PCD

MARSH BELLOFRAM
Group of Companies

Electro-Pneumatic Servo Pressure Controllers

Electro-Pneumatic I/P, E/P, & P/I Transducers

Rolling Diaphragm Regulators & Relays

Rolling Diaphragm Cylinders

Filter-Regulator-Lubricators

Precision Control Devices

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Type 10
Pressure Regulator Series

Features

Highly Accurate Pressure Regulation

The Bellofram Type 10 Regulator controls output pressure with an accuracy of 0.1%, and has very low sensitivity to changes in supply pressure and flow.

Start-Up Stability

The Type 10 Regulator has been designed to eliminate the need for any readjustment of the regulated pressure after long "down time." At start-up, the regulated pressure will return to its output setting.

Flow Stability

The regulated pressure is held constant over substantial changes in flow due to the high-gain pneumatic servo amplifier. Particularly good from dead end to 20 cubic meters per hour (12 SCFM).

Automatic High Downstream Relief Capacity

An integral relief valve provides for exhaust flow whenever the regulated pressure is reset to a lower value. The exceptionally large capacity of this relief valve assures immediate response when the downstream regulated pressure must be reduced under dead-end conditions.

Pressure Stability

A high performance servo-operated control mechanism is utilized in the regulator. The pressure supplied to the pneumatic servo amplifier is reduced and held constant.

Locking Capability

The standard Type 10 regulator has a locking nut which, when tightened, prevents inadvertent adjustment of pressure.

Temperature Stability

Shifts in the regulated pressure over wide ambient temperature variations are minimized by the use of a measuring capsule made of specially selected stainless steel alloys.

Proven Reliability

Thousands of Type 10 Regulators are in the field. Proof of the accuracy of the regulator is reflected by its use in most air gauging systems and other precision pressure control applications.

Mounting

The unit may be installed in any position. It can be panel mounted or supported by in-line plumbing.

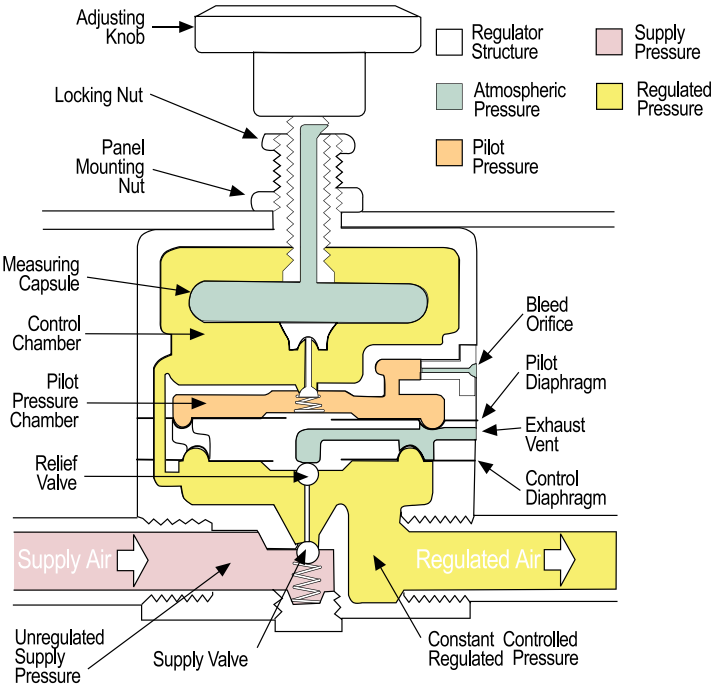
Applications

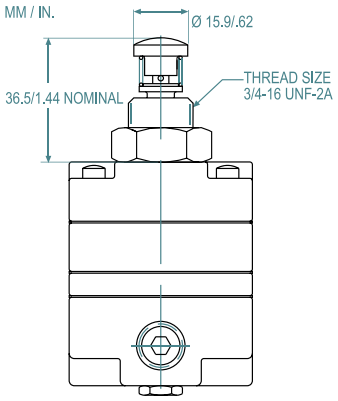
Industrial processes, inspection procedures, control and analytical instrumentation require precise regulation of air pressure in pipes and vessels. Maintaining constant pressures in these applications is usually complicated by the presence of numerous disturbances, such as changes in supply pressure, flow, and ambient temperature, that tend to upset prevailing conditions.

Bellofram Pressure Regulators provide accuracy, precision control, and maximum stability under the most adverse operating conditions.

Type 10 Pressure Regulator Applications

- Gas Mixing
- Valve Operators
- Gate Actuators
- Positioner Signal
- Calibration Stands
- Air Hoists
- Air Gauging
- Cylinder Loading
- Force Balance Hoists
- Disc and Shoe Air Brakes
- Clamp Units
- Web Tensioning
- Press Units
- Roll Loading





Plunger

Type 10PL

Plunger Operated Regulator

This reliable plunger operated regulator provides unmatched accuracy and repeatability. Regulated pressure is changed by direct linear actuation of the plunger instead of turning a knob.

Plunger Travel

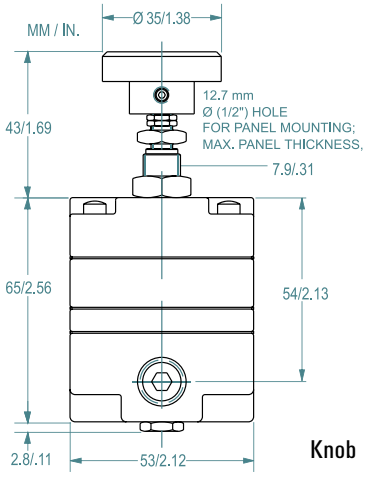
Pressure Range		Plunger Travel*	
BAR	psig	mm	inch
0.1–1.7	2-25	1.9	.075
0.1–4.1	2-60	2.3	.090
0.1–8.3	2-120	2.5	.100

*±10% manufacturing tolerance

Return Spring

0.4 in. (10mm) nominal return height; 7 oz. (200g) approximate preload force; 7.5 lb./in. (135g/mm) approximate spring rate, between 0.4 in. (10mm) and 0.24 in. (6.5mm) compressed height.

Plunger Knob Material: Steel



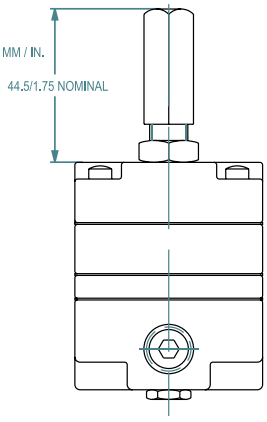
Knob

The basic Type 10 Regulator is offered with a choice of three port sizes and three output ranges.

Type 10HR & 10EXHR

High Relief Regulators

Similar in proven accuracy and rugged construction to other Type 10 Regulators, these units provide extra fast "blowdown" for very rapid release of down stream pressure. The extra relief feature makes these regulators suitable for cylinder return stroke actuation, air hoists, and similar applications requiring fast exhaust.



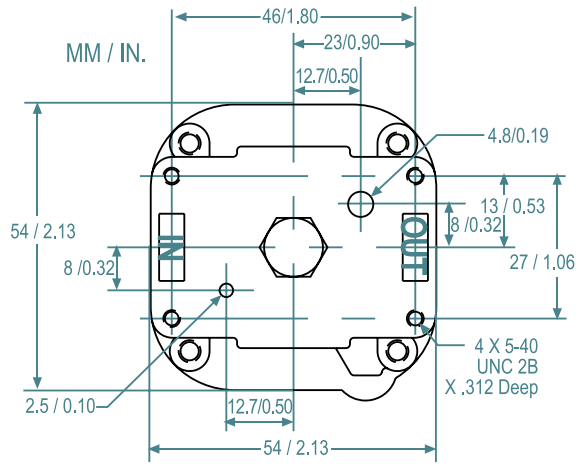
Tamper Resistant

The Type 10 Regulator is available with a tamper resistant cover, as illustrated. The cover is threaded over the adjusting screw to prevent inadvertent or unwarranted adjustment of output pressure.

Type 10LR

Low Range Regulator

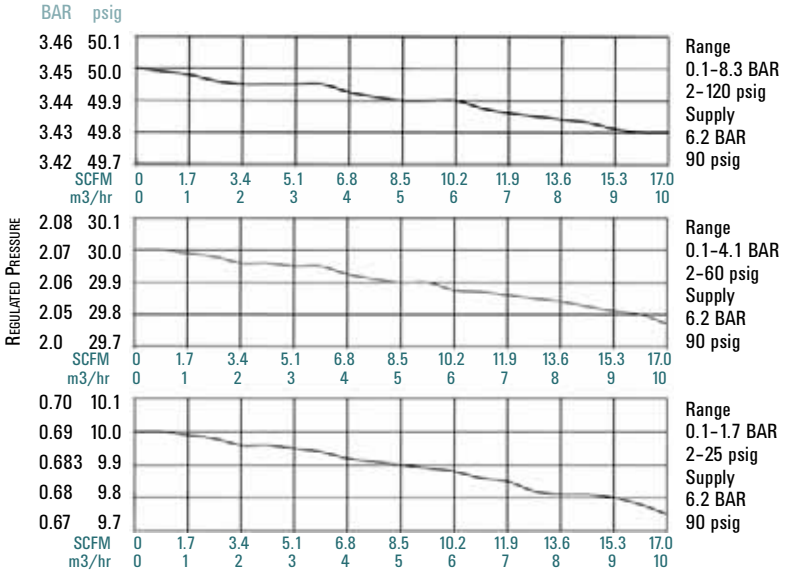
The main feature of the Type 10LR is its low-range pressure characteristic. It operates on a maximum of 50 psig / 3.4 BAR supply pressure and offers an output pressure range of 0.5 psig / 0.03 BAR to 25 psig / 1.7 BAR



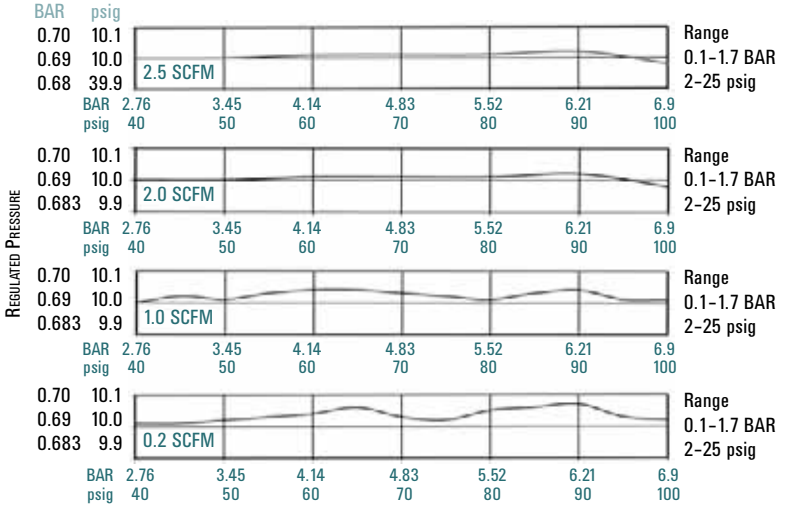
The Type 10 Regulator is also available with bottomp orts, (Type1 0BM) consult factory.

	Type 10LR	Type 10 / 10PL	Type 10 BM	Type 10HR	Type 10 EXHR	Type 10 HF	Type 10 Motorized
Maximum Supply Pressure	50 psig / 3.4 BAR	150 psig / 10.3 BAR	150 psig / 10.3 BAR	150 psig / 10.3 BAR	150 psig / 10.3 BAR	50 psig / 3.4 BAR	150 psig / 10.3 BAR
Pressure Ranges	.5-25 psig 0.03 - 1.7 BAR	2-25, 2-60, 2-120 psig 0.14-1.7, 0.14-4.1, 0.14-8.3 BAR	2-25, 2-60, 2-120 psig 0.14-1.7, 0.14-4.1, 0.14-8.3 BAR	2-120 psig 0.14-8.3 BAR	2-120 psig 0.14-8.3 BAR	2-25 psig 0.14-1.7 BAR	0.5-25, 2-25, 2-60, 2-120 psig 0.03-1.7, 0.14-1.7, 0.14-4.1, 0.14-4.1, 0.14-8.3 BAR
Port Sizes	1/4	1/8, 1/4, 3/8	N/A	1/8, 1/4, 3/8	1/8, 1/4, 3/8	3/8	1/8, 1/4, 3/8
Effect of Supply Pressure Variation on Outlet Pressure	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change	0.005 psig / 0.3 mBAR per 25 psig / 1.7 BAR change
Sensitivity	1/8" / 3.2mm of water	1/8" / 3.2mm of water	1/8" / 3.2mm of water	1/8" / 3.2mm of water	1/8" / 3.2mm of water	1/8" / 3.2mm of water	1/8" / 3.2mm of water
Bleed Rate	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM	4.8 scfh / 2.3 LPM
Forward Flow Capacity	4 scfm / 113 LPM	14 scfm / 396 LPM	3 scfm / 85 LPM	14 scfm / 396 LPM	14 scfm / 396 LPM	40 scfm / 1132 LPM	10 scfm / 283 LPM
Exhaust Capacity @ 5 psig (0.4 BAR) above setpoint	2 scfm / 56 LPM	2 scfm / 56 LPM	2 scfm / 56 LPM	10 scfm / 283 LPM	15 scfm / 424 LPM	2 scfm / 56 LPM	2 scfm / 56 LPM
Temperature Range	-20 to 160˚F -29 to 71˚C	-20 to 160˚F -29 to 71˚C	-20 to 160˚F -29 to 71˚C	-20 to 160˚F -29 to 71˚C	-20 to 160˚F -29 to 71˚C	-20 to 160˚F -29 to 71˚C	0 to 140˚F -18 to 60˚C
Effect of Changes in Flow on Regulated Pressure	N/A	0.25 psig / 0.01 BAR per 10 scfm / 283 LPM	N/A	0.25 psig / 0.01 BAR per 10 scfm / 283 LPM	0.25 psig / 0.01 BAR per 10 scfm / 283 LPM	0.25 psig / 0.01 BAR per 10 scfm / 283 LPM	0.25 psig / 0.01 BAR per 10 scfm / 283 LPM

Effect of Changes in Flow on Regulated Pressure



Effect of Upstream Pressure Variations on Regulated Pressure



Manual Type 10 Ordering Information

Type	Part Number	Port Size NPT	Control Range BAR	Control Range psig
10	960-001-000	1/8	0.1-1.7	2-25
	960-003-000	1/4	0.1-1.7	2-25
	960-005-000	3/8	0.1-1.7	2-25
10	960-007-000	1/8	0.1-4.1	2-60
	960-009-000	1/4	0.1-4.1	2-60
	960-011-000	3/8	0.1-4.1	2-60
10	960-013-000	1/8	0.1-8.3	2-120
	960-015-000	1/4	0.1-8.3	2-120
	960-017-000	3/8	0.1-8.3	2-120
10BM	960-126-000		0.1-1.7	2-25
	960-127-000	N/A	0.1-4.1	2-60
	960-128-000		0.1-8.3	2-120
10HR	960-028-000	1/8	0.1-8.3	2-120
	960-029-000	1/4	0.1-8.3	2-120
	960-030-000	3/8	0.1-8.3	2-120
10EXHR	960-072-000	1/8	0.1-8.3	2-120
	960-073-000	1/4	0.1-8.3	2-120
	960-074-000	3/8	0.1-8.3	2-120
10PL	960-019-000	1/8	0.1-1.7	2-25
	960-020-000	1/4	0.1-1.7	2-25
	960-021-000	3/8	0.1-1.7	2-25
10PL	960-022-000	1/8	0.1-4.1	2-60
	960-023-000	1/4	0.1-4.1	2-60
	960-024-000	3/8	0.1-4.1	2-60
10PL	960-025-000	1/8	0.1-8.3	2-120
	960-026-000	1/4	0.1-8.3	2-120
	960-027-000	3/8	0.1-8.3	2-120
10LR	960-053-000	1/4	0.03-1.7	0.5-25

Type 10 Motorized

Pressure Regulators

Bellofram's high precision Type 10 pressure regulator – a servo balanced system in which the main valve is operated by a pilot valve – is also available in a motorized configuration. This combination is particularly attractive because it offers low power requirements (2 rpm/4 watts; 6 rpm/6 watts) with extremely high accuracy.

Applications

The motorized Type 10 pressure regulator can be used for any application where electric control of a pneumatic system is desired. It is often used for remote pressure control and for ventilation systems. It can also be easily integrated into open or closed loop process control systems and may be used with programmable controllers.

Features

- Mountable at any angle
- In the event of power failure, the pneumatic output remains constant at last setting
- Low electrical power requirements
- Adjustable mechanical stop limits maximum output pressure
- No electrical power is required when operating at constant output pressure
- No pre-regulation of supply pressure required
- Built-in overload slip clutch prevents damage to gear train at end of travel, eliminating the need for limit switches in most applications.

Construction

The regulator and motor are mounted to a bracket and connected to each other through a flexible coupling. The assembly can be mounted through holes in the bracket.

Motor Specifications

Reversible, synchronous motor with gear drive and slip clutch.

Operating Voltage 110VAC, 24VAC, 24VDC or 220VAC.

Frequency

60 Hz, Except 220 VAC model is 50 Hz.

Power Consumption (maximum)

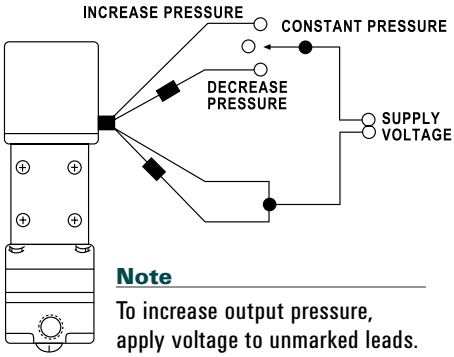
2 rpm/4 watts, 6 rpm/6 watts.

Speeds Available 2 and 6 rpm.

Torque Approx. 8 in. oz.

Typical Installation

Control Circuit Diagram



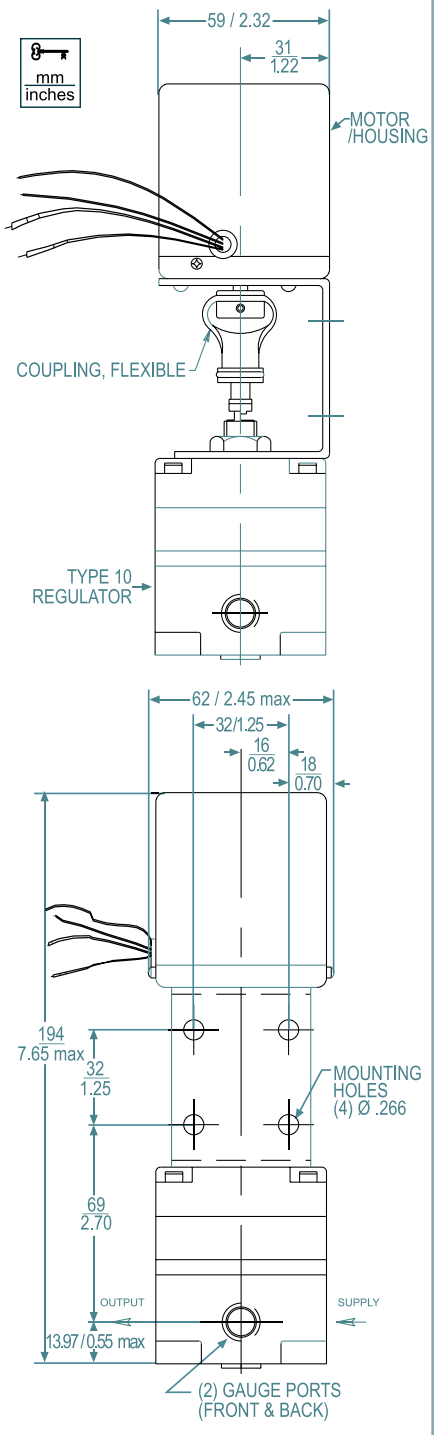
Note

To increase output pressure, apply voltage to unmarked leads. To decrease output pressure, apply voltage to marked leads.

Regulator-Motor Specifications

Pressure Range		Approximate Time to Cover Full Range (seconds)	
BAR	psig	2 rpm	6 rpm
0.1-1.7	2-25	75	25
0.1-4.1	2-60	90	30
0.1-8.3	2-120	150	50

*±10% manufacturing tolerance



Drawings and dimensions are for reference only.

Motorized Type 10 Ordering Information

9 6 0 - 1 8 0 -

				Motor Specifications
1			2 RPM	110 VAC 4 WATTS 60 Hz
2			6 RPM	110 VAC 6 WATTS 60 Hz
3			6 RPM	220 VAC 6 WATTS 50 Hz
4			2 RPM	24 VAC 4 WATTS 60 Hz
5			6 RPM	24 VAC 6 WATTS 60 Hz
6			6 RPM	24 VDC
				Pressure Range
	1		2-25 psig / 0.1-1.7 BAR	
	2		2-60 psig / 0.1-4.1 BAR	
	3		2-120 psig / 0.1-8.3 BAR	
	4		L. R. Model, 0.5-25 psig / 0.03-1.7 BAR	
	5		H.R. Model, 2-120 PSI / 0.1-8.3 BAR	
				Port Size
		1	1/8 NPT	
		2	1/4 NPT	
		3	3/8 NPT	

Type 110

Pressure Regulator Series

Features

- Highly Accurate Pressure Regulation
- Large Port Sizes Available:
  3/8, 1/2, 3/4 and 1 NPT
  (BSPP and BSPT also Available)
- Adjustment Stem Locking Capability
- High Forward Flow Capacity – 150+ SCFM
- High Exhaust Capacity
- Balanced Supply Valve
- Low Sensitivity to Supply Pressure Variations
- Low Sensitivity to Flow Variations

Applications

The Type 110 was developed specifically for use with Air Balancing Systems or Zero-Gravity Arms. Such systems require very small forward to reverse flow offsets for smooth operation. The precision regulators that can achieve the sensitivity requirements do not typically possess the forward or exhaust capacity to handle large balancing arms or cylinders. The Type 110 does not have this limitation. It is ideal for use in any application where precise regulation of pressure is required along with high flow or high exhaust capacity.

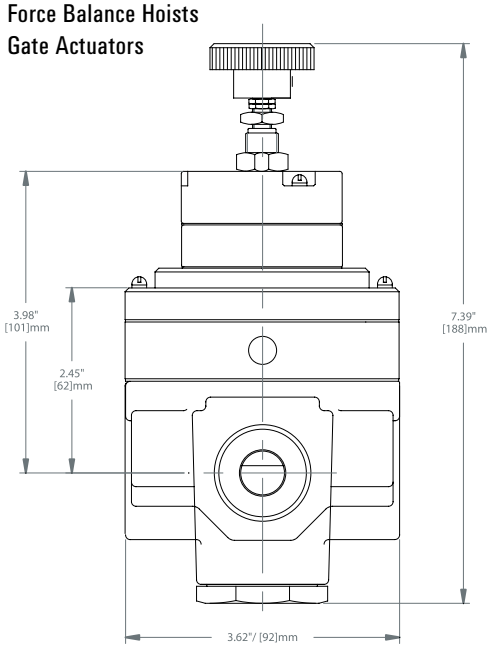
Other typical applications

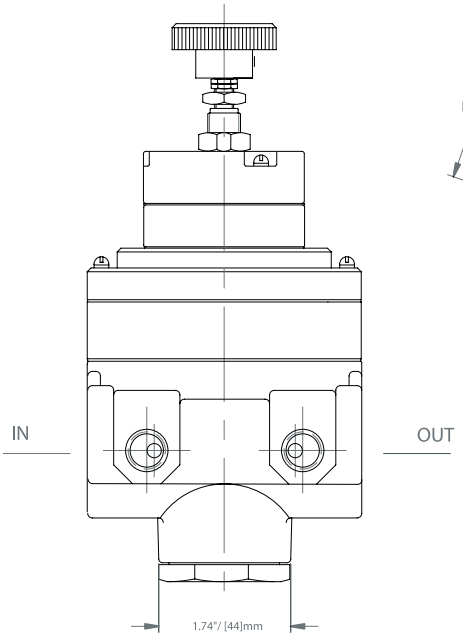
- Valve Operators
- Air Hoists
- Web Tensioning
- Roll Loading
- Large Cylinder Loading
- Air Brakes
- Force Balance Hoists
- Gate Actuators

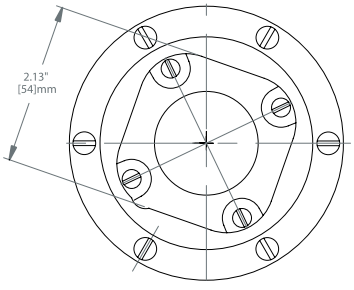
Description

The Type 110 combines the proven technology of the Marsh Bellofram Type 10 regulator with the large pneumatic booster of the Type 79 Relay. The result is a precise, crisply responding regulator that can achieve very large forward and exhaust flows. Forward to reverse flow offset is minimized by the capsule operated, servo-control system located in the upper portion of the regulator. This servo-control system supplies a pilot pressure to the large integral pneumatic booster. The large supply and exhaust orifices of the integral booster enable this regulator to produce very high forward and exhaust flow rates. Few regulators can offer this combination of sensitivity and large flow capacity.

As with all of the Type 10 regulators, the stainless steel measuring capsule is the "heart" of the Type 110 Pressure Regulator. Originally developed for sensitive aircraft altimeters, this precision-sensing element provides the energy to activate the servo-control mechanism. It provides greater regulation and accuracy while eliminating the problems usually encountered with range springs and conventional diaphragms. Because of the balanced supply valve in the integral pneumatic booster, the Type 110 can work with higher supply pressures (250 PSIG) than many other regulators.







	Type 110
Maximum Supply Pressure	250 PSIG / 17.2 BAR
Output Pressure Ranges	2-25 PSIG / 0.14-1.7 BAR 2-50 PSIG / 0.14-3.5 BAR 2-110 PSIG / 0.14-7.6 BAR
Port Sizes	3/8, 1/2, 3/4, 1 NPT, BSPT or BSPP
Effect of Supply Pressure Variation on Outlet Pressure	0.01 psig / 0.6 mBAR change in output for a 25 psig/1.7 BAR change in supply pressure
Sensitivity	1/4" / 6.4 mm of water column
Air Consumption	14 scfh / 6.6 slpm @ max output pressure
Forward Flow Capacity (100 psig/ 6.9 BAR supply, 20 psig / 1.4 BAR set point)	3/8 NPT - 110 SCFM+ / 3105 SLPM 1/2 NPT - 110 SCFM+ / 3105 SLPM 3/4 NPT - 200 SCFM+ / 5645 SLPM 1 NPT - 200 SCFM+ / 5645 SLPM
Exhaust Capacity (based on raising output 5 psig / .34 BAR above 20 psig / 1.4 BAR set point)	30 scfm / 847 slpm
Temperature Range	-20˚ to +160˚F -29˚ to +71˚C
Weight	5.4 lbs / 2.45 Kg

Type 110 Ordering Information

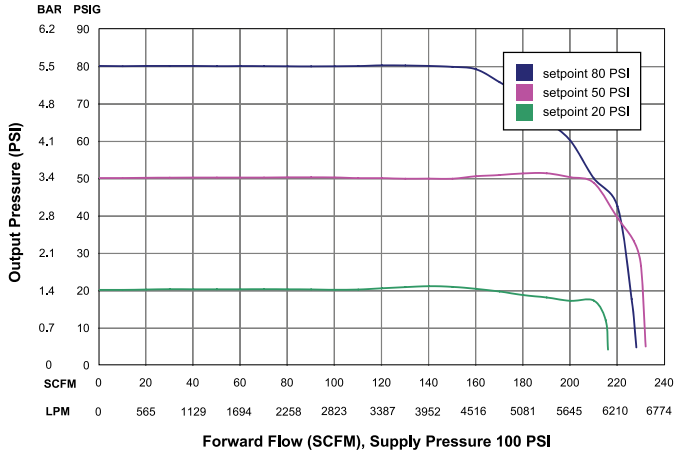
	Part Number	Port Size (NPT)	Pressure Ranges	
			BAR	psig
T110	960-510-000	3/8	0.1-1.7	2-25
	960-511-000		0.1-3.5	2-50
	960-512-000		0.1-7.6	2-110
	960-513-000	1/2	0.1-1.7	2-25
	960-514-000		0.1-3.5	2-50
	960-515-000		0.1-7.6	2-110
	960-516-000	3/4	0.1-1.7	2-25
	960-517-000		0.1-3.5	2-50
	960-518-000		0.1-7.6	2-110
	960-519-000	1	0.1-1.7	2-25
	960-520-000		0.1-3.5	2-50
	960-521-000		0.1-7.6	2-110

For BSPT or BSPP pipe threads, add BSPT or BSPP to the end of the part number. For mounting bracket, order P/N 607-293-000

Type 110 Materials of Construction

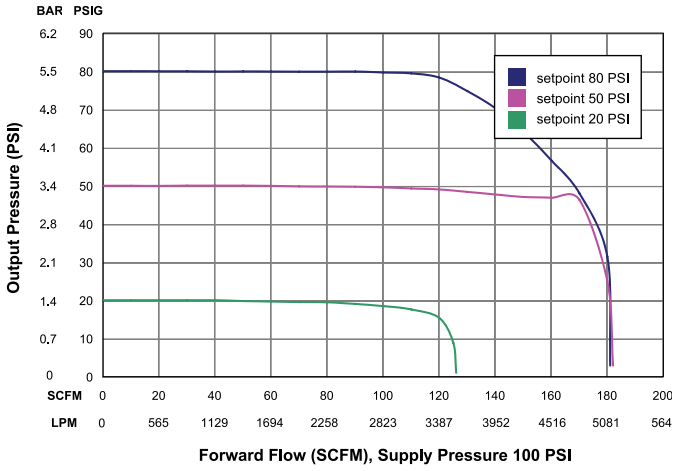
Body, bonnet and housing	Die Cast Zinc Alloy
Capsule and adjustable screw	Stainless Steel
Spacer	Aluminum
Diaphragm	Nitrile Elastomer and Polyester Fabric
Trim	Stainless Steel, Brass, Plated Steel, Acetal
Knob	Phenolic Plastic

Type 110: Forward Flow Curve, 3/4 and 1 NPT

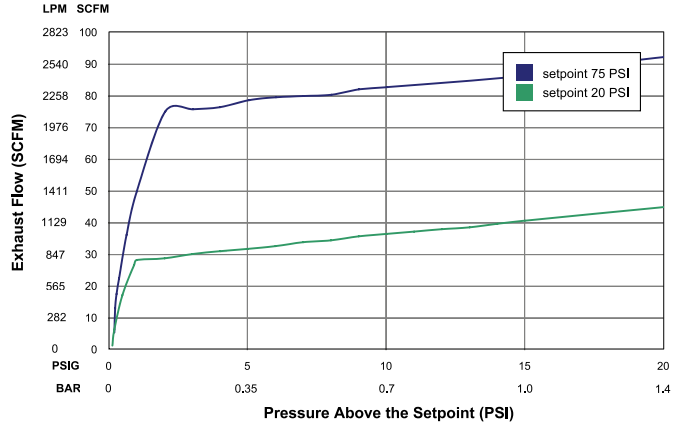


Type 110: Forward Flow Curve, 3/8 and 1/2 NPT

@ 100 PSIG Supply Pressure



Type 110: Exhaust Curve



Type 40

Pressure Regulator Series

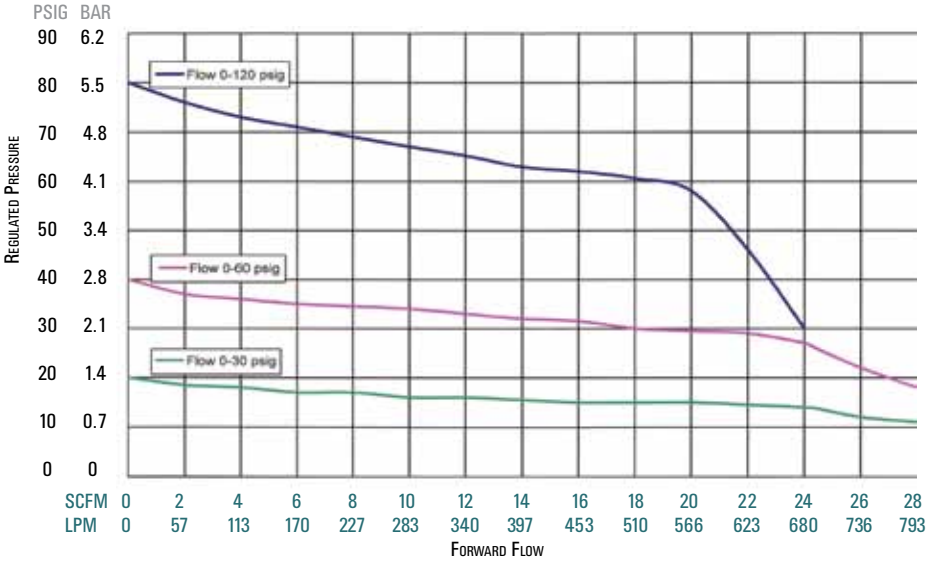
Features

- Superior regulation characteristics
- Rugged, corrosion resistant construction
- Low cost
- Excellent stability and repeatability
- Self-relieving
- Low droop at high flow
- Several mounting options

Type 40 Specifications

Sensitivity	1" Water Column (2.5 cm)
Flow Capacity @ 100 psig (6.9 BAR) Supply and 20 psig (1.4 BAR) outlet	20 SCFM (566 LPM)
Effect of Supply Pressure Variation (25 psig/1.7 BAR) on Outlet Pressure	Less than 0.2 psig (0.01 BAR)
Exhaust Capacity 5 psig (0.35 BAR) above 20 PSIG set point	0.1–0.45 SCFM Typical 2.8 - 12.7 LPM
Max Supply Pressure	250 PSIG (17.2 BAR)
Effect of Changes in Flow on Regulated Pressure (100 psig / 6.9 BAR Supply)	2 PSIG over flow of 10 SCFM / 283 LPM (0-30 PSIG / 0-2.1 BAR range 1/4 NPT, 20 PSIG / 1.4 BAR set point)
Output Pressure Ranges	0-10 PSIG (0-0.7 BAR) 0-35 PSIG (0-2.4 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)
Temperature Range	0-160˚F (-18 to 71˚C)
Total Air Consumption @ Maximum Output	6 SCFH (2.8 LPM)
Port Size	1/4 NPT, BSPT
Materials of Construction	Body: Die cast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated steel, brass, acetal resin Diaphragm: Buna-N elastomer and polyester fabric Knob: Phenolic Plastic (option) Spring: Music wire
Tamper Resistant Cover	Optional
Mounting Options	Pipe, Panel or Bracket

Type 40: Regulated Pressure VS. Flow



Description

Marsh Bellofram's General Purpose Type 40 Pressure Regulator is a reliable precision unit designed for instrumentation and general purpose use.

Test data for the Type 40 regulator shows excellent performance characteristics compared with those of similar units presently on the market. The Type 40 regulator is generally superior in regulated pressure vs. flow, forward-to-reverse flow offset, supply pressure sensitivity, repeatability and stability.

Ruggedly designed and constructed, the Type 40 has housings of diecast aluminum. Every regulator is finished with vinyl paint (which resists scratching, weathering and other physical abuse) and is pressure and leak tested prior to shipment from the factory. Careful design and quality materials throughout assure long, trouble-free operation in the most difficult industrial environments. A rubberized, soft-seat valve stem provides positive shut-off and "forgives" dirt or other foreign matter. An aspirator maintains downstream pressure and compensates for droop when high flow occurs. The gauge port is convenient for gauge installation and can also be used as an additional full flow outlet.

The Type 40 regulator has a 60-mesh 304 stainless steel screen to block foreign particles from entering the output stream. The design of these regulators is especially well suited to pilot-operated controllers and instruments, as well as applications such as air chucks, air spray guns, air cylinders and actuators, and a wide range of industrial pneumatic systems and equipment.

Type 40 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range	
			BAR	psig
T40	960-063-000	1/4	0-0.7	0-10
	960-064-000		0-2.4	0-35
	960-065-000		0-4.1	0-60
	960-066-000		0-8.3	0-120

Type 40 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	3	5	6	7	8	9	10	11
1	Fluorocarbon Pintle	001	021	031	051	061	071	081	091	101	111
2	Non-Relieving		002	032	052		072	082	092		112
3	Knob			003	053	063	073	083		103	113
5	Epoxy Finish				005	065	075	085	095	105	115
6	Tapped Vent					006	076	086	096	106	116
7	Mounting Bracket						007	087	097	107	117
8	Pressure Gauge							008	098	108	118
9	Tamper-Resistant Cover								009	109	119
10	Soft Relief Seat									010	110
11	Fluorocarbon Diaphragm										011

To order BSPT threads (including the gauge port) add "BSPT" to end of part number.

Fluorocarbon Pintle

A special elastomeric pintle used where elements in the supply air, such as flame retardant synthetic lubricants, are particularly destructive to ordinary pintle material.

Non Relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications, and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the body and bonnet of the regulator exterior surfaces to provide increased corrosion resistance.

Mounting Bracket

Steel (dichromate finish) bracket for side mounting. P/N: 607-000-057

Knob

Option to replace the square head pressure adjusting screw.

Tapped Vent

Allows installation of plumbing to capture exhaust air.

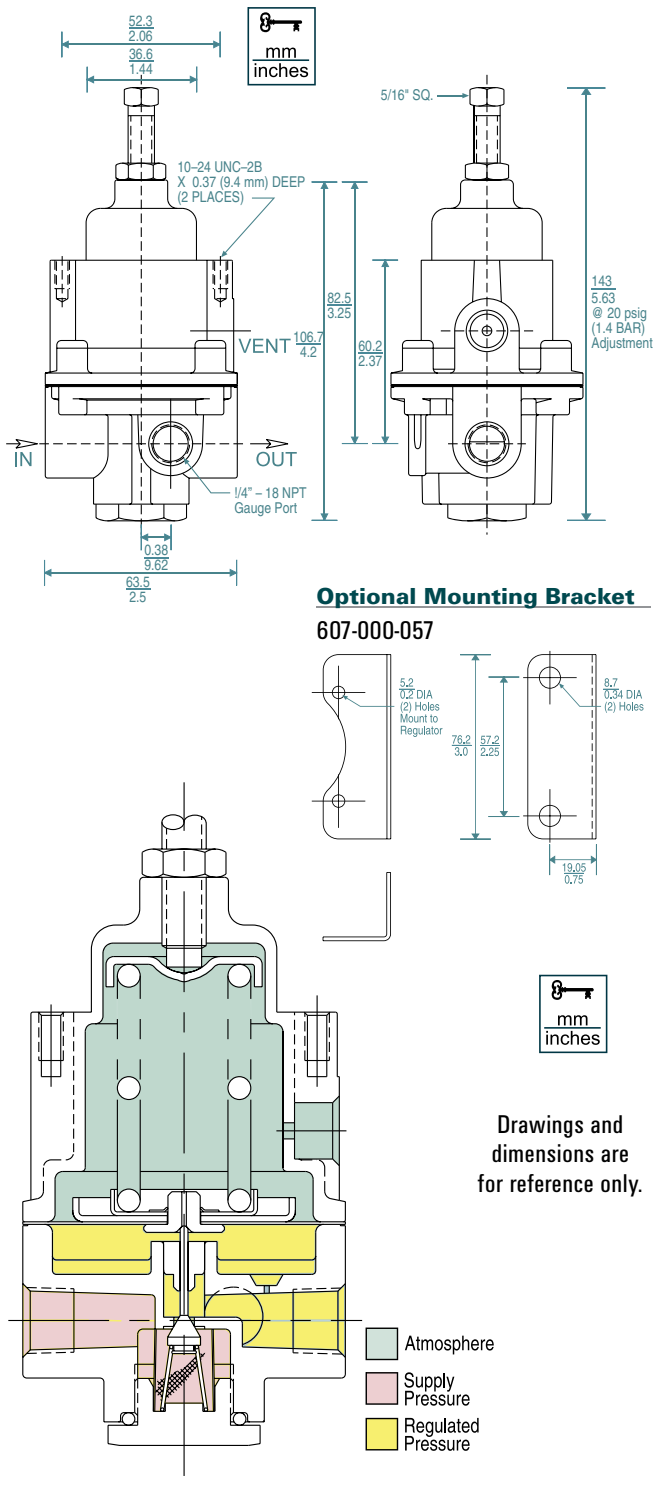
Pressure Gauge

Dual scale 2 in. (50.8 mm) gauges. Ranges include 0-30 psig (0-200 kPa), 0-60 psig (0-400 kPa), 0-100 psig (0-700 kPa) and 0-160 psig (0-1100 kPa). When specified with regulator, the correct range will be supplied. For NPT versions only.

Tamper Resistant Cover

An aluminum tubular cover placed over a slotted head adjusting screw and screwed onto the bonnet of the regulator with a wrench. Prevents ordinary hand adjustments.

Type 40 Dimensional Drawing



Soft Relief Seat

Used in applications where it is desirable to reduce the standard bleed rate from 6 SCFH [0.17 m^3hr] to less than 0.1 SCFH [0.003 m^3hr].

Fluorocarbon Diaphragm

Diaphragm as well as all seals are made of fluorocarbon elastomer to prevent deterioration from elements in the air supply, such as flame retardant synthetic lubricants normally destructive to standard Nitrile material.

Type 41-1 & Type 41-2

Pressure Regulator Series

Features

- Superior regulation characteristics
- Rugged, corrosion-resistant construction
- Excellent stability and repeatability
- Self-relieving of excess down stream pressure
- Low droop at high flow
- Mounting options available

Description

The Type 41 regulators are designed for applications requiring high flow capacity, low droop, high accuracy, and fine adjustment sensitivity. The use of Bellofram's rolling diaphragm provides greater sensitivity and improved accuracy. In addition, Type 41 regulators offer reduced over-all size and several mounting options, providing direct interchangeability with more expensive competitors' units.

Ruggedly designed and constructed, the Type 41 regulators have housings of precision-cast aluminum. They are pressure tested, and are chromate treated for internal corrosion resistance. Every regulator is finished with vinyl paint which resists scratching, weathering and other physical abuse.

Careful design and quality materials throughout assure long, trouble-free operation in the most difficult industrial environments. A rubberized, soft-seat valve stem provides stability and "forgives" dirt and other foreign matter. An aspirator maintains downstream pressure and compensates for droop when high flow occurs. The gauge port is convenient for gauge installation and can also be used as an additional full flow outlet.

The design of these regulators is especially well suited for panel applications due to ease of mounting (only one panel hole required), small size, adjustment sensitivity (32 threads per inch on the adjusting screw), and knob.

Models

The Type 41 comes in two versions, Type 41-1 and Type 41-2. These two regulators offer the same performance in two slightly different packages.

Type 41-1

This unit comes standard with 1/4 NPT ports and a knob, and can be panel mounted using either the center nut or the threaded shoulder holes, spaced 1.5 in. (38.1 mm) center-to-center.

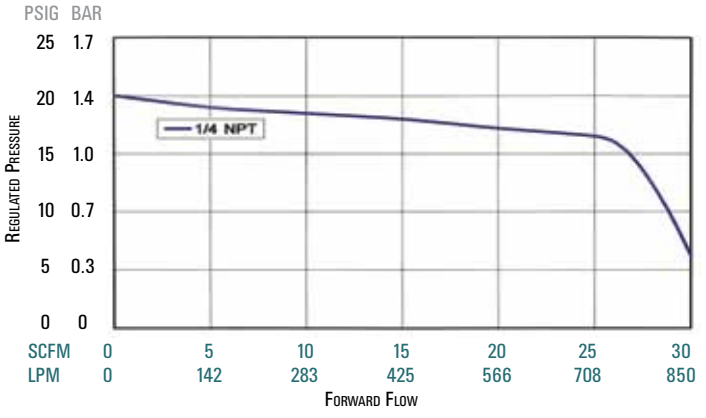
Type 41-2

This unit comes standard with 1/4 NPT ports, a knob and a bonnet vent port which can be tapped for a 1/4 NPT fitting if desired. It can be panel mounted using either the center nut or the threaded shoulder holes, spaced 1.25 in. (32.7 mm) center-to-center.

Type 41-1
Pressure Regulator Series

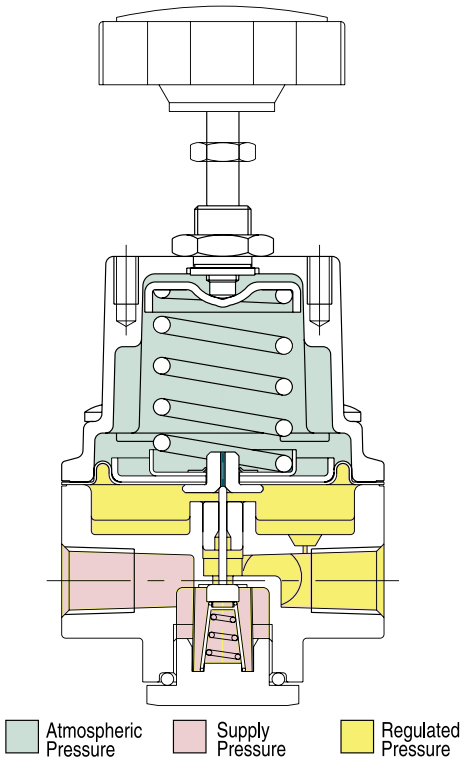
Type 41-2
Pressure Regulator Series

Type 41: Regulated Pressure VS. Flow

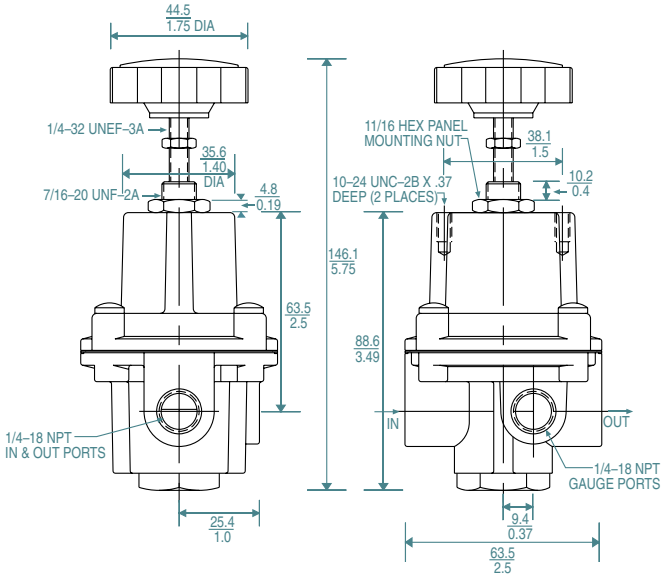


T41 Regulator Specifications

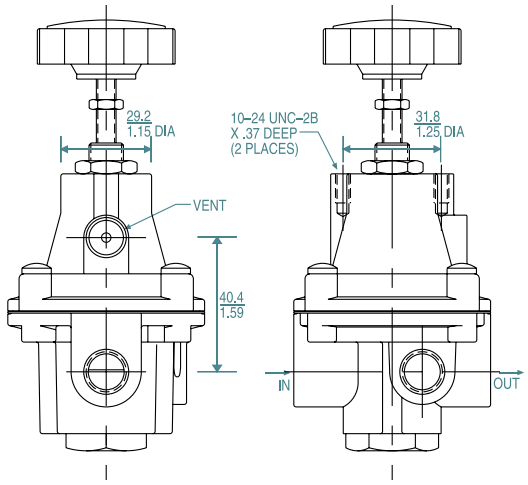
Sensitivity	1" Water Column (2.5 cm)
Flow Capacity @ 100 psig (6.9 BAR) Supply and 20 psig (1.4 BAR) outlet	25 SCFM (700 LPM)
Effect of Supply Pressure Variation (25 psig/1.7 BAR) on Outlet Pressure	±0.35 PSIG (24 mBAR)
Exhaust Capacity 5 psig (0.35 BAR) above 20 psig set point	0.1–0.45 SCFM Typical 2.8 - 12.7 LPM
Max Supply Pressure	250 PSIG (17.2 BAR)
Effect of Changes in Flow on Regulated Pressure (100 psig / 6.9 BAR Supply)	1 psig (0.07 BAR) over flow of 10 SCFM (0-30 psig / 0-2.1 BAR range, 1/4 NPT, 20 psig / 1.4 BAR set point)
Output Pressure Ranges	0-2 PSIG (0-0.14 BAR) 0-10 PSIG (0-0.69 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)
Temperature Range	0-160˚F (-18 to 71˚C)
Total Air Consumption @ Maximum Output	6 SCFH (2.8 LPM)
Port Size	1/4 NPT, BSPT
Materials of Construction	Body: Die cast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated steel, brass, acetal resin Diaphragm: Buna-N polyester fabric Knob: Phenolic Plastic Spring: Music wire
Mounting Options	Pipe, Panel or Bracket



Type 41-1 Dimensional Drawing

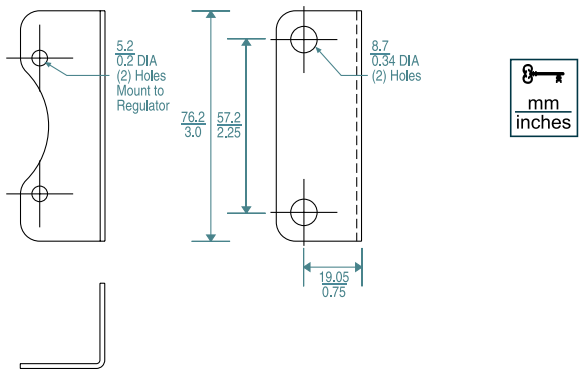


Type 41-2 Dimensional Drawing



Optional Mounting Bracket

607-000-057



Type 41 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range	
			BAR	psig
T41-1	960-113-000	1/4	0-0.14	0-2
	960-114-000		0-0.69	0-10
	960-170-000		0-2.1	0-30
	960-171-000		0-4.1	0-60
	960-172-000		0-6.9	0-100
T41-2	960-115-000	1/4	0-0.14	0-2
	960-116-000		0-0.69	0-10
	960-181-000		0-2.1	0-30
	960-182-000		0-4.1	0-60
	960-183-000		0-6.9	0-100

Type 41 Options

• = option is available		T41-1	T41-2
1	Fluorocarbon Pintle	•	•
2	Non-Relieving	•	•
5	Epoxy Finish	•	•
6	Tapped Vent	n/a	•
7	Mounting Bracket	•	•
8	Pressure Gauge	•	•

Type 41 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	5	6	7	8
1	Fluorocarbon Pintle	001	021	051	061	071	081
2	Non-Relieving		002	052	062	072	082
5	Epoxy Coating			005	065	075	085
6	Tapped Vent				006	076	086
7	Mounting Bracket					007	087
8	Pressure Gauge						008

Type 41 Regulator Options and Accessories

Fluorocarbon Pintle

A special elastomeric pintle used where elements in the supply air, such as flame retardant synthetic lubricants, are particularly destructive to ordinary pintle material.

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications, and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the outside surface of the regulator to provide increased resistance to corrosive environments.

Tapped Vent (41-2 only)

Allows installation of plumbing to capture exhaust air.

Mounting Bracket

Steel (dichromate finish) bracket for side mounting. P/N: 607-000-057

Pressure Gauge

Dual scale 2 in. (50.8 mm) gauges. Ranges include 0-30 psig (0-200 kPa), 0-60 psig (0-400 kPa), 0-100 psig (0-700 kPa) and 0-160 psig (0-1100 kPa). When specified with regulator, the correct range will be supplied.

Type 50 & Type 50 NACE

Filter Regulator Series

Features

- Superior regulation characteristics
- Rugged, corrosion-resistant construction
- Excellent stability and repeatability
- Self-relieving
- Integral, 40 micron, self cleaning filter
- Low droop at high flow
- Several mounting options
- Meets ATEX ⟨Ex⟩ II 2 G Dc T 6 (Non-electrical certification)

Type 50
Pressure Regulator Series

Applications

The design of these regulators is well suited to pilot-operated controllers, and instruments, applications such as air chucks, air spray guns, air cylinders and actuators, and a wide range of industrial pneumatic systems and equipment.

Type 50 NACE
Pressure Regulator Series

Description

Marsh Bellofram's General Purpose Type 50 and Type 50 NACE Filter Regulators are reliable precision units designed for instrumentation and general purpose use in both standard environments (Type 50), and corrosive environments (Type 50 NACE). The Type 50 NACE complies with NACE material requirement #MR-01-75 for sulfide stress cracking resistant metallic material for oil field equipment.

Test data for these regulators show excellent performance characteristics compared with those of similar units presently on the market. These Marsh Bellofram regulators are generally superior in regulated pressure vs. flow, forward-to-reverse flow offset, supply pressure sensitivity, repeatability and stability.

The Type 50 NACE is available for use in corrosive environments. This complies with NACE material requirement #MR0175 for sulfide stress cracking resistant metallic material for oil field equipment.

Ruggedly designed and constructed, the regulators have housings of diecast aluminum. The Type 50 Regulator is finished with vinyl paint (which resists scratching, weathering and other physical abuse), while the Type 50 NACE is finished with epoxy paint for added protection. Both models are pressure and leak tested prior to shipment from the factory.

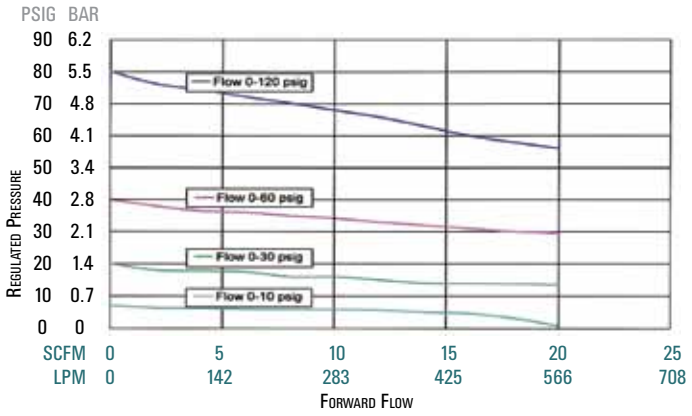
Careful design and quality materials throughout assure long, trouble-free operation in the most difficult industrial environments. A rubberized, soft-seat valve stem provides positive shut-off and "forgives" dirt or other foreign matter. An aspirator maintains downstream pressure and compensates for droop when high flow occurs. The gauge port is convenient for gauge installation and can also be used as an additional full flow outlet. The Type 50 regulators include a unique self-cleaning 40 micron nylon mesh filter (316 stainless steel in the Type 50 NACE) that can be easily removed.

Contact Us About IP65 Compatible T50 FR

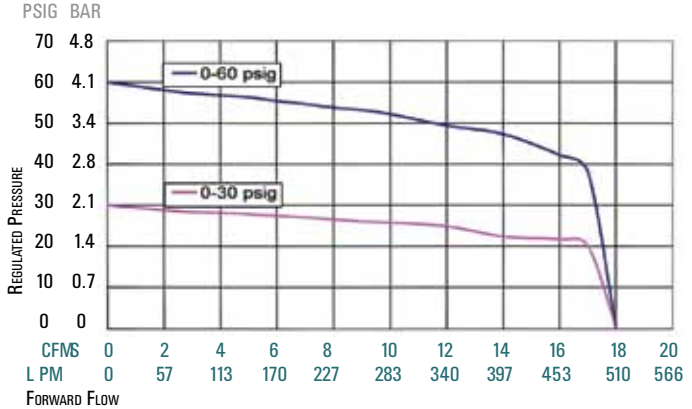
Type 50 and 50 NACE Specifications

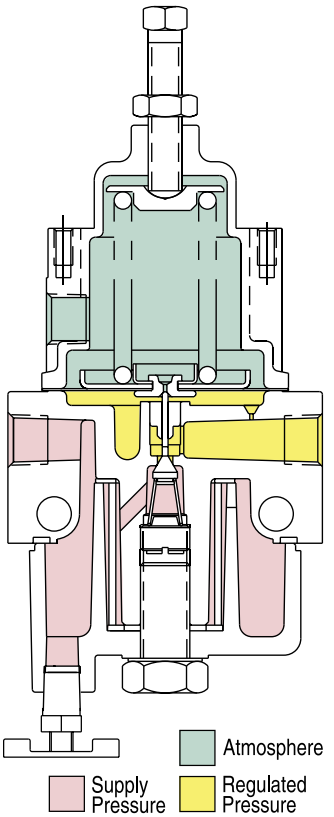
	Type 50	Type 50 NACE
Sensitivity	1" Water Column (2.5 cm)	1" Water Column (2.5 cm)
Flow Capacity @ 100 PSIG (6.9 BAR) Supply and 20 PSIG (1.4 BAR) outlet	20 SCFM (566 LPM)	18 SCFM (510 LPM)
Effect of Supply Pressure Variation (25 PSIG/1.7 BAR) on Outlet Pressure	< 0.2 psig (0.01 BAR)	< 0.2 PSIG (0.01 BAR)
Exhaust Capacity 5 psig (0.35 BAR) above 20 psig set point	0.1–0.45 SCFM Typical (2.8 - 12.7 LPM)	0.1–0.45 SCFM Typical (2.8 - 12.7 LPM)
Maximum Supply Pressure	250 PSIG (17.2 BAR)	250 PSIG (17.2 BAR)
Effect of Changes in Flow on Regulated Pressure (100 PSIG / 6.9 BAR Supply)	4 PSIG / 0.3 BAR over flow of 10 SCFM / 283 LPM (1/4 NPT, 20 PSIG / 1.4 BAR set point)	5 PSIG / 0.3 BAR over flow of 10 SCFM / 283 LPM (1/4 NPT, 20 psig / 1.4 BAR set point)
Output Pressure Ranges	0-10 PSIG (0-0.7 BAR) 0-35 PSIG (0-2.4 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)
Temperature Range	0-160˚F (-18 to 71˚C)	-20 to 180˚F (-29 to 82˚C)
Total Air Consumption @ Maximum Output	6 SCFH (2.8 LPM)	6 SCFH (2.8 LPM)
Port Size	1/4 NPT, BSPT	1/4 NPT, BSPT
Size	3.19" X 3.19" X 7.25" (81 X 81 X 184 mm)	3.19" X 3.19" X 7.25" (81 X 81 X 184 mm)
Weight	1.81 lb. (0.8 kg)	1.81 lb. (0.8 kg)
Materials of Construction	Body: Die cast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated Steel, Brass, Acetal Resin Diaphragm: Buna-N Elastomer and Polyester Fabric Knob: Phenolic Plastic (option) Spring: Music wire	Body: Die cast aluminum with epoxy paint Adjusting Screw: Stainless steel Trim: Stainless steel, Neoprene, EPDM Diaphragm: Neoprene, Polyester Fabric Spring: Inconel
Tamper Resistant Cover	Yes	Yes
Mounting Options	Pipe, Panel, Bracket or Thru Body Holes	Pipe, Panel, Bracket or Thru Body Holes

Type 50: Regulated Pressure VS. Flow

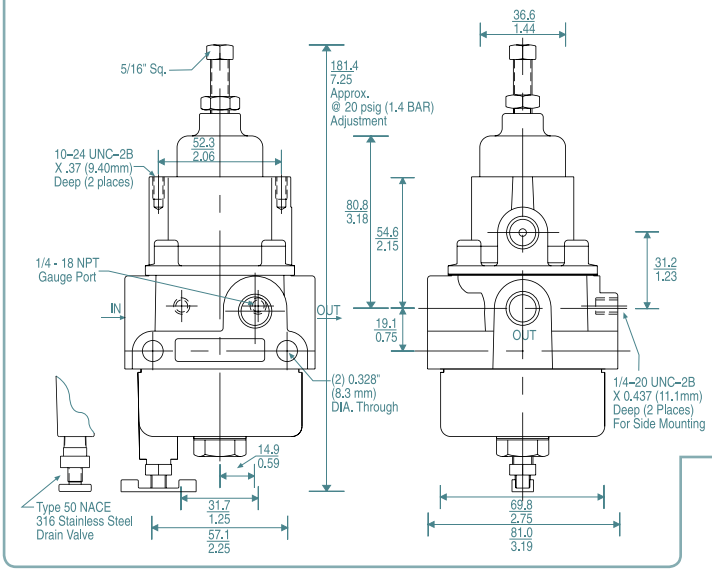


Type 50: Regulated Pressure VS. Flow



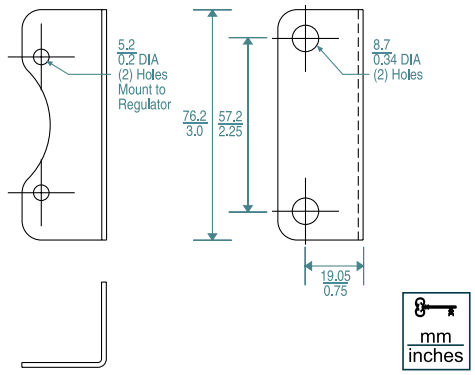


Type 50 Dimensional Drawing



Optional Mounting Bracket

607-000-057



Type 50 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range	
			BAR	PSIG
T50	960-062-000	1/4	0-0.7	0-10
	960-067-000		0-2.4	0-35
	960-068-000		0-4.1	0-60
	960-069-000		0-8.3	0-120
T50 NACE	960-300-000	1/4	0-2.1	0-30
	960-301-000		0-4.1	0-60
	960-302-000		0-8.3	0-120

Type 50 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	3	4	5	6	7	8	9	10	11
1	Fluorocarbon Pintle	001	021	031	041	051	061	071	081	091	101	111
2	Non-Relieving		002	032	042	052		072	082	092		112
3	Knob			003	043	053	063	073	083		103	113
4	5 Micron Filter				004	054	064	074	084	094	104	114
5	Epoxy Finish					005	065	075	085	095	105	115
6	Tapped Vent						006	076	086	096	106	116
7	Mounting Bracket							007	087	097	107	117
8	Pressure Gauge								008	098	108	118
9	Tamper-Resistant Cover									009	109	119
10	Soft Relief Seat										010	110
11	Fluorocarbon Diaphragm											011

Type 50 Regulator Options and Accessories

Fluorocarbon Pintle

A special elastomeric pintle used where elements in the supply air, such as flame retardant synthetic lubricants, are particularly destructive to ordinary pintle material.

Non Relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications, and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Knob

Option to replace the square head pressure adjusting screw.

5 Micron Filter

Replaces the 40 micron filter supplied with the standard Type 50 for more complete air filtration.

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the body and dripwell of the regulator exterior surfaces to provide increased corrosion resistance. (Standard with Type 50 NACE)

Tapped Vent

Allows installation of plumbing to capture exhaust air. (Standard with T-50 NACE)

Mounting Bracket: Type 50

Steel (dichromate finish) bracket for side mounting.

Type 50 NACE

Stainless Steel bracket for side mounting.

Pressure Gauge: Type 50

Dual scale 2 in. (50.8 mm) gauges. Ranges include 0-30 PSIG (0-200 kPa), 0-60 PSIG (0-400 kPa), 0-100 PSIG (0-700 kPa) and 0-160 PSIG (0-1100 kPa). When specified with regulator, the correct range will be supplied.

Type 50 NACE

A dual scale, 0-60 PSIG (0-400 kPa) P/N 625-000-016, or 0-200 PSIG (0-1400 kPa) P/N 625-000-018, 2.47" diameter (63mm) stainless steel pressure gauge is available and must be ordered separately. NOTE: Although the case is stainless steel, the internal components are not made of NACE qualified materials.

Tamper Resistant Cover

An aluminum tubular cover placed over a slotted head adjusting screw and screwed onto the bonnet of the regulator with a wrench. Prevents ordinary hand adjustments. Supplied with an o-ring that is designed to seal the adjusting screw threads in capture bleed applications.

Soft Relief Seat

Used in applications where it is desirable to reduce the standard bleed rate from 6 SCFH [0.17 m3hr] to less than 0.1 SCFH [0.003 m3hr].
(Not available with Type 50 NACE)

Fluorocarbon Diaphragm

Diaphragm as well as all seals are made of fluorocarbon elastomer to prevent deterioration from elements in the air supply, such as flame retardant synthetic lubricants normally destructive to standard Buna-N material.

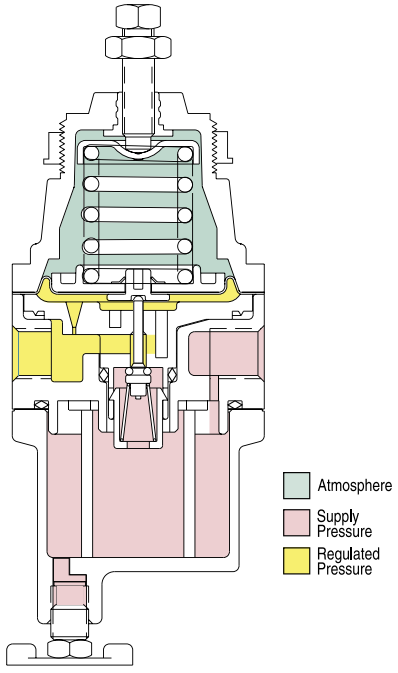
To order BSPT add "BSPT" to end of part number.

Type 51

Pressure Regulator Series

Features

- Excellent regulation, stability and repeatability
- Corrosion-resistant construction (no brass components, Type 51FR and Type 51AFR)
- NACE Constructed (Type 51FRCT Corrosive Tec)
- Low droop
- Small package size
- Panel, bracket or pipe mounting
- Fluorocarbon pintle seat (Type 51FR, Type 51AFR and Type 51FRCT)
- Auto drain option (Type 51AFR)
- Meets ATEX ⟨Ex⟩ II 2 G Dc T 6 (Non-electrical certification)



Description

The Bellofram Type 51 Precision Air Regulator series offers a high-performance regulator in a compact, low cost package. It operates in output pressure ranges up to 100 PSIG / 6.9 BAR (120 PSIG / 8.3 BAR in T-51FR Corrosive Tec), with a maximum supply pressure of 250 psi (17.3 BAR).

Materials of Construction for Standard Type 51 Series Regulators

Diecast aluminum for the body and dripwell; glass-reinforced thermoplastic polyester for the bonnet; acetal resin for the internals; BUNA-N for the diaphragm, gaskets and O-ring, fluorocarbon for the pintle seat, and aluminum for the drain valve (plated steel handle).

Materials of Construction for Corrosive Tec Type 51FRCT

Aluminum alloy bonnet, body, and filter bowl, 316 stainless steel internals, Inconel alloy range spring, nitrile diaphragm (fluorocarbon optional), 316 stainless steel valve assembly, and finished with an epoxy paint. All metallic parts for this unit conform to NACE material requirements #MR-01-75.

Materials of Construction for 51FRWT

Aluminum alloy bonnet, body, and filter bowl, acetal resin, plated steel and aluminum internals. Nitrile diaphragm and finished with an vinyl paint.

From industry to industry, Marsh Bellofram's Type 51 Series of Regulators offer a low-cost, high performance option for a wide range of applications.

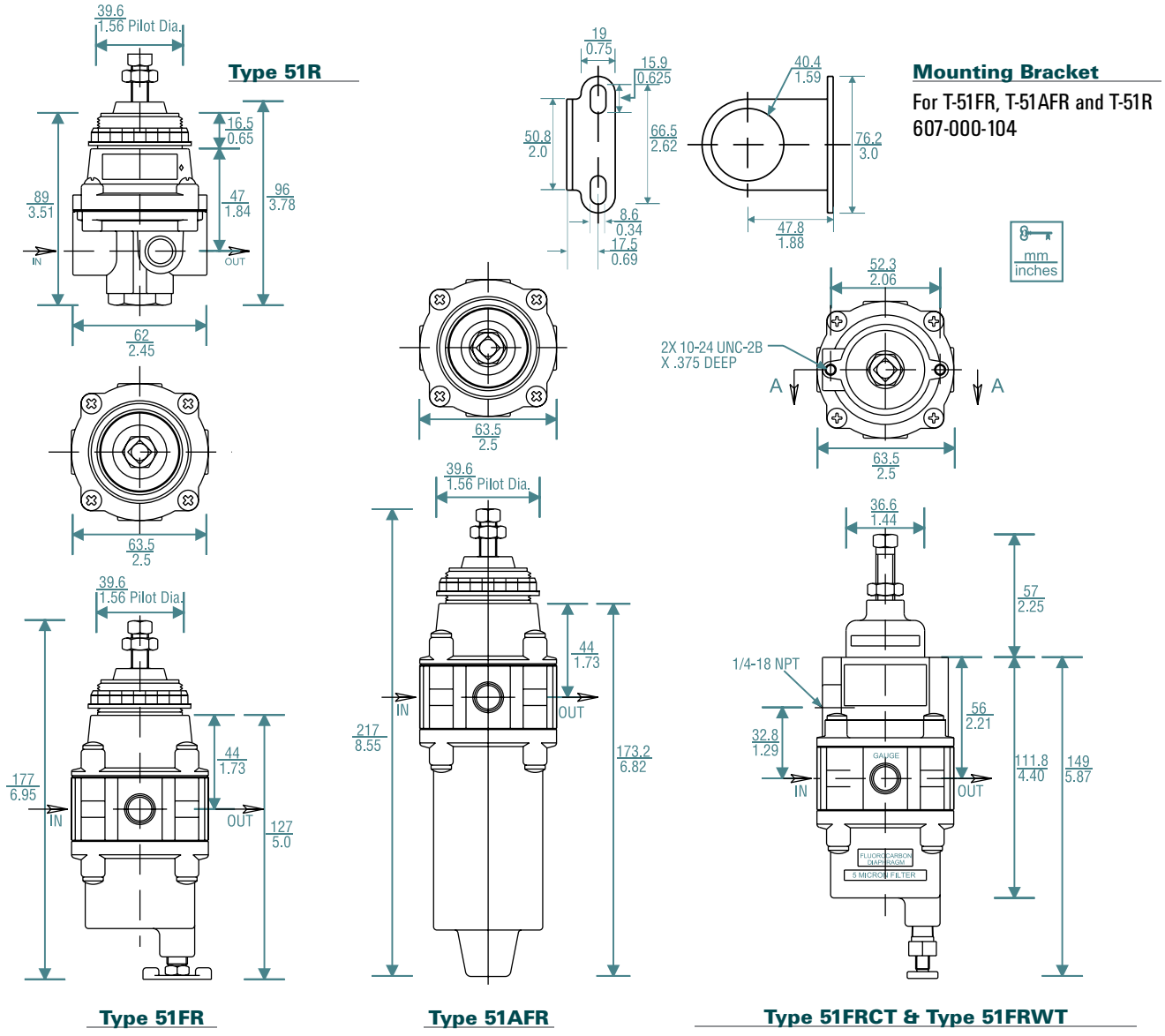
Type 51 Options

• = option is available s = option is standard		Type 51R	Type 51FR	Type 51AFR	Type 51FRCT
1	Fluorocarbon Pintle	•	s	s	s
2	Non-Relieving	•	•	•	•
3	Knob Sq. Head Adj. Screw	• s	• s	• s	 s
4	5 Micron Filter		•	•	•
5	Epoxy Finish	•	•	•	s
6	Tapped Vent Coalescing Filter			 •	s
7	Mounting Bracket	•	•	•	•
8	Pressure Gauge	•	•	•	•
9	Tamper Resistant Cover Panel Nut Mount	 s	 s	 s	•
10	Soft Relief Seat Low Bleed				 •
11	Fluorocarbon Diaphragm	•	•	•	•

These regulators are available standard (Type 51R) or as filter-regulators (Type 51FR and Type 51FRCT) and are even available with an automatic drain, for automated flushing out of contaminants (Type 51 AFR). These versatile regulators provide excellent regulation for a wide range of applications, including pneumatic instruments, controllers, chucks, and actuators. They can be through-panel mounted with the supplied mounting nut, bracket-mounted with the optional bracket or, due to their light weight, mounted by their ports. The Corrosive Tec is supplied with a tapped bonnet vent, to allow for the capture of exhaust air.

	Type 51R	Type 51FR Filter and Type 51AFR Auto Filter	Type 51FRCT Corrosive Tec	Type 51FRWT
Maximum Supply Pressure	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)
Output Pressure Range	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)
Supply Pressure Sensitivity @ 25 psig / 1.7 BAR change in supply	0.20 PSIG (0.01 BAR) output change	0.45 PSIG (0.03 BAR) output change	0.45 PSIG (0.03 BAR) output change	0.45 PSIG (0.03 BAR) output change
Sensitivity	1" (2.5 cm) of water	1" (2.5 cm) of water	1" (2.5 cm) of water	1" (2.5 cm) of water
Repeatability	0.1 PSIG (0.01 BAR)	0.1 PSIG (0.01 BAR)	0.1 PSIG (0.01 BAR)	0.1 PSIG (0.01 BAR)
Flow @ 100 psig (6.9 BAR) Supply 20 psig (1.4 BAR) outlet	15 SCFM (425 LPM)	20 SCFM (566 LPM)	20 SCFM (566 LPM)	20 SCFM (566 LPM)
Exhaust Capacity @ 5 psig (0.34 BAR) above setpoint	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)
Temperature Range	-0 to 125˚F (-18 to 52˚C)	-0 to 125˚F (-18 to 52˚C)	0 to 180˚F (-18 to 82˚C)	-40 to 185˚F (-40 to 85˚C)
Air Consumption	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum
Port Size	1/4 NPT	1/4 NPT	1/4 NPT	1/4 NPT
Materials of Construction	Aluminum, Plated Steel, Brass, Acetal Resin, Buna-N /Polyester, Music Wire	Aluminum, Plated Steel, Acetal Resin, Buna-N / Polyester, Music Wire, Fluorocarbon	Aluminum, Stainless Steel, Inconel, Buna-N / polyester, Fluorocarbon, acetal, polyphenylene sulfide	Aluminum, Plated Steel, Acetal Resin, Buna-N /Polyester, Music Wire

Type 51R, 51FR, 51AFR and 51FRCT Dimensional Drawings



Type 51 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range	
			BAR	psig
T51R	960-222-000	1/4	0-2.1	0-30
	960-223-000		0-4.1	0-60
	960-224-000		0-6.9	0-100
T51FR	960-175-000	1/4	0-2.1	0-30
	960-176-000		0-4.1	0-60
	960-177-000		0-6.9	0-100
T51AFR	960-284-000	1/4	0-2.1	0-30
	960-285-000		0-4.1	0-60
	960-286-000		0-6.9	0-100
T51 FRCT	960-303-000	1/4	0-2.1	0-30
	960-304-000		0-4.1	0-60
	960-305-000		0-8.3	0-120

Type 51 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	3	4	5	6	7	8	9	10	11
1	Fluorocarbon Pintle	001	021	031	041	051	061	071	081	091	101	111
2	Non-Relieving		002	032	042	052	062	072	082	092		112
3	Knob			003	043	053	063	073	083		103	113
4	5 Micron Filter				004	054		074	084	094	104	114
5	Epoxy Finish					005	065	075	085	095	105	115
6	Coalescing Filter (Type 51AFR only)						006	076	086	096	106	116
7	Mounting Bracket							007	087	097	107	117
8	Pressure Gauge								008	098	108	118
9	Tamper-Resistant Cover									009	109	119
10	Soft Relief Seat										010	110
11	Fluorocarbon Diaphragm											011

Type 51 Regulator Options and Accessories

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream and not at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Knob

Replaces the standard square head adjusting screw. (except Type 51FRCT)

5 Micron Filter

Replaces the 40 micron filter for more complete air filtration. (Except Type 51R)

Epoxy Finish

An epoxy paint applied to the body and dripwell of the regulator exterior surfaces to provide increased corrosion resistance. (Standard for Type 51FRCT)

Mounting Bracket

Plated steel bracket for side mounting. (316 SS for Type 51FRCT)

Coalescing Filter

Replaces the 40 micron filter for both moisture and particulate filtration. (Type 51AFR only)

Pressure Gauge

Dual scale (psi/kPa) 2" (50mm) gauges. Ranges include 0-60 psi (0-4.1 BAR), 0-100 psi (0-6.9 BAR) and 0-120 psi (0-8.3 BAR). When specified with regulator, the correct range will be supplied.

Fluorocarbon Elastomers

Diaphragm, as well as gaskets and O-rings, are made with a special elastomer to prevent deterioration from elements in the air supply, such as flame retardant synthetic lubricants normally destructive to the standard BUNA-N material.

Tamper Resistant Cover

A 316 stainless steel hexagonal cover placed over the adjusting screw and threaded onto the bonnet of the regulator with a wrench, prevents ordinary hand adjustments. Supplied with an O-ring that is designed to seal the adjusting screws threads in captured bleed applications. (T-51FRCT Only)

Low Bleed Diaphragm (Soft Relief Seat)

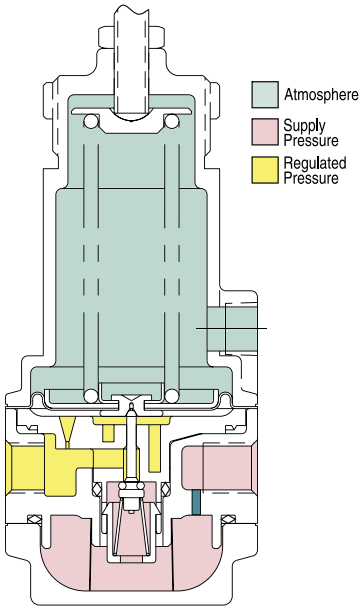
Used in applications where it is desirable to minimize the standard bleed rate of the regulator while maintaining the ability to relieve excess pressure at the regulator. Bleed rate is reduced from less than 6 SCFH (2.8 LPM) to less than 0.1 SCFH (0.05 LPM). (Type 51FRCT only)

Type 51 Stainless Steel

Pressure Regulator Series

Features

- Ideal for sour gas and corrosive applications or environments
- Excellent stability and repeatability
- Low droop
- Tapped vent for exhaust gas capture
- Built-in filter assemblies and dripwells
- Manual or automatic drain options
- Filter only assemblies available
- Panel, bracket or pipe mounting



Description

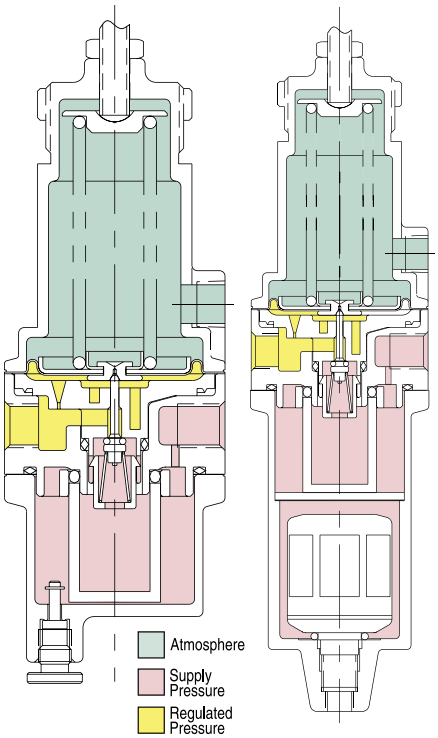
The Type 51SS regulator product line is designed for service with a wide variety of corrosive gases and environments. Special construction features include 316 stainless steel for the housing and filter assemblies, with fluorocarbon elastomers used for the control diaphragm and the supply valve.

These corrosion resistant materials are compatible with sour gas and for use in off-shore environments. Typical applications include petrochemical processing, chemical plants, food processing and paper/pulp mills.

This ruggedly built regulator operates in pressure ranges up to 150 PSIG (10.3 BAR). The Type 51SSFR and Type 51SSAR Regulators and the Type 51SSF and Type 51SSAF filter assemblies have built-in dripwells which trap water, oil and other contaminants. The contaminants are easily flushed out of the dripwell via a convenient manual or automatic drain valve. The 40-48 Micron Filter is constructed of sintered 316 stainless steel, and is easily removed.

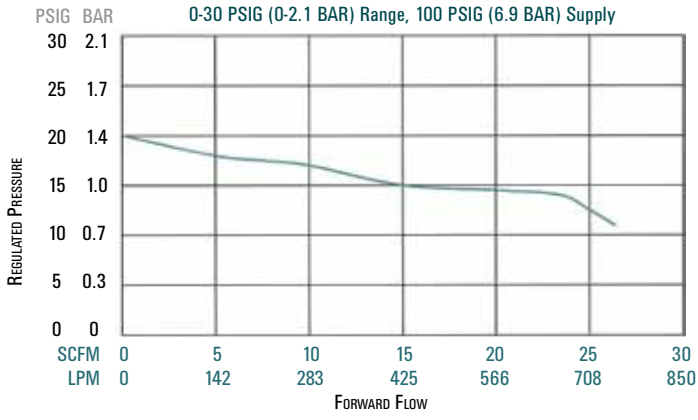
The Type 51SS products can be through-panel mounted with the mounting nut supplied (regulators only), bracket-mounted using the optional bracket (regulators only), or pipe mounted by its ports (regulators and filters).

The regulators and filter assemblies comply with NACE material requirement #MR-01-75 for sulfide stress cracking resistant metallic material for oil field equipment.



Once set to a desired pressure, the Marsh Bellofram Type 51 Stainless Steel Regulators maintain their settings permanently. The integral convoluted diaphragm provides constant adjustment to downstream pressure drop, downstream pressure increase and changes in forward flow.

Type 51SS: Regulated Pressure VS. Flow

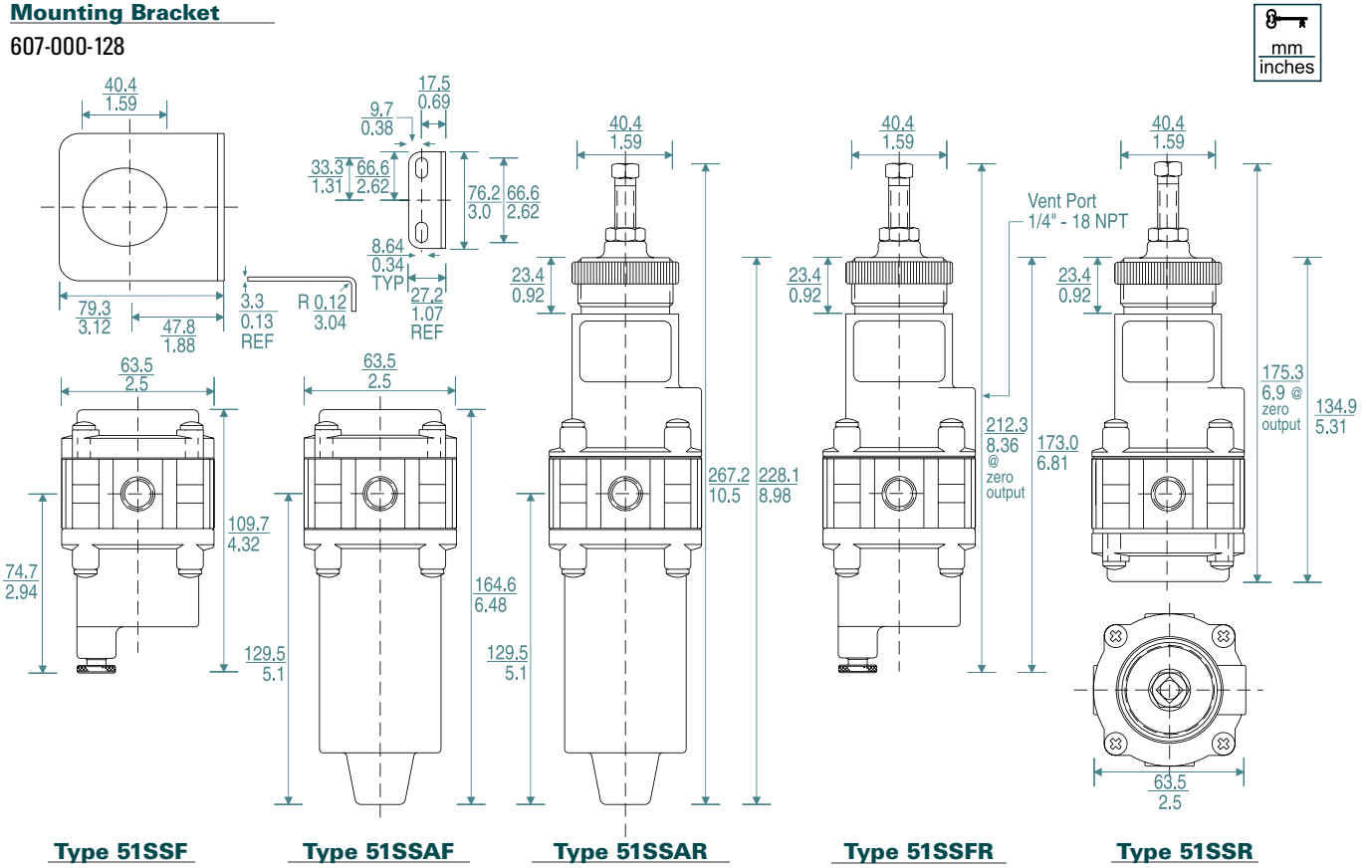


	Type 51SSR	Type 51SSFR	Type 51SSAR Auto Filter	Type 51SSF	Type 51SSAF
Filter	n/a	Built in 40 micron filter with manual drain	Built in 40 micron filter with auto-drain	40 micron filter	40 micron filter
Maximum Supply Pressure	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)	250 psig (17.3 BAR)	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)
Output Pressure Range	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR) 2-150 PSIG (0.1-10.3 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR) 2-150 PSIG (0.1-10.3 BAR)	0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR) 2-150 PSIG (0.1-10.3 BAR)	N/A	N/A
Supply Pressure Sensitivity @ 25 psig / 1.7 BAR change in supply	0.20 PSIG (0.01 BAR) output change	0.45 PSIG (0.03 BAR) output change	0.45 PSIG (0.03 BAR) output change	N/A	N/A
Sensitivity	1" (2.5 cm) of water	1" (2.5 cm) of water	01" (2.5 cm) of water	N/A	N/A
Repeatability	0.1 PSIG (0.01 BAR)	0.1 PSIG (0.01 BAR)	0.1 PSIG (0.01 BAR)	N/A	N/A
Flow @ 100 psig (6.9 BAR) Supply 20 psig (1.4 BAR) outlet	20 SCFM (566 LPM)	20 SCFM (566 LPM)	20 SCFM (566 LPM)	N/A	N/A
Exhaust Capacity @ 5 psig (0.34 BAR) above setpoint	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)	N/A	N/A
Temperature Range	-0 to 180˚F (-18 to 82˚C)	-0 to 180˚F (-18 to 82˚C)	0 to 180˚F (-18 to 82˚C)	0 to 180˚F (-18 to 82˚C)	0 to 180˚F (-18 to 82˚C)
Air Consumption	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum	N/A	N/A
Port Size	1/4 NPT or 3/8 NPT	1/4 NPT or 3/8 NPT	1/4 NPT or 3/8 NPT	1/4 NPT or 3/8 NPT	1/4 NPT or 3/8 NPT
Materials of Construction	316 Stainless Steel housing and screen fluorocarbon elastomers	316 Stainless Steel housing and filter assemblies fluorocarbon elastomers	316 Stainless Steel housing and filter assemblies fluorocarbon elastomers	316 Stainless Steel housing and filter assemblies fluorocarbon elastomers	316 Stainless Steel housing and filter assemblies fluorocarbon elastomers

Dimensional Drawings

Mounting Bracket

607-000-128



Type 51SSF | Type 51SSAF | Type 51SSAR | Type 51SSFR | Type 51SSR

Type 51SS Ordering Information

	Part Number	Set Point Range	
		BAR	psig
51SSR	960-245-000	0-2.1	0-30
	960-246-000	0-4.1	0-60
	960-247-000	0-6.9	0-100
	960-248-000	0.1-10.3	2-150
51SSFR	960-242-000	0-2.1	0-30
	960-243-000	0-4.1	0-60
	960-244-000	0-6.9	0-100
	960-241-000	0.1-10.3	2-150
51SSAR	960-249-000	0-2.1	0-30
	960-250-000	0-4.1	0-60
	960-251-000	0-6.9	0-100
	960-252-000	0.1-10.3	2-150
51SSF	960-253-000	-	-
51SSAF	960-254-000	-	-

Type 51SS Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option	1	2	3	4	7	8	9	10	11
2 Non-Relieving		002	032	042	072	082	092		112
3 Socket Head Build Screw			003	043	073	083	093	103	113
4 5 Micron Filter				004	074	084	094	104	114
7 Mounting Bracket					007	087	097	107	117
8 Pressure Gauge						008	098	108	118
9 Tamper-Resistant Cover							009	109	119
10 Low Bleed								010	110
11 3/8 NPT Port									011

Options

	• = option is available	T-51SSR	T-51SSFR	T-51SSAR	T-51SSF	T-51SSF
2	Non-Relieving	•	•	•		
3	Socket Head Build Screw	•	•	•	•	•
4	5 Micron Filter		•	•	•	•
7	Mounting Bracket	•	•	•		
8	Pressure Gauge	•	•	•	•	•
9	Tamper Resistant Cover	•	•	•		
10	Low Bleed	•	•	•		
11	3/8" Port	•	•	•	•	•

Regulator Options and Accessories

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream and not at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Socket Head Build Screw

Socket head build screws are provided in place of phillips drive screws.

5 Micron Filter

Replaces the 40 micron filter for more complete air filtration. (Except Type 51SSR)
P/N 836-000-002

Mounting Bracket

316 Stainless Steel bracket for side mounting.
P/N 607-000-128

Pressure Gauge

Dual scale (PSI / kPa) 2-1/2" (63mm) gauges. Ranges include 0-60 PSI (0-410 kPa), 0-100 PSI (0-690 kPa) and 0-200 PSI 0-1400 kPa). When specified with regulator, the correct range will be supplied.

Tamper Resistant Cover

A 316 stainless steel hexagonal cover placed over the adjusting screw and threaded onto the bonnet of the regulator with a wrench, prevents ordinary hand adjustments.

Low Bleed Diaphragm (Soft Relief Seat)

Used in applications where it is desirable to minimize the standard bleed rate of the regulator while maintaining the ability to relieve excess pressure at the regulator. (Bleed rate is reduced from less than 6 SCFH (2.8 LPM) to less than 0.1 SCFH (0.05 LPM).

Type 60 & Type 65

Pre-set Pressure Regulators

Features

- Pre-Set, ideal for OSHA regulations
- Superior regulation characteristics
- Rugged, corrosion-resistant construction
- Excellent stability and repeatability
- Self-relieving
- Low droop at high flow
- Several mounting options
- Low cost

Applications

The design of these regulators is especially well suited to pilot-operated controllers, and instruments, as well as applications such as air chucks, air spray guns, air cylinders and actuators, and a wide range of industrial pneumatic systems and equipment.

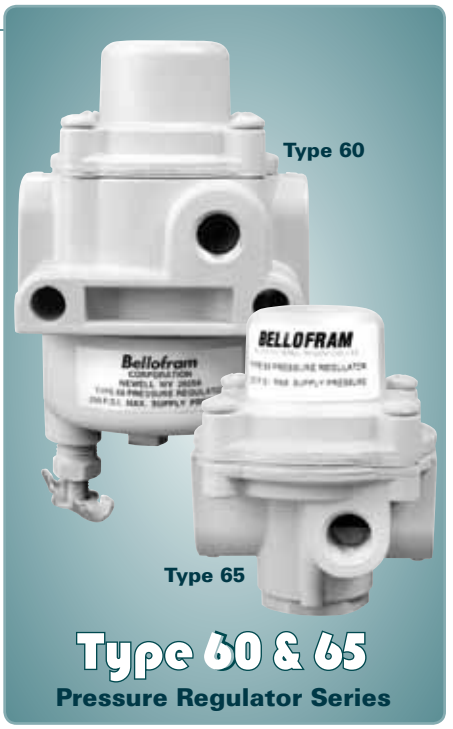
Description

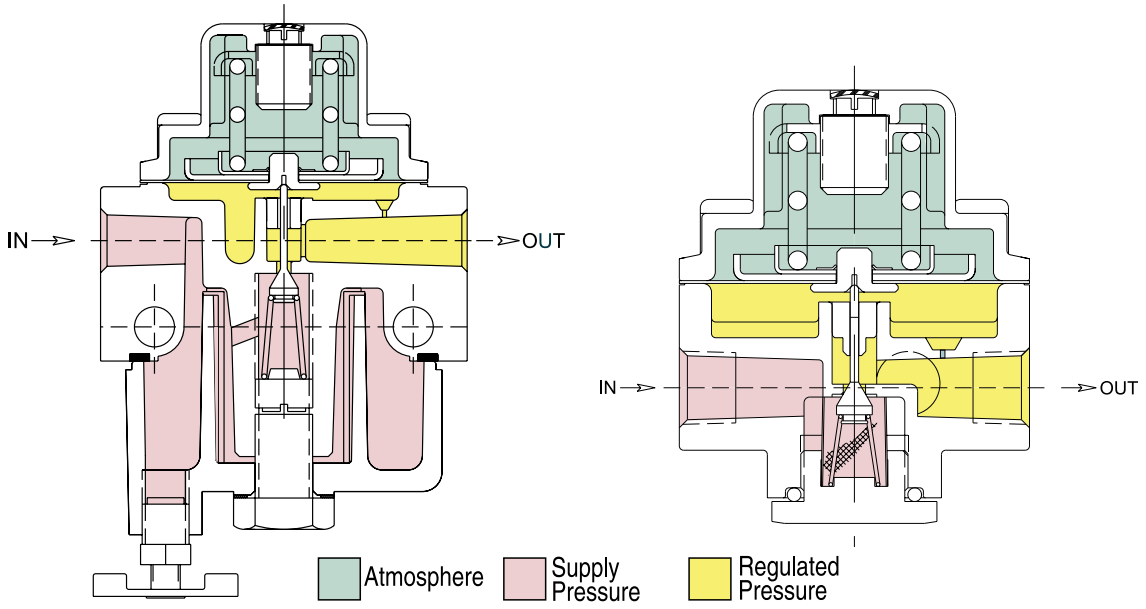
Marsh Bellofram's General Purpose Type 60 and Type 65 Precision Air Regulators are reliable precision units designed for instrumentation and general purpose use. The Type 60 is a pre-set, fixed-pressure unit with a dripwell. The Type 65 is similar to the Type 60, but without a dripwell.

Test data for these regulators show excellent performance characteristics compared with those of similar units presently on the market. These Marsh Bellofram regulators are generally superior in regulated pressure vs. flow, forward-to-reverse flow offset, supply pressure sensitivity, repeatability and stability.

Ruggedly designed and constructed, the regulators have housings of diecast aluminum. Both models are finished with vinyl paint (which resist scratching, weathering and other physical abuse), and are pressure and leak tested prior to shipment from the factory.

Careful design and quality materials throughout assure long, trouble-free operation in the most difficult industrial environments. A rubberized, soft-seat valve stem provides positive shut-off and "forgives" dirt or other foreign matter. An aspirator maintains downstream pressure and compensates for droop when high flow occurs. The gauge port is convenient for gauge installation and can also be used as an additional full flow outlet. The Type 65 regulator has a 60-mesh 304 stainless steel screen to block foreign particles from entering the output stream. The Type 60 regulator has a unique self-cleaning nylon 40 micron mesh filter that can be easily removed. Type 60 and Type 65 tamper resistant regulators meet OSHA requirements for air supplied to hand-held air guns (if preset to 30 psig).



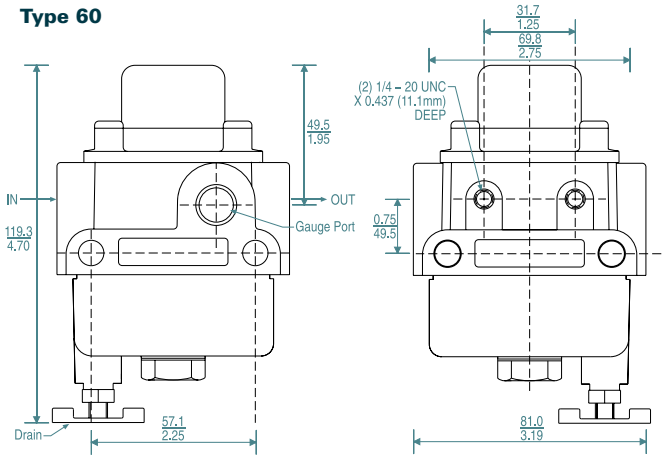


	Type 60	Type 65
Sensitivity	1" (2.5 cm) Water Column	1" (2.5 cm) Water Column
Flow @ 100 PSIG (6.9 BAR) Supply 20 PSIG (1.4 BAR) outlet	20 SCFM (566 LPM)	20 SCFM (566 LPM)
Effect of Supply Pressure variation (25 PSIG) on Outlet Pressure	< 0.2 PSIG (0.01 BAR) for 25 PSIG (1.7 BAR)	< 0.2 PSIG (0.01 BAR) for 25 PSIG (1.7 BAR)
Exhaust Capacity@ 5 psig above 20 PSIG setpoint	0.1 SCFM (2.8 LPM)	0.1 SCFM (2.8 LPM)
Maximum Supply Pressure	250 PSIG (17.3 BAR)	250 PSIG (17.3 BAR)
Effect of Changes in Flow on Regulated Pressure (100 PSIG/6.9 BAR Supply)	3 PSIG (0.2 BAR) for 10 SCFM (283 LPM) (1/4 NPT, 20 PSIG / 1.4 BAR set point)	3 PSIG (0.2 BAR) for 10 SCFM (283 LPM) (1/4 NPT, 20 PSIG / 1.4 BAR set point)
Output Pressure Range	0-20 PSIG (0-1.4 BAR) 20-40 PSIG (1.4-2.8 BAR) 40-60 PSIG (2.8-4.1 BAR)	0-20 PSIG (0-1.4 BAR) 20-40 PSIG (1.4-2.8 BAR) 40-60 PSIG (2.8-4.1 BAR)
Total Air Consumption @ Maximum Output	6 SCFH (2.84 LPM) Maximum	6 SCFH (2.84 LPM) Maximum
Port Size	1/4 NPT, BSPT	1/4 NPT, BSPT
Materials of Construction	Body: Diecast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated steel, brass, acetal resin Diaphragm: Buna-N elastomer with polyester fabric Spring: Music wire	Body: Diecast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated steel, brass, acetal resin Diaphragm: Buna-N elastomer with polyester fabric Spring: Music wire
Size	3.19" X 3.19" X 4.70" (81 X 81 X 119 mm)	2.5" X 2.5" X 3.13"
Weight	1.59 lb. (0.7 kg)	0.69 lb. (0.3 kg)
Mounting	Pipe, Bracket or Thru Body Holes	Pipe or Bracket

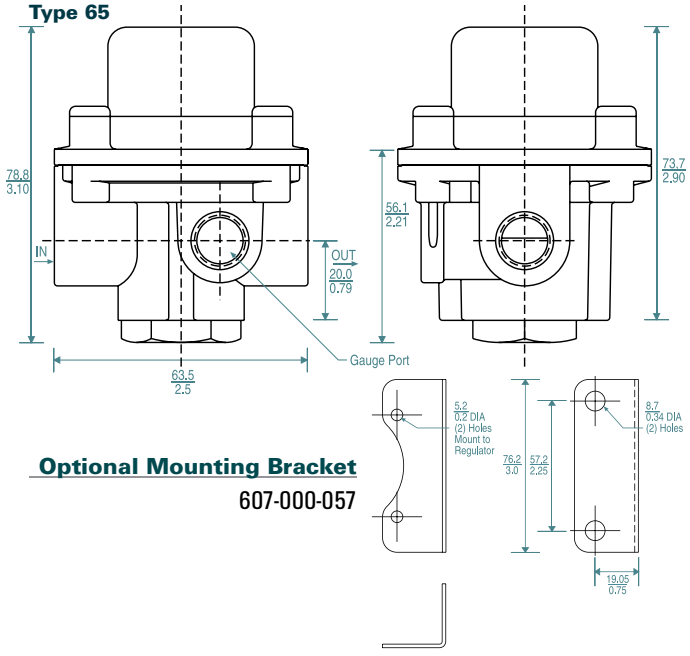
Type 60 and Type 65 Dimensional Drawings

mm
inches

Type 60

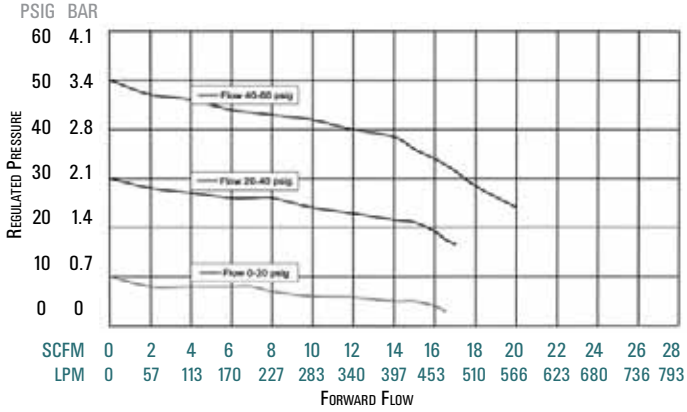


Type 65

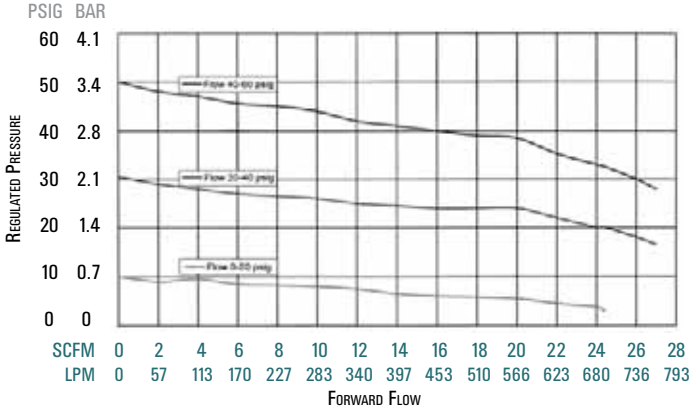


Optional Mounting Bracket
607-000-057

Type 60: Regulated Pressure VS. Flow



Type 65: Regulated Pressure VS. Flow



Type 60 and Type 65 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range	
			BAR	PSIG
Type 60	960-070-000	1/4	0-1.4	0-20
	960-109-000		1.4-2.8	20-40
	960-110-000		2.8-4.1	40-60
Type 65	960-071-000	1/4	0-1.4	0-20
	960-150-000		1.4-2.8	20-40
	960-151-000		2.8-4.1	40-60

NOTE: Because the Types 60 and 65 are preset at the factory, it is necessary to provide the supply pressure and preset pressure setting when ordering.

Type 60 and Type 65 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	4	5	7	8	10	11
1	Fluorocarbon Pintle	001	021	041	051	071	081	101	111
2	Non-Relieving		002	042	052	072	082		112
4	5 Micron Filter (Type 60 only)			004	054	074	084	104	114
5	Epoxy Finish				005	075	085	105	115
7	Mounting Bracket					007	087	107	117
8	Pressure Gauge						008	108	118
10	Soft Relief Seat							010	110
11	Fluorocarbon Diaphragm								011

Options and Accessories:

Fluorocarbon Pintle

A special elastomeric pintle used where elements in the supply air, such as flame retardant synthetic lubricants, are particularly destructive to ordinary pintle material.

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications, and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

5 Micron Filter

Replaces the 40 micron filter supplied with the standard Type 60 for more complete air filtration. P/N 677-000-002

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the body, bonnet and dripwell of the regulator exterior surfaces to provide increased corrosion resistance.

Mounting Bracket

Steel (dichromate finish) bracket for side mounting. P/N 607-000-057

Pressure Gauge

Dual scale 2 in. (50.8 mm) gauges.

When specified with a regulator, the correct range will be supplied. (NPT versions only)

Soft Relief Seat

Used in applications where it is desirable to reduce the standard bleed rate from 6 SCFH (2.83 LPM) to less than 0.1 SCFH (0.05 LPM).

Fluorocarbon Diaphragm

Diaphragm as well as all seals are made of fluorocarbon elastomer to prevent deterioration from elements in the air supply, such as flame retardant synthetic lubricants normally destructive to standard Nitrile material.

To order BSPT add "BSPT" to end of part number.

The Type 65 small stature makes it ideal for compact applications

Type 70

High Flow Pressure Regulator

Features

- High flow capacity - Up to 80 SCFM (2266 LPM)
- Responds quickly to minute changes in downstream pressure
- Dampening action of aspirator tube maintains downstream pressure
- Balanced supply valve minimizes the effect of supply pressure changes
- Bellofram's Buna-N and polyester rolling diaphragms are designed to give millions of cycles
- Honking and buzzing eliminated by action of integral baffle and aspirator tube
- Stack up construction can be disassembled and serviced without removal from air line

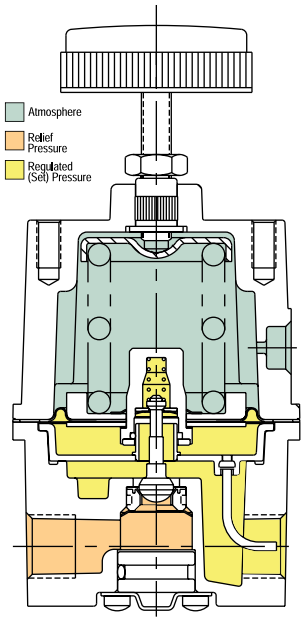
Type 70 & 70BP
Pressure Regulator Series

Type 70BP

High Flow Back Pressure Regulator

Features

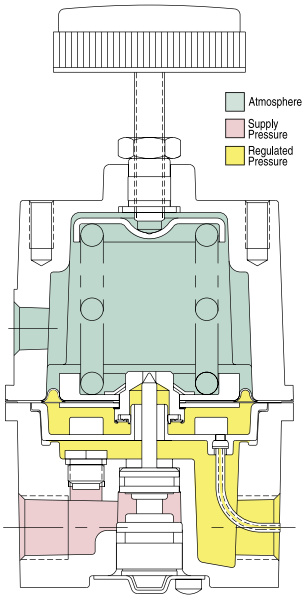
- High flow Capacity - Up to 50 SCFM (1400 LPM)
- Responds quickly to minute changes in upstream pressure
- Bellofram's Buna-N and polyester rolling diaphragms are designed to give millions of cycles
- Stack up construction can be disassembled and serviced without removal from air line



Type 70 Description

The Type 70 Regulator is specifically designed for applications that require substantial flow capacity and accurate pressure controls. Flows of 80 SCFM (2250 LPM) can be attained.

Downstream pressure can be set within 0.25 in. (6.3mm) of water column and is accurately maintained under varying flow conditions with the help of an aspirator tube which adjusts the air supply in accordance with the flow velocity. A balanced supply valve, utilizing a rolling diaphragm, makes the regulator virtually immune to changes in supply pressure.



The Type 70 has a rugged precision die cast aluminum housing, and is pressure-tested and chromate-treated for internal corrosion resistance. The regulator housing is finished with vinyl paint which resists scratching, weathering and other physical abuse.

Type 70BP Description

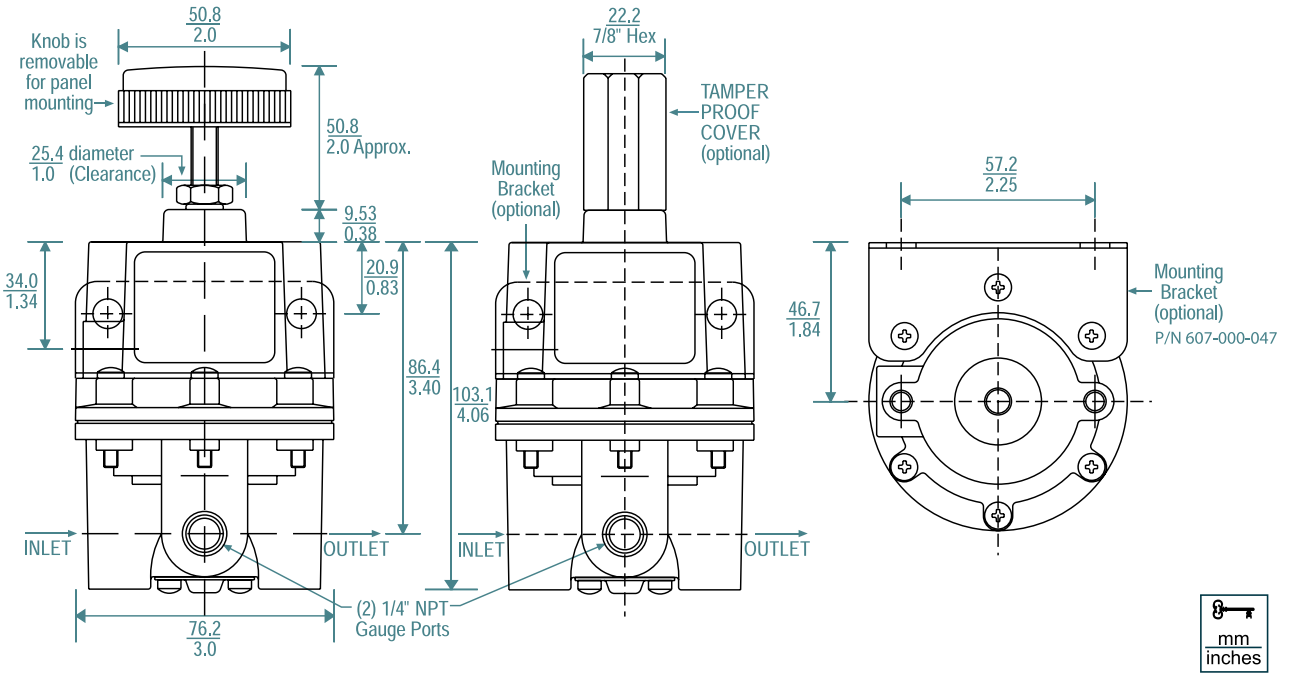
The Type 70 Back Pressure Regulator functions as a high flow, high precision pneumatic relief valve with an adjustable setpoint. The Type 70BP can be used in place of a standard relief valve to improve pressure control while maintaining protection against over pressurization, as in supply pressure lines to instruments and other control devices.

It is most often used in conjunction with a diaphragm-operated valve and bleed orifice as a compressor controller. Excess compressor pressure is relieved through the regulator to actuate the intake restricting valve. When the regulator is shut off, downstream air escapes through the bleed orifice, allowing the restricting valve to open.

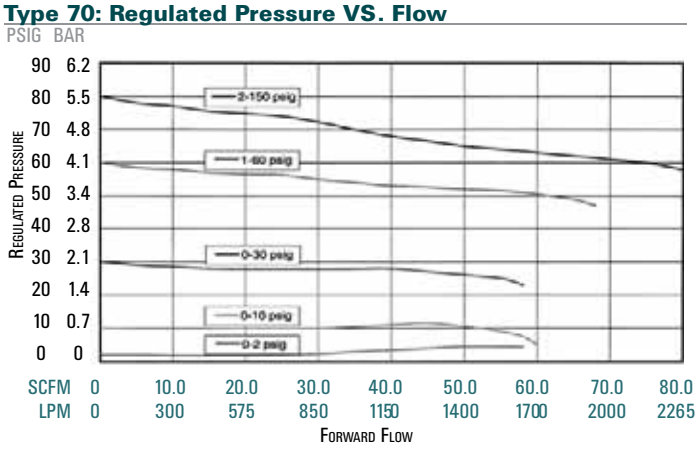
Contact Us About NACE Compatible T70 Regulator "No Yellow Metals"

	Type 70	Type 70BP
Sensitivity	1/4" (6.4 mm) Water Column	1/8" (3.2 mm) Water Column
Flow Capacity	40 (1113 LPM) 50 (1416 LPM) or 80 SCFM (2266 LPM)	50 SCFM (1416 LPM)
Effect of Supply Pressure variation (25 psig) on Outlet Pressure	< 0.025 PSIG (1.7 BAR)	N/A
Exhaust Capacity (5 above psig 20 psig set point)	4 SCFM (113 LPM)	N/A
Maximum Supply Pressure	250 PSIG (17.2 BAR)	250 PSIG (17.2 BAR)
Effect of Changes in Flow on Regulated Pressure (100 psig/6.9 BAR Supply)	2.5 PSIG (0.2 BAR) over flow 50 SCFM (1416 LPM) (3/8 NPT, 0-30 PSIG / 0-2.1 BAR range, 15 PSIG / 1 BAR set point)	N/A
Output Pressure Ranges (Type 70)	0-2 PSIG (0-0.1 BAR) 0-10 PSIG (0-0.7 BAR) 0-30 PSIG (0-2.1 BAR) 1-60 PSIG (0.1-4.1 BAR) 2-150 PSIG (0.1-10.3 BAR) 3-200 PSIG (0.2-13.8 BAR)	N/A
Set Point Ranges (Type 70BP)	N/A	0-2 PSIG (0-0.1 BAR) 0-10 PSIG (0-0.7 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-150 PSIG (0-10.3 BAR)
Total Air Consumption @ Maximum Output	from 1.0 to 12.5 SCFH (0.5-6 LPM)	N/A
Temperature Range	-40˚ to 200˚F (-40˚ to 93˚C)	-40˚ to 200˚F (-40˚ to 93˚C)
Port Size	1/4, 3/8, 1/2 NPT, BSPT	1/4, 3/8, 1/2 NPT, BSPT
Materials of Construction	Body: Diecast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Plated steel, brass, acetal resin Diaphragm: Buna-N with polyester fabric Knob: Phenolic plastic Spring: Music wire	Body: Diecast aluminum with vinyl paint Adjusting Screw: Plated steel Trim: Acetal, brass, plated steel, nitrile Diaphragm: Buna-N with polyester fabric Knob: Phenolic plastic Spring: Music wire
Size	3.0" X 3.0" X 6.0" (76 X 76 X 152 mm)	3.0" X 3.0" X 6.0" (76 X 76 X 152 mm)
Weight	1.41 lb. (0.6 kg)	1.5 lb. (0.7 kg)
Preset Pressure	No	No
Tamper Resistant Cover	Yes	Yes
Mounting	Pipe, panel, or bracket	Pipe, panel, or bracket

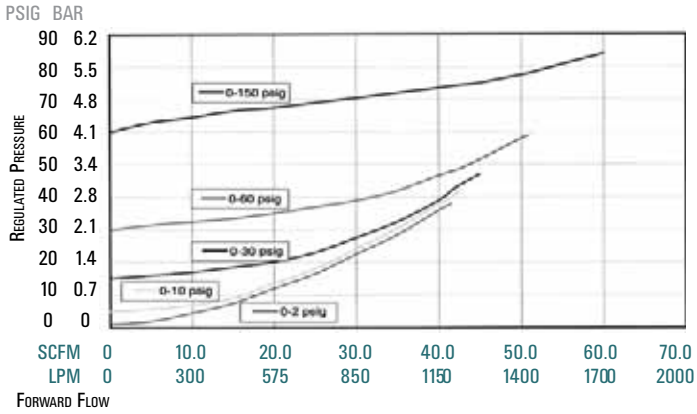
Type 70 and 70BP Dimensional Drawings



Type 70: Regulated Pressure VS. Flow



Type 70BP: Regulated Pressure VS. Flow



Type 70 and 70BP Ordering Information

	Part Number	Port Size (NPT)	Set Point Range BAR	Set Point Range PSIG
T70	960-129-000	1/4	0-0.1	0-2
	960-174-000	3/8	0-0.1	0-2
	960-162-000	1/2	0-0.1	0-2
	960-130-000	1/4	0-0.7	0-10
	960-131-000	3/8	0-0.7	0-10
	960-163-000	1/2	0-0.7	0-10
	960-089-000	3/8	0-2.1	0-30
	960-090-000	1/4	0-2.1	0-30
	960-159-000	1/2	0-2.1	0-30
	960-091-000	3/8	0.1-4.1	1-60
	960-092-000	1/4	0.1-4.1	1-60
	960-160-000	1/2	0.1-4.1	1-60
	960-093-000	3/8	0.1-10.3	2-150
	960-094-000	1/4	0.1-10.3	2-150
	960-161-000	1/2	0.1-10.3	2-150
	960-152-000	1/4	0.2-13.8	3-200
	960-153-000	3/8	0.2-13.8	3-200
	960-164-000	1/2	0.2-13.8	3-200
T70BP	960-191-000	1/4	0-0.1	0-2
	960-192-000	3/8	0-0.1	0-2
	960-193-000	1/2	0-0.1	0-2
	960-194-000	1/4	0-0.7	0-10
	960-195-000	3/8	0-0.7	0-10
	960-196-000	1/2	0-0.7	0-10
	960-197-000	1/4	0-2.1	0-30
	960-198-000	3/8	0-2.1	0-30
	960-199-000	1/2	0-2.1	0-30
	960-200-000	1/4	0-4.1	0-60
	960-201-000	3/8	0-4.1	0-60
	960-202-000	1/2	0-4.1	0-60
	960-203-000	1/4	0-10.3	0-150
	960-204-000	3/8	0-10.3	0-150
	960-205-000	1/2	0-10.3	0-150

Options

	• = option is available s = option is standard	TYPE 70	TYPE 70BP
2	Non-Relieving	•	
3	Knob	s	s
	Sq. Head Adj. Screw	•	•
5	Epoxy Coating	•	•
6	Tapped Vent	•	
7	Mounting Bracket	•	•
8	Pressure Gauge	•	•
9	Tamper Resistant Cover	•	•
10	Low Bleed	•	
11	Check Valve	•	

Type 70 and 70BP Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		2	3	5	6	7	8	9	10	11
2	Non-Relieving	002	032	052	062	072	082	092		112
3	Sq. Head Adj. Screw		003	053	063	073	083		103	113
5	Epoxy Finish			005	065	075	085	095	105	115
6	Tapped Vent				006	076	086	096	106	116
7	Mounting Bracket					007	087	097	107	117
8	Pressure Gauge						008	098	108	118
9	Tamper-Resistant Cover							009	109	119
10	Low Bleed								010	110
11	Check Valve									011

Options and Accessories

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications, and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the body of the regulator exterior surfaces to provide increased corrosion resistance.

Tapped Vent

Allows installation of plumbing to capture exhaust air.

Mounting Bracket

Steel (dichromate finish) bracket for side mounting.

Pressure Gauge

Dual scale 2 in. (50.8 mm) gauges. Ranges include 0-30 PSIG (0-200 kPa), 0-60 PSIG (0-400 kPa), 0-100 PSIG (0-700 kPa) and 0-160 PSIG (0-1100 kPa). When specified with regulator, the correct range will be supplied.

Tamper Resistant Cover

An aluminum tubular cover placed over a slotted head adjusting screw and screwed onto the bonnet of the regulator with a wrench. Prevents ordinary hand adjustments.

Low Bleed

Reduces steady-state air consumption by approximately 50%.

Check Valve

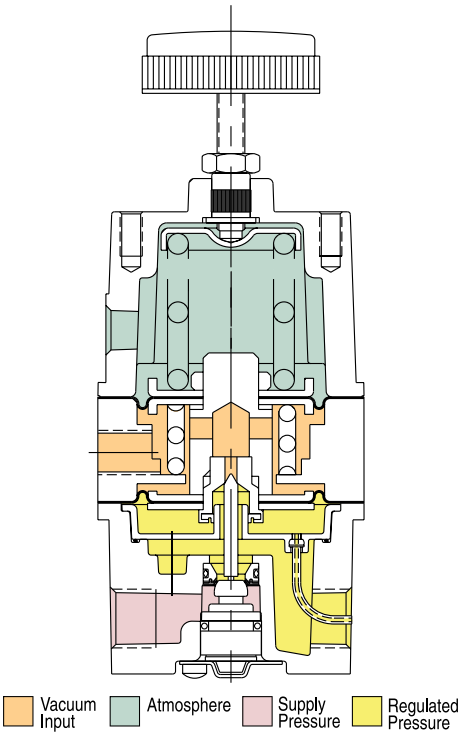
Allows quick dumping of output line pressure through the supply air line when the supply is shut down.

Type 77

Vacuum Regulator Series

Features

- Single-unit control of pressures from 29" Hg vacuum to 150 PSI
- Flow capacity up to 40 SCFM
- Dampening action of aspirator tube maintains stable output pressure
- Output virtually unaffected by changes in supply pressure
- Can be disassembled and serviced without removing from line



Description

Bellofram's Type 77 Vacuum Regulator incorporates a fixed negative 15 PSIG bias spring to maintain vacuum outputs up to 29" Hg. An adjustable opposing range spring increases controlled pressure outputs up to 150 PSIG.

Output pressure droop under varying downstream flow conditions is minimized by use of an aspirator tube which adjusts the air supply valve opening in accordance with flow velocity. A balanced supply valve, utilizing a reinforced rolling diaphragm, keeps regulator output virtually immune to changes in supply pressure. Stack-up construction makes the Type 77 easily serviceable, without removing it from the air line.

Applications

The Type 77 provides precise control in subatmospheric pressure applications. Specific uses include sample collecting systems, air quality monitoring, parts coating operations, and other industrial functions requiring controlled system pressure from 29" Hg vacuum to 150 PSIG.

The regulator may be installed either upstream or downstream from the vacuum pump. Upstream installation (Figure 1) is preferred when rapid evacuation of a vessel or system is required, because the exhaust capacity of the pump is normally greater than that of the regulator. In all other applications, the regulator can be located between the pump and the vessel. (Figure 2)

	TYPE 77
Sensitivity	1/2" (1.3 cm) Water Column
Flow Capacity	2.5 SCFM (71 L/M) @ 29" Hg (740 mm Hg) Vacuum 40 SCFM (1130 L/M) @ 100 PSIG (6.9 BAR) supply, 20 PSIG (1.4 BAR) output
Effect of Supply Pressure variation (25 psig/1.7 BAR) on Outlet Pressure	Less than 0.1 PSIG (0.01 BAR)
Exhaust Capacity@ 5 psig (0.34 BAR) above setpoint	4 SCFM (113 LPM)
Maximum Supply Pressure	250 PSIG (17.2 BAR)
Ambient Temperature Limits	-40 to 200˚F (-40 to 93˚C)
Output Pressure Ranges	Vacuum to 2 PSIG (0.1 BAR) Vacuum to 10 PSIG (0.7 BAR) Vacuum to 30 PSIG (2.1 BAR) Vacuum to 100 PSIG (6.9 BAR) Vacuum to 150 PSIG (10.3 BAR)
Total Air Consumption @ Maximum Output	6 SCFH (2.8 LPM)
Port Size	1/4 NPT, 3/8 NPT, 1/4 BSPT, 3/8 BSPT
Materials of Construction	Body: Diecast Aluminum with Vinyl Paint Trim: Stainless steel, Brass, Plated steel, Acetal and Buna-N Diaphragm: Buna-N with Polyester Fabric Knob: Phenolic Plastic Spring: Music wire
Mounting Options	Pipe, Panel or Bracket

Type 77 Ordering Information

T70	Range		Part Number	
	BAR	PSIG	1/4 NPT Port	3/8 NPT Port
Vac. to	0.1	2	960-500-000	960-505-000
Vac. to	0.7	10	960-501-000	960-506-000
Vac. to	2.1	30	960-502-000	960-507-000
Vac. to	6.9	100	960-503-000	960-508-000
Vac. to	10.3	150	960-504-000	960-509-000

Type 77 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		5	7	8
5	Epoxy Finish	005	075	085
7	Mounting Bracket		007	087
8	Pressure Gauge			008

To order BSPT threads (including the gauge port) add "BSPT" to end of part number.

Regulator Options and Accessories

Corrosive Resistant Epoxy Finish

An epoxy paint applied to the body and bonnet of the regulator exterior surfaces to provide increased corrosion resistance.

Mounting Bracket

Steel (dichromate finish) bracket for side mounting.

Pressure Gauge

Dual scale 2.5 in. (63 mm) gauges. Ranges include 30" Hg – 15 PSIG (-100 to 100 kPa), 30" Hg – 60 PSIG (-100 to 400 kPa), and 30" Hg – 150 PSIG (-100 to 1100 kPa). When specified with regulator, the correct range will be supplied. For NPT versions only.

Figure 1

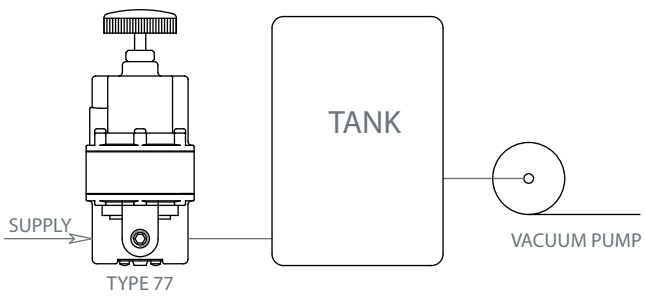
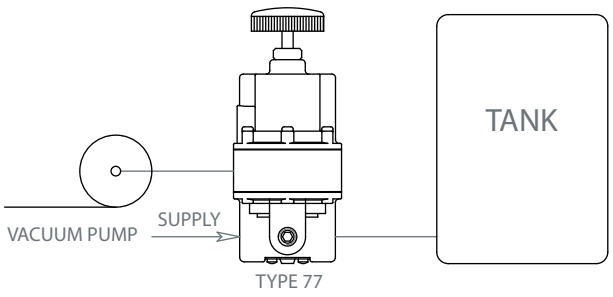
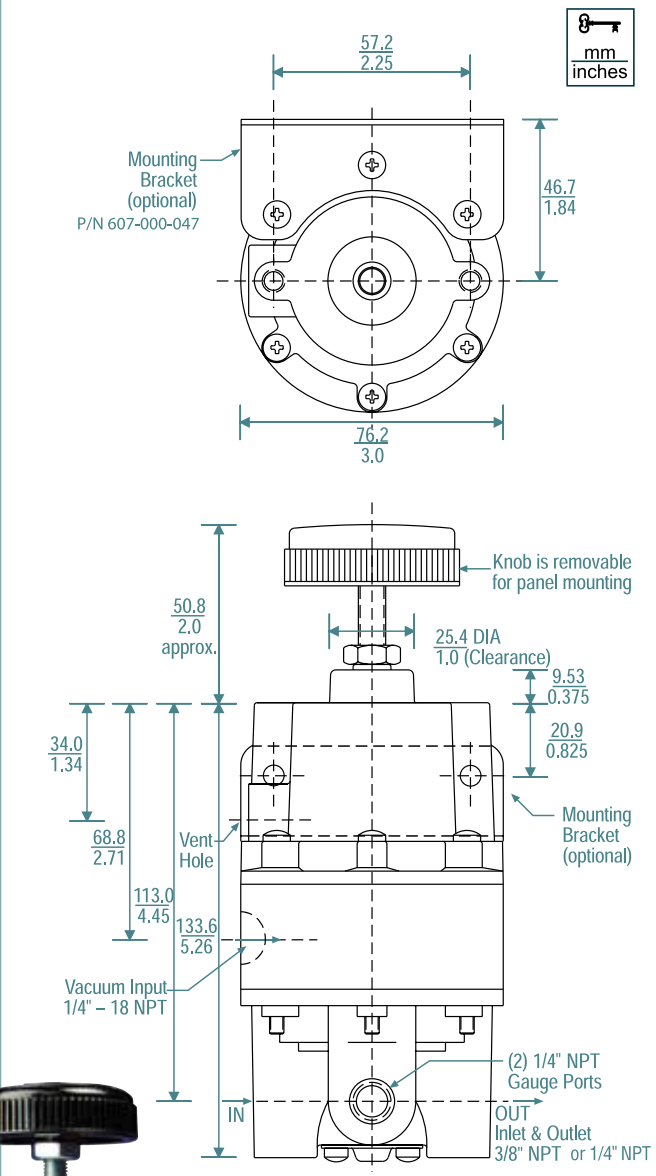


Figure 2



Type 77 Dimensional Drawing



Type 78

High Flow Air Regulator Series

Features

- Bellofram Rolling Diaphragm Provides Low-Friction, Long Life Service
- Available in 3/8, 1/2, 3/4, and 1 NPT and BSPT
- Output Gauge Ports are 1/4 NPT
- Options: Low-bleed, Non-relieving, Tamper Resistant Cover, Square-head Adjustment, T-handle Adjustment, Epoxy Paint, Tapped Supply Gauge Port, and Tapped Exhaust
- Mounting Brackets and Repair Kits Available
- Output Ranges are 0-2, 0-10, 0-30, 0-60, 0-125 PSIG 0-0.1, 0-0.7, 0-2.1, 0-4.1, 0-8.6 BAR
- Maximum Supply Pressure is Rated at 400 PSIG / 27.6 BAR
- Flow rates of well over 200 SCFM

Description

The Type 78 regulator is specifically designed for applications that require large flow capability and accurate pressure control. This regulator offers low droop, high accuracy, and fine adjustment sensitivity. The use of a Bellofram rolling diaphragm provides greater sensitivity and improved accuracy. The Type 78 offers a balanced pintle, which minimizes output pressure changes caused by fluctuations in supply pressure. Careful design and quality materials throughout assure long, trouble-free operation. The rugged die-cast zinc and aluminum housings are pressure tested to assure safe operation, and are designed to withstand harsh and abusive environments. This durability is attributed to a chemical conversion coating of all cast components and a vinyl paint finish.

With a maximum supply pressure of up to 400 PSIG/27.6 BAR and output ranges up to 125 PSIG/8.6 BAR, the Type 78 can achieve flow rates of well over 200 SCFM. It can be panel or pipe mounted.

Operation

Marsh Bellofram's Type 78 is a direct acting, diaphragm-operated regulator. Once set to a desired output pressure, this precision regulator maintains the setting permanently. The range spring, which has been compressed by the adjustment knob, causes the pintle to move downward, opening the supply valve and allowing air flow. The pressure builds up against the control diaphragm until the supply valve closes. This is the equilibrium or set pressure, which is closely maintained under changes in operating conditions in the following manner:

Downstream Pressure Drop

A drop in downstream pressure reduces the diaphragm pressure force, upsetting the equilibrium condition. This unbalance causes the supply valve to open until the pressure builds up once more to the equilibrium condition.

Downstream Pressure Increase

An increase in downstream pressure acts on the diaphragm, causing the relief seat in the diaphragm assembly to lift and open. The excess pressure is exhausted through the vent port until the output pressure is restored to the set point. The relief valve then closes.

Changes in Forward Flow

Under forward flow conditions, the range spring force is balanced by the diaphragm pressure force, with the supply valve open just enough to maintain the required forward flow. When high flow occurs, a specially designed aspirator helps maintain downstream pressure and compensates for droop.

The Type 78 regulator is specifically designed for applications that require large flow capability and accurate pressure control.

	Type 78
Sensitivity	Less than 1" water column
Flow Capacity	See Performance Curves
Exhaust Capacity	14 SCFM at 5 PSI / 0.3 BAR above 20 PSIG / 1.4 BAR set point (0-30 PSIG / 0-2.1 BAR range unit)
Air Consumption	less than 12 SCFH at 125 PSIG / 8.6 BAR output pressure
Effect of Supply Pressure on Regulated Pressure	less than ± 0.35 PSIG / 0.02 BAR for a supply variation of 100 PSIG / 6.9 BAR
Supply Pressure Max	400 PSIG / 27.6 BAR
Weight	Approx. 5 lbs.
Materials of Construction	Body: Die Cast Zinc Bonnet: Die Cast Aluminum Alloy Knob: Phenolic Plastic, Plated Steel Diaphragms: Nitrile Elastomers with Dacron Fabric Other Internal Materials: Brass, Stainless Steel, and Zinc
Mounting Options	Pipe or Panel

Options

Low Bleed

Reduces steady-state air consumption by approximately 50%.

Non-relieving

Used in applications where it is desirable to relieve pressure downstream of the regulator, for some constant flow applications and where the gas flowing through the regulator must not escape at the regulator. Non-relieving regulators should not be used for low or no flow applications.

Handle Options

"T" handle or square head.

Epoxy Paint

A gray epoxy finish applied to the body of the regulator to provide greater resistance to corrosive environments.

Tapped Vent (Exhaust)

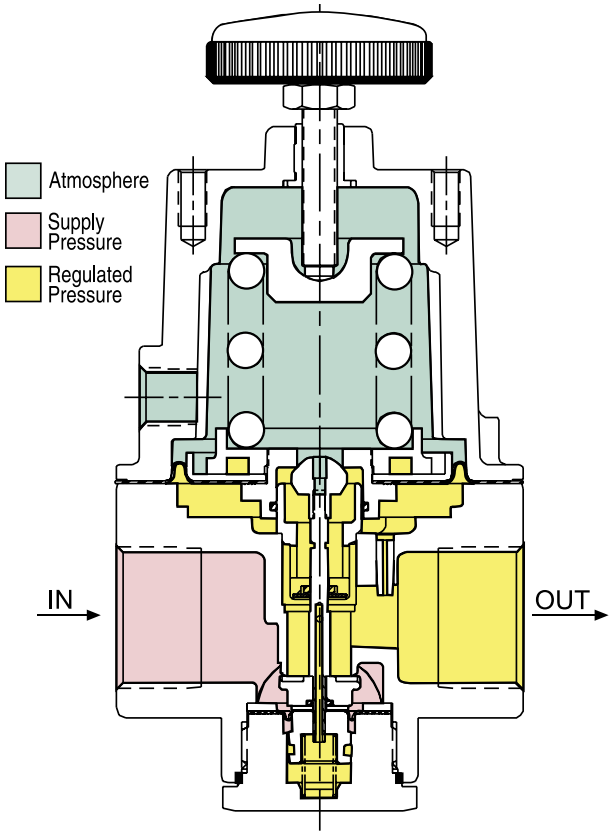
1/4 NPT tapped port to allow for installation of plumbing to capture exhaust air.

Tapped Supply Gauge Port

1/4 NPT tapped port is offered as a pressure tap for monitoring the inlet or upstream pressure supplied to the regulator.

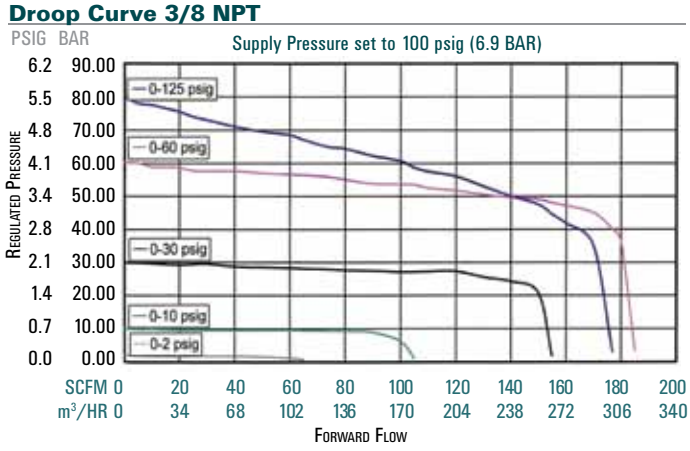
Tamper Resistant Cover

An aluminum tubular cover placed over a slotted head adjusting screw and screwed on the bonnet of the regulator with a wrench, prevents ordinary hand adjustments.

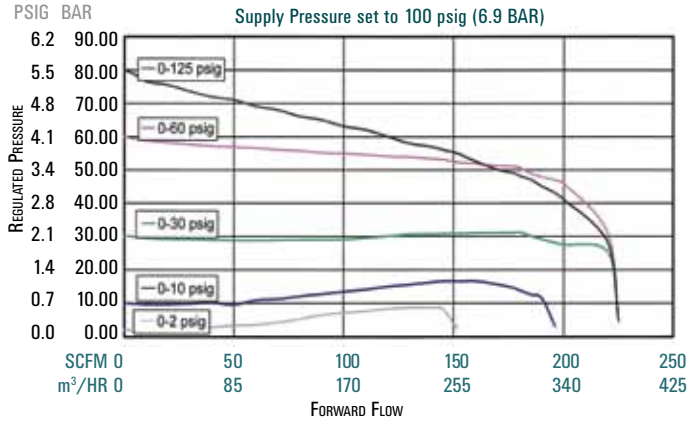


Type 78 Typical Performance Curves

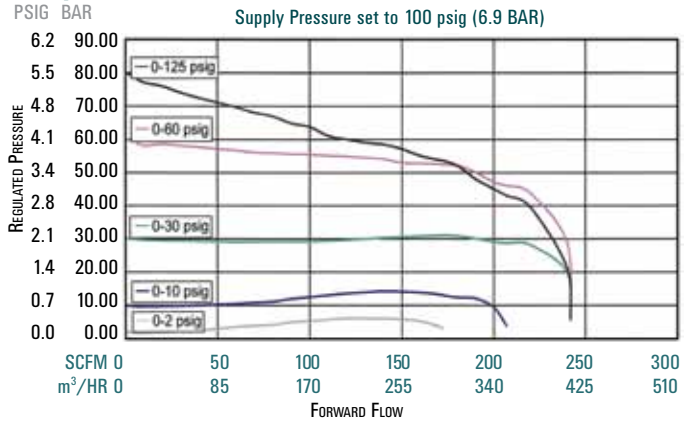
Droop Curve 3/8 NPT



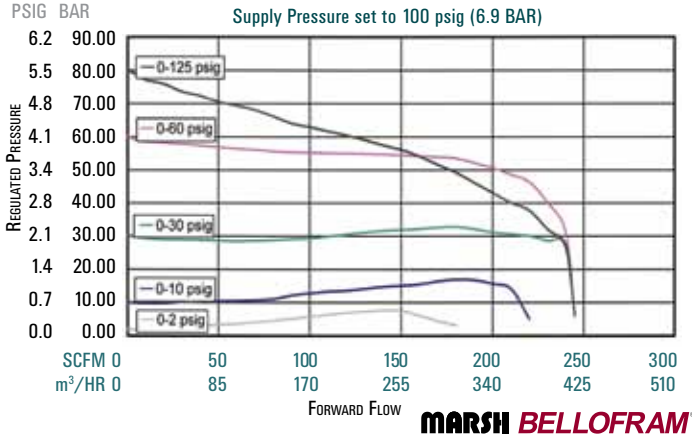
Droop Curve 1/2 NPT



Droop Curve 3/4 NPT



Droop Curve 1 NPT



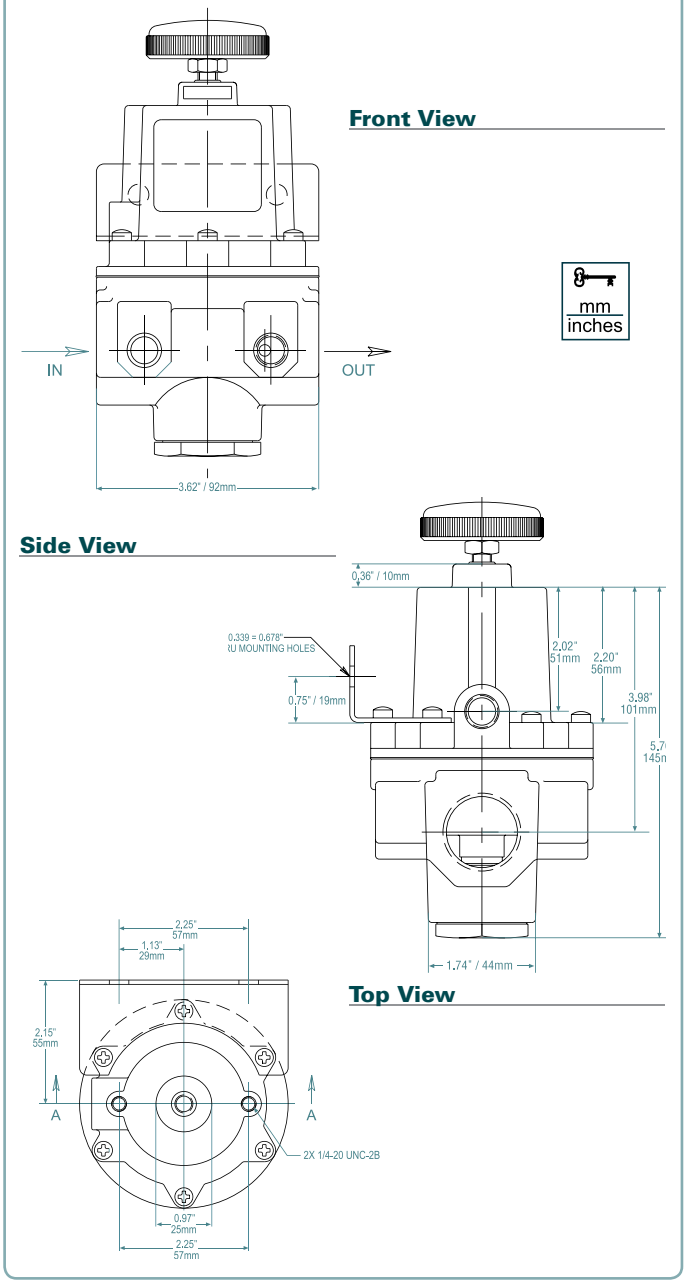
Type 78 Ordering Information

	Part Number	Port Size (NPT)	Range*	
			BAR	PSIG
T78	960-326-000	3/8	0-2.1	0-30
	960-327-000	1/2	0-2.1	0-30
	960-328-000	3/4	0-2.1	0-30
	960-329-000	1	0-2.1	0-30
	960-330-000	3/8	0-4.1	0-60
	960-331-000	1/2	0-4.1	0-60
	960-332-000	3/4	0-4.1	0-60
	960-333-000	1	0-4.1	0-60
	960-334-000	3/8	0-8.6	0-125
	960-335-000	1/2	0-8.6	0-125
	960-336-000	3/4	0-8.6	0-125
	960-337-000	1	0-8.6	0-125
	960-346-000	3/8	0-0.1	0-2
	960-347-000	1/2	0-0.1	0-2
	960-348-000	3/4	0-0.1	0-2
	960-349-000	1	0-0.1	0-2
	960-350-000	3/8	0-0.7	0-10
	960-351-000	1/2	0-0.7	0-10
	960-352-000	3/4	0-0.7	0-10
	960-353-000	1	0-0.7	0-10

BSPT: British Standard Pipe Threads can by ordered by adding "BSPT" to the end of the part number.

*Although the regulator can be shut off, the recommended operating ranges are between 10% and 100% of the adjustment range.

Type 78 Dimensional Drawing



Accessories

Gauges

1-1/2" gauge kits are recommended for supply and output.

Mounting Brackets

Zinc plated steel bracket to allow for side or panel mounting.
Part #607-293-000

Repair Kit

Includes control diaphragm and pintle assembly. Part #971-157-000

Type 78 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	3	4	5	6	7	8
1	Low Bleed	001		031	041	051	061	071	081
2	Non-Relieving		002	032	042	052	062	072	082
3	Sq. head Adj. Screw			003		053	063	073	
4	"T" Handle				004	054	064	074	
5	Epoxy Finish					005	065	075	085
6	Tapped Vent						006	076	086
7	Tapped Supply Port							007	087
8	Tamper Resistant Cover								008

Type 91
Subminiature Regulator Series

Features

- Designed for applications with limited space and for low flow or dead end service
- Small package size and lightweight construction
- Standard or low bleed versions available
- Corrosion resistant anodized aluminum exterior
- Excellent stability and repeatability
- Self relieving
- Low cost

Type 91

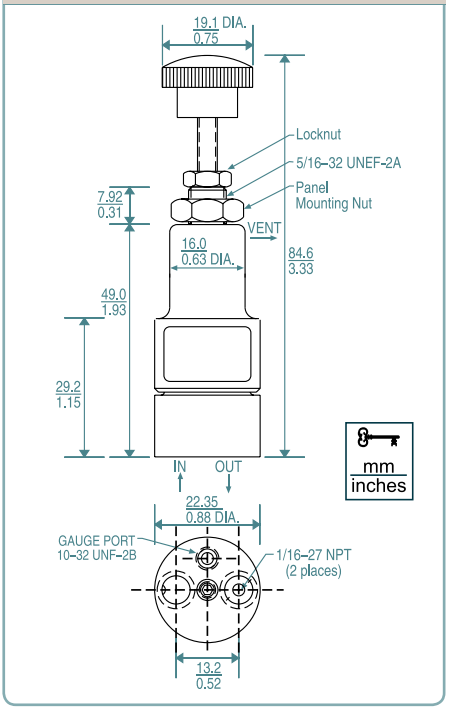
The Type 91 Subminiature Regulator is a compact, low-cost unit which operates in pressure ranges up to 100 PSI, with a maximum supply pressure of 250 PSI. It provides dependable reliability and accuracy for low flow or dead end applications, but is not designed for critical flow applications. The Type 91 subminiature regulator is available with a corrosion resistant anodized aluminum body and bonnet or with a brass body and bonnet. Both come standard with a fluorocarbon diaphragm.

Type 91 Low Bleed

The Type 91 low bleed version is designed for applications where low air consumption is required. The Type 91 is ideal for applications where space is limited and for dead ended/low flow service. Such applications include ink control on printing presses, panel loading applications, hand-held analyzers and calibration equipment, small cylinder operations, and all types of instrumentation applications. It can be through panel mounted or, due to its lightweight, pipe mounted. A slotted adjustment screw is available for precision control.

	Type 91	Type 91 Low Bleed
Effect of Supply Pressure Variation (25 psig) on Outlet Pressure	< 0.25 PSIG (17.02 mBAR)	< 0.5 PSIG (34.5 mBAR)
Exhaust Capacity (5 psig above 20 psig set point)	0.1–0.3 SCFM Typical (2.8-8.5 LPM)	0.1–0.3 SCFM Typical (2.8-8.5 LPM)
Max. Supply Pressure	250 PSIG (17.2 BAR)	150 PSIG (10.3 BAR)
Flow Capacity at 100 psig (6.9 BAR) Supply and 20 psig (1.4 BAR) Outlet	2.5 SCFM (71 LPM)	1.4 SCFM (40 LPM)
Output Pressure Ranges	0-5 PSIG (0-0.35 BAR) 0-15 PSIG (0-1.0 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)	0-5 PSIG (0-0.35 BAR) 0-15 PSIG (0-1.0 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)
Total Air Consumption @ Max Output	3 SCFH (1.42 LPM)	0.3 SCFH (0.14 LPM)
Port Size	1/16 NPT / 5mm	1/16 NPT / 5mm
Materials of Construction	Body: Anodized Aluminum Adjusting Screw: Plated Steel Trim: Brass, Acetal Diaphragm: Fluorocarbon with Polyester Fabric Knob: Acetal Resin Spring: Music Wire	Body: Anodized Aluminum Adjusting Screw: Plated Steel Trim: Brass, Acetal Diaphragm: Fluorocarbon with Polyester Fabric Knob: Acetal Resin Spring: Music Wire
Size and Weight	0.875" X 0.875" X 3.33" (22.2 X 22.2 X 84.6 mm) 2.2 oz. (0.06 kg)	0.875" X 0.875" X 3.33" (22.2 X 22.2 X 84.6 mm) 2.2 oz. (0.06 kg)
Mounting Options	Pipe or Panel	Pipe or Panel

Type 91 Dimensional Drawing



Type 91 and 91 Low Bleed Ordering Information

	Part Number	Port Size (NPT)	Set Point Range BAR	Set Point Range PSIG
Type 91	960-240-000	1/16	0-0.3	0-5
	960-236-000		0-1.0	0-15
	960-237-000		0-2.1	0-30
	960-238-000		0-4.1	0-60
	960-239-000		0-6.9	0-100
	962-036-000	5mm	0-0.3	0-5
	962-083-000		0-1.0	0-15
	962-033-000		0-2.1	0-30
	962-034-000		0-4.1	0-60
	962-035-000		0-6.9	0-100

Type 91 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option	Non-Relieving	Slotted Adj. Screw	Low Bleed
Non Relieving	002	032	–
Slotted Adj. Screw		003	103
Low Bleed			010

Type 91 Barbed Fittings

Port	Size	Part Number
In/Out Port	1/16 NPT	622-000-007
Gauge Port	10 - 32 UNF	622-000-031

Type 92
Subminiature Regulator Series

Features

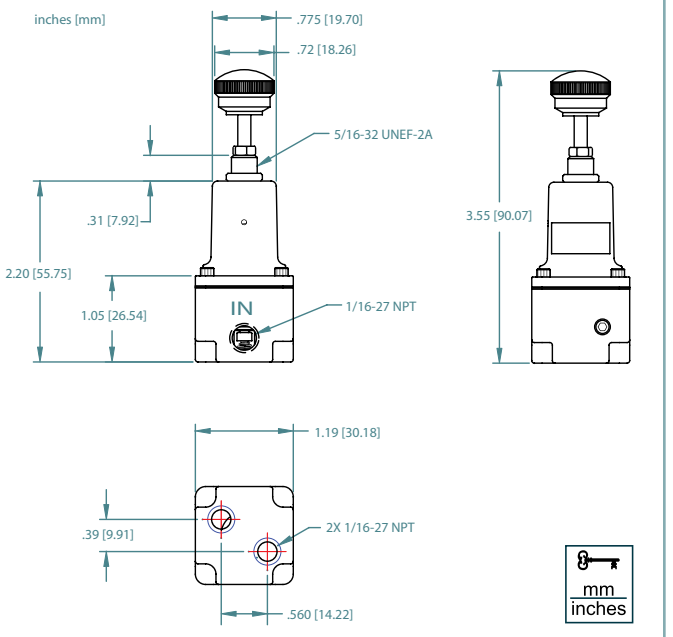
- Designed for applications with limited space and for low flow or dead end service
- Small package size and lightweight construction
- Corrosion resistant anodized aluminum exterior
- Excellent stability and repeatability
- Self relieving
- Low cost

With the new Type 92, Marsh Bellofram has created a subminiature regulator with a true rolling diaphragm design. Most subminiature regulators utilize a flat diaphragm, which in this small of a regulator causes excessive droop and low stability. By utilizing a larger diameter rolling diaphragm, the Type 92 regulator offers a more sensitive regulator with excellent stability and significantly less droop.

The Type 92 Subminiature Regulator is a compact, low-cost unit which operates in pressure ranges up to 100 PSI, with a maximum supply pressure of 150 PSI. It provides dependable reliability and accuracy for low flow or dead end applications. The Type 92 subminiature regulator is available with a corrosion resistant anodized aluminum body and bonnet. Comes standard with a fluorocarbon diaphragm.

	Type 92
Effect of Supply Pressure Variation (25 PSIG) on Outlet Pressure	< 0.5 PSIG (35.5 mBAR)
Exhaust Capacity (5 psig above 20 PSIG set point)	0.1–0.3 SCFM Typical (2.8-8.5 LPM)
Maximum Supply Pressure	150 PSIG (10.3 BAR)
Flow Capacity at 100 PSIG (6.9 BAR) Supply and 20 psig (1.4 BAR) Outlet	5 SCFM (141 LPM)
Standard Output Pressure Ranges	0-5 PSIG (0-0.35 BAR) 0-15 PSIG (0-1.0 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-100 PSIG (0-6.9 BAR)
Total Air Consumption at Max Output Pressure	0.3 SCFH (0.14 SLPM)
Operating Temperature Range	0 - +160˚F (-18˚- 71˚C)
Port Size	1/16 NPT - Side and Bottom Ports
Materials of Construction	Body: Anodized Aluminum Bonnet: Anodized Aluminum Trim: Acetal, Brass, Stainless Steel Diaphragm: Fluorocarbon with Polyester Fabric Knob: Acetal Resin Spring: Stainless Steel, Music Wire
Size and Weight	1.19" X 1.19" X 3.55" (30.2 X 30.2 X 90.2 mm) 2.8 oz. (0.08 kg)
Mounting Options	Pipe or Panel

Type 92 Dimensional Drawing



Type 92 Ordering Information

	Part Number	Port Size (NPT)	Set Point Range BAR	Set Point Range PSIG
Type 92	960-540-000	1/16	0-0.3	0-5
	960-541-000		0-1.0	0-15
	960-542-000		0-2.1	0-30
	960-543-000		0-4.1	0-60
	960-544-000		0-6.9	0-100

Type 92 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option	Non- Relieving	Slotted Adj. Screw
Non Relieving	002	032
Slotted Adj. Screw		003

Type 92 Barbed Fittings

Port	Size	Part Number
In/Out Port	1/16 NPT	622-000-007
Gauge Port	10 - 32 UNF	622-000-031

Filters, Regulators and Lubricators

Features

- Modular design for service and interchangeability
- Miniature (M1) and Standard (M2)
- Small package size and light weight construction
- Competitively priced

Filters

- M1 has polycarbonate bowl
- M2 has polycarbonate bowl with metal guard
- Stock Elements - 5, 25 or 50 micron
- Manual, semi-auto or auto drain available

Regulators

- Bellofram® Rolling Diaphragm for superior regulator performance
- Panel, pipe, or bracket (included) mounting
- Metal body, polycarbonate bonnet and knob
- Non-rising adjustment knob with push-pull lock ring feature

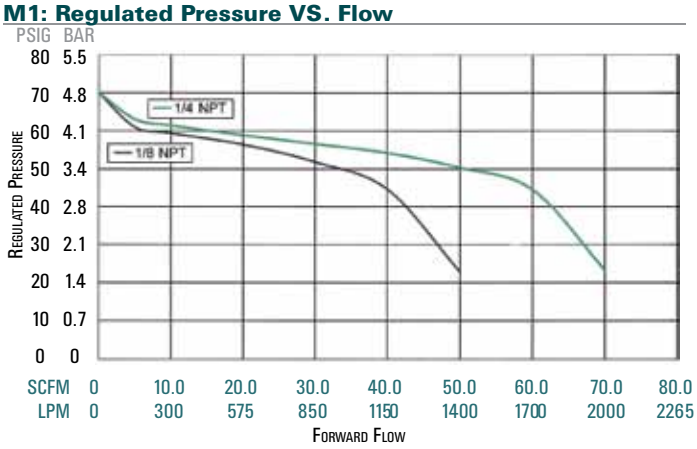
Filter Regulators

- Aluminum and polycarbonate construction
- Manual, semi-auto or autodrain available
- M1 has polycarbonate bowl;
- M2 have polycarbonate bowl with metal guard
- Non-rising adjustment knob with push-pull lock ring feature
- For panel or bracket mounting
- Bellofram® Rolling Diaphragm for superior regulator performance

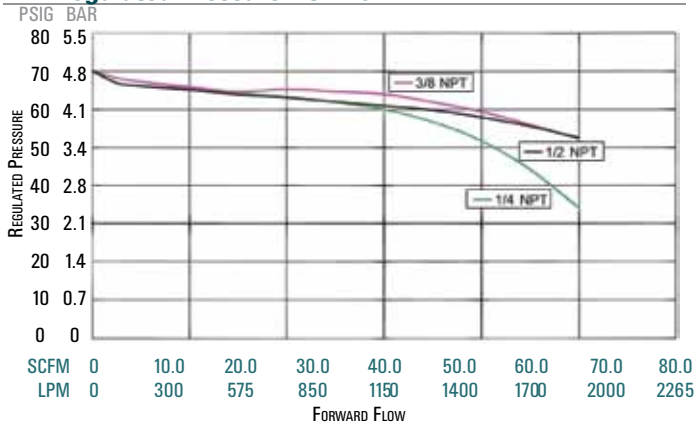
Lubricators

- M1 has polycarbonate bowl; remove bowl for filling.
- M2 has polycarbonate bowl with metal guard; top plug permits filling without removing bowl or shutting off air
- Adjust drip rate by hand, using graduated ring on M1, with screwdriver on M2

M1: Regulated Pressure VS. Flow



M2: Regulated Pressure VS. Flow



	Type M1	Type M2
Filters		
Port Size	1/8, 1/4 NPT	1/4, 3/8, 1/2 NPT
Filtration (micron)	5µ, 25µ, 50µ	5µ, 25µ, 50µ
Maximum Supply Pressure	1.0 MPa 10 BAR 145 PSI	1.0 MPa 10 BAR 145 PSI
Temperature Range	41-140˚F / 5-60˚C	41-140˚F / 5-60˚C
Drain	Manual / Semi-Auto	Manual / Semi-Auto / Auto
Bowl Capacity	0.75 inch^3	2.75 inch^3
Flow (based on 100 PSI inlet pressure with 50 micron filter)	55, 85 SCFM	120, 120, 120 SCFM
Regulators		
Effect of Supply Pressure variation (25 PSIG) on Outlet Pressure	< 0.2 PSIG (13.8 mBAR)	< 0.2 PSIG (13.8 mBAR)
Exhaust Capacity (5 PSIG above 20 psig set point)	<0.25 SCFM (<7 LPM	<0.25 SCFM (<7 LPM)
Maximum Supply Pressure	145 PSIG (10 BAR)	145 PSIG (10 BAR)
Flow Capacity at 100 PSIG (6.9 BAR) supply and 70 PSIG (4.8 BAR) outlet	40, 60 SCFM	90, 120, 120 SCFM
Output Pressure Ranges	0-10 PSIG (0-0.69 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)	0-10 PSIG (0-0.69 BAR) 0-30 PSIG (0-2.1 BAR) 0-60 PSIG (0-4.1 BAR) 0-120 PSIG (0-8.3 BAR)
Total Air Consumption @ Maximum Output	0.3 SCFH (0.14 LPM)	0.3 SCFH (0.14 LPM)
Port Size	1/8, 1/4 NPT	1/4, 3/8, 1/2 NPT
Mounting Options	Pipe, Panel or Bracket	Pipe, Panel or Bracket
Filter-Regulators		
Port Size	1/8, 1/4 NPT	1/4, 3/8, 1/2 NPT
Filtration (micron)	5µ, 25µ, 50µ	5µ, 25µ, 50µ
Maximum Supply Pressure	1.0 MPa 10 BAR 145 PSI	1.0 MPa 10 BAR 145 PSI
Temperature Range	41-140˚F / 5-60˚C	41-140˚F / 5-60˚C
Drain	Manual / Semi-Auto	Manual / Semi-Auto / Auto
Bowl Capacity	0.75 inch^3	2.75 inch^3
Regulator Output Range	0-10, 0-30, 0-60, 0-120 psi	0-10, 0-30, 0-60, 0-120 psi
Flow (based on 100 PSI supply/70 PSI out)	40, 60 SCFM	90, 120, 120 SCFM
Lubricators		
Port Size	1/8, 1/4 NPT	1/4, 3/8, 1/2 NPT
Lubrication	Mist	Mist
Maximum Supply Pressure	1.0 MPa 10 BAR 145 PSI	1.0 MPa 10 BAR 145 PSI
Temperature Range	41-140˚F / 5-60˚C	41˚-140˚F / 5˚-60˚C
Bowl Capacity	1.22 inch^3	5.18 inch^3
Flow (based on 100 PSI inlet pressure)	55, 115 SCFM	125, 125, 125 SCFM

FRL Ordering Information

M							
	↑	↑	↑	↑	↑	↑	Size
	1						Miniature Series
	2						Standard Series
							Description
		F					Filter
		R					Regulator
		L					Lubricator
		FR					Filter Regulator
		FRP					Filter Regulator PLUS Lubricator
		FRL					Filter, Regulator, Lubricator
							Port Size
			1N				1/8 NPT (M1 only)
			2N				1/4 NPT (M1 or M2)
			3N				3/8 NPT (M2 only)
			4N				1/2 NPT (M2 only)
							Pressure Ranges
				A			0-10 PSI, (M1 and M2)
				L			0-30 PSI
				M			0-60 PSI
				H			0-120 PSI, Standard
				–			Omit for Filters and Lubricators
							Filters
					C		50 Micron Filter, Standard
					B		25 Micron Filter
					F		5 Micron Filter
					–		Omit for Regulators and Lubricators
							Drain
						M	Manual Drain, Standard
						S	Semi-Automatic Drain
						A	Auto Drain (M2 only)
						–	Omit for Regulators and Lubricators

NOTE: Individual regulators, FRs, filters, and lubricators come complete with bracket. FRL assemblies come complete with all bracket/connectors.

Relays & Volume Boosters

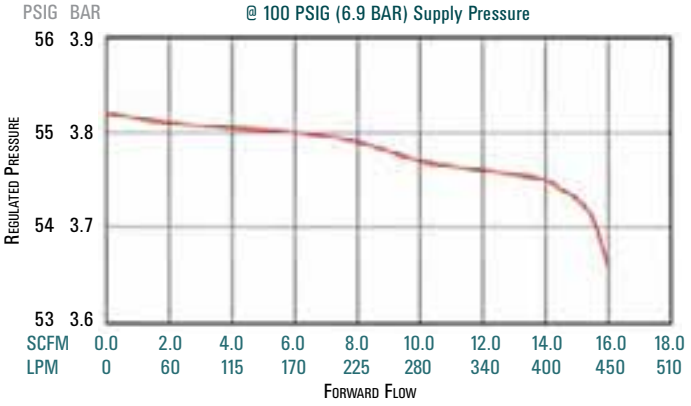
- Type 20
- Type 20 HR
- Type 20 EX HR
- Type 72
- Type 72 HR
- Type 75
- Type 75 HR
- Type 79
- Type 79 HR

Relays - Volume Boosters

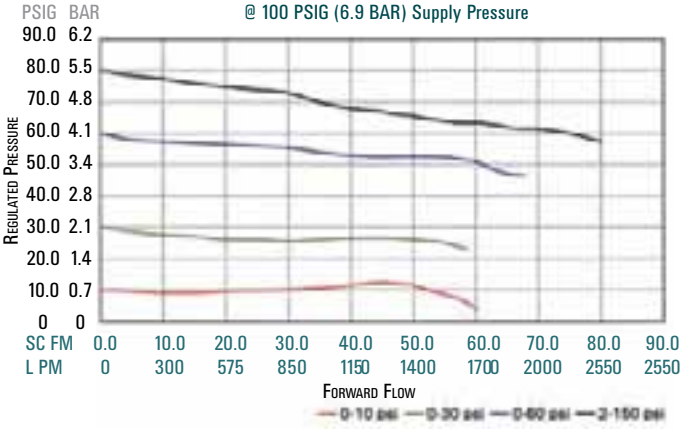
Comparison Chart

	Type 20	Type 20 HR	Type 20 EX HR
Maximum Supply Pressure	150 PSIG (10.3 BAR)	150 PSIG (10.3 BAR)	150 PSIG (10.3 BAR)
Sensitivity	1/8" H_2O (3.2mm)	1/8" H_2O (3.2mm)	1/8" H_2O (3.2mm)
Supply Pressure Sensitivity	0.005 PSIG (0.35 mBAR) per 25 PSIG (1.7 BAR) change in supply pressure	0.005 PSIG (0.35 mBAR) per 25 PSIG (1.7 BAR) change in supply pressure	0.005 PSIG (0.35 mBAR) per 25 PSIG (1.7 BAR) change in supply pressure
Flow Capacity	14 SCFM (400 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	14 SCFM (400 LPM) @ 20 psig (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	14 SCFM (400 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply
Exhaust Capacity	2 SCFM (55 LPM) @ 5 PSIG (0.35 BAR) above a 20 PSIG (1.4 BAR) setpoint	10 SCFM (285 LPM) @ 5 PSIG (0.35 BAR) above a 20 PSIG (1.4 BAR) setpoint	15 SCFM (425 LPM) @ 5 PSIG (0.35 BAR) above a 20 PSIG (1.4 BAR) setpoint
Temperature Limits	-20 to 160˚F (-29 to 71˚C)	-20 to 160˚F (-29 to 71˚C)	-20 to 160˚F (-29 to 71˚C)
Air Consumption	8 SCFH (4 LPM)	8 SCFH (4 LPM)	8 SCFH (4 LPM)
Port Size	1/8", 1/4", 3/8" NPT, BSPP, BSPT	1/8", 1/4", 3/8" NPT, BSPP, BSPT	1/8", 1/4", 3/8" NPT, BSPP, BSPT
Output Pressure Range	2-120 PSIG (0.1 – 8.3 BAR)	2-120 PSIG (0.1 – 8.3 BAR)	2-120 PSIG (0.1 – 8.3 BAR)
Maximum Signal	120 PSIG (8.3 BAR)	120 PSIG (8.3 BAR)	120 PSIG (8.3 BAR)
Weight	1.4 lb. (0.6 kg.)	1.4 lb. (0.6 kg.)	1.4 lb. (0.6 kg.)
Ratio of Accuracy for a 12 PSIG span	<0.5%	<0.5%	<0.5%

Type 20, 20HR and 20 EXHR Flow Curve - 1/8

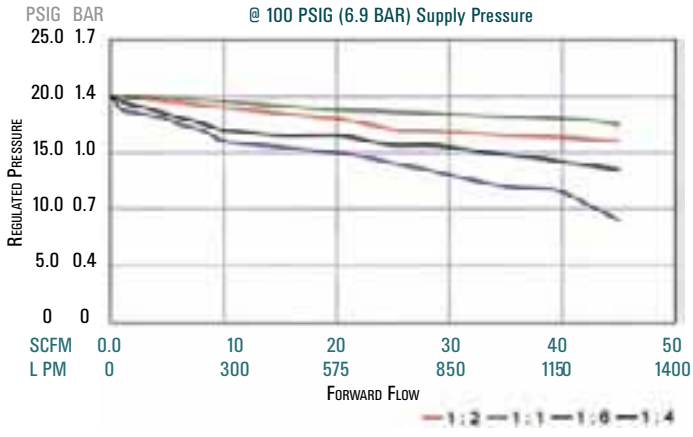


Type 72 and Typo 72 HR Flow Curves - 1/4

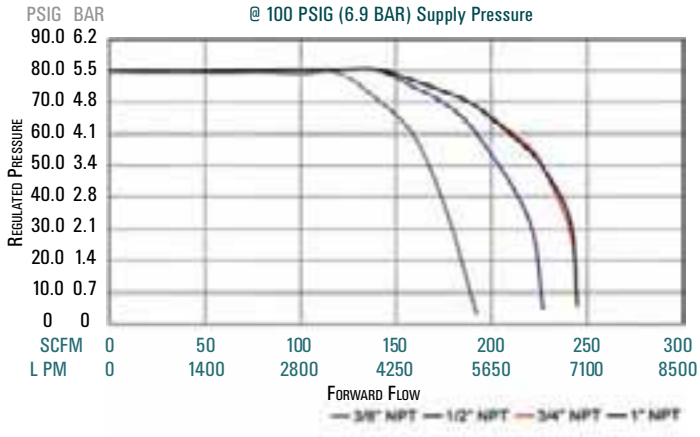


	Type 72	Type 72 HR	Type 75	Type 75 HR	Type 79	Type 79HR
Maximum Supply Pressure	250 PSIG (17.2 BAR)	250 PSIG (17.2 BAR)	250 PSIG (17.2 BAR)	250 PSIG (17.2 BAR)	400 PSIG (27.6 BAR)	400 PSIG (27.6 BAR)
Sensitivity	1/4" H_2O (6.4mm)	1/4" H_2O (6.4mm)	1/4" H_2O (6.4mm)	1/4" H_2O (6.4mm)	1" H_2O (25mm)	1" H_2O (25mm)
Supply Pressure Sensitivity	< 0.6 PSIG (0.01 BAR) per 50 PSIG (1.4 BAR) change in supply pressure	< 0.6 PSIG (0.01 BAR) per 50 PSIG (1.4 BAR) change in supply pressure	< 0.6 PSIG (0.04 BAR) per 50 PSIG (6.9 BAR) change in supply pressure	< 0.6 PSIG (0.04 BAR) per 50 PSIG (3.5 BAR) change in supply pressure	<0.35 PSIG (0.02 BAR) per 100 PSIG (3.5 BAR) change in supply pressure	<0.35 PSIG (0.02 BAR) per 100 PSIG (3.5 BAR) change in supply pressure
Flow Capacity	40 SCFM (1150 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	40 SCFM (1150 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	40 SCFM (1150 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	40 SCFM (1150 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	>125 SCFM (3500 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply	>125 SCFM (3500 LPM) @ 20 PSIG (1.4 BAR) signal and 100 PSIG (6.9 BAR) supply
Exhaust Capacity	6 SCFM (170 LPM) @ 10 PSIG (0.69 BAR) above a 20 PSIG (1.4 BAR) setpoint	15 SCFM (425 LPM) @ 10 PSIG (0.69 BAR) above a 20 PSIG (1.4 BAR) setpoint	6 SCFM (170 LPM) @ 10 PSIG (0.69 BAR) above a 20 PSIG (1.4 BAR) setpoint	15 SCFM (425 LPM) @ 10 PSIG (0.69 BAR) above a 20 PSIG (1.4 BAR) setpoint	31 SCFM (875 LPM) @ 5 PSIG (0.35 BAR) above a 20 PSIG (1.4 BAR) setpoint	39 SCFM (3500 LPM) @ 5 PSIG (0.35 BAR) above a 20 PSIG (1.4 BAR) setpoint
Temperature Limits	-40 to 200˚F (-40 to 93˚C)	-40 to 200˚F (-40 to 93˚C)	-40 to 200˚F (-40 to 93˚C)	-40 to 200˚F (-40 to 93˚C)	-40 to 200˚F (-40 to 93˚C)	-40 to 200˚F (-40 to 93˚C)
Air Consumption	<12 SCFH (5.7 LPM)	<12 SCFH (5.7 LPM)	<12 SCFH (5.7 LPM)	<12 SCFH (5.7 LPM)	<12 SCFH (5.7 LPM)	<12 SCFH (5.7 LPM)
Port Size	1/4", 3/8", 1/2" NPT, BSPP, BSPT	1/4", 3/8", 1/2" NPT, BSPP, BSPT	1/4", 3/8" NPT, BSPP, BSPT	1/4", 3/8", 1/2" NPT, BSPP, BSPT	3/8", 1/2", 3/4", 1" NPT, BSPP, BSPT	3/8", 1/2", 3/4", 1" NPT, BSPP, BSPT
Output Pressure Range	0-150 PSIG (0-10.3 BAR)	0-150 PSIG (0-10.3 BAR)	0-150 PSIG (0-10.3 BAR)	0-150 PSIG (0-10.3 BAR)	0-200 PSIG (0-13.8 BAR)	0-200 PSIG (0-13.8 BAR)
Maximum Signal	150 PSIG (10.3 BAR)	150 PSIG (10.3 BAR)	150 PSIG (10.3 BAR) for 1:1 ratio	150 PSIG (10.3 BAR) for 1:1 ratio	200 PSIG (13.8 BAR)	200 PSIG (13.8 BAR)
Weight	1.75 lb. (0.8 kg.)	1.75 lb. (0.8 kg.)	1.3 lb. (0.6 kg.)	1.3 lb. (0.6 kg.)	4.5 lb. (2.0 kg.)	4.5 lb. (2.0 kg.)
Ratio of Accuracy for a 12 psig span	< 2%	< 2%	< 2% (1:1)	< 2% (1:1)	<1.5%	<1.5%

Type 75: Regulated Pressure VS. Flow



Type 79 and 79 HR: Regulated Pressure VS. Flow



Type 20
Precision Air Relays

Features

- Extreme accuracy
- Positive and negative bias capability
- Small size
- Rugged and stable

Description

The Type 20 Air Relay is a compact, two-stage, pilot operated 1:1 relay with positive and negative bias adjustment capability. It accepts a signal pressure and combined with the bias adjustment, maintains a resulting output pressure with an accuracy and reliability unmatched by any other pressure relay in its price range.

Models

Type 20

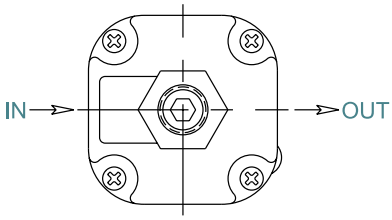
The basic relay is offered with a choice of three port sizes.

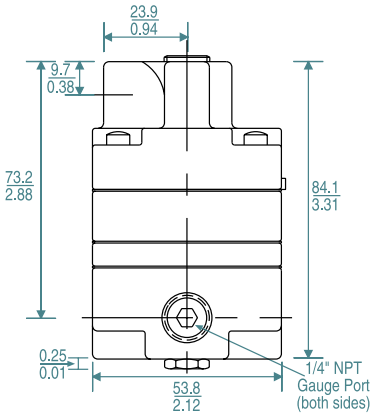
Type 20HR and Type 20EXHR

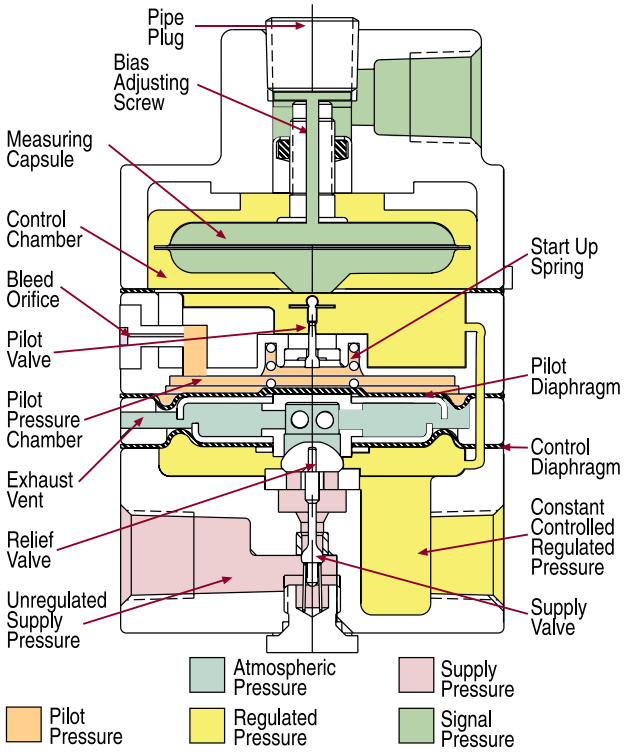
High Relief Relays - These relays provide extra fast "blowdown" for very rapid release of output pressure. The extra relief feature makes this relay suitable for cylinder return stroke actuation, air hoists, and similar applications requiring fast exhaust.

Applications

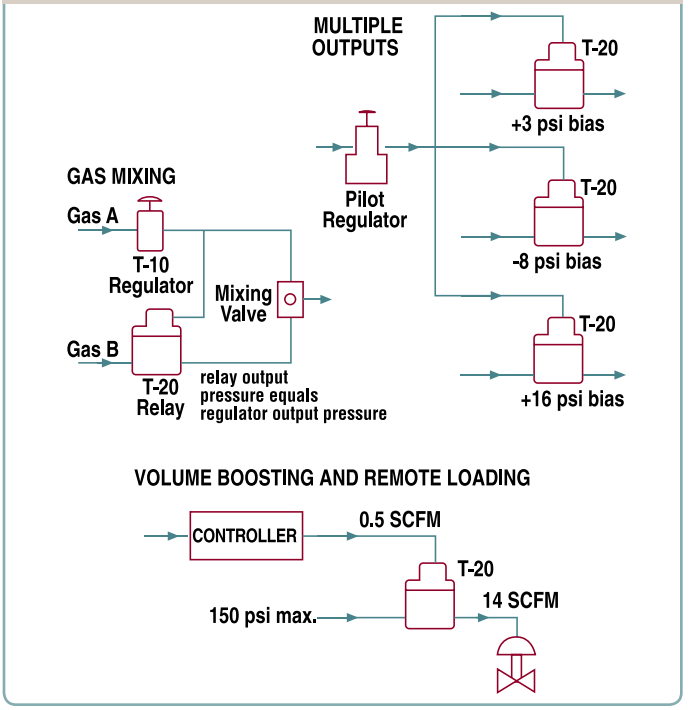
- Gate Actuators
- Air Hoists
- Disc and Shoe Brakes
- Remote Positioning Devices
- Valve Rotors
- Control Valves
- Tensioning Systems
- Web Tracking Systems







Type 20 Application Diagrams



Type 72 & 72HR

Positive Bias Booster Relays

Features

- Four adjustable positive bias ranges, from 0-10 PSI (0-0.7 BAR) to 2-150 PSI (0.1-10.3 BAR)
- Flow capacity up to 50 SCFM
- Quick response to minute changes in down-stream pressure
- Dampening action of aspirator tube maintains stable output pressure
- Output virtually unaffected by changes in supply pressure
- Internal rolling diaphragm designed for millions of cycles
- Honking and buzzing eliminated by action of integral baffle and aspirator tube
- Can be disassembled and serviced without removing from line
- Also available in a high relieving version (72HR)

Description

The Type 72 Relay features an adjustable bias pressure which enables users to obtain an output pressure which is the sum of a controlled input signal pressure plus the bias. The relay offers an exceptionally high flow capacity (up to 50 SCFM/1400 LPM) with minimal pressure droop.

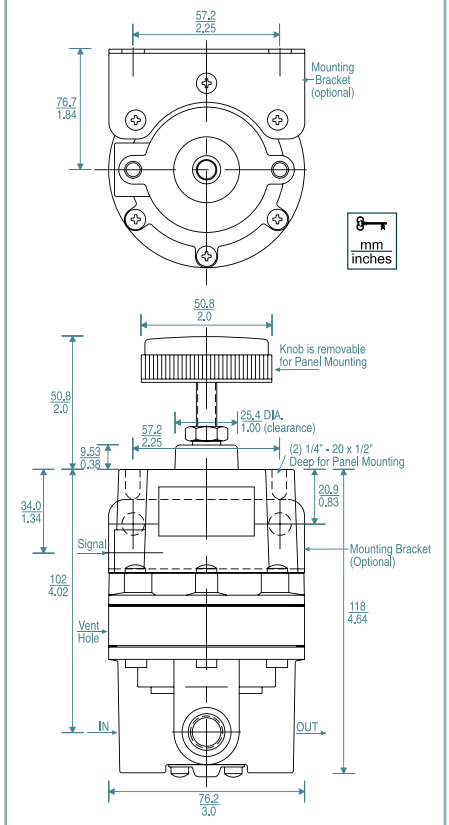
Output pressure is accurately maintained under varying flow conditions by means of an aspirator tube, which adjusts the air supply valve opening in proportion to flow velocity. A balanced supply valve utilizing a rolling diaphragm makes the relay virtually immune to changes in supply pressure. Simple design makes maintenance easy, and the relay can be serviced without removing it from the line. The standard signal-to-output ratio is 1:1, but 1:2, 1:4 and 1:6 ratios are available on special request.

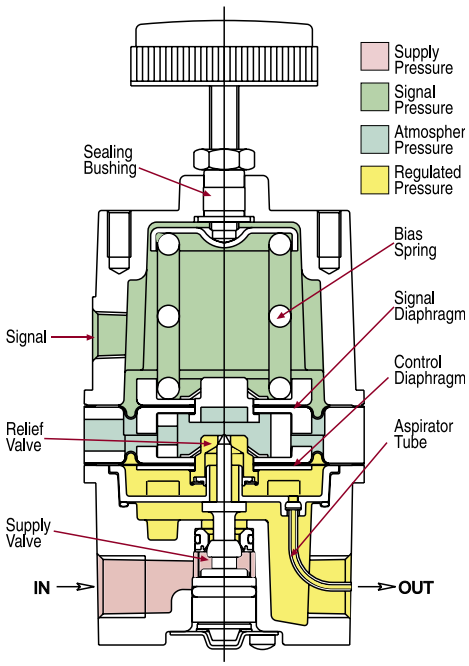
Applications

The Type 72 Relay is used when high flow capacity is required in conjunction with a positive output pressure bias. Typical applications include:

- Gas Flow Control
- Tensioning Control
- Clutch and Brake Controls
- Volume Boosting
- Dancer Roll Loading
- Calendar Roll Loading
- Cylinder Bucking Control
- Valve Motor Loading

Type 72 Dimensional Drawing

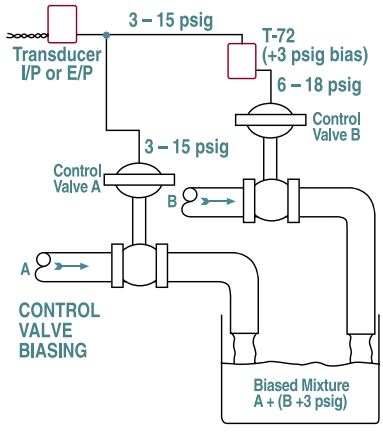




Type 72

Positive Bias Booster Relay

Type 72 Application Diagrams



Type 75
Air Relays

Features

- Balanced valve design
- High flow capacity
- Field serviceable
- Multiple output ratios
- Negative biasing option

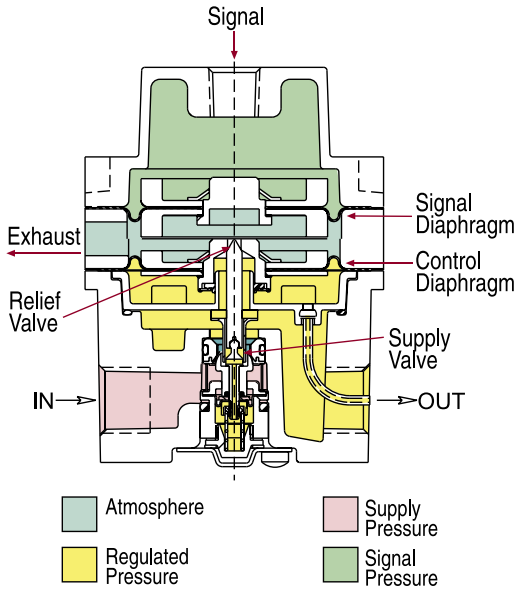
Description

The Type 75 relay uses signal pressure to accurately control output pressure over a wide range of flow and supply pressure variation.

Under varying flow conditions output pressure is maintained by use of an aspirator tube, which adjusts the air supply valve opening in accordance with the flow velocity. A balanced supply valve, utilizing a rolling diaphragm, makes the relay virtually immune to changes in supply pressure. Maintenance is simple due to the unit construction, and the relay can be serviced without removing it from the line. Signal to output pressure ratios of 1:1, 1:2, 1:4 and 1:6 are available. Maximum output is 150 PSIG (10.3 BAR).

Applications

- Volume Boosting
- Dancer Roll Loading
- Calendar Roll Loading
- Cylinder Bucking Control
- Clutch and Brake Controls
- Gas Flow Control
- Tensioning Control
- Valve Motor Loading



Models

Type 75

The basic relay offers excellent precision along with high forward flow rates.

Type 75 High Relief Relays

These relays provide extra fast "blowdown" for very rapid release of output pressure. The extra relief feature makes this relay suitable for cylinder return stroke actuation, air hoists, and similar applications requiring fast exhaust.

Type 75 Negative Bias

The Type 75 Relay is also available with a 4 ± 1 psig (0.3 ± 0.07 BAR) negative bias spring mounted internally. (See cross-sectional drawing on previous page.) This bias spring automatically subtracts 4 ± 1 psig (0.3 ± 0.07 BAR) from any signal pressure introduced. The relay then multiplies the net signal pressure by its ratio value to obtain final output pressure.

This option is particularly useful in obtaining zero pressure from pneumatic devices such as I/P transducers that normally cannot be adjusted this low, as well as obtaining higher outputs from such devices.

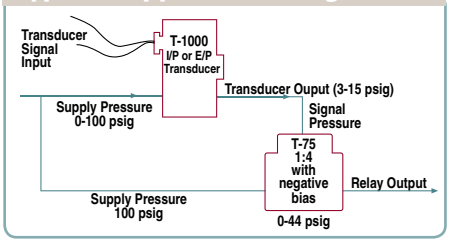
Typical applications of the Type 75 Relay with fixed negative bias include the electronic control of the applications listed for the standard Type 75 Relay.

To calculate relay output:

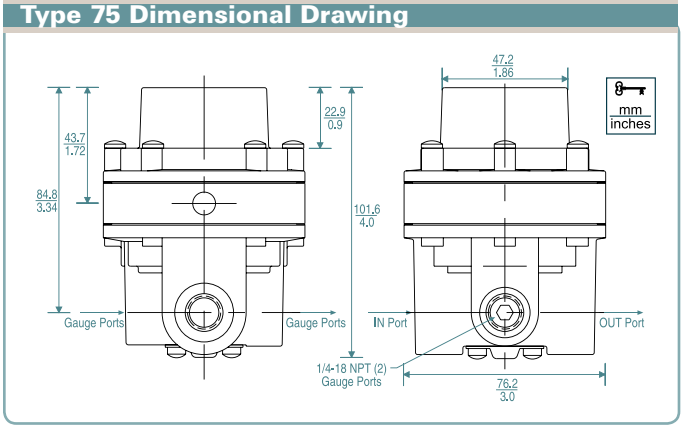
Relay output = (signal pressure) - 4 PSI bias x (relay ratio factor) where the relay ratio factor is defined as follows:

Relay Ratio	Factor
1:1	1
1:2	2
1:4	4
1:6	6

Type 75 Application Diagrams



Type 75 Dimensional Drawing



Type 79
High Flow Air Relays

Features

- Balanced pintle
- High flow capacity
- Field serviceable
- Large port sizes available
- Air piloted or dome loaded
- 200 PSIG output
- Also available in a high relieving version (Type 79HR)

Description

The Type 79 1:1 Ratio High Flow Precision Air Relay brings additional precision and control to the Bellofram line of precision control products.

The Type 79 relay is designed for applications where a precise control of flow is needed. This regulator offers low droop, high accuracy and fine adjustment sensitivity. The use of a Bellofram rolling diaphragm provides greater sensitivity and improved accuracy. The balanced pintle minimizes output pressure changes caused by fluctuations in supply pressure.

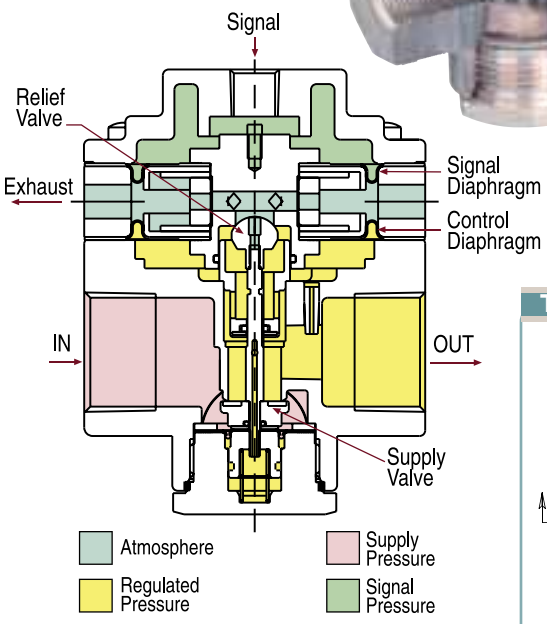
Careful design and quality materials throughout assure long, trouble-free operation. The rugged die-cast zinc and aluminum housings are pressure tested to assure safe operation. The Type 79 is designed to withstand harsh and abusive environments. This is attributed to a chemical conversion coating of all cast components, and a vinyl paint finish.

The Type 79 can achieve flow rates of well over 200 SCFM (5695 LPM). This relay can be pipe or bracket mounted.

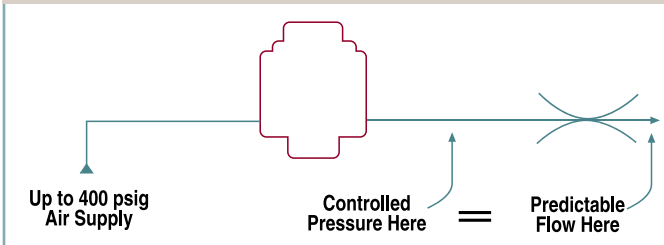
A version of the Type 79 for valve control applications is available. The Type 79V utilizes soft exhaust seats to minimize air consumption, increased deadband to ignore valve oscillations, and an integral bypass valve that can be 'tuned' for optimum valve response.

Applications

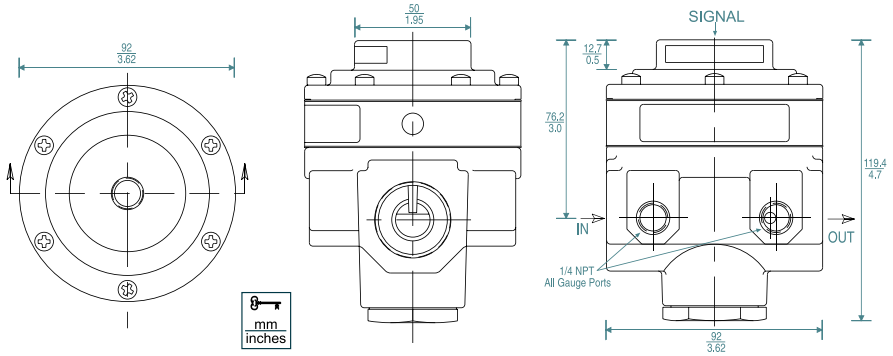
- Clutch and Brake Controls
- Gas Flow Control
- Cylinder Bucking Control
- Tension Control
- Dancer (Calendar) Roll Loading
- Volume Boosting
- Valve Motor Loading



Type 79 Application Diagrams



Type 79 Dimensional Drawing



Volume Booster Ordering Information

	Ratio	Port Size (NPT)	Set Point Range BAR	Set Point Range PSIG	Part Number
Type 20 Precision Relay	1:1	1/8	0.1-8.3	2-120	961-004-000
		1/4	0.1-8.3	2-120	961-005-000
		3/8	0.1-8.3	2-120	961-006-000
Type 20HR Precision Relay High Relief Capacity	1:1	1/8	0.1-8.3	2-120	961-001-000
		1/4	0.1-8.3	2-120	961-002-000
		3/8	0.1-8.3	2-120	961-003-000
Type 20 EXHR	1:1	1/8	0.1-8.3	2-120	961-009-000
		1/4	0.1-8.3	2-120	961-010-000
		3/8	0.1-8.3	2-120	961-011-000
Type 72 Positive Bias Booster Relay	1:1	3/8	0-0.7	0-10	961-062-000
		3/8	0-2.1	0-30	961-063-000
		3/8	0.07-4.1	1-60	961-064-000
		3/8	0.1-10.3	2-150	961-065-000
		1/4	0-0.7	0-10	961-052-000
		1/4	0-2.1	0-30	961-053-000
		1/4	0.07-4.1	1-60	961-054-000
		1/4	0.1-10.3	2-150	961-055-000
Type 72 HR High Relief Positive Bias Booster Relay	1:1	3/8	0-0.7	0-10	961-182-000
		3/8	0-2.1	0-30	961-183-000
		3/8	0.07-4.1	1-60	961-184-000
		3/8	0.1-10.3	2-150	961-185-000
		1/4	0-0.7	0-10	961-178-000
		1/4	0-2.1	0-30	961-179-000
		1/4	0.07-4.1	1-60	961-180-000
		1/4	0.1-10.3	2-150	961-181-000
Type 75 Precision Relay	1:1	1/4	0-10.3	0-150	961-058-000
	1:1	3/8	0-10.3	0-150	961-066-000
	1:2	1/4	0-10.3	0-150	961-059-000
	1:2	3/8	0-10.3	0-150	961-067-000
	1:4	1/4	0-10.3	0-150	961-060-000
	1:4	3/8	0-10.3	0-150	961-068-000
	1:6	1/4	0-10.3	0-150	961-045-000
	1:6	3/8	0-10.3	0-150	961-069-000
Type 75 Precision Relay Fixed Negative Bias (4 PSI)	1:1	1/4	0-10.3	0-150	961-090-000
	1:1	3/8	0-10.3	0-150	961-091-000
	1:2	1/4	0-10.3	0-150	961-092-000
	1:2	3/8	0-10.3	0-150	961-093-000
	1:4	1/4	0-10.3	0-150	961-094-000
	1:4	3/8	0-10.3	0-150	961-095-000
	1:6	1/4	0-10.3	0-150	961-096-000
	1:6	3/8	0-10.3	0-150	961-097-000
Type 75HR Precision Relay	1:1	1/4	0-10.3	0-150	961-144-000
	1:1	3/8	0-10.3	0-150	961-145-000
	1:1	1/2	0-10.3	0-150	961-146-000
	1:2	1/4	0-10.3	0-150	961-147-000
	1:2	3/8	0-10.3	0-150	961-148-000
	1:2	1/2	0-10.3	0-150	961-149-000
Type 75HR Precision Relay Fixed Negative Bias (4 PSI)	1:1	1/4	0-10.3	0-150	961-150-000
	1:1	3/8	0-10.3	0-150	961-151-000
	1:1	1/2	0-10.3	0-150	961-152-000
	1:2	1/4	0-10.3	0-150	961-153-000
	1:2	3/8	0-10.3	0-150	961-154-000
	1:2	1/2	0-10.3	0-150	961-155-000
Type 79 High Flow Capacity	1:1	3/8	0-13.8	0-200	961-156-000
		1/2	0-13.8	0-200	961-157-000
		3/4	0-13.8	0-200	961-158-000
		1	0-13.8	0-200	961-159-000
Type 79 HR High Relief High Flow Capacity	1:1	3/8	0-13.8	0-200	962-378-000
		1/2	0-13.8	0-200	962-378-100
		3/4	0-13.8	0-200	962-378-200
		1	0-13.8	0-200	962-378-300

Type 20 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		8
8	Pressure Gauge	008

Type 72 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		3	5	7	8	9
3	Square Head	003	053	073	083	
5	Epoxy Finish		005	075	085	095
7	Mounting Bracket			007	087	097
8	Pressure Gauge				008	098
9	Tamper-Resistant Cover					009

Type 75 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		5	7	8
5	Epoxy Finish	005	075	085
7	Mounting Bracket		007	087
8	Pressure Gauge			008

Type 79 Option Ordering Matrix

Replace last three digits of part number with digits from table below.

Option		1	2	5	6	7
1	Low Bleed	001		051	061	071
2	Non-Relieving		002	052	062	072
5	Epoxy Finish			005	065	075
6	Tapped Vent				006	076
7	Tapped Supply Port					007

Relay Options and Accessories

Pressure Gauge

Dual scale (English and Metric) 2 inch (50.8 mm) gauges are available

Epoxy Finish - Gray epoxy coating for greater corrosion resistance.

Mounting Bracket

Zinc-plated steel bracket for side mounting.
(For Type 79 order part number 607-293-000)
(For Type 75 order part number 607-000-047)

Tamper Resistant Cover

A cover placed over the adjusting screw to prevent ordinary hand adjustments.

Low Bleed

Reduces steady-state air consumption by approximately 50%.

Non-Relieving

Used in applications where it is desirable to relieve pressure downstream of the relay. Non-relieving relays should not be used for low or no flow applications.

Tapped Vent (Exhaust)

1/4 NPT tapped port to allow for installation of plumbing to capture exhaust air.

Tapped Supply Gauge Port

1/4 NPT tapped port is offered as a pressure tap for monitoring the inlet or upstream pressure supplied to the regulator. (Type 79 only)

BSPP or BSPT

British Standard Threads can be ordered by adding either "BSPT" or "BSPP" to the end of the part number.

Diaphragm Air Cylinders

Small bore Cylinders

Standard Cylinders

Super Cylinders

Diaphragm Air Cylinders

Features

- Low start up pressure
- Low breakaway force
- Extremely sensitive response
- Very smooth, "non-jarring" action
- Wide temperature range
- Very low friction
- No edge seals to replace
- No blow-by leakage
- Numerous varieties
- Low total cost

Description

Diaphragm Air Cylinders are actuators made from elastomers, engineered metals and fabrics. They require no lubrication, are virtually frictionless, and economical. They can be used to provide lifting, clamping, pushing, coining, turning, and other linear force or actuation motions in many applications.

The development of the long stroke rolling diaphragm for dynamic sealing proved to be the solution for many applications requiring low friction, no lubrication, low leakage, wide temperature variations, and low total cost. The popularity of the rolling diaphragm as a sealing means led to many requests for a standard line of "off the shelf" diaphragm cylinders; single and double acting, short and long stroke with a wide selection of effective areas. To meet these requests, the long stroke rolling diaphragm cylinder was developed and Bellofram has supplied many thousands of them since their 1965 introduction.

Applications

Diaphragm Air Cylinder applications are almost unlimited. They are replacing conventionally sealed cylinders and actuators where low cost and reliability are requirements. They can be used with vacuum and gaseous pressure systems. They are currently solving many unique problems, being used as:

- Expansion Chambers
- Accumulators
- Pumps
- Reservoirs
- Shock Mounts
- Impact Absorbers
- Weld Drivers
- Tensioners
- Dancer Rolls
- Valve Actuation
- Louver Controls

Standard Cylinders

Standard Bellofram Air Cylinders are available in eight sizes. Each size is available in both a spring-return and a double-acting variety, with one or two stroke variations (Series E or F).

Sizes 4 and 6 have impact-extruded aluminum shells. Larger sizes have steel shells. Rods are ground, polished and hard-chrome plated steel. Bearings are sintered bronze, molybdenum disulphite impregnated. Other components are high strength materials with suitable corrosion resistant treatment.

- Bellofram engineers will help you define your specific needs.
- All Standard cylinders can be ordered with either no spring, or no bearing, as standard options.
- Standard cylinders can be ordered with one of six different mounting options.
- Specifications for Standard cylinders are shown in the table on the next page.

Super Cylinders

Bellofram Super Cylinders are standard spring-return cylinders equipped with linear ball bearings and hardened steel rods. This refinement allows an absolute minimum of friction for applications where maximum sensitivity is needed.

Super Cylinders are available only in spring-return varieties and in Series F stroke variations.

All mounting options offered on standard cylinders are also available on super cylinders.

Standard and Super Cylinder Specifications

Plant Air	Up to 145 PSIG (10 BAR)
Temperatures	-40˚ to 225˚F (-40˚ to 107˚C)
Materials of Construction	Body: Sizes 4 and 6 are impact-extruded aluminum shell. Larger sizes are made from a steel shell. Diaphragm: Neoprene® elastomer reinforced with Flex-Weave Dacron® fabric. Rods: Ground, polished and hard-chrome plated steel. Bearings: Sintered bronze, molybdenum disulphite impregnated. Other components are high strength materials with suitable corrosion resistant treatment.
Testing	All cylinders are leak-tested prior to shipment. However, the cylinder is not a bubble tight assembly

Standard and Super Cylinder Operating Data

Size (Effective Area) (Sq. Inches)	Equivalent Bore Diam. (Inches)	Spring Return						Double Acting	
		Stroke +.03/-.12 (Inches)	Stroke +.03/-.12 (Inches)	Approx. Spring Force - Zero Stroke (lbs.)		Approx. Increase Force Per Inches of Stroke (lbs.)		Stroke +.03/-.12 (Inches)	Stroke +.03/-.12 (Inches)
		Series E	Series F	Series E	Series F	Series E	Series F	Series E	Series F
4	2.3		1.80		6		3		1.3
6	2.8		2.40		9		4		1.9
9	3.4	2.20	3.00	17	12	4	4		2.5
12	3.9	2.30	3.60	18	18	6	6	1.8	3.1
16	4.5	2.62	4.20	24	24	8	8	2.1	3.7
24	5.5	2.60	5.24	36	36	11	11	2.0	4.6
30	6.3	3.07	6.00	45	54	13	14	2.4	5.4
36	6.8	3.55	6.00	54	54	16	14	2.9	5.4

Small Bore Cylinders

Bellofram's 0.38 and 1.7 sq. inch effective area diaphragm cylinders combine the performance of the diaphragm cylinder with small size. Two different stroke options are available in each size, with either flush or extended rods on 0.38 sq. inch cylinders. Only spring return varieties are available.

Specifications

0.38 sq. inch Cylinders have aluminum alloy shells and end caps, and carbon steel rods. 1.7 sq. inch Cylinders have die-cast aluminum shells and end caps, and chrome-plated carbon steel rods. All varieties have oil-impregnated bronze bearings, polyester fabric reinforced Nitrile diaphragms, and music wire springs. Optional foot mounts are available for the 1.7 sq. inch Cylinders.

External stroke limiters should be provided by the customer to limit the stroke in both directions on both single-acting and double-acting cylinders.

Installation and operation procedures furnished with each cylinder should be followed for maximum service life.

Marsh Bellofram offers very smooth, "Non-Jarring" action in a Low Cost Cylinder

Small Bore Cylinder Operating Data

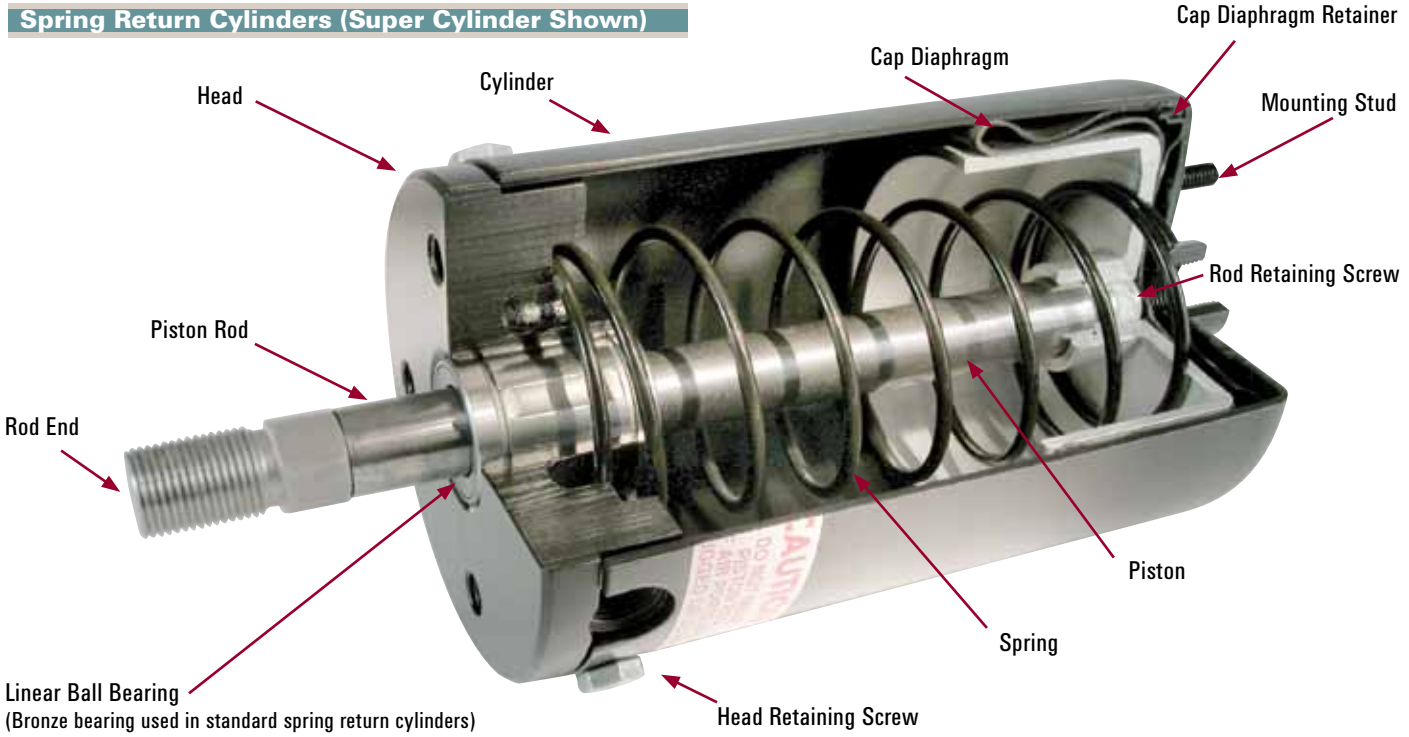
Part Number	Size (Effective Area) Sq. In.	Stroke In.	Load @ 0 Stroke Lbs.	Spring Load @ Max. Stroke Lbs.	Equiv. Bore Dia. In.	Maximum Operating Press. PSI	Rod Type
908-013-000	0.384	0.70	2	7	0.7	125	Flush
908-034-000	0.384	0.70	2	7	0.7	125	3/4"
908-014-000	0.384	0.32	5	7	0.7	125	Flush
908-035-000	0.384	0.32	5	7	0.7	125	3/4"
980-008-000	1.7	1.0	4	8	1.5	125	–
980-077-000	1.7	1.75	4	11	1.5	125	–

Cylinder Replacement Parts

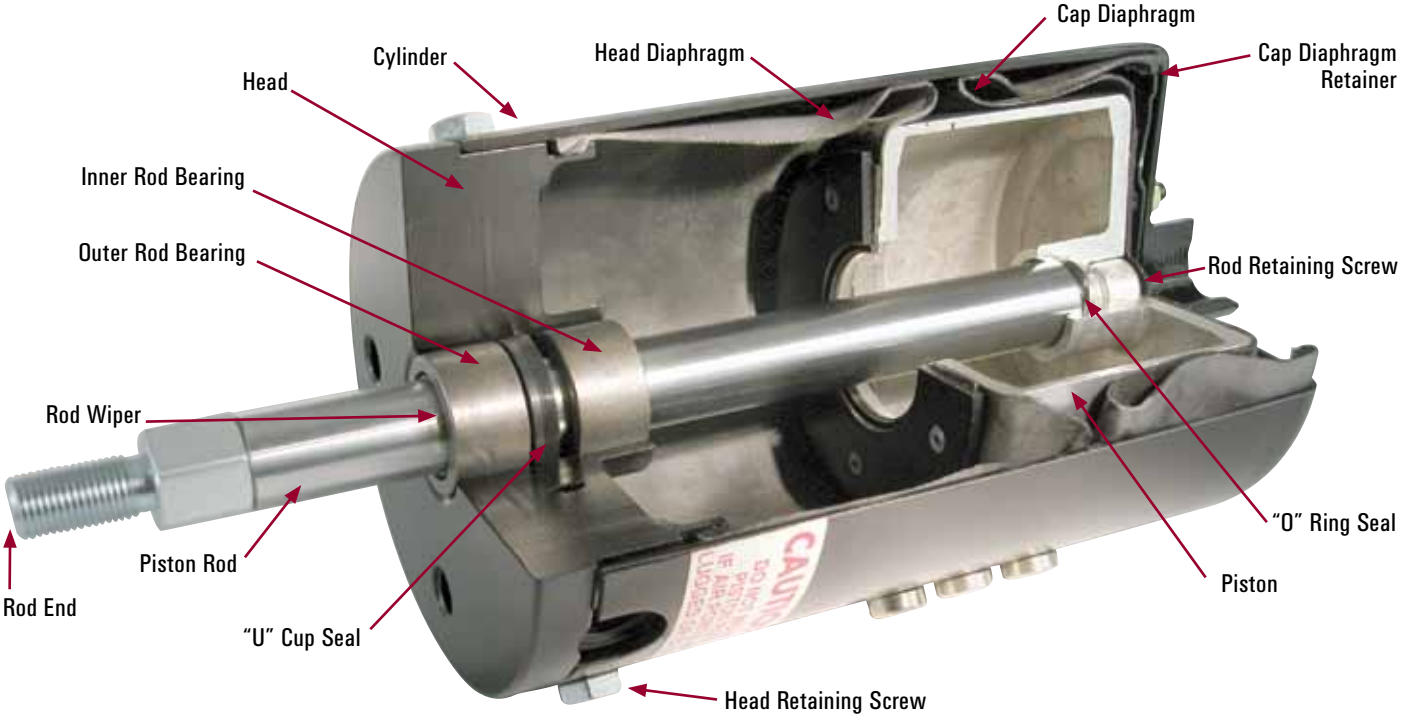
When ordering replacement parts, provide nomenclature of part from photographs in addition to the following information from the nameplate on the cylinder: Type, Size, Series, and Rod type.

Complete kits are available for replacement of diaphragm or bearings.

Spring Return Cylinders (Super Cylinder Shown)



Double Acting Cylinders



Standard Cylinders Ordering Information

						Type
S						Spring Return
D						Double Acting
						Size
	04					4 Square Inches
	06					6 Square Inches
	09					9 Square Inches
	12					12 Square Inches
	16					16 Square Inches
	24					24 Square Inches
	30					30 Square Inches
	36					36 Square Inches
						Series
		E				Determines Stroke
		F				
						Make a selection from Operating Data Table on pg. 47
						Rod
			BP			Bellofram Product Standard
			SM			National Fluid Power Assoc. Standard
						Make a selection from dimensional data tables on pgs. 51-54
						Mounting
				N		Nose Mount
				UM		Universal Mount
				FM		Foot Mount
				CFM		Cap Flange Mount
				HFM		Head Flange Mount
				CBM		Clevis Bracket Mount
				CBS		Clevis Bracket Stud
						Standard Options
					NS	No Spring
					NB	No Bearing
					NBS	No Bearing or Spring
						No Standard Option Requested

Example: D-12-F-BP-CBM is a Double Acting, 12 sq. in., 3.1" Stroke, BP Rod End Cylinder with Clevis Bracket Mount.

Super Cylinders Ordering Information

SS		F				
						Type
SS						Super Cylinders
						Size
	04					4 Square Inches
	06					6 Square Inches
	09					9 Square Inches
	12					12 Square Inches
	16					16 Square Inches
	24					24 Square Inches
	30					30 Square Inches
	36					36 Square Inches
						Series
		F				Determines Stroke
						Make a selection from Operating Data Table on pg. 47
						Rod
			BP			Bellofram Product Standard
			SM			National Fluid Power Assoc. Standard
						Make a selection from dimensional data table on pgs. 51-54
						Mounting
				UM		Universal Mount
				FM		Foot Mount
				CFM		Cap Flange Mount
				HFM		Head Flange Mount
				CBM		Clevis Bracket Mount
				CBS		Clevis Bracket Stud
						Standard Options
					NS	No Spring
						No Standard Option Requested

Example: SS-12-F-SM-HFM is a Single Acting Super Cylinder, 12 sq. in., 3.6" stroke, SM Rod End Cylinder with a Head Flange Mount.

Repair Kits

Repair Kits are available to permit user in-plant maintenance without delay and expense of returning parts to the factory. Each kit includes installation instructions. Nameplate data of the cylinder must accompany order to insure receipt of correct parts.

The following is included in the repair kits:

Spring Return Diaphragm Kit

1. Diaphragm, Cap
2. Adhesive, Cap
3. Nuts, Cap Retainer
4. Instructions

Spring Return Bearing Kit

1. Inner Bearing
2. Outer Bearing
3. Rod Wiper
4. Instructions

Double Acting Diaphragm Kit

1. Diaphragm, Cap
2. Diaphragm, Head
3. Adhesive, Cap
4. Adhesive, Head
5. Rivets, Blind (or Screws)
6. Nuts, Cap Retainer
7. Seal "O" Ring
8. Instructions

Double Acting Bearing Kit

1. Inner Bearing
2. Outer Bearing
3. Rod Wiper
4. U-Cup Seal
5. Instructions

Breather Vents

Breather vents are available for use on Bellofram Spring Return Air Cylinders.

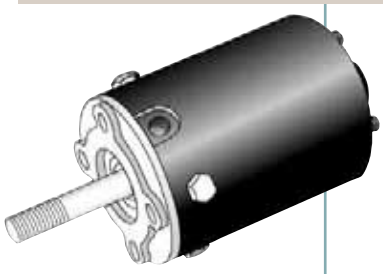
The Breather, which contains a 40 micron bronze filter, is simply threaded into the air relief port of the cylinder head. It prevents foreign matter from being drawn into the cylinder on the return stroke of the piston, and also acts as a snubber. The snubbing reduces the piston speed and impact at the end of the stroke in both directions.

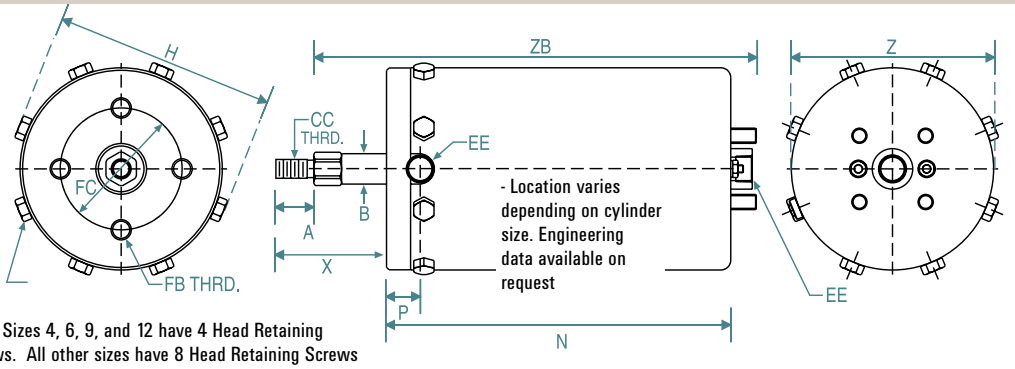
Breather Vents Ordering Data

Breather Vent for 1/4" Pipe Tap
(Fits cylinder sizes 4, 6, 9)
Part No. 661-000-001

Breather Vent for 3/8" Pipe Tap
(Fits cylinder sizes 12, 16, 24, 30, 36)
Part No. 661-000-002

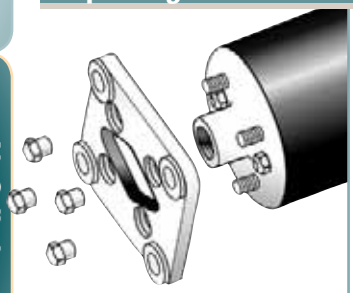
Universal Mount

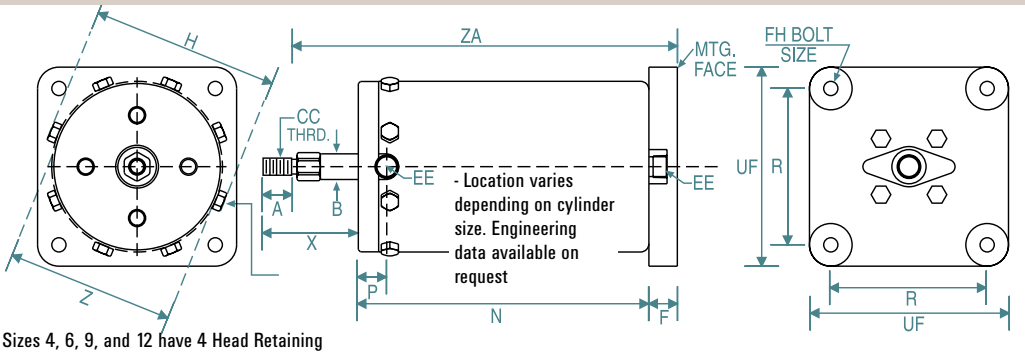




Note: Sizes 4, 6, 9, and 12 have 4 Head Retaining Screws. All other sizes have 8 Head Retaining Screws

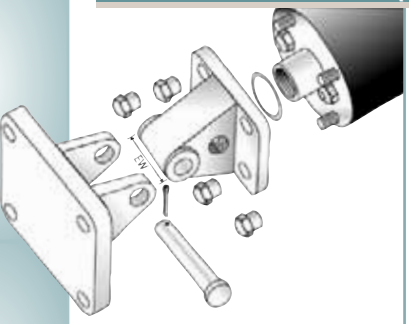
Cap Flange Mount



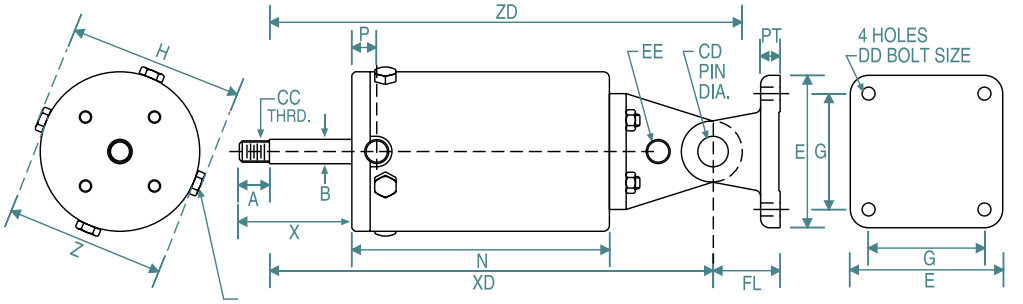


Note: Sizes 4, 6, 9, and 12 have 4 Head Retaining Screws. All other sizes have 8 Head Retaining Screws

Clevis Bracket Mount (or Stud)

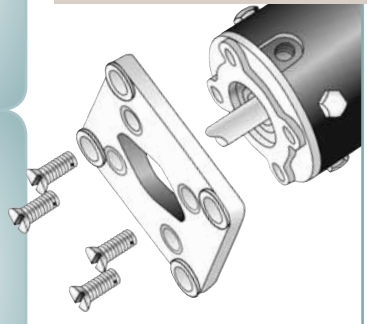


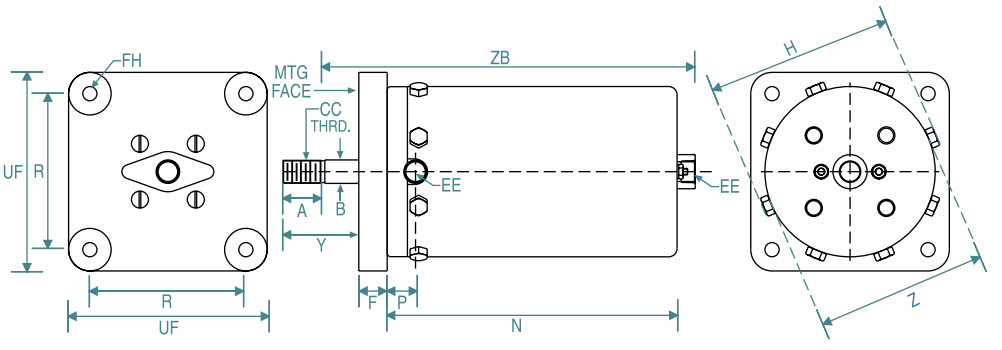
*EW = External width of clevis bracket stud.



Note: Sizes 4, 6, 9, and 12 have 4 Head Retaining Screws. All other sizes have 8 Head Retaining Screws

Head Flange Mount





Standard Cylinders - Universal, Cap Flange, Clevis Bracket, Head Flange Mounts — Dimensions - Inches

Size	Series	Z	H	N	EE	FC	FB	B	P	F	R	UF	FH	CD	DD	E	FL	EW	PT	G
4	F	2.71	3.02	4.34	1/4 NPT	2.00	1/4 - 20	1/2	.50	.781	2.81	3.62	1/4	.625	1/4	3.12	1.38	.93	3/8	2.38
6	F	3.27	3.58	5.28	1/4 NPT	2.00	1/4 - 20	1/2	.51	.781	2.81	3.62	1/4	.625	1/4	3.12	1.38	.93	1/2	2.38
9	E	3.84	4.25	5.31	1/4 NPT	3.00	7/16-14	3/4	.75	.690	4.38	5.50	7/16	.750	1/4	3.75	1.69	.99	1/2	3.0
	F			6.34																
12	E	4.38	4.79	5.31	3/8 NPT	3.00	7/16-14	3/4	.75	.690	4.38	5.50	7/16	.750	1/2	4.00	1.75	1.24	1/2	3.0
	F			7.28																
16	E	4.99	5.40	6.03	3/8 NPT	3.00	1/2-13	3/4	.87	.690	4.38	5.50	1/2	.750	1/2	4.00	1.75	1.24	1/2	3.0
	F			8.38																
24	E	6.16	6.57	6.28	3/8 NPT	4.75	5/8-11	3/4	1.00	.656	6.00	7.50	1/2	1.00	1/2	5.12	2.00	1.49	5/8	4.0
	F			10.22																
30	E	6.88	7.29	7.00	3/8 NPT	4.75	5/8-11	1	1.00	.656	6.00	7.50	1/2	1.00	1/2	5.12	2.00	1.49	5/8	4.0
	F			11.44																
36	E	7.38	7.79	7.69	3/8 NPT	4.75	5/8-11	1	1.00	.656	6.00	7.50	1/2	1.00	1/2	5.12	2.00	1.49	5/8	4.0
	F			11.47																

Size	Series	BP Rod End*								SM Rod End†					
		X	Y	A	ZA	ZD	XD	ZB	CC	A	ZA	ZD	XD	ZB	CC
4	F	2.73	1.95	.75	7.10	9.07	8.45	6.72	3/8-24	1.00	6.85	8.82	8.19	6.47	7/16-20
6	F	2.69	1.91	.75	8.00	9.97	9.35	7.63	3/8-24	1.00	7.75	9.72	9.09	7.38	7/16-20
9	E	2.92	2.23	1.00	7.92	10.73	9.98	7.63	1/2-20	1.12	7.80	10.61	9.86	7.56	3/4-16
	F	2.69	2.00		8.72	11.55	10.80	8.44			8.60	11.42	10.67	8.32	
12	E	2.92	2.23	1.00	7.92	10.98	10.23	7.78	1/2-20	1.12	7.80	10.86	10.11	7.66	3/4-16
	F	2.95	2.26		9.91	12.98	12.23	9.78			9.80	12.86	12.11	9.66	
16	E	3.06	2.37	1.00	8.18	11.84	11.09	8.64	1/2-20	1.12	8.66	11.72	10.97	8.52	3/4-16
	F	2.78	2.09		10.85	13.91	13.16	10.71			10.73	13.78	13.03	10.59	
24	E	2.86	2.17	1.00	8.53	11.78	10.78	8.73	1/2-20	1.12	8.71	12.16	11.16	8.59	3/4-16
	F	2.44	1.78		12.35	16.22	15.22	12.08			12.23	15.68	14.68	12.03	
30	E	2.83	2.14	1.25	9.27	12.70	11.70	9.26	5/8-18	1.50	8.02	12.89	11.89	9.30	1-14
	F	3.05	2.36	1.50	13.68	17.11	16.11	13.53	1-12		13.68	17.11	16.11	13.53	
36	E	2.83	2.14	1.25	9.96	13.31	12.31	9.82	5/8-18	1.50	9.71	13.60	12.60	10.00	1-14
	F	3.05	2.36	1.50	13.71	17.13	16.13	13.54	1-12		13.71	17.13	16.13	13.54	

*BP Rod End - Bellofram Products Co. Standard

†SM Rod End - National Fluid Power Assoc. Standards

Standard Cylinders - Universal, Cap Flange, Clevis Bracket, Head Flange Mounts — Dimensions - Millimeters

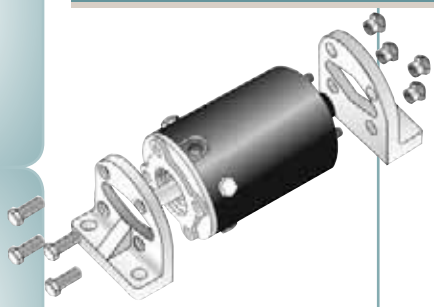
Size	Series	Z	H	N	FC	B	P	F	R	UF	FH	CD	DD	E	FL	EW	PT	G
4	F	68.83	76.71	110.24	50.80	12.70	12.70	19.84	71.37	91.95	6.35	15.88	6.25	79.25	35.05	23.62	9.53	60.45
6	F	83.06	90.93	134.11	50.80	12.70	12.95	19.84	71.37	91.95	6.35	15.88	6.25	79.25	35.05	23.62	12.70	60.45
9	E	97.52	107.95	134.87	76.20	19.05	19.05	17.53	111.25	139.70	11.11	19.50	6.25	95.25	42.93	25.15	12.70	76.20
	F			161.04														
12	E	11.25	121.67	134.87	76.20	19.05	19.05	17.53	111.25	139.70	11.11	19.50	12.70	101.60	44.45	31.50	12.70	76.20
	F			184.91														
16	E	126.75	137.16	153.16	76.20	19.50	22.10	17.53	111.25	139.70	12.70	19.50	12.70	101.60	44.45	31.50	12.70	76.20
	F			212.85														
24	E	156.46	166.88	159.51	120.65	19.50	25.40	16.66	152.40	190.50	12.70	25.40	12.70	130.05	50.80	37.85	15.88	101.60
	F			259.59														
30	E	174.75	185.17	177.80	120.65	25.40	25.40	16.66	152.40	190.50	12.70	25.40	12.70	130.05	50.80	37.85	15.88	101.60
	F			290.58														
36	E	187.45	197.87	195.33	120.65	25.40	25.40	16.66	152.40	190.50	12.70	25.40	12.70	130.05	50.80	37.85	15.88	101.60
	F			291.34														

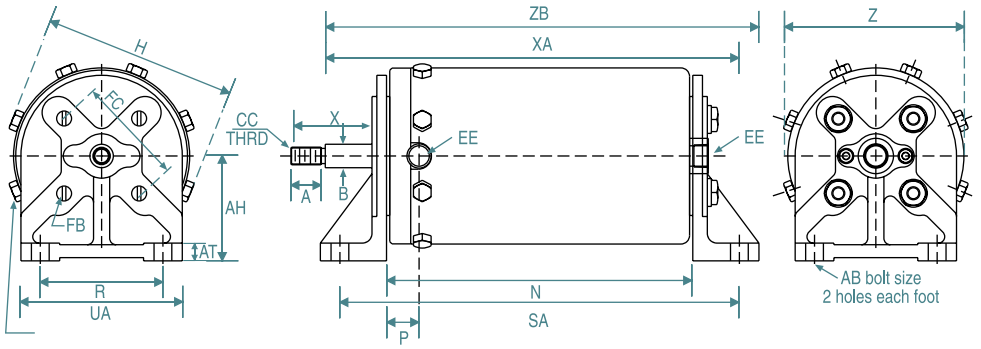
Size	Series	BP Rod End*							SM Rod End†				
		X	Y	A	ZA	ZD	XD	ZB	A	ZA	ZD	XD	ZB
4	F	69.34	49.53	19.05	180.34	230.38	244.63	170.69	25.40	173.99	224.03	208.03	164.34
6	F	68.33	48.51	19.05	203.20	253.24	237.49	193.80	25.40	196.85	246.89	230.89	187.45
9	E	74.17	56.64	25.40	201.17	272.54	253.49	193.80	28.45	198.12	269.49	250.44	192.02
	F	68.33	50.80		221.49	293.37	274.32	214.38		218.44	290.07	271.02	211.33
12	E	74.17	56.64	25.40	201.17	278.89	259.84	197.61	28.45	198.12	275.84	256.79	194.56
	F	74.93	57.40		251.97	329.69	310.64	257.41		248.92	326.64	307.59	245.36
16	E	77.72	60.20	25.40	207.77	300.74	281.69	219.46	28.45	219.93	279.69	278.64	216.41
	F	70.61	53.09		275.59	353.31	334.26	272.03		272.54	350.01	330.96	268.99
24	E	72.64	55.12	25.40	216.66	299.21	273.81	221.74	28.45	221.23	308.86	283.46	218.19
	F	61.98	45.21		313.69	411.99	286.59	306.83		310.64	398.27	372.87	305.56
30	E	71.88	54.36	31.75	235.46	322.58	297.18	235.20	38.10	203.71	327.41	302.00	236.22
	F	77.47	59.94	38.10	347.47	434.59	409.19	343.66		347.47	434.59	409.19	343.66
36	E	71.88	54.36	31.75	252.98	338.07	312.67	249.43	38.10	246.63	345.44	320.04	254.00
	F	77.47	59.94	38.10	248.23	435.10	409.70	343.92		248.23	435.10	409.70	343.92

*BP Rod End - Bellofram Products Co. Standard

†SM Rod End - National Fluid Power Assoc. Standards

Foot Mount





Note: Sizes 4, 6, 9, and 12 have 4 Head Retaining Screws. All other sizes have 8 Head Retaining Screws

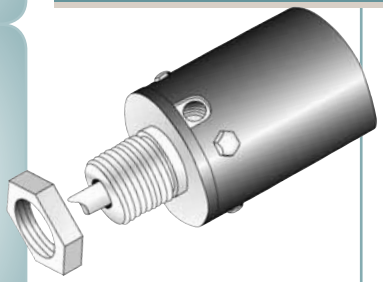
Standard Cylinders with Foot Mount Dimensions - Inches

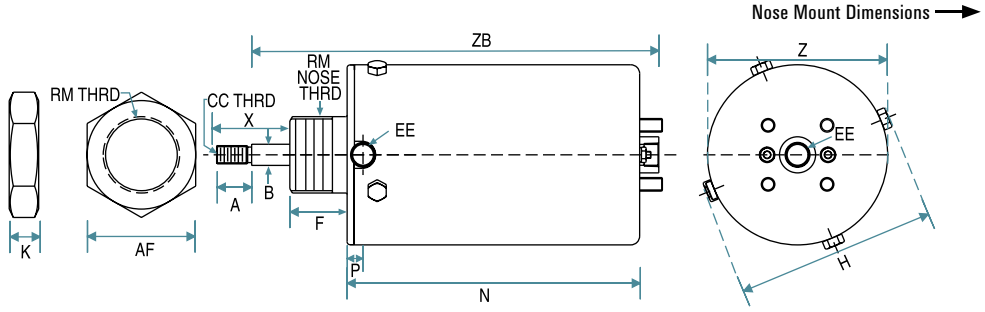
Size	Series	Z	H	N	EE	FC	FB	B	P	AT	AH	UA	R	SA	AB	X	BP Rod End*				SM Rod End†			
																	A	XA	ZB	CC	A	XA	ZB	CC
4	F	2.71	3.02	4.34	1/4 NPT	2.00	1/4 - 20	1/2	.50	.38	1.88	2.62	2.00	6.59	1/4	2.41	.75	7.44	7.82	3/8-24	1.00	7.19	7.57	7/16-20
6	F	3.27	3.58	5.28	1/4 NPT	2.00	1/4 - 20	1/2	.51	.38	1.88	2.62	2.00	7.53	1/4	2.38	.75	8.35	8.72	3/8-24	1.00	8.10	8.47	7/16-20
9	E	3.84	4.25	5.31	1/4 NPT	3.00	7/16-14	3/4	.75	.56	2.75	4.00	3.00	8.56	1/2	2.24	1.00	8.86	9.55	1/2-20	1.12	8.74	9.43	3/4-16
	F			6.34										9.59		2.06		9.67	10.29			9.55	10.16	
12	E	4.38	4.79	5.31	3/8 NPT	3.00	7/16-14	3/4	.75	.56	2.75	4.00	3.00	8.56	1/2	2.30	1.00	8.86	9.56	1/2-20	1.12	8.73	9.44	3/4-16
	F			7.28										10.53		2.33		10.86	11.56			10.73	11.36	
16	E	4.99	5.40	6.03	3/8 NPT	3.00	1/2-13	3/4	.87	.56	2.75	4.00	3.00	9.28	1/2	2.31	1.00	9.72	10.42	1/2-20	1.12	9.59	10.22	3/4-16
	F			8.38										11.62		2.16		11.78	12.41			11.66	12.28	
24	E	6.16	6.57	6.28	3/8 NPT	4.75	5/8-11	3/4	1.00	.68	4.00	6.25	4.75	10.16	5/8	2.23	1.00	10.09	10.86	1/2-20	1.12	9.94	10.63	3/4-16
	F			10.22										14.09		1.80		13.06	14.29			13.10	13.79	
30	E	6.88	7.29	7.00	3/8 NPT	4.75	5/8-11	1	1.00	.68	4.00	6.25	4.75	10.88	5/8	2.20	1.25	10.52	11.20	5/8-18	1.50	10.26	10.95	1-14
	F			11.44										15.31		2.41	1.50	14.92	15.61	1-12		14.92	15.69	
36	E	7.38	7.79	7.69	3/8 NPT	4.75	5/8-11	1	1.00	.68	4.00	6.25	4.75	11.56	5/8	2.20	1.25	11.22	11.91	5/8-18	1.50	10.97	11.66	1-14
	F			11.47										15.34		2.41	1.50	14.94	15.62	1-12		14.94	15.62	

Standard Cylinders with Foot Mount Dimensions - Millimeters

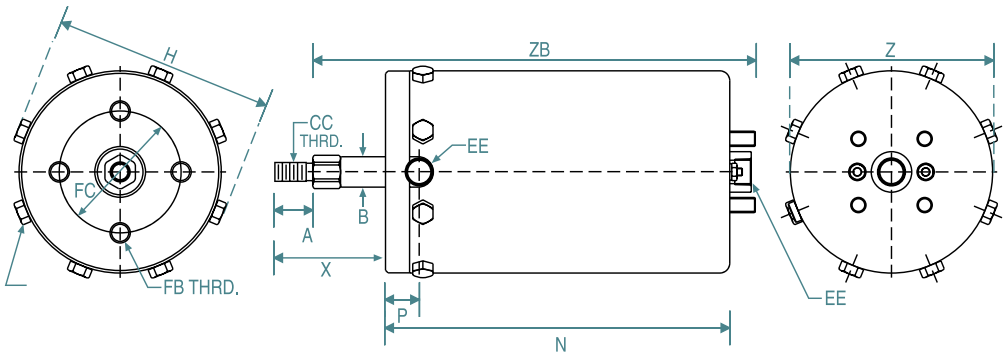
Size	Series	Z	H	N	FC	B	P	AT	AH	UA	R	SA	AB	X	BP Rod End*			SM Rod End†		
															A	XA	ZB	A	XA	ZB
4	F	68.83	76.71	110.24	50.80	12.70	12.70	9.65	47.75	66.65	50.80	167.39	6.35	61.21	19.05	188.98	198.63	25.40	182.63	192.28
6	F	83.06	90.93	134.11	50.80	12.70	12.95	9.65	47.75	66.55	50.80	191.26	6.35	60.45	19.05	212.09	221.49	25.40	205.74	215.14
9	E	97.54	107.95	134.87	76.20	19.05	19.05	14.22	69.85	101.60	76.20	273.41	12.70	56.90	25.40	225.04	242.57	28.45	222.00	239.52
	F			161.04								243.59		52.32		245.62	261.37		242.57	258.06
12	E	111.25	121.67	134.87	76.20	19.05	19.05	14.22	69.85	101.60	76.20	273.41	12.70	58.42	25.40	225.04	242.82	28.45	221.74	239.78
	F			184.91								267.46		59.18		275.84	293.62		272.54	288.54
16	E	126.75	137.16	153.16	76.20	19.05	22.10	14.22	69.85	101.60	76.20	235.71	12.70	58.67	25.40	246.89	264.67	28.45	243.59	259.59
	F			212.85								295.15		54.86		299.21	315.21		296.16	311.91
24	E	156.46	166.88	159.51	120.65	19.05	25.40	17.27	101.60	158.75	120.65	258.06	15.88	56.64	25.40	256.29	275.84	28.45	252.48	270.00
	F			259.59								357.89		45.72		331.72	362.97		332.74	350.27
30	E	174.75	185.17	177.80	120.65	25.40	25.40	17.27	101.60	158.75	120.65	276.35	15.88	55.88	31.75	267.21	284.48	38.10	260.60	278.13
	F			290.58								388.87		61.21	38.10	378.97	396.49		378.97	398.53
36	E	187.45	197.8	195.33	120.65	25.40	25.40	17.27	101.60	158.75	120.65	293.62	15.88	55.88	31.75	284.99	302.51	38.10	278.64	296.16
	F			291.34								389.64		61.21	38.10	379.48	396.75		379.48	396.75

Universal Mount





Super Cylinder



Standard Cylinders with Foot Mount Dimensions - Inches

Size	Series	Z	H	N	EE	FC	FB	B	P	X	BP Rod End*			SM Rod End†		
											A	ZB	CC	A	ZB	CC
4	F	2.71	3.02	4.34	1/4 NPT	2.00	1/4 - 20	1/2	.50	3.10	.75	7.09	3/8-24	1.00	6.85	7/16-20
6	F	3.27	3.58	5.28	1/4 NPT	2.00	1/4 - 20	1/2	.51	2.16	.75	7.09	3/8-24	1.00	6.85	7/16-20
9	F	3.84	4.25	6.34	1/4 NPT	3.00	7/16-14	3/4	.75	3.50	1.00	9.25	1/2-20	1.12	9.13	3/4-16
12	F	4.38	4.79	7.28	3/8 NPT	3.00	7/16-14	3/4	.75	2.57	1.00	9.38	1/2-20	1.12	9.26	3/4-16
16	F	4.99	5.40	8.38	3/8 NPT	3.00	1/2-13	3/4	.87	3.78	1.00	11.69	1/2-20	1.12	11.57	3/4-16
24	F	6.16	6.57	10.22	3/8 NPT	4.75	5/8-11	3/4	1.00	2.00	1.00	11.75	1/2-20	1.12	11.75	3/4-16
30	F	6.88	7.29	11.44	3/8 NPT	4.75	5/8-11	1	1.00	3.05	1.50	13.52	1-12	1.50	13.52	1-14
36	F	7.38	7.79	11.47	3/8 NPT	4.75	5/8-11	1	1.00	3.05	1.50	13.55	1-12	1.50	13.55	1-14

Standard Cylinders with Foot Mount Dimensions - Millimeters

Size	Series	Z	H	N	FC	B	P	X	BP Rod End*		SM Rod End†	
									A	ZB	A	ZB
4	F	68.83	76.71	110.24	50.80	12.70	12.70	78.74	19.05	180.09	25.40	173.99
6	F	83.06	90.93	134.11	50.80	12.70	12.95	54.86	19.05	180.09	25.40	173.99
9	F	97.54	107.95	161.04	76.20	19.05	19.05	88.90	25.40	234.95	28.45	231.90
12	F	111.25	121.67	184.91	76.20	19.05	19.05	65.28	25.40	238.25	28.45	235.20
16	F	126.75	137.16	212.85	76.20	19.05	22.10	96.01	25.40	296.93	28.45	293.88
24	F	156.46	166.88	259.59	120.65	19.05	25.40	50.80	25.40	298.45	28.45	298.45
30	F	174.75	185.17	290.58	120.65	25.40	25.40	77.47	38.10	343.41	38.10	343.41
36	F	187.45	197.80	195.33	120.65	25.40	25.40	77.47	38.10	344.17	38.10	344.17

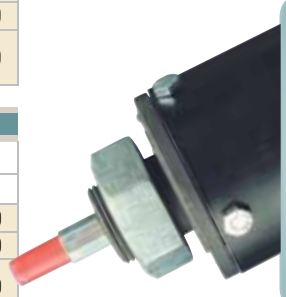
Super Cylinders are equipped with linear ball bearings and hardened steel rods.

Nose Mount Dimensions - Inches

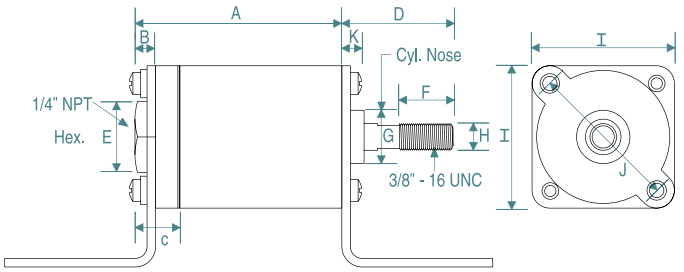
Size	Series	Z	H	N	EE	F	RM	B	X	BP Rod End*			SM Rod End†					
										A	ZB	CC	A	ZB	CC	AF	K	P
4	F	2.71	3.02	4.34	1/4 NPT	1.25	1-3/8 - 12	1/2	1.48	.75	6.72	3/8 - 24	1.00	6.47	7/16 - 20	2.06	.78	.59
6	F	3.27	3.58	5.28	1/4 NPT	1.25	1-3/8 - 12	1/2	1.44	.75	7.63	3/8 - 24	1.00	7.06	7/16 - 20	2.06	.78	.59
9	E	3.84	4.15	5.16	1/4 NPT	1.25	1-5/8 - 12	3/4	1.83	1.00	7.65	1/2 - 20	1.12	7.53	3/4-16	2.44	.91	.59
	F			6.19					1.61		8.45			8.33				

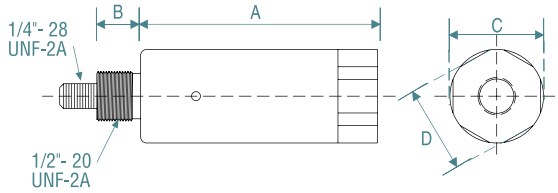
Nose Mount Dimensions - Millimeters

Size	Series	Z	H	N	F	B	X	BP Rod End*		SM Rod End†				
								A	ZB	A	ZB	AF	K	P
4	F	68.83	76.71	110.24	31.75	12.70	37.59	19.05	170.69	25.40	164.34	52.32	19.81	14.99
6	F	83.06	91.93	134.11	31.75	12.70	36.58	19.05	193.80	25.40	179.32	52.32	19.81	14.99
9	E	97.54	105.41	131.06	31.75	19.05	46.48	25.40	194.31	28.45	191.26	61.98	23.11	14.99
	F			157.23			40.89		214.63		211.58			



Small Bore Cylinder





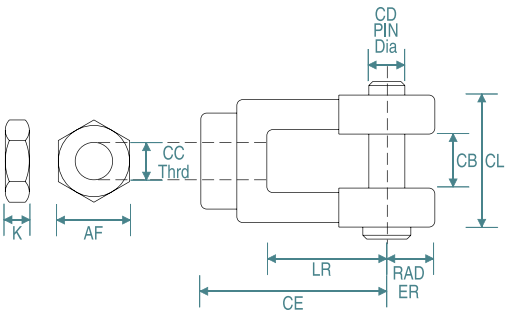
Small Bore Cylinder Dimensions - Inches

Part Number	A	B	C	D	E	F	G	H	I	J	K	Part Number	A	B	C	D
980-008-000	2-29/32	13/64	5/8	19/16	13/16	3/4	3/4	3/8	2	2-1/8	5/16	908-013-000	2.81	0.438	15/16	7/8
												908-034-000				
980-077-000	3-21/32	13/64	5/8	19/16	13/16	3/4	3/4	3/8	2	2-1/8	5/16	908-014-000	1.95	0.244	15/16	7/8
												908-035-000				

Small Bore Cylinder Dimensions - Millimeters

Part Number	A	B	C	D	E	F	G	H	I	J	K	Part Number	A	B	C	D
980-008-000	73.8	5.2	15.9	39.6	20.6	19.1	19.1	9.5	50.8	54.0	7.9	908-013-000	71.4	11.1	23.8	22.2
												908-034-000				
980-077-000	92.9	5.2	15.9	39.6	20.6	19.1	19.1	9.5	50.8	54.0	7.9	908-014-000	49.5	6.2	23.8	22.2
												908-035-000				

Rod Clevis and Jam Nut



Rod Clevis and Jam Nut Ordering Information

	Size
04	Area in Square Inches: 04, 06, 09, 16, 24, 30, or 36
	Series
E	Determines Stroke: Make a selection from Operating Data Table on pg. 47
F	
	Rod
BP	Bellofram Product Standard
SM	National Fluid Power Assoc. Standard
	Make a selection from dimensional data table on pgs. 51-54
	Rod Clevis
RC	Rod Clevis

Example: 36-F-BP-RC is a Rod Clevis for a size 36 sq. in. cylinder with a 1-12 rod thread.

Rod Clevis and Jam Nut Dimensions - Inches

Size	Rod End	Rod End CC Thrd.	Series	CB	CD Pin Dia.	CE	CL	Rad. ER	LR	AF	K
4	BP	3/8-24	F	.56	3/8	1-7/8	1.38	.53	1.25	9/16	7/32
	SM	7/16-20			7/16					11/16	1/4
6	BP	3/8-24	F	.56	3/8	1-7/8	1.38	.53	1.25	9/16	7/32
	SM	7/16-20			7/16					11/16	1/4
9	BP	1/2-20	E or F	.56	1/2	1-7/8	1.38	.53	1.25	3/4	5/16
	SM	3/4-16		.88	3/4	2-3/8	2.12	.75		1-1/8	27/64
12	BP	1/2-20	E or F	.56	1/2	1-7/8	1.38	.53	1.25	3/4	5/16
	SM	3/4-16		.88	3/4	2-3/8	2.12	.75		1-1/8	27/64
16	BP	1/2-20	E or F	.56	1/2	1-7/8	1.38	.53	1.25	3/4	5/16
	SM	3/4-16		.88	3/4	2-3/8	2.12	.75		1-1/8	27/64
24	BP	1/2-20	E or F	.56	1/2	1-7/8	1.38	.53	1.25	3/4	5/16
	SM	3/4-16		.88	3/4	2-3/8	2.12	.75		1-1/8	27/64
30 and 36	BP	5/8-18	E	.56	9/16	1-7/8	1.38	.53	1.25	1-15/16	3/8
	BP	1-12	F	1.50	1	3-1/2	3.50	1.00	1.50	1-1/2	35/64
	SM	3/4-16									
	SM	1-14	E or F	1.50	1	3-1/2	3.50	1.00	1.50	1-1/2	35/64

BP Rod End – Bellofram Products Co. Standard, SM Rod End – National Fluid Power Assoc. Standards

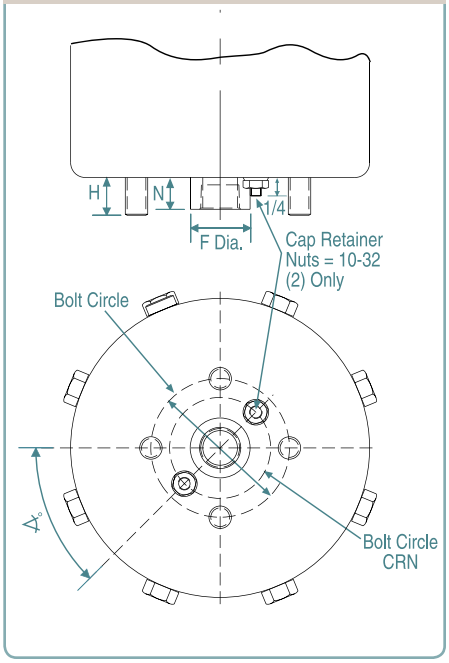
Rod Clevis and Jam Nut Dimensions - Millimeters

Size	Rod End	Series	CB	CD Pin Dia.	CE	CL	Rad. ER	LR	AF	K
4	BP	F	14.22	9.53	47.63	35.05	13.46	31.75	14.29	5.56
	SM			11.11					17.46	6.36
6	BP	F	14.22	9.53	47.63	35.05	13.56	31.75	14.29	5.56
	SM			11.11					17.46	6.35
9	BP	E or F	14.22	12.70	47.63	35.05	13.56	31.75	19.05	7.94
	SM		22.35	19.05	60.33	53.85	19.05		18.58	10.72
12	BP	E or F	14.22	12.70	47.63	35.05	13.56	31.75	19.05	7.94
	SM		22.35	19.05	60.33	53.85	19.05		28.58	10.72
16	BP	E or F	14.22	12.70	47.63	35.05	13.56	31.75	19.05	7.94
	SM		22.35	19.05	60.33	53.85	19.05		28.59	10.72
24	BP	E or F	14.22	12.70	47.63	35.05	13.56	31.75	19.05	7.94
	SM		22.35	19.05	60.33	53.85	19.05		28.59	13.89
30 and 36	BP	E	14.22	14.29	47.63	35.05	13.46	31.75	33.34	9.53
	BP	F	38.1	25.4	88.90	88.90	25.4	38.1	38.1	13.89
	SM									
	SM	E or F	38.1	25.4	88.90	88.90	25.4	38.1	38.1	13.89

Cylinder Cap End Mounting Studs Dimensions - Inches

Size	Number of Studs	Size of Stud	H (Approx.)	Bolt Circle	F (Boss)	N	Bolt Circle CRN	<°
4	2	1/4-20	5/8	1-5/16	11/16	13/32	1-3/8	90
6	2	1/4-20	5/8	1-1/2	11/16	13/32	1-3/8	90
9	4	1/4-20	5/8	2	11/16	13/32	1-3/8	45
12	4	1/4-20	5/8	2-5/16	1	17/32	1-11/16	45
16	4	3/8-16	5/8	2-5/16	1	17/32	1-11/16	45
24	4	3/8-16	9/16	3-1/8	1	17/32	1-11/16	45
30	4	1/2-13	11/16	4	1	17/32	1-11/16	45
36	4	1/2-13	11/16	4	1	17/32	1-11/16	45

Cylinder Cap End Mounting Studs



All Diaphragm Cylinders feature Bellofram Rolling Diaphragms for low friction and increased sensitivity!

Diaphragm Cylinders Part Numbers

Type S (Spring Return)

Series		E				F			
Rod		BP		SM		BP		SM	
Mount		UM	N	ZB	N	UM	N	UM	N
Size (sq. in.)	4					900-002-000	900-006-000	900-004-000	900-008-000
	6					900-010-000	900-014-000	900-012-000	900-016-000
	9	900-018-000	900-022-000	900-020-000	900-024-000	900-026-000	900-030-000	900-028-000	900-032-000
	12	900-034-000		900-036-000		900-038-000		900-040-000	
	16	900-042-000		900-044-000		900-046-000		900-048-000	
	24	900-050-000		900-052-000		900-054-000		900-056-000	
	30	900-058-000		900-060-000		900-062-000		900-064-000	
	36	900-066-000		900-068-000		900-070-000		900-072-000	

All cylinders are supplied with cap mounting studs. Consult factory for cylinders required without cap mounting studs.
Select part numbers from non-shaded areas only.

Type D Cylinders (Double Acting)

Series		E		F			
Rod		BP	SM	BP		SM	
Mount		UM	UM	UM	N	UM	N
Size (sq. in.)	4			902-002-000	902-006-000	902-004-000	902-008-000
	6			902-010-000	902-014-000	902-012-000	902-016-000
	9			902-018-000	902-022-000	902-020-000	902-024-000
	12	902-026-000	902-028-000	902-030-000		902-032-000	
	16	902-034-000	902-036-000	902-038-000		902-040-000	
	24	902-042-000	902-044-000	902-046-000		902-048-000	
	30	902-050-000	902-052-000	902-054-000		902-056-000	
	36	902-058-000	902-060-000	902-062-000		902-064-000	

All cylinders are supplied with cap mounting studs. Consult factory for cylinders required without cap mounting studs.
Select part numbers from non-shaded areas only.

Type SS (Super Cylinders)

Series		F	
Rod		BP	SM
Mount		UM	UM
Size (sq. in.)	4	903-074-000	903-001-000
	6	903-076-000	903-011-000
	9	903-078-000	903-021-000
	12	903-080-000	903-031-000
	16	903-082-000	903-041-000
	24	903-084-000	903-051-000
	30	903-086-000	903-061-000
	36	903-088-000	903-071-000

Repair Kits

Spring Return Cylinders				Double Acting Cylinders				Super Cylinders	
Diaphragm Kits		Bearing Kits		Diaphragm Kits		Bearing Kits		Bearing Kits	
Kit No.	Part No.	Kit No.	Part No.	Kit No.	Part No.	Kit No.	Part No.	Kit No.	Part No.
S4FN	970-041-000	SB46S	970-058-000	D4S	970-014-000	DB46S	970-064-000	SSB46S	970-134-000
S6FN	970-042-000	SB924S	970-060-000	D6S	970-018-000	DB924S	970-066-000	SSB924S	970-133-000
S9EN	970-043-000	SB36FB	970-062-000	D9S	970-020-000	DB36FB	970-068-000	SSB36FB	970-135-000
S9FN	970-044-000			D12ES	970-022-000				
S12E	970-045-000			D12FS	970-024-000				
S12F	970-046-000			D16ES	970-026-000				
S16E	970-047-000			D16FS	970-028-000				
S16F	970-048-000			D24ES	970-030-000				
S24E	970-049-000			D24FS	970-032-000				
S24F	970-050-000			D30ES	970-034-000				
S30E	970-051-000			D30FS	970-036-000				
S30F	970-052-000			D36ES	970-038-000				
S36E	970-053-000			D36FS	970-040-000				
S36F	970-054-000								

Mounting Kits

Size	FM	CFM	HFM	CBM	CBS
4	904-001-000	904-012-000	904-008-000	904-026-000	904-019-000
6	904-002-000	904-013-000	904-008-000	904-027-000	904-020-000
9	904-003-000	904-014-000	904-009-000	904-028-000	904-021-000
12	904-004-000	904-015-000	904-009-000	904-029-000	904-022-000
16	904-005-000	904-016-000	904-010-000	904-030-000	904-023-000
24	904-006-000	904-017-000	904-010-000	904-031-000	904-024-000
30	904-007-000	904-018-000	904-011-000	904-032-000	904-025-000
36	904-007-000	904-018-000	904-011-000	904-032-000	904-025-000

Rod Clevis Mounts

Rod		BP	SM
Size (sq. in.)	4	904-033-000	904-037-000
	6	904-033-000	904-037-000
	9	904-034-000	904-038-000
	12	904-034-000	904-038-000
	16	904-034-000	904-038-000
	24	904-034-000	904-038-000
	30 and 36 (E stroke)		904-039-000
	30 and 36 (F stroke)	904-036-000	904-039-000

I/P, E/P & P/I Transducers

- Type 1000
- Type 1000EX
- Type 1000HR
- Type 1000 Hazardous Use
- Type 1001
- Type 1001 Nema 3R
- Type 1001 Nema 4X
- Type 1500
- Type 1500 Zero Based
- Type 2000
- Type 2000 Hazardous Use
- Type 5000

Type 1000

I/P & E/P Transducers

Description

The Type 1000 Transducer is an electro-pneumatic device that reduces a supply pressure to a regulated output pressure directly proportional to an electrical input signal. The Type 1000 accepts a wide range of supply pressures, ranging from a minimum of 3 psig (0.2 BAR) above the maximum output up to 100 PSIG (6.9 BAR). An integral pneumatic volume booster is included in the design to provide high flow capacity (up to 12 SCFM/339 SLPM). Model selections include general purpose, NEMA 4X Type, extended range, high relief, intrinsically safe, and explosion proof.

Applications

The Type 1000 Transducer converts an electrical signal to a pneumatic output which can be used to operate the following:

- Valve actuators
- Damper and louver actuators
- Valve positioners
- Controllers
- Relays
- Air cylinders
- Clutches and brakes

Used in:

- Liquid, gas and slurry processing instrumentation
- HVAC systems
- Paper handling controls
- Textile processing systems
- Energy management systems
- Petrochemical processing systems

Standard Features

- Low Cost
- Built-in Volume Booster
- Small Size
- Field Reversible
- Low Air Consumption
- Mounts at Any Angle
- Convenient External Span & Zero Adjusts (Except for Explosion Proof Models)
- Light Weight
- Wide Supply Pressure Range
- Low Supply Pressure Sensitivity

Principle of Operation

The Type 1000 Transducer is a force balance device in which a coil is suspended in the field of a magnet by a flexure. Current flowing through the coil generates axial movement of the coil and flexure. The flexure moves against the end of a nozzle, and creates a back pressure in the nozzle by restricting air flow through it. This back pressure acts as a pilot pressure to an integral booster relay. Consequently, as the input signal increases (or decreases, for reverse acting), output pressure increases proportionally. Zero and span are calibrated by turning easily accessible adjusting screws on the front face of the unit. The zero adjusting screw causes the nozzle to move relative to the flexure. The span adjusting screw is a potentiometer that limits the current through the coil. A thermistor circuit in series with the coil provides temperature compensation.

Split Ranging

The 4-20 mA input, 3-15 PSIG output model can be recalibrated to provide 3-9 PSIG or 9-15 PSIG output, for split ranging applications.

Mounting

The Type 1000 transducers can be pipe, panel, or bracket mounted in any position. Positions other than vertical will require recalibration of the zero adjustment. For maximum output pressure stability, the Type 1000 should be mounted in a vibration-free location or such that vibration is isolated to the X and Z axis shown on the dimensional drawings.

Field Reversible

All Type 1000 transducers are calibrated at the factory for direct acting operation but may be used in the reverse acting mode by reversing the polarity of the signal leads and recalibrating. When calibrated for reverse acting applications, the Type 1000 transducers provide a minimum of their full rated output pressure (i.e., 15, 27, or 30 PSIG) upon input signal failure.

Type 1000 for Extended Range

Description

The Bellofram Extended Range I/P and E/P Transducers are based on Bellofram's proven Type 1000 transducer line - the best selling transducers in the business.

The large span adjustment range of this line allows recalibration to fit applications with output ranges from approximately 3-35 PSIG (0.2-2.4 BAR) to 3-145 PSIG (0.2-10 BAR).

The units accept supply pressures up to 150 PSIG (10.5 BAR) and provide flow capacity to 24 SCFM (677 SLPM).

The Type 1000 I/P and E/P Transducers are more cost effective and more accurate than typical high output systems using transducers coupled to boosting or multiplying relays.

Type 1000 with High Relief

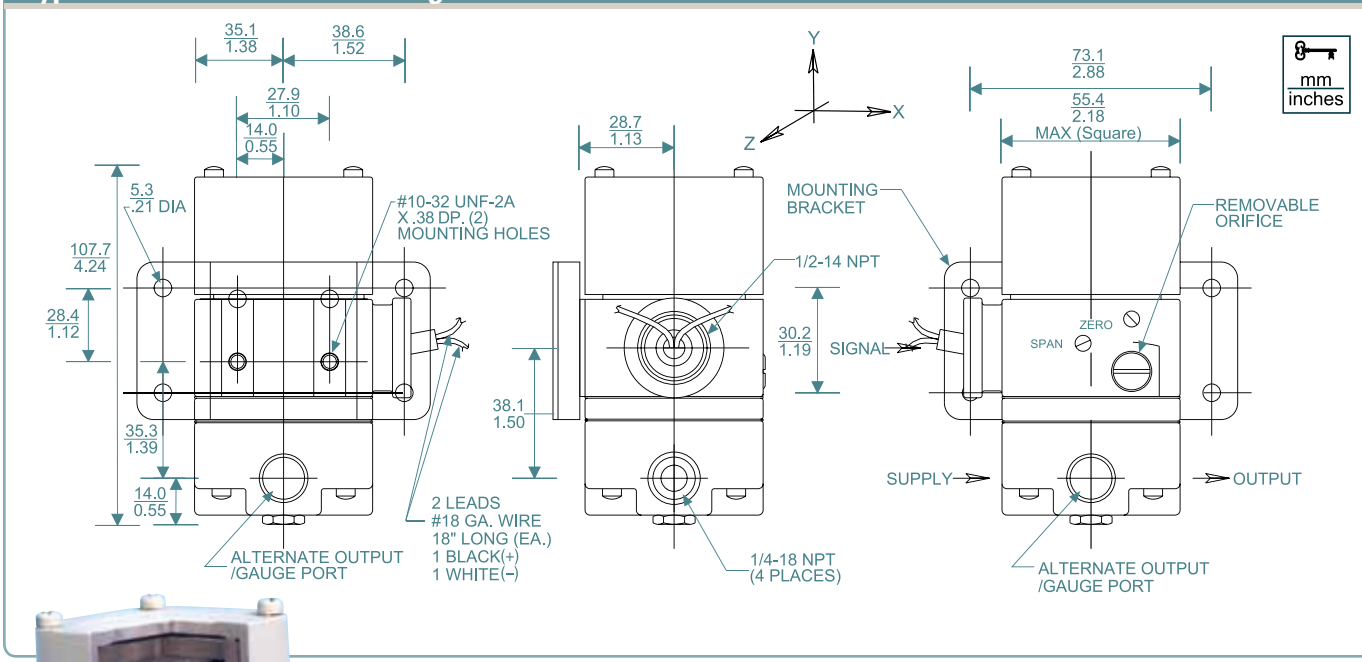
Description

Expanding upon the proven accuracy, reliability, and rugged construction of the Type 1000 General Purpose, these transducers provide extra fast "blowdown" for a very rapid release of downstream pressure. The extra relief feature makes these units suitable for cylinder return stroke actuation, air hoists, and similar applications requiring fast exhaust. These units accept supply pressures to 100 PSIG (6.9 BAR), with output ranges from 1-17 PSIG (0.07-1.2 BAR) to 6-30 PSIG (0.4-2.1 BAR), and provide exhaust capacities of 7 SCFM (336 SLPM).

Type 1000 Transducers

		Type 1000 General Purpose	Type 1000 High Relief	Type 1000 Extended Range	Type 1000 Explosion Proof
Supply Pressure Range		3 PSIG (0.2 BAR) above max. output to 100 psig (7 BAR)	3 PSIG (0.2 BAR) above max. output to 100 PSIG (7 BAR)	5 PSIG (0.4 BAR) above max. output to 150 PSIG (10.4 BAR) (100 PSIG / 7 BAR for 2-60 PSIG / 0.1-4.1 BAR models)	3 PSIG (0.2 BAR) above max. output to 100 PSIG (7 BAR)
Supply Pressure Sensitivity		±0.15% of span per 1.5 PSIG (0.1 BAR)	±0.15% of span per 1.5 PSIG (6.1 BAR)	±0.004% of span per 1.0 PSIG (0.07 BAR)	±0.15% of span per 1.5 PSIG (0.1 BAR)
Linearity (terminal based)		<1.0% of span	<1.0% of span	<2.0% of span	<1.0% of span
Repeatability		<0.5% of span	<0.5% of span	<0.5% of span	<0.5% of span
Hysteresis		<1.0% of span	<1.0% of span	<1.0% of span	<1.0% of span
Minimum Flow Rate at Midrange 100 PSIG / 7 BAR		12 SCFM (339 SLPM)	12 SCFM (339 SLPM)	24 SCFM (677 SLPM) 150 PSIG (10.4 BAR) Supply	12 SCFM (339 SLPM)
Exhaust Capacity @ 5 psig (0.4 BAR) above setpoint		2 SCFM (56.5 SLPM)	7 SCFM (336 SLPM)	2 SCFM (56.5 SLPM)	2 SCFM (56.5 SLPM)
Air Consumption (max) at Midrange		0.1 SCFM (2.8 SLPM)	0.1 SCFM (2.8 SLPM)	0.07 SCFM (2.0 SLPM)	0.1 SCFM (2.8 SLPM)
Port Size (pneumatic / electric)		1/4 NPT and 1/2 NPT	1/4 NPT and 1/2 NPT	1/4 NPT and 1/2 NPT	1/4 NPT and 1/2 NPT
Size	inches	2-1/8 X 2-1/8 X 4	2-1/8 X 2-1/8 X 4	2-1/8 X 2-1/8 X 4	6-13/32 X 5-15/16 X 7-9/16
	mm	54 X 54 X 101	54 X 54 X 101	54 X 54 X 101	163 X 151 X 192
Weight		2.1 lb. / 0.95 Kg	2.1 lb. / 0.95 kg	2.1 lb. / 0.95 kg	5.2 lb. / 2.4 kg

Type 1000 Dimensional Drawing

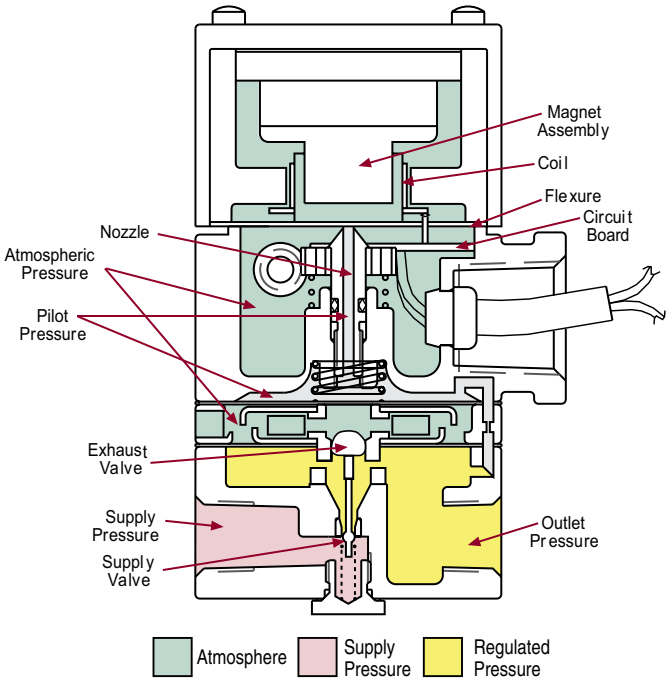


The Type 1000 has long been a standard in the I/P & E/P industry. With a built-in booster, the T-1000 provides a flow capacity up to 12 SCFM, making it a versatile transducer for many applications.

Type 1000 General Purpose Ordering Information

Input	Output*		Part Number	Impedance (Nominal)
	BAR	PSIG		
4-20mA	0.2-0.6	3-9	961-072-000	90 Ω
	0.6-1.0	9-15	961-073-000	90 Ω
	0.2-1.0	3-15	961-070-000	180 Ω
	0.2-1.9	3-27	961-074-000	220 Ω
	0.4-2.1	6-30	961-075-000	220 Ω
	0.07-1.2	1-17	961-116-000	250 Ω
	0.2-1.0	3-15	961-089-000	180 Ω
10-50mA	0.2-1.0	3-15	961-076-000	70 Ω
	0.2-1.9	3-27	961-077-000	85 Ω
	0.4-2.1	6-30	961-078-000	85 Ω
0-5V	0.2-1.0	3-15	961-079-000	615 Ω
	0.2-1.9	3-27	961-080-000	530 Ω
	0.4-2.1	6-30	961-081-000	530 Ω
1-9V	0.2-1.0	3-15	961-085-000	985 Ω
	0.2-1.9	3-27	961-086-000	840 Ω
	0.4-2.1	6-30	961-087-000	840 Ω

NOTE: For NEMA4X, add 004 suffix.



Type 1000 Extended Range Ordering Information

Input	Output*		Part Number	Impedance (Nominal)
	BAR	PSIG		
0-60mA	0.1-8.3	2-120	961-107-000	220 Ω
4-20mA	0.2-8.3	3-120	961-111-000	260 Ω
	0.1-4.1	2-60	961-117-000	225 Ω
0-10V	0.2-8.3	3-120	961-112-000	805 Ω
0-5V	0.1-4.1	2-60	961-118-000	500 Ω

Type 1000 High Relief Ordering Information

Input	Output*		Part Number	Impedance (Nominal)
	BAR	PSIG		
4-20mA	0.2-0.6	3-9	961-130-000	90 Ω
	0.6-1.0	9-15	961-131-000	90 Ω
	0.2-1.0	3-15	961-132-000	180 Ω
	0.2-1.9	3-27	961-133-000	220 Ω
	0.4-2.1	6-30	961-134-000	220 Ω
	0.2-1.0	3-15	961-135-000	180 Ω
	0.07-1.2	1-17	961-136-000	250 Ω
10-50mA	0.2-1.0	3-15	961-137-000	70 Ω
	0.2-1.9	3-27	961-138-000	85 Ω
	0.4-2.1	6-30	961-139-000	85 Ω

Agency Approval Notes

Factory Mutual
T-1000 I/P Transducers
Intrinsically Safe: Class I, Division 1, Groups A, B, C, & D, T6
Non-Incendive: Class I, Division 2 , Groups A, B, C, & D, T6.
T-1000 I/P / E/P Transducer
Explosion Proof: Class I, Division 1, Group D, T6
Dust-Ignition Proof: Classes II & III, Division 1, Groups E, F, & G, T6
Type 4 **NEMA 4**

Canadian Standards Association
T-1000 I/P Transducers
Hazardous Locations: Class I, Group D; Class II, Groups E, F, & G; Class III; CSA Enc. 4 **NEMA 4**:
I/P transducer, supply pressure 100 psig max, input 4-20mA, output 3-15 psig.
Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations: Class I, Groups A, B, C, & D; Class II, Groups E, F, & G; Class III:
I/P transducer rated input 4-20mA, intrinsically safe when connected through CSA Certified diode safety barriers in accordance with Bellofram Installation Instruction.

Explosion proof, intrinsically safe, and non-incendive ratings are not affected by recalibrating for split range or reverse acting applications.

The Bellofram T-1000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body.

Type 1000 Options and Accessories

	Part Number
Explosion Proof Mounting Kit	971-079-000
Explosion Proof Panel Mounting Kit	971-078-000
DIN Rail Kit	010-115-000
Hirschman Connector Kit (3-prong)	971-126-000
Filter Kit, 60 micron	010-139-000
Output Gauges	Option "8" ie: last 3 digits become - 008
Dielectric Strength Testing	Option "12" ie: last 3 digits become - 012
NEMA 4X Type Enclosure Option	Option "4" ie: last 3 digits become - 004

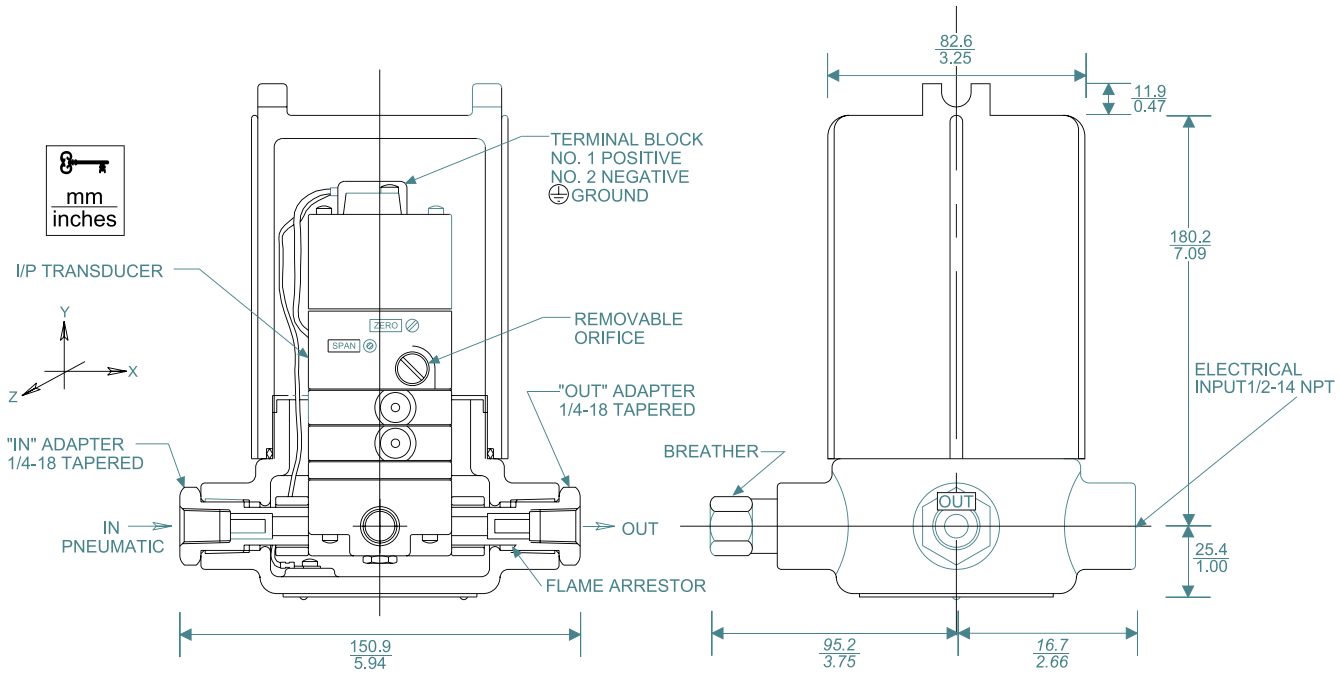
Filter Note

Bellofram specifies the use of instrument quality air (clean, dry, oil-free) for all transducers. The use of filters in the supply air system is highly recommended. Contact us for information on our filters and filter regulators.

* For output pressures less than 3 PSI (0.2 BAR) or greater than 30 PSI (21 BAR), the Type 1000 transducer can be coupled to Bellofram Type 75 pneumatic relay. Consult Applications Engineers for further information.

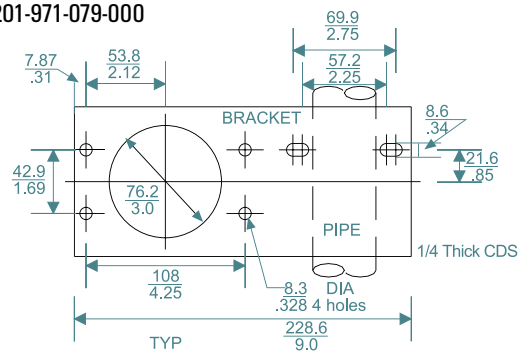
** NEMA 4 type enclosure option available on all input/output ranges. This option is separate from explosion proof, NEMA 4 units.

Type 1000 Explosion Proof Dimensional Drawing;



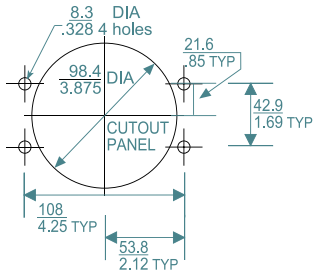
Optional Mounting Bracket & Hardware

Order kit #201-971-079-000



Optional Mounting Hardware

Order Kit #201-971-078-000



Drawings and dimensions are for reference only.

Type 1000 Hazardous Location Use Ordering Information

Input	Output* BAR	Output* PSIG	Part Number	Impedance (Nominal)	Agency Approvals (See notes)
Type 1000 Explosion Proof					
4-20mA	0.2-1.0	3-15	961-098-000	180 Ω	Explosion-Proof, Factory Mutual[1]
	0.2-1.0	3-15	961-098-100	180 Ω	CSA Explosion Proof
1-9v	20-100	3-15	961-142-000	985 Ω	Explosion Proof Factory Mutual[1]
Type 1000 Intrinsically Safe					
4-20mA	0.2-1.0	3-15	961-099-000	180 Ω	Intrinsically Safe, Factory Mutual [3,4]
	0.2-1.9	3-27	961-100-000	220 Ω	Intrinsically Safe, Factory Mutual [3,4]
	0.2-1.0	3-15	961-105-000	180 Ω	Intrinsically Safe, CSA[5]
	0.2-1.9	3-27	961-106-000	220 Ω	Intrinsically Safe, CSA[5]
	0.4-2.1	6-30	961-101-000	220 Ω	Intrinsically Safe, Factory Mutual [3,4]
	1.0-0.2	15-3	961-175-000	180 Ω	Intrinsically Safe, Factory Mutual [3,4]
	1.9-0.2	27-3	961-176-000	220 Ω	Intrinsically Safe, Factory Mutual [3,4]
	2.1-0.4	30-6	961-177-000	220 Ω	Intrinsically Safe, Factory Mutual [3,4]

*For output pressures less than 3 psi or greater than 30 psi the Type 1000 transducer can be coupled to Bellofram Type 75 pneumatic relay. Consult application engineers for further information.

Type 1001

I/P & E/P Transducers

Description

The Type 1001 is a patented family of electro-pneumatic instruments that is used to reduce a supply pressure to a regulated output pressure which is directly proportional to a two-wire current or three-wire voltage input. This design incorporates closed loop sensing of the output pressure to achieve excellent accuracy and vibration stability. It also features a unique damping circuit which can be adjusted to prevent over-shoot and actuator "hunting." Model selection includes General Purpose (NEMA 1), Rainproof (NEMA 3R), and Watertight/Corrosion Resistant (NEMA 4X). NEMA 4X models are also explosion-proof, and all models are intrinsically safe.

Features

- 0.1% accuracy typical
- Closed loop pressure feedback control minimizes effects of vibration, temperature, supply pressure and mounting angle
- Built-in volume booster provides flows up to 12 SCFM
- Easy access zero and span adjustment
- Damping pot prevents over shoot and "hunting"
- Low air consumption
- Mounts at any angle (NEMA 3R limited)
- Compact and lightweight
- Virtually no sensitivity to supply pressure changes
- Removable orifice (screw) for easy maintenance

Applications

The Type 1001's precisely regulated pneumatic output can be used to operate:

- Valve actuators
- Louver and damper actuators
- Valve positioners
- Relays
- Clutches and brakes
- Controllers
- Air cylinders

Industry Applications Include:

- Liquid and Gas Processing
- Pulp and Paper
- Petrochemical Processing
- HVAC Systems
- Textile Productions
- Energy Management
- Environmental Control
- Medical Equipment

Calibration Adjustments

The Type 1001 contains multi-turn Zero and Span adjustment potentiometers which are accessible on NEMA 1 models by sliding the cover window open to its first detent position. Pots are clearly distinguished by legend on the cover. On NEMA 3R and 4X models, the cover should be removed to reach the pots (marked Z for zero and S for span).

Adjust the pots clockwise to increase Zero and Span as required to optimize factory set output with appropriate input signal and supply pressure applied.

Damping Adjustment

To eliminate undesirable system oscillation, the Type 1001 features a unique damping adjustment. The output response is optimized to varying downstream volumes by adjusting the feedback time constant of the coil drive amplifier. This is accomplished on NEMA 1 models by sliding the cover window open to its second detent position to expose the single-turn Damping Potentiometer (remove the cover on NEMA 3R and 4X models). To optimize response, turn the pot fully counterclockwise until system oscillation is just eliminated. System oscillation may be observed by monitoring output pressure or by observing the behavior of directly actuated system components in response to a changing input.

Mounting

The Type 1001 transducers are designed to be position insensitive. They can be panel, valve, or pipe mounted at any angle (see NEMA 3R limitation) without a need for in place recalibration. Panel mounting can be either direct or with the bracket furnished with each unit. Mounting holes are located on the bottom and side to provide maximum mounting flexibility. Users may order the optional DIN Rail Adapter or a bracket suitable for either valve or 2" pipe mounting. Special pipe clamps may be ordered as a separate kit.

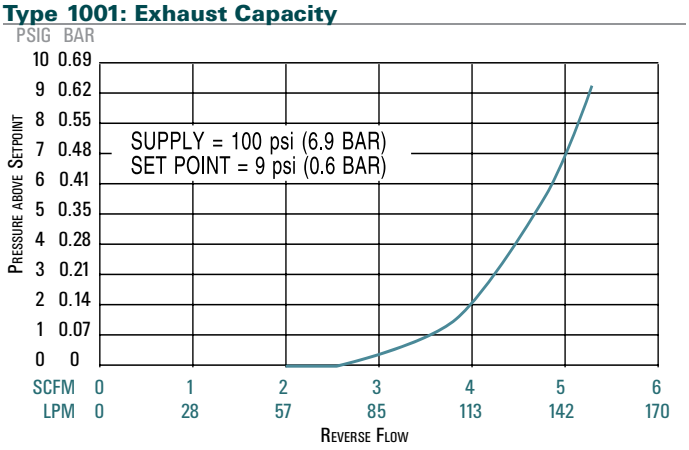
Agency Approval Notes

Factory Mutual
T-1001 I/P and E/P Transducers
Intrinsically Safe:
Class I, Division 1, Groups A, B, C, & D, T6 Ta = 40°C
Non-Incendive: Class I, Division 2, Groups A, B, C, & D, T6
Entity Parameters: V_{Max} = 28 V, I_{Max} = 150 mA, C_i = 0.22 µF, L_i = 0.
T-1001 I/P and E/P Transducers Explosion Proof: Class I, Division 1, Groups B, C, & D, T6
Dust-Ignition Proof: Classes II & III, Division 1, Groups E, F, & G, T6 Type 4X **NEMA 4X**

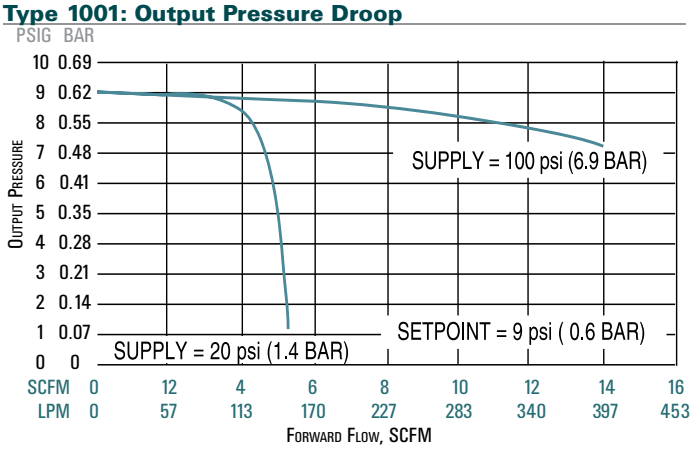
Canadian Standards Association
T-1001 and T-1001XP I/P and E/P Transducers
Hazardous Locations: Class I, Groups B, C, & D; Class II, Group E, F, & G; Class III; Encl 4 **NEMA 4**:
I/P or E/P transducer, input 4-20,10-50mA dc, 0-5, 1-5, 1-9 & 1-10V dc; supply voltage 40V dc max; supply current 100mA max; maximum ambient temp 70˚C.
Output pressure ranges:
Standard: 3-9, 9-15, 3-15, 3-27, 6-30, 1-17 psig.
Extended: 0-15, 0-120 psig.
T-1001 I/P and E/P Transducers
Hazardous Locations:
Class I, Division 2, Groups A, B, C, & D:
I/P transducer, rated input 4-20mA or 10-50mA, 30V dc max.
E/P transducer, rated supply 24V dc, 10mA, rated 0-5, 1-5,1-9 & 1-10V dc. IN COMPLIANCE WITH STD C22.2 No 213.
Intrinsically Safe and Non-Incendive Systems - Hazardous Locations:
Class I, Groups A, B, C, & D:
I/P transducer, rated input 4-20mA or 10-50mA, 30V dc max; intrinsically safe when connected through CSA Certified zener barrier devices or converters as per Bellofram Installation Instruction.
E/P transducer, rated supply 24V dc, 10mA; rated input 0-5, 1-5, 1-9 & 1-10V dc; intrinsically safe when connected through CSA Certified zener barrier devices as per Bellofram Installation Instructions.

The Bellofram T-1001 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial # 107 was written and Certificate of Conformity issued by a Competent Body.

Type 1001: Exhaust Capacity



Type 1001: Output Pressure Droop



Type 1001 Specifications

Accuracy (per ISA 51.1)	± 0.10% of output span, typical ± 0.25% of output span, maximum (Guaranteed)
Hysteresis	0.01% of output span, typical 0.10% of output span, maximum
Dead Band	No effect
Repeatability	0.01% of output span, typical 0.10% of output span, maximum
Ambient Temperature Effect	± 0.004% of nominal span per °F, typical ±0.022% of nominal span per °F, maximum
Span	±0.013% of calibrated span per °F, typical ±0.022% of calibrated span per °F, maximum
Temperature Effect	0.02%/°F, zero and span effects combined
Operating Temperature Range Buna-N elastomers Viton elastomers	 -20°F to 160°F (-29 to 71°C) 0°F to 160°F (-18 to 71°C)
Storage Temperature Range Buna-N elastomers Viton elastomers	 -40°F to 200°F (-40 to 93°C) -15°F to 200°F (-26 to 93°C)
Vibration Effect	Less than 0.5% of span per 1G, 5-2000 Hz, 3G maximum, 3 axes
Mounting Position Effect	Not measurable
Loop Load, I/P Transducer	Less than 10 VDC drop at 20 mA Less than 12 VDC drop at 50 mA
Supply Voltage, E/P Transducer Intrinsically Safe/Nonincendive General Purpose	 9 VDC to 28 VDC, less than 20 mA 9 VDC to 40 VDC, less than 20 mA
Supply Voltage Effect	No effect
Signal Impedance, E/P Transducer	6000 Ohm minimum
RFI/EMI Effect (NEMA 4X)	Less than 0.25% of span change in output 10V/meter, 20-1000 MHz. (Reference SAMA PML 33.1-1978, 2-abc)
Supply Pressure Sensitivity	No effect
Air Consumption:	0.07 SCFM (2 LPM) maximum
Supply Pressure	100 psig (6.9 BAR) maximum
Port Sizes	Pneumatic: 1/4 NPT Electrical: 1/2 NPT

* For models with zero output capability maximum supply pressure = 40 PSI (2.8 BAR) above maximum output, except for 0-100 PSI and 0-120 PSI models that have a maximum supply pressure of 130 PSI (9 BAR) & 140 psi (9.7 BAR) respectively.

Bellofram specifies the use of instrument quality air (clean, dry, oil free) for all transducers.
Transducers should be used within the following conditions:
Dew Point < 35°F (2°C) (indoor); Oil Content < 1PPM; Particles < 3µm.
The use of filters in the supply air system is highly recommended. Contact us for information on our filters and filter regulators.

Type 1001 Accessories

Kits	Part Number
Panel Mounting Kit	010135-000
Valve Mounting Kit***	010134-000
2" Pipe Mounting Kit (Valve Mounting Kit is required)	010143-000
DIN Rail Adapter	010115-000
Cover for Locking Device Kit (for NEMA 4X enclosure only)	010136-000
Type 1 Orifice with Buna-N O-rings*	010137-000
Type 1 Orifice with Viton O-rings*	010137-002
Type 2 Orifice with Buna-N O-rings**	010137-001
Type 2 Orifice with Viton O-rings**	010137-003
Filter Kit, 60 microns	010139-000
Hirschmann® Connector Kit (Din 43 650-A) (3 prong plug, O-ring sealed)	010142-000
Pressure Gauge Kit, 15 PSI	010138-000
Pressure Gauge Kit, 30 PSI	010138-001
Pressure Gauge Kit, 60 PSI	010138-002
Pressure Gauge Kit, 160 PSI	010138-003

* Type 1 Kits to be used with Ø based output units and 1-17 PSIG unit.
** Type 2 Kits to be used with all other units.
*** Supplied standard with Nema 4X

Type 1001 Specials Table

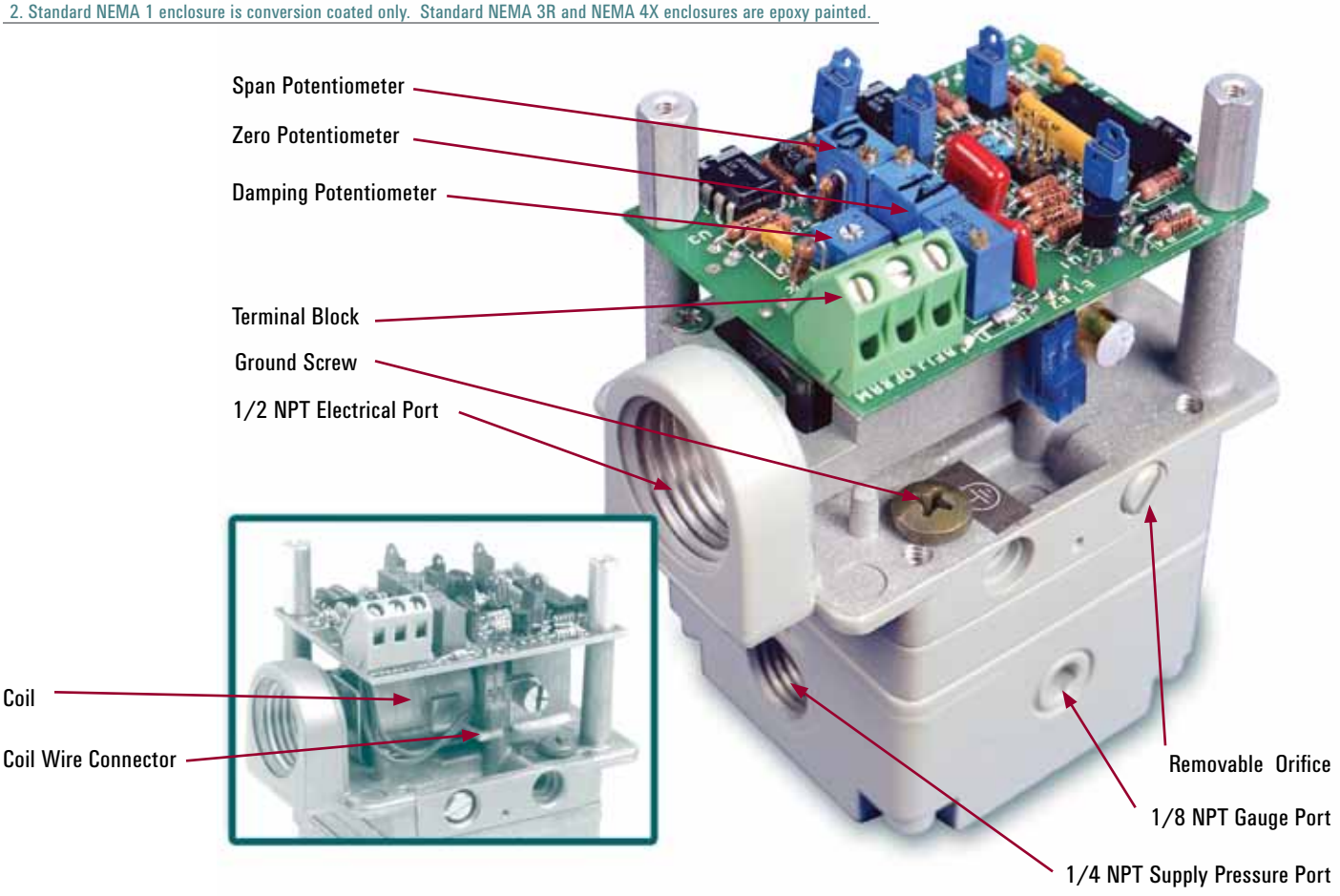
Input	Output	Comments	Part Number
4-20 mA	20-100 kPa	NEMA 1	962-145-000
4-20 mA	20-100 kPa	NEMA 3R	962-146-000
4-20 mA	0-200 kPa	NEMA 1	962-148-000

Type 1001 Ordering Information

9 6				0		
	↑	↑ ↑	↑		↑ ↑	Enclosures
	6					NEMA 1, General Purpose[2]
	7					NEMA 3R, Rainproof[2]
	8					NEMA 4X, Water-tight, Dust-tight, Corrosion Resistant, and Explosion-Proof[2]
		_ _				Calibration
						See Input / Output matrix below[1]
						Agency Approvals
			0			None
			1			Factory Mutual and CSA Explosion Proof
						Options
					00	None
					06	Fluorocarbon Elastomeric Diaphragm

Notes to Nomenclature:

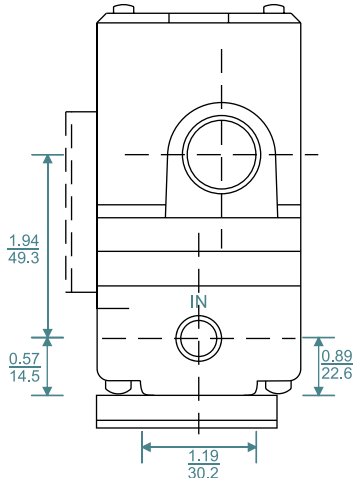
1. Transducer operating in the voltage mode (E/P), can be adjusted with the "span" potentiometer for any input between 0-10 VDC. The input range is limited to a minimum 4VDC difference between 100% and 0% Input voltage.
2. Standard NEMA 1 enclosure is conversion coated only. Standard NEMA 3R and NEMA 4X enclosures are epoxy painted.

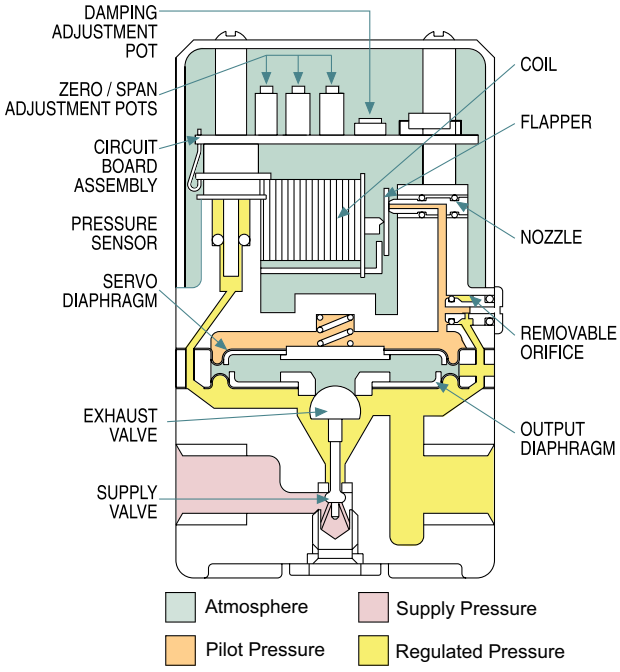


Type 1001 Standard Input/Output Matrix

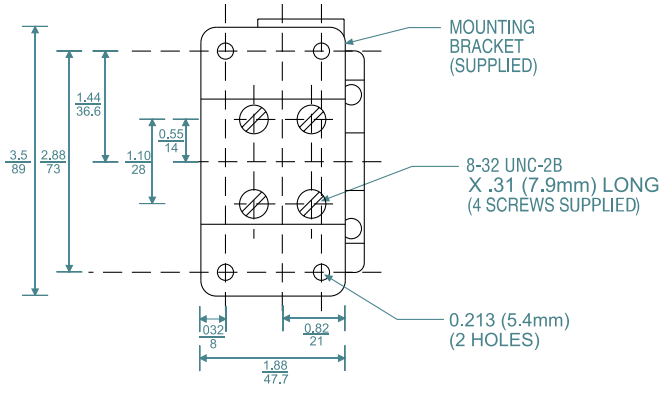
PSIG	0-5	0-15	0-30	0-60	0-100	1-17	3-15	3-27	6-30	3-9	9-15	0-2	0-120
4-20 mA	19	06	20	08	09	05	02	03	04	00	01	13	07
10-50 mA	11	16	A5	98	89	15	12	87	14	10	90	B1	17
0-5 VDC	21	26	18	28	29	25	22	35	24	30	31	B2	27
1-5 VDC	A1	36	A6	38	39	97	32	33	34	50	41	B3	37
1-9 VDC	A2	46	40	48	49	45	42	43	44	60	51	B4	47
1-10 VDC	A3	56	B6	58	59	55	52	53	54	88	61	B5	57
0-10 VDC	A4	66	70	68	69	65	62	63	64	80	99	23	67

Front View



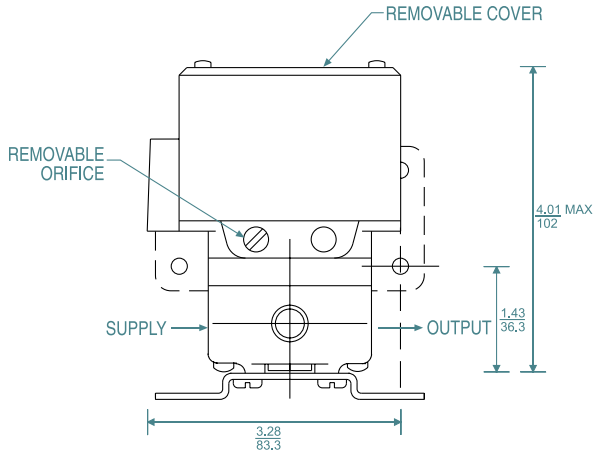


Bottom View

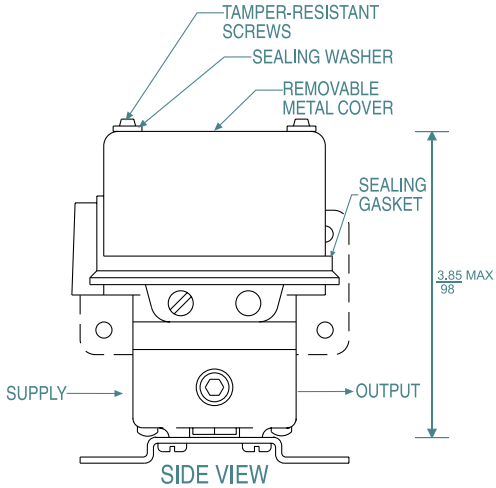


BOTTOM VIEW

Side View

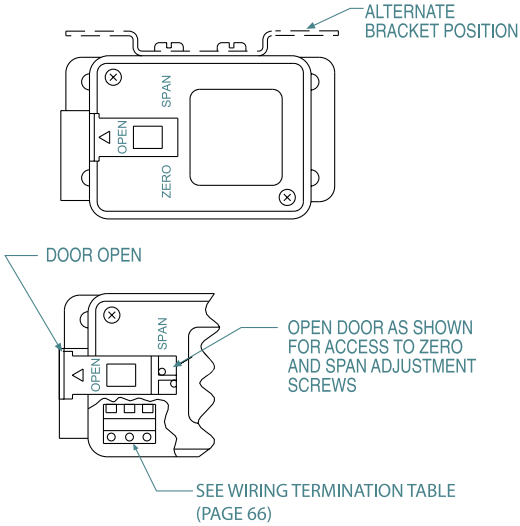


Side View (Vertical Mount Only) NEMA 3R

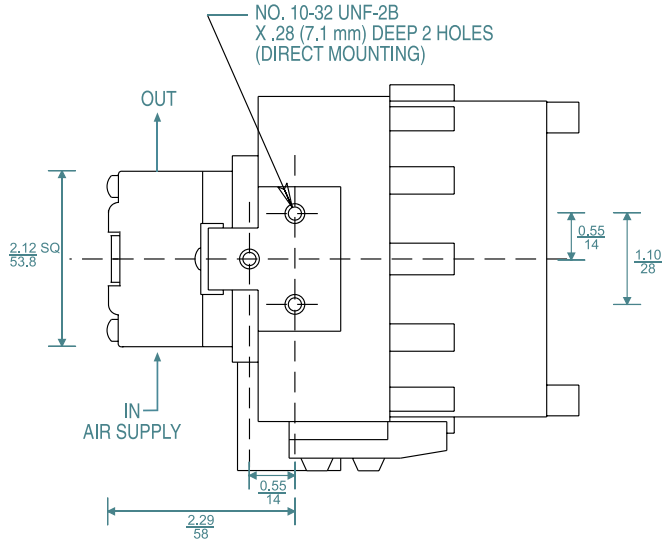


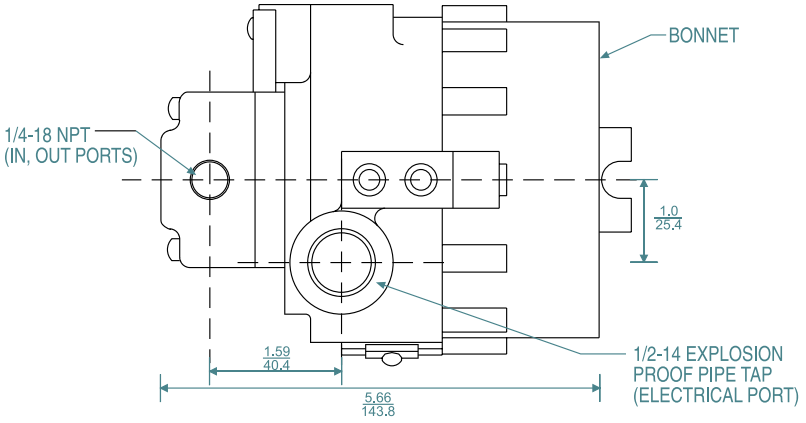
SIDE VIEW
(NEMA 3R-Vertical Mount Only)

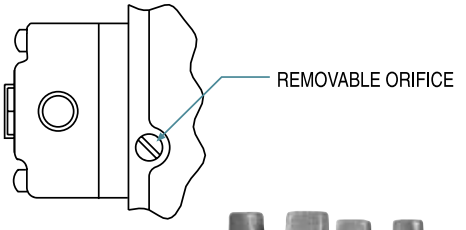
Top View



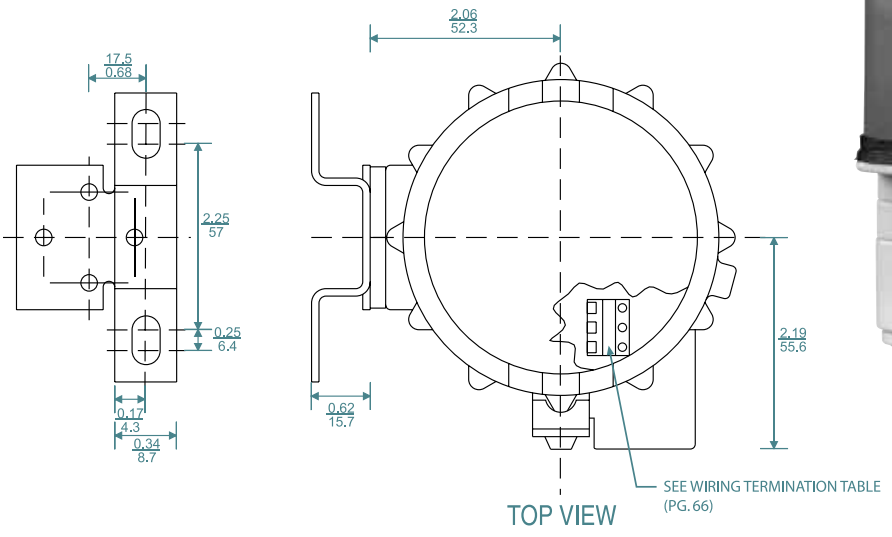
Side Views







Bottom View



Type 1001 EX Wiring Termination

PWB Terminal Block	I/P Transducer	E/P Transducer
Position 3	Positive (+)	Supply (+)
Position 2	No Connection	Common
Position 1	Negative (-)	Signal (+)

Type 1500

I/P & E/P Transducers

Type 1500 Description

The T-1500 is a new series of electro-pneumatic transducers that convert an electrical signal to a proportional pressure output. It provides precision electro-pneumatic control to actuators, valves, positioners, final control elements and is ideally used for high-flow control devices. The Type 1500's compact size and accessibility to ports and adjustments allow the unit to be installed in space-constrained locations or in a manifold for multi-device control.

DIN rail and manifold assemblies are available in kits that provide three, five or ten mounting points.

An integral pneumatic volume booster is included in the Type 1500 design to provide high flow capacity. (See specifications for flow data.)

Standard Features

- Small footprint, compact size
- Manifold mounting configurations
- Built-in volume booster
- Electrical Connections: Conduit 1/2 NPT or BSPT, Terminal Block, Hirschmann® Connectors (DIN 43 650-A)
- Supply and output ports on front and back of unit
- Low air consumption
- External zero and span adjustments
- Low cost
- Field accessible orifice
- Electrical conduit connection meets CE requirements

Options Available

- Intrinsically Safe (FM, CSA, ATEX)
- NEMA 4X (FM, CSA) Excludes Terminal Block

Applications

The T-1500 transducer can be used as an electro-pneumatic control device to operate:

- Valve actuators
- Valve positioners
- HVAC systems
- Material handling systems
- Paper handling controls
- Automation systems
- Liquid and gas processing systems

Principle of Operation

(See Fig. 2 and 6) The T-1500 Transducer is a force balance device in which a coil is suspended in the field of a magnet by a flexure. Current flowing through the coil generates axial movement of the coil and flexure. The flexure moves against the end of a nozzle and creates a back pressure in the nozzle by restricting air flow. This back pressure acts as a pilot pressure to an integral booster relay. Consequently, as the input signal increases (or decreases for reverse acting), output pressure increases proportionally.

In the zero based T-1500, the output of the transducer section is routed to an integral negative bias booster relay. The bias relay allows the complete unit to regulate output pressure down to 0 psig/BAR. The bias relay also amplifies the output of the transducer which allows the zero based units to regulate higher output pressures than the standard T-1500.

Zero and Span are calibrated by turning easily accessible adjusting screws on the front face of the unit (see Figures 3, 4, 5, 7, 8 and 9). The zero adjustment causes the nozzle to move relative to the flexure. The span adjustment is a potentiometer that limits the flow of current through the coil. A thermistor circuit in series with the coil provides temperature compensation.

Mounting

The T-1500 can be mounted at any angle but should be calibrated after mounting. For maximum output pressure stability, the T-1500 should be mounted vertically in a vibration free location or such that the vibration is isolated to the X and Z axis. The T-1500 can be in-line, panel, pipe, DIN rail or manifold mounted.

Air Connections

1. Supply Air must be instrument quality air regulated between 5 PSI above maximum output pressure up to 120 PSIG / 8.3 BAR (See table: Supply Pressure Range).
2. Instrument-quality air consists of:
   a. A dew point less than 35 ˚F
   b. No particles larger than three microns
   c. Maximum oil content of 1 ppm
3. All unused ports must be plugged.

Supply

Connect supply to either of two ports marked "IN" on the base of the transducer. Avoid getting pipe sealant inside the piping or transducer.

Output

Connect output to either of two ports marked "OUT" on the base of the transducer. The second "OUT" port may be used for a pressure gauge.

Type 1500 Transducers

	Standard Range	Zero Based
Hysteresis	<0.75% of span	<1.0% of span
Repeatability	<0.5% of span	<0.5% of span
Linearity (Independent)	<0.75% of span <1.0% of span for fluorocarbon units	<1.0% of span
Flow @ Mid Range	6.5 SCFM (Minimum) @ 15.0 PSIG / 1.0 BAR output pressure, 120 PSIG / 8.3 BAR supply pressure	9.0 SCFM (Minimum) @ 15.0 PSIG / 1.0 Bar output pressure, 150 PSIG / 10.3 BAR supply pressure
Maximum Air Consumption	3 SCFH @ 15 PSI / 1.0 BAR output pressure	18 SCFH @ Maximum output pressure
Exhaust Capacity	>1.0 SCFM @ 5 PSI / 0.4 BAR above set point	>1.0 SCFM @ 5 PSI / 0.4 BAR above set point
Supply Pressure Range	5 psi above maximum output up to 120 psig / 8.3 BAR maximum	0-15 units: 25-150 PSIG / 1.7-10.3 BAR 0-30 units: 40-150 PSIG / 2.8-10.3 BAR 0-60 units: 70-150 PSIG / 4.8-10.3 BAR 0-120 units: 125-150 PSIG / 8.6-10.3 BAR
Weight	1.3 lbs.	1.63 lbs.
Port Size	1/4 NPT, BSPT, BSPP	1/4 NPT, BSPT, BSPP
Supply Pressure Sensitivity	<2.5% of span for a supply pressure change of 15 PSIG / 1.0 BAR	<1.7% of span change in output pressure over full supply pressure range (0-120 units)
Temperature Range	-20°F to +150°F	-20°F to +150°F
Input Signal	4-20 mA DC, 0-5 VDC, 1-5 VDC, 1-9 VDC, 0-10 VDC, 1-10 VDC	4-20 mA DC, 0-5 VDC, 1-5 VDC, 1-9 VDC, 0-10 VDC, 1-10 VDC
Output Range	3-15, 3-27, 6-30 PSIG 0.2-1.0, 0.2-1.9, 0.4-2.1 BAR	0-15, 0-30, 0-60, 0-120 PSIG 0-1.0, 0-2.1, 0-4.1, 0-8.3 BAR

Electrical Connections: Both the I/P & E/P versions are two-wire devices, plus a safety ground. The E/P requires a DC voltage input signal; example: 1 to 9 VDC.
The I/P models require an input current of 4 to 20 mA.

Type 1500 Ordering Information

96								
								Enclosure Rating
	6						**0**	NEMA 4X (Includes Approvals)
	9							Indoor Use / General Purpose
								"In and Out" Pneumatic Port Connections
		7						1/4 NPT
		8						1/4 BSPT
		9						1/4 BSPP
								Input (Signal)
			1					4-20 mA DC
			2					0-5 VDC
			3					1-9 VDC
			4					1-10 VDC
			5					0-10 VDC
			6					1-5 VDC
								Output (Pressure)
				0				3-15 PSIG / 0.2-1.0 BAR
				1				3-27 PSIG / 0.2-1.9 BAR
				2				6-30 PSIG / 0.4-2.1 BAR
				3				0-15 PSIG / 0-1.0 BAR
				4				0-30 PSIG / 0-2.1 BAR
				5				0-60 PSIG / 0-4.1 BAR
				6				0-120 PSIG / 0-8.3 BAR
								Electrical Connection
					0			1/2 NPT (1/4 NPT Ports Only)
					1			Terminal Block (Indoor Use / General Purpose Only)
					2			Hirschmann® Connection (DIN 43 650-A)
					3			1/2 BSPT Conduit (1/4 BSPT or BSPP Ports Only)
								Elastomer
						0		Nitrile
						1		Fluorocarbon
								Agency Approvals and Certifications
							0	FM, CSA and ATEX Intrinsically Safe
							1	None - General Purpose Only

NOTE: Individual regulators, FRs, filters, and lubricators come complete with bracket.
FRL assemblies come complete with all bracket/connectors.

T-1500 Manifold and Adapter Kit

Principle of Operation

The T-1500 manifold assembly allows multiple T-1500 Transducers to be mounted in parallel. This minimizes the number of individual supply air lines required. Manifolds are available to hold three, five, or ten units. Each manifold comes with check valves so that a unit can be pulled off of the manifold for service or replacement without affecting the whole manifold. (See Figure 1.)

Mounting

The manifolds may be mounted flush with a wall or cabinet or may be mounted away from the wall. Both mounting options are included in the basic manifold kit. In addition, all fittings required to mount the full number of units in each manifold are included in the basic kit. An additional adapter kit may be purchased which contains all of the hardware required to manifold mount a single T-1500 Transducer should the need arise.

Air Supply Attachment

The air supply can be attached to either side of the manifold via a 3/4 NPT connection or to the back of the manifold via a 3/8 NPT connection. After an air supply port is selected, the open ports should be plugged using the plugs provided with the manifold kit and a pneumatic sealant.

Output Air Attachment

Connect the output ports from each of the T-1500 Transducers to the bottom or back of the manifold. After connecting the transducers, plug the other 1/8 NPT ports using the plugs provided and a pneumatic sealant.

T-1500 Manifold Adapter Kit

The T-1500 manifold kit includes the adapter kits required for each transducer.

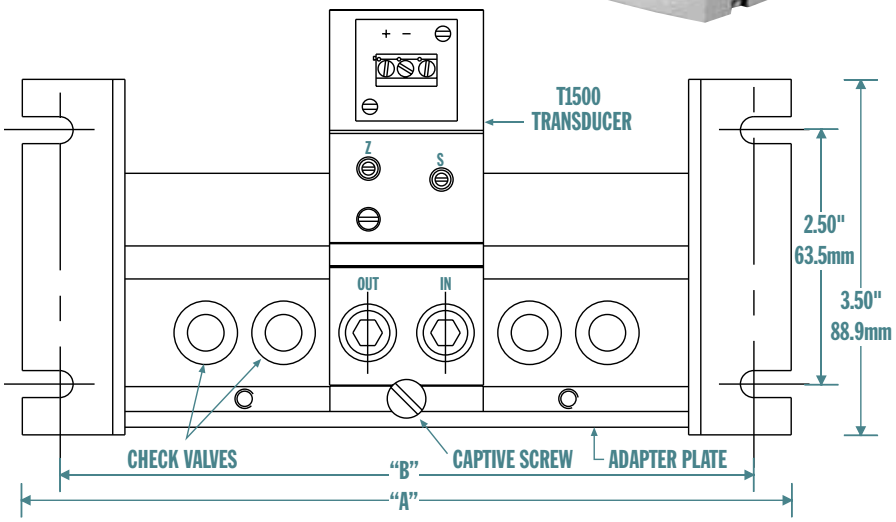
Electrical Connections

Two brackets supplied with the manifold kit allow an electrical conduit to be attached to the manifold. Mounting screws and nuts are provided, and the brackets have an 11/64" diameter hole which will fit standard 8-36 UNF or 8-32 UNC screws (not supplied).

Type 1500 Dimensions

Number of Transducers	Length A	Length B
3	7.57" 192.3 mm	6.83" 173.5 mm
5	10.75" 273.1 mm	10.01" 254.3 mm
10	18.70" 475.0 mm	17.96" 456.2 mm

Figure 1 - Manifold Front View



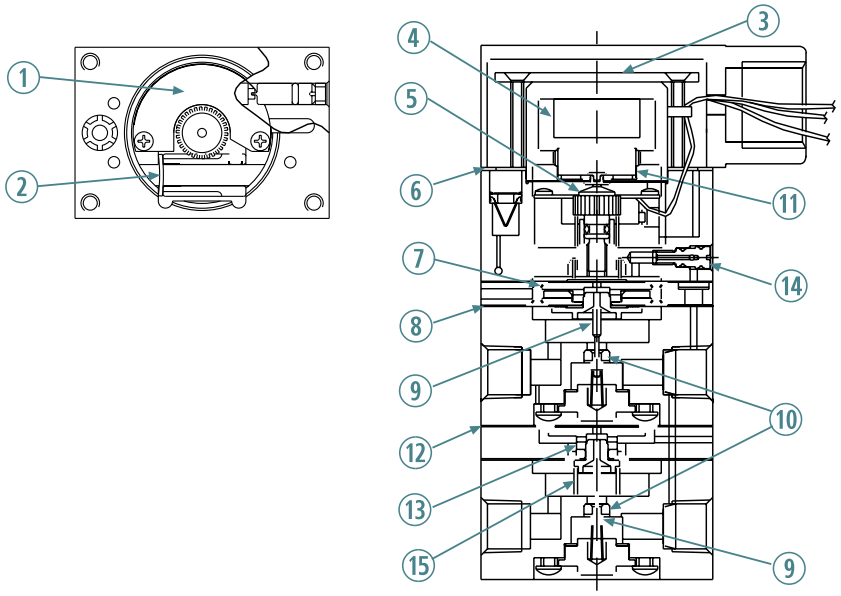
Type 1500 Manifold Ordering Information

Kit	Part Number
T-1500 Wall Mount Kit, 3 unit	010-606-000
T-1500 Wall Mount Kit, 5 unit	010-606-001
T-1500 Wall Mount Kit, 10 unit	010-606-002
T-1500 Manifold Adapter Kit (Replacement)	010-602-000
DIN Rail Mounting Kit	971-140-000
Pneumatic Repair Kit (3-15, 3-27 PSIG / 0.2-1.0, 0.2-1.9 BAR)	971-141-000
Pneumatic Repair Kit (6-30 PSIG / 0.4-2.1 BAR)	971-141-002
Pneumatic Repair Kit, Fluorocarbon (3-15, 3-27 PSIG / 0.2-1.0, 0.2-1.9 BAR)	971-141-003
Pneumatic Repair Kit, Fluorocarbon (6-30 psig / 0.4-2.1 BAR)	971-141-004
Pneumatic Repair Kit (0-120 PSIG / 0-8.3 BAR)	971-145-000
Pneumatic Repair Kit Fluorocarbon, (0-120 psi / 0-8.3 BAR)	971-145-001
Electronic Repair Kit (4-20 mA)	971-142-000
Electronic Repair Kit (0-5 VDC or 1-5 VDC)	971-142-001
Electronic Repair Kit (1-9, 1-10 VDC, or 0-10 VDC)	971-142-002
2" Pipe Mounting Kit	971-159-000
Filter Kit, 60 Micron	010-139-000

Type 1500 Extended Range Parts

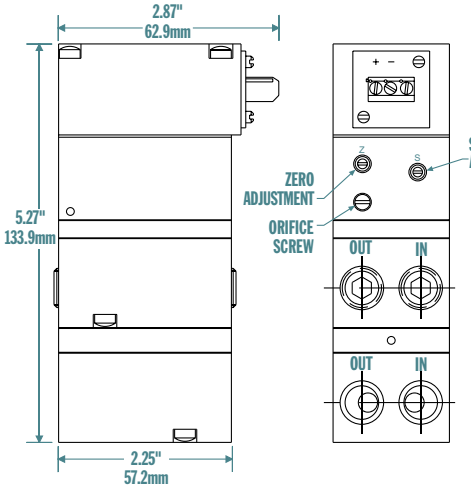
Number	Description
1	Circuit Board
2	Worm Gear
3	Duckbill Valve (NEMA 4X Only)
4	Magnet Assembly
5	Nozzle Assembly
6	Bonnet Gasket (NEMA 4X Only)
7	Servo Diaphragm (I/P Section)
8	Control Diaphragm (I/P Section)
9	Pintle
10	Supply Seat
11	Coil/Flexure Assembly
12	Servo Diaphragm (Bias Relay)
13	Control Diaphragm (Bias Relay)
14	Orifice Screw
15	Bias Spring

Figure 2: Type 1500 Extended Range Parts



Type 1500 Extended Range Dimensions

Figure 3: Terminal Block



Back Dimensions

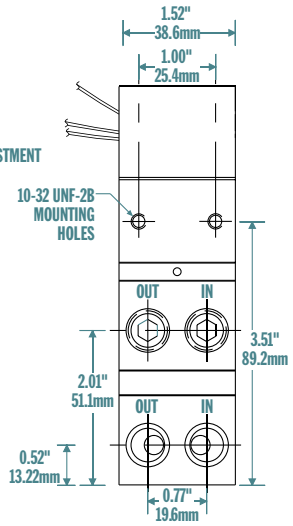


Figure 4 - Hirschmann® (DIN 43 650-A)

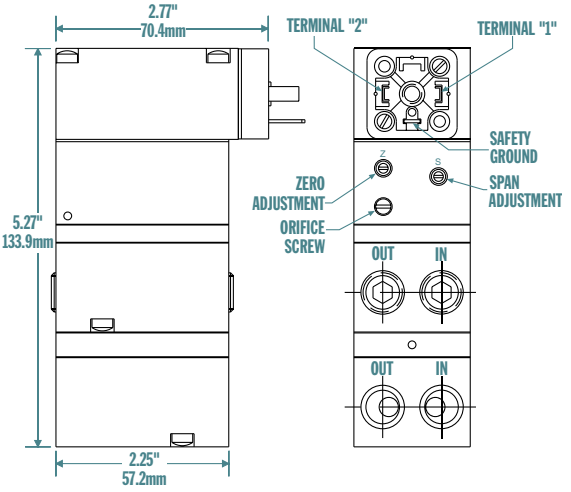
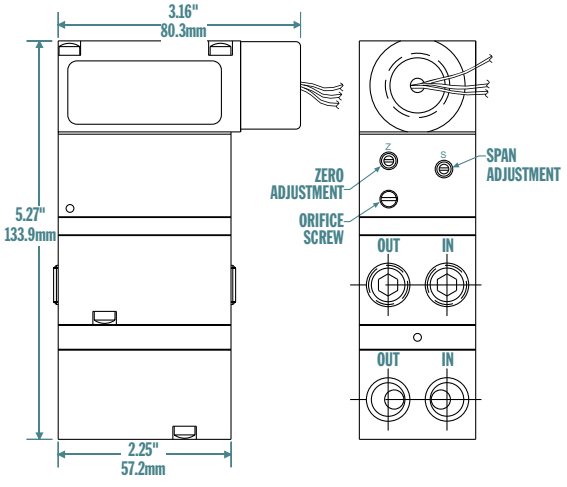


FIGURE 5: 1/2 NPT / BSPT

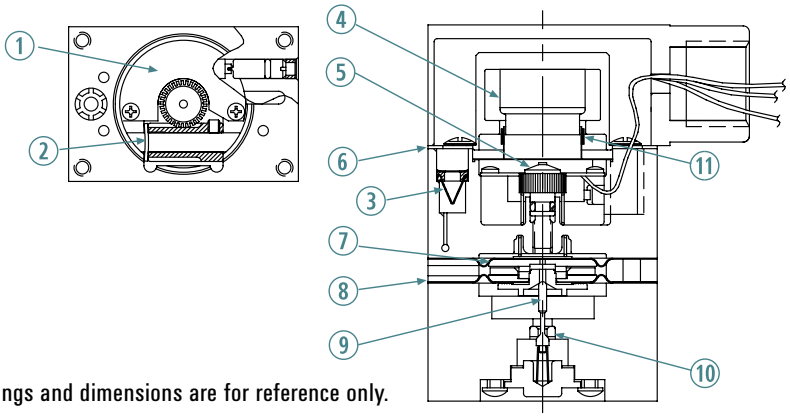


Drawings and dimensions are for reference only.

Type 1500 Standard Range Parts

Number	Description
1	Circuit Board
2	Worm Gear
3	Duckbill Valve (NEMA 4X Only)
4	Magnet Assembly
5	Nozzle Assembly
6	Bonnet Gasket (NEMA 4X Only)
7	Servo Diaphragm (I/P Section)
8	Control Diaphragm (I/P Section)
9	Pintle
10	Supply Seat
11	Coil/Flexure Assembly

Figure 6: Type 1500 Standard Range Parts



Drawings and dimensions are for reference only.

Type 1500 Standard Range Dimensions

Back Dimensions

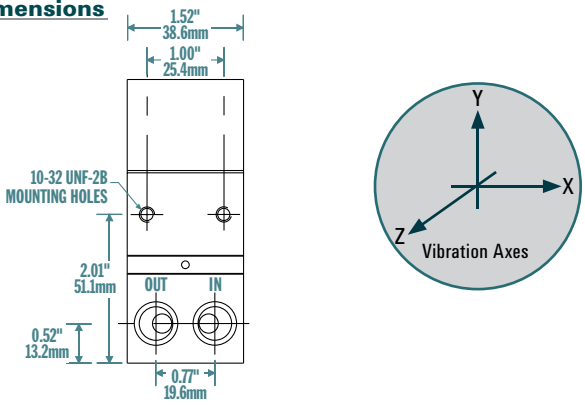


Figure 7: Terminal Block

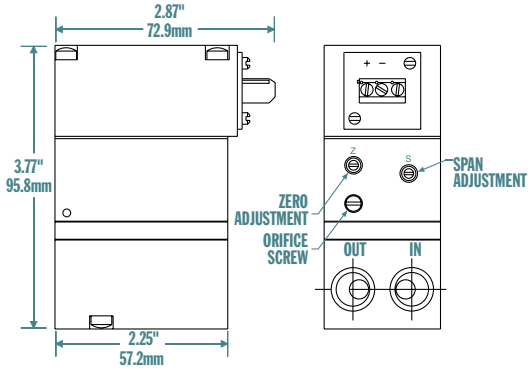


FIGURE 8: 1/2 NPT / BSPT

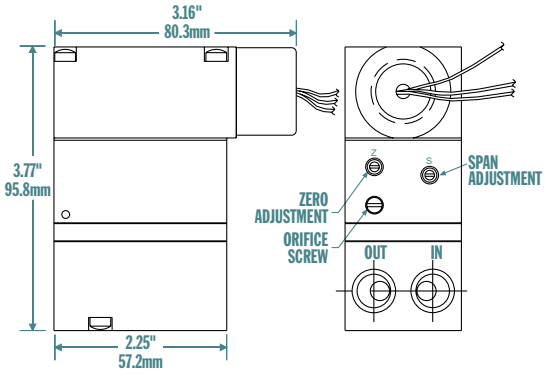
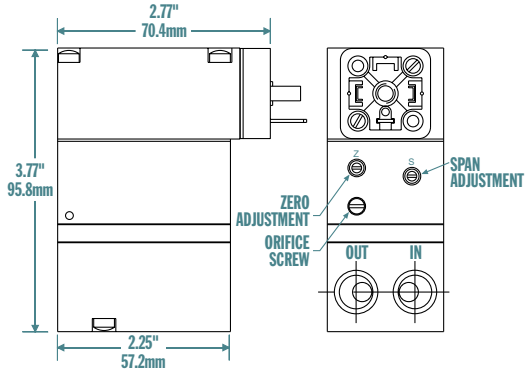


Figure 9: Hirschmann® (DIN 43 650-A)



Agency Approvals - Applies only to units ordered with approvals

Factory Mutual
T-1500 I/P and E/P Transducers
Intrinsically Safe: Class I, Division 1, Groups A, B, C, & D, T4 Ta = 70°C; Entity;
Non-Incendive: Class I, Division 2, Groups A, B, C, & D, T4 Ta = 70°C
Dust-Ignition Proof: Classes II & III, Division 1, Groups E, F, & G, T4 Ta = 70°C
Suitable: Classes II & III, Division 2, Groups F & G, T4 Ta = 70°C Type 4X **NEMA 4X**
Entity Parameters: V_{Max} = 30 V dc, I_{Max} = 100 mA, C_i = 0 µF, L_i = 0 mH.

Canadian Standards Association
T-1500 I/P Transducers Hazardous Locations: Class I, Division 2, Groups A, B, C, & D; Type 4X **NEMA 4X**:
I/P transducer, rated V_{Max} = 30V dc, I_{Max} = 100mA. Temp Code T4. Max ambient 70°C.
IN COMPLIANCE WITH STD C22.2 No 213.
Intrinsically Safe, Entity - Hazardous Locations: Class I, Groups A, B, C, & D; Class II, Group E, F, & G; Class III; Type 4X **NEMA 4X**:
I/P transducer. Entity Parameters: V_{Max} = 30V dc, I_{Max} = 100mA, C_i = 0, L_i = 0. Intrinsically Safe when connected per Installation Instruction 010632. Temp Code T4. Max ambient 70°C.

ATEX
Intrinsically safe for II 1 G EEx ia IIB T4 Tamb = -20 to 65 ˚C
Input Parameters: V_{Max} = 30V, Pi = 1W, Ii = 100 mA, Req = 180 OHMS, C_i = 0, L_i = 24mH

Models are CE marked for use in the European Union, and meet the EMC heavy machinery directives.

The Bellofram T-1500 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body

Type 2000

I/P & E/P Transducers

Description

The Marsh Bellofram Type 2000 is a robust electronic instrument that regulates an incoming supply pressure down to a precise output pressure which is directly proportional to an electrical control signal. The secret to the Type 2000's precise, reliable performance under a variety of demanding environmental conditions is a patented piezo-ceramic actuator with many industry-wide firsts.

The Type 2000 has been designed to meet the electro-pneumatic needs of the world:

- Field-selectable inputs and direct/reverse/split ranging
- Multiple input/output/mounting configurations
- Precise, reliable performance under extreme conditions of temperature, vibration, orientation, supply pressure changes, supply voltage changes, RFI/EMI, humid / oil-laden media, and corrosive surroundings

Applications

The Type 2000's precisely regulated pneumatic output can be used to operate:

- Valve Actuators
- Louver and Damper Actuators
- Valve Positioners
- Relays
- Clutches and Brakes
- Controllers
- Air Cylinders

Industry Applications Include

- Chemical and Petrochemical Industries
- Petroleum Production
- Pipeline Transmission
- Electric Utilities
- Water and Wastewater Systems
- Pulp and Paper
- Textiles
- Semiconductor Industry
- Food and Beverage
- Environmental Control Systems
- Construction Equipment
- Agricultural Equipment
- Machine Tool
- Material Handling
- Automotive Testing and Assembly
- Medical Equipment

Principle of Operation

The Type 2000 I/P and E/P transducers utilize closed-loop pressure feedback-control for precision pressure output and minimized effects of temperature, supply pressure changes, supply voltage changes, and mounting angle.

Supply pressure is reduced by the supply valve to provide an output pressure which is internally routed to a precision temperature compensated piezo-resistive pressure sensor. Supply pressure is also routed to an externally removable orifice which provides a reduced pilot pressure to a chamber containing a servo diaphragm and nozzle. Pilot pressure is controlled by modulating the gap between the face of a nozzle and an adjacent piezo-ceramic actuator, which is part of a unique patented mechanism.

The piezo-ceramic actuator serves as a control link between electrical input and pressure output as follows:

- The input current (I/P) or voltage (E/P) signal is conditioned to provide a normalized control signal directly proportional to the desired pressure output.
- Simultaneously the output of the pressure sensor is amplified and conditioned to produce a feedback signal.
- The sum of the control signal and the feedback signal produce a command signal which is delivered as a DC voltage to the piezo-ceramic actuator.
- As voltage increases, the force applied by the actuator increases, so as to restrict nozzle bleed and thus increase pilot pressure.
- Increased pilot pressure applied to the servo diaphragm directly causes opening of the supply valve and an increase in the output pressure until the output feedback signal and control signal combine to produce the correct command signal.

Fine-Tuning Your Application

For optimal performance in your application, the calibration of the Type 2000 can be fine-tuned in the field. An easily-removable cover provides access to the isolated electronics. All potentiometers, connections, jumpers, and switches are clearly marked on the circuit board or on the handy chart located on the inside of the cover. The three elements of calibration (Gain, Zero, and Span) are described below. Consult the Type 2000 User's Manual for detailed calibration procedures, cautions, and instrumentation requirements.

Gain (Damping) Adjustment

The output response of the Type 2000 can be optimized for varying downstream volumes by adjusting the system gain of the control circuit. Adjust the Gain Pot counterclockwise for increased gain; clockwise for increased oscillation damping. For maximum allowable gain in your application, the pot should be turned clockwise until oscillation just disappears.

Zero and Span Adjustments

The Type 2000 contains multi-turn Coarse-Zero, Fine-Zero, and Span adjustment potentiometers which are clockwise positive. Adjustment of either Zero Pot changes the unit's minimum output while the Span Pot changes the maximum output. The adjustments are interactive, so it may take iterations to reach the desired calibration.

Wide Rangeability

The Type 2000 can be field calibrated to pressure ranges other than the standard ones by combinations of recalibration, pressure range switching, and split high/low ranging. A unit should not be switched to a range outside its pressure sensor family (eg., a 0-15 PSIG can be switched to a 3-15 PSIG, but not to 0-30 PSIG). (Caution: Do not exceed the range of the onboard pressure sensor.) For example, the easiest way to recalibrate a 0-30 PSIG unit to 3-15 psig would be to change the switch setting to 3-27 PSIG, then switch to split range low.

Field-Selectable Features

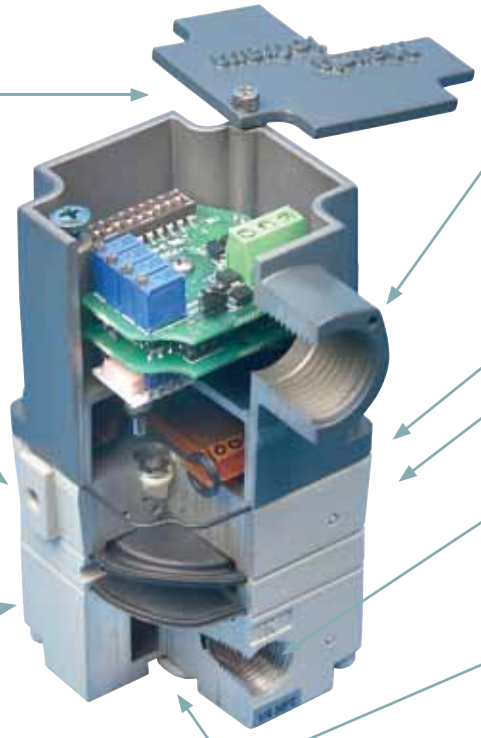
Onboard switches allow the user to easily reconfigure the Type 2000 for any of several electrical inputs, direct/reverse acting, or output split-ranging high/low. Fine tuning of the unit's calibration may be necessary after a reconfiguration.

Direct/Reverse Acting

Direct Acting transducers regulate to their minimum output when supplied with minimum input; maximum out with maximum in. Reverse Acting transducers regulate to their maximum output at minimum input.

Split Ranging (High or Low)

The Type 2000 can be configured to regulate either half (top or bottom) of its normal output range, when supplied with its normal full-ranging electrical input. For example, a 0-10V 0-30 PSI unit set to split range low will regulate 0-15 PSI @ 0-10V. It will regulate 15-30 PSI @ 0-10V if set to split range high.



Easy Access Top Cover
1) Isolated electronics
2) Calibration adjustments
3) Configuration switches
4) Switch information on inside of cover

Mounting Options
1) In-Line
2) Direct: Holes on left rear and bottom faces
3) Bracket Mounting options: Panel, Pipe, Valve, DIN-Rail

Integral Booster
Flows up to 21 scfm for quick system response

Gauge Port
1/8 NPT on all models
(Not shown; rear face)

Electrical Port Options
1) 1/2 NPT Conduit
2) 20mm Conduit
3) Hirschmann® (DIN 43 650-A)
4) Terminal Block

Easy Access Orifice

Output Port
Same as Input Port
(Not shown; rear face)

Input Port Options
1) 1/4 NPT
2) 1/4 BSPP
3) 1/4 BSPT

Manifold-Mounting Option
Supply and Output ports on the bottom face rather than "through the body"

Agency Approvals - Applies only to units ordered with approvals

Factory Mutual
T-2000 I/P & E/P Transducers Explosion Proof / Intrinsically Safe Model
Explosion Proof: Class I, Division 1, Groups A, B, C, & D, T6 Ta = 60°C
Dust-Ignition Proof: Classes II & III, Division 1, Groups E, F, & G , T6 Ta = 60°C; Type 4X **NEMA 4X**, IP66
Intrinsically Safe: Classes I, II, & III, Division 1, Groups A, B, C, D, E, F, & G , T4 Ta = 60°C; Entity; Type 4X **NEMA 4X**, IP66
Non-Incendive: Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
Suitable: Class II, Division 2, Groups F & G , T4 Ta = 60°C
Suitable: Class III, Division 2, T4 Ta = 60°C, Type 4X, IP66
Entity Parameters:
Input Option b = 42: V_{Max} = 30 V, I_{Max} = 200 mA, P_{Max} = 1 W, C_i = 0, L_i = 0.
Input Option b = 01, 05, 11, 15 or 19: V_{Max} = 30 V, I_{Max} = 100 mA, P_{Max} = 0.75 W, C_i = 0, L_i = 0.
Special Conditions of Use:
The T-2000 Non-Incendive not for use with natural gas or other non-inert gases as a process medium.

T-2000 E/P or I/P Transducers Intrinsically Safe Model
Intrinsically Safe: Classes I, II, & III, Division 1, Groups A, B, C, D, E, F, & G, T4 Ta = 60°C; Entity;
Non-Incendive: Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
Suitable: Class II, Division 2, Groups F & G, T4 Ta = 60°C
Suitable: Class III, Division 2, T4 Ta = 60°C Type 4X **NEMA 4X**
Entity Parameters:
When Electrical Input Option *c* = 42: VMax = 30 V, IMax = 200 mA, PMax = 1 W, C_i = 0, L_i = 0.
When Electrical Input Option *c* = 05, 15, 19, 11 or 01: V_{Max} = 30 V, I_{Max} = 100 mA, P_{Max} = 0.75 W, C_i = 0, L_i = 0.

T-2000 E/P or I/P Transducers Intrinsically Safe with Terminal Block Model
Intrinsically Safe: Class I, Division 1, Groups A, B, C, & D, T4 Ta = 60°C Entity;
Non-Incendive: Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
Entity Parameters:
When Electrical Input Option c = 42: V_{Max} = 30 V, I_{Max} = 200 mA, P_{Max} = 1 W, C_i = 0, L_i = 0.
When Electrical Input Option c = 05, 15, 19, 11 or 01: V_{Max} = 30 V, I_{Max} = 100 mA, P_{Max} = 0.75 W, C_i = 0, L_i = 0.

Canadian Standards Association - T-2000 I/P & E/P Transducers
Hazardous Locations: Class I, Division 1, Groups A, B, C, & D; Class II, Groups E, F & G; Class III.

Explosion proof I/P & E/P Transducer, Rated: 28Vdc, 8mA; T-Code T6; Enclosure Type 4X **NEMA 4X**, IP66;
Max Ambient Temperature: +60°C. IN COMPLIANCE WITH STD C22.2 No 213.

T-2000 I/P & E/P Transducers
Intrinsically Safe, Entity - Hazardous Locations: Class I, Divisions 1 & 2, Groups A , B, C, & D; Class II, Division 1, Groups E, F, & G, Division 2, Groups F & G; Class III Hazardous Locations
Electro-Pneumatic I/P and E/P Transducers. Maximum Ambient Temperature: +60°C. Enclosure Type 4X **NEMA 4X**, T4. Intrinsically Safe when installed.
Explosion proof: Class I, Division 1, Groups A, B, C & D; Class II, Groups E, F, & G; Class III. **NEMA 4X**
Rated: 28Vdc, 8mA; T-Code T6; Enclosure Type 4X, IP66; Max Ambient Temperature: +60°C. Intrinsically Safe when installed. Two sets of Entity Parameters may be used in the installation of this product.
Entity Parameters
I/P: V_{Max} = 30V I_{max} = 200mA P_{Max} = 1.0W C_i = 0mF L_i = 0mH
E/P: V_{Max} = 30V I_{Max} = 100mA P_{Max} = 0.75W C_i = 0mF L_i = 0mH

ATEX (EUROPEAN MODEL)
T-2000 I/P & E/P Transducers
INTRINSIC SAFETY: II 1 G EEx ia IIC T4 (-20<Ta<+60) EN 50014:1997 (A2) EN 50020:1994 EN 500284:1999

ENTELA
T-2000 I/P Transducers
Explosion Proof: Class I, Division I, Groups C and D, T3.
Exia IIB Ci=0 Li=0, 24VDC, 25mA
Note: Meets the requirements for CSA Class I Div. 1, Group D media gas (Natural Gas Use) Also includes factory conduit seal. EN 50081-1 Residential, commercial & light industry, EN-50082-2 Heavy Industrial. Certified to CSA C22.2 No 30,14,157,1010

The Bellofram T-2000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body.

Type 2000 Specifications

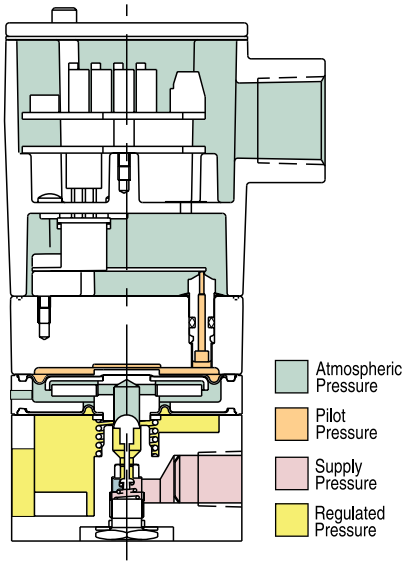
Accuracy	0.1% of full-scale output typical (0.25% guaranteed); includes effects of hysteresis, dead band, and repeatability
Electrical	
Inputs	Switch-Selectable 4-20mA. 0-5, 1-5, 1-9, 1-10, or 0-10VDC
Connections	1/2 NPT or 20mm Conduit DIN Hirschmann (S model only) External Terminal Block (S model only)
Power Supply	5-28VDC (with voltage inputs only)
Direct/Reverse Acting	Switch-Selectable
Pneumatic	
Outputs	0-5, 0-15, 3-15, 1-17, 0-30, 6-30, 3-27, 0-60, 0-100, or 120 PSIG 0-0.1, 0-0.3, 0-1.0, 0.2-1.0, 0.07-1.2, 0-2.1, 0.4-2.1, 0.2-1.9, 0-4.1, 0-6.9, 0-8.3 BAR
Ports (Input/Output)	1/4" (NPT, BSPT, or BSPP threads) Bottom-ported for Manifold Mounting
Exhaust	(Explosion proof only) 1/8 - 27 NPT
Ports (Gauge)	1/8 NPT
Supply	For 0–5 PSIG (0.3 BAR) Through 0–60 PSIG From 5 PSIG (0.3 BAR) above maximum output to 100 PSIG maximum For 0-100 PSIG and 0–120 PSIG Ranges From 5 PSIG (0.3 BAR) above maximum output to 140 PSIG maximum
Split-Ranging	Switch-Selectable, Full-Range or Split-Range High or Split-Range Low
Consumption	4 SCFH maximum (1.9 LPM)

Flow Capacity

Range		Sensor		Flow	
PSIG	BAR	PSIG	BAR	SCFM	LPM
0-5	0-0.3	5	0.3	11	312
0-15	0-1.0	15	1.0	15	423
3-15	0.2-1.0	15	1.0	15	423
1-17	0.07-1.2	15	1.0	15	423
0-30	0-2.1	30	2.1	15	423
3-27	0.2-1.9	30	2.1	15	423
6-30	0.4-2.1	30	2.1	15	423
0-60	0-4.1	50	3.5	17	480
(Typical Flow @ 100 PSIG (6.9 BAR) in and maximum out)					
0-100	0-6.9	100	6.9	21	595
0-120	0-8.3	100	6.9	21	595
(Typical Flow @ 140 PSIG (9.7 BAR) in and maximum out)					

Exhaust Capacity	3 SCFM (85 LPM) @ 5 PSIG (0.3 BAR) above setpoint (0-15 PSIG range unit set at mid range)
Stability	
Supply Voltage Effect	None
Supply Pressure Effect	None
Vibration Effect	<1% FS (+/-1G; 5-1000Hz)
Mounting Position Effect	None
RFI/EMI	CE-Compliant
Temperature Effect	0.02% FS/˚F (-40˚ to 180˚F [-40˚ to 82˚C])
Storage Temperature	-40˚to 200˚F (-40 to 93˚C)
Approximate Weight	3.0 lbs, 1.35 kg

The secret to the Type 2000's precise, reliable performance under a variety of demanding environmental conditions is a patented piezo-ceramic actuator with many industry-wide firsts.

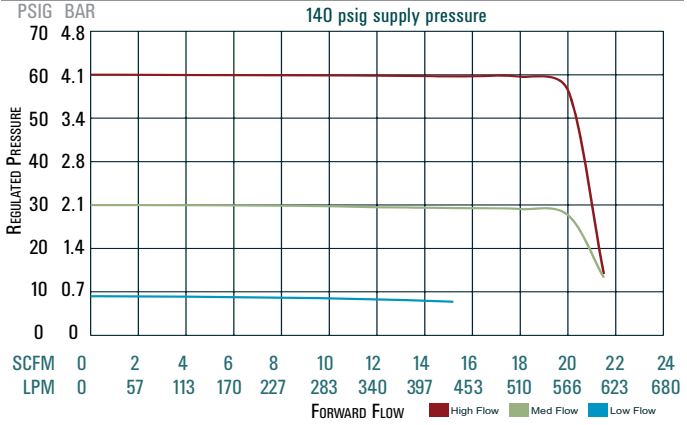


Air Quality

Instrument-quality air consists of:

a. A dew point less than 35º F
b. No particles larger than three microns
c. Maximum oil content of 1 ppm

TYPE 2000: REGULATED PRESSURE VS. FLOW



Type 2000 Mounting Options

Mounting Method	Intrinsically-Safe (S) Model	Explosion-Proof (E) Model
In-Line	Yes	Yes
Direct Mounting	Side or Bottom Holes	Side or Bottom Holes
Panel Bracket	Supplied	Accessory
Valve Bracket	Accessory	Supplied
Pipe Bracket	Accessory	Accessory
DIN-Rail Bracket	Accessory	Accessory
Manifold Plate	Accessory	Accessory

Mounting: The Type 2000 can be mounted in-line, or directly to a panel via mounting holes located in the side and bottom of the unit. In addition, the S model includes a panel-mounting bracket; while the E model includes a valve-mounting bracket. Kits are available for mounting of either model to panel, valve, pipe, or DIN-Rail. A custom plate is available for mounting of the bottom-ported version to a manifold. (See Accessories)

Type 2000 Ordering Information

2 K										
										Enclosure
	S									Intrinsically Safe
	E									Explosion Proof
										Electrical Port[1]
		N								1/2 NPT Conduit
		M								20mm Conduit "S" Unit Only
		H								Hirschmann[5]
		T								Terminal Block[2] "S" Unit Only
										Pneumatic Ports
			N							NPT
			T							BSPT
			P							BSPP
			M							Manifold Mount[3]
										Agency Approval[6]
				F						FM/CSA
				C						ATEX "S" Unit Only
				G						Certified to CSA Standards[4]
										Electrical Input
					42					4-20 mA
					05					0-5 V
					15					1-5 V
					19					1-9 V
					11					1-10 V
					01					0-10 V
										Mode
						D				Direct Acting
						R				Reverse Acting
										Mode
							F			Full Range
							H			Split Range High
							L			Split Range Low
										Pneumatic Output
								005		0-5 PSIG 0-0.3 BAR
								015		0-15 PSIG 0-1.0 BAR
								315		3-15 PSIG 0.2-1.0 BAR
								117		1-17 PSIG 0.07-1.2 BAR
								030		0-30 PSIG 0-2.1 BAR
								630		6-30 PSIG 0.4-2.1 BAR
								327		3-27 PSIG 0.2-1.9 BAR
								060		0-60 PSIG 0-4.1 BAR
								100		0-100 PSIG 0-6.9 BAR
								120		0-120 PSIG 0-8.3 BAR
										Special
									00	None

Maximum Supply for these regulators is 100 PSIG

Maximum Supply for these regulators is 140 PSIG

Type 2000 Accessories

	Part Number
Panel Mounting Kit	010-135-000
Valve Mounting Kit	010-134-000
2" Pipe Mounting Kit (Valve Mounting Kit is required)	010-143-000
DIN Rail Adapter	010-115-000
Manifold Adapter Kit	971-158-000
Filter Kit, 60 microns	010-139-000
Pressure Gauge Kit 15 PSIG (1 BAR)	010-138-000
Pressure Gauge Kit 30 PSIG (2.1 BAR)	010-138-001
Pressure Gauge Kit 60 PSIG (4.1 BAR)	010-138-002
Pressure Gauge Kit 160 PSIG (11 BAR)	010-138-003

Type 2000 Notes

[1] Availability			Enclosure S	Enclosure E
Electrical Port		N	Yes	Yes
		M	Yes	Yes
		H	Yes	No
		T	Yes	No

[2] NEMA 4X / IP66 not available

[3] Bottom O-Ring Ports

[4] "E" Enclosure and "N" Electrical port required

[5] Not Agency Approved

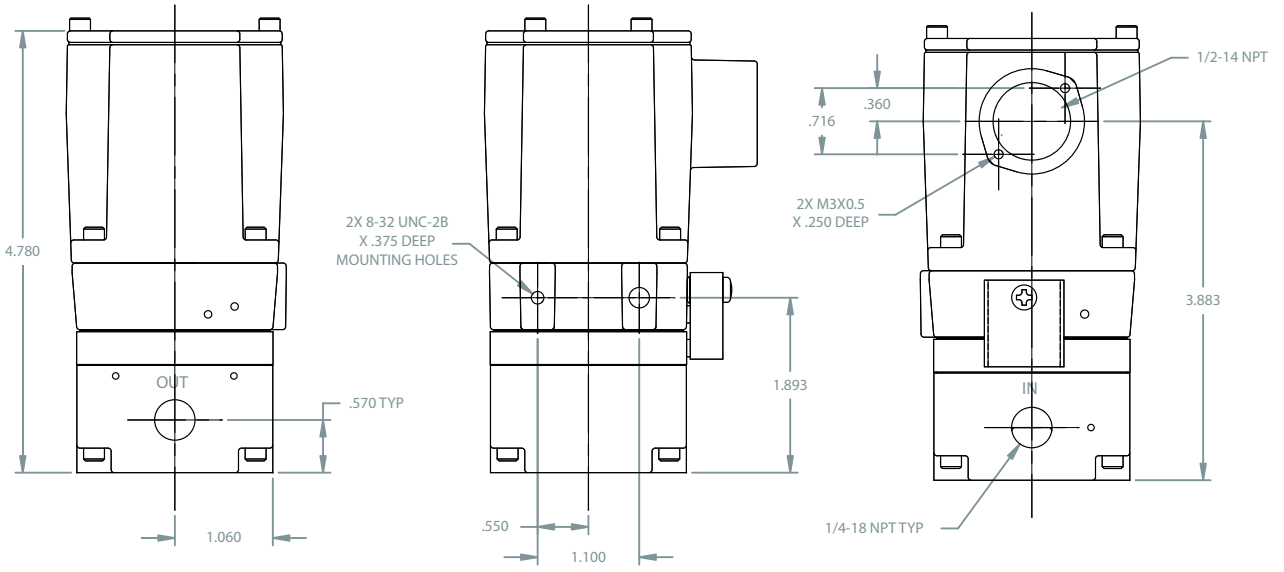
[6] Agency Approval			F FM/CSA	C ATEX	G Gas
Enclosure	S	Intrinsic Safety	Yes	Yes	No
	E	Explosion Proof	Yes	No	Yes

Terminal Block	I/P Transducer	E/P Transducer
S	N/C	+ Signal
+	+ Signal	+ Power Supply
-	- Signal	Common

Type 2000 Wiring Connections and Switch Positions

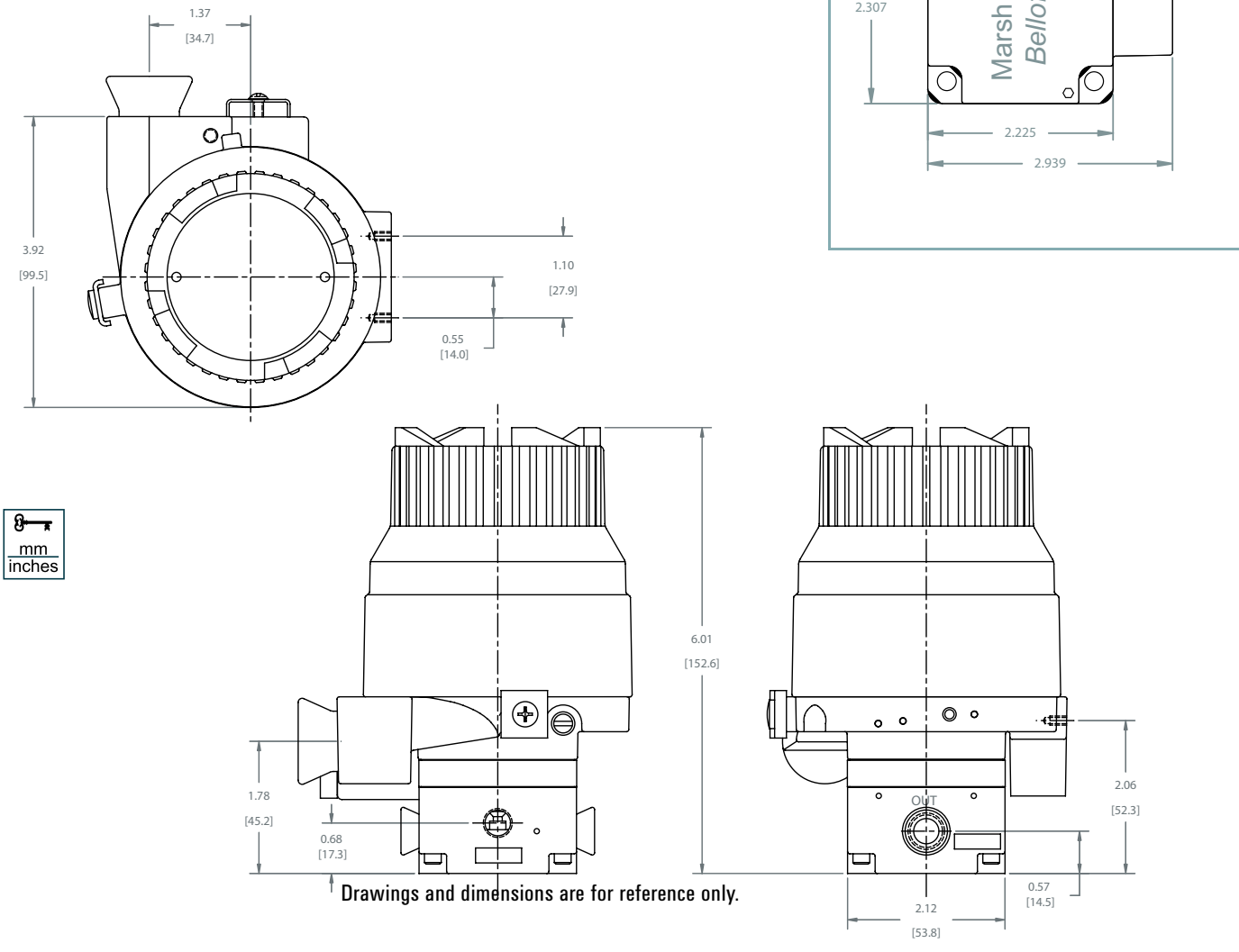
Switch #	1: PSIG	BAR	2	3	4	5	6: psig	BAR	7	8	9
ON	0-15 3-15 1-17 0-30 3-27 6-30 0-100	0-1.0 0.2-1.0 0.07-1.2 0-2.1 0.2-1.9 0.4-2.1 0-6.9	1-5 VDC 0-5 VDC	Split Low	Voltage Input (E/P)	Split Low Full	0-15 1-17 0-30 0-60 0-100 0-120	0-1.0 0.07-1.2 0-2.1 0-4.1 0-6.9 0-8.3	Reverse Acting	Full	I/P
Switch #	1: PSIG	BAR	2	3	4	5	6: psig	BAR	7	8	9
OFF	0-60 0-120	0-4.1 0-8.3	1-9 VDC 0-10 VDC 4-20 mA	Full Split High	Current Input (I/P)	Split High	3-15 3-27 6-30	0.2-1.0 0.2-1.9 0.4-2.1	Direct Acting	Split Low Split High	E/P

Type 2000 Dimensions



mm
inches

Type 2000 Explosion Proof Dimensions



mm
inches

Drawings and dimensions are for reference only.

Type 5000
P/I Transducers

Description

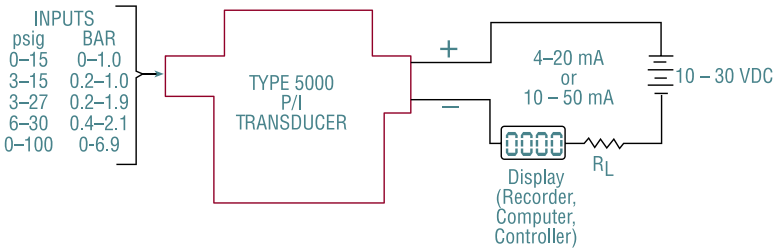
The Type 5000 series is a compact, rugged and reliable family of two-wire pressure transmitters designed for industrial field service. These instruments convert a signal pressure input into a precise 4-20 or 10-50mA output. The lightweight transmitter housing includes a 1/4 NPT pressure port and a 1/2 NPT conduit port for field wiring. Connections are easily accessible simply by removing the top cover. Zero and span adjustments are available within the field wiring compartment for fine, on-site calibration adjustment.

The Type 5000 uses a unique, temperature compensated piezo resistive sensor suitable for gauge pressure measurement of non-corrosive liquids and gases. The sensor has excellent dynamic response and is virtually insensitive to mounting orientation and ordinary industrial vibration. Mounting holes on the transmitter housing are arranged to permit direct pipe (2") mounting for minimum installed cost.

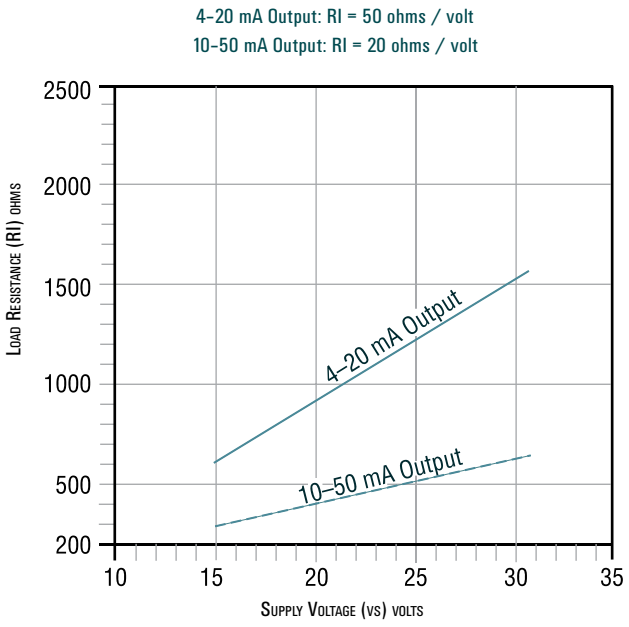
Features

- 0.1% accuracy typical
- Piezo resistive pressure sensor resists vibration
- Mounts at any angle
- Easily accessible zero and span adjustments
- NEMA 4X housing approved for explosion proof service

Type 5000 Functional Diagram



TYPE 5000: Max Load Resistance VS. Supply Voltage



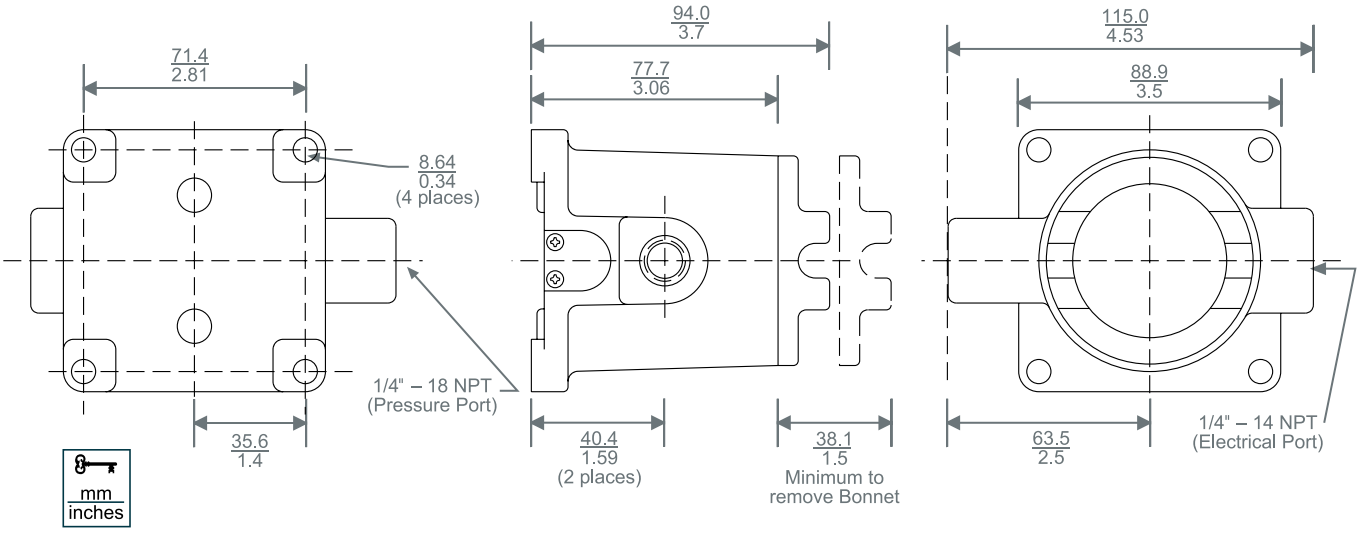
Agency Approval Notes

Factory Mutual
T-5000 P/I Transducers NEMA 4X
Explosion Proof: Class I, Division 1, Groups B, C, & D, T6
Dust-Ignition Proof: Classes II & III, Division 1, Groups E, F, & G, T6, Type 4X **NEMA 4X**

Canadian Standards Association
T-5000 P/I Transducers
Hazardous Locations:
Class I, Groups B, C & D; Class II, Group E, F & G; Class III; Encl **4 NEMA** 4: P/I transmitter, rated output 4-20mA dc or 10-50mA dc, power supply 30V dc max.

The Bellofram T-5000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body

Type 5000 Dimensions



Type 1500 Specifications

Input signal	0–15 PSIG	0–1.0 BAR
	3–15 PSIG	0.2–1.0 BAR
	3–27 PSIG	0.2–1.9 BAR
	6–30 PSIG	0.4–2.1 BAR
	0.2–1.0 BAR	3–15 PSIG
	0–100 PSIG	0–6.9 BAR
Output Signal	4–20 mA DC, 2 wire	
	10–50 mA DC, 2 wire	
Output Protections	Reverse polarity protected	
Accuracy includes nonlinearity, hysteresis and non-repeatability	± 0.1% span typical; ± 0.25% span max.	
Overpressure	45 PSIG (3.1 BAR) without calibration shift 60 PSIG (4.1 BAR) without failure	
Allowable Loads	See Graph	
Response Time	Less than 10 msec for step change to 99% R	
Temperature Range-Operating	-40˚F to +180˚F (-40˚C to +82˚C)	
Temperature Effect	Zero - Less than ± 0.01% R/˚F Span - Less than ± 0.01% R/˚F	
RFI Effect	Less than 1% R at 10V/meter per SAMA PMC 33.1, 2-abc	
Power Supply	12–30 VDC	
Power Supply Effect	Less than 0.005% per volt change at the input terminals within specified power supply limits	
Calibration Adjustments	Multi-turn Zero and Span potentiometers with ± 25% min. adjustment	
In-Process Output Monitoring	Via test jacks within enclosure without disturbing field wiring	
Connections	1/4 – 18 NPT female pressure input, 1/2 – 14 NPT female electrical output	
Mounting	Suitable bracket or optional 1/4–20 U-bolt pipe mounting kit (P/N 971-109-000)	
Finish	Epoxy coated aluminum body and cover	
Weight	1.7 lbs. (0.8 kg)	

Type 5000 Ordering Information

9	6	4			1		
			↑	↑	↑	↑↑↑	Input
			0				0–15 PSIG (0–1.0 BAR)
			1				3–15 PSIG (0.2– 1.0 BAR)
			2				3–27 PSIG (0.2–1.9 BAR)
			3				6–30 PSIG (0.4–2.1 BAR)
			4				0.2–1.0 BAR (3–15 PSIG)
			5				0–100 PSIG (0–6.9 BAR)
							Output
				0			4–20 mA
				1			10–50 mA
							Agency approval
					1		X /P FM/CSA
							Options
						000	None
						001	Pipe Clamp Mounting Kit

Type 3000 I/P's & E/P's

- Type 3110
- Type 3111
- Type 3120
- Type 3210
- Type 3220
- Type 3211
- Type 3221
- Type 3212
- Type 3222
- Type 3215
- Type 3410
- Type 3411
- Type 3420
- Type 3510
- Type 3520
- Type 3511
- Type 3521
- Type 3512
- Type 3522

Type 3000
Comparison of I/P's

Type 3000 Series Comparison Chart

T1000, T1500, T1001 and T2000	T3000 Series
Steady Air Consumption	Minimal Air Consumption at Steady State
Many are Loop Powered	All Require Supply Voltage
Most Available in Intrinsically Safe or Explosion Proof Versions	No Hazardous Area Approvals
"Standard" Pressure Range to 120 PSI, No Vacuum Models, Limited Low Pressure Control Capability	Wide variety to 600 psi or vacuum, even possible in 0 to 0.2 psi range
Downstream Sensor Feedback Not Available	Second Loop Feedback Available
	Analog and Logic Output Signal Monitoring
	Digital Versions have Keypad or Serial User Interface
	Wide Range of Input Signal/Output Pressure Endpoint, Available in Digital

Type 3110

Type 3110
Manifold Mount

Air Quality

Bellofram specifies the use of instrument quality air (clean, dry, oil free) for all transducers. Transducers should be used within the following conditions:

Dew Point < 35°F (2°C) (indoor)
Oil Content < 1ppm
Particles < 3µm.

The use of filters in the supply air system is highly recommended. Contact us for information on our filters and filter regulators.

Type 3000 Series Electro-Pneumatic Transducers

		Packaging				
		DIN-mount Circuit Card	Weatherproof Enclosure			
		Low Flow (1.2 SCFM) (34 LPM)	Low Flow (1.2 SCFM) (34 LPM)	Medium Flow (15 SCFM) (425 LPM)	High Flow (60 SCFM) (1700 LPM)	Very High Flow (175 SCFM) (5000 LPM)
User Interface	Analog 0-10V 4-20mA	T3110, T3120 or T3111	T3210 or T3220	T3211, T3221 or T3311	T3212 or T3222	T3215
	Serial RS-485, RS-232, USB	T3410S or T3420S	T3510S or T3520S	T3511S or T3521S	T3512S or T3522S	
	Keypad/Display Programmer	N/A	T3510P or T3520P	T3511P or T3521P	T3512P or T3522P	
	DeviceNet	T3410D or T3420D	T3510D or T3520D	T3511D or T3521D	T3512P or T3522P	
Mounting		DIN tray, manifold, panel	In-line, DIN-rail, panel bracket, or manifold	In-line, DIN-rail, panel bracket, or manifold	In-line, DIN-rail, panel bracket, or manifold	In-line or panel bracket

Type 3000 Series

Overview

Features and Capabilities

The Type 3000 series of electro-pneumatic transducers offers an innovative set of features and capabilities. Each electronic pressure regulator utilizes a pair of reliable quick-firing solenoid valves and an onboard pressure sensor to precisely control downstream pressure and at the same time achieve excellent accuracy and stability.

Feed-and-bleed transducers are inherently resistant to shock, vibration, and orientation. To size the regulator for the application, a selection of external volume boosters up to 2000 SCFM (56,000 lpm) are available.

- Analog Control Signals: 0-10v, 4-20 mA, etc.
- Remote Sensor Feedback
- Monitor Output
- High/Low Logic Output
- Digital Signal Processing
- PID Tuning
- Deadband Adjustment
- Serial, Keypad/Display, DeviceNet Interfaces

Theory of Operation

T3000 transducers utilize proven feed-and-bleed technology. The Supply Solenoid Valve feeds supply pressure to the downstream application. The Exhaust Solenoid Valve bleeds off overpressure. By monitoring the onboard pressure sensor (or the user-supplied remote sensor on two-loop units), the electronics rapidly fire one solenoid or the other to maintain the desired setpoint.

Standard Type 3000s hold output pressure upon loss of electrical power, as long as there are no downstream flow demands. Special versions are available for Fail High or Low Operation.

Type 3110

Type 3210

Type 3211

Type 3110/Type 3120

Analog Circuit-Card Regulators

Description

The compact Type 3110 (one-loop) and 3120 (two-loop) Circuit-Card Pressure Regulators are perfect for size-conscious OEM's, without sacrificing any of the high-end performance normally associated with full-size I/P's.

Industry-standard analog control signals (0-10V or 4-20 mA) are user-selectable (V or mA) and configurable (zero and span). Industry-standard analog monitor output signal (0-10V) available for user-monitoring of actual output pressure. Industry-standard logic output signals (high or low) are available for user-monitoring of setpoint status – 'at setpoint' or 'still searching'.

Features

- Small Footprint
- User Selectable Input
- Analog Monitor Output
- Single Loop and Dual Loop Control
- Economical

Type 3110/T3120 Ordering Information

1		0	T		0		600			0		
												Number of Loops
	1											1 Loop
	2											2 Loop
		0										
												Logic Output
			T									TTL
												Analog Control Signal
				E								0-10V
				I								4-20mA
												Lower Output Pressure
					0							Lower Limit of Output Pressure
												Pressure Units
						G						PSIG
						A						PSIA absolute
						V						Vacuum
						W						Inches of water column
												Upper Output Pressure
							600					Upper Limit of Output Pressure (PSIG)
												Mounting
								D				DIN Tray
								P				Panel-Mount *
								M				Manifold-Mount (150 psig max output)
												Supply and Output Ports
									0			1/8 NPT
									1			1/8 BSPT
									2			1/8 BSPP
												Connector
										0		
												Options
											00	None
											14	12VDC supply

*For flush panel mounting specify 'P' option and order 161-520-000 bracket.

	Type 3110 and 3120	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	15-24VDC (12VDC option)	
Stand by Supply Current	80 mA	
Maximum Supply Current	250 mA	
E/P Control	0-10V, 10K OHMS	
I/P Control	4-20 mA , 250 OHMS	
Electrical Outputs		
Mounting Options	0-10V	
Logic Output	TTL	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
	>150 to 300 (10.3-20.7)	350 (24.1)
	>300 to 600 (20.7-41.4)	650 (44.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150, 300, 500, 600 psig	
	0.07, 0.35, 1.03, 2.07, 6.9, 10.34, 20.68, 34.47, 68.95 BAR	
Vacuum Pressure Ranges	30" Hg, 30,150 PSIA (2.1 BAR, 10.3 BAR)	
Forward Flow Capacity	1.25 SCFM (35.4 LPM)	
Exhaust Flow Capacity	1.25 SCFM (35.4 LPM)	
Environmental		
Operating Temperature	32-141 °F (0-60 °C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Recommended Accessories	Manifold, Power Supply, Control Knob, Remote Pressure Sensor, External Volume Booster	

Type 3111

Analog Circuit-Card Regulators

Description

The T3111 Compact Analog Pressure Controller is an economical version of the T3100 with no remote feedback or logic output capabilities. Output pressure is limited to 150 PSIG maximum. Jumper selections include AC/DC power and several control signal ranges. Manual output pressure adjustment and differential control signals are available. Overall product dimensions are identical to Type 3110.

Features

- HVAC application
- Mounts on panel, DIN rail, or directly to multi-station manifold
- Small Footprint
- No Analog Monitor Output
- Economical
- Manual override for output span adjustments

Type 3111/Ordering Information

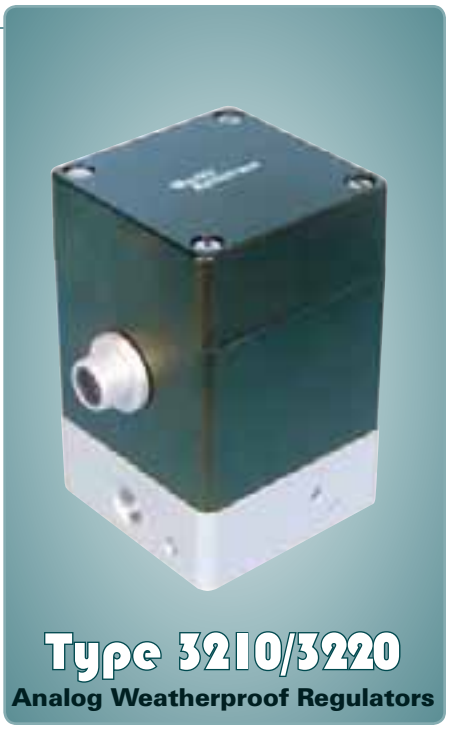
111Z		0		150			0		
									Analog Control Signal
	E								0-10V
	I								0-20 mA
	0								0-5V
	1								0-15V
									Lower Output Pressure
		0							Lower Limit of Output Pressure
									Pressure Units
			G						PSIG
			A						PSIA absolute
			V						Vacuum
			W						Inches of water column
									Upper Output Pressure
				150					Upper Limit of Output Pressure (PSIG)
									Mounting
					D				DIN Tray
					P				Panel-Mount *
					M				Manifold-Mount
									Supply and Output Ports
						0			1/8 NPT
						1			1/8 BSPT
						2			1/8 BSPP
									Connector
							0		
									Options
								00	None
								14	12 VDC supply

*For flush panel mounting specify 'P' option and order 161-520-000 bracket.

	Type 3111	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	24VDC (12VDC option) 24VAC	
Stand by Supply Current	80 mA	
Maximum Supply Current	250 mA	
E/P Control	0-5V, 0-10V, 0-15V 2K-100K ohms	
I/P Control	0-20 mA , 250 ohms	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150 PSIG	
	0.07, 0.35, 1.03, 2.07, 6.9, 10.34 BAR	
Vacuum Pressure Ranges	30" Hg, 30, 150 PSIA (2.1 BAR, 10.3 BAR)	
Forward Flow Capacity	1.25 SCFM (35.4 LPM)	
Exhaust Flow Capacity	1.25 SCFM (35.4 LPM)	
Environmental		
Operating Temperature	32-141 °F (0-60 °C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Recommended Accessories	Manifold, Power Supply, Control Knob, Remote Pressure Sensor, External Volume Booster	

Type 3210 & 3220

Analog Weatherproof Regulators



Description

The Type 3210 single loop and 3220 double loop electro-pneumatic servo pressure controllers incorporate two solenoid valves and an internal pressure sensor for increased sensitivity and accuracy. With current or voltage signal inputs, the Type 3210/3220 controls an output pressure with an accuracy of ± .5% or better full scale. A wide range of output pressures available, from 29" Hg vacuum to 600 psig. With a flow of 1.25 SCFM at 100 PSI, the 3210/3220 can be used alone or in conjunction with a volume booster to achieve flow rates in excess of 2,000 SCFM. The double loop (3220) option permits 0-10 VDC feedback from a remote sensor.

Applications include: Semiconductor, Robotics Controller, Machine Automation, Tire Manufacturing and Testing, Molding and Forming Operations and a wide variety of industrial applications.

Features

- Weatherproof Enclosure
- User Selectable Input Signal
- Analog Monitor Output
- Single Loop and Dual Loop Control
- 1.25 SCFM Flow Rate

Type 3210/3220 Ordering Information

2		0			0		600	P		1		
	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑↑	Number of Loops
	1											1 Loop
	2											2 Loop
		0										
												Logic Output
			M									CMOS
			T									TTL
			O									Open-Collector
												Analog Control Signal
				E								0-10V
				I								4-20mA
												Lower Output Pressure
					0							Lower Limit of Output Pressure
												Pressure Units
						G						PSIG
						A						PSIA absolute
						V						Vacuum
						W						Inches of water column
												Upper Output Pressure
							600					Upper Limit of Output Pressure (PSIG)
												Mounting
								P				Pipe (in-line)
												Supply and Output Ports
									0			1/8 NPT
									1			1/8 BSPT
									2			1/8 BSPP
												Connector
										1		
												Options
											00	None
											14	12 VDC supply
											– –	External Volume Booster: X2, X3, Z2, Z3, Z4, N3, N4, N6, N8, Q6, Q8, QA, QB, QC, V2, V3: see chart on page 88

	Type 3210 and 3220	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	15-24VDC (12VDC option)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
E/P Control	0-10V,10K OHMS	
I/P Control	4-20 mA , 250 OHMS	
2nd-loop Remote Sensor Feedback	T3220: 0-10V	
Electrical Outputs		
Monitor Output	0-10V	
Logic Output	CMOS, TTL, Open-Collector	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
	>150 to 300 (10.3-20.7)	350 (24.1)
	>300 to 600 (20.7-41.4)	650 (44.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150, 300, 500, 600 PSIG 0.07, 0.35, 1.03, 2.07, 6.9, 10.34, 20.68, 34.47, 68.95 BAR	
Vacuum Pressure Ranges	30" Hg, 150 PSIA (2.1 BAR, 10.3 BAR)	
Forward Flow Capacity	1.25 SCFM (35.4 LPM)	
Exhaust Flow Capacity	1.25 SCFM (35.4 LPM)	
Environmental		
Operating Temperature	32-141˚F (0-60˚C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Required Accessories	6-pin micro cordset	
Recommended Accessories	DIN-rail Bracket, Panel Bracket, Power Supply, Control Knob, Remote Pressure Sensor, External Volume Booster	

Type 3211 & 3221

Analog Weatherproof Regulators

Description

The Type 3211 single loop and 3221 double loop controllers offer non-bleeding solenoid valve technology with an integral flow booster that produces forward flows equivalent to standard industrial electronic regulators or I/P converters. The 3211/3221 offers analog monitoring of the output pressure by a 0-10 VDC signal, plus logic monitor output of the solenoid valves. Many output pressures are available up to 150 psi. A built in air volume booster provides for a forward flow of up to 15 SCFM and a reverse flow (exhaust) of up to 7 SCFM. The double loop (3221) option permits 0-10 VDC feedback from a remote sensor.

Applications include; Machine Automotive, Robotics Control, Web Tension Control, Tire Manufacturing and Testing, Torque Control, Molding and Forming Operations, and Paint Spray.

Features

- Weatherproof Enclosure
- User Selectable Input Signal
- Analog Monitor Output
- Single Loop and Dual Loop Control

Type 3211/3221 Ordering Information

2		1			0		150			1		
	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑↑	Number of Loops
	1											1 Loop
	2											2 Loop
		1										
												Logic Output
			M									CMOS
			T									TTL
			O									Open-Collector
												Analog Control Signal
				E								0-10V
				I								4-20mA
												Lower Output Pressure
					0							Lower Limit of Output Pressure
												Pressure Units
						G						PSIG
						W						Inches of water column
												Upper Output Pressure
							150					Upper Limit of Output Pressure (PSIG)
												Mounting*
								P				Pipe (in-line)
								M				Manifold-Mount
												Supply and Output Ports
									0			1/4 NPT
									1			1/4 BSPT
									2			1/4 BSPP
												Connector
										1		
												Options
											00	None
											14	12 VDC supply

*Order panel bracket and DIN rail clip separately.
For Manifold-Mount (no threads), specify 0 for Supply and Output Ports.

	Type 3211 and 3221	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	15-24VDC (12VDC option)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
E/P Control	0-10V,10K OHMS	
I/P Control	4-20 mA , 250 OHMS	
2nd-loop Remote Sensor Feedback	T3221: 0-10V (4-20mA option)	
Electrical Outputs		
Monitor Output	0-10V (4-20 mA option)	
Logic Output	CMOS, TTL, Open-Collector	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150 psig	
	0.07, 0.35, 1.03, 2.07, 6.9, 10.34 BAR	
Forward Flow Capacity	15 SCFM 425 LPM	
Exhaust Flow Capacity	7 SCFM 198 LPM	
Environmental		
Operating Temperature	32-141˚F (0-60˚C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Required Accessories	6-pin micro cordset	
Recommended Accessories	DIN-rail Bracket, Panel Bracket, Power Supply, Control Knob, Remote Pressure Sensor, External Volume Booster	

Type 3212 & 3222

Analog Weatherproof Regulators

Description

The Type 3212 single loop and 3222 double loop are non-bleeding electro-pneumatic controller with flows exceeding those of most compact standard industrial electronic regulators or I/P transducers. The 3212/3222 offers analog monitoring of the output pressure by a 0-10 VDC signal. Many output pressures are available up to 150 PSI. Flows to 60 SCFM are possible from the compact Type 3212/3222 electronic controller with integrated booster relay. A reliable twin solenoid valve system, with an integral pressure sensor, controls pressures to an accuracy of ± .5%. Custom output ranges are available.

Applications include: Automotive, Industrial Machinery, Web Tension Control, and Tire Manufacturing and Testing.

Features

- Closed Loop Technology
- Integrated Air Volume Booster
- Current/Voltage Command and Monitor Signals
- Compact Unit with Flows up to 60 SCFM

Type 3212/3222 Ordering Information

2		2			0	G	150	P		1		
	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑↑	Number of Loops
	1											1 Loop
	2											2 Loop
		2										
												Logic Output
			M									CMOS
			T									TTL
			O									Open-Collector
												Analog Control Signal
				E								0-10V
				I								4-20mA
												Lower Output Pressure
					0							Lower Limit of Output Pressure
												Pressure Units
						G						PSIG
												Upper Output Pressure
							150					Upper Limit of Output Pressure (PSIG)
												Mounting
								P				Pipe (in-line)
												Supply and Output Ports
									0			1/4 NPT
									1			1/4 BSPT
									2			1/4 BSPP
									3			3/8 NPT
									4			3/8 BSPT
									5			3/8 BSPP
												Connector
										1		
												Options
											00	None
											14	12 VDC supply

	Type 3212 and 3222	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	15-24VDC (12VDC option)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
E/P Control	0-10V,10K OHMS	
I/P Control	4-20 mA , 250 OHMS	
2nd-loop Remote Sensor Feedback	T3222: 0-10V (4-20mA option)	
Electrical Outputs		
Monitor Output	0-10V	
Logic Output	CMOS, TTL, Open-Collector	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150, 300 PSIG	
	0.07, 0.35, 1.03, 2.07, 6.9, 10.34, 20.68 BAR	
Forward Flow Capacity	60 SCFM (1700 LPM)	
Exhaust Flow Capacity	15 SCFM (425 LPM)	
Environmental		
Operating Temperature	32-141˚F (0-60˚C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Required Accessories	6-pin micro cordset	
Recommended Accessories	DIN-rail Bracket, Panel Bracket, Power Supply, Control Knob, Remote Pressure Sensor, External Volume Booster	

Type 3215

Weatherproof Regulator with Super High Flow

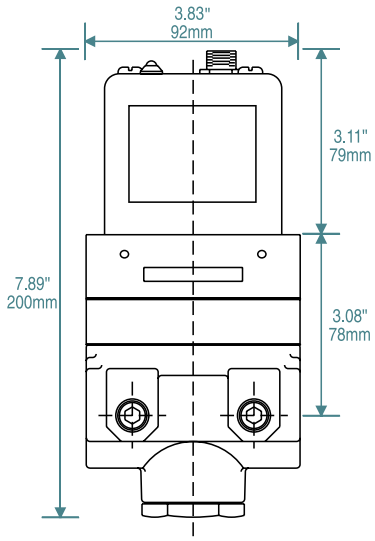
Description

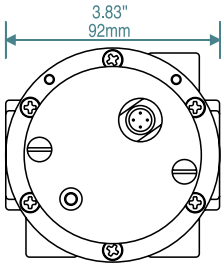
The T3215 High-Flow Pressure Controller utilizes reliable, quick-firing solenoids, an onboard pressure sensor, and a precision 180 scfm booster to achieve excellent accuracy and stability. There are many custom output ranges between 0 and 150 PSIG (1.0 MPa). The T3215 is CE-rated, weatherproof, and vibration-resistant. Analog electrical connections include control and monitor output. Mounting options include in-line and panel.

The T3215 is available with or without pressure monitor and logic outputs (6-pin or 4-pin micro connector, respectively). The T3215 is also available with a 6-pin DIN 43650 connector. Differential inputs mean problem-free integration with PLC grounding systems.

Features

- Single Unit–Integrated Controller and Booster
- Very High Flow Volume Booster–Greater than 200 SCFM
- High Accuracy Control of Air Pressure
- Low Air Consumption
- Weatherproof Housing
- Shock Resistant, Position Insensitive
- CE Approved





Type 3215 Ordering Information

215			0	G		P			00	
	↑	↑	↑	↑	↑	↑	↑	↑	↑↑	Logic Output
	M									CMOS
	T									TTL
	O									Open-Collector
	Z									No Logic Output
										Analog Control Signal
		E								0-10V
		I								4-20mA
										Lower Output Pressure
			0							Lower Limit of Output Pressure
										Pressure Units
				G						PSIG
										Upper Output Pressure
					030					30 PSIG
					100					100 PSIG
					150					150 PSIG
										Mounting
						P				Pipe (in-line)
										Supply and Output Ports
							3			3/8 NPT
							4			1/2 BSPT
							6			3/4 BSPP
							8			1 NPT
										Connector
								1		Micro Connector
								D		DIN 43650 Connector
										Options
									00	None

Type 3215		
Performance	Full-Scale Accuracy 1.0%	
Electrical Inputs		
Supply Voltage	15-24VDC (12VDC option)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
E/P Control	0-10V, 10K OHMS	
I/P Control	4-20 mA , 250 OHMS	
Electrical Outputs		
Monitor Output	0-10V	
Logic Output	CMOS, TTL, Open-Collector	
Pneumatic Inputs		
Supply Pressure	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.03)	30 (2.1)
	>15 to 30 (1.03-2.1)	60 (4.1)
	>30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Pneumatic Outputs		
Full-scale Atmospheric Pressure Ranges	30, 100, 150, PSIG 2.07, 6.9, 10.34 BAR	
Forward Flow Capacity	180 SCFM (5100 LPM)	
Exhaust Flow Capacity	30 SCFM (850 LPM)	
Environmental		
Operating Temperature	32-141 °F (0-60 °C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	
Required Accessories	4 or 6-pin micro cordset	
Recommended Accessories	Panel Bracket, Power Supply, Control Knob, External Volume Booster	

External Volume Boosters

Description

Volume Boosters increase the flow capacity of electro-pneumatic transducers, leading to faster response time and increased ability to remain at setpoint.

Low-flow transducers (T3210, T3220, T3510, and T3520) can be mounted on the volume booster of your choice. Simply add the booster's 2-letter code (from below) to the Options field of the T3000 part number.

The RPS sensor can be used with two-loop transducers (T3120, T322X, T3420, and T352X), closing the loop to the booster's output and increasing overall accuracy.

When the distance between transducer and volume booster is large (e.g., when the transducer is mounted in a cabinet and the booster is installed directly at the application), one of the high-flow transducers (e.g., T3211 or T3512) can drive the booster over distance.

The X booster is the Marsh Bellofram Type 20EXHR. It utilizes two-stage technology to maintain setpoint over a wide range of flows (Note: minimum output is 2 PSIG). The Z booster is the Marsh Bellofram Type 75HR. The N booster is the Marsh Bellofram Type 79. Consult the documentation for these products for more information.

The Q boosters are ultra-high flow boosters. The V booster can be used with vacuum versions of the T3210, T3220, T3510, and T3520.

Flow capacities are for comparison purposes only. Forward flow is typically measured at 100 PSIG / 6.9 BAR supply and 80 PSIG / 5.5 BAR output. Exhaust flow is typically measured at 5-10 psig / 8.3-6.7 BAR above 20 PSIG setpoint.

External Volume Boosters

Part Number	Marsh Bellofram Booster	Supply and Output Port Size (NPT)	Maximum Supply (PSIG / BAR)	Maximum Signal and Output (PSIG / BAR)	Typical Forward Flow (SCFM / SLPM)	Typical Exhaust Flow (SCFM / SLPM)
X2	T20 EX HR Pg. 40	1/4	150 / 10.3	120 / 8.3	14 / 396	10 / 283
X3		3/8	150 / 10.3	120 / 8.3	14 / 396	10 / 283
Z2	T75 HR Pg. 42	1/4	250 / 17.2	150 / 10.3	40 / 1133	15 / 425
Z3		3/8	250 / 17.2	150 / 10.3	50 / 1416	15 / 425
Z4		1/2	250 / 17.2	150 / 10.3	50 / 1416	15 / 425
N3	T79 Pg. 43	3/8	400 / 27.6	200 / 13.8	170 / 4814	31 / 878
N4		1/2	400 / 27.6	200 / 13.8	200 / 5664	31 / 878
N6		3/4	400 / 27.6	200 / 13.8	220 / 6230	31 / 878
N8		1	400 / 27.6	200 / 13.8	220 / 6230	31 / 878
Q6		3/4	300 / 20.7	160 / 11	550 / 15576	220 / 6230
Q8		1	300 / 20.7	160 / 11	550 / 15576	220 / 6230
QA		1-1/4	300 / 20.7	160 / 11	2200 / 62304	200 / 5664
QB		1-1/2	300 / 20.7	160 / 11	2200 / 62304	200 / 5664
QC		2	300 / 20.7	160 / 11	2200 / 62304	200 / 5664
V2		1/4	140 / 9.7	100 / 6.9	50 / 1416	6 / 170
V3		3/8	140 / 9.7	100 / 6.9	50 / 1416	6 / 170

Digital Electro-Pneumatic Transducers

Features

Multiple User Interfaces

(See examples on these pages)

- Analog interface (mA or voltage signal)
- Serial RS-485 (RS-232 and USB via converters) – use our program or write your own, as several high tech customers have done! Control up to 24 addressable units on an RS485 link. The serial link permits customizing the factory settings to your needs.
- Keypad /display: easily configure the transducer to your needs
- DeviceNet through serial communications link

Input and Output Settings

With keypad or serial communications, you can set almost any low and high end points (input/output points) within the range of the selected sensor. You are not limited to points on a linear zero to maximum span I/O plot as on other I/Ps and E/Ps. *(For example, if your primary process settings require an output of 25 PSI at 2 volts signal and 50 PSI at 8.5 volts, you can choose those as your "Cal-L" and "Cal-H" points and the unit will be linear between those two settings. If you would like the reverse, then select 50 PSI at 2 volts, and so forth.)*

- Capability to change PID settings to match your system requirements
- Second loop feedback (from a remote sensor) available. Digital units permit user to add, delete, or scale the second loop signal.
- Choices of circuit card mounted or weatherproof factory/field units
- Very wide range of output pressures, including vacuum, absolute, and high pressures.
- Monitor output signal options
- Resistant to vibration and changes in orientation
- Multiple mounting options

Digital Circuit-Card Regulators

The compact Type 3410 (one-loop) and 3420 (two-loop) Circuit-Card Pressure Regulators are perfect for size-conscious OEM's, without sacrificing any of the high-end performance normally associated with full-size I/P's.

The T3400 can be controlled digitally or with industry-standard analog control signals (0-10V or 4-20mA). Industry-standard analog monitor output signals (0-10V or 4-20mA optional) are available for user-monitoring of actual output pressure.

Electrical Connections

- Serial RS-485 Connections
- DC Power
- Optional Monitor Output, Analog Setpoint and Remote Sensor Feedback

T3410S
Panel Mount

Type 3400
Circuit-Card Regulators

- Analog Interface

Type 3500
Digital Weatherproof Regulators with Keypad

Keypad/Display Interface

Selection include: input signal, minimum and maximum input signal/output values, units in the display, second loop feedback signal settings, deadband, and proportional gain factor.

A CD with the user manual and a program to configure and control the serial units is included with all digital units, including those with keypad. A small adapter cable is included to permit removal of the keypad to connect to a computer PID settings and other functions not available through the keypad. In effect, this permits serial communications with the keypad removed.

Digital User Interfaces

Type 3000 Serial RS-485 User Interfaces

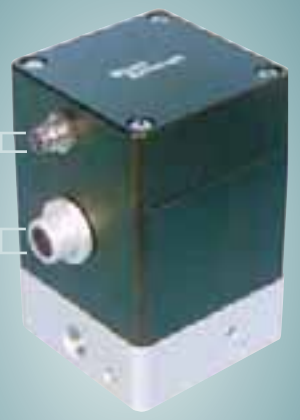
Serial RS-485 User Interface

(RS-232 and USB via converters)

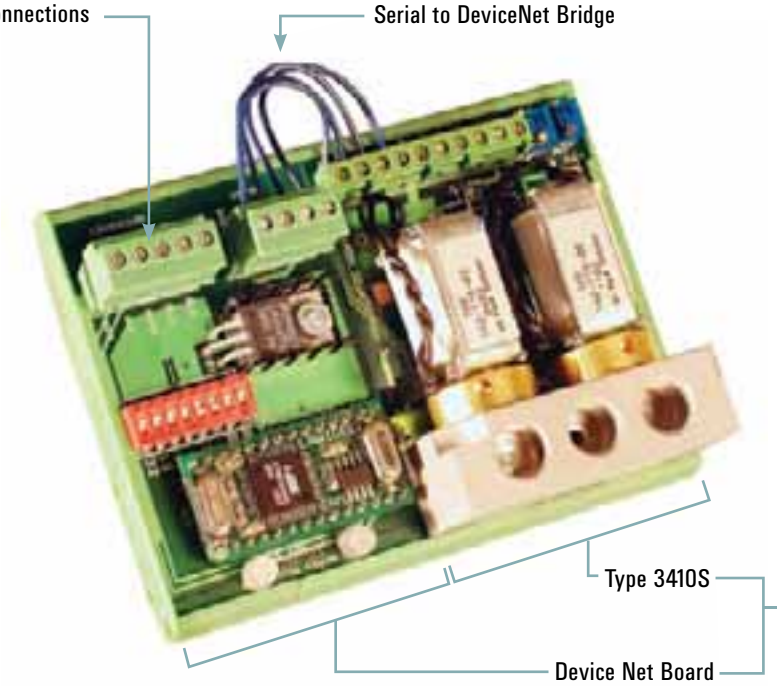
User connection to the T3500 serial interface is made via the 4-pin connector near the top of the product. The 4N cordset is a required accessory.

User connection to the T3400 serial interface is made via the product's terminal block.

- Serial Interface
- Analog Interface



Type 3500
Digital Weatherproof Regulator with Serial Interface



DeviceNet

The T3500D DeviceNet cap communicates with its Base through a Serial Communications link. The 5P cordset is a required accessory. DeviceNet communication with the T3500D includes Send Setpoint and Get Actual Pressure. The EDS file and Device Profile are available upon request.

DeviceNet Connection

(5-pin micro-style connector)

- Power Supplied by DeviceNet bus
- Voltage: 11 to 25 VDC
- Current: 70 mA at 12 VDC (nominal)

Base Power

(6-pin micro-style connector)

- Must be supplied by user
- Voltage: 24VDC (+/-1VDC) —— (15VDC optional)
- Current: 375 mA maximum

Network Specifics

- Compatibility: Group 2 Server Only, not UCMM capable.
- Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud.
- Bus Interface: Phillips 82C250; mis-wiring protection per DeviceNet Vol. I Sec 10.2.2.
- Node Isolation: Bus powered, optically isolated node.
- Bus Connection: Micro connector per DeviceNet Volume I Appendix C-5.
- Factory Defaults: Baud rate = 125 K baud. MAC ID = 63.
- Device Type: 0 (Generic)
- Device Profile: DeviceNet Specification (Volumes I and II of version 2.0).
- Device Configuration: No DeviceNet configuration is supported.
- Status LED's: Network Status (NS) and Module Status (MS) LED's are provided.

Type 3410 & 3420

Digital Circuit-Card Regulators

Description

The compact Type 3410 (one-loop) and 3420 (two-loop) Circuit-Card Pressure Regulators are perfect for size-conscious OEM's, without sacrificing any of the high-end performance normally associated with full-size I/P's.

The T3400 is available with either of two user interfaces: the T3400S with serial interface or the T3400D with DeviceNet interface. The T3400D consists of the T3400S plus a sister board for DeviceNet functions.

The T3400 can be controlled digitally (via the serial or DeviceNet interfaces) or with industry standard analog control signals (0-10V or 4-20mA). Industry-standard analog monitor output signals (0-10V or 4-20mA optional) are available for user-monitoring of actual output pressure.

Features

- Small Footprint
- Serial or DeviceNet Interface
- Digital or Analog Inputs
- Analog Monitor Output
- Single Loop and Dual Loop Control

Type 3410 and 3420 Ordering Information

4	0		0		600			0		
										Loops
	1									1 loop
	2									2 loops
	0									
										Digital Interface
		S								Serial RS-485 (RS-232 and USB via converters)
		D								DeviceNet
										Analog Control Signal
			E							0-10V
			I							4-20mA
										Lower Output Pressure
				0						Lower Limit of Output Pressure
										Pressure Units
					G					PSIG
					A					PSIG Absolute
					V					Vacuum
					W					Inches of Water Column
										Upper Output Pressure
						600				Upper Limit of Output Pressure
										Mounting
							D			DIN tray
							P			Panel Mount
							M			Manifold-Mount (150 PSIG/ 16.3 BAR max output)
										Supply and Output Ports
								0		1/8 NPT
								1		1/8 BSPT
								2		1/8 BSPP
										Options
									00	None
									15	15VDC Supply

* Type 3400 DeviceNet "D" mounting, Type 3400S and DeviceNet board installed in a single extended DIN tray. 'P' or 'M' mounting, DeviceNet board is supplied with 4 screws and stand-offs for panel mounting.

	Type 3410 and 3420
Performance	Full-Scale Accuracy 0.5%
Electrical Inputs	
Supply Voltage	24VDC (optional 15VDC)
Stand by Supply Current	80 mA
Maximum Supply Current	250 mA
Supply Pressure	
Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150, 300, 500 PSIG 0.07, 0.35, 1.03, 2.07, 6.9, 10.34, 20.68, 34.47, 68.95 BAR
Vacuum Pressure Ranges	30" Hg, 150 PSIA (2.1 BAR, 10.3 BAR)
Forward Flow Capacity	1.25 SCFM (35.4 LPM)
Exhaust Flow Capacity	1.25 SCFM (35.4 LPM)
Analog Setpoint Control	0-5V, 0-10V, 4-20mA*
Digital Setpoint Control	0-100% full scale (installed sensor=100%)
Digital Communications	Serial RS-485 interface
Serial Address	Addresses a-z available (except p and q reserved). 'r' default*
Loop Options	Regulate 1st loop (onboard sensor) or 2nd loop (remote sensor)
Remote Sensor Feedback	0-10V, 0-5V, 4-20 mA, (Forward and Reverse Acting)*
Analog Output Source	Follow Setpoint, Output Pressure, or Remote Sensor*
Analog Output Range	0-10V, 0-5V*
Environmental	
Operating Temperature	32-141 °F (0-60 °C)
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS

* Selectable and configurable via Serial or DeviceNet Interface

Type 3411

Digital Circuit-Card Pressure Regulators

Description

The Type 3411 Circuit Card Pressure Regulator regulates air pressure in proportion to an analog electrical signal (AUTO) or via an over-ride thumbwheel (MANUAL). The 3411 utilizes a unique patent-pending LEARN mode to characterize the users specific downstream load. Quiet Valve Operation produces crisp accurate regulation without the chattering noise typical of other solenoid-valve-based products.

The Type 3411 is specifically designed for use with spring-return air-duct cylinders in the Heating, Ventilating, and Air Conditioning (HVAC) industries. Any application involving single-acting cylinders, valves, or bladders may benefit from the unique advanced features of this product. These include Vent Hood Control, Damper Control, Instrumentation, and Medical Applications. At just 2.1" / 51mm by 2.8" / 71mm with a height of 1.3" / 33mm, the 3411 is ideal for OEM's and other space-conscious customers.

Type 3411
Digital Circuit-Card Pressure Regulators

Features

- Mounting DIN Tray, Panel, or Multi-Unit Manifold
- Zero Air Consumption at steady state
- Failure Mode upon loss of power: Lock-in-Place or To-Atmosphere
- Available with snap tracks, barbed air fittings, and pressure gauges
- Quiet Valve Operation
- AUTO / MANUAL / LEARN Modes

Type 3411 Ordering Information

411	Z		0	G		0		0		
										Logic Output
	Z									No Logic Output
										Analog Control Signal
		E								0-10V
		I								4-20mA
										Lower Output Pressure
			0							Lower Limit of Output Pressure
										Pressure Units
				G						PSIG
										Upper Limit Output Pressure
					015					15 PSIG
					030					30 PSIG
										Mounting
						D				DIN tray
						P				Panel Mount
						M				Manifold-Mount (150 PSIG maximum output)
										Supply and Output Ports
							0			1/8 NPT
							1			1/8 BSPT
							2			1/8 BSPP
										Connector
								0		Terminal Block
										Options
									00	None
									03	Fail Safe (to atmosphere)

	Type 3411
Performance	Full-Scale Accuracy 1.0%
Electrical Inputs	
Supply Voltage	24VDC, 24 VAC
Stand by Supply Current	80 mA
Maximum Supply Current	120 mA
E/P Control	0-10V, 15K OHMS
I/P Control	4-20 mA , 250 OHMS
Electrical Outputs	
Monitor Output	0-10V, 0-5V
Pneumatic Inputs	
For outputs ≤ 15 PSIG	30 PSIG
For outputs > 15 PSIG	60 PSIG
Pneumatic Outputs	
Full-scale Atmospheric Pressure Ranges	15, 30 PSIG (1.0, 2.1 BAR)
Forward Flow Capacity	1.25 SCFM (35.4 LPM)
Exhaust Flow Capacity	1.25 SCFM (35.4 LPM)
Environmental	
Operating Temperature	32-141˚F (0-60˚C)
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS
Recommended Accessories	Manifold, Power Supply, Control Knob, External Volume Booster, Snap Track, Barbed Air Fittings, Gauge

Type 3510 & 3520

Digital Weatherproof Regulators

Description

The Type 3510 single and 3520 double loop electro-pneumatic servo pressure controllers combine the advantages of reliable solenoid valves and digital control. Available with a local keypad programming option or RS-485 Digital Communications for PLC or PC control. The digital pressure controller is one of the most precise, accurate, and reliable devices available in the industry today, by giving the user the ability to set and extract data directly from the transducer with a PC or automation system. With a forward flow of 1.25 SCFM at 100 PSI, the 3510/3520 can be used alone for many applications or combined with a volume booster for flows in excess of 2,000 SCFM. Many output ranges are available, from 29" Hg vacuum to 600 PSIG. Standard accuracy is ±0.5% FS or better. A four digit display of the output pressure is available with the keypad model.

Applications include: Gripper Control, Welding Operations, Actuator Control, Machinery Automation, Precision Robotics, Tire Production and Testing, Web Tension, Semiconductor Equipment, and Molding and Forming Operations.

Features

- Digital Display
- Serial or DeviceNet Interface
- Digital or Analog Inputs
- Analog Monitor Output
- Single Loop and Dual Loop Control
- Forward Flow 1.25 SCFM at 100 PSI
- Weather Proof Housing

Type 3510 and 3520 Ordering Information

5	0			0		600	P		1		
											Loops
	1										1 loop
	2										2 loops
	0										
											Digital Interface
		S									Serial RS-485 (RS-232 and USB via converters)
		P									Keypad/display programmer
		D									DeviceNet
											Analog Control Signal
			E								0-10V
			I								4-20mA
											Lower Output Pressure
				0							Lower Limit of Output Pressure (PSIG)
											Pressure Units
					G						PSIG
					A						PSIG Absolute
					V						Vacuum
					W						Inches of Water Column
											Upper Output Pressure
						600					Upper Limit of Output Pressure
											Mounting
							P				Pipe Mount
											Supply and Output Ports
								0			1/8 NPT
								1			1/8 BSPT
								2			1/8 BSPP
									1		
											Options
										00	None
										15	15VDC Supply
										_ _	External Volume Booster: X2, X3, Z2, Z3, Z4, N3, N4, N6, N8, Q6, Q8, QA, QB, QC, V2, V3: see chart on page 88

	Type 3510/3520	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	24VDC (optional 15VDC)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
Supply Pressure		
	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.0)	30 (2.1)
	>15 to 30 (1.0-2.1)	60 (4.1)
	> 30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
	>150 to 300 (10.3-20.7)	350 (24.1)
	>300 to 600 (20.7-41.4)	650 (44.8)
Outputs		
Atmospheric Pressure Ranges	1, 5, 15, 30, 100, 150, 300, 500, 600 PSIG 0.07, 0.35, 1.03, 2.07, 6.9, 10.34, 20.68, 34.47, 68.95 BAR	
Vacuum Pressure Ranges	30" Hg, 150 PSIA (2.1 bar, 10.3 bar)	
Forward Flow Capacity	1.25 SCFM (425 LPM)	
Exhaust Flow Capacity	1.25 SCFM (198 LPM)	
Analog Setpoint Control	0-5V, 0-10V, 4-20mA	
Digital Setpoint Control	0-100% full scale (installed sensor=100%)	
Digital Communications	Serial RS-485 interface	
Serial Address	Addresses a-z available (except p and q reserved). 'r' default selectable and configurable via Serial or Keypad Display Interface	
Loop Options	Regulate first loop (onboard sensor) or 2nd loop (remote sensor)	
Remote Sensor Feedback	0-10V, 0-5V, 4-20 mA, (Forward and Reverse Acting)	
Analog Output Source	Follow Setpoint, Output Pressure, or Remote Sensor	
Analog Output Range	0-10V, 0-5V	
Environmental		
Operating Temperature	32-141 °F (0-60 °C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	

Type 3511 & 3521

Digital Weatherproof Regulators

Description

The 3511 offers solenoid valve technology with forward flow equivalent to standard industrial electronic regulators or I/P transducers. Available with local keypad programming option or RS-485 Digital Communications for PLC or PC control. Dual solenoid valves with internal pressure sensor and advanced microprocessor control. A built-in air volume booster provides the 3511 with forward flow up to 17 SCFM. Proportional - Integral - Derivative (PID) control. Ranges from 0 to 150 PSIG. Reverse flow (exhaust) of up to 7 SCFM. The double loop (3521) option permits 0-10 VDC feedback from a remote sensor. The keypad is available with a four digit display of the output pressure.

Applications include: Gripper Control, Welding Operations, Actuator Control, Machinery Automation, Precision Robotics, Tire Production and Testing, Web Tension Semiconductor Equipment and Molding and Forming Operations.

Features

- Serial or DeviceNet Interface
- Digital or Analog Inputs
- Analog Monitor Output
- Single Loop and Dual Loop Control
- Forward Flow up to 17 SCFM
- Digital Display
- Weather Proof Housing

Type 3511 and 3521 Ordering Information

5	1			0		150	P		1		
											Loops
	1										1 loop
	2										2 loops
		1									
											Digital Interface
			S								Serial RS-485 (RS-232 and USB via converters)
			P								Keypad/display programmer
			D								DeviceNet
											Analog Control Signal
				E							0-10V
				I							4-20mA
											Lower Output Pressure
					0						Lower Limit of Output Pressure
											Pressure Units
						G					PSIG
						W					Inches of Water Column
											Upper Output Pressure
						150					Upper Limit of Output Pressure
											Mounting*
							P				Pipe Mount
							M				Manifold-Mount
											Supply and Output Ports
								0			1/4 NPT
								1			1/4 BSPT
								2			1/4 BSPP
									1		
											Options
										00	None
										15	15VDC Supply

*Order panel bracket and DIN rail clip separately.
For Manifold-Mount (no threads), specify 0 for Supply and Output Ports.

	Type 3511/3521	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	24VDC (optional 15VDC)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
Supply Pressure		
	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.0)	30 (2.1)
	>15 to 30 (1.0-2.1)	60 (4.1)
	> 30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Outputs		
Atmospheric Pressure Ranges	5, 15, 30, 100, 150 PSIG 0.35, 1.03, 2.07, 6.9, 10.34 BAR	
Forward Flow Capacity	15 SCFM (425 LPM)	
Exhaust Flow Capacity	7 SCFM (198 LPM)	
Analog Setpoint Control	0-5V, 0-10V, 4-20mA	
Digital Setpoint Control	0-100% full scale (installed sensor=100%)	
Digital Communications	Serial RS-485 interface	
Serial Address	Addresses a-z available (except p and q reserved). 'r' default selectable and configurable via Serial or Keypad Display Interface	
Loop Options	Regulate first loop (onboard sensor) or 2nd loop (remote sensor)	
Remote Sensor Feedback	0-10V, 0-5V, 4-20 mA, (Forward and Reverse Acting)	
Analog Output Source	Follow Setpoint, Output Pressure, or Remote Sensor	
Analog Output Range	0-10V, 0-5V	
Environmental		
Operating Temperature	32-141 °F (0-60 °C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	

Type 3512 & 3522

Digital Weatherproof Regulators

Description

The Type 3512 single loop and 3522 double loop are single units - integrated controller and booster. The 3512/3522 offers solenoid valve technology with forward flow exceeding those of most standard industrial electronic regulators or I/P transducers. Available with a local keypad programming option or RS-485 digital communications for PLC or PC control. Many output pressure ranges are available up to 150 PSI. With a reliable twin solenoid valve system, and an integral pressure sensor, an accuracy of ± 0.5% is obtainable.

Applications include; Gripper Control, Welding Operations, Actuator Control, Machinery Automation, Precision Robotics, Web Tension, Semiconductor Equipment, Molding and Forming Operations and Tire Manufacturing and Testing.

Features

- Serial or DeviceNet Interface
- Digital or Analog Inputs
- Analog Monitor Output
- Single Loop and Dual Loop Control
- Forward Flow up to 60 SCFM
- Digital Display

Type 3512 and 3522 Ordering Information

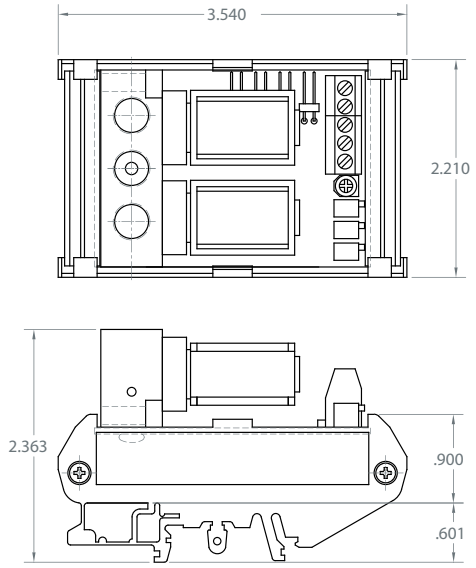
5	2			0		150	P		1		
											Loops
	1										1 loop
	2										2 loops
	2										
											Digital Interface
		S									Serial RS-485 (RS-232 and USB via converters)
		P									Keypad/display programmer
		D									DeviceNet
											Analog Control Signal
			E								0-10V
			I								4-20 mA
											Lower Output Pressure
				0							Lower Limit of Output Pressure
											Pressure Units
					G						PSIG
											Upper Output Pressure
						150					Upper Limit of Output Pressure
											Mounting
							P				Pipe Mount
											Supply and Output Ports
								0			1/4 NPT
								1			1/4 BSPT
								2			1/4 BSPP
								3			3/8 NPT
								4			3/8 BSPT
								5			3/8 BSPP
									1		
											Options
										00	None
										15	15 VDC Supply

	Type 3512/3522	
Performance	Full-Scale Accuracy 0.5%	
Electrical Inputs		
Supply Voltage	24VDC (optional 15VDC)	
Stand by Supply Current	80 mA	
Maximum Supply Current	325 mA	
Supply Pressure		
	Max. Output PSIG (BAR)	Max. Supply PSIG (BAR)
	Up to 5 (.35)	20 (1.4)
	>5 to 15 (.35-1.0)	30 (2.1)
	>15 to 30 (1.0-2.1)	60 (4.1)
	> 30 to 100 (2.1-6.9)	165 (11.4)
	>100 to 150 (6.9-10.3)	200 (13.8)
Outputs		
Atmospheric Pressure Ranges	5, 15, 30, 100, 150 PSIG	
	0.35, 1.03, 2.07, 6.9, 10.34 BAR	
Forward Flow Capacity	60 SCFM (1700 LPM)	
Exhaust Flow Capacity	15 SCFM (425 LPM)	
Analog Setpoint Control	0-5V, 0-10V, 4-20mA	
Digital Setpoint Control	0-100% full scale (installed sensor=100%)	
Digital Communications	Serial RS-485 interface	
Serial Address	Addresses a-z available (except p and q reserved). 'r' default selectable and configurable via Serial or Keypad Display Interface	
Loop Options	Regulate first loop (onboard sensor) or 2nd loop (remote sensor)	
Remote Sensor Feedback	0-10V, 0-5V, 4-20 mA, (Forward and Reverse Acting)	
Analog Output Source	Follow Setpoint, Output Pressure, or Remote Sensor	
Analog Output Range	0-10V, 0-5V	
Environmental		
Operating Temperature	32-141 ˚F (0-60 ˚C)	
Media-Wetted Materials	Aluminum, copper alloys, nickel, buna-n, silicon, 316SS	

Dimensional Drawings

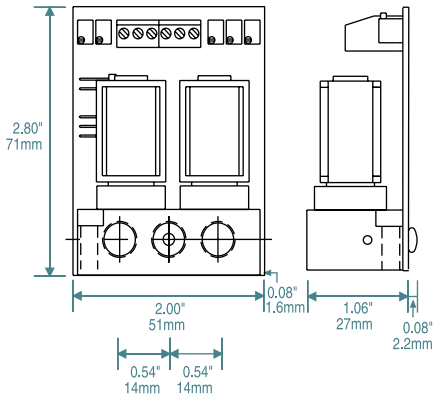
DIN Tray Mount

(3100, 3400) Dust Cover = 157-201-01



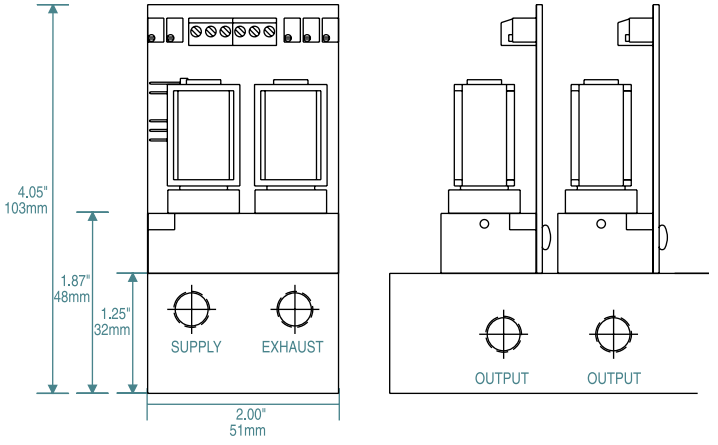
Panel Mount

(3100, 3400)



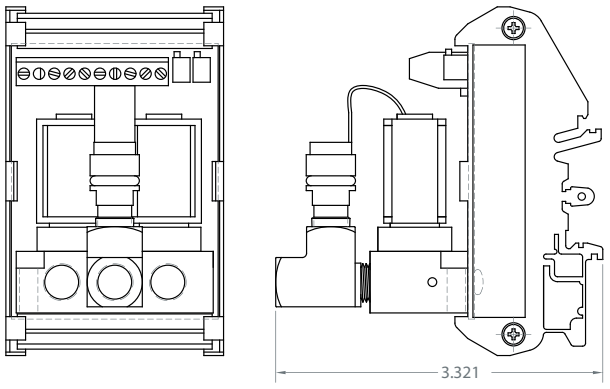
Manifold Mount

(3100, 3400)

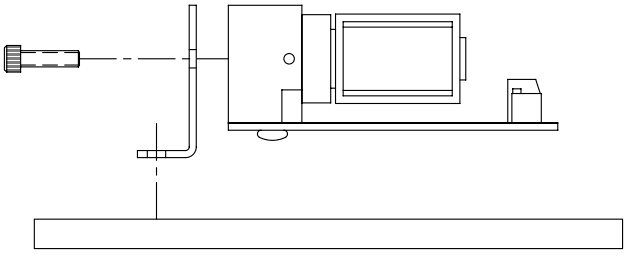


High-Pressure Units (>300 PSIG) T3111, 3410 and 3420

High Pressure (>300 PSIG / 20.7 BAR) units



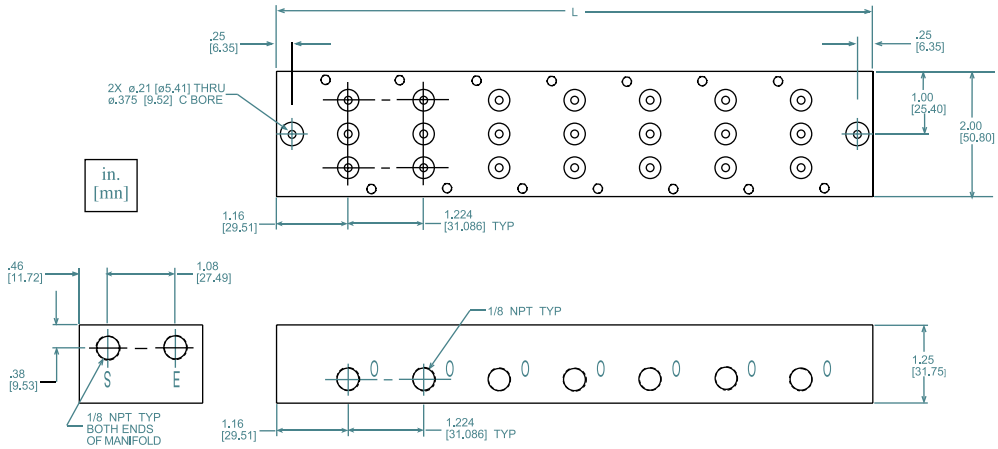
Flush Panel Mount T3100, T3111



Electro-Pneumatics

Type 3100 and 3400 Series Manifold Block (7 Station Manifold Shown)

(7 station manifold shown)



Manifolds are available in 2 to 10 stations.
To calculate the overall length "L" of the manifold use the following formula:

L= 2 X 1.16 + (S-1) X 1.224

Where S = the number of manifold stations

EXAMPLE: 7 Station Manifold:

L = 2 X 1.16 + (7-1) X 1.224

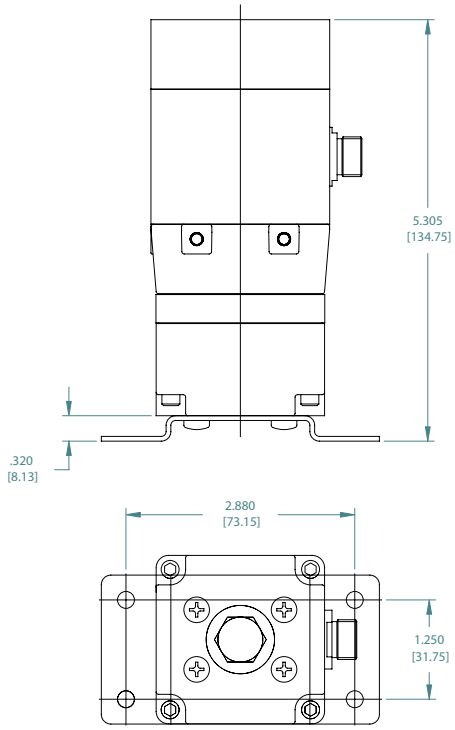
L = 9.664 in. [245.47 mm]

Circuit Board Regulators — Mounting and Packaging

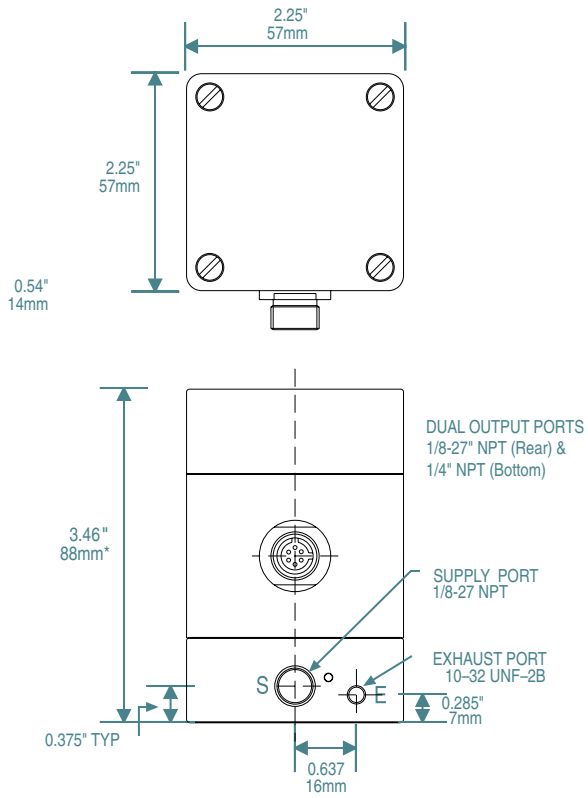
Mounting	Product Configuration	Accessories
DIN Tray	Product mounted in DIN Tray	None
Panel	Product configured for panel mounting	For 'flush' mounting, order Flush Mount Bracket (161-520-00) separately
Multi-Unit Manifold	Product configured for multi-unit manifold mounting	Order Multi-Unit Manifold (350-110-XX) separately. XX = # stations.

Weatherproof Regulator Mounting Options

The Type 3200 and 3500 regulators can be mounted in-line or by brackets which are available separately (DIN-rail bracket – 010-115-000; Panel bracket – 010-135-000). Bracket mounting holes (2 X 8-32 UNC 2B X 0.375"/9.5mm deep minimum) are available on the rear and right faces (when looking at product with IN/OUT flow from left to right) and also on the bottom of the medium-flow booster (shown in diagram).

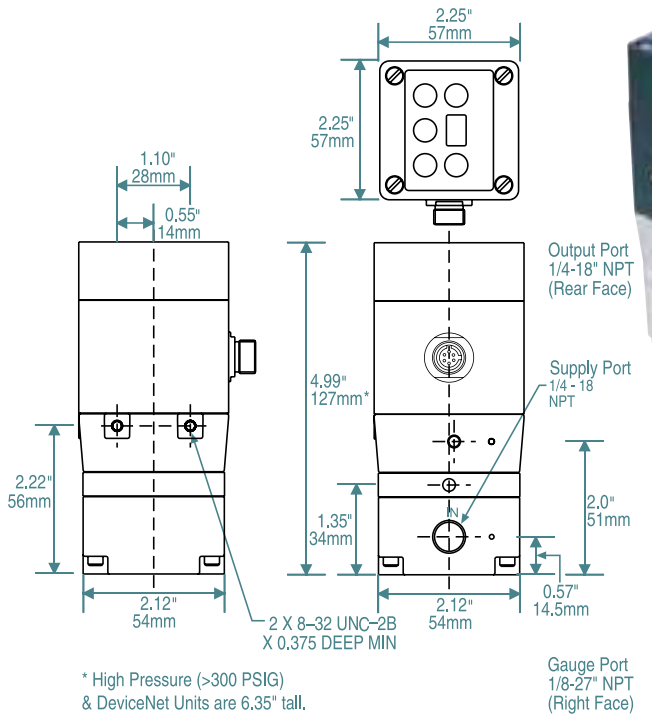


Low-Flow Weatherproof T3210, T3220, T3510, T3520

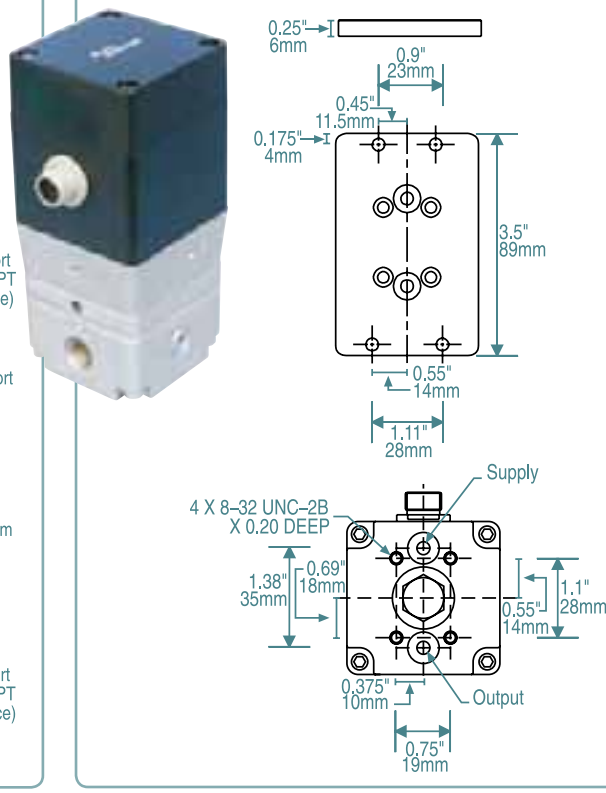


* High Pressure (>300 PSIG / 20.7BAR) & DeviceNet units are 5.00" / 127mm tall.

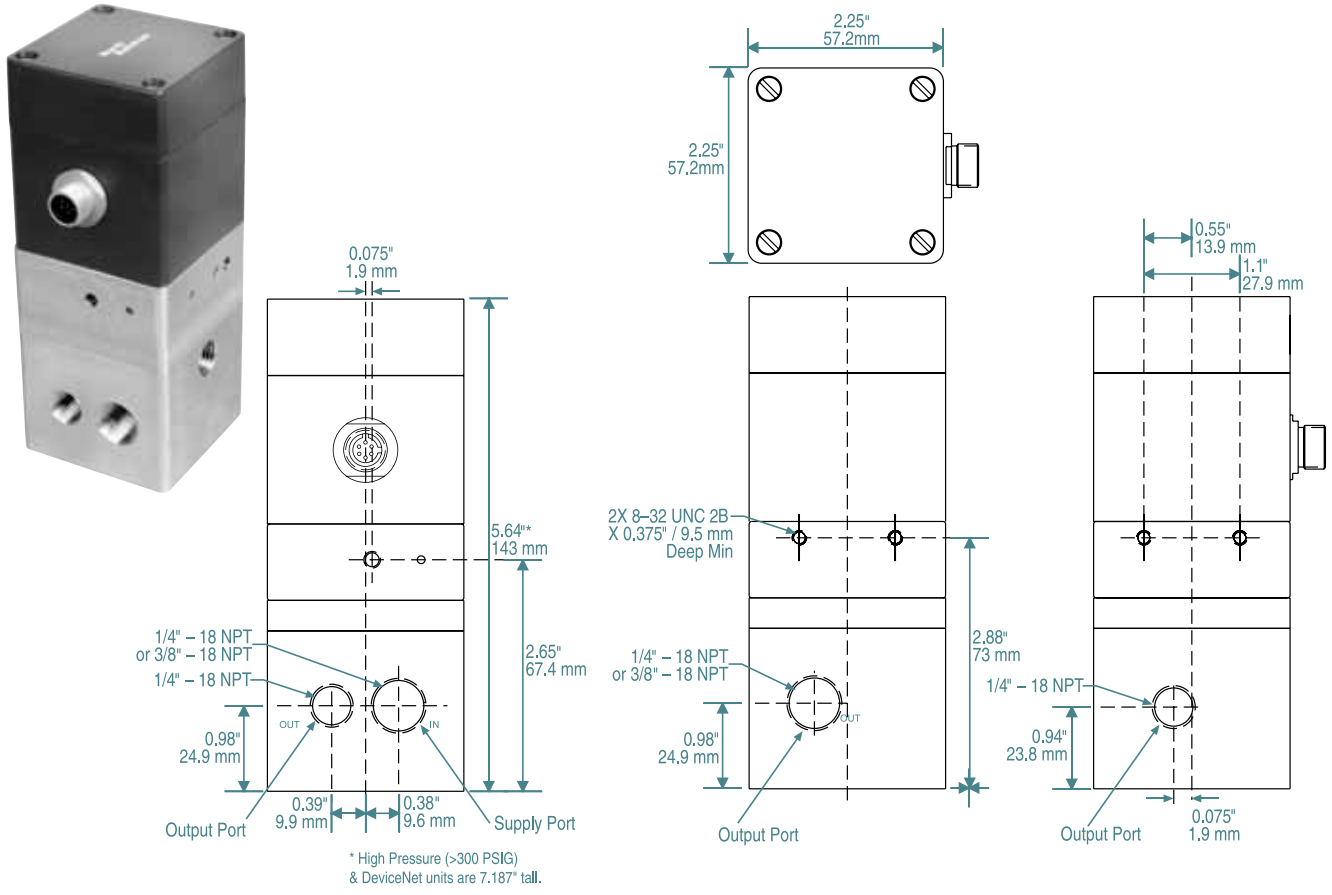
Medium-Flow Weatherproof T3211, T3221, 3511, 3521



Manifold Mount T3211, T3221, 3511, 3521



High -Flow Weatherproof T3212, T3222



Remote Pressure Sensors
(RPS)

Description

The RPS is designed for connection to the T3000's 2nd loop input. When used to monitor pressure at the output of an external volume booster, or directly at the user's remote application, the RPS sensor increases overall accuracy and speed of response to downstream changes.

Pressure ranges from vacuum to 1000 PSIG / 69 BAR are available. RPS outputs (0-10V or 4-20 mA) are field-adjustable. 4-20 mA versions require 12-24 VDC external power, while 0-10V versions require 15-24 VDC. The RPS weatherproof housing is 1.8" / 46mm wide X 2.6" / 66mm tall (for pressures above 300 PSIG / 20.7 BAR, extended height housing is required). The RPS can be directly mounted to the application with its male 1/4 NPT pneumatic connection, or with the SPC-MB1 bracket (available separately).

Temperature range is 0-50˚C.

Part Numbers: RPS 0GXXX YYYY ZZ

XXX = upper end of pressure range (e.g., '030' for 30 PSIG)*

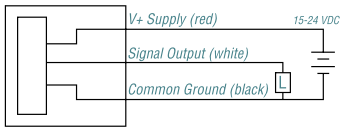
YYYY = electrical output ('0E10' for 0-10V or '4I20' for 4-20 mA)

ZZ = length of wiring ('W' for 3' or 'W6' for 6')

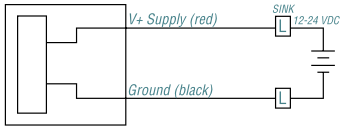
*Full scale ranges:
1, 5, 15, 30, 100, 150, 300, 500, 1000 PSIG
0.07, 0.3, 1.0, 2.1, 6.9, 10.3, 20.7, 34.5, 69 BAR
Vacuum (29" Hg)

Sensor Wiring Diagrams

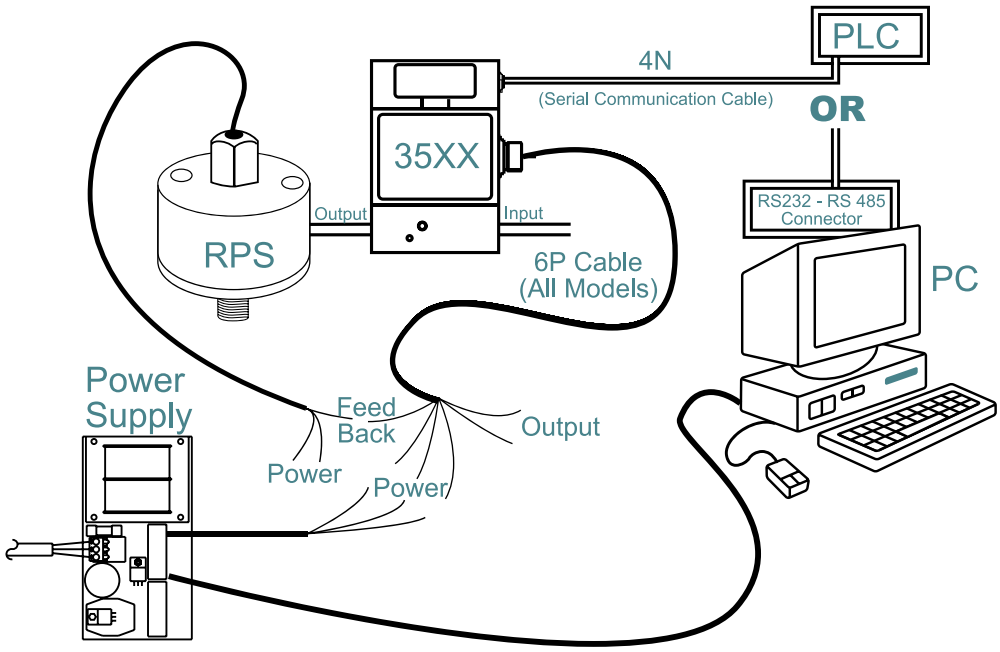
OE10



4120 Model



Cable Applications



Cordsets

DC Power and Analog I/O

Required on all T3200 and T3500 transducers. Single-ended cordset with 6-pin female M12 micro-style connector.

Length of Wiring	Part Number
3' (0.9m)	122-004-08
6' (1.83m)	122-004-09
12' (3.66m)	122-004-10
20' (6.10m)	122-004-11

DC Power and Analog I/O

Required on Z-option Type 3215.

Single-ended cordset with 4-pin female M12 micro-style connector.

Length of Wiring	Part Number
3' (0.9m)	122-004-04
6' (1.83m)	122-004-05
12' (3.66m)	122-004-06
20' (6.10m)	122-004-07

Serial RS-485

Required on all T3500 Serial RS-485 transducers.

Single-ended cordset with 4-pin female nano-style connector.

Length of Wiring	Part Number
6.5' (2m)	122-000-00
16.5' (5m)	122-000-01

DeviceNet

Required on all T3500 DeviceNet transducers. Single-ended cordset with 5-pin female M12 micro-style connector.

Length of Wiring	Part Number
3' (0.9m)	160-560-01
16.5' (5m)	122-000-01

Cordsets

Converters

RS-232 Converter

Converts T3400/T3500 Serial RS-485 interface to RS-232. Part Number: 160-700-00.

USB Converter

Used in combination with RS-232 Converter, allows connection of T3400 or T3500 Serial to USB port. Part Number: 160-710-00

Converters

Power Supplies & Control Knobs

A pair of 15VDC circuit-card power supplies is available for integration of Type 3000 transducers into 120VAC systems. The ZMS-JR powers a single Type 3000; the ZMS15-2 powers up to two. In addition, the ZMS15-2 can control a pair of Type 3000 transducers with 0-10V when combined with the P1 Control Knob.

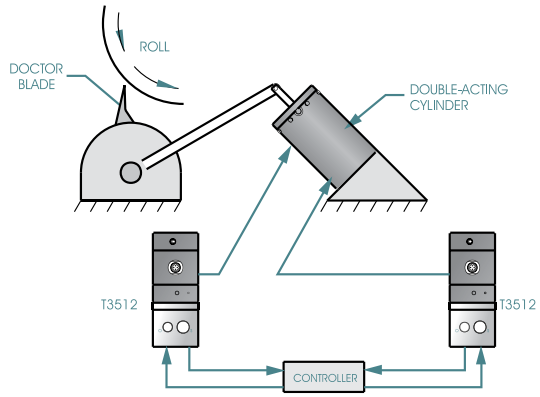
The ZMSJR is rated at 375 mA maximum output; the ZMS15-2 at 750mA. Connections are made via removable terminal blocks. Both power supplies are short circuit protected, and mounted in trays for easy DIN rail mounting. The ZMSJR (without DIN tray) can also be standoff mounted. AC power cords are included. The ZMS-JR has a 3.6" / 91mm X 3.1" / 79mm footprint and is 2.6" / 66mm high when mounted in its DIN tray; the ZMS15-2 is 5.4" / 137mm X 3.1" / 79mm and 2.7" / 69mm.

		Part Number
ZMSJR	Powers one Type 3000	501-200-04
ZMS15-2	Powers and Controls two T3000's	501-200-00
P1-3	Control Knob with 3' (0.91m) wiring	504-100-00
P1-6	Control Knob with 6' (1.83m) wiring	504-100-01
P1-12	Control Knob with 12' (3.66m) wiring	504-100-02

Applications

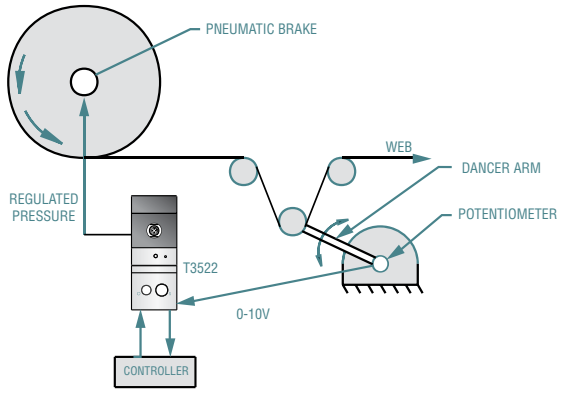
Doctor Blade Control

Doctor blades are used through-out the paper process to remove water and contaminants from the roll. The use of a double-acting cylinder (or bladders or bellows) on each end of the roll, with two T3512's controlling the position of each cylinder, increases the positioning accuracy of the doctor blade.



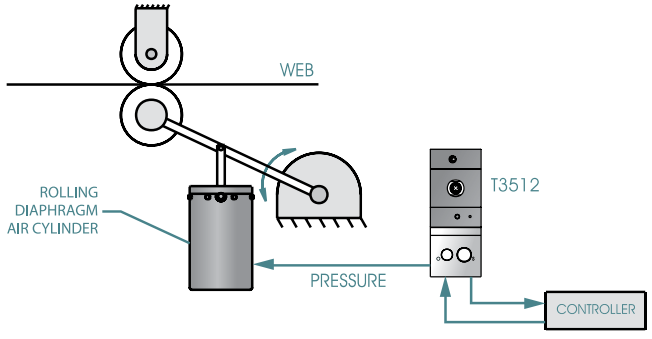
Web Tension

A web-tensioning system serves as a kind of shock absorber, keeping the web at the same tension no matter what the roll size. The T3522 utilizes closed-loop feedback from the dancer arm, to adjust pressure delivered to the pneumatic brake, keep the dancer arm at the desired position, and maintain the desired web tension. The two-loop capability of the T3522 frees up the Controller for other tasks.



Web Caliper (Thickness)

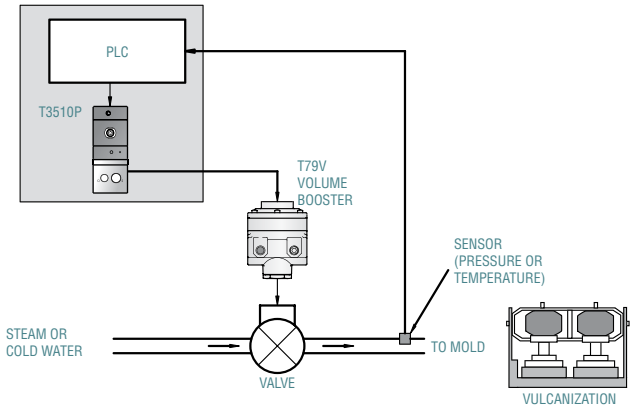
In the calendar section of the paper machine, the T3512 regulates pressure delivered to an air cylinder (or bladder or bellows) to regulate the thickness of the paper. The calendar section consists of calendar stacks with a reel device for winding the paper onto a reel as it leaves the machine. The calendar finishes the paper by smoothing it to the desired finish, thickness, or gloss.



Tire Molding

During the vulcanization stage of tire making, a green tire is molded into a finished tire – ready for testing, inspection, and shipment. Tight control of pressure and temperature is absolutely critical to the making of high-quality tires. This requires valves for steam, cold water, and air pressure, as well as devices to monitor pressure and temperature. In the illustration, the T3510P I/P is mounted in the cabinet with the PLC, to locate all the electronics in a single location. The T79V volume booster provides the flow capacity to open and close the valve rapidly, as well as a 'tunable' integral needle valve to provide stable operation.

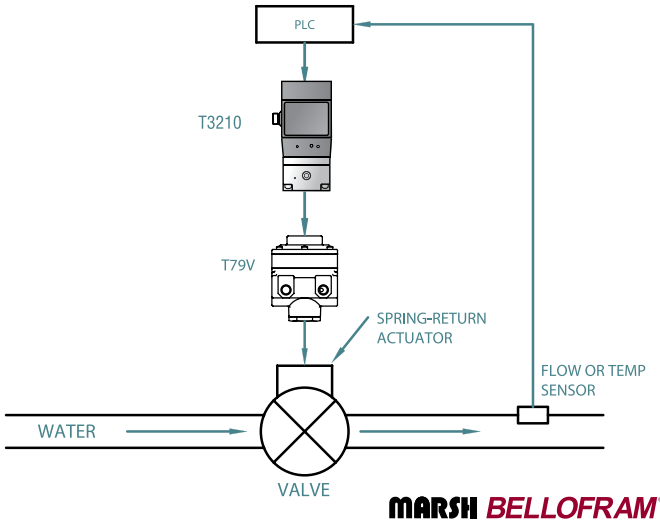
Other products used in tire molding include filter-regulators (T51), regulators (T70 and T78), and Positive-Bias Relays (T72).



Valve Control

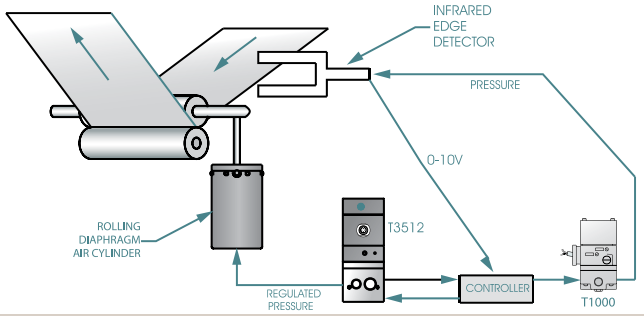
Valves are used throughout the paper-making process to control the flow of water, steam, pulp, and chemicals. Valves are found in Water Treatment facilities (both incoming and outgoing), as well as Power Generation facilities. Some paper mills install steam-shower valves after the dryer section to control paper curl.

Valves can be actuated by Valve Positioners, I/P Electro-Pneumatic Transducers, or both. In the example below, the Type 3210 is used to regulate the amount of water (or other fluid) passing through a valve. The T3210 receives a control signal from a Programmable Logic Controller and regulates the speed and position of the valve actuator. The T79V Volume Booster increases valve opening/closing speed by increasing dramatically the amount of compressed air being fed to the actuator. Other products used in valve control include Filter-Regulators (T50 and T51), Regulators (T70), Positive-Bias Relays (T72), P/I Transducers (T5000), and pressure gauges.



Edge-Guiding and Web-Break Detection

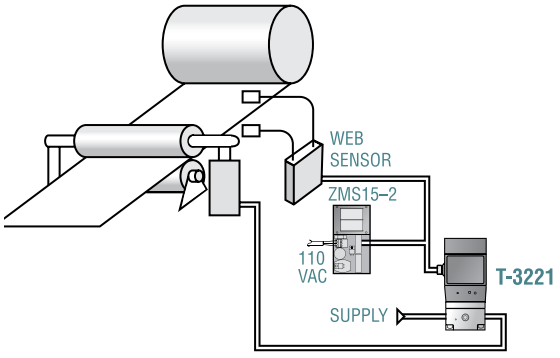
The Controller uses feedback from an infrared edge detector to control horizontal web position. The T3512 controls the extension of a cylinder (or bladder or bellows) which moves the web from side to side. In the event of a web break, the output of the edge detector signals the Controller to begin remedial action. The T1000 (or T1500) supplies a steady stream of air to keep the edge detector's sensing elements free of contamination.



Edge Guiding

Using a Web Sensor and Type 3221

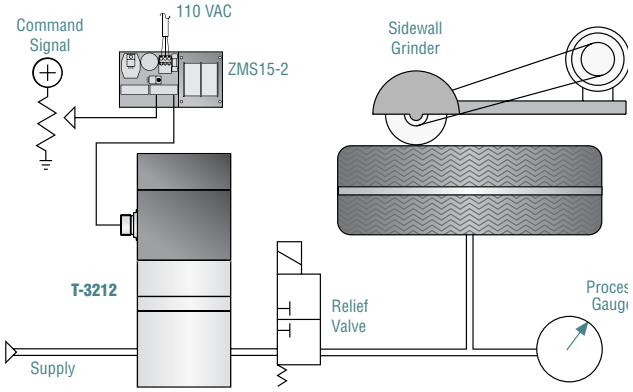
As the web position varies, the web sensor detects the change and feeds a signal back to the Type 3221 Pressure Controller. The Type 3221 then applies pressure to the cylinder to compensate for the shift in web position. The ZMS15-2 Power Supply provides both the command signal and the supply voltage that sets the initial web position while allowing for adjustments.



Sidewall Grinding

Using the Type 3212

A Type 3212 provides pressure control in a tire sidewall grinding application. A command signal is channeled through a ZMS15-2 Power Supply which feeds the command signal as well as the 15 volts DC supply voltage to the Type 3212. A gauge monitors the downstream pressure of the Type 3212, with a relief valve to protect against over pressurization.



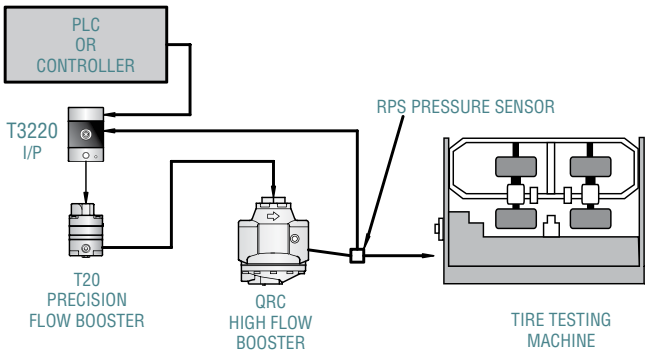
Tire Testing

Most manufacturers run finished tires through a battery of tests and inspections. To minimize total testing time, multiple tires must be inflated and deflated very rapidly, with pressure held constant during the testing.

In the illustrated example, the PLC begins the test by sending a setpoint to the T3220 electronic pressure controller. The T20 pre-amplifies the flow of the T3220, to provide tight responsive control of pressure delivered to the High Flow Booster. The T3220 and T20 can be ordered as a single integrated unit.

The High Flow Booster is selected based on the size and number of tires to be tested. Marsh Bellofram has a full range of flow boosters up to 2" port size and 2000 SCFM / 56640 SLPM.

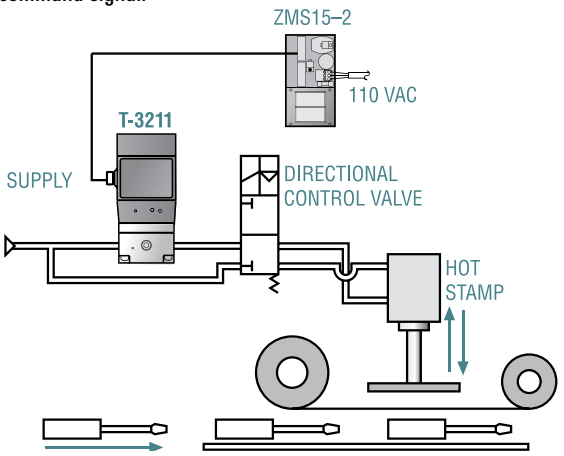
In order to maintain the highest accuracy, the RPS pressure sensor is mounted close to the tire. The T3220's two-loop capability allows it to close the loop with the downstream sensor, freeing up the PLC for other things.



Hot Stamping Force Control

Using the Type 3211

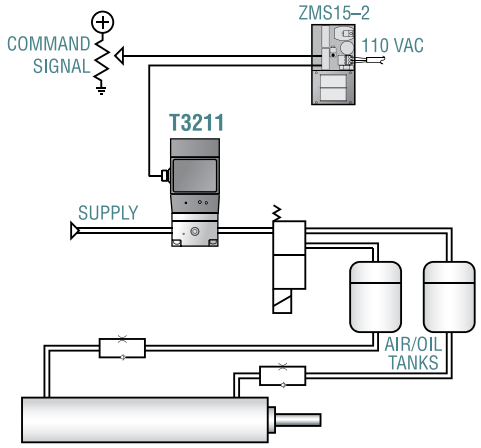
The Type 3211 pressure controller applies pressure to the cylinder to develop a force for the hot stamping operation. In this configuration, the ZMS15-2 Power Supply provides both the command signal and supply voltage necessary to control the Type 3211. A programmable controller may also supply this command signal.



Air Over Oil Speed Control

Using the Type 3211

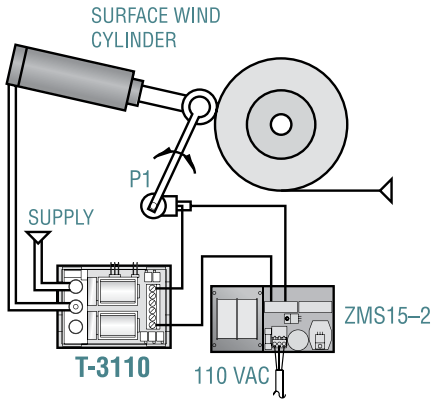
The Type 3211 varies the cylinder speed by varying the pressure in the air over oil tanks. The ZMS15-2 Power Supply provides both the command signal and the supply voltage to the Type 3211. The output pressure, through a directional control valve, controls the speed at which the cylinder extends and retracts.



Surface Winding Control

Using the Type 3110

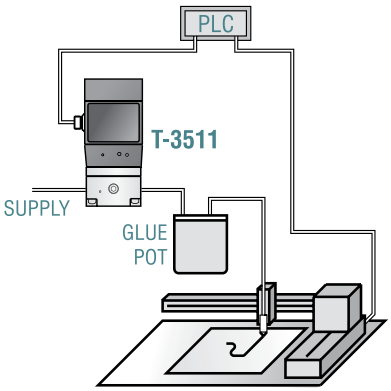
As the roll diameter and the cylinder position change, the feedback arm moves the rotary potentiometer. This rotary potentiometer output changes the regulated output pressure of the Type 3110 to control the pressure to the surface wind cylinder.



Adhesive Dispensing

Using the Type 3511

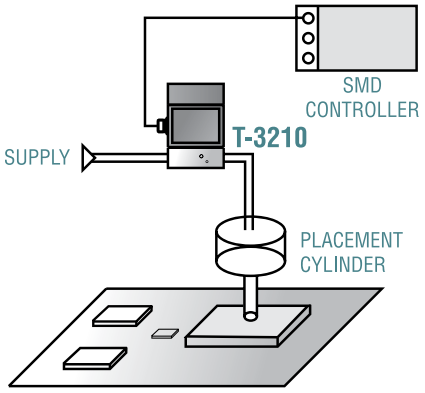
The Type 3511 pressure controller, after receiving its signal from the PLC, applies air pressure to the glue pot. This in turn controls the glue pressure and flow to the automatic glue dispensing machine. A sensor in the automatic glue dispensing machine provides feedback to the PLC for fine tuning of the application.



Surface Mount Force Control

Using the Type 3210

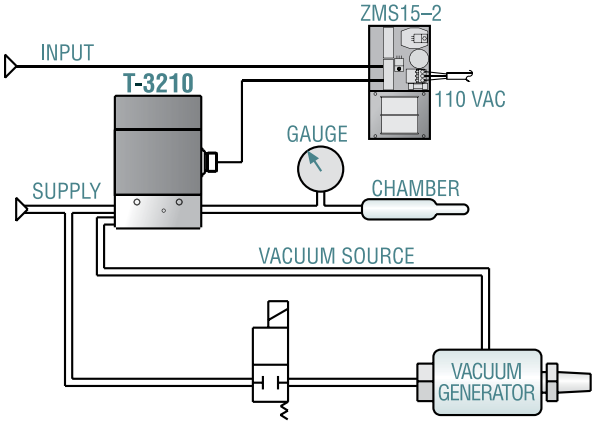
The Type 3210 Pressure Controller can provide precise control of force for automated placement of surface mount IC's. In this application, an SMD Machine Controller sets the pressure for each chip placement.



Electronic Control of Vacuum Through Pressure

Using the Type 3210

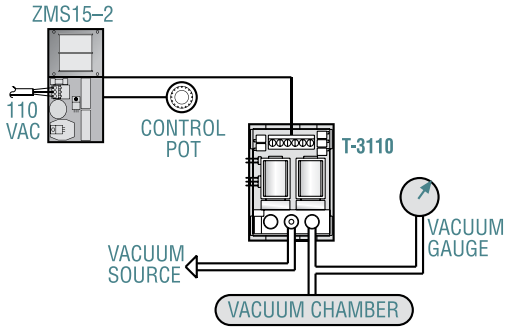
The Type 3210 can be calibrated to operate in both the vacuum and pressure ranges. The ZMS15-2 Power Supply provides the Type 3210 with the command signal and supply voltage. Supply pressure is routed to both the vacuum generator and the Type 3210 with an on-off switch in front of the vacuum generator. The Type 3210 then can regulate both vacuum and pressure to the chamber. A compound gauge monitors the pressure in the chamber.



Electronic Control of Vacuum

Using a Type 3110

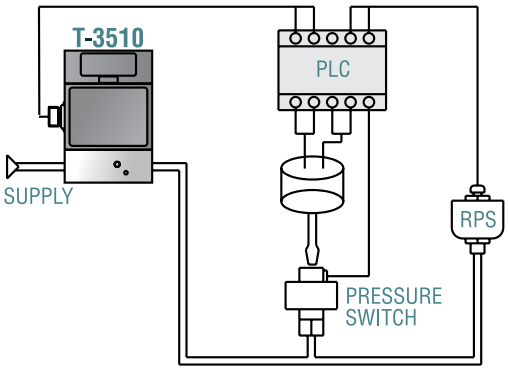
The Type 3110 is used to control pressure to a vacuum process chamber. A control potentiometer channels the command signal through a ZMS15-2 Power Supply to operate the Type 3110. A vacuum gauge is used to monitor the regulated vacuum from the Type 3110.



Automated Pressure Switch Calibrator

Using a Type 3510

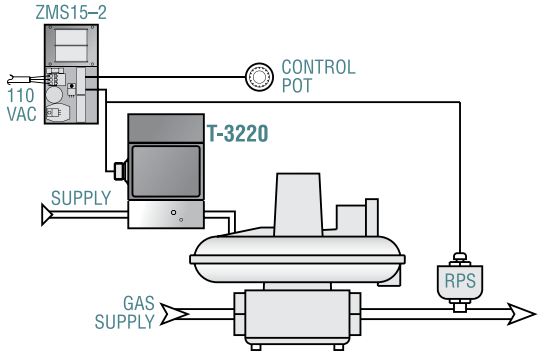
The Type 3110 is used to control pressure to a vacuum process chamber. A control potentiometer channels the command signal through a ZMS15-2 Power Supply to operate the Type 3110. A vacuum gauge is used to monitor the regulated vacuum from the Type 3110.



Control of High Flow, Low Pressure

Using the Type 3220

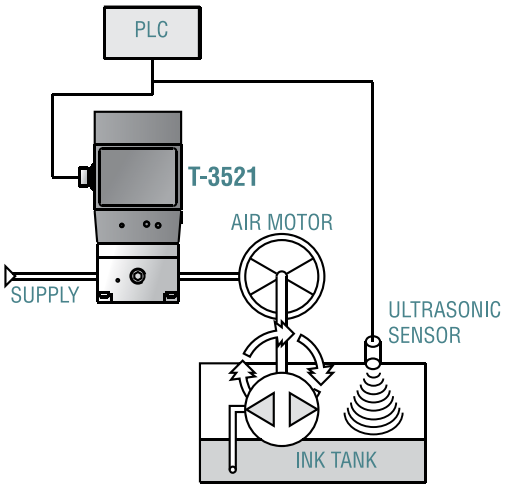
This circuit provides an adjustable control of clamping force that is directly proportional to the tension of the material being stretched by the servo motor. The initial clamping pressure is set by the process controller and as the servo motor applies tension to the material being tested, the load cell's output signal commands the Type 3510 pressure controller to increase the clamping force.



Liquid Level Control

Using the Type 3521

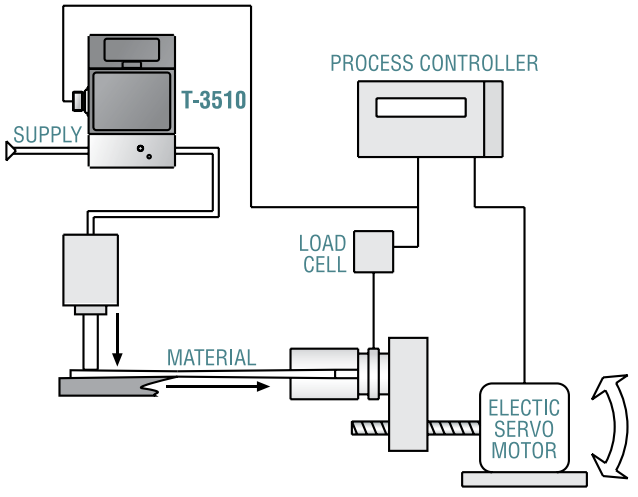
The ultrasonic sensor provides feedback to the Type 3521 for controlling the liquid level of an ink tank. The liquid level setpoint is controlled by the PLC by varying the command signal to the Type 3521.



Clamping Force Control

Using the Type 3510

This circuit provides an adjustable control of clamping force that is directly proportional to the tension of the material being stretched by the servo motor. The initial clamping pressure is set by the process controller and as the servo motor applies tension to the material being tested, the load cell's output signal commands the Type 3510 pressure controller to increase the clamping force.



Accessories

Value Series Gauges

Diaphragm Seals

Pressure Indicators

MPS 8

Manual Panel Station

Description

Marsh Bellofram's Manual Panel Stations offer a precision high flow regulator with a quality gauge in a space saving package for ease of installation and versatility. Most often found in laboratory panels, and control rooms, they are ideally suited for applications that require maintaining and monitoring critical pressures in a system. The addition of a three-way valve allows for operation in either a manual mode where the pressure is set and monitored at the panel, or automatic mode where the pressure is established from a remote location but monitored at the panel.

Standard Features

- Uses a Marsh Bellofram Type 41 Precision Regulator
- Self Relieving
- High flow capacity
- Direct or reverse acting styles
- Clockwise or counterclockwise adjustment rotation

MPS 8 Ordering Information

MPS8					
	↑	↑↑↑	↑↑↑	↑↑↑	Regulator
	41				Type 41
	44				Type 41 Left Hand Thread*
					Regulator Range
		315			3-15 PSIG
		630			6-30 PSIG
		153**			15 to 3 PSIG*
		306**			30 to 6 PSIG*
					Gauge Style
			DPG		Dual Plain Gauge Direct Acting
			DRG		Dual Receiver Gauge Direct Acting
			DPR		Dual Plain Gauge Reverse Acting
			DRR		Dual Receiver Gauge Reverse Acting
					Pressure Gauge Range
				015	15 PSI
				030	30 PSI

* Type 44 is used to decrease pressure with clockwise knob rotation

** Must order either DPR or DRR Reverse Acting Receiver Gauges

MPS 8

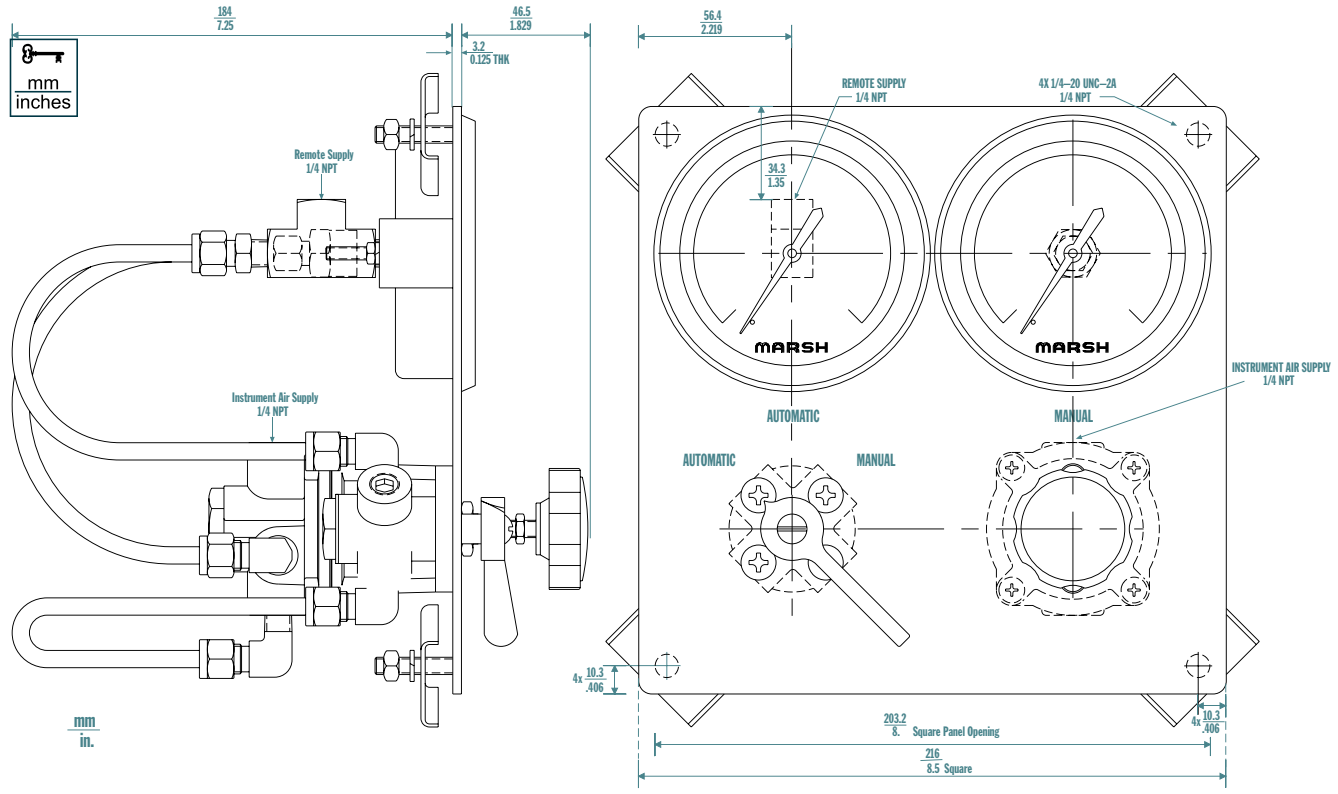
Regulator Specifications

Ranges	0-15 PSIG 0-30 PSIG	0-1 BAR 0-2.1 BAR
Flow Capacity	25 SCFM	700 LPM
Sensitivity	1" w.c.	25 mm
Port size	1/4 NPT	
Supply Pressure (max)	250 PSIG	17.2 BAR
Temperature Range	-20 to 160 ˚F	-29 to 71 ˚C

Gauge Specifications

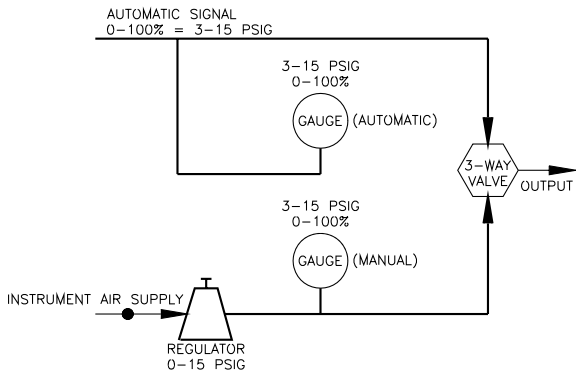
Accuracy	ASME Grade B or ±3/2/3% (±2% of range across middle half of scale)
Case	3-1/2" rust resistant drawn steel, acrylic window, brass tube, socket and movement.
Dial Face	Black markings on white background, dual scale psi and kPa, or 0-100% linear

MPS 8 Dimensional Drawings



MPS 8 Principles of Operation

Panel Loading Station MPS 8 consists of a T41 regulator and a standard 3-1/2" gauge configured as shown. The three-way valve allows switching the load to a panel-mounted regulator which is manually adjusted or to a controller external to the panel loading station. In either case, the regulated output to the load is monitored.



mm
inches

Type 41
Pressure Regulator Series
See Page 10

Marshalltown

Value Series Gauges

Features

- ASME Grade B Accuracy
- Extra Savings with Quantity Pricing
- 4 Standard Mounting Options: LM, CB, Right and Left

Marshalltown Value Series are the most economical, general purpose gauge in the Marsh gauge line. Suited for use with water, oil, air, gas, and other non-corrosive media. Typical applications include FRL's, compressors, pumps, boilers, regulators, dryers as well as commercial and industrial equipment.

Specifications

Accuracy
ASME Grade B = ±3/2/3%
(±2% of range across middle half of scale)

Case Material
Steel, black painted

Tube and Socket
Copper alloy

Movement
Brass

Ranges
15 to 160 PSI

Dial Standard
Dual scale PSI and kPa standard

Dial
Black markings on white

Pointer
Aluminum, black painted

Window
Flat plastic with steel friction ring

MARSHALLTOWN Value Series

Marshalltown Value Series Standard Ranges and Part Numbers

Size	1-1/2"				2"			
Mounting	LM	CB	Right	Left	LM	CB	LM	CB
Connection NPT	1/8	1/8	1/8	1/8	1/4	1/4	1/8	1/8
0 to 15 PSI		GG1515C8						
0 to 30 PSI	GG1530L8	GG1530C8	GG1530G8	GG1530F8	GG2030L4	GG2030C4	GG2030L8	GG2030C8
0 to 60 PSI	GG1560L8	GG1560C8	GG1560G8	GG1560F8	GG2060L4	GG2060C4		
0 to 100 PSI	GG15100L8	GG15100C8			GG20100L4	GG20100C4	GG20100L8	GG20100C8
0 to 160 PSI	GG15160L8	GG15160C8			GG20160L4	GG20160C4	GG20160L8	GG20160C8
0 to 200 PSI		GG15200C8				GG20200C4		GG20200C8
0 to 300 PSI						GG20300C9		

Diaphragm Seals

Features

Diaphragm seals are isolation devices which separate pressure gauges and other instruments from the process media while allowing the instrument to measure the process pressure. The service life of the instrument is greatly extended, because it is protected from corrosion, clogging, freezing, and pulsation.

Liquid Fillings

The selection of the fill depends on the temperature expected in any given application. Temperature ratings for available fillings are listed below.

Glycerine	0 to 400˚F
Silicone	-40 to 600˚F

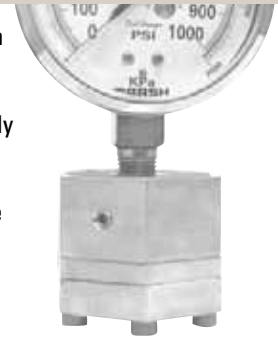
Model 12000

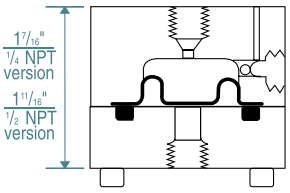
Mini Serviceable Rubber Diaphragm Seal

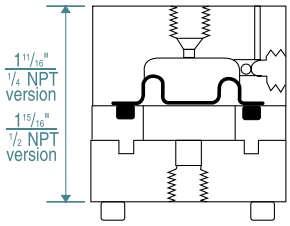
Description

The Model 12000 Serviceable Mini Diaphragm Seal is designed for gauges and instruments with operating pressure to 2500 psi with stainless and 500 PSI with PVC models. Ideally suited for small applications and corrosive installations. The optional 'Easy Clean Out' feature allows the removal of the process side housing without losing the instrument side fill fluid. Fill/bleed screw port in the instrument side housing, and stainless steel build screws are standard.

Filled and calibrated to Gauges only.







Model 12000 Ordering Info

12000							
						Upper Housing	
					22	1/4	316SS
					24	1/2	
					52	1/4	PVC
					54	1/2	
						Lower Housing	
				22		1/4	316SS
				24		1/2	
				52		1/4	PVC
				54		1/2	
						Diaphragm	
			3			Nitrile	
			4			Fluorocarbon	
			5			Neoprene	
						Easy Clean Out	
		0				None	
		2				Clean Out	
						Fill	
	0					No Fill	
	G					Glycerine	
	S					Silicone	

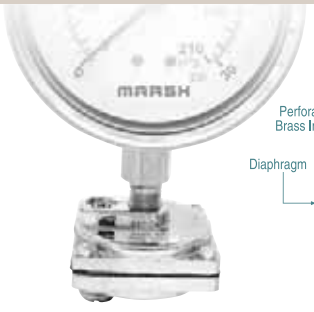
Model B8498

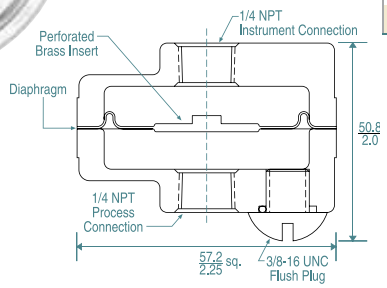
Gauge Protector with Rubber Diaphragm Seal

Description

The Model B8498 Gauge Protector is designed for extremely high volume displacement. Ideally suited for gauges and instruments with operating pressures up to 200 psi and vacuum applications. Available in 1/4 NPT threaded connections and chrome plated zinc construction. A 3/8" flush plug is standard in the process side housing.

Filled and calibrated to gauges only.





Model B8498 Ordering Info

B8498				
				Assembly
	22			1/4
				Diaphragm
		3		Nitrile
		4		Fluorocarbon
		5		Neoprene
				Fill
			0	No Fill
			G	Glycerine
			S	Silicone

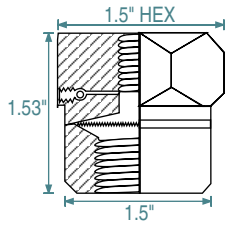
Model 13000

Mini / All Welded Diaphragm Seal

Description

The Model 13000 Mini Welded Seal is designed for 2" to 3-1/2" bourdon tube gauges with a minimum pressure of 100 PSI. The maximum operating pressure is 2000 PSI at 100˚F. Available in all 316 SS or Hastelloy C process housing and diaphragm.

Filled and calibrated to gauges only.



Model 13000 Ordering Info

13000					
					Upper Housing
	22				1/4 316SS
					Lower Housing
		22			1/4 316SS
		24			1/2
		42			1/4 Hastelloy
		44			1/2
					Diaphragm
			1		316SS
			2		Hastelloy C
					Fill
				0	No Fill
				G	Glycerine
				S	Silicone

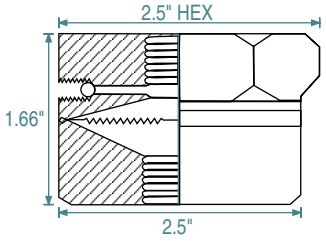
Model 13040

All Welded Diaphragm Seal

Description

The Model 13040 All Welded Seal is designed for 2" to 4-1/2" bourdon tube gauges with pressure ranges from vacuum to 1000 psi. Available in all 316SS or Hastelloy C process housing and diaphragm, with threaded connections. Optional flushing connections also available.

Filled and calibrated to gauges only.



Model 13040 Ordering Info

13040							
						Upper Housing	
	22					1/4	316SS
	24					1/2	
						Lower Housing	
		22				1/4	316SS
		24				1/2	
		26				3/4	
		28				1	
		42				1/4	Hastelloy
		44				1/2	
		46				3/4	
		48				1	
						Diaphragm	
			1			316SS	
			2			Hastelloy C	
						Flush Connection	
				0		None	
				2		1/4	
						Fill	
					0	No Fill	
					G	Glycerine	
					S	Silicone	

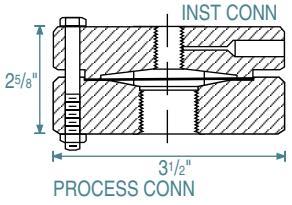
Model 14000

Diaphragm Seal

Description

The Model 14000 Diaphragm Seal is a clamped metal design featuring interlocking construction inside of the bolt circle for perfect alignment. The upper and lower housings clamp the diaphragm in place and allow for field servicing. The 14000 is available in threaded connections for pressures vacuum to 2500 PSI. Fill/bleed port screw in the upper is standard and an optional flush connection is available.

Filled and calibrated to gauges only.



Model 14000 Ordering Info

14000							
						Upper Housing	
	12					1/4	Steel
	14					1/2	
	22					1/4	316SS
	24					1/2	
						Lower Housing	
		12				1/4	Steel
		14				1/2	
		16				3/4	
		18				1	
		22				1/4	316SS
		24				1/2	
		26				3/4	
		28				1	
						Diaphragm	
			1			316SS	
			2			Hastelloy C	
			3			Tantalum	
						Flush Connection	
				0		None	
				2		1/4"	
						Bolts and Nuts	
					0	Steel	
					1	Stainless	
						Fill	
					0	No Fill	
					G	Glycerine	
					S	Silicone	

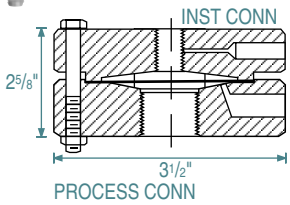
Model 14040

Removable Diaphragm Seal

Description

The Model 14040 Removable Diaphragm Seal is a welded diaphragm-to-upper design allowing the upper housing to be removed with the instrument in place without loosing fill. The same interlocking feature as the 14000 is used to assure alignment of the upper to the lower. Available in threaded connections for pressures vacuum to 2500 PSI. Fill/bleed port screw in the upper is standard and an optional flush connection is available.

Filled and calibrated to gauges only



Model 14040 Ordering Info

14040								
							Upper Housing	
	12						1/4	Steel
	14						1/2	
	22						1/4	316SS
	24						1/2	
							Lower Housing	
		12					1/4	Steel
		14					1/2	
		16					3/4	
		18					1	
		22					1/4	316SS
		24					1/2	
		26					3/4	
		28					1	
							Diaphragm	
			1				316SS	
			2				Hastelloy C	
			3				Tantalum	
							Flush Connection	
				0			None	
				2			1/4	
							Bolts and Nuts	
					0		Steel	
					1		Stainless	
							Fill	
						0	No Fill	
						G	Glycerine	
						S	Silicone	

Hand Held Digital Pressure Indicator

Features

- Converts Pressure Input to LCD Digital Readout
- High Accuracy in Lightweight, Portable Package
- State of the Art Semi-Conductor

Marsh Instruments offers the Handheld Digital Pressure Indicator and Calibrator ideal for calibrating DP cells, I/P's and P/I's. The indicator tests installed instruments and transmitters, verifies operation and settings of valves and switches, detects system leaks, and is used for other testing or maintenance applications.

Specifications

Pneumatic Range

Range: –14.7 to 200 psig; with corresponding inches of water column and inches of mercury

Wetted Material

Brass fitting, silicone wafer diaphragm, suitable for instrument air (clean and dry) or any clean, non-conductive fluid

Pressure Fitting

5/16" quick-connect tube fitting standard, with mating nickel-plated brass locking quick-connector and 8" of 1/4" O.D. plastic tubing.

Display

3-1/2 digit LCD, 1/2" high black numerals on light background, with polarity and low battery indicators

Accuracy

±0.5% of reading ±1 count, must be zeroed at barometric pressure

Temperature

Calibration range: 50°-90°F.
Operating range: 30°-130°F.
Effect of temperature outside calibration range is ±0.01% per degree F

Power

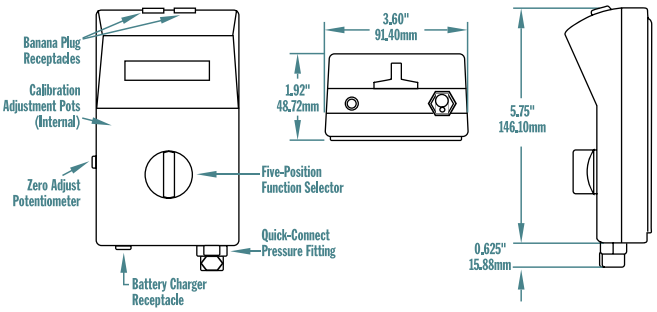
Internal: 9-volt transistor battery
Ni-Cad chargeable. External: 12-volt adapter will power unit or charge battery in approx. 14 hours. Approximate operation is 8-10 hours per charge

Case Size

3.60" wide x 5-3/4" long x 1.92" high, ABS plastic

Includes

Carrying case, battery charger, 8" plastic hose, quick-connect fitting, and technical manual



4-DP Series Master Test Digital Pressure Indicator

Connection	5/16" quick connect tube fitting
Range	
-14.7 to 50psi	4-DPP-20050-BBC
-14.7 to 60psi	4-DP-20060-B3
-14.7 to 200psi	4-DPP-20200-BBC

To Our Customers

Terms and Conditions

Marsh Bellofram Group of Companies is the consolidation of pneumatics, electronics and electrical components for the industrial, process and automation markets. Electro-pneumatic and pneumatic controls, pressure and temperature instruments, digital counters and timers, motor controls and motion control instrumentation make up the main stay of the Companies products. The Groups include Marsh and Marshalltown pressure instruments, Bellofram pneumatic products, Automatic Timing and Controls counters and timers, Diversified Electronics motor protection products, Thermo-Couple Products temperature instruments and our new line of BelGAS oil, gas and industrial products.

Marsh Bellofram is an ISO 9001:2000 firm, we also recognize the importance of quality throughout our entire organization, and constantly strive to deliver value in our product and throughout our whole company.

Remember that orders are accepted via fax or mail:
Sales Fax: 304-387-4417
Mail: Marsh Bellofram, State Route 2, Box 305, Newell, WV 26050

Statement of Warranty

Warranty extends for 18 months from the manufacturing date code to be free of defects in materials and workmanship in normal use. The warranty is limited to repair or replacement of the defective product at the discretion of Bellofram. Products returned for repair under warranty will be guaranteed for the remainder of the warranty period or 90 days which ever is longer. Products returned for repair under non-warranty will be guaranteed for a period of 90 days.

Important Notice

Our Recommendations, if any, for the use of our products are based on tests believed to be reliable. The greatest care is exercised in the selection of raw materials and in our manufacturing operations. However, since the use of this product is beyond the control of the manufacturer, no guarantee or warranty, expressed or implied is made as to such use or effects incidental to such use, handling or possession or results to be obtained, whether in accordance with the directions or claimed so to be. The manufacturer expressly disclaims responsibility therefor. Furthermore, nothing contained herein shall be construed as a recommendation to use any product in conflict with existing laws and/or patents covering any material or use.

Standard Additional Fees

Drop Ship Fee: There is a $10.00 fee per shipment for products shipped to someone other than the Distributor. The exception to this fee is if the product is late and it is Bellofram's error. Remember we can only ship to one address for each factory order per day. Note – cylinders are exempt from this fee.

Expedite Fee: There is a $15.00 fee per factory order line item for this service. This applies to any order that must ship within two business days after receipt of the order. It also applies to accelerate delivery of product on existing order, if the product is available. The Distributor can expedite without charge if the product does not have to ship until the third business day after notification. Note–cylinders are exempt from this fee.

Retesting Fee: There is a $25.00 fee per unit on products returned which successfully test within Quality Control Specifications. For example, if three units came back on an RGA and all three tests within our testing specification there would be a $25.00 per unit fee imposed, for a total of $75.00 for the three units. However, if a unit is returned and does not meet our Quality Control Specifications there will not be a charge for the defective unit. Note: If the product lists for $50.00 or less, the Retesting Fee will be equal to the repair charge which is less than $25.00.

Restocking Fee: On rare occasions Bellofram may authorize a credit return, when this occurs there will be a 25% restocking fee imposed. If Bellofram ships a product in error the fee will be waived. It is important that all communication be written and faxed such as order cancellations, additions, corrects, release date changes (the number release change can be limited). If a product ships and you had canceled it there will not be a restocking fee provided there is a written cancellation request on file.

Handling Fee: A $10.00 handling fee will be imposed on RGA's out of warranty. However, if you decide to pay to have the product repaired this fee would not apply.

Evaluation Fee: For mechanical products, there will be a $25.00 fee per unit if the product is out of warranty. For electro-mechanical, the fee is $25.00 to $75.00 depending on product.

Return Goods Authorization Procedure

Returns can be made for such reasons as defective product, authorized 90-day samples, wrong product shipped, duplicate shipment or warranty repair. Defective product will be confirmed prior to credit being issued.

The following procedure must be adhered to before material can be authorized for return:

1. An RGA number must be issued with all questions answered and information blocks completed. The more information obtained on the RGA will better help Bellofram to correct the problem.
2. The customer is to be notified that the RGA number MUST accompany the package on the outside of the box and on the packing slip.
3. All RGA's are to be shipped to Bellofram freight pre-paid. Freight for duplicate shipments, wrong products and defective product will be issued as credit.
4. All RGA's must be authorized by the Bellofram CS Manager or VP Sales and are valid for only 45 days from issue.

NOTE: All RGA's must have as a minimum the following information before being approved:

- Customer invoice number
- Customer account number
- Customer PO number
- Bellofram system number
- Product catalog number and quantity
- Product description
- Reason for return

let Us Design One for you!

Custom Designed Regulators

- Specialized in meeting OEM Design Requirements
- Forward Flows to 2000 SCFM
- Supply Pressures to 5500 psi / 379.2 BAR
- Vacuum to 600 psi / 41.2 BAR Regulated Output

Contact the Applications Engineers at Marsh Bellofram

800-727-5646 • FAX: (304) 387-4417

Visit Us Online

www.marshbellofram.com

www.marshbellofram.com/PCD

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