

### Flow Control: FQPV, FQB3 & FQB2

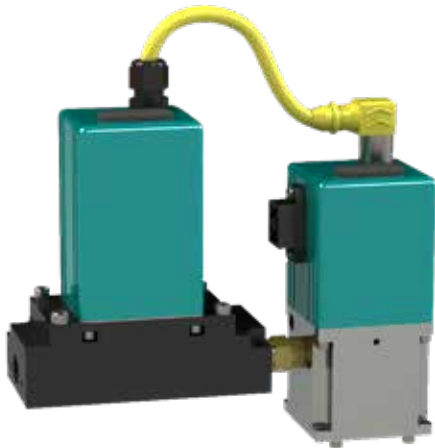


#### FQPV2 & F-Series

**MIN Flow Range**  
4 to 40 SCFH (1.89 to 18.9 LPM)

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

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#### 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)

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#### 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)

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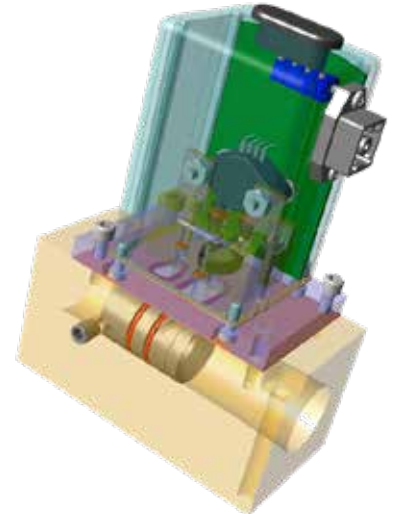
# Functional Descriptions

## 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. **Using 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.



## FQPV2

The FQPV2 is a compressed gas flow device. 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. 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 device. 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. 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 device. 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 may cause 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 PSR main valve position to control the flow rate. The FQB2 continuously monitors the user command and F-Series feedback signals to keep the assemblies flow rate at the desired point.

# General Specifications & Warnings

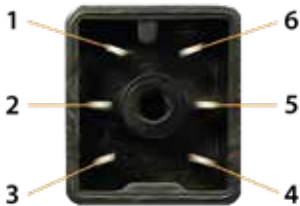
## **Before you start, please read these warnings:**

- Examine the product. Ensure that you received what you ordered.
- Read this guide before you start and save it for later.
- You must have a good understanding of what the adjustments are on this product before using them.
- 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 to avoid the risk of injury or death.
- Please read the additional warnings, disclaimers and warranty material in this document.

### **ELECTRICAL**

**POWER REQUIREMENT**  
17-24 VDC

**SUPPLY CURRENT**  
450 mA (MAX)



**6-PIN HIRSCHMANN** (pin numbers)

### **MECHANICAL**

**ACCURACY**  
 $\pm 4\%$  F.S.

**REPEATABILITY**  
 $\pm 0.25\%$  F.S.

**RESPONSE TIME**  
< 10 MS

**SHOCK RATING**  
20 G Forces

**TURNDOWN RATIO**  
10:1  
*20:1 available in some applications*

### **PHYSICAL**

**MEDIA TEMPERATURE**  
32°F (0°C) to 122°F (50°C)

**AMBIENT TEMPERATURE**  
32°F (0°C) to 158°F (70°C)

**TEMPERATURE SENSITIVITY**  
0.25% / °C

## Typical Applications

Air Cooling Molds  
Atomizing Spray Control  
Cylinder Speed Control  
Die Cast Temperature Control  
Glass Agitator  
Painting, Spraying & Coating  
Pig Velocity Control  
Radiator Leak Monitoring

Shot Air Volume Sensing  
Air Motor Control  
Compressor Testing  
Retort Oven  
Sparging  
Thermoforming  
Temperature Control  
Low Pressure Casting

# Electrical Connections

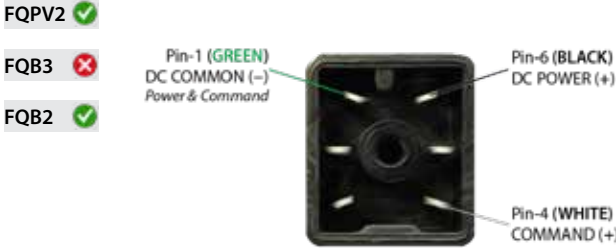
1. Turn off all power to valve.
2. Identify the valve's command input (*Input Signal Range*) and analog output (*Output Signal Range*) using the calibration card included in the package and the part number schematic in this document.
3. Proceed to the appropriate section corresponding to the type of valve being installed

**NOTE: ALL COLOR CODES RELATE TO THE FACTORY WIRED QBT POWER CORD**

## COMMAND SIGNAL CONFIGURATIONS

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

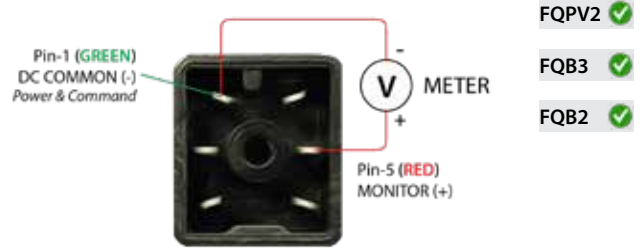
All VDC command controllers use common mode voltage, meaning the DC Common pin (*pin-1*) is the common reference for both power and command. Pin-1 is used as both the command signal command and power supply common.



## MONITOR SIGNAL CONFIGURATIONS

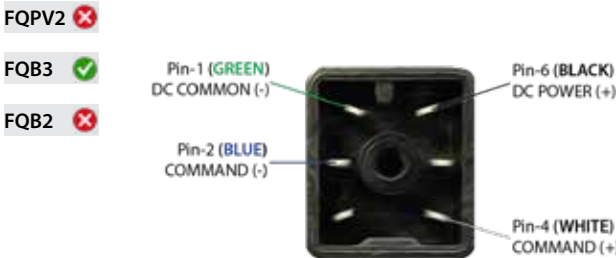
### Voltage Monitor (E, K, V)

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



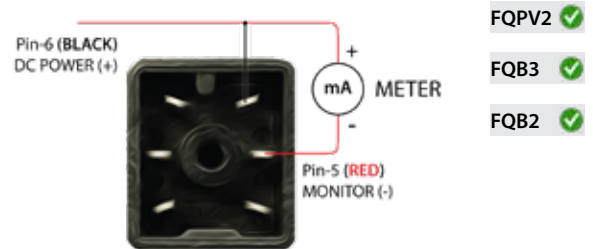
## Voltage (Differential) Commanded (E, K, V)

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.



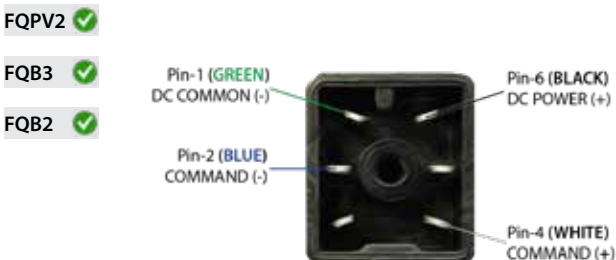
## Current (Sinking) Monitor (C)

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



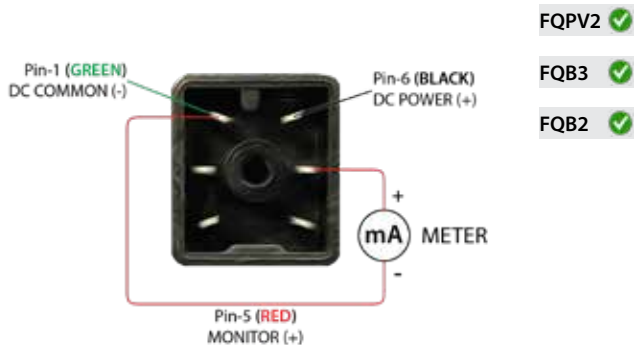
## Current Commanded (I)

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



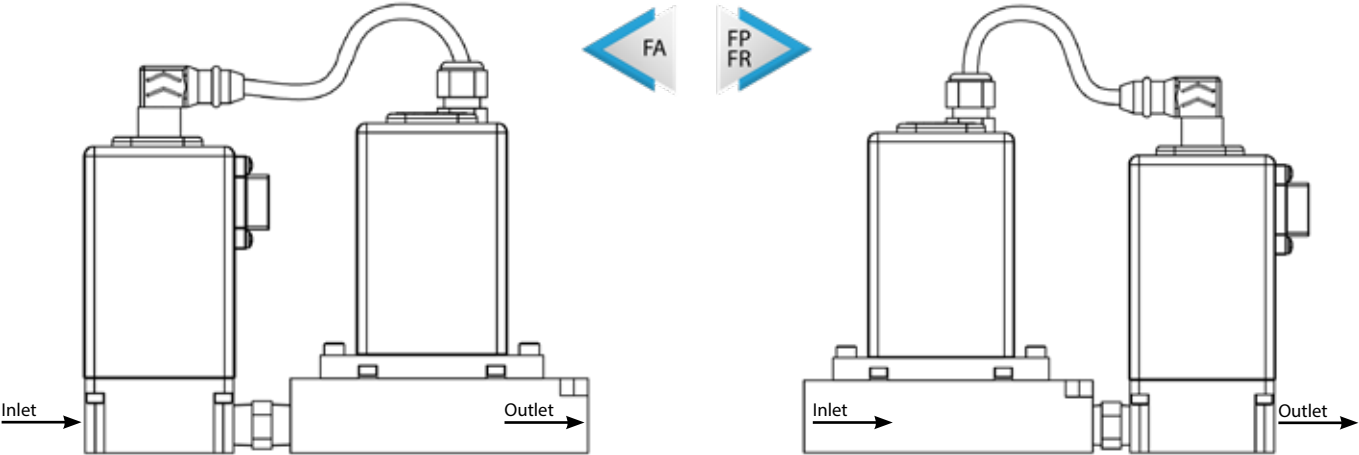
## Current (Sourcing) Monitor (S)

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

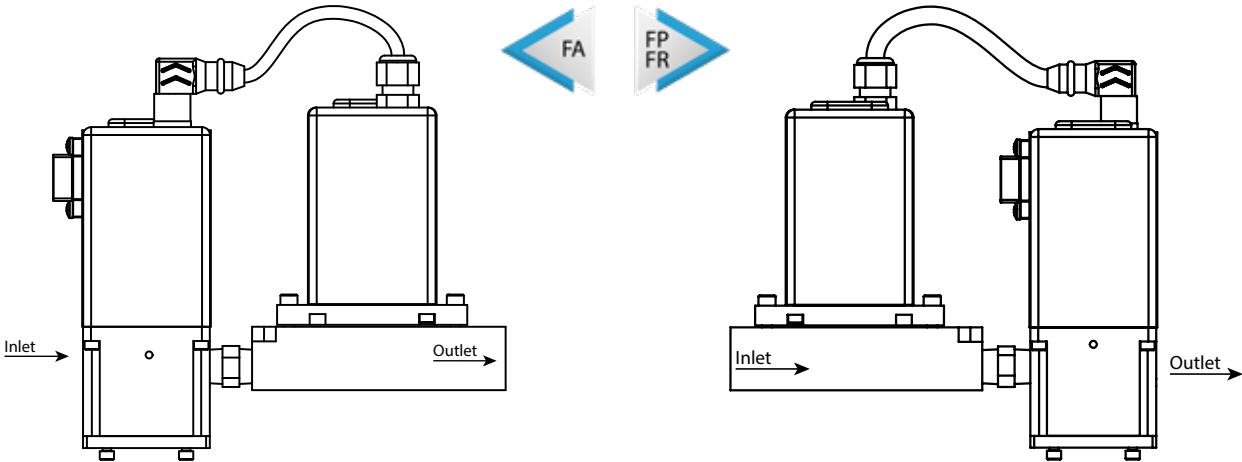


# Pneumatic Connections

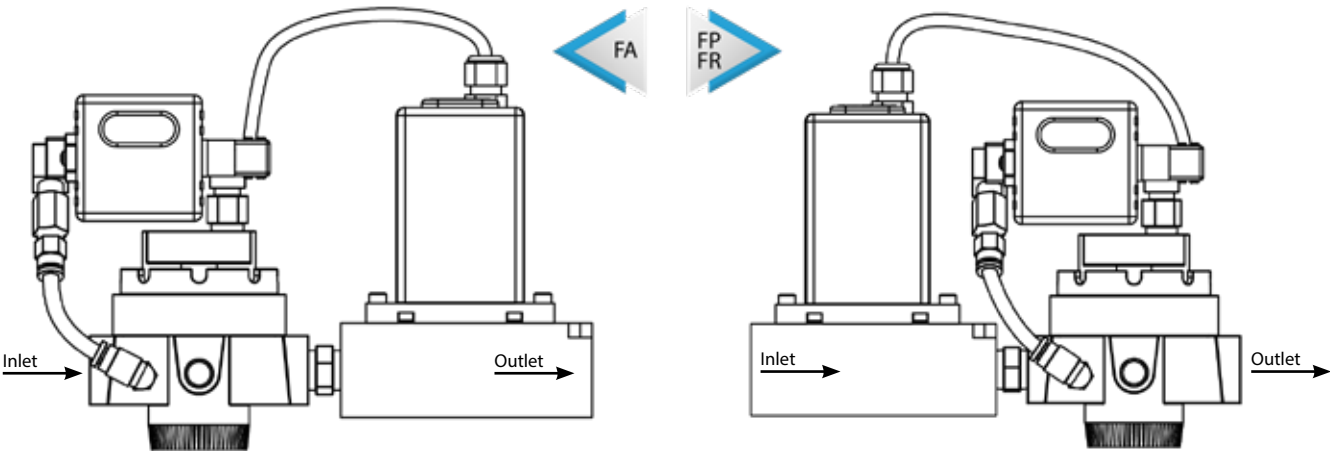
## FQPV2



## FQB3



## FQB2/PSR



# F-Series - Dimensions & Part Numbering

## F-Series

Example Part Number

F	P	4	N	A	E	N	75	A	90	PS	A	A	DD
1	2	3	4	5	6	7	8	9	10	11	12	OPTIONS	

ACCURACY	±4% F.S.	MAX INLET	150 PSIG (10 Bar)
PORT SIZE	1/4 to 1.5"	FLOW RANGES	2-20 SCFH up to 25-250 SCFM

F-SERIES	"A"	"B"	"C"		"D"		
FR2/FP2/FA2	1/4" NPT	2.00"	50.80	4.00"	101.60	4.56"	115.90
FR3/FP3/FA3	3/8" NPT	2.00"	50.80	4.00"	101.60	5.06"	128.52
FR4/FP4/FA4	1/2" NPT	2.00"	50.80	4.00"	101.60	5.06"	128.52
FR6/FP6/FA6	3/4" NPT	2.00"	50.80	4.00"	101.60	5.56"	141.22
FR8/FP8/FA8	1" NPT	2.00"	50.80	4.00"	101.60	5.56"	141.22
FRA/FPA/FAA	1-1/4" NPT	2.50"	63.50	5.00"	127.00	6.06"	153.92
FRB/FPB/FAB	1-1/2" NPT	2.50"	63.50	5.00"	127.00	6.06"	153.92

### Section Reference

<b>1</b> Type	<b>2</b> Port Size
A Atmospheric Pressure	2 1/4"
P Pressure Compensated	3 3/8"
R Regulated Pressure	4 1/2"
<b>3</b> Thread Type	6 3/4"
N NPT	8 1"
P BSPP	A 1-1/4"
	B 1-1/2"

<b>4</b> Manifold Material
A Aluminum (Anodized Black)
B Brass (Port size 2 & 3 only)

<b>5</b> Output Signal Range
E 1 to 10 VDC
K 0.5 to 5 VDC
C 5.6 to 20 mADC (Sinking)
S 5.6 to 20 mADC (Sourcing)

<b>6</b> Media (no additional cost - all)		
A Air	Carbon Dioxide (CO2)	C
R Argon (Ar)	Helium (He)	H
L Nitrous Oxide* (N2O)	Oxygen* (O2)	O
N Nitrogen (N2)		

\* Please Consult Factory for Application Assistance

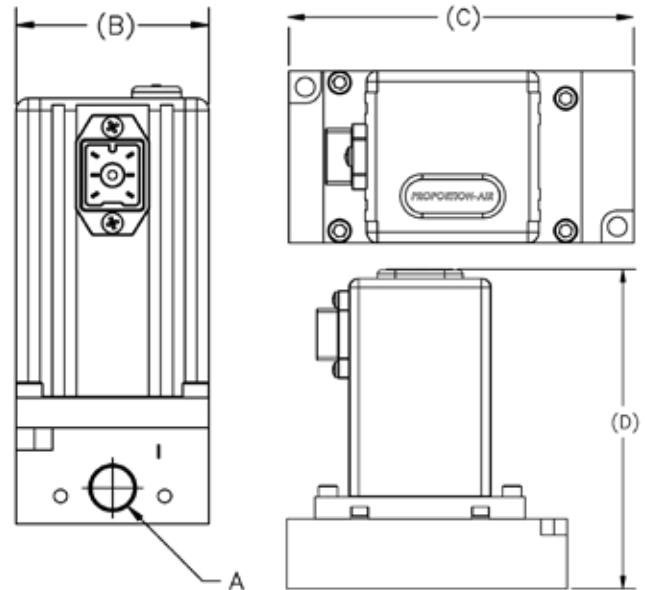
<b>7</b> Maximum Flow
Maximum Flow Based on 10:1 Turn-down. MIN: 2-20 SCFH, MAX: 25-250 SCFM

<b>8</b> Unit of Measure	<b>9</b> Maximum Pressure		
A SCFM	Must be less than or equal to 150 psig		
B SCFH			
C SLPM	<b>10</b> Pressure Unit		
D SLPH	PS PSI	MPa	MP
E SCMH	KP kPa	kg/cm <sup>2</sup>	KG
	BR Bar		

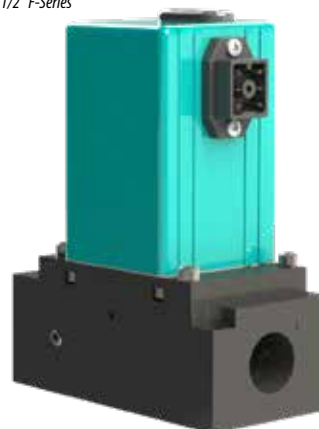
<b>11</b> Pressure Unit of Measure
A Absolute Pressure (Pressure Compensated Model Only)
G Gauge Pressure (Atmospheric & Regulated Models Only)

<b>12</b> Electrical Connection
A 3' Cord with 3-pin Female*
C 18" Flying Leads
D 3-pin Male Connector
E 6-pin Hirschmann Connector
G 6' Shielded Cord with 3-pin Female
H 4-pin Hirschmann Connector

\*A shorter cable will be used when F-Series used in flow control assembly



1/2" F-Series



3/8" F-Series



\*Shown with optional Digital Display



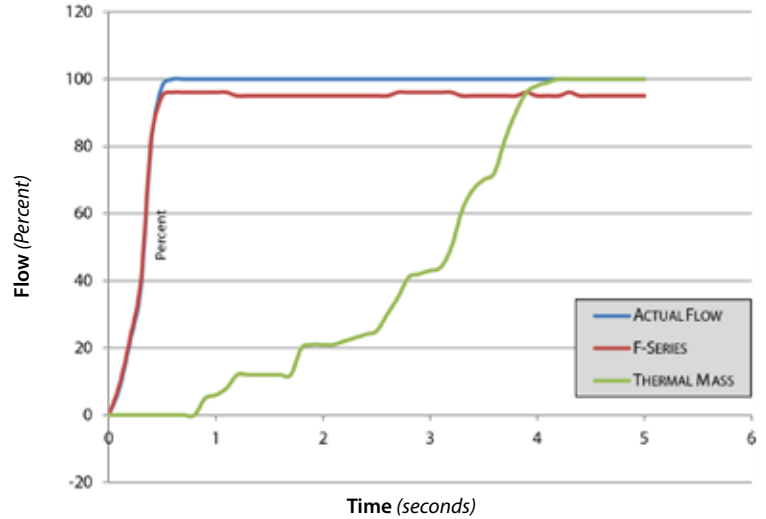
# F-Series - Performance Characteristics

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.

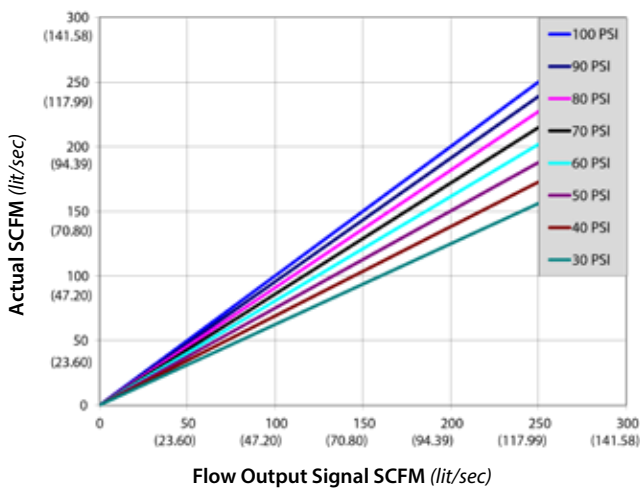
The response time and 'time to flow' of the F-Series flow transducer is very fast when compared to Thermal Mass Flow technology. This makes the accuracy of the F-Series extremely good in fast paced applications. The F-Series is also very rugged and designed for demanding industrial environments with 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.

**F-Series Flow Over Time**



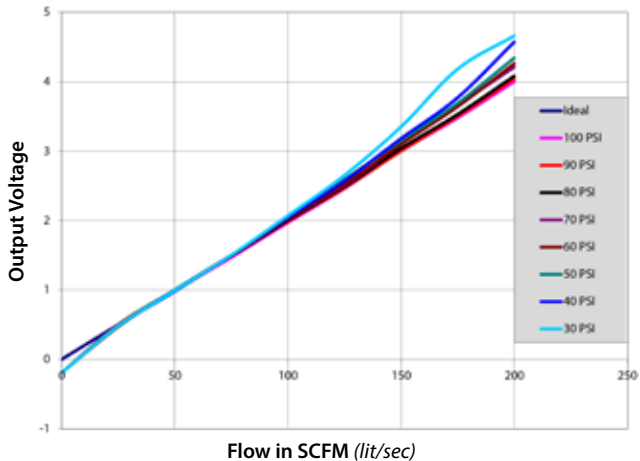
**Non-Pressure Compensated (FR)**



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.

**Pressure Compensated (FP)**



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

## FQPV2

Example Part Number

FQPV2	M	A	N	E	E	9	BR	G	A	X		
	1	2	3	4	5	6	7	8	9	10	OPTIONS	

Section Reference

<b>1</b> Type	<b>2</b> Manifold Material
M -14.7 to 150 psig	A Aluminum B Brass

<b>3</b> Thread Type
N NPT P BSPP

<b>4</b> Input Signal Range	<b>5</b> Output Signal Range
E 1 to 10 VDC I 5.6 to 20 mADC K 0.5 to 5 VDC A RS232 Serial Input* B RS485 Serial Input*	X No Monitor E 1 to 10 VDC K 0.5 to 5 VDC* C 5.6 to 20 mADC (Sinking) S 5.6 to 20 mADC (Sourcing)
*Requires X for Monitor Signal (#5)	*Requires E, I or K for Input Signal Range (#4) **Requires V for Input Signal Range (#4)

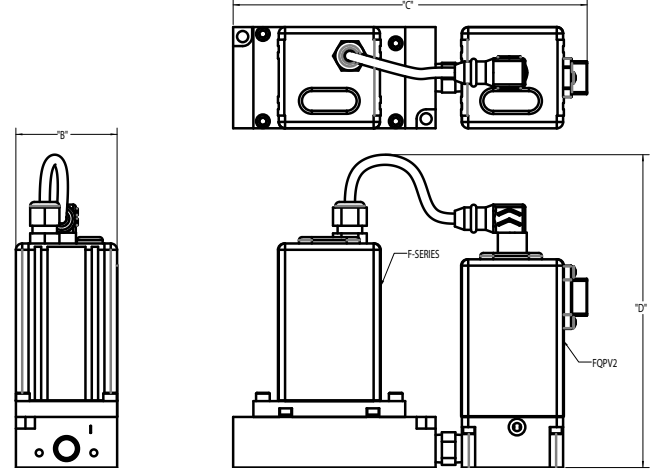
<b>6</b> Full Scale Pressure
Must be less than or equal to 150 psig

<b>7a</b> Pressure Unit (no additional fee - all)
PS PSI Bar BR KP Kilo-pascal Kilograms/cm <sup>2</sup> KG MP Mega-pascal

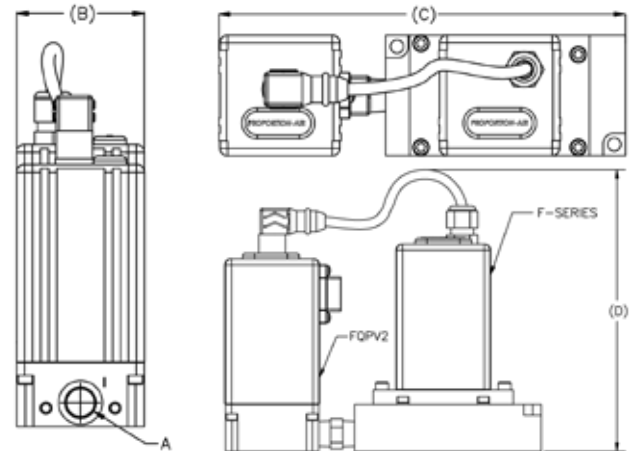
<b>8</b> Pressure Unit of Measure
G Gauge Pressure

<b>9</b> Inlet Valve
D 0.060"
E 0.089"

F-SERIES CONTROL VALVE	1"	2"	3"	4"	
FR2/FP2	QPV2	1/4" NPT	2.07" (52.58)	7.00" (177.80)	6.00" (152.40)



F-SERIES CONTROL VALVE	"A"	"B"	"C"	"D"	
FA2	QPV2	1/4" NPT	2.07" (52.58)	6.78" (172.26)	6.00" (152.40)



**PLEASE CONTACT FACTORY FOR VALVE & ORIFICE SELECTION**

Please remember to configure the F-Series flow monitor when building a flow control assembly.







# FQB2 - Dimensions & Part Numbering

## FQB2

Example Part Number

ACCURACY		±4% F.S.		PRESSURE		Up to 150 psig (10 Bar)			
PORT SIZE		1/8"		FLOW CONTROL REGULATOR					
FQB2	X	A	N	E	E	90	PS	G	
	1	2	3	4	5	6	7	8	OPTIONS

F-SERIES	CONTROL	BOOSTER	"A"	"B"	"C"	"D"			
FR3/FP3	QB2X	PSR3	3/8" NPT	5.00"	127.00	8.00"	203.20	7.00"	177.80
FR4/FP4	QB2X	PSR4	1/2" NPT	5.00"	127.00	8.25"	209.55	7.00"	177.80
FR6/FP6	QB2X	PSR6	3/4" NPT	5.00"	127.00	9.37"	238.00	8.75"	222.25
FR8/FP8	QB2X	PSR8	1" NPT	5.00"	127.00	9.64"	244.86	8.75"	222.25
FRA/FPA	QB2X	PSRA	1-1/4" NPT	5.00"	127.00	11.00"	279.40	9.00"	228.60
FRB/FPB	QB2X	PSRB	1-1/2" NPT	5.00"	127.00	11.03"	280.25	9.00"	228.60

DIMENSIONS ARE FOR REFERENCE USE ONLY.

### Section Reference

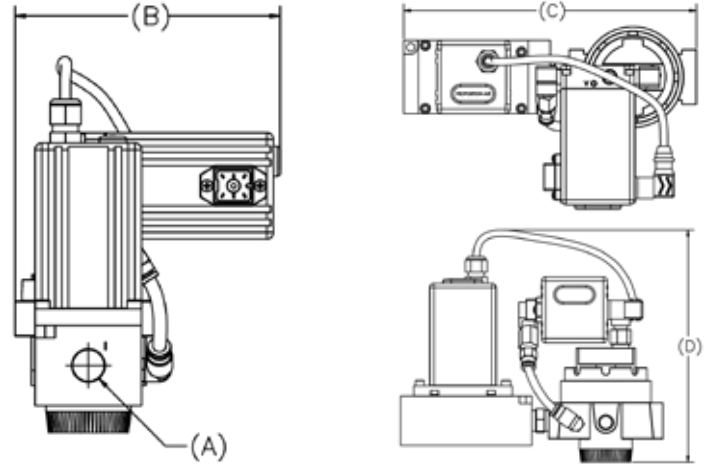
<b>1</b> Type	<b>2</b> Manifold Material
X QBX Model without side fittings*	A Anodized Aluminum
*Legacy model FQB2 used T for Type	B Brass*
	*Includes O2 Cleaning

<b>3</b> Thread Type
N NPT
P BSPP

<b>4</b> Input Signal Range
E 0 to 10 VDC
I 4 to 20 mA DC
K 0 to 5 VDC
V 1 to 5 VDC (Requires V for Monitor Signal #5)
N Ethernet/Proportion-Air (Requires X for Monitor Signal #5)
M Ethernet/MODBUS TCP (Requires X for Monitor Signal #5)
A RS232 Serial Input (Requires X for Monitor Signal #5)
B RS485 Serial Input (Requires X for Monitor Signal #5)
P P2 Profiler (Integrated)

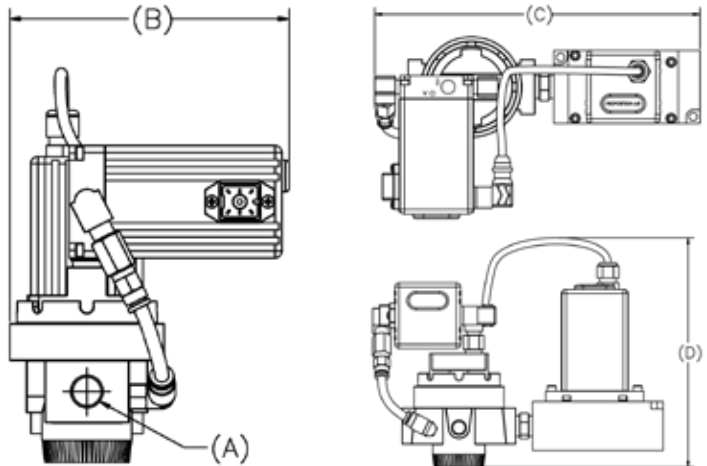
<b>5</b> Output Signal Range	<b>6</b> Full Scale Pressure
X No Monitor	Must be less than or equal to 150 psig
E 0 to 10 VDC	
K 0 to 5 VDC*	
V 1 to 5 VDC*1	
C 4 to 20 mA DC (Sinking)	<b>7</b> Pressure Unit
S 4 to 20 mA DC (Sourcing)	PS PSI Bar BR
*Requires E, I or K for Input Signal Range (#4)	KP Kilo-pascal Kilograms/cm <sup>2</sup> KG
*1Requires V for Input Signal Range (#4)	MP Mega-pascal

<b>8</b> Pressure Unit of Measure
G Gauge Pressure



F-SERIES	CONTROL	BOOSTER	"A"	"B"	"C"	"D"		
FA3	QB2X	PSR3	3/8" NPT	5.00"	8.00"	203.20	7.00"	177.80
FA4	QB2X	PSR4	1/2" NPT	5.00"	8.25"	209.55	7.00"	177.80
FA6	QB2X	PSR6	3/4" NPT	5.00"	9.37"	238.00	8.75"	222.25
FA8	QB2X	PSR8	1" NPT	5.00"	9.64"	244.86	8.75"	222.25
FAA	QB2X	PSRA	1-1/4" NPT	5.00"	11.00"	279.40	9.00"	228.60
FAB	QB2X	PSRB	1-1/2" NPT	5.00"	11.03"	280.25	9.00"	228.60

DIMENSIONS ARE FOR REFERENCE USE ONLY.



## SAFETY PRECAUTIONS



**PLEASE READ ALL OF THE FOLLOWING SAFETY PRECAUTIONS BEFORE INSTALLING OR OPERATING ANY PROPORTION-AIR, INC. EQUIPMENT OR ACCESSORIES. TO CONFIRM SAFETY, BE SURE TO OBSERVE 'ISO 4414: PNEUMATIC FLUID POWER - GENERAL RULES RELATING TO SYSTEMS' AND OTHER SAFETY PRACTICES.**

### 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, accidents, 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 18 MONTHS 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, Inc.

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# PROPORTION

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Handcrafted in the USA  
ISO 9001-2015 Certified



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.