

# QPV1 Electronic Pressure Regulator

## INSTALLATION AND MAINTENANCE INSTRUCTIONS

### DESCRIPTION / IDENTIFICATION

The QPV1 is a high resolution electronic pressure regulator. It provides a regulated output pressure that is proportional to an electrical command signal input. The QPV1 is available in a wide range of calibrated pressure ranges covering vacuum through 150 psig (10 Bar). The QPV1 is available in either 0 -10 VDC or 4-20 mA analog signal types.

The QPV1 is a complete closed loop control valve consisting of two internal solenoid valves, a manifold, an electronic control circuit board, and a pressure transducer all contained in a protective IP65/NEMA4 housing. Pressure is controlled by the use of two solenoid valves. One valve functions as inlet control and acts to allow supply media into the system to increase the controlled pressure. The other solenoid valve acts as the exhaust and will decrease the controlled pressure by venting to atmosphere. The inlet solenoid valve operates in a proportional manner to the current supplied by the QPV1's electronic control circuit. This variable orifice affect allows precise control of pressure at low flow conditions and avoids the digital steps of traditional ON/OFF solenoids. The ability to vary the inlet solenoid valve orifice opening in an analog fashion allows the QPV1 to control pressure with extremely high resolution. The exhaust solenoid is a standard ON/OFF solenoid and allows excess media to be vented from the system.

The regulated pressure output is measured by a pressure transducer internal to the QPV1. This pressure transducer provides a feedback signal to the QPV1's electronic control circuit. The control circuit compares the internal sensor feedback signal to the command signal input. Any difference between the two signals causes the appropriate solenoid valve to open, allowing flow in or out of the system. Accurate pressure is maintained by controlling these two valves.

The QPV1 is a relatively low flow regulator. This makes the QPV1 a great choice any time low flow rates or small volumes require precise pressure control. The QPV1 is often used to provide the pilot pressure signal to the dome of either an Equilibar® back pressure regulator or an Equilibar® vacuum regulator. The QPV1 can then be used to electronically control back pressure or vacuum pressure in line sizes from 1/8 inch through 6 inch by pilot operating the appropriately sized regulator.

An electronic monitor output signal from the internal pressure transducer is provided. All QPV1 valves come standard with an analog voltage monitor output. A 4-20mA monitor is available optionally.

The QPV1 series is available in two generations. The older 'T' models used brass hex fittings in the side of the canister for the inlet and outlet port connections. An improved 'M' series uses a solid aluminum base with integral inlet and outlet ports. Both models have identical performance and are pin- for-pin compatible. Both models use the same control circuit, solenoid valves, electrical connector, and internal pressure sensor.



### SPECIFICATIONS

ELECTRICAL	
SUPPLY VOLTAGE	15-24 VDC
SUPPLY CURRENT	350mA required.
COMMAND SIGNAL	
VOLTAGE	0-10 VDC single ended
CURRENT	4-20 mA differential
COMMAND SIGNAL IMPEDANCE	
VOLTAGE	10 KΩ
CURRENT	100 Ω
ANALOG MONITOR SIGNAL	
VOLTAGE	0-10 VDC @ 10mA max
CURRENT	4 - 20 mA (Sourcing @ 12 VDC)
PNEUMATIC	
PRESSURE RANGES	29.9 in. Hg (vac) - 150 psig 760 mmHg (vac) - 10.34 BAR
FLOW RATE	Based on the inlet valve orifice size (ORDERING INFORMATION)
MINIMUM VOLUME	1 cubic in (17cc)
BLEED TO ATMOSPHERE	.0047" bleed orifice
FILTRATION RECOMMENDED	20 micron nominal (included)
PORT SIZE	1/8" NPT
LINEARITY/HYSTERESIS	<±0.15% F.S. BFSL
REPEATABILITY	<±0.02% F.S.
ACCURACY	<±0.2% F.S.
RESOLUTION	<±0.02% F.S.
WETTED PARTS <sup>1</sup>	Elastomers - Fluorocarbon Manifold - Brass, Anodized Aluminum Valves - Nickel plate brass P.Transducer - Silicon, Aluminum
PHYSICAL	
OPERATING TEMPERATURE	32-158°F [0-70C]
WEIGHT	1.02 lb [0.50 Kg]
PROTECTION RATING	NEMA 4 / IP65
HOUSING	Aluminum
FINISH	Black Anodized Aluminum

<sup>1</sup> Others available

# QPV1 Electronic Pressure Regulator

QPV1 units come in two styles: 'T' and 'M'. See page 5 for details. To determine which style you have, review your part number against the QPV Part Configuration chart on page 6. Follow instructions for positive pressure or vacuum installation accordingly. **If you ordered a model with absolute pressure units of measure, it will arrive with brass fittings and tubing installed. follow instructions on the installation addendum on page 6.**

## INSTALLING POSITIVE PRESSURE UNITS

1. Apply a small amount of the provided anaerobic sealant to the male threads of the FPP1 in-line filter shipped with the QPV unit.

**NOTE:** Use only the thread sealant provided. Other sealants such as PTFE tape and pipe dope can migrate into the internal solenoid valves causing blockages and failures.

2. Thread the FPP1 in-line filter into the Inlet Port labeled **IN** (on 'T' style) or **I** (on 'M' style) QPV1 valve. See NOTE 2.
3. Connect supply pressure to the FPP1 in-line filter port. See TABLE 1 for maximum inlet pressure ratings. Supply gas must be air or inert gas only and within the limits specified on TABLE 1.
4. Connect the device being controlled to the Outlet Port labeled **OUT** (on 'T' style) or **O** (on 'M' style). 'M' style has two ports labeled **O**. Either may be used.

**NOTE:** Too small of a volume connected to the outlet port may cause the QPV to be unstable and oscillate. A length of tubing providing 1 cubic inch (17cc) of volume or more is recommended on the QPV outlet port to prevent instability.

5. The valve can be mounted in any orientation without affecting performance. Mounting bracket QBT-01 (ordered separately) can be used to attach the QPV to a panel or wall surface.
6. Proceed with electrical connections discussed on page 3.

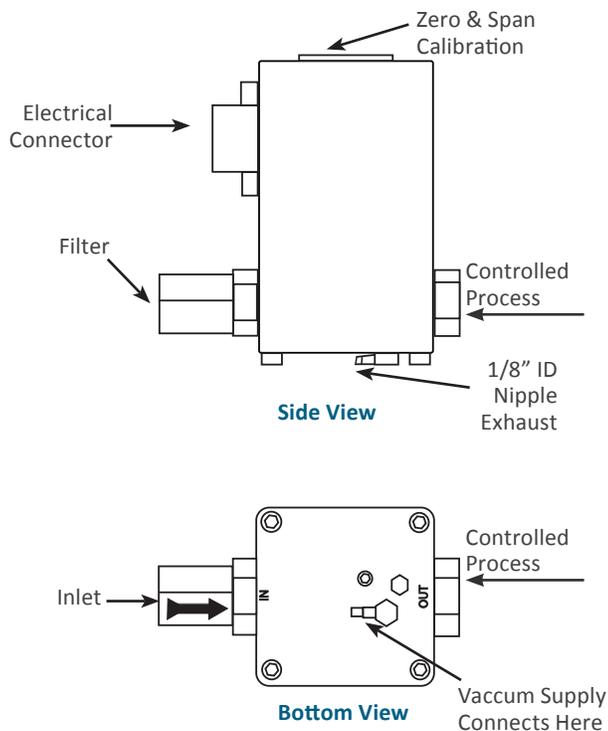


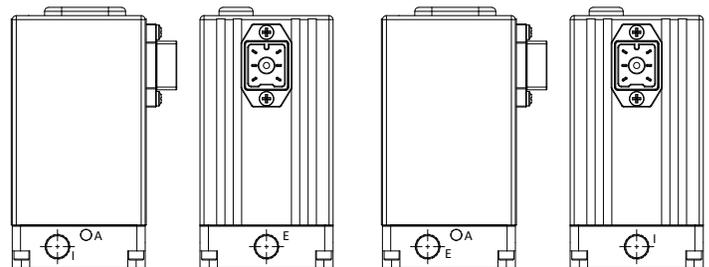
Figure 2: 'T' Style Vacuum Installation

TABLE 1

RATED INLET PRESSURE FOR STANDARD QPV1 VALVES	
For valves ordered with <b>MAX</b> calibrated pressure	<b>MAX</b> Inlet Pressure
Vacuum up to 10 psig (0.69 bar)	15 psig (1 bar)
10.1 up to 30 psig (0.70 up to 2 bar)	35 psig (2.4 bar)
31 up to 100 psig (2.1 up to 7 bar)	100 psig (7.6 bar)
101 up to 150 psig (6.96 up to 10.34)	160 psig (11 bar)

**NOTE 2:** Positive pressure "M" style QPV units have different "I" port locations for units rated vacuum or below 100 psi and units rated above 100 psi.

See Figure 1 below, where I = Inlet, A = atmospheric reference, and E = Exhaust



Port locations on 'M' Units above 100 psi.

Port locations on 'M' Units below 100 psi and vacuum units.

Figure 1: 'M' Style Port Locations

## INSTALLATION OF VACUUM UNITS

1. Apply a small amount of the provided anaerobic sealant to the male threads of the FPP1 in-line filter shipped with the QPV unit.
2. Thread the FPP1 in-line filter into the Inlet Port labeled **IN** (on 'T' style) or **I** (on 'M' style) QPV1 valve.
3. Connect the process where vacuum pressure is to be controlled to the Outlet Port. (See Figure 2)
4. Connect vacuum supply to the QPV Exhaust Port. For the 'T' style this is the 1/8" ID tube nipple installed in the 10-32 exhaust on the bottom lid (See Figure 2). On the 'M' series this is the port in the side of the aluminum manifold labeled 'E' (See Figure 1).
5. In typical applications leave Inlet Port, labeled **IN** (on 'T' style) or **I** (on 'M' style), open to atmosphere. This allows the QPV to add atmospheric air to the system when excess vacuum is present. Alternatively, low positive pressure may be supplied to the inlet port.
6. Proceed with electrical connections discussed on page 3.

# QPV1 Electronic Pressure Regulator

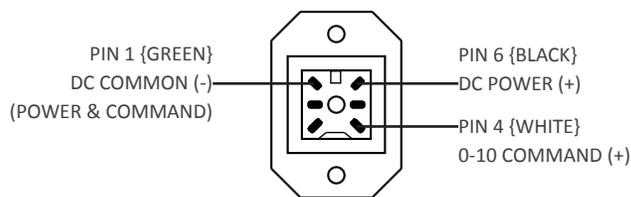
## ELECTRICAL CONNECTIONS

1. Make sure all electrical power is OFF while making electrical connections. Improper connections can damage the QPV.
2. Identify the command input and analog output signal types for your specific QPV part number using the ordering information section on the last page of this sheet. Confirm this against the calibration card included in the packaging.
3. Use the information below to wire the QPV according to your specific part number and signal type(s).

**NOTE: ALL COLOR CODES RELATE TO THE FACTORY WIRED QBT-C-x POWER CORD.**

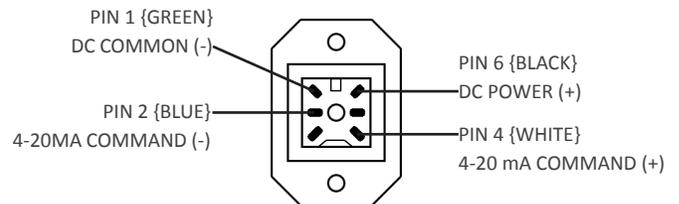
## VOLTAGE COMMAND VALVES

All voltage command QPV1 models use single ended voltage, meaning the DC Common pin (Pin 1) is the common reference for both power and command. Pin 1 is used as both the command signal common and power supply common.

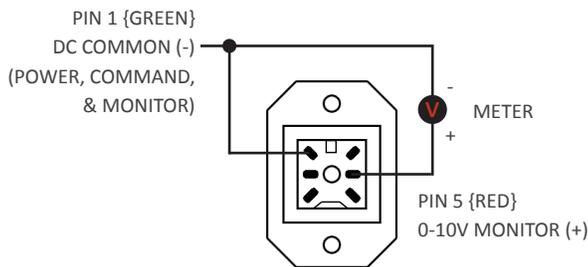


## CURRENT COMMAND VALVES

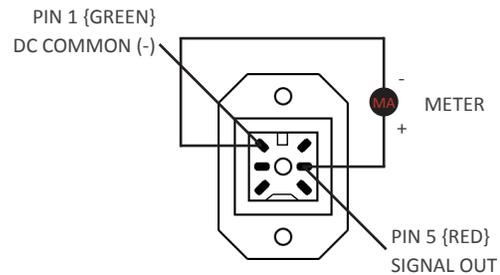
All current command QPV1 models use a differential current loop scheme (not isolated), meaning current flow is from Pin 4 to Pin 2 on the QPV valve. Some applications may require the common of the power supply that provides loop power for the 4-20mA command to be tied to power supply common.



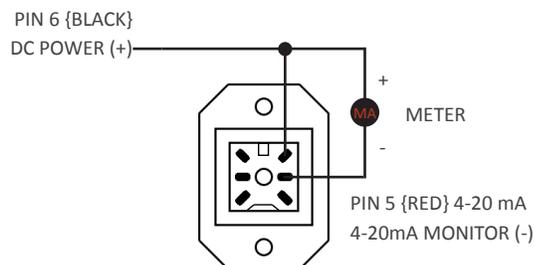
## VOLTAGE MONITOR



## CURRENT SOURCING MONITOR



## CURRENT SINKING MONITOR (Special Order Option)



# QPV1 Electronic Pressure Regulator

## RE-CALIBRATION PROCEDURE

All QPV1 control valves come calibrated from the factory by trained personnel using precision calibration equipment. The calibration and operation of each QPV1 is checked by two different operators using independent test equipment. The QPV1 valve is a closed loop control valve using a precision electronic pressure sensor. Typical drift is less than 1% over the life of the product. If your QPV1 valve appears to be out of calibration by more than 1%, it is

not likely to be the QPV1. Check the system for adequate supply pressure, wiring and electronic signal levels. Verify the accuracy of your measuring equipment before re-calibrating. Consult factory if you have any questions or require assistance. If the QPV1 valve needs re-calibration, use the procedure described below. The range which a QPV1 may be calibrated is typically limited to -20% to +10% of its original factory calibration.

## QPV1 VALVES

1. Identify the inputs and outputs of the valve using the model number of the valve, calibration card included with the valve, and the information provided in this sheet.
2. Connect a precision measuring gage or pressure transducer to the OUT port of the QPV1. Too small of connected volume may cause the QPV1 to be unstable. A length of tubing providing 1 cubic inch (17cc) of volume or more is recommended on the QPV outlet port to prevent instability.
3. Connect the correct supply source to the IN port of the QPV1, making sure the pressure does not exceed the rating for the valve (See **Table 1**).
4. Locate the plastic calibration access cap on top of the QPV1 valve and completely remove it. Located underneath are two adjustment trimpots, Zero "Z" and Span "S". See **Figure 2** for trimpots location.

**NOTE:** The QPV1 uses an advanced analog PID circuit to modulate the internal solenoid valves. These four potentiometers (Proportional, Integral, Bias and Exhaust Trip Point) are set at the factory and should not require adjustment. These settings are based on the specific parameters of your application. If the response of the QPV1 requires adjustment, contact the factory for special

instructions.

5. **NOTE:** Only use this step if your device is totally out of calibration. If it is slightly out of calibration, omit this step and move on to step 6. Using a small screwdriver, turn the Z and S trimpots 15 turns clockwise. Then turn the Z and S trimpots 7 turns counterclockwise. This will put the QPV1 roughly at midscale.
6. Make correct electrical connections as noted. Make sure there is a proper meter in place to measure the command input to the QPV1.
7. Set the electrical command input to MAXIMUM value.
8. Adjust the SPAN pot until MAXIMUM desired pressure is reached (clockwise increases pressure).
9. Set the electrical command input to MINIMUM value.
10. Adjust the ZERO pot until MINIMUM desired pressure is reached (clockwise increases pressure).
11. Repeat ZERO and SPAN adjustments (steps 7-10), which interact slightly, until QPV1 valve is calibrated back to proper range.
12. Replace calibration access cap

TABLE 1

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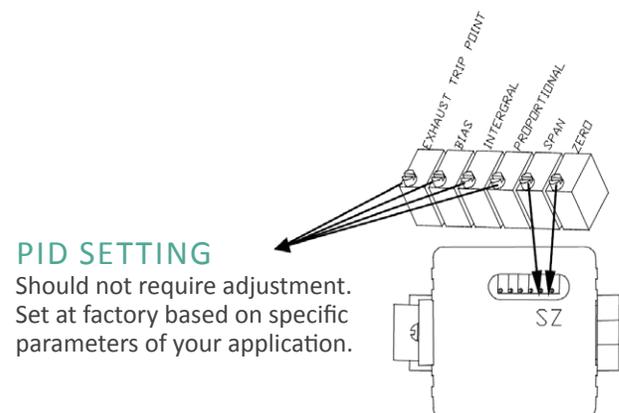
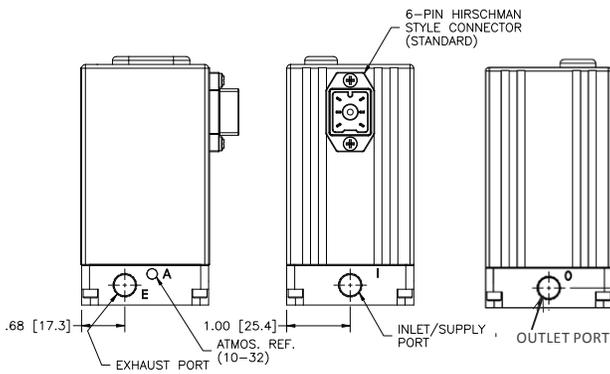


Figure 2: Location of adjustment trimpots for Zero "Z" and Span "S"

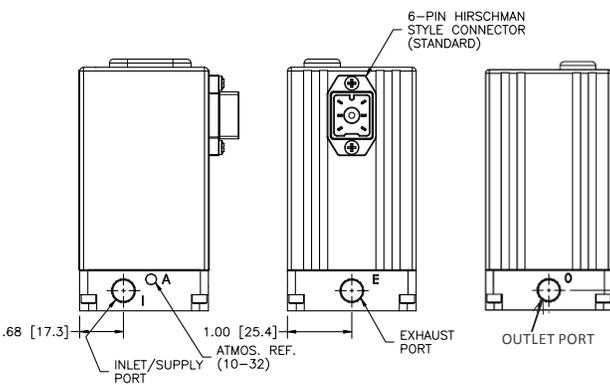
# QPV1 Electronic Pressure Regulator

DIMENSIONS - IN [MM]

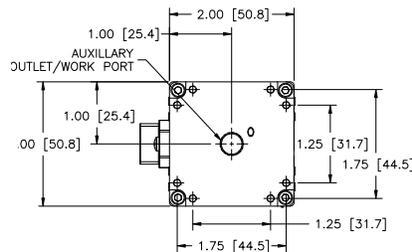
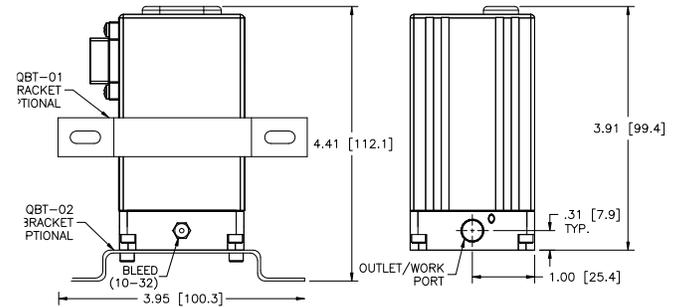
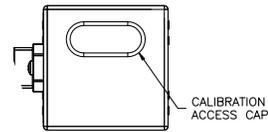
## 'M' STYLE UNIT DIMENSIONS



Port Locations on 'M' Units Below 100 psi

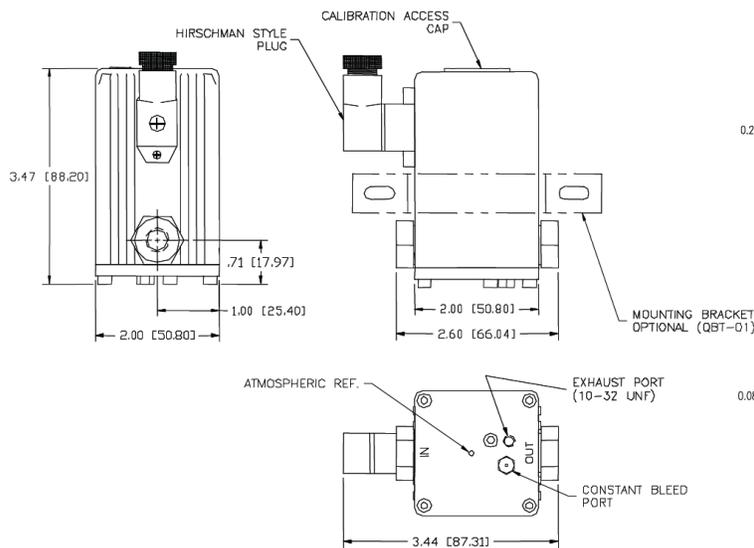


Port Locations on 'M' Units Above 100 psi

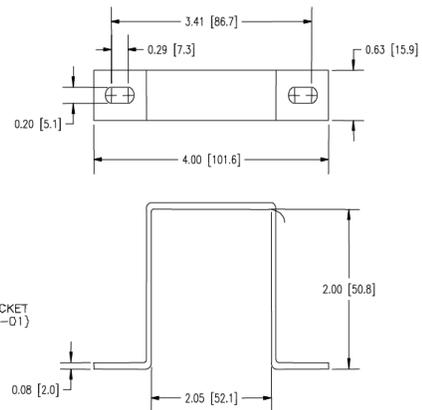


Dimensions for all 'M' Units

## 'T' STYLE UNIT DIMENSIONS



## MOUNTING BRACKET DIMENSIONS



**WARNING:** Installation and use of this product should be under the supervision and control of properly qualified personnel in order to avoid the risk of injury or death.

# QPV Part Configuration

EXAMPLE PART NUMBER	QPV	2	M	B	N	E	E	Z	0	P	150	PS	G	A	X	L	DD
Your Part Number:	QPV		M														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

## 1 TYPE

- 1 Single Loop
- 2 External Loop

## 2 MANIFOLD CONFIGURATION

- T External Hex Fittings (obsolete)
- M Integrated Manifold

## 3 MANIFOLD MATERIAL

- B Brass ('T' Hex Fitting Style) (obsolete)
- A Aluminum ('M' Manifold Style)

## 4 THREAD TYPE

- N NPT
- P BSPP (ISO G Thread)

## 5 INPUT SIGNAL RANGE

- E 0 to 10 Vdc (Single Ended)
- I 4 to 20 mA DC (current, differential)
- K 0 to 5 Vdc
- V 1 to 5 Vdc
- A RS 232 Serial Input\*
- B RS 485 Serial Input\*
- N Ethernet (Mod-bus TCP)

\*Requires X for MONITOR SIGNAL RANGE

## 6 MONITOR SIGNAL RANGE

- X No Analog Monitor
- E 0 to 10 Vdc
- K 0 to 5 Vdc\*
- V 1 to 5 Vdc#
- C 4 to 20 mA DC (current, sinking)
- S 4 to 20 mA DC (current, sourcing)

\*Requires E, I, or K for INPUT SIGNAL RANGE

# Requires V for INPUT SIGNAL RANGE

## 7 ZERO OFFSET

- N 0% Pressure Starts Below Atmosphere
- P 0% Pressure Starts Above Atmosphere
- Z 0% Pressure Starts at Zero (Typical)

## 8 ZERO OFFSET PRESSURE

Typical is blank\* - If greater than 30% of full scale Pressure (#9 below) please consult factory

\*If Z for ZERO OFFSET (#6), please leave blank

## 9 FULL SCALE PRESSURE TYPE

- N 100% Pressure Is Below Zero (Requires L option #14)
- P 100% Pressure is Above Zero
- Z 100% Pressure is Zero (Typical)

## 10 FULL SCALE PRESSURE

Must be less than or equal to 150 psig

## 11 PRESSURE UNIT

- PS PSI
- MB Millibars
- BR Bar
- KP Kilopascal
- MP Megapascal
- MH mm Hg
- IH Inches Hg
- IW Inches H<sub>2</sub>O
- MW mm H<sub>2</sub>O
- KG Kilograms/cm<sup>2</sup>
- TR Torr\*
- CW Centimeters H<sub>2</sub>O

\*Requires A for PRESSURE UNIT OF MEASURE

## 12 PRESSURE UNIT OF MEASURE

- A Absolute Pressure
- D Differential Pressure
- G Gage Pressure

13 INLET VALVE <sup>1</sup>	14 EXHAUST VALVE <sup>1</sup>
-----------------------------	-------------------------------

- |                  |                    |
|------------------|--------------------|
| A 0.013"         | A 0.013"           |
| B 0.025"         | B 0.025"           |
| C 0.040"         | C 0.040"           |
| D 0.060"         | D 0.060"           |
| E 0.089"         | E 0.089"           |
| N No Inlet Valve | N No Exhaust Valve |
| X 0.040" digital | X 0.040" digital   |

## 15 BLEED ORIFICE<sup>2</sup>

- N No Bleed Orifice
- L Include Bleed Orifice (0.0047 inch diameter typical)

## 16 DIGITAL DISPLAY

- No Digital Display
- DD Digital Display Included

<sup>1</sup> Inlet valves orifice size and the exhaust valve are factory determined based on the application's flow and pressure specs.

<sup>2</sup> Bleed orifice is required when the QPV is used in an application that is static (no flow). Dynamic applications (under flow) do not need a bleed orifice to function properly. Consult our Application Engineering Department for your specific application needs. We are here to help you.

# SAFETY PRECAUTIONS

Please read all of the following Safety Precautions before installing or operating any Equilibar, LLC. equipment or accessories. To confirm safety, be sure to observe 'ISO 4414: Pneumatic Fluid Power - General rules relating to systems' and other safety practices. Improper operation could result in serious injury to persons or loss of life!

## 1. OVERPRESSURIZATION

The QPV1 electronic pressure regulator is not a safety device and must not be relied upon to prevent dangerously high pressures. Where danger from overpressurization exists then an additional valve that is designed and marketed as a safety pressure relief valve must be used to protect the QPV1 against excess supply pressure and to protect the system should the QPV produce excess pressure on its outlet.

## 2. PRODUCT COMPATIBILITY

Equilibar products and accessories are for use in industrial pneumatic applications with compressed air or inert gas media. The compatibility of the equipment is the responsibility of the end user. Product performance and safety are the responsibility of the person who determined the compatibility of the system. Also, this person is responsible for continuously reviewing the suitability of the products specified for the system, referencing the latest catalog, installation manual, Safety Precautions and all materials related to the product.

## 3. EMERGENCY SHUTOFF

Equilibar products cannot be used as an emergency shutoff. A redundant safety system should be installed in the system to prevent serious injury or loss of life.

## 4. EXPLOSIVE ATMOSPHERES

The QPV Series should not be used where harmful, corrosive or explosive materials or gases are present. Unless specifically certified and labeled, Equilibar, Inc. products cannot be used with flammable gases or in hazardous environments.

## 5. COMPRESSED GAS QUALITY

Clean, dry air is not required for Equilibar, Inc. products. However, a 40 micron particulate filter is recommended to prevent solid contamination from entering the product. Only neutral gasses should be used.

## 6. TEMPERATURE

Products should be used with a media and ambient environment inside of the specified temperature range of 32°F to 158°F. Consult factory for expanded temperature ranges.

## 7. OPERATION

Only trained and certified personnel should operate electronic and pneumatic machinery and equipment. Electronics and pneumatics are very dangerous when handled incorrectly. All industry standard safety guidelines should be observed.

## 8. SERVICE AND MAINTENANCE

Service and maintenance of machinery and equipment should only be handled by trained and experienced operators. Inspection should only be performed after safety has been confirmed. Ensure all supply pressure has been exhausted and residual energy (compressed gas, springs, gravity, etc.) has been released in the entire system prior to removing equipment for service or maintenance. Be sure to employ lock out / tag out procedures.



**WARNING** Improper operation could result in serious injury to persons or damages to equipment

## 1. PNEUMATIC CONNECTION

All pipes, pneumatic hose and tubing should be free of all contamination, debris and chips prior to installation. Flush pipes with compressed air to remove any loose particles.

## 2. THREAD SEALANT

To prevent product contamination, thread tape is not recommended. Instead, a non-migrating thread sealant is recommended for installation. Apply sealant two threads from the end of the pipe thread to prevent contamination.

## 3. ELECTRICAL CONNECTION

To prevent electronic damage, all electrical specifications should be reviewed, and all electrical connections should be verified prior to operation.

## WARRANTY

Equilibar products are warranted to the original purchaser only against defects in material or workmanship for one (1) year from the date of manufacture. The extent of Equilibar's liability under this warranty is limited to repair or replacement of the defective unit at Equilibar's option. Equilibar shall have no liability under this warranty where improper installation or filtration occurred. All specifications are subject to change without notice.

**THIS WARRANTY IS GIVEN IN LIEU OF, AND BUYER HEREBY EXPRESSLY WAIVES, WARRANTIES OR LIABILITIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY OBLIGATION OF EQUILIBAR WITH REGARD TO CONSEQUENTIAL DAMAGES, WARRANTIES OF MERCHANTABILITY, DESCRIPTION, AND FITNESS FOR A PARTICULAR PURPOSE.**

# QPV1 Electronic Pressure Regulator

## INSTALLATION ADDENDUM - INSTRUCTIONS FOR ABSOLUTE PRESSURE MODEL

If you ordered a model with absolute pressure units of measure, it will arrive with brass fittings and tubing installed as seen below. Keep those installed as-is and follow the instructions below.

### INSTALLING ABSOLUTE PRESSURE UNITS

1. Apply a small amount of the provided anaerobic sealant to the male threads of the FPP1 in-line filter shipped with the QPV unit. **NOTE:** Use only the thread sealant provided. Other sealants such as PTFE tape and pipe dope can migrate into the internal solenoid valves causing blockages and failures.
2. Thread the FPP1 in-line filter into the Inlet Port labeled **IN** (on 'T' style) or **I** (on 'M' style) QPV1 valve.
3. In typical applications leave Inlet Port open to atmosphere. This allows the QPV to add atmospheric air to the system when excess vacuum is present. If the calibrated control range is above atmospheric pressure, then a positive supply pressure that exceeds the desired control pressure must be applied to the FPP1 on the Inlet Port.
4. Connect the process where absolute pressure is to be controlled to the Outlet Port labeled **OUT** (on 'T' style) or **O** (on 'M' style) QPV1 valve.
5. Connect vacuum supply to the brass "Tee" in the QPV Exhaust Port. (See Figure 1)
6. Absolute pressure units generally operate where 0% command provides absolute zero pressure.
7. Proceed with electrical connections discussed on page 3 of the QPV1 Installation & Maintenance Instructions.

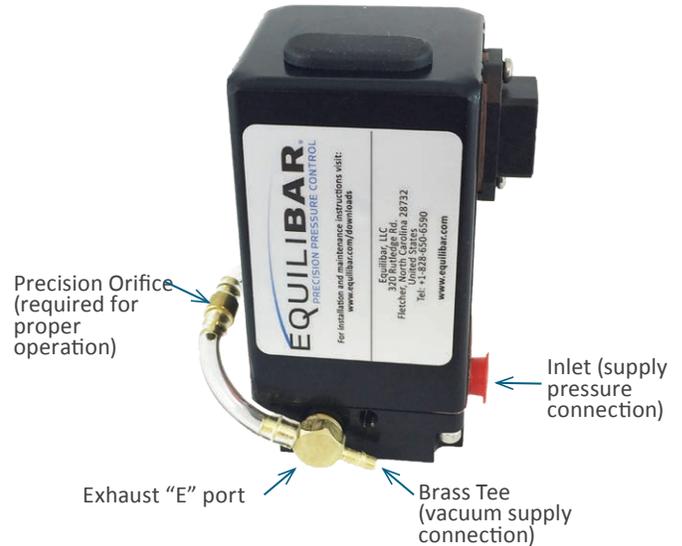


Figure 1 "M" Style QPV with absolute pressure installation configuration - side view



Figure 2 "M" Style QPV with absolute pressure installation configuration - back view

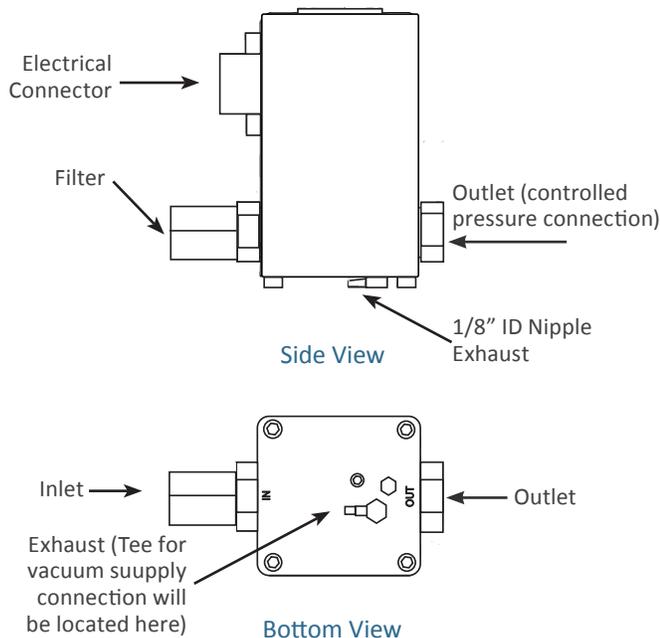


Figure 4: 'T' Style Installation

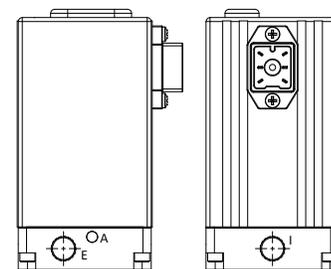


Figure 3 Port locations on 'M' Style Vacuum Unit  
I = Inlet, A = atmospheric reference, and E = Exhaust