

# molbox RFM™ Reference Flow Monitor



## 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 settable reference pressure and temperature conditions.

## DESCRIPTION

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)

#### Measurement

**Update Rate:** 1 second

**Range:** 0 to molbloc full scale depending on gas and molbloc pressure dependent calibration type (see molbloc-L tables)

**Resolution:** 0.01% FS

**Linearity:** ± 0.23% of reading from 10 to 100% FS, ± 0.023% FS under 10% FS

**Repeatability:** ± 0.1% of reading from 10 to 100% FS, ± 0.01% FS under 10% FS

**Precision<sup>1</sup>:** ± 0.25% of reading from 10 to 100% FS, ± 0.025% FS under 10% FS

#### Predicted

**Stability<sup>2</sup>:** ± 0.15% of reading from 10 to 100% FS, (One Year) ± 0.015% FS under 10% FS

#### Measurement

**Uncertainty<sup>3</sup>:** ± 0.5% of reading from 10 to 100% FS, ± 0.05% FS under 10% FS

### molbloc-S (all ranges)

**Update Rate:** 1 second

**Range:** The flow related to 20 to 200 kPa absolute (3 to 30 psia) or 50 to 500 kPa absolute (7 to 70 psia) upstream (see molbloc-S table)

**Resolution:** ±0.01% of reading

**Linearity:** ±0.25% of reading

**Repeatability:** ±0.1% of reading

**Precision<sup>1</sup>:** ±0.3% of reading

#### Predicted

**Stability<sup>2</sup>:** ±0.2% of reading (One Year)

#### Measurement

**Uncertainty<sup>3</sup>:** ±0.5% of reading from 50-500kPa, ±0.5% of the flow @ 50kPa from 20-50kPa

## molbox RFM with Microrange Option

### molbloc-L (ranges 1E1-L thru 3E4-L)

#### Measurement

**Update Rate:** 1 second

**Range:** 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

**Linearity:** ±0.23% of reading from 1 to 100% FS, ±0.0023% FS under 1% FS

**Repeatability:** ±0.1% of reading from 1 to 100% FS, ±0.001% FS under 1% FS

**Precision<sup>1</sup>:** ±0.25% of reading from 1 to 100% FS, ±0.0025% FS under 1% FS

#### Predicted

**Stability<sup>2</sup>:** ±0.15% of reading from 1 to 100% FS, (One Year) ±0.0015% FS under 1% FS

#### Measurement

**Uncertainty<sup>3</sup>:** ±0.5% of reading from 1 to 100% FS, ±0.005% FS under 1% FS

### molbloc-L (ranges 1E5 only)

#### Measurement

**Update Rate:** 1 second

**Range:** 0 to molbloc full scale depending on gas and molbloc pressure dependent calibration type (see molbloc-L tables)

**Resolution:** 0.01% FS

**Linearity:** ± 0.25% of reading from 5 to 100% FS, ± 0.0125% FS under 5% FS

**Repeatability:** ± 0.2% of reading from 5 to 100% FS, ± 0.01% FS under 5% FS

**Precision<sup>1</sup>:** ± 0.32% of reading from 5 to 100% FS, ± 0.016% FS under 5% FS

#### Predicted

**Stability<sup>2</sup>:** ± 0.2% of reading from 5 to 100% FS, (One Year) ± 0.01% FS under 5% FS

#### Measurement

**Uncertainty<sup>3</sup>:** ± 0.5% of reading from 5 to 100% FS, ± 0.025% FS under 5% FS

### 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.

<sup>1</sup> **Precision:** Combined linearity, hysteresis, repeatability.

<sup>2</sup> **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.

<sup>3</sup> **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 N<sub>2</sub>. 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.

## 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 to 500 kPa absolute (7 to 70 psia) gives the most flexibility and allows partial use of the range without a vacuum. The Low Pressure (LP) calibration of 20 to 200 kPa (3 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 on page 3.

Calibration Type	Operating Pressure	Considerations
Standard pressure	50-500kPa absolute (7 to 70 psia)	Must be flowing to a vacuum to obtain full range
Low pressure	20-200 kPa absolute (3 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: KF (sccm/kPa):	1E1-S 10	2E1-S 20	5E1-S 50	1E2-S 100	2E2-S 200	5E2-S 500	1E3-S 1000	2E3-S 2000	5E3-S 5000	1E4-S 10000		
GASES		Ratio	Cal Type												
<b>INERT</b>	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 <sup>1</sup>	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	
	<b>FLAMMABLE</b>	Ethane <sup>1</sup>	C2H6	0.960	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 <sup>1</sup>		C2H4	0.996	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	3.730	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	1.320	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 <sup>1</sup>		C3H8	0.789	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	
<b>FLUORO-CARBONS</b>		Carbon Tetrafluoride <sup>1</sup>	CF4	0.563	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 <sup>1</sup>	C2F6	0.447	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 <sup>1</sup>	CHF3	0.629	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		
<b>OTHER</b>	Air	Air	0.983	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	0.795	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	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	7.8	15.6	27.4	68.7	138	276	592	1186	
	Nitrous Oxide	N2O	0.795	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 <sup>1</sup>	C4F8	0.367	SP <sup>2</sup>	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α
				LP	0.73	1.47	3.7	7.3	14.7	36.7	73	147	367	733	
				minimum	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α	n/α
	Oxygen	O2	0.935	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 - 500kPa absolute; table shows flow @ 500 kPa, flow @ 50 kPa is 10% of value shown.

LP = Low Pressure calibration 20 - 200kPa; 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 600kPa absolute

<sup>1</sup>This gas is not currently supported by the molbox RFM

<sup>2</sup>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 to 325 kPa absolute (22 to 33 psig) upstream of molbloc	0 to 50 kPa (7.5 psi)
Full mod, high pressure	325 to 525 kPa absolute (33 to 62 psig) upstream of molbloc	0 to 50 kPa (7.5 psi)
Full mod, downstream	atmospheric pressure downstream of molbloc	0 to 100 kPa (15 psi)
Single P, low pressure (non-N2 gases only)	Any specified single molbloc upstream pressure between 250 and 325 kPa absolute (22 to 33 psig)	0 to 50 kPa (7.5 psi)
Single P, high pressure (non-N2 gases only)	Any specified single molbloc upstream pressure between 325 and 525 kPa absolute (33 to 62 psig)	0 to 50 kPa (7.5 psi)

## molbloc-L Ranges with Low Pressure Calibrations

- full mod, low pressure
- full mod, downstream
- single P, low pressure

			molbloc-L SIZE AND FULL SCALE FLOW (sccm)									
GASES			SIZE 1E1	SIZE 5E1	SIZE 1E2	SIZE 2E2	SIZE 5E2	SIZE 1E3	SIZE 5E3	SIZE 1E4	SIZE 3E4	SIZE 1E5
INERT	Nitrogen	N <sub>2</sub>	10	50	100	200	500	1 000	5 000	10 000	30 000	100 000
	Argon	Ar	10	50	100	200	500	1 000	5 000	10 000	25 000	80 000
	Helium	He	10	50	100	200	500	1 000	5 000	10 000	30 000	100 000
	Sulfur Hexafluoride	SF <sub>6</sub>	10	50	100	200	500	1 000	<b>2 000</b> <b>500</b>	<b>6 000</b> <b>1 000</b>	<b>6 000</b> <b>4 000</b>	-- --
	Xenon	XE	10	40	80	150	400	800	<b>3 500</b> <b>500</b>	8 000	<b>11 000</b> <b>3 000</b>	<b>30 000</b> <b>20 000</b>
FLAMMABLE	Butane	C <sub>4</sub> H <sub>10</sub>	20	100	<b>130</b> <b>30</b>	<b>270</b> <b>50</b>	<b>670</b> <b>140</b>	2 300	<b>2 200</b> <b>1 400</b>	<b>7 000</b> <b>3 000</b>	-- --	-- --
	Ethane	C <sub>2</sub> H <sub>6</sub>	20	100	200	400	1 000	2 000	<b>6 000</b> <b>1 000</b>	<b>18 000</b> <b>2 000</b>	<b>18 000</b> <b>6 000</b>	<b>60 000</b> <b>50 000</b>
	Ethylene	C <sub>2</sub> H <sub>4</sub>	16	80	160	320	800	1 600	<b>7 000</b> <b>1 000</b>	16 000	<b>20 000</b> <b>5 000</b>	<b>70 000</b> <b>40 000</b>
	Hydrogen	H <sub>2</sub>	20	100	200	400	1 000	2 000	10 000	20 000	60 000	200 000
	Methane	CH <sub>4</sub>	16	80	160	320	800	1 600	8 000	16 000	<b>40 000</b> <b>5 000</b>	<b>120 000</b> <b>40 000</b>
	Propane	C <sub>3</sub> H <sub>8</sub>	20	100	200	400	1 000	2 000	<b>3 000</b> <b>1 000</b>	<b>10 000</b> <b>2 000</b>	<b>10 000</b> <b>7 000</b>	-- --
FLUORO-CARBONS	Carbon Tetrafluoride	CF <sub>4</sub>	10	50	100	200	500	1 000	<b>4 000</b> <b>600</b>	10 000	<b>12 000</b> <b>3 000</b>	<b>36 000</b> <b>25 000</b>
	Hexafluoroethene	C <sub>2</sub> F <sub>6</sub>	10	50	100	200	500	1 000	<b>2 000</b> <b>600</b>	<b>6 000</b> <b>1 200</b>	<b>6 000</b> <b>4 000</b>	-- --
	Trifluoromethane	CHF <sub>3</sub>	10	50	100	200	500	1 000	<b>4 000</b> <b>600</b>	10 000	<b>12 000</b> <b>4 000</b>	<b>38 000</b> <b>30 000</b>
OTHER	Air	Air	10	50	100	200	500	1 000	5 000	10 000	30 000	100 000
	Carbon Dioxide	CO <sub>2</sub>	10	50	100	200	500	1 000	5 000	10 000	<b>20 000</b> <b>4 000</b>	<b>60 000</b> <b>30 000</b>
	Carbon Monoxide	CO	10	50	100	200	500	1 000	5 000	10 000	30 000	100 000
	Nitrous Oxide	N <sub>2</sub> O	10	50	100	200	500	1 000	5 000	10 000	<b>20 000</b> <b>4 000</b>	<b>60 000</b> <b>30 000</b>
	Octafluorocyclobutane	C <sub>4</sub> F <sub>8</sub>	15	<b>60</b> <b>9</b>	<b>65</b> <b>17</b>	<b>130</b> <b>34</b>	<b>330</b> <b>85</b>	<b>1 100</b> <b>175</b>	<b>1 050</b> <b>840</b>	<b>3 400</b> <b>1 700</b>	-- --	-- --
	Oxygen	O <sub>2</sub>	10	50	100	200	500	1 000	5 000	10 000	30 000	80 000

# molbloc-L Ranges with High Pressure Calibrations

• full mod, high pressure

• single P, high pressure

GASES			molbloc-L SIZE AND FULL SCALE FLOW (sccm)									
			SIZE 1E1	SIZE 5E1	SIZE 1E2	SIZE 2E2	SIZE 5E2	SIZE 1E3	SIZE 5E3	SIZE 1E4	SIZE 3E4	SIZE 1E5
INERT	Nitrogen	N <sub>2</sub>	20	100	200	400	1 000	2 000	10 000	20 000	<b>40 000</b> 7 500	--
	Argon	Ar	20	100	200	400	1 000	2 000	10 000	17 000	<b>35 000</b> 6 000	--
	Helium	He	20	100	200	400	1 000	2 000	10 000	20 000	65 000	--
	Sulfur Hexafluoride	SF <sub>6</sub>	25	<b>100</b> 15	<b>120</b> 30	<b>250</b> 50	<b>600</b> 150	<b>2 000</b> 300	<b>2 000</b> 1 400	<b>6 200</b> 2 800	--	--
	Xenon	XE	20	100	150	350	650	1 700	<b>3350</b> 950	<b>11 000</b> 1 900	<b>11 000</b> 5 700	--
FLAMMABLE	Butane	C <sub>4</sub> H <sub>10</sub>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Ethane	C <sub>2</sub> H <sub>6</sub>	40	200	<b>350</b> 50	<b>700</b> 100	<b>1 800</b> 200	4 000	<b>6 000</b> 2 300	<b>20 000</b> 4 500	<b>20 000</b> 13 800	--
	Ethylene	C <sub>2</sub> H <sub>4</sub>	40	200	350	700	2 000	4 000	<b>7 000</b> 2 000	<b>22 000</b> 4 000	<b>22 000</b> 12 700	--
	Hydrogen	H <sub>2</sub>	40	200	400	900	2 000	4 500	22 000	45 000	130 000	--
	Methane	CH <sub>4</sub>	35	175	350	700	1 700	3 500	<b>13 000</b> 2 000	33 000	<b>42 000</b> 12 000	--
	Propane	C <sub>3</sub> H <sub>8</sub>	50	<b>200</b> 25	<b>200</b> 50	<b>400</b> 100	<b>1 000</b> 250	<b>3 500</b> 500	<b>3 500</b> 2 600	<b>11 000</b> 5 400	--	--
FLURO-CARBONS	Carbon Tetrafluoride	CF <sub>4</sub>	20	100	200	400	1 000	2 000	<b>3 700</b> 1 200	<b>12 000</b> 2 400	<b>12 000</b> 7 300	--
	Hexafluoroethene	C <sub>2</sub> F <sub>6</sub>	25	<b>100</b> 15	<b>120</b> 30	<b>250</b> 50	<b>600</b> 150	<b>2 000</b> 300	<b>1 800</b> 1 500	<b>6 000</b> 3 000	--	--
	Trifluoromethane	CHF <sub>3</sub>	25	125	<b>240</b> 30	<b>450</b> 60	<b>1 200</b> 150	2 500	<b>4 000</b> 1 500	<b>12 000</b> 3 000	<b>12 000</b> 8 800	--
OTHER	Air	Air	20	100	200	400	1 000	2 000	10 000	20 000	<b>40 000</b> 7 200	--
	Carbon Dioxide	CO <sub>2</sub>	25	125	250	500	1 250	2 500	<b>6 600</b> 1 400	<b>20 000</b> 2 500	<b>20 000</b> 8 800	--
	Carbon Monoxide	CO	20	100	200	400	1 000	2 000	10 000	20 000	<b>40 000</b> 7 500	--
	Nitrous Oxide	N <sub>2</sub> O	25	125	250	500	1 250	2 500	<b>11 000</b> 1 500	<b>20 000</b> 3 000	<b>20 000</b> 9 000	--
	Octafluorocyclobutane	C <sub>4</sub> F <sub>8</sub>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Oxygen	O <sub>2</sub>	20	100	200	400	1 000	2 000	10 000	20 000	<b>40 000</b> 6 500	--

A bold value indicates that the maximum flow is limited by the maximum Reynolds number value of 1 200 which is reached before the normal differential pressure range is reached. In that case, the second value gives the minimum flow for which relative accuracy is ± 0.5% of reading. With the microrange option, this value is divided by 10.

Where there is no value in the table (-), this indicates that the maximum Reynolds number is reached before the differential pressures reaches 5 kPa, therefore calibration with that gas is not useful.

# molbox RFM™ Reference Flow Monitor

## GENERAL SPECIFICATIONS

<b>Power Requirements:</b> 85 to 264 VAC, 47 to 440 Hz, 18 VA max consumption	<b>Gases Supported:</b> <b>for molbloc-L</b> Nitrogen (N <sub>2</sub> ), Air, Argon (Ar), Carbon Monoxide (CO), Helium (He), Oxygen (O <sub>2</sub> ), Carbon Dioxide (CO <sub>2</sub> ), Carbon Tetrafluoride (CF <sub>4</sub> ), Ethane (C <sub>2</sub> H <sub>6</sub> ), Ethylene (C <sub>2</sub> H <sub>4</sub> ), Fluoroform (CHF <sub>3</sub> ), Hexafluoroethane (C <sub>2</sub> F <sub>6</sub> ), Hydrogen (H <sub>2</sub> ), Methane (CH <sub>4</sub> ), Nitrous Oxide (N <sub>2</sub> O), Propane (C <sub>3</sub> H <sub>8</sub> ), Sulfur Hexafluoride (SF <sub>6</sub> )
<b>Operating Temperature Range:</b> 15 to 35 °C	<b>for molbloc-S</b> N <sub>2</sub> , He, Ar, H <sub>2</sub> , O <sub>2</sub> , CH <sub>4</sub> , Air, N <sub>2</sub> O, SF <sub>6</sub> , CO <sub>2</sub> , CO
<b>Storage Temperature Range:</b> -20 to 70 °C	<b>Pressure Connections:</b> Quick connectors equivalent to Swagelok QM Series (-QM2-B200)
<b>Vibration:</b> Meets MIL-T-28800D	<b>Pressure Limits:</b> Maximum Working Pressure: 600 kPa absolute (87 psia)
<b>Weight:</b> 2.55 kg (5.6 lb) max	<b>Flow Ranges:</b> Covers the flow range of 1 sccm to 100 slm with molbloc-L, and up to 5000 slm with molbloc-S.
<b>Dimensions:</b> 8 cm H x 22.5 cm W x 20 cm D (3.1" x 8.9" x 7.9") approx.	<b>Flow Measurement Uncertainty:</b> ± 0.5% of reading
<b>Microprocessor:</b> Motorola 68302, 16 MHz	<b>CE Conformance:</b> Available. Must be specified
<b>Communication Ports:</b> RS-232 (COM1), RS-232 (COM2), IEEE-488	
<b>Reference Pressure Transducers (RPTs):</b> Standard: 2 x 600 kPa (87 psia) piezoresistive silicon. Microrange Option: 12.5 kPa (1.8 psid) piezoresistive silicon	

## ORDERING INFORMATION

### STANDARD DELIVERY

- 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

**Product Designation:** molbox RFM

**Part Number:** FAM0005

**Ordering Description:** Reference flow monitor

### OPTIONS

**RFM 02:** Microrange

### ACCESSORIES

**RFM-RMK:** Rack mount kit  
(401465)

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

**molstic:** molbloc mounting systems (see molstic brochure)

**COMPASS® for molbox for Windows:** Calibration software  
(401211)

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*Due to a policy of continual product improvement, product specifications, descriptions and features are subject to change without notice.*

**DH Instruments, a Fluke Company**

4765 East Beautiful Lane  
Phoenix, AZ 85044-5318  
USA

