AIR PREPARATION SYSTEM
PRECISION REGULATORS

1/4, 3/8 Body Ports

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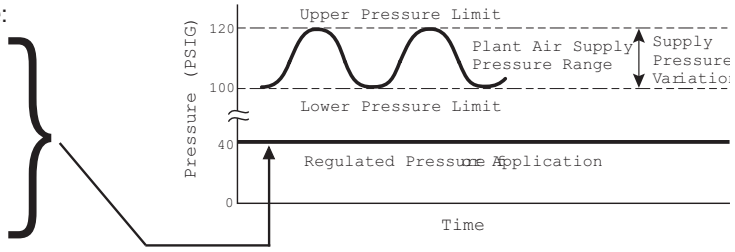
Precision Regulators Application Guide

Pneumatic pressure regulators are designed to provide a constant pressure output from a fluctuating supply pressure – much the way an electronic voltage regulator works. Pressure regulators provide varying degrees of accuracy with regard to their reduced pressure output. General Purpose pressure regulators work for most fluid power applications. However, for more pressure-critical applications precision regulators can provide the customer with the control they need.

A partial listing of things that can potentially cause regulator output pressure variation are:

- Temperature changes
- Inlet pressure changes
- Variations in flow
- Excess downstream pressure
- Cycling
- Time
- Leakage



Who needs precision regulators?

Design level applications:
When designing a pneumatic system it is important to determine not only the air flow that the application will require but also the acceptable level of pressure variation. Some pneumatic applications cannot tolerate fluctuations in pressure. These applications can include static situations with only a steady pressure maintained, or dynamic flow situations involving any number of changing variables in play while trying to maintain a constant pressure.

Problem solving device for existing applications:
Sometimes an existing pneumatic application does not meet the customer's needs with regards to pressure control and/or stability. Any or all of the variables listed above can cause issues with pressure stability. As applications are expanded, added on to, or modified the pressure and flow requirements can change.

How do precision regulators differ from general purpose pneumatic regulators?

Examples: →	**High Precision Regulators** P3RA302, P3RA102, P3RA102BP, P3RA171	**Precision Regulators** P32RB, R216	**General Purpose Regulators** Global Regulators, P3Y, P3Z
Sensitivity: Reduced pressure repeatability/variation under no-flow condition	.005 to .010 psig (1/8" to 1/4" of water column)	.5 to 1 psig	2 to 4 psig
Regulator's ability to control back pressure accurately: *key for cylinder applications	Begins to relieve at .005 to .010 psig overpressure	Begins to relieve at .5 to 2 psig overpressure	Begins to relieve at 5 to 10 psig overpressure
Regulator's ability to maintain set pressure under varying flow, input pressure, temperature conditions:	High	Medium	Standard
Constant Bleed - does the regulator constantly bleed a small volume of air to the atmosphere to maintain stability?	Yes	No	No

1" Water Column = .0360 psi

1 PSI = 27.7612 Inches Water Column

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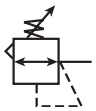
Semi-Precision Regulators - R216

Symbols



- High flow performance featuring rugged design for the most demanding applications
- Ideal for those installations calling for constant pressure with wide variation in flow
- Diaphragm operated with large surface area and aspirator for quick and precise regulation
- Heavy duty tee handle adjustment
- Panel mount version available
- 1/4", 3/8" ports (BSPP, NPT)

Order Code for Ordering:

BSPP Port size	Description (Relieving Type)	Flow‡ dm^3/s (scfm)	Max. bar (psig)	Height mm (inches)	Width mm (inches)	Depth mm (inches)	Part number
1/4"	Tee Handle, Without Gauge	19,3 (40)	20,7 (300)	121 (4.78)	180 (4.25)	180 (4.25)	**R216G02F**
1/4"	Hand Wheel Knob, Without Gauge	19,3 (40)	20,7 (300)	121 (4.78)	180 (4.25)	180 (4.25)	**R216G02FP**
3/8"	Tee Handle, Without Gauge	19,3 (40)	20,7 (300)	121 (4.78)	180 (4.25)	180 (4.25)	**R216G03F**
3/8"	Hand Wheel Knob, Without Gauge	19,3 (40)	20,7 (300)	121 (4.78)	180 (4.25)	180 (4.25)	**R216G03FP**

‡ dm^3/s (scfm) = Standard cubic feet per minute at 7 bar (100 psig) inlet, 5,2 bar (75 psig) no flow secondary setting and 1,4 bar (20 psig) pressure drop.

Options:

R216 [ ] [ ] [ ] [ ] [/*]

Port Threads	
NPT	–
BSPP	**G**

Pressure Range	
1/4 inch	02
3/8 inch	03

Reduced Pressure Range	
0 to 0,6 bar (8 psig)	E
0 to 1,4 bar (20 psig)	F
0 to 3,4 bar (50 psig)	H

Options	
K	Non-relieving
P	Panel mount with nut

Engineering Level
Will be entered at factory.

Standard order code shown in bold.

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Specifications

Flow capacity‡	19,3 dm^3/s ANR (40 scfm)
Operating temperature	4,4°C to 52°C (40°F to 125°F)
Max supply pressure	20,7 bar (300 psig)
Reduced pressure range	0,03 to 1,4 bar (0.5 to 20 psig)
Port size	1/4, 3/8
Gauge ports (1)	1/8"
Weight	100 kg (2.2 lb)

‡ dm^3/s (scfm) = Standard cubic feet per minute at 7 bar (100 psig) inlet, 5,2 bar (75 psig) no flow secondary setting and 1,4 bar (20 psig) pressure drop.

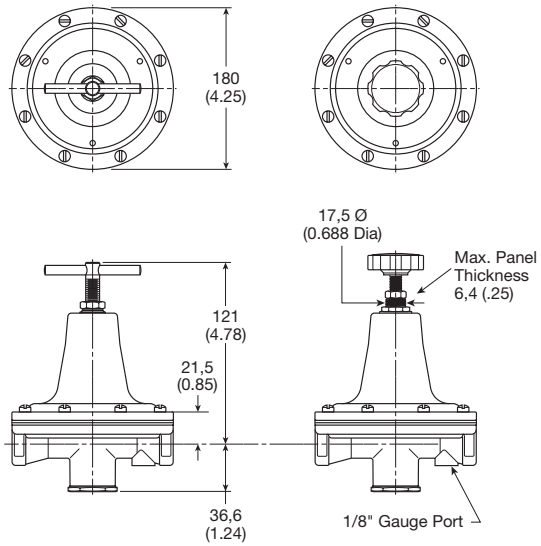
Material Specifications

Body, spring cage	Zinc
Bottom plug	Brass
Seals	Buna N

Repair and Service Kits

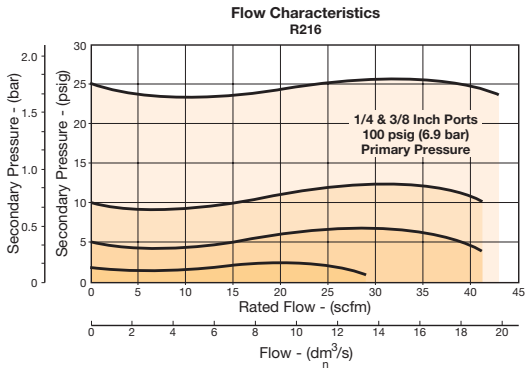
Round plastic knob	**118Y51**
Panel mount conversion kit (Spring cage, knob, hardware)	**4206**
Non-relieving diaphragm, valve assembly (1/4", 3/8")	**RK216KY**
Relieving diaphragm, valve assembly (1/4", 3/8")	**RK216Y**

Dimensions mm (inches)



Flow Charts

R216 1/4" & 3/8" Regulator



⚠ WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed Maximum primary pressure rating.

CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.

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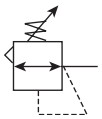
P3RA171 High Precision Vacuum Regulator

The P3RA171 is a high accuracy vacuum regulator that provides uniform vacuum regulation independent of vacuum supply changes and flow demand.

This unit has a diaphragm assembly with three springs to provide a more balanced loading of the diaphragm.

Symbols



- Control sensitivity of .32 cm 0.0003 bar (0.125 in, 0.005 psig) water column allows use in precision applications
- Balanced supply valve minimizes effects of vacuum variation
- Aspirator tube compensates for downstream pressure droop under flow conditions
- Separate control chamber isolates the diaphragm from the main flow to eliminate hunting and buzzing
- Construction allows servicing without removing from the line

Order Code for Ordering:

Port size	Description	Flow‡ dm³/s (scfm)	Height mm (inches)	Width mm (inches)	Depth mm (inches)	Part number
1/4"	0 to 30 Hg	1,41 (3)	151,9 (5.96)	76,2 (3.00)	76,2 (3.00)	**P3RA17132NNKN**

‡ dm³/s (scfm) = @ 650 torr supply, 250 torr setpoint

Options:

P3RA171 3 2 N N K N

Pressure range	
0 to 30 Hg	3

Pipe Size	
1/4 inch	2

Thread Type	
NPT	N

Options	
N	Non-relieving

Options	
K	Knob assembly

Options	
N	Nitrile

Note: Other spring ranges, port sizes, and options available. Please consult factory

Standard order code shown in bold.

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Specifications

Flow capacity‡	1,41 dm³/s (3 scfm)
Ambient temperature	-40°C to 93°C (-40°F to 200°F)
Sensitivity	0,32 cm 0,0003 bar, (0.125 in 0.005 psig)
Vacuum supply effect	Less than 1 torr for 100 torr (.04 Hg for 3.94 Hg) change in vacuum supply
Port size	1/4"
Gauge ports (2)	1/4 NPTF
Weight	0,74 kg (1 lb 10 oz)

‡ bar (scfm) @ 650 torr supply, 250 torr setpoint

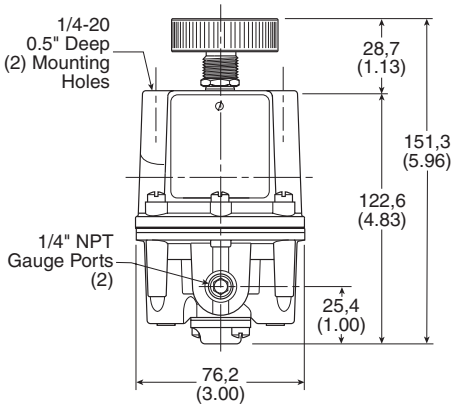
Material Specifications

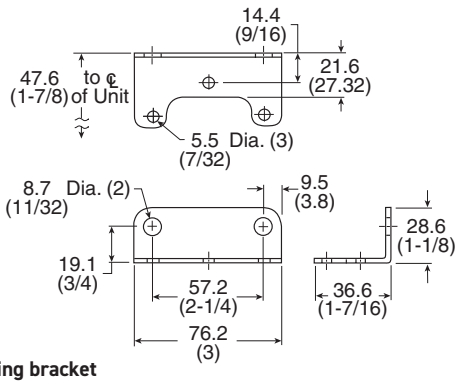
Body and housing	Aluminum
Trim	Zinc plated steel, brass
Elastomers	Nitrile

Repair and Service Kits

Service kits – (includes diaphragm assy, valve assy, seat assy & gasket) 0-30" Hg, nitrile, non-relieving	**PS20966-9**
Tamper resistant kit	**PS20967-1**
Mounting bracket	**PS09921**

Dimensions mm (inches)

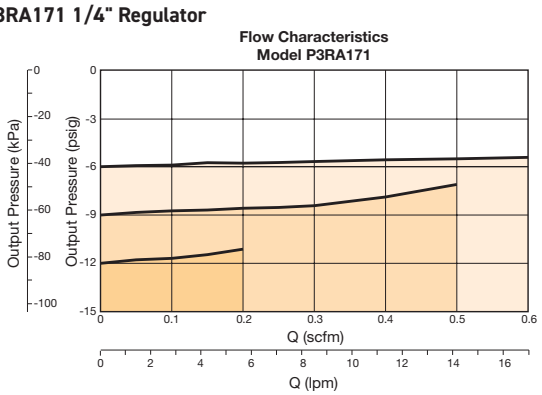


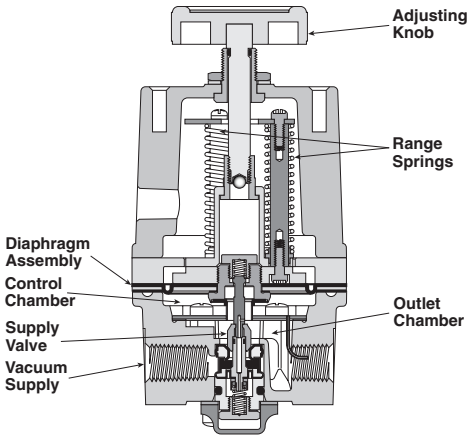


Mounting bracket

Flow Charts

P3RA171 1/4" Regulator





Operating Principles

The Model P3RA171 Series vacuum regulator uses the force balance principle to control the movement of the Valve Assembly that controls output vacuum.

When the regulator is adjusted for a specific set point, the upward force of the Range Springs moves the Diaphragm Assembly upward. The Supply Valve opens and allows air to pass to the inlet port. As the set point is reached, the upward force exerted by the Range Springs is balanced by the force of the vacuum that pulls downward on the Diaphragm Assembly. The resultant force moves the Supply Valve downward to reduce the flow of air to the inlet port. Outlet vacuum is maintained as a result of balance between forces acting on the top and bottom of the Diaphragm Assembly.

⚠ WARNING

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Do not connect regulator to bottled gas.
Do not exceed Maximum primary pressure rating.

CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.

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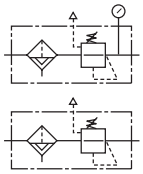
P3EA632 Precision Filter / Regulator

Symbols



- The no-brass construction is well suited to harsh environments
- Internal and external epoxy finish for superior corrosion resistance
- Non-bleed design to reduce consumption
- Integral relief valve
- A gauge port provides convenient pressure gauge mounting
- The standard 5-micron filter minimizes internal contamination
- The filter dripwell contains a drain plug to easily drain trapped liquids
- Standard tapped exhaust
- Soft relief seat minimizes air loss

Order Code for Ordering:

BSPP Port size	Description	Flow ‡ dm³/s (scfm)	Height mm (inches)	Width mm (inches)	Depth mm (inches)	Part number
1/4"	0,07 to 4,1 bar (1 to 60 psig)	11,75 (25)	209 (819)	71,9 (2.83)	71,9 (2.83)	**P3EA63242US**
1/4"	0,14 to 8,3 bar (2 to 120 psig)	11,75 (25)	209 (819)	71,9 (2.83)	71,9 (2.83)	**P3EA63252US**

‡ dm³/s (scfm) = (42,5 m³/HR) @ 7 bar (100 psig), (700 kPa) supply and 1,4 bar (20 psig), (150 kPa) setpoint

Options:

P3EA632 [ ] **2** [ ] [ ] [ ]

Pressure Range	
0 to 1,7 bar (0 to 60 psig)	4
0,14 to 8,3 bar (2 to 120 psig)	5

Pipe	
1/4 inch	2

Thread	
NPT	N
BSPP	U

Adjustment	
S	Screw (std)
K	Knob
T	Tamperproof

Options	
Blank	None

Note: Other spring ranges, port sizes, and options available. Please consult factory

Standard order code shown in bold.

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Specifications

Flow capacity ‡	11,75 dm³/s ANR (25 scfm)
Exhaust capacity †	0,376 dm³/s ANR (0.8 scfm)
Temperature range	-40°C to 160°C (-40°F to 71°F)
Max supply pressure	17,2 bar (250 psig), (1700 kPa)
Sensitivity	1.0" (2.54 cm) (0.36 psig)
Consumption	Undetectable
Supply pressure effect ◊	Less than 0,09 bar (1.25 psig), (9 kPa)
Gauge ports (1)	1/4"

‡ dm³/s (scfm) = (42,5 m³/HR) @ 7 bar (100 psig), (700 kPa) supply and 1.4 (20 psig), (150 kPa) setpoint

† dm³/s (scfm) = (1,36 m³/HR) where downstream pressure is 0,34 bar (5 psig), (35 kPa) above 1,4 bar (20 psig), (150 kPa) setpoint (0.8 SCFM for 120 # unit)

◊ change for 7 bar (100 psig), (700 kPa) change in supply pressure (0,13 bar, 1.90 psig for 120 # unit)

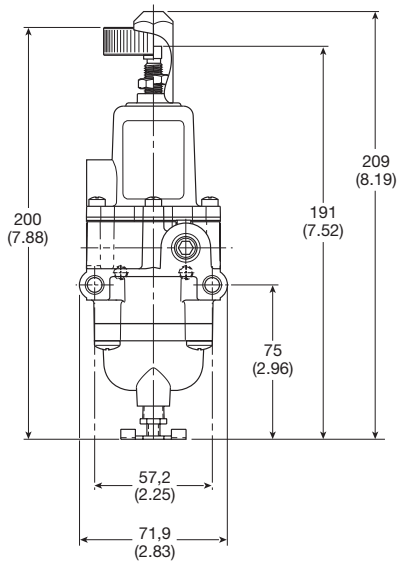
Material Specifications

Body and housing	Epoxy coated, aluminum
Trim	Stainless steel, nickel plated steel
Elastomers	Nitrile

Repair and Service Kits

0,07 to 41 0.14 to 8,3 bar (1 to 60, 2 to 120 psig)	**PS19968-NR**
Tamper resistant kit	**PS12165**

Dimensions mm (inches)



⚠ WARNING

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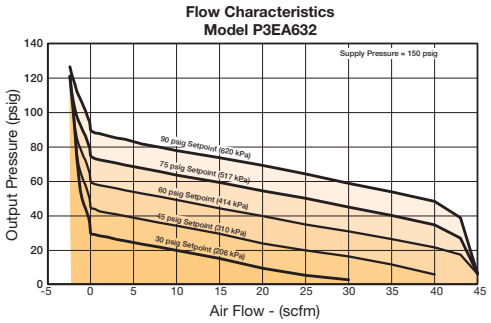
Do not exceed Maximum primary pressure rating.

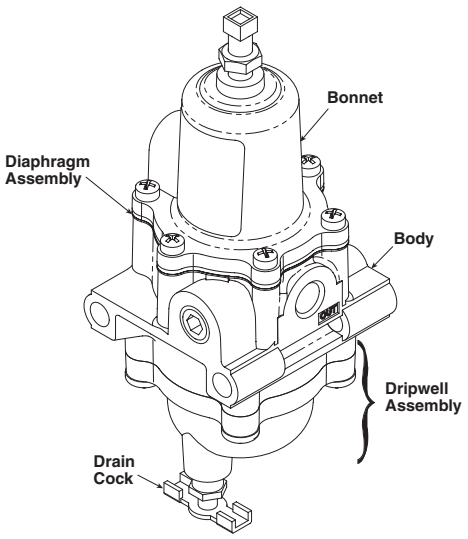
CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.

Flow Charts

P3EA632 1/4" Filter / Regulator





Operating Principles

When you turn the Adjustment Screw to a specific setpoint, the Spring exerts a downward force against the top of the Diaphragm Assembly. This downward force opens the Supply Valve. Output pressure flows through the Outlet Port and the passage to the Control Chamber where it creates an upward force on the bottom of the Diaphragm Assembly.

When the setpoint is reached, the force of the Spring that acts on the top of the Diaphragm Assembly balances with the force of output pressure that acts on the bottom of the Diaphragm Assembly and closes the Supply Valve.

When the output pressure increases above the setpoint, the Diaphragm Assembly moves upward to close the Supply Valve and open the Exhaust Valve. Output pressure flows through the Exhaust Valve and out of the Exhaust Vent on the side of the unit until it reaches the setpoint.

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R210 / R220 High Precision Regulator

The R210 / R220 are high precision, multi-stage pressure regulators. This pressure controller provides the highest level of regulation accuracy and repeatability available and is ideal for applications that call for the utmost in control and maximum stability under variable operating conditions.

A stainless steel measuring capsule is used as a sensing element to activate the high gain servo balanced control mechanism in which the main valve is controlled by a pilot valve. This allows for greater accuracy and eliminates many of the problems associated with conventional regulators using range springs and diaphragms.

Symbols

- Accurate pressure regulation controls output pressure to within 0.1% accuracy
- Multi-stage regulation for maximum control and stability
- Two full flow gauge ports
- Super sensitive relief. Downstream pressure buildup, down to 0,0003 bar (0.005 psig) above the set pressure, is automatically vented through internal relief valve
- R220 has high exhaust relief capacity

Applications

The R210 and R220 regulators are well suited for any process that requires very precise regulation of air pressure in pipes and vessels. These regulators are often used, but not limited to the following applications:

- Air gauging
- Gas mixing
- Calibration standards
- Air hoists
- Web tensioning
- Gate actuators
- Roll loading
- Valve operators
- Cylinder loading

Order Code for Ordering:

BSPP Port size	Description (Relieving Type)	Flow capacity ‡ dm^3/s (scfm)	Reduced pressure range bar (psig)	Height mm (inches)	Width mm (inches)	Depth mm (inches)	Part number
1/4"	Knob, Without Gauge	6,58 (14)	0,14 to 2,75 (2 to 40)	110 (4.38)	53 (2.10)	54 (2.16)	**R210G02A**
1/4"	Knob, Without Gauge	6,58 (14)	0,14 to 8,3 (2 to 120)	110 (4.38)	53 (2.10)	54 (2.16)	**R210G02C**
1/4"	Knob, High Relief, Without Gauge	6,58 (14)	0,14 to 8,3 (2 to 120)	110 (4.38)	53 (2.10)	54 (2.16)	**R220G02C**

‡ dm^3/s (scfm) = @ 7 bar (100 psig) supply, and 1,4 bar (20 psig), (150 kPa) outlet.

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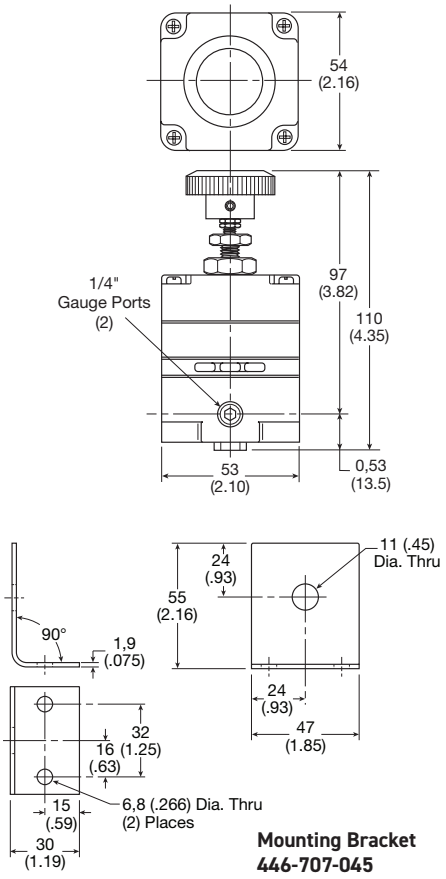
Specifications

Flow capacity‡		6,58 dm³/s (14 scfm)
Operating pressure range Primary – maximum		10,3 bar (150 psig)
Secondary, spring pressure 40 psig	Minimum Maximum	0,14 bar (2 psig) 3 bar (40 psig)
120 psig	Minimum Maximum	0,14 bar (2 psig) 8,3 bar (120 psig)
Operating temperature range * temperatures below 0°C (32°F) require moisture free air.		-18°C * to 65°C (0°F* to 150°F)
Repeatability / sensitivity		0,0003 bar (0.005 psig) inches of water column = 1/8"
Constant bleed rate		less than 0,15 m³/hr (0.08 scfm) (equals bleed rate plus other consumption)
Total air consumption		0.21 m³/hr (6 scfh)
Effect of supply pressure variation of 1.7 bar (25 psig) on outlet: less than 0,0003 bar (0.005 psig)		
Exhaust (relief) capacity at 0,34 bar (5 psig) above 1,38 bar (20 psig) setpoint		
Standard model		3,4 m³/hr (3 scfm)
High-relief model		17 m³/hr (11 scfm)
Gauge ports (can be used as additional full flow 1/4" outlet ports)		1/4"
Weight		0,64 kg (1.4 lb)

‡ m³/hr (scfm) = @ 7 bar (100 psig) supply, and 1,4 bar (20 psig), (150 kPa) outlet

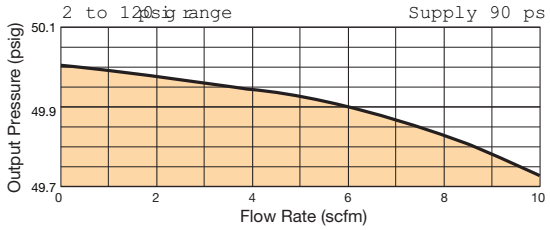
Dimensions mm (inches)

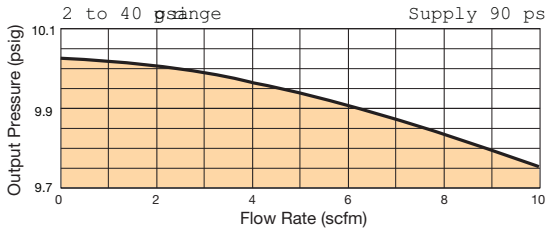


Mounting Bracket
446-707-045

Flow Charts

R210 / R220 1/4" Regulator





Material Specifications

Adjusting stem & capsule	Stainless steel
Body	Zinc
Control knob	Plastic
Diaphragm(s)	Buna-N
Seals	Buna-N
Springs	Stainless steel
Valve poppet	Stainless steel

Repair and Service Kits

Mounting bracket kits –	Pipe mounting (pair)	**SA200YW57**
	Right angle mounting	**446-707-045**
Service kits –		
0,14 to 3 bar (2 to 40 psig)		**RKR210A***
0,14 to 8,3 bar (2 to 120 psig)		**RKR210C***
0,14 to 8,3 bar (2 to 120 psig) [high relieving]		**RKR220C***

* Parts in kit: diaphragm, gasket, bleed orifice

⚠ WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed Maximum primary pressure rating.

CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.

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R230 High Flow Precision Regulator

The R230 is designed for applications that require high flow capacity and accurate process control. A poppet valve which is balanced by utilizing a rolling diaphragm, insures a constant output pressure even during wide supply pressure variations. Stability of regulated pressure is maintained under varying flow conditions through the use of an aspirator tube which adjusts the air supply in accordance with the flow velocity.

Symbols

- Adjusting knob
- Diaphragm design for good repeatability, response and sensitivity
- Balanced poppet
- Two full flow gauge ports
- Precise regulation will sense a decrease in downstream pressure as small as 1/4" of water column (0.010 psig)
- High flow capacity, flows of 80 scfm attainable with minimal drop
- Stable output, dampening action of aspiration tube makes regulator insensitive to changes in flow
- On-line maintenance. Can be serviced without removal of air line

Applications

The R230 regulators are an ideal choice for any application that calls for accurately maintained output pressure under high flow conditions. This includes, but is not limited to such applications as:

- Test equipment
- Gas mixing
- Valve operators
- Positioning cylinders
- Laboratory equipment
- Web tensioning
- Clutch & brake controls
- Roll loading
- Test panels
- Actuators

Order Code for Ordering:

BSPP Port size	Description (Relieving type)	Flow capacity ‡ dm^3/s (scfm)	Reduced pressure range bar (psig)	Height mm (inches)	Width mm (inches)	Depth mm (inches)	Part number
1/4"	Knob, Without Gauge	37,6 (80)	0 to 0,14 (0 to 2)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G02E**
1/4"	Knob, Without Gauge	37,6 (80)	0 to 2,1 (0 to 30)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G02B**
1/4"	Knob, Without Gauge	37,6 (80)	0 to 4,1 (0 to 60)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G02C**
1/4"	Knob, Without Gauge	37,6 (80)	0 to 10,3 (0 to 150)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G02D**
3/8"	Knob, Without Gauge	37,6 (80)	0 to 2,1 (0 to 30)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G03B**
3/8"	Knob, Without Gauge	37,6 (80)	0 to 4,1 (0 to 60)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G03C**
3/8"	Knob, Without Gauge	37,6 (80)	0 to 10,3 (0 to 150)	154 (6.06)	76 (3.00)	76 (3.00)	**R230G03D**

‡ dm^3/s (scfm) = @ 7 bar (100 psig) supply, and 5,5 bar (80 psig) outlet

Parker Hannifin Corporation
Electric Motion and Pneumatic Division - Europe

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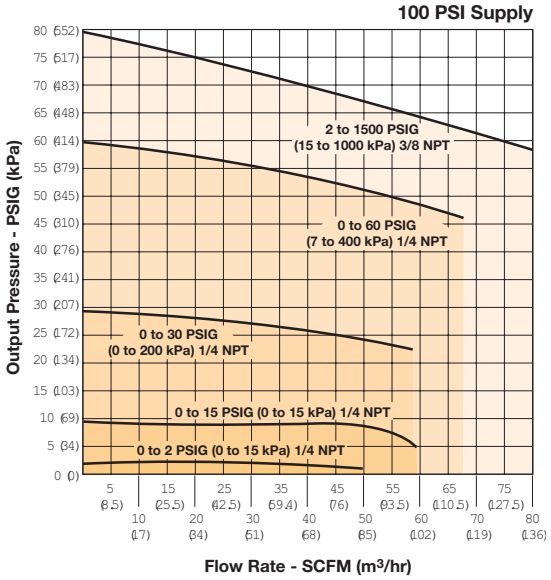
Specifications

Flow capacity ‡	37,6 dm³/s (80 scfm)
Operating temperature range -40°C to 71°C (-40°F to 160°F)	
Operating pressure range Primary – maximum	17,2 bar (250 psig)
Constant bleed rate	1.0 to 12.5 scfh (depending upon output pressure)
Gauge ports (2) (can be used as additional full flow 1/4" outlet ports)	1/4" NPTF
Repeatability / sensitivity	±0,00068 bar (±0.010 psig) inches of Water Column = 1/4"
Response (the valve will open to full flow and fill a volume of 1250 cm³)	250 ms
Effect of supply pressure variation	less than 0,006 bar (0.1 psig) for 7 bar (100 psig) change
Exhaust (relief) capacity with downstream pressure 0.34 bar (5 psig) above set pressure.	1,88 dm³/s (4 scfm)
Exhaust commences at 0.0007 bar (0.01 psig) above set pressure.	
Port Threads	1/4"
Exhaust (relief) capacity (downstream pressure 0.34 (5 psi) above set pressure)	1,88 dm³/s (4 scfm)
Weight	0,74 kg (1 lb 10 oz)

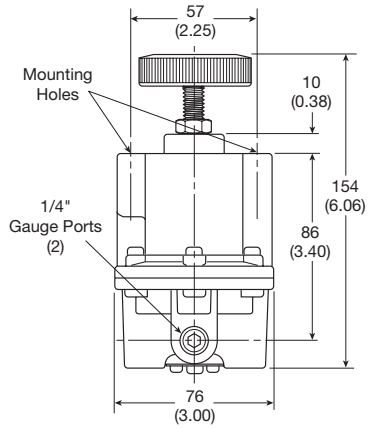
‡ dm³/s (scfm) = @ 7 bar (100 psig) supply, and 5,5 bar (80 psig) outlet

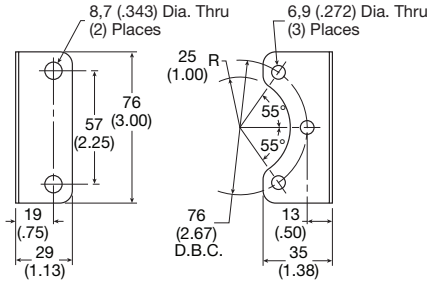
Flow Charts

R230 Regulator



Dimensions mm (inches)





Mounting Bracket 446-707-025

Material Specifications

Adjusting stem & spring	Steel
Biased spring	Stainless steel
Body, bonnet	Aluminum
Control knob	Plastic
Diaphragm	Buna-N elastomer and polyester fabric
Seals	Buna-N
Valve poppet	Brass
Valve poppet seat	Buna-N

Repair and Service Kits

Mounting bracket kit	**446-707-025**
Service kits, relieving	
0 to 0,14 bar (0 to 2 psig)	**RKR230E***
0 to 2,1 bar (0 to 30 psig)	**RKR230B***
0 to 4,1 bar (0 to 60 psig)	**RKR230C***
0 to 10,3 bar (0 to 150 psig)	**RKR230D***

* Parts in Kit: Diaphragm, Gasket, Bleed Orifice

⚠ WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed Maximum primary pressure rating.

CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.

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Parker Hannifin Corporation
Electric Motion and Pneumatic Division Europe
Robert-Bosch-Strasse 22
77656 Offenburg
Germany
www.parker.com

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