

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



Miniature Proportional Valves

Precision Fluidics



ENGINEERING YOUR SUCCESS.

Innovative solutions for health care success






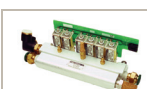
ENGINEERING **YOUR** SUCCESS.

When you partner with the global leader in motion and control technologies, expect to move your business and the world forward. From miniature solenoid valves to highly integrated automation systems, our innovations are critical to life-saving medical devices and scientific instruments used for drug discovery and pathogen detection. Not to mention, critical to decreasing time to market and lowering your overall cost of ownership. So partner with Parker, and get ready to move, well, anything.



www.parker.com/precisionfluidics 1 603 595-1500

Table of Contents

	product		page
	VSO®	Thermally Compensated Miniature Proportional Valve Thermally compensated design provides precise flow control up to 56 slpm	4
	VSO® LowPro	Low Profile Proportional Valve Controls the flow rate of inert gases. Typical flow rates up to 50 slpm with a maximum of 1.5 Watts at room temperature	12
	VSO® Low Flow	Thermally Compensated Low Flow Miniature Proportional Valve Thermally compensated design provides precise controllable low flow of 1 to 500 sccm	21
	VSO®-MI	Thermally Compensated Miniature Proportional Valve High performance, efficient design provides precise flow control up to 40 slpm	26
	MD PRO	Miniature Proportional Valve Economical design provides pressure and flow control up to 56 slpm	34
	Lone Wolf	Normally Open Miniature Proportional Valve Normally open design provides rapid response with stable and accurate performance	41
	VSO® MAX HP	High Flow Miniature Proportional Valve Provides maximum flow capabilities greater than 200 slpm and 45 psi	49
	HF PRO	High Flow Miniature Proportional Valve Efficient design delivers up to 60 slpm of flow at a pressure of 50 psi (3.4 bar)	55
	Value Added	Application-Specific Solutions	61

VSO® Miniature Proportional Valve

Thermally Compensated Proportional Valve




Typical Applications

- Gas Chromatography
- Mass Spectrometry
- Ventilators
- O₂ Concentrators/Conservers
- Anesthesia Delivery & Monitors
- Pressure & Flow Control
- Mass Flow Control

The VSO® miniature proportional valve provides enhanced flow control for applications where precise control flow control is required up to 56 slpm. The VSO® miniature proportional valve provides precise flow control of gas in proportion to input current. The valve can be controlled with either DC current or pulse width modulation along with closed loop feedback to deliver optimal system performance. Together with its ability to provide precise control over varying temperatures and media types, the VSO® miniature proportional valve is ideally suited for manufacturers of medical and analytical equipment.

Features

- Enables precise flow control for improved instrument accuracy
- Thermally compensated to maintain precise flow over a wide range of media
- Computer automated calibration and serialization for performance traceability
- Cleaned for Oxygen and Analytical Service use
- Proven performance tested to 100 million life cycles
- RoHS compliant 

Product Specifications

Physical Properties

Valve Type:
2-Way Normally Closed
Media:
Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others
Operating Environment:
32 to 131°F (0 to 55°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
1.79 in (45.3 mm)
Width:
0.63 in (15.9 mm)
Height:
0.67 in (17.0 mm)
Porting:
1/8" (3 mm) barbs or 10-32 female; manifold mount (available with screens)
Weight:
2.2 oz (63 g)

Physical Properties

Internal Volume:
0.031 in ³ (0.508 cm ³)
Filtration: (Suggested and Available)
Models 1 & 2: 17 micron Models 3, 4, 5, & 6: 40 micron
Flow Direction:
Inlet Port Port 2 Outlet Port Port 1

Electrical

Power:
2.0 Watts maximum
Voltage:
See Table 2
Electrical Termination:
18" (45.7 cm) Wire Leads, PC Mount, Quick Disconnect Spade

Wetted Materials

Series 11 Body:
360 HO ₂ Brass or 300 Series Stainless Steel
Series 25 Body:
Nickel-Plated Brass
Stem Base:
430 FR Stainless Steel and Brass 360 HT
All Others:
FKM; FFKM; 430 FR Stainless Steel; 300 Series Stainless Steel

Performance Characteristics

Leak Rate:
The leakage shall not exceed the following values: Internal 0.2 SCCM of He with a differential pressure of 1 psid, 25 psid and 150 psid External 0.016 SCCM of He at 150 psi
Pressure:
0 to 50 psi (3.45 bar) 0 to 75 psi (5.17 bar) 0 to 100 psi (6.89 bar) 0 to 150 psi (10.34 bar) See Table 1
Vacuum:
0-27 in Hg (0-686 mm Hg)
Orifice Sizes:
0.010 in (0.25 mm) 0.020 in (0.51 mm) 0.030 in (0.76 mm) 0.040 in (1.02 mm) 0.050 in (1.27 mm) 0.065 in (1.65 mm)
Hysteresis:
7% of full scale current (Typical) 15% of full scale current (Max)



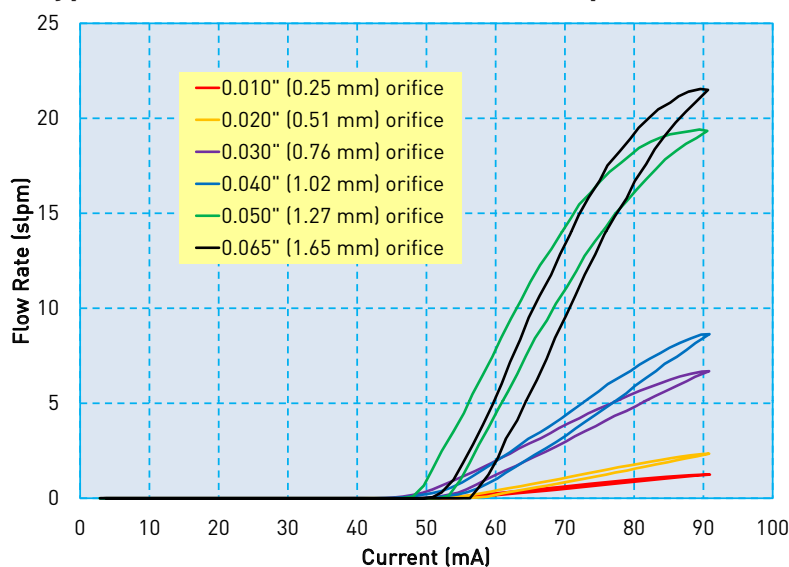
VSO is a registered trademark of Parker Hannifin Corporation.

VSO® Thermally Compensated Proportional Valve

Typical Flow Curve

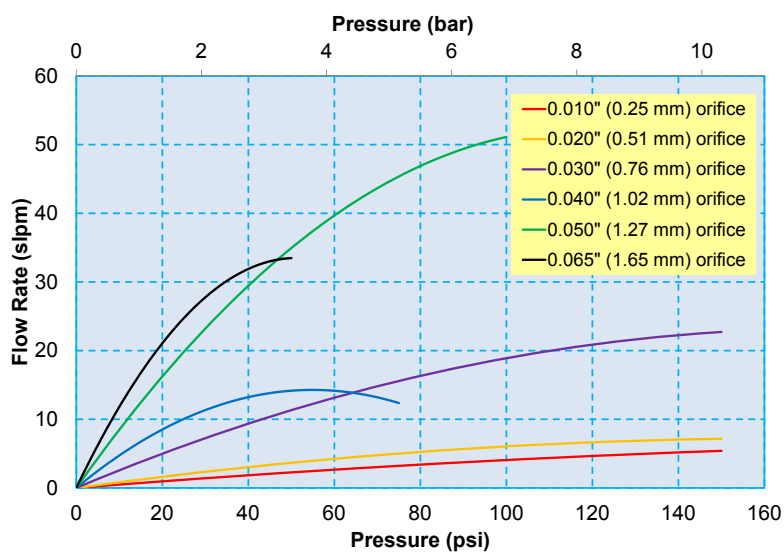
All Models

Typical Air Flow with 20 VDC Coil @ 25 psid (1.7 bar)



Models 1-6

Pressure vs Flow Curves



Pressure and Flow Capabilities

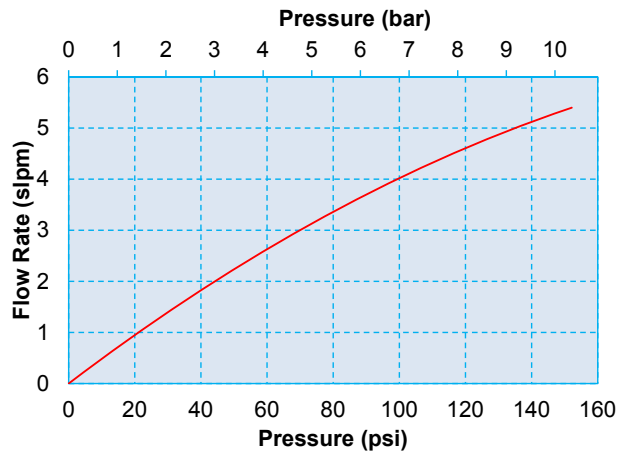
Table 1

Orifice Diameter	Maximum Operating Inlet Pressure	Maximum Operating Pressure Differential
0.010 in (0.25 mm)	150 psig (10.34 bar)	150 psid (10.34 bar)
0.020 in (0.51 mm)	150 psig (10.34 bar)	150 psid (10.34 bar)
0.030 in (0.76 mm)	150 psig (10.34 bar)	150 psid (10.34 bar)
0.040 in (1.02 mm)	150 psig (10.34 bar)	75 psid (5.17 bar)
0.050 in (1.27 mm)	150 psig (10.34 bar)	100 psid (6.89 bar)
0.065 in (1.65 mm)	150 psig (10.34 bar)	50 psid (3.45 bar)

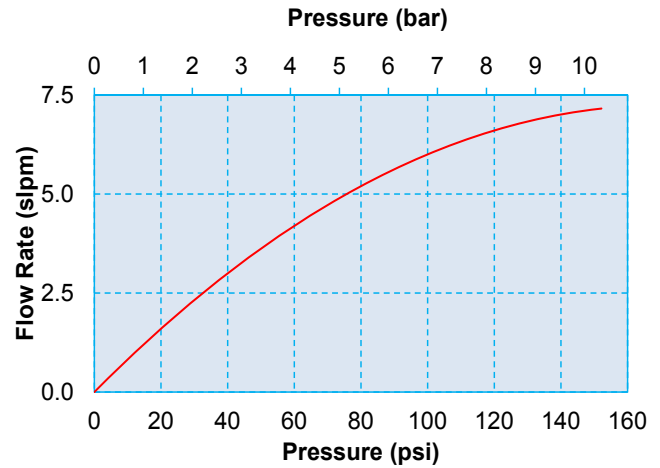
VSO® Thermally Compensated Proportional Valve

VSO® Sizing Charts

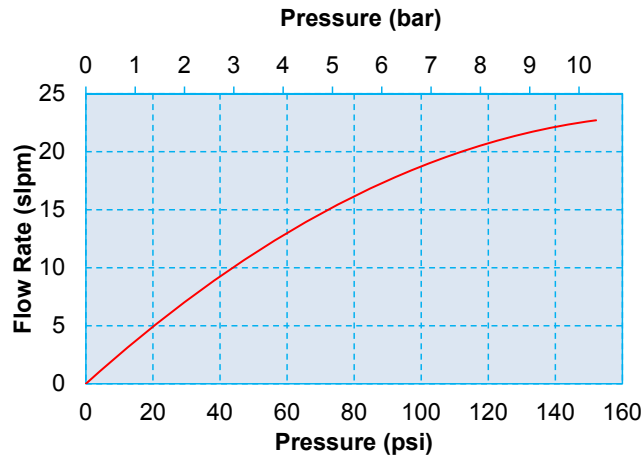
Model 1 - 0.010" (0.25 mm) Orifice



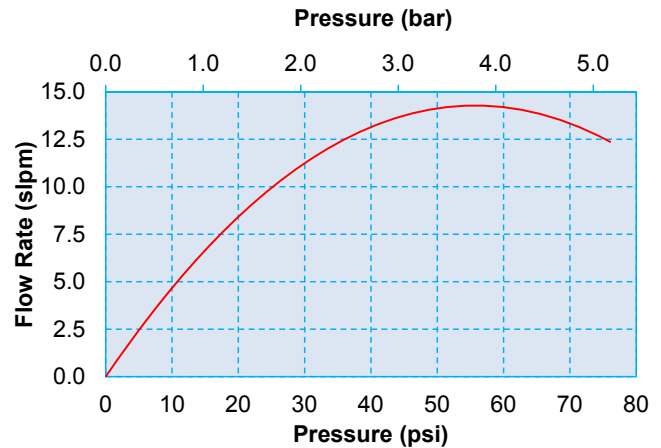
Model 2 - 0.020" (0.51 mm) Orifice



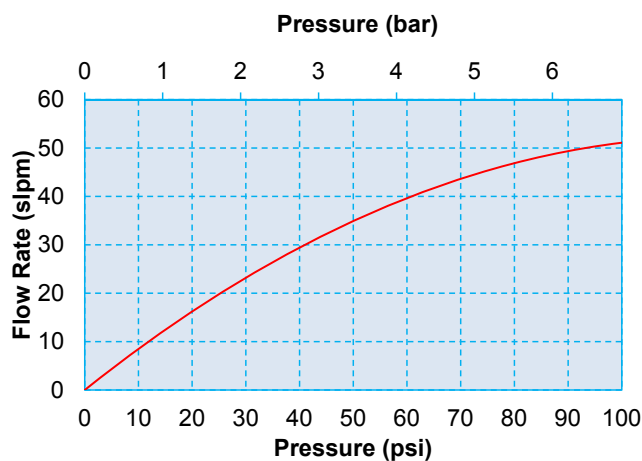
Model 3 - 0.030" (0.76 mm) Orifice



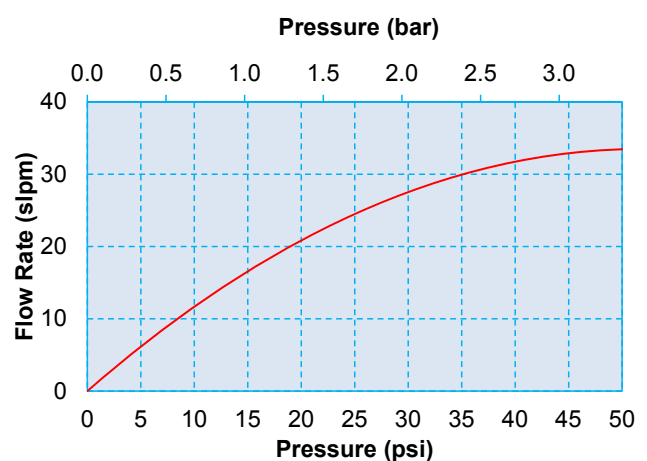
Model 4 - 0.040" (1.02 mm) Orifice



Model 5 - 0.050" (1.27 mm) Orifice



Model 6 - 0.065" (1.65 mm) Orifice



VS0® Thermally Compensated Proportional Valve

Pneumatic Interface

**VS0® Series 11
Manifold Mount**



**VS0® Series 11
Barbed**



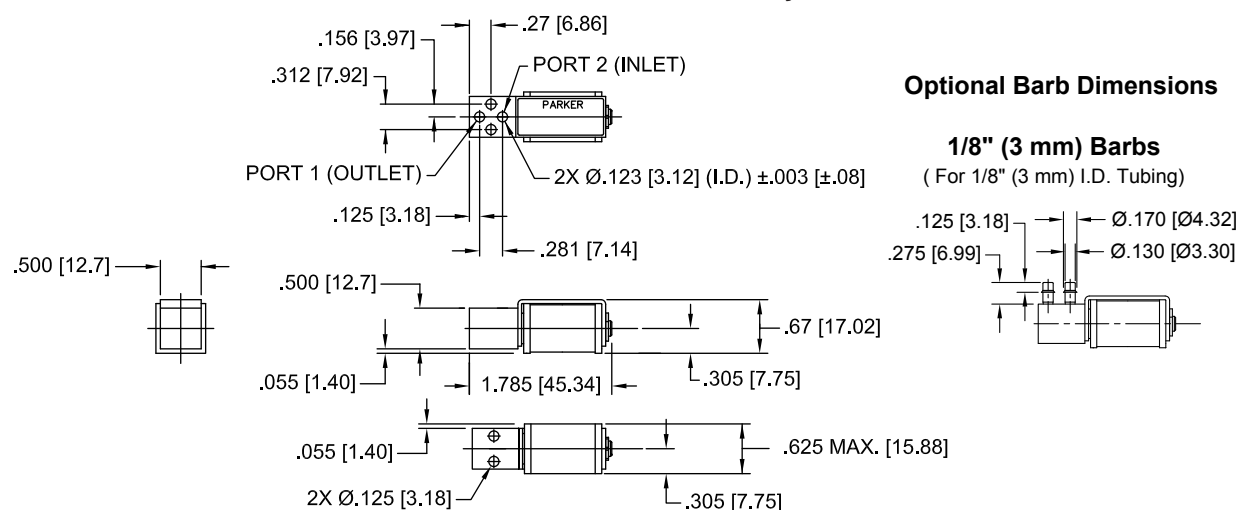
**VS0® Series 25
10-32 Threaded**



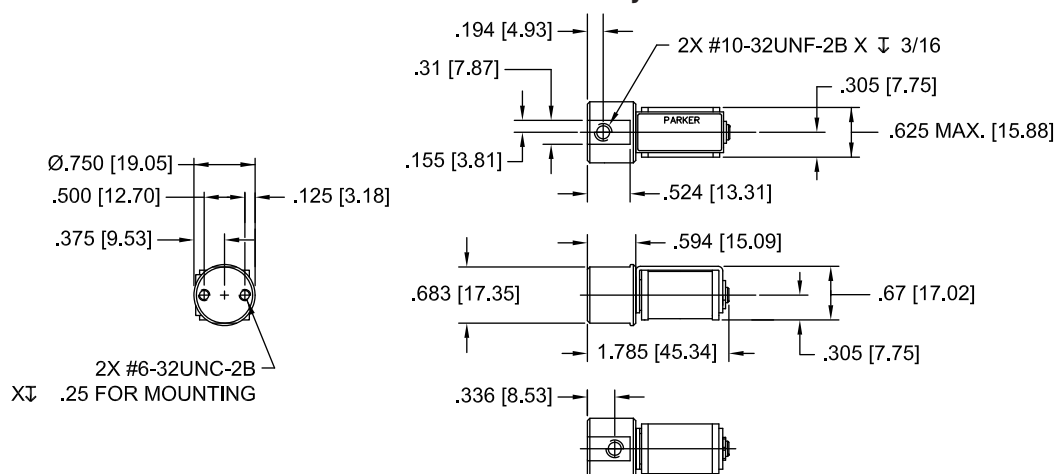
Mechanical Integration

Dimensions

VS0® Series 11 Manifold Mount and Barbed Body Basic Valve Dimensions



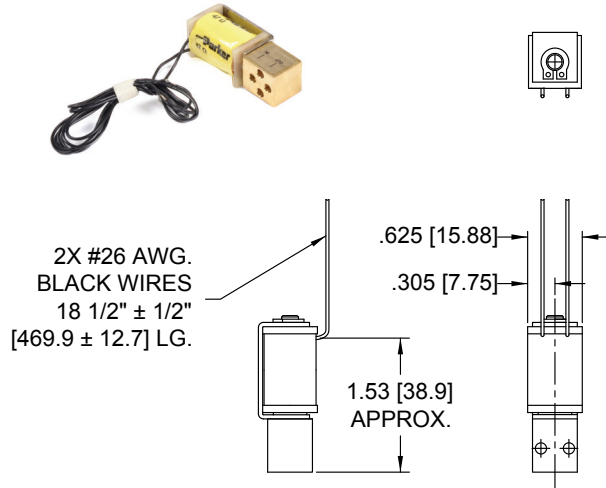
VS0® Series 25 10-32 Threaded Body Basic Valve Dimensions



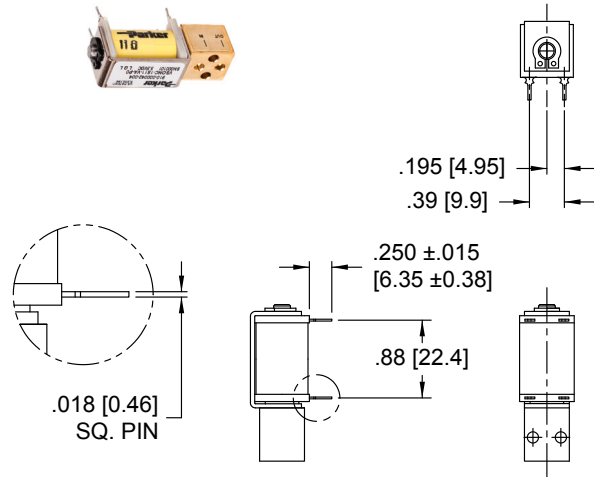
VSO® Thermally Compensated Proportional Valve

Electrical Interface

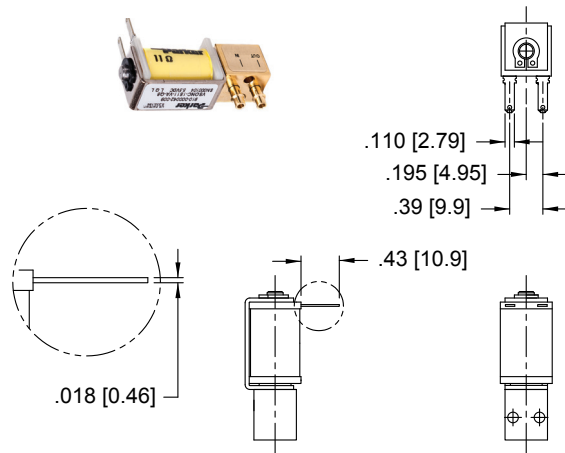
Coil Type: Wire Leads



Coil Type: 4 PC Pin*

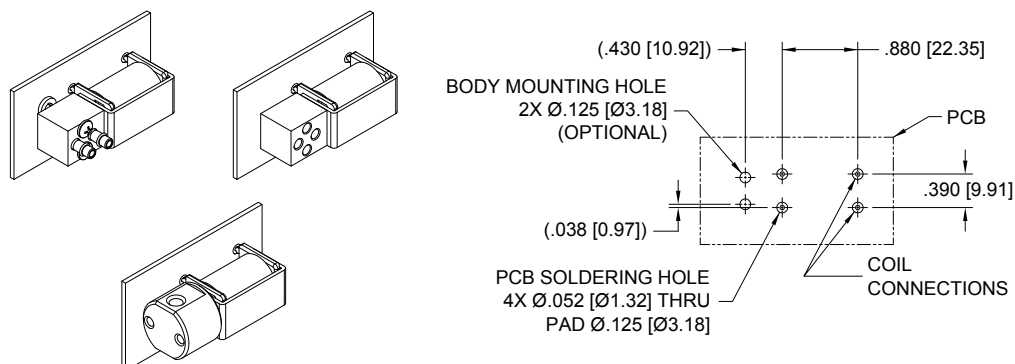


Coil Type: Quick Connect Spade



UNITS
IN. [mm.]

*PCB Pin Layout (Coil Type 4 PC Pin)



VSO® Thermally Compensated Proportional Valve

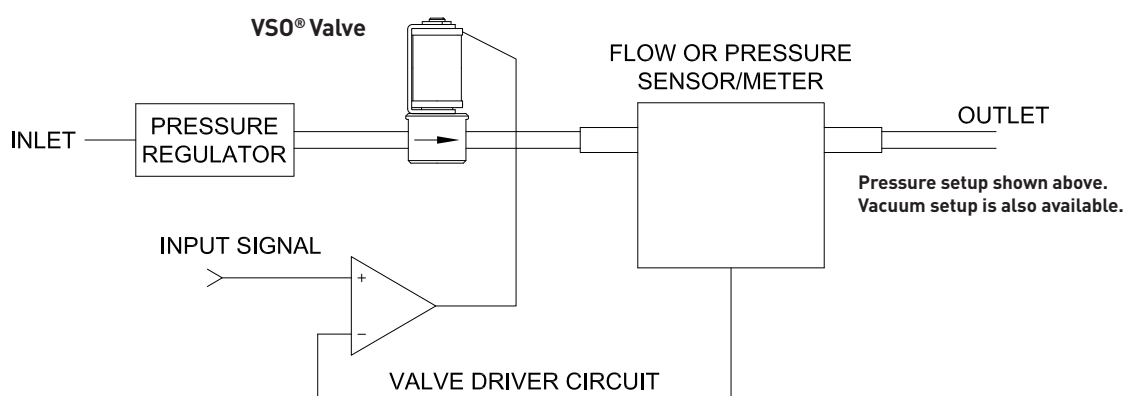
Electrical Requirements

Table 2

Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)
5.5	11	304
8.0	23	212
11.5	47	152
13.5	68	125
20.0	136	91
29.0	274	66
41.0	547	47
56.0	1094	32

Installation and Use

Typical Valve Set-up



Valve Electrical Control

Basic Control:

The VSO® 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.

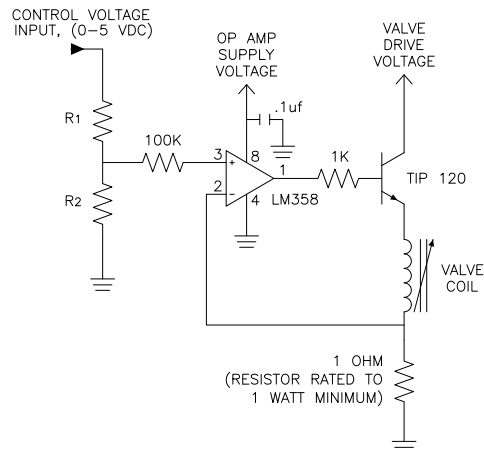
PWM Control:

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

VSO® Thermally Compensated Proportional Valve

Installation and Use

Suggested VSO® Current Driver Schematic



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

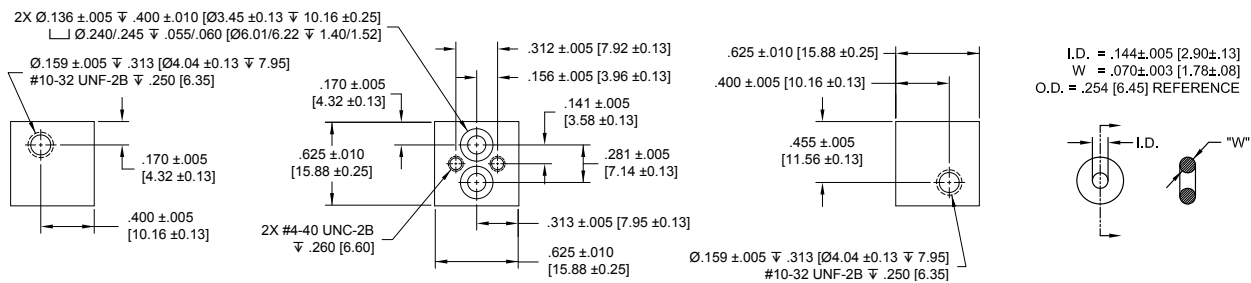
Table 3 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

**Table 3: Selectable Resistor Values for a Low Current (1 mA)
LM358-Based Current Driver**

Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)	R1 (Ohms)	R2 (Ohms)
5.5	7.5	11	304	5100	330
8.0	10.0	23	212	4990	221
11.5	13.5	47	152	5100	160
13.5	15.5	68	125	4420	113
20.0	22.0	136	91	4420	82
29.0	31.0	274	66	4990	66.5

Manifold & O-Ring Dimensions & Design

Not shipped with valves.



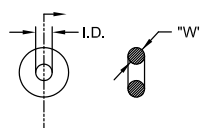
VSO® Thermally Compensated Proportional Valve

Accessories

O-Ring (Manifold Seal) Dimensions

190-007024-002 (2 required for each valve)

I.D. = .144±.005 [2.90±.13]
W = .070±.003 [1.78±.08]
O.D. = .254 [6.45] REFERENCE



Screw 4-40 x 5/8" Pan Head, Phillips

191-000115-010 (2 required for each valve)



Ordering Information

Sample Part ID	VSONC	1	S	11	V	A	F	8
Description	Standard	Model Number: Maximum Operating Pressure / Orifice Size	Series	Body Series	Elastomer/ Body Material	Coil Voltage/Coil Resistance/Coil Current*	Electrical Interface	Pneumatic Interface
Options		1: 150 psi / 0.010" (0.25 mm) 2: 150 psi / 0.020" (0.51 mm) 3: 150 psi / 0.030" (0.76 mm) 4: 75 psi / 0.040" (1.02 mm) 5: 100 psi / 0.050" (1.27 mm) 6: 50 psi / 0.065" (1.65 mm)		11: Series 11 25: Series 25	V: FKM / Brass C: FFKM / Brass I: FKM / Stainless Steel H: FFKM / Stainless Steel	A: 5.5 VDC / 11 Ohm / 0.304 Amp B: 8 VDC / 23 Ohm / 0.212 Amp C: 11.5 VDC / 47 Ohm / 0.152 Amp D: 13.5 VDC / 68 Ohm / 0.125 Amp E: 20 VDC / 136 Ohm / 0.091 Amp F: 29 VDC / 274 Ohm / 0.066 Amp * Maximum voltage for continuous full flow, ambient temperature 55°C	F: Wire Leads, 18" (45.7 cm) P: PC Board Mount, 4 Pin Q: Quick Connect, Spade	0: Manifold Mount 1: Manifold Mount w/screens 5: 10-32 Threaded Female (Series 25) 8: 1/8" (3 mm) Barbs

Accessories	
190-007024-002: O-ring, FKM, 0.114" ID x 0.070" Thick*	* Not supplied with the valve. Used as a seal between the valve body and manifold.
191-000115-010: Screw 4-40 x 5/8" Pan Head **	**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
- Media & Ambient Temperature Range

Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/vso) to configure your VSO® Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to VSO® Series 11 Performance Spec. #790-002115-001 and Drawings #890-003022-001 and #890-003022-003. VSO® Series 25 Performance Spec. #790-002115-001 and Drawing # 890-003023-001.

VSO® LowPro Miniature Proportional Valve

Low Profile Proportional Valve



Markets

- Portable Oxygen Concentrators
- Ventilators
- Patient Monitors

Typical Applications

- Pressure Control
- Volumetric Flow Control
- Pulse Dose Control

The VSO® LowPro is a miniature proportional valve that controls the flow rate of inert gases. Typical flow rates up to 50 SLPM with a maximum of 1.5 Watts at room temperature. At just 16 mm wide by 14 mm tall, the valve can be populated into the smallest portable device improving performance, size and weight. With an orifice of up to 0.080" (2.03 mm) and a weight of 12 g, the VSO® LowPro can perform the function of valves three times its size without sacrificing the power. Mounting only requires a simple, machined manifold.

Features

- Very low power required of typically 1 Watt enables portable capability and low power control increasing battery life or reducing the size of your power supply or battery
- Low profile design simplifies mounting and eliminates cartridge configurations that require complex & expensive machining
- Delivers consistent performance on every valve
- Reach, RoHS, ISO 15001, IP65, and CE compliant



Product Specifications

Physical Properties

Valve Type:
2-Way Normally Closed
Media:
Air, Oxygen or any non-reactive, non-condensing gases
Operating Environment:
32 to 131°F (0 to 55°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
0.80 in (20 mm)
Width:
0.63 in (16 mm)
Height:
0.55 in (14 mm)
Porting:
Face Seal to Manifold with integrated FKM seal
Weight:
0.42 oz (12 g)

Electrical

Power:
1.0 Watt Typical 2.0 Watt Maximum
Voltage:
5, 12 and 24 VDC See Table 2
Electrical Termination:
4.5" (114 mm) Wire leads [26 AWG] with Molex 50-57-9402 connector

Wetted Materials

Body & Cover:
Aluminum 430 Stainless Steel
Armature & Spring:
Carbon Steel (Nickel Plated) Stainless Steel
Coil:
Urethane Polyvinyl Butyral
All Others:
FKM, Epoxy
Regulatory:
Compliant with RoHS directive (2002/95/EC), REACH EC 1907/2006, ISO 15001, IP65(IEC/EN 60529), and CE

Performance Characteristics

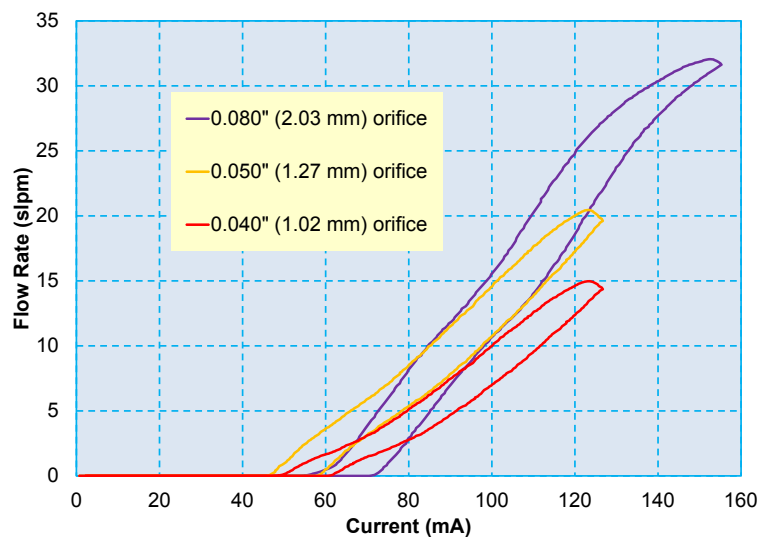
Leak Rate:
The leakage shall not exceed the following values: Internal: 0.5 SCCM of Air with a differential pressure of 50 psid External: 0.2 SCCM of Air with a differential pressure of 50 psid
Operating Pressure:
0 - 50 psi (3.45 bar) See Table 1
Vacuum:
0-27 in Hg (0-686 mm Hg)
Proof Pressure:
100 psi (6.9 bar)
Orifice Sizes:
0.040 in (1.02 mm) 0.050 in (1.27 mm) 0.080 in (2.03 mm)
Hysteresis:
10% of full scale current (Typical) 15% of full scale current (Maximum)
Recommended Filtration:
40 µm (not supplied)
Response time:
10 ms Typical
Reliability:
100 Million Cycles



VSO is a registered trademark of Parker Hannifin Corporation.
Patent pending with the United States Patent and Trademark Office (USPTO).

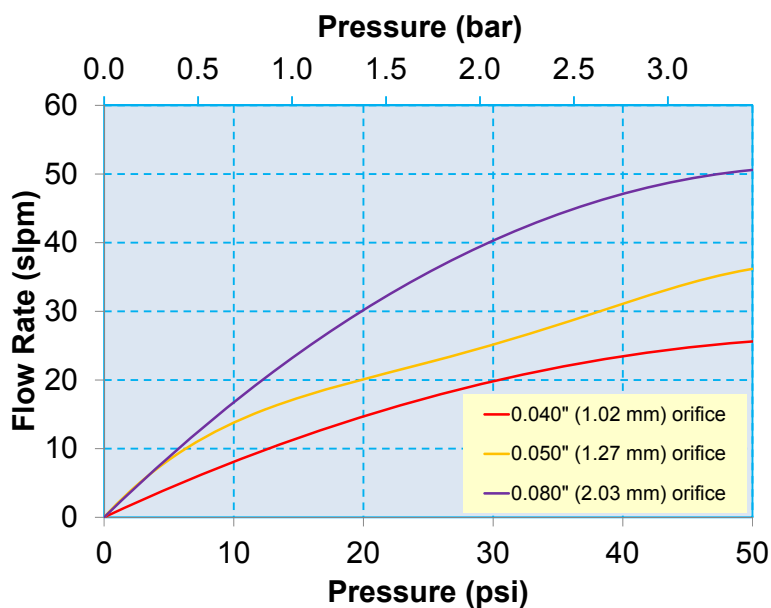
VSO® LowPro Low Profile Proportional Valve Typical Flow Curve

All Models
Typical Air Flow with 12 VDC Coil @ 25 psid (1.7 bar)



Pressure vs Flow Curve

The curve below shows the maximum output flow for each orifice size as a function of inlet pressure up to the maximum rated pressure for the valve.



Pressure and Flow Capabilities

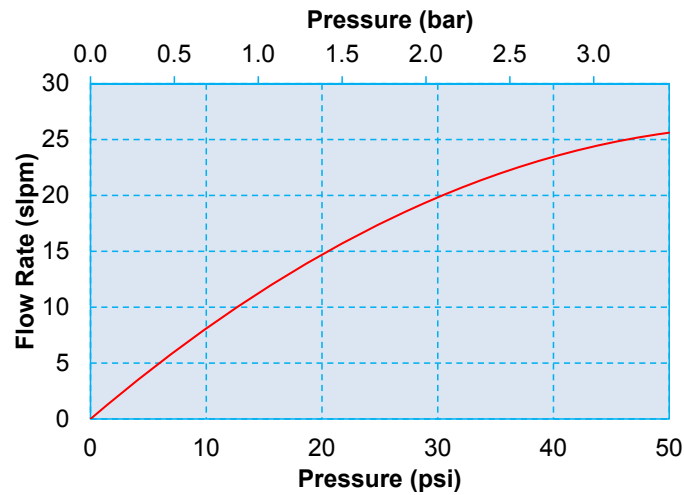
Table 1

Model No.	Orifice Diameter	Cv at Maximum Pressure	Maximum Inlet Pressure	Maximum Differential Pressure
4	0.040" (1.02 mm)	0.010	50psi (3.45 bar)	50 psig (3.45 bar)
5	0.050" (1.27 mm)	0.025	50 psi (3.45 bar)	50 psig (3.45 bar)
8	0.080" (2.03 mm)	0.062	50psi (3.45 bar)	50 psig (3.45 bar)

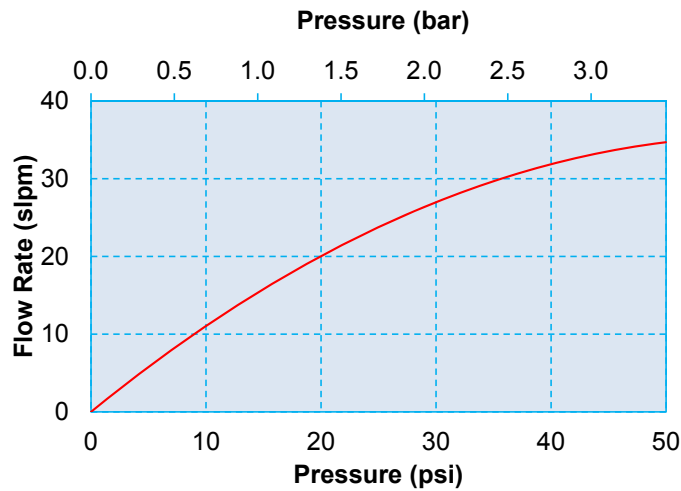
VSO[®] LowPro Low Profile Proportional Valve

VSO[®] LowPro Sizing Charts

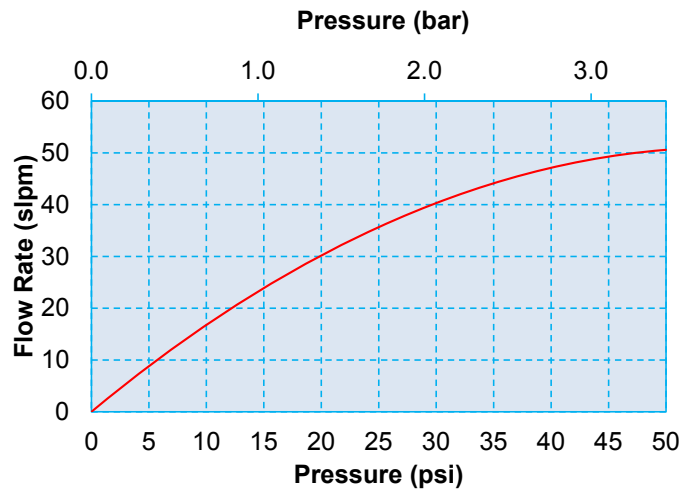
Model 4 - 0.040" (1.02 mm) Orifice



Model 5 - 0.050" (1.27 mm) Orifice



Model 8 - 0.080" (2.03 mm) Orifice



VS0® LowPro Low Profile Proportional Valve

Pneumatic Interface

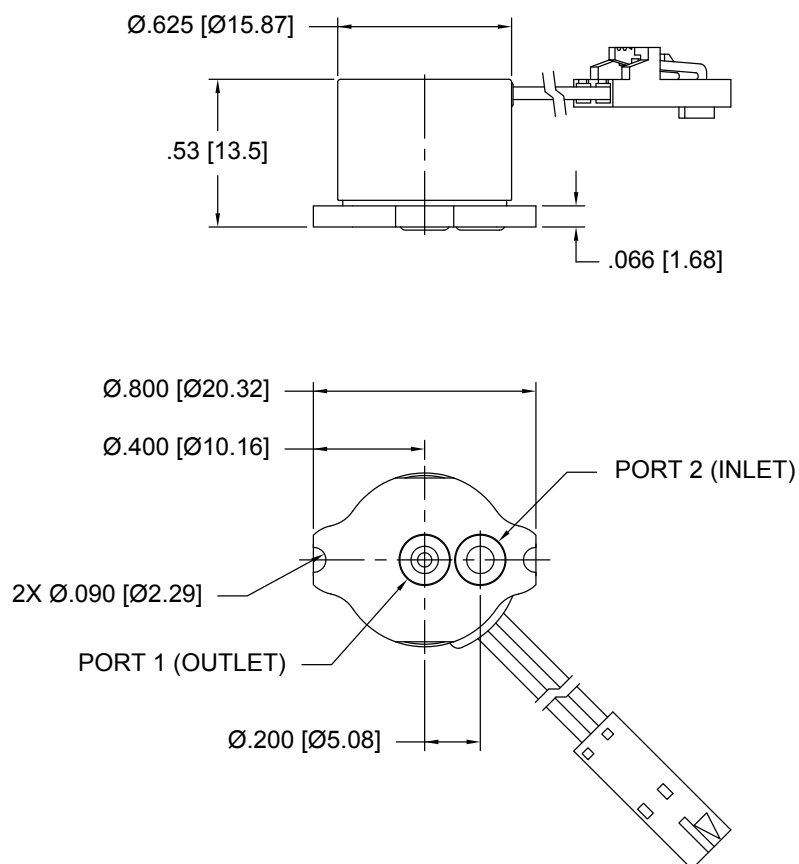
VS0® LowPro Manifold Mount



Mechanical Integration

Dimensions

VS0® LowPro Basic Valve Dimensions

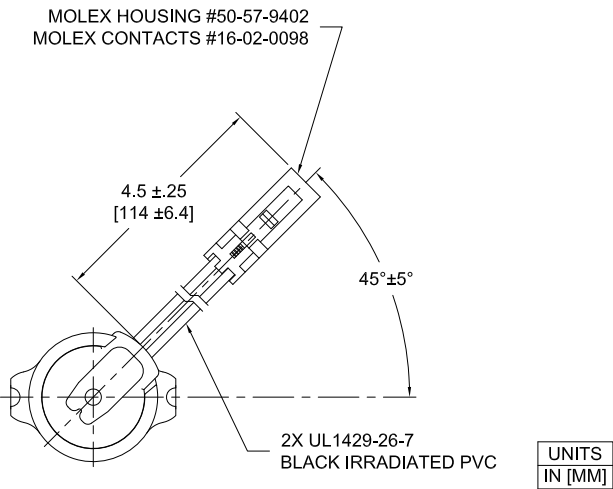


UNITS
IN [MM]



VSO® LowPro Low Profile Proportional Valve

Electrical Interface



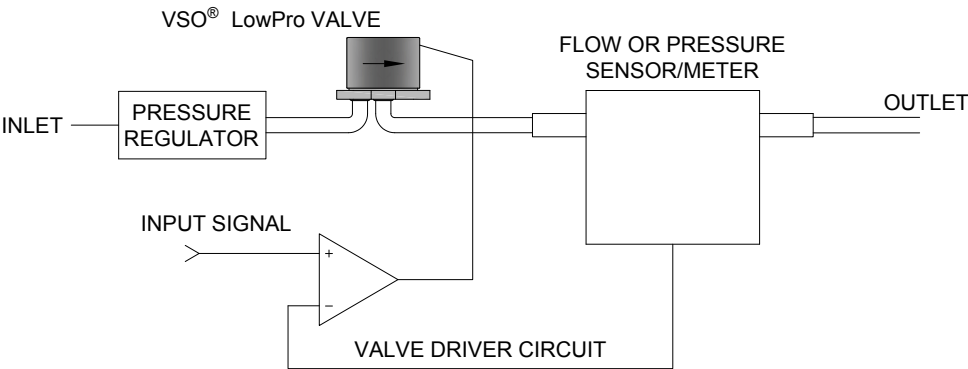
Electrical Requirements

Table 2

Rated Voltage	Nominal Coil Resistance at 20 °C	Control Current at Maximum Flow	
		Model 4 & 5	Model 8
5 VDC	10 Ω	311 mA	385 mA
12 VDC	61 Ω	127 mA	156 mA
24 VDC	179 Ω	75 mA	92 mA

Installation and Use

Typical Valve Set-up



Valve Electrical Control

Basic Control:

The VSO® LowPro 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:

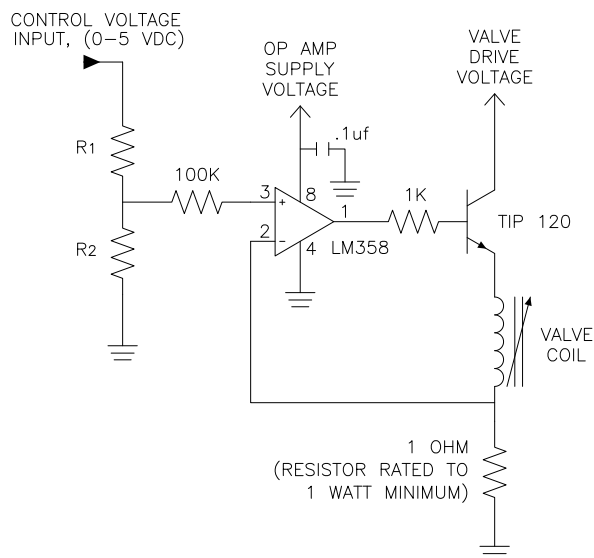
For PWM control, the signal applied to the valve should have a frequency of 10 kHz or greater. Optimum frequency will be application dependent.



VSO® LowPro Low Profile Proportional Valve

Installation and Use

Suggested VSO® LowPro Current Driver Schematic



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

Table 3 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

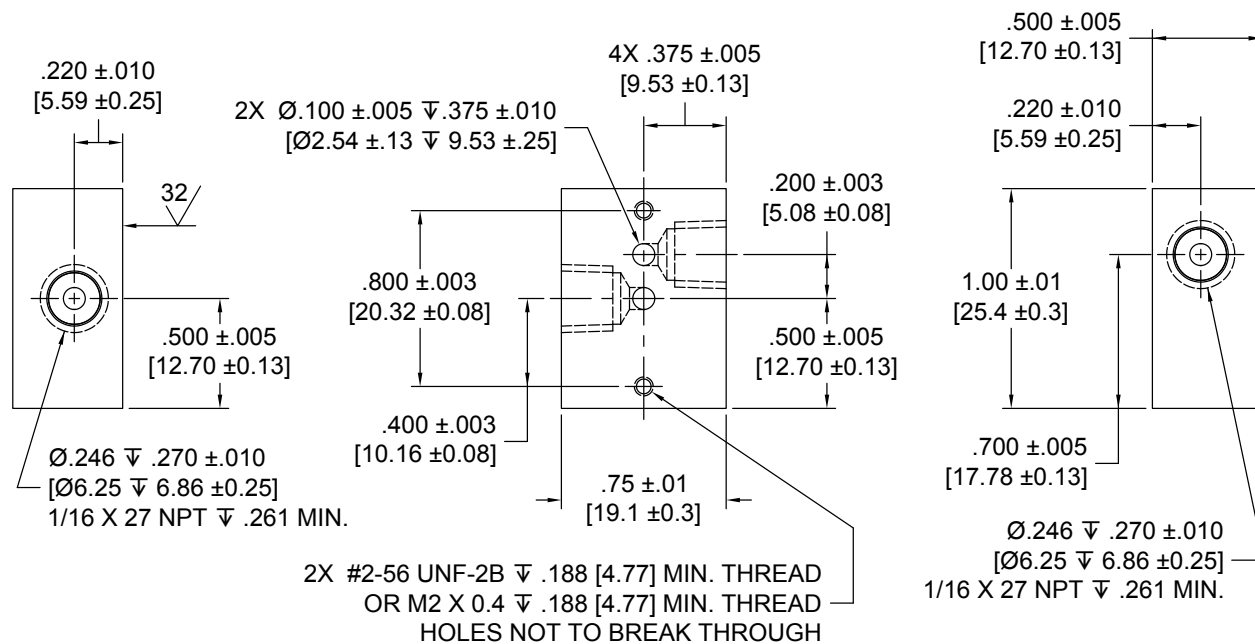
**Table 3: Selectable Resistor Values for a Low Current (1 mA)
LM358-Based Current Driver (Models 4, 5 & 8)**

Maximum Solenoid Voltage (VDC)	Circuit Supply Voltage (VDC)	Nominal Coil Resistance @ 20 °C (Ohms)	Maximum Output Current from Circuit (mA)	R1 (Ohms)	R2 (Ohms)
6.0	8.0	10.1	396	4910	422
13.0	15.0	61.3	160	3320	110
22.0	24.0	178.5	94	2100	40.2

Installation and Use

Not shipped with valves.

Parker Precision Fluidics recommends 24 in-oz (17 N-cm) of torque for the screws.

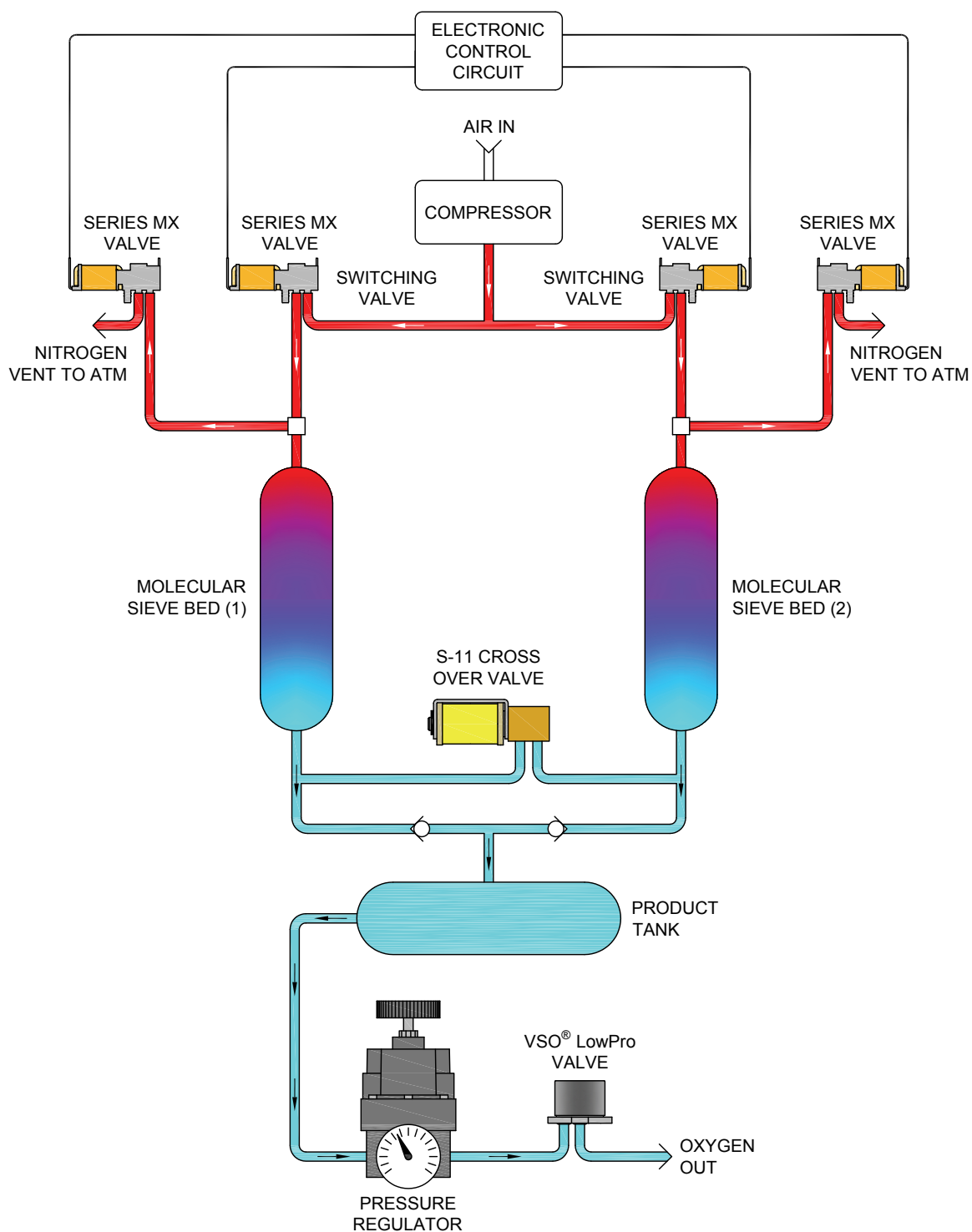


UNITS
IN [MM]

VSO® LowPro Low Profile Proportional Valve

Typical Flow Diagram

Oxygen Concentrator Application



VS0® LowPro Low Profile Proportional Valve

Accessories

12.5" Adapter Wire Leads
290-006061-003



Single Station Manifold
890-009042-001



Screw #2-56 x 3/16"
Socket Head Cap Screw
191-000112-404

(see valve mounting recommendations above)



Manifold O-Ring (FKM)
190-007059-001
(supplied with valve)



Ordering Information

Sample Part ID	935	-	4	0	0	05	0	-	000
Description	Series	-	Model Number	Pneumatic Interface	Elastomer	Voltage	Electrical Interface	-	000
Options	935	-	4: 50psi / 0.040" (1.02 mm) 5: 50psi / 0.050" (1.27 mm) 8: 50psi / 0.080" (2.03 mm)	0: Manifold Mount	0: FKM Seals	05: 5 VDC 12: 12 VDC 24: 24 VDC	0: Wire Leads w/ connector	-	000

Accessories	
290-006061-003: 12.5" Wire Leads	Not supplied with the valve.
890-009042-001 Single Station Manifold	Not supplied with the valve.
190-007059-001 Manifold O-Ring (FKM)	Supplied with the valve.
191-000112-404 Screw #2-56 x 3/16" Socket Head Cap Screw	Not supplied with the valve. See valve mounting recommendations above

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
- Media & Ambient Temperature Range



Please click on the Order On-line button to configure your VS0® LowPro Proportional Valve (or go to www.parker.com/precisionfluidics/VSOLowProMiniatureProportionalValve). For more detailed information, visit us on the Web, or call and refer to VS0® LowPro Performance Spec. 790-002490-001.

PPF-MPV-002/US March 2016

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



VSO® Low Flow

Thermally Compensated Proportional Valve




The VSO® Low Flow valve provides enhanced flow control for applications where precise flow control is required between 0 - 500 sccm. Like the VSO® miniature proportional valve, the VSO® Low Flow miniature proportional valve provides precise flow control of gas in proportion to input current. The valve can be controlled with either DC current or pulse width modulation along with closed loop feedback to deliver optimal system performance. Together with its ability to provide precise control over a wide range of media, the VSO® Low Flow miniature proportional valve is ideally suited for manufacturers of Gas Chromatography and Mass Spectrometry equipment.

Typical Applications

- Gas Chromatography
- Mass Spectrometry
- Pressure & Flow Control
- Mass Flow Control

Features

- Enables precise low flow (0 - 500 sccm) control for improved instrument accuracy
- Thermally compensated to maintain precise flow over a wide range of media
- Computer automated calibration and serialization for performance traceability
- Cleaned for Oxygen and Analytical Service use
- Proven performance tested to 10 million life cycles
- RoHS compliant 

Product Specifications

Physical Properties

Valve Type:
2-Way Normally Closed
Media:
Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others
Operating Environment:
32 to 131°F (0 to 55°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
1.79 in (45.3 mm)
Width:
0.63 in (15.9 mm)
Height:
0.67 in (17.0 mm)
Porting:
Manifold mount
Weight:
2.2 oz (63 grams)

Physical Properties

Internal Volume:
0.031 in ³ (0.508 cm ³)
Filtration:
5 Micron (Customer Supplied)
Flow Direction:
Inlet Port Port 2
Outlet Port Port 1
Oxygen and Analytically Clean:
Standard

Electrical

Power:
1.0 Watt maximum
Voltage:
See Table 2
Electrical Termination:
18" (45.7 cm) Wire Leads

Wetted Materials

Body: 360 H02 Brass, 300 Series Stainless Steel
Stem Base:
430 FR Stainless Steel and Brass 360 HT
All Others:
FKM; 430 FR Stainless Steel; 300 Series Stainless Steel

Performance Characteristics

Leak Rate:
The leakage shall not exceed the following values:
Internal 0.2 SCCM of He with a differential pressure of 1 psid, 25 psid and 150 psid
External 0.016 SCCM of He at 150 psi
Pressure:
0 to 150 psi (10.34 bar)
See Table 1
Vacuum:
0-27 in Hg (0-686 mm Hg)
Orifice Size:
0.003" (0.076 mm)
Hysteresis:
7% of full scale current (Typical)
15% of full scale current (Max)

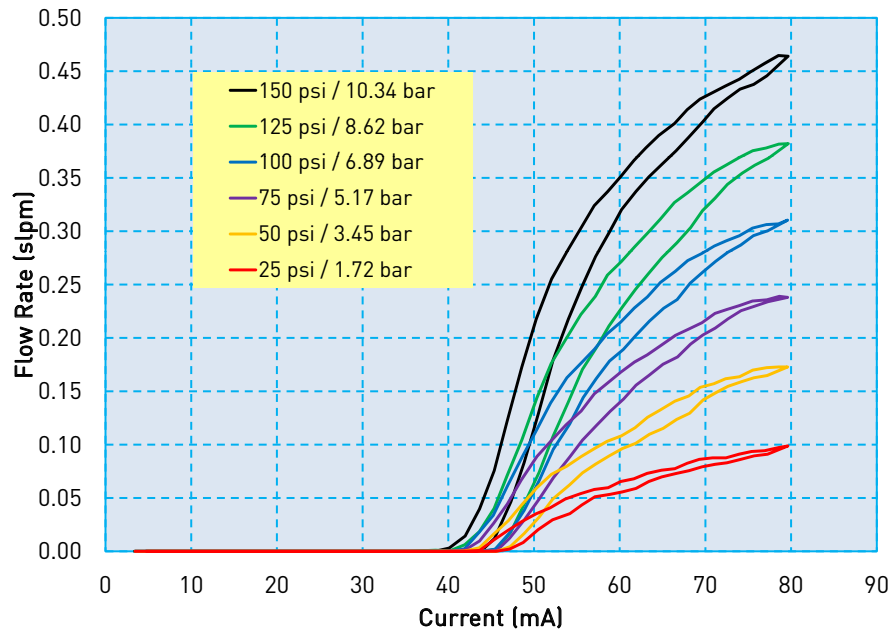
VSO is a registered trademark of Parker Hannifin Corporation.



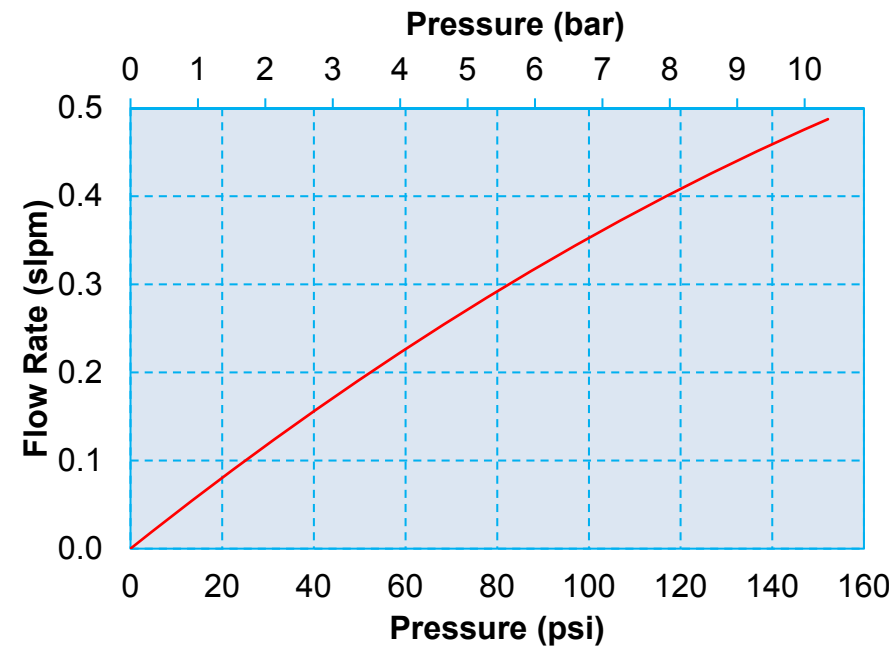
VSO® Low Flow Thermally Compensated Proportional Valve

Typical Flow Curve

Typical Air Flow with 13.5 VDC Coil



Model L3 - 0.003" (0.076 mm) Orifice
Pressure vs Flow Curve



Pressure and Flow Capabilities

Table 1

Orifice Diameter	Maximum Operating Inlet Pressure	Maximum Operating Pressure Differential
0.003 in (0.076 mm)	150 psig (10.34 bar)	150 psid (10.34 bar)



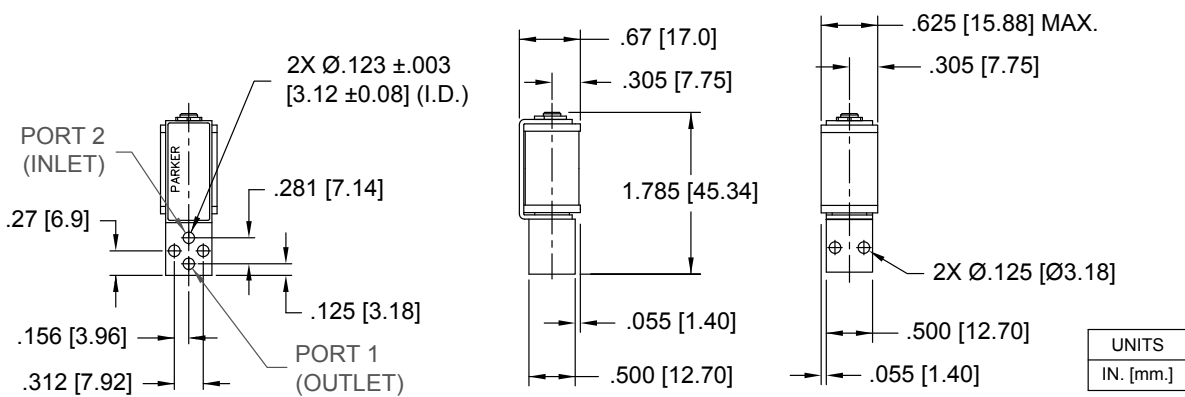
VS0[®] Low Flow Thermally Compensated Proportional Valve **Pneumatic Interface**

VS0[®] Low Flow **Manifold Mount**



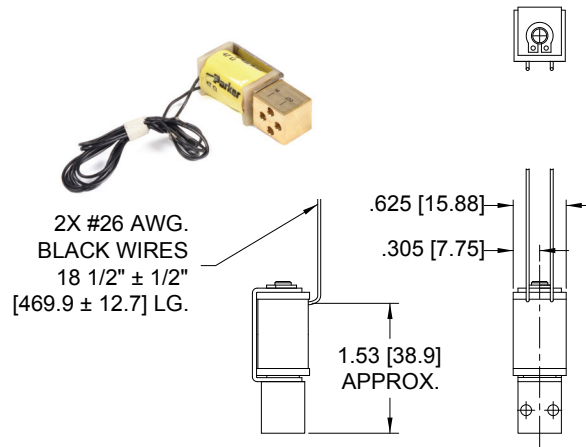
Mechanical Integration **Dimensions**

VS0[®] Low Flow Basic Valve Dimensions



Electrical Interface

Coil Type: 18" Wire Lead



Electrical Requirements

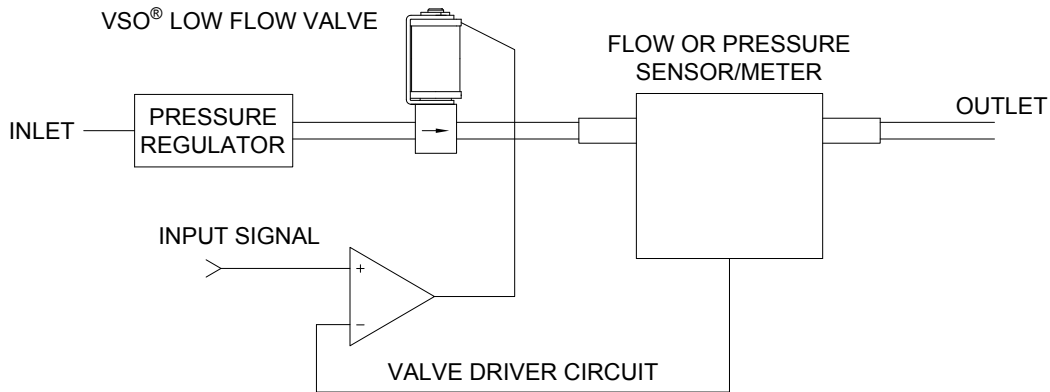
Table 2

Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20° C (Ohms)	Input Current for Full Flow (mA)
6.5	47	130
8.0	68	115
12	136	80
18	274	60
24.0	547	43



VSO® Low Flow Thermally Compensated Proportional Valve Installation and Use

Typical Valve Set-up



Valve Electrical Control

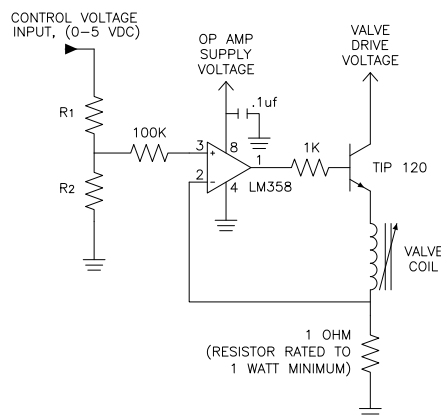
Basic Control:

The VSO® Low Flow 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.

Suggested VSO® Low Flow Current Driver Schematic



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

Table 3 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

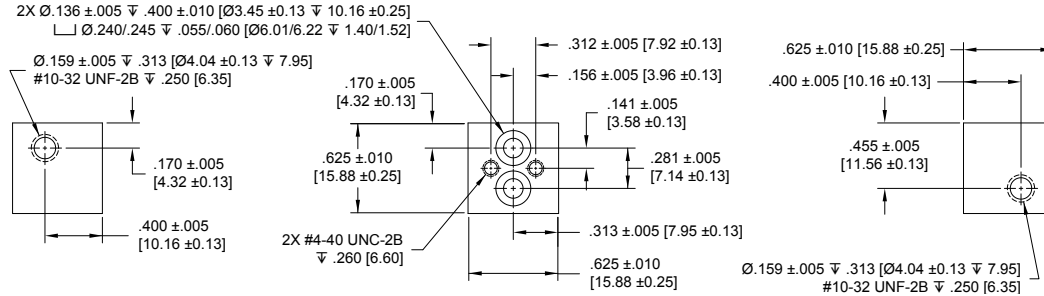
**Table 3: Selectable Resistor Values for a Low Current (1mA)
LM358-Based Current Driver**

Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)	R1 (Ohms)	R2 (Ohms)
6.5	8.5	47	130	4990	102
8.0	10.0	68	115	4990	73
12.0	14.0	136	80	5100	34.4
18.0	20.0	274	60	8560	28.7
24.0	26.0	547	43	8560	15.4

VSO® Low Flow Thermally Compensated Proportional Valve Installation and Use

Manifold & O-Ring Dimensions & Design

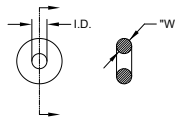
Not shipped with valves.



Accessories

O-Ring (Manifold Seal) Dimensions
190-007024-002 (2 required for each valve)

I.D. = Ø.114 ±.005 [2.90 ±.013]
W = .070 ±.003 [1.78 ±.008]
O.D. = Ø.254 [6.45] REFERENCE



Screw 4-40 x 5/8" Pan Head, Phillips
191-000115-010 (2 required for each valve)



Ordering Information

Sample Part ID	910	-	0	0020	0	-	001
Description	Series	-	Body / Elastomer	Model Number	Electrical Interface	-	Coil Voltage*/ Resistance
Options	VSO	-	0: FKM / Brass 1: FKM / Stainless Steel	VSO Low Flow, 0.003" (0.076 mm) Orifice	0: Wire Leads, 18" (45.7 cm)	-	001: 6.5 VDC / 47 OHMS 002: 8 VDC / 68 OHMS 003: 12 VDC / 136 OHMS 004: 18 VDC / 274 OHMS 005: 24 VDC / 547 OHMS * Maximum voltage for continuous full flow, ambient temperature 55°C

Accessories

190-007024-002: O-ring, FKM, 0.114" ID x 0.070" Thick* * Not supplied with the valve. Used as a seal between the valve body and manifold.
191-000115-010: Screw 4-40 x 5/8" Pan Head ** **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
- Media & Ambient Temperature Range



Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/lowflow) to configure your VSO® Low Flow Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Spec. #790-002160-002 and Drawing #890-003022-022.

PPF-MPV-002/US March 2016

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



VSO® - MI Miniature Proportional Valve

Thermally Compensated Proportional Valve




The VSO® - MI is miniature proportional valve 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.

Typical Applications

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

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 

Product Specifications

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

Physical Properties

Internal Volume:
0.031 in ³ (0.508 cm ³)
Filtration:
Integrated 40 micron filters (inlet and outlet ports)
Flow Direction:
Inlet Port Port 2
Outlet Port Port 1

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

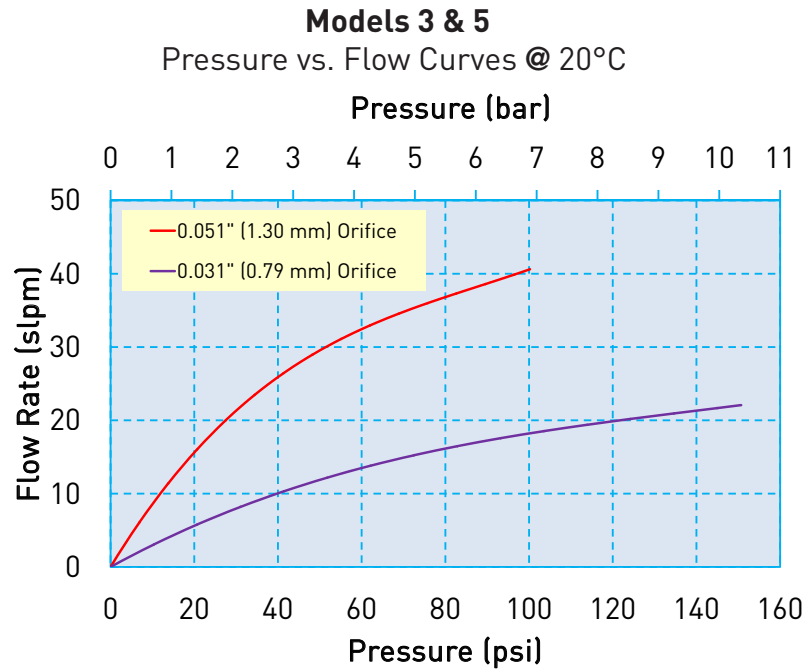
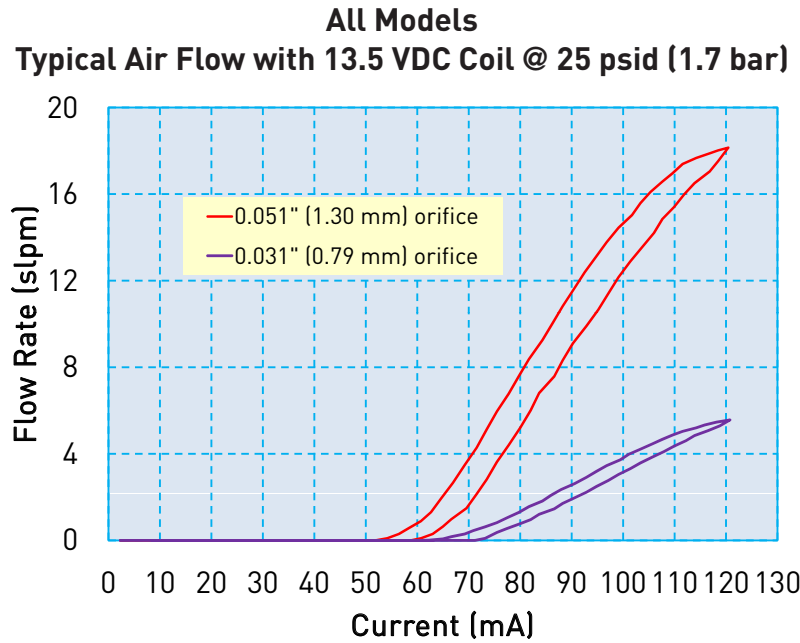
Leak Rate:
The leakage shall not exceed the following values:
Internal 0.2 SCCM of N ₂ over rated pressure range
External 0.016 SCCM of N ₂ at 150 psig
Pressure:
Model 3: 0 to 150 psid (10.34 Bar)
Model 5: 0 to 100 psid (6.89 Bar)
See Table 1
Vacuum:
0-27 in Hg (0-686 mm Hg)
Orifice Sizes:
0.031 in (0.79 mm)
0.051 in (1.30 mm)
Hysteresis:
7% of full scale current (Typical)
15% of full scale current (Max)



VSO is a registered trademark of Parker Hannifin Corporation.

VSO®- MI Miniature Proportional Valve

Typical Flow Curve



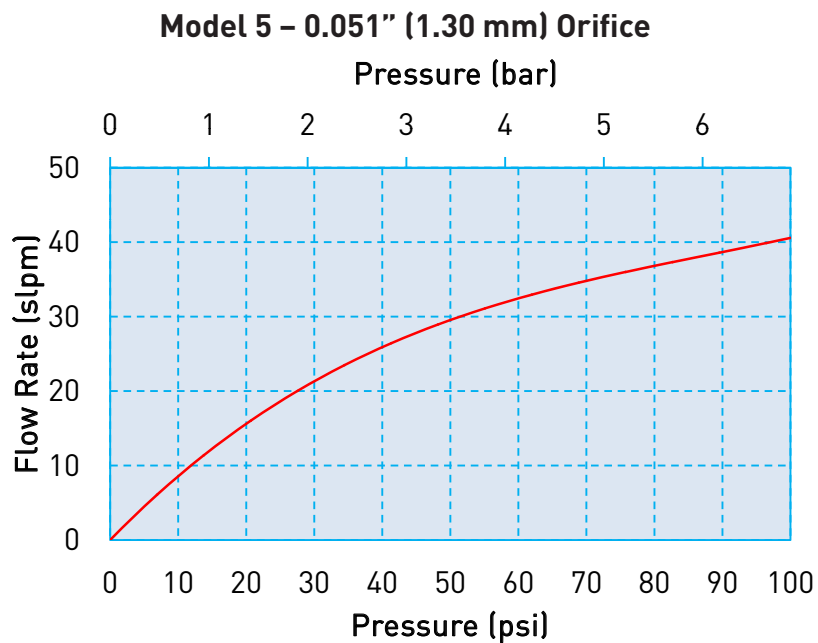
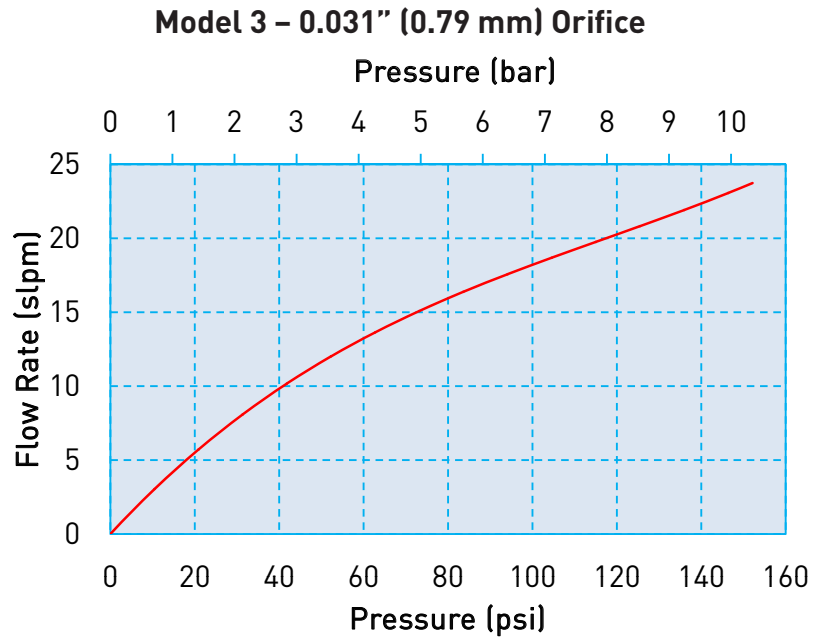
Pressure and Flow Capabilities

Table 1

Model No.	Orifice Diameter inch (mm)	Cv at Max Pressure	Maximum Inlet Pressure psi (bar)	Maximum Differential Pressure psid (bar)
3	0.031 (0.79)	0.010	150 (10.34)	150 (10.34)
5	0.051 (1.30)	0.025	150 (10.34)	100 (6.89)

VSO® - MI Miniature Proportional Valve

VSO® - MI Sizing Charts



VSO®- MI Miniature Proportional Valve

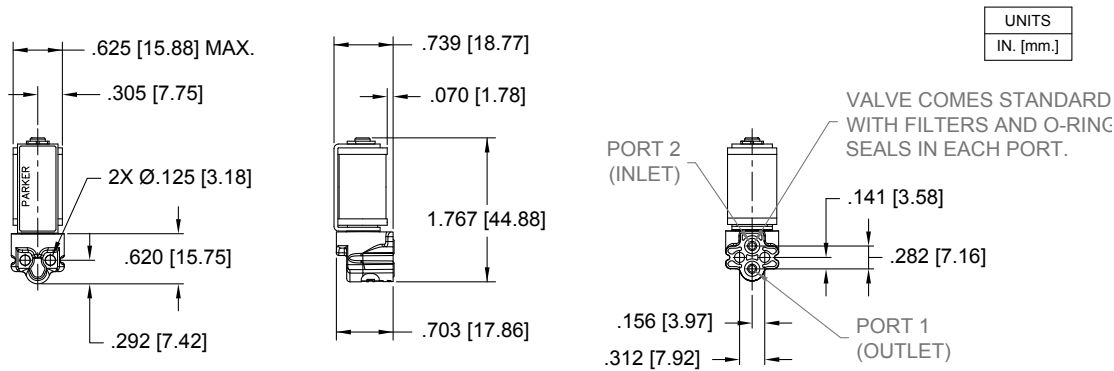
Pneumatic Interface



Mechanical Integration

Dimensions

VSO®- MI Basic Valve Dimensions



Mounting Requirements

Table 2

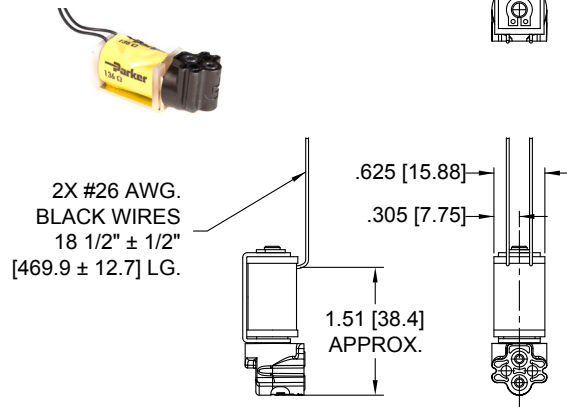
Mounting Screw Sizes (Pan Head Machine Screw)	Mounting Screw Torque
4-40 x 3/4"	45 oz-in
M3 x 20 mm	0.32 N.m.



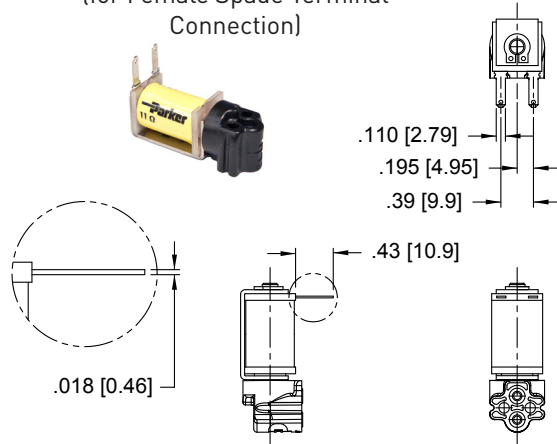
VSO®- MI Miniature Proportional Valve

Electrical Interface

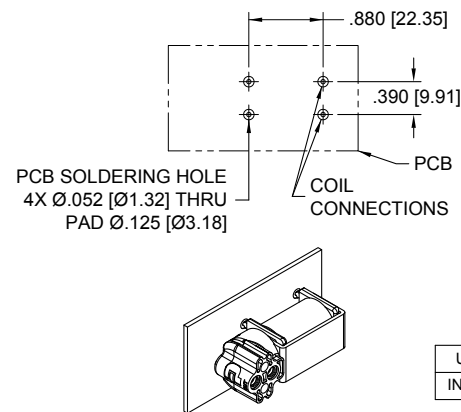
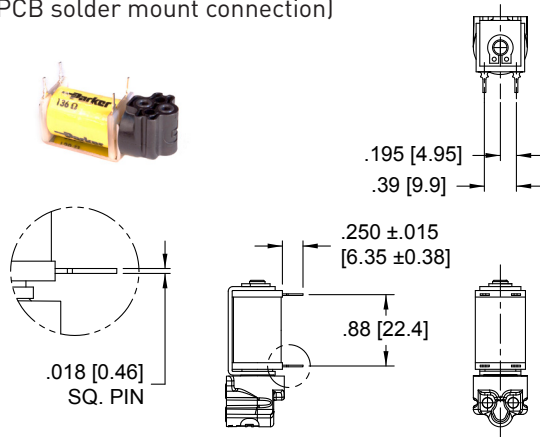
Coil Type: Wire Leads (for Terminal Block Connection)



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



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



UNITS
IN. [mm.]

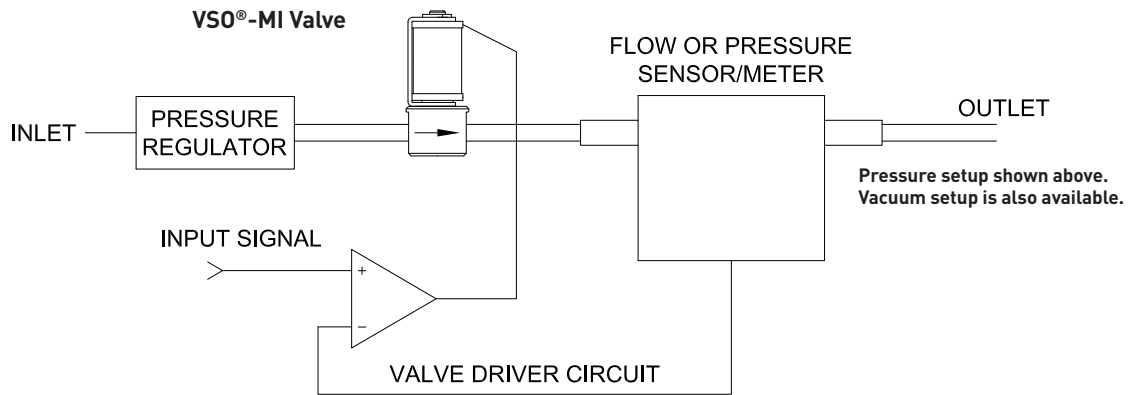
Electrical Requirements

Table 3

Maximum Supply Voltage (VDC)	Nominal Coil Resistance (Ohms) at 20°C	Control Current at Maximum Flow (mA)
5.5	11	304
13.5	68	125
29	274	66

VSO®-MI Miniature Proportional Valve Installation and Use

VSO®-MI Typical Valve Set-up



Valve Electrical Control

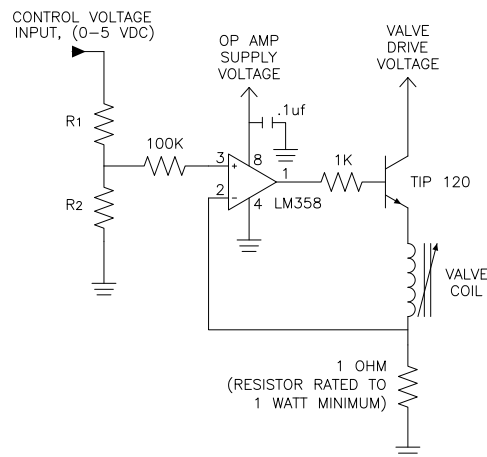
Basic Control:

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.

Suggested VSO®-MI Current Driver Schematic



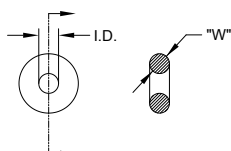
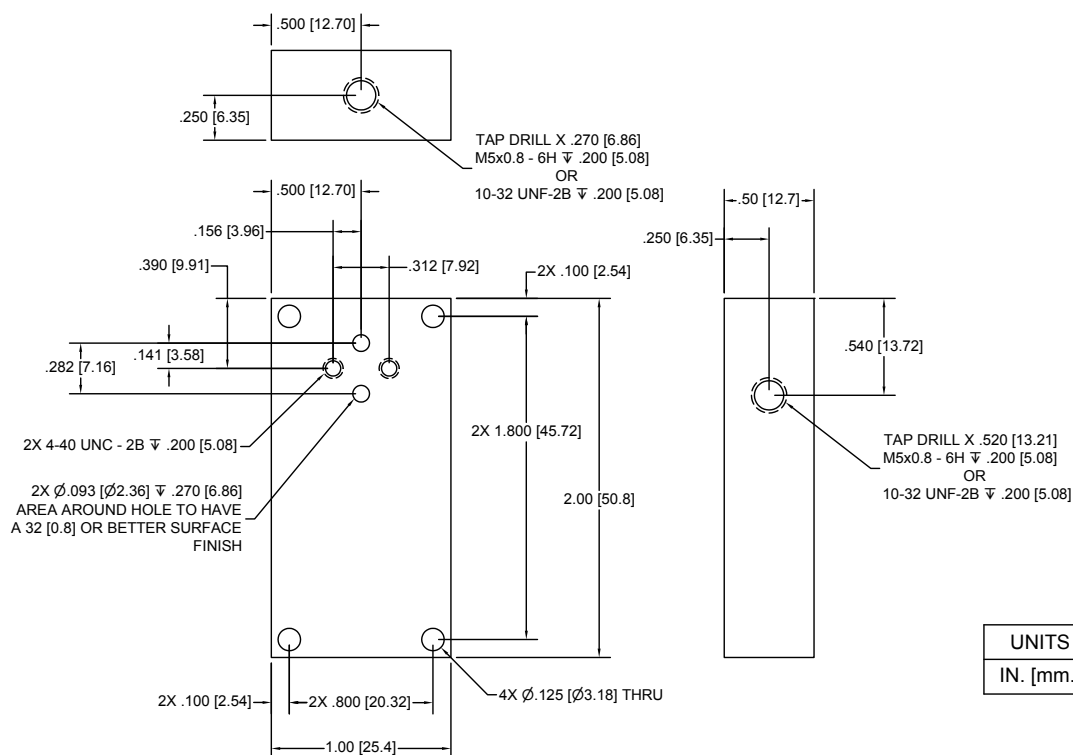
This simple current driver circuit draws only 1 mA at the input control (0-5VDC) and provides control for any VSO®-MI valve configuration regardless of valve voltage or resistance.

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

**Table 4: Selectable Resistor Values for a Low Current (1mA)
LM358-Based Current Driver**

Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)	R1 (Ohms)	R2 (Ohms)
5.5	7.5	11	304	5100	330
13.5	15.5	68	125	4420	113
29.0	31.0	274	66	4990	66.5

Recommended VSO®-MI Manifold Dimensions



VSO®- MI Miniature Proportional Valve

Ordering Information

Sample Part ID	931	3	1	1	05	1	000
Description	Series	Model Number: Operating Pressure / Orifice Size	Elastomer / Body	Pneumatic Interface	Voltage/ Coil Selection	Electrical Interface	
Options	931	3: 150 psid / 0.031" (0.79 mm) 5: 100 psid / 0.051" (1.30 mm)	1: FKM / PBT	1: Manifold Mount* *Includes integrated 40 micron filters and FKM manifold seals	05: 5.5 VDC / 11 Ohm 13: 13.5 VDC / 68 Ohm 29: 29 VDC / 274 Ohm	1: Wire Leads, 18" (45.7 cm) 2: Quick Connect, Spade 3: PC Board Mount, 4 Pin	

Accessories	
190-007059-001: O-ring, FKM, 0.114" ID x 0.039" Thick*	*Supplied with each valve. Used as a seal between the valve body and manifold.
191-000115-012: Screw, Pan head, 4-40 x 3/4", Stainless Steel**	**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.

MD PRO Miniature Proportional Valve

Miniature Proportional Valve




The MD PRO is a miniature 2-way normally closed (NC) proportional valve that controls gas flow proportionally to input current for flow rates up to 56 slpm. When used with closed loop feedback, the MD PRO is an economical solution that provides repeatable pressure and flow control. The MD PRO is ideal for applications such as respiratory therapy, anesthesia delivery and patient monitoring devices.

Typical Applications

- O₂ Concentrators/Conservers
- Ventilators
- Anesthesia Delivery
- Pressure & Flow Control
- Patient Monitors

Features

- Provides repeatable flow performance over its rated life
- Offers a superior combination of value and performance to reduce system cost
- Available Oxygen and Analytical Service use clean
- Proven performance tested to 10 million life cycles
- RoHS compliant 

Product Specifications

Physical Properties

Valve Type:
2-Way Normally Closed
Media:
Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others
Operating Environment:
32 to 140°F (0 to 60°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
1.79 in (45.3 mm)
Width:
0.63 in (15.9 mm)
Height:
0.67 in (17.0 mm)
Porting:
1/8" (3 mm) barbs; manifold mount
Weight:
2.2 oz (63 grams)
Internal Volume:
0.031 in ³ (0.508 cm ³)
Filtration (Suggested and Available):
40 micron
Flow Direction:
Inlet Port Port 2
Outlet Port Port 1

Electrical

Power:
2.0 Watts maximum
Voltage:
See table 2
Electrical Termination:
18.5" (47 cm) Wire Leads, PC Mount, Quick Disconnect Spade

Wetted Materials

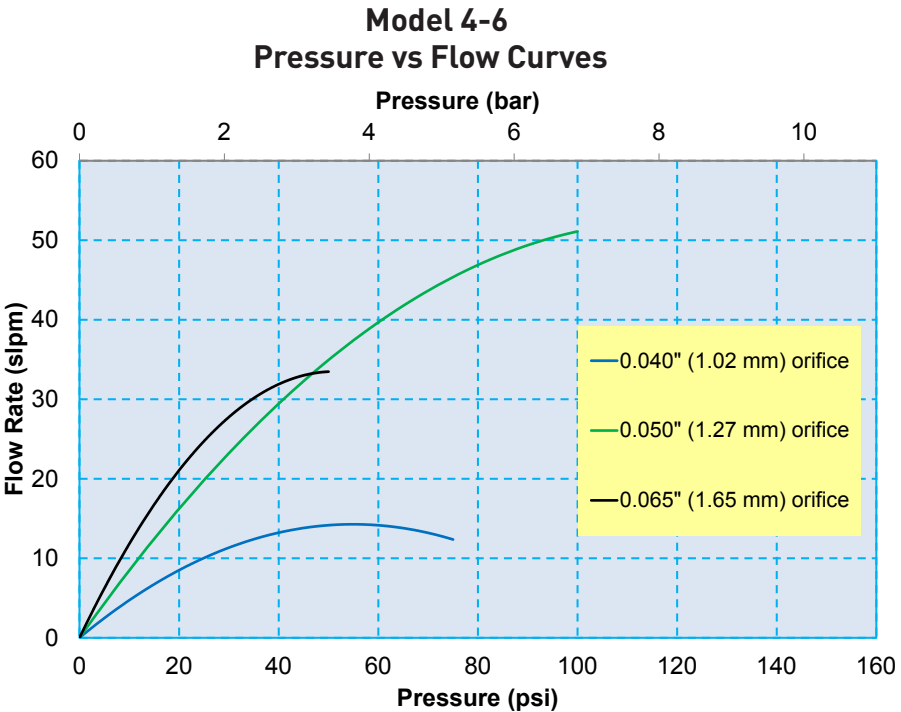
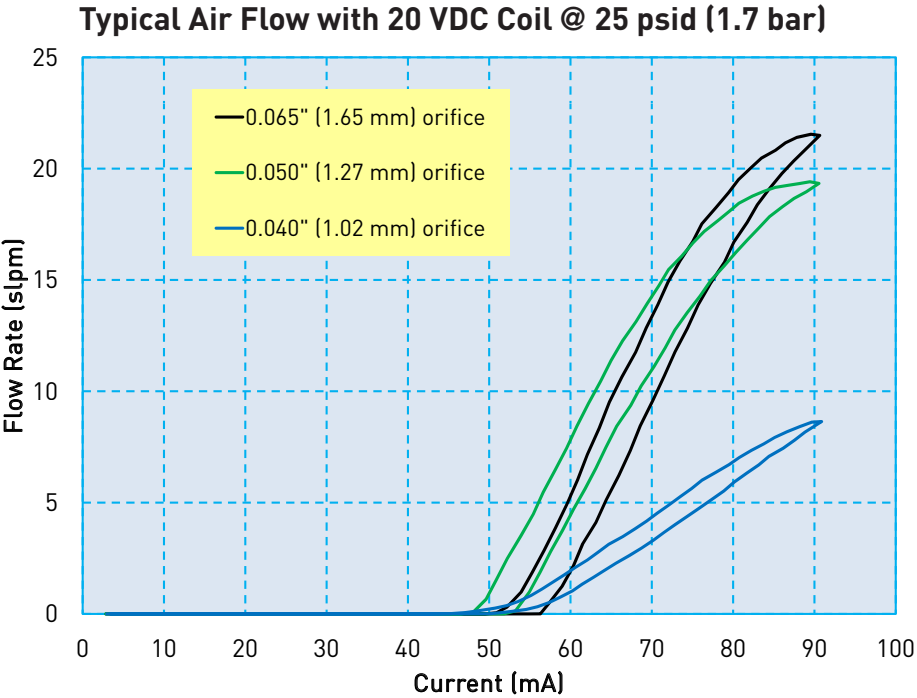
Body:
360 HO ₂ Brass
Stem Base:
430 FR Stainless Steel and Brass 360 HT
All Others:
FKM; 430 FR Stainless Steel; 300 Series Stainless Steel

Performance Characteristics

Leak Rate:
The leakage shall not exceed the following values: Internal 0.2 SCCM of air with a differential pressure of 1 psid, 25 psid and 150 psid External 0.016 SCCM of air at 150 psi
Pressure:
0 to 50 psi (3.45 bar) 0 to 75 psi (5.17 bar) 0 to 100 psi (6.89 bar) See Table 1
Vacuum:
0-27 in Hg (0-686 mm Hg)
Orifice Sizes:
0.040 in (1.02 mm) 0.050 in (1.27 mm) 0.065 in (1.65 mm)
Hysteresis:
7% of full scale current (Typical) 15% of full scale current (Max)



MD PRO Miniature Proportional Valve Typical Flow Curve



Pressure Capabilities

Table 1

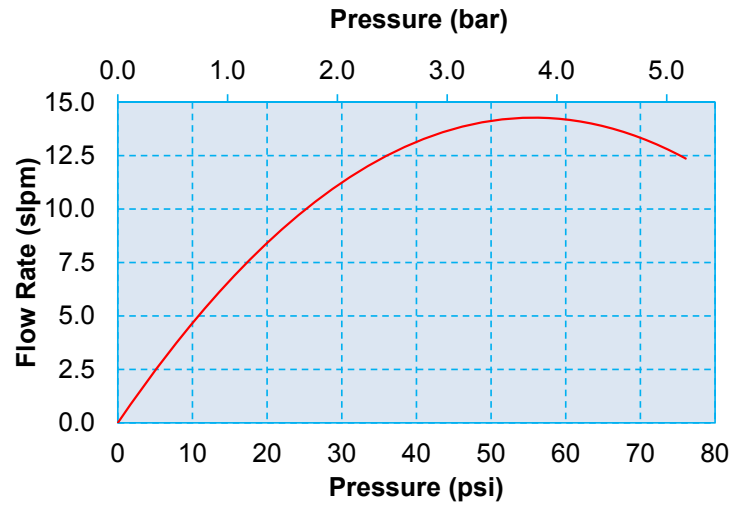
Orifice Diameter	Maximum Operating Inlet Pressure	Maximum Operating Pressure Differential
0.040 in (1.02 mm)	150 psig (10.34 bar)	75 psid (5.17 bar)
0.050 in (1.27 mm)	150 psig (10.34 bar)	100 psid (6.89 bar)
0.065 in (1.65 mm)	150 psig (10.34 bar)	50 psid (3.45 bar)



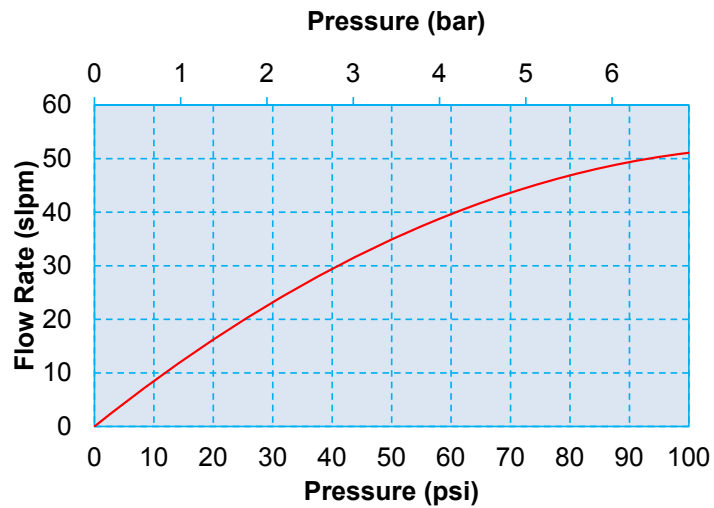
MD PRO Miniature Proportional Valve

MD PRO Sizing Charts

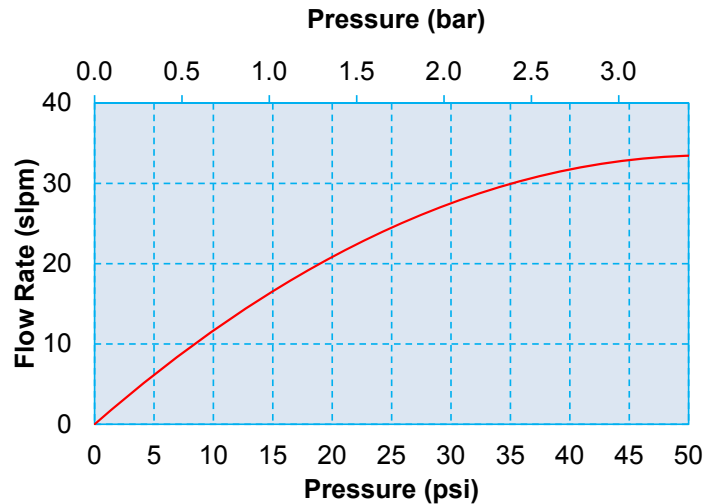
Model 4 - 0.040" (1.02 mm) Orifice



Model 5 - 0.050" (1.27 mm) Orifice



Model 6 - 0.065" (1.65 mm) Orifice



MD PRO Miniature Proportional Valve

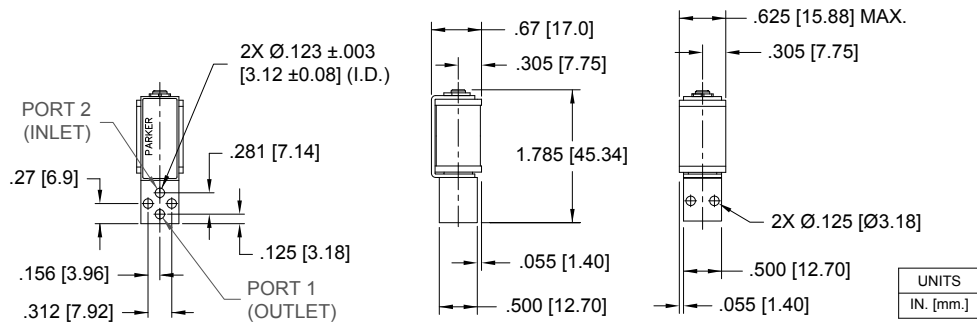
Pneumatic Interface

MD PRO Manifold Mount



Mechanical Integration Dimensions

MD PRO Basic Valve Dimensions



Pneumatic Interface

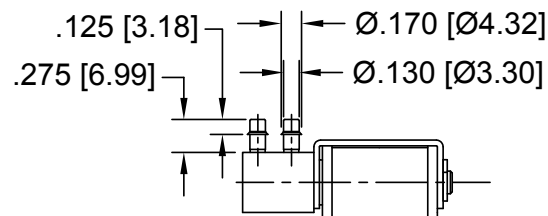
MD PRO Barbed



Barb Options

1/8" (3 mm) Barbs

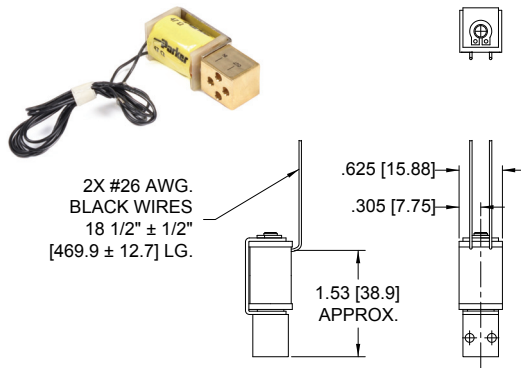
(For 1/8" (3 mm) I.D. Tubing)



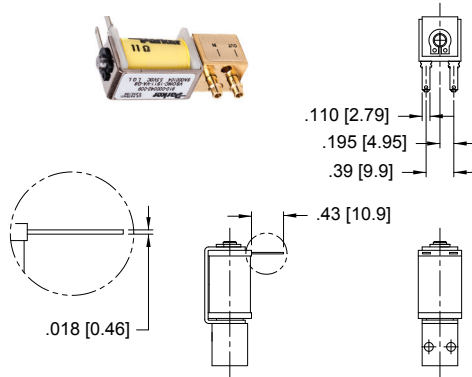
MD PRO Miniature Proportional Valve

Electrical Interface

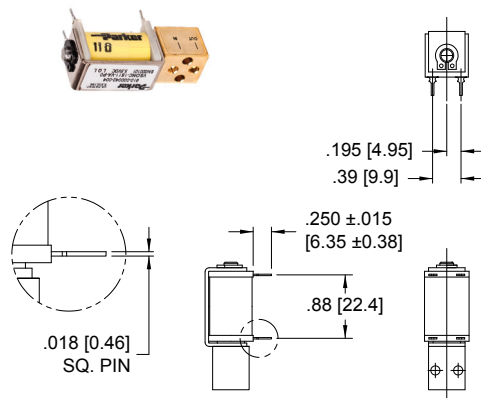
Coil Type: Wire Leads



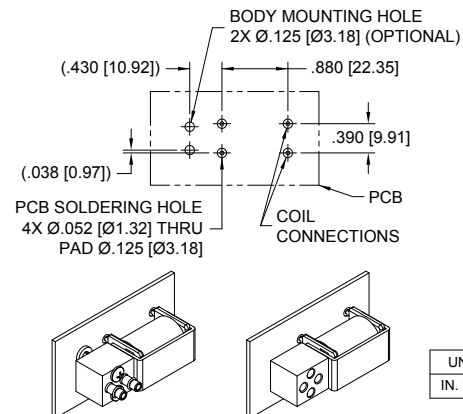
Coil Type: Quick Connect Spade



Coil Type: 4 PC Pin



PCB Pin Layout (Coil Type 4 PC Pin)



Electrical Requirements

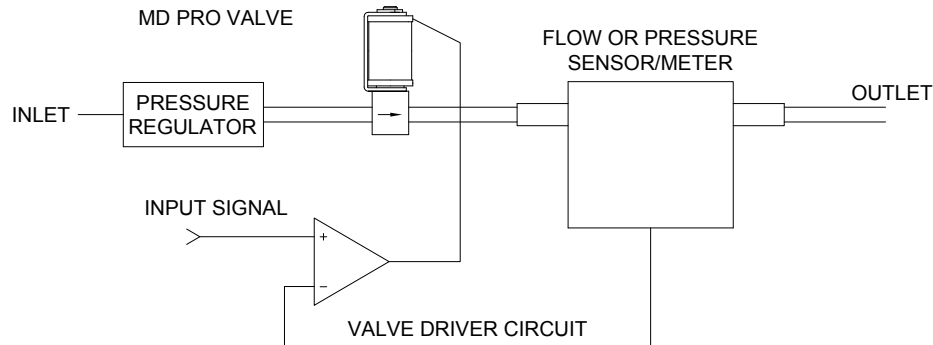
Table 2

Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20 °C (Ohms)
5.5	11
8.0	23
11.5	47
13.5	68
20.0	136
29.0	274

MD PRO Miniature Proportional Valve

Installation and Use

Typical Valve Set-up



Valve Electrical Control

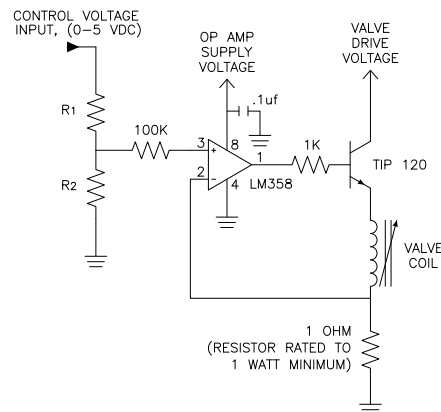
Basic Control:

The MD PRO 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.

Suggested MD PRO Current Driver Schematic



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

Table 3 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

Table 3: Selectable Resistor Values for a Low Current (1 mA) LM358-Based Current Driver

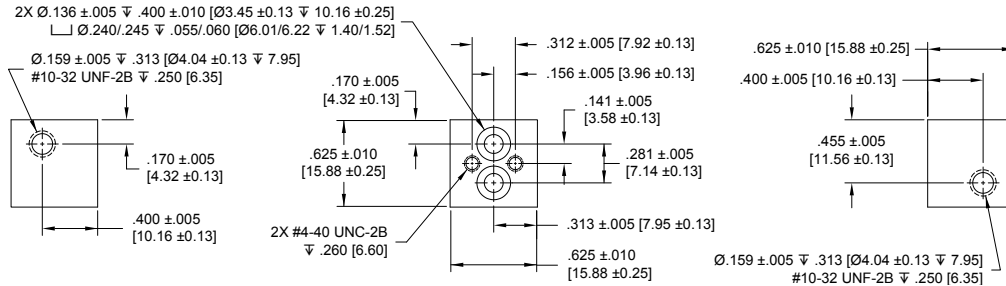
Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)	R1 (Ohms)	R2 (Ohms)
5.5	7.5	11	304	5100	330
8.0	10.0	23	212	4990	221
11.5	13.5	47	152	5100	160
13.5	15.5	68	125	4420	113
20.0	22.0	136	91	4420	82
29.0	31.0	274	66	4990	66.5

MD PRO Miniature Proportional Valve

Installation and Use

Manifold & O-Ring Dimensions & Design

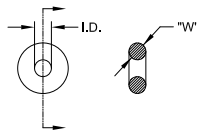
Not shipped with valves.



Accessories

O-Ring (Manifold Seal) Dimensions
190-007024-002 (2 required for each valve)

I.D. = Ø.114 ±.005 [Ø2.90 ±.013]
W = .070 ±.003 [1.78 ±.008]
O.D. = Ø.254 [Ø6.45] REFERENCE



Screw 4-40 x 5/8" Pan Head, Phillips
191-000115-010 (2 required for each valve)



Ordering Information

Sample Part ID	MDPRO	4	V	A	F	8	S
Description	Standard	Model Number: Maximum Operating Pressure / Orifice Size	Elastomer/ Body Material	Coil Voltage/Coil Resistance/Coil Current*	Electrical Interface	Pneumatic Interface	
Options		4: 75 psi / 0.040" (1.02 mm) 5: 100 psi / 0.050" (1.27 mm) 6: 50 psi / 0.065" (1.65 mm)	V: FKM / Brass	A: 5.5 VDC / 11 Ohm / 0.304 Amp B: 8 VDC / 23 Ohm / 0.212 Amp C: 11.5 VDC / 47 Ohm / 0.152 Amp D: 13.5 VDC / 68 Ohm / 0.125 Amp E: 20 VDC / 136 Ohm / 0.091 Amp F: 29 VDC / 274 Ohm / 0.066 Amp *Maximum voltage for continuous full flow, ambient temperature 55°C	F: Wire Leads, 18.5" (47 cm) P: PC Board Mount, 4 Pin Q: Quick Connect, Spade	1: Manifold Mount w/screens* 8: 1/8" (3 mm) Barbs *40 Micron Screen (Port 2)	S: Standard Cleaning O: Oxygen Service

Accessories	
190-007024-002: O-ring, FKM, 0.114" ID x 0.070" Thick*	*Not supplied with the valve. Used as a seal between the valve body and manifold.
191-000115-010: Screw 4-40 x 5/8" Pan Head**	**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
- Media & Ambient Temperature Range

Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/mdpro) to configure your MD PRO® Non-Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Spec. #790-002206-001 and Drawings #890-003022-001 and #890-003022-003.

PPF-MPV-002/US March 2016

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



Lone Wolf


Normally Open Miniature Proportional Valve

Thermally Compensated Proportional Valve



The Lone Wolf miniature proportional valve is a thermally compensated 2-way normally open (NO) proportional valve designed to maintain accurate and repeatable flow over a wide range of media. With the highest performance characteristics of any NO proportional valve available on the market, the Lone Wolf miniature proportional valve is an ideal choice for medical devices and patient monitoring applications that require rapid response along with stable and accurate performance.

Features

- Provides rapid, stable performance to improve system accuracy
- Enhances system control and patient comfort
- Maintains ideal flow across numerous media types and its entire operating temperature range
- Proven performance tested to 100 million life cycles
- RoHS compliant 

Typical Applications

- Blood Pressure Monitoring
- Vitreo Retinal Surgery

Product Specifications

Physical Properties

Valve Type:
2-Way Normally Open
Media:
Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others
Operating Environment:
32 to 131°F (0 to 55°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
1.79 in (45.3 mm)
Width:
0.63 in (16.5 mm)
Height:
0.67 in (17.0 mm)
Porting:
Barbs; manifold mount (with available screens)
Weight:
2.2 oz (62.9 g)

Physical Properties

Internal Volume:
0.031 in ³ (0.508 cm ³)
Filtration: (Suggested and Available)
40 micron
Flow Direction:
Inlet Port Port 1
Outlet Port Port 2

Electrical

Power:
2.0 Watts maximum
Voltage:
See Table 2
Electrical Termination:
18 in Wire Leads, PC Mount

Wetted Materials

Body:
360 HO ₂ Brass
Stem Base:
430 FR Stainless Steel and Brass
360 HT
All Others:
FKM; 430 FR Stainless Steel; 300 Series Stainless Steel

Performance Characteristics

Leak Rate:
The leakage shall not exceed the following values:
Internal 0.2 SCCM of He with a differential pressure of 1 psid, 5 psid and 25 psid
External 0.016 SCCM of He at 25 psig
Pressure:
0 to 10 psi (0.69 bar)
0 to 20 psi (1.37 bar)
0 to 25 psi (1.72 bar)
See Table 1
Vacuum:
0-20 in Hg (0-508 mm Hg)
Orifice Sizes:
0.024 in (0.61 mm)
0.030 in (0.76 mm)
0.036 in (0.91 mm)
Hysteresis:
7% of full scale current (Typical)
15% of full scale current (Max)

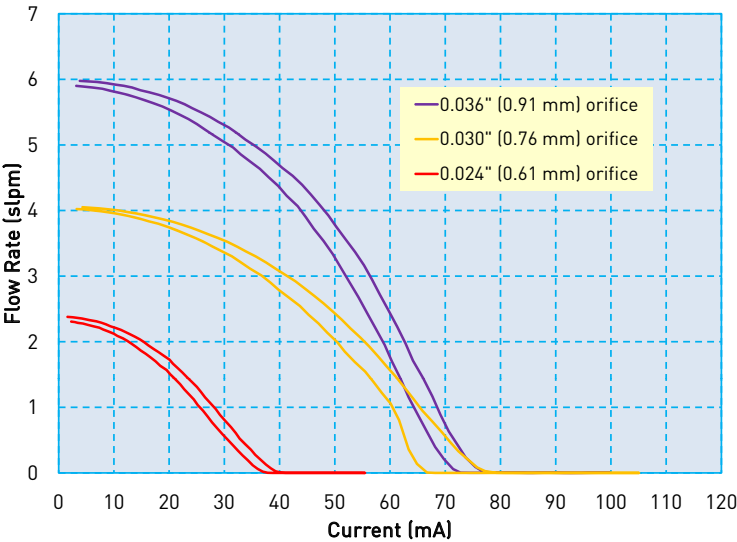
VSO is a registered trademark of Parker Hannifin Corporation.



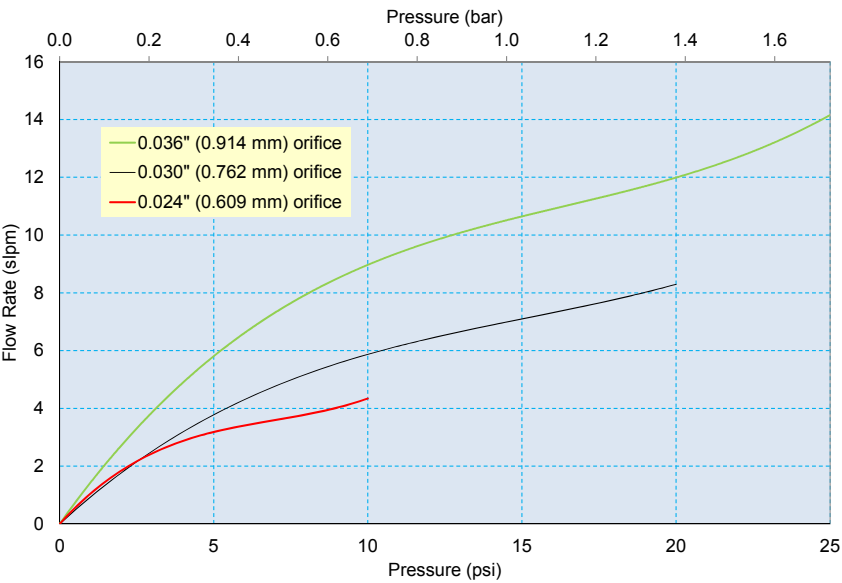
Lone Wolf Thermally Compensated Proportional Valve

Typical Flow Curve

All Models
Typical Air Flow with 13.5 VDC Coil @ 5 psid (0.34 bar)



Model 1-3
Lone Wolf Pressure vs Flow Curves



Pressure and Flow Capabilities

Table 1

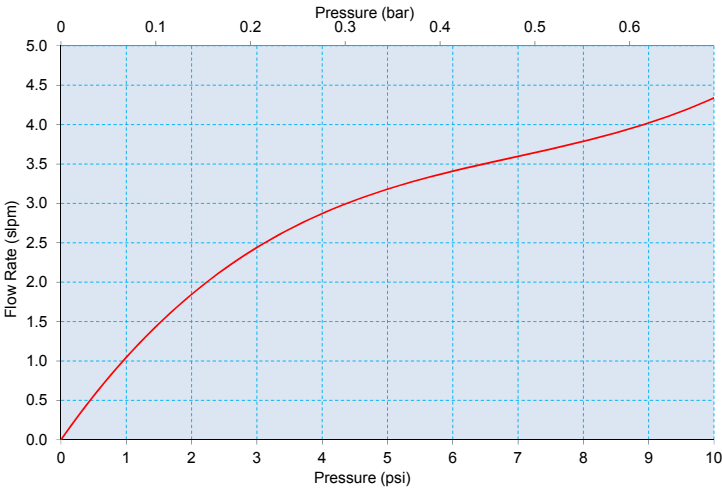
Model No.	Orifice Diameter in (mm)	Maximum Operating Inlet Pressure psig (bar)	Maximum Operating Pressure Differential psid (bar)
1	0.024 in (0.61mm)	0-25 psig (1.72 bar)	10 psid (0.69 bar)
2	0.030 in (0.76mm)	0-25 psig (1.72 bar)	20 psid (1.37 bar)
3	0.036 in (0.91mm)	0-25 psig (1.72 bar)	25 psid (1.72 bar)



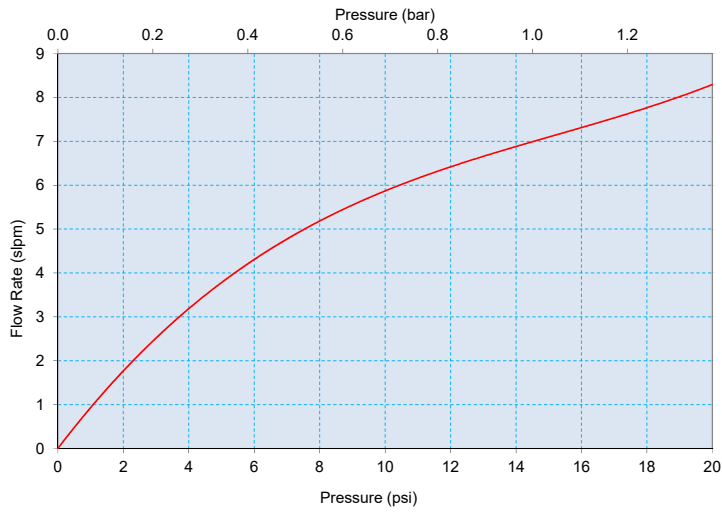
Lone Wolf Thermally Compensated Proportional Valve

Lone Wolf Sizing Charts

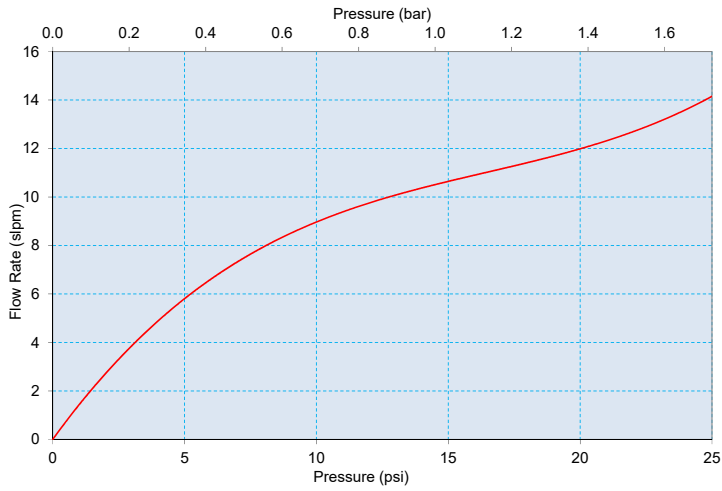
Model 1 – 0.024" (0.61 mm) Orifice



Model 2 – 0.030" (0.76 mm) Orifice



Model 3 – 0.036" (0.91 mm) Orifice



Lone Wolf Thermally Compensated Proportional Valve

Pneumatic Interface

**Lone Wolf
Manifold Mount**

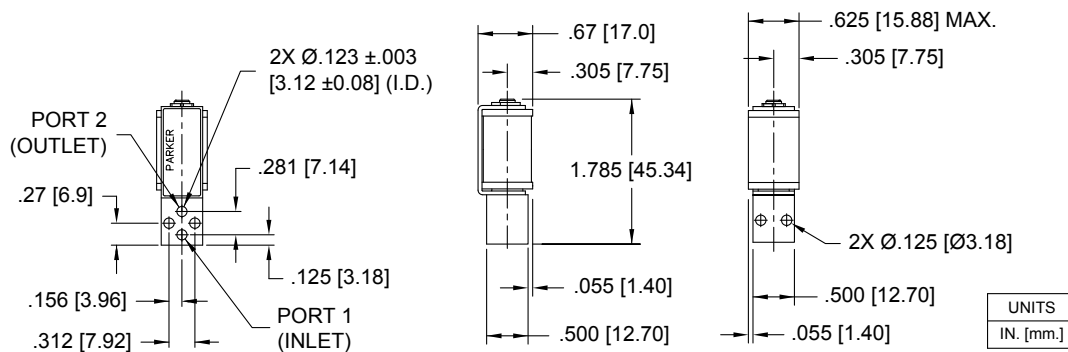


**Lone Wolf
Barbed**



Mechanical Integration Dimensions

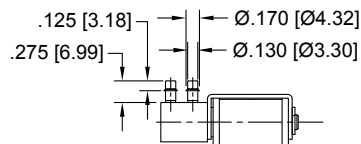
Lone Wolf Manifold Mount and Barbed Body Basic Valve Dimensions



Optional Barb Dimensions

1/8" (3 mm) Barbs

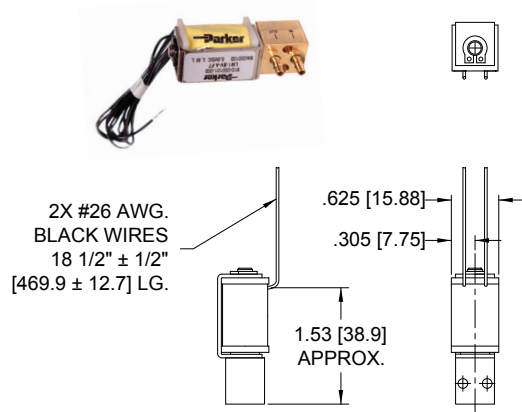
(For 1/8" (3 mm) I.D. Tubing)



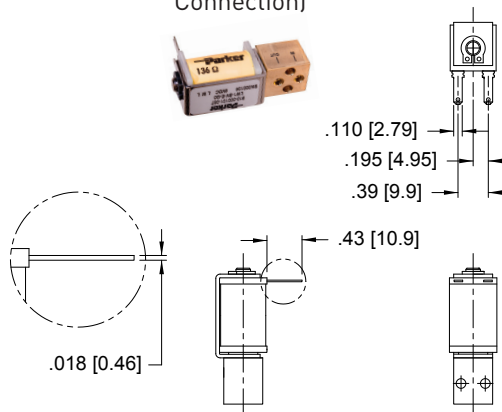
Lone Wolf Thermally Compensated Proportional Valve

Electrical Interface

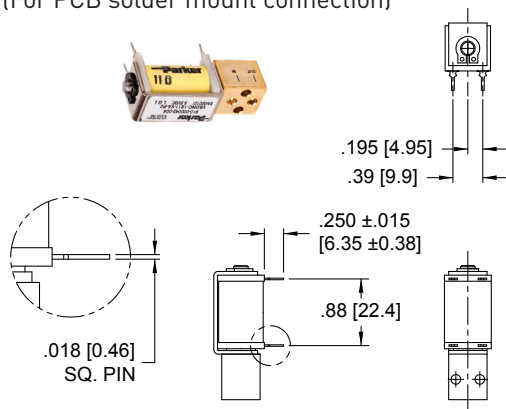
Coil Type: Wire Leads (for Terminal Block Connection)



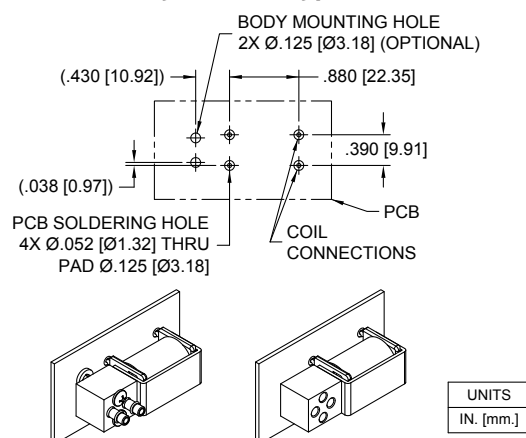
Coil Type: Quick Connect Spade (for Female Spade Terminal Connection)



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



PCB Pin Layout (Coil Type 4 PC Pin)



Electrical Requirements

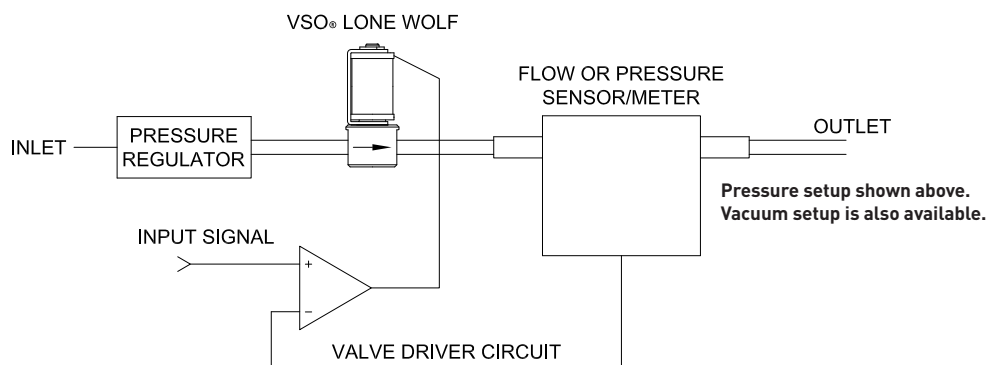
Table 2

Model 1 0.024" (0.61 mm) orifice			Model 2 0.030" orifice (0.76 mm)			Model 3 0.036" (0.91 mm) orifice		
Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20° C (Ohms)	Input Current for Full Shut Off (mA)	Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20° C (Ohms)	Input Current for Full Shut Off (mA)	Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20° C (Ohms)	Input Current for Full Shut Off (mA)
3.0	11	184	4.0	11	254	5.0	11	335
4.0	23	128	5.0	23	177	8.0	23	233
5.0	47	92	7.5	47	127	11.0	47	168
6.0	68	76	9.0	68	105	13.0	68	138
9.0	136	55	13.0	136	76	19.0	136	100
13.0	274	40	19.0	274	55	28.0	274	73
18.0	547	28	26.0	547	40	39.0	547	52
24.0	1094	20	36.0	1094	27	54.0	1094	36

Lone Wolf Thermally Compensated Proportional Valve

Installation and Use

Typical Valve Set-up



Valve Electrical Control

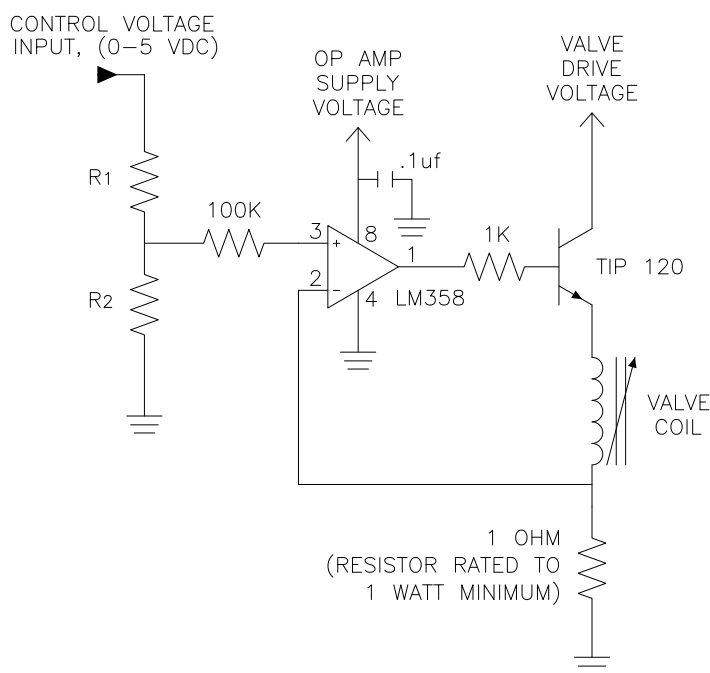
Basic Control:

The Lone Wolf 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.

Suggested Lone Wolf Current Driver Schematic



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

Table 3 (next page) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

Lone Wolf Thermally Compensated Proportional Valve

Table 3: Selectable Resistor Values for a Low Current (1mA) LM358-Based Current Driver

Model 1 0.024" (0.61 mm) orifice					
Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Shut Off (mA)	R1 (Ohms)	R2 (Ohms)
3.0	5.0	11	184	4816	184
4.0	6.0	23	128	4872	128
5.0	7.0	47	92	4908	92
6.0	8.0	68	76	4924	76
9.0	11.0	136	55	4945	55
13.0	15.0	274	40	4960	40
18.0	20.0	547	28	4972	28
24.0	26.0	1094	20	4980	20

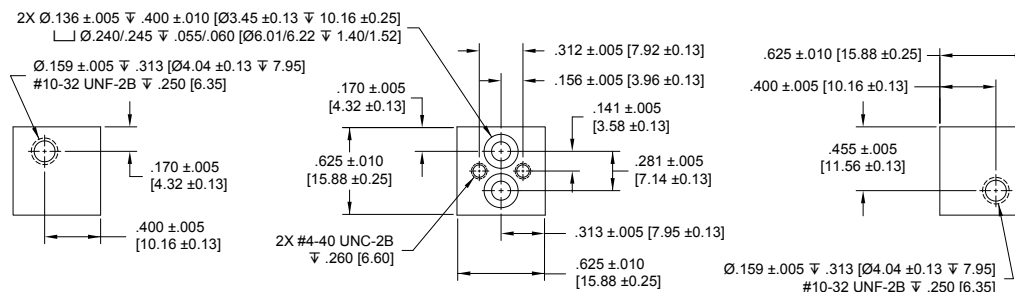
Model 2 0.030" (0.76 mm) orifice					
Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Shut Off (mA)	R1 (Ohms)	R2 (Ohms)
4.0	6.0	11	254	4746	254
5.0	7.0	23	177	4723	177
7.5	9.5	47	127	4873	127
9.0	11.0	68	105	4895	105
13.0	15.0	136	76	4924	76
19.0	21.0	274	55	4945	55
26.0	28.0	547	40	4960	40
36.0	38.0	1094	27	4973	27

Model 3 0.036" (0.91 mm) orifice					
Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Shut Off (mA)	R1 (Ohms)	R2 (Ohms)
5.0	7.0	11	335	4665	335
8.0	10.0	23	233	4767	233
11.0	13.0	47	168	4832	168
13.0	15.0	68	138	4862	138
19.0	21.0	136	100	4900	100
28.0	30.0	274	73	4927	73
39.0	41.0	547	52	4948	52
54.0	56.0	1094	36	4964	36

Lone Wolf Thermally Compensated Proportional Valve

Installation and Use

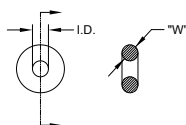
Recommended Manifold Dimensions & Design



Accessories

O-Ring (Manifold Seal) Dimensions
190-007024-002 [2 required for each valve]

I.D. = Ø.114 ±.005 [Ø2.90 ±.013]
W = .070 ±.003 [1.78 ±.008]
O.D. = Ø.254 [Ø6.45] REFERENCE



Screw 4-40 x 5/8" Pan Head, Phillips
191-000115-010 [2 required for each valve]



Ordering Information

Sample Part ID	LW	1	B	V	A	F	8
Description	Series	Model Number: Max Operating Pressure / Orifice Size	Body/ Material	Elastomer	Coil Resistance*	Electrical Interface	Pneumatic Interface
Options	LW	1: 0-10 psi / 0.024" (0.61 mm) 2: 0-20 psi / 0.030" (0.76 mm) 3: 0-25 psi / 0.036" (0.91 mm)	B: Brass	V: FKM	A: 11 Ohm B: 23 Ohm C: 47 Ohm D: 68 Ohm E: 136 Ohm F: 274 Ohm G: 547 Ohm H: 1094 Ohm	F: Wire Leads, 18" (45.7 cm) P: PC Board Mount, 4 Pin Q: Quick Connect, Spade	0: Manifold Mount 1: Manifold Mount w/screens 8: 1/8" (3 mm) Barbs

*See Table 2: Electrical Requirements to properly reference a coil resistance to the appropriate control voltage for each model

Accessories	
190-007024-002: O-ring, FKM, 0.114" ID x 0.070" Thick*	* Not supplied with the valve. Used as a seal between the valve body and manifold.
191-000115-010: Screw 4-40 x 5/8" Pan Head **	**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
- Media & Ambient Temperature Range

Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/lonewolf) to configure your Lone Wolf Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Spec. #790-002130-001 and Drawings #890-003079-001 and #890-003079-004.

PPF-MPV-002/US March 2016

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



VSO® MAX HP

Miniature High Flow Proportional Valve

High Flow Proportional Valve



The VSO® MAX HP is a miniature high flow proportional valve that provides maximum flow capabilities greater than 200 slpm @ 45 psi (3.10 bar), while consuming less than two watts of power. The valve delivers a high range of controllable flow while consuming 25% less power than comparable miniature proportional valves. In today's medical device industry, size is an important element. VSO® MAX HP's operating pressure of up to 120 psi (8.27 bar) eliminates the need for an inlet regulator. This translates to a smaller, sleek medical device design and offers potential savings and features three standard control voltage ranges (5, 12 and 24 VDC).

Typical Applications

- Ventilators
- Insufflators
- Anesthesia Delivery & Monitors
- Pressure & Flow Control
- Mass Flow Control

Features

- Delivers a wide range of controllable flow
- Provides repeatable flow performance over its rated life
- Cleaned for Oxygen service use
- Low power consumption generates less heat
- Proven performance tested to 25 million life cycles
- Reach and RoHS compliant



Product Specifications

Physical Properties

Valve Type:
2-Way Normally Closed
Media:
Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others
Operating Environment:
41 to 131°F (5 to 55°C)
Storage Temperature:
-40 to 158°F (-40 to 70°C)
Length:
2.02 in (51.4 mm)
Width:
0.63 in (15.9 mm)
Height:
0.69 in (17.4 mm)
Porting:
Manifold mount
Weight:
2.45 oz (69.5 g)

Electrical

Power:
2.0 Watts Maximum @ 20°C
Voltage:
See Table 1
Electrical Termination:
18 in Wire Leads

Wetted Materials

Body:
C36000 Brass
Stem Base:
430 FR Stainless Steel C36000 Brass
All Others:
FKM; 430 FR Stainless Steel; Stainless Steel

Performance Characteristics

Leak Rate:
The leakage shall not exceed the following values: Internal: 5.0 sccm of Air up to 120 psi (8.27 bar) External: 0.5 sccm of Air up to 120 psi (8.27 bar)
Pressure:
Operating: 0 - 120 psi (0 - 8.27 bar) Proof: 300 psi (20.7 bar)
Orifice Sizes:
0.116" (2.95 mm) effective 0.200" (5.08 mm) actual
Hysteresis:
7% of full scale current (Typical) 15% of full scale current (Max)
Recommended Filtration:
40 Micron (not supplied)
Response time:
10 ms Typical
Reliability:
25 Million Cycles

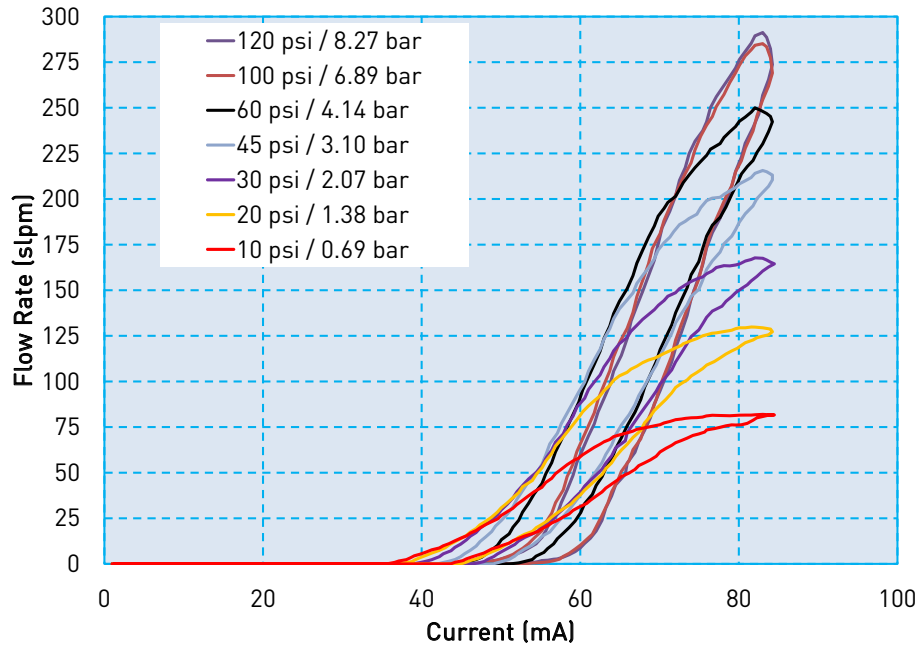
VSO is a registered trademark of Parker Hannifin Corporation.



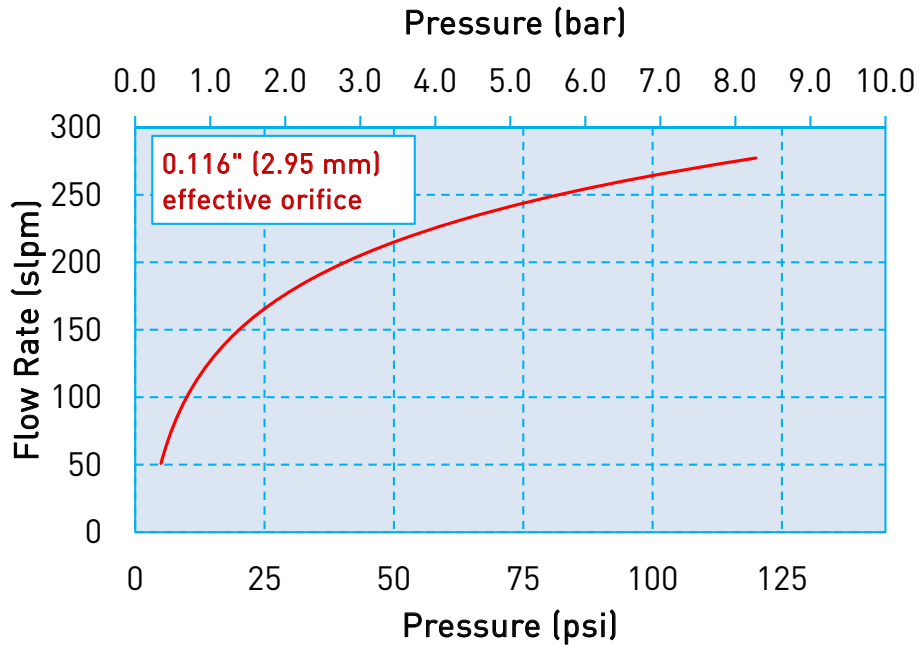
VSO® MAX HP Miniature High Flow Proportional Valve

Typical Flow Curves

Typical Air Flow with 12VDC 68 Ohm Coil
(Tested w/air 20° C)



Pressure vs Flow



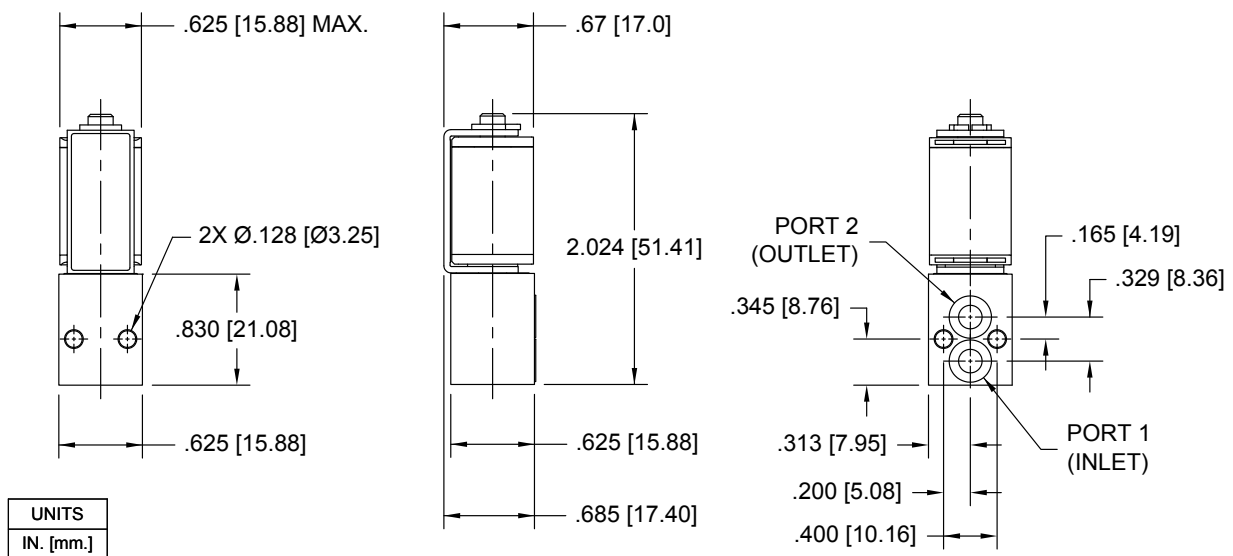
VSO® MAX HP Miniature High Flow Proportional Valve Pneumatic Interface

VSO® MAX HP Manifold Mount



Mechanical Integration Dimensions

VSO® MAX HP Manifold Body Basic Valve Dimensions

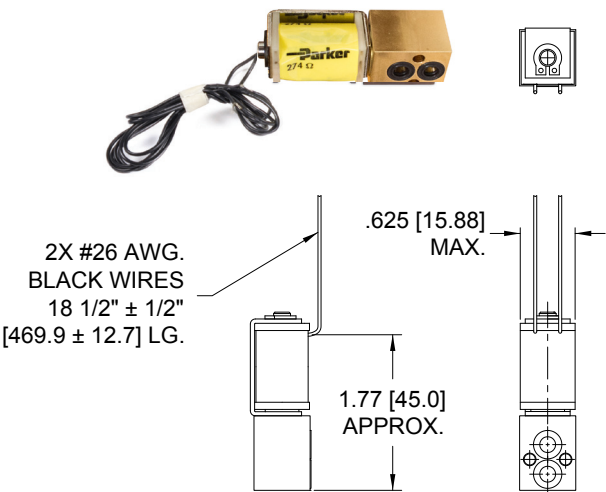


VSO® MAX HP Miniature High Flow Proportional Valve

Electrical Interface

VSO® MAX HP Manifold Mount

Coil Type: 18" Wire Lead



Electrical Requirements

Table 1

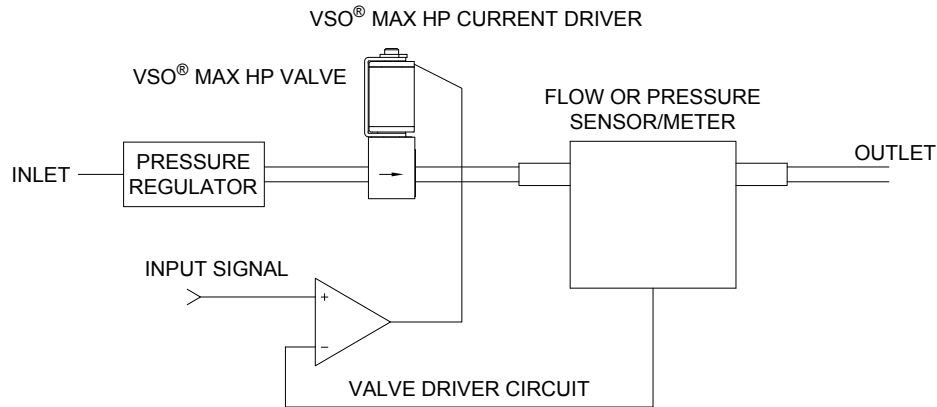
Maximum Supply Voltage (VDC)	Nominal Coil Resistance (Ohms) @ 20°C	Control Current at Maximum Flow (mA)
5	11.9	423
12	68.4	170
24	273.6	85



VSO® MAX HP Miniature High Flow Proportional Valve

Installation and Use

Typical Valve Set-up



Valve Electrical Control

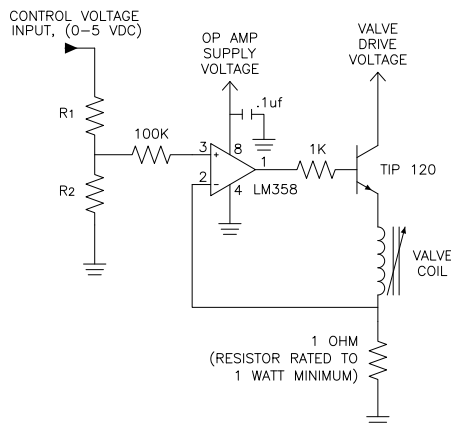
Basic Control:

The VSO® MAX HP 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 of 5 kHz or greater. Optimal frequency will be application dependent.

Suggested VSO® MAX HP Current Driver Schematic



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

Table 2 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

**Table 2: Selectable Resistor Values for a Low Current (1mA)
LM358-Based Current Driver**

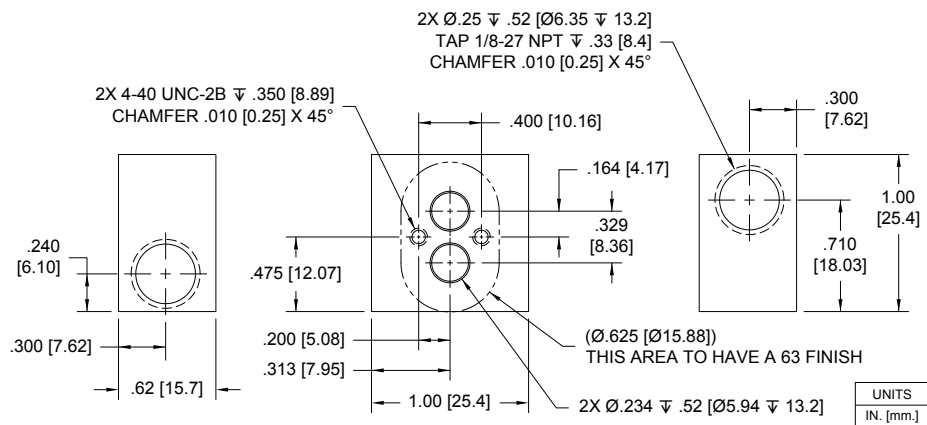
Maximum Solenoid Voltage (VDC)	Circuit Supply Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Maximum Output Current from Circuit (mA)	R1 (Ohms)	R2 (Ohms)
5	7	11.9	425	4990	464
12	14	68.4	172	4990	178
24	26	273.6	85	4990	86.6

VSO® MAX HP Miniature High Flow Proportional Valve

Installation and Use

VSO® MAX HP Manifold Dimensions

890-009034-001



Ordering Information

Sample Part ID	921	2	1	1	05	1	000
Description	Series	Type	Pneumatic Interface	Body /Elastomer	Coil Voltage	Electrical Interface	
Options		2: 120 PSI	1: Manifold Mount	1: Brass / FKM	05: 5 VDC 12: 12 VDC 24: 24 VDC	1: Wire Leads, 18" (45.7 cm)	

Accessories

191-000214-002: Screw 4-40 x 7/8" Stainless Steel, Socket Head Cap**

**Not supplied with the valve. Used to mount the valve to a manifold.

190-007060-001: Spare Manifold Gasket, Quad Ring FKM*

*Supplied with the valve. Used as a seal between the valve body and manifold. (2 Required)

890-009034-001: Manifold, Single Station, 1/8" NPT

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
- Media & Ambient Temperature Range



Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/vsmaxhp) to configure your VSO® Max HP Non-Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Spec. #790-002506-001 and Drawing #890-003423-001.

PPF-MPV-002/US March 2016

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




HF PRO High Flow Proportional Valve

Miniature Proportional Valve



The HF PRO is a miniature 2-way normally closed (NC) high flow proportional valve that controls gas flow proportionally to input current with flow rates up to 60 slpm at 50 psig. The valve can be controlled with either DC current or pulse width modulation along with closed loop feedback to deliver optimal system performance. The HF Pro miniature proportional valve is an ideal choice for applications that require repeatable pressure and flow control such as respiratory and patient monitoring applications.

Features

- Capable of controllable flow rates of up to 60 slpm and pressures of 50 psig
- Provides repeatability across its operating range for improved accuracy
- Available Oxygen Service use clean
- Proven performance tested to 35 million life cycles
- RoHS compliant 

Typical Applications

- Ventilators
- O₂ Concentrators/Conservers
- Anesthesia Delivery
- Patient Monitors
- Pressure & Flow Control

Product Specifications

Physical Properties

Valve Type:

2-Way Normally Closed

Media:

Air, argon, helium, hydrogen, methane, nitrogen, oxygen, & others

Operating Environment:

32 to 131°F (0 to 55°C)

Storage Temperature:

-40 to 158°F (-40 to 70°C)

Length:

1.785 in (45.3 mm)

Width:

0.625 in (15.88 mm)

Height:

0.67 in (17.0 mm)

Porting:

1/4" Barbs, Manifold Mount

Weight:

2.2 oz (62.9 grams)

Physical Properties

Internal Volume:

0.031 in³ (0.508 cm³)

Filtration:

43 micron

Flow Direction:

Inlet Port Port 2

Outlet Port Port 1

Oxygen and Analytically Clean:

Standard

Electrical

Power:

3.0 Watts maximum

Voltage:

See Table 2

Electrical Termination:

18 in Wire Leads

Wetted Materials

Body: 360 HO2 Brass

Stem Base:

430 FR Stainless Steel and
Brass 360 HT

All Others:

FKM; 430 FR Stainless Steel;
300 Series Stainless Steel

Performance Characteristics

Leak Rate:

The leakage shall not exceed the following values:

Internal 0.5 SCCM of N₂
External 0.016 SCCM of N₂

Pressure:

0 to 50 psi (3.45 bar)

See Table 1

Vacuum:

0-27 in Hg (0-686 mm Hg)

Orifice Size:

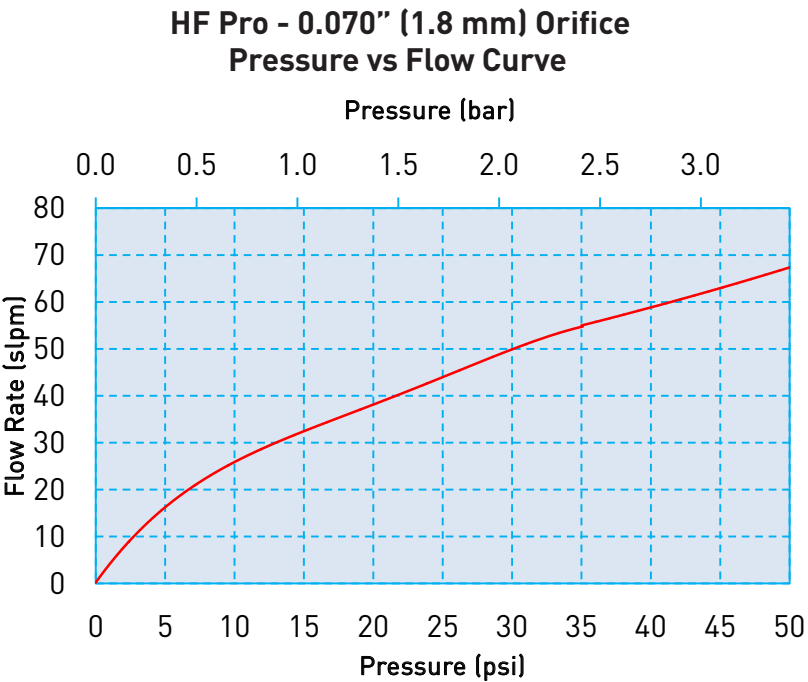
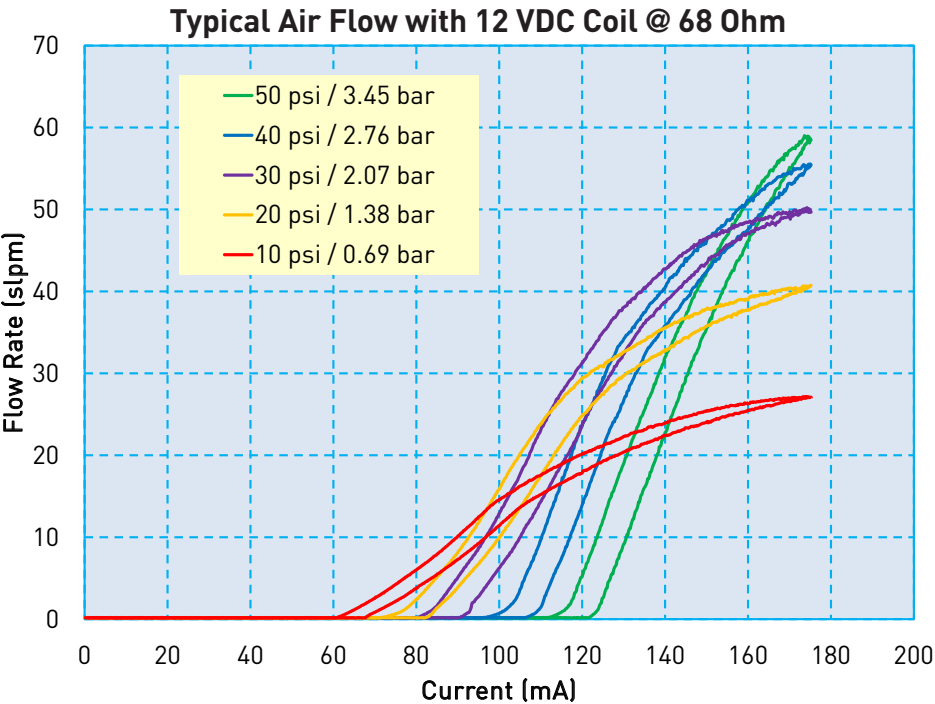
0.070" (1.8 mm) effective

Hysteresis:

7% of full scale current (Typical)
15% of full scale current (Max)

HF PRO Miniature High Flow Proportional Valve

Typical Flow Curve



Pressure and Flow Capabilities

Table 1

Orifice Diameter	Maximum Operating Inlet Pressure	Maximum Operating Pressure Differential
0.070 in (1.8 mm)	150 psig (10.34 bar)	50 psid (3.45 bar)



HF PRO Miniature Proportional Valve

Pneumatic Interface

**HF PRO
Manifold Mount**



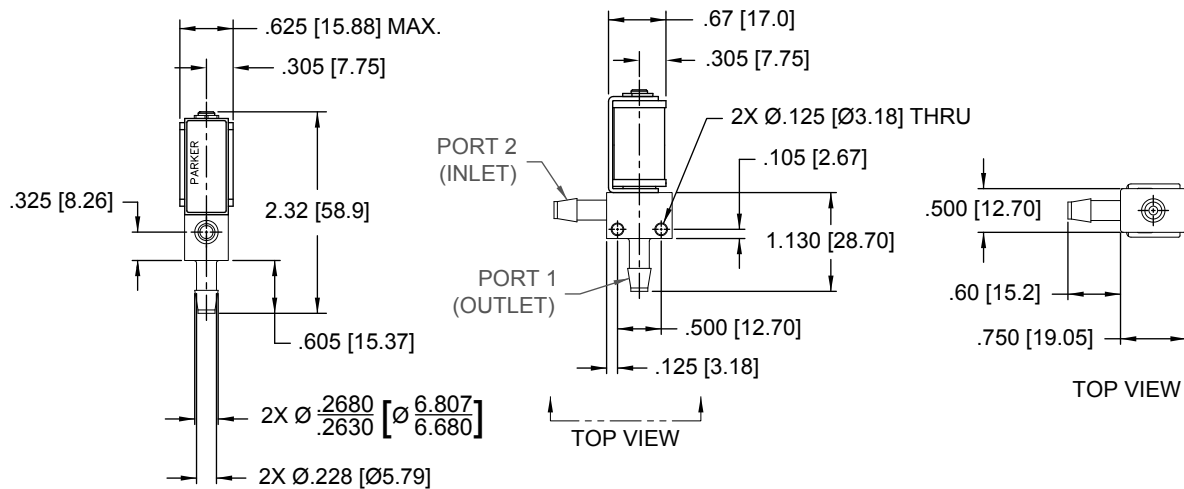
**HF PRO
Barbed**



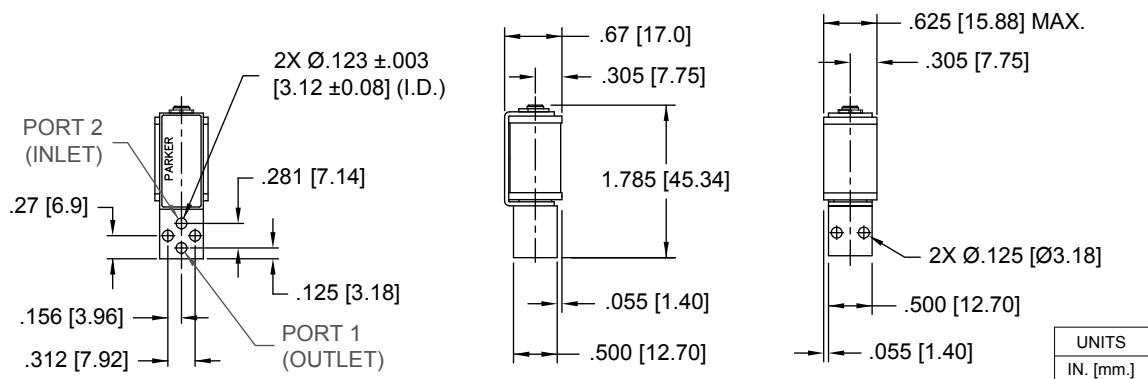
Mechanical Integration

Dimensions

HF PRO Barb Mount Basic Valve Dimensions



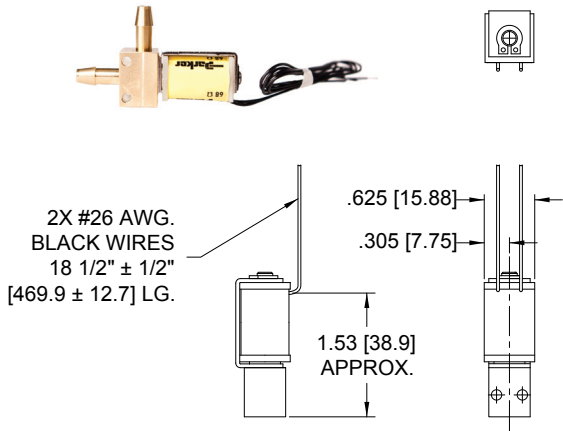
HF PRO Manifold Mount Basic Valve Dimensions



HF PRO Miniature Proportional Valve

Electrical Interface

Coil Type: 18" Wire Lead



Electrical Requirements

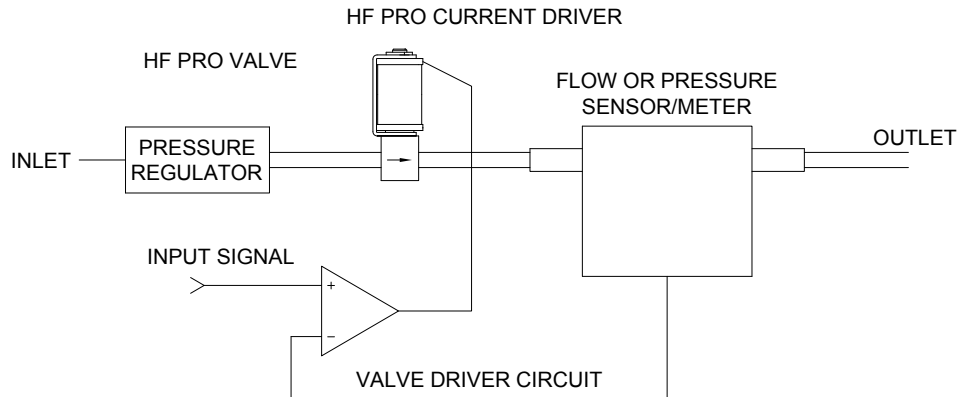
Table 2

Minimum Available Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)
5	11.9	435
12	68	175
24	274	87

HF PRO Miniature Proportional Valve

Installation and Use

Typical Valve Set-up



Valve Electrical Control

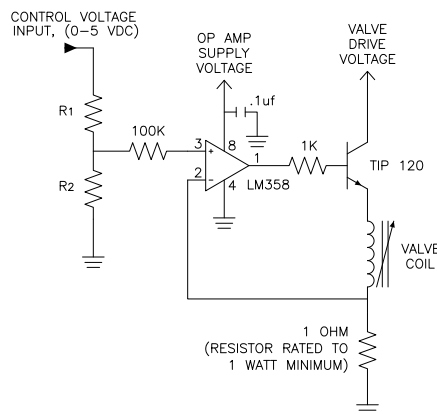
Basic Control:

The HF PRO 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.

Suggested HF PRO Current Driver Schematic



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

Table 3 (below) describes the recommended R1 and R2 resistor values based upon the full shut-off current.

**Table 3: Selectable Resistor Values for a Low Current (1mA)
LM358-Based Current Driver**

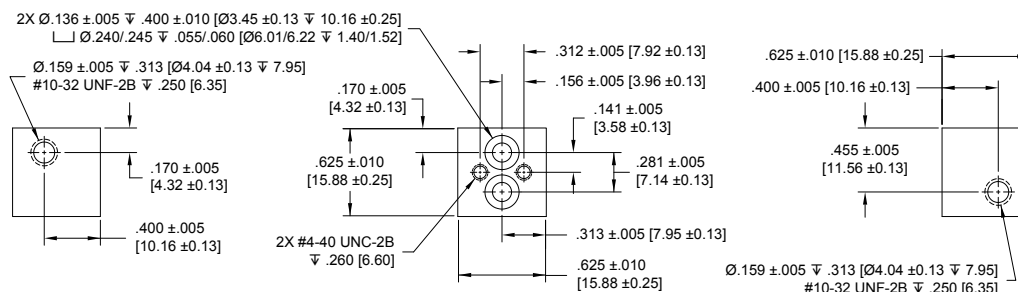
Voltage Supplied to Valve Coil (Reference)	Valve Drive Voltage (VDC)	Nominal Coil Resistance @ 20°C (Ohms)	Input Current for Full Flow (mA)	R1 (Ohms)	R2 (Ohms)
5	7	11.9	435	1000	95.3
12	14	68	175	2260	33.6
24	26	274	87	4990	18.2

HF PRO Miniature High Flow Proportional Valve

Installation and Use

Manifold & O-Ring Dimensions & Design

Not shipped with valves.



Ordering Information

Sample Part ID	HFPRO	7	V	A	F	8	O
Description	Series	Model Number: Maximum Operating Pressure / Orifice Size	Elastomer/ Body Material	Coil Voltage*	Electrical Interface	Pneumatic Interface	Cleaning
Options		7: 50 psi / 0.070" (1.78 mm)	V: FKM / Brass	A: 5 VDC D: 12 VDC F: 24 VDC *Maximum voltage for continuous full flow, ambient temperature 55°C	F: Wire Leads, 18" (45.7 cm)	1: Manifold Mount 8: 1/4" (6 mm) Barbs	O: Oxygen Service

Accessories	
190-007024-002: O-ring, FKM, 0.114" ID x 0.070" Thick*	*Not supplied with the valve. Used as a seal between the valve body and manifold.
191-000115-010: Screw 4-40 x 5/8" Pan Head**	**Not supplied with the valve. Used to mount the valve to a manifold.



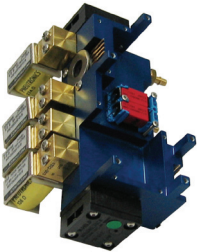
NOTE: In order to provide the best possible solution for your application, please provide the following requirements when contacting Applications Engineering:

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

Please click on the Order On-line button (or go to www.parker.com/precisionfluidics/hfpro) to configure your HF PRO Non-Thermally Compensated Proportional Valve. For more detailed information, visit us on the Web, or call and refer to Performance Spec. #790-002243-001 and HF PRO Barbed Drawing #890-003192-001 and HF PRO Manifold Mount Drawing #890-003191-001.

Value Added Application-Specific Solutions

Gassing Control System



- Mixed gassing logic design includes VSO® proportional valves, X-Valve®, pressure switch, pressure sensors, and PCB interface

Pneumatic Module



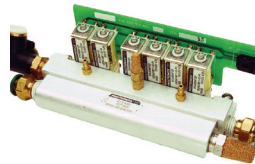
- Integrated valve manifold
- Compact design
- Single electrical connection
- Valves configured per specifications

Vacuum Gas Control Module



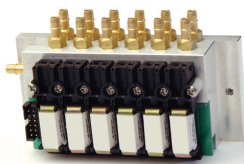
- Tested to 1×10^7 cc/sec/atm Helium
- Assembly tested on mass spectrometer

6 Position VSO® Proportional Pneumatic Manifold Assembly



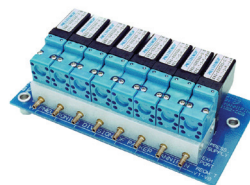
- Quick connect fittings
- Circuit board with mass electrical termination

Magnum Manifold Assembly



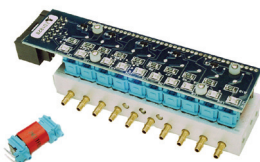
- Integrated circuit board with single connection
- Compact design
- Easily adaptable
- 2 way and 3 way designs

8 Position SRS Model Pneumatic Manifold



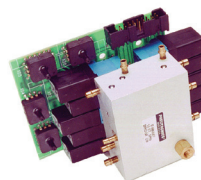
- Integrated pressure/vacuum sensors
- Mixed pneumatic logic design
- Ultem® manifold pressure/vacuum sensors

10 Position X-Valve® Pneumatic Manifold



- Mixed pneumatic logic design
- Ultra-miniature design with PCB for mass termination

10 Position SRS Model Pneumatic Manifold



- Integrated pressure/vacuum sensors
- Mixed pneumatic logic design
- Ultem® manifold pressure/vacuum sensors

NOTES



WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY, AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or systems in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.



Parker Hannifin Corporation
Precision Fluidics Division
26 Clinton Dr., Unit 103
Hollis, NH 03049
phone 603 595 1500
fax 603 595 8080
www.parker.com/precisionfluidics