

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

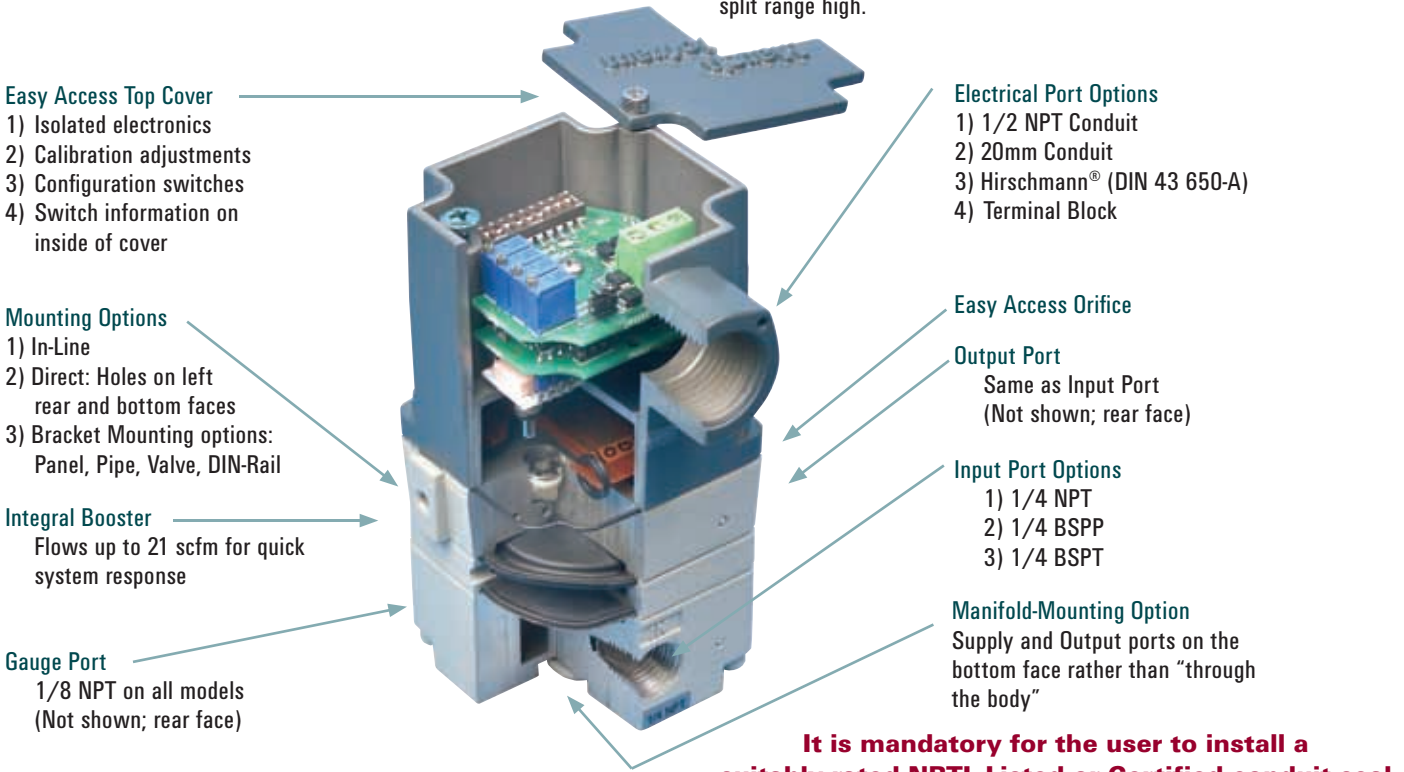
Onboard switches allow the user to easily reconfigure the Type 2000 for any of several electrical inputs, direct/reverse acting, or output split-ranging high/low. Fine tuning of the unit's calibration may be necessary after a reconfiguration.

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.



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"

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: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1.0W$, $Ci=0\mu\text{F}$
E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75W$, $Ci=0\mu\text{F}$, $Li=0\mu\text{H}$

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: $V_{MAX}=30V$, $I_{MAX}=200\text{ mA}$, $P_{MAX}=1.0W$, $Ci=0\mu\text{F}$, $Li=0\mu\text{H}$
E/P: $V_{MAX}=30V$, $I_{MAX}=100\text{ mA}$, $P_{MAX}=0.75W$, $Ci=0\mu\text{F}$, $Li=0\mu\text{H}$

ATEX (European Model)

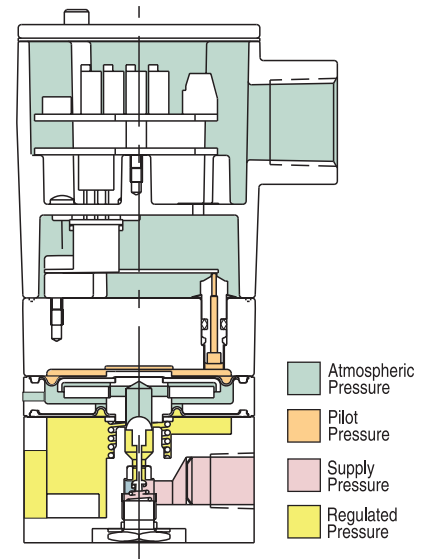
INTRINSIC SAFETY: II 1 G EEx ia IIC T4 (-20<Ta<+60) EN 50014: 1997 (A2) EN 50020:1994 EN 500284: 1999

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.



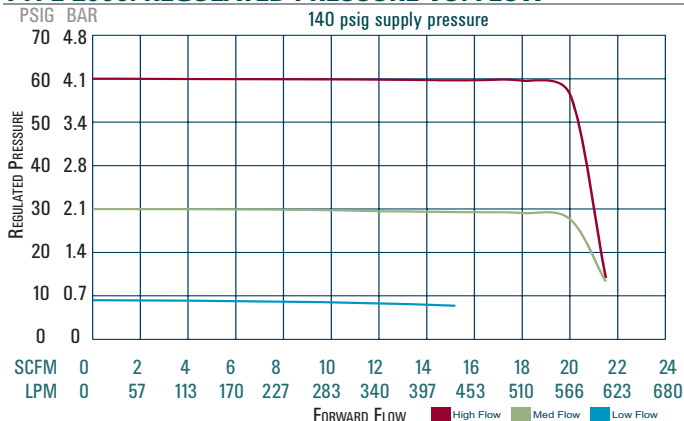
Air Quality

Instrument-quality air consists of:

- A dew point less than 35° F
- No particles larger than three microns
- 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

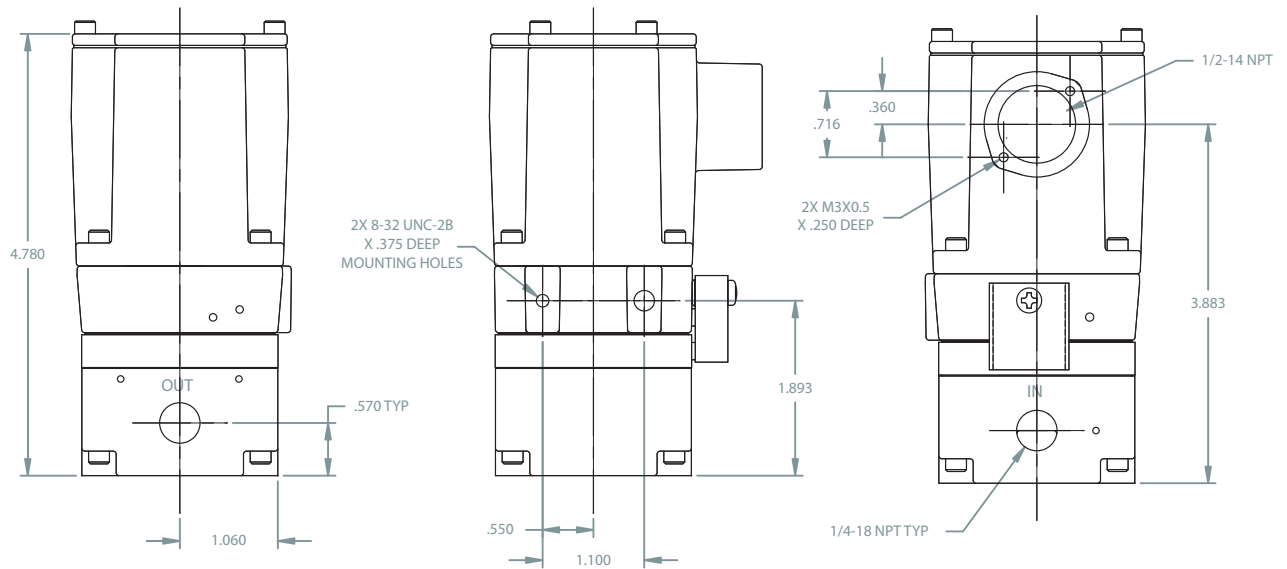


Type 2000 Mounting Options

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

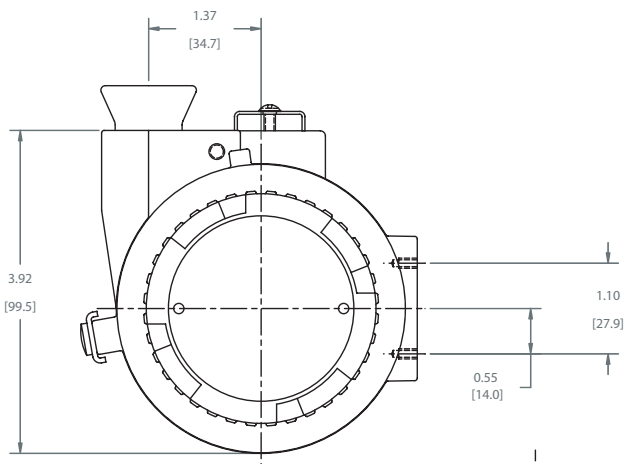
Mounting: The Type 2000 can be mounted in-line, or directly to a panel via mounting holes located in the side and bottom of the unit. In addition, the S model includes a panel-mounting bracket; while the E model includes a valve-mounting bracket. Kits are available for mounting of either model to panel,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

Type 2000 Dimensions

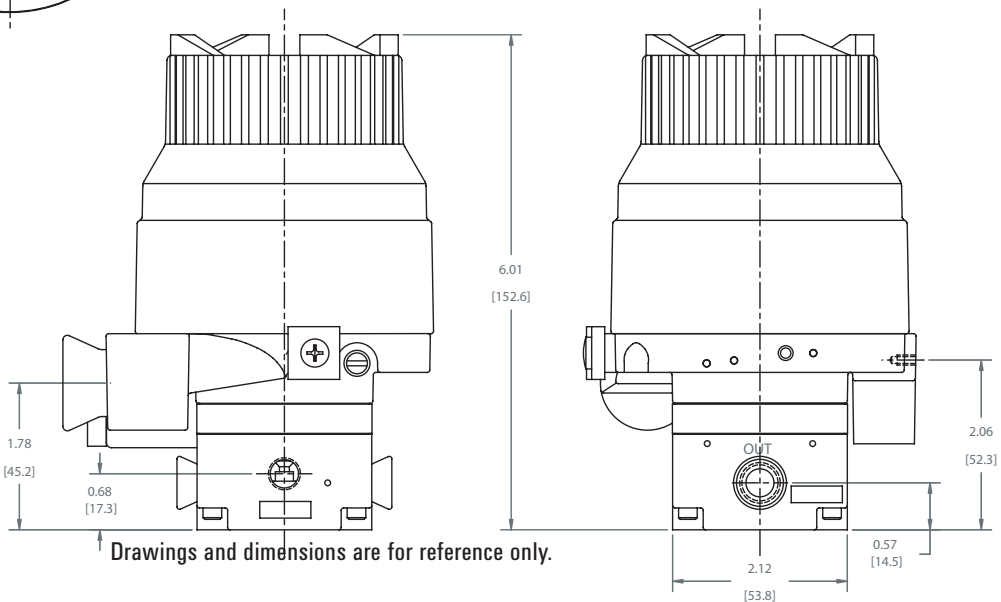
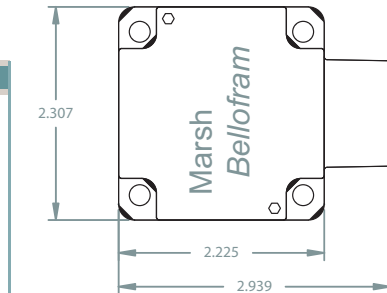


mm
inches

Type 2000 Explosion Proof Dimensions



mm
inches



Drawings and dimensions are for reference only.