

# Series 150 and 150K

## 150 MM, Calibration Chart Referenced, Flowmeters

The Series 150 & 150K Flowmeters offer precise measurement of gas or liquid flow over a wide range of flow rates at low pressures. Suitable for plant and laboratory use, they are widely used in gas chromatography, atomic absorption spectroscopy and process control.

Each flowmeter consists of a replaceable glass metering tube and two standard floats (glass and stainless steel) which expand the range of the flowmeter. The linear scale allows each flowmeter to be used with a variety of gases via a calibration chart (see "Calibration" information box at bottom of page). Tube selection depends on the gas being metered and the range of flow rates required. See Tube Selection Table (pages 116–117).

### Standard Features

- Two Floats per Tube (Standard) expand range of flowmeter.
- Ribbed Tubes stabilize floats and improve accuracy and readability.
- Borosilicate Glass Tubes allow operating temperatures up to 250°F (200°F for Series 150K).
- Linear Scale (10–150 mm) allows each flowmeter to be used with a variety of gases via a calibration chart.
- Threaded Fittings with Locking Nuts (Standard on Series 150) permit front panel mounting.\*
- Unique Valve Design allows bubble-tight shutoff.
- Availability of Aluminum, Stainless Steel or Kynar® Construction provides a wide material selection for maximum gas compatibility.

\*Series 150K Flowmeters may be front panel mounted using predrilled holes on rear of flowmeter and self-tapping screws.

### Optional Features

- Sapphire, Carboloy or Tantalum Floats allow range of flowmeter to be changed without replacing the tube.
- Baseplate with Leveling Screws permits bench use.
- Aluminum Bezel permits flush panel mounting.
- Individual Calibration provides  $\pm 1\%$  of full scale accuracy ( $\pm 2\%$  on tube No. 1).
- Inlet Filter traps foreign matter, extends flowmeter life and reduces maintenance.
- High Accuracy Valve with Non-Rotating Stem (NRS) allows very fine adjustments to flow settings (see Table I).

### Specifications

Maximum Pressure and Temperature:  
 Series 150: 200 psig at 250°F  
 Series 150K:  
 150 psig at 100°F  
 75 psig at 200°F

Minimum Operating Temperature: 32°F

Accuracy:  $\pm 5\%$  of full scale (standard) from 10% to 100% of range. Optional  $\pm 1\%$  of full scale calibration is available.

Repeatability: Within 0.5% of full scale

Tube Graduations: Millimeters (0–150)

Scale Length: 150 mm

Inlet and Outlet Connections:  
 150: 1/8" NPT female  
 150K: 1/4" NPT female

Approximate Weight: 1 lb

### Materials of Construction

Tubes: Borosilicate Glass with float stops of Teflon®

Floats: Borosilicate Glass and Type 316 Stainless Steel are standard. Other materials are available—see Tube Selection Table (pages 116 & 117) and Optional Equipment

End Blocks: See Table I

Inlet/Outlet Adaptors: See Table I

Side Plates: Aluminum

Back Plate: White Plastic

Front Plate: Clear Plastic

Seals and Packing: Viton® (other materials available on special order)

Valve(s):  
 FM4302, FM4602: Chrome-Plated Brass  
 All Others: Type 316 Stainless Steel

### Calibration

Standard ( $\pm 5\%$  accuracy) calibration is performed using Air at normal temperature (70°F) and pressure (14.7 psia). Calibrations for gases other than Air are mathematically derived from the Air calibration. Calibration charts for Air are shipped with each flowmeter or replacement tube. Calibration charts for many other gases and gas mixtures are available at no additional charge. Specify the required calibration charts when ordering. The accuracy of this calibration is  $\pm 5\%$  of full scale.



Series 150 Single Tube Flowmeter with Optional Baseplate



Series 150 Four Tube Flowmeter with Optional Baseplate

**Table I**

| Series             | Configuration                               | End Blocks Material                      | Inlet/Outlet Adaptor Material          | Single Tube Flowmeter Part No.         | Four Tube Flowmeter Part No.              |
|--------------------|---|--|--|--|---|
| 150<br>150<br>150K | [ Without Metering Valve ]                  | Aluminum<br>Type 316 Stn. Stl.<br>Kynar® | Aluminum<br>Type 316 Stn. Stl.<br>None | FM4300-( )<br>FM4310-( )<br>FM4440-( ) | FM4600-( )<br>FM4610-( )<br>Not Available |
| 150<br>150<br>150K | [ With Standard Metering Valve ]            | Aluminum<br>Type 316 Stn. Stl.<br>Kynar® | Aluminum<br>Type 316 Stn. Stl.<br>None | FM4301-( )<br>FM4311-( )<br>FM4441-( ) | FM4601-( )<br>FM4611-( )<br>Not Available |
| 150<br>150<br>150K | [ With High Accuracy (NRS) Metering Valve ] | Aluminum<br>Type 316 Stn. Stl.<br>Kynar® | Aluminum<br>Type 316 Stn. Stl.<br>None | FM4302-( )<br>FM4312-( )<br>FM4442-( ) | FM4602-( )<br>FM4612-( )<br>Not Available |

Where "( )" is indicated above under "Single Tube Flowmeter," complete the part number by inserting applicable tube number from Tube Selection Table on pages 116 & 117. Example: FM4300-1. Order by complete part number.

Where "( )" is indicated above under "Four Tube Flowmeter," complete the part number by inserting four applicable tube numbers from Tube Selection Table on pages 116 & 117. Place the desired tube numbers in the order in which they are to be installed in the flowmeter, from left to right. Example: FM4601-2314 for tube nos. 2, 3, 1 and 4. Order by complete part number.

**Table II, Replacement Metering Valves**

| Flowmeter Tube No. | Standard Metering Valve Part No. (Size) | Chrome-Plated Brass High Accuracy (NRS) Valve Part No. (Size) | 316 Stainless Steel High Accuracy (NRS) Valve Part No. (Size) |
|--------------------|---|---|---|
| FM4331             | 0202-4113 (L)                           | 0202-4080 (1)   | 0202-4086 (1)   |
| FM4332             | 0202-4113 (L)                           | 0202-4081 (2)   | 0202-4087 (2)   |
| FM4333             | 0202-4113 (L)                           | 0202-4082 (3)   | 0202-4088 (3)   |
| FM4333A            | 0202-4113 (L)                           | 0202-4083 (4)   | 0202-4089 (4)   |
| FM4334             | 0202-4114 (M)                           | 0202-4084 (5)   | 0202-4090 (5)   |
| FM4334B            | 0202-4114 (M)                           | 0202-4085 (6)   | 0202-4091 (6)   |
| FM4335             | 0202-4115 (H)                           | 0202-4085 (6)   | 0202-4091 (6)   |
| FM4336             | 0202-4115 (H)                           | 0202-4085 (6)   | 0202-4091 (6)   |

**Optional Equipment**

| Equipment  | Part No.     |
|--|--------------|
| Baseplate—Fits single or four tube flowmeters                    | FM4702       |
| Inlet Filter, 2 micron   |              |
| Aluminum   | FM4741       |
| Type 316 Stainless Steel (Series 150)                            | FM4746       |
| Type 316 Stainless Steel (Series 150K)                           | SG6113       |
| Replacement Metering Valves                                      | See Table II |
| Replacement Tubes  | See page 117 |
| Floats*  |              |
| Sapphire Float   |              |
| Flowmeters with Tube Numbers FM4331 – FM4334B                    | S1000        |
| Flowmeters with Tube Numbers FM4335 – FM4336                     | S1001        |
| Carboloy Float   |              |
| Flowmeters with Tube Numbers FM4331 – FM4334B                    | C1000        |
| Flowmeters with Tube Numbers FM4335 – FM4336                     | C1001        |
| Tantalum Float   |              |
| Flowmeters with Tube Numbers FM4331 – FM4334B                    | T1000        |
| Flowmeters with Tube Numbers FM4335 – FM4336                     | T1001        |
| Aluminum Bezel for Flush Panel Mounting—single tube version only | FM4710       |
| ± 1% Full Scale Calibration** (one tube, both floats)            | CC100        |

\* Tubes are supplied standard with borosilicate glass and stainless steel floats. As an option, the glass float may be replaced by sapphire; the stainless steel float may be replaced by either carboloy or tantalum.

\*\* Specify gas, temperature and pressure when ordering a ±1% calibration. Please note the accuracy for tube No. 1 is ±2%.

### Tube Selection Table for Series 150 and 150K Flowmeters

Flow rates shown are maximum flow rates at 70°F and 14.7 psia. (Minimum flow rates = 1/10 of maximum)

| Tube No. | Float Material* | Air   |       | Argon |       | Carbon Dioxide |       | Helium |       |
|----------|-----------------|-------|-------|-------|-------|----------------|-------|--------|-------|
|          |                 | slpm  | scfh  | slpm  | scfh  | slpm           | scfh  | slpm   | scfh  |
| 1        | Glass           | 0.050 | 0.106 | 0.041 | 0.087 | 0.059          | 0.125 | 0.045  | 0.095 |
|          | Sapphire        | 0.077 | 0.163 | 0.063 | 0.134 | 0.088          | 0.186 | 0.071  | 0.150 |
|          | 316 Stn. Stl.   | 0.148 | 0.313 | 0.122 | 0.259 | 0.160          | 0.339 | 0.145  | 0.307 |
|          | Carboly         | 0.251 | 0.531 | 0.208 | 0.441 | 0.268          | 0.568 | 0.269  | 0.570 |
|          | Tantalum        | 0.274 | 0.580 | 0.227 | 0.481 | 0.293          | 0.621 | 0.299  | 0.634 |
| 2        | Glass           | 0.088 | 0.186 | 0.072 | 0.153 | 0.103          | 0.218 | 0.083  | 0.176 |
|          | Sapphire        | 0.136 | 0.288 | 0.111 | 0.235 | 0.154          | 0.326 | 0.130  | 0.275 |
|          | 316 Stn. Stl.   | 0.258 | 0.546 | 0.213 | 0.451 | 0.278          | 0.589 | 0.262  | 0.555 |
|          | Carboly         | 0.439 | 0.929 | 0.363 | 0.769 | 0.446          | 0.945 | 0.483  | 1.02  |
|          | Tantalum        | 0.478 | 1.01  | 0.396 | 0.839 | 0.481          | 1.02  | 0.535  | 1.13  |
| 3        | Glass           | 0.380 | 0.805 | 0.318 | 0.674 | 0.358          | 0.759 | 0.494  | 1.05  |
|          | Sapphire        | 0.518 | 1.10  | 0.433 | 0.918 | 0.482          | 1.02  | 0.759  | 1.61  |
|          | 316 Stn. Stl.   | 0.832 | 1.76  | 0.697 | 1.48  | 0.754          | 1.60  | 1.41   | 2.99  |
|          | Carboly         | 1.24  | 2.62  | 1.04  | 2.20  | 1.10           | 2.33  | 2.29   | 4.85  |
|          | Tantalum        | 1.33  | 2.82  | 1.11  | 2.35  | 1.17           | 2.48  | 2.47   | 5.23  |
| A        | Glass           | 0.830 | 1.76  | 0.701 | 1.48  | 0.741          | 1.57  | 1.55   | 3.29  |
|          | Sapphire        | 1.10  | 2.33  | 0.926 | 1.96  | 0.974          | 2.06  | 2.15   | 4.56  |
|          | 316 Stn. Stl.   | 1.69  | 3.58  | 1.42  | 3.02  | 1.47           | 3.12  | 3.44   | 7.30  |
|          | Carboly         | 2.44  | 5.17  | 2.06  | 4.37  | 2.11           | 4.49  | 5.16   | 11.0  |
|          | Tantalum        | 2.60  | 5.51  | 2.19  | 4.65  | 2.25           | 4.77  | 5.52   | 11.7  |
| 4        | Glass           | 2.37  | 5.02  | 2.00  | 4.24  | 2.06           | 4.37  | 5.03   | 10.7  |
|          | Sapphire        | 3.08  | 6.52  | 2.60  | 5.51  | 2.68           | 5.68  | 6.69   | 14.2  |
|          | 316 Stn. Stl.   | 4.65  | 9.84  | 3.92  | 8.31  | 4.02           | 8.52  | 10.3   | 21.9  |
|          | Carboly         | 6.67  | 14.1  | 5.64  | 12.0  | 5.65           | 12.0  | 15.0   | 31.7  |
|          | Tantalum        | 7.09  | 15.0  | 5.99  | 12.7  | 5.97           | 12.7  | 15.9   | 33.7  |
| B        | Glass           | 3.89  | 8.24  | 3.28  | 6.96  | 3.37           | 7.15  | 8.01   | 16.9  |
|          | Sapphire        | 5.06  | 10.7  | 4.27  | 9.06  | 4.35           | 9.23  | 10.7   | 22.7  |
|          | 316 Stn. Stl.   | 7.61  | 16.1  | 6.44  | 13.6  | 6.34           | 13.4  | 16.7   | 35.4  |
|          | Carboly         | 10.65 | 22.6  | 9.03  | 19.1  | 8.79           | 18.6  | 24.5   | 51.9  |
|          | Tantalum        | 11.25 | 23.8  | 9.54  | 20.2  | 9.29           | 19.7  | 26.1   | 55.3  |
| 5        | Glass           | 8.68  | 18.4  | 7.34  | 15.6  | 7.39           | 15.7  | 19.3   | 40.0  |
|          | Sapphire        | 11.2  | 23.7  | 9.46  | 20.1  | 9.47           | 20.1  | 25.3   | 53.6  |
|          | 316 Stn. Stl.   | 16.5  | 35.0  | 14.0  | 29.7  | 13.9           | 29.5  | 38.4   | 81.4  |
|          | Carboly         | 23.2  | 49.1  | 19.6  | 41.5  | 19.4           | 41.1  | 55.1   | 116.8 |
|          | Tantalum        | 24.5  | 51.9  | 20.8  | 44.1  | 20.5           | 43.4  | 58.5   | 124.0 |
| 6        | Glass           | 23.7  | 50.2  | 20.1  | 42.6  | 19.6           | 41.5  | 55.5   | 117.6 |
|          | Sapphire        | 30.1  | 63.7  | 25.5  | 54.0  | 25.0           | 53.0  | 72.7   | 154.1 |
|          | 316 Stn. Stl.   | 43.7  | 92.5  | 37.0  | 78.4  | 36.5           | 77.4  | 109.4  | 231.8 |
|          | Carboly         | 61.1  | 129.3 | 51.8  | 109.8 | 50.9           | 107.9 | 153.2  | 324.7 |
|          | Tantalum        | 64.6  | 136.8 | 54.8  | 116.1 | 53.8           | 114.0 | 162.0  | 343.3 |

Flow capacities for gases not listed may be obtained from your Advanced Representative.

\*Series 150 flow tubes are supplied standard with both a glass and stainless steel float. Other float materials listed are optional.

See Optional Equipment on page 115

| Tube No. | Hydrogen     |              | Nitrogen     |              | Oxygen       |              | Water<br>ccm  |
|----------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
|          | slpm         | scfh         | slpm         | scfh         | slpm         | scfh         |               |
| 1        | 0.101        | 0.214        | 0.051        | 0.108        | 0.044        | 0.093        | 0.551         |
|          | 0.160        | 0.339        | 0.080        | 0.170        | 0.069        | 0.146        | 1.08          |
|          | <b>0.323</b> | <b>0.685</b> | <b>0.152</b> | <b>0.322</b> | <b>0.133</b> | <b>0.282</b> | <b>2.56</b>   |
|          | 0.592        | 1.25         | 0.258        | 0.547        | 0.228        | 0.483        | 5.02          |
|          | 0.653        | 1.38         | 0.282        | 0.598        | 0.249        | 0.528        | 5.58          |
| 2        | <b>0.185</b> | <b>0.392</b> | <b>0.091</b> | <b>0.193</b> | <b>0.078</b> | <b>0.165</b> | <b>1.01</b>   |
|          | 0.288        | 0.610        | 0.140        | 0.297        | 0.121        | 0.256        | 1.96          |
|          | <b>0.574</b> | <b>1.22</b>  | <b>0.266</b> | <b>0.564</b> | <b>0.232</b> | <b>0.492</b> | <b>4.56</b>   |
|          | 1.04         | 2.20         | 0.451        | 0.956        | 0.398        | 0.843        | 8.80          |
|          | 1.14         | 2.42         | 0.491        | 1.04         | 0.434        | 0.920        | 9.77          |
| 3        | <b>1.03</b>  | <b>2.18</b>  | <b>0.389</b> | <b>0.824</b> | <b>0.351</b> | <b>0.744</b> | <b>5.94</b>   |
|          | 1.49         | 3.16         | 0.529        | 1.12         | 0.479        | 1.02         | 10.71         |
|          | <b>2.53</b>  | <b>5.36</b>  | <b>0.849</b> | <b>1.80</b>  | <b>0.771</b> | <b>1.63</b>  | <b>20.9</b>   |
|          | 3.87         | 8.20         | 1.26         | 2.67         | 1.15         | 2.44         | 33.6          |
|          | 4.16         | 8.82         | 1.35         | 2.86         | 1.23         | 2.61         | 36.2          |
| A        | <b>2.62</b>  | <b>5.55</b>  | <b>0.848</b> | <b>1.80</b>  | <b>0.777</b> | <b>1.65</b>  | <b>17.0</b>   |
|          | 3.53         | 7.48         | 1.12         | 2.37         | 1.03         | 2.18         | 26.6          |
|          | <b>5.55</b>  | <b>11.8</b>  | <b>1.72</b>  | <b>3.64</b>  | <b>1.58</b>  | <b>3.35</b>  | <b>46.6</b>   |
|          | 8.15         | 17.3         | 2.49         | 5.28         | 2.30         | 4.87         | 71.3          |
|          | 8.70         | 18.4         | 2.64         | 5.60         | 2.44         | 5.17         | 76.4          |
| 4        | <b>7.99</b>  | <b>16.9</b>  | <b>2.41</b>  | <b>5.11</b>  | <b>2.22</b>  | <b>4.70</b>  | <b>53.3</b>   |
|          | 10.5         | 22.2         | 3.14         | 6.65         | 2.89         | 6.12         | 80.2          |
|          | <b>15.9</b>  | <b>33.7</b>  | <b>4.74</b>  | <b>10.0</b>  | <b>4.36</b>  | <b>9.24</b>  | <b>134.0</b>  |
|          | 22.8         | 48.4         | 6.81         | 14.4         | 6.27         | 13.3         | 199.7         |
|          | 24.3         | 51.5         | 7.23         | 15.3         | 6.66         | 14.1         | 213.2         |
| B        | <b>12.9</b>  | <b>27.3</b>  | <b>3.96</b>  | <b>8.39</b>  | <b>3.65</b>  | <b>7.73</b>  | <b>85.4</b>   |
|          | 17.0         | 36.0         | 5.15         | 10.9         | 4.76         | 10.1         | 129.8         |
|          | <b>26.0</b>  | <b>55.1</b>  | <b>7.74</b>  | <b>16.4</b>  | <b>7.17</b>  | <b>15.2</b>  | <b>219.8</b>  |
|          | 37.4         | 79.3         | 10.8         | 22.9         | 10.1         | 21.4         | 328.6         |
|          | 39.8         | 84.3         | 11.4         | 24.2         | 10.6         | 22.5         | 350.7         |
| 5        | <b>29.9</b>  | <b>63.4</b>  | <b>8.85</b>  | <b>18.8</b>  | <b>8.16</b>  | <b>17.3</b>  | <b>202.1</b>  |
|          | 38.9         | 82.4         | 11.4         | 24.2         | 10.5         | 22.3         | 299.1         |
|          | <b>58.4</b>  | <b>123.8</b> | <b>16.8</b>  | <b>35.7</b>  | <b>15.6</b>  | <b>33.0</b>  | <b>492.8</b>  |
|          | 82.9         | 175.7        | 23.6         | 50.0         | 21.9         | 46.4         | 726.4         |
|          | 87.9         | 186.3        | 25.0         | 53.0         | 23.2         | 49.2         | 773.4         |
| 6        | <b>85.4</b>  | <b>181.0</b> | <b>24.2</b>  | <b>51.3</b>  | <b>22.5</b>  | <b>47.7</b>  | <b>580.4</b>  |
|          | 110.0        | 233.1        | 30.6         | 64.8         | 28.5         | 60.4         | 853.1         |
|          | <b>160.3</b> | <b>339.7</b> | <b>44.5</b>  | <b>94.3</b>  | <b>41.3</b>  | <b>87.5</b>  | <b>1362.0</b> |
|          | 222.0        | 470.5        | 62.2         | 131.8        | 57.7         | 122.3        | 1952.0        |
|          | 234.5        | 497.0        | 65.8         | 139.4        | 61.0         | 129.3        | 2069.0        |

| Replacement Tubes and Packing Part No. |
|--|
| FM4331                                 |
| FM4332                                 |
| FM4333                                 |
| FM4333A                                |
| FM4334                                 |
| FM4334B                                |
| FM4335                                 |
| FM4336                                 |

