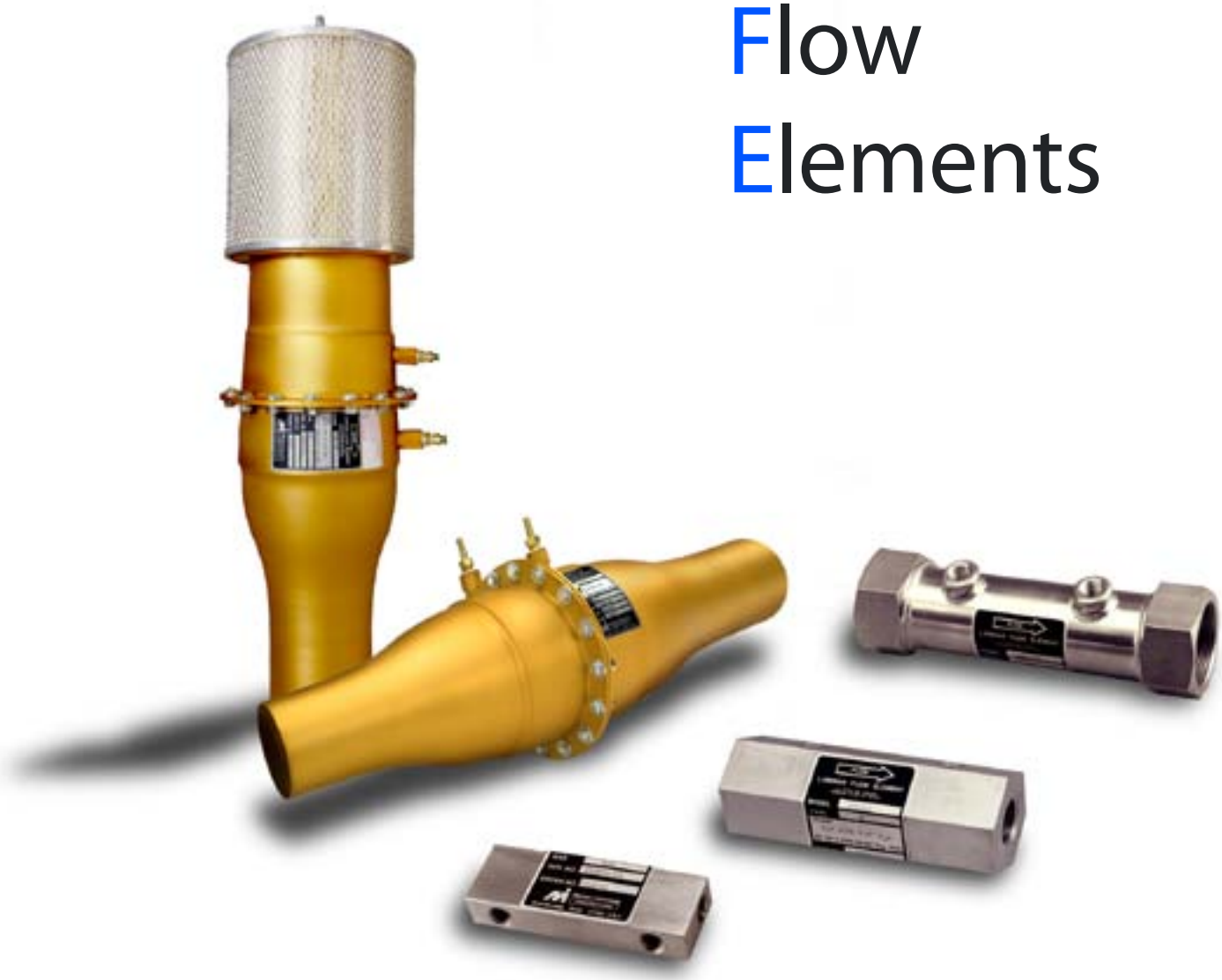
Meriam LFE Laminar Flow Elements



meriam

Meriam's Laminar Flow Element (LFE)

Meriam LFEs are excellent for measuring low gas flow rates from 0.2 SCCM up to 2250 SCFM. They are inherently accurate and repeatable and are calibrated traceable to NIST. Flow turndown s 20:1 or better and the differential pressure generated is nearly linear to flow. This combination makes an LFE a great choice for gas flow measurement

LFE NPT Connection

PERFORMANCE

Standard LFE calibration accuracy is ± 0.72% of Reading (not % of Full Scale) traceable to the National Institute of Standards and Technology (NIST). Rigid construction and lack of any moving parts make the LFE calibration stable. Only physical damage or particulate deposition in the element will cause a calibration shift.

Standard Accuracy:	± 0.72% to ± 0.86% of Reading
Repeatability:	0.1%
Response time:	16 ms
Turndown:	20:1 achievable with accurate DP device Greater turndown achievable with precision DP device

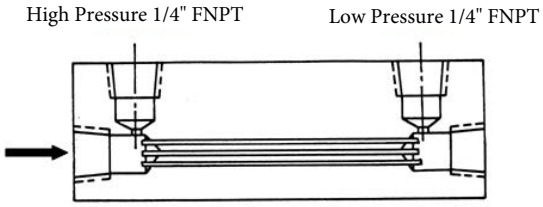
UTILITY

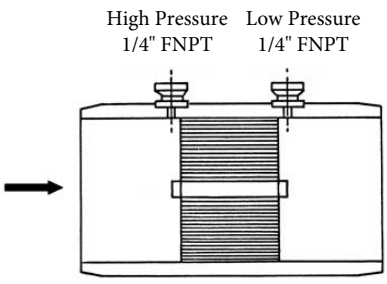
LFEs can be used to measure flow rate for a variety of gases and applications. Standard models are available to measure as little as 0.2 SCCM (5.9 E-06 SCFM) to as much as 2250 SCFM of air flow at standard conditions. Custom models for up to 15,000 SCFM of air are available. Stainless steel or aluminum materials make LFEs compatible with most gases. Flow rate of gas mixtures can also be measured when the percentages of component gases and mixture properties are known.

LFEs for hose type process connections

APPLICATIONS

LFEs are applicable in most clean and non-condensing gas flow applications. They excel in critical gas flow measurement applications and make excellent calibration standards because of their inherent accuracy, stable calibration, excellent response time and repeatability. LFEs are used to calibrate turbine meters, variable area meters, flow regulators, mass flow meters, and thermal anemometers to name a few. Gas flow measurement for demanding flow control is a common application. Other applications include leak detection and quantification, design and testing of discrete parts, automotive engine and emissions testing, and window and door leak testing.





Capillary Tube Bundle (top); Capillary Matrix Array (bottom)

THE LFE MATRIX

The LFE matrix can be made from individual SS tubes or windings of SS foil. These tubes are long enough, relative to their inside diameter, to cause laminar flow to occur inside each tube. The result is a near linear relationship between DP and flow rate. The DP generated across the matrix responds very quickly to changes in flow. All DP is permanent pressure loss to the system but LFEs are sized to produce no greater than 8" water column at maximum flowing conditions. Individual tube diameters are very small so flowing gases need to be clean and dry to preserve the calibration. Filtered inlet versions of most LFE models are available to keep the matrix clean and the calibration constant.

LFEs for flanged process connections

CALIBRATION AND ACCURACY

Meriam LFEs are calibrated with air at atmospheric conditions referenced to 29.92" mercury absolute (760mm Hg. Abs.) and 70° F. (21.1° C). Each completed element is calibrated and traceable to the National Institute of Standards and Technology. Meriam LFEs are supplied with a reproducible flow curve in terms of SCFM versus inches of water differential pressure. Correction factors are included to cover an inlet pressure range from 26 to 36" Hg Abs. and an inlet temperature from 50° F to 150° F. For special flow applications, we request that you contact Meriam with complete flow information. The rated accuracy* of all Meriam LFEs is percentage of actual reading; not the much wider percentage of full scale flow rate tolerance of other devices.

*Accuracy Levels Available:

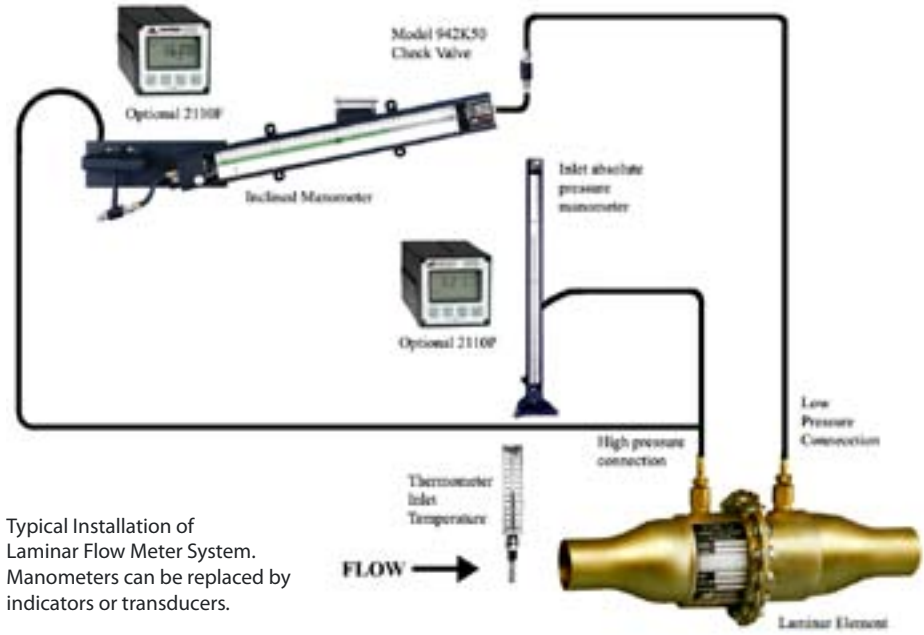
Commercial Calibration	± 0.72% of Actual Reading†
Master Calibration	± 0.64% of Actual Reading††
Independent Lab Calibration	± 0.50% of Actual Reading or better, consult factory

† ± 0.86% Reading for full scale flow of 1000 SCFM or higher
†† ± 0.70% Reading for full scale flow of 1000 SCFM or higher

The Special Calibration Procedure #A- 33544 is designed to meet the basic requirements of MIL-STD-45662A, ANSI Z540, 10CFR50 and MIL-Q-9858A. Complies to 40CFR 1065.225 and 1065.240.

Contact Meriam for more information.

Filtered inlet LFEs available for intake measurement applications



Typical Installation of Laminar Flow Meter System. Manometers can be replaced by indicators or transducers.

MDT500 Flow Measurement System

The Meriam MDT500 Flow Measurement System is designed to allow users to accurately measure air and gas flow rates. The direct mounted, multivariable transmitter mounts to any Meriam LFE Model.

LabVIEW® Drivers and Software Development Kit are included to make using the MDT500 even easier. Using LabVIEW® executable, ACFM, SCFM and mass flow are displayed on your PC.

The MDT500 delivers impressive system accuracy of +/- 0.8% Flow Rate and a response time of less than 0.1 second. With long term stability and no moving parts the unit is maintenance free.

The MDT500 provides a wide flow range, while maintaining accuracy and there is no drift over time and temperature. It delivers best repeatability and is also independent of orientation. The MDT500 offers linear response and a low head loss model is also available.

Laminar applications include leak detection, calibration reference standards, critical gas flow measurements, combustion air flow to engines and many more.

LFS-1 Flow Measurement System

The LFS-1 Flow Measurement System for Meriam LFEs takes advantage of the wide flow turndown and the percent of Reading precision of the LFE, as well as Meriam's calibration expertise, to provide a superior gas flow measurement solution. The integral flow computer makes real time corrections for changes in differential pressure, static pressure, temperature and relative humidity to provide the most accurate results possible. Calibration coefficients for up to five (5) LFEs can be stored in memory and called up for later use with a push of a button. For control or data transmission purposes, the LFS-1 Flow Measurement System has both analog and digital outputs. 4–20 mA and 0–10 volts analog output options are ideal for control and recording functions. RS-232 and RS-485 digital communications are standard.

Special application requirements can often be accommodated by the LFS. For example, simultaneous flow measurement of two LFEs can be made and the summation of the two flows calculated and displayed. Or, for testing over a wide range for flow, the LFS can be set up to automatically switch from one LFE to an LFE of a different flow capacity as flow rate increases to a predetermined set point.

Meriam's LFS-1 provides standard system accuracy of ± 1.0% of Reading over a 10:1 flow turndown and ± 1.1% over 20:1 turndown. Calibration of the LFE and LFS-1 as a system makes this possible. Meriam can offer LFS accuracy as low as 0.60% of Reading over a 10:1 flow turndown by using better calibration standards. All LFS packages include complete instrumentation, system calibration and NIST traceable documentation. LFEs and systems cover gas flow ranges from 0.2 SCCM to 15,000 SCFM.

To provide the accurate answers you need in the shortest amount of time...

Please Provide us With the Following Ordering Data:

1. Model number.
2. Flowing gas data;
    a. Flow rate in desired units.
    b. Base conditions.
        i. Pressure
        ii. Temperature
    c. Flowing conditions
        i. Pressure
        ii. Temperature
        iii. Viscosity at flowing temperature.
    d. Differential at maximum flow.
    e. Specific gravity, if other than air.
    f. Flowing gas, if other than air.
3. Readout instrument.
4. Description of installation configuration.
5. Line size.
6. Line Material.
7. Accuracy required

Special Calibration Procedure
A special service is available for those Meriam LFE units which are governed by quality programs requiring periodic recalibration. The Special Calibration Procedure #A-33544 is designed to meet the basic requirements of 10CFR50, ANSI-Z540-I & ML-Q-9858A. Complies to 40CFR 1065.225 and 1065.240. Contact Meriam direct for information.

Extended Range Calibration to extend calibrated flow range by 50% available for many models.

Meriam Field Representatives in principal cities throughout the country are ready to serve you. Call on them for help when you have flow measurement problems. Or, if you prefer, contact us direct.

Model Number & Description		Pipe Size	NPT tapered thread
	50MK10 Utilizes stainless steel capillary tubes cemented into a stainless steel body. Inlet, outlet and differential pressure connections are 1/4".	1/4" 1/4" 1/4" 1/4" 1/4" 1/4" 1/4" 1/4"	50MK10-8 50MK10-7 50MK10-6 50MK10-5 50MK10-4 50MK10-3 50MK10-2 50MK10-1
	Model 50MJ10 All stainless steel unit with fused matrix. Differential pressure connections are 1/4". Line connections 1/2" NPT, except Type 9 which has 3/4" NPT.	1/2" 1/2" 1/2" 1/2" 1/2" 3/4"	50MJ10-14 50MJ10-13 50MJ10-12 50MJ10-11 50MJ10-10 50MJ10-9
	50MW20 All stainless steel welded unit with fused matrix. Line connections are threaded. Differential pressure connections are 1/4".	1" 1 1/2" 2"	50MW20-1 50MW20-1 1/2 50MW20-2
	50MH10 All stainless steel welded unit with fused matrix. Line connections are tapered ends (no threads) for hose connection. Differential pressure connections are 1/4" NPT.	1" 1 1/4" 1 1/2" 2" 3" 4" 5" 6" 8" 10" 12" 16"	50MH10-1 50MH10-1 1/4 50MH10-1 1/2 50MH10-2 50MH10-3 50MH10-4 50MH10-5 50MH10-6 50MH10-8 (x) 50MH10-10 (x) 50MH10-12 (x) 50MH10-16 (x)
	50MY15 All stainless steel welded unit with fused matrix. Line connections are 150 lb ANSI flanges. Differential pressure connections are 1/4" NPT.	2 1/2" 3" 4" 5" 6" 8" 10" 12" 16"	50MY15-2 1/2 50MY15-3 50MY15-4 50MY15-5 50MY15-6 50MY15-8 (x) 50MY15-10 (x) 50MY15-12 (x) 50MY15-16 (x)
	50MR2 Aluminum housing for low pressure applications. Line connections are 150 lb ANSI flanges. Differential pressure connections 1/4" hose barb.	2" 4" 6" 8"	50MR2-2 50MR2-4 50MR2-6 50MR2-8
	50MC2 Aluminum housing for low pressure applications. Inlet and outlet are for hose type connections. Differential pressure connections 1/4" hose barb.	2"I.D. 4"I.D. 6"I.D. 8"I.D.	50MC2-2 50MC2-4 50MC2-6 50MC2-8

NOTES:

1. The flows and differential pressure rating of production units are subject to a variation of plus or minus 10% from the nominal values listed above.
2. Each LFE unit is calibrated with air to Meriam flow standards which are traceable to the National Bureau of Standards. Meriam calibration flow curves are furnished with each unit.
3. A special service is available for those Meriam LFE units which are governed by quality programs requiring periodic recalibration. The Special Calibration Procedure A-33544 is designed to meet the basic requirements of 10CFR50, ANSI-Z540-I & ML-Q-9858A. Contact Meriam direct for information.

Nominal Air Flow Range (29.92" Hg. Abs. & 70° F)		Max. DP In. H_2O	Pipe Size	Nominal Air Flow Range 760 MM Hg. Abs. & 21.1° C)			Max DP MM H_2O
SCFM*	PPM			CC/MIN*	LPM*	Kg/M	
0.00019	1.42×10^{-5}	4"	1/4"	5.38	0.00538	6.44×10^{-6}	101.6
0.00062	4.64×10^{-5}	4"	1/4"	17.5	0.0175	2.10×10^{-5}	101.6
0.000124	9.28×10^{-5}	4"	1/4"	35.1	0.0351	4.21×10^{-5}	101.6
0.0025	1.87×10^{-4}	4"	1/4"	70.8	0.0708	8.48×10^{-5}	101.6
0.0046	3.45×10^{-4}	4"	1/4"	130	0.130	1.56×10^{-4}	101.6
0.0081	6.07×10^{-4}	4"	1/4"	229	.229	2.75×10^{-4}	101.6
0.0149	0.00112	4"	1/4"	422	.422	5.06×10^{-4}	101.6
0.046	0.00344	4"	1/4"	1300	1.30	0.00156	101.6
0.10	0.00749	8"	1/2"	2830	2.83	0.00339	203.2
0.18	0.0135	8"	1/2"	5100	5.10	0.0061	203.2
0.38	0.0285	8"	1/2"	10700	10.8	0.0129	203.2
0.70	0.0524	8"	1/2"	19800	19.8	0.0237	203.2
1.60	0.120	8"	1/2"	45300	45.3	0.0543	203.2
3.00	0.225	8"	3/4"	85000	85.0	0.102	203.2
7.5	0.562	8"	1"	2.12×10^{5}	212	0.254	203.2
22	1.65	8"	1 1/2"	6.23×10^{5}	623	0.746	203.2
40	3.00	8"	2"	1.13×10^{6}	1130	1.357	203.2
7.5	0.562	8"	1"	2.12×10^{5}	212	0.254	203.2
16	1.20	8"	1 1/4"	4.53×10^{5}	453	0.543	203.2
23	1.72	8"	1 1/2"	6.51×10^{5}	651	.780	203.2
40	3.00	8"	2"	1.13×10^{6}	1130	1.35	203.2
90	6.74	8"	3"	2.55×10^{6}	2550	3.05	203.2
160	12.0	8"	4"	4.53×10^{6}	4530	5.43	203.2
250	18.7	8"	5"	7.08×10^{6}	7080	8.48	203.2
360	27.0	8"	6"	1.02×10^{7}	10200	12.2	203.2
640	47.9	8"	8"	1.81×10^{7}	18100	21.7	203.2
1000	74.9	8"	10"	2.83×10^{7}	28300	33.9	203.2
1440	108	8"	12"	4.07×10^{7}	40800	48.8	203.2
2250	168	8"	16"	6.37×10^{7}	63700	76.3	203.2
60	4.50	8"	2 1/2"	1.69×10^{6}	1700	2.03	203.2
90	6.74	8"	3"	2.55×10^{6}	2550	3.05	203.2
160	12.0	8"	4"	4.53×10^{6}	4530	5.43	203.2
250	18.7	8"	5"	7.08×10^{6}	7080	8.48	203.2
360	27.0	8"	6"	1.02×10^{7}	10200	12.2	203.2
640	47.9	8"	8"	1.81×10^{7}	18100	21.7	203.2
1000	74.9	8"	10"	2.83×10^{7}	28300	33.9	203.2
1440	108	8"	12"	4.07×10^{7}	40800	48.8	203.2
2250	169	8"	16"	6.37×10^{7}	63700	76.6	203.2
100	7.49	8"	2"	2.83×10^{6}	2830	3.39	203.2
400	30.0	8"	4"	1.13×10^{7}	11300	13.6	203.2
1000	74.9	8"	6"	2.83×10^{7}	28300	33.9	203.2
2250	168	8"	8"	6.37×10^{7}	63700	76.3	203.2
100	7.49	8"	2"I.D.	2.83×10^{6}	2830	3.39	203.2
400	30.0	8"	4"I.D.	1.13×10^{7}	11300	13.6	203.2
1000	74.9	8"	6"I.D.	2.83×10^{7}	28300	33.9	203.2
2250	168	8"	8"I.D.	6.37×10^{7}	63700	76.3	203.2

4. The catalog capacities refer to the following base conditions:
   Air, 29.92" Hg Abs., 70° F, 181.87 micropoises.
   Base Reynold's Number: 300 at 8" H_2O, 150 at 4" H_2O.
5. SCFM* - Equivalent air flow at base conditions listed above.
6. All units are offered with optional integral filter on inlet side except those marked (x). Removal or replacement of filter necessitates recalibration.
7. Rated flow pressure and temperature for standard units are 30 psig and 150°F to maintain laminar flow, calibration, linearity and accuracy. For higher pressure and temperature rating contact a Meriam Representative, or Meriam Process Technologies direct.