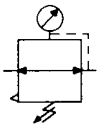
FRL Products and Accessories

Precision Pneumatic Controls

PRECISION REGULATOR R80 / R82 Series


ANSI SYMBOL


R820-02F pictured

Application

The 80 and 82 Series regulators are high-precision, multi-stage pressure regulators. The highest degree of regulation and repeatability are achievable by reacting to downstream pressure fluctuations as small as 0.01 PSIG (.07 kPa). Action occurs as downstream pressure is piloted to the control chamber to act on a finely tuned stainless steel volume capsule. A continuous bleed of less than 0.08 SCFM (.15 m^3/hr) adjusts the pilot diaphragm causing appropriate movement of the supply valve or relief valve. Relief flows of up to 10 SCFM can be achieved through the large exhaust port located in the control diaphragm. Exhaust is achieved through the exhaust vents located in the side of the body.

Recommended Uses

- Air gauging
- Gas mixing
- Web tensioning
- Roll loading
- Air hoists

Specifications

Flow Capacity: 14 SCFM (25m^3/hr)
Exhaust Capacity: model 80 - 2 SCFM (3.4 m^3/hr)
model 82 - 10 SCFM (17.0 m^3/hr)
Sensitivity: .125 inches (3.2 mm) water
Pilot Bleed Rate: .08 SCFM (.15 m^3/hr)
Supply Pressure Variation: less than .005 PSI (.03 kPa)@25 PSI variance
Maximum Supply Pressure: 150 PSIG (1050 kPa)
Weight: 1.4 lbs (.64 kg)

Materials of Construction

Body: die cast zinc
Diaphragms: Buna - N
Volume Capsule: stainless steel
Knob: phanolic plastic

How to Order

R 80 0 - 02 DT

Model:
R = Regulator

Series:
80 = standard
82 = high relief

Style:
0 = all precision regulators

Threads:
- = NPTF
G = G tap (BSPP)

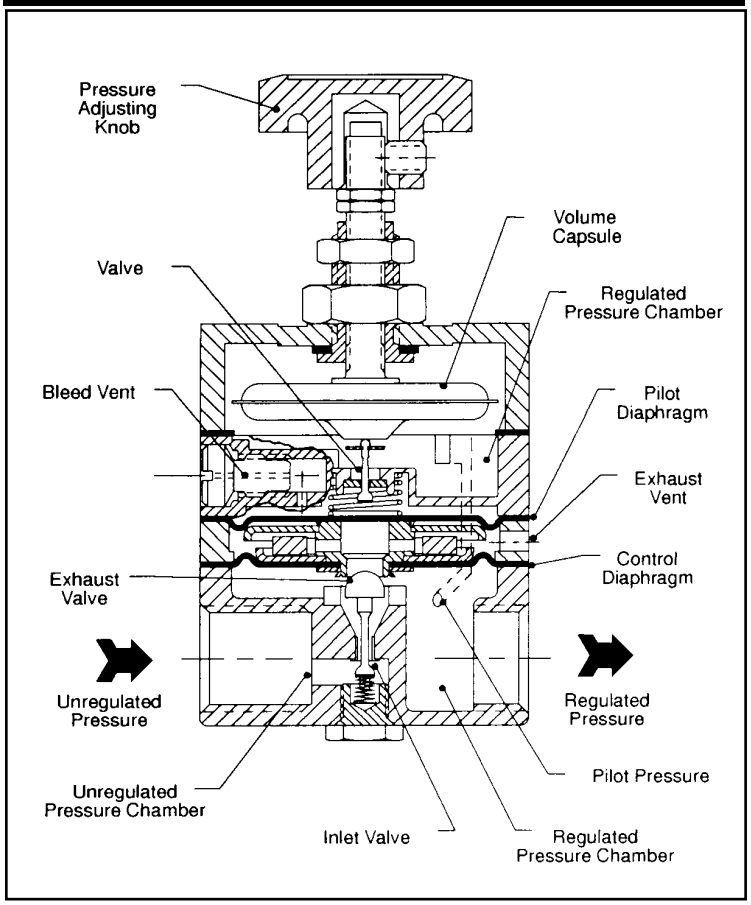
Port Size:
02 = 1/4
03 = 3/8

Options (see pg 101):
D = 2-40 PSIG (80 Series only)
not available on 82 Series
E = 2-60 PSIG (80 Series only)
not available on 82 Series
F = 2-120 PSIG
G = gauge
T = tamperproof

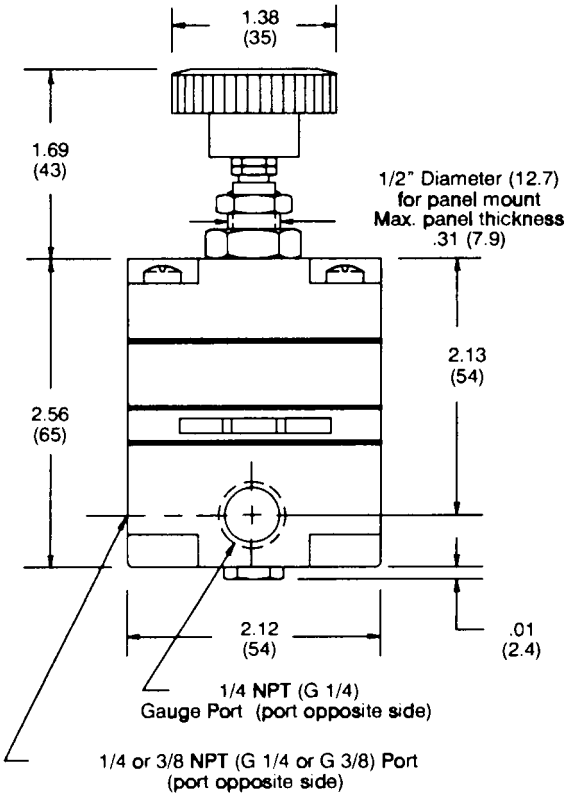
NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

NEED MORE PARTS AND INFORMATION?
• See page 119 for information on ordering replacement filters, bowls, etc.
• See page 101 for more information on available options.

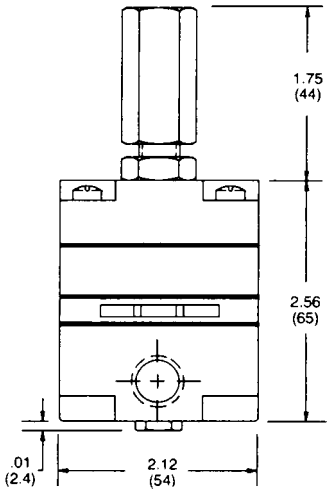
Product Cross Section



Dimensions



Tamperproof Model



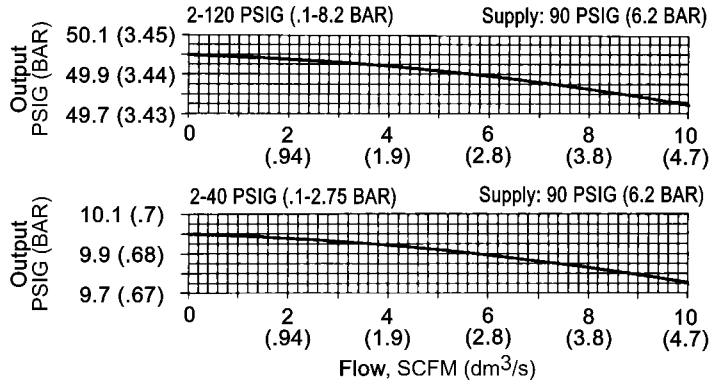
Notes

Installation The Precision Regulator is designed for air service only. A 5 micron filter installed before the Precision Regulator is recommended to prevent contaminant from affecting the regulator's performance. Clean all air lines before installation and apply a small amount of compound to the male threads only. Be sure that the exhaust vents are not blocked. The Precision Regulator can be mounted in any position.

Operation Back off the pressure adjusting knob before putting the regulator into operation. Turn on the supply pressure slowly then turn the adjusting knob until the desired output pressure is reached. A minimum supply pressure of 20 PSI more than the regulated pressure is recommended. Since this instrument utilizes an air bleed servo-control action, escaping air may be audible near the area of the bleed screw - this is normal and is required for precise control.

Maintenance Occasional attention may be required due to the natural accumulation of foreign matter in the instrument. If gauge readings appear to fluctuate for no reason it is usually an indication that the bleed screw requires cleaning. This can be performed by simply removing the bleed screw from the body and cleaning both the screen and the bleed screw. Clean any foreign matter from the small orifice in the tip of the screw.

Flow Rates



ELECTROPNEUMATIC TRANSDUCER I/P,E/P R83 Series

R832-02E pictured

Application

The Electropneumatic Transducer (I/P, E/P) converts a current or voltage input signal to a linearly proportional pneumatic output pressure. This versatile instrument is designed for control applications that require a high degree of reliability and repeatability at an economical cost. These units are used for applications that require the operation of valve actuators, pneumatic valve positioners, damper and louver actuators, final control elements, relays, air cylinders, web tensioners, clutches, and brakes.

Features

- Integral volume booster
- Compact size
- Low air consumption
- Field reversible
- Flexible zero and span adjustments
- Standard process inputs
- Split ranging
- FM - NEMA 4x

Specifications

	Low Output Range (up to 30 PSIG)	High Output Range (up to 120 PSIG)
Min./Max. Supply Pressure:	minimum 3 PSIG (21 kPa) above maximum output maximum 100 PSIG (700 kPa)	minimum 5 PSIG (35 kPa) above maximum output maximum 150 PSIG (1050 kPa)
Supply Pressure Sensitivity:	< +/- .1% of span per PSIG (< +/- .15% of span per 10 kPa)	< +/- .004% of span per 1.0 PSIG (7 kPa)
Terminal Based Linearity:	< +/- .75% of span	< +/- 1.5% of span typ., +/- 2.0% max
Repeatability:	< .5% of span	< .5% of span
Hysteresis:	< 1.0% of span	< .5% of span
Response Time:	dependent on pressure range, typically less than .25 sec. for 3 - 15 PSIG units	dependent on pressure range, typically less than .25 sec. for 3 - 15 PSIG units
Flow Rate:	4.5 SCFM (7.6 m^3/hr ANR) at 25 PSIG (175 kPa) supply 12 SCFM (20 m^3/hr ANR) at 100 PSIG (700 kPa) supply	20 SCFM (34 m^3/hr ANR) at 150 PSIG (1050 kPa) supply
Relief Capacity:	2.0 SCFM (3.4 m^3/hr) at 5 PSIG (35 kPa) above set point	2.0 SCFM (3.4 m^3/hr) at 5 PSIG (35 kPa)
Maximum Air Consumption:	.03 SCFM (.07 m^3/hr) typical	.05 SCFM (.14 m^3/hr) typical
Media:	oil free, clean dry air filtered to 40 micron	oil free, clean dry air filtered to 40 micron
Temp. Range (operating):	-20ºF to 140ºF (-30ºC to 60ºC)	-20ºF to 140ºF (-30ºC to 60ºC)

NOTE: This unit, as is, is a Class 1, Division 2 hazardous location item (non-incendive). With the proper barrier it is a Class 1,2,3; Division 1; Groups C,D,E,F,G item (applies only to 4-20 Ma I/P).

Mounting Bracket

The mounting bracket for the R85 Series Electropneumatic Transducer is included with the unit.

How to Order

R 83 1 - 02 F G

Options (see pg 101):
G = Gauge

Model:
R = Regulator

Series:
83 = I/P,E/P Transducer

Style:
1 = 4-20 Ma
2 = 0-5 VDC
3 = 0-10 VDC

Threads:
- = NPTF
G = G tap (BSPP)

Port Size:
02 = 1/4

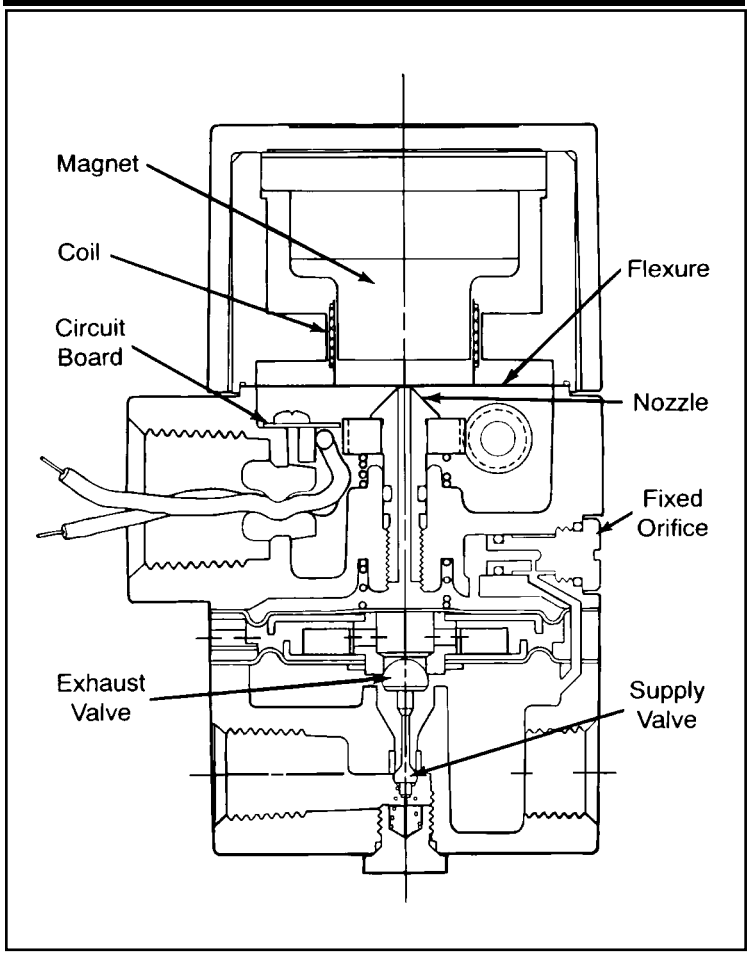
Output Range:
B = 3-15 PSIG (4-20 Ma input signal available)
C = 3-27 PSIG (4-20 Ma input signal available)
E = 2-60 PSIG (4-20 & 0-5 VDC Ma input)
F = 3-120 PSIG (4-20 & 0-10 VDC Ma input signal available)

NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

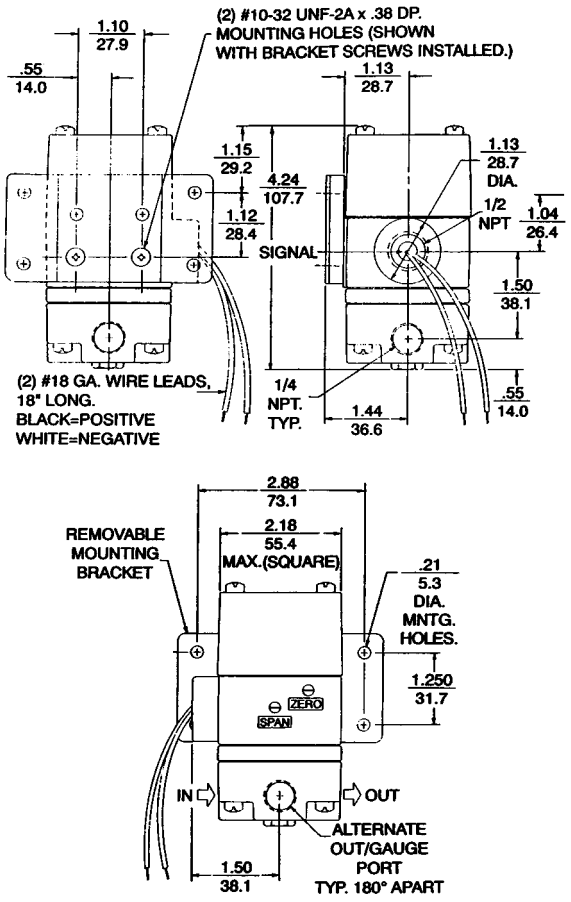
NEED MORE PARTS AND INFORMATION?

- **See page 119 for information on ordering replacement filters, bowls, etc.**
- **See page 101 for more information on available options.**

Product Cross Section



Dimensions



Notes

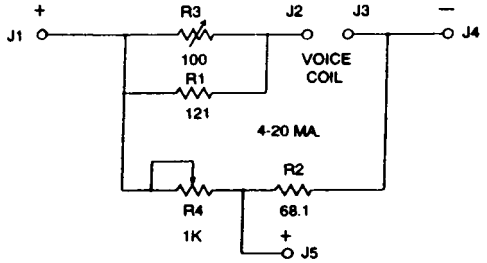
Installation This unit may be mounted using pipe, panel, or bracket mounting. It may be mounted at any angle, although some angles may require field adjustment. High external vibration may cause output fluctuations. Mounting in a vibration-free area is recommended.

Electrical Connections Electrical connections are made to the black and white leads extending out from the 1/2 NPT conduit fitting. When the positive side of the input signal is connected to the black lead, the output pressure will increase as the input signal increases. To decrease the output pressure while increasing the input signal, connect the positive side of the input signal to the white lead.

Calibration Zero and Span should always be checked after mounting. If unit is calibrated in a vertical position then mounted at an angle, readjustment of the Zero is necessary. Calibration instructions are included with each unit.

Maintenance Under normal circumstances, no maintenance should be required. If dirty and/or wet air is used the orifice can become blocked. To clean, first turn off the supply air then unscrew and remove the orifice assembly. Unplug the orifice using a wire with a diameter under 0.015 in (0.38 mm). use compressed air to blow out any loose particles inside the orifice assembly. Replace the orifice assembly and reassemble the unit.

Electrical Schematic



NOTE: FOR 4-20MA AND 10-MA USE J1 AS POSITIVE INPUT.

MINIATURE ELECTROPNEUMATIC TRANSDUCER

I/P, E/P R85 Series

R851-02EA pictured

Application

The R85 Series I/P, E/P transducers are a series of compact electronic pressure regulators that convert an electrical signal (current or voltage) to a proportional pneumatic output. Utilizing internal solid-state feedback circuitry, the R85 provides precise, stable pressure outputs to final control elements. Immunity to the effects of vibration or mounting position, high tolerance to impure air, and low air consumption make this unit ideal for use in demanding applications.

The heart of this unique technology is a bimorph piezo actuator that is encapsulated in a protective skin. This protective skin provides defense against the humidity and contaminant often found in process operating environments.

Features

- Reliable in harsh environments
- Low air consumption - 3 SCFH typical
- High accuracy - +/-0.10% of span
- NEMA-4X (IP65) enclosure
- Vibration/position insensitive
- Compact size
- Wall, panel, pipe, or din rail mounting
- Supply pressures up to 100 PSIG
- Built-in volume booster - 10 SCFM flow
- Input/output ports on front and back
- Conduit fitting or din connector
- Split range operation
- Field reversible

Specifications

Port sizes:	Pneumatic: 1/4 NPT Electric: 1/2 NPT	
Media:	Clean, dry, oil-free, air filtered to 40 micron	
Mounting:	Wall, Panel, 2" pipe, or DIN rail (optional)	
Materials:	Housing: Chromate treated aluminum with baked paint. NEMA-4X (IP65) Elastomers: Buna-N Trim: Stainless steel, brass, zinc plated steel	
Weight:	13.0 oz (0.4 kg)	
Inputs:	4-20mA	0-10 VDC, 1-9 VDC 0-5 VDC, 1-5 VDC
Outputs:	3-15 PSIG 3-27 PSIG 2-60 PSIG 3-100 PSIG	0.21-1.03 BAR 0.21-1.86 BAR 0.14-4.14 BAR 0.21-6.89 BAR
Air consumption:	3.0 SCFH (0.11 m^3/hr) at mid-range typical	
Supply pressure:	100 PSIG (7.0 BAR) maximum Note: Supply pressure must be at a minimum of 5 PSIG above maximum output	
Flow capacity at mid-range:	4.5 SCFM (7.6 m^3/hr) at 25 PSIG (1.7 BAR) supply 12 SCFM (20 m^3/hr) at 100 PSIG (7 BAR) supply	
Relief Capacity:	2.0 SCFM (3.4 m^3/hr) at 5 PSIG (35 kPa) above set point	2.0 SCFM (3.4 m^3/hr) at 5 PSIG (35 kPa)
Temperature limits:	Operating: -40º to +160º F (-40º to +71º C) Storage: -40º to +200º F (-40º to +93º C)	
Loop load, I/P Transducer:	7.5 VDC @ 20mA	
Supply Voltage, E/P Transducer:	7-30 VDC, less than 3mA	
Signal impedance:	7-30 VDC, less than 3mA	

How to Order

R 85 3 - 02 B F R

Options (see pg 101):
G = Gauge
R = DIN Rail Mount

Electrical Connection:
A = 1/2 NPT conduit w/ pigtail
F = DIN 43650 connector

Model:
R = Regulator

Series:
85 = I/P,E/P Miniature Transducer w/ pressure feedback control

Threads:
- = NPTF
G = G tap (BSPP)

Input Signal:
1 = 4-20 Ma
2 = 0-5 VDC
3 = 0-10 VDC

Port Size:
02 = 1/4

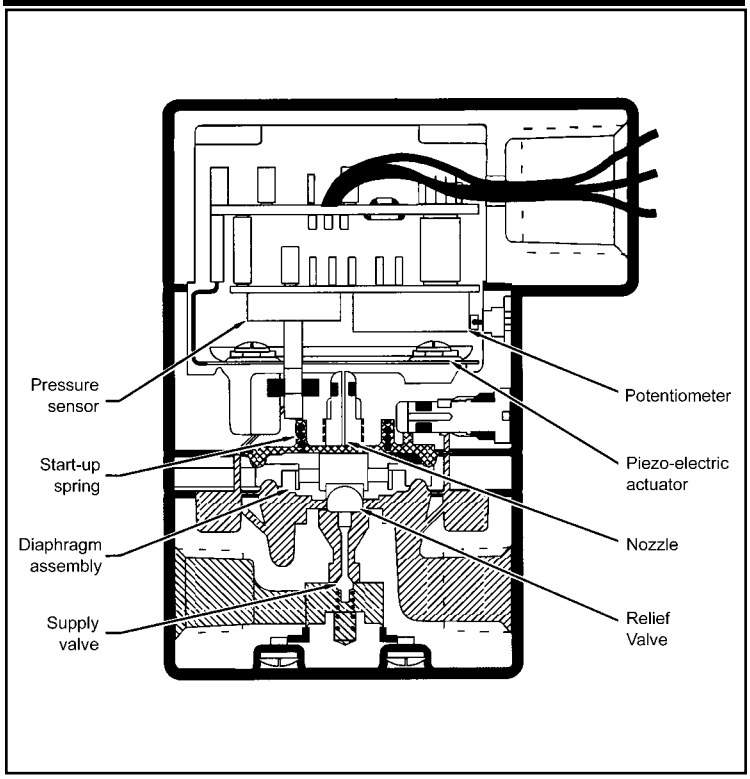
Output Range:
B = 3-15 PSIG
C = 3-27 PSIG
E = 2-60 PSIG
F = 3-100 PSIG

NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

NEED MORE PARTS AND INFORMATION?

- **See page 119 for information on ordering replacement filters, bowls, etc.**
- **See page 101 for more information on available options.**

Product Cross Section



Notes

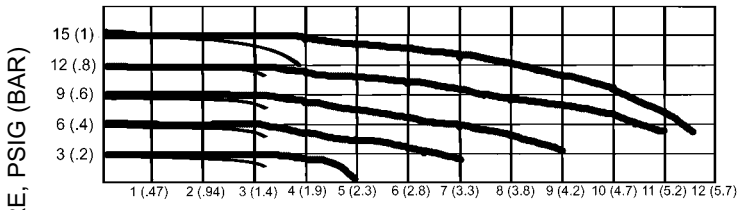
Installation Clean all pipe lines to remove dirt and scale before installation. Supply air must be filtered to 5 microns and free of moisture and lubricants.

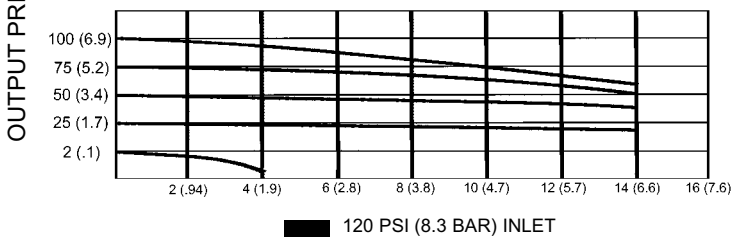
Electrical Connections For current to pressure connection, electrical connections are made to the red (+) and black (-) leads. The green lead is used for case ground. For voltage to pressure connection, electrical connections are made to the red (+, supply), black (-), and orange (+ signal) leads. The green lead is used for case ground. Recommended supply voltage is 7-30 vDC. Electrical diagrams are included with unit.

Calibration All units are shipped from the factory calibrated, direct acting. Calibration instructions are included with each unit

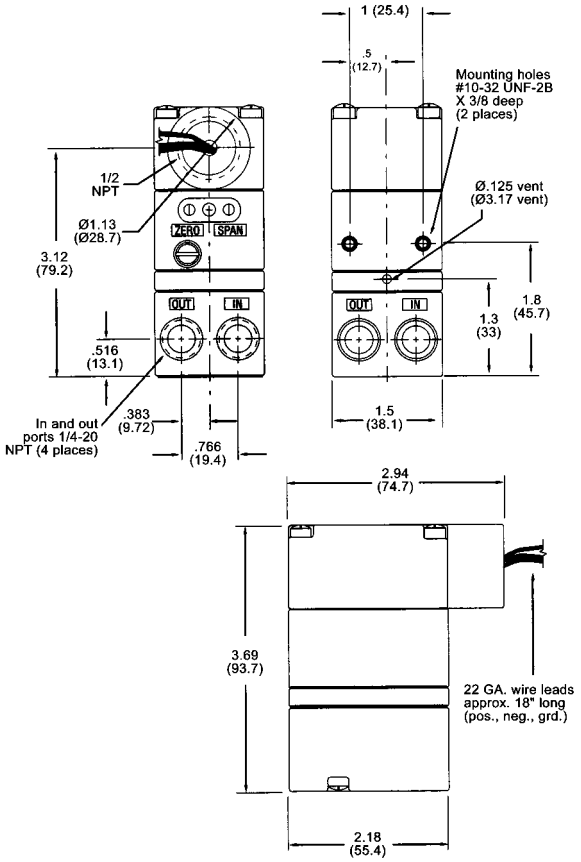
Maintenance Under normal circumstances, no maintenance should be required. If dirty and/or wet air is used the orifice can become blocked. To clean, first turn off the supply air then remove the screw located under the zero adjustment. Unplug the orifice using a wire with a diameter smaller than 0.012 in (0.30 mm). Use compressed air to blow out any loose particles inside the orifice screw assembly.

Flow Rates

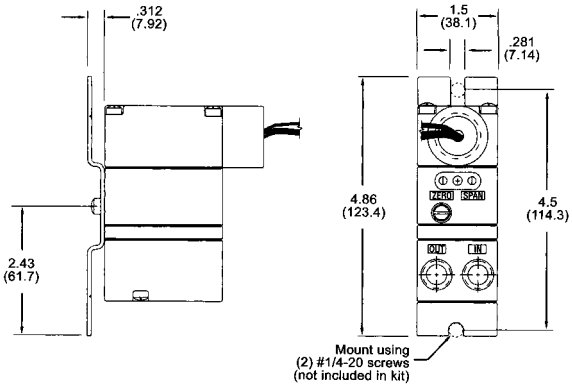




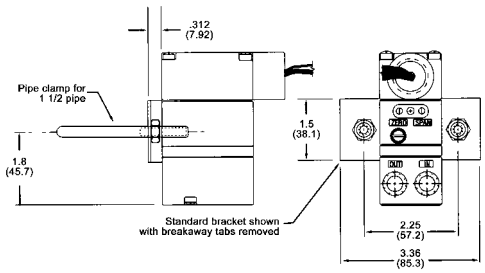
Dimensions



Panel Mounting (included with standard unit)



Pipe Mounting (included with standard unit)



RATIO RELAY VOLUME BOOSTER R87 Series

R871-02 pictured

Applications

The 87 Series Volume Boosters are used extensively for increased flow capacity, pressure amplification, or remote pressure control applications. This includes web tensioning, roll loading, control valve actuators, I/P volume boosting, cylinder actuation, clutch and brake control, and gas flow control.

Features

- High flow capacity - allows flows up to 50 SCFM
- Amplified output - available in a signal to output pressure ratio of 1:6
- High exhaust capacity - large relief provides 15 SCFM flow capacity
- Stable output - Venturi aspirator maintains output pressure under varying flow conditions
- Balanced supply valve - rolling diaphragm design makes unit immune to supply pressure variation
- Negative bias - 4 PSI negative bias option allows “zero” of I/Ps

Specifications

Ratio:	1:1	1:6
Flow capacity, SCFM (m^3/hr) 100 PSIG (700 kPa) supply, 20 PSIG (140 kPa) output:	50 (76.5)	50 (76.5)
Exhaust capacity, SCFM (m^3/hr) Downstream 5 PSIG (35 kPa) above set pressure:	15 (25.5)	7.5 (12.8)
Sensitivity, inches water (cm):	.25 (.64)	1.5 (3.8)
Ratio accuracy (%) of output span with 3-15 PSIG (20-105 kPa) signal:	1.0	2.0
Zero error (%) - % of output span with 3-15 PSIG (21-105 kPa) signal:	2.0	3.0
Effect of supply pressure change of 50 PSIG (350 kPa):	.1 PSI	.6 PSI
Maximum supply pressure, PSIG (kPa):	250 (1750)	250 (1750)
Maximum signal pressure, PSIG (kPa):	150 (1034)	25 (172)
Ambient temperature limits, ºF (ºC):	-40 to 200 (-40 to 93)	-40 to 200 (-40 to 93)
Weight, lbs (gm):	1.4 (635)	1.4 (635)

Optional Fixed Negative Bias

The 87 Series Volume Booster is available with an optional 4±1 PSIG (30±7 kPa) less than the signal pressure (Z option).
This option allows zero output when utilizing I/P transducers that typically only are capable of providing pressures down to 3 PSI. Note that the negative bias has a tolerance of ±1 PSI. This means that actual bias will range from -3 PSI to -5 PSI. Use the zero adjustment of the I/P to reach desired setting.

Mounting Bracket

The mounting bracket for the R87 Series Ratio Relay Volume Booster, part number PK88, is included. See pg. 114 for details.

How to Order

R 87 6 - 03 G Z

Model:
R = Regulator

Series:
87 = Volume Booster

Style:
1 = 1:1 ratio
6 = 1:6 ratio

Threads:
- = NPTF
G = G tap (BSPP)

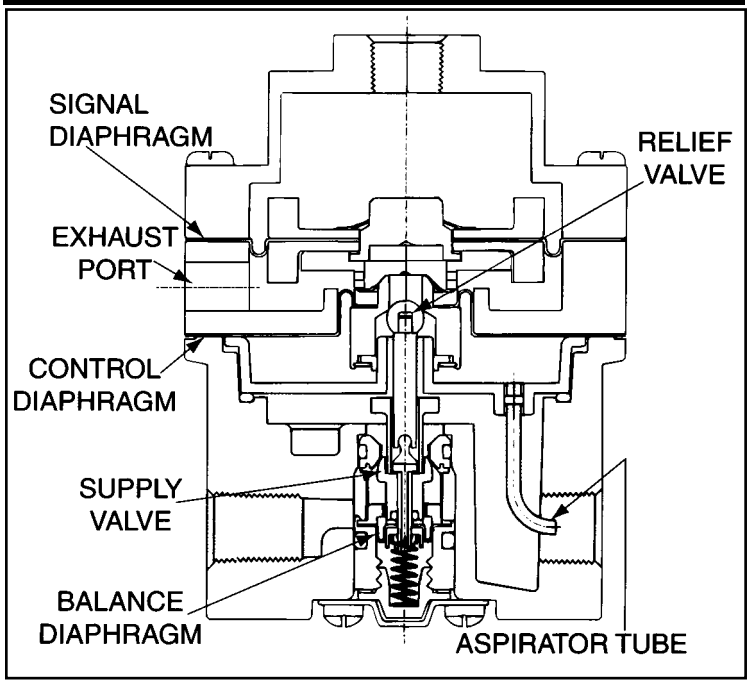
Port Size:
02 = 1/4
03 = 3/8

Options (see pg 101):
B = mounting bracket
G = gauge
Z = negative bias

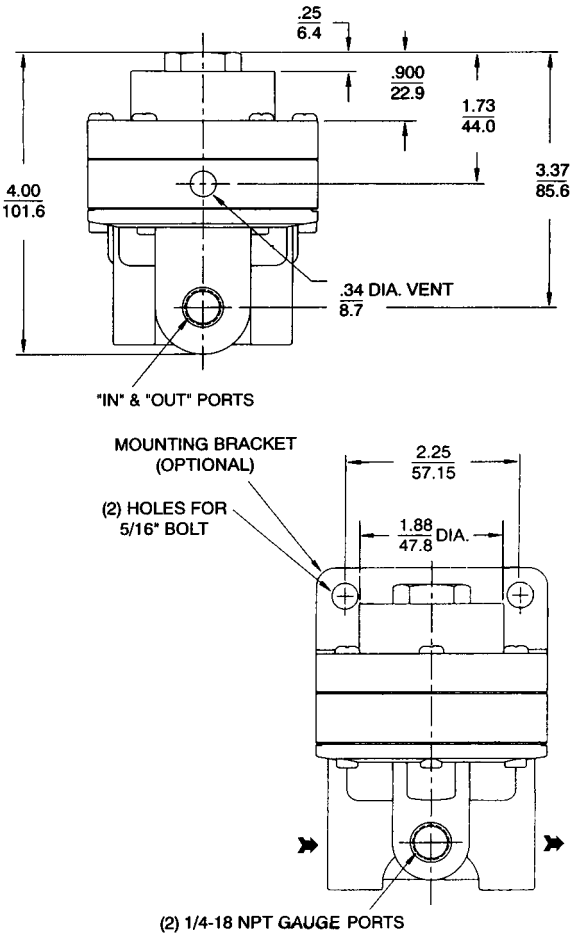
NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

NEED MORE PARTS AND INFORMATION?
- **See page 119 for information on ordering replacement filters, bowls, etc.**
- **See page 101 for more information on available options.**

Product Cross Section



Dimensions



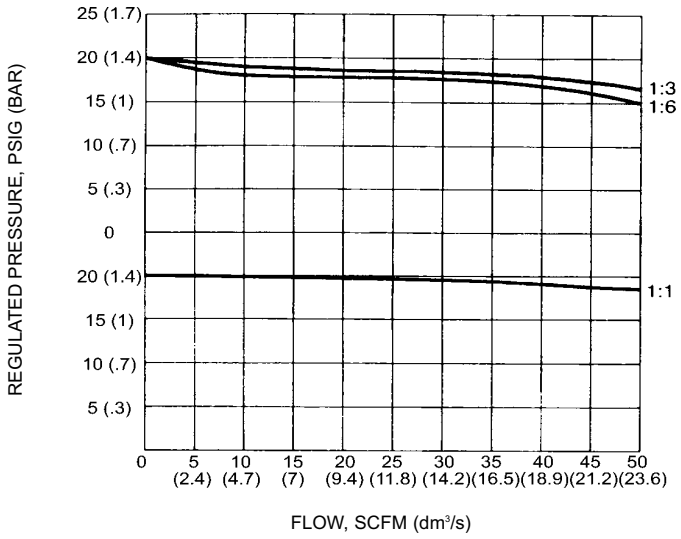
Notes

Installation The Ratio Relay Volume Booster is designed for air service only. Clean all air lines before installation and apply a small amount of compound to the male threads only. Be sure all connections are tight and that the exhaust vents are not blocked. The Ratio Relay Volume Booster can be mounted in any position.

Operation Apply an input signal to the signal port. There are no manual controls on the Ratio Relay Volume Booster.

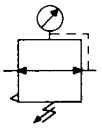
Maintenance Occasional attention may be required due to the natural accumulation of foreign matter in the instrument. The regulator is easily disassembled without removal from the line. Before disassembly, shut off valve upstream of the volume booster to prevent escape of air when disassembled. Remove the two No. 8-32 screws on the bottom of the unit and pull out the pintle assembly. Wash the inner valve assembly with solvent, taking care not to damage the diaphragms and valve facings. Do not use solvents such as acetone, carbon tet, and trichlorethlene. Carefully reassemble unit after cleaning. The vent hole in the bonnet should be kept clean. A slight flow of air through this hole is necessary for proper operation of the volume booster.

Flow Rates based on 100 PSIG (7 BAR) inlet



HIGH FLOW PRECISION REGULATOR

R88 Series



ANSI SYMBOL

R880-02F pictured

Function

The **880 Series** pressure control regulator is designed for high flow and accurate pressure control utilizing a rolling diaphragm to insure a constant output pressure. The 88 model maintains stability even with wide supply pressure variations.

The **881 Series** back pressure regulator is a high flow, highly accurate pneumatic relief valve with an adjustable set point. It's primary function is to provide protection against overpressurization in the downstream portion of a pneumatic system. This precision unit is capable of handling flows up to 50 SCFM. A rolling diaphragm provides the sensitivity that causes the unit to vent to atmosphere in response to the slightest upstream changes.

Applications

- Test equipment
- Roll loading
- Web tensioning
- Actuators
- Gas mixing
- Test panels
- Clutch and brake controls

Specifications

Flow Capacity: see flow characteristics (next page)
Exhaust Capacity: 4 SCFM (6.7 m^3/hr)
Sensitivity: .25 inches (6.33 mm) of water
Total Air Consumption: 1.0 to 12.5 SCFH (.03 to .37 m^3/hr), depending on output pressure
Supply Pressure Variation: .1 PSI (.7 kPa) @ 100 PSI (700 kPa) change
Maximum Supply Pressure: 250 PSIG (1750 kPa)
Weight: 1.6 lbs (.74 kg)

Materials of Construction

Body: die cast aluminum
Diaphragms: Buna - N
Volume Capsule: stainless steel
Knob: phanolic plastic

Mounting Bracket

The mounting bracket for the R88 Series High Flow Precision Regulator, part number PK88, is available and sold separately. See pg. 114 for details.

How to Order

R 88 0 - 02 CGMT

Model:
R = Regulator

Series:
88 = high flow precision

Style:
0 = standard high flow precision regulator
1 = back pressure precision regulator

Threads:
- = NPTF
G = G tap (BSPP)

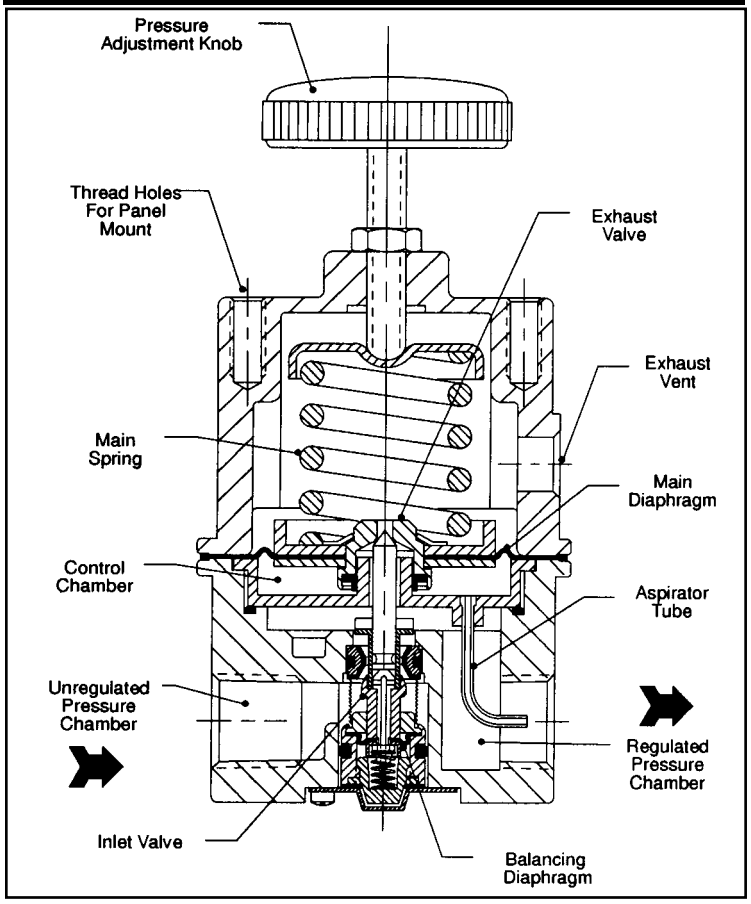
Port Size:
02 = 1/4
03 = 3/8
04 = 1/2

Options (see pg 101):
A = 0-2 PSIG
B = 0-15 PSIG
C = 0-30 PSIG
E = 1-60 PSIG
F = 2-150 PSIG
G = gauge
M = mounting bracket
T = tamperproof

NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

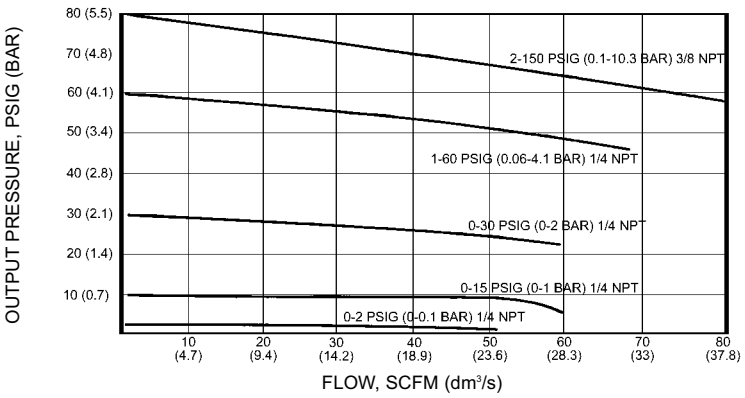
NEED MORE PARTS AND INFORMATION?
• See page 119 for information on ordering replacement filters, bowls, etc.
• See page 101 for more information on available options.

Product Cross Section

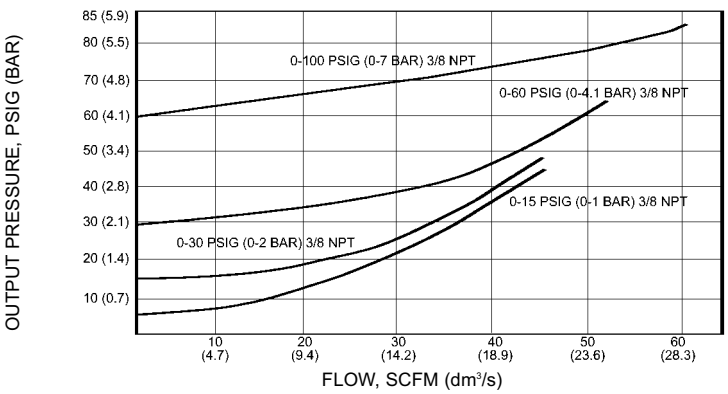


Flow Rates based on 100 PSIG (7 BAR) inlet

Standard Precision Regulator (R880 Series)



Back Pressure Precision Regulator (R881 Series)



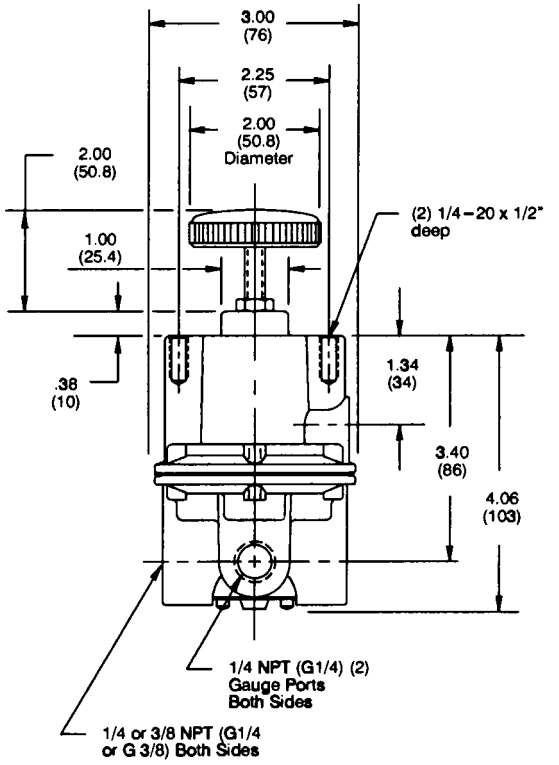
Notes

Installation The High Flow Precision Regulator is designed for air service only. Clean all air lines before installation and apply a small amount of compound to the male threads only. Avoid undersized fittings which will limit flow and cause pressure drop downstream. The use of a 5 micron filter installed before the Precision Regulator is recommended to remove contaminant which would affect performance. Be sure all connections are tight and that the exhaust vents are not blocked. The High Flow Precision Regulator can be mounted in any position.

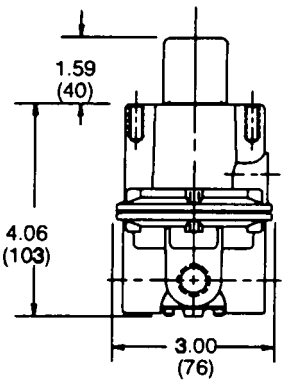
Operation Before using the regulator for the first time, relieve pressure on the range spring by turning the knob counterclockwise. To operate, turn the pressure adjusting knob slowly clockwise until desired pressure is reached.

Maintenance Occasional attention may be required due to the natural accumulation of foreign matter in the instrument. The regulator is easily disassembled without removal from the line. Before disassembly, shut off valve upstream of the regulator to prevent escape of air when disassembled. Remove the two No. 8-32 screws on the bottom of the unit and pull out the pintle assembly. Wash the inner valve assembly with solvent, taking care not to damage the diaphragms and valve facings. Do not use solvents such as acetone, carbon tet, and trichlorethlene. Carefully reassemble unit after cleaning. The vent hole in the bonnet should be kept clean. A slight flow of air through this hole is necessary for proper operation of the volume booster.

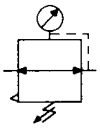
Dimensions



Tamperproof Model



INSTRUMENT AIR REGULATOR R89 Series


ANSI SYMBOL

R890-02F pictured

Application

The Instrument Air Regulator is designed to provide clean, accurate air pressure to instruments, valves, and other automatic control equipment. It is used extensively to supply air to pneumatic controllers, transmitters, transducers, valve positioners, air cylinders, and a wide range of pneumatic control systems.

Features

- Stable output and repeatability
- Corrosion-resistant construction
- 5 micron depth filter
- Self-relieving
- Low droop at high flow levels
- Tight shut off

Specifications

Port Size: 1/4 NPT
Standard Output Pressure: 0 - 120 PSIG (0 - 800 kPa)
Maximum Supply Pressure: 250 PSIG (1700 kPa)
Mounting: pipe or integral mounting
Flow Capacity: see flow characteristics (next page)
Exhaust Capacity: .1 SCFM (.17 m^3/hr) @ 5 PSIG (35 kPa) above set point
Sensitivity: 1" (2.5 cm) of water
Air Consumption: less than 5 SCFH (.17 m^3/hr)
Effect of Supply Pressure Variation: less than .2 PSIG (1.4 kPa) @ 25 PSI (170 kPa) change
Weight: 1.6 lbs (.74 kg)

Materials of Construction

Body: die cast aluminum alloy, irridite, baked epoxy finish
Filter: 5 micron phenolic impregnated cellulose
Diaphragms: nitrile elastomer and nylon fabric
Valve Seat Plug: nitrile elastomer
Additional Materials: brass, zinc, plated steel, acetal

Mounting Bracket

The mounting bracket for the R89 Series Instrument Air Regulator, part number PK89, is available and sold separately. See pg. 114 for details.

How to Order

R 89 0 - 02 FKP

Model:
R = Regulator

Series:
89 = Instrument Air Regulators

Style:
0 = all Instrument Air Regulators

Threads:
- = NPTF
G = G tap (BSPP)

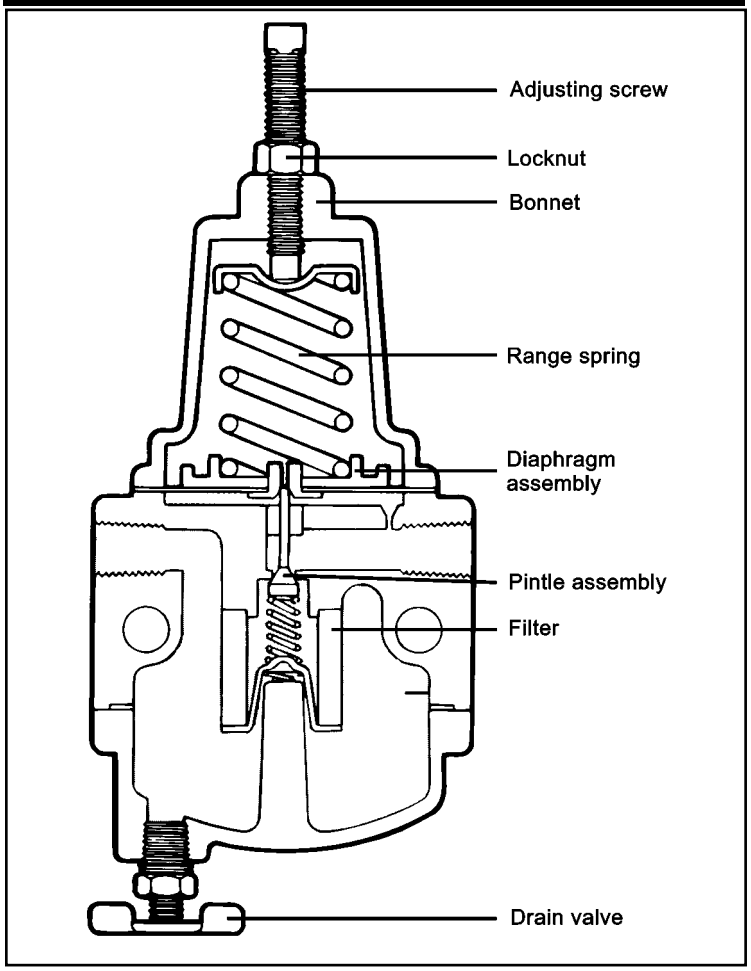
Port Size:
02 = 1/4

Options (see pg 101):
B = 0-10 PSIG
C = 0-30 PSIG
E = 0-60 PSIG
F = 0-150 PSIG
G = gauge
K = knob
M = mounting bracket
N = non-relieving
P = panel mount

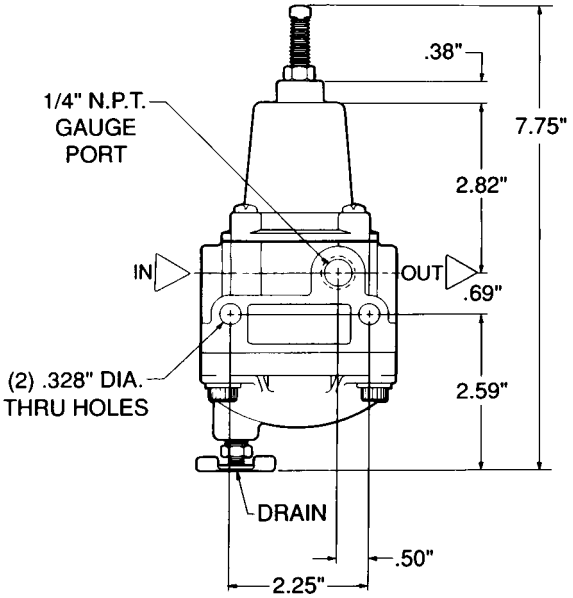
NOTE: *All BSPP (G tap) and BSPT (R tap) models use BSPT gauge threads*

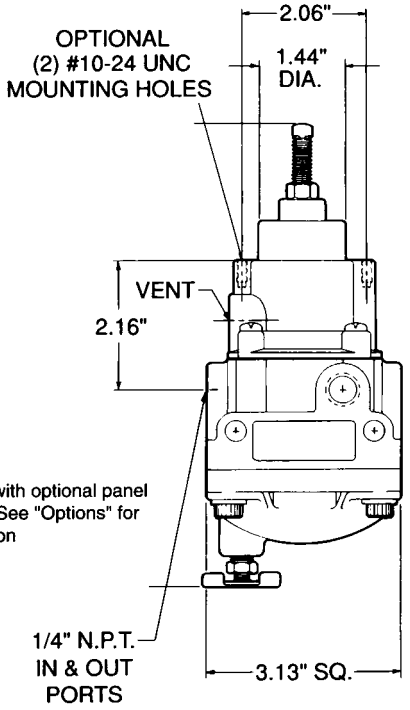
NEED MORE PARTS AND INFORMATION?
• See page 119 for information on ordering replacement filters, bowls, etc.
• See page 101 for more information on available options.

Product Cross Section



Dimensions





Note:
This view shown with optional panel mount capability. See "Options" for ordering information

Notes

Installation Install the Instrument Air Regulator as close as possible to the instrument or tool it is to service. For best filter drainage, position the drain valve so that it is at the lowest point on the dripwell housing. IN and OUT are cast onto the body to indicate the direction of flow.
Operation Before turning on the supply air, back off the adjusting screw until there is no compression of the range spring. After turning the supply pressure on, turn the adjusting screw clockwise to increase outlet pressure
Maintenance To remove condensate, slowly open the drain valve and bleed the liquid. To clean the filter element, first shut off the supply air and drain the contents through the drain valve. Remove the four corner bolts from the bottom of the unit and remove the dripwell housing and filter. Then clean the parts and reassemble.

Flow Rates based on 100 PSIG (7 BAR) inlet