Installation and Operating Instructions for HPO Precision Pressure Transducer

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Tel: 203-378-8281, Fax: 203-385-0357, www.ashcroft.com

I&M002-10038-10_00(250-3129)B_01-28-22

IMPORTANT

Please read the operating and installation instructions thoroughly before using this instrument or attempting any repair work. Installation and operation of this instrument should be performed by a qualified instrumentation engineer or technician only.

This instrument is not field repairable outside of routine zero and span adjustment. Problems which cannot be remedied by following the instructions in this manual should be referred to the manufacturer. Immediate assistance can often be supplied by telephone. Defective components will be repaired or replaced by the manufacturer at his discretion and will be returned to the user by the same mode of shipment. For application assistance or repair service please contact our customer service department at:

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Stratford, CT 06614
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WARRANTY AND LIMITATION OF LIABILITY

All Heise Products and Parts carry a warranty against defective material and workmanship for a period of one (1) year from date of shipment.

A. Seller warrants that its products and parts, when shipped, and its work (including installation, construction and startup), when performed, will meet all applicable specifications and other specific product and work requirements (including those of performance), if any, of this agreement, will be of good quality and will be free from defects in material and workmanship. All claims under this warranty must be made in writing immediately upon discovery and, in any event, within one (1) year from shipment of the applicable item unless Seller specifically assumes installation, construction or start-up responsibility. All claims when Seller specifically assumes installation, construction or startup responsibility, must be made in writing immediately upon discovery and, in any event, within one (1) year from completion of the applicable work by Seller, provided, however all claims must be made in writing no later than eighteen (18) months after shipment. Defective items must be held for Seller's inspection and returned to the original f.o.b. point upon request.

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D. In the event certifications are required, certifications are based on adherence to rigid fabrication, assembly and test procedures during production at our manufacturing facility and attest to the condition of the product at the time of shipment. Any disassembly, modifications, testing, tampering or inadequate storage of products covered by the certifications will void the certifications. Should disassembly or re-setting of this product be necessary, such work must be conducted in the presence of, and under procedures approved by Seller in order to maintain validity of the certifications.

Electronic pressure instruments must be selected in accordance with industry codes and safety practices to avoid the possibility of misuse or misapplication which could result in personal injury or property damage. Personnel responsible for selection and installation should also be familiar with the safety recommendations of ASME B40.1, that apply to elastic pressure elements and their application in general and specific services. ASME B40.1 is available from:

ASME
345 47th Street
New York, NY 10017

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SAFETY PRECAUTIONS

Pressure - Select a range so that the maximum applied pressure will never exceed the upper range limit.

Vibration - Excessive vibration could cause loosening of components resulting in loss of instrument accuracy or failure to provide valid data.

Pulsation - Excessive pressure pulsation could result in fatigue failure of the pressure element.

Temperature - Operation of the instrument in an environment where temperatures are in excess of design ratings may result in loss of accuracy and failure.

Process - Pressure boundary materials must be resistant to the process media. Failure to assure compatibility may result in pressure sensing element deterioration or failure. Instruments used on high pressure gas, or potentially hazardous service, such as oxygen should be carefully selected in accordance with the recommendations of ASME B40.1.

Hazardous Location - Only approved explosion proof or intrinsically safe instruments should be used in hazardous locations.

Electro-Magnetic Interference - Instruments used in locations where EMI/RFI conditions exist may exhibit erroneous performance.

⚠ **WARNING** - THESE INSTRUMENTS ARE NOT EXPLOSION PROOF OR INTRINSICALLY SAFE. POWER LEVELS PRESENT PRECLUDE USE IN HAZARDOUS LOCATIONS.

INSPECTION

Examine the instrument carefully for any visible signs of damage that may have occurred during shipment. In the absence of any damage proceed with installation.

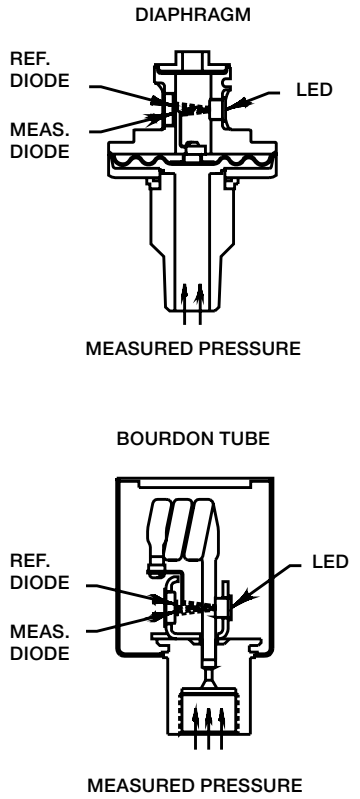
Theory of Operation

The Heise HPO pressure transducer uses an optical means of detecting the effective pressure acting on an elastic member (an Inconel diaphragm up to 250 psi and an Inconel Bourdon tube above 250 psi), therefore, there is no physical contact between the force summing element and the means by which the electrical output signal is produced. This unique sensor design results in extraordinary repeatability and accuracy.

The basic operation of the sensor is simple. The diaphragm or Bourdon tube element moves only 0.020 of an inch during a full span pressure excursion. This small motion combined with the use of high strength materials result in minimum stress levels, well below metal yield points, to assure stability, repeatability, and long sensor life.

Attached to the diaphragm or Bourdon tube is an opaque vane, the movement of which is sensed by an optical system comprised of an LED light source adjacent to a monolithic dual diode package. See figure 1, right.

FIGURE 1. SENSOR CUTAWAY



One diode serves as a reference output and the other as a measuring output. The position of the vane (dependent upon the applied pressure) determines how much of the measuring photodiode's active surface is exposed to the LED light source. The output of the reference diode is used to regulate power supplied to the LED to insure consistent light levels. The measuring diode's output current is converted to voltage which is further processed by the transducer's analog conditioning circuitry to produce the desired voltage or current output.

IMPORTANT - SEALED HOUSING AND VENT INFORMATION

Gauge, Vacuum and Compound Pressure Types
Changes in ambient temperature will affect the pressure of a fixed volume of gas on the order of approximately .03 psi per degree Fahrenheit. Since all units are supplied with a NEMA 4X sealed housing, this may be a significant effect when compared to the instrument's accuracy rating particularly on low pressure ranges.

The standard pigtail connector includes an integral vent tube which prevents pressure changes within the housing from affecting the output signal.

The optional Bendix PTO connector has no provision for a vent tube. A sealed, # 2-56 screw located on the bottom of the housing adjacent to the pressure inlet fitting (see page 10) can be removed to provide ventilation of the housing. Removal of this screw does, however, invalidate the NEMA 4X rating. As an alternative the housing is also available with an optional atmospheric reference port which can be connected to a protected junction box or reference manifold.

Absolute Pressure Types
Absolute pressure instruments employ an evacuated reference chamber integral to the sensor. This design is immune from the effects of pressure changes within the sealed housing and therefore requires no special attention for either type of connector.

PRESSURE CONNECTION

Ranges up to and including 5000 psi are supplied with a 1/4 NPT male pressure fitting. Ranges above 5000 psi are supplied with a 9/16 - 18 UNF female port for 1/4 inch O.D. high pressure tubing.

ELECTRICAL CONNECTION

The unit is provided with either a three foot pigtail (standard) or a Bendix PTO2 (optional) connector as specified at time of purchase. There are three basic signal output configurations also specified at time of purchase. They are non-isolated voltage, transformer isolated voltage and current output.

Cable recommendations, Grounding
Shielded, number 26 AWG (minimum) cable is generally recommended as a starting point for all installations. Actual gage will depend on distance (I/R drop) considerations. Shield drain wires should be terminated at one end only, usually at the data acquisition or display device. Terminating the shield at both ends will eliminate the effectiveness of the shield and may also contribute to ground loop problems.

In each configuration the sensor body is electrically isolated from the power supply and output signal circuitry. Each output type includes either an orange wire (pigtail) or connection at pin E (Bendix) which is tied to the sensor body. This is provided to offer an earth ground point if required by NEC or local electrical codes. **NOTE:** It is not advisable to connect supply (-), signal (-), or shield to this reference as it may contribute to noise sensitivity or ground loop effects.

The connector assignments are per the following tables.

TABLE I: VOLTAGE OUTPUT - NON-ISOLATED (3 Wire)

Although the non-isolated voltage output (0 to 5, 0 to 10, or -5 to +5 VDC) offers four connections for power supply and signal output it is actually a "three wire" system in that the power supply (-) and signal (-) share the same reference. A separate signal (-) is offered to help reduce the effects of I/R drop in system installation wiring.

Pigtail	Bendix	Function
Red	A	20-40 VDC Supply (+)
Black	B	20-40 VDC Supply (- common)
	C	No Connect
White	D	Output Signal (+)
Orange	E	Sensor Body
Green	F	Output Signal (- common)

TABLE II: VOLTAGE OUTPUT - ISOLATED (4 Wire)

The optional transformer isolated voltage output offers superior immunity to EMI/RFI interference, ground loop effects, and I/R drop. Shielded, twisted pair cable is recommended for all installation wiring.

Pigtail	Bendix	Function
Red	A	15-24 VDC Supply (+)
Black	B	15-24 VDC Supply (-)
	C	No Connect
White	D	Output Signal (+)
Orange	E	Sensor Body
Green	F	Output Signal (-)

TABLE III: CURRENT OUTPUT - 4/20 mA

Current loop signals offer naturally high noise immunity; however, shielded cable still may be desirable in extremely noisy environments. Note that a minimum of 12 VDC must be present at the unit's input terminals and is dependent on the sampling resistance of the acquisition or display device. This can easily be determined by the following formula:

Supply min. (VDC) = 12 VDC + [.02 x (total loop resistance)]

Pigtail	Bendix	Function
Red	A.	12-24 VDC Supply (+)
Black	B.	Common (-)
	C.	No Connect
White	D.	No Connect
Orange	E.	Sensor Body
Green	F.	No Connect

INSTALLATION ADJUSTMENTS AND FIELD CALIBRATION

Zero should be adjusted as part of the initial installation procedure. Other field adjustments are limited to setting span as compared to a suitable deadweight tester. A primary standard with and accuracy of + 0.01% of reading is recommended. Note: Zero and span adjustment of absolute pressure types require an absolute pressure standard and a vacuum pump. Zero and span adjustment of vacuum and compound pressure types will require a vacuum standard.

There are two adjustment potentiometers available to the user. They are located on the top of the housing and are accessed by removing the screws labeled “Z” (zero) and “S” (span). These adjustments are referenced to the full pressure span of the instrument and provide approximately $\pm$ 3% FS adjustment range.

Connect the transducer to a suitable pressure source and display device. Apply power and allow at least 45 minutes for warm up before making any adjustments. The adjustment procedure is dependent on the pressure type as described in the following sections.

GAUGE PRESSURE TYPE

ZERO - Check the zero indication on the display device with the pressure inlet open to atmospheric pressure. If it does not indicate zero use a small screwdriver to turn the potentiometer labeled “Z” counter-clockwise to reduce the reading or clockwise to increase the reading until a display value corresponding to zero pressure is achieved.

SPAN - Apply full pressure and adjust the potentiometer labeled “S” as required. Release the pressure and verify the zero adjustment. Repeat process if necessary until the zero and full scale readings conform to the pressure standard.

VACUUM PRESSURE TYPE

ZERO - Check the zero indication on the display device with the pressure inlet open to atmospheric pressure. If it does not indicate zero use a small screwdriver to turn the potentiometer labeled “Z” counter-clockwise to reduce the reading or clockwise to increase the reading as required.

SPAN - Apply full scale vacuum and adjust the potentiometer labeled “S” as required. Release the vacuum and verify the zero adjustment. Repeat process if necessary until the zero and span readings conform to the pressure standard.

NOTE - Units supplied with full vacuum ranges are based on 0 to 14.7 psi vacuum or 0 to 30 in HG. As this vacuum level is difficult to achieve, 14.5 psi vacuum or 29 in Hg should be used as the span adjustment pressure (vacuum) value The span potentiometer should then be adjusted to achieve 98.64% of the full span voltage or current output at 14.5 psi vacuum or 96.66% of the full span voltage or current output at 29 in HG vacuum. For example:

A. 14.7 PSI VACUUM SCALE

The span adjustment should be made at 14.5 psiv with a target output of 9.864 VDC for a 0 to 10 VDC output or 19.782 mA for a 4 to 20 mA output.

B. 30 in HG Scale

The span adjustment should be made at 29 in HG with a target output of 9.667 VDC for a 0 to 10 VDC output or 19.467 mA for a 4 to 20 mA output.

COMPOUND PRESSURE TYPE

Types of signal output

A compound range HPO is available with one of two output configurations depending on the original purchase specification.

Symetrical pressure ranges such as - 3 to 3 psi, -14.7 to 14.7 psi etc. are available with a uni-polar (0 to 5 or 10 VDC or 4 to20 mA) output or an optional bi-polar voltage (-5 to +5 VDC) output.

Non-symetrical pressure ranges such as -14.7 to 30 psi are only available with uni-polar (0 to 5 or 10VDC or 4 to 20 mA) outputs.

ZERO - A vacuum standard is required for adjusting zero on a compound range unit. The “zero” potentiometer affects the full vacuum point of the pressure rating (not the gauge pressure zero). For example, the zero adjustment on a transducer with a pressure range of -14.7 to 15 psi is made at -14.5 psiv or for -28 to 30 in HG the zero adjustment is made at 29 in HG (see instructions for vacuum pressure type in the preceeding section).

SPAN - Apply full scale pressure and adjust the span potentiometer as required. Release pressure and verify “zero” adjustment. Repeat if required. With zero and span properly adjusted the unit should read zero + 0.05% of its full span rating.

ABSOLUTE PRESSURE TYPE

zero - An absolute pressure standard with a vacuum pump capable of achieving a vacuum level of at least one half the value of the least significant digit of its pressure range resolution will be required (a vacuum level of 50 microns absolute is used at the factory). Connect the unit to the pressure standard and evacuate. If the signal output varies from an indication of zero adjust the zero potentiometer labeled (Z) as required.

SPAN - Apply full scale absolute pressure and adjust the span potentiometer labeled "S" as required. Verify the zero and repeat if required.

GENERAL SPECIFICATIONS

Performance

Accuracy: + 0.05% of span (including non-linearity, hysteresis and non-repeatability) at reference conditions (72°F)

Repeatability: + 0.005% of span

Resolution: + 0.01% FS

Temperature Compensated Range: 20 to 120 F (–7 to + 49°C)

Operating Temperature Range: 0 to 180°F (–18 to 83°C)

Temperature Effects Over Compensated Range: + 0.004% per °F. (.002% per °C) for both zero and span

Warm Up: 5 minutes to rated accuracy 45 minutes for complete stability

Functional Characteristics

Ranges: 0-5 psi to 0-10,000 psi

Pressure Types: Gauge, Absolute, Compound and Vacuum

Output Signal: 0/5 or 0/10 VDC into a load of 5k ohms or greater, 3 wire non-isolated or 4 wire isolated, and 4/20 mA

Power Requirements: 20-40 VDC (non-isolated 3 wire voltage output), 15-24 VDC (isolated 4 wire output), 12-24 VDC (current output)

Power Supply Effect: Less than +0.002% of span per 1 volt change

Overpressure Limits:
400% of span 0/5 to 0/250 psi
30% of span 0/300 to 10,000 psi

Sensor Volume: Approximately 4 cc 0/5 to 0/250 psi and 0.38 cc from 0/300 to 0/10,000 psi

Volume Displacement: Approximately 0.5 cc to 250 psi. Negligible for ranges above 250 psi

Response Time: 3 mS

Frequency Response: Approximately 300 Hz

Wetted Materials: Inconel and 300 Series Stainless Steel (all welded construction)

Media Compatibility: Gas, vapor or liquid non corrosive to Inconel or 300 Series Stainless Steel

Mounting Position Effects: Less than the following values per 30 degree inclination in any plane for zero only - no span effect: + 0.05% of span up to 250 psi, + 0.3% of span ranges above 250 psi. Correctable by zero adjustment after final installation orientation.

Physical Characteristics

Process Connection: 1/4 male NPT for 5 psi through 5000 psi - 9/16-18 female port for 1/4 inch O.D. high pressure tubing for ranges over 5000 psi.

Electrical Connector: 1 Meter vented pigtail (standard), Bendix PTO2, 6 Pin (optional)

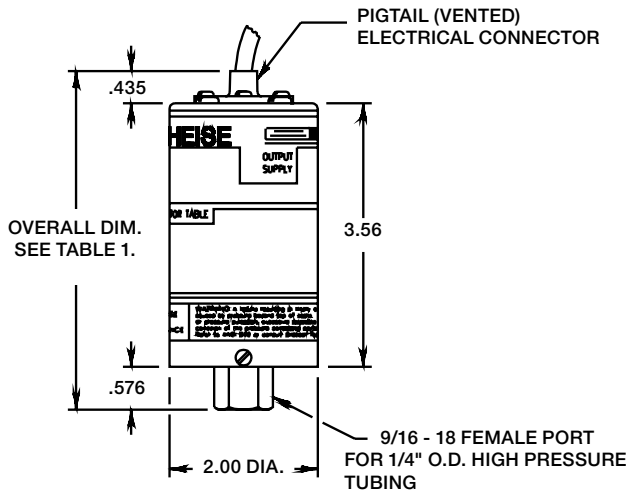
Housing: Sealed NEMA 4X, 300 Series Stainless Steel

Mounting: Stem Mount (standard) - Wall/Pipe Bracket (optional)

Dimensions: Diameter: 2.0 inches, Height: See table page 10

Weight:16 oz.

GENERAL DIMENSIONS (inches)



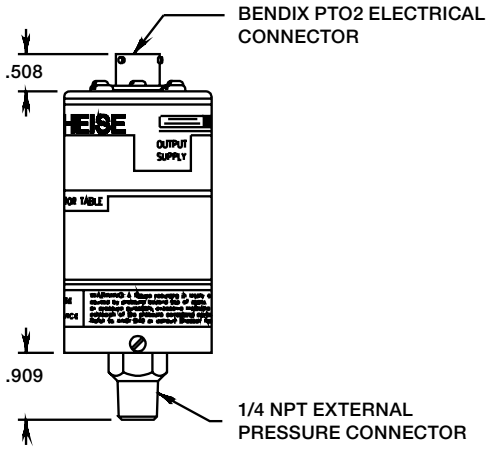
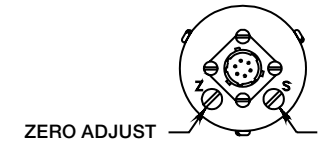


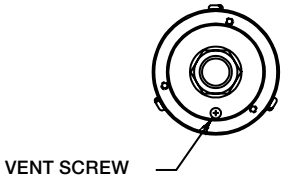
Table 1: Overall Height Dimensions

	Pigtail Connector	Bendix Connector
1/4 NPT	4.904	4.977
9/16 - 18	4.571	4.644

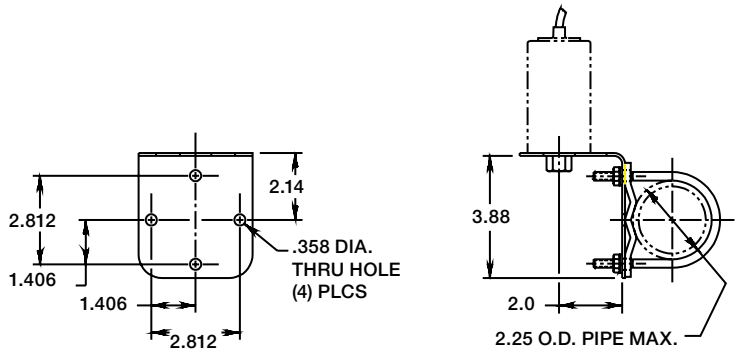
Top View (Bendix)



Bottom View (all)



Mounting Bracket Assembly



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