

molbox RFM™

Reference Flow Monitor

Technical Data



Features

- Compact presentation
- Covers the flow range of 1 sccm to 100 slm with molbloc-L, and up to 5000 slm with molbloc-S
- Select from 20 different gases with molbloc-L and 10 with molbloc-S
- Accredited measurement uncertainty of $\pm 0.5\%$ of reading with 100:1 rangeability
- Internal valving for on-board purge, leak test and tare support
- Includes advanced measurement functions such as totalize, average, hi/lo and deviation
- Complete front panel control and RS232 and IEEE-488 remote communications
- Measures mass and volume flow with user setable reference pressure and temperature conditions

molbox RFM is a support unit for making mass flow measurements using molbloc-L laminar and molbloc-S sonic flow elements.

molbloc flow elements are connected to molbox RFM with two pressure connections and one data line. molbox RFM reads calibration data off the molbloc EEPROM and measures molbloc upstream and downstream pressure with its built-in high accuracy Reference Pressure Transducers (RPTs). An ohmic measurement system reads the resistance of the molbloc platinum resistance thermometers from which molbloc temperature is calculated. Using

the molbloc calibration data, pressures, temperature and gas properties stored in molbox RFM memory, the flow rate of the gas flowing through the molbloc is calculated. For molbloc-L flow elements, a microrange option is available to increase flow measurement resolution and accuracy under 10% FS of the flow range.

molbox RFM and molbloc flow elements are useful in a variety of measurement, test and calibration applications in which highly accurate measurement of low gas flows where maximum accuracy is the most notable specification is needed. molbox RFM is specifically designed for

applications in which a highly compact presentation, great rangeability and reduced cost are the primary considerations. A second model, molbox1, is available for applications in which lowest possible uncertainty is the top priority.

To configure your mass flow calibration system, see the pages that follow to select the molbloc and pressure dependent calibrations to best cover your flow ranges and pressure conditions. molstic mounting systems and COMPASS® for molbox calibration software are available to complete the system (see molstic and COMPASS product brochures).

Flow measurement specifications

molbox RFM measures the flow through molbloc flow elements. The flow range, usable operating pressure, and differential pressure for molbloc-L, or the flow range and absolute pressure range for molbloc-S, depend on the molbloc element used and the calibration options. For molbloc-L ranges up to 3E4, the resolution and accuracy under 10 % FS are improved by the microrange option. For the 1E5-L molbloc, the microrange option is necessary to achieve the specification.

molbox RFM

| | molbloc-L (ranges 1E1-L thru 3E4-L) | molbloc-S (all ranges) |
|---|---|---|
| Measurement update rate | 1 second | 1 second |
| Range | 0 to molbloc full scale depending on gas and molbloc pressure dependent calibration type (see molbloc-L tables) | The flow related to 20 kPa to 200 kPa absolute (3 psia to 30 psia) or 50 kPa to 500 kPa absolute (7 psia to 70 psia) upstream (see molbloc-S table) |
| Resolution | 0.01 % FS | ± 0.01 % of reading |
| Linearity | ± 0.23 % of reading from 10 % to 100 % FS, ± 0.023 % FS under 10 % FS | ± 0.25 % of reading |
| Repeatability | ± 0.1% of reading from 10 % to 100 % FS, ± 0.01% FS under 10 % FS | ± 0.1 % of reading |
| Precision ¹ | ± 0.25 % of reading from 10 % to 100 % FS, ± 0.025 % FS under 10 % FS | ± 0.3 % of reading |
| Predicted stability ² (one year) | ± 0.15 % of reading from 10% to 100% FS, ± 0.015 % FS under 10% FS | ± 0.2 % of reading |
| Measurement uncertainty ³ | ± 0.5 % of reading from 10% to 100% FS, ± 0.05 % FS under 10% FS | ± 0.5 % of reading from 50 kPa to 500 kPa, ± 0.5 % of the flow @ 50 kPa from 20 kPa to 50 kPa |

molbox RFM with Microrange option

| | molbloc-L (ranges 1E1-L thru 3E4-L) | molbloc-L (ranges 1E5 only) |
|---|---|---|
| Measurement update rate | 1 second | 1 second |
| Range | 0 to molbloc full scale depending on gas and molbloc pressure dependent calibration type (see molbloc-L tables) | 0 to molbloc full scale depending on gas and molbloc pressure dependent calibration type (see molbloc-L tables) |
| Resolution | 0.01 % FS, 0.001 % FS under 10 % FS | 0.01 % FS |
| Linearity | ± 0.23 % of reading from 1 % to 100 % FS, ± 0.0023 % FS under 1 % FS | ± 0.25 % of reading from 5 % to 100 % FS, ± 0.0125 % FS under 5 % FS |
| Repeatability | ± 0.1 % of reading from 1 % to 100 % FS, ± 0.001 % FS under 1 % FS | ± 0.2 % of reading from 5 % to 100 % FS, ± 0.01 % FS under 5% FS |
| Precision ¹ | ± 0.25 % of reading from 1 % to 100 % FS, ± 0.0025 % FS under 1% FS | ± 0.32 % of reading from 5 % to 100 % FS, ± 0.016 % FS under 5% FS |
| Predicted stability ² (one year) | ± 0.15 % of reading from 1 % to 100 % FS, ± 0.0015 % FS under 1 % FS | ± 0.2 % of reading from 5 % to 100 % FS, ± 0.01 % FS under 5 % FS |
| Measurement uncertainty ³ | ± 0.5 % of reading from 1 % to 100 % FS, ± 0.005 % FS under 1 % FS | ± 0.5 % of reading from 5 % to 100 % FS, ± 0.025 % FS under 5 % FS |

¹ Precision: Combined linearity, hysteresis, repeatability.

² Predicted Stability: Maximum change in zero and span over one year for typical molbox RFM and molbloc used under typical conditions. As stability can only be predicted, stability for a specific molbox RFM should be established from experience.

³ Measurement Uncertainty: Maximum deviation of the molbox RFM flow indication from the true value of the flow through the molbloc including precision, stability and DHI calibration standard uncertainty. Measurement uncertainty specifications for molblocs are valid only for gases with which the molbloc has been calibrated. All molblocs are calibrated for N₂. Calibrations with other gases are optional. DHI calibration capability is not maintained at all times for all gases on all molbloc designations. Check for availability before ordering.

molbloc-S (all ranges)

Specifications are the same as a molbox RFM without Microrange. The Microrange transducer is disabled whenever the molbox RFM is connected to a molbloc-S.

Pressure dependent calibration types for molbloc-S

The operating range of molbloc-S is dependent upon the absolute upstream pressure. Two different calibration options are offered to accommodate the requirement of the user's application. The Standard Pressure (SP) calibration of 50 kPa to 500 kPa absolute (7 psia to 70 psia) gives the most flexibility and allows partial use of the range without a vacuum. The Low Pressure (LP) calibration of 20 kPa to 200 kPa (3 psia to 30 psia) requires the use of a vacuum downstream. The resulting flow range for different gases at these pressures can be found in the molbloc-S range table below.

| Calibration type | Operating pressure | Considerations |
|-------------------|---|--|
| Standard pressure | 50 kPa to 500 kPa absolute (7 psia to 70 psia) | Must be flowing to a vacuum to obtain full range |
| Low pressure | 20 kPa to 200 kPa absolute (3 psia to 30 psia) | |

molbloc-S ranges with standard and low pressure calibrations

| | | | | molbloc-S designator, KF (sccm/kPa), and full scale flow (slm @ 0°C) | | | | | | | | | | |
|------------------------------------|-----------------------------------|-------|----------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | | Designator | 1E1-S | 2E1-S | 5E1-S | 1E2-S | 2E2-S | 5E2-S | 1E3-S | 2E3-S | 5E3-S | 1E4-S |
| | | | | KF (sccm/kPa) | 10 | 20 | 50 | 100 | 200 | 500 | 1000 | 2000 | 5000 | 10000 |
| Gases | | Ratio | Cal type | | | | | | | | | | | |
| Inert | Nitrogen | N2 | 1.000 | SP | 5.00 | 10.00 | 25.0 | 50.0 | 100.0 | 250.0 | 500 | 1000 | 2500 | 5000 |
| | | | | LP | 2.00 | 4.00 | 10.0 | 20.0 | 40.0 | 100.0 | 200 | 400 | 1000 | 2000 |
| | | | | minimum | 2.00 | 3.50 | 7.7 | 15.0 | 28.0 | 67.0 | 129 | 248 | 596 | 1173 |
| | Argon | Ar | 0.837 | SP | 4.19 | 8.37 | 20.9 | 41.9 | 83.7 | 209.3 | 419 | 837 | 2093 | 4186 |
| | | | | LP | 1.67 | 3.35 | 8.4 | 16.7 | 33.5 | 83.7 | 167 | 335 | 837 | 1674 |
| minimum | | | | 1.67 | 3.00 | 6.9 | 13.9 | 24.3 | 61.0 | 122 | 245 | 526 | 1053 | |
| Helium | He | 2.647 | SP | 13.23 | 26.47 | 66.2 | 132.3 | 264.7 | 661.7 | 1323 | 2647 | 6617 | 13234 | |
| | | | LP | 5.29 | 10.59 | 26.5 | 52.9 | 105.9 | 264.7 | 529 | 1059 | 2647 | 5294 | |
| | | | minimum | 9.00 | 16.00 | 29.7 | 54.1 | 98.0 | 218.4 | 383 | 768 | 1928 | 3865 | |
| Sulfur hexafluoride | SF6 | 0.435 | SP | 2.17 | 4.35 | 10.9 | 21.7 | 43.5 | 108.7 | 217 | 435 | 1087 | 2174 | |
| | | | LP | 0.87 | 1.74 | 4.3 | 8.7 | 17.4 | 43.5 | 87 | 174 | 435 | 870 | |
| | | | minimum | 0.63 | 1.10 | 2.7 | 5.5 | 10.9 | 23.4 | 47 | 94 | 235 | 471 | |
| Xenon | Xe | 0.460 | SP | 2.30 | 4.60 | 11.5 | 23.0 | 46.0 | 115.1 | 230 | 460 | 1151 | 2302 | |
| | | | LP | 0.92 | 1.84 | 4.6 | 9.2 | 18.4 | 46.0 | 92 | 184 | 460 | 921 | |
| | | | minimum | 0.80 | 1.50 | 3.3 | 6.7 | 13.4 | 33.7 | 58 | 116 | 290 | 580 | |
| Flammable | Ethane ¹ | C2H6 | 0.996 | SP | 4.80 | 9.60 | 24.0 | 48.0 | 96.0 | 240.1 | 480 | 960 | 2401 | 4802 |
| | | | | LP | 1.92 | 3.84 | 9.6 | 19.2 | 38.4 | 96.0 | 192 | 384 | 960 | 1921 |
| | | | | minimum | 1.40 | 2.80 | 6.2 | 12.4 | 24.9 | 62.4 | 107 | 214 | 537 | 1074 |
| | Ethylene ¹ | C2H4 | 3.730 | SP | 4.98 | 9.96 | 24.9 | 49.8 | 99.6 | 248.9 | 498 | 996 | 2489 | 4979 |
| | | | | LP | 1.99 | 3.98 | 10.0 | 19.9 | 39.8 | 99.6 | 199 | 398 | 996 | 1992 |
| | | | | minimum | 1.70 | 3.00 | 6.5 | 13.1 | 26.2 | 65.8 | 113 | 226 | 565 | 1132 |
| | Hydrogen | H2 | 1.320 | SP | 18.65 | 37.30 | 93.2 | 186.5 | 373.0 | 932.4 | 1865 | 3730 | 9324 | 18649 |
| | | | | LP | 7.46 | 14.92 | 37.3 | 74.6 | 149.2 | 373.0 | 746 | 1492 | 3730 | 7460 |
| | | | | minimum | 10.50 | 15.80 | 36.1 | 65.2 | 116.2 | 255.0 | 512 | 1026 | 2573 | 4415 |
| | Methane | CH4 | 0.789 | SP | 6.60 | 13.20 | 33.0 | 66.0 | 132.0 | 330.0 | 660 | 1320 | 3300 | 6601 |
| LP | | | | 2.64 | 5.28 | 13.2 | 26.4 | 52.8 | 132.0 | 264 | 528 | 1320 | 2640 | |
| minimum | | | | 2.64 | 4.50 | 10.0 | 17.6 | 35.3 | 88.6 | 178 | 304 | 763 | 1527 | |
| Propane ¹ | C3H8 | 0.563 | SP | 3.94 | 7.89 | 19.7 | 39.4 | 78.9 | 197.2 | 394 | 789 | 1972 | 3944 | |
| | | | LP | 1.58 | 3.15 | 7.9 | 15.8 | 31.5 | 78.9 | 158 | 315 | 789 | 1577 | |
| | | | minimum | 1.16 | 2.00 | 5.0 | 10.0 | 20.0 | 42.9 | 86 | 172 | 431 | 862 | |
| Fluoro-carbons | Carbon tetrafluoride ¹ | CF4 | 0.447 | SP | 2.81 | 5.63 | 14.1 | 28.1 | 56.3 | 140.7 | 281 | 563 | 1407 | 2814 |
| | | | | LP | 1.13 | 2.25 | 5.6 | 11.3 | 22.5 | 56.3 | 113 | 225 | 563 | 1126 |
| | | | | minimum | 0.84 | 1.60 | 3.6 | 7.2 | 14.5 | 36.3 | 62 | 125 | 312 | 624 |
| Hexafluoroethene ¹ | C2F6 | 0.629 | SP | 2.24 | 4.47 | 11.2 | 22.4 | 44.7 | 111.8 | 224 | 447 | 1118 | 2237 | |
| | | | LP | 0.89 | 1.79 | 4.5 | 8.9 | 17.9 | 44.7 | 89 | 179 | 447 | 895 | |
| | | | minimum | 0.65 | 1.10 | 2.8 | 5.6 | 11.2 | 24.1 | 48 | 96 | 241 | 483 | |
| Trifluoromethane ¹ | CHF3 | 0.983 | SP | 3.15 | 6.29 | 15.7 | 31.5 | 62.9 | 157.3 | 315 | 629 | 1573 | 3147 | |
| | | | LP | 1.26 | 2.52 | 6.3 | 12.6 | 25.2 | 62.9 | 126 | 252 | 629 | 1259 | |
| | | | minimum | 0.95 | 1.90 | 4.1 | 8.2 | 16.3 | 41.0 | 70 | 141 | 352 | 705 | |
| Other | Air | Air | 0.795 | SP | 4.92 | 9.83 | 24.6 | 49.2 | 98.3 | 245.9 | 492 | 983 | 2459 | 4917 |
| | | | | LP | 1.97 | 3.93 | 9.8 | 19.7 | 39.3 | 98.3 | 197 | 393 | 983 | 1967 |
| | | | | minimum | 1.97 | 3.40 | 7.7 | 15.0 | 28.0 | 67.0 | 129 | 248 | 596 | 1173 |
| | Carbon dioxide | CO2 | 1.000 | SP | 3.98 | 7.95 | 19.9 | 39.8 | 79.5 | 198.8 | 398 | 795 | 1988 | 3977 |
| | | | | LP | 1.59 | 3.18 | 8.0 | 15.9 | 31.8 | 79.5 | 159 | 318 | 795 | 1591 |
| | | | | minimum | 1.40 | 2.40 | 6.0 | 10.6 | 21.2 | 53.2 | 91 | 183 | 458 | 916 |
| | Carbon monoxide | CO | 0.795 | SP | 5.00 | 10.00 | 25.0 | 50.0 | 100.0 | 250.0 | 500 | 1000 | 2500 | 5000 |
| | | | | LP | 2.00 | 4.00 | 10.0 | 20.0 | 40.0 | 100.0 | 200 | 400 | 1000 | 2000 |
| | | | | minimum | 2.00 | 3.50 | 7.8 | 15.6 | 27.4 | 68.7 | 138 | 276 | 592 | 1186 |
| | Nitrous oxide | N2O | 0.367 | SP | 3.98 | 7.95 | 19.9 | 39.8 | 79.5 | 198.8 | 398 | 795 | 1988 | 3976 |
| LP | | | | 1.59 | 3.18 | 8.0 | 15.9 | 31.8 | 79.5 | 159 | 318 | 795 | 1590 | |
| minimum | | | | 1.40 | 2.40 | 6.0 | 10.6 | 21.1 | 53.0 | 91 | 182 | 456 | 912 | |
| Octafluorocyclobutane ¹ | C4F8 | 0.935 | SP2 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | |
| | | | LP | 0.73 | 1.47 | 3.7 | 7.3 | 14.7 | 36.7 | 73 | 147 | 367 | 733 | |
| | | | minimum | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | |
| Oxygen | O2 | | SP | 4.68 | 9.35 | 23.4 | 46.8 | 93.5 | 233.9 | 468 | 935 | 2339 | 4677 | |
| | | | LP | 1.87 | 3.74 | 9.4 | 18.7 | 37.4 | 93.5 | 187 | 374 | 935 | 1871 | |
| | | | minimum | 1.87 | 3.20 | 7.3 | 14.6 | 25.6 | 64.2 | 129 | 258 | 553 | 1107 | |

Ratio = Inverse square root density ratio of the current gas to nitrogen

KF = Pressure to flow conversion ratio, sccm/kPa

To estimate a flow in a given gas at a given pressure: Flow(slm) = KF * pressure in kPa absolute/1000 * Gas Ratio

Cal types:

SP = Standard Pressure calibration 50 kPa to 500kPa absolute; table shows flow @ 500 kPa, flow @ 50 kPa is 10% of value shown.

LP = Low Pressure calibration 20 kPa to 200 kPa; table shows flow @ 200 kPa, flow @ 20 kPa is 10% of value shown.

minimum = table shows estimated minimum flow without vacuum if atmospheric pressure is ~ 100 kPa

Note: Non-Standard Pressure (NSP) calibrations are available up to 600 kPa absolute

¹ This gas is not currently supported by the molbox RFM

² The vapor pressure of octafluorocyclobutane is 230 kPa absolute, SP operation is not possible

All flows are nominal and approximate; in gases other than N2 and Air, flows may vary up to 10 % due to differences in characteristics and manufacturing

Pressure dependent calibration types for molbloc-L

Different pressure dependent calibration options for molbloc-Ls determine the range of operating pressures over which a molbloc-L can be used within its mass flow measurement specifications. The calibration option also affects the molbloc-L flow range and the differential pressure associated with the flow range. The different calibration options are offered to accommodate the requirement of the user's application. All molbloc-Ls are delivered with an N₂ calibration (full mod, low pressure) by default. Calibrations with other gases or N₂ calibration other than full mod, low pressure, must be specified.

| Calibration type | Operating pressure | Nominal differential pressure at FS flow |
|---|--|--|
| Full mod, low pressure | 250 kPa to 325 kPa absolute (22 psig to 33 psig) upstream of molbloc | 0 kPa to 50 kPa (7.5 psi) |
| Full mod, high pressure | 325 kPa to 525 kPa absolute (33 psig to 62 psig) upstream of molbloc | 0 kPa to 50 kPa (7.5 psi) |
| Full mod, downstream | Atmospheric pressure downstream of molbloc | 0 kPa to 100 kPa (15 psi) |
| Single P, low pressure (non-N ₂ gases only) | Any specified single molbloc upstream pressure between 250 kPa and 325 kPa absolute (22 psig to 33 psig) | 0 kPa to 50 kPa (7.5 psi) |
| Single P, high pressure (non-N ₂ gases only) | Any specified single molbloc upstream pressure between 325 kPa and 525 kPa absolute (33 psig to 62 psig) | 0 kPa to 50 kPa (7.5 psi) |

molbloc-L ranges with low pressure calibrations

| | | molbloc-L size and full scale flow (sccm @ 0 °C) | | | | | | | | | |
|----------------|---|--|---------|-----------|-----------|------------|-------------|--------------|---------------|---------------|-----------------|
| | | Size | | | | | | | | | |
| Gases | | 1E1 | 5E1 | 1E2 | 2E2 | 5E2 | 1E3 | 5E3 | 1E4 | 3E4 | 1E5 |
| Inert | Nitrogen N ₂ | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 100000 |
| | Argon Ar | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 80000 |
| | Helium He | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 100000 |
| | Sulfur hexafluoride SF ₆ | 10 | 50 | 100 | 200 | 500 | 1000 | 2000 500 | 6000 1000 | 6000 4000 | — |
| | Xenon Xe | 10 | 40 | 80 | 150 | 400 | 800 | 3500 500 | 8000 | 11000 3000 | 30000 20000 |
| Flammable | Butane C ₄ H ₁₀ | 20 | 100 | 130 30 | 270 50 | 670 140 | 2300 | 2200 1400 | 7000 3000 | — — | — |
| | Ethane C ₂ H ₆ | 20 | 100 | 200 | 400 | 1000 | 2000 | 6000 1000 | 18000 2000 | 18000 6000 | 60000 50000 |
| | Ethylene C ₂ H ₄ | 16 | 18 | 160 | 320 | 800 | 1600 | 7000 1000 | 16000 | 20000 5000 | 70000 40000 |
| | Hydrogen H ₂ | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 60000 | 200000 |
| | Methane CH ₄ | 16 | 80 | 160 | 320 | 800 | 1600 | 8000 | 16000 | 40000 5000 | 120000 40000 |
| | Propane C ₃ H ₈ | 20 | 100 | 200 | 400 | 1000 | 2000 | 3000 1000 | 10000 2000 | 10000 7000 | — |
| Fluoro-carbons | Carbon tetrafluoride CF ₄ | 10 | 50 | 100 | 200 | 500 | 1000 | 4000 600 | 10000 | 12000 3000 | 36000 25000 |
| | Hexafluoroethene C ₂ F ₆ | 10 | 50 | 100 | 200 | 500 | 1000 | 2000 600 | 6000 1200 | 6000 4000 | — |
| | Trifluoromethane CHF ₃ | 10 | 50 | 100 | 200 | 500 | 1000 | 4000 600 | 10000 | 12000 4000 | 38000 30000 |
| Other | Air | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 100000 |
| | Carbon dioxide CO ₂ | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 20000 4000 | 60000 30000 |
| | Carbon monoxide CO | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 100000 |
| | Nitrous oxide N ₂ O | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 20000 4000 | 60000 30000 |
| | Octafluorocyclobutane ¹ C ₄ F ₈ | 15 | 60 9 | 65 17 | 130 34 | 330 85 | 1100 175 | 1050 840 | 3400 1700 | — — | — |
| | Oxygen O ₂ | 10 | 50 | 100 | 200 | 500 | 1000 | 5000 | 10000 | 30000 | 80000 |

See page 5 for footnotes.

molbloc-L ranges with high pressure calibrations

| | | molbloc-L size and full scale flow (sccm @ 0 °C) | | | | | | | | | | |
|----------------|------------------------------------|--|-----|-----------|-----------|------------|-------------|-------------|---------------|---------------|----------------|------------|
| | | Size | | | | | | | | | | |
| Gases | | 1E1 | 5E1 | 1E2 | 2E2 | 5E2 | 1E3 | 5E3 | 1E4 | 3E4 | 1E5 | |
| Inert | Nitrogen | N ₂ | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 40000 7500 | N/A |
| | Argon | Ar | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 17000 | 35000 6000 | N/A |
| | Helium | He | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 65000 | N/A |
| | Sulfur hexafluoride | SF ₆ | 25 | 100 15 | 120 30 | 250 50 | 600 150 | 2000 300 | 2000 1400 | 6200 2800 | – | N/A N/A |
| | Xenon | Xe | 20 | 100 | 150 | 350 | 650 | 1700 | 3350 950 | 11000 1900 | 11000 5700 | N/A |
| Flammable | Butane ² | C ₄ H ₁₀ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Ethane | C ₂ H ₆ | 40 | 200 | 350 50 | 700 100 | 1800 200 | 4000 | 6000 2300 | 20000 4500 | 20000 13800 | N/A N/A |
| | Ethylene | C ₂ H ₄ | 40 | 200 | 350 | 700 | 1800 | 4000 | 7000 2000 | 22000 4000 | 22000 12700 | N/A |
| | Hydrogen | H ₂ | 40 | 200 | 400 | 900 | 2000 | 4500 | 22000 | 45000 | 130000 | N/A |
| | Methane | CH ₄ | 35 | 175 | 350 | 700 | 1700 | 3500 | 13000 2000 | 33000 | 42000 12000 | N/A |
| | Propane | C ₃ H ₈ | 50 | 200 25 | 200 50 | 400 100 | 1000 250 | 3500 500 | 3500 2600 | 11000 5400 | – – | N/A |
| Fluoro-carbons | Carbon tetrafluoride | CF ₄ | 20 | 100 | 200 | 400 | 1000 | 2000 | 3700 1200 | 12000 2400 | 12000 7300 | N/A |
| | Hexafluoroethene | C ₂ F ₆ | 25 | 100 15 | 120 30 | 250 50 | 600 150 | 2000 300 | 1800 1500 | 6000 3000 | – – | N/A |
| | Trifluoromethane | CHF ₃ | 25 | 125 | 240 30 | 450 60 | 1200 150 | 2500 | 4000 1500 | 12000 3000 | 12000 8800 | N/A |
| Other | Air | Air | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 40000 7200 | N/A |
| | Carbon dioxide | CO ₂ | 25 | 125 | 250 | 500 | 1250 | 2500 | 6600 1400 | 20000 2500 | 40000 8800 | N/A |
| | Carbon monoxide | CO | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 40000 7500 | N/A |
| | Nitrous oxide | N ₂ O | 25 | 125 | 250 | 500 | 1250 | 2500 | 11000 1500 | 20000 3000 | 20000 9000 | N/A |
| | Octafluorocyclobutane ² | C ₄ F ₈ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Oxygen | O ₂ | 20 | 100 | 200 | 400 | 1000 | 2000 | 10000 | 20000 | 40000 6500 | N/A |

A bold value indicates that the maximum flow is limited by the maximum Reynolds number value of 1200 which is reached before the normal differential pressure range is reached. In that case, the second value gives the minimum flow for which measurement uncertainty (accuracy) is equal to the nominal uncertainty specification. Divide the second value by 10 when using molbox RFM microrange option.

¹ Due to low vapor pressure, only downstream calibration type is available.

² The operating pressure range is greater than the vapor pressure value for this gas.

Where there is no value in the field (–), this indicates that the maximum Reynolds number is reached before the differential pressure reaches 5 kPa (1 kPa in the case of the 1E5 molbloc), therefore calibration with that gas is not useful.

General specifications

| | | |
|---------------------------------------|---|---|
| Power requirements | 85 V ac to 264 V ac, 47 Hz to 440 Hz, 18 VA max consumption | |
| Operating temperature range | 15 °C to 35 °C (59 °F to 95 °F) | |
| Storage temperature range | -20 °C to 70 °C (-4 °F to 158 °F) | |
| Vibration | Meets MIL-T-28800D | |
| Weight | 2.55 kg (5.6 lb) max | |
| Dimensions (H x W x D) | 8 cm x 22.5 cm x 20 cm (3.1 in x 8.9 in x 7.9 in) approx. | |
| Microprocessor | Motorola 68302, 16 MHz | |
| Communication ports | RS-232 (COM1), RS-232 (COM2), IEEE-488 | |
| Reference pressure transducers (RPTs) | Standard | 2 x 600 kPa (87 psia) piezoresistive silicon |
| | Microrange Option | 12.5 kPa (1.8 psid) piezoresistive silicon |
| Gases supported | for molbloc-L | Nitrogen (N ₂), Air, Argon (Ar), Carbon Monoxide (CO), Helium (He), Oxygen (O ₂), Carbon Dioxide (CO ₂), Carbon Tetrafluoride (CF ₄), Ethane (C ₂ H ₆), Ethylene (C ₂ H ₄), Fluoroform (CHF ₃), Hexafluoroethane (C ₂ F ₆), Hydrogen (H ₂), Methane (CH ₄), Nitrous Oxide (N ₂ O), Propane (C ₃ H ₈), Sulfur Hexafluoride (SF ₆) |
| | for molbloc-S | N ₂ , He, Ar, H ₂ , O ₂ , CH ₄ , Air, N ₂ O, SF ₆ , CO ₂ , CO |
| Pressure connections | Quick connectors equivalent to Swagelok QM Series (-QM2-B200) | |
| Pressure limits | Maximum working pressure: 600 kPa absolute (87 psia) | |
| Flow ranges | Covers the flow range of 1 sccm to | |
| | 100 slm with molbloc-L, and up to 5000 slm with molbloc-S | |
| Flow measurement uncertainty | ± 0.5 % of reading | |
| CE conformance | Available. Must be specified | |

Ordering information

Model

molbox RFM Reference flow monitor

Includes

Users manual, calibration certificate, power cord, (2) molbox RFM to molbloc pressure lines, (1) molbox RFM to molbloc data line, (2) Straight through pressure quick connectors

Options

RFM 02 Microrange

Accessories

RFM-RMK (401465) Rack mount kit

mfc-CB Analog MFC interface system (see mfc-CB brochure)

molstic molbloc mounting systems (see molstic brochure)

COMPASS® for molbox for Windows (401211) Calibration software

Fluke. Keeping your world up and running.®

Fluke Calibration

PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.

PO Box 1186, 5602 BD Eindhoven, The Netherlands

For more information call:

In the U.S.A. (800) 443-5853 or

Fax (425) 446-5116

In Europe/M-East/Africa +31 (0) 40 2675 200 or

Fax +31 (0) 40 2675 222

In Canada (800)-36-FLUKE or

Fax (905) 890-6866

From other countries +1 (425) 446-5500 or

Fax +1 (425) 446-5116

Web access: <http://www.fluke.com>

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