MARSH BELLOFRAM®

Type-2000

Electro-Pneumatic I/P & E/P Transducers

Precision Control Devices

ISO 9001:2000 certified

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 electropneumatic 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

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 piezoresistive 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.

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

MARSH BELLOFRAM
The standard in Components, Instrumentation & Controls

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 & 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 & LOW

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

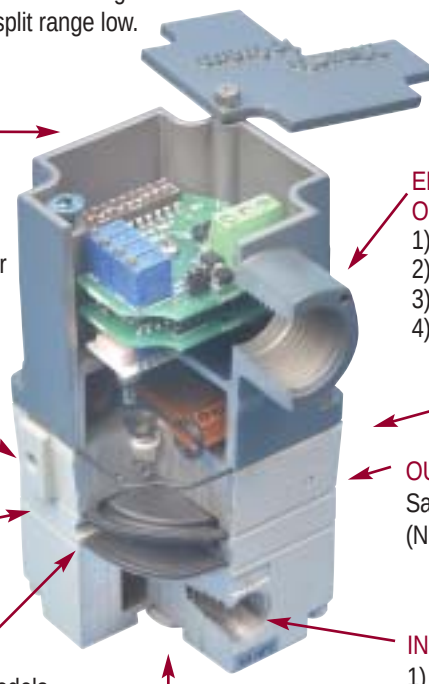
HAZARDOUS AREA & USAGE CLASSIFICATION

INTRINSIC SAFETY: (S Enclosure) Factory Mutual approvals: Class I, II, and III, Divisions 1 and 2, Groups A through G. ATEX Approvals: ⟨Ex⟩ II 1 G EEx ia IIC T4 (-20˚C<Ta<+60˚C)

NEMA 4X / IP66: (Conduit and Hirschmann Connectors only) Water tight, dust tight, and corrosion resistant.

EXPLOSION PROOF: (E Enclosure; N Electrical Port; G Agency Approval) Certified to CSA standards. Class I, Division 1, Groups C and D, T3. Exia IIB Ci=0, Li=0, 24VDC, 25MA. Meets the requirements for CSA Class I Division 1, Group D gas use, including natural gas as the media flowing through the transducer.

CE: (Conduit Connector Only) EN 50081-1 Residential, commercial & light industry; EN-50082-2 Heavy Industrial.



EASY ACCESS TOP COVER
1) Isolated electronics
2) Calibration adjustments
3) Configuration switches
4) Switch information on inside of cover

ELECTRICAL PORT OPTIONS
1) 1/2" NPT Conduit
2) 20mm Conduit
3) Hirschmann (DIN 43 650-A)
4) Terminal Block

MOUNTING OPTIONS
1) In-Line
2) Direct: Holes on left rear and bottom faces
3) Bracket Mounting options: Panel, pipe, valve, DIN-rail

EASY ACCESS ORIFICE

OUTPUT PORT
Same as Input Port
(Not shown; rear face)

INTEGRAL BOOSTER
Flows up to 21 SCFM
for quick system response

GAUGE PORT
1/8" NPT on all models

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"

SPECIFICATIONS

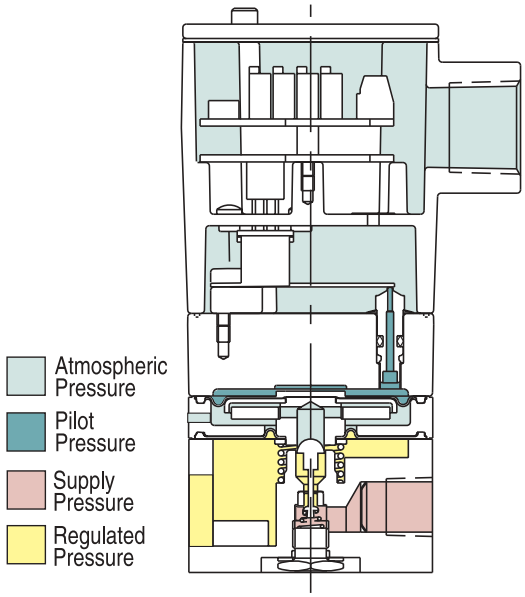
ACCURACY	0.1% of full-scale output typical (0.25% guaranteed); includes effects of hysteresis, dead band, and repeatability
ELECTRICAL	
Inputs	Switch-Selectable 4-20mA. 0-5, 1-5, 1-9, 1-10, or 0-10VDC
Connections	1/2" NPT or 20mm Conduit DIN Hirschmann (S model only) External Terminal Block (S model only)
Power Supply	5-28VDC (with voltage inputs only)
Direct/Reverse Acting	Switch-Selectable
PNEUMATIC	
Outputs	0-2, 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	From 5 psi (0.3 BAR) above output, up to 140 psi (9.7 BAR) maximum (20 psi [1.4 BAR] minimum)
Split-Ranging	Switch-Selectable, Full-Range or Split-Range High or Split-Range Low
Consumption	4 scfh maximum (1.9 LPM)
Flow Capacity	(see table below)
Exhaust Capacity	3 SCFM (85 LPM) @ 5 psig (0.3 BAR) above setpoint (0-15 psig range unit set at mid range)

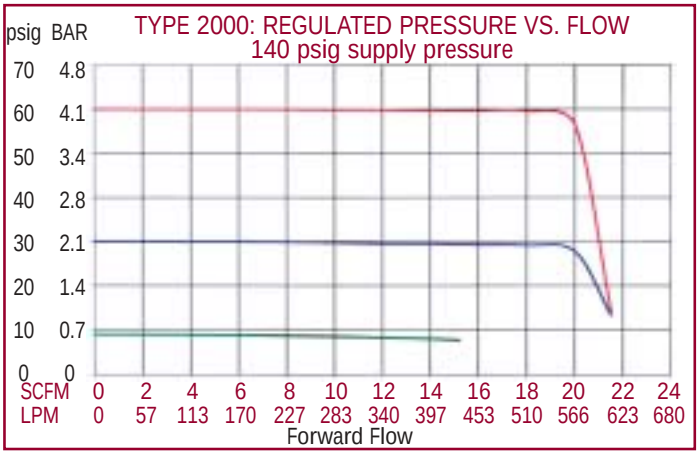
RANGE		SENSOR		FLOW	
psig	BAR	psig	BAR	scfm	LPM
0-2	0-0.1	2	0.1	4	113
0-5	0-0.3	5	0.3	11	312
0-15	0-1.0	15	1.0	19	538
3-15	0.2-1.0	15	1.0	19	538
1-17	0.07-1.2	15	1.0	19	538
0-30	0-2.1	30	2.1	21	595
3-27	0.2-1.9	30	2.1	21	595
6-30	0.4-2.1	30	2.1	21	595
0-60	0-4.1	50	3.5	21	595
0-100	0-6.9	100	6.9	21	595
0-120	0-8.3	100	6.9	21	595

(Typical Flow @ 140 psi (9.7 BAR) in and maximum out)

STABILITY	
Supply Voltage Effect	None
Supply Pressure Effect	None
Vibration Effect	<1%FS (+/-1G; 5-1000Hz)
Temperature Effect	0.02%FS/˚F (-40˚ to 180˚F [-40˚ to 82˚C])
Mounting Position Effect	None
RFI/EMI	CE-compliant
Storage Temperature	-40˚ to 200˚F (-40˚ to 93˚C)

TYPE 2000
EXPLOSION PROOF





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)

ORDERING INFORMATION

Series: 2K - Model: [ ][ ][ ][ ] - Electrical Input: [ ][ ][ ] Pneumatic Output: [ ][ ][ ][ ] - Specials: 00

Enclosure
- S = Intrinsically Safe
- E = Explosion Proof

Electrical Port [1]
- N = 1/2" NPT Conduit
- M = 20mm Conduit
- H = Hirschmann
- T = Terminal Block [2]

Pneumatic Ports
- N = NPT
- T = BSPT
- P = BSPP
- M = Manifold Mount [3]

Agency Approval
- F = FM/CSA
- C = ATEX
- G = Certified to CSA Standards [4]
- N = None

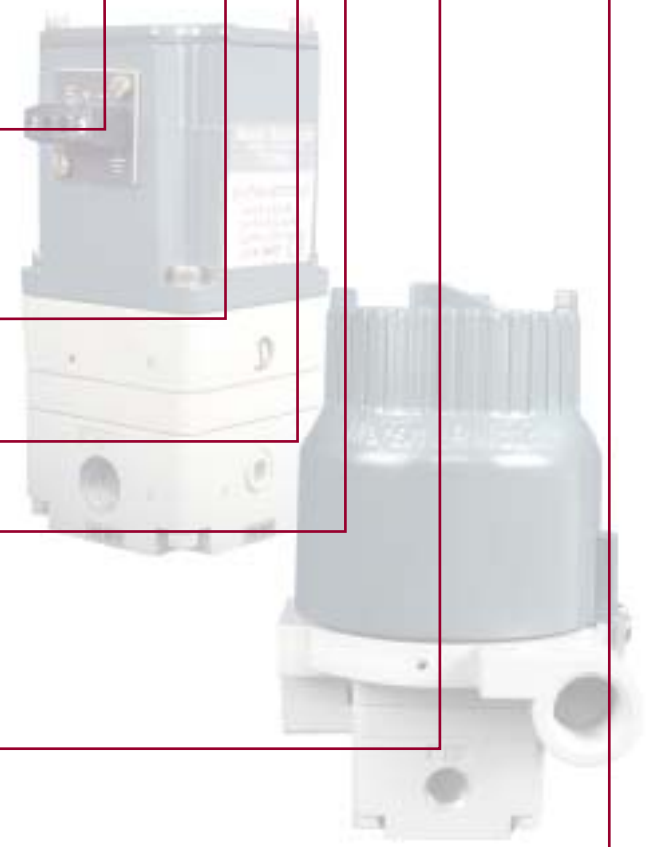
- 42 = 4-20 mA
- 05 = 0-5 V
- 15 = 1-5 V
- 19 = 1-9 V
- 11 = 1-10 V
- 01 = 0-10 V

- D = Direct Acting
- R = Reverse Acting

- F = Full Range
- H = Split Range High
- L = Split Range Low

002	0-2 psig	0-0.1 BAR
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

- 00 = None



ACCESSORIES

	P/N
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
Filter Kit, Coalescing, 0.1 microns	010-140-000
Filter Element Kit (for coalescing filter, package of 10)	010-141-000
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

NOTES:

[1]Availability Matrix		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]Including Natural Gas Use (E Enclosure; N Electrical Port)

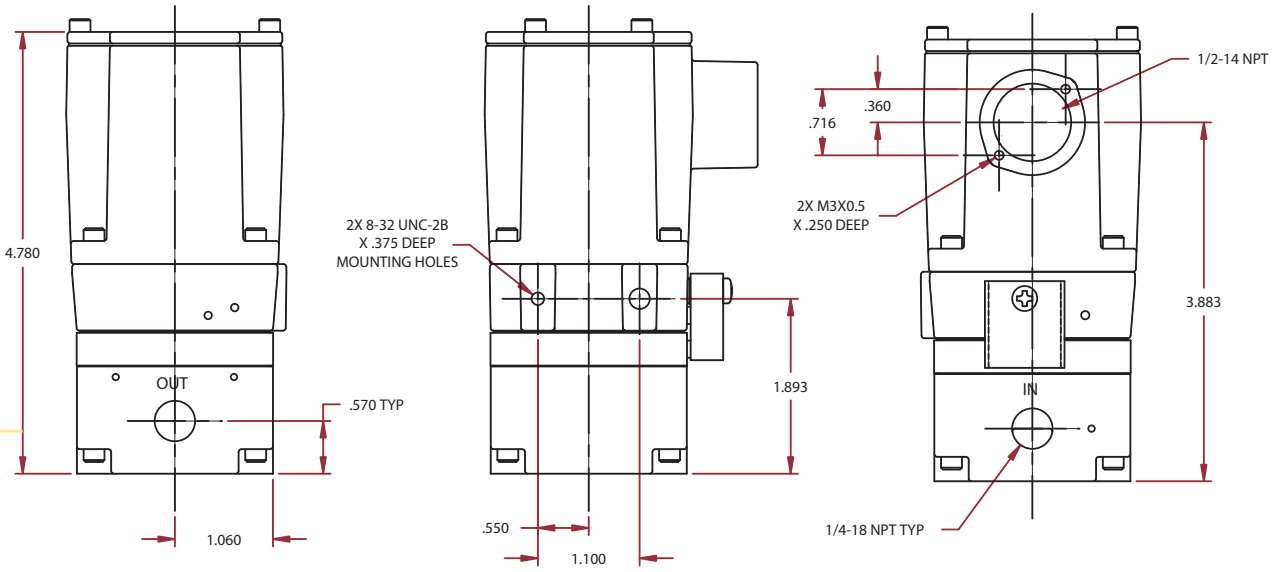
TYPE 2000 SPECIFICATIONS

WIRING CONNECTIONS AND SWITCH POSITIONS

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

Switch #	1: psig	BAR	2	3	4	5	6: psig	BAR	7	8	9
ON	0-2 0-15 3-15 1-17 0-30 3-27 6-30 0-100	0-0.3 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)	Full Split Low	0-2 0-15 1-17 0-30 0-60 0-100 0-120	0-0.3 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 1-10 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

T-2000 DIMENSIONAL DRAWINGS



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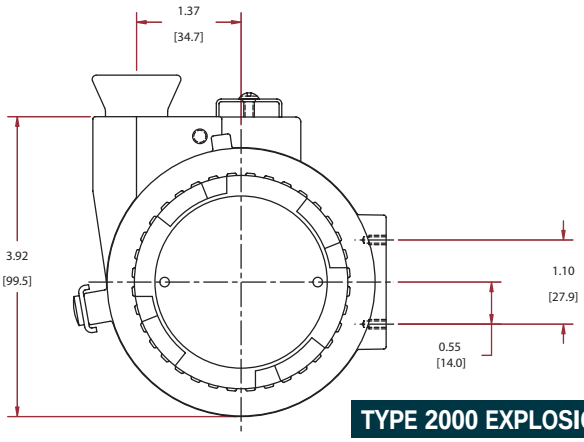
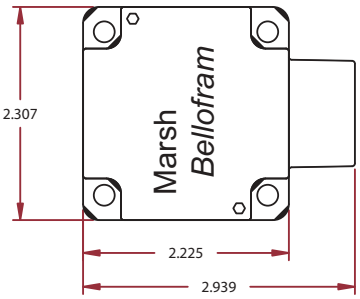
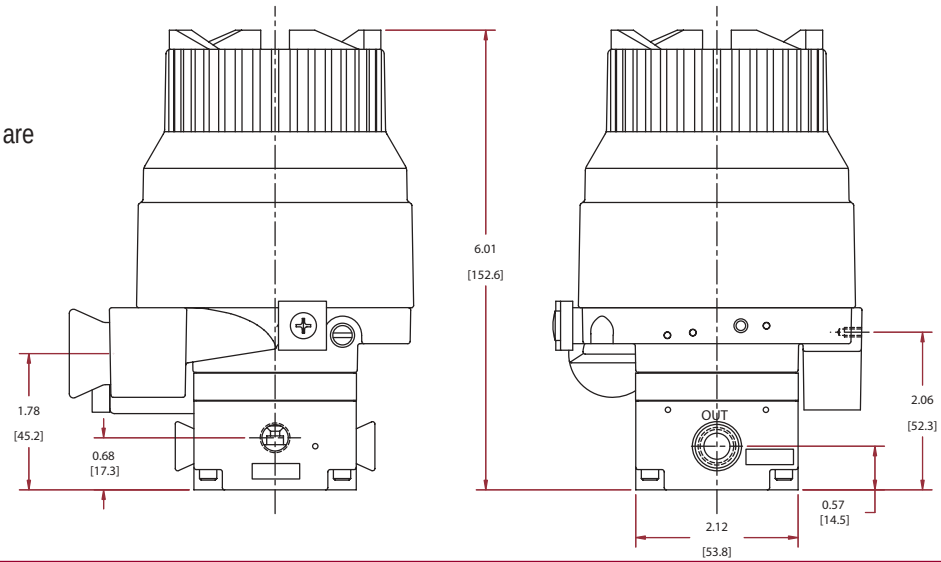




TYPE 2000 EXPLOSION PROOF



Drawings and dimensions are for reference only.

mm
inches

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