The VSO®- MI miniature proportional valve is specifically designed for medical device manufacturers. Based upon Parker Hannifin's benchmark VSO® design, the VSO®- MI miniature proportional valve incorporates thermal compensation to provide precise flow control and stability over a wide operating temperature range. The VSO®- MI miniature proportional valve is oxygen service clean and has been evaluated by registered laboratories to guidelines established within the ISO 10993-1:2009 matrix and USP regulatory standards for bio-compatibility. Together with integrated filtration and manifold seals, low power consumption and its light weight design, the VSO®- MI helps reduce the time and cost of system integration and compliance.

**Features**
- Thermally compensated to maintain precision flow and accuracy
- Evaluated to established guidelines within the ISO 10993-1:2009 matrix and USP regulatory standards for bio-compatibility
- Proven performance tested to 25 million life cycles
- Integrated filters to protect the valve from damaging upstream and downstream particulates
- Cleaned for Oxygen Service Use
- RoHS compliant

**Typical Applications**
- Ventilators
- Oxygen Concentrators
- Oxygen Conservers
- Anesthesia Delivery & Monitors
- Pressure & Flow Control
- Blood Pressure Monitoring

**Physical Properties**

| Valve Type: | 2-Way Normally Closed |
| Media: | Air, carbon dioxide, nitrogen, oxygen and helium |
| Operating Environment: | 32 - 140°F (0 - 60°C) |
| Storage Temperature: | -40 to 158°F (-40 to 70°C) |
| Length: | 1.77 in (44.9 mm) |
| Width: | 0.66 in (16.7 mm) |
| Height: | 0.74 in (18.8 mm) |
| Porting: | Manifold mount with integrated filters and FKM manifold seals |
| Weight: | 1.23 oz (34.9 g) |
| Mounting Requirements: | See Table 2 |

| Internal Volume: | 0.031 in³ (0.508 cm³) |
| Filtration: | Integrated 40 micron filters (inlet and outlet ports) |
| Flow Direction: | Inlet Port, Outlet Port, Port 1, Port 2 |
| Electrical Power: | 2.0 Watts maximum |
| Voltage: | See Table 3 |
| Electrical Termination: | 18.5 in (47 cm) Wire Leads, Quick Disconnect Spade, PC Mount |

| Wetted Materials Valve Body: | Polybutylene terephthalate (PBT) |
| Stem Base: | 430 FR Stainless Steel and Brass C3600 HT |
| All Others: | FKM, 430 FR Stainless Steel, 300 Series Stainless Steel, Brass C3600 HT |

| Performance Characteristics Leak Rate: | The leakage shall not exceed the following values: |
| Internal | 0.2 SCCM of N₂ over rated pressure range |
| External | 0.016 SCCM of N₂ at 150 psig |
| Pressure: | Model 3: 0 to 150 psid (10.34 Bar) |
| Vacuum: | Model 5: 0 to 100 psid (6.89 Bar) |
| See Table 1 |
| Orifice Sizes: | 0.031 in (0.79 mm) |
| 0.051 in (1.30 mm) |
| Hysteresis: | 7% of full scale current (Typical) 15% of full scale current (Max) |

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**VSO®- MI** Miniature Proportional Valve

**Typical Flow Curve**

**All Models**
Typical Air Flow with 13.5 VDC Coil @ 25 psid (1.7 bar)

**Models 3 & 5**
Pressure vs. Flow Curves @ 20°C

**Pressure and Flow Capabilities**

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Orifice Diameter inch (mm)</th>
<th>Cv at Max Pressure</th>
<th>Maximum Inlet Pressure psi (bar)</th>
<th>Maximum Differential Pressure psid (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.031 (0.79)</td>
<td>0.010</td>
<td>150 (10.34)</td>
<td>150 (10.34)</td>
</tr>
<tr>
<td>5</td>
<td>0.051 (1.30)</td>
<td>0.025</td>
<td>150 (10.34)</td>
<td>100 (6.89)</td>
</tr>
</tbody>
</table>
**VSO°- MI** Miniature Proportional Valve

**VSO°- MI Sizing Charts**

Model 3 – 0.031” (0.79 mm) Orifice

![Graph showing flow rate vs. pressure for Model 3](image1)

- Pressure (psi): 0 to 100
- Flow Rate (slpm): 0 to 25

Model 5 – 0.051” (1.30 mm) Orifice

![Graph showing flow rate vs. pressure for Model 5](image2)

- Pressure (psi): 0 to 100
- Flow Rate (slpm): 0 to 50

---

**Parker**
**VSO®- MI Miniature Proportional Valve**

**Pneumatic Interface**

**Mechanical Integration**

**Dimensions**

![Diagram of VSO®-MI Basic Valve Dimensions]

**Mounting Requirements**

**Table 2**

<table>
<thead>
<tr>
<th>Mounting Screw Sizes (Pan Head Machine Screw)</th>
<th>Mounting Screw Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-40 x 3/4&quot;</td>
<td>45 oz-in</td>
</tr>
<tr>
<td>M3 x 20 mm</td>
<td>0.32 N.m.</td>
</tr>
</tbody>
</table>
**Electrical Interface**

**Coil Type: Wire Leads**
(for Terminal Block Connection)

- 2X #26 AWG. BLACK WIRES
- 18 1/2" ± 1/2" [469.9 ± 12.7] LG.
- 6.25 [15.88] APPROX.
- .305 [7.75]

**Coil Type: Quick Connect Spade**
(for Female Spade Terminal Connection)

- .110 [2.79]
- .195 [4.95]
- .39 [9.9]

**Coil Type: 4 PC Pins**
(For PCB solder mount connection)

- .030 [0.76] PIN
- .195 [4.95]
- .39 [9.9]
- .250 ±.015 [6.35 ±.038]
- .88 [22.4]

**Electrical Requirements**

**Table 3**

<table>
<thead>
<tr>
<th>Maximum Supply Voltage (VDC)</th>
<th>Nominal Coil Resistance (Ohms) at 20°C</th>
<th>Control Current at Maximum Flow (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>11</td>
<td>304</td>
</tr>
<tr>
<td>13.5</td>
<td>68</td>
<td>125</td>
</tr>
<tr>
<td>29</td>
<td>274</td>
<td>66</td>
</tr>
</tbody>
</table>
Miniature Proportional Valve
Installation and Use

**VSO®-MI Typical Valve Set-up**

**Valve Electrical Control**

**Basic Control:**
The VSO®-MI valve can be controlled by either voltage or current; however, it is highly recommended that current control be employed to ensure the most repeatable valve flow performance.

**PWM Control:**
For PWM control, the signal applied to the valve should have a frequency between 5-12kHz. Optimum frequency will be application dependent.

This simple current driver circuit draws only 1 mA at the input control (0-5VDC) and provides control for any VSO®-MI valve configuration regardless of valve voltage or resistance.

Table 4 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

<table>
<thead>
<tr>
<th>Voltage Supplied (Reference)</th>
<th>Valve Drive Voltage (VDC)</th>
<th>Nominal Coil Resistance @ 20°C (Ohms)</th>
<th>Input Current for Full Flow (mA)</th>
<th>R1 (Ohms)</th>
<th>R2 (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>7.5</td>
<td>11</td>
<td>304</td>
<td>5100</td>
<td>330</td>
</tr>
<tr>
<td>13.5</td>
<td>15.5</td>
<td>68</td>
<td>125</td>
<td>4420</td>
<td>113</td>
</tr>
<tr>
<td>29.0</td>
<td>31.0</td>
<td>274</td>
<td>66</td>
<td>4990</td>
<td>66.5</td>
</tr>
</tbody>
</table>
**Miniature Proportional Valves**

**Recommended VSO®-MI Manifold Dimensions**

**Accessories**

- **O-Ring (Manifold Seal) Dimensions**
  190-007059-001 [2 supplied with each valve]
  - I.D. = .114 ± .006 [2.90 ± 0.15]
  - W = .039 ± .003 [0.99 ± 0.08]

- **Screw 4-40 x 3/4” Pan Head, Phillips**
  191-000115-012 [2 required for each valve]
  - TAP DRILL X .270 [6.86] M5x0.8 - 6H kills 200 [5.08]
  - 2X 4-40 UNC - 2B  kills 200 [5.08]
  - 4X Ø .125 [Ø3.18] THRU
  - 2X .100 [2.54]
  - 2X .800 [20.32] 4X .125 [Ø3.18] THRU

- **UNITS**
  - IN. [mm.]
Miniature Proportional Valve

Ordering Information

<table>
<thead>
<tr>
<th>Sample Part ID</th>
<th>Description</th>
<th>Series</th>
<th>Operating Pressure / Orifice Size</th>
<th>Elastomer / Body</th>
<th>Pneumatic Interface</th>
<th>Voltage/Coil Selection</th>
<th>Electrical Interface</th>
</tr>
</thead>
</table>
| 931            | Options     | 931    | 3: 150 psid / 0.031" (0.79 mm)  
E: 100 psid / 0.051" (1.30 mm) | FKM / PBT | Manifold Mount* | 5: 5.5 VDC / 11 Ohm  
13: 13.5 VDC / 68 Ohm  
29: 29 VDC / 274 Ohm | Wire Leads, 18" (45.7 cm)  
Quick Connect, Spade  
PC Board Mount, 4 Pin |

*Includes integrated 40 micron filters and FKM manifold seals

Accessories

- **190-007059-001**: O-ring, FKM, 0.114" ID x 0.039" Thick*
- **191-000115-012**: Screw, Pan head, 4-40 x 3/4", Stainless Steel**

*Supplied with each valve. Used as a seal between the valve body and manifold.
**Not supplied with the valve. Used to mount the valve to a manifold.

NOTE: In order to provide the best possible solution for your application, please provide the following requirements when contacting Applications Engineering:

- Media, Inlet & Outlet Pressures
- Minimum Required Flow Rate
- System Supply Voltage or Current
- Flow Media & Ambient Temperature Range

Please click on the Order On-line button or go to www.parker.com/precisionfluidics/vsomi to configure your VSO®-MI Miniature Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Specification #790-002356-001 and Drawing #890-003292-001.

Parker Hannifin Precision Fluidics Division reserves the right to make changes. Drawings are for reference only.

For more information call +1 603 595 1500 or email ppinfo@parker.com
Visit www.parker.com/precisionfluidics