Flow Control Installation Guide
FQPV, FQB3 & FQB2

**FQPV2 & F-Series**

- **MIN Flow Range**
  2 to 20 SCFH (0.94 to 9.4 LPM)

- **MAX Flow Range**
  0.1 to 1 SCFM (2.83 to 28.3 LPM)

- Functional Description | Page 2
- Electrical Connections | Page 4
- Dimensions & Part Numbering | Page 8

**FQB3 & F-Series**

- **MIN Flow Range**
  1 to 10 SCFM (28.3 to 283 LPM)

- **MAX Flow Range**
  2.5 to 25 SCFM (70.8 to 708 LPM)

- Functional Description | Page 2
- Electrical Connections | Page 4
- Dimensions & Part Numbering | Page 9

**FQB2, PSR & F-Series**

- **MIN Flow Range**
  3 to 30 SCFM (85 to 850 LPM)

- **MAX Flow Range**
  25 to 250 SCFM (708 to 7,080 LPM)

- Functional Description | Page 2
- Electrical Connections | Page 4
- Dimensions & Part Numbering | Page 10

**Questions?**
317-335-2602
info@proportionair.com

Electro-Pneumatic Pressure Regulators & Flow Controllers
Functional Descriptions

FQPV2
The FQPV2 is a compressed gas flow control assembly. The assembly consists of an FQPV2-Series proportional control valve and an F-Series high speed flow monitor. The FQPV2 control valve consists of one normally closed solenoid valve, one true proportional valve, a control circuit board and a protective canister. The FQPV2 operates by comparing the user’s electronic command input signal to the signal being returned to the FQPV2 from the F-Series flow monitor. The on-board control circuit examines any differences between these signals and actuates the solenoid valves in response. Opening one solenoid valve removes compressed gas while opening the other solenoid valve adds compressed gas from the supply. The FQPV2 continuously monitors the user command and F-Series feedback signals to keep the assemblies flow rate at the desired point.

FQB3
The FQB3 is a compressed gas flow control assembly. The assembly consists of an FQB3-Series proportional control valve and an F-Series high speed flow monitor. The FQB3 control valve consists of two normally closed solenoid valves, an integrated volume booster, a control circuit board and a protective canister. The FQB3 operates by comparing the user’s electronic command input signal to the signal being returned to the FQB3 from the F-Series flow monitor. The on-board control circuit examines any differences between these signals and actuates the solenoid valves in response. Opening one solenoid valve removes compressed gas while opening the other solenoid valve adds compressed gas from the supply. The FQB3 continuously monitors the user command and F-Series feedback signals to keep the assemblies flow rate at the desired point.

FQB2/PSR
The FQB2 is a compressed gas flow control assembly. The assembly consists of an FQB2-Series proportional control valve, a PSR volume booster and an F-Series high speed flow monitor. The FQB2 control valve consists of two normally closed solenoid valves, a control circuit board and a protective canister. The FQB2 operates by comparing the user’s electronic command input signal to the signal being returned to the FQB2 from the F-Series flow monitor. The on-board control circuit examines any differences between these signals and actuates the solenoid valves in response. Opening one solenoid valve removes compressed gas from the dome of the PSR (which causes the PSR to exhaust downstream gas) while opening the other solenoid valve adds compressed gas to the dome of the PSR from the supply. The volume of compressed gas on the dome of the PSR regulator sets the output flow rate. The FQB2 continuously monitors the user command and F-Series feedback signals to keep the assemblies flow rate at the desired point.

F-Series Flow Monitor
The F-Series flow monitor is used in conjunction with all flow control assemblies. The F-Series is a transducer that measures compressed gas flow rates. This measurement is made with a differential pressure transducer. P1 measures the input pressure of a Venturi and P2 measures the pressure in the throat of the Venturi. The difference in these two measurements is used to calculate the actual flow through the F-Series. Utilizing an all analog circuit results in an extremely fast flow detection of less than 10ms, in most instances. This high speed functionality also allows the F-Series products to be used in conjunction with Proportion-Air’s proportional regulators for compressed gas flow control. To ensure high speeds, the F-Series products use analog electronics internally for signal amplification and calibration. All F-Series products are mass flow (implied) measurements.

THE F-SERIES IS AVAILABLE IN THREE DIFFERENT MODELS:

1. **Pressure Regulated (FRxxx):** This model requires a known and fixed regulated supply pressure to maintain its calibration. By regulating the input pressure, the incoming density of the gas is known and the FR model output is calibrated for that density.
2. **Pressure Compensated (FPxxx):** This model has a 2nd transducer that measures the absolute pressure of the incoming gas. This allows the unit to compensate for changes in gas density due to changes in pressure. The FP model can compensate from 50 to 100% of the maximum calibrated absolute supply pressure, as called out in the part number.
3. **Atmospheric (FAxxx):** This model must have its output port open to atmosphere in order to work properly. It is calibrated for the density of gas at atmosphere. The FA model is most commonly used to meter out gas in cylinder speed control applications.
Please read these warnings

- Examine the product. Please ensure that you received what you ordered.
- Read this guide first, before you start and save it for later use.
- All compressed air and power should be shut off before installing, removing or performing maintenance on this product.
- 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.
- Media vents through the exhaust port. The exhaust port should be vented into a safe area.
- Please read the additional warnings, disclaimers and warranty material on page 8.

## Typical Applications

**Electrical**

<table>
<thead>
<tr>
<th>Power Requirement</th>
<th>17–24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Current</td>
<td>450 mA (MAX)</td>
</tr>
</tbody>
</table>

**Mechanical**

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>± 4% F.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability</td>
<td>± 0.25% F.S.</td>
</tr>
<tr>
<td>Response Time</td>
<td>&lt; 10 ms</td>
</tr>
<tr>
<td>Shock Rating</td>
<td>20 G Forces</td>
</tr>
<tr>
<td>Turndown Ratio</td>
<td>10:1 20:1 available in some applications</td>
</tr>
</tbody>
</table>

**Physical**

<table>
<thead>
<tr>
<th>Media Temperature</th>
<th>32°F (0°C) to 122°F (50°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>32°F (0°C) to 158°F (70°C)</td>
</tr>
<tr>
<td>Temperature Sensitivity</td>
<td>0.25% / °C</td>
</tr>
<tr>
<td>Housing Rating</td>
<td>IP65</td>
</tr>
</tbody>
</table>
1. Turn off all power to valve.
2. Identify the valve's command input (Input Signal Range) and analog output (Output Signal Range) using the calibration card included in the package and the part number schematic in this document.
3. Proceed to the appropriate section corresponding to the type of valve being installed.

### COMMAND SIGNAL CONFIGURATIONS

#### Voltage Commanded (E, K, V)

All VDC command controllers use common mode 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 command and power supply common.

- **FQPV2**: ✔️
- **FQB3**: ❌
- **FQB2**: ✔️

#### Voltage (Differential) Commanded (E, K, V)

All VDC command FQB3s use a differential command loop where the command flow is from Pin-4 to Pin-2. If a single ended voltage will be used, tie the command return wire to the DC Common.

- **FQPV2**: ❌
- **FQB3**: ✔️
- **FQB2**: ❌

### MONITOR SIGNAL CONFIGURATIONS

#### Voltage Monitor (E, K, V)

Voltage monitor out signal is applicable to all voltage output signal ranges including: 0-10 VDC, 0-5 VDC and 1-5 VDC.

- **FQPV2**: ✔️
- **FQB3**: ✔️
- **FQB2**: ✔️

#### Current (Sinking) Monitor (C)

The 4-20 mA Sinking monitor requires external power (most likely from your controller) for the monitor out signal to be obtained.

- **FQPV2**: ✔️
- **FQB3**: ✔️
- **FQB2**: ✔️

#### Current Commanded (I)

All current command controllers use a differential current loop scheme (not isolated), meaning current flow is from Pin-4 to Pin-2.

- **FQPV2**: ✔️
- **FQB3**: ✔️
- **FQB2**: ✔️

#### Current (Sourcing) Monitor (S)

The 4-20 mA Sourcing monitor requires an external ground reference for the monitor out signal to be obtained.

- **FQPV2**: ✔️
- **FQB3**: ✔️
- **FQB2**: ✔️
Pneumatic Connections

**FQPV2**

![Diagram of FQPV2](image)

**FQB3**

![Diagram of FQB3](image)

**FQB2/PSR**

![Diagram of FQB2/PSR](image)
F-Series - Dimensions & Part Numbering

<table>
<thead>
<tr>
<th>ACURACY</th>
<th>MAX INLET</th>
<th>FLOW RANGES</th>
<th>PORT SIZE</th>
<th>1/2&quot; to 1.5&quot;</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Example Part Number</th>
<th>F</th>
<th>P</th>
<th>N</th>
<th>A</th>
<th>E</th>
<th>N</th>
<th>75</th>
<th>A</th>
<th>90</th>
<th>P</th>
<th>S</th>
<th>A</th>
<th>A</th>
<th>DD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Type**
   - A: Atmospheric Pressure
   - P: Pressure Compensated
   - R: Regulated Pressure

2. **Port Size**
   - 1/4" (shown with optional Digital Display)
   - 3/8" (shown with optional Digital Display)

3. **Thread Type**
   - N: NPT
   - P: BSPP

4. **Manifold Material**
   - A: Aluminum (Anodized Black)
   - B: Brass (port size 2 & 3 only)

5. **Output Signal Range**
   - E: 1 to 10 VDC
   - K: 0 to 5 VDC
   - C: 5.6 to 20 mA DC (sinking)
   - S: 5.6 to 20 mA DC (sourcing)

6. **Media (no additional cost – all)**
   - A: Air
   - R: Argon (Ar)
   - L: Nitrous Oxide (N20)
   - N: Nitrogen (N2)
   - C: Carbon Dioxide (CO2)
   - H: Helium (He)
   - O: Oxygen (O2)

7. **Max Flow**
   - Max Flow Based on 10:1 Turndown, Min. 2 SCFH, Max. 26 - 256 SCFM

8. **Unit of Measure**
   - A: SCFM
   - B: SCFH
   - C: SLPM
   - D: SPLH
   - E: SCMH

9. **Max Pressure**
   - Must be less than or equal to 150 psig

10. **Pressure Unit**
    - PS: PSI
    - MP: MPa
    - K: kPa
    - KG: kg/cm²

11. **Pressure Unit of Measure**
    - A: Absolute Pressure (Pressure Compensated Models Only)
    - G: Gauge Pressure (Atmospheric & Regulated Models Only)

12. **Electrical Connection**
    - A: 3-Wire with 3-pin Female*
    - C: 1/8" NPT Female
    - D: 3-pin Male Connector
    - E: 6-pin Hirohmann Connector
    - G: 6' Shielded Cord with 3-pin Female
    - H: 4-pin Hirohmann Connector

*Please consult factory for application assistance

*Shown with optional Digital Display

*A shorter cable will be used when F-Series used in flow control assembly
The differential pressure technology incorporated in Proportion-Air’s F-Series flow transducer is ideally suited for rugged commercial and industrial applications. The benefits of the real-time measurement make the F-Series a must in many rapid sequence applications. For example, in the chart below, the response time to achieve the commanded flow rate of the 0.1% accurate thermal mass flow meter isn’t even close. The F-Series provides a 96% accurate signal for more than four seconds before the thermal mass achieves the flow.

The response time and ‘time to flow’ of the F-Series flow transducer is very fast when compared to Thermal Mass Flow technology. This makes the accuracy of the F-Series extremely good in fast paced applications. The F-Series is also very rugged and designed for demanding industrial environments with an IP65 housing and shock rating of 20G.

The F-Series employs a large internal venturi that allows it to digest contaminants and moisture. It is also insensitive to mounting position and vibration.

This graph illustrates the effect of varying supply pressures on the flow output signal of an FR Model Flow Transducer. This graph can be used to correct for variations in gas density due to the temperature and/or specific gravity of different gases by purposely altering the supply pressure with a Proportion-Air pressure control valve.

Regulating the inlet pressure to a constant value by fixing it to a specific pressure produces a linearly proportional signal.

This graph illustrates how effectively the FP Model Flow Transducer automatically corrects the flow output signal when the supply pressure varies over a wide range.

Compare this to the results of a traditional non-pressure compensated flow transducer as shown in the ‘Non-Pressure Compensated’ graph above. With the Pressure Compensated model, the max inlet pressure can drop by as much as 50% and the F-Series Flow Transducer will compensate and provide accurate flow measurements.
### FQPV2 - Dimensions & Part Numbering

<table>
<thead>
<tr>
<th>FQPV2</th>
<th>ACCURACY</th>
<th>POINT SIZE</th>
<th>PRESSURE</th>
<th>FLOW CONTROL REGULATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>±1 to 4% F.S.</td>
<td>1/8&quot;</td>
<td>Up to 150 psig (10 Bar)</td>
<td></td>
</tr>
</tbody>
</table>

**Section Reference**

1. **Type**
   - T: 14.7 to 150 psig

2. **Manifold Material**
   - A: Aluminum
   - B: Brass

3. **Thread Type**
   - N: NPT
   - P: BSPP

4. **Input Signal Range**
   - E: 1 to 10 VDC
   - I: 5.6 to 20 mA DC
   - K: 0.5 to 5 VDC
   - A: RS232 Serial Input*
   - B: RS485 Serial Input*
   - P: P2 Profiler (requires X)

5. **Output Signal Range**
   - X: No Monitor
   - E: 1 to 10 VDC
   - K: 0.5 to 5 VDC*
   - C: 5.6 to 20 mA DC (Sink/Sour)
   - S: 5.6 to 20 mA DC (Source)

   *Requires E, J, K for Input Signal Range

   **Requires X for Input Signal Range

6. **Full Scale Pressure**
   - Must be less than or equal to 150 psig

7. **Pressure Unit (no additional fee - all)**
   - PS: PSI
   - KP: Kilo-pascal
   - MP: Mega-pascal
   - BR: Bar
   - KG: Kilograms/cm²

8. **Pressure Unit of Measure**
   - G: Gauge Pressure

9. **Inlet Valve**
   - A: 0.013"
   - B: 0.025"
   - C: 0.040"
   - D: 0.060"
   - E: 0.089"

10. **Outlet Valve**
    - N: No Exhaust Valve
    - X: 0.340” (Typical)

---

**Additional Documents** *(Click to Download)*

- RS232 & RS485 Serial Input
  - ProportionAir.com/literature/installation-guides/RS232-RS485-Installation.pdf

- P2 Profiler
  - ProportionAir.com/literature/installation-guides/P2-Profiler-Manual.pdf
# FQB3 - Dimensions & Part Numbering

<table>
<thead>
<tr>
<th>Flow Control Installation - 2017.v2</th>
</tr>
</thead>
</table>

## FQB3 Example Part Number

<table>
<thead>
<tr>
<th>PORT SIZE</th>
<th>FLOW CONTROL REGULATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FQB3</th>
<th>T</th>
<th>A</th>
<th>N</th>
<th>E</th>
<th>E90</th>
<th>PS</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

### Section Reference

1. **Type**
   - T: ±0.7 to 150 psig

2. **Manifold Material**
   - A: Nickel-Plated Aluminium
   - B: Nickel-Plated Brass (Includes O2 Cleaning)

3. **Thread Type**
   - N: NPT
   - P: BSP

4. **Input Signal Range**
   - E: 1 to 10 VDC
   - I: 0.5 to 20 mA DC
   - K: 0.5 to 5 VDC
   - A: RS232 Serial Input*
   - B: RS485 Serial Input*
   - P: P2 Profiler (Recommended)

5. **Output Signal Range**
   - X: No Monitor
   - E: 1 to 10 VDC
   - K: 0.5 to 5 VDC
   - C: 5.8 to 20 mA DC (Sinking)
   - S: 5.8 to 20 mA DC (Sourcing)

   *Requires X, E, or K for Input Signal Range (4)
   **Requires V for Input Signal Range (4)

6. **Full Scale Pressure**
   - Must be less than or equal to 150 psig

7a. **Pressure Unit (no additional fee - all)**
   - PS: PSI
   - KPa: Kilo-pascal
   - MPa: Mega pascal

8. **Pressure Unit of Measure**
   - G: Gauge Pressure

---

### Additional Documents (Click to Download)

- **RS232 & RS485 Serial Input**

- **P2 Profiler**
  ProportionAir.com/literature/installation-guides/P2-Profiler-Manual.pdf

---
**FQB2 - Dimensions & Part Numbering**

<table>
<thead>
<tr>
<th>Type</th>
<th>Manifold Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>A: Anodized Aluminum</td>
</tr>
<tr>
<td></td>
<td>B: Brass*</td>
</tr>
</tbody>
</table>

*Includes O2 Greasing

**Additional Documents (Click to Download)**

- **Ethernet/Proportion-Air Protocol**
  - ProportionAir.com/literature/installation-guides/PAir_Ethernet-Protocol_TCP-IP.pdf

- **Ethernet/MODBUS TCP**
  - ProportionAir.com/literature/installation-guides/Modbus-TcpManual.pdf

- **RS232 & RS485 Serial Input**
  - ProportionAir.com/literature/installation-guides/RS232-RS485-Installation.pdf

- **P2 Profiler**
  - ProportionAir.com/literature/installation-guides/P2-Profiler-Manual.pdf
WARNING
Improper operation could result in serious injury to persons or loss of life!

1. PRODUCT COMPATIBILITY
Proportion-Air, Inc. products and accessories are for use in industrial pneumatic applications with compressed air 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.

2. EMERGENCY SHUTOFF
Proportion, Inc. 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.

3. EXPLOSIVE ATMOSPHERES
Products and equipment should not be used where harmful, corrosive or explosive materials or gases are present. Unless certified, Proportion-Air, Inc. products cannot be used with flammable gases or in hazardous environments.

4. AIR QUALITY
Clean, dry air is not required for Proportion-Air, Inc. products. However, a 40 micron particulate filter is recommended to prevent solid contamination from entering the product.

5. 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.

6. 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.

7. 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.

CAUTION
Improper operation could result in serious injury to persons or damage 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 a couple 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.

Exemption from Liability
1. Proportion-Air, Inc. is exempted from any damages resulting from any operations not contained within the catalogs and/or instruction manuals and operations outside the range of its product specifications.

2. Proportion-Air, Inc. is exempted from any damage or loss whatsoever caused by malfunctions of its products when combined with other devices or software.

3. Proportion-Air, Inc. and its employees shall be exempted from any damage or loss resulting from earthquakes, fire, third person actions, intentional or unintentional operator error, product misapplication or irregular operating conditions.

4. Proportion-Air, Inc. and its employees shall be exempted from any damage or loss, either direct or indirect, including consequential damage or loss, claims, proceedings, demands, costs, expenses, judgments, awards, loss of profits or loss of chance and any other liability whatsoever including legal expenses and costs, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.

Warranty
Proportion-Air, Inc. 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 Proportion-Air’s liability under this warranty is limited to repair or replacement of the defective unit at Proportion-Air’s option. Proportion-Air shall have no liability under this warranty where improper installation or filtration occurred.
Proportion-Air products are warranted to the original purchaser only against defects in material or workmanship for (1) year from the date of manufacture. The extent of Proportion-Air’s liability under this warranty is limited to repair or replacement of the defective unit at Proportion-Air’s option. Proportion-Air shall have no liability under this warranty where improper installation or filtration occurred.

THE WARRANTY IS GIVEN IN-LIEU OF, AND BUYER HERBY EXPRESSLY WAIVES, WARRANTIES OR LIABILITIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY OBLIGATION OF PROPORTION-AIR WITH REGARD TO CONSEQUENTIAL DAMAGES, WARRANTIES OF MERCHANTABILITY, DESCRIPTION AND FITNESS FOR A PARTICULAR PURPOSE.

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 death or injury.