

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



Transducers

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).



Type 1000
Transducers



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

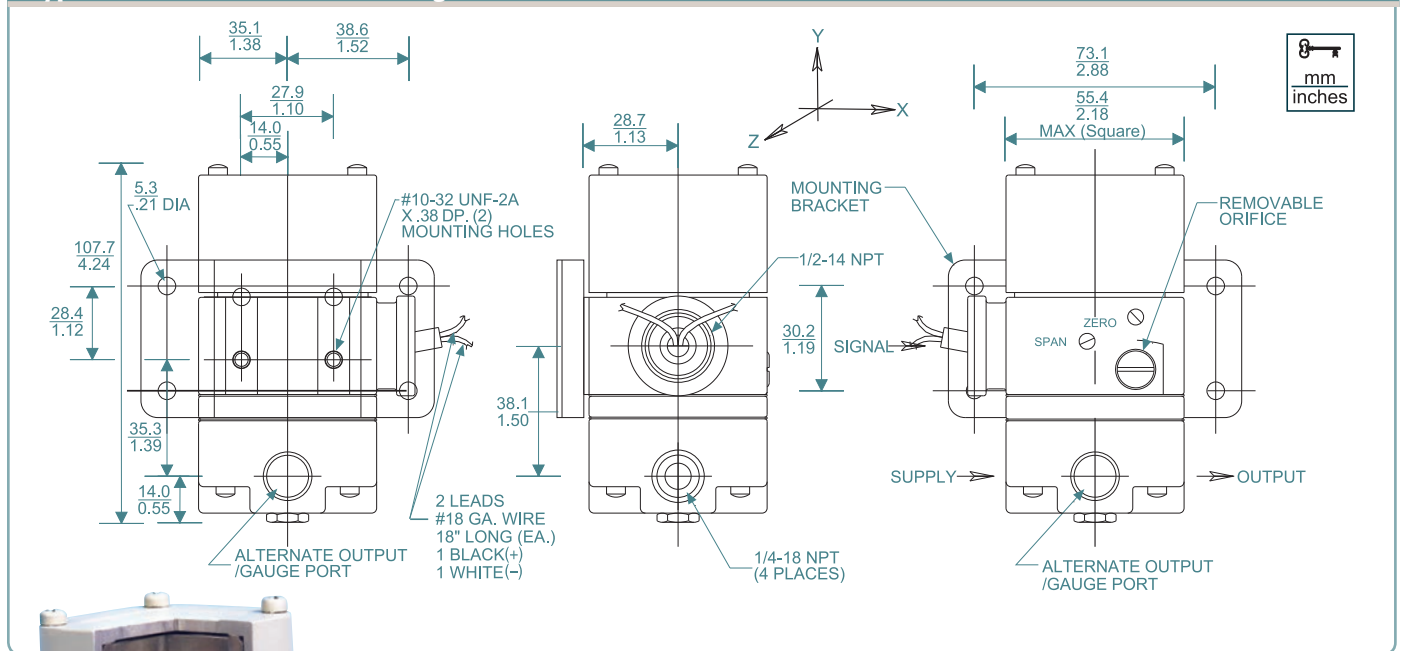
Description

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) 50 PSIG max. for 1-17 psi models	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) (4.5 SCFM for 1-17 psi model)	12 SCFM (339 SLPM)	24 SCFM (677 SLPM) 150 PSIG (10.4 BAR) Supply (12 SCFM for 2-60 psi model)	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	6-13/32 X 5-15/16 X 7-9/16
	mm	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
10-50mA	0.2-1.0	3-15	961-089-000	180 Ω
	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

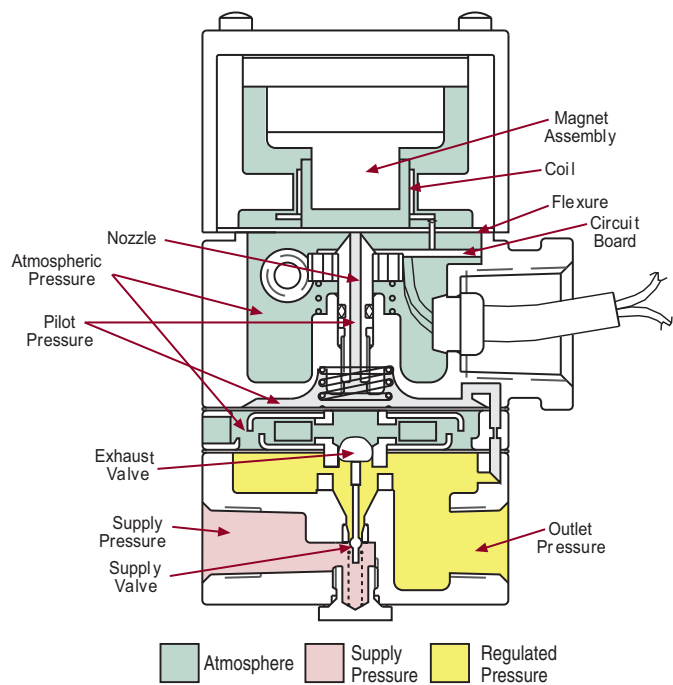
Input	Output*		Part Number	Impedance (Nominal)
	BAR	PSIG		
0-60mA	0.1-8.3	2-120	961-107-000	220 Ω
4-20mA	0.2-8.3	3-120	961-111-000	260 Ω
	0.1-4.1	2-60	961-117-000	225 Ω
0-10V	0.2-8.3	3-120	961-112-000	805 Ω
0-5V	0.1-4.1	2-60	961-118-000	500 Ω

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
10-50mA	0.07-1.2	1-17	961-136-000	250 Ω
	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

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



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.

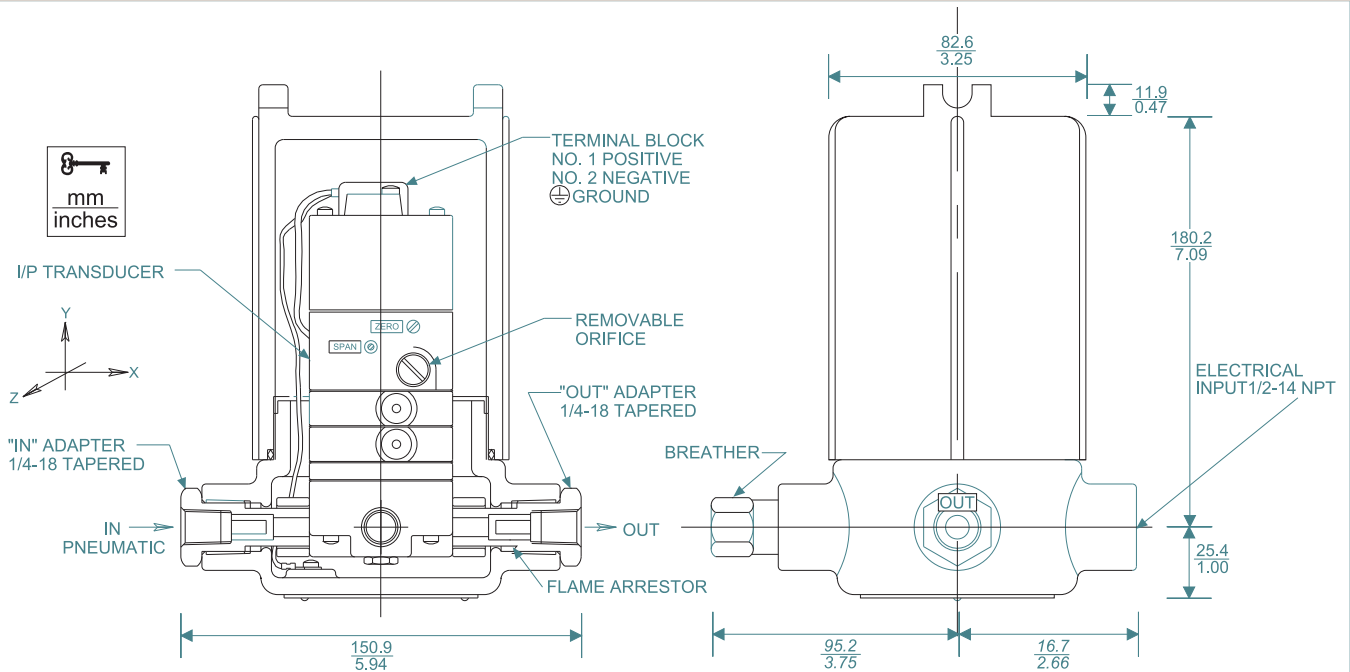
Filter Note

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.

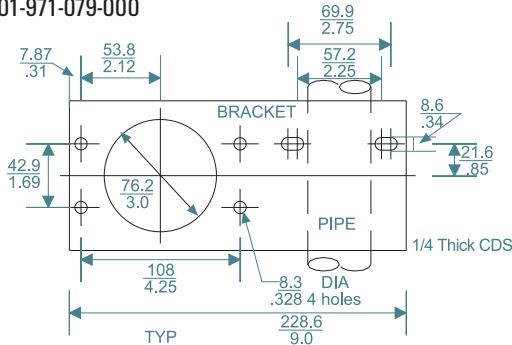
** NEMA 4 type enclosure option available on all input/output ranges. This option is separate from explosion proof, NEMA 4 units.

Type 1000 Explosion Proof Dimensional Drawing;



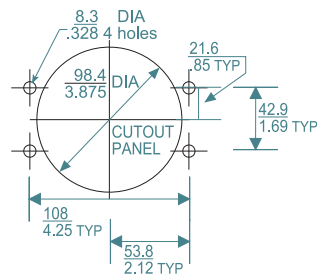
Optional Mounting Bracket & Hardware

Order kit #201-971-079-000



Optional Mounting Hardware

Order Kit #201-971-078-000



Drawings and dimensions are for reference only.

Transducers

Type 1000 Hazardous Location Use Ordering Information

Input	Output*		Part Number	Impedance (Nominal)	Agency Approvals (See notes)
	BAR	PSIG			
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 overshoot 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: $V_{Max} = 28 V$, $I_{Max} = 150 mA$, $C_1 = 0.22 \mu F$, $L_1 = 0$.
 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:



Type 1001
Transducers



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.

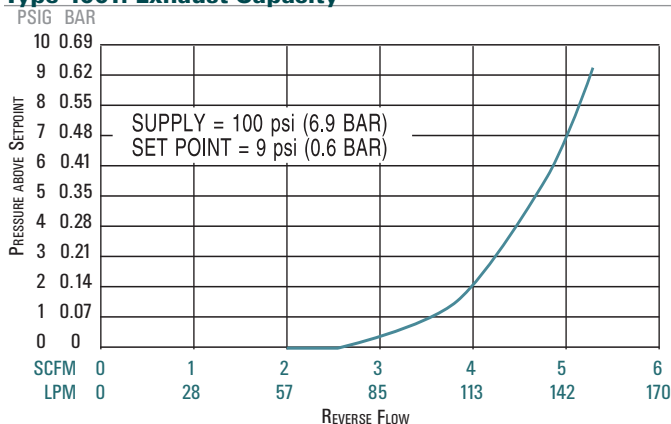
Intrinsically Safe and Non-Incendive Systems - Hazardous Locations:

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.

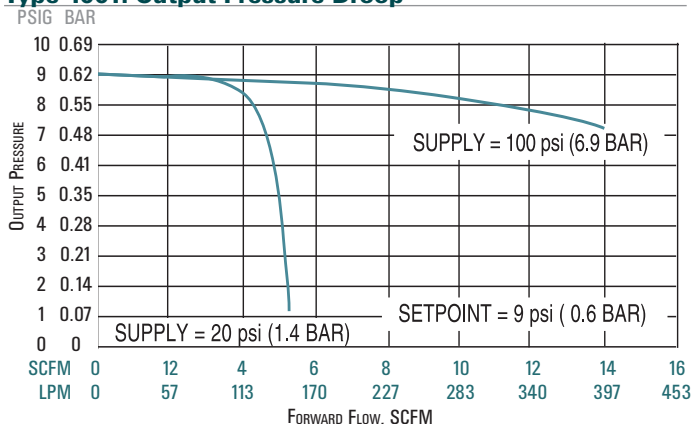
E/P transducer, rated supply 24V dc, 10mA; rated input 0-5, 1-5, 1-9 & 1-10V dc; intrinsically safe when connected through CSA Certified zener barrier devices as per Bellofram Installation Instructions.

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 Drop



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	-20°F to 160°F (-29 to 71°C)
Viton elastomers	0°F to 160°F (-18 to 71°C)
Storage Temperature Range	
Buna-N elastomers	-40°F to 200°F (-40 to 93°C)
Viton elastomers	-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	9 VDC to 28 VDC, less than 20 mA
General Purpose	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
Std./Nitrile Repair Kit	971-122-001
Std./Fluorocarbon Repair Kit	971-122-002
Extended Range/Nitrile Repair Kit	971-122-003
Extended Range/Fluorocarbon Repair Kit	971-122-004
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

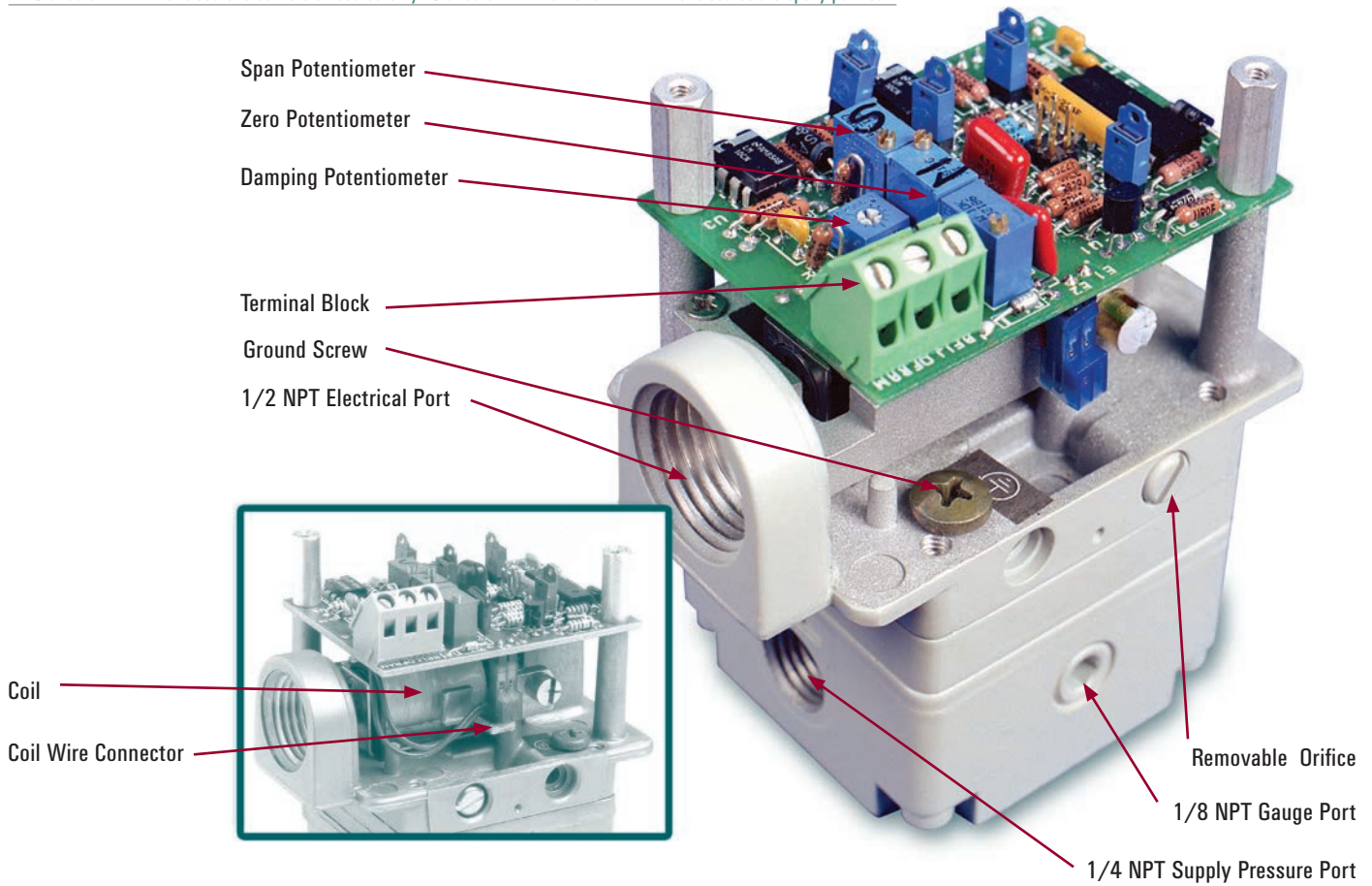
Input	Output	Comments	Part Number
4-20 mA	20-100 kPa	NEMA 1	962-145-000
4-20 mA	20-100 kPa	NEMA 3R	962-146-000
4-20 mA	0-200 kPa	NEMA 1	962-148-000

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	Intrinsically Safe (standard)								
							1	Factory Mutual and CSA Explosion Proof								
								Options								
							00	None								
							06	Fluorocarbon Elastomeric Diaphragm								

Notes to Nomenclature:

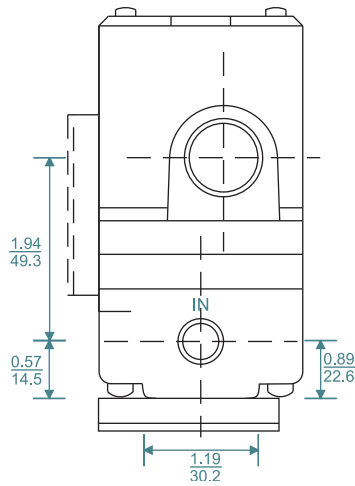
1. Transducer operating in the voltage mode (E/P), can be adjusted with the "span" potentiometer for any input between 0-10 VDC. The input range is limited to a minimum 4VDC difference between 100% and 0% Input voltage.
2. Standard NEMA 1 enclosure is conversion coated only. Standard NEMA 3R and NEMA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



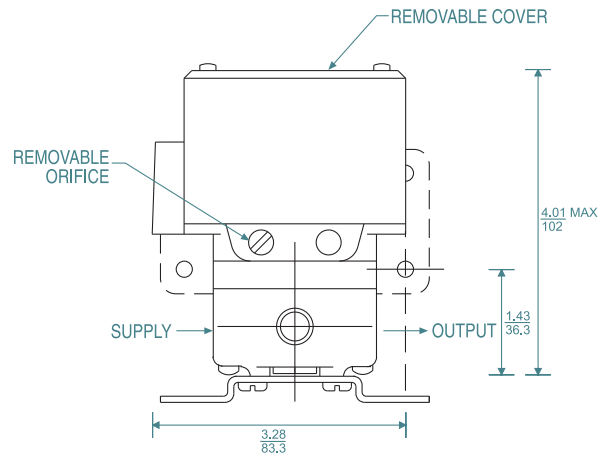
Type 1001 Standard Input/Output Matrix

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

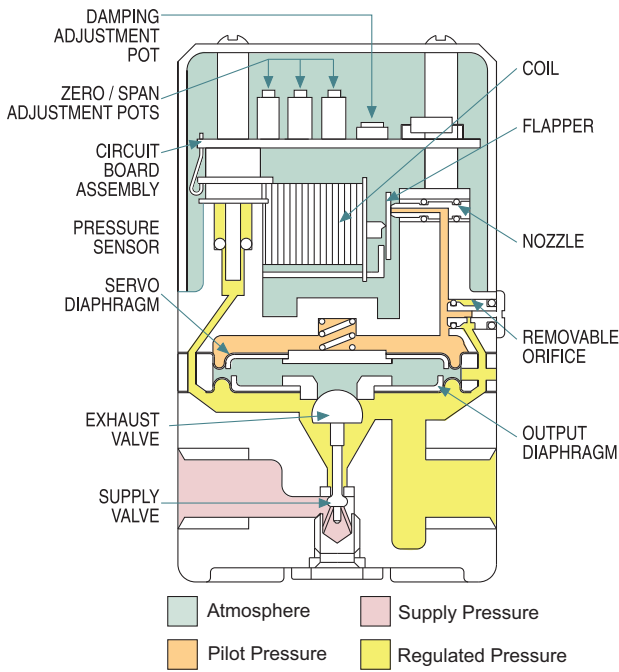
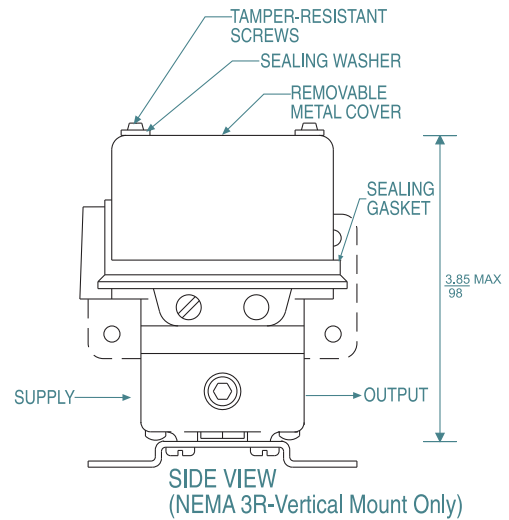
Front View



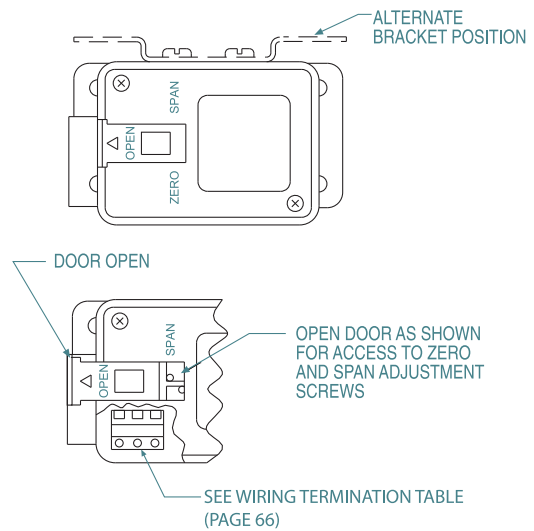
Side View



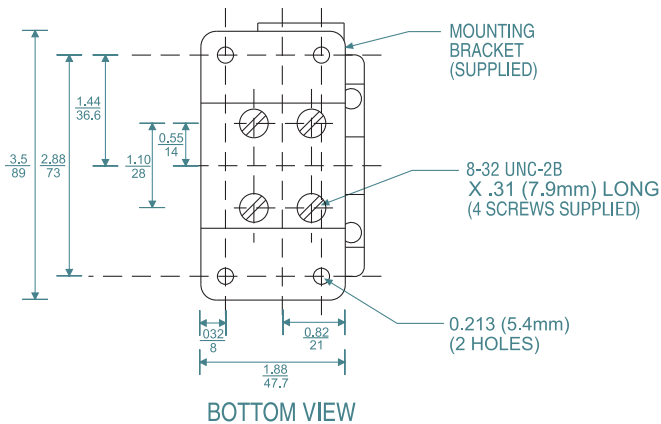
Side View (Vertical Mount Only) NEMA 3R



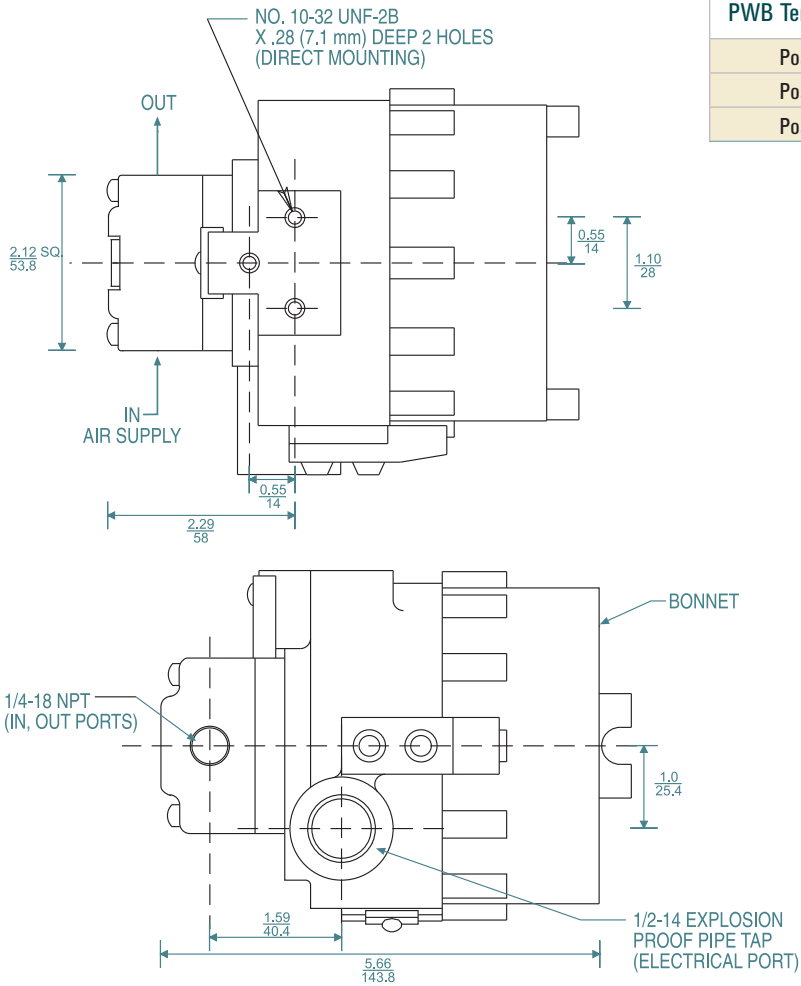
Top View



Bottom View

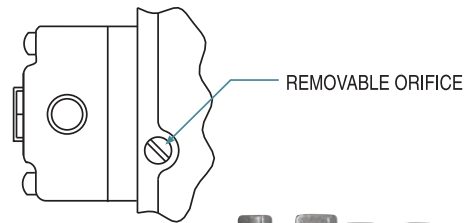


Side Views

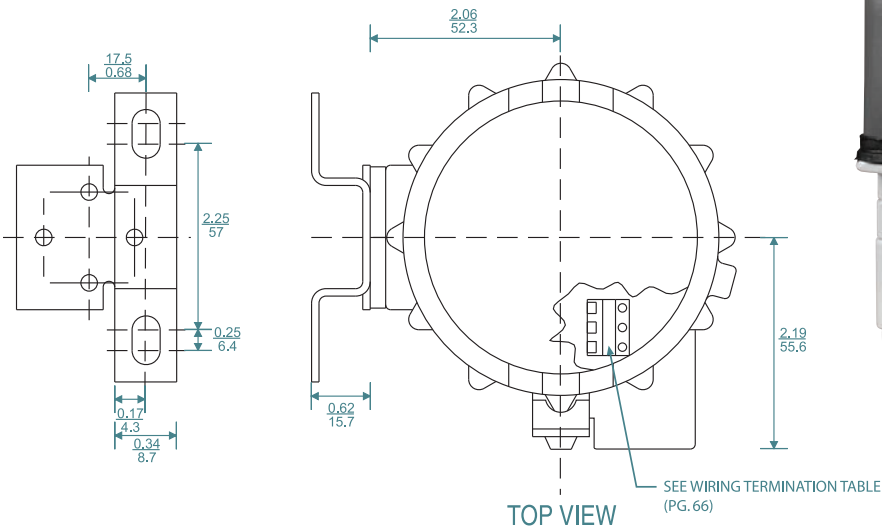


Type 1001 EX Wiring Termination

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



Bottom View



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.



Type 1500
Transducers



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).

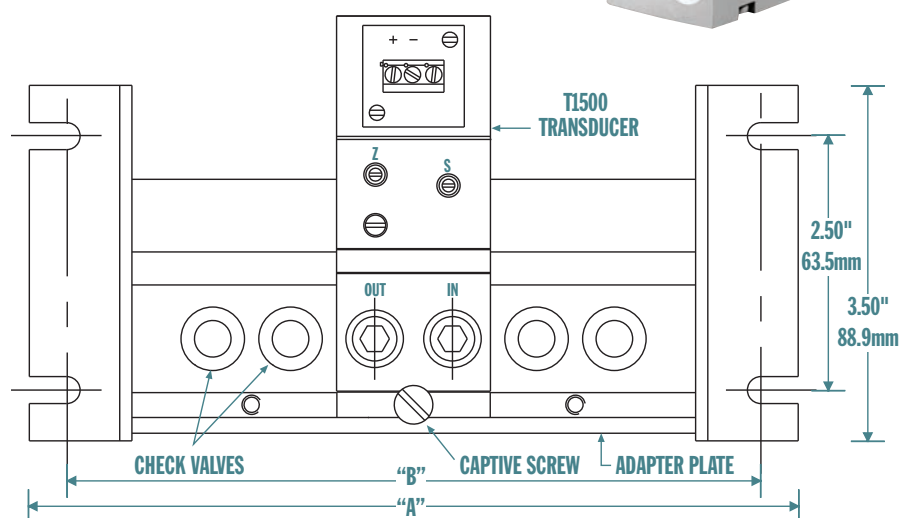


Type 1500 Dimensions

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



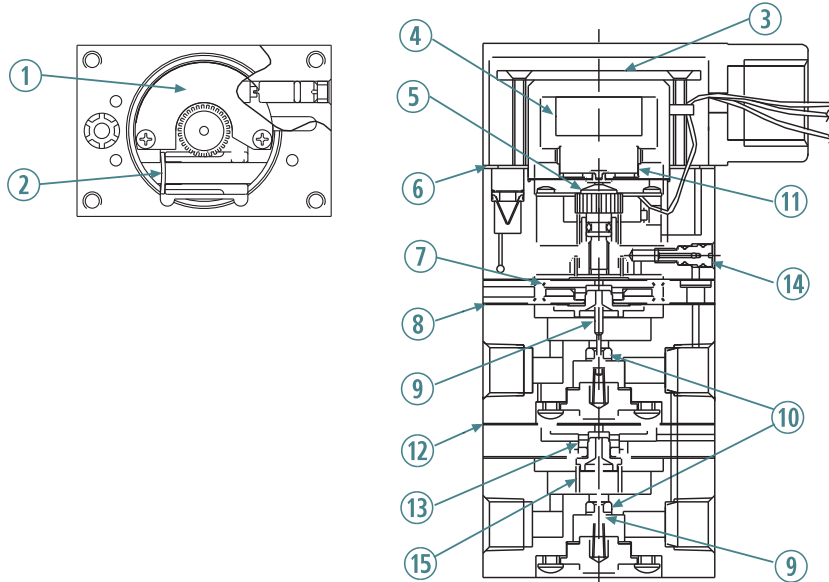
Type 1500 Manifold Ordering Information

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

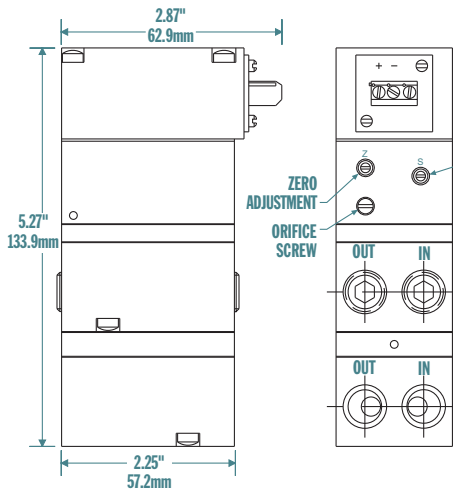
Number	Description
1	Circuit Board
2	Worm Gear
3	Duckbill Valve (NEMA 4X Only)
4	Magnet Assembly
5	Nozzle Assembly
6	Bonnet Gasket (NEMA 4X Only)
7	Servo Diaphragm (I/P Section)
8	Control Diaphragm (I/P Section)
9	Pintle
10	Supply Seat
11	Coil/Flexure Assembly
12	Servo Diaphragm (Bias Relay)
13	Control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

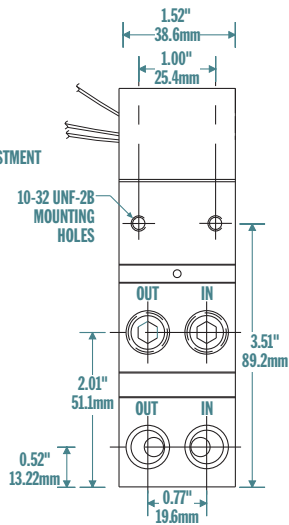


Figure 4 - Hirschmann® (DIN 43 650-A)

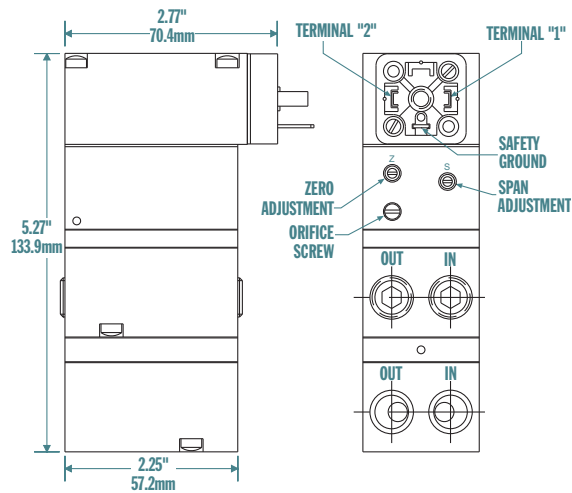
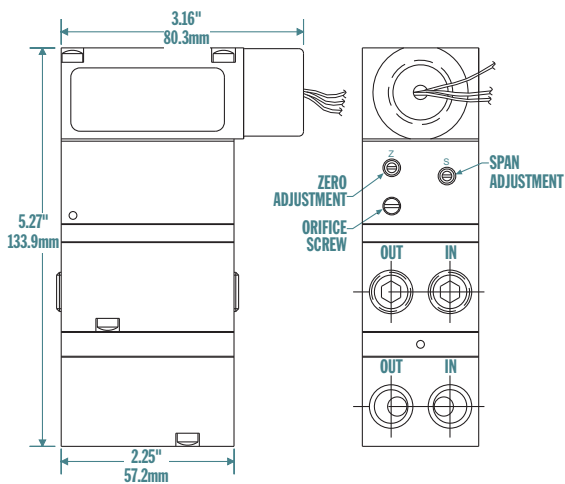


FIGURE 5: 1/2 NPT / BSPT

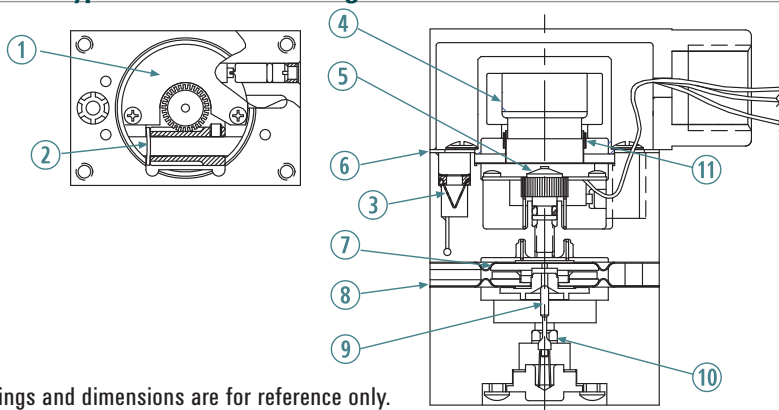


Drawings and dimensions are for reference only.

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

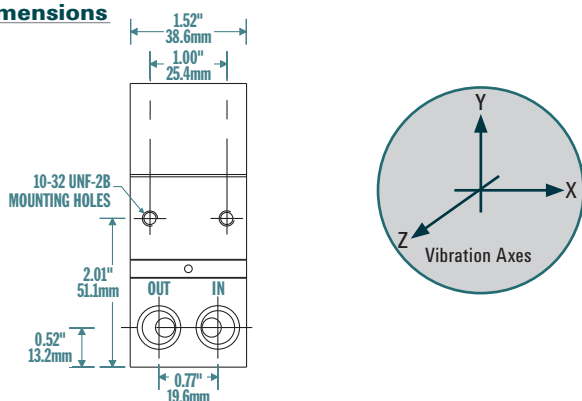


FIGURE 8: 1/2 NPT / BSPT

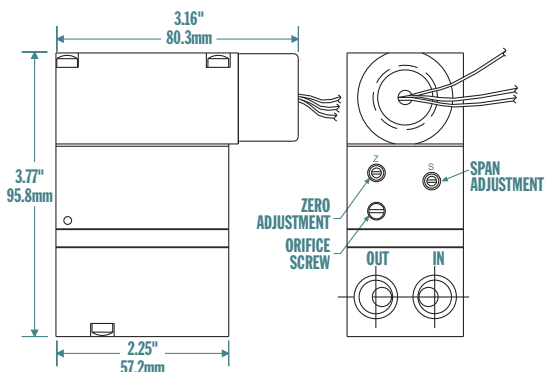


Figure 7: Terminal Block

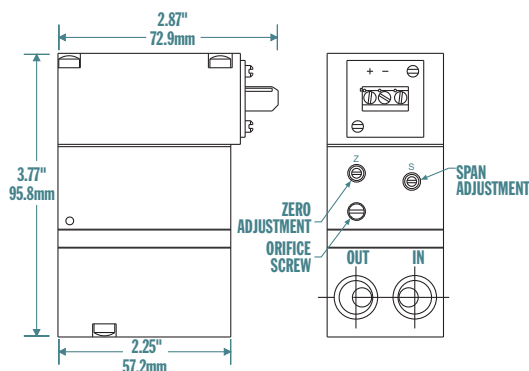
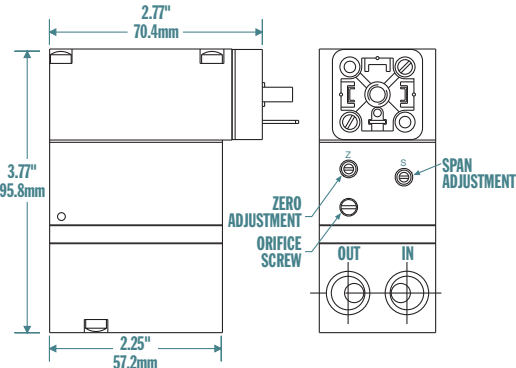


Figure 9: Hirschmann® (DIN 43 650-A)



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, $C_i = 0$ μ F, $L_i = 0$ 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 $V_{Max} = 30$ V dc, $I_{Max} = 100$ mA. 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: $V_{Max} = 30$ V dc, $I_{Max} = 100$ mA, $C_i = 0$, $L_i = 0$. 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: $V_{Max} = 30$ V, $P_i = 1$ W, $I_i = 100$ mA, $R_{eq} = 180$ OHMS, $C_i = 0$, $L_i = 24$ mH

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.



Note

The combined adjustments of Gain, Zero and Span are all interactive. It may take several adjustment attempts to accomplish final desired setting.

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.

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 on-board 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

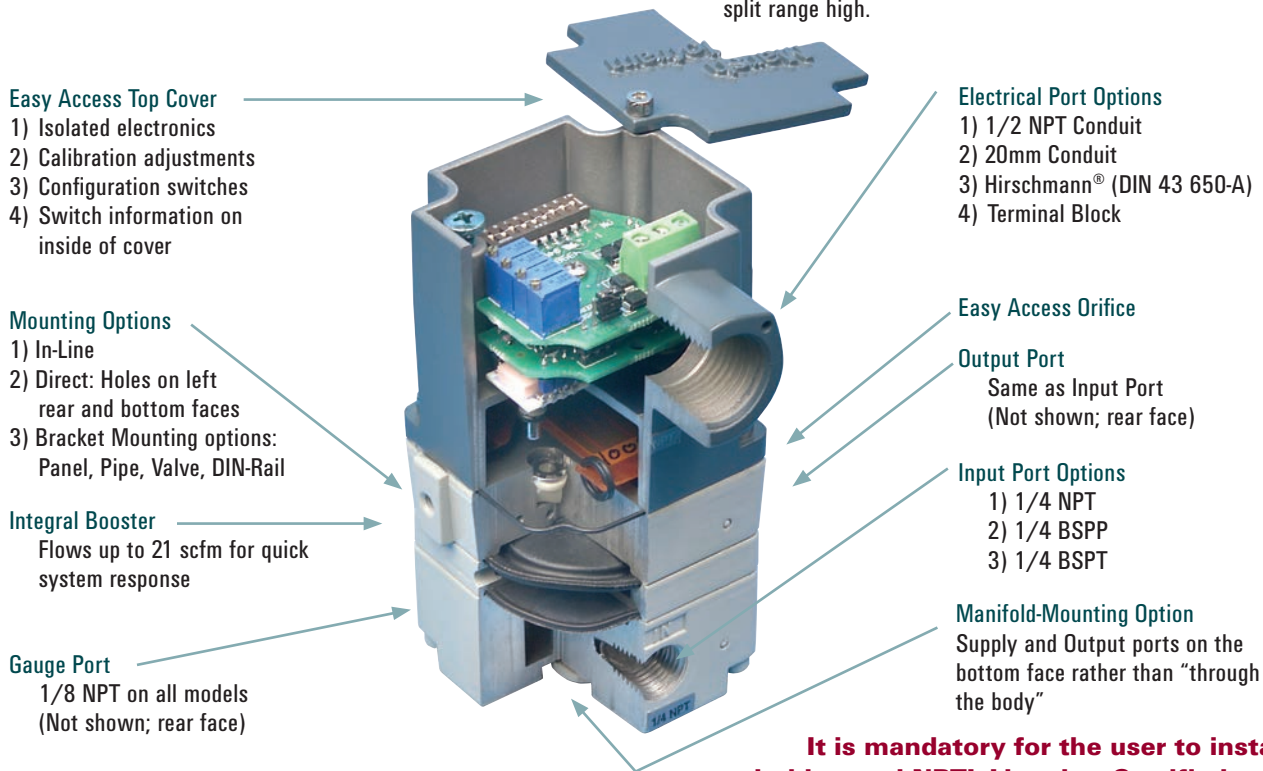
Onboard switches allow the user to easily reconfigure the Type 2000 for any of several electrical inputs, direct/reverse acting, or output split-ranging high/low. Fine tuning of the unit's calibration may be necessary after a reconfiguration.

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.



It is mandatory for the user to install a suitably rated NRTL Listed or Certified conduit seal

Agency Approvals - Applies only to units ordered with approvals

Factory Mutual

E Model with F approval, Explosion Proof/Intrinsically Safe

Not for use with natural gas or other Non-Inert Gases

Explosion Proof: Class I, Div 1, Groups A, B, C & D; T6, Ta = 60 °C

Dust-Ignition Proof: Classes II & III, Div 1, Groups E, F & G; T6, Ta = 60 °C

TYPE 4X, IP 66

Intrinsically Safe: Class I, II & III, Div 1, Groups A, B, C, D, E, F & G; T4, Ta = 60 °C; TYPE 4X, IP 66

Non-Incendive: Class I, Div 2, Groups A, B, C & D; T4, Ta=60 °C

Suitable: Class II, Div 2, Groups F & G; T4, Ta = 60 °C

Suitable: Class III, Div 2; T4, Ta = 60 °C

Type 4X, IP 66

Entity Parameters:

I/P: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1W$, $Ci=0$, $Li=0$

E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75\text{ W}$, $Ci=0$, $Li=0$

E Model with G approval, Explosion Proof, United States and Canada

For use with natural gas or other non-inert gases as a process medium up to a maximum input pressure of 140 PSI when installed with suitable NRTL listed, certified or approved conduit seal installed at the enclosure.

Explosion Proof: Class I, Div 1, Groups A, B, C & D, T6 Ta = 60 °C

Dust-Ignition Proof: Classes II&III, Div 1, Groups E, F & G, T6 Ta = 60 °C

NEMA 4X, IP 66

S Model, Intrinsically Safe

Intrinsically Safe: Class I, II & III, Div 1,

Groups A, B, C, D, E, F & G, T4 Ta = 60 °C;

Non-Incendive: Class I, Div 2, Groups A, B, C & D, T4 Ta=60 °C

Suitable: Class II, Div 2, Groups F & G, T4 Ta=60 °C

Suitable: Class III, Div 2, T4 Ta=60 °C

Type 4X, IP 66

Entity Parameters:

I/P: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1W$, $Ci=0$, $Li=0$

E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75\text{ W}$, $Ci=0$, $Li=0$

S Model with Terminal Block, Intrinsically Safe

Intrinsically Safe: Class I, Div 1, Groups A, B, C, D; T4, Ta = 60 °C;

Non-Incendive: Class I, Div 2, Groups A, B, C & D; T4, Ta=60 °C

Entity Parameters:

I/P: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1W$, $Ci=0$, $Li=0$

E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75\text{ W}$, $Ci=0$, $Li=0$

CANADIAN STANDARD ASSOCIATION

E Model with F approval, Explosion Proof/Intrinsically Safe, Certified to Two Standards.

Certified to CLASS 2258 04 PROCESS CONTROL EQUIPMENT

Class I, Div 1 & 2, Groups A, B, C, D; Class II, Div 1, Groups E, F and G; Div 2, Groups F and G; Class III.

Rated: 28Vdc, 8mA, T6; Enclosure TYPE 4X, IP66; Max Ambient Temperature 60 °C.

Entity Parameters:

I/P: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1.0W$, $Ci=0\mu F$

E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75W$, $Ci=0\mu F$, $Li=0\mu H$

Certified to CLASS 2258 02 PROCESS CONTROL EQUIPMENT

Class I, Div 1 & 2, Groups A,B,C,D; Class II, Div 1, Groups E, F, G; Div 2, Groups F & G; Class III

Rated: 28Vdc, 8mA, T6; Enclosure TYPE 4X, IP66; Max Ambient Temperature 60 °C.

Entity Parameters:

I/P: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1.0W$, $Ci=0\mu F$, $Li=0\mu H$

E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75W$, $Ci=0\mu F$, $Li=0\mu H$

ATEX (European Model)

INTRINSIC SAFETY: II 1 G EEx ia IIC T4 (-20<Ta<+60) EN 50014: 1997 (A2) EN 50020:1994 EN 500284: 1999

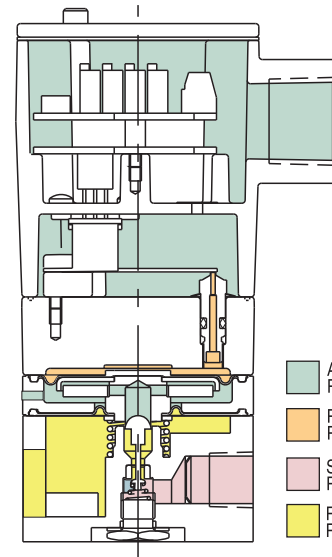
The Bellofram T-2000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate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



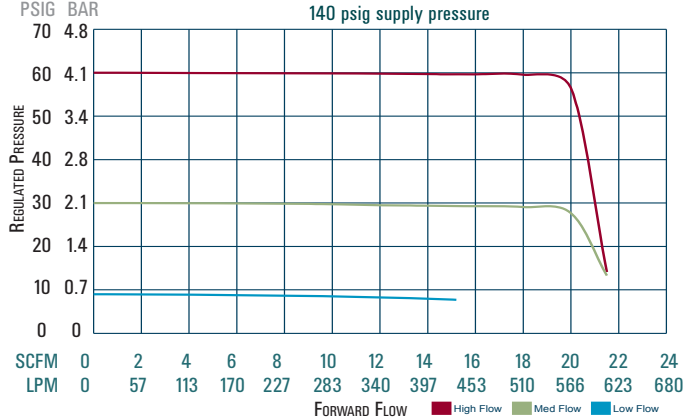
- Atmospheric Pressure
- Pilot Pressure
- Supply Pressure
- Regulated Pressure

Air Quality

- 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

It is mandatory for the user to install a suitably rated NRTL Listed or Certified conduit seal

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
																										Intrinsically Safe
																										Explosion Proof
																										Electrical Port ¹
																										1/2 NPT Conduit
																										20mm Conduit "S" Unit Only
																										Hirschmann ⁵
																										Terminal Block ² "S" Unit Only
																										Pneumatic Ports
																										NPT
																										BSPT
																										BSPP
																										Manifold Mount ³
																										Agency Approval ⁶
																										FM/CSA
																										ATEX "S" Unit Only
																										FM Natural Gas Approved for US and Canada ⁴
																										Electrical Input
																										4-20 mA
																										0-5 V
																										1-5 V
																										1-9 V
																										1-10 V
																										0-10 V
																										Mode
																										Direct Acting
																										Reverse Acting
																										Mode
																										Full Range
																										Split Range High
																										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

It is mandatory for the user to install a suitably rated NRTL Listed or Certified conduit seal

Type 2000 Wiring Connections and Switch Positions

Switch #	1: PSIG	BAR	2	3	4	5	6: psig	BAR	7	8	9
ON	0-5	0-0.3					0-5	0-0.3			
	0-15	0-1.0					0-15	0-1.0			
	3-15	0.2-1.0					1-17	0.07-1.2			
	1-17	0.07-1.2	1-5 VDC	Split Low	Voltage Input (E/P)	Split Low Full	0-30	0-2.1	Reverse Acting	Full	I/P
	0-30	0-2.1	0-5 VDC				0-60	0-4.1			
	3-27	0.2-1.9					0-100	0-6.9			
	6-30	0.4-2.1			0-120	0-8.3					
	0-100	0-6.9									
Switch #	1: PSIG	BAR	2	3	4	5	6: psig	BAR	7	8	9
OFF	0-60	0-4.1	1-9 VDC	Full Split High	Current Input (I/P)	Split High	3-15	0.2-1.0	Direct Acting	Split Low Split High	E/P
	0-120	0-8.3	0-10 VDC				3-27	0.2-1.9			
			4-20 mA				6-30	0.4-2.1			

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			
Electrical Port		S	E	E	
		N	Yes	Yes	Yes
		M	Yes	Yes	Yes
		H	Yes	No	No
		T	Yes	No	

² NEMA 4X / IP66 not available

³ Bottom O-Ring Ports

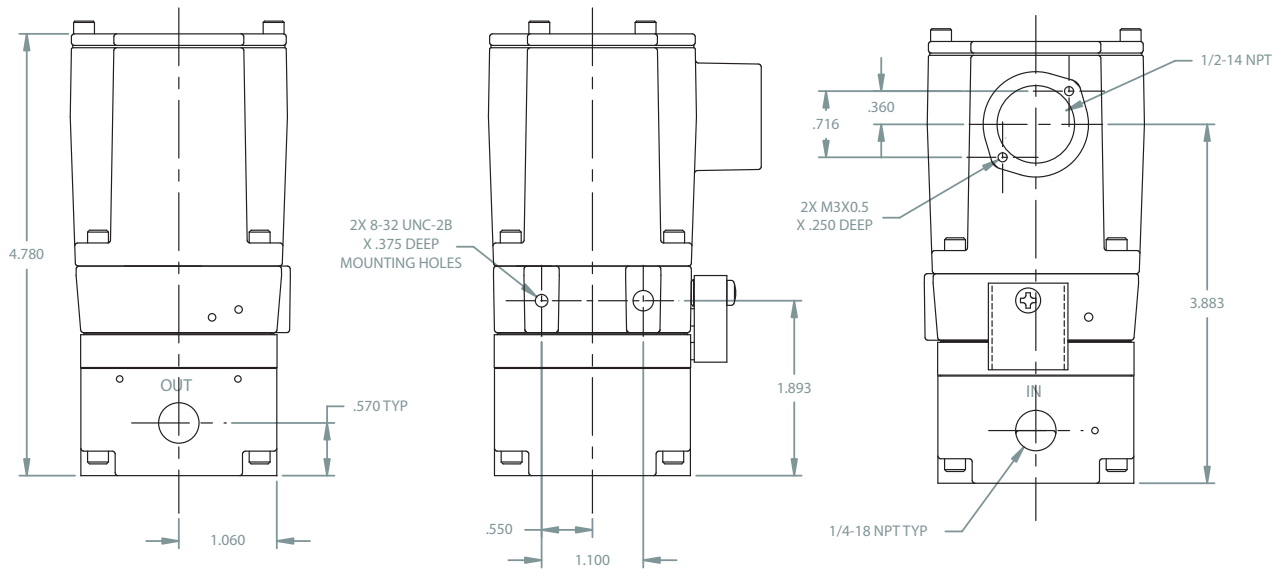
⁴ NRTL listed or certified conduit seal installed by user

⁵ Not Agency Approved

		⁶ Agency Approval		
		F	C	G
Enclosure	S	FM/CSA	ATEX	Gas
	E	Yes	Yes	No
		Yes	No	Yes

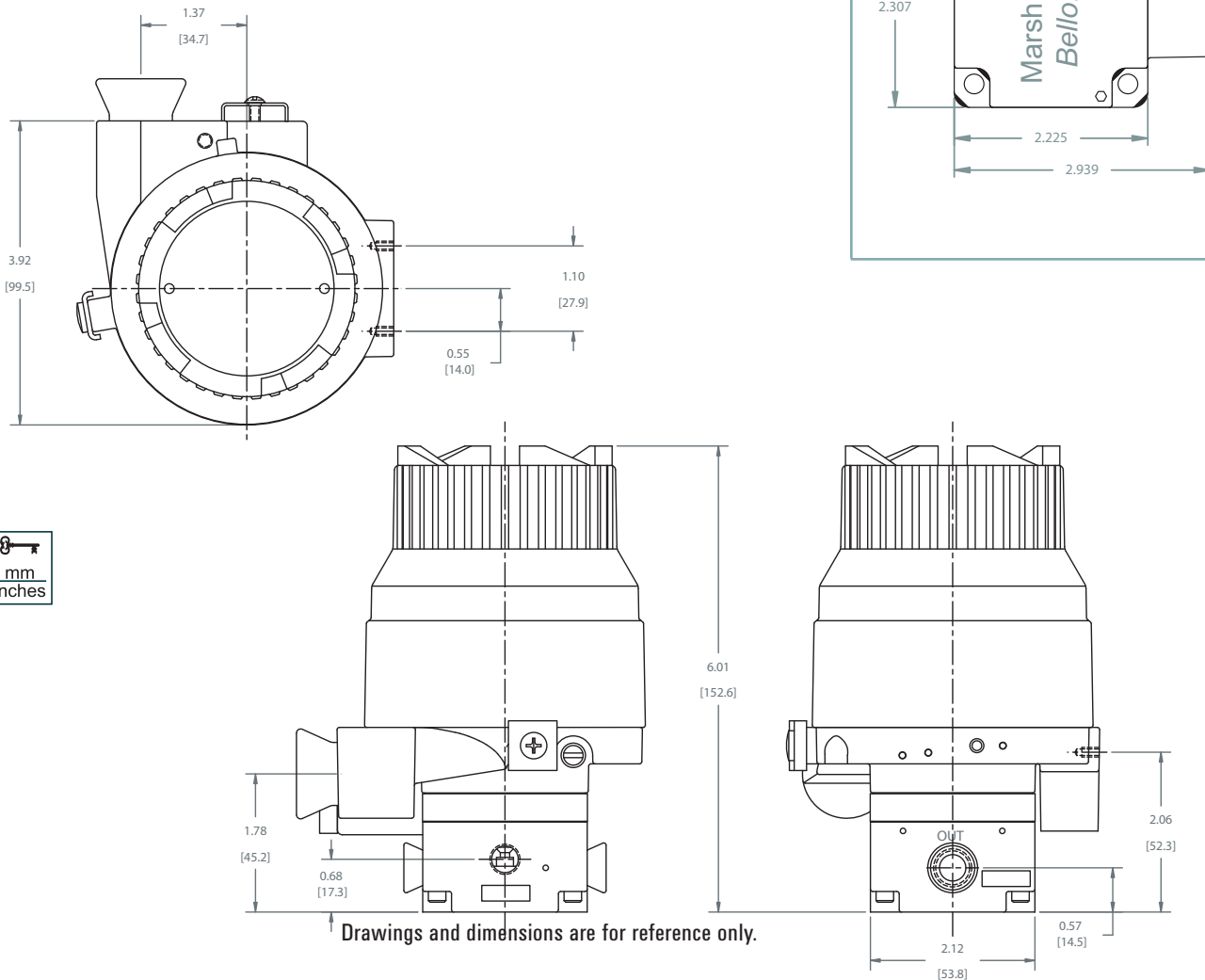
Terminal Block	I/P Transducer	E/P Transducer
S	N/C	+ Signal
+	+ Signal	+ Power Supply
-	- Signal	Common

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.

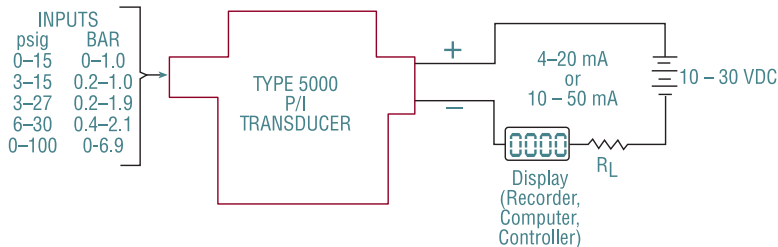
Features

- 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



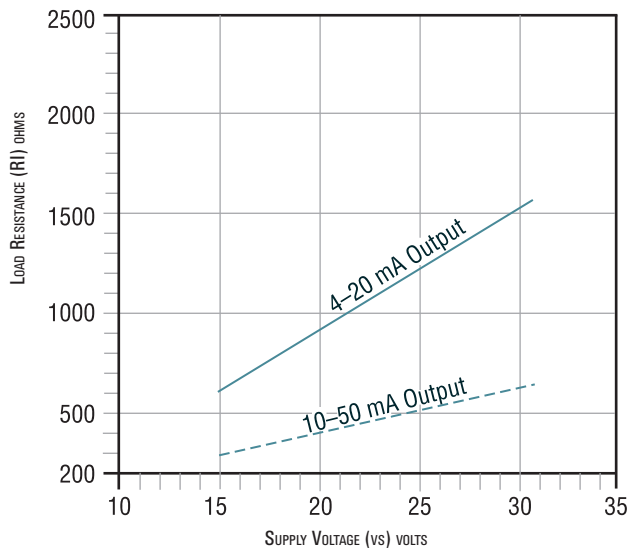
Type 5000
P/I Transducers

Type 5000 Functional Diagram



TYPE 5000: Max Load Resistance VS. Supply Voltage

4-20 mA Output: $R_L = 50 \text{ ohms / volt}$
 10-50 mA Output: $R_L = 20 \text{ ohms / volt}$



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

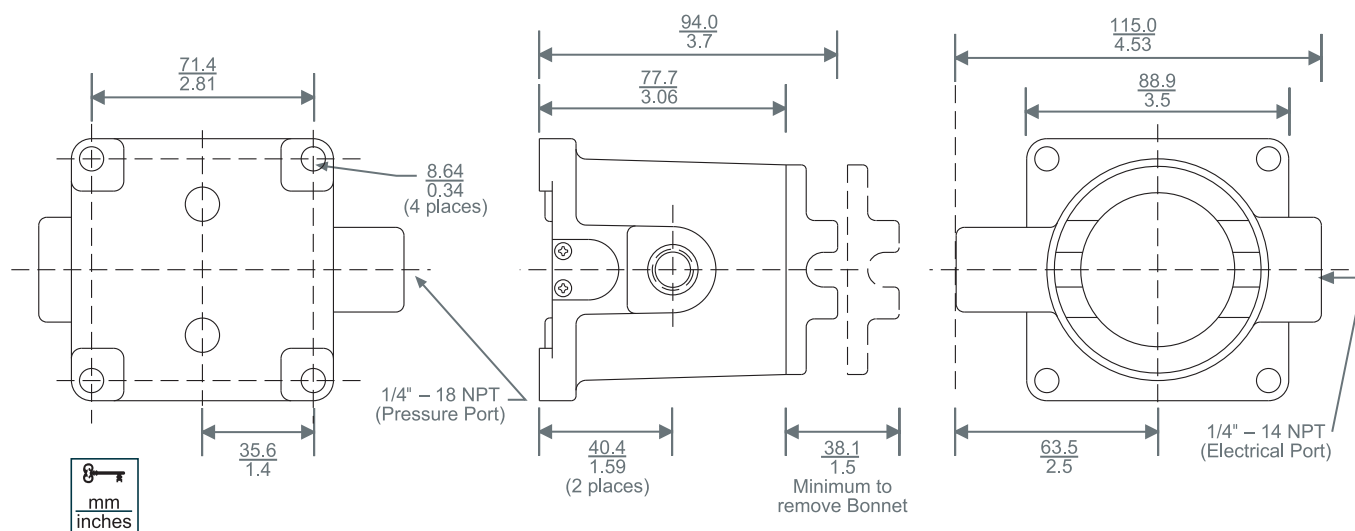
Hazardous Locations:

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
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

