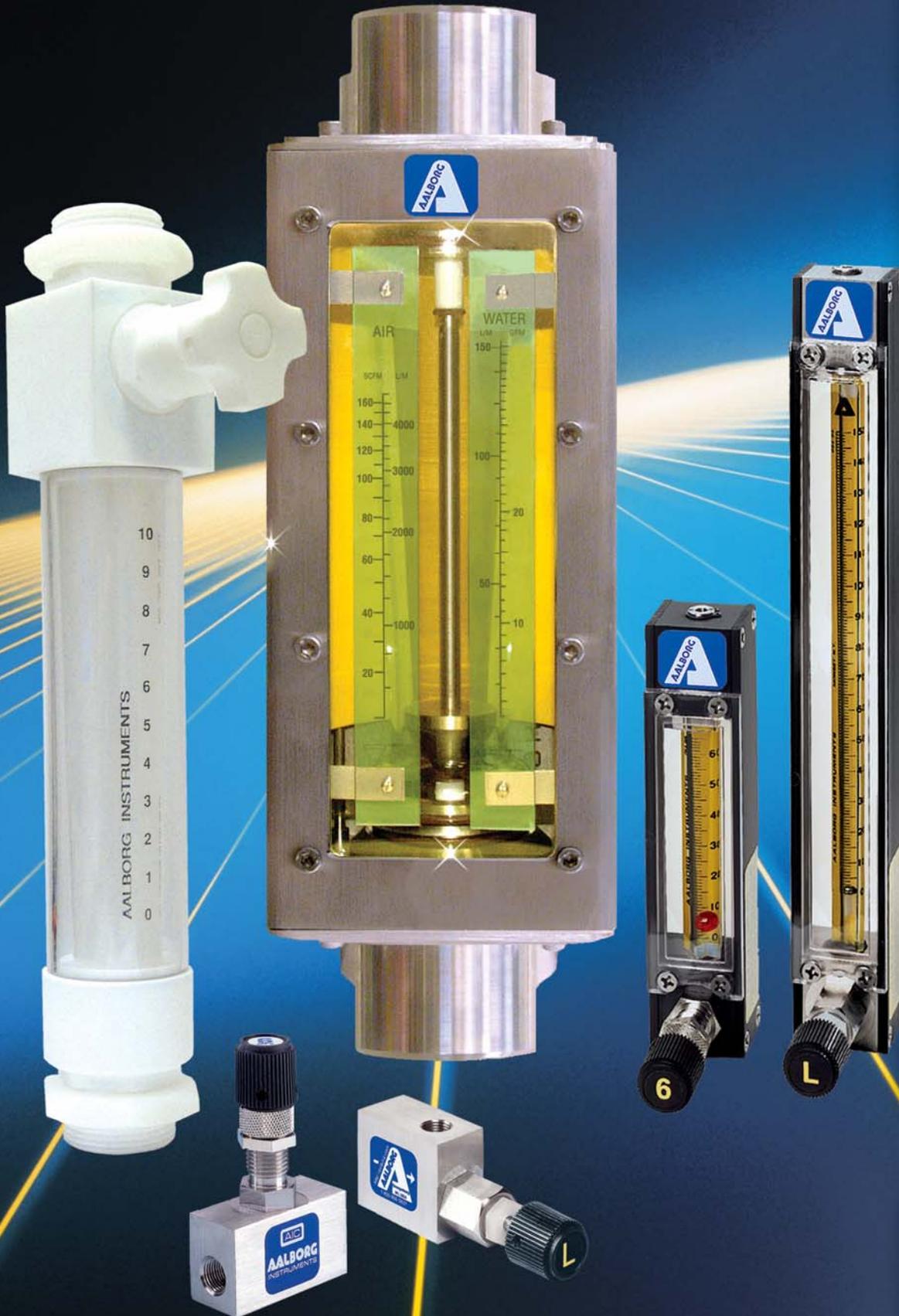
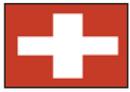


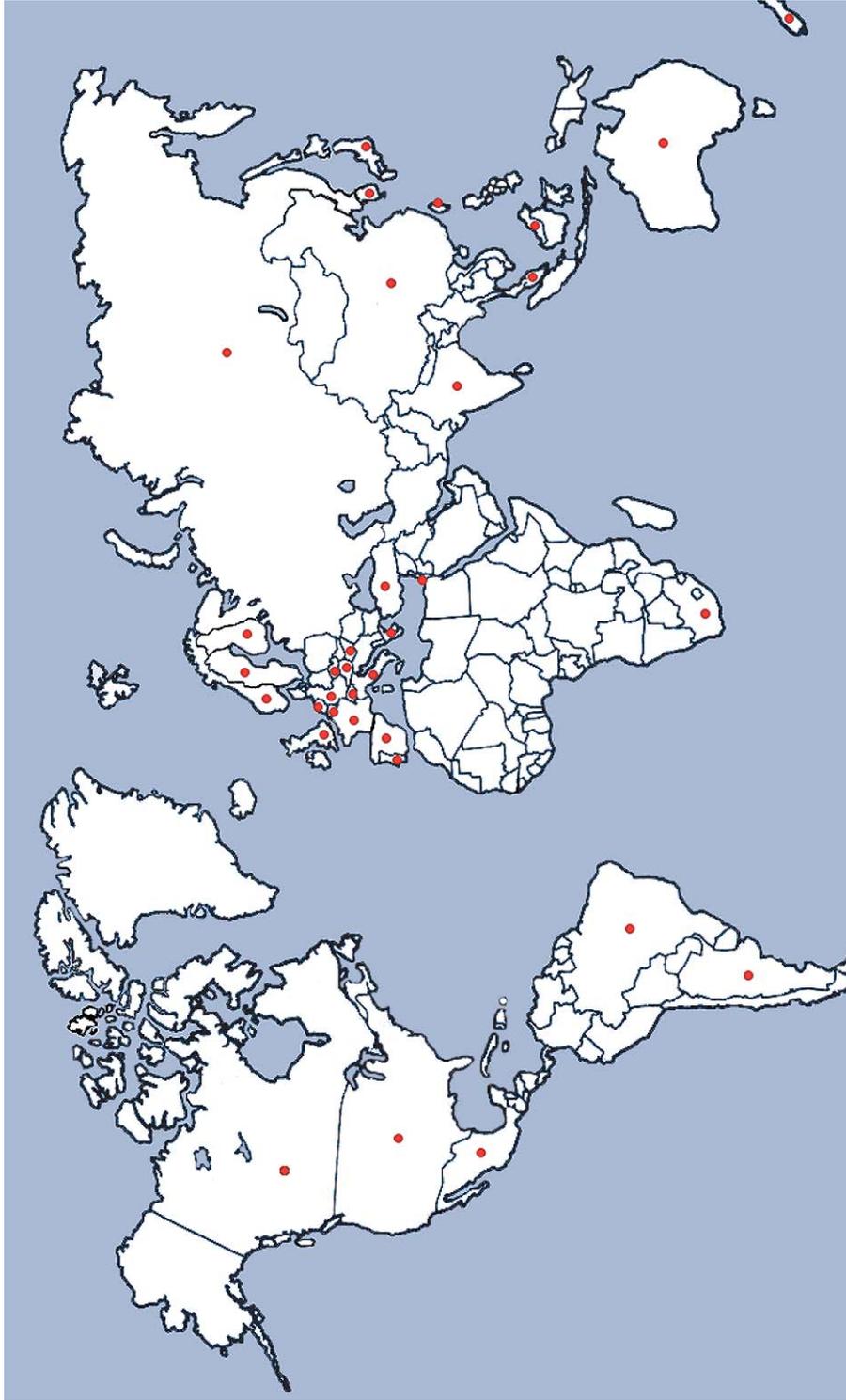
rotameters



AALBORG



Worldwide Distribution



Visit our web site at: aalborg.com





About the Company

Founded in 1972, AALBORG® is well known throughout the world as a primary manufacturer of precision instrumentation for flow measurement and control.

We operate two divisions:

The Variable Area Division manufactures a complete line of glass tube rotameters. These flow meters are available with aluminum, brass, stainless, steel or PTFE wetted components. AALBORG® also manufactures a unique line of PFA tube meters for ultrapure or corrosive applications. Precision barstock stainless steel or brass needle valves, as well as PTFE valves, are also manufactured in this division.

The Electronics Division produces analog and digital mass flow meters and controllers, as well as a diverse line of wafer and insertion type vortex flow meters for steam, liquid or gases. In addition, stepping motor driven valves made in this department are highly useful in processing and OEM applications.

NIST Traceable

NIST traceable flow meter calibrations are performed in our state of the art laboratories.

Technical Assistance

Technical Assistance is readily available. Customers are invited to contact the company or our distributors to discuss individual requirements. OEM applications are welcome.

ISO9001 2000 Certification

AALBORG® has been ISO 9001 certified since April of 1995. We are very proud of the design features and the exceptionally high quality for which our products which have been known since 1972. It is our policy that through strict enforcement of exacting manufacturing standards the AALBORG® brand name continues to be associated with a reputation of high quality and reliability. Our products are backed by meticulous innovative engineering combined with efficient manufacturing practices and a highly skilled work force guaranteeing total customer satisfaction.

Our Mission

It is the policy of AALBORG® to develop, produce and deliver products and services which consistently conform to or exceed customer requirements.

Our commitment is to provide cutting edge technology combined with a sincere desire to serve our customers and produce the highest quality products attainable.

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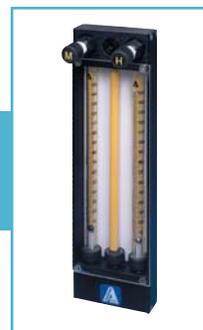
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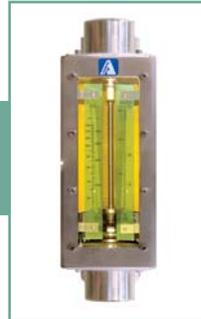
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TRADEMARKS

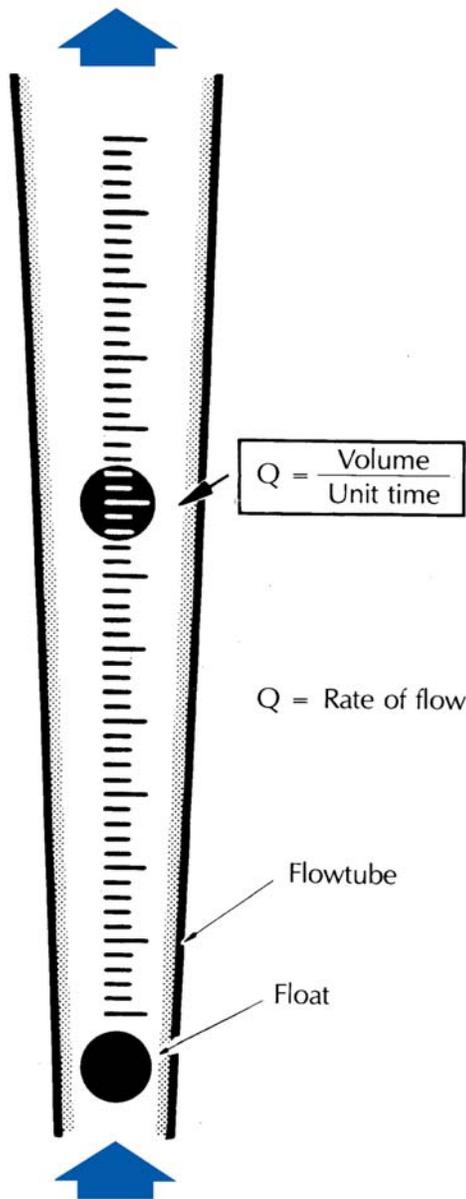
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Viton[®] -is a registered trademark of DuPont Dow Elastomers.
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For certified dimensions please contact *Aalborg*[®] Instruments and Controls.

PRINCIPLE OF OPERATION

When compared with other types of flow instrumentation, variable area interchangeable flow meters offer the most practical, precise and economical means of visually indicating flow rate measurement.



These meters have the highest useful flow ranges providing consistently reliable readings from maximum flow down to 5 to 10% of capacity.

They require no electrical connections, and have low meter related pressure drops.

Meters are available in a large selection of flow rates and configurations, to accommodate the unique requirements of most applications.

Included in the line are flow tube assemblies, single and multiple tube flow meters. PTFE-Glass meters are for metering corrosive fluids or for high purity requirements.

Back pressure compensated Gas Proportioners are popular choices for blending component gases accurately to customized end use requirements at great savings.

Multiple tube flow meters are available with or without manifolding.

A tapered glass FLOW TUBE, and a spherical FLOAT inside it, constitute the heart of variable area type flow meters.

Flow meters are installed vertically in lines carrying gases or liquids to be monitored.

Fluids enter through the smaller opening at the bottom, and exit through the upper end. Upward pressure causes the float to rise. Flow takes place through the circular area between the float and the inside surface of the flow tube. As the float rises, the flow area increases, due to the tapered bore of the flow tube.

Dynamic equilibrium results when the buoyant force, due to the float and the upward force, due to fluid pressure, balance the weight of the float.

The vertical position of the float at equilibrium corresponds exclusively to one particular flow rate.

This flow rate is obtained by determining the height of the float with the aid of a scale etched on the flow tube.

INTERCHANGEABILITY

Flow tubes and other components are thoroughly interchangeable resulting in greatly increased versatility. Meters are even interchangeable with standard sizes made by other manufacturers.

As a result of simple assembly and installation procedures, it is possible to use several sets of flow tubes in conjunction with one mounting frame.

flow tubes

- ✓ Precision fabricated from heavy walled, shock resistant borosilicate glass.
- ✓ Bores are uniformly tapered or formed with internal "rib-guides" or flutes.
- ✓ Floats are retained by TFE plugs.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Interchangeability.
- ✓ Self cleaning.
- ✓ Low differential pressures that stay independent of Flow rate changes.

OPTIGRAD™ SCALES

The vertical "tangential locator line" facilitates hairline accuracy and convenience of reading. Flow tubes are supplied with millimeter, or direct reading scales.

Standard scale lengths are 65 mm (2.56 in) or 150mm (5.91 in). Flow rates are determined by lining up the scale graduation at the center of the spherical float.

Parallax and lack of visual reference will affect the accuracy and reproducibility of metering to a great extent. Such a drawback is eliminated by OPTIGRAD™ scales.

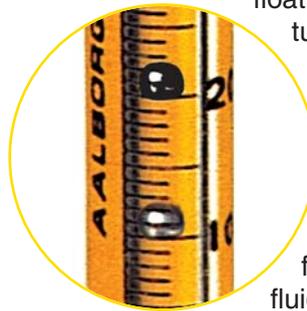
A vertical "locator" line is incorporated into the geometry of the scale graduation. To pinpoint the center of the float with "hairline" accuracy.

readings are taken as follows:

- 1) Position head in front of flow meter, with eyes at level with the float.
- 2) Move head horizontally to the left until the contour of the float appears to just touch the "locator" line tangentially.
- 3) The intersection of the "locator" line with the horizontal graduation at the center of the float, pinpoints the appropriate reading value.

UNIVERSAL MILLIMETER SCALES

Millimeter scales indicate the height to which the float rises within the metering tube and are correlated with specific flow rates through the use of appropriate calibration data sheets or curves.



Scales of this type permit utilization of a given flow meter for a great number of different fluids at diverse pressure and temperature conditions. See tables 6,7,8, 9 and 10 on pages 43-46 for maximum flow rates.

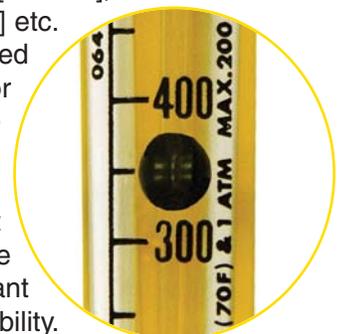
To minimize eye fatigue associated with periods of repetitive readings, contrasting yellow backgrounds are provided behind scales

DIRECT READING SCALES

Direct reading scales are indicating flow rates, in engineering units such as [mL/min], standard cubic feet per hour [scfh] etc.

Such scales are designed exclusively for a specific gas or liquid at a given set of pressure and temperature and are valid for the associated units of flow only. Thus, the convenience of direct reading scale designs should be weighed against the resultant limitations of applicability.

For listing of flow tubes with standard Direct Reading Scales, see tables 11-22 on pages 47 and 49.



BUILT-IN VALVES

Meters are available with built-in needle valves (CV™), high precision metering valves (MFV™) with “non-rising stems”, or with no valves.

Built-in valves are mounted at the inlet (bottom) or outlet (top) of flow meters. Generally, for gas metering it is recommended that valves are positioned at inlets - for liquids valves may be positioned either at inlets or outlets. For vacuum service, valves must be mounted at outlets.

If unspecified at the time of ordering, meters will be shipped with valves mounted at the inlets.

HIGH PRECISION VALVES (MFV™)

The higher cost of MFV™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates. A choice of six MFV™ flow capacities are offered (see Table 1 on page 40) to be matched with individual flow meter ranges.

This unique design comprises rectilinear motion valve needles, with non-rising stems. As the needle advances into and out of high precision cylindrical orifices, the flat tapered surface of the needle gradually, without turning, uncovers the flow area.



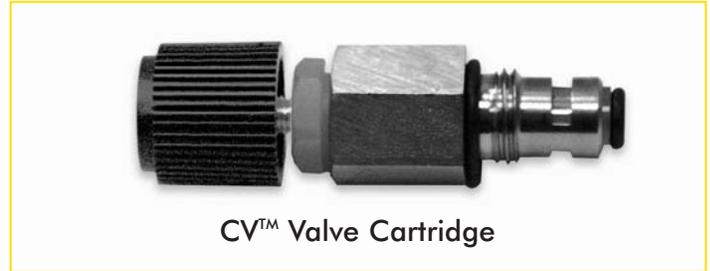
MFV™ Valve Cartridge

CV™ VALVE CARTRIDGES

These valves are designed for adjusting flow rates in applications where high resolution metering regulation is not essential. Available in three ranges, (see Table 2 on page 40) they represent a relatively inexpensive option.

The simple construction of CV™ valves incorporate a VALVE SPINDLE with conical ends and compound angles for optimal resolution.

The VALVE NEEDLE turns as it travels into or out of the VALVE ORIFICE. In conjunction with the cylindrical cross section, the conical front tip of the VALVE SPINDLE increases or decreases the annular flow area. The cartridge serves as a bubble-tight “shut-off” valve when the tip of the VALVE SPINDLE comes into a stop position against the VALVE ORIFICE.



CV™ Valve Cartridge

to reverse the position of valves

- 1) Disassemble flow tubes from frames.
- 2) Install flow tubes upside down in frame.
- 3) Invert flow meter.



FRONT SHIELDS WITH MAGNIFIER LENSES

A unique longitudinal magnifier is part of the molded Lexan® front shield which is supplied on all single tube flow meters.

The magnification of the scale reading facilitates greatly enhanced resolution of measurement.

MOUNTINGS

Flow meters are shipped ready for panel mounting. Meters may be mounted on or behind panels.

For “on-panel” installations holes are drilled for inlet and outlet fittings and meters are mounted simply by means of panel mounting nuts supplied.

Mounting behind panels is done by utilizing the screws from front shields. Panel mounting is easily converted to self standing bench mounting by using the appropriate optional acrylic tripod base.

NIST CALIBRATIONS

Our laboratories are fully equipped to perform NIST traceable flow calibrations for Rotameters, Mass Flow instruments and many other flow products.

We also offer calibration service on equipment and instrumentation of other manufactures products which are comparable to those manufactured by Aalborg®.

- ✓ Calibrations are performed at standard (STP) conditions (70°F/21.1 °C and 14.7 psia/1 atm abs).
- ✓ Gas calibrations for up to 2000 L/min and water calibrations up to 4 L/min available.
- ✓ Calibrated to NIST traceable standards.
- ✓ State-of-the-art Precision Glass-Piston, and Bell Prover type calibrations.

PRESSURE LIMITS OF CALIBRATIONS

Up to 500 PSIG for routine gases (Air, N₂, He, CO₂, Ar and O₂) with a maximum flow of 250 L/min. Up to 80 PSIG for Air, with a maximum flow of 1000 L/min.

European Service Facility



Authorized repair and service facility for AALBORG® Thermal Mass Flow Systems and Rotameter Products. Calibrated to NMI (Netherlands Metering Institute) standards.

AALBORG - ANALYT-MTC

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Typical Bell Prover used for NIST traceable calibrations

INTERCHANGEABLE

Designed for low flow rates, the **Model P** flow meter is a precision instrument embodying the inherent simplicity, versatility and economy of the classical rotameter. It is particularly suitable for metering carrier gases in chromatography, indicating and controlling gases in manufacturing processes, liquid and gas measurement in laboratories, pilot plants, flow and level indicating, etc.

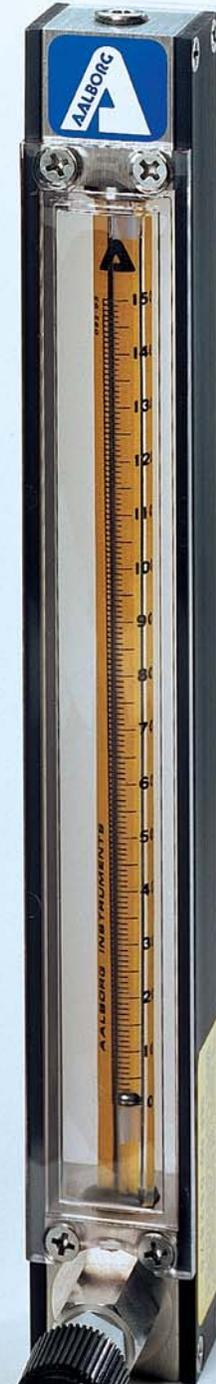
Shipped completely assembled, flow meters include standard mounting fittings in a choice of materials, side plates, thick protective magnifying front shield and back plate, optional built-in control valve, and flow tubes selected from the Flow Capacities tables. Panel mounting style is convertible to bench mounting through the use of the optional acrylic tripod. The tripod has a built-in spirit leveler and leveling screws.

For multiple tube meters see pages 7 and 8.

design features

- ✓ Rib-guided or fluted metering tubes facilitate stable, accurate readings.
- ✓ Magnifier lens in front shield to enhance reading resolution.
- ✓ Interchangeability of flow tubes and floats.
- ✓ Ease of installation and exchange of flow tubes.
- ✓ "Non-rotating" adapter feature - glass flow tubes are prevented from turning during the tightening phase of the assembly procedure.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Chemical compatibility.
- ✓ Simple means of panel mounting.

150 mm Meter with CV™ Valve



65 mm Meter with MFV™ Valve

BUILT-IN VALVES

Meters are available with built-in needle valves (CV™), high precision metering valves (MFV™) with “non-rising stems”, or with no valves. The higher cost of MFV™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates.

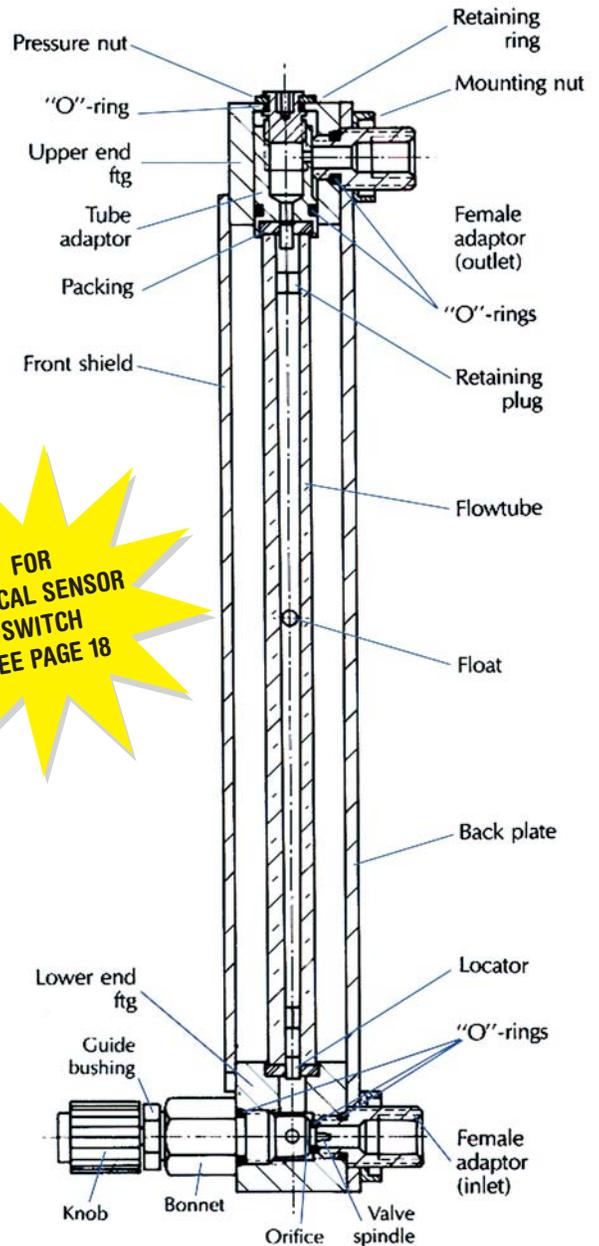
Generally, for gas metering it is recommended that valves are positioned at inlets (bottom) for liquids valves may be positioned either at inlets or outlets (top). For vacuum services, valves must be mounted at outlets. If unspecified at the time of ordering, meters will be shipped with valves mounted at the inlets.

Panel mounting is convertible to bench mounting through the use of an optional acrylic tripod base with spirit leveler (catalog No. TP1).

| SPECIFICATIONS | |
|--------------------------------------|--|
| STANDARD ACCURACY | ±2% FS mm scales except 042 flow tubes. ±5% FS direct reading scales and 042 flow tubes. |
| CALIBRATED ACCURACY | ±1% FS optional. |
| REPEATABILITY | ±0.25%. |
| USEFUL FLOW RANGE | 10:1 minimum with one float and better than 20:1 with combination of two floats installed in meters. |
| MAXIMUM OPERATING PRESSURE | 200 psig/13.8 bars. |
| MAXIMUM OPERATING TEMPERATURE | 250 °F/ 121 °C. |

| **MATERIALS OF CONSTRUCTION | |
|---|--|
| FLOW TUBES | Heavy walled borosilicate glass. |
| FLOATS | Glass, Sapphire, 316 Stainless Steel, Carboloy® and Tantalum. |
| CHOICE OF MOUNTING FITTINGS IN CONTACT WITH FLUIDS | a) Aluminum, black anodized. b) Brass, chrome plated. c) 316 stainless steel. |
| SIDE PANELS | Aluminum, black anodized. |
| FRONT SHIELD | Lexan® with longitudinal magnifier lens for enhanced reading resolution. |
| BACK PLATE | 1/8" thick white acrylics. |
| O-RINGS AND PACKING | Buna-N® o-rings in aluminum/ brass model. Viton® o-rings in stainless steel meters. OPTIONAL Viton® PTFE Kalrez® and EPR. |
| CONNECTIONS | 1/8" NPT female inlet and outlet connections. OPTIONAL 1/4" FNPT, hose and compression fittings are available. |

Select flow tube consistent with requirements from flow capacity tables 6 to 22 (page 43 to 49).



FOR OPTICAL SENSOR SWITCH SEE PAGE 18

Assorted flow tubes may be used in conjunction with a single mounting frame, an apparent benefit in many laboratory applications.

Ordering information see page 9.
Dimensional information see page 8.

**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

The **Model Px** multiple tube flow meter line offers, the convenience and simplicity of 2, 3, 4, 5 and 6 tube meters, retaining most of the unique design features associated with single tube units. Multiple tube meters are available with 65mm or 150mm flow tubes same as used in single unit flow meters.

Px meters are convenient for applications where several streams of gases or liquids are to be metered in individual channels, or manifolded.

Shipped completely assembled, flow meters include standard mounting fittings in a choice of materials, side plates, thick protective front shield and back plate, optional built-in control valve, and flow tubes selected from the Flow Capacities tables.

Panel mounting style is convertible to bench mounting through the use of the optional acrylic tripod. The tripod has a built-in spirit leveler and leveling screws.

design features

- ✓ Rib-guided or fluted metering tubes facilitate stable, accurate readings.
- ✓ Interchangeability of flow tubes and floats.
- ✓ Manifolding at inlet or outlet.
- ✓ Ease of installation and exchange of flow tubes.
- ✓ "Non-rotating" adapter feature - glass flow tubes are prevented from turning during the tightening phase of the assembly procedure.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Chemical compatibility.
- ✓ Simple means of panel mounting.



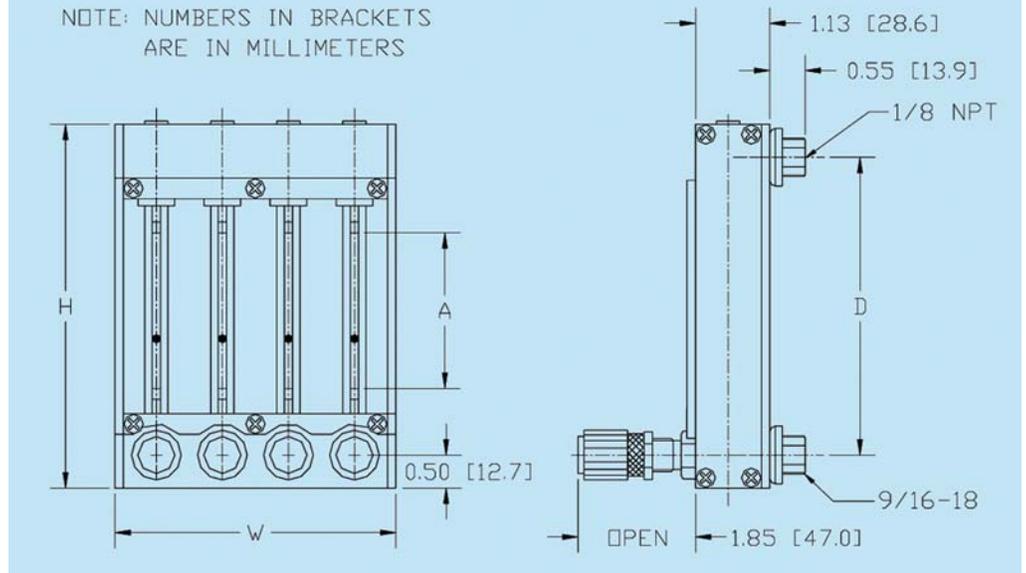
Four Tube Meter shown with MFV™ Valves



BUILT-IN VALVES

Meters may be supplied with built-in needle valves (CV™), high precision metering valves (MFV™) with “non-rising stems”, or with no valves. Generally for gas metering, it is recommended that valves are positioned at inlets (bottom) for liquids valves may be positioned either at outlets (top) or inlets. For vacuum service, valves must be mounted at outlets. If unspecified at the time of ordering, meters will be shipped with valves mounted at inlets.

MOUNTING DIMENSIONS



SPECIFICATIONS

STANDARD ACCURACY

±2% FS mm scales except 042 flow tubes.
±5% FS direct reading scales and 042 flow tubes.
Conforming to ISA RP. 16-1.2.3 Specification 2-S-10. Manifoldd models excepted.

CALIBRATED ACCURACY

±1% FS optional.

REPEATABILITY ± 0.25%

USEFUL FLOW RANGES

10:1 minimum with one float. Better than 20:1 with combinations of two floats installed in meters.

MAXIMUM OPERATING PRESSURE

200 psig /13.8 bars.

MAXIMUM OPERATING TEMPERATURE

250 °F /121 °C.

**MATERIALS OF CONSTRUCTION

FLOW TUBES Heavy walled borosilicate glass.

CHOICE OF MOUNTING FITTINGS IN CONTACT WITH FLUIDS

- a) Aluminum, black anodized.
- b) 316 Stainless Steel.

SIDE PANELS Aluminum, black anodized.

FRONT SHIELD AND BACK PLATE

1/8" thick clear polycarbonate and white acrylics.

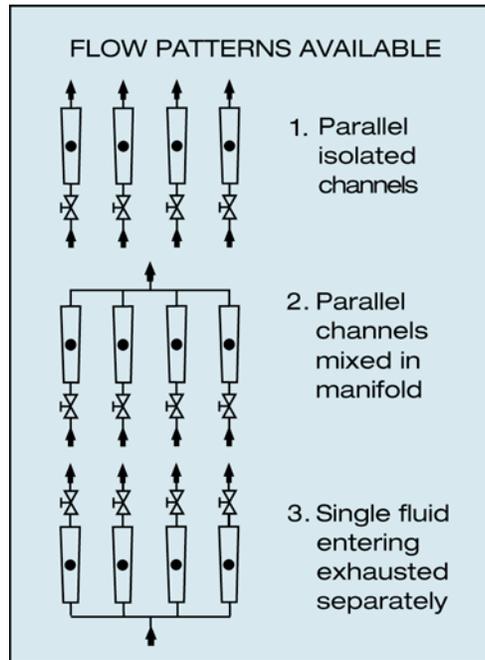
O-RINGS AND PACKING

Buna-N® o-rings in aluminum model.
Viton® o-rings in stainless steel meters.
OPTIONAL Viton®, PTFE/Kalrez®, EPR.

CONNECTIONS 1/8" NPT female inlet and outlet connections.

OPTIONAL: 1/4" FNPT, hose & compression fittings are available.

Ordering information see page 9.



The built-in-valves are always installed in the end block opposite to the manifolded one.

Thus, if a meter is manifolded at the outlet, valves are installed at the inlets; if a meter is manifolded at the inlet, valves are installed at the outlets.

DIMENSIONS FOR P STYLE METERS

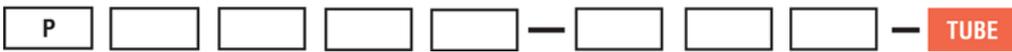
| SCALE LENGTH (A) | ALL P METERS | | WIDTH (W) | | | | | |
|------------------|--------------|----------------------|-----------|--------|--------|--------|--------|--------|
| | HEIGHT (H) | CENTER TO CENTER (D) | 1 TUBE | 2 TUBE | 3 TUBE | 4 TUBE | 5 TUBE | 6 TUBE |
| 65mm | 5.500 | 4.500 | 1.250 | 2.250 | 3.250 | 4.250 | 5.250 | 6.250 |
| 150mm | 9.813 | 8.813 | 1.250 | 2.250 | 3.250 | 4.250 | 5.250 | 6.250 |



ORDERING INFORMATION MODEL P METERS

EXAMPLE

| | | |
|-------------|--------------------------------------|--|
| P | P STYLE METERS | |
| CODE | NUMBER OF CHANNELS | |
| 1 | SINGLE CHANNEL (ONE TUBE) | |
| 2 | TWO CHANNEL METER (TWO TUBES) | |
| 3 | THREE CHANNEL METER (THREE TUBES) | |
| 4 | FOUR CHANNEL METER (FOUR TUBES) | |
| 5 | FIVE CHANNEL METER (FIVE TUBES) | |
| 6 | SIX CHANNEL METER (SIX TUBES) | |
| CODE | SIZE | |
| 6 | 65 mm | |
| 1 | 150 mm | |
| CODE | MATERIAL | |
| A | ALUMINUM | |
| B | BRASS | |
| S | STAINLESS STEEL | |
| CODE | VALVE POSITION | |
| 1 | MFV (HIGH PRECISION) INLET | |
| 3 | NO VALVE | |
| 4 | CV (STANDARD CARTRIDGE) INLET | |
| 5 | MFV (HIGH PRECISION) OUTLET | |
| 6 | CV (STANDARD CARTRIDGE) OUTLET | |
| CODE | SEALS | |
| V | VITON® STANDARD ON STAINLESS METERS | |
| B | BUNA® STANDARD ON BRASS AND ALUMINUM | |
| E | EPR | |
| T | PTFE / KALREZ® | |
| CODE | FITTINGS | |
| A | 1/8" FNPT (STANDARD) | |
| B | 1/4" FNPT | |
| C | 1/8" HOSE NIPPLE | |
| D | 1/4" HOSE NIPPLE | |
| E | 1/8" COMPRESSION | |
| F | 1/4" COMPRESSION | |
| H | VCR FITTINGS | |
| CODE | MANIFOLD | |
| 0 | NONE (STANDARD FOR SINGLE CHANNEL) | |
| 1 | BOTTOM | |
| 2 | TOP | |



Optional Accessories

TP1-Tripod for single channel meter.
 TP2-Tripod for 2, 4 and 6 isolated channels or manifolding at top.
 TP3-Tripod for 3 and 5 isolated channels or manifolding at bottom.
 TP5-Tripod for 3 single tube meters.

Select tube from the following tables:

Tables 6 to 22. Pages 43 to 49.

GENERAL DESCRIPTION

Model T flow meters incorporate the principles of traditional variable area flow technology.

These rugged PTFE-Glass flow meters offer solutions to low to medium flow range measurements of highly corrosive or ultra-pure liquids and gases.

Wetted inert components are surrounded by structurally rigid anodized aluminum. The resultant design represents a unique combination of a rugged mechanically rigid frame and chemically inert wetted parts.

For additional protection of personnel each meter is supplied with a thick protective magnifying safety shield.

*Glass and Sapphire floats are recommended.

design features

- ✓ Constructed of inert materials: Borosilicate Glass, PTFE and PCTFE.
- ✓ Chemically inert wetted parts within mechanically rigid frame.
- ✓ Rib-guided or fluted metering tubes facilitate stable, accurate readings.
- ✓ Magnifier lens in front shield to enhance reading resolution.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Simple means of panel mounting.
- ✓ Interchangeability of flow tubes and floats.
- ✓ Conveniently overlapping flow ranges available in both standard millimeter and "direct reading" scales.



T

PTFE-SINGLE GLASS FLOW METERS

LEAK INTEGRITY

Flow meters are individually tested on a Mass Spectrometer Leak Detector and certified to a leak integrity rating of 1×10^{-7} sccs Helium or better.

BUILT-IN VALVES

Meters are available with built-in needle valves (CVT™), high precision metering valves (MVT™) with “non-rising stems”, or with no valves. The higher cost of MVT™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates.

When meters with valves are ordered the valve cartridges are installed at the inlet. For vacuum service it is recommended that meters are ordered with valves at the outlet.

Assorted flow tubes may be used in conjunction with a single mounting frame, an apparent benefit in many laboratory applications.

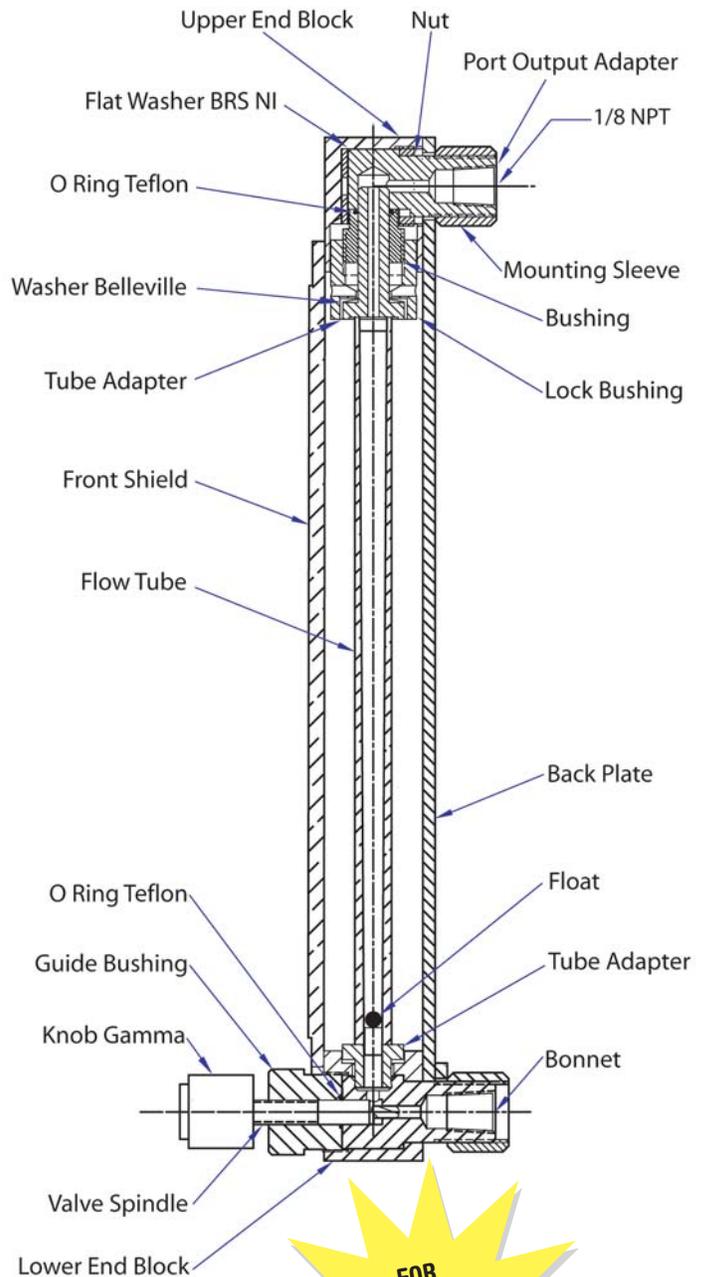
SPECIFICATIONS

| | |
|--------------------------------------|--|
| STANDARD ACCURACY | ±2% FS mm scales except 042 flow tubes. ±5% FS direct reading scales and 042 flow tubes. |
| REPEATABILITY | ± 0.25%. |
| USEFUL FLOW RANGES | 10:1 minimum with one float. |
| MAXIMUM OPERATING PRESSURE | 100 psig/6.7 bars. |
| MAXIMUM OPERATING TEMPERATURE | 150 °F/ 65 °C. |
| LEAK INTEGRITY | Individually pressure and leak tested and certified to a rating of 1×10^{-7} sccs Helium. |

**MATERIALS OF CONSTRUCTION

| | |
|--|---|
| FLOW TUBES | Heavy walled borosilicate glass. (Sapphire or glass floats recommended). |
| FITTINGS IN CONTACT WITH FLUIDS | Virgin PTFE PCTFE. |
| SIDE PLATES | Aluminum, black anodized. |
| FRONT SHIELD AND BACK PLATE | 1/8" thick clear polycarbonate and white acrylics. |
| O-RINGS | PTFE. |
| CONNECTIONS | 1/8" NPT female inlet and outlet connections. |
| OPTIONAL | glass hose nipples or compression fittings. |

*The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.



**FOR
OPTICAL SENSOR
SWITCH
SEE PAGE 18**

Panel mounting is convertible to bench mounting through the use of an optional acrylic tripod base with spirit leveler (catalog No. TP1).

**Ordering information see page 14.
Dimensional information see page 13.**

Model Tx Multiple Tube PTFE-Glass Flow meters combine the convenience of multiple tube meters with the unique design features of single tube PTFE-Glass flow meters. These meters are available with the same interchangeable 65mm or 150mm glass flow tubes used in single tube designs and they are available with or without built-in PTFE needle valves.

Wetted inert components are surrounded by structurally rigid anodized aluminum. The resultant design represents a unique combination of a rugged mechanically rigid frame and chemically inert wetted parts.

They are ideal for applications where several streams of corrosive gases or liquids are to be metered in individual channels or as a controlled mixer in manifolded models.

design features

- ✓ Constructed of inert materials: Borosilicate Glass, PTFE and PCTFE.
- ✓ Chemical inert wetted parts within mechanically rigid frame.
- ✓ Rib-guided or fluted metering tubes facilitate: stable, accurate readings.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Simple means of panel mounting.
- ✓ Interchangeability of flow tubes and floats.
- ✓ Conveniently overlapping flow ranges available in both standard millimeter and direct reading scales.

Four Tube PTFE meter shown with CVT™ valves





MULTIPLE TUBE-PTFE GLASS FLOW METERS

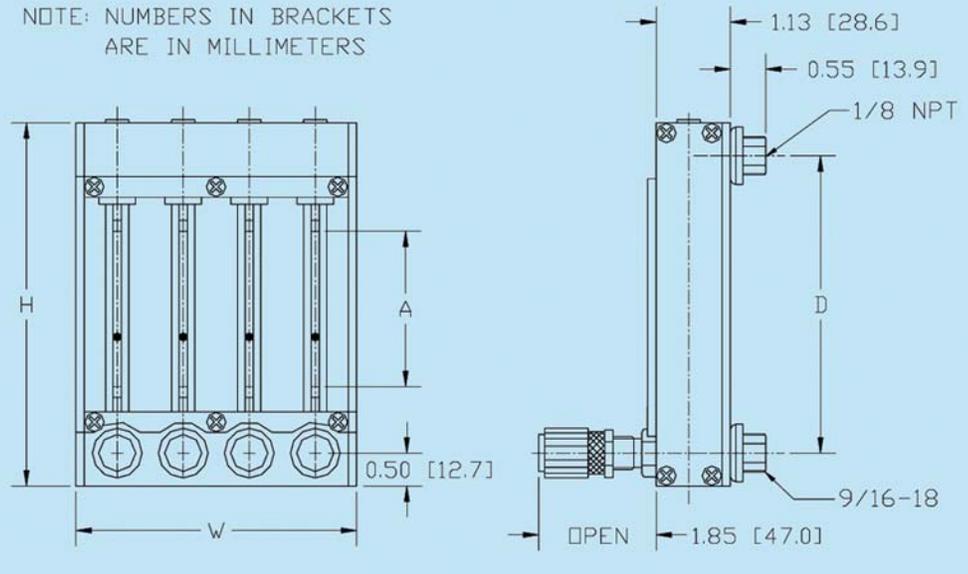
BUILT-IN VALVES

Meters are available with built-in needle valves (CVT™), high precision metering valves (MVT™) with non-rising stems, or with no valves. The higher cost of MVT™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates.

For vacuum service it is recommended that meters are ordered with valves at the outlet.

DIMENSIONS

NOTE: NUMBERS IN BRACKETS ARE IN MILLIMETERS



LEAK INTEGRITY

Flow meters are individually tested on a Mass Spectrometer Leak Detector and certified to a leak integrity rating of 1×10^{-7} sccs Helium or better.

Note: To obtain millimeters multiply inch dimensions by 2.54.

SPECIFICATIONS

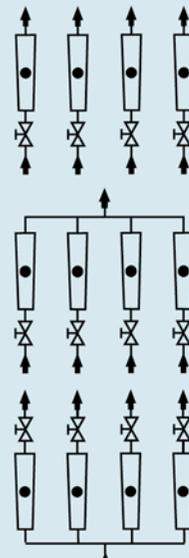
| | |
|--------------------------------------|---|
| STANDARD ACCURACY | $\pm 2\%$ FS mm scales except 042 flow tubes. $\pm 5\%$ FS direct reading scales and 042 flow tubes. |
| REPEATABILITY | $\pm 0.25\%$. |
| USEFUL FLOW RANGES | 10:1 minimum with one float. |
| MAXIMUM OPERATING PRESSURE | 100 psig /6.7 bars. |
| MAXIMUM OPERATING TEMPERATURE | 150 °F/ 65 °C. |
| LEAK INTEGRITY | Individually pressure and leak tested and certified to a rating of 1×10^{-7} sccs Helium. |

**MATERIALS OF CONSTRUCTION

| | |
|--|---|
| FLOW TUBES | Heavy walled borosilicate glass. (Sapphire or glass floats recommended). |
| FITTINGS IN CONTACT WITH FLUIDS | Virgin PTFE PCTFE. |
| SIDE PANELS | Aluminum, black anodized. |
| FRONT SHIELD AND BACK PLATE | 1/8" thick clear polycarbonate and white acrylics. |
| O-RINGS | PTFE. |
| CONNECTIONS | 1/8" NPT female inlet and outlet connections. |
| OPTIONAL | glass hose nipples or compression fittings. |

*The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

FLOW PATTERNS AVAILABLE



1. Parallel isolated channels
2. Parallel channels mixed in manifold
3. Single fluid entering exhausted separately

When meters with valves are ordered the valve cartridges are installed at the inlet.

DIMENSIONS FOR T STYLE METERS

| SCALE LENGTH (A) | ALL METERS | | WIDTH (W) | | | |
|------------------|------------|----------------------|-----------|--------|--------|--------|
| | HEIGHT (H) | CENTER TO CENTER (D) | TUBE 1 | TUBE 2 | TUBE 3 | TUBE 4 |
| 65mm | 6.156 | 5.156 | 1.250 | 2.250 | 3.250 | 4.250 |
| 150mm | 10.46 | 9.469 | 1.250 | 2.250 | 3.250 | 4.250 |



EXAMPLE

| | | | | | | | | | | |
|----------|----------------|------------------------------------|--|--|---|--|--|--|---|-------------|
| T | T STYLE METERS | | | | | | | | | |
| | CODE | NUMBER OF CHANNELS | | | | | | | | |
| | 1 | SINGLE CHANNEL (ONE TUBE) | | | | | | | | |
| | 2 | TWO CHANNEL METER (TWO TUBES) | | | | | | | | |
| | 3 | THREE CHANNEL METER (THREE TUBES) | | | | | | | | |
| | 4 | FOUR CHANNEL METER (FOUR TUBES) | | | | | | | | |
| | CODE | SIZE | | | | | | | | |
| | 6 | 65 mm | | | | | | | | |
| | 1 | 150 mm | | | | | | | | |
| | CODE | MATERIAL | | | | | | | | |
| | T | PTFE | | | | | | | | |
| | CODE | VALVE POSITION | | | | | | | | |
| | 1 | MVT (HIGH PRECISION) INLET | | | | | | | | |
| | 3 | NO VALVE | | | | | | | | |
| | 4 | CVT (STANDARD CARTRIDGE) INLET | | | | | | | | |
| | 5 | MVT (HIGH PRECISION) OUTLET | | | | | | | | |
| | 6 | CVT (STANDARD CARTRIDGE) OUTLET | | | | | | | | |
| | CODE | SEALS | | | | | | | | |
| | T | PTFE | | | | | | | | |
| | CODE | FITTINGS | | | | | | | | |
| | A | 1/8" FNPT (STANDARD) | | | | | | | | |
| | F | 1/4" COMPRESSION | | | | | | | | |
| | G | GLASS NIPPLE | | | | | | | | |
| | CODE | MANIFOLD | | | | | | | | |
| | 0 | NONE (STANDARD FOR SINGLE CHANNEL) | | | | | | | | |
| | 1 | BOTTOM | | | | | | | | |
| | 2 | TOP | | | | | | | | |
| T | | | | | — | | | | — | TUBE |

Optional Accessories

TP1-Tripod for single channel meter.
TP2-Tripod for 2 and 4 isolated channels or manifolding at top.
TP3-Tripod for 3 isolated channels or manifolding at bottom.
TP5-Tripod for 3 single tube meters.

Select tube from the following tables:

Tables 6 to 22. Pages 43 to 49.

S

SINGLE TUBE FLOW METERS

S STYLE

Model S single-tube flow meters pictured on this page are similar to *P* meters in design, employing the same interchangeable flow tubes, valves, and accessories. Likewise they may be panel or bench mounted.

Model S Flow Meter Shown.
With Optional Tripod Base and CV™ Valve



FOR
OPTICAL SENSOR
SWITCH
SEE PAGE 18

The important advantage of the *S* meter is convenience in applications, where frequent changing of tubes in meter cases is desired.

An example is when several flow tubes are used in conjunction with a single meter case, or when because of the nature of the fluid, periodic cleaning necessitates disassembly.

Aalborg's® exclusive TUBELOK™ design facilitates simple installation and replacement of tubes in mounting cases.

As a result of the “non-rotating” adapter feature, glass flow tubes are prevented from turning during the tightening phase of the assembly procedure.

design features

- ✓ TUBELOK™ design simplifies installation and replacement of tubes.
- ✓ Rib-guided or fluted metering tubes facilitate stable, accurate readings.
- ✓ Magnifier lens in front shield to enhance reading resolution.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Simple means of panel mounting.
- ✓ Interchangeable flow tubes and floats.



BUILT-IN VALVES

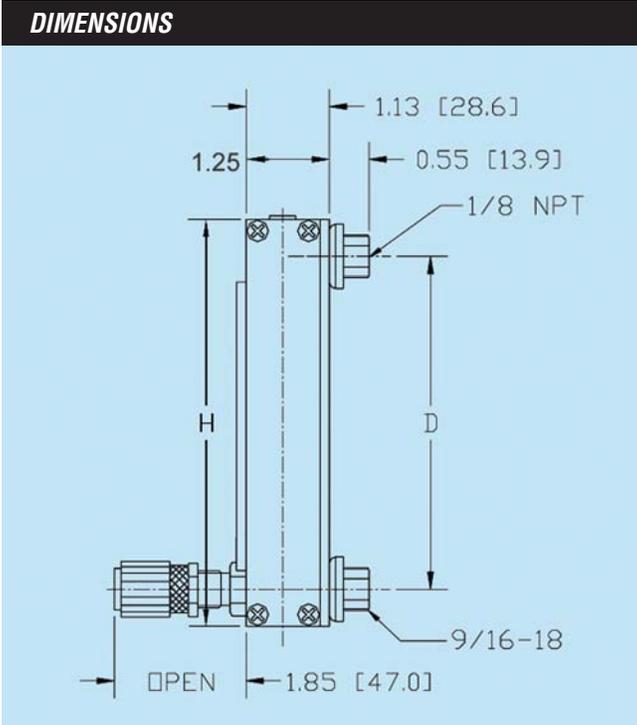
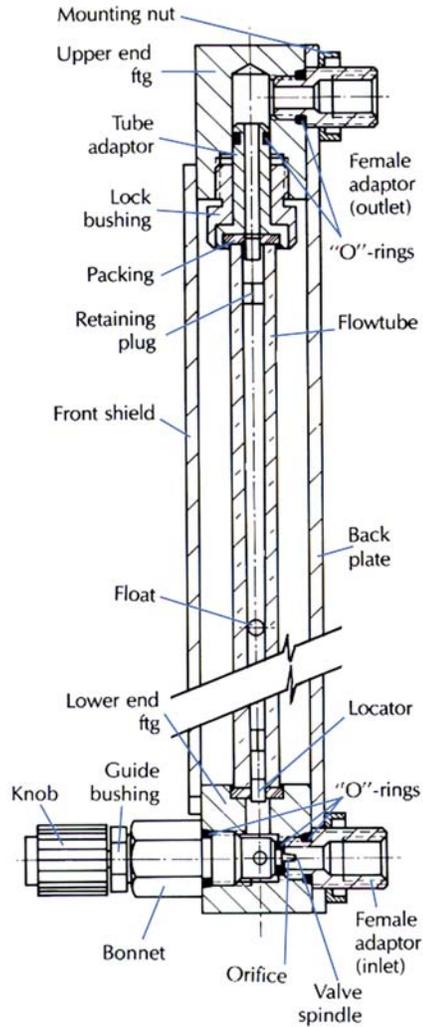
Meters are available with built-in needle valves (CV™), high precision metering valves (MFV™) with “non-rising stems”, or with no valves. The higher cost of MFV™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates. Generally, for gas metering it is recommended that valves are positioned at inlets (bottom) for liquids valves may be positioned either at inlets or outlets (top). For vacuum services, valves must be mounted at outlets. If unspecified at the time of ordering, meters will be shipped with valves mounted at the inlets.

| SPECIFICATIONS | |
|--------------------------------------|--|
| STANDARD ACCURACY | ±2% FS mm scales except 042 flow tubes. ±5% FS direct reading scales and 042 flow tubes. |
| CALIBRATED ACCURACY | ±1% FS optional. |
| REPEATABILITY | ±0.25%. |
| USEFUL FLOW RANGE | 10:1 minimum with one float. Better than 20:1 with combination of two floats installed in meters. |
| MAXIMUM OPERATING PRESSURE | 200 psig/13.8 bars. |
| MAXIMUM OPERATING TEMPERATURE | 250 °F/ 121 °C. |

| **MATERIALS OF CONSTRUCTION | |
|---|--|
| FLOW TUBES | Heavy walled borosilicate glass. |
| FLOATS | Glass, Sapphire, 316 Stainless Steel, Carboloy® and Tantalum. |
| CHOICE OF MOUNTING FITTINGS IN CONTACT WITH FLUIDS | a) Aluminum, black anodized. b) Brass, chrome plated. c) 316 stainless steel. |
| SIDE PANELS | Aluminum, black anodized. |
| FRONT SHIELD | Lexan® with longitudinal magnifier lens for enhanced reading resolution. |
| BACK PLATE | 1/8" thick white acrylics. |
| O-RINGS AND PACKING | Buna-N® o-rings in aluminum model. Viton® o-rings in stainless steel meters. OPTIONAL Viton®, PTFE/Kalrez® and EPR. |
| CONNECTIONS | 1/8" NPT female inlet and outlet connections. |
| OPTIONAL | 1/4" FNPT, hose and compression fittings are available. |

**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

| DIMENSIONS FOR S STYLE METERS | | |
|-------------------------------|------------|----------------------|
| SCALE LENGTH (A) | ALL METERS | |
| | HEIGHT (H) | CENTER TO CENTER (D) |
| 65mm | 6.156 | 5.156 |
| 150mm | 10.46 | 9.469 |



S

ORDERING INFORMATION MODEL S METERS

EXAMPLE

| | | |
|-------------|---------------------------------|--|
| S | S STYLE METERS | |
| CODE | NUMBER OF CHANNELS | |
| 1 | SINGLE CHANNEL (ONE TUBE) | |
| CODE | SIZE | |
| 6 | 65 mm | |
| 1 | 150 mm | |
| CODE | MATERIAL | |
| A | ALUMINUM | |
| B | BRASS | |
| S | STAINLESS STEEL | |
| CODE | VALVE POSITION | |
| 1 | MFV (HIGH PRECISION) INLET | |
| 3 | NO VALVE | |
| 4 | CV (STANDARD CARTRIDGE) INLET | |
| 5 | MFV (HIGH PRECISION) OUTLET | |
| 6 | CV (STANDARD CARTRIDGE) OUTLET | |
| CODE | SEALS | |
| V | VITON® STD ON STAINLESS METERS | |
| B | BUNA® STD ON BRASS AND ALUMINUM | |
| E | EPR | |
| T | PTFE/KALREZ® | |
| CODE | FITTINGS | |
| A | 1/8" FNPT | |
| B | 1/4" FNPT | |
| C | 1/8" HOSE NIPPLE | |
| D | 1/4" HOSE NIPPLE | |
| E | 1/8" COMPRESSION | |
| F | 1/4" COMPRESSION | |
| H | VCR | |
| CODE | FITTINGS | |
| 0 | NONE | |

| | | | | | | | | | | | |
|----------|--|--|--|--|---|--|--|--|--|---|-------------|
| S | | | | | — | | | | | — | TUBE |
|----------|--|--|--|--|---|--|--|--|--|---|-------------|

Optional Accessories

TP1-Tripod for single channel meter.

Select tube from the following tables:

Tables 6 to 22. Pages 43 to 49.

GENERAL DESCRIPTION

The **Optical Sensor Switch** is a noninvasive means for detection of a HI or LOW flow. This sensor is ideal for signaling an alarm, cutoff valve, or other device when the float passes the detector (alarm, valve etc. not included). Helps protect your processes and equipment from damage caused by extreme flow rates.

It's compact design and ease of operation make it a nonobtrusive simple to use addition to your flow meter. Perfect for OEM applications. Use whenever maximum or minimum flow levels need to be monitored automatically. Also can be used in conjunction with a control relay to power alternate equipment or monitoring devices.

PRINCIPLE OF OPERATION

A small LED sensor and receiver are mounted on one side of the flow meter. The float inside the flow tube is detected as it passes across the beam of light. Sensor can be used to detect float passage beyond the setpoint of the sensor, or also can be set to monitor float position at specific level, signalling when float is outside of the range of the sensor light beam.



| SPECIFICATIONS | |
|----------------------------|---|
| MODE OF DETECTION | Red LED beam break. |
| POWER REQUIREMENTS | 10 to 30 Vdc @50 mA max. |
| OUTPUT TRANSISTORS | NPN (1) and PNP (1) output transistors provided. |
| NPN | Sink up to 100 mA. |
| PNP | Source up to 100 mA. |
| RESPONSE TIME | 500 msec. |
| LIGHT IMMUNITY | Pulse modulated to provide extremely high immunity to ambient light. |
| AMBIENT TEMPERATURE | -30 + 70 degree C operating range. |
| SENSOR CONSTRUCTION | High impact polycarbonate housing. Epoxy encapsulated for mechanical strength. |
| LIGHT SOURCE | LED |
| WAVELENGTH | High intensity red = 650 nm connections. |

Used in conjunction with P, S and T Style Flow Meters

To order a flow meter with a single Optical Sensor Switch add "E1-" to P, S, to T Model Numbers.
Example: E1-P11A4-BA0A-032-41-ST-VN

| OPTICAL SENSOR SWITCH CONNECTION | |
|----------------------------------|--|
| WIRE LEAD COLOR | CONNECTION |
| BLACK | Positive Power Lead (+10 to 30 VDC) |
| WHITE | Negative Power Lead |
| GREEN* | PNP (Current Source) - to Positive of Load |
| WHITE* | NPN (Current Sink) - to Positive of Load |
| BLUE | Connect to Red Lead + Power |

| ORDERING INFORMATION FOR OPTICAL SENSOR SWITCH ACCESSORY | |
|--|---|
| PART NUMBER | DESCRIPTION |
| OSS-6-P | Optical Sensor Switch for 65mm P Style Meter |
| OSS-1-P | Optical Sensor Switch for 150mm P Style Meter |
| OSS-6-S | Optical Sensor Switch for 65mm S Style Meter |
| OSS-1-S | Optical Sensor Switch for 150mm S Style Meter |
| OSS-6-T | Optical Sensor Switch for 65mm T Style Meter |
| OSS-1-T | Optical Sensor Switch for 150mm T Style Meter |

GENERAL DESCRIPTION

The 150mm High /Low Alarm Flow Meter with the **Optical Sensor Switch** is a non-invasive means for detecting flows. This switch is ideal for signaling an alarm, as the float interrupts the sensor light beams (alarm, valve etc. not included).

Helps protect your processes and equipment from damage caused by extreme flow rates.

Its compact design and ease of operation make it a non-obtrusive simple-to-use addition to your flow meter.

Perfect for OEM applications. Also can be used in conjunction with a control relay to power alternate equipment or monitoring devices.

Use whenever maximum or minimum flow levels need to be monitored automatically.

**MATERIALS OF CONSTRUCTION

END BLOCKS: Aluminum or 316 Stainless Steel.

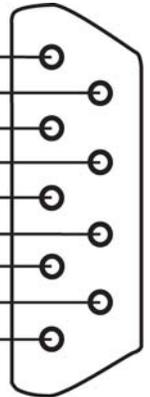
ELASTOMERS: Buna® & Viton® (Aluminum), Viton® (316 SS).

TUBE: Borosilicate.

INTERFACE CONNECTION

| | | |
|----------------|------|---|
| RELAY #1 | COM. | 5 |
| RELAY #1 | N.O. | 9 |
| RELAY #1 | N.C. | 4 |
| RELAY #2 | COM. | 8 |
| RELAY #2 | N.O. | 3 |
| RELAY #2 | N.C. | 7 |
| External Reset | | 2 |
| Common Power | | 6 |
| Plus Power | | 1 |

DB9M Connector



***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*



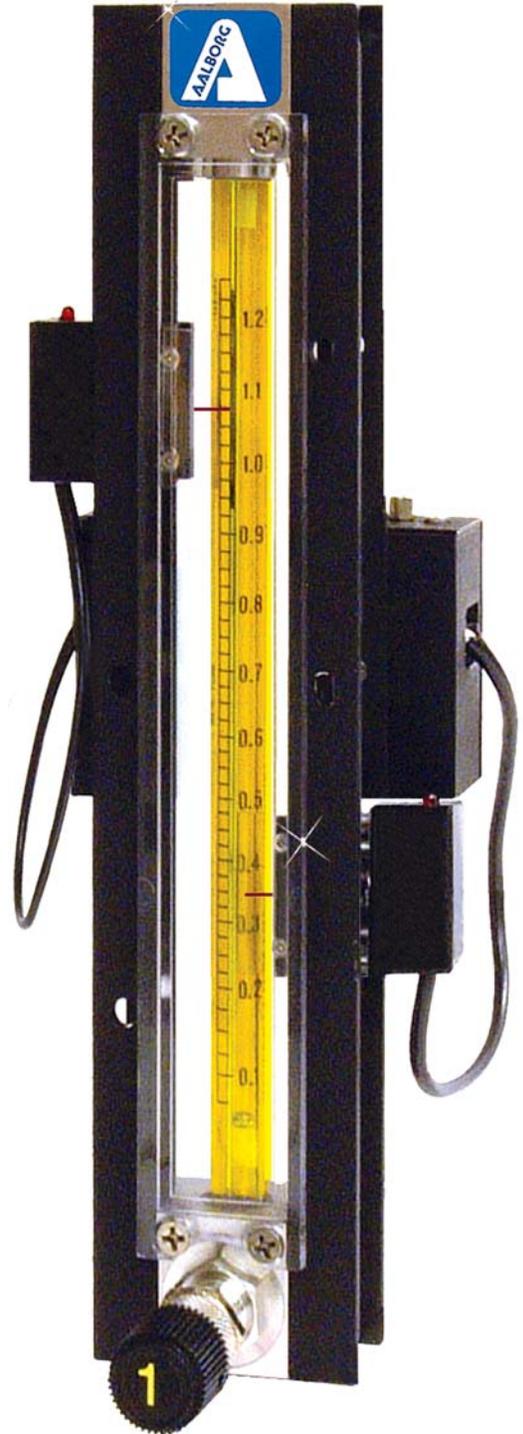
SPECIFICATIONS

| | |
|------------------------------|---|
| REPEATABILITY: | 0.5% of full scale. |
| AMBIENT TEMPERATURE: | 0-70 deg. C |
| MAXIMUM PRESSURE: | 200 PSIG |
| CONNECTIONS: | 1/8" FNPT |
| INPUT POWER: | 12 VDC, 15 VDC maximum, 250mA regulated, peak to peak maximum 100mA. |
| POWER CONSUMPTION: | Less than 100mA. |
| RESPONSE TIME: | 500 milliseconds. |
| SOURCE OF LIGHT: | 65 nm, red LED. |
| LIGHT IMMUNITY: | Pulse modulated. |
| DRY CONTACT CLOSURES: | 2 normally open, and normally closed relay's. |
| ALARM: | 70 dB audible buzzer and /or visual LED. |
| ALARM OPTIONS: | High, Low or High/Low. |
| BUZZER: | User configurable, momentary or latch. |
| RESET: | Reset button or remote through "D"-connector, to disable relay or buzzer. |
| INTERFACE: | 9-pin "D"-connector. |
| OPTIONAL: | 12VDC Power Supply, Tripod Base. |



PRINCIPLE OF OPERATION

LED Receiver / Sensors are mounted at each side of the flow meter. The position of the float inside the flow tube is detected as it passes across the sensor light beam. The sensor can alternately be used to detect float passage beyond a set point, or it can be set to monitor the float position at a specific level, signalling when the float is outside of the range of the sensor light beams.



Stainless Steel Meter with High Precision Valve

| ORDERING INFORMATION OPTICAL SENSOR SWITCH 150MM HIGH / LOW ALARM FLOW METERS | | | | | |
|--|----------------------------|--------------|---------------------------|-------|--|
| MODEL NUMBER | | MAX FLOW | | FLOAT | |
| ALUMINUM | STAINLESS STEEL | [mL/min] Air | [mL/min] H ₂ O | | |
| STANDARD VALVE | | | | | |
| E2-P11A4-BA0A-032-41-GL-VN | E2-P11S4-VA0A-032-41-GL-VN | 49 | 0.49 | GL | |
| E2-P11A4-BA0A-062-01-GL-VN | E2-P11S4-VA0A-062-01-GL-VN | 92 | 0.9 | GL | |
| E2-P11A4-BA0A-062-01-ST-VN | E2-P11S4-VA0A-062-01-ST-VN | 264 | 4.7 | ST | |
| E2-P11A4-BA0A-112-02-GL-VN | E2-P11S4-VA0A-112-02-GL-VN | 374 | 5.5 | GL | |
| E2-P11A4-BA0A-112-02-ST-VN | E2-P11S4-VA0A-112-02-ST-VN | 814 | 20.4 | ST | |
| E2-P11A4-BA0A-082-03-ST-VN | E2-P11S4-VA0A-082-03-ST-VN | 1682 | 44.6 | ST | |
| E2-P11A4-BA0A-092-04-GL-VN | E2-P11S4-VA0A-092-04-GL-VN | 2313 | 54 | GL | |
| E2-P11A4-BA0A-092-04-ST-VN | E2-P11S4-VA0A-092-04-ST-VN | 4662 | 133 | ST | |
| E2-P11A4-BA0A-102-05-ST-VN | E2-P11S4-VA0A-102-05-ST-VN | 7825 | 217 | ST | |
| E2-P11A4-BA0A-034-39-ST-VN | E2-P11S4-VA0A-034-39-ST-VN | 16,737 | 506 | ST | |
| E2-P11A4-BA0A-044-40-GL-VN | E2-P11S4-VA0A-044-40-GL-VN | 23,742 | 541 | GL | |
| E2-P11A4-BA0A-044-40-ST-VN | E2-P11S4-VA0A-044-40-ST-VN | 45,227 | 1288 | ST | |
| E2-P11A4-BA0A-044-40-TA-VN | E2-P11S4-VA0A-044-40-TA-VN | 69,940 | 2000 | TANT | |
| HIGH PRECISION VALVE | | | | | |
| E2-P11A1-BA0A-032-41-GL-VN | E2-P11S1-VA0A-032-41-GL-VN | 49 | 0.49 | GL | |
| E2-P11A1-BA0A-062-01-GL-VN | E2-P11S1-VA0A-062-01-GL-VN | 92 | 0.9 | GL | |
| E2-P11A1-BA0A-062-01-ST-VN | E2-P11S1-VA0A-062-01-ST-VN | 264 | 4.7 | ST | |
| E2-P11A1-BA0A-112-02-GL-VN | E2-P11S1-VA0A-112-02-GL-VN | 374 | 5.5 | GL | |
| E2-P11A1-BA0A-112-02-ST-VN | E2-P11S1-VA0A-112-02-ST-VN | 814 | 20.4 | ST | |
| E2-P11A1-BA0A-082-03-ST-VN | E2-P11S1-VA0A-082-02-ST-VN | 1682 | 44.6 | ST | |
| E2-P11A1-BA0A-092-04-GL-VN | E2-P11S1-VA0A-092-04-GL-VN | 2313 | 54 | GL | |
| E2-P11A1-BA0A-092-04-ST-VN | E2-P11S1-VA0A-092-04-ST-VN | 4662 | 133 | ST | |
| E2-P11A1-BA0A-102-05-ST-VN | E2-P11S1-VA0A-102-05-ST-VN | 7825 | 217 | ST | |
| E2-P11A1-BA0A-034-39-ST-VN | E2-P11S1-VA0A-034-39-ST-VN | 16,737 | 506 | ST | |
| E2-P11A1-BA0A-044-40-GL-VN | E2-P11S1-VA0A-044-40-GL-VN | 23,742 | 541 | GL | |
| E2-P11A1-BA0A-044-40-ST-VN | E2-P11S1-VA0A-044-40-ST-VN | 45,227 | 1288 | ST | |
| E2-P11A1-BA0A-044-40-TA-VN | E2-P11S1-VA0A-044-40-TA-VN | 69,940 | 2000 | TANT | |

| OPTIONAL ACCESSORIES OPTICAL SENSOR SWITCH | |
|--|--|
| MODEL NUMBER | DESCRIPTION |
| PS-GFM-110NA-2 | Power Supply 110vac/12Vdc (North America) |
| PS-GFM-230EU-2 | Power Supply 230vac/12Vdc (Europe) |
| PS-GFM-240AU-2 | Power Supply 240vac/12Vdc (Australia) |
| PS-GFM-240UK-2 | Power Supply 240vac/12Vdc (United Kingdom) |
| TPI | Tripod for Single Tube Meter |



Gas Proportioner with CV™ valve
for blending two gases

To blend two or three gases in homogeneous infinitely variable concentrations, directly at the end use point, this *Model G* gas proportioner is unsurpassed in convenience and economy.

Gas proportioners pay for themselves since they eliminate the need for expensive custom blended gas mixtures.

They lend flexibility and economy to the utilization of component gas cylinders and “piped-in” supply lines.

Another advantage in laboratory investigations is the freedom to reproducibility increase or decrease concentrations during the course of an experiment.

The flow rates are not affected by downstream pressure variations as long as back pressures do not approach or exceed the input pressure. Input pressures of up to 200 psig (13.8 bars) can be used; however, customers very often find 50 psig (3.45 bars) a convenient setting to work with.

design features

- ✓ Blending of two or three gases with gas proportioners obviates the need for:
 - ✓ ORDERING FIXED GAS MIXTURES.
 - ✓ CONTAMINATION FROM REUSABLE GAS CYLINDERS.
 - ✓ POTENTIALLY INACCURATE MIXTURES BY GAS SUPPLIERS.
- ✓ Rib-guided or fluted metering tubes facilitate stable, accurate readings.
- ✓ OPTIGRAD™ scales minimize parallax and eye fatigue.
- ✓ Interchangeability of flow tubes and floats.
- ✓ Simple means of panel mounting.



BUILT-IN VALVES

Meters are available with built-in needle valves (CV™), high precision metering valves (MFV™) with “non-rising stems”, or with no valves.

The higher cost of MFV™ valves is justified whenever high sensitivity control and resolution are desirable particularly in conjunction with metering tubes of very low flow rates.

flow tubes

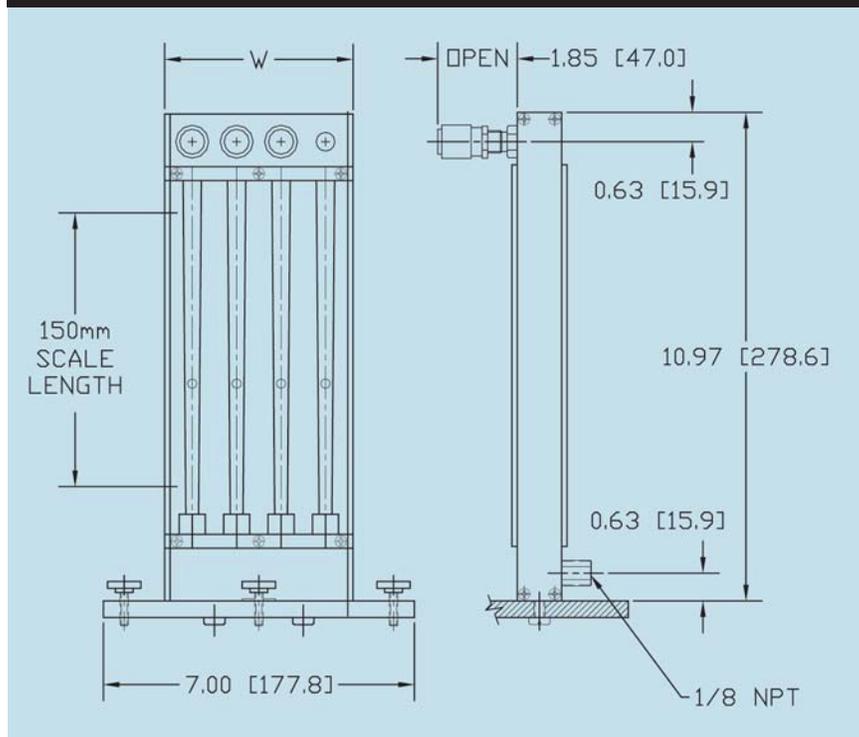
- ✓ Precision fabricated from heavy walled, shock resistant borosilicate glass.
- ✓ Bores are uniformly tapered or formed with internal “rib-guides” or flutes.
- ✓ Floats are retained by TFE plugs.
- ✓ Self cleaning.
- ✓ Low differential pressures that stay independent of flow rate changes.

DIMENSIONS FOR G STYLE METERS

| WIDTH (W) | | |
|--------------|-----------|-----------|
| SCALE LENGTH | 2 CHANNEL | 3 CHANNEL |
| 150mm | 3.24 | 4.24 |

Bench mounting acrylic tripod bases are optional.

DIMENSIONS



SPECIFICATIONS STANDARD COMPONENT

FLOW TUBE ACCURACY

±2% FS mm scales except 042 flow tubes ±5%, from 10 to 100% of scale. Conforming to ISA RP. 16-1.2.3. Specification 2-S-10.

COMPONENT FLOW TUBE REPEATABILITY

±0.25%. Typical calibration curves for air at 50 psig /3.5 bars using glass floats are available. Consult the company on the availability of calibration data for non-hazardous gases and special individual calibrations.

MAX OPERATING PRESSURE 200 psig/13.8 bars.

MAX OPERATING TEMPERATURE 250 °F /121 °C.

**MATERIALS OF CONSTRUCTION

| | |
|--|---|
| FLOW TUBES | Heavy walled borosilicate glass. |
| CHOICE OF MOUNTING FITTINGS IN CONTACT WITH GASES | a) Aluminum, black anodized. b) 316 stainless steel. |
| SIDE PANELS | Aluminum, black anodized. |
| FRONT SHIELD | Clear polycarbonate. |
| BACK PLATE | 1/8" thick white acrylics. |
| O-RINGS AND PACKING | Buna-N® O-rings in aluminum model. Viton-A® O-rings in stainless steel meters. |
| OPTIONAL | Viton®, PTFE/Kalrez®. |
| CONNECTIONS | 1/8" NPT female inlet and outlet connections. |
| OPTIONAL | Hose and compression fittings are available. |

**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

Ordering information see page 23.

For flow capacities see table 10 page 46.

G

ORDERING INFORMATION G STYLE METER

EXAMPLE

| | | |
|-------------|---|--|
| G | G STYLE METERS | |
| CODE | TUBE QUANTITIES | |
| 2 | TWO CHANNEL METER (TWO TUBES AND ONE MIXING TUBE) | |
| 3 | THREE CHANNEL METER (THREE TUBES AND ONE MIXING TUBE) | |
| CODE | SIZE | |
| 1 | 150 mm | |
| CODE | MATERIAL | |
| A | ALUMINUM | |
| S | STAINLESS | |
| CODE | VALVE | |
| 5 | MFV (HIGH PRECISION) OUTLET | |
| 6 | CV OUTLET (STANDARD CARTRIDGE) | |
| CODE | SEALS | |
| V | VITON® STD ON STAINLESS METERS | |
| B | BUNA® STD ON BRASS AND ALUMINUM | |
| E | EPR | |
| T | PTFE | |
| CODE | FITTINGS | |
| A | 1/8" FNPT | |
| B | 1/4" FNPT | |
| C | 1/8" HOSE NIPPLE | |
| D | 1/4" HOSE NIPPLE | |
| E | 1/8" COMPRESSION | |
| F | 1/4" COMPRESSION | |
| H | VCR | |
| CODE | MANIFOLD | |
| 0 | NONE | |

| | | | | | | | | | | | |
|----------|--|--|--|--|---|--|--|--|--|--|-------------|
| G | | | | | — | | | | | | TUBE |
|----------|--|--|--|--|---|--|--|--|--|--|-------------|

Optional Accessories

TPG-Tripod for 2 channel gas proportioner.
TPH-Tripod for 3 channel gas proportioner.

Select tube from the following table:

Table 10 page 46.

Designed especially for the laboratory these kits offer a diverse economical way of acquiring flow measurement capabilities. Since all 150 mm flow tubes in this catalog are interchangeable, additional flow tubes may be added later (see flow tables, pages 43 to 49). A handy selection of flow meters is presented in kit form.

THREE TYPES OF KITS ARE OFFERED

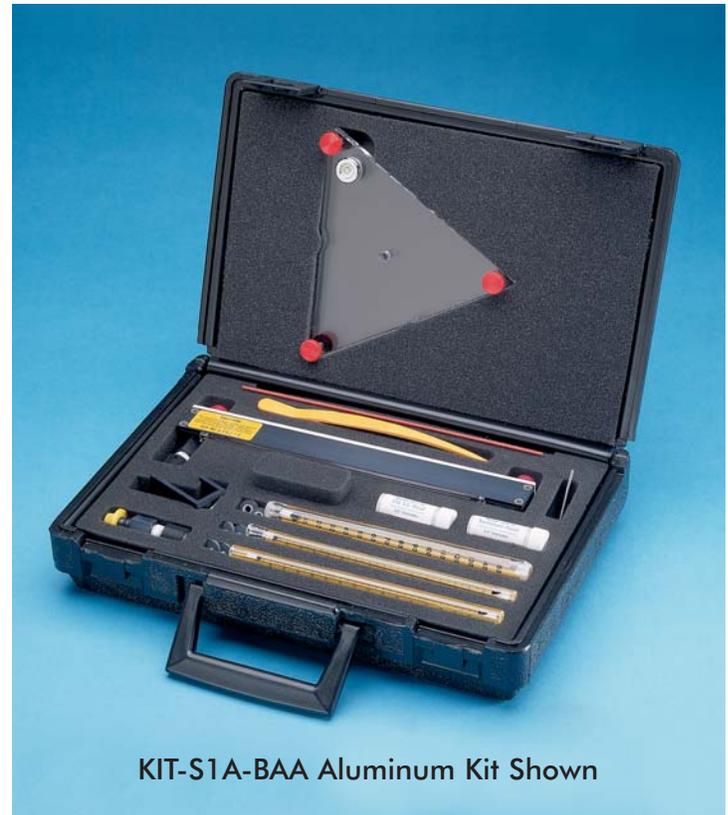
- ✓ Aluminum Flow Meter Kit.
- ✓ Stainless Steel Flow Meter Kit.
- ✓ PTFE Flow Meter Kit.

Kits are shipped in convenient molded plastic carrying cases. Flow tubes and floats are interchangeable in frames supplied facilitating overlapping flow ranges.

For non-corrosive fluids use the Aluminum Kit. For corrosives consider the Stainless Steel Kit. For corrosive applications at lower pressure or for high purity fluid service specify the PTFE Kit.

All three units are supplied with glass floats installed.

Aluminum and Stainless Steel kits come with spare stainless steel and tantalum interchangeable floats to extend flow capacities. Due to chemical compatibility considerations PTFE kits are supplied with spare sapphire floats.



KIT-S1A-BAA Aluminum Kit Shown

FLOW CAPACITIES OF FLOW TUBES USED IN KITS [mL/min].

| FLOW TUBE NUMBER | FLOAT MATERIAL | | | | | |
|------------------|----------------|--------------|---------------|-------------|-----------------|--------------|
| | GLASS | | SAPPHIRE | | STAINLESS STEEL | |
| | AIR | WATER | AIR | WATER | AIR | WATER |
| 042-15 | 1.8 to 18.9 | 0.02 to 0.19 | 2.9 to 30 | .04 to .38 | 5.8 to 60.6 | 0.09 to .945 |
| 112-02 | 21 to 374 | .023 to 5.5 | 29 to 513 | .39 to 9.96 | 36 to 814 | 1.1 to 20.4 |
| 102-05 | 135 to 3922 | 2 to 84 | 198 to 5188 | 3 to 126 | 351 to 7825 | 6 to 217 |
| 044-40 | 791 to 23742 | 15 to 541 | 1208 to 30711 | 30 to 806 | 2182 to 45227 | 57 to 1288 |

ORDERING INFORMATION FOR FLOW METER KITS

| MODEL NUMBER | CONTENTS | DESCRIPTION |
|--------------|---|--|
| KIT-S1A-BA | ALUMINUM FLOW METER KIT: Assembled with 042-15-GL flow tube. Extra flow tubes as listed in above table. Stainless steel float for 042,112 and 102 flow tubes. Tantalum float for 044 flow tube. High flow valve cartridge. Tripod base, tweezers, pushrod and locking tool for changing floats and flow tubes. Calibration data and carrying case. | Wetted parts are borosilicate glass, aluminum, 316 stainless steel. Buna-N® o-rings and Viton® packings. |
| KIT-S1S-VA | STAINLESS STEEL FLOW METER KITS: Assembled with 042-15-GL flow tube. Extra flow tubes as listed in above table. Stainless steel float for 042, 112 and 102 flow tubes. Tantalum float for 044 flow tube. High flow valve cartridge. Tripod base, tweezers, pushrod and locking tool for changing floats and flow tubes. Calibration data and carrying case. | Wetted parts are borosilicate glass, 316 stainless steel, Viton® o-rings and packings. |
| KIT-T1T-TA | PTFE FLOW METER KIT: Assembled with 042-15-GL flow tube. Extra flow tubes as listed in above table. Sapphire floats. High flow valve cartridge. Tripod base, tweezers, pushrod and locking tool for changing floats and flow tubes. Calibration data and carrying case. | Wetted parts are borosilicate glass, PTFE and PCTFE. |

BULLETIN EM201007 K

V

MEDIUM RANGE BRASS AND STAINLESS FLOW METERS

Incorporating traditional rotameter precision glass technology, these rugged brass and stainless steel flow meters offer accurate and economical solutions to medium flow range measurements. **V meters** are designed with unique rotatable scales of dual air-water direct reading graduations showing SCFM and L/min (air), as well as GPM and LPM (water) markings.

design features

- ✓ Rigid, compact construction.
- ✓ Dual, rotatable direct reading scales for air and water.
- ✓ Graduations reflect both metric and English systems.
- ✓ Vertical In-line or Panel Mount.
- ✓ Flow ranges from 4 to 20 L/min water and 140 to 900 L/min air.

SPECIFICATIONS

| | |
|----------------------------|--|
| SCALES | Rotatable, direct reading air, (SCFM-L/min) and water (GPM-LPM). |
| ACCURACY | ±5% of full scale. |
| MAXIMUM TEMPERATURE | 250 °F (121 °C). |
| MAXIMUM PRESSURE | 150 psig (@200 °F). |
| CONNECTIONS | 3/8" NPT female in line or horizontal rear. |

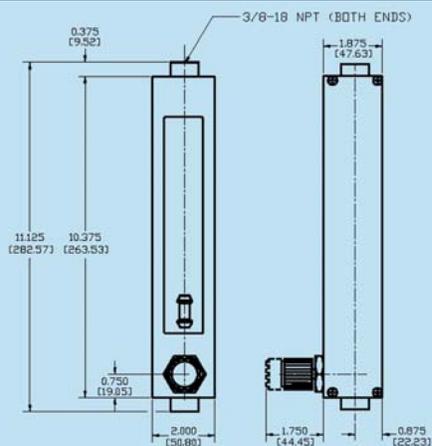
**MATERIALS OF CONSTRUCTION

| | |
|---------------------|---|
| TUBE SHIELDS | Polycarbonate |
| FLOW TUBES | Heavy walled precision formed borosilicate glass. |
| FLOATS | Type 316 stainless steel. |
| WETTED PARTS | Brass or type 316 stainless steel. |
| SEALS | Viton® standard. |
| OPTIONAL: | Buna-N®, PTFE /Kalrez® and EPR. |

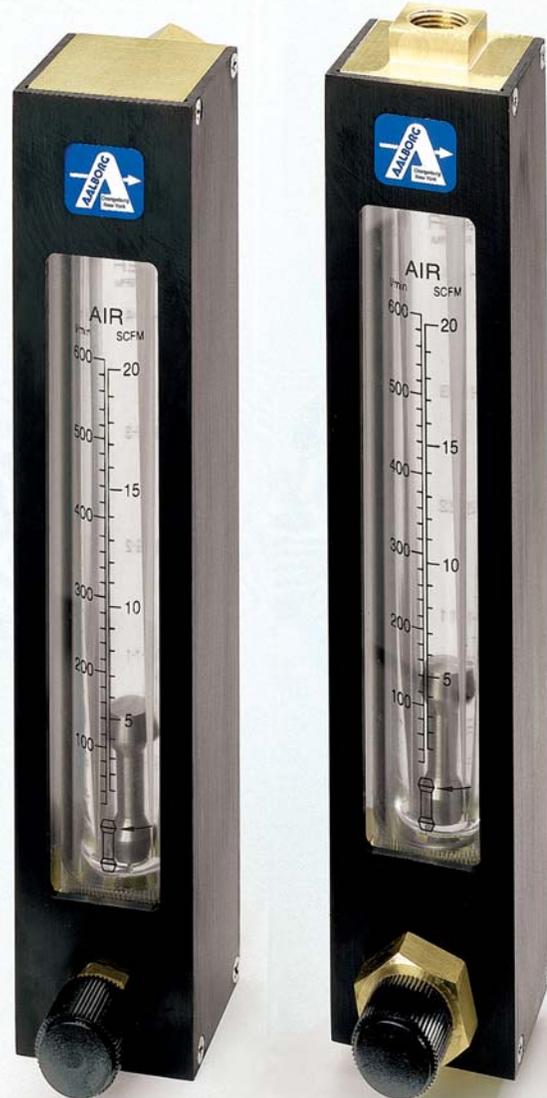
**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

Ordering information see page 27.

DIMENSIONS (IN LINE MODEL)

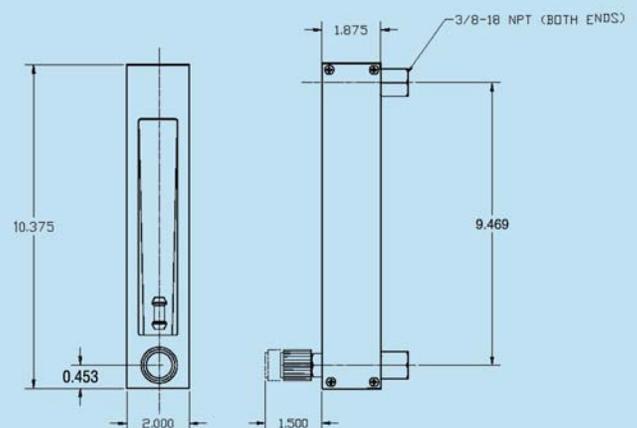


Panel Mount Meter with Valve



In-line Meter with Valve

DIMENSIONS (PANEL MOUNT MODEL)





Incorporating traditional variable area precision glass technology, these rugged PTFE flow meters offer accurate and economical solutions to medium flow range measurements. **V meters** are designed with unique rotatable scales of dual air-water direct reading graduations showing SCFM and L/min (air), as well as GPM and LPM (water) markings.

LEAK INTEGRITY

Flow meters are individually tested on a Mass Spectrometer Leak Detector and certified to a leak integrity rating of 1×10^{-7} sccs Helium or better.

SPECIFICATIONS

| | |
|----------------------------|---|
| SCALES | Rotatable, direct reading air, (SCFM-L/min) and water (GPM-LPM). Scale length is 127mm (nominal). |
| ACCURACY | $\pm 5\%$ of full scale. |
| MAXIMUM TEMPERATURE | 150 °F (65 °C.) |
| MAXIMUM PRESSURE | 100 psig (6.7) bars. |
| CONNECTIONS | 3/8" NPT female in line or horizontal rear. |
| LEAK INTEGRITY | Individually leak tested and certified. |

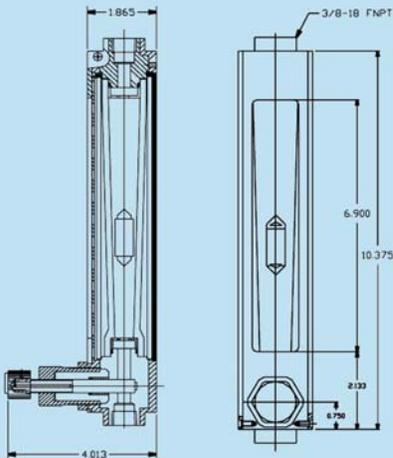
**MATERIALS OF CONSTRUCTION

| | |
|---------------------|---|
| TUBE SHIELDS | Polycarbonate. |
| FLOW TUBES | Heavy walled precision formed borosilicate glass. |
| FLOATS | PTFE. |
| WETTED PARTS | PTFE, PCTFE. |
| SEALS | PTFE. |

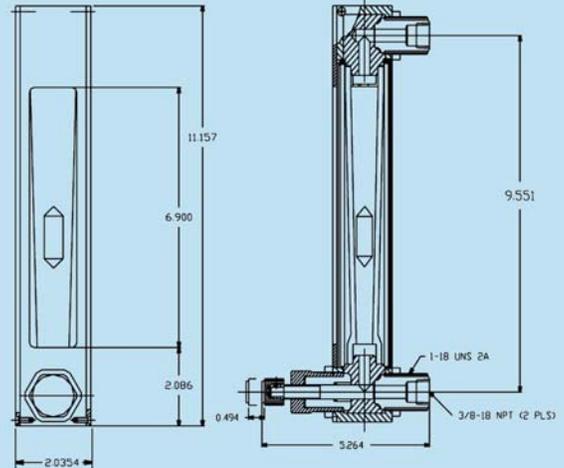
***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

Ordering information see page 27.

DIMENSIONS (IN LINE MODEL)



DIMENSIONS (PANEL MOUNT MODEL)





ORDERING INFORMATION MEDIUM RANGE FLOW METERS

| VERTICAL IN LINE | | | | | | | |
|-------------------|-------------------|----------------------|--------------|-------|-------|------|--|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | Air | | Water | | |
| | | | SCFM | L/min | GPM | LPM | |
| VIB4-VA-V01-01-ST | VIB3-VA-V01-01-ST | Brass | 5 | 140 | 1.2 | 4 | |
| VIB4-VA-V02-01-ST | VIB3-VA-V02-01-ST | Brass | 10 | 280 | 2 | 8 | |
| VIB4-VA-V03-01-ST | VIB3-VA-V03-01-ST | Brass | 15 | 425 | 3 | 11.5 | |
| VIB4-VA-V04-01-ST | VIB3-VA-V04-01-ST | Brass | 20 | 575 | 4 | 15 | |
| VIB4-VA-V05-01-ST | VIB3-VA-V05-01-ST | Brass | 30 | 900 | 5 | 20 | |
| VIS4-VA-V01-01-ST | VIS3-VA-V01-01-ST | 316 s.s | 5 | 140 | 1.2 | 4 | |
| VIS4-VA-V02-01-ST | VIS3-VA-V02-01-ST | 316 s.s | 10 | 280 | 2 | 8 | |
| VIS4-VA-V03-01-ST | VIS3-VA-V03-01-ST | 316 s.s | 15 | 425 | 3 | 11.5 | |
| VIS4-VA-V04-01-ST | VIS3-VA-V04-01-ST | 316 s.s | 20 | 575 | 4 | 15 | |
| VIS4-VA-V05-01-ST | VIS3-VA-V05-01-ST | 316 s.s | 30 | 900 | 5 | 20 | |

| PANEL MOUNT METERS | | | | | | | |
|--------------------|-------------------|----------------------|--------------|-------|-------|------|--|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | Air | | Water | | |
| | | | SCFM | L/min | GPM | LPM | |
| VPB4-VA-V01-02-ST | VPB3-VA-V01-02-ST | Brass | 5 | 140 | 1.2 | 4 | |
| VPB4-VA-V02-02-ST | VPB3-VA-V02-02-ST | Brass | 10 | 280 | 2 | 8 | |
| VPB4-VA-V03-02-ST | VPB3-VA-V03-02-ST | Brass | 15 | 425 | 3 | 11.5 | |
| VPB4-VA-V04-02-ST | VPB3-VA-V04-02-ST | Brass | 20 | 575 | 4 | 15 | |
| VPB4-VA-V05-02-ST | VPB3-VA-V05-02-ST | Brass | 30 | 900 | 5 | 20 | |
| VPS4-VA-V01-02-ST | VPS3-VA-V01-02-ST | 316 s.s | 5 | 140 | 1.2 | 4 | |
| VPS4-VA-V02-02-ST | VPS3-VA-V02-02-ST | 316 s.s | 10 | 280 | 2 | 8 | |
| VPS4-VA-V03-02-ST | VPS3-VA-V03-02-ST | 316 s.s | 15 | 425 | 3 | 11.5 | |
| VPS4-VA-V04-02-ST | VPS3-VA-V04-02-ST | 316 s.s | 20 | 575 | 4 | 15 | |
| VPS4-VA-V05-02-ST | VPS3-VA-V05-02-ST | 316 s.s | 30 | 900 | 5 | 20 | |

| PTFE VERTICAL IN LINE METERS | | | | | | | |
|------------------------------|-------------------|----------------------|--------------|-------|-------|-------|--|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | Air | | Water | | |
| | | | SCFM | L/min | GPM | LPM | |
| VIT4-TA-V06-01-TF | VIT3-TA-V06-01-TF | PTFE | 3.5 | 100 | 0.8 | 3 | |
| VIT4-TA-V07-01-TF | VIT3-TA-V07-01-TF | PTFE | 7 | 200 | 1.5 | 5.75 | |
| VIT4-TA-V08-01-TF | VIT3-TA-V08-01-TF | PTFE | 10.5 | 300 | 2.2 | 8.25 | |
| VIT4-TA-V09-01-TF | VIT3-TA-V09-01-TF | PTFE | 14 | 400 | 2.9 | 11 | |
| VIT4-TA-V10-01-TF | VIT3-TA-V10-01-TF | PTFE | 17.5 | 500 | 3.5 | 13.25 | |
| VIT4-TA-V11-01-TF | VIT3-TA-V11-01-TF | PTFE | 22 | 625 | 4.1 | 16 | |

| PTFE PANEL MOUNT METERS | | | | | | | |
|-------------------------|-------------------|----------------------|--------------|-------|-------|-------|--|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | Air | | Water | | |
| | | | SCFM | L/min | GPM | LPM | |
| VPT4-TA-V06-02-TF | VPT3-TA-V06-02-TF | PTFE | 3.5 | 100 | 0.8 | 3 | |
| VPT4-TA-V07-02-TF | VPT3-TA-V07-02-TF | PTFE | 7 | 200 | 1.5 | 5.75 | |
| VPT4-TA-V08-02-TF | VPT3-TA-V08-02-TF | PTFE | 10.5 | 300 | 2.2 | 8.25 | |
| VPT4-TA-V09-02-TF | VPT3-TA-V09-02-TF | PTFE | 14 | 400 | 2.9 | 11 | |
| VPT4-TA-V10-02-TF | VPT3-TA-V10-02-TF | PTFE | 17.5 | 500 | 3.5 | 13.25 | |
| VPT4-TA-V11-02-TF | VPT3-TA-V11-02-TF | PTFE | 22 | 625 | 4.1 | 16 | |

BULLETIN EM201007 V

Incorporating traditional rotameter precision glass technology, these rugged brass and stainless steel flow meters offer accurate and economical solutions to medium flow range measurements.

xV meters are designed with unique rotatable scales in either SCFM or L/min. Each features direct reading scales for 5 gases. (Argon, CO₂, He, N₂, & O₂).

design features

- ✓ Rigid, compact construction.
- ✓ Multi-gas, rotatable direct reading scales for 5 gases.
- ✓ Graduations reflect both metric or English systems.
- ✓ Vertical In-line or Panel Mount.

SPECIFICATIONS

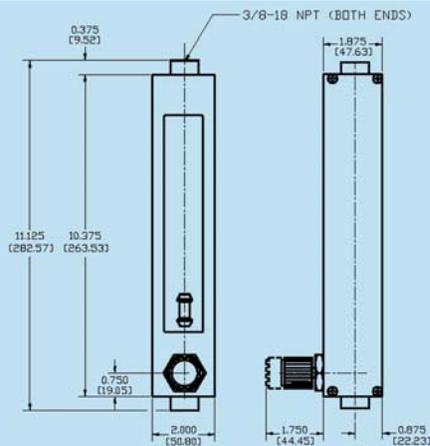
| | |
|----------------------------|--|
| SCALES | Rotatable, direct reading Argon, CO ₂ , He, N ₂ , & O ₂ . |
| ACCURACY | ±5% of full scale. |
| MAXIMUM TEMPERATURE | 250 °F (121 °C). |
| MAXIMUM PRESSURE | 150 psig (@200 °F). |
| CONNECTIONS | 3/8" NPT female in line or horizontal rear. |

**MATERIALS OF CONSTRUCTION

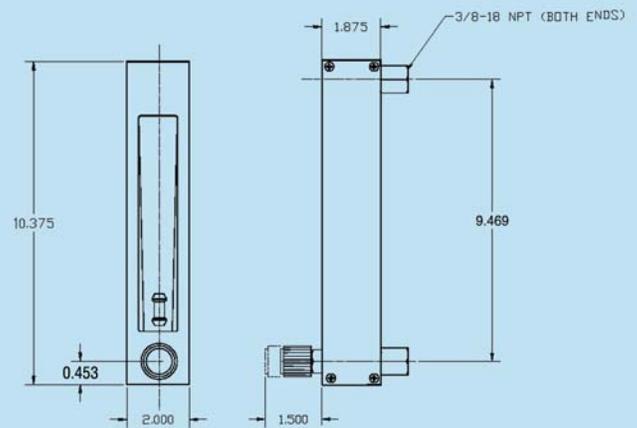
| | |
|---------------------|---|
| TUBE SHIELDS | Polycarbonate. |
| FLOW TUBES | Heavy walled precision formed borosilicate glass. |
| FLOATS | Type 316 stainless steel. |
| WETTED PARTS | Brass or type 316 stainless steel. |
| SEALS | Viton® standard. |
| OPTIONAL: | Buna-N®, PTFE /Kalrez® and EPR. |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

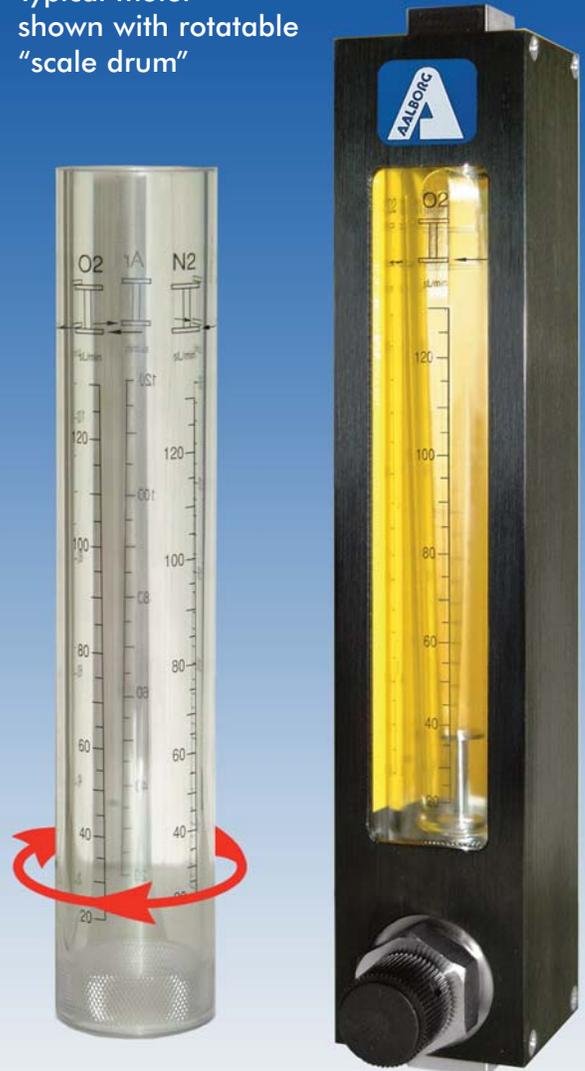
DIMENSIONS (IN LINE MODEL)



DIMENSIONS (PANEL MOUNT MODEL)



Typical meter shown with rotatable "scale drum"





DIRECT READING MULTI-GAS FLOW METERS

| VERTICAL IN LINE | | | | | | | |
|-------------------|-------------------|----------------------|--------------|-----------------|--------|----------|--------|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | SCFM | | | | |
| | | | Argon | CO ₂ | Helium | Nitrogen | Oxygen |
| VIB4-VA-V01-03-ST | VIB3-VA-V01-03-ST | Brass | 4.2 | 3.8 | 12.0 | 4.5 | 4.5 |
| VIB4-VA-V02-03-ST | VIB3-VA-V02-03-ST | Brass | 8.0 | 8.0 | 23.0 | 9.5 | 9.0 |
| VIB4-VA-V03-03-ST | VIB3-VA-V03-03-ST | Brass | 12.5 | 12.5 | 35.0 | 14.0 | 14.0 |
| VIB4-VA-V04-03-ST | VIB3-VA-V04-03-ST | Brass | 15.5 | 15.5 | 42.5 | 19.0 | 18.0 |
| VIB4-VA-V05-03-ST | VIB3-VA-V05-03-ST | Brass | 26.0 | 24.0 | 60.0 | 30.0 | 28.0 |
| VIS4-VA-V01-03-ST | VIS3-VA-V01-03-ST | 316 s.s | 4.2 | 3.8 | 12.0 | 4.5 | 4.5 |
| VIS4-VA-V02-03-ST | VIS3-VA-V02-03-ST | 316 s.s | 8.0 | 8.0 | 23.0 | 9.5 | 9.0 |
| VIS4-VA-V03-03-ST | VIS3-VA-V03-03-ST | 316 s.s | 12.5 | 12.5 | 35.0 | 14.0 | 14.0 |
| VIS4-VA-V04-03-ST | VIS3-VA-V04-03-ST | 316 s.s | 15.5 | 15.5 | 42.5 | 19.0 | 18.0 |
| VIS4-VA-V05-03-ST | VIS3-VA-V05-03-ST | 316 s.s | 26.0 | 24.0 | 60.0 | 30.0 | 28.0 |

| VERTICAL IN LINE | | | | | | | |
|-------------------|-------------------|----------------------|--------------|-----------------|--------|----------|--------|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | L/min | | | | |
| | | | Argon | CO ₂ | Helium | Nitrogen | Oxygen |
| VIB4-VA-V01-05-ST | VIB3-VA-V01-05-ST | Brass | 120 | 105 | 350 | 130 | 130 |
| VIB4-VA-V02-05-ST | VIB3-VA-V02-05-ST | Brass | 230 | 220 | 650 | 270 | 260 |
| VIB4-VA-V03-05-ST | VIB3-VA-V03-05-ST | Brass | 360 | 360 | 1000 | 400 | 400 |
| VIB4-VA-V04-05-ST | VIB3-VA-V04-05-ST | Brass | 440 | 440 | 1250 | 550 | 525 |
| VIB4-VA-V05-05-ST | VIB3-VA-V05-05-ST | Brass | 750 | 700 | 1800 | 850 | 800 |
| VIS4-VA-V01-05-ST | VIS3-VA-V01-05-ST | 316 s.s | 120 | 105 | 350 | 130 | 130 |
| VIS4-VA-V02-05-ST | VIS3-VA-V02-05-ST | 316 s.s | 230 | 220 | 650 | 270 | 260 |
| VIS4-VA-V03-05-ST | VIS3-VA-V03-05-ST | 316 s.s | 360 | 360 | 1000 | 400 | 400 |
| VIS4-VA-V04-05-ST | VIS3-VA-V04-05-ST | 316 s.s | 440 | 440 | 1250 | 550 | 525 |
| VIS4-VA-V05-05-ST | VIS3-VA-V05-05-ST | 316 s.s | 750 | 700 | 1800 | 850 | 800 |

| PANEL MOUNT METERS | | | | | | | |
|--------------------|-------------------|----------------------|--------------|-----------------|--------|----------|--------|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | SCFM | | | | |
| | | | Argon | CO ₂ | Helium | Nitrogen | Oxygen |
| VPB4-VA-V01-04-ST | VPB3-VA-V01-04-ST | Brass | 4.2 | 3.8 | 12.0 | 4.5 | 4.5 |
| VPB4-VA-V02-04-ST | VPB3-VA-V02-04-ST | Brass | 8.0 | 8.0 | 23.0 | 9.5 | 9.0 |
| VPB4-VA-V03-04-ST | VPB3-VA-V03-04-ST | Brass | 12.5 | 12.5 | 35.0 | 14.0 | 14.0 |
| VPB4-VA-V04-04-ST | VPB3-VA-V04-04-ST | Brass | 15.5 | 15.5 | 42.5 | 19.0 | 18.0 |
| VPB4-VA-V05-04-ST | VPB3-VA-V05-04-ST | Brass | 26.0 | 24.0 | 60.0 | 30.0 | 28.0 |
| VPS4-VA-V01-04-ST | VPS3-VA-V01-04-ST | 316 s.s | 4.2 | 3.8 | 12.0 | 4.5 | 4.5 |
| VPS4-VA-V02-04-ST | VPS3-VA-V02-04-ST | 316 s.s | 8.0 | 8.0 | 23.0 | 9.5 | 9.0 |
| VPS4-VA-V03-04-ST | VPS3-VA-V03-04-ST | 316 s.s | 12.5 | 12.5 | 35.0 | 14.0 | 14.0 |
| VPS4-VA-V04-04-ST | VPS3-VA-V04-04-ST | 316 s.s | 15.5 | 15.5 | 42.5 | 19.0 | 18.0 |
| VPS4-VA-V05-04-ST | VPS3-VA-V05-04-ST | 316 s.s | 26.0 | 24.0 | 60.0 | 30.0 | 28.0 |

| PANEL MOUNT METERS | | | | | | | |
|--------------------|-------------------|----------------------|--------------|-----------------|--------|----------|--------|
| MODEL NUMBER | | END FITTING MATERIAL | MAXIMUM FLOW | | | | |
| BUILT IN VALVE | NO VALVE | | L/min | | | | |
| | | | Argon | CO ₂ | Helium | Nitrogen | Oxygen |
| VPB4-VA-V01-06-ST | VPB3-VA-V01-06-ST | Brass | 120 | 105 | 350 | 130 | 130 |
| VPB4-VA-V02-06-ST | VPB3-VA-V02-06-ST | Brass | 230 | 220 | 650 | 270 | 260 |
| VPB4-VA-V03-06-ST | VPB3-VA-V03-06-ST | Brass | 360 | 360 | 1000 | 400 | 400 |
| VPB4-VA-V04-06-ST | VPB3-VA-V04-06-ST | Brass | 440 | 440 | 1250 | 550 | 525 |
| VPB4-VA-V05-06-ST | VPB3-VA-V05-06-ST | Brass | 750 | 700 | 1800 | 850 | 800 |
| VPS4-VA-V01-06-ST | VPS3-VA-V01-06-ST | 316 s.s | 120 | 105 | 350 | 130 | 130 |
| VPS4-VA-V02-06-ST | VPS3-VA-V02-06-ST | 316 s.s | 230 | 220 | 650 | 270 | 260 |
| VPS4-VA-V03-06-ST | VPS3-VA-V03-06-ST | 316 s.s | 360 | 360 | 1000 | 400 | 400 |
| VPS4-VA-V04-06-ST | VPS3-VA-V04-06-ST | 316 s.s | 440 | 440 | 1250 | 550 | 525 |
| VPS4-VA-V05-06-ST | VPS3-VA-V05-06-ST | 316 s.s | 750 | 700 | 1800 | 850 | 800 |

design features

- ✓ Heavy duty stainless steel.
- ✓ Thick polycarbonate safety shields.
- ✓ Fluted or plain tapered tubes.
- ✓ Direct reading metric and English system scales.
- ✓ Unique design facilitates ease of maintenance cleaning processes.

Heavy-duty flow meters are fully enclosed in a brushed stainless steel case. Ideal for industrial applications with flow rates of up to 116 GPM / 440 L/min and 250 SCFM / 7080 L/min. Used for flow measurements of liquids (water) and gases (air).



Meters are graduated for direct reading of water and air. Flow meters come with FNPT or flanged end fittings for easy in-line installation. Wetted parts include borosilicate glass flow tubes, Viton® o-rings, and 316 Stainless steel fittings, guide rods, floats and float stops.

Flanged
M Style Meter



In Line
M Style Meters

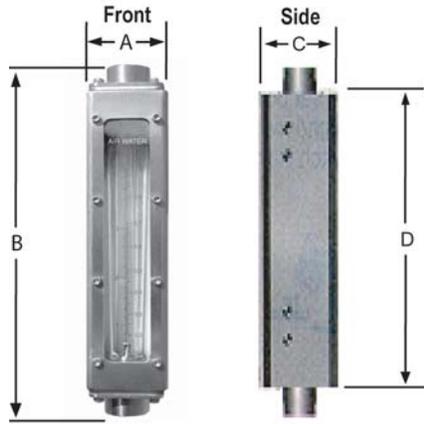
SPECIFICATIONS

| | |
|---|---|
| ACCURACY | ±3% of full scale. |
| MINIMUM FLOW RATE | Approximately 10% of maximum flow rate. |
| REPEATABILITY | ±0.5% of full scale. |
| MAXIMUM PRESSURE AT 200°F (93°C) | 200 psig / 13.6 bar gauge (tube size 3, 4, 5 and 6). 125 psig / 8.5 bar gauge (tube size 8 and 9). |
| MAXIMUM OPERATING TEMPERATURE | 200 °F (93 °C). |

**MATERIALS OF CONSTRUCTION

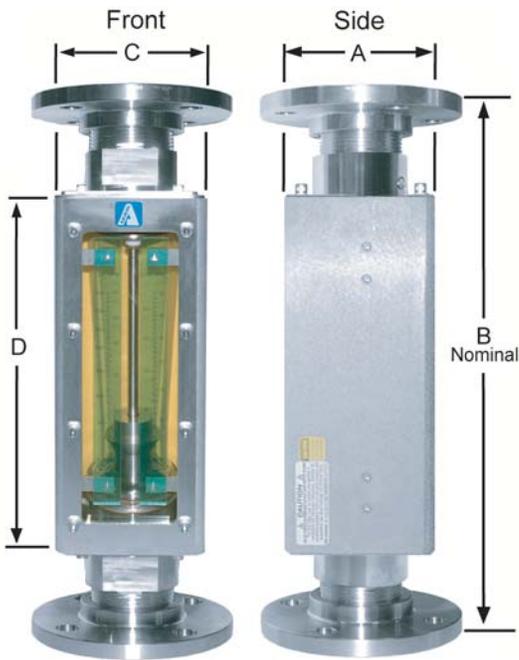
| | |
|--|--|
| FLOW TUBES | Heavy walled borosilicate glass. |
| FITTINGS IN CONTACT WITH FLUIDS | 316 Stainless Steel. |
| FRONT SHIELD | Thick clear polycarbonate and white acrylics. |
| O-RINGS | Viton®. |
| OPTIONAL | PTFE/ Kalrez®, EPR. |
| CONNECTIONS | IN LINE: 1/2", 1-1/2", 2", NPT. 150 ANSI FLANGED: 3/4", 1-1/2", 2-1/2". |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*



DIMENSIONS FOR IN-LINE M STYLE METERS

| NPT (F) | A | B | C | D |
|---------|-----|-------|------|-------|
| 1/2" | 2 | 9.54 | 2.25 | 8.04 |
| 1" | 3.5 | 13.69 | 3.75 | 10.50 |
| 2" | 5 | 15.59 | 5.25 | 11.55 |



DIMENSIONS FOR FLANGED M STYLE METERS

| Flange Size | A | B (Nominal) | C | D |
|-------------|-----|-------------|------|-------|
| 3/4" | 2 | 9.58 | 2.25 | 8.04 |
| 1 1/2" | 3.5 | 14.15 | 3.75 | 10.50 |
| 2 1/2" | 5 | 17.98 | 5.25 | 11.55 |

IN LINE M STYLE METERS

| CATALOG NUMBER | MAX FLOW RATE | | | | PRESSURE DROP ("OF H ₂ O) | TUBE SIZE | NPT CONNECTION |
|-----------------|---------------|------------|---------------|-------------|--------------------------------------|-----------|----------------|
| | WATER [GPM] | AIR [SCFM] | WATER [L/min] | AIR [L/min] | | | |
| MS-VJ-M01-02-ST | 0.25 | 1.2 | .95 | 35 | - | 3 | 1/2" |
| MS-VJ-M02-02-ST | 0.36 | 1.7 | 1.3 | 50 | 2 | 3 | |
| MS-VJ-M03-02-ST | 0.76 | 3.3 | 3.0 | 90 | 5 | 3 | |
| MS-VJ-M04-02-ST | 1.0 | 4.2 | 3.7 | 120 | 6 | 4 | |
| MS-VJ-M05-02-ST | 1.5 | 6.5 | 5.6 | 180 | - | 4 | |
| MS-VJ-M06-02-ST | 2.2 | 8.5 | 8.2 | 250 | 10 | 4 | |
| MS-VK-M07-02-ST | 3.8 | 16 | 14 | 475 | 10 | 5 | 1" |
| MS-VK-M08-02-ST | 5.0 | 21.5 | 18 | 650 | 14 | 5 | |
| MS-VK-M09-02-ST | 6.0 | 25.5 | 20 | 725 | 5 | 6 | |
| MS-VK-M10-02-ST | 7.4 | 30 | 27.5 | 900 | 6 | 6 | |
| MS-VK-M11-02-ST | 9.6 | 40 | 35 | 1200 | 10 | 6 | |
| MS-VK-M12-02-ST | 11 | 47.5 | 40 | 1400 | 13 | 6 | |
| MS-VK-M13-02-ST | 14 | 62 | 50 | 1800 | 24 | 6 | 2" |
| MS-VK-M14-02-ST | 20 | 90 | 75 | 2600 | 39 | 6 | |
| MS-VL-M15-02-ST | 22 | 90 | 83 | 2550 | 16 | 8 | 2" |
| MS-VK-M16-02-ST | 26 | - | 98 | - | 70 | 6 | |
| MS-VQ-M17-02-ST | 41 | 160 | 155 | 4531 | 5 | 9 | |
| MS-VL-M18-02-ST | 44 | 180 | 167 | 5098 | 30 | 8 | |
| MS-VQ-M19-02-ST | 60 | 245 | 227 | 6938 | 16 | 9 | |
| MS-VL-M20-02-ST | 61 | 250 | 231 | 7080 | 40 | 8 | |
| MS-VQ-M21-02-ST | 86 | - | 326 | - | 25 | 9 | 9 |
| MS-VQ-M22-02-ST | 116 | - | 439 | - | 45 | | |

FLANGED M STYLE METERS

| CATALOG NUMBER | MAX FLOW RATE | | | | PRESSURE DROP ("OF H ₂ O) | TUBE SIZE | FLANGE CONNECTION |
|-----------------|---------------|------------|---------------|-------------|--------------------------------------|-----------|-------------------|
| | WATER [GPM] | AIR [SCFM] | WATER [L/min] | AIR [L/min] | | | |
| MS-VR-M01-02-ST | 0.25 | 1.2 | .95 | 35 | - | 3 | 3/4" |
| MS-VR-M02-02-ST | 0.36 | 1.7 | 1.3 | 50 | 2 | 3 | |
| MS-VR-M03-02-ST | 0.76 | 3.3 | 3.0 | 90 | 5 | 3 | |
| MS-VR-M04-02-ST | 1.0 | 4.2 | 3.7 | 120 | 6 | 4 | |
| MS-VR-M05-02-ST | 1.5 | 6.5 | 5.6 | 180 | - | 4 | |
| MS-VR-M06-02-ST | 2.2 | 8.5 | 8.2 | 250 | 10 | 4 | |
| MS-VS-M07-02-ST | 3.8 | 16 | 14 | 475 | 10 | 5 | 1 1/2" |
| MS-VS-M08-02-ST | 5.0 | 21.5 | 18 | 650 | 14 | 5 | |
| MS-VS-M09-02-ST | 6.0 | 25.5 | 20 | 725 | 5 | 6 | |
| MS-VS-M10-02-ST | 7.4 | 30 | 27.5 | 900 | 6 | 6 | |
| MS-VS-M11-02-ST | 9.6 | 40 | 35 | 1200 | 10 | 6 | |
| MS-VS-M12-02-ST | 11 | 47.5 | 40 | 1400 | 13 | 6 | |
| MS-VS-M13-02-ST | 14 | 62 | 50 | 1800 | 24 | 6 | 2 1/2" |
| MS-VS-M14-02-ST | 20 | 90 | 75 | 2600 | 39 | 6 | |
| MS-VT-M15-02-ST | 22 | 90 | 83 | 2550 | 16 | 8 | 2 1/2" |
| MS-VS-M16-02-ST | 26 | - | 98 | - | 70 | 6 | |
| MS-VU-M17-02-ST | 41 | 160 | 155 | 4531 | 5 | 9 | |
| MS-VT-M18-02-ST | 44 | 180 | 167 | 5098 | 30 | 8 | |
| MS-VU-M19-02-ST | 60 | 245 | 227 | 6938 | 16 | 9 | |
| MS-VT-M20-02-ST | 61 | 250 | 231 | 7080 | 40 | 8 | |
| MS-VU-M21-02-ST | 86 | - | 326 | - | 25 | 9 | 9 |
| MS-VU-M22-02-ST | 116 | - | 439 | - | 45 | | |



Made entirely of PTFE, PFA, and PCTFE, the *Model F* flow meter is excellent for high-purity applications or use with corrosive liquids.

Units are available with a standard valve to monitor and control flow or without a valve to just monitor flow.

Flow meters are individually tested on a Mass Spectrometer Leak Detector and certified to a leak integrity rating of 1×10^{-7} sccs Helium or better.

design features

- ✓ Chemically inert wetted components.
- ✓ Removable protective shield.
- ✓ Individually leak tested.



SPECIFICATIONS

| | |
|----------------------------|---|
| SCALES | 0 to 10 markings. |
| ACCURACY | ±5% of full scale. |
| MAXIMUM TEMPERATURE | 250 °F (121 °C). |
| MAXIMUM PRESSURE | 100 psig (6.7 bars). |
| LEAK INTEGRITY | Individually, leak tested and certified to a rating of 1×10^{-7} sccs of Helium. |

**MATERIALS OF CONSTRUCTION

| | |
|---------------------|--------------------------------------|
| TUBE SHIELDS | Polycarbonate. |
| FLOW TUBES | PFA. |
| FLOATS | PTFE. |
| WETTED PARTS | PTFE end fittings. PCTFE guide rods. |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

DIMENSIONS FOR F STYLE METERS

| LOW RANGE MODELS | HIGH RANGE MODELS |
|-------------------------------|--------------------------|
| 5-11/16" Length x 1-1/4" O.D. | 10-1/2" Length x 2" O.D. |

ORDERING INFORMATION

F STYLE LOW RANGE METERS

| MODEL NUMBER | | CONNECTION | MAXIMUM FLOW | |
|----------------|---------------|------------|-------------------|----------------|
| BUILT IN VALVE | NO VALVE | | [mL/min] WATER | [gph] WATER |
| F6C-F01-01-TF | F3C-F01-01-TF | 1/4" FNPT | 125 | 1.98 |
| F6C-F02-01-TF | F3C-F02-01-TF | 1/4" FNPT | 250 | 3.96 |
| F6C-F03-01-TF | F3C-F03-01-TF | 1/4" FNPT | 400 | 6.34 |
| F6C-F04-01-TF | F3C-F04-01-TF | 1/4" FNPT | 500 | 7.92 |
| F6C-F05-01-TF | F3C-F05-01-TF | 1/4" FNPT | 1000 | 15.85 |
| F6D-F06-01-TF | F3D-F06-01-TF | 3/8" FNPT | 2000 | 31.69 |
| F6D-F07-01-TF | F3D-F07-01-TF | 3/8" FNPT | 2500 | 39.62 |
| F6D-F08-01-TF | F3D-F08-01-TF | 3/8" FNPT | 3000 | 47.54 |
| F6D-F09-01-TF | F3D-F09-01-TF | 3/8" FNPT | 5000 | 79.23 |

F STYLE HIGH RANGE METERS

| MODEL NUMBER | | CONNECTION | MAXIMUM FLOW | |
|----------------|---------------|------------|------------------|----------------|
| BUILT IN VALVE | NO VALVE | | [L/min] WATER | [gpm] WATER |
| F6E-F10-01-TF | F3E-F10-01-TF | 1/2" FNPT | 13 | 3.43 |
| F6E-F11-01-TF | F3E-F11-01-TF | 1/2" FNPT | 20 | 5.28 |
| F6F-F12-01-TF | F3F-F12-01-TF | 3/4" FNPT | 30 | 7.93 |
| F6F-F13-01-TF | F3F-F13-01-TF | 3/4" FNPT | 40 | 10.57 |
| F6F-F14-01-TF | F3F-F14-01-TF | 3/4" FNPT | 45 | 11.89 |

L

PTFE-PFA FLOW METERS

Incorporating the principles of traditional rotameter flow technology, these rugged PTFE-PFA flow meters offer solutions to low to medium flow range measurements of highly corrosive or ultra-pure liquids.

Wetted inert components are surrounded by structurally rigid materials such as PFA-clad aluminum, KYNAR®. The resultant design represents a unique combination of a rugged mechanically rigid frame and the chemically inert wetted parts. Model L Meters are constructed of inert materials such as PFA, PTFE and PCTFE.

Flow meters are also resistant to external, ambient corrosives.

For the protection of personnel each flow meter is supplied with a safety shield.

Flow meters are supplied with or without built-in needle valves and they are panel mountable, by means of KYNAR® panel nuts.

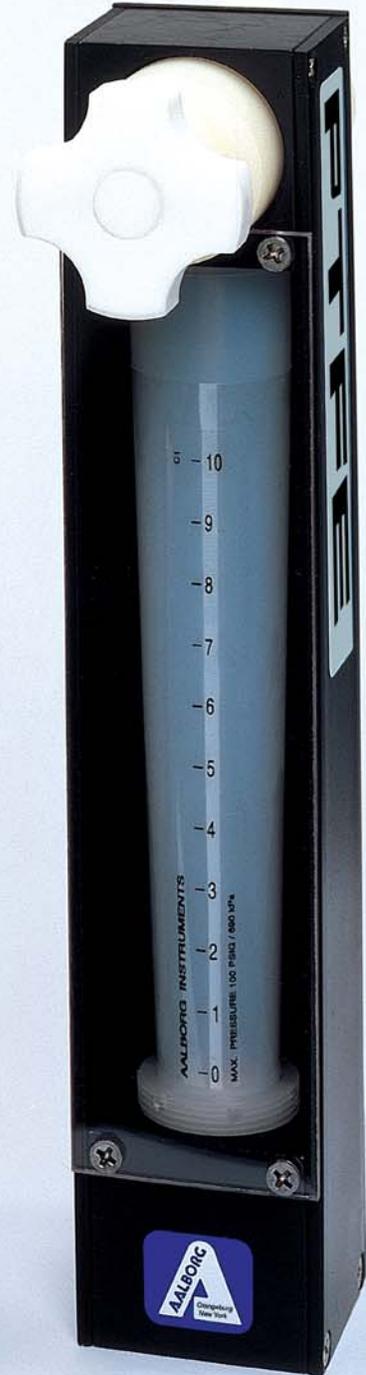
design features

- ✓ Chemically inert wetted components constructed from PFA PTFE and PCTE.
- ✓ Non-fluid contacting structurally rigid frame constructed from PFA-clad aluminum and KYNAR®.
- ✓ Overlapping flow ranges are available for water from 5 mL/min (0.00132 GPM) to 45 L/min (12 GPM).
- ✓ Individually leak tested.

LEAK INTEGRITY

Flow meters are individually tested on a Mass Spectrometer Leak Detector and certified to a leak integrity rating of 1×10^{-7} sccs Helium or better.

High Range PTFE meter with Valve



Low Range PTFE meter without Valve



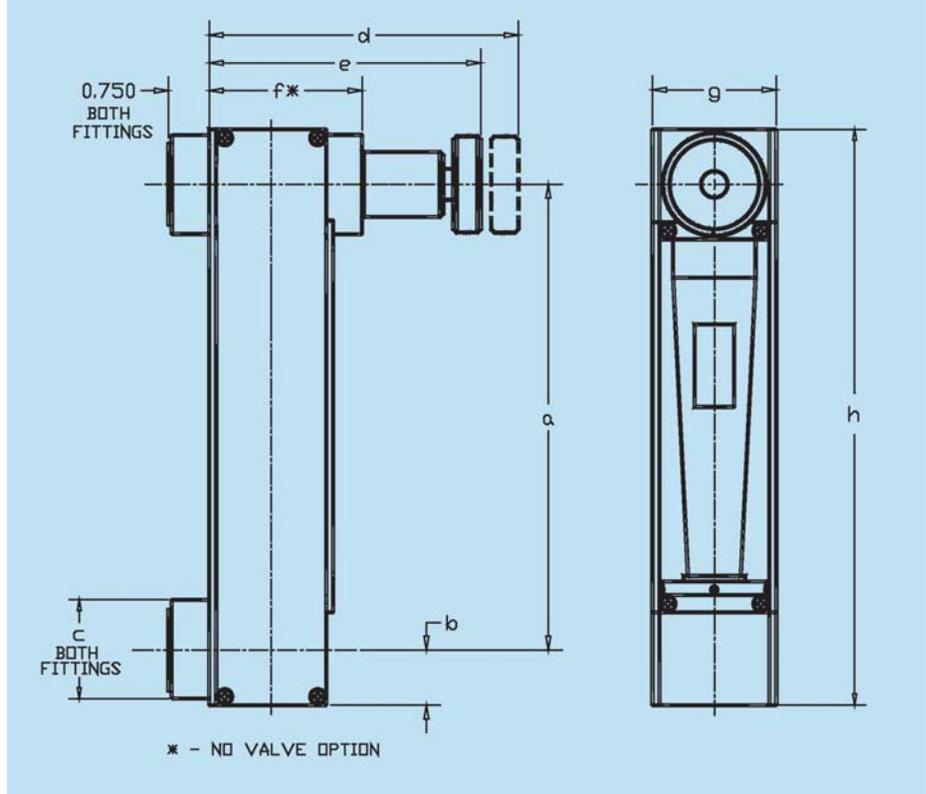
PRINCIPLES OF OPERATION

A cylindrical float freely moving inside a tapered flow tube comprises the flow measurement element of PTFE - PFA flow meters. The translucent PFA flow tube is installed vertically in-line in the liquid stream.

As flow takes place the float is propelled up inside the flow tube. The area between the float and the inside diameter of the flow tube gradually increases with increasing flow and correspondingly the pressure lifting the float decreases until the weight of the float and its buoyant force come to equilibrium.

At equilibrium the top of the float is lined up with a scale graduation on the flow tube denoting a discrete rate of flow.

MOUNTING DIMENSIONS



| SPECIFICATIONS | |
|---------------------|---|
| SCALES | 0 to 10 markings (see dimension table for scale lengths). |
| ACCURACY | ±5% of full scale. |
| MAXIMUM TEMPERATURE | 250° F (121°C). |
| MAXIMUM PRESSURE | 100 psig (6.7 bars). |
| LEAK INTEGRITY | Individually pressure and leak tested and certified to a rating of 1 x 10 ⁻⁷ sccs of Helium. |

| **MATERIALS OF CONSTRUCTION | |
|-----------------------------|---|
| FLOW TUBES | PFA. |
| FLOATS | PTFE. |
| WETTED PARTS | PFA (flow tubes) and PTFE (end fittings and floats) and PCTFE (guide rods). |

**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

| DIMENSIONS FOR L STYLE METERS | | | | | | | | | |
|-------------------------------|------|------|------|------|------|------|------|------|--------------|
| METER SIZE | A | B | C | D | E | F | G | H | SCALE LENGTH |
| C | 4.97 | 0.56 | 1.06 | 3.35 | 3.15 | 1.52 | 1.25 | 6.16 | 75mm |
| D | 4.97 | 0.56 | 1.25 | 4.65 | 4.25 | 1.82 | 1.50 | 6.16 | 75mm |
| E | 8.72 | 0.88 | 1.75 | 4.57 | 4.07 | 2.12 | 2.00 | 10.4 | 125mm |
| F | 8.47 | 1.00 | 1.75 | 5.95 | 5.00 | 2.32 | 2.25 | 10.4 | 125mm |

* Dimensions are in inches, except as shown in [mm]; for certified dimensions contact the company.

| ORDERING INFORMATION | | | | |
|--------------------------|---------------|------------|----------------|-------------|
| L STYLE LOW RANGE METERS | | | | |
| MODEL NUMBER | | CONNECTION | MAXIMUM FLOW | |
| BUILT IN VALVE | NO VALVE | | [mL/min] WATER | [gph] WATER |
| L6C-L01-01-SA | L3C-L01-01-SA | 1/4" FNPT | 75 | 1.19 |
| L6C-L02-01-TF | L3C-L02-01-TF | 1/4" FNPT | 250 | 3.96 |
| L6C-L03-01-TF | L3C-L03-01-TF | 1/4" FNPT | 400 | 6.34 |
| L6C-L04-01-TF | L3C-L04-01-TF | 1/4" FNPT | 500 | 7.92 |
| L6C-L05-01-TF | L3C-L05-01-TF | 1/4" FNPT | 1000 | 15.85 |
| L6D-L06-01-TF | L3D-L06-01-TF | 3/8" FNPT | 2000 | 31.69 |
| L6D-L07-01-TF | L3D-L07-01-TF | 3/8" FNPT | 2500 | 39.62 |
| L6D-L08-01-TF | L3D-L08-01-TF | 3/8" FNPT | 3000 | 47.54 |
| L6D-L09-01-TF | L3D-L09-01-TF | 3/8" FNPT | 5000 | 79.23 |

| L STYLE HIGH RANGE METERS | | | | |
|---------------------------|---------------|------------|---------------|-------------|
| MODEL NUMBER | | CONNECTION | MAXIMUM FLOW | |
| BUILT IN VALVE | NO VALVE | | [L/min] WATER | [gpm] WATER |
| L6E-L10-01-TF | L3E-L10-01-TF | 1/2" FNPT | 13 | 3.43 |
| L6E-L11-01-TF | L3E-L11-01-TF | 1/2" FNPT | 20 | 5.28 |
| L6F-L12-01-TF | L3F-L12-01-TF | 3/4" FNPT | 30 | 7.93 |
| L6F-L13-01-TF | L3F-L13-01-TF | 3/4" FNPT | 40 | 10.57 |
| L6F-L14-01-TF | L3F-L14-01-TF | 3/4" FNPT | 45 | 11.89 |

BULLETIN EM201007 L

BARSTOCK METERING VALVES MFV™

Offered in straight (T) and 90 degree (L) flow patterns, the MFV™ Barstock Valve includes a “non-rising stem” design, it’s unique non-rotating needle is cylindrical with a precision ground tapered metering surface. The needle moves in a rectilinear fashion which accounts for its desirable sixteen- turn high resolution attribute. Hysteresis is virtually eliminated due to the needle design and the closely fitting fine thread on its adjustment plunger. The valve body is precision machined chrome plated brass or type 316 stainless steel.



Designed for controlling very low flow rates of liquids and gases, MFV™ Barstock valves are available in six conveniently overlapping orifice-needle sizes.

design features

- ✓ Virtually free of hysteresis (see-sawing).
- ✓ Bubble tight shutoff.
- ✓ Straight or 90 degree flow patterns.
- ✓ Brass or 316 stainless steel high resolution.
- ✓ Sixteen turns to full open.

SPECIFICATIONS

| | |
|----------------------------|---|
| MAXIMUM PRESSURE | 500 psig (3792 kPa). |
| MAXIMUM TEMPERATURE | 180 °F (82 °C)-brass. 250 °F (121 °C)-stainless. |
| VALVE STEM | Sixteen turns, non-rising type. |

**MATERIALS OF CONSTRUCTION

| | |
|---------------------|--|
| BODY | Chrome plated brass or 316 stainless steel. |
| VALVE NEEDLE | 316 stainless steel. |
| ORIFICE | 316 stainless steel with PTFE liner. |
| O-RINGS | Buna-N® (brass valves). Viton® (stainless valves). |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

ORDERING INFORMATION BARSTOCK METERING VALVES MFV™

| MODEL NUMBER | FLOW PATTERN | MATERIAL | MAXIMUM FLOW [mL/min] | | ORIFICE [in] | CV |
|--------------|--------------|-----------|-----------------------|-------|--------------|--------|
| | | | Air | Water | | |
| VM1-BB-1A | Straight | Brass | 200 | 6 | 0.042 | 0.0005 |
| VM2-BB-1A | Straight | Brass | 400 | 12 | 0.042 | 0.001 |
| VM3-BB-1A | Straight | Brass | 1000 | 30 | 0.042 | 0.0025 |
| VM4-BB-1A | Straight | Brass | 2500 | 70 | 0.093 | 0.0061 |
| VM5-BB-1A | Straight | Brass | 6200 | 200 | 0.093 | 0.016 |
| VM6-BB-1A | Straight | Brass | 21500 | 650 | 0.093 | 0.054 |
| VM1-SV-2A | Straight | Stainless | 200 | 6 | 0.042 | 0.0005 |
| VM2-SV-2A | Straight | Stainless | 400 | 12 | 0.042 | 0.001 |
| VM3-SV-2A | Straight | Stainless | 1000 | 30 | 0.042 | 0.0025 |
| VM4-SV-2A | Straight | Stainless | 2500 | 70 | 0.093 | 0.0061 |
| VM5-SV-2A | Straight | Stainless | 6200 | 200 | 0.093 | 0.016 |
| VM6-SV-2A | Straight | Stainless | 21500 | 650 | 0.093 | 0.054 |
| VM1-BB-6A | 90 degree | Brass | 200 | 6 | 0.042 | 0.0005 |
| VM2-BB-6A | 90 degree | Brass | 400 | 12 | 0.042 | 0.001 |
| VM3-BB-6A | 90 degree | Brass | 1000 | 30 | 0.042 | 0.0025 |
| VM4-BB-6A | 90 degree | Brass | 2500 | 70 | 0.093 | 0.0061 |
| VM5-BB-6A | 90 degree | Brass | 6200 | 200 | 0.093 | 0.016 |
| VM6-BB-6A | 90 degree | Brass | 21500 | 650 | 0.093 | 0.054 |
| VM1-SV-7A | 90 degree | Stainless | 200 | 6 | 0.042 | 0.0005 |
| VM2-SV-7A | 90 degree | Stainless | 400 | 12 | 0.042 | 0.001 |
| VM3-SV-7A | 90 degree | Stainless | 1000 | 30 | 0.042 | 0.0025 |
| VM4-SV-7A | 90 degree | Stainless | 2500 | 70 | 0.093 | 0.0061 |
| VM5-SV-7A | 90 degree | Stainless | 6200 | 200 | 0.093 | 0.016 |
| VM6-SV-7A | 90 degree | Stainless | 21500 | 650 | 0.093 | 0.054 |

Note: Based on 10psig(69 kPa) inlet pressure and atmospheric exhaust.

Designed for controlling a broad range of flow rates of liquids and gases, CV™ Utility valves are available in three conveniently overlapping orifice-needle sizes.

BARSTOCK \ UTILITY VALVES CV™

These versatile, rugged and reliable valves are suitable for laboratory instrumentation, bench top or OEM flow control purposes.



SPECIFICATIONS

| | |
|----------------------------|---|
| MAXIMUM PRESSURE | 500 psig (3792 kPa). |
| MAXIMUM TEMPERATURE | 180 °F (82 °C) - (brass valves). 250 °F (121 °C) - (stainless valves). |

Valves are offered in straight (T) and 90 degree (L) flow patterns. All valves are supplied with 1/8" FNPT inlet and outlet ports.

Valve cartridges are also interchangeable with built-in valves of Aalborg's series of P, T, S, and G flow meter product line.

The valve body is precision machined chrome plated brass or type 316 stainless steel.

****MATERIALS OF CONSTRUCTION**

| | |
|--------------------|---|
| CONNECTIONS | 1/8" female NPT. |
| O-RINGS | PTFE and Buna-N® (brass valves). PTFE and Viton® (stainless valves). |

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

design features

- ✓ Bubble tight shutoff.
- ✓ Straight or 90 degree flow patterns.
- ✓ Brass or 316 stainless steel.

ORDERING INFORMATION BARSTOCK UTILITY VALVES CV™

| MODEL NUMBER | FLOW PATTERN | MATERIAL | MAXIMUM FLOW [mL/min] | | ORIFICE [in] | Cv |
|--------------|--------------|-----------|-----------------------|-------|--------------|------|
| | | | Air | Water | | |
| VCL-BB-1A | Straight | Brass | 5000 | 350 | 0.052 | 0.03 |
| VCL-SV-2A | Straight | Stainless | 5000 | 350 | 0.052 | 0.03 |
| VCL-BB-6A | 90 degree | Brass | 5000 | 350 | 0.052 | 0.03 |
| VCL-SV-7A | 90 degree | Stainless | 5000 | 350 | 0.052 | 0.03 |
| VCM-BB-1A | Straight | Brass | 20000 | 1200 | 0.082 | 0.10 |
| VCM-SV-2A | Straight | Stainless | 20000 | 1200 | 0.082 | 0.10 |
| VCM-BB-6A | 90 degree | Brass | 20000 | 1200 | 0.082 | 0.10 |
| VCM-SV-7A | 90 degree | Stainless | 20000 | 1200 | 0.082 | 0.10 |
| VCH-BB-1A | Straight | Brass | 60000 | 3500 | 0.120 | 0.30 |
| VCH-SV-2A | Straight | Stainless | 60000 | 3500 | 0.120 | 0.30 |
| VCH-BB-6A | 90 degree | Brass | 60000 | 3500 | 0.120 | 0.30 |
| VCH-SV-7A | 90 degree | Stainless | 60000 | 3500 | 0.120 | 0.30 |

Note: Based on 10psig (69 kPa) inlet pressure and atmospheric exhaust.

These compact and reliable PTFE needle valves are designed for laboratory and industrial applications for regulating corrosive gases and liquids or for high purity service. They may also be used as shut off valves.

Pliant PTFE bodies of the valves are reinforced by structurally rigid metallic shells. Fluids contact only PTFE and PCTFE materials. Shells are made of anodized aluminum or type 316 stainless steel and bushings are made of plated brass or 316 stainless steel. Where externally corrosive conditions exist stainless steel is recommended.

Valve spindles are made of rigid PCTFE to minimize the undesirable material "creeping" normally associated with PTFE.

PTFE valves are designed for relatively high flow ranges while still performing well in low flow rates.

Valves may be used in pressure or non-critical vacuum service.

The simplicity of design - there are only seven components (including a single PTFE o-ring) - assures reliability and minimizes sources of leakage. It takes seconds to disassemble the valve for cleaning and maintenance. The PTFE o-ring is radially compressed and due to this unique design feature the degree of compression may be adjusted without disassembly by tightening the hexagonal bushing.

design features

- ✓ Fluids contact PTFE and PCTFE only.
- ✓ Structurally Rigid Metal Shell.
- ✓ One PTFE o-ring.
- ✓ Simplicity only seven components.

Note: Based on 10psig (69 kPa) inlet pressure and atmospheric exhaust.



PTFE Needle valve with Stainless Shell and FNPT Fittings

ORDERING INFORMATION PTFE NEEDLE VALVES

| MODEL NUMBER | MAXIMUM FLOW [ml/min] | | CV | NON WETTED MATERIALS | | CONNECTIONS |
|--------------|-----------------------|-------|-------|----------------------|-----------|---------------|
| | AIR | WATER | | SHELL | BUSHING | |
| VCL-TT-0A | 2400 | 130 | 0.011 | Aluminum | Brass | 1/8" FNPT |
| VCH-TT-0A | 55000 | 2800 | 0.250 | Aluminum | Brass | 1/8" FNPT |
| VCL-TT-0F | 2400 | 130 | 0.011 | Aluminum | Brass | 1/4" Comp. |
| VCH-TT-0F | 55000 | 2800 | 0.250 | Aluminum | Brass | 1/4" Comp. |
| VCL-TT-0G | 2400 | 130 | 0.011 | Aluminum | Brass | Glass Nipples |
| VCH-TT-0G | 55000 | 2800 | 0.250 | Aluminum | Brass | Glass Nipples |
| VCL-TT-2A | 2400 | 130 | 0.011 | Stainless | Stainless | 1/8" FNPT |
| VCH-TT-2A | 55000 | 2800 | 0.250 | Stainless | Stainless | 1/8" FNPT |
| VCL-TT-2F | 2400 | 130 | 0.011 | Stainless | Stainless | 1/4" Comp. |
| VCH-TT-2F | 55000 | 2800 | 0.250 | Stainless | Stainless | 1/4" Comp. |
| VCL-TT-2G | 2400 | 130 | 0.011 | Stainless | Stainless | Glass Nipples |
| VCH-TT-2G | 55000 | 2800 | 0.250 | Stainless | Stainless | Glass Nipples |

SPECIFICATIONS

| | |
|---|--|
| MAXIMUM PRESSURE | 75 psig (517 kPa) |
| MAXIMUM TEMPERATURE | 150 °F (65 °C) |
| ORIFICE SIZE | 0.125" diameter (3.175 mm) |
| **MATERIALS OF CONSTRUCTION FLUID CONTACTING | Body and o-ring-PTFE. Valve spindle-PCTFE. |
| NON FLUID CONTACTING | Shell - Aluminum (anodized) or 316 stainless steel. Bushing plated brass, or 316 stainless steel. Adjusting Knob-phenolic. |

**The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

MVT™ Metering valves are constructed of PTFE and PCTFE materials.

Non-fluid contacting external parts are made of anodized aluminum.

Valves are offered in three conveniently overlapping flow ranges. Safety handle prevents over tightening and facilitates fine metered regulation. MVT™ valves are useful in regulating the flow of corrosive gases and liquids.

They may be used in pressure or non-critical vacuum service and serve as bubble tight shutoff valves.



PTFE Needle valve with Aluminum Shell and Glass Nipples



PTFE Metering Valve

ORDERING INFORMATION PTFE METERING VALVE

| MODEL NUMBER | MAXIMUM FLOW [mL/min] | | Cv | CONNECTIONS |
|--------------|-----------------------|-------|-------|---------------|
| | Air | Water | | |
| VM1-TT-0A | 600 | 36 | 0.003 | 1/8" FNPT |
| VM3-TT-0A | 3000 | 180 | 0.015 | 1/8" FNPT |
| VM6-TT-0A | 30000 | 1800 | 0.150 | 1/8" FNPT |
| VM1-TT-0F | 600 | 36 | 0.003 | 1/4" Comp. |
| VM3-TT-0F | 3000 | 180 | 0.015 | 1/4" Comp. |
| VM6-TT-0F | 30000 | 1800 | 0.150 | 1/4" Comp. |
| VM1-TT-0G | 600 | 36 | 0.003 | Glass Nipples |
| VM3-TT-0G | 3000 | 180 | 0.015 | Glass Nipples |
| VM6-TT-0G | 30000 | 1800 | 0.150 | Glass Nipples |

SPECIFICATIONS

| | |
|--|--|
| MAXIMUM PRESSURE | 75 psig (517 kPa) |
| MAXIMUM TEMPERATURE | 150 °F (65 °C) |
| ORIFICE SIZE | 0.125" diameter (3.175 mm) |
| NUMBER OF TURNS TO FULLY OPEN | Eight. |
| STEM | Non-rising type. |
| FLUID CONTACTING COMPONENTS | Body /o-ring-PTFE. Valve spindle-PCTFE. |
| NON-FLUID CONTACTING COMPONENTS | Shell + Handle - Aluminum (anodized). |

* Based on 10 psig (69 kPa) inlet pressure and atmospheric exhaust.

design features

- ✓ Fluids contact PTFE and PCTFE only.
- ✓ One PTFE o-ring.
- ✓ Simplicity, only six components.

PTFE needle valves are designed for laboratory and industrial applications for regulating corrosive gases and liquids or for high purity service. They may also be used as shut off valves.

Fluids contact only PTFE and PCTFE materials. Bushings are made of 316 stainless steel.

Valve spindles are made of rigid PCTFE to minimize the undesirable material “creeping” normally associated with PTFE.

PTFE valves are designed for relatively high flow ranges while still performing well in low flow rates.

Valves may be used in pressure or non-critical vacuum service.

The simplicity of design - there are only six components (including a single PTFE o-ring) - assures reliability and minimizes sources of leakage. It takes seconds to disassemble the valve for cleaning and maintenance.

The PTFE o-ring is radially compressed and due to this unique design feature the degree of compression may be adjusted without disassembly by tightening the bushing.

***The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*



6mm PTFE Needle Valves

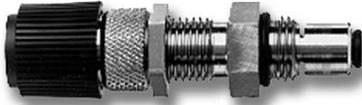
ORDERING INFORMATION FOR 6mm PTFE NEEDLE VALVES

| MODEL NUMBER | MAXIMUM FLOW LPM | | CV | CONNECTIONS |
|--------------|------------------|-------|-------|-------------|
| | AIR | WATER | | |
| VTF-TT-0A | 300 | 9 | 0.765 | 3/8" FNPT |

Note: Based on 10psig(69 kPa) inlet pressure and atmospheric exhaust.

SPECIFICATIONS

| | |
|---|--|
| MAXIMUM PRESSURE | 75 psig (517 kPa) |
| MAXIMUM TEMPERATURE | 150 °F (65 °C) |
| ORIFICE SIZE | 6.0 mm (0.250") diameter. |
| **MATERIALS OF CONSTRUCTION FLUID CONTACTING | Body and o-ring-PTFE. Valve spindle-PCTFE. |
| NON FLUID CONTACTING | Bushings 316 stainless steel. Mounting Nut and Adjusting Knob Delrin. |



FLOW CAPACITIES Spare valve cartridges P, Px and S meters

TABLE 1 - MFV™ VALVE FLOW CAPACITIES 10 psig (0.7 kPa gauge) INLET PRESSURE, ATMOSPHERIC EXHAUST

| SIZE | AIR | | HELIUM | | WATER | |
|------|----------|--------|----------|--------|----------|--------|
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [gph] |
| 1 | 200 | 0.42 | 400 | 0.85 | 6 | 0.095 |
| 2 | 400 | 0.85 | 850 | 1.80 | 12 | 0.190 |
| 3 | 1020 | 2.15 | 2100 | 4.45 | 28 | 0.444 |
| 4 | 2600 | 5.50 | 6050 | 12.80 | 85 | 1.347 |
| 5 | 8900 | 18.85 | 20800 | 44.05 | 270 | 4.279 |
| 6 | 35000 | 74.15 | 84500 | 179.10 | 1070 | 16.960 |
| 7 | 63000 | 133.50 | 156000 | 330.50 | 1930 | 30.590 |



TABLE 2 - CV™ VALVE FLOW CAPACITIES 10 psig (0.7 kPa gauge) INLET PRESSURE, ATMOSPHERIC EXHAUST

| SIZE | AIR | | HELIUM | | WATER | |
|------|----------|--------|----------|--------|----------|-------|
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [gph] |
| L | 5050 | 10.70 | 11500 | 24.35 | 360 | 5.70 |
| M | 30000 | 63.55 | 71500 | 151.50 | 1760 | 27.90 |
| H | 76000 | 161.05 | 180000 | 381.40 | 4500 | 71.33 |



FLOW CAPACITIES Spare valve cartridges T and Tx meters

TABLE 1a - MVT™ VALVE FLOW CAPACITIES 10 psig (0.7 kPa gauge) INLET PRESSURE, ATMOSPHERIC EXHAUST

| SIZE | AIR | | HELIUM | | WATER | |
|------|----------|--------|----------|--------|----------|-------|
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [gph] |
| 1 | 600 | 1.25 | 1250 | 2.65 | 36 | 0.57 |
| 2 | 3000 | 6.35 | 6900 | 14.60 | 180 | 2.85 |
| 3 | 30000 | 63.55 | 71500 | 151.50 | 1800 | 28.53 |



TABLE 2a - CVT™ VALVE FLOW CAPACITIES 10 psig (0.7 kPa gauge) INLET PRESSURE, ATMOSPHERIC EXHAUST

| SIZE | AIR | | HELIUM | | WATER | |
|------|----------|--------|----------|--------|----------|-------|
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [gph] |
| L | 2400 | 5.10 | 5300 | 11.23 | 130 | 2.05 |
| H | 55000 | 116.55 | 135000 | 286.05 | 2800 | 44.40 |

METER SIZING FOR P, Px, T, Tx AND S METERS

Flow capacity tables 6, 7, 8, 9 and 10 (pages 43 to 46) are based on calibrations at standard conditions, meaning 14.7 psia (1 atm) pressure and 70 °F (21.1 °C).

Tables list maximum flow rates of flow tubes. The usable range of meters is at least 10:1, often more. Thus, as a rule of thumb, to estimate the minimum metering limit divide the flow rates listed, by ten.

For gases or liquids with fluid properties not greatly different from the calibration media, tables apply directly, when working pressure and temperature are also approximately standard.

Where the above conditions do not apply the maximum flow rates of the metered fluids are converted to equivalent standard flow rates of air or water.

To do this calculate “K” as shown in charts, multiply the maximum flow rate with this factor, and select the appropriate flow tube size from the Flow Capacity tables 6, 7, 8, 9 and 10 (pages 43 to 46).

gas flow

$$Q_{air} = K_{gas} \times Q_{gas}$$

$$K_{gas} = \sqrt{G \times \frac{T_{act}}{T_o} \times \frac{P_o}{P_{act}}}$$

where:

- Q_{air} = equivalent air flow capacity at Standard Conditions (SPT).
- Q_{gas} = maximum flow of metered gas.
- G = specific gravity of metered gas (from table 5).
- T_{act} = absolute temperature at flow condition, deg R or deg K.
- T_o = absolute temperature at Standard Conditions. (STP) deg R (530) or deg K (294).
- P_{act} = pressure at flow conditions, psia.
- P_o = pressure at Standard Conditions (STP), (14.7 psia).

liquid flow

$$Q_{water} = K_{liq} \times Q_{liq}$$

$$K_{liq} = \sqrt{\frac{(d_F - d_W)}{(d_F - d_L)} \times \frac{d_L}{d_W}}$$

where:

- Q_{water} = equivalent water flow capacity at Standard Conditions (STP).
- Q_{liq} = maximum flow of metered liquid.
- d_F = density of float selected, (see table 3), (g/ml).
- d_L = density of metered liquid, (g/ml).
- d_W = density of water at Standard Conditions (STP) (1.0 g/ml).

CALCULATION VS. CALIBRATION FOR P, Px, S, T and Tx METERS

In case of liquid flows at each major point along the scale, sample volumes are collected in a buret of a volumetric flask during measured time intervals. Volumes are interpolated to a unit of time such as for example [mL/min] or [cu. ft/hr] etc. A table or a graph is then constructed to establish a complete set of calibration data. In case of gas flows, calibration data can be similarly developed, except that collection of sample volumes is accomplished by means of gas sampling devices, the simplest of which is a “soap bubble” meter.

It is very important that the correction factors as calculated from the accompanying equations are used for sizing only. These relationships are greatly simplified and will not provide precise predictable flow corrections. It is always best practice to calibrate meters for non-standard conditions on site, by using reliable means of calibration.

TABLE 3 - FLOAT DENSITIES

| MATERIAL | DENSITY [g/ml] |
|-----------------|----------------|
| GLASS | 2.53 |
| SAPPHIRE | 3.98 |
| STAINLESS STEEL | 8.04 |
| CARBOLOY | 14.98 |
| TANTALUM | 16.58 |

TABLE 4 - CONVERSION FACTORS

| MULTIPLY | BY | TO OBTAIN |
|----------------------------|------------------------|---------------------|
| atm | 14.70 | lbs/sq. in. |
| atm | 1.0333 | kg/sq. cm. |
| lbs/square inch | 0.07031 | kg/sq. cm. |
| ml/min | 0.001 | liters/min. |
| ml/min | 3.531×10^{-5} | cu. ft/min. |
| ml/min | 1.585×10^{-2} | gal/hr. |
| cubic ft/hr | 472 | ml/min. |
| gal/min | 3785 | ml/min. |
| g/ml | 62.43 | lbs/cu. ft. |
| g/ml | 0.03613 | lbs/cu. in. |
| cc/mn | 1 | mL/min. |
| cfm (ft ³ /min) | 28.31 | L/min. |
| cfm (ft ³ /min) | 1.699 | m ³ /hr. |
| oz/min | 29.57 | mL/min. |

PRESSURE

| MULTIPLY | BY | TO OBTAIN |
|----------|-------|----------------------|
| PSI | 27.71 | in. H ₂ O |
| PSI | 2.036 | in. Hg |
| PSI | 703.1 | mm/H ₂ O |
| PSI | 51.75 | mm/Hg |
| PSI | .0703 | kg/cm ² |
| PSI | .0689 | bar |
| PSI | 68.95 | mbar |
| PSI | 6895 | Pa |
| PSI | 6.895 | kPa |

TEMPERATURE

$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$
 $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 0.555$
 $^{\circ}\text{Kelvin} = ^{\circ}\text{C} + 273.2$

LENGTH

| MULTIPLY | BY | TO OBTAIN |
|----------|-----------|-----------|
| Multiply | 2.54 | cm |
| Inch | 12 | inch |
| Ft. | 0.305 | meter |
| Yard | 1.094 | meter |
| Angstrom | 10^{10} | meter |

TABLE 5- DENSITY, VISCOSITY & SPECIFIC GRAVITY OF GASES

| GAS | DENSITY [g/ml] | VISCOSITY [centipols] | SPECIFIC GRAVITY G [air=1.0] |
|-------------------|----------------|-----------------------|------------------------------|
| Acetylene | 0.001090 | 0.00988 | 0.9073 |
| Air | 0.001200 | 0.01812 | 1.0000 |
| Ammonia | 0.000716 | 0.00994 | 0.5963 |
| Argon | 0.001660 | 0.02220 | 1.3796 |
| Butane | 0.002484 | 0.00848 | 2.0854 |
| Carbon Dioxide | 0.001835 | 0.01470 | 1.5290 |
| Carbon Monoxide | 0.001163 | 0.01750 | 0.9671 |
| Chlorine | 0.002983 | 0.01330 | 2.4860 |
| Ethane | 0.001260 | 0.00901 | 1.0493 |
| Ethylene | 0.001170 | 0.00994 | 0.9749 |
| Helium | 0.0001656 | 0.01980 | 0.13804 |
| Hydrogen | 0.0000834 | 0.00885 | 0.06952 |
| Hydrogen Chloride | 0.001512 | 0.01560 | 1.2678 |
| Methane | 0.0006653 | 0.01099 | 0.5544 |
| Nitrogen | 0.001160 | 0.01756 | 0.96724 |
| Nitrous Oxide | 0.001833 | 0.01453 | 1.5297 |
| Oxygen | 0.001326 | 0.02030 | 1.10527 |
| Propane | 0.001874 | 0.00805 | 1.5620 |
| Sulfur Dioxide | 0.002717 | 0.01270 | 2.2638 |

TABLES OF STANDARD FLOW CAPACITIES P, Px, T, Tx AND S METERS

TABLE 6
150mm Flow tubes (See Table 8 for Gas Flow Capacities)

| FLOW TUBE NUMBER | FLOW TUBE MAXIMUM FLOW RATE | | | |
|------------------|-----------------------------|--------|----------|-------|
| | AIR | | WATER | |
| | [mL/min] | [scfh] | [mL/min] | [gph] |
| 042-15-GL | 19 | 0.040 | 0.19 | 0.003 |
| 042-15-SA | 30 | 0.064 | 0.39 | 0.006 |
| 042-15-ST | 61 | 0.128 | 0.94 | 0.015 |
| 042-15-CA | 110 | 0.234 | 1.91 | 0.030 |
| 042-15-TA | 121 | 0.257 | 2.13 | 0.033 |
| 032-41-GL | 49 | 0.104 | 0.49 | 0.008 |
| 032-41-SA | 73 | 0.155 | 0.98 | 0.016 |
| 032-41-ST | 143 | 0.290 | 2.34 | 0.039 |
| 032-41-CA | 246 | 0.521 | 4.7 | 0.078 |
| 032-41-TA | 264 | 0.559 | 5.1 | 0.087 |
| 062-01-GL | 92 | 0.195 | 0.9 | 0.013 |
| 062-01-SA | 141 | 0.297 | 1.9 | 0.030 |
| 062-01-ST | 264 | 0.559 | 4.7 | 0.075 |
| 062-01-CA | 444 | 0.962 | 8.5 | 0.135 |
| 062-01-TA | 484 | 1.025 | 9.2 | 0.146 |
| 112-02-GL | 374 | 0.792 | 5.5 | 0.087 |
| 112-02-SA | 513 | 1.087 | 10.0 | 0.159 |
| 112-02-ST | 814 | 1.725 | 20.4 | 0.323 |
| 112-02-CA | 1222 | 2.589 | 33.7 | 0.534 |
| 112-02-TA | 1331 | 2.820 | 36.1 | 0.572 |
| 082-03-GL | 844 | 1.748 | 16.5 | 0.262 |
| 082-03-SA | 1093 | 2.316 | 26.1 | 0.414 |
| 082-03-ST | 1682 | 3.564 | 44.6 | 0.729 |
| 082-03-CA | 2423 | 5.133 | 70.5 | 1.117 |
| 082-03-TA | 2576 | 5.458 | 75.6 | 1.198 |
| 092-04-GL | 2313 | 4.900 | 54 | 0.848 |
| 092-04-SA | 3079 | 6.523 | 78 | 1.233 |
| 092-04-ST | 4562 | 9.665 | 133 | 2.067 |
| 092-04-CA | 6621 | 14.02 | 201 | 3.180 |
| 092-04-TA | 6932 | 14.68 | 212 | 3.357 |
| 102-05-GL | 3922 | 8.07 | 84 | 1.336 |
| 102-05-SA | 5188 | 10.60 | 126 | 2.002 |
| 102-05-ST | 7825 | 16.08 | 217 | 3.433 |
| 102-05-CA | 11371 | 22.94 | 329 | 5.219 |
| 102-05-TA | 11965 | 24.10 | 353 | 5.589 |
| 034-39-GL | 8505 | 18.38 | 210 | 3.32 |
| 034-39-SA | 11357 | 24.05 | 306 | 4.84 |
| 034-39-ST | 16737 | 35.46 | 506 | 8.02 |
| 034-39-CA | 23752 | 50.32 | 747 | 11.84 |
| 034-39-TA | 25252 | 53.50 | 790 | 12.52 |
| 044-40-GL | 23742 | 47.7 | 541 | 8.58 |
| 044-40-SA | 30711 | 62.6 | 806 | 12.77 |
| 044-40-ST | 45227 | 87.9 | 1288 | 20.41 |
| 044-40-CA | 66346 | 126.0 | 1881 | 29.81 |
| 044-40-TA | 69940 | 132.6 | 2001 | 31.72 |

TABLE 7
65mm Flow tubes (See Table 9 for Gas Flow Capacities)

| FLOW TUBE NUMBER | FLOW TUBE MAXIMUM FLOW RATE | | | |
|------------------|-----------------------------|--------|----------|-------|
| | AIR | | WATER | |
| | [mL/min] | [scfh] | [mL/min] | [gph] |
| 042-07-GL | 6 | 0.013 | 0.07 | 0.001 |
| 042-07-SA | 9 | 0.017 | 0.08 | 0.001 |
| 042-07-ST | 19 | 0.036 | 0.28 | 0.004 |
| 042-07-CA | 33 | 0.070 | 0.62 | 0.009 |
| 042-07-TA | 36 | 0.072 | 0.66 | 0.010 |
| 032-15-GL | 49 | 0.104 | 0.55 | 0.009 |
| 032-15-SA | 74 | 0.153 | 0.98 | 0.016 |
| 032-15-ST | 145 | 0.307 | 2.38 | 0.038 |
| 032-15-CA | 246 | 0.528 | 4.60 | 0.073 |
| 032-15-TA | 271 | 0.578 | 5.25 | 0.084 |
| 022-13-GL | 104 | 0.220 | 1.8 | 0.028 |
| 022-13-SA | 159 | 0.337 | 3.4 | 0.054 |
| 022-13-ST | 299 | 0.633 | 5.8 | 0.122 |
| 022-13-CA | 516 | 1.093 | 14.1 | 0.223 |
| 022-13-TA | 530 | 1.123 | 15.5 | 0.246 |
| 012-10-GL | 202 | 0.43 | 2.6 | 0.041 |
| 012-10-SA | 300 | 0.64 | 4.7 | 0.074 |
| 012-10-ST | 522 | 1.11 | 12.0 | 0.190 |
| 012-10-CA | 818 | 1.73 | 20.8 | 0.330 |
| 012-10-TA | 859 | 1.82 | 23.5 | 0.372 |
| 052-01-GL | 986 | 2.09 | 20.5 | 0.325 |
| 052-01-SA | 1299 | 2.75 | 34.0 | 0.539 |
| 052-01-ST | 1946 | 4.12 | 55.6 | 0.881 |
| 052-01-CA | 2827 | 5.99 | 88.5 | 1.403 |
| 052-01-TA | 3020 | 6.40 | 94.0 | 1.490 |
| 023-92-GL | 1249 | 2.65 | 25 | 0.428 |
| 023-92-SA | 1623 | 3.44 | 37 | 0.586 |
| 023-92-ST | 2520 | 5.34 | 71 | 1.125 |
| 023-92-CA | 3680 | 7.80 | 104 | 1.648 |
| 013-88-GL | 2040 | 4.32 | 40 | 0.63 |
| 013-88-SA | 2704 | 5.73 | 61 | 0.97 |
| 013-88-ST | 3990 | 8.45 | 108 | 1.71 |
| 013-88-CA | 5739 | 12.16 | 170 | 2.69 |
| 365-02-GL | 2678 | 5.67 | 52 | 0.82 |
| 365-02-ST | 4922 | 10.40 | 150 | 2.38 |
| 014-96-GL | 6318 | 13.4 | 147 | 2.33 |
| 014-96-SA | 8145 | 17.3 | 217 | 3.44 |
| 014-96-ST | 12058 | 25.5 | 364 | 5.77 |
| 014-96-CA | 17153 | 36.3 | 540 | 8.56 |
| 014-96-TA | 18213 | 38.6 | 568 | 9.00 |
| 054-17-GL | 13153 | 27.9 | 309 | 4.90 |
| 054-17-SA | 16980 | 36.0 | 456 | 7.23 |
| 054-17-ST | 24680 | 52.3 | 745 | 11.8 |
| 054-17-CA | 35320 | 74.8 | 1110 | 17.59 |
| 054-17-TA | 37589 | 79.6 | 1182 | 18.73 |
| 064-63-GL | 23169 | 49.1 | 522 | 8.27 |
| 064-63-SA | 29218 | 61.9 | 798 | 12.65 |
| 064-63-ST | 42094 | 89.2 | 1261 | 19.97 |
| 064-63-CA | 58500 | 123.9 | 1866 | 29.58 |
| 064-63-TA | 62100 | 131.6 | 2027 | 32.13 |

*SUFFIX REFERS TO FLOAT MATERIALS;

- GL = Black Glass
- SA = Sapphire (red)
- ST = 316 Stainless Steel
- CA = Carboloy®
- TA = Tantalum

TABLE OF STANDARD FLOW CAPACITIES P, Px, T, Tx AND S METERS

TABLE 8 - 150mm FLOW TUBES, GAS FLOW CAPACITIES OF ROUTINE GASES

| FLOW TUBE MAXIMUM FLOW RATES | | | | | | | | | | | | |
|------------------------------|----------|--------|----------------|--------|----------|--------|----------|--------|----------|--------|----------|--------|
| FLOW TUBE NUMBER | ARGON | | CARBON DIOXIDE | | HELIUM | | HYDROGEN | | NITROGEN | | OXYGEN | |
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] |
| 042-15-GL | 15 | 0.033 | 23 | 0.050 | 16 | 0.034 | 37 | 0.078 | 20 | 0.041 | 17 | 0.036 |
| 042-15-SA | 24 | 0.052 | 37 | 0.078 | 26 | 0.054 | 59 | 0.126 | 31 | 0.066 | 27 | 0.057 |
| 042-15-ST | 49 | 0.104 | 72 | 0.153 | 53 | 0.112 | 123 | 0.260 | 62 | 0.132 | 54 | 0.115 |
| 042-15-CA | 90 | 0.192 | 127 | 0.269 | 101 | 0.214 | 232 | 0.491 | 114 | 0.241 | 99 | 0.210 |
| 042-15-TA | 99 | 0.211 | 139 | 0.294 | 112 | 0.238 | 256 | 0.543 | 125 | 0.265 | 109 | 0.231 |
| 032-41-GL | 44 | 0.093 | 56 | 0.121 | 46 | 0.100 | 94 | 0.212 | 48 | 0.119 | 42 | 0.104 |
| 032-41-SA | 60 | 0.127 | 84 | 0.178 | 69 | 0.148 | 149 | 0.318 | 76 | 0.161 | 70.4 | 0.149 |
| 032-41-ST | 113 | 0.239 | 150 | 0.318 | 133 | 0.282 | 301 | 0.646 | 143 | 0.303 | 131 | 0.278 |
| 032-41-CA | 202 | 0.428 | 251 | 0.532 | 260 | 0.551 | 567 | 1.258 | 255 | 0.540 | 228 | 0.483 |
| 032-41-TA | 222 | 0.470 | 263 | 0.557 | 288 | 0.610 | 602 | 1.390 | 274 | 0.581 | 244 | 0.517 |
| 062-01-GL | 76 | 0.161 | 103 | 0.218 | 90 | 0.191 | 208 | 0.441 | 92 | 0.195 | 81 | 0.172 |
| 062-01-SA | 111 | 0.235 | 157 | 0.333 | 142 | 0.301 | 322 | 0.682 | 139 | 0.294 | 121 | 0.256 |
| 062-01-ST | 218 | 0.462 | 281 | 0.595 | 283 | 0.600 | 627 | 1.328 | 271 | 0.574 | 233 | 0.494 |
| 062-01-CA | 373 | 0.790 | 445 | 0.943 | 519 | 1.100 | 1120 | 2.373 | 462 | 0.979 | 407 | 0.862 |
| 062-01-TA | 393 | 0.833 | 470 | 0.996 | 555 | 1.176 | 1225 | 2.595 | 495 | 1.049 | 433 | 0.917 |
| 112-02-GL | 305 | 0.646 | 355 | 0.752 | 450 | 0.953 | 1021 | 2.163 | 382 | 0.809 | 340 | 0.720 |
| 112-02-SA | 429 | 0.909 | 472 | 1.000 | 681 | 1.443 | 1497 | 3.172 | 520 | 1.102 | 472 | 1.000 |
| 112-02-ST | 676 | 1.432 | 728 | 1.542 | 1290 | 2.733 | 2496 | 5.288 | 824 | 1.746 | 753 | 1.595 |
| 112-02-CA | 1020 | 2.161 | 1072 | 2.271 | 2221 | 4.706 | 3876 | 8.212 | 1220 | 2.585 | 1131 | 2.396 |
| 112-02-TA | 1085 | 2.299 | 1134 | 2.403 | 2356 | 4.992 | 4257 | 9.019 | 1310 | 2.775 | 1206 | 2.555 |
| 082-03-GL | 687 | 1.46 | 725 | 1.54 | 1490 | 3.16 | 2620 | 5.55 | 827 | 1.75 | 772 | 1.64 |
| 082-03-SA | 910 | 1.93 | 944 | 2.00 | 2059 | 4.36 | 3546 | 7.51 | 1110 | 2.35 | 1024 | 2.18 |
| 082-03-ST | 1380 | 2.92 | 1420 | 3.01 | 3397 | 7.20 | 5547 | 11.75 | 1662 | 3.52 | 1545 | 3.27 |
| 082-03-CA | 1996 | 4.23 | 2039 | 4.32 | 5120 | 10.85 | 8170 | 17.31 | 2405 | 5.10 | 2246 | 4.76 |
| 082-03-TA | 2131 | 4.51 | 2163 | 4.58 | 5437 | 11.52 | 8717 | 18.47 | 2575 | 5.46 | 2364 | 5.01 |
| 092-04-GL | 1949 | 4.13 | 2048 | 4.34 | 4880 | 10.34 | 7817 | 16.56 | 2395 | 5.07 | 2169 | 4.60 |
| 092-04-SA | 2605 | 5.52 | 2620 | 5.55 | 6458 | 13.68 | 10455 | 22.15 | 3142 | 6.66 | 2860 | 6.06 |
| 092-04-ST | 3903 | 8.27 | 3990 | 8.45 | 9770 | 20.70 | 15855 | 33.59 | 4685 | 9.93 | 4341 | 9.20 |
| 092-04-CA | 5665 | 12.00 | 5743 | 12.17 | 14500 | 30.72 | 22790 | 48.28 | 6845 | 14.50 | 6307 | 13.36 |
| 092-04-TA | 6040 | 12.80 | 6018 | 12.75 | 15420 | 32.67 | 24252 | 51.38 | 7080 | 15.00 | 6690 | 14.17 |
| 102-05-GL | 3151 | 6.68 | 3374 | 7.15 | 7803 | 16.53 | 13105 | 27.76 | 3868 | 8.19 | 3485 | 7.38 |
| 102-05-SA | 4175 | 8.85 | 4388 | 9.30 | 10336 | 21.89 | 16108 | 34.13 | 5090 | 10.78 | 4652 | 9.86 |
| 102-05-ST | 6384 | 13.54 | 6308 | 13.36 | 15960 | 33.82 | 27804 | 58.91 | 7722 | 16.36 | 6992 | 14.81 |
| 102-05-CA | 9069 | 19.21 | 9069 | 19.21 | 23509 | 49.81 | 37553 | 79.57 | 10973 | 23.25 | 10082 | 21.36 |
| 102-05-TA | 9627 | 20.40 | 9475 | 20.07 | 25131 | 53.24 | 39998 | 84.74 | 11628 | 24.64 | 10741 | 22.76 |
| 034-39-GL | 7366 | 15.61 | 7485 | 15.86 | 19426 | 41.16 | 29840 | 63.22 | 8916 | 18.89 | 8269 | 17.52 |
| 034-39-SA | 9539 | 20.21 | 9557 | 20.25 | 25400 | 53.81 | 40006 | 84.76 | 11524 | 24.42 | 10706 | 22.68 |
| 034-39-ST | 14131 | 29.94 | 14051 | 29.77 | 38576 | 81.73 | 59996 | 127.1 | 17021 | 36.06 | 15710 | 33.28 |
| 034-39-CA | 20166 | 42.72 | 19854 | 42.06 | 56220 | 119.1 | 83052 | 175.9 | 24071 | 51.00 | 22432 | 47.53 |
| 034-39-TA | 21414 | 45.37 | 21115 | 44.74 | 60596 | 128.3 | 90410 | 191.5 | 25709 | 54.47 | 23790 | 50.40 |
| 044-40-GL | 19761 | 41.9 | 18989 | 40.2 | 53100 | 112.5 | 85812 | 181.8 | 23512 | 49.8 | 21350 | 45.2 |
| 044-40-SA | 24563 | 52.0 | 23855 | 50.6 | 70100 | 148.5 | 110100 | 233.2 | 29930 | 63.4 | 27181 | 57.5 |
| 044-40-ST | 35300 | 74.8 | 34287 | 72.6 | 103647 | 219.6 | 159699 | 338.3 | 43000 | 91.1 | 39567 | 83.8 |
| 044-40-CA | 47890 | 101.4 | 46311 | 98.1 | 146500 | 310.4 | 221872 | 470.0 | 59580 | 126.2 | 54902 | 116.3 |
| 044-40-TA | 51997 | 110.2 | 49009 | 103.8 | 189826 | 402.2 | 234423 | 496.6 | 63826 | 135.2 | 57960 | 122.8 |

*Suffix refers to float materials: G = black glass, S = sapphire (red), ST = 316 stainless steel, C = Carboloy®, T = tantalum.

Flow capacities shown in Tables 4, 5, 6 and 7 are based on calibrations at standard (STP) conditions (70 °F /21.1 °C and 14.7psia/1 atm abs). For fluids other than air or water at STP conditions see paragraph on METER SIZING on page 41. For special OEM requirements call toll free 1-800-866-3837.

for direct reading (engineering units) scale flow tubes contact the company or visit us at www.aalborg.com

TABLE OF STANDARD FLOW CAPACITIES P, Px, T, Tx AND S METERS

TABLE 9 - 65mm FLOW TUBES, GAS FLOW CAPACITIES OF ROUTINE GASES

| FLOW TUBE MAXIMUM FLOW RATES | | | | | | | | | | | | |
|------------------------------|----------|--------|----------------|--------|----------|--------|----------|--------|----------|--------|----------|--------|
| FLOW TUBE NUMBER | ARGON | | CARBON DIOXIDE | | HELIUM | | HYDROGEN | | NITROGEN | | OXYGEN | |
| | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] | [mL/min] | [scfh] |
| 042-07-GL | 4 | 0.01 | 6.5 | 0.01 | 5.5 | 0.01 | 9.6 | 0.02 | 5.6 | 0.01 | 5 | 0.01 |
| 042-07-SA | 7.7 | 0.02 | 10 | 0.02 | 8 | 0.02 | 15.3 | 0.03 | 8.5 | 0.02 | 7 | 0.01 |
| 042-07-ST | 14 | 0.03 | 20 | 0.04 | 16 | 0.03 | 32.3 | 0.07 | 18 | 0.04 | 15 | 0.03 |
| 042-07-CA | 28 | 0.06 | 39 | 0.08 | 30 | 0.06 | 53.6 | 0.11 | 34 | 0.07 | 29 | 0.06 |
| 042-07-TA | 29 | 0.06 | 40 | 0.08 | 32 | 0.07 | 64.8 | 0.14 | 34 | 0.07 | 30 | 0.06 |
| 032-15-GL | 38 | 0.08 | 59 | 0.13 | 47 | 0.10 | 100 | 0.21 | 51 | 0.11 | 46 | 0.10 |
| 032-15-SA | 63 | 0.13 | 90 | 0.19 | 71 | 0.15 | 150 | 0.32 | 78 | 0.17 | 72 | 0.15 |
| 032-15-ST | 122 | 0.26 | 160 | 0.34 | 146 | 0.31 | 314 | 0.67 | 149 | 0.32 | 132 | 0.28 |
| 032-15-CA | 214 | 0.45 | 263 | 0.56 | 274 | 0.58 | 593 | 1.26 | 264 | 0.56 | 239 | 0.51 |
| 032-15-TA | 224 | 0.47 | 279 | 0.59 | 294 | 0.62 | 654 | 1.39 | 276 | 0.58 | 248 | 0.53 |
| 022-13-GL | 86 | 0.18 | 122 | 0.26 | 99 | 0.21 | 284 | 0.60 | 113 | 0.24 | 94 | 0.20 |
| 022-13-SA | 131 | 0.28 | 181 | 0.38 | 157 | 0.33 | 435 | 0.92 | 167 | 0.35 | 147 | 0.31 |
| 022-13-ST | 246 | 0.52 | 310 | 0.66 | 313 | 0.66 | 700 | 1.75 | 312 | 0.66 | 268 | 0.57 |
| 022-13-CA | 420 | 0.89 | 494 | 1.05 | 604 | 1.28 | 1500 | 3.18 | 524 | 1.11 | 456 | 0.97 |
| 022-13-TA | 446 | 0.94 | 519 | 1.10 | 632 | 1.34 | 1553 | 3.29 | 563 | 1.19 | 486 | 1.03 |
| 012-10-GL | 174 | 0.37 | 221 | 0.47 | 211 | 0.45 | 502 | 1.06 | 215 | 0.46 | 189 | 0.40 |
| 012-10-SA | 257 | 0.54 | 307 | 0.65 | 327 | 0.69 | 788 | 1.67 | 312 | 0.66 | 279 | 0.59 |
| 012-10-ST | 429 | 0.91 | 489 | 1.04 | 636 | 1.35 | 1488 | 3.15 | 530 | 1.12 | 480 | 1.02 |
| 012-10-CA | 685 | 1.45 | 735 | 1.56 | 1185 | 2.51 | 2455 | 5.20 | 838 | 1.78 | 761 | 1.61 |
| 012-10-TA | 724 | 1.53 | 775 | 1.64 | 1300 | 2.75 | 2728 | 5.78 | 877 | 1.86 | 800 | 1.69 |
| 052-01-GL | 829 | 1.76 | 883 | 1.87 | 1903 | 4.03 | 3212 | 6.82 | 1015 | 2.15 | 970 | 2.06 |
| 052-01-SA | 1095 | 2.32 | 1143 | 2.42 | 2606 | 5.52 | 4215 | 8.93 | 1321 | 2.80 | 1217 | 2.58 |
| 052-01-ST | 1645 | 3.49 | 1699 | 3.60 | 4128 | 8.75 | 6598 | 13.98 | 1983 | 4.20 | 1842 | 3.90 |
| 052-01-CA | 2415 | 5.12 | 2438 | 5.17 | 6175 | 13.08 | 9450 | 20.02 | 2900 | 6.14 | 2676 | 5.67 |
| 052-01-TA | 2559 | 5.42 | 2587 | 5.48 | 6588 | 13.96 | 10332 | 21.89 | 3063 | 6.49 | 2837 | 6.01 |
| 023-92-GL | 1065 | 2.26 | 1110 | 2.35 | 1990 | 4.22 | 3923 | 8.31 | 1293 | 2.74 | 1165 | 2.47 |
| 023-92-SA | 1395 | 2.96 | 1500 | 3.18 | 2950 | 6.25 | 5258 | 11.14 | 1710 | 3.62 | 1575 | 3.34 |
| 023-92-ST | 2124 | 4.50 | 2190 | 4.64 | 4970 | 10.53 | 8602 | 18.22 | 2610 | 5.53 | 2360 | 5.00 |
| 023-92-CA | 3125 | 6.62 | 3210 | 6.80 | 7675 | 16.26 | 12850 | 27.22 | 3820 | 8.09 | 3485 | 7.38 |
| 013-88-GL | 1784 | 3.78 | 1794 | 3.80 | 3470 | 7.35 | 6359 | 13.47 | 2091 | 4.43 | 1928 | 4.08 |
| 013-88-SA | 2279 | 4.83 | 2314 | 4.90 | 4932 | 10.45 | 9130 | 19.34 | 2859 | 6.06 | 2522 | 5.34 |
| 013-88-ST | 3388 | 7.18 | 3449 | 7.31 | 8699 | 18.43 | 13600 | 28.81 | 4097 | 8.68 | 3761 | 7.97 |
| 013-88-CA | 4904 | 10.39 | 4937 | 10.46 | 13227 | 28.02 | 19682 | 41.70 | 5928 | 12.56 | 5380 | 11.40 |
| 365-02-GL | 2171 | 4.60 | 2237 | 4.74 | 4853 | 10.28 | 9410 | 19.94 | 2624 | 5.56 | 2323 | 4.92 |
| 365-02-ST | 4172 | 8.84 | 4225 | 8.95 | 10947 | 23.19 | 16857 | 38.06 | 5026 | 10.65 | 4733 | 10.03 |
| 014-96-GL | 5290 | 11.21 | 5470 | 11.59 | 13750 | 29.13 | 21712 | 46.00 | 6380 | 13.52 | 5880 | 124.5 |
| 014-96-SA | 6900 | 14.62 | 6980 | 14.79 | 18500 | 39.19 | 28211 | 59.77 | 8280 | 17.54 | 7640 | 16.19 |
| 014-96-ST | 10175 | 21.56 | 10150 | 21.50 | 27300 | 57.84 | 42040 | 89.07 | 12200 | 25.85 | 11250 | 23.83 |
| 014-96-CA | 14150 | 29.98 | 14200 | 30.08 | 39500 | 83.69 | 58498 | 123.9 | 17050 | 36.12 | 15875 | 33.63 |
| 014-96-TA | 15300 | 32.42 | 15050 | 31.89 | 41400 | 87.71 | 63804 | 135.1 | 18250 | 38.67 | 16700 | 35.38 |
| 054-17-GL | 11125 | 23.57 | 11156 | 23.64 | 29762 | 63.1 | 47100 | 99.8 | 13412 | 28.42 | 12341 | 26.15 |
| 054-17-SA | 14389 | 30.49 | 14256 | 30.20 | 38731 | 82.1 | 61715 | 130.7 | 17351 | 36.76 | 16047 | 34.00 |
| 054-17-ST | 21116 | 44.74 | 20798 | 44.06 | 58472 | 123.8 | 90323 | 191.3 | 25311 | 53.63 | 23322 | 49.41 |
| 054-17-CA | 30126 | 63.83 | 29156 | 61.77 | 84632 | 179.3 | 130805 | 277.1 | 35830 | 75.91 | 33287 | 70.52 |
| 054-17-TA | 31622 | 67.00 | 31126 | 65.94 | 88862 | 188.2 | 139224 | 294.9 | 37724 | 79.92 | 35738 | 75.72 |
| 064-63-GL | 19817 | 42.0 | 19379 | 41.1 | 51380 | 108.8 | 80752 | 171.0 | 23506 | 49.80 | 21686 | 45.9 |
| 064-63-SA | 24597 | 52.1 | 24630 | 52.2 | 67754 | 143.5 | 106000 | 224.5 | 30337 | 64.27 | 27901 | 59.1 |
| 064-63-ST | 37441 | 79.3 | 35100 | 74.4 | 104600 | 221.6 | 154750 | 327.8 | 43487 | 92.13 | 40053 | 84.9 |
| 064-63-CA | 50200 | 106.3 | 47950 | 101.5 | 148114 | 313.8 | 220500 | 467.1 | 60618 | 128.4 | 55539 | 117.6 |
| 064-63-TA | 52850 | 111.9 | 53200 | 112.7 | 156500 | 331.5 | 222300 | 470.9 | 64051 | 135.7 | 58300 | 123.5 |

TABLE OF FLOW CAPACITIES at 50 PSIG for GAS PROPORTIONERS

TABLE 10 - 150mm FLOW TUBES, GAS FLOW CAPACITIES FOR GAS PROPORTIONERS at 50 PSIG

| FLOW TUBE MAXIMUM FLOW RATES | | | | | | | |
|------------------------------|--------------|----------------|-------------------------|-----------------|-------------------|-------------------|-----------------|
| FLOW TUBE NUMBER | AIR [mL/min] | ARGON [mL/min] | CARBON DIOXIDE [mL/min] | HELIUM [mL/min] | HYDROGEN [mL/min] | NITROGEN [mL/min] | OXYGEN [mL/min] |
| 042-15-GL | 83 | 67 | 97 | 73 | 169 | 85 | 74 |
| 042-15-SA | 127 | 104 | 146 | 117 | 267 | 131 | 114 |
| 042-15-ST | 242 | 200 | 265 | 241 | 535 | 249 | 218 |
| 042-15-CA | 415 | 343 | 437 | 450 | 967 | 426 | 376 |
| 032-41-GL | 191 | 161 | 195 | 203 | 399 | 197 | 166 |
| 032-41-SA | 270 | 229 | 302 | 279 | 662 | 283 | 246 |
| 032-41-ST | 460 | 383 | 574 | 478 | 1185 | 471 | 442 |
| 032-41-CA | 743 | 625 | 1094 | 702 | 2013 | 771 | 719 |
| 062-01-GL | 324 | 270 | 346 | 333 | 844 | 331 | 294 |
| 062-01-SA | 505 | 412 | 494 | 569 | 1209 | 467 | 460 |
| 062-01-ST | 825 | 687 | 771 | 1089 | 2432 | 833 | 764 |
| 062-01-CA | 1275 | 1062 | 1132 | 1972 | 3732 | 1303 | 1175 |
| 112-02-GL | 1086 | 855 | 934 | 1779 | 3110 | 1016 | 930 |
| 112-02-SA | 1324 | 1115 | 1168 | 2468 | 4289 | 1340 | 1228 |
| 112-02-ST | 2024 | 1717 | 1724 | 4083 | 6740 | 2034 | 1905 |
| 112-02-CA | 2912 | 2472 | 2521 | 6927 | 9979 | 2997 | 2703 |
| 082-03-GL | 2008 | 1697 | 1747 | 4214 | 6711 | 2039 | 1865 |
| 082-03-SA | 2590 | 2186 | 2264 | 5656 | 8995 | 2643 | 2503 |
| 082-03-ST | 3903 | 3274 | 3343 | 8669 | 14490 | 3731 | 3685 |
| 082-03-CA | 5547 | 4697 | 4691 | 12717 | 19993 | 6169 | 5210 |
| 092-04-GL | 5528 | 4794 | 4954 | 12540 | 18862 | 5801 | 5381 |
| 092-04-SA | 7240 | 6163 | 6217 | 15703 | 25235 | 7415 | 6826 |
| 092-04-ST | 10813 | 9077 | 9178 | 24629 | 38556 | 11044 | 10335 |
| 092-04-CA | 15322 | 12904 | 12879 | 34709 | 55936 | 15433 | 14451 |
| 102-05-GL | 9294 | 7705 | 7888 | 19830 | 30900 | 9419 | 8749 |
| 102-05-SA | 11647 | 9969 | 10042 | 26008 | 45263 | 11955 | 11137 |
| 102-05-ST | 17311 | 14489 | 14420 | 40831 | 60300 | 17525 | 16353 |
| 102-05-CA | 24065 | 20744 | 20099 | 59702 | 86369 | 24549 | 22905 |
| 034-39-GL | 19767 | 17978 | 17936 | 48193 | 73500 | 21676 | 19931 |
| 034-39-SA | 27514 | 32001 | 54010 | 63240 | 97000 | 27449 | 25800 |
| 034-39-ST | 38995 | 33778 | 33087 | 98676 | 142000 | 40086 | 36821 |
| 034-39-CA | 55293 | 47151 | 45745 | 139847 | 200500 | 55930 | 52494 |
| 044-40-GL | 49374 | 41899 | 40520 | 125617 | 182239 | 50258 | 46851 |
| 044-40-SA | 62480 | 53038 | 51220 | 159976 | 231239 | 63595 | 59304 |
| 044-40-ST | 89880 | 76322 | 73584 | 231946 | 333775 | 91478 | 85341 |
| 044-40-CA | 123846 | 105182 | 101303 | 321265 | 460942 | 126041 | 117615 |

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DIRECT READING SCALES FOR P, Px AND S METERS

| TABLE 11 - FLOW TUBES FOR AIR | | | | | | | |
|-------------------------------|---------|---------|------------|-----------|--------|---------|------------|
| 65mm | | | | 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 042-10-GL | 7.00 | mL/min | 14.70 psia | 042-12-SA | 25.00 | mL/min | 14.70 psia |
| 032-01-ST | 50.00 | mL/min | 14.70 psia | 032-06-SA | 52.00 | mL/min | 14.70 psia |
| 062-04-ST | 75.00 | mL/min | 14.70 psia | 042-06-CA | 75.00 | mL/min | 14.70 psia |
| 022-14-GL | 100.00 | mL/min | 14.70 psia | 032-10-ST | 100.00 | mL/min | 14.70 psia |
| 032-11-ST | 130.00 | mL/min | 14.70 psia | 042-75-CA | 100.00 | mL/min | 14.70 psia |
| 032-03-CA | 250.00 | mL/min | 14.70 psia | 032-21-ST | 150.00 | mL/min | 14.70 psia |
| 022-05-CA | 500.00 | mL/min | 14.70 psia | 062-03-ST | 200.00 | mL/min | 14.70 psia |
| 052-12-GL | 1000.00 | mL/min | 14.70 psia | 112-10-GL | 300.00 | mL/min | 14.70 psia |
| 052-04-GL | 1.00 | L/min | 14.70 psia | 112-08-SA | 500.00 | mL/min | 14.70 psia |
| 023-03-GL | 1.15 | L/min | 14.70 psia | 082-02-GL | 800.00 | mL/min | 14.70 psia |
| 052-07-ST | 2.00 | L/min | 14.70 psia | 112-19-CA | 1.25 | L/min | 14.70 psia |
| 013-89-ST | 4.00 | L/min | 14.70 psia | 082-12-ST | 1.80 | L/min | 14.70 psia |
| 014-03-GL | 5.00 | L/min | 14.70 psia | 092-25-GL | 2.50 | L/min | 14.70 psia |
| 014-02-ST | 10.00 | L/min | 14.70 psia | 102-07-GL | 4.00 | L/min | 14.70 psia |
| 044-11-ST | 16.00 | L/min | 14.70 psia | 102-03-SA | 4.50 | L/min | 14.70 psia |
| 054-01-ST | 25.00 | L/min | 14.70 psia | 092-14-ST | 4.80 | L/min | 14.70 psia |
| 064-03-ST | 40.00 | L/min | 14.70 psia | 102-01-SA | 5.00 | L/min | 14.70 psia |
| 052-05-GL | 2.20 | scfh | 14.70 psia | 034-62-GL | 10.00 | L/min | 14.70 psia |
| 365-18-GL | 6.00 | scfh | 14.70 psia | 102-16-CA | 10.00 | L/min | 14.70 psia |
| 365-19-ST | 10.00 | scfh | 14.70 psia | 034-13-ST | 17.00 | L/min | 14.70 psia |
| 034-61-ST | 18.00 | scfh | 14.70 psia | 044-14-GL | 23.00 | L/min | 14.70 psia |
| 014-17-ST | 25.00 | scfh | 14.70 psia | 044-41-ST | 42.00 | L/min | 14.70 psia |
| 054-02-ST | 50.00 | scfh | 14.70 psia | 044-16-CA | 60.00 | L/min | 14.70 psia |
| 064-62-ST | 90.00 | scfh | 14.70 psia | 112-01-CA | 2.50 | scfh | 14.70 psia |
| 074-02-CA | 150.00 | scfh | 14.70 psia | 092-09-GL | 5.00 | scfh | 14.70 psia |
| 014-01-CA | 0.60 | scfm | 14.70 psia | 102-06-GL | 8.25 | scfh | 14.70 psia |
| | | | | 092-10-ST | 10.00 | scfh | 14.70 psia |
| | | | | 102-08-ST | 16.50 | scfh | 14.70 psia |
| | | | | 102-09-CA | 23.00 | scfh | 14.70 psia |
| | | | | 044-05-GL | 55.00 | scfh | 14.70 psia |
| | | | | 044-18-ST | 90.00 | scfh | 14.70 psia |
| | | | | 044-07-ST | 94.00 | scfh | 14.70 psia |
| | | | | 044-23-SA | 1.00 | scfm | 14.70 psia |
| | | | | 044-43-ST | 1.50 | scfm | 14.70 psia |

| TABLE 12 - FLOW TUBES FOR WATER | | | | | | | |
|---------------------------------|--------|---------|------------|-----------|--------|---------|------------|
| 65mm | | | | 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 032-04-GL | 0.50 | mL/min | 14.70 psia | 032-05-SA | 1.00 | mL/min | 14.70 psia |
| 022-08-ST | 6.00 | mL/min | 14.70 psia | 112-12-SA | 10.00 | mL/min | 14.70 psia |
| 052-09-GL | 25.00 | mL/min | 14.70 psia | 112-05-ST | 20.00 | mL/min | 14.70 psia |
| 052-08-ST | 60.00 | mL/min | 14.70 psia | 092-02-GL | 50.00 | mL/min | 14.70 psia |
| 013-02-ST | 115.00 | mL/min | 14.70 psia | 092-08-GL | 60.00 | mL/min | 14.70 psia |
| 365-01-ST | 150.00 | mL/min | 14.70 psia | 102-11-GL | 100.00 | mL/min | 14.70 psia |
| 044-09-GL | 250.00 | mL/min | 14.70 psia | 092-06-CA | 200.00 | mL/min | 14.70 psia |
| 064-05-GL | 500.00 | mL/min | 14.70 psia | 044-15-ST | 1.20 | L/min | 14.70 psia |
| 054-03-ST | 750.00 | mL/min | 14.70 psia | 044-01-TA | 2.00 | L/min | 14.70 psia |
| 064-04-SA | 1.00 | L/min | 14.70 psia | 044-12-SA | 0.22 | gpm | 14.70 psia |
| 064-06-ST | 1.20 | L/min | 14.70 psia | 044-42-CA | 0.45 | gpm | 14.70 psia |
| 052-16-ST | 3.00 | L/hr | 14.70 psia | 044-10-CA | 29.00 | gph | 14.70 psia |
| 034-74-ST | 2.7 | gph | 14.70 psia | | | | |
| 064-12-GL | 10.00 | gph | 14.70 psia | | | | |
| 064-09-CA | 24.00 | gph | 14.70 psia | | | | |
| 064-11-TA | 32.00 | gph | 14.70 psia | | | | |

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TABLE 13 - FLOW TUBES FOR ARGON

| 65mm | | | | 150mm | | | |
|-----------|---------|---------|------------|-----------|--------|---------|------------|
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 052-15-SA | 1000.00 | mL/min | 14.70 psia | 062-10-CA | 325.00 | mL/min | 14.70 psia |
| 013-09-CA | 4.5 | L/min | 14.70 psia | 032-18-GL | 33.00 | mL/min | 14.70 psia |
| 064-14-SA | 26.00 | L/min | 14.70 psia | 082-11-CA | 2.00 | L/min | 14.70 psia |
| 023-05-GL | 2.50 | scfh | 14.70 psia | 034-07-ST | 15.00 | L/min | 14.70 psia |
| 365-17-ST | 10.00 | scfh | 14.70 psia | 044-22-SA | 25.00 | L/min | 14.70 psia |
| 014-14-ST | 22.00 | scfh | 14.70 psia | | | | |
| 064-01-GL | 50.00 | scfh | 14.70 psia | | | | |

TABLE 14 - FLOW TUBES FOR CARBON DIOXIDE

| 65mm | | | | 150mm | | | |
|-----------|--------|---------|------------|-----------|--------|---------|------------|
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 042-20-SA | 10.00 | mL/min | 14.70 psia | 062-09-GL | 100.00 | mL/min | 14.70 psia |
| 042-09-ST | 20.00 | mL/min | 14.70 psia | 032-32-ST | 150.00 | mL/min | 14.70 psia |
| 032-20-GL | 55.00 | mL/min | 14.70 psia | 062-14-ST | 300.00 | mL/min | 14.70 psia |
| 022-24-SA | 220.00 | mL/min | 14.70 psia | 092-18-SA | 2.5 | L/min | 14.70 psia |
| 052-14-GL | 1.00 | L/min | 14.70 psia | 034-18-SA | 10.00 | L/min | 14.70 psia |
| 023-07-ST | 2.00 | L/min | 14.70 psia | | | | |
| 014-18-GL | 6.00 | L/min | 14.70 psia | | | | |
| 014-19-ST | 10.00 | L/min | 14.70 psia | | | | |
| 064-08-ST | 35.00 | L/min | 14.70 psia | | | | |

TABLE 15 - DIRECT READING FLOW TUBES FOR FUEL OIL

| 150mm | | | |
|-----------|------|---------|------------|
| FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 034-60-GL | 3.00 | gph | 14.70 psia |

TABLE 16 - DIRECT READING FLOW TUBES FOR HELIUM

| 65mm | | | | 150mm | | | |
|-----------|--------|---------|------------|-----------|---------|---------|------------|
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 032-07-SA | 65.00 | mL/min | 14.70 psia | 062-13-GL | 100.00 | mL/min | 14.70 psia |
| 022-02-GL | 120.00 | mL/min | 14.70 psia | 062-07-CA | 500.00 | mL/min | 14.70 psia |
| 014-04-GL | 30.00 | scfh | 14.70 psia | 082-05-GL | 1500.00 | mL/min | 14.70 psia |
| | | | | 082-07-CA | 5.00 | L/min | 14.70 psia |
| | | | | 034-09-ST | 40.00 | L/min | 14.70 psia |
| | | | | 112-03-SA | 1.25 | scfh | 14.70 psia |

TABLE 17 - DIRECT READING FLOW TUBES FOR HYDROGEN

| 65mm | | | | 150mm | | | |
|-----------|--------|---------|------------|-----------|--------|---------|------------|
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 032-13-GL | 35.00 | mL/min | 14.70 psia | 032-12-GL | 100.00 | mL/min | 14.70 psia |
| 042-01-ST | 100.00 | mL/min | 14.70 psia | 092-15-SA | 20.00 | scfh | 14.70 psia |
| 032-02-SA | 150.00 | mL/min | 14.70 psia | 044-20-SA | 225.00 | scfh | 14.70 psia |
| 012-01-GL | 600.00 | mL/min | 14.70 psia | | | | |
| 022-01-CA | 1.50 | L/min | 14.70 psia | | | | |
| 023-01-GL | 3.50 | L/min | 14.70 psia | | | | |
| 013-01-GL | 6.00 | L/min | 14.70 psia | | | | |
| 014-15-ST | 42.00 | L/min | 14.70 psia | | | | |
| 013-08-ST | 30.00 | scfh | 14.70 psia | | | | |

DIRECT READING SCALES FOR P, P_x AND S METERS

| TABLE 18- DIRECT READING FLOW TUBES FOR METHANE | | | |
|---|-------|---------|------------|
| 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 042-03-ST | 40.00 | mL/min | 14.70 psia |

| TABLE 19- DIRECT READING FLOW TUBES FOR NITROUS OXIDE | | | |
|---|--------|---------|------------|
| 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 112-11-SA | 500.00 | mL/min | 14.70 psia |

| TABLE 20 - DIRECT READING FLOW TUBES FOR NITROGEN | | | | | | | |
|---|--------|---------|------------|-----------|--------|---------|------------|
| 65mm | | | | 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 042-08-GL | 6.00 | mL/min | 14.70 psia | 062-12-GL | 100.00 | mL/min | 14.70 psia |
| 032-16-ST | 50.00 | mL/min | 14.70 psia | 032-22-CA | 200.00 | mL/min | 14.70 psia |
| 032-08-SA | 60.00 | mL/min | 14.70 psia | 062-30-CA | 300.00 | mL/min | 14.70 psia |
| 022-15-GL | 120.00 | mL/min | 14.70 psia | 112-06-SA | 500.00 | mL/min | 14.70 psia |
| 022-06-SA | 200.00 | mL/min | 14.70 psia | 032-31-GL | 50.00 | mL/min | 14.70 psia |
| 014-16-ST | 12.00 | L/min | 14.70 psia | 092-05-GL | 2.00 | L/min | 14.70 psia |
| 064-13-GL | 20.00 | L/min | 14.70 psia | 102-21-ST | 7.00 | L/min | 14.70 psia |
| | | | | 034-24-ST | 14.00 | L/min | 14.70 psia |
| | | | | 044-25-CA | 50.00 | L/min | 14.70 psia |
| | | | | 044-24-TA | 66.00 | L/min | 14.70 psia |
| | | | | 044-06-ST | 1.60 | scfm | 14.70 psia |

| TABLE 21 - DIRECT READING FLOW TUBES FOR OXYGEN | | | | | | | |
|---|--------|---------|------------|-----------|--------|---------|------------|
| 65mm | | | | 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE | FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 042-21-ST | 10.00 | mL/min | 14.70 psia | 032-33-ST | 150.00 | mL/min | 14.70 psia |
| 032-09-GL | 35.00 | mL/min | 14.70 psia | 062-02-ST | 250.00 | mL/min | 14.70 psia |
| 032-19-GL | 50.00 | mL/min | 14.70 psia | 112-04-SA | 400.00 | mL/min | 14.70 psia |
| 022-07-ST | 300.00 | mL/min | 14.70 psia | 062-16-CA | 600.00 | mL/min | 14.70 psia |
| 012-02-ST | 500.00 | mL/min | 14.70 psia | 082-08-SA | 1.00 | L/min | 14.70 psia |
| 052-02-GL | 1.00 | L/min | 14.70 psia | 102-12-SA | 5.00 | L/min | 14.70 psia |
| 013-25-ST | 4.00 | L/min | 14.70 psia | 102-17-CA | 10.00 | L/min | 14.70 psia |
| 034-08-ST | 8.00 | L/min | 14.70 psia | 034-15-ST | 16.50 | L/min | 14.70 psia |
| 044-04-ST | 15.00 | L/min | 14.70 psia | 044-19-CA | 58.00 | L/min | 14.70 psia |

| TABLE 22 - DIRECT READING FLOW TUBES FOR PROPANE | | | |
|--|-------|---------|------------|
| 150mm | | | |
| FLOW TUBE | QMAX | [UNITS] | PRESSURE |
| 092-01-ST | 4.20 | L/min | 14.70 psia |
| 102-02-CA | 10.00 | L/min | 14.70 psia |
| 044-02-ST | 38.00 | L/min | 14.70 psia |

COMMON EQUIVALENTS AND CONVERSIONS

| Approximate Common Equivalents | |
|--------------------------------|-----------------------|
| 1 inch | = 25 millimeter |
| 1 foot | = 0.3 meter |
| 1 yard | = 0.9 meter |
| 1 mile | = 1.6 kilometers |
| 1 square inch | = 6.5 sq centimeters |
| 1 square foot | = 0.09 square meter |
| 1 square yard | = 0.8 square meter |
| 1 acre | = 0.4 hectare + |
| 1 cubic inch | = 16 cu centimeters |
| 1 cubic foot | = 0.03 cubic meter |
| 1 cubic yard | = 0.8 cubic meter |
| 1 quart (lq) | = 1 liter + |
| 1 gallon | = 0.004 cubic meter |
| 1 ounce (avdp) | = 28 grams |
| 1 pound (avdp) | = 0.45 kilogram |
| 1 horsepower | = 0.75 kilowatt |
| | |
| 1 millimeter | = 0.04 inch |
| 1 meter | = 3.3 feet |
| 1 meter | = 1.1 yards |
| 1 kilometer | = 0.6 mile |
| 1 square centimeter | = 0.16 square inch |
| 1 square meter | = 11 square feet |
| 1 square meter | = 1.2 square yards |
| 1 hectare + | = 2.5 acres |
| 1 cubic centimeter | = 0.06 cubic feet |
| 1 cubic meter | = 35 cubic feet |
| 1 cubic meter | = 1.3 cubic yards |
| 1 liter + | = 1 quart |
| 1 cubic meter | = 250 gallons |
| 1 gram | = 0.035 ounces (avdp) |
| 1 kilogram | = 2.2 pounds (avdp) |
| 1 kilowatt | = 1.3 horsepower |

| Conversions Accurate to Parts Per Million | |
|---|----------------------|
| inches X 25.4* | = millimeters |
| feet X 0.3048* | = meters |
| yards X 0.9144* | = meters |
| miles X 1.603 34 | = kilometers |
| square inches X 6.4516* | = square centimeters |
| square feet X 0.92 903 0 | = square meters |
| square yards X 0.836 127 | = square meters |
| acres X 0.404 686 | = hectares |
| cubic inches X 16.3871 | = cubic centimeters |
| cubic feet X 0.028 316.8 | = cubic meters |
| cubic yards X 0.764 555 | = cubic meters |
| quarts (lq) X 0.946 353 | = liters |
| gallons X 0.003 785 41 | = cubic meters |
| ounces (avdp) X 28.3495 | = grams |
| pounds (avdp) X 0.453 592 | = kilograms |
| horsepower X 0.745 700 | = kilowatts |
| | |
| millimeters X 0.039 370 1 | = inchs |
| meters X 3.280 84 | = feet |
| meters X 1.093 61 | = yards |
| kilometers X 0.621 371 | = miles |
| sq centimeters X 0.155 000 | = square inchs |
| square meters X 10.7639 | = square feet |
| square meters X 1.195 99 | = square yards |
| hectares X 2.471 05 | = acres |
| cu centimeters X 0.061 623 7 | = cubic inchs |
| cubic meters X 35.3147 | = cubic feet |
| cubic meters X 1.307 95 | = cubic yards |
| liters X 1.056 69 | = quarts (lq) |
| cubic meters X 264.172 | = gallons |
| grams 0.035 274 0 | = ounces (avdp) |
| kilograms X 2.204 62 | = pounds (avdp) |
| kilowatts 1.341 02 | = horsepower |

| THESE PREFIXES MAY BE APPLIED TO ALL SI UNITS | |
|---|---------------------|
| Multiples and Submultiples | |
| 1 000 000 000 000 | = 10 ¹² |
| 1 000 000 000 | = 10 ⁹ |
| 1 000 000 | = 10 ⁶ |
| 1000 | = 10 ³ |
| 100 | = 10 ² |
| 10 | = 10 |
| 0.1 | = 10 ⁻¹ |
| 0.01 | = 10 ⁻² |
| 0.001 | = 10 ⁻³ |
| 0.000 001 | = 10 ⁻⁶ |
| 0.000 000 001 | = 10 ⁻⁹ |
| 0.000 000 000 001 | = 10 ⁻¹² |
| 0.000 000 000 000 001 | = 10 ⁻¹⁵ |
| 0.000 000 000 000 000 001 | = 10 ⁻¹⁸ |

| Prefixes | Symbols |
|-----------------|---------|
| tara (ter'a) | T |
| giga (ji ga) | G |
| mega (meg'a) | Ma |
| kilo (kil o) | k* |
| hecto (hek'to) | h |
| deka (dek'a) | da |
| deci (des'i) | d |
| centi (sen'ti) | c* |
| milli (mil'i) | m* |
| micro (mi' kro) | u* |
| nano (nan'o) | n |
| pico (pe'ko) | p |
| femto (fem'to) | f |
| atto (at'to) | a |

+ common term not used in S1
 * exact
 Source: NBS Special Pub. 304.

EUROPEAN SERVICE CENTER

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*Keine Zertifizierung nach SGS ISO9001.

PRODUCTS MANUFACTURED BY AALBORG®

ROTAMETERS

Single Tube

Aluminum / Brass / Stainless ● Interchangeable Glass Flow Tubes ● Optional Valves

Multiple Tube

Two to Six Channels ● Aluminum/ Stainless

PTFE Single and Multiple Tube

Chemically Inert ● 1 to 4 Channels ● Interchangeable Glass Flow tubes

Gas Proportioners

Aluminum / Stainless ● Used for Blending Two or Three Gases

Kits

Aluminum / Stainless / PTFE ● Including Five Glass Flow Tubes and a Set of Floats

PTFE - PFA

Chemically Inert ● Low to Medium Flow of Corrosive Liquids with PFA Flow Tube

Medium Range

Glass Safety Shield ● Dual Air and Water Scale

Optical Sensor Switch

Non-Invasive Means for Detection of a High or Low Flow

High Flow Industrial Stainless Steel Flow Meters

Heavy Duty Stainless Steel ● Direct Reading Air and Water Scales

VALVES

Barstock

Brass / Stainless ● Standard or High Precision

PTFE

Chemically Inert ● Needle or Metering

Proportionating Solenoid

Stainless ● For Controlling Gas or Liquid Flow ● Pulse width Modulated

SMV ● Stepping Motor Valve

PUMPS

Tubing Pumps Fixed RPM

Tubing Pump Heads

Tubing Pumps Variable Speeds

Dispensing Pumps

Flexible Tubings

ELECTRONIC METERS and CONTROLLERS

Low Cost Mass Flow Meters

Aluminum / Stainless ● With or Without LCD Readout

Low Cost Mass Flow Controllers

Aluminum / Stainless ● With or Without LCD Readout

Mass Flow Controllers

Stainless ● One to Four Channel Systems

Totalizer

Accumulation Up to 7 Digits

Digital Mass Flow Controller

Auto Zero ● Totalizer ● Alarms ● Built in RS485

Multi Parameter Digital Mass Flow Meter

Displays flow Pressure and Temperature

Vortex In-Line and Insertion Flow Meters

Steam / Liquid and Gas Service

Input / Output Devices

RS232 / RS485 - Converts Analog to Digital and Digital to Analog