



## MEMFlo “RangeMaster™” FLOWMETERS

### Features & Benefits

- Tough, simple & accurate meters for low pressure, low density gas measurement.
- Extended flow ranges averaging 25 to 1.
- Verifiable accuracy for combustion gases, annealing atmospheres, vacuum flows, digesters, and gas mixing.
- Average pressure drop is 21/23 water column.
- Disassembles in less than a minute with-out removing the meter from the pipeline.
- Liquid dashpot to eliminate float bounce.
- Standard 3/43 thru 43 female NPT connections or optional flanges.
- Rugged steel and stainless steel constructions with standard pressure ratings of 150 psig for maximum safety.
- Interchangeable flow internals.
- Options include alarms, pressure gage on meter, oxygen cleaning, KIST™ or Courier™ Remote Transmitters.

### Specifications

**ACCURACY:** ±2% of 100% flow rating standard, ±1% is optional.

**REPEATABILITY:** ±1/4% of indicated flow rate on transparent tube models, ±1/2% on magnetic indicating units.

**RANGEABILITY:** 25 to 1 average.

**MATERIALS:** Standard body material is carbon steel, with primary internal flow components of 18-8 stainless steel and/or aluminum. Sight tubes are polysulfone, heavy-walled borosilicate glass within an armor sleeve, or stainless steel (the latter is required with Courier™ systems). All stainless construction, including the body, is optional for corrosive service.

**SCALES:** Standard direct reading (SCFH Dry Air @0 psig, 70°F.) or percentage scale. Scales are photo-etched, anodized aluminum. Special scales for other flow units or media conditions, or mylar scales for corrosive environments, are available. Scale length is approximately 3.2” for Size 6 meters, 5.2” on all larger units.

**OPERATING LIMITS:** 150 psig standard, higher pressures optional. Temperatures to 600°F. at lower pressures are possible.

**“O” RINGS:** Buna N standard; Viton, Ethylene-Propylene (EPR), Silicone, Neoprene, and Teflon optional.

### Sight Tube Options

The fluid to be metered enters the flowmeter inlet port (port closest to the meter scale) and flows vertically upward in the core tube, horizontally thru the core tube slot, exiting thru the meter outlet (top of the body in line with the inlet) port. During this process, the fluid lifts the float assembly in the core tube, displacing it in proportion to the rate of flow passing thru the slot.

The float assembly includes a lower extension and indicator moving within a transparent sight tube below the body. When gas is being metered, this sight tube is filled with a transparent oil (or water for oxygen service) to dampen pulsations. The indicator is a sharp-edged disk, and flow is read directly from the external scale as the number nearest the top edge of the disk. On models with metal sight tubes, magnets attached to the float carry an external ball indicator. Flow is read as the number nearest the center of the ball.

Flow Line Options’s patented RangeMaster™ Flowmeters are precision instruments for flow measurement of gas. These rugged meters provide verifiable accuracy for applications including combustion fluids to burners, annealing atmospheres, vacuum flows, and gas mixing.

Available in a wide range of sizes and model types, RangeMaster flowmeters for gas service incorporate a liquid dashpot to eliminate pulsations. Other unique RangeMaster features include:

## 25 to 1 TURNDOWNS

RangeMaster flowmeters offer calibrated flow readings over a 25 to 1 range. This 25 to 1 turndown (the ratio of the 100% flow reading to the minimum flow reading) is a result of Flow Line Options's unique, patented design. The high turndown often means a single RangeMaster meter can be used where two tapered tube units would be necessary.

## ±2% or ±1% VERIFIABLE ACCURACY

Standard accuracy for RangeMaster flowmeters is ±2% full scale, with ±1/2% of rate repeatability. Special ±1% calibrations are optional. Flow Line Options can certify calibrations traceable to NIST (National Institute of Standards and Technology, formerly NBS) per MIL-STD-45662A.

## QUICK DISASSEMBLY FOR MAINTENANCE OR CHANGING FLOW INTERNALS

RangeMaster flowmeters disassemble without special tools in less than a minute without removing the unit from the pipeline. All flow internals can be removed from the body to facilitate cleaning. Different flow internals may be put into the same body to completely change the meter capacity.

## STANDARD STEEL OR OPTIONAL STAINLESS STEEL CONSTRUCTION

Standard body material is carbon steel, with primary internal flow components of 18-8 stainless steel and/or aluminum. Standard sight tubes are polysulfone (a high impact thermoplastic rated for operating service to 300°F. and resistant to many corrosives) or heavy-walled borosilicate glass within a steel armor. All stainless steel construction, including the body, is optional for corrosive service.

## OPTIONAL ALL METAL CONSTRUCTION

Flow Line Options can also provide RangeMaster meters with a metal sight tube for harsh environments where use of a plastic or glass tube is unacceptable. An external indicator is magnetically coupled to the float.

## STANDARD 150 PSIG RATINGS

RangeMaster flowmeters have a standard operating limit of 150 psig. While most applications for RangeMaster meters involve low pressures, the high rating provides an important safety margin in the event a pressure regulator fails, or some other surge, shock, or system error occur. If your application pressure is higher than 150 psig, Flow Line Options can offer models for up to 3000 psig service.

## AVERAGE ΔP OF 2 1/2" W. C.

The maximum ΔP for most RangeMaster flowmeters is 2 1/2" water column or less. If requested, meters with higher pressure drops can be built to allow higher flow capacities within a given body size.

## ALARM & REMOTE OUTPUTS

RangeMaster meters can be provided with MEMFlo's Flo-Sentry™ High-Low Alarms or Flow and Mass Courier™

Systems. The Flo-Sentry provides high and/or low alarm functions through externally housed switches without interfering with meter operation. Standard switch enclosures are NEMA 12, with NEMA 4X and explosion-proof optional.

Courier™ Systems extend the capabilities of RangeMaster meters, adding remote display and signal functions. The Flow Courier™ offers rate, total, and grand total flows plus batch control and two flow alarms. The Mass Courier™ displays pressure and temperature corrected mass, volume, or heat flows. Both Courier™ systems maintain mechanical, visual flow rate readings at the meter, plus 4-20mA analog output, pulse outputs, and alarms as standard features.

## CUSTOM ENGINEERING SERVICES

Flow Line Options is an established manufacturer of variable area flow instrumentation for industry. Our experience in the general flow market allows us to offer custom modifications for OEM and quantity RangeMaster users. Flanged connections, special flow ranges, and other materials (including all PVC or CPVC construction for corrosive environments) can be offered. Please contact Flow Line Options for a quote on your specialized requirements.

## DEFINITION

SCFH means Standard Cubic Foot per Hour. For MEMFlo standards, it is one cubic foot of the gas existing at 14.696 psia, 70°F. The exact value of the standard cubic foot actually defines a weight of gas at any pressure-temperature (0.07492 lbs. on the MEMFlo base of dry air), but defines volume only at specified conditions. Thus, a flow of 1 SCFH of air is 0.075 lbs. per minute at any pressure or temperature, but is 1 actual cubic foot per minute only at 14.696 psia, 70°F., but only 0.595 actual cubic feet per minute at 10 psig, 0.424 actual cubic feet at 20 psig, etc.

Standard MEMFlo Flowmeters for gas service are listed for a single pressure-temperature condition (as shown in Table 3) — Dry Air @ 0 psig, 70°F. (Specific Gravity = 1.00 at 14.697 psia, 70°F.). Compensation for other pressures, temperatures, and specific gravities must be made using the sizing equation.

## DIRECT READING SCALES

Flow Line Options calibrates RANGE MASTER meters and scales them for the customer's operating conditions at no additional charge for the first scale. If multiple scaling is requested, extra charges may apply to the additional scales. Each meter is tagged with the fluid being metered and its pressure-temperature data. Correction data is supplied with each MEMFlo Flowmeter for changing service conditions in the field.

## DETERMINING PROPER FLOWMETER CAPACITY

The capacities shown in the table are based on MEMFlo's standard conditions for RangeMaster flowmeters; namely, SCFH at 0 psig, 70°F. If your flow data match these conditions, the 100% flows shown in the table may be used directly.

For applications involving other gases, pressures, or temperatures, the Gas Sizing Equation may be used to determine equivalent flows. Please note that these equations are for flowmeter sizing only, and are not to be used to correct readings for changed fluid conditions on installed meters (that formula is included with the meter instructions).

### SPECIAL & UNUSUAL CONSIDERATIONS

Generally, proper MEMFlo Flowmeter selection only requires compensation for different pressures, temperatures, and densities. Occasionally, other factors such as significant vapor content in the metered gas, gases near their condensation point, etc., require special compensations. Please consult Flow Line Options for specific recommendations if these or other special circumstances are anticipated.

### GROSS BTUH per SCFH CONVERSIONS

TYPE OF GAS	BTUH/CUBIC FOOT
Natural Gas*	1050
Propane	2520
Butane	3260
Acetylene	1499
Carbon Monoxide	322
Hydrogen	325
Methane	1013

\* Average. In USA, specific gravities range from 0.586 to 0.695; Btuh/SCFH from 945 to 1093 depending on geographic location.

## Gas Sizing Equation

$$Q_R = Q_g \times 0.1665 \times \sqrt{\frac{\rho_g \times T_g}{P_g}}$$

Where:

$Q_R$  = SCFH DRY AIR @ 0 psig, 70°F. (MEMFlo Base)

$Q_g$  = SCFH of gas to be metered at operating conditions

$\rho_g$  = Specific gravity of gas to be metered at standard conditions (14.696 psia, 70°F.)

$T_g$  = Metering temperature, absolute, °R (460 + °F.)

$P_g$  = Metering pressure, absolute (14.696 + psig)

EXAMPLE: What is the equivalent flow to SCFH Dry Air @ 0 psig, 70°F. of 1500 SCFH of natural gas at 5 psig, 100°F. (Sp. Gr. = 0.65)?

ANSWER:

$$Q_R = 1500 \times 0.1665 \times \sqrt{\frac{.65 \times 560}{19.7}}$$

$$= 1073.8 \text{ SCFH}$$

(For 2" pipe, a 16R1200 model would be selected from Table 3, & MEMFlo would provide a scale for 1500 SCFH at 5 psig, 70°F., Sp. Gr. = 0.65 at no extra charge)

## RANGEMASTER Flowmeter Capacities Based on Dry Air @ 0 PSIG, 70°F.

PART NO.	NPT	100% SCFH	Min. SCFH	Min. Scale Div.	PART NO.	100% SCFH	Min. SCFH	Min. Scale Div.
6R20.0	3/4" Also offered in compact 6IR style. Simply substitute 6IR for 6R	*20.0	0.8	0.20	16R500	500	20	5.0
6R30.0		*30.0	1.0	0.25	16R750	750	30	5.0
6R50.0		*50.0	2.0	0.50	16R1000	1000	40	10
6R75.0		*75.0	3.0	0.50	16R1200	1200	50	10
6R100		*100	4.0	1.0	16R1500	1500	60	10
6R150		*150	6.0	2.0	16R2000	2000	80	20
6R250		250	10	2.5	16R2500	*2500	100	25
6R350		350	10	2.5	16R3000	3000	120	30
6R500		500	20	5.0	16R4000	4000	160	40
6R750		750	30	5.0	16R5000	5000	200	50
6R1000	3"	1000	40	10	32R10.0K	10000	400	100
24R2000		2000	80	20	32R12.0K	12000	500	100
24R3000		3000	120	30	32R15.0K	15000	600	100
24R4000		4000	160	40	32R17.5K	*17500	700	150
24R5000		5000	200	50	32R20.0K	20000	800	200
24R7500		*7500	300	50	32R25.0K	25000	1000	250
24R10.0K		10000	400	100	32R30.0K	30000	1200	300

\* These models cannot currently be equipped with either Flo-Sentry™ or Flo-CAT™ Alarms, KIST™ 4-20mA transmitters, or Courier™ Remote Systems.

# How to Order "RangeMaster™" Flowmeters

Example: A 2" meter for 1800 SCFH of Natural Gas at 2 PSIG, 70°F., would be:

16R1500 A U S B

**PART NO.**

From Capacity Table

3/4" meters are offered in either standard "6R" style, or compact "6IR" bodies

**MATERIAL OPTIONS**

Steel body, stainless & aluminum internals = A

Steel body, all stainless internals = B

All stainless steel = C

**SIGHT TUBE OPTION**

Polysulfone = U

Armored Glass = A

Stainless Steel = S

**SCALING OPTIONS**

Standard SCFH Air (0 psig, 70°F.) = D

Percent of Flow = P

SCFH per customer's application data = S

BTUH per customer's application data = H

Multiple scales = M

Other units & data per customer data = X

**SPECIAL OPTIONS & ACCESSORIES**

Space for various options & accessories, including Flo-Sentry™ & Flo-Guardian™ alarms, KIST two-wire transmitters, & Courier Systems all adaptable to most RangeMasters. All but the Flo-Sentry require use of the stainless sight tube.

**CUSTOM OPTIONS**

Please consult Flo-Corp with your requirements

Blank = No options required

V = Throttling valve option

F = Flanged connections

G = Safety Guard Tube (std. on glass tubes)

C = ±1 % Calibration

**O-RINGS**

B = Buna N (Std.)

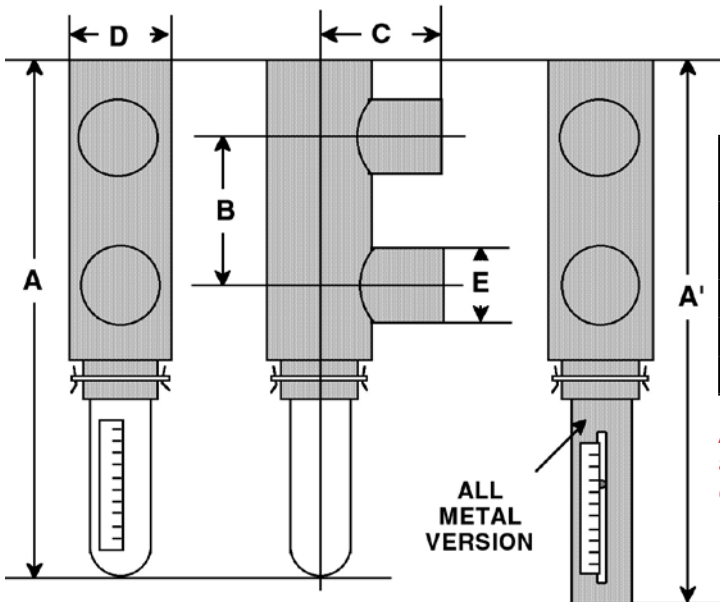
E = EPR (Ethylene-Propylene)

N = Neoprene

S = Silicone

V = Viton

T = Teflon



## RangeMaster Roughing Dimensions

MODEL TYPE	A	A'	B	C	D	E	NPT	Wt., lbs.
6IR	12.5	13.75	8.80	1.40	2.80	NA	3/4"	9
6R	18.15	18.90	7.88	2.20	2.50	1.44	3/4"	8
16R	26.36	26.96	12.63	3.40	3.50	2.75	2"	25
24R	31.20	32.20	14.63	4.88	4.75	4.00	3"	62
32R	33.57	34.57	16.13	6.00	6.00	5.00	4"	70

All dimensions are in inches. Dimensions & weights above are approximate, and should not be used For layout purposes. Certified prints are available on request.