

Absolute, Gauge, and Differential Pressure: IAP10S, IGP10S, IDP10S

Advanced Performance Pressure Transmitters

PSS 2A-1S10 A

Product Specification

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Introduction

The next generation family of pressure transmitters are intelligent, open-loop, two-wire measuring devices that convert process pressure to a proportional analog and/or digital signal. The versatility of the Value, Advanced, and Performance transmitter families allow you to select the transmitter best suited for your application in terms of features, performance, and price.



Value Performance Transmitters

The competitively priced IAP05S, IGP05S, and IDP05S pressure transmitters provide a robust design without compromising quality. This transmitter family has been designed for applications requiring an accuracy of up to $\pm 0.075\%$ of span, and HART transmitters are SIL 2 certified.

- Remote communication capabilities
- Stability: $< \pm 0.05\%$ of URL/yr for 5 years
- Direct Connect AP/GP response time: < 100 ms
- SIL 2 as standard (HART)
- Robust design: 2-year warranty (optional 5-year warranty)
- DP and Biplanar AP/GP response time: < 125 ms
- High pressure measurement (direct connect GP) and low power options
- In-service time tracking (HART)
- High Turndown Capability¹ (up to 400:1)

Advanced Performance Transmitters

Considered the one transmitter that can do it all, the IAP10S, IGP10S, and IDP10S pressure transmitters cover most of your application needs with a single range. These transmitters offer embedded FoxCal™ technology and multiple points of calibration, which allow you to benefit from wide rangeability and one of the best reference accuracy turndowns on the market. These transmitters have an accuracy of up to $\pm 0.05\%$ of reading, and HART transmitters are SIL 2 certified.

- Remote communication capabilities
- Stability: $< \pm 0.03\%$ of URL/yr for 10 years
- Direct Connect AP/GP response time: < 100 ms²
- SIL 2 as standard (HART)
- Robust Design: 5-year warranty (optional 17-year warranty)
- DP and Biplanar AP/GP response time: < 125 ms²
- FoxCal™ technology
- In-service time tracking
- High Turndown Capability³ (up to 400:1)

Premium Performance Transmitters

Transmitters with high accuracy are required for the most demanding applications, and with an accuracy of up to $\pm 0.025\%$ of reading, the IAP50S, IGP50S, and IDP50S pressure transmitters fit the bill. These transmitters offer embedded FoxCal™ technology and multiple points of calibration, which allow you to benefit from wide rangeability and one of the best reference accuracy turndowns on the market. These transmitters also offer more exotic materials to accommodate severe environments, and HART transmitters are SIL 2 certified.

- Remote communication capabilities
- Stability: $< \pm 0.015\%$ of URL/yr for 10 years
- Direct Connect AP/GP response time: < 100 ms²
- SIL 2 as standard (HART)
- Robust Design: 5-year warranty (optional 17-year warranty)
- DP and Biplanar AP/GP response time: < 125 ms²
- FoxCal™ technology
- In-service time tracking
- High Turndown Capability³ (up to 400:1)

1. Turndown capability refers to Maximum span/Minimum span.

2. For FOUNDATION Fieldbus, this is the average time primary value is measured in the transducer block.

3. Turndown capability refers to Maximum span/Minimum span,

These pressure transmitters provide absolute pressure (AP), gauge pressure (GP), and differential pressure (DP) measurement.

- Absolute pressure transmitters measure pressure relative to vacuum. Gauge pressure transmitters measure pressure relative to ambient air pressure. Both absolute and gauge transmitters are used in a wide variety of oil, gas, water and industrial applications.
- Differential pressure transmitters measure the difference between *two* pressures applied to opposite sides of the sensor. The output signal is proportional to either the differential pressure or its square root.
 - Differential pressure transmitters are often used for measuring fluid flow rates across a primary device such as an orifice plate, but can also be used for other types of differential pressure measurements such as liquid level, interface level, or density measurements.

Transmitters can be connected in series to instruments such as recorders, controllers, and indicators.

This Document

This document discusses the Advanced Performance family of pressure transmitters. This family provides Absolute Pressure (AP), Gauge Pressure (GP), and Differential Pressure (DP) transmitter options that operate with HART, Modbus, or FOUNDATION Fieldbus communication.

Key Features

The Advanced Performance pressure transmitters offer the following features:

- Absolute, Gauge, and Differential Pressure transmitters
- HART, Modbus, or FOUNDATION Fieldbus digital outputs, or 4 to 20 mA outputs (HART only)
- TÜV SIL 2 certification for HART transmitters
- 5-year proof test interval for pressure transmitters installed in SIL 2 Safety loops
- Accuracy up to $\pm 0.05\%$ of reading
- Response time of 100 ms for AP/GP transmitters and 125 ms for DP transmitters⁴
- Innovative and dynamic FoxCal™ technology allows the transmitter to store multiple factory-preset calibration ranges up to 30:1 turndown, while maintaining published accuracy without the need for field calibration
- Time in Service meter features cumulative power-up time and time powered since last user reset for HART, Modbus, and FOUNDATION Fieldbus transmitters
- High Turndown Capabilities⁵ (up to 400:1)
- Ability to locally configure the device with pushbuttons on the optional local display
- Ability to remotely communicate with and configure the device using the device descriptor (DD), Device Type Manager (DTM), or the Field Device Integration (FDI) package. For Modbus, the ability to remotely communicate using the Modbus RTU.
- Optional External Zero Adjustment
- Field-proven piezoresistive silicon microsensors help ensure excellent measurement performance
- Simple, elegant sensor design with very few parts achieves exceptional reliability
- Durable aluminum or 316 ss housing options are available; both meet NEMA Type 4X and IEC IP66/67 ratings
- Differential pressure (DP) transmitters are available with traditional and low profile or Coplanar™ structures
- Depending on transmitter structure, sensor diaphragm materials include 316L ss, nickel alloy⁶, Co-Ni-Cr, Monel™, or Tantalum™
- ½ NPT external thread, ½ NPT internal thread, or M20 external thread process connections
- Numerous mounting bracket set options
- Process venting and bleeding options
- Special degreasing and cleaning options
- Low temperature options
- Custody transfer lock and seal options
- Many configurations of direct connect or capillary connected seals
- Dual Seal certified by CSA to meet ANSI/ISA 12.27.01-2011 requirements
- Complies with electromagnetic compatibility requirements of European EMC Directive 2014/30/EU by conforming to following EN and IEC Standard: EN 61326-1:2013
- NACE MR0175 and MR0103 compliant process wetted parts and bolt material available

4. For FOUNDATION Fieldbus, this is the average time primary value is measured in the transducer block.

5. Turndown capability refers to Maximum span/Minimum span

6. Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

- Optional certification options allow transmitters to meet numerous requirements for hazardous and non-hazardous locations
- CE marked; meets the requirements of applicable EMC, ATEX, RoHS, and PED European Union Directives
- UKCA marked; meets the requirements of applicable EMC, UKEX, RoHS, and PER UK legislation
- Multi-marking protection concepts available for ATEX/UKEX, CSA, FM, IECEx, and INMETRO
- Standard 5-year warranty (optional 17-year warranty)

Transmitters Using HART Communication

Transmitters using HART communication provide the following features:

- Ability to remotely configure the device using a HART communicator or PC-based configurator
- Support for HART 7 communication protocol in single loop or multidrop mode
- Compliance with NAMUR NE 21 interference immunity requirement, and NAMUR NE 43 analog output overrange and underrange annunciations
- Interoperability tested and registered with the FieldComm Group

Transmitters Using Modbus Communication

Transmitters using Modbus communication provide the following features:

- Ability to configure the device locally or remotely. Use the optional LCD display to configure the transmitter locally or use a Modbus RTU host to configure the transmitter remotely.
- Uses a Modbus RTU (Remote Terminal Unit) mode over a two-wire RS-485 multidrop serial connection for communication at a baud rate up to 38400. The transmitter functions as a Modbus server device. Server (station) addresses are in the range of 1 to 247.

Transmitters Using FOUNDATION Fieldbus Communication

Transmitters using FOUNDATION Fieldbus communication provide the following features:

- Ability to remotely configure the device over the fieldbus network or with a PC-based configurator
- FOUNDATION Fieldbus 31.25 kbits/s, Voltage Mode; MAU (Media Access Unit) specification compliant for intrinsic safety
- FISCO compliant
- Interoperability tested and registered with the FieldComm Group
- FOUNDATION Fieldbus blocks allow you to:
 - Configure the measurement
 - Select the transmitter's output in terms of pressure, flow (for DP transmitters), or transmitter and sensor temperature
 - Configure up to four *additional* process variables to appear on the local display
 - Auto-Tune control specific to your process
 - Access information about potential diagnostic conditions with NAMUR NE 107 compliant FOUNDATION Fieldbus diagnostics

Safety Integrity Level (SIL)

In addition to the traditional Explosion Proof certifications (ATEX/UKEX or IECEx), Pressure Transmitters with HART communication offer standard Safety SIL certification. Absolute, gauge, and differential transmitters can now be deployed for either standard or safety applications. The transmitters' model codes allow you to customize your transmitter with a red or yellow cover to identify that the transmitter is part of a safety loop. Safety SIL certification is performed by TÜV, an independent third-party laboratory.

Pressure transmitters can be used in SIL 2 safety functions in 1oo1 single mode or in SIL 3 safety functions in 1oo2, dual mode.

Figure 1 - Red or Yellow Covers to Indicate Safety Integrity Level



Acronyms and Definitions

Acronym	Definitions
FIT	Failures in Time (failures per 1E09 hours)
λ	Failure rate
λ_{DD}	Failure rate for Dangerous Detected
λ_{DU}	Failure rate for Dangerous Undetected
λ_S	Failure rate for Safe Detected + failure rate for Safe Undetected
PFD_{AVG}	Average Probability of Failure on Demand
PFH	Probability of Failure per Hour
SFF	Safe Failure Fraction
SIL	Safety Integrity Level

Reliability Data

Failure Data According to IEC 61508

λ	λ_s	λ_{DD}	λ_{DU}	SFF
2400 FIT	1340 FIT	996 FIT	62 FIT	97.42%

The PFD_{AVG} value for a single pressure transmitter is $2.7E-4$ per year.

Certification Data

- Safety SIL certification is performed by TÜV, an independent laboratory.
- The Pressure Transmitter is classified as a Type B device according to IEC 61508, having a hardware fault tolerance of 0.

NOTE: Type B component: “Complex” component (using microcontrollers or programmable logic); for details see section 7.4.4.1.3 of IEC 61508-2:2010.

- Based on internal diagnostics, the Pressure Transmitter has a Safe Failure Fraction of 97.42% (assuming that the logic solver is configured to detect over-scale and under-scale currents), and therefore may be used up to SIL 2 as a single device and up to SIL 3 redundantly (systematic capability SC3).
- The Pressure Transmitter has a proof test interval of up to five years in order to maintain a SIL 2 rating, allowing it to be used as a single device.

NOTE: Per Table 3 of IEC 61508-2:2010 section 7.4.4.2.2, the preceding information allows the Pressure Transmitter, when used in a 1 of 2 system architecture, to be used as a SIL 3 application with an HFT of 1.

Innovative FoxCal™ Technology

Industry landscape is changing with the need to produce more with less and the introduction of new IIoT (Industrial Internet of Things) technologies in our industrial world, such as Cloud Computing, Big Data, and Predictive and Conditional Maintenance. This new revolution is all about data, real-time data, and how you can capitalize on these data in an efficient way. That’s why measuring reliable and accurate data from the process is mandatory.

Where traditional suppliers have a static calibration approach with the traditional 2-point calibration, Schneider Electric invented FoxCal™ dynamic technology, which integrates 11 calibration curves in a single transmitter, and consequently stores 11 times more data in the transmitter firmware. The calibration curves are preset in the factory and cover the full pressure range of the transmitter. FoxCal technology allows the pressure transmitter to transition seamlessly and automatically to the appropriate calibration curve based on the transmitter’s input, while maintaining digital accuracy as a percent of reading from 100% of the upper range limit (URL) to as low as 4% of the URL. This results in a wide reference accuracy turndown. Patented FoxCal™ technology is thus improving the reliability, stability and repeatability of the pressure measurement.

Factory calibration and field calibration for specific applications are not required for zero-based ranges up to 30:1 turndown. You can simply configure or rerange the HART upper range value (URV) or FOUNDATION Fieldbus primary value range (EU_100) without performing a recalibration at the HART URV or FOUNDATION Fieldbus primary value range. You will only need to perform a zero adjustment after installation to obtain performance to the specified reference accuracy.

Time in Service Meter

Similar to how an odometer allows an automobile owner to track the total number of miles driven and a trip odometer tracks the number of miles driven since a user-defined starting point, HART, Modbus, or FOUNDATION Fieldbus transmitters allow you to keep track of the number of days the transmitter has been in service. The Time In Service meter tracks both the total number of days the transmitter has been powered up in the field over its lifetime (total days), and also tracks the number of days the transmitter has been powered up since the last Time in Service meter reset (user days). You can reset the user days value to zero locally with the local display or remotely with a HART communicator or a PC-based configurator on HART transmitters, with a Modbus RTU host on Modbus transmitters, or over Fieldbus on FOUNDATION Fieldbus transmitters. You cannot reset the lifetime service parameter.

Vacuum Service

AP and Biplanar GP Transmitters:

A lower range limit of -100 kPa (-14.7 psi, -1 bar) means that vacuum measurements are easily handled with the versatile direct connect AP, biplanar AP, or biplanar GP transmitters.

Direct Connect GP Transmitters:

A lower range limit of -100 kPa (-14.7 psi, -1 bar) allows vacuum limits for direct connect GP transmitters with Span Codes E and F.

Variety of Materials

With process connections of 316L ss or nickel alloy⁷ and sensor diaphragms available in 316L ss, nickel alloy⁷, or corrosion-resistant cobalt-nickel-chrome (Co-Ni-Cr), direct connect AP/GP transmitters are an excellent choice for the majority of process pressure measurements.

For biplanar GP transmitters, Monel, Co-Ni-Cr, and tantalum are also available.

DP transmitters with traditional structures are offered with a choice of 316L ss, Co-Ni-Cr, nickel alloy⁷, Monel, gold-plated 316L ss, and tantalum materials. The high corrosion resistance of Co-Ni-Cr means a longer service life in many difficult applications without the extra cost for exotic materials.

For DP and biplanar AP/GP transmitters with low profile structures, 316L ss and nickel alloy⁷ are offered as sensor materials. Refer to [Transmitter Structures for DP and Biplanar AP/GP Transmitters](#), page 14 for a description and application of traditional and low profile (LP1 and LP2) structures.

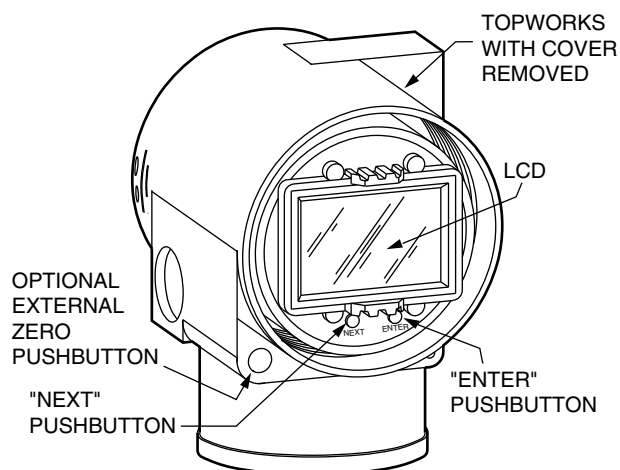
7. Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

Design Specifications

Digital Liquid Crystal Display (LCD)

A two-line local digital display with on-board pushbuttons is provided as an option with HART, Modbus, and FOUNDATION Fieldbus transmitters. The display can be rotated into any one of four 90 degree positions and shows the current measurement configured with your choice of units. The pushbuttons allow you to locally configure and calibrate the device, for example, by adjusting the zero and span or by fine-tuning the high and low calibration points (FOUNDATION Fieldbus transmitters). Pushbutton pads are designed to help protect the transmitter from electrostatic discharge and moisture.

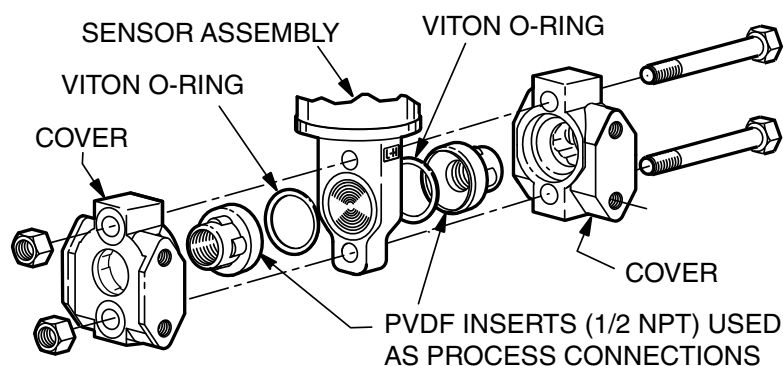
Figure 2 - Digital LCD with On-Board Pushbuttons



Process Connectors for DP and Biplanar AP/GP Transmitters

Removable, gasketed process connectors allow a wide range of selections, including $\frac{1}{4}$ NPT, $\frac{1}{2}$ NPT, Rc $\frac{1}{4}$, Rc $\frac{1}{2}$, and weld neck connections. For highly corrosive chemical processes when a traditional structure is used (see *Transmitter Structures for DP and Biplanar AP/GP Transmitters*, page 14), two $\frac{1}{2}$ NPT PVDF inserts are installed in both 316 ss covers and are used as the process connectors. In these applications, tantalum is used as the sensor diaphragm material.

Figure 3 - Bottomworks Shown with $\frac{1}{2}$ NPT PVDF Inserts Installed in HI- and LO-Side Covers with Traditional Structure



Ease of Installation

Pressure transmitters are lightweight and easy to install, and are offered with:

- **Rotatable Topworks** allows transmitter installation in tight places, allows the display to be positioned in the preferred direction, and eases field retrofit.
- **Two Conduit Entrances** offer a choice of entry positions for ease of installation and self-draining of condensation regardless of mounting position and topworks rotation.
- **Wiring Guides and Terminations** provide ease of wire entry and support, plenty of space to work and store excess wire, and large, rugged screw terminals for easy wire termination.
- **Two-Valve Manifolds**, which isolate and vent pressure from biplanar GP transmitters, can be easily mounted directly to transmitter.

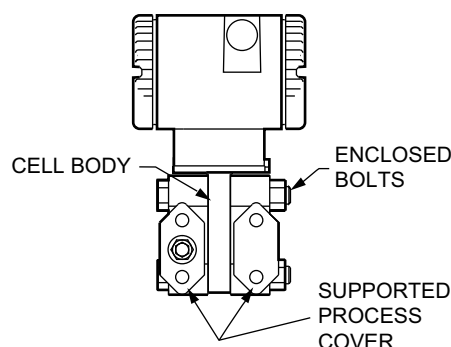
Optional Mounting Bracket Sets for DP and Biplanar AP/GP Transmitters

Mounting bracket sets allow you to mount the transmitter to a surface, pipe, or manifold. In addition to the standard-style mounting bracket sets available, a unique universal style mounting bracket has been developed to allow wide flexibility in transmitter mounting configurations consistent with installation requirements. Refer to *Dimensions*, page 65.

Unique Process Cover and Cell Body Design for DP and Biplanar AP/GP Transmitters

Biplanar Construction maintains the traditional horizontal process connections and vertical mounting by providing a cell body contained between two process covers, while still achieving light weight, small size, and high standard static pressure rating of 25 MPa (3626 psi). This design provides easy retrofit of any conventional differential pressure transmitter, and also allows the transmitter to be easily mounted in the horizontal position with vertical process connections.

Figure 4 - Biplanar Construction Shown with Traditional Horizontal Process Connections



- **Process Covers** are fully supported by the cell body over their entire height. This helps prevent bending and results in a firm seal. Also, this provides dimensional stability to the process covers, helping ensure they will mate properly with 3-valve bypass manifolds.

- **Process Cover Bolts** are enclosed to minimize corrosion and to minimize early elongation with rapid temperature increases. The design makes it less likely for the transmitter to release process liquid during a fire.
- **Process Cover Gaskets** are PTFE as standard; PTFE provides nearly universal corrosion resistance, so you do not need to select and stock various elastomers to provide process compatibility.
- **Light Weight** provides ease of handling, installation, and direct mounting without requiring costly pipe stands.

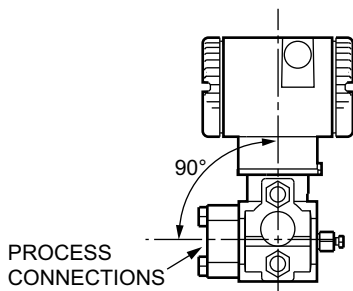
Transmitter Structures for DP and Biplanar AP/GP Transmitters

For DP and biplanar AP and GP transmitters, traditional and low profile structures (LP1 and LP2) are offered to accommodate and to provide flexibility in transmitter installations.

Traditional Structure for DP and Biplanar AP/GP Transmitters

The traditional structure utilizes the right angle design common to most DP and biplanar AP/GP transmitters in use throughout the world. Process connections are oriented 90 degrees from the transmitter centerline. This traditional structure makes it easy to retrofit any transmitters of similar design.

Figure 5 - Vertical Mounting Showing Process Connections at 90 Degrees



Sensor cavity venting and draining is provided for both vertical and horizontal transmitter installation, using innovative tangential connections to the sensor cavity. Optional side vents are offered for sensor cavity venting in the upright position.

Figure 6 - Vertical Mounting – Cavity Draining

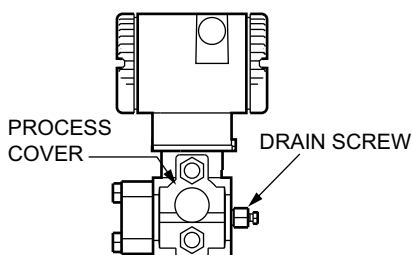


Figure 7 - Horizontal Mounting – Cavity Venting, and Self-Draining into Process Line

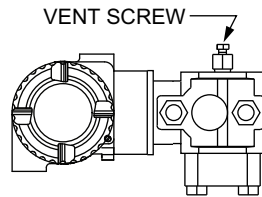
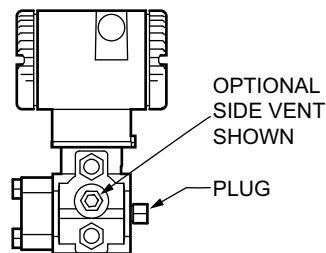


Figure 8 - Vertical Mounting – Cavity Venting, and Self-Draining into Process Line



Low Profile Structures for DP and Biplanar AP/GP Transmitters

The low profile structures use an in-line design, meaning that the process connections are in line with the transmitter centerline. This allows you to mount the transmitter in the upright position with the process connections facing downward for connection to vertical process piping or for mounting directly to a three- or five-valve manifold.

For convenience, two types of low profile structures are offered, LP1 and LP2. The process covers and the external shape of the sensor cell body are the only transmitter parts that differ between LP1 and LP2.

Figure 9 - Low Profile (LP1) Structure with In-Line Process Connections

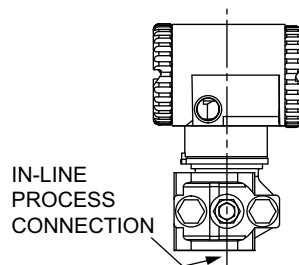
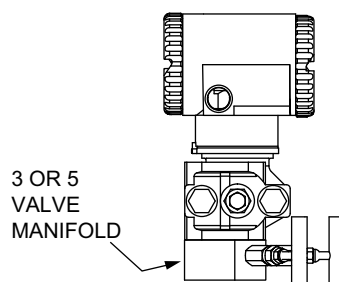


Figure 10 - Low Profile (LP1) Structure Directly Mounted to Manifold



The low profile structures provide a mounting style similar to that used by competitive Coplanar™ transmitters. This makes it easy to select these transmitters for both retrofit and new applications where this type of installation is desired.

Transmitters with the low profile structure can be attached directly to existing, installed Coplanar manifolds, such as the Anderson Greenwood Models MB3, MB5G, and MB5P by using an optional adapter plate. See [Low Profile \(LP1\) Transmitter – Mounted to a Coplanar Manifold using an Optional Intermediate Adapter Plate](#), page 16. Also, when assembled to the same process piping or manifold as a Coplanar transmitter, one of the electrical conduit connections is located within ± 1 inch of the similar conduit connection on the competitive transmitter, providing for ease of retrofit or conformance with installation design drawings.

Low Profile Structure LP1 – Direct Mount

Low Profile Structure LP1 is a compact, inexpensive, lightweight design that you can mount directly to a separately mounted manifold or to process piping. These transmitters are not typically bracket-mounted.

By default, LP1 transmitters are supplied with a single vent/drain screw in the side of each process cover. In conjunction with the standard tangential venting and draining design, they are suitable for mounting either vertically or horizontally, and are suitable for most applications, including liquids, gases, and steam.

In the vertical, upright position, the LP1 transmitter is self-draining and is ideal for gas flow rate service when directly mounted to a manifold located above the horizontal pipeline. If desired, you can omit the vent screw for this or other applications.

Figure 11 - Low Profile (LP1) Transmitter – Upright Mounting

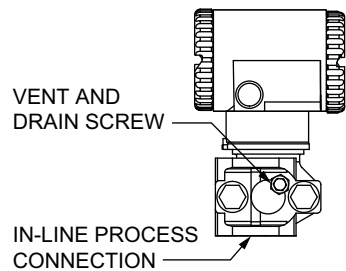
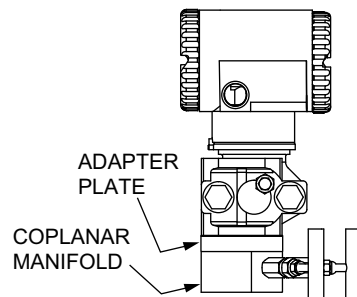
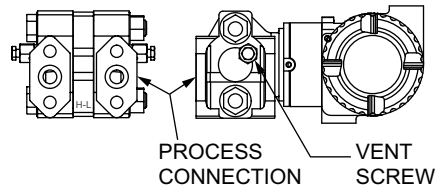
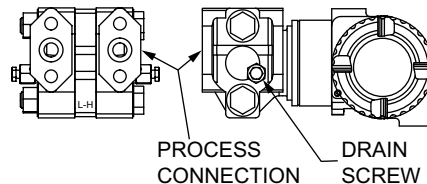


Figure 12 - Low Profile (LP1) Transmitter – Mounted to a Coplanar Manifold Using an Optional Intermediate Adapter Plate



For horizontal installations, rotate the transmitter 180 degrees to orient the high and low pressure sides to the preferred locations. You do not need to unbolt process covers. You can also rotate the topworks housing as shown to orient the conduit connections in the desired position.

Figure 13 - Low Profile (LP1) Transmitter – Horizontal Mounting with Vent Screw**Figure 14 - Low Profile (LP1) Transmitter – Horizontal Mounting with Drain Screw**

Low Profile Structure LP2 – Bracket or Direct Mount

Low Profile Structure LP2 is a universal design for either bracket or direct mounting. Drilled and tapped mounting holes facilitate mounting to either new or existing Schneider Electric brackets (Options -M1, -M2, and -M3), as well as standard brackets supplied with existing Coplanar™ transmitters.

These transmitters can also be directly mounted to manifolds or process piping and are available with the same optional adapter used with low profile structure LP1 to fit existing Coplanar manifolds.

For extra convenience, they use a vent and drain design, with separate vent and drain screws positioned in each cover for venting or draining directly from the sensor cavity. They are normally recommended for upright, vertical installation.

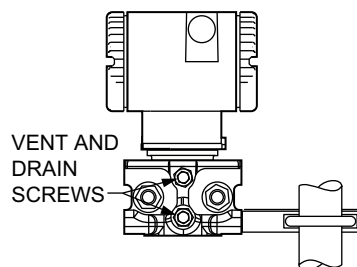
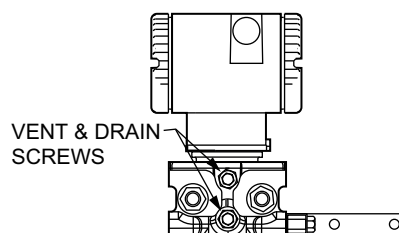
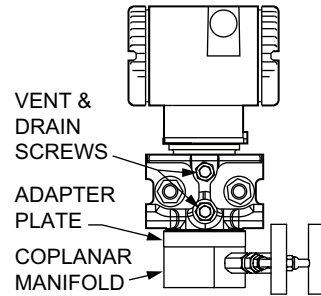
Figure 15 - Low Profile (LP2) Transmitter – Mounted on the Schneider Electric Universal Bracket**Figure 16 - Low Profile (LP2) Transmitter – Shown on a Coplanar Bracket**

Figure 17 - Low Profile (LP2) Transmitter – Mounted to an Existing Coplanar Manifold Using Adapter Plate

Optional Custom Factory Calibration (Option -C1)

With the -C1 Model Code option selected, the factory performs a custom 2-point factory calibration on the transmitter based on the calibration range and units you require before shipping the transmitter. A 2-point calibration is useful if your application requires non-zero based ranges with greater than 10:1 turndown, zero-based ranges with greater than 30:1 turndown, or when mandated by a specific requirement. Simply indicate the calibration range and units you require in the sales order. See *Units*, page 34.

When a transmitter is shipped with the custom factory calibration option, the FoxCal feature is automatically disabled and a traditional two-point calibration is performed.

Table 1 - Example of Custom Factory Calibration Option -C1 for a HART Transmitter

Parameter	Standard (Default) Configuration	Example of Custom Factory Calibration (Option -C1)
Calibrated Range		
Pressure Engineering Units (EGUs)	per sales order ⁸	inH ₂ O
LRV	per sales order ⁹	0
URV	per sales order ¹⁰	100
Measurement #1		
Linear (pressure units, AP or GP) or Square Root (flow units, DP only)	Linear	Square Root
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹¹	gal/m
Range (DP)	per sales order ¹⁰	0 to 500 gal/m
Output	4 to 20 mA ¹²	4 to 20 mA ¹²
Measurement #2		
Linear (pressure units, AP or GP) or Square Root (flow units, DP only)	Linear	Square Root
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹¹	gal/m
Range (DP)	per sales order ¹⁰	0 to 500 gal/m

8. Pressure units from *Units*, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

9. Within Span and Range Limits for selected sensor code.

10. Same as Calibrated Range.

11. Pressure or flow units from *Units*, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

12. Fixed current is used for multidrop applications.

Table 2 - Example of Custom Factory Calibration Option -C1 for a FOUNDATION Fieldbus or Modbus Transmitter

Parameter	Standard (Default) Configuration	Example of Custom Factory Calibration (Option -C1)
Calibrated Range		
Pressure Engineering Units (EGUs)	per sales order ¹³	inH ₂ O
Engineering units at 0% of range (EU_0)	per sales order ¹⁴	0
Engineering units at 100% of range (EU_100)	per sales order ¹⁵	100
Measurement #1		
Linear (pressure units)	Linear	Linear
Pressure Engineering Units (EGUs)	per sales order ¹³	inH ₂ O
Range (DP)	per sales order ¹⁵	0 to 100
Output	Primary Value	Primary Value
Measurement #2		
Linear (pressure units)	Linear	Linear
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹⁶	inH ₂ O

Optional Factory Configuration (Option -C2)

You also have the option to have the transmitter configured by the factory prior to shipment by selecting Model Code Option -C2. For the transmitter to be custom configured by the factory, you must fill out a data form. If this option is not selected, a standard (default) configuration is provided.

In addition to the example parameters listed in the table, the data form allows you to configure any of the transmitter's user-configurable parameters.

Table 3 - Example Parameters: Factory Configuration Option -C2 for a HART Transmitter

Parameter	Standard (Default) Configuration	Example of Factory Configuration (Option -C2)
Calibrated Range		
Pressure Engineering Units (EGUs)	per sales order ¹³	inH ₂ O
LRV	per sales order ¹⁴	0
URV	per sales order ¹⁵	100
Measurement #1		
Linear (pressure units, AP or GP) or Square Root (flow units, DP only)	Linear	Square Root
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹⁶	gal/m

13. Pressure units from Units, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

14. Within Span and Range Limits for selected sensor code.

15. Same as Calibrated Range.

16. Pressure or flow units from Units, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

Table 3 - Example Parameters: Factory Configuration Option -C2 for a HART Transmitter (Continued)

Parameter	Standard (Default) Configuration	Example of Factory Configuration (Option -C2)
Range (DP)	per sales order ¹⁷	0 to 500 gal/m
Output	4 to 20 mA ¹⁸	4 to 20 mA ¹⁸
Measurement #2		
Linear (pressure units, AP or GP) or Square Root (flow units, DP only)	Linear	Square Root
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹⁹	gal/m
Range (DP)	per sales order ¹⁷	0 to 500 gal/m

Table 4 - Example Parameters: Factory Configuration Option -C2 for a FOUNDATION Fieldbus or Modbus Transmitter

Parameter	Standard (Default) Configuration	Example of Factory Configuration (Option -C2)
Application	Pressure	Flow 4% cutoff
Calibrated Range		
Pressure Engineering Units (EGUs)	per sales order ²⁰	inH ₂ O
Engineering units at 0% of range (EU_0)	per sales order ²¹	0
Engineering units at 100% of range (EU_100)	per sales order ¹⁷	100
Measurement #1		
Linear (pressure units)	Linear	Linear
Pressure EGU	per sales order ²⁰	inH ₂ O
Range (DP)	per sales order ¹⁷	0 to 100
Output	Primary Value	Primary Value
Measurement #2		
Linear (pressure units)	Linear	Linear
Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹⁹	inH ₂ O
Range (DP)	per sales order ¹⁷	0 to 100

Diaphragm Seals

Diaphragm seals are used when it is necessary to keep the transmitter isolated from the process. A sealed system is used for a process fluid that may be corrosive, viscous, subject to temperature extremes, toxic, sanitary, or that may tend to collect and solidify.

17. Same as Calibrated Range.

18. Fixed current is used for multidrop applications.

19. Pressure or flow units from Units, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

20. Pressure units from Units, page 34. If not specified, the factory default calibration is zero to maximum span and the default units vary by sensor code.

21. Within Span and Range Limits for selected sensor code.

Diaphragm seals can be used with direct connect AP/GP transmitters as well as DP and biplanar AP/GP transmitters that have a traditional structure (see [Transmitter Structures for DP and Biplanar AP/GP Transmitters](#), page 14).

NOTE: When used with diaphragm seals, FoxCal is disabled because seals require a two-point calibration and accuracy specifications for Advanced Performance transmitters do not apply.

The following table describes each diaphragm seal and indicates with which transmitter types the seal can be used. To order a transmitter with seals, select both a transmitter model code and a seal model code. See PSS 2A-1Z11 B for diaphragm seal model codes and specifications.

Table 5 - Diaphragm Seals

Model	Description	Process Connections ²²
Direct Connect Diaphragm Seal Assemblies		
DS-N	Diaphragm Seal Flanged (Through Bolt)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-M	Diaphragm Seal Flanged (Stud Bolt)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-H	Diaphragm Seal Flanged Extended	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-F	Diaphragm Seal Flanged (One Piece Construction)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-G	Diaphragm Seal Flanged (Multi Piece Construction)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-L	Diaphragm Seal Inline Saddle	3", 4" Pipe
DS-C	Diaphragm Seal Sanitary Tri-Clamp	1", 1.5", 2", 2.5", 3", 4" Pipe
DS-P	Diaphragm Seal Tank Spud	2.5", 4" Pipe
DS-K	Diaphragm Seal Threaded	G 1/4 – G 1 Internal thread; G 1/4 – G 1 External thread; 1/4 NPT – 1 NPT Internal thread; 1/4 NPT – 1 NPT External thread
Remote Mount, Capillary-Connected Diaphragm Seal Assemblies		
DS-N	Diaphragm Seal Flanged (Through Bolt)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-M	Diaphragm Seal Flanged (Stud Bolt)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-H	Diaphragm Seal Flanged Extended	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-F	Diaphragm Seal Flanged (One Piece Construction)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-G	Diaphragm Seal Flanged (Multi Piece Construction)	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-J	Diaphragm Seal Pancake	ASME CL150–2500; EN1092 PN1–100; JIS 10K, 16K, 20K
DS-L	Diaphragm Seal Inline Saddle	3", 4" Pipe
DS-C	Diaphragm Seal Sanitary Tri-Clamp	1", 1.5", 2", 2.5", 3", 4" Pipe
DS-P	Diaphragm Seal Tank Spud	2.5", 4" Pipe
DS-K	Diaphragm Seal Threaded	G 1/4 – G 1 Internal thread; G 1/4 – G 1 External thread; 1/4 NPT – 1 NPT Internal thread; 1/4 NPT – 1 NPT External thread

22. See PSS 2A-1Z11 B for specific process size, connections, and face.

Figure 18 - Typical Diaphragm Seals



Physical Specifications

Transmitter Materials and Construction

Housing and Housing Cover Design

The housing has two compartments to separate the electronics from the field connections. The housing and covers are made from low copper (0.6% maximum) die-cast aluminum alloy with an epoxy finish, or from 316 ss.

O-ring seals are used to seal the threaded housing covers, housing neck, and terminal block.

Process Wetted Materials

Table 6 - Process Covers and Connections

Transmitter Type	Materials
Direct Connect AP/GP	316L ss or nickel alloy ²³
Biplanar AP/GP	316 ss, carbon steel, Monel, PVDF, or nickel alloy ²³
DP ²⁴	316 ss, carbon steel, Monel, nickel alloy CW2M ²⁵ , or PVDF (Kynar™) inserts in 316 ss covers for transmitters with traditional structures; and 316 ss for transmitters with low profile structures

Table 7 - Process Cover Nuts and Bolts

Transmitter Type	Materials
Biplanar AP/GP	ASTM A193, Grade B7 high strength alloy steel for bolts, and ASTM A194 Grade 2H high strength alloy steel for nuts are standard. Options include NACE Class B7M bolting, 17-4 ss bolting, and 316 ss bolting.
DP	

Table 8 - Sensor Diaphragm

Transmitter Type	Materials
Direct Connect AP/GP	316L ss, Co-Ni-Cr, or nickel alloy ²³
Biplanar AP/GP	316 ss, gold-plated 316L ss, Co-Ni-Cr, Monel, tantalum, or nickel alloy ²³
DP ^{26 27}	316L ss, gold-plated 316L ss, Co-Ni-Cr, Monel, tantalum, or nickel alloy ²³ for transmitters with traditional structures; and 316L ss or nickel alloy ²³ for transmitters with low profile structures

Table 9 - Gaskets

Transmitter Type	Materials
Direct Connect AP/GP Biplanar AP/GP	Glass-filled PTFE or Viton™
DP	Glass filled PTFE or Viton™ when Structure Codes 78/79 (PVDF inserts) are used

23. Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

24. For exceptional value and corrosion resistance, 316 ss is the least expensive material.

25. Equivalent to Hastelloy® C-4C. Hastelloy is a registered trademark of Haynes International, Inc.

26. For exceptional value and corrosion resistance, 316L ss is the least expensive material.

27. Refer to TI 037-078 and TI 37-75b for information regarding the corrosion resistance of Co-Ni-Cr and other sensor materials.

Reference (Low) Pressure Side Materials (All Transmitters) and Reference (Atmospheric) Pressure Side Materials (GP Only)

Silicone, Pyrex, RTV silicone, or 316L ss

Sensor Fill Fluid

- Silicone fluid — dodecamethylpentasiloxane
- 3M™ Fluorinert™ Electronic Liquid FC-43 — perfluorotributylamine
- NEOBEE® M-20 — propylene glycol di(octanoate/decanoate)

Environmental Protection

The transmitter's enclosure has the weatherproof, dust-tight, and water-tight rating of IP66/67 as defined by IEC 60529, and provides the environmental and corrosion resistant protection rating of NEMA Type 4X.

Electronics Module

Printed wiring assemblies are potted or conformally coated for moisture and dust protection.

Mounting Position

The transmitter can be mounted in any orientation. The housing can be rotated up to one full turn to any desired position for access to adjustments, display, or conduit connections.

The display (if applicable) can also be rotated at 90° increments within the housing.

- Mount the transmitter so that any moisture condensing or draining into the field wiring compartment can exit through one of the two threaded conduit connections.
- Use a suitable thread sealant on all connections.
- Position effect zero shift for all calibrated spans can be calibrated out by readjusting zero output after installation.

Approximate Mass

Transmitter mass does not include diaphragm seals.

Transmitter and Option(s)	Approximate Mass
Direct Connect AP or GP, Aluminum Housing	1.4 kg (3.1 lb)
Biplanar or Traditional DP Structure, Aluminum, without Process Connectors	3.5 kg (7.8 lb)
Biplanar or Traditional DP Structure, Aluminum, with Process Connectors	4.2 kg (9.2 lb)
Optional Display	Add 0.2 kg (0.4 lb)
Substitute 316 ss Housing	Add 1.1 kg (2.4 lb)
Low Profile/Biplanar LP1 Structure	Add 0.1 kg (0.2 lb)
Low Profile/Biplanar LP2 Structure	Add 0.8 kg (1.8 lb)

Functional Specifications

Span and Range Limits

Limits for Direct Connect (AP or GP) Transmitters

Table 10 - Span Limits for Direct Connect Transmitters

Code	Span Limits ²⁸
D	3.4 and 1380 kPa (0.5 and 200 psi)
E	0.034 and 13.8 MPa (5 and 2000 psi)
F	0.52 and 41.4 MPa (75 and 6000 psi) ²⁹
J	6.9 and 69 MPa (1000 and 10000 psi) ²⁹

Table 11 - Range Limits for Direct Connect Transmitters

Code	Range Limits — AP	Range Limits — GP
D	0 and 1400 kPaa (0 and 200 psia)	0 and 1400 kPa (0 and 200 psig)
E	0 and 14 MPaa (0 and 2000 psia) ³⁰	0 and 14 MPag (0 and 2000 psig) ³⁰
F	n/a	0 and 42 MPag (0 and 6000 psig) ³⁰
J	n/a	0 to 69 MPag (0 to 10000 psig) ³⁰

Limits for Biplanar (AP or GP) Transmitters

Table 12 - Span Limits for Biplanar Transmitters

Code	Span Limits ²⁸
A	0.12 and 7.5 kPa (0.5 and 30 inH ₂ O) ²⁹
B	0.12 and 50 kPa (0.5 and 200 inH ₂ O)
C	0.62 and 250 kPa (2.49 and 1000 inH ₂ O)
D	26 and 2070 kPa (3.75 and 300 psi)
E	0.26 and 20.7 MPa (37.5 and 3000 psi) ³¹
F	1.1 and 34.5 MPa (165 and 5000 psi) ^{29 31}

28. Values listed are in absolute or gauge pressure units, as applicable.

29. Available for gauge pressure transmitters only.

30. This direct connect range can withstand and indicate a vacuum condition down to a full vacuum, but cannot be ranged to that condition.

31. Span limit, maximum working pressure, maximum overrange pressure, and maximum static pressure (d/p) are derated for optional IEC 61518 Construction and optional Bolting except for codes -D3, -D7, and -B2. Option -D1 is derated to 2320 psi. Options -D5 and -B1 are derated to 2175 psi. Options -D2, -D4, -D6, and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

Table 13 - Range Limits for Biplanar Transmitters

Code	Range Limits — AP	Range Limits — GP
A	n/a	-7.5 and +7.5 kPag (-30 and +30 inH ₂ Og)
B	5 and 50 kPaa (20 and 200 inH ₂ Oa)	-50 and +50 kPag (-200 and +200 inH ₂ Og)
C	0 and 250 kPaa (0 and 1000 inH ₂ Oa)	-100 and +250 kPag (-400 and +1000 inH ₂ Og)
D	0 and 2100 kPaa (0 and 300 psia) ³²	-100 and +2100 kPag (-14.7 and +300 psig) ³²
E	0 and 21 MPaa (0 and 3000 psia) ³²	-0.1 and +21 MPag (-14.7 and +3000 psig) ³²
F	n/a	-0.1 and +35 MPag (-14.7 and +5000 psig) ³²

Limits for DP Transmitters

Table 14 - Span Limits for DP Transmitters

Code	Span Limits
A	0.12 and 7.5 kPa; 0.5 and 30 inH ₂ O; 1.2 and 75 mbar
B	0.12 and 50 kPa; 0.5 and 200 inH ₂ O; 1.2 and 500 mbar
C	0.62 and 250 kPa; 2.5 and 1000 inH ₂ O; 6.22 and 2500 mbar
D	0.026 and 2.07 MPa; 3.75 and 300 psi; 0.26 and 20.7 bar
E	0.26 and 20.7 MPa; 37.5 and 3000 psi; 2.6 and 207 bar

Table 15 - Range Limits for DP Transmitters

Code	Range Limits
A	-7.5 and +7.5 kPa (-30 and +30 inH ₂ O)
B	-50 and +50 kPa (-200 and +200 inH ₂ O)
C	-250 and +250 kPa (-1000 and +1000 inH ₂ O)
D	-0.103 and +2.1 MPa (-30 and +300 psi)
E	0 and 21 MPa (0 and 3000 psi)

Maximum Static, Overrange, and Proof Pressure Ratings

DANGER

HAZARD OF EXPLOSION

Exceeding the proof pressure can cause the sensor to rupture forcefully. Avoid exposing the transmitter to the proof pressure limit.

Failure to follow these instructions will result in death or serious injury.

32. Span limit, maximum working pressure, maximum overrange pressure, and maximum static pressure (d/p) are derated for optional IEC 61518 Construction and optional Bolting except for codes -D3, -D7, and -B2. Option -D1 is derated to 2320 psi. Options -D5 and -B1 are derated to 2175 psi. Options -D2, -D4, -D6, and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

NOTICE

POTENTIAL EQUIPMENT DAMAGE

Exceeding the overrange pressure limit for the transmitter can cause damage to the transmitter, degrading its performance. The transmitter could become nonfunctional after exceeding the overrange pressure. Avoid exposure to the overrange pressure limit.

Failure to follow these instructions can result in equipment damage.

Ratings for Direct Connect AP and GP Transmitters

Table 16 - Maximum Overrange and Proof Pressure for Direct Connect Transmitters

Span Limit Code	Maximum Overrange Pressure	Maximum Proof Pressure ³³
D	2.1 MPa (300 psi)	5.51 MPa (800 psi)
E	20.7 MPa (3,000 psi)	55.1 MPa (8,000 psi)
F ³⁴	59.1 MPa (8,580 psig)	165 MPa (24,000 psig)
J ³⁵	99 MPa (14,300 psig)	180 MPa (26,015 psig)

Ratings for DP Transmitters and Biplanar AP and GP Transmitters

For DP transmitters and for AP and GP transmitters with biplanar structures, pressure ratings may be affected by bolting options and other model code selections.

Table 17 - Maximum Static/Overrange and Proof Pressure for DP and Biplanar Transmitters

Transmitter Configuration ³⁶	Maximum Static ³⁷ and Overrange Pressure ³⁸	Maximum Proof Pressure ³³
Standard (B7 steel) with Span Codes A to E, or with Option -B2 (17-4 PH ss), -D3, -D7, -P3, or -P7	25 MPa (3,626 psi)	100 MPa (14,500 psi)
Standard with Span Code F ³⁴	40 MPa (5,800 psi)	100 MPa (14,500 psi)
Option -B3 (B7M), -P4, or -P8	20 MPa (2,900 psi)	77 MPa (11,150 psi)
With Option -D1	16 MPa (2,320 psi)	64 MPa (9,280 psi)
Option -B1 (316 ss), -D5, -P2, or -P6	15 MPa (2,175 psi)	60 MPa (8,700 psi)
With Option -D2, -D4, -D6, or -D8 ³⁹	10 MPa (1,500 psi)	40 MPa (6,000 psi)
Option -D9 (17-4 PH ss) or -Y ⁴⁰	40 MPa (5,800 psi)	100 MPa (14,500 psi)
With Structure Code 78 or 79 (PVDF insert) ⁴¹	2.1 MPa (300 psi)	8.4 MPa (1,200 psi)

33. Meets ANSI/ISA Standard S82.03-1988.

34. Available for gauge pressure transmitters only.

35. Available for gauge pressure transmitters only.

36. Refer to the model code for option descriptions, and for applications and restrictions related to the items listed in the table.

37. Static pressure is relevant only for differential pressure transmitters.

38. Either side can be at higher pressure during overrange.

39. Limited to operating temperatures ranging from -10 to +80°C (14 to 176°F).

40. Differential pressure transmitters only.

41. With PVDF insert, temperature limits are -7 and +82°C (20 and 180°F).

Elevated Zero and Suppressed Zero

For applications requiring an elevated or suppressed zero, it is not possible to exceed the maximum span and the upper and lower range limits of the transmitter.

Output Signal

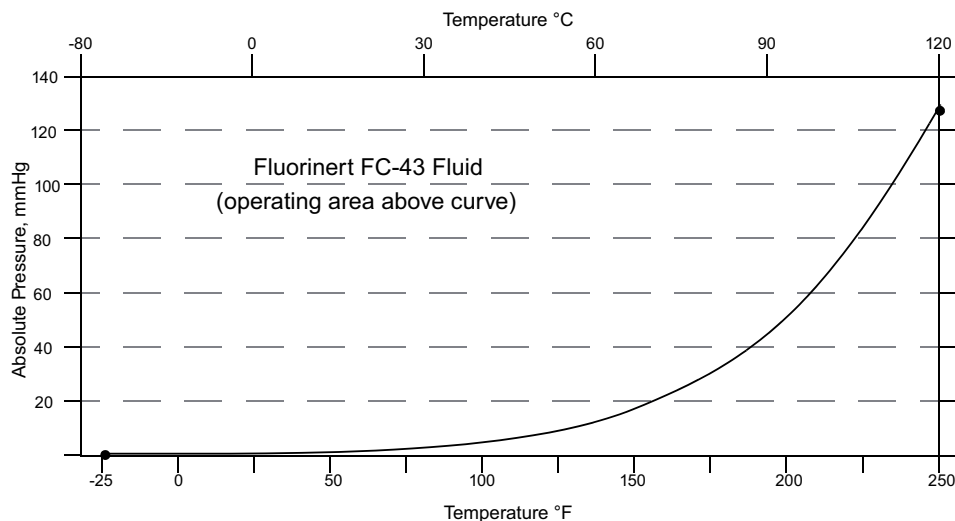
For HART transmitters, 4 to 20 mA dc square root (for DP only) or 4 to 20 mA dc linear with digital HART communication. The output is software-selectable and remotely configurable from the HART Communicator, and locally configurable with the pushbuttons on the optional display. HART 7 allows the mA signal to be fixed or live when multidrop is enabled.

For FOUNDATION Fieldbus transmitters, FOUNDATION Fieldbus square root (for DP only) or FOUNDATION Fieldbus linear. The digital output is software-selectable and remotely configurable from a FOUNDATION Fieldbus host computer or a console equipped with a FOUNDATION Fieldbus Interface Module. It is also locally configurable with the pushbuttons on the optional display.

For Modbus transmitters, digital information is conveyed using the Modbus RTU protocol over an RS-485 interface communicating at a baud rate of up to 19200. The output is configured via the front panel or Modbus.

Minimum Allowable Absolute Pressure vs Process Temperature

- With silicone fill fluid: up to 121°C (250°F) at full vacuum
- With inert fill fluid: refer to the graph



Supply Voltage

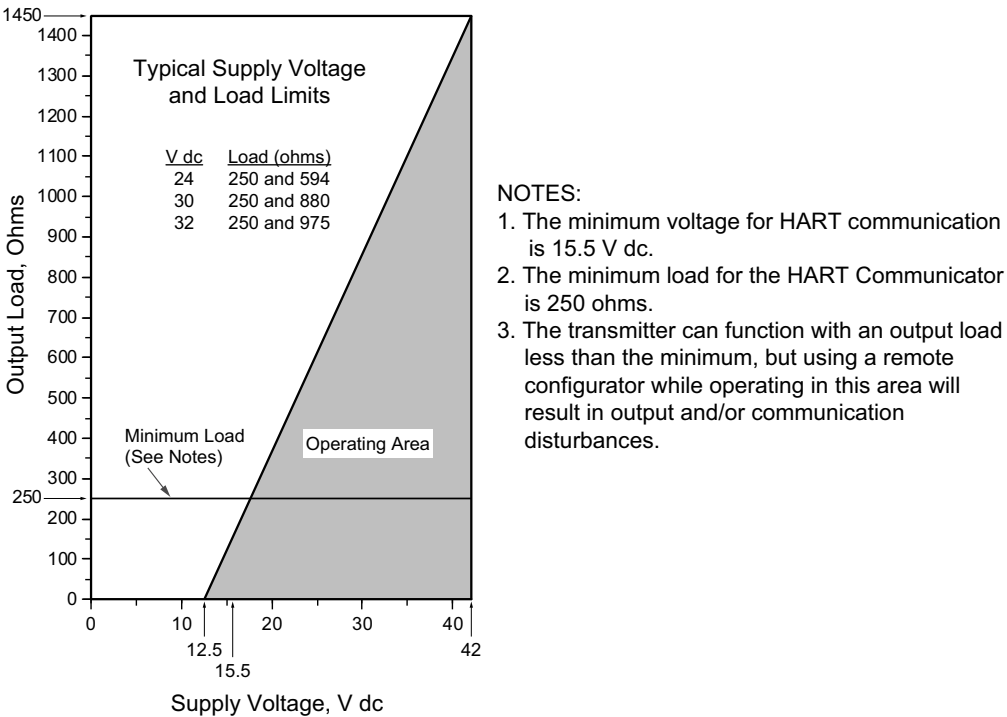
HART Transmitters

The power supply must be capable of providing 22 mA when the transmitter is configured for 4 to 20 mA output. Ripple of up to 2 V pp (50/60/100/120 Hz) is tolerable, but instantaneous voltage must remain within the specified range.

The supply voltage and loop load must be within specified limits. Nominal minimum supply voltage is 12.5 V dc. The supply output load vs. voltage relationship, shown in the following graph, is $R_{max} = 47.5 (V - 12.5 \text{ V dc})$.

You can use any combination of supply voltage and loop load resistance in the shaded area shown in the graph below. To determine the loop load resistance (transmitter output load), add the series resistance of each component in the loop, excluding the transmitter.

Figure 19 - 4 to 20 mA Output Supply Voltage vs Output Load



	HART Communication	No HART Communication
Minimum Resistance	250 Ω	0 Ω
Minimum Supply Voltage	15.5 V dc	12.5 V dc
Maximum Supply Voltage	42 V dc	

FOUNDATION Fieldbus Transmitters

The power supply (a FOUNDATION Fieldbus Power Supply Module) must be capable of providing at least 17 mA for each transmitter connected.

Minimum Supply Voltage	9 V dc
Recommended Supply Voltage	24 V dc
Maximum Supply Voltage	32 V dc

Modbus Transmitters

The following table summarizes the requirements.

Minimum Supply Voltage	9 V dc
Maximum Supply Voltage	30 V dc
Supply Current	Average current of 4 mA at 9 V dc under reference conditions with no Modbus communication

Square Root Low Flow Cutoff for DP Transmitters

The square root low flow cutoff is configurable using a field communicator, PC-based configurator, or the local display. The square root low flow cutoff can be set to:

- Cutoff to zero at any flow rate between 0 and 20% of maximum flow
- Cutoff to zero at flows <10% of maximum flow (1% of maximum differential pressure)
- Active point-to-point line between zero and 20% of maximum flow (4% of maximum differential pressure)

Current Outputs for Low and High Alarms, Underrange, Overrange, Offline, and Other Conditions (HART Only)

Output for Low Alarm	≤ 3.60 mA
Output for High Alarm	≥ 21.00 mA
Output when underrange	3.8 mA
Output when overrange	20.50 mA
Output if the sensor is potentially bad	Configurable to either the high value or low value
Output when offline	Configurable to a constant value between 3.6 mA and 21.0 mA

Adjustable Damping

Damping is user-selectable to values of 0, 0.25, 0.5, 1, 2, 4, 8, 16, or 32 seconds.

Selecting a value of **DAMP 0** in the Damping menu provides the fastest response (HART and FOUNDATION Fieldbus only).

Field Wiring Reversal

HART (-T) Transmitters:

Reversal of field wiring does not damage the transmitter, provided the current is limited to 1 A or less by active current limiting or loop resistance. However, the transmitter is polarity-sensitive.

NOTICE

RISK OF EQUIPMENT DAMAGE

Sustained currents of 1 A do not damage the electronics module or sensor, but can damage the terminal block assembly and external instruments in the loop.

Failure to follow these instructions can result in equipment damage.

Modbus (-M) and FOUNDATION Fieldbus (-F) Transmitters:

The power connections on the transmitter have reverse polarity protection. Reversing the field wiring does not damage the transmitter; the transmitter functions when wired either way.

Calibration High and Low Points for FOUNDATION Fieldbus Transmitters

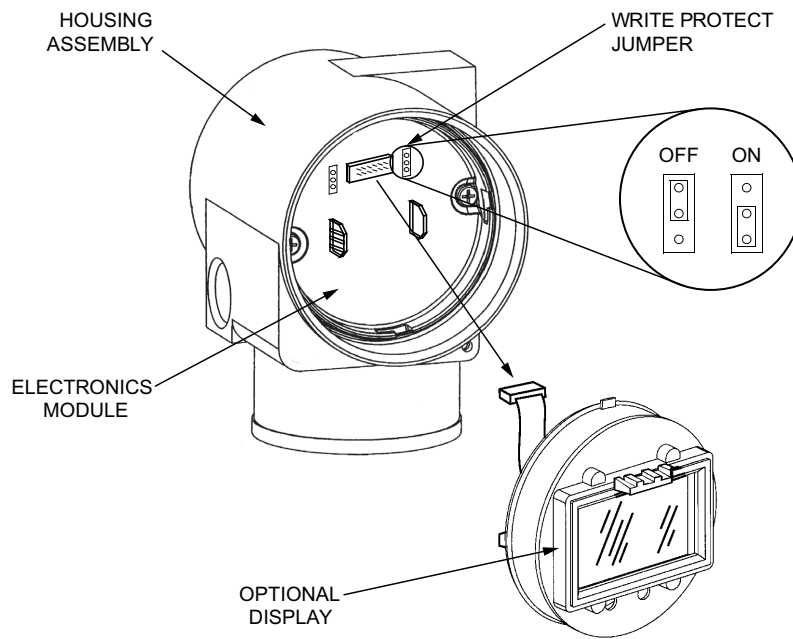
The transmitter's span, or calibrated range, is adjustable using two points: the Calibration High Point (100% of the transmitter's calibrated range) and Calibration Low Point (0% of the transmitter's calibrated range). Calibrated range is adjustable from a FOUNDATION Fieldbus host computer, a console equipped with a FOUNDATION Fieldbus Interface Module, or the transmitter's pushbuttons on the optional local display.

Simulation Jumper for FOUNDATION Fieldbus Transmitters

Transmitters with FOUNDATION Fieldbus have a simulation mode that can be used for troubleshooting the system when the process is not running. Once the simulation jumper is set, you can select any value as the input to the AI Block for testing or debugging purposes.

Write Protect Jumper

The transmitter has a write protect jumper that can be positioned to lock out configurators from making transmitter database changes.

Figure 20 - Write Protect Jumper

Zeroing For Nonzero-Based Ranges

You can zero the transmitter when it is open to atmosphere, even when there is a nonzero-based range. This greatly simplifies position effect zeroing on many pressure and level applications. To zero the transmitter, you can use the local display, a PC-based configurator, Modbus host, or the optional External Zero Adjustment button.

Calibrated Range

The calibrated range of the transmitter is defined as the input range within span and range limits. The transmitter's calibrated range can be expressed in pressure units or flow units, depending on the communication protocol and whether the transmitter is in linear mode or square root mode.

Measurement Values

Output Measurement #1 – Digital Primary Variable and 4 to 20 mA

Mode: Linear or Square Root

Pressure units for AP, GP, and DP transmitters in linear mode and flow units for DP transmitters⁴² in square root mode are provided in *Units*, page 34.

Output Measurement #2 – Digital Secondary Variable

Mode: Linear or Square Root

42. With HART (-T) Communication only.

Pressure units for AP, GP, and DP transmitters in linear mode and flow units for DP transmitters in square root mode, independent of Measurement #1, are provided in Units, page 34.

Units

Table 18 - Allowable Units for Transmitters in Linear and Square Root Mode

Communication Protocol and Transmitter Mode	Units ⁴³
Pressure Units for HART and Modbus Transmitters in Linear Mode	inH2O, ftH2O, mmH2O, inHg, mmHg, cmHg, mHg, psi, psf, mbar, bar, g/cm2,, kg/cm2, kg/m2,, Pa, hPa, kPa, MPa, torr, inWC60, ftWC60, inWC4, ftWC4, mmWC4, cmWC4, mWC4, atm, dy/cm2
Flow Units for HART and Modbus Transmitters in Linear Mode Transmitters in Square Root Mode	gal/s, gal/m, gal/h, gal/d, Mgal/d, ft3/s, ft3/m, ft3/h, ft3/d, lgal/s, lgal/m, lgal/h, lgal/d, l/s, l/m, l/h, Ml/d, m3/s, m3/m, m3/h, m3/d, Nl/h, Nm3/h, Sm3/h, Am3/h, Sft3/m, MSCFD, MMSCFD, bbl/s, bbl/m, bbl/h, bbl/d, g/s, g/m, g/h, kg/s, kg/m, kg/h, kg/d, lb/s, lb/m, lb/h, lb/d, t/m, t/h, t/d, STon/m, STon/h, STon/d, LTon/h, LTon/d, %flow
Pressure Units for Foundation Fieldbus Transmitters in Linear Mode	Pa, MPa, kPa, hPa, bar, mbar, torr, atm, psi, g/cm2, kg/cm2, inH2O (4°C), inH2O (68°F), mmH2O (4°C), mmH2O (68°F), ftH2O (4°C), ftH2O (68°F), inHg (0°C), mmHg (0°C)
Flow Units for Foundation Fieldbus Transmitters in Square Root Mode	g/s, g/min, g/h, kg/s, kg/min, kg/h, kg/d, t/min, t/h, t/d, lb/s, lb/min, lb/h, lb/d, STon/min, STon/h, STon/d, LTon/h, LTon/d, %, m3/s, m3/min, m3/h, m3/d, L/s, L/min, L/h, ML/d, CFS, CFM, CFH, ft3/d, SCFM, gal/s, GPM, gal/h, gal/d, Mgal/d, ImpGal/s, ImpGal/min, ImpGal/h, ImpGal/d, bbl/s, bbl/min, bbl/h, bbl/d, Nm3/h, Sm3/h, NL/h, MSCFD, MMSCFD

Optional External Zero Adjustment

An optional external zero pushbutton (see Digital Liquid Crystal Display (LCD), page 12) is isolated from the electronics compartment and magnetically activates an internal switch through the housing. This helps eliminate a potential leak path for moisture or contaminants to get into the electronics compartment. This zero adjustment can be disabled by a configuration selection.

43. For AP transmitters, 'a' is typically added to the EGU name on the display (for example, psia or mmHga). However, if the EGU name is six characters long, the 'a' is not added.

Performance Specifications

Accuracy (Includes Linearity, Hysteresis, and Repeatability)

Accuracy specifications are described below for Advanced Performance Transmitters with zero-based ranges under reference operating conditions unless otherwise specified.

In the tables that follow:

- If the measurement is within the % of Reading Range and the FoxCal multiple calibration feature is enabled, reference accuracy can be expressed as a “% of Reading”, displayed in the second column of each table [Reference Accuracy (% of Reading Range)]. FoxCal maintains this reference accuracy for zero-based spans down to the turndown limits in the fourth column of each table below without the need for a span point recalibration.
- For measurements below the % of Reading Range, the accuracy is a constant percent of URL based on the accuracy at the lower limit of the % of Reading Range.
- For spans less than URL, reference accuracy is expressed as a “% of Span”, displayed in the last column of each table, (Reference Accuracy for Spans Less than % of Reading Range).
- URL = Upper Range Limit

Table 19 - IGP10S Direct Connect Accuracy⁴⁴

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than % of Reading Range
D	±0.05% of reading	> 4% URL	±0.05% of span For turndowns greater than 30:1, accuracy = ±[0.001667 (URL/Span)]%
E			±0.05% of span For turndowns greater than 80:1 ⁴⁵ , accuracy = ±[0.000625 (URL/Span)]%
F	±0.05% of reading	> 33% URL	±0.05% of span For turndowns greater than 3:1, accuracy = ±[0.01 (URL/Span)]%
J		> 33% URL	±0.05% of span For turndowns greater than 3:1, accuracy = ±[0.01667 (URL/Span)]%

Table 20 - IGP10S Biplanar Accuracy⁴⁴

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than % of Reading Range
A	±0.05% of reading	> 33% URL	±0.05% of span For turndowns greater than 3:1, accuracy = ±[0.016667 (URL/Span)]%
B		> 33% URL	±0.05% of span For turndowns greater than 10:1, accuracy = ±[0.005 (URL/Span)]%
C			±0.05% of span For turndowns greater than 20:1, accuracy = ±[0.0025 (URL/Span)]%
D		> 4% URL	±0.05% of span For turndowns greater than 30:1, accuracy = ±[0.001667 (URL/Span)]%
E		> 33% URL	±0.05% of span For turndowns greater than 3:1, accuracy = ±[0.01667 (URL/Span)]%
F			±0.05% of span For turndowns greater than 5:1, accuracy = ±[0.01 (URL/Span)]%

44. This table is for digital accuracy; add 0.01% span for analog accuracy (HART only).

45. For optimum performance beyond 30:1 turndown, a two-point calibration is recommended.

Table 21 - IAP10S Direct Connect Accuracy⁴⁶

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than % of Reading Range
D	±0.05% of reading	> 4% URL	±0.05% of span For turndowns greater than 30:1, accuracy = ±[0.001667 (URL/Span)]%
E			±0.05% of span For turndowns greater than 80:1 ⁴⁷ , accuracy = ±[0.000625 (URL/Span)]%

Table 22 - IAP10S Biplanar Accuracy⁴⁶

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than % of Reading Range
B	±0.05% of reading	> 33% URL	±0.05% of span For turndowns greater than 8:1, accuracy = ±[0.00625 (URL/Span)]%
C			±0.05% of span For turndowns greater than 20:1, accuracy = ±[0.0025 (URL/Span)]%
D		> 4% URL	±0.05% of span For turndowns greater than 30:1, accuracy = ±[0.001667 (URL/Span)]%
E			±0.05% of span For turndowns greater than 10:1, accuracy = ±[0.005 (URL/Span)]%

Table 23 - IDP10S Accuracy⁴⁶

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than % of Reading Range
A	±0.05% of reading	> 33% URL	±0.05% of span For turndowns greater than 3:1, accuracy = ±[0.016667 (URL/Span)]%
B			±0.05% of span For turndowns greater than 10:1, accuracy = ±[0.005 (URL/Span)]%
C			±0.05% of span For turndowns greater than 20:1, accuracy = ±[0.0025 (URL/Span)]%
D		> 10% URL	±0.05% of span For turndowns greater than 30:1, accuracy = ±[0.001667 (URL/Span)]%
E			±0.05% of span For turndowns greater than 10:1, accuracy = ±[0.005 (URL/Span)]%

Stability

Long term drift for Advanced Performance pressure transmitters is < ±0.03% of URL/yr for 10 years.

Turndown Capabilities

The turndown capability of a pressure transmitter, also known as the “turndown ratio”, “rangeability”, or simply “turndown”, is the ratio between the highest and lowest span settings for a transmitter:

$$\text{Turndown} = \frac{\text{Maximum Span}}{\text{Minimum Span}}$$

46. This table is for digital accuracy; add 0.01% span for analog accuracy (HART only).

47. For optimum performance beyond 30:1 turndown, a two-point calibration is recommended.

Our pressure transmitters have high turndown capabilities of up to 400:1.

Supply Voltage Effect

The output changes less than 0.005% of span for each 1 V change within the specified supply voltage requirements.

Position Effect

You can mount the transmitter in any position. Any zero effect caused by the mounting position can be removed by rezeroing. There is no span effect.

Ambient Temperature Effect

For direct connect AP/GP transmitters:

- With Span Code C, D, E, or F, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.03\% \text{ URL} + 0.06\% \text{ Span})$.
- With Span Code J, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.08\% \text{ URL} + 0.025\% \text{ Span})$.

For biplanar AP/GP transmitters:

- With Span Code A, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.18\% \text{ URL} + 0.025\% \text{ Span})$.
- With Span Code B, C, or D, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.04\% \text{ URL} + 0.050\% \text{ Span})$.
- With Span Code E or F, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.08\% \text{ URL} + 0.025\% \text{ Span})$.

For DP transmitters:

- With Span Code A, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.18\% \text{ URL} + 0.025\% \text{ Span})$.
- With Span Code B, C, or D, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.04\% \text{ URL} + 0.050\% \text{ Span})$.
- With Span Code E or F, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.08\% \text{ URL} + 0.025\% \text{ Span})$.

Vibration Effect

With aluminum housing, per IEC 61298-3, Section 7, Table 2 for “field with high vibration level or pipeline with high vibration level”: 0.42 mm peak to peak displacement from 10 to 60 Hz, 3 “g” constant acceleration input over a frequency range of 60 to 1000 Hz. Total effect is less than 0.1% of URL/sensor range per “g”.

With stainless steel housing, per IEC 61298-3, Section 7, Table 2 for “field with general application or pipeline with low vibration level”: 0.30 mm peak to peak displacement from 10 to 60 Hz, 2 “g” constant acceleration input over a frequency range of 60 to 1000 Hz. Total effect is less than 0.1% of URL/sensor range per “g”.

RFI Effect

For AP and GP transmitters, the output error is less than 0.1% of calibrated span for radio frequencies in the range of 30 to 1000 MHz and field intensity of 30 V/m when the transmitter is properly installed with shielded conduit and grounding, and housing covers are in place (per IEC Std. 61000-4-3).

For DP transmitters, the output error is less than 0.1% of span within standard accuracy turndown limits, for radio frequencies from 27 to 1000 MHz and field intensity of 30 V/m when the transmitter is properly installed with shielded conduit and grounding, and housing covers are in place (per IEC Std. 61000-4-3).

Switching and Indirect Lightning Transients

The transmitter can withstand a transient surge up to 2000 V (common mode) or 1000 V (normal mode) without permanent damage. The output shift is less than 1.0%. (Per ANSI/IEEE C62.41-1980 and IEC Std. 61000-4-5.)

Re-zero Calibration Frequency

The re-zero calibration frequency is five years. The five years is derived using the values of allowable error (% span), TPE (% span), performance margin (% span), and stability (% span/month); where:

Calibration Frequency = $\frac{\text{Performance Margin}}{\text{Stability}}$ = Months

NOTE: Do not perform a span point recalibration when FoxCal is enabled.

Static Pressure Effect for DP Transmitters

The zero and span shift for a 1,000 psi (7 MPa) change in static pressure is described below.

Zero Shift

Zero shift can be calibrated out by zeroing at nominal line pressure.

Span Code	Zero Shift Static Pressure Effect ⁴⁸
A	±0.03% of URL
B	±0.07% of URL
C	±0.02% of URL
D and E	±0.50% URL ⁴⁹

48. This table is for digital accuracy; add 0.01% span for analog accuracy (HART only).
49. Per 3.5 MPa (500 psi) for Span Code D

Span Shift

Span Shift is $\pm 0.15\%$ of reading.

Communication

HART Communication Protocol

Transmitters using HART communication transmit a 4 to 20 mA output signal with a superimposed HART digital signal for remote configuration and monitoring. This allows direct analog connection to common receivers while still providing digital communications using a HART communicator, PC-based configurator, or the local display.

Transmitter communication is configurable for either analog or multidrop (fixed current) mode. Digital communication is provided in both modes based upon the FSK (Frequency Shift Keying) technique which alternately superimposes one of two different frequencies on the uninterrupted current carried by the two signal/power wires. See HART Communication Configured for Analog Mode (4 to 20 mA Output), page 40 and Multidrop (Fixed Current) Communication, page 41.

HART Communication Configured for Analog Mode (4 to 20 mA Output)

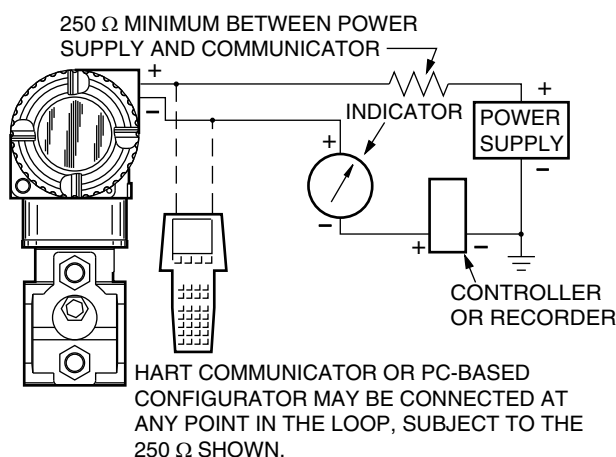
Measurements and diagnostics are available from the HART communicator connected to the two-wire loop carrying the 4 to 20 mA measurement signal by using a bidirectional digital signal superimposed on the 4 to 20 mA current signal.

Multiple measurements are transmitted digitally, including not only the pressure measurement but also the electronics temperature and sensor temperature, which can be used to monitor external heat tracing equipment. For AP and GP transmitters, the primary measurement is expressed in pressure units, and for DP transmitters, the primary measurement can be expressed in either pressure or flow units. Transmitter diagnostics are also communicated.

The 4 to 20 mA output signal is updated multiple times per second. Digital communications between the transmitter and HART communicator or PC-based configurator is rated for distances up to 3,050 m (10,000 ft). The communications rate is 1200 baud and requires a minimum loop load of 250 ohms.

Configuration and reranging can be accomplished with a HART communicator, PC-based configurator, or the pushbuttons on the optional local display.

Figure 21 - 4 to 20 mA Output Functional Block Diagram, Point-to-Point Communications

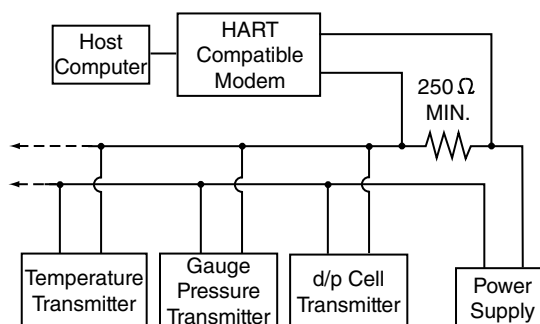


Multidrop (Fixed Current) Communication

Multidrop communication is the connection of several transmitters to a single communications line. Communication between the host computer and transmitters takes place digitally with the analog output of the transmitter fixed.

This mode supports communication with up to 64 transmitters on a single pair of signal/power wires. The output signal is updated 4 times per second and carries not only the pressure measurement, but also the sensor and electronics temperatures. Communication between the transmitter and system, or between the transmitter and communicator or configurator, is rated for distances up to 1525 m (5000 ft). The communications rate is 1200 baud and requires a minimum loop load of 250 ohms.

Figure 22 - Typical Multidrop Functional Block Diagram



FOUNDATION Fieldbus Technology

The FOUNDATION Fieldbus protocol is a digital, serial, two-way communication system that interconnects field devices, such as transmitters, actuators, and controllers. It is a Local Area Network with built-in capability to distribute control application across the network. This technology consists of a physical layer, a communication stack, and user application blocks. Transmitters using FOUNDATION Fieldbus communications are FISCO compliant and receive power from, and communicate digitally over the FOUNDATION Fieldbus segment. Device descriptors (DDs), filed with the FieldComm Group, provide interoperability with any host supporting FOUNDATION Fieldbus communication. In addition, you can communicate with and configure the transmitter using the local display, the device descriptor (DD), Device Type Manager (DTM), or the standardized Field Device Integration (FDI) package.

The FOUNDATION Fieldbus specification FF816 uses IEC 1158-2 and ISA S50.02 Physical Layer Standards as references to define, as a minimum, the signaling and electrical properties of a fieldbus device's Physical Layer interface.

These transmitters are polarity independent and have intrinsically safe parameters per the following table:

Table 24 - FOUNDATION Fieldbus Intrinsically Safe Parameters

Parameter	Recommended Value
Approval Voltage	24 V dc
Approval Current	250 mA
Input Power	1.2 W
Residual Capacitance	< 5 nF
Residual Inductance	< 20 μ H

Fieldbus Characteristics

Table 25 - Fieldbus Characteristics

Parameter	Specification	
Intrinsically Safe	No	Yes
Maximum No. of Devices ⁵⁰	32	6
Maximum Total Bus Length ⁵¹	1900 m (6235 ft)	
Maximum Spur Length ⁵²	120 m (395 ft)	

Bus Sizing Parameters

- Current Consumption: 16.5 mA, nominal
- Minimum Voltage: 9 V dc
- Virtual Communication Relationships: 24 VCR

FOUNDATION Fieldbus Blocks

FOUNDATION Fieldbus blocks for pressure transmitters include:

- One Resource block
- One Transducer block
- One Display block
- Multiple function blocks, each of which executes different application functions of the transmitter:
 - Three Analog Input (AI) function Blocks
 - One PID function block

Resource Block

The Resource block defines device-specific information such as manufacturer name, device name, DD, block status, and hardware-specific data. In addition, the Resource block includes the Namur NE107 compliant FOUNDATION Fieldbus diagnostics that can indicate potential diagnostic conditions.

Transducer Block

The Transducer block interfaces with hardware to configure the measurement and display and contains all of the manufacturer-specific parameters that define how the pressure transmitter functions. The Transducer block also allows you to influence the input and output variables of function blocks. Block parameters allow you to configure the sensor, physical units, calibration, damping, messages, and other device-specific parameters.

50. Maximum number of devices may be less depending on device power consumption, type of cable used, addition of accessory devices such as repeaters, etc.

51. Total bus length including all spurs is based on use of #18 AWG (0.8 mm²) shielded twisted pair cable. See Installation Manual for the precise relationship between cable length, spur lengths, cable type, and number of devices.

52. Maximum spur length is as listed. However, for hybrid installations, the maximum intrinsically safe (IS) spur length is dependent on the field barrier used. For IS installations, the maximum spur length is 30 m (98 ft). Minimum spur length is 1 m (3.3 ft)

Display Block

The Display Block allows you to configure up to four additional process variables to appear on the transmitter's local display in addition to the two primary measurements. These additional four process variables can originate from other FOUNDATION Fieldbus devices, the transmitter's Analog Input blocks, or the final output of the transmitter's PID block.

The Display block functionality is configured with a Multiple Analog Output (MAO) function block and specific parameters in the Transducer block.

Analog Input (AI) Function Block

The host control system connects to the Analog Input (AI) function block to get the measured value from the transmitter. The AI block allows you to select the output of the transmitter in terms of pressure, flow (for DP transmitters), or transmitter and sensor temperature and allows you to rescale a measurement, add an offset to a measurement, or both.

The Schneider Electric AI block allows you to set limits on the output, and furthermore, provides the capability to configure a Boolean output if those limits are exceeded and the alarm limits of the standard FOUNDATION Fieldbus AI block are also exceeded.

There are three AI function blocks provided with these pressure transmitters, two of which can be instantiated in addition to one permanent AI block. Instantiation and deinstantiation (which is a means of hiding a block) can be accomplished using the host control system or Device Type Manager (DTM).

AI block parameters include revision level, tag description, alarms, process variables, transducer scale values, and strategy.

Proportional, Integral, Derivative (PID) Function Block

The Proportional, Integral, Derivative (PID) function block can be used in conjunction with internal blocks, external blocks, or both. The PID block contains the standard parameters required to implement a general purpose, automatic PID control scheme, and in addition, the PID block can regulate a process based on a measurement and a setpoint. The Auto Tune feature provided with the Schneider Electric PID block allows the PID block to automatically determine unique characteristics of your process by making small bumps to the value of the OUT parameter and measuring the response at the IN parameter.

Display Block

The Display Block allows you to configure up to four additional process variables to appear on the transmitter's local display in addition to the two primary measurements. These additional four process variables can originate from other FOUNDATION Fieldbus devices, the transmitter's Analog Input blocks, or the final output of the transmitter's PID block.

The Display block functionality is configured with a Multiple Analog Output (MAO) function block and specific parameters in the Transducer block.

Device Descriptors (DDs)

DD and function block parameters allow device interoperability. The DD allows the host to interpret device data, including calibration and diagnostics. DDs are available from the device vendor or from the FieldComm organization.

Modbus Communication

This transmitter combines proven multivariable sensing technology with the advanced development of the Modbus protocol. Communication with a host processor is made using the Modbus RTU (Remote Terminal Unit) mode over a 2-wire RS-485 multidrop serial connection.

The transmitter functions as a server device. Server (station) addresses are in the range of 1 to 247.

Table 26 - Modbus Communication Parameters

Parameter	Values
Serial Connection	RS-485
Serial Protocol	Modbus RTU Server
Supported Baud Rate	1200, 4800, 9600, and 19200
Modbus Address	Supports Standard (1-254) and Extended (1-65534). (Default=99)
Parity	User selectable (Default=No Parity)
Word Length	8 bits
Stop Bit	User selectable (Default=2 bits)

Operating Conditions

Description	Reference Operating Conditions	Normal Operating Conditions ⁵³	Operative Limits ⁵³
Sensor Body Temperature ⁵⁴			
Silicone	24 ± 2°C (75 ± 3°F)	-29 to +82°C (-20 to +180°F) ⁵⁵	-46 and +121°C (-50 and +250°F) ^{56 57}
Fluorinert	24 ± 2°C (75 ± 3°F)	-29 to +82°C (-20 to +180°F)	-29 and +121°C (-20 and +250°F)
NEOBEE®	24 ± 2°C (75 ± 3°F)	-18 to +82°C (0 to +180°F)	-18 and +121°C (0 and 250°F)
Electronics Temperature			
Without display	24 ± 2°C (75 ± 3°F)	-29 to +82°C (-20 to +180°F) ⁵⁸	-40 and +85°C (-40 and +185° F) ^{59 60}
With display	24 ± 2°C (75 ± 3°F) ⁶¹	-20 to 82°C (-4 to +180°F) ^{62 63 61}	-40 and +85°C (-40 and +185° F) ^{59 60 64 61}
Relative Humidity	50 ± 10% ⁶⁵	0 to 100% ⁶⁵	0 and 100% ⁶⁵
Ambient Pressure (DP HART)	860 to 1060 mbar	Atmospheric	Atmospheric
Supply Voltage, dc (HART) ⁶⁶	30 ± 0.5 V dc	15.5 to 42 V dc	12.5 V dc and 42 V dc
Supply Voltage, dc (FOUNDATION Fieldbus)	24 V dc	9 to 32 V dc	9 V dc and 32 V dc
Output Load (HART)	650 Ω	0 to 1,450 Ω ⁶⁷	0 and 1,450 Ω ⁶⁷
Mounting Position			
AP and GP	Upright	Upright	No limit
DP	Upright or Horizontal ⁶⁸	Upright or Horizontal ⁶⁸	
Vibration			
Aluminum Housing	1 m/s² (0.1 "g")	Per IEC 60770 for "field with high vibration level or pipeline with high vibration level": 0.42 mm peak-to-peak displacement from 10 to 60 Hz, 3 "g" constant acceleration input over a frequency range of 60 to 1000 Hz	
SS Housing	1 m/s² (0.1 "g")	Per IEC 60770 for "field with general application or pipeline with low vibration level": 0.3 mm peak-to-peak displacement from 10 to 60 Hz, 2 "g" constant acceleration input over a frequency range of 60 to 1000 Hz	

53. Normal Operating Conditions and Operative Limits are defined per ANSI/ISA 51.1-1979 (R1993).

54. When Traditional Structure Codes 78/79 (PVDF inserts in Hi- and Lo-side process covers) are used, temperature limits are -7 and +82°C (+20 and 180°F).

55. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters

56. Selection of Option -J extends the low temperature operative limit of transmitters with silicone filled sensors down to -50°C (-58°F). Performance is not assured below -29°C. Sensor damage may occur if process is frozen. Contact Global Customer Support for availability of this option.

57. -46 and +50°C (-50 and +122°F) for biplanar AP transmitters.

58. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters.

59. -40 and +75°C (-40 and +167°F) for transmitters with flameproof classification.

60. -40 and +50°C (-40 and +122°F) for biplanar AP transmitters.

61. Although the LCD will not be damaged by any temperature within the storage and transportation limits, updates will be slowed and readability decreased at temperatures outside the normal operating conditions.

62. -20 to +50°C (-20 to +122°F) for biplanar AP transmitters.

63. Refer to Electrical Certifications, page 47 for a restriction in ambient temperature limits with certain electrical approvals/certifications.

64. Display updates are slowed and readability is decreased at temperatures less than -20°C (-4°F).

65. Relative humidity refers to transmitters with housing covers installed and conduit entrances sealed. To maintain IEC IP66/IP67 and NEMA Type 4X protection, plug the unused conduit opening with the metal plug provided. Use a suitable thread sealant on both conduit connections. In addition, the threaded housing covers must be installed. Turn covers to seat the o-ring into the housing, then continue to hand-tighten until the cover contacts the housing metal-to-metal.

66. Refer to Supply Voltage, page 30.

67. 250 Ω minimum load is required for communication with a HART communicator.

68. Sensor process wetted diaphragms in a vertical plane.

Storage and Transportation Conditions

Description	Storage and Transportation Limits
Sensor Body Temperature	-29 to +82°C (-20 to +180°F) ⁶⁹
Electronics Temperature	-20 to +82°C (-4 to +180°F) ^{70 71 69}
Relative Humidity	0 to 100% Noncondensing ⁷²
Ambient Pressure (DP HART)	Atmospheric

69. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters.

70. -20 to +50°C (-4 to +122°F) for biplanar AP transmitters.

71. Refer to *Electrical Certifications*, page 47 for a restriction in ambient temperature limits with certain electrical approvals/certifications.

72. Relative humidity refers to transmitters with housing covers installed and conduit entrances sealed. To maintain IEC IP66/IP67 and NEMA Type 4X protection, plug the unused conduit opening with the metal plug provided. Use a suitable thread sealant on both conduit connections. In addition, the threaded housing covers must be installed. Turn covers to seat the o-ring into the housing, then continue to hand-tighten until the cover contacts the housing metal-to-metal.

Electrical Certifications

These transmitters have been designed to meet the electrical safety descriptions listed in the following table. For detailed information or status of testing laboratory approvals/certifications, contact Global Customer Support.

Refer to *Model Codes*, page 49 for the availability of electrical safety design codes with specific transmitter structures.

⚠️ DANGER

When selecting an Electrical Safety Design Code that ends in “M” or “P,” you must permanently mark (check off in the rectangular block on the data plate) one type of protection only. Do not change this mark once it has been applied.

Failure to follow these instructions will result in death or serious injury.

Table 27 - Electrical Certifications

Agency Certification, Types of Protection, and Area Classification	Application Conditions ⁷³	Model Code Option
ATEX/UKEX intrinsically safe, Ex ia IIC ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	AA
ATEX/UKEX flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	AD
ATEX/UKEX multiple certifications (includes Codes AA and AN) ⁷⁴	Applies to Codes AA and AN	AM
ATEX/UKEX protection type n, Ex ic IIC, or Ex nA ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	AN
ATEX/UKEX multiple certifications (includes Codes AA, AD and AN) ⁷⁴	Applies to Codes AA, AN, and AD	AP
INMETRO intrinsically safe, Ex ia IIC ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	BA
INMETRO flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	BD
INMETRO multiple certifications (includes INMETRO Codes BA and BD) ⁷⁴	Applies to codes BA and BD	BP
CSA intrinsically safe, Zone certified Ex ia ⁷⁴	Temperature Class T4A at 40°C and T3C at 85°C maximum ambient	CA
CSA zone certified flameproof Ex db IIC; also explosion proof, dust ignition-proof	T6, Maximum Ambient Temperature 75°C	CD
CSA multiple certifications (includes CSA Codes CA and CN) ⁷⁴	Applies to codes CA and CN	CM
CSA non-incendive, Zone certified Ex nA IIC ⁷⁴	Temperature Class T4A at 40°C and T3C at 85°C maximum ambient	CN
CSA multiple certifications (includes CSA Codes CA, CD and CN) ⁷⁴	Applies to codes CA, CD, and CN	CP
Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	DA
Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	DD
Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	DN
IECEx intrinsically safe, Ex ia IIC ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	EA
IECEx flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	ED
IECEx multiple certifications, ia, ic, nA ⁷⁴	Applies to Codes EA and EN	EM
IECEx protection type n, Ex ic IIC, or Ex nA ⁷⁴	Temperature Class T4, Ta = -40°C to +80°C	EN
IECEx multiple certifications, ia, ic, nA, and db ⁷⁴	Applies to Codes EA, EN, and ED	EP

73. Selection of Option -J extends the low temperature operative limit of transmitters with silicone filled sensors down to -50°C (-58°F).

74. Not available with Electronics Version -M.

Table 27 - Electrical Certifications (Continued)

Agency Certification, Types of Protection, and Area Classification	Application Conditions ⁷⁵	Model Code Option
FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC ⁷⁶	Temperature Class T4, Ta = -40°C to +80°C	FA
FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC	Temperature Class T6 at 75°C and T5 at 85°C maximum ambient	FD
FM multiple certifications (includes FM Codes FA or FN) ⁷⁶	Applies to codes FA or FN	FM
FM Classes I, II and III, Division 2 non-incendive, Zone approved AEx nA IIC ⁷⁶	Temperature Class T4, Ta = -40°C to +80°C	FN
FM multiple certifications (includes FM Codes FA, FD or FN) ⁷⁶	Applies to codes FA, FD, or FN	FP
KC Certification Ex db	Temperature Class T6, T85°C, Ta = -40°C to +75°C	KD
NEPSI intrinsically safe ⁷⁶	Temperature Class T4, Ta = -40°C to +80°C	NA
NEPSI flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	ND
EAC intrinsically safe, Ex ia ⁷⁶	Temperature Class T4, Ta = -40°C to +80°C	RA
EAC flameproof, Ex db	Temperature Class T4, Ta = -40°C to +75°C	RD
EAC protection type n, Ex ic IIC or Ex nA ⁷⁶	Temperature Class T4, Ta = -40°C to +80°C	RN
No certification ⁷⁶	n/a	ZZ

75. Selection of Option -J extends the low temperature operative limit of transmitters with silicone filled sensors down to -50°C (-58°F).

76. Not available with Electronics Version -M.

Model Codes

These tables list the available options for the Absolute, Gauge, and Differential Pressure Transmitters described in this document.

Absolute and Gauge Pressure Transmitters

Table 28 - Absolute and Gauge Pressure Transmitters

Code	Description
Model⁷⁷	
IAP10S	Absolute Pressure Transmitter, Advanced Tier with FoxCal™
IGP10S	Gauge Pressure Transmitter, Advanced Tier with FoxCal™
Electronics Versions/Output Signals	
-T	HART and 4 to 20 mA with SIL 2
-F	FOUNDATION Fieldbus H1 Digital Communications
-M	Modbus RTU
Structure Codes	
Structure — Direct Connect^{78 79}	
20	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
21	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
22	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
23	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
30	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
31	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
32	C276 Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
33	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
34	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸⁰
35	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸⁰
36	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸⁰
37	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸⁰
38	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸⁰
39	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸⁰

77. Refer to Accuracy (Includes Linearity, Hysteresis, and Repeatability), page 35 for accuracy specifications.

78. Not available with Electrical Certification codes that end in D or P.

79. Not available with Electronics Version -M.

80. Not available with option codes -V1, -V2, -V3, and -V4.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
E2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
E3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹
E4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
E5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹
E6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
E7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹
Structure — Direct Connect Gold-Plated^{82 83}	
42	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸¹
43	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸¹
44	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸¹
45	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸¹
46	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸¹
47	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸¹
70	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
71	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
72	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
73	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
80	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
81	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
82	C276 Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
83	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
G2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
G3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹
G4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
G5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹
G6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸¹
G7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸¹

81. Not available with option codes -V1, -V2, -V3, and -V4.

82. Not available with Electrical Certification codes that end in D or P.

83. Not available with Electronics Version -M.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Structure — Direct Connect Flameproof	
52	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
5G	316L ss Process Sensor; 316L ss/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
53	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
60	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
6G	316L ss Process Sensor; C276/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
61	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
62	C276 Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
6P	C276 Process Sensor; C276/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
63	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
90	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸⁴
91	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸⁴
92	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸⁴
93	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸⁴
F2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only ⁸⁴
F3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only ⁸⁴
F4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸⁴
F5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸⁴
F6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸⁴
F7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸⁴
Structure — Direct Connect, Prepared for Diaphragm Seals — Diaphragm Seals Provided^{85 86}	
D1	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁸⁷
D2	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁸⁷
S3	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁸⁸
S4	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁸⁸
Structure — Direct Connect, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided^{85 89 86}	
SC	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal
SD	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal
Structure — Direct Connect Flameproof, Prepared for Diaphragm Seals — Diaphragm Seals Provided	
D5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁸⁷
D6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁸⁷
S5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁸⁸
S6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁸⁸
Structure — Direct Connect Flameproof, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided⁸⁹	

84. Not available with option codes -V1, -V2, -V3, and -V4.

85. Not available with Electrical Certification codes that end in D or P.

86. Not available with Electronics Version -M.

87. Specify direct connect seal DS-F, DS-G, DS-H, DS-K, DS-L, DS-M, or DS-N.

88. Specify remote mount seal DS-C, DS-F, DS-G, DS-H, DS-J, DS-K, DS-L, DS-M, or DS-N.

89. These structures are prepared for attachment of diaphragm seals by others. Do not specify a seal model code.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
SH	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal
SJ	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal
Structure — Direct Connect, Prepared for Sanitary or Pulp and Paper Seals (Vented Housing)^{90 91 92}	
TA	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; 1.5" Tri-Clamp Sanitary Connection
T2	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; 2.0" Tri-Clamp Sanitary Connection
T3	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; 3.0" Tri-Clamp Sanitary Connection
TB	316L ss Process Sensor; C276 Diaphragm; Neobee Fill; 1.5" Tri-Clamp Sanitary Connection
T4	316L ss Process Sensor; C276 Diaphragm; Neobee Fill; 2.0" Tri-Clamp Sanitary Connection
T5	316L ss Process Sensor; C276 Diaphragm; Neobee Fill; 3.0" Tri-Clamp Sanitary Connection
M1	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; Mini Tank Spud Seal, 1.5" Ext.
M6	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; Mini Tank Spud Seal, 6" Ext.
M9	316L ss Process Sensor; 316L ss Diaphragm; Neobee Fill; Mini Tank Spud Seal, 9" Ext.
PA	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Sleeve Type 1" (nominal)
PB	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Threaded Type 1" (nominal)
PC	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Sleeve Type 1.5" (nominal)
PD	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Threaded Type 1.5" (nominal)
PE	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Sleeve Type 1" (nominal)
PF	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1" (nominal)
PG	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Sleeve Type 1.5" (nominal)
PH	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1.5" (nominal)
PJ	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1.5" (fits Ametek spud)
Structure — Direct Connect, High Pressure (Gauge Pressure Only)	
28	13-8 Moly ss Process Sensor and Diaphragm; Autoclave F-250-C Connection ⁹³
Structure — Biplanar (Vented Low Side Process Cover and Diaphragm)	
B0	316 ss Cover; Co-Ni-Cr Diaphragm; Silicone Fill
B1	316 ss Cover; Co-Ni-Cr Diaphragm; Inert Fill
B2	316 ss Cover; 316L ss Diaphragm; Silicone Fill
B3	316 ss Cover; 316L ss Diaphragm; Inert Fill
BG	316 ss Cover; 316 ss Gold-Plated Diaphragm; Silicone Fill
B4	316 ss Cover; Monel Diaphragm; Silicone Fill
B5	316 ss Cover; Monel Diaphragm; Inert Fill
B6	316 ss Cover; C276 Diaphragm; Silicone Fill
B7	316 ss Cover; C276 Diaphragm; Inert Fill
N4	Monel Cover; Monel Diaphragm; Silicone Fill
N5	Monel Cover; Monel Diaphragm; Inert Fill

90. Not available with Electrical Certification codes that end in D or P.

91. Available with Span Limit codes C and D for -T electronics, and available only with Span code D for -F electronics.

92. Not available with Electronics Version -M.

93. Available with Span Limit code H only.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
C6	C276 Cover; C276 Diaphragm; Silicone Fill
C7	C276 Cover; C276 Diaphragm; Inert Fill
C8	C276 Cover; Tantalum Diaphragm; Silicone Fill
C9	C276 Cover; Tantalum Diaphragm; Inert Fill
78	PVDF Insert; Tantalum Diaphragm; Silicone Fill ⁹⁴
79	PVDF Insert; Tantalum Diaphragm; Inert Fill ⁹⁴
Structure — LP1 Biplanar (Not Available with Diaphragm Seals)	
LL	316 ss Cover; 316L ss Diaphragm; Silicone Fill
LM	316 ss Cover; 316L ss Diaphragm; Inert Fill
LC	316 ss Cover; C276 Diaphragm; Silicone Fill
LD	316 ss Cover; C276 Diaphragm; Inert Fill
CC	C276 Cover; C276 Diaphragm; Silicone Fill
CD	C276 Cover; C276 Diaphragm; Inert Fill
Structure — LP2 Biplanar (Not Available with Diaphragm Seals)	
L2	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill
L3	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill
L6	316 ss Cover; 316L ss Process Sensor; C276 Diaphragm; Silicone Fill
L7	316 ss Cover; 316L ss Process Sensor; C276 Diaphragm; Inert Fill
Structure — Biplanar, Prepared for Diaphragm Seals — Diaphragm Seals Provided^{95 96 97}	
P1	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁹⁸
P2	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁹⁸
P3	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁹⁹
P4	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁹⁹
Structure — Biplanar, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided^{95 96 97 100}	
P5	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal
P6	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal

94. Maximum pressure rating is 2.1 MPa (300 psi); temperature limits are derated to -7 and +82°C (+20 and +180°F).

95. Not available with optional Biplanar Process Connector (codes -F1 through -F6).

96. Not available with options -X1, -X2, or -X3.

97. Span Limit code A not available for biplanar structures P1, P2, P3, P4, P5, and P6.

98. Specify direct connect seal DS-C, DS-F, DS-G, DS-H, DS-K, DS-L, DS-M, DS-N, or DS-P.

99. Specify remote mount seal DS-C, DS-F, DS-G, DS-H, DS-J, DS-K, DS-L, DS-M, or DS-N.

100. These structures are prepared for attachment of diaphragm seals by others. Do not specify a seal model code.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Span Limits	
Transmitters with Direct Connect Structures	
D	3.4 and 1380 kPa (0.5 and 200 psi)
E	0.034 and 13.8 MPa (5 and 2000 psi)
F ¹⁰¹	0.52 and 41.4 MPa (75 and 6000 psi)
J ¹⁰²	6.9 and 69 MPa (1000 and 10000 psi) ¹⁰³
Transmitters with Biplanar Structures	
A ¹⁰¹	0.12 and 7.5 kPa (0.5 and 30 inH ₂ O)
B	0.12 and 50 kPa (0.5 and 200 inH ₂ O)
C	0.62 and 250 kPa (2.49 and 1000 inH ₂ O)
D	26 and 2070 kPa (3.75 and 300 psi) ¹⁰⁴
E	0.26 and 20.7 MPa (37.5 and 3000 psi) ¹⁰⁴
F ¹⁰¹	1.1 and 34.5 MPa (165 and 5000 psi) ¹⁰⁴
Conduit Connection and Housing Material	
1	1/2 NPT Conduit Connection, Both Sides, Aluminum Housing
3	1/2 NPT Conduit Connection, Both Sides, 316 ss Housing
5	M20 Conduit Connection, Both Sides, Aluminum Housing
6	M20 Conduit Connection, Both Sides, 316 ss Housing
Electrical Certifications	
AA	ATEX/UKEX intrinsically safe, Ex ia IIC ^{105 106}
AD	ATEX/UKEX flameproof, Ex db IIC ¹⁰⁷
AM	ATEX/UKEX multiple certifications (includes Codes AA and AN) ^{105 106}
AN	ATEX/UKEX protection type n, Ex ic IIC, or Ex nA ^{105 106}
AP	ATEX/UKEX multiple certifications (includes Codes AA, AD and AN) ^{105 107}
BA	INMETRO intrinsically safe, Ex ia IIC ^{105 106}
BD	INMETRO flameproof, Ex db IIC ¹⁰⁷
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD) ^{105 107}
CA	CSA intrinsically safe, Zone certified Ex ia ¹⁰⁵
CD	CSA zone certified flameproof Ex db IIC; also explosion proof, dust ignition-proof ¹⁰⁷
CM	CSA multiple certifications (includes CSA Codes CA and CN) ¹⁰⁵
CN	CSA non-incendive, Zone certified Ex nA IIC ¹⁰⁵
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN) ^{105 107}

101. Available for gauge pressure transmitters only.

102. Available for gauge pressure transmitters only.

103. Available only with Direct Connect structures that have 1/2 NPT external diameter and either 316L ss or C276 diaphragm material.

104. Not available with Structure codes 78 and 79 (PVDF process covers).

105. Not available with Electronics Version -M.

106. Not available with Structure codes TA, T2, T3, TB, T4, T5, M1, M6, M9.

107. Available with all biplanar structures and only the following Direct Connect Structure codes: 52, 5G, 53, 60, 6G, 61, 62, 6P, 63, 90, 91, 92, 93, F2, F3, F4, F5, F6, F7, D5, D6, S5, S6, SH, SJ.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
DA	Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC ^{108 109}
DD	Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC ¹¹⁰
DM	Multi-marked ATEX/UKEX and IECEx multiple certifications, ia, ic ^{108 109}
DN	Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC ^{108 109}
DP	Multi-marked ATEX/UKEX and IECEx multiple certifications, ia, ic, and db ^{108 110}
EA	IECEx intrinsically safe, Ex ia IIC ^{108 109}
ED	IECEx flameproof, Ex db IIC ¹¹⁰
EM	IECEx multiple certifications, ia, ic, nA ^{108 109}
EN	IECEx protection type n, Ex ic IIC, or Ex nA ^{108 109}
EP	IECEx multiple certifications, ia, ic, nA, and db ^{108 110}
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC ¹⁰⁸
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC ¹¹⁰
FM	FM multiple certifications (includes FM Codes FA or FN) ¹⁰⁸
FN	FM Classes I, II and III, Division 2 non-incendive, Zone approved AEx nA IIC ¹⁰⁸
FP	FM multiple certifications (includes FM Codes FA, FD or FN) ^{108 110}
KD	KC Certification Ex db ¹¹⁰
NA	NEPSI intrinsically safe ^{108 109}
ND	NEPSI flameproof, Ex db IIC ¹¹⁰
RA	EAC intrinsically safe, Ex ia ^{108 109}
RD	EAC flameproof, Ex db ¹¹⁰
RN	EAC protection type n, Ex ic IIC or Ex nA ^{108 109}
ZZ	No certification ¹⁰⁸
Optional Mounting Bracket Sets	
-M1	Painted Steel Bracket, Plated Steel Bolts, 1/2 NPT, Direct Connect Only ^{111 112 113}
-M2	Stainless Steel Bracket, Stainless Steel Bolts, 1/2 NPT, Direct Connect Only ^{111 112 113}
-M3	Universal Stainless Steel Mounting Bracket Set, Stainless Steel Hardware, Biplanar Only
-M5	Painted Steel Bracket, Plated Steel Bolts, M20, Direct Connect Only ^{111 112 114}
-M6	Stainless Steel Bracket, Stainless Steel Bolts, M20, Direct Connect Only ^{111 112 114}
-M7	Stainless Steel Bracket for Flameproof Direct Connect Sensor Structures ¹¹⁵
-M8	Painted Steel Bracket for Flameproof Direct Connect Sensor Structures ¹¹⁵
-M9	Painted Steel Bracket, Plated Steel Bolts, Biplanar Only
-M0	Stainless Steel Bracket, Stainless Steel Bolts, Biplanar Only

108. Not available with Electronics Version -M.

109. Not available with Structure codes TA, T2, T3, TB, T4, T5, M1, M6, M9.

110. Available with all biplanar structures and only the following Direct Connect Structure codes: 52, 5G, 53, 60, 6G, 61, 62, 6P, 63, 90, 91, 92, 93, F2, F3, F4, F5, F6, F7, D5, D6, S5, S6, SH, SJ.

111. Not available with biplanar structures.

112. Not available with Electrical Certification codes that end in D or P.

113. Available with Conduit Connection and Housing Material codes 1 and 3 only.

114. Available with Conduit Connection and Housing Material codes 5 and 6 only.

115. Available only with flameproof Direct Connect Structure codes, excluding D5 and D6.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional Vent Screw and Block and Bleed Valve	
-V1	316 ss Vent Screw in Process Connection ^{116 117 118}
-V2	Block and Bleed Valve, Carbon Steel ^{116 117 119}
-V3	Block and Bleed Valve, 316 ss ^{116 117 119}
-V4	Block and Bleed Valve, 316 ss w/ Monel Trim, NACE Approved ^{116 117 119}
-V5	Vent Screw in Side of Process Cover ^{120 121}
-V6	Omit Vent Screw ¹²²
Optional Biplanar Process Connector Type (same material as Process Cover)¹²³	
-F1	1/4 NPT ¹²⁴
-F2	1/2 NPT ¹²⁵
-F3	RC 1/4 ¹²⁴
-F4	RC 1/2 ¹²⁵
-F6	1/2 Schedule 80 Weld Neck ¹²⁴
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover
Optional IEC 61518 Construction^{126 127}	
-D1	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=2320 psi ¹²⁸
-D2	Double-Ended Process Cover ¹²⁹ with B7 Steel Bolt; Size M10 Steel Connector Screw; MWP=1500 psi ^{130 131 132}
-D3	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=3626 psi ¹²⁸
-D4	Double-Ended Process Cover ¹²⁹ with B7 Steel Bolt; Size 7/16 Steel Connector Screw; MWP=1500 psi ^{130 131 132}
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi ¹²⁸
-D6	Double-Ended Process Cover ¹²⁹ with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi ^{130 131 132}
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi ¹²⁸
-D8	Double-Ended Process Cover ¹²⁹ with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi ^{130 131 132}
-D9	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=5800 psi ¹²⁸

116. Not available with biplanar structures.

117. Not available with option -G.

118. Available only with 1/2 NPT 316L ss Structure codes 22, 23, 30, 31, 52, 5G, 53, 60, 6G, and 61. Structure Codes 70, 71, 72, 73, 80, and 81 also available for -T and -F electronics only.

119. Available only with structures that have 1/2 NPT external connections.

120. Available only with biplanar Structure codes B0, B1, B2, B3, BG, B4, B5, B6, B7, N4, N5, C6, C7, C8, C9.

121. Not available with optional IEC 61518 Construction codes -D1 through -D9.

122. Available only for transmitters with LP1 structures.

123. Process Connectors not available with Structure codes LL, LM, LC, or LD when Optional Mounting Bracket option -M3, -M9, or -M0 is selected.

124. Available with all biplanar structures that have 316L ss or Monel process covers.

125. Available with all biplanar structures except those with PVDF process covers.

126. Span limit, maximum working pressure, maximum overrange pressure, and maximum static pressure (d/p) are derated for optional IEC 61518 Construction and optional Bolting except for codes -D3, -D7, and -B2. Option -D1 is derated to 2320 psi. Options -D5 and -B1 are derated to 2175 psi. Options -D2, -D4, -D6, and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

127. Not available with optional Biplanar Process Connector (codes -F1 through -F6).

128. Available with Biplanar Structure codes B0, B1, B2, B3, BG, B4, B5, B6, B7, LL, LM, LC, and LD.

129. Blind connector supplied.

130. Temperature limits are derated to -10 and +80°C (14 and 176°F) for optional IEC 61518 Construction codes -D2, -D4, -D6, and -D8 only.

131. Available only with Structure codes B0, B1, B2, B3, BG, B4, B5, B6, and B7.

132. Not available with optional Mounting Bracket Sets -M3, -M9, and -M0.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional Cleaning and Preparation	
-X1	Unit Degreased – for Silicone Fill Sensors Only ¹³³
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only ^{134 135}
-X3	Cleaned and Prepared for Chlorine Service ^{134 136}
Optional Bolting (Process Covers and Process Connectors)^{137 138 139 140}	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi) ¹⁴¹
-B2	17-4 PH ss Bolts and Nuts (bright acid tin coated corrosion protection with no pressure derating)
-B3	B7M Bolts and 2HM Nuts (conforms to NACE MR0175/MR0103, Class II; MWP derated to 2900 psi) ¹⁴¹
Optional Conduit Thread Adapters^{142 143 144}	
-A1	Hawke-Type 1/2 NPT Brass Cable Gland
-A3	M20 Connector
Optional Custom Factory Configuration	
-C1	Custom Factory Calibration (Calibration and Unit Tags Required)
-C2	Custom Factory Configuration (requires Configuration Form to be filled out)
Optional Electronics Housing Features	
-Z1	External Zero Adjustment ¹⁴⁵
-Z2	Custody Transfer Lock and Seal ¹⁴⁶
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal ^{145 146}
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector ¹⁴⁷
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector ¹⁴⁸
Optional Manifold Configurations	
-H1	Manifold Mounted to Transmitter and Pressure Tested (1.5 times transmitter range or 1.5 times manifold rating, whichever is less)
-H2	Manifold Mounted to Transmitter and Pressure Tested (Certificate)

133. Available only with structures that have silicone fill and are not prepared for seals.

134. Available only with structures that have inert fill (excluding Structure code 79) and are not prepared for seals.

135. After units are cleaned and reassembled for oxygen service, they are not rechecked for accuracy. This may affect performance for DP and biplanar GP transmitters.

136. For -X3, standard bolting is replaced with 17-4 ph ss bolts and nuts. Therefore, Bolting codes -B1, -B2, and -B3 are not available with -X3.

137. Span limit, maximum working pressure, maximum overrange pressure, and maximum static pressure (d/p) are derated for optional IEC 61518 Construction and optional Bolting except for codes -D3, -D7, and -B2. Option -D1 is derated to 2320 psi. Options -D5 and -B1 are derated to 2175 psi. Options -D2, -D4, -D6, and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

138. Not available with Structure codes 78 and 79 (PVDF process covers).

139. Not available with optional IEC 61518 Construction codes -D1 through -D9.

140. Available with biplanar structures only.

141. See Maximum Static, Overrange, and Proof Pressure Ratings, page 27 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.

142. Not available with Electrical Certification codes that end in D or P.

143. Available with Conduit Connection and Housing Material codes 1 and 3 only.

144. Available only with -ZZ (no extra certification).

145. Not available for structures with sanitary or pulp and paper seals.

146. For flameproof models, the -Z2 and -Z3 options provide the seals in addition to the cover locks that are already included in the standard offering for these models.

147. Available only with Biplanar Structure codes B0, B1, B2, B3, BG, B4, B5, B6, and B7, and Optional Biplanar Process Connector Type code -F1.

148. Available only with Biplanar Structure codes B0, B1, B2, B3, BG, B4, B5, B6, and B7, and Optional Biplanar Process Connector Type code -F2.

Table 28 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional SIL 2 Selections¹⁴⁹	
-S1	Yellow Cover for SIL 2 on Electronics/Indicator Side of Housing ¹⁵⁰
-S2	Red Cover for SIL 2 on Electronics/Indicator Side of Housing ¹⁵⁰
Miscellaneous Optional Selections	
-F	Autoclave F-250-C (GP transmitters only)
-G	G 1/2 B Manometer Process Connection ¹⁵¹
-G1	Metal O-Ring for Diaphragm Seals in Vacuum Service ¹⁵²
-J	Low Temperature Operative Limit -50°C (-58°F) ^{153 154 155}
-R	R 1/2 Process Connection (1/2 NPT to R 1/2 Adapter) ¹⁵⁶
-S7	Ra 15 Sanitary Seal Finish ¹⁵⁷
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)

149. Available only with Electronics Version -T.

150. Not available with Electronics Version -M.

151. Available with non-gold-plated 316L ss direct connect structures with 1/2 NPT external connections.

152. Available only with Structure codes P1, P2, P3, P4, P5, and P6.

153. Not available with Structure codes 78 and 79 (PVDF process covers).

154. Not available with Optional IEC 61518 Construction codes -D2, -D4, -D6, and -D8.

155. Not available with Direct Connect Structure codes 21, 23, 31, 33, 35, 37, 39, E3, E5, E7, 43, 45, 47, 71, 73, 81, 83, G3, G5, G7, 53, 61, 63, 91, 93, F3, F5, F7; Biplanar Structure codes B1, B3, B5, B7, N5, C7, C9, 78, 79, LM, LD, CD, L3, L7, D2, S4, SD, P2, P4, P6, D6, S6, SJ; and all Sanitary/Pulp and Paper structures.

156. Available with 316L ss direct connect structures with 1/2 NPT external connections.

157. Only available with Structure codes TA, T2, T3, TB, T4, T5, M1, M6, M9.

Differential Pressure Transmitters

Table 29 - Differential Pressure Transmitters

Code	Description
Model¹⁵⁸	
IDP10S	Differential Pressure Transmitter, Advanced Tier with FoxCal™
Electronics Versions/Output Signals	
-T	HART and 4 to 20 mA with SIL 2
-F	FOUNDATION Fieldbus H1 Digital Communications
-M	Modbus RTU
Structure Codes	
Structure — Traditional¹⁵⁹	
20	316 ss Cover; Co-Ni-Cr Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
21	316 ss Cover; Co-Ni-Cr Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
22	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
23	316 ss Cover; 316L ss Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
24	316 ss Cover; Monel Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
25	316 ss Cover; Monel Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
26	316 ss Cover; C276 Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
27	316 ss Cover; C276 Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
34	Monel Cover; Monel Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
35	Monel Cover; Monel Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
46	C276 Cover; C276 Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
47	C276 Cover; C276 Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
48	C276 Cover; Tantalum Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)
49	C276 Cover; Tantalum Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)
78	PVDF Insert; Tantalum Diaphragm; Silicone Fill; Max Static Pressure=2.07 MPa (300 psi) ¹⁶⁰
79	PVDF Insert; Tantalum Diaphragm; Inert Fill; Max Static Pressure=2.07 MPa (300 psi) ¹⁶⁰
Structure — LP1 Direct Mount (Not Available with Diaphragm Seals); Maximum Static Pressure=25 MPa (3626 psi)¹⁵⁹	
LL	316 ss Cover; 316L ss Diaphragm; Silicone Fill
LM	316 ss Cover; 316L ss Diaphragm; Inert Fill
LC	316 ss Cover; C276 Diaphragm; Silicone Fill
LD	316 ss Cover; C276 Diaphragm; Inert Fill
CC	C276 Cover; C276 Diaphragm; Silicone Fill
CD	C276 Cover; C276 Diaphragm; Inert Fill

158. Refer to Accuracy (Includes Linearity, Hysteresis, and Repeatability), page 35 for accuracy specifications.

159. Maximum static pressure can be derated by optional selections.

160. Maximum static pressure rating is 2.1 MPa (300 psi); temperature limits are -7 and +82°C (+20 and +180°F).

Table 29 - Differential Pressure Transmitters (Continued)

Code	Description
Structure — LP2 Bracket Mount or Direct Mount (Not Available with Diaphragm Seals); Maximum Static Pressure=25 MPa (3626 psi)¹⁶¹	
52	316 ss Cover; 316L ss Diaphragm; Silicone Fill
53	316 ss Cover; 316L ss Diaphragm; Inert Fill
56	316 ss Cover; C276 Diaphragm; Silicone Fill
57	316 ss Cover; C276 Diaphragm; Inert Fill
Structure — Prepared for Diaphragm Seals — Diaphragm Seals Provided (Static Pressure Rating Limited by Seal)^{162 163 164}	
S1	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seals, Both Sides
S2	316 ss Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seals, Both Sides
S3	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, High Side
S4	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, High Side
S5	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, Low Side
S6	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, Low Side
F1	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Direct Connect Seal, High Side
F2	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Direct Connect Seal, High Side
F3	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Direct Connect Seal, High Side and Remote Mount Seal, Low Side
F4	316 ss Cover; 316L ss Diaphragm; Inert Fill; Direct Connect Seal, High Side and Remote Mount Seal, Low Side
Structure — Prepared for Diaphragm Seals — Diaphragm Seals Not Provided (Static Pressure Rating Limited by Seal)^{162 164}	
SA	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seals, Both Sides
SB	316 ss Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seals, Both Sides
SC	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, High Side
SD	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, High Side
SE	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, Low Side
SF	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, Low Side
Span Limits	
A ¹⁶⁵	0.12 and 7.5 kPa; 0.5 and 30 inH ₂ O; 1.2 and 75 mbar
B	0.12 and 50 kPa; 0.5 and 200 inH ₂ O; 1.2 and 500 mbar
C	0.62 and 250 kPa; 2.5 and 1000 inH ₂ O; 6.22 and 2500 mbar
D	0.026 and 2.07 MPa; 3.75 and 300 psi; 0.26 and 20.7 bar
E ¹⁶⁶	0.26 and 20.7 MPa; 37.5 and 3000 psi; 2.6 and 207 bar

161. Maximum static pressure can be derated by optional selections.

162. Not available with options -X1, -X2, or -X3.

163. Both transmitter and diaphragm seal model numbers are required. See PSS 2A-1Z11 B for diaphragm seal model codes.

164. Available only with Process Connector Type code 0.

165. Span limit code A is not available with diaphragm seals, except for sanitary spud seal model DS-P4.

166. Not available with Structure codes 78 and 79 (PVDF process covers).

Table 29 - Differential Pressure Transmitters (Continued)

Code	Description
Process Connector Type (Same Material as the Process Cover)	
0	None
1	1/4 NPT ^{167 168 169}
2	1/2 NPT ^{167 168}
3	RC 1/4 ^{167 168 169}
4	RC 1/2 ^{167 168}
6	1/2 Schedule 80 Weld Neck ^{167 168 169}
7	None; PVDF insert tapped for 1/2 NPT process inlet located on side of process cover ¹⁷⁰
Conduit Connection and Housing Material	
1	1/2 NPT Conduit Connection, Both Sides, Aluminum Housing
3	1/2 NPT Conduit Connection, Both Sides, 316 ss Housing
5	M20 Conduit Connection, Both Sides, Aluminum Housing
6	M20 Conduit Connection, Both Sides, 316 ss Housing
Electrical Certifications	
AA	ATEX/UKEX intrinsically safe, Ex ia IIC ¹⁷¹
AD	ATEX/UKEX flameproof, Ex db IIC
AM	ATEX/UKEX multiple certifications (includes Codes AA and AN) ¹⁷¹
AN	ATEX/UKEX protection type n, Ex ic IIC, or Ex nA ¹⁷¹
AP	ATEX/UKEX multiple certifications (includes Codes AA, AD and AN) ¹⁷¹
BA	INMETRO intrinsically safe, Ex ia IIC ¹⁷¹
BD	INMETRO flameproof, Ex db IIC
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD) ¹⁷¹
CA	CSA intrinsically safe, Zone certified Ex ia ¹⁷¹
CD	CSA zone certified flameproof Ex db IIC; also explosion proof, dust ignition-proof
CM	CSA multiple certifications (includes CSA Codes CA and CN) ¹⁷¹
CN	CSA non-incendive, Zone certified Ex nA IIC ¹⁷¹
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN) ¹⁷¹
DA	Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC ¹⁷¹
DD	Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC
DN	Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC ¹⁷¹
EA	IECEx intrinsically safe, Ex ia IIC ¹⁷¹
ED	IECEx flameproof, Ex db IIC
EM	IECEx multiple certifications, ia, ic, nA ¹⁷¹
EN	IECEx protection type n, Ex ic IIC, or Ex nA ¹⁷¹
EP	IECEx multiple certifications, ia, ic, nA, and db ¹⁷¹

167. Not available with Structure codes 78 and 79 (PVDF process covers).

168. Not available with structures that have seals on both sides.

169. Not available with structures that have C276 process covers.

170. Available only with Structure codes 78 and 79 (PVDF process covers).

171. Not available with Electronics Version -M.

Table 29 - Differential Pressure Transmitters (Continued)

Code	Description
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC ¹⁷²
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC
FM	FM multiple certifications (includes FM Codes FA or FN) ¹⁷²
FN	FM Classes I, II and III, Division 2 non-incendive, Zone approved AEx nA IIC ¹⁷²
FP	FM multiple certifications (includes FM Codes FA, FD or FN) ¹⁷²
KD	KC Certification Ex db
NA	NEPSI intrinsically safe ¹⁷²
ND	NEPSI flameproof, Ex db IIC
RA	EAC intrinsically safe, Ex ia ¹⁷²
RD	EAC flameproof, Ex db
RN	EAC protection type n, Ex ic IIC or Ex nA ¹⁷²
ZZ	No certification ¹⁷²
Optional Mounting Bracket Sets^{173 174}	
-M1	Standard Style Painted Steel Bracket with Plated Steel Bolts
-M2	Standard Style Stainless Steel Bracket with Stainless Steel Bolts
-M3	Universal Style Stainless Steel Bracket with Stainless Steel Bolts
Optional Adapter Plates^{175 176 177}	
-P1	Adapter Set for MC Coplanar Manifolds, B7 Bolts ¹⁷⁸
-P2	Adapter Set for MC Coplanar Manifolds, 316 ss Bolts ¹⁷⁹
-P3	Adapter Set for MC Coplanar Manifolds, 17-4 ss Bolts ¹⁸⁰
-P4	Adapter Set for MC Coplanar Manifolds, B7M Bolts ¹⁸¹
-P5	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7 Bolts ¹⁷⁸
-P6	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 316 ss Bolts ¹⁷⁹
-P7	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 17-4 ss Bolts ¹⁸⁰
-P8	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7M Bolts ¹⁸¹
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover

172. Not available with Electronics Version -M.

173. Not available with Structure codes F1, F2, F3, and F4 (direct connect seal).

174. Requires Process Connection 0 for LP1 structures LL, LM, LC, LD, CC, and CD.

175. Not available with optional IEC 61518 Construction codes -D1 through -D9.

176. Available only with Process Connector Type code 0.

177. Only available with LP1 and LP2 structures that have 316 ss process covers.

178. Not available with Bolting Options -B1, -B2, or -B3.

179. Available only with option -B1.

180. Available only with option -B2.

181. Available only with option -B3.

Table 29 - Differential Pressure Transmitters (Continued)

Code	Description
Optional IEC 61518 Construction^{182 183 184}	
-D1	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=2320 psi
-D2	Double-Ended Process Cover ¹⁸⁵ with B7 Steel Bolt; Size M10 Steel Connector Screw; MWP=1500 psi ^{186 187}
-D3	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=3626 psi
-D4	Double-Ended Process Cover ¹⁸⁵ with B7 Steel Bolt; Size 7/16 Steel Connector Screw; MWP=1500 psi ^{186 187}
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi
-D6	Double-Ended Process Cover ¹⁸⁵ with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi ^{186 187}
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi
-D8	Double-Ended Process Cover ¹⁸⁵ with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi ^{186 187}
-D9	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=5800 psi
Optional Cleaning and Preparation	
-X1	Unit Degreased – for Silicone Fill Sensors Only ¹⁸⁸
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only ^{189 190}
-X3	Cleaned and Prepared for Chlorine Service ^{189 191}
Optional Bolting (Process Covers and Process Connectors)^{192 193 194 195}	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi) ¹⁸³
-B2	17-4 PH ss Bolts and Nuts (bright acid tin coated corrosion protection with no pressure derating)
-B3	B7M Bolts and 2HM Nuts (conforms to NACE MR0175/MR0103, Class II; MWP derated to 2900 psi) ¹⁸³
Optional Conduit Thread Adapters^{196 197 198}	
-A1	Hawke-Type 1/2 NPT Brass Cable Gland
-A3	M20 Connector
Optional Custom Factory Configuration	
-C1	Custom Factory Calibration (Calibration and Unit Tags Required)
-C2	Custom Factory Configuration (requires Configuration Form to be filled out)

182. Available only with Process Connector Type code 0.

183. See Maximum Static, Overrange, and Proof Pressure Ratings, page 27 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.

184. Available only with Structure codes 20 through 27. Not available with options -V and -V1.

185. Blind connector supplied.

186. Not available with Mounting Bracket Set options -M1, -M2, and -M3.

187. Temperature limits are derated to -10 and +80°C (14 and 176°F) for optional IEC 61518 Construction codes -D2, -D4, -D6, and -D8 only.

188. Available only with structures that have silicone fill and are not prepared for seals.

189. Available only with structures that have inert fill (excluding Structure code 79) and are not prepared for seals.

190. After units are cleaned and reassembled for oxygen service, they are not rechecked for accuracy. This may affect performance for DP and biplanar GP transmitters.

191. For -X3, standard bolting is replaced with 17-4 ph ss bolts and nuts. Therefore, Bolting codes -B1, -B2, and -B3 are not available with -X3.

192. Not available with Structure codes 78 and 79 (PVDF process covers).

193. Not available with optional IEC 61518 Construction codes -D1 through -D9.

194. For stainless steel bolts with IEC 61518 construction, specify -D5 to -D9, as required, instead of -B1 or -B2.

195. Not available with structures that have Monel process covers.

196. Not available with Electrical Certification codes that end in D or P.

197. Available with Conduit Connection and Housing Material codes 1 and 3 only.

198. Available only with -ZZ (no extra certification).

Table 29 - Differential Pressure Transmitters (Continued)

Code	Description
Optional Electronics Housing Features	
-Z1	External Zero Adjustment
-Z2	Custody Transfer Lock and Seal ¹⁹⁹
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal ¹⁹⁹
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector ²⁰⁰
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector ²⁰¹
Optional Manifold Configurations	
-H1	Manifold Mounted to Transmitter and Pressure Tested (1.5 times transmitter range or 1.5 times manifold rating, whichever is less)
-H2	Manifold Mounted to Transmitter and Pressure Tested (Certificate)
Optional SIL 2 Selections²⁰²	
-S1	Yellow Cover for SIL 2 on Electronics/Indicator Side of Housing ²⁰³
-S2	Red Cover for SIL 2 on Electronics/Indicator Side of Housing ²⁰³
Miscellaneous Optional Selections	
-G1	Metal O-Ring for Diaphragm Seals in Vacuum Service ^{204 205}
-GP	Gold Plated Diaphragm ^{206 207}
-J	Low Temperature Operative Limit -50°C (-58°F) ^{208 209 210}
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)
-V	Supply Vent Screw in Side of Each Process Cover ²¹¹
-V1	Omit Vent Screw in Side of Each Process Cover ²¹²
-Y	Static Pressure Rating to 40 MPa (5800 psi) and 17-4 ss Bolts and Nuts ^{208 213 214 215}

199. Cover locks are provided as standard with Electrical Certification codes that end in D or P (flameproof).

200. Available only with Structure codes 20 to 27, and Process Connector codes 0 and 1.

201. Available only with Structure codes 20 to 27, and Process Connector code 2.

202. Available only with Electronics Version -T.

203. Not available with Electronics Version -M.

204. When the diaphragm seal is used in vacuum applications, -G1 is required. This selection substitutes a vacuum service metal gasket for the standard PTFE process cover gasket.

205. Available only with structure codes for diaphragm seals.

206. Available only with Structure code 22.

207. Not available with options -X1, -X2, or -X3.

208. Not available with Structure codes 78 and 79 (PVDF process covers).

209. Not available with Optional IEC 61518 Construction codes -D2, -D4, -D6, and -D8.

210. Not available with structures that have inert fill fluid.

211. Available only with Traditional Structure codes 20 to 49.

212. Available only with LP1 Direct Mount structures with 316 ss process covers.

213. Not available with structures prepared for diaphragm seals.

214. Not available with Bolting Options -B1, -B2, or -B3.

215. Not available with structures that have Monel process covers.

Dimensions

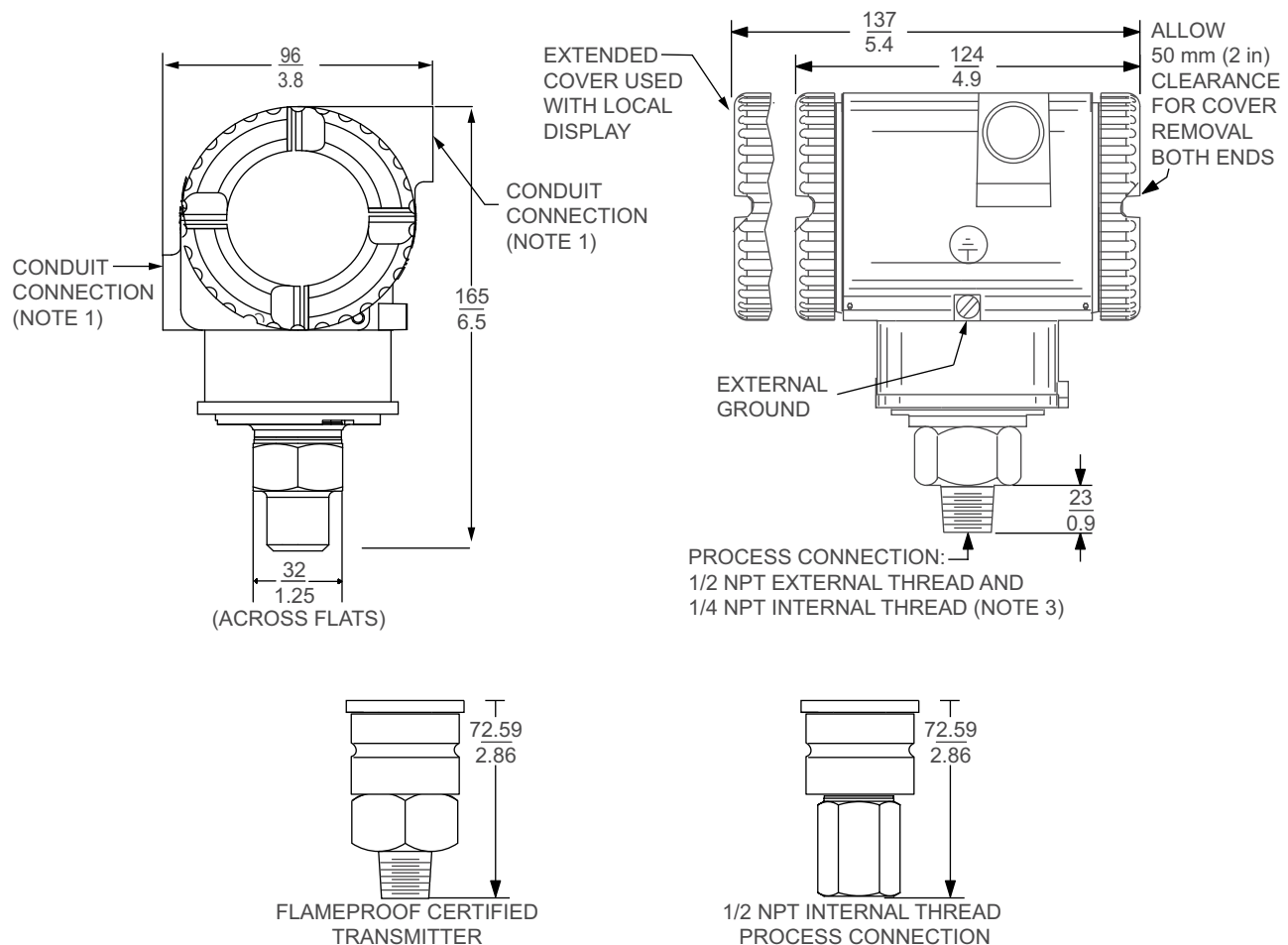
For dimensional information specific to your sales order, contact your sales representative to order a Certified Dimensional Print (CDP).

All dimensions in diagrams are shown in millimeters over inches ($\frac{\text{mm}}{\text{in}}$).

NOTE: For dimensional information on diaphragm seals, see PSS 2A-1Z11 B.

Direct Connect AP and Direct Connect GP Transmitters

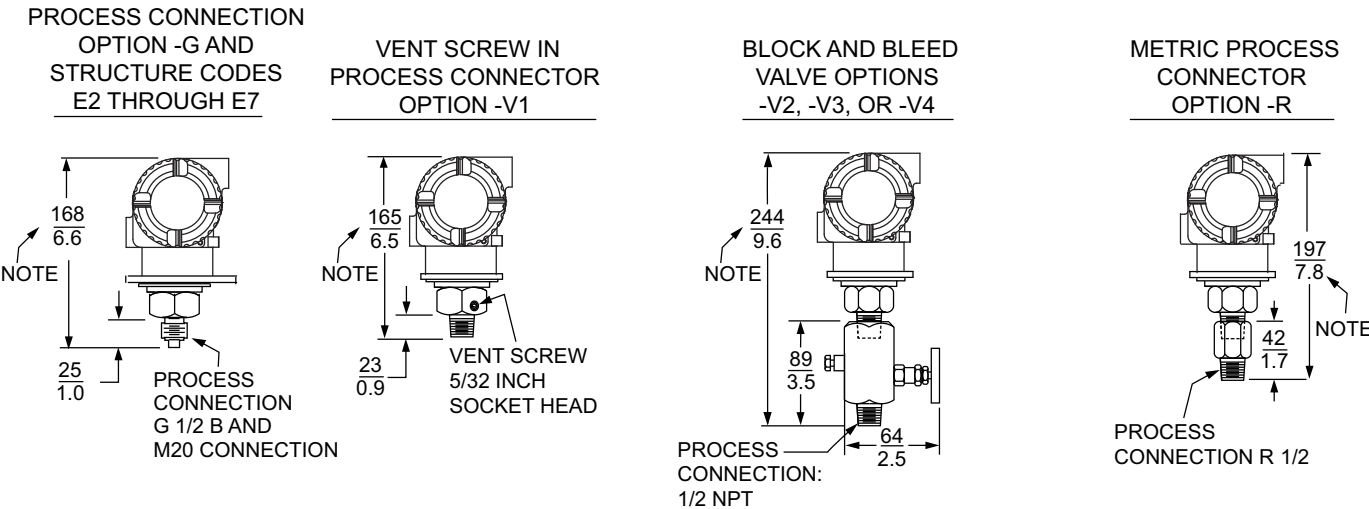
Figure 23 - Direct Connect AP/GP Transmitters



NOTES:

1. CONDUIT CONNECTION 1/2 NPT OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH SUPPLIED METAL PLUG.
2. TOPWORKS ROTATABLE TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF FULLY TIGHTENED POSITION.
3. DO NOT USE THE 1/4 NPT INTERNAL THREAD TO DIRECTLY CONNECT THE TRANSMITTER. USE A MOUNTING BRACKET.

Figure 24 - Direct Connect AP/GP Transmitters with Options -G, -V1, -V2, -V3, -V4, and -R



NOTE: FOR FLAMEPROOF CERTIFIED TRANSMITTERS, ADD 28 mm (1.1 in) TO OVERALL HEIGHT DIMENSION.

Figure 25 - Direct Connect AP/GP Transmitters with Options -M1, -M2, -M5, and -M6

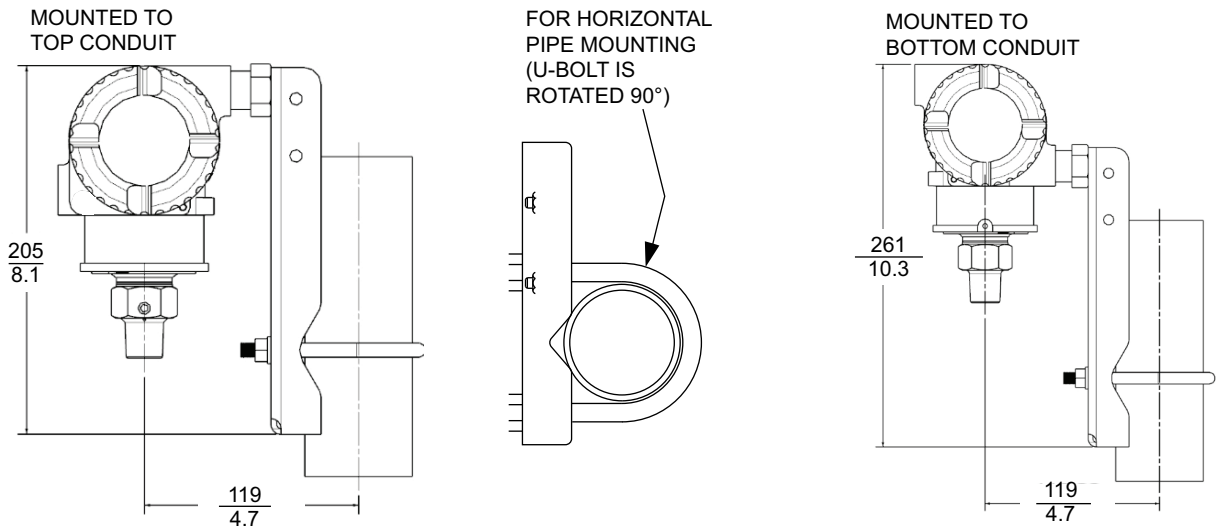
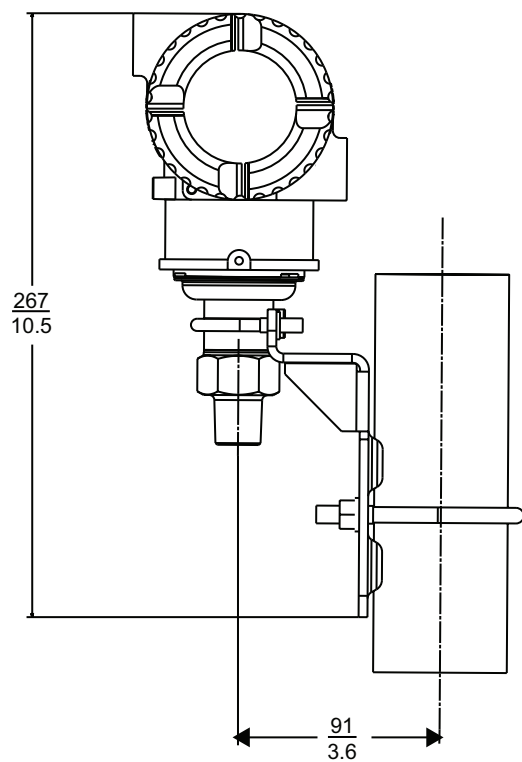
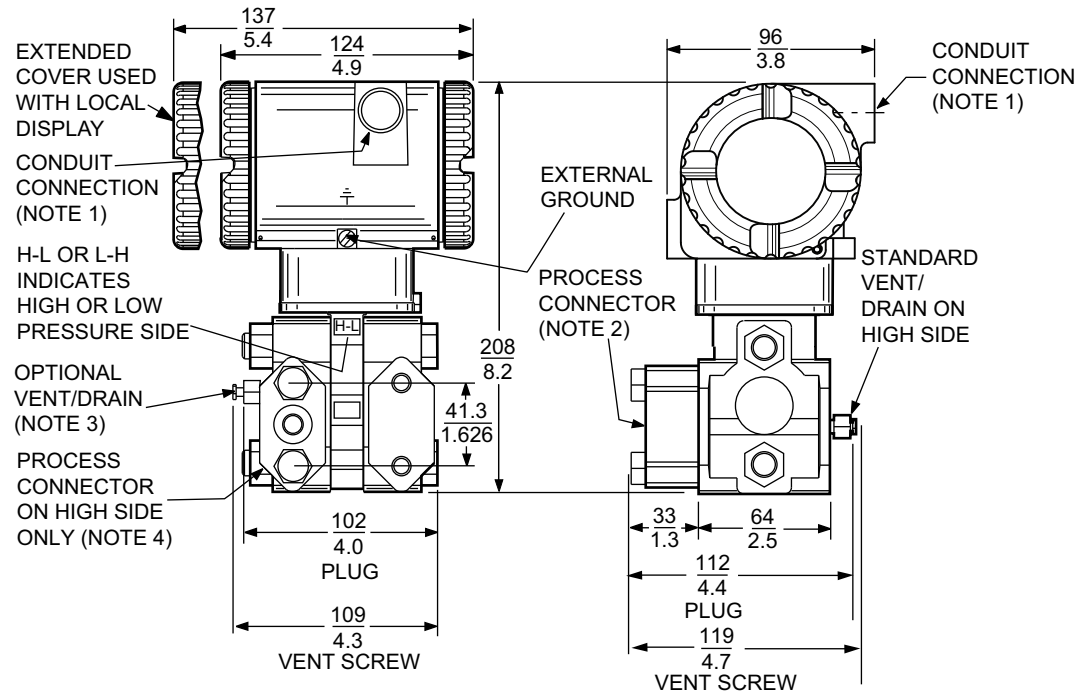


Figure 26 - Flameproof Direct Connect AP/GP Transmitters with Options -M7 and -M8

Biplanar AP and Biplanar GP Transmitters

Figure 27 - Biplanar AP/GP Transmitters



NOTES

- 1. CONDUIT CONNECTION 1/2 NPT OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH SUPPLIED METAL PLUG.
- 2. PROCESS CONNECTOR CAN BE REMOVED AND CONNECTION MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER. NOTE THAT WITH PROCESS CONNECTION CODE "0", THERE IS NO CONNECTOR.
- 3. PROCESS COVER CAN BE INVERTED MAKING OPTIONAL SIDE VENT A SIDE DRAIN.
- 4. FOR USERS WHO DESIRE THE PROCESS CONNECTOR ON THE RIGHT SIDE, ROTATE TRANSMITTER 180° AND RELOCATE PROCESS CONNECTOR (AND VENT SCREW, IF APPLICABLE).
- 5. DO NOT USE THE 1/4 NPT INTERNAL THREAD TO DIRECT-CONNECT THE TRANSMITTER WITHOUT A MOUNTING BRACKET.

Figure 28 - Biplanar AP/GP Transmitters with Options -D1, -D2, -D3, -D4, -D5, -D6, -D7, -D8, and -D9

IEC 61518 CONSTRUCTION OPTIONS

SINGLE ENDED PROCESS COVER OPTIONS	DOUBLE ENDED PROCESS COVER OPTIONS
-D1, -D3, -D5, -D7, -D9	-D2, -D4, -D6, -D8

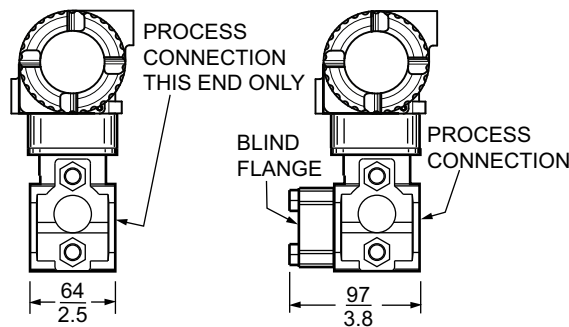


Figure 29 - Biplanar AP/GP Transmitters with Options -M0 and -M9 (Standard Stainless Steel or Painted Steel Bracket)

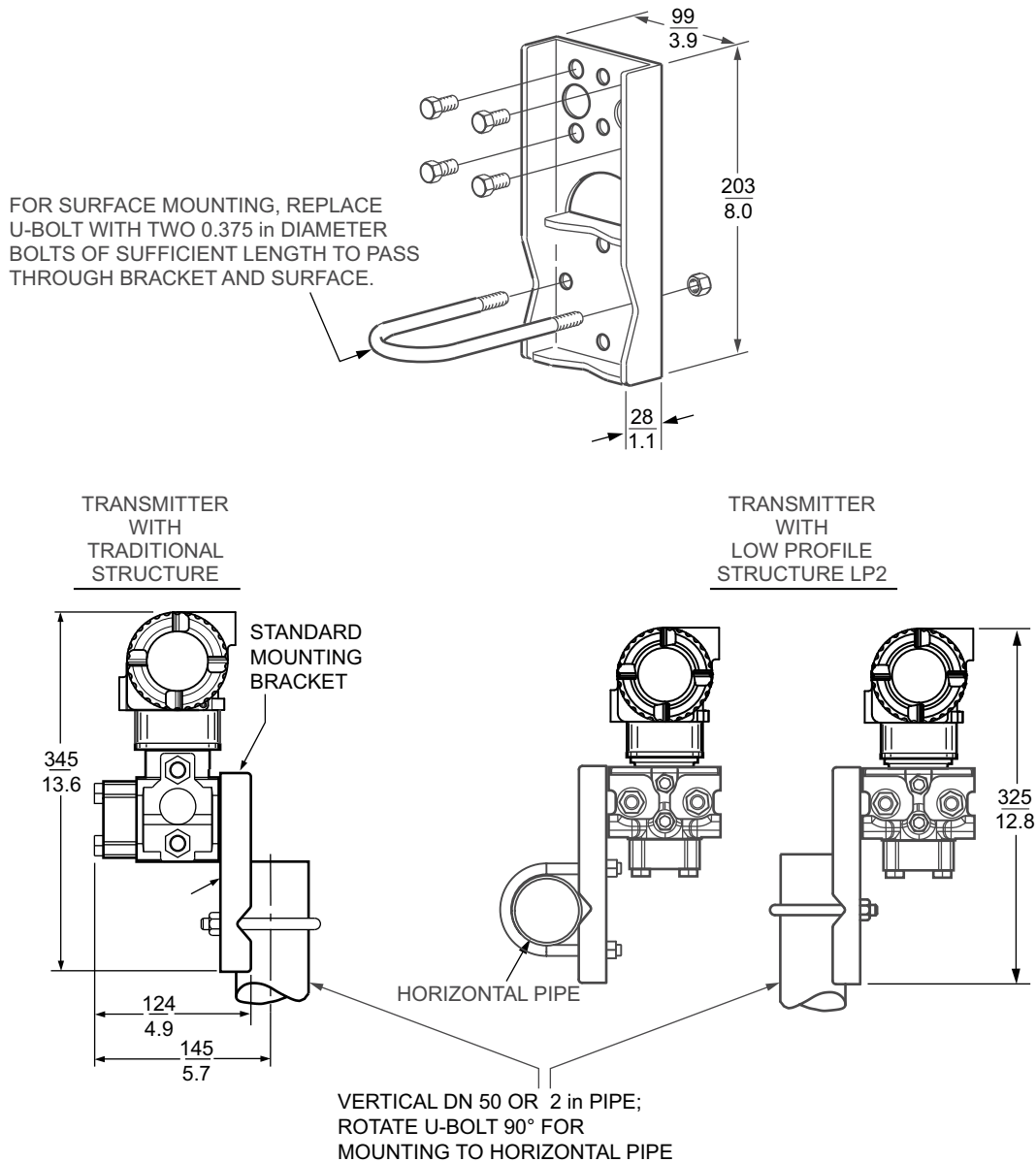
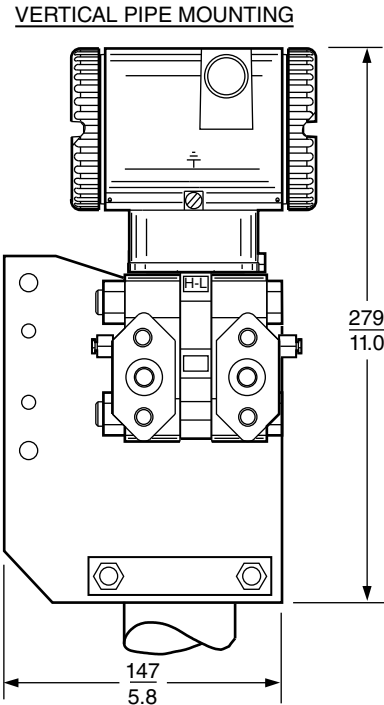
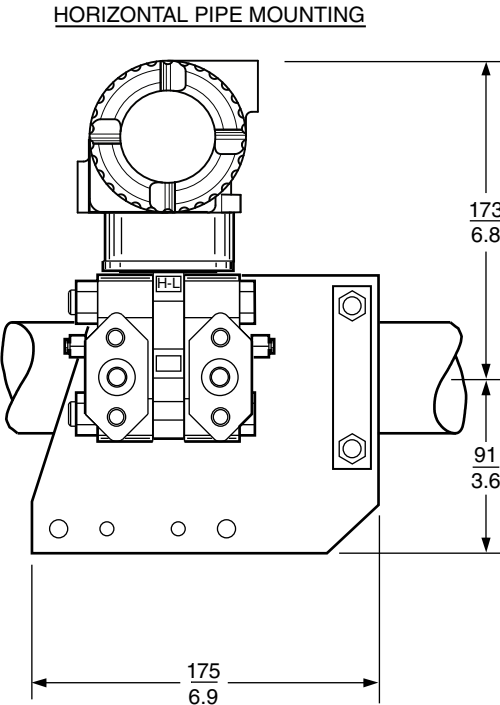
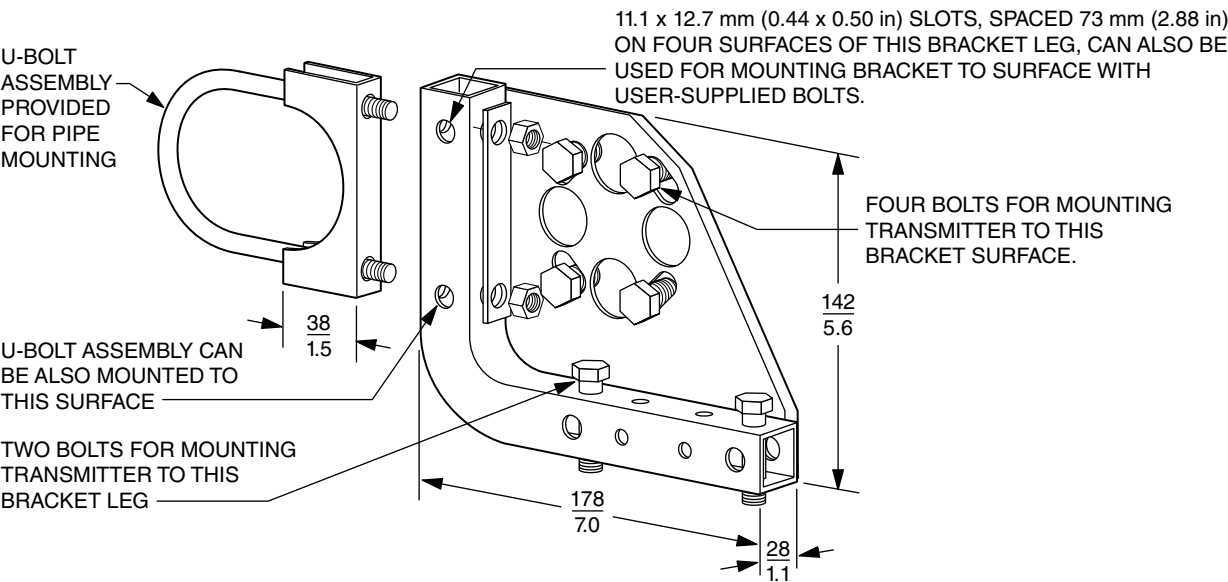
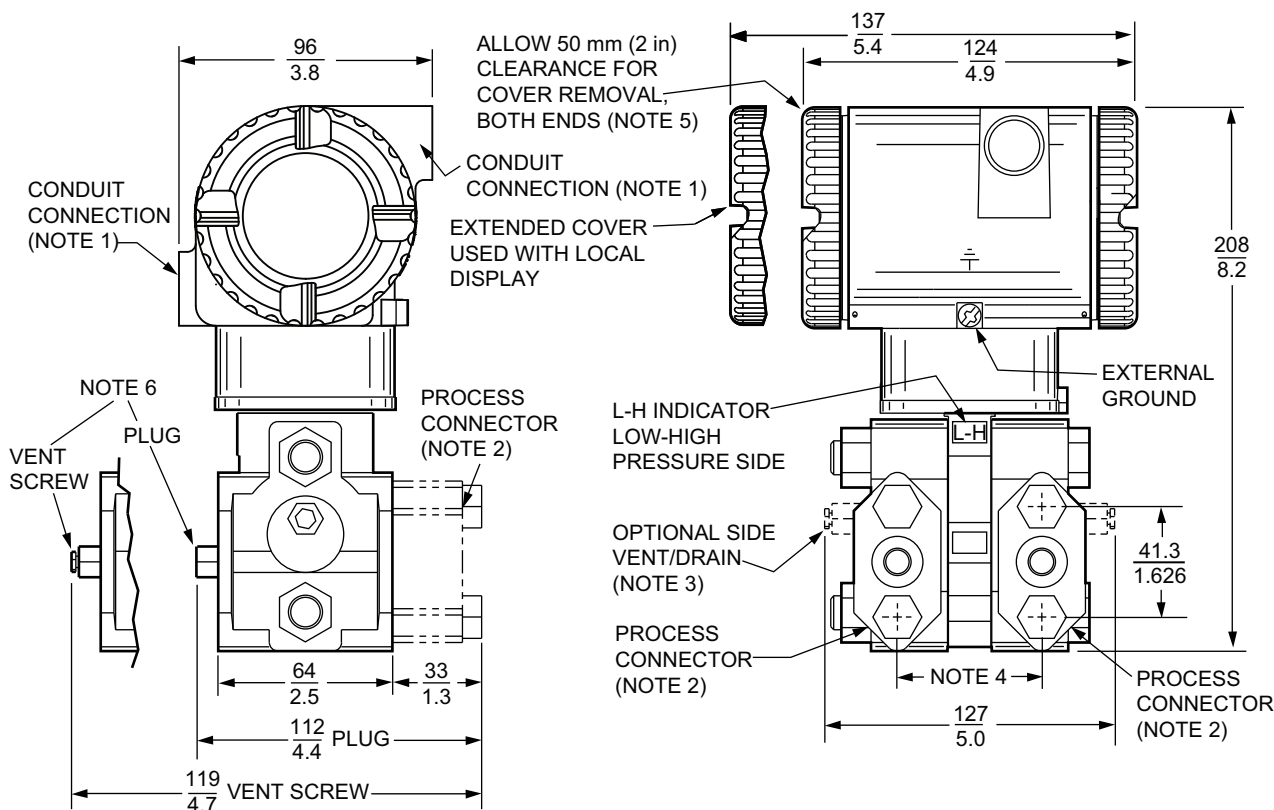


Figure 30 - Biplanar AP/GP Transmitters with Option -M3 (Universal Bracket)



DP Transmitters

Figure 31 - DP Transmitters with Traditional Structure



NOTES:

1. CONDUIT CONNECTION 1/2 NPT, BOTH SIDES: PLUG UNUSED CONNECTION WITH SUPPLIED METAL PLUG.
2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
3. PROCESS COVER CAN BE INVERTED MAKING OPTIONAL SIDE VENTS OR SIDE DRAINS.
4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.
6. PROCESS COVER END PLUGS ARE SUBSTITUTED FOR VENT SCREWS WHEN OPTIONAL SIDE VENTS (NOTE 3) ARE SPECIFIED.

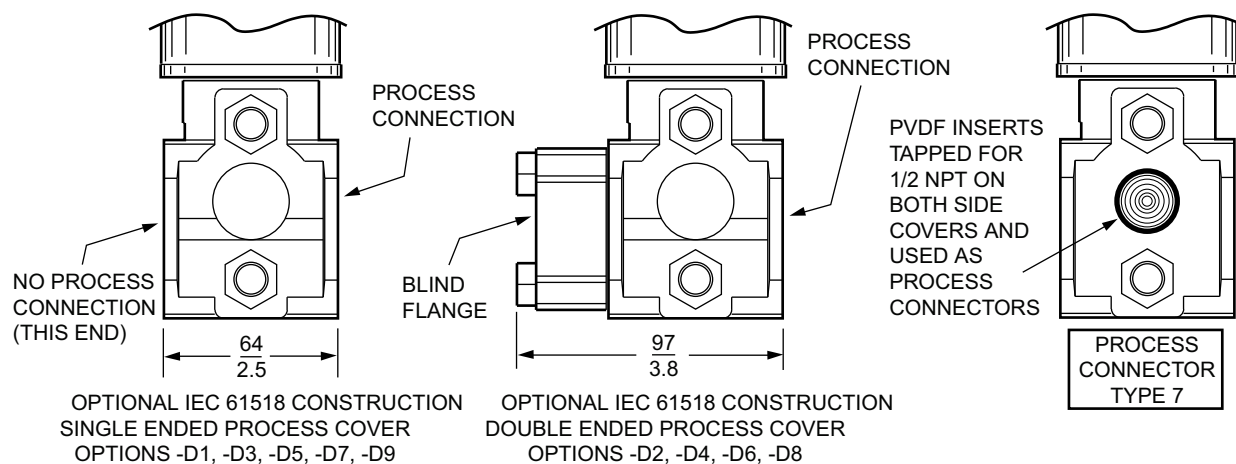
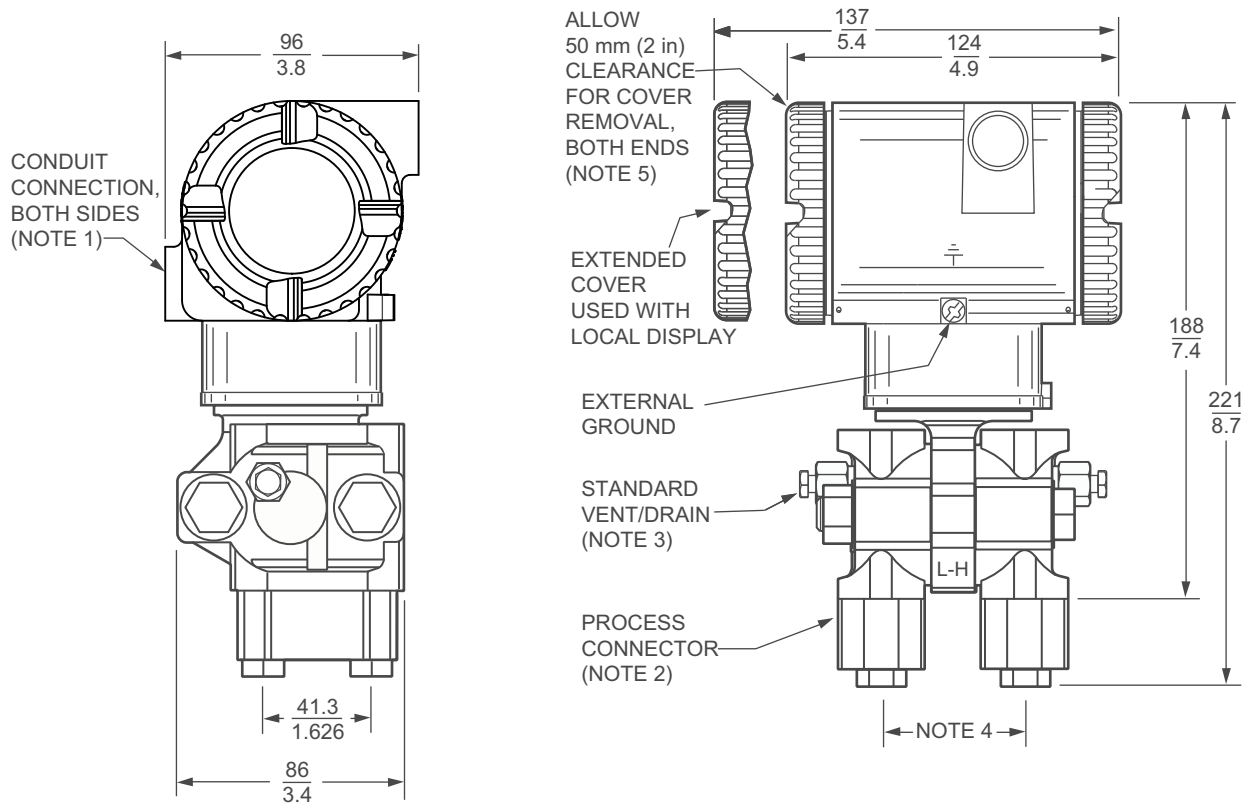
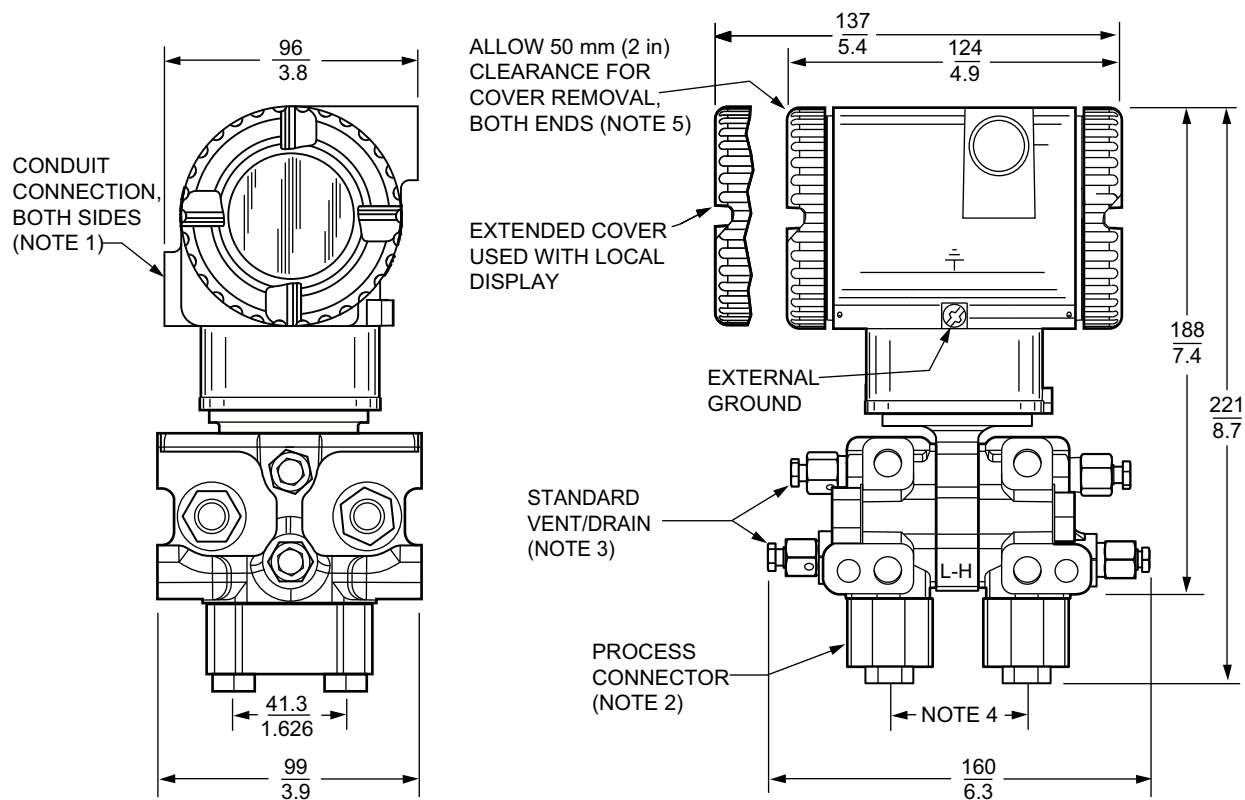


Figure 32 - DP Transmitters with Low Profile 1 (LP1) Structure**NOTES:**

1. CONDUIT CONNECTION 1/2 NPT OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH SUPPLIED METAL PLUG.
2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
3. THE TRANSMITTER'S LOW PROFILE STRUCTURE LP1 IS SHOWN IN THE VERTICALLY UPRIGHT POSITION. NOTE THE LOCATION OF THE STANDARD VENT/DRAIN SCREW. IN THIS CONFIGURATION, THE TRANSMITTER CAN BE VENTED OR IS SELF-DRAINING. ALSO RECOMMENDED IS A HORIZONTAL INSTALLATION WHERE THE INSTALLED ORIENTATION CAN BE SET TO ALLOW FOR VENTING OR DRAINING.
4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.

Figure 33 - DP Transmitters with Low Profile 2 (LP2) Structure**NOTES:**

1. CONDUIT CONNECTION 1/2 NPT OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH SUPPLIED METAL PLUG.
2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
3. THE TRANSMITTER'S LOW PROFILE STRUCTURE LP2 IS SHOWN IN THE RECOMMENDED VERTICAL UPRIGHT POSITION. NOTE THE STANDARD VENT OR DRAIN SCREWS. HORIZONTAL INSTALLATIONS ARE NOT RECOMMENDED.
4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.

Figure 34 - DP Transmitters with Traditional or LP2 Structure and Options -M1 and -M2 (Standard Style Mounting Bracket)

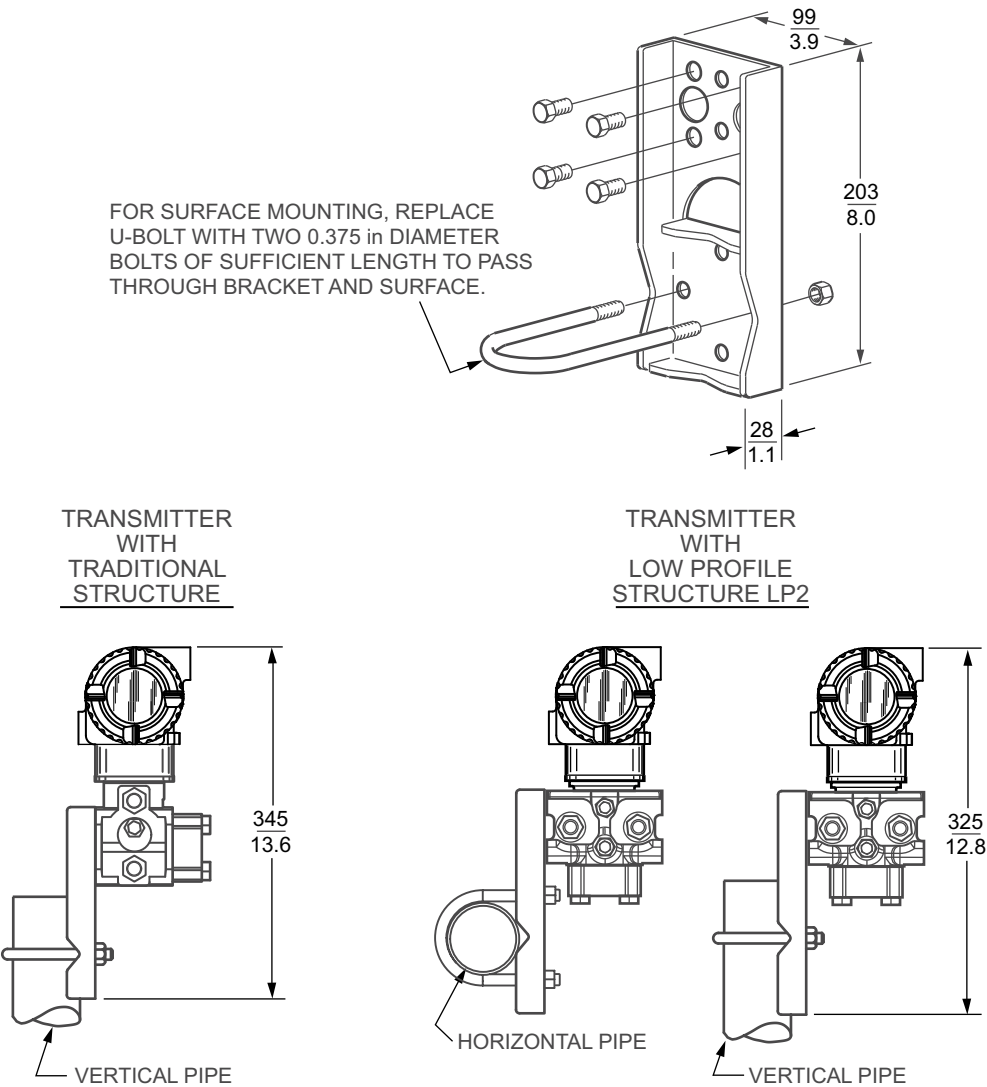
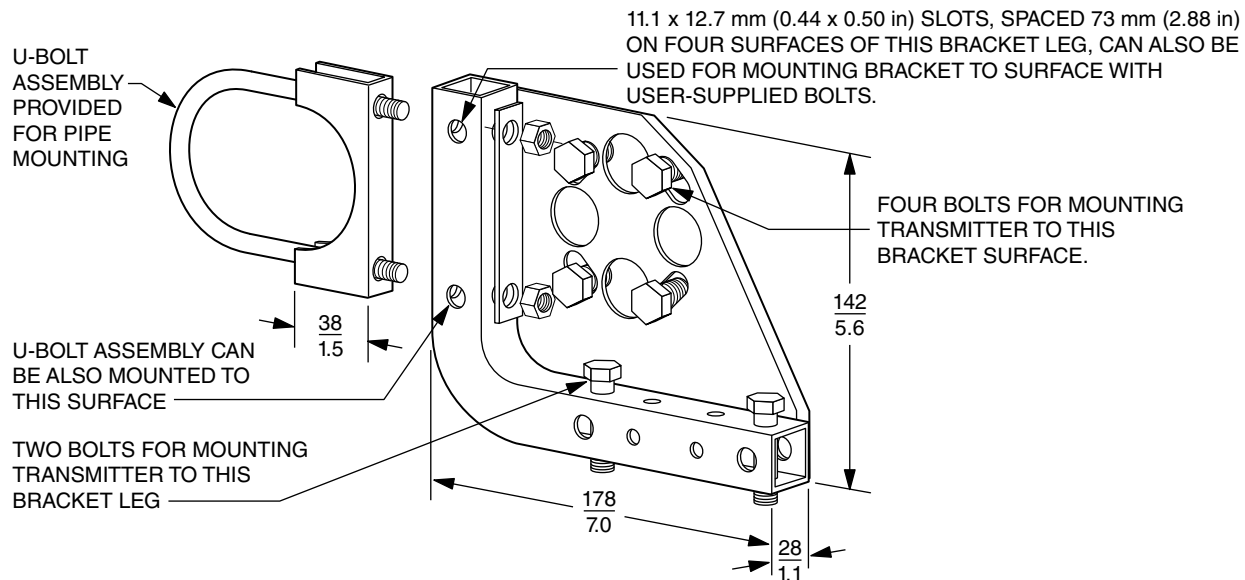
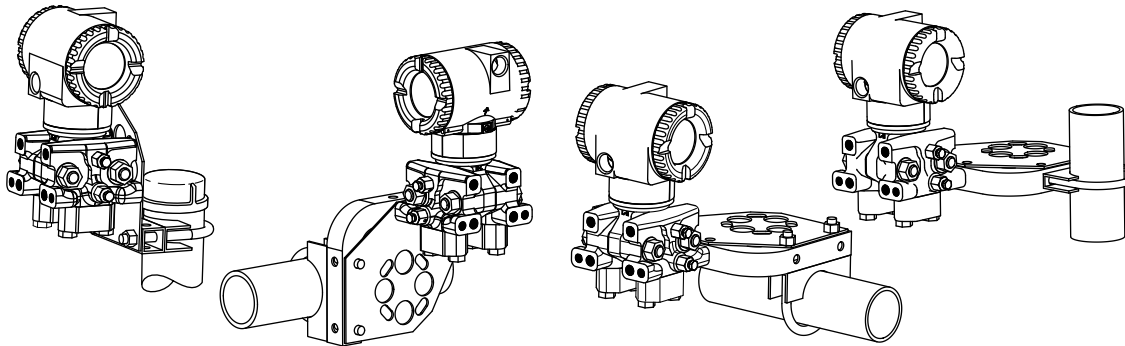
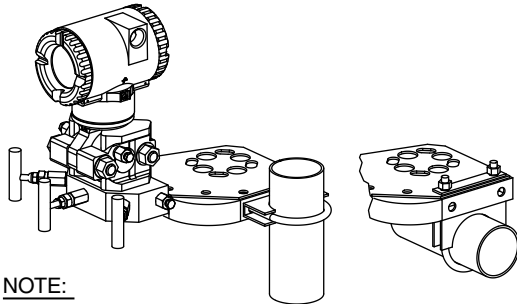
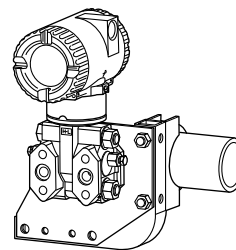
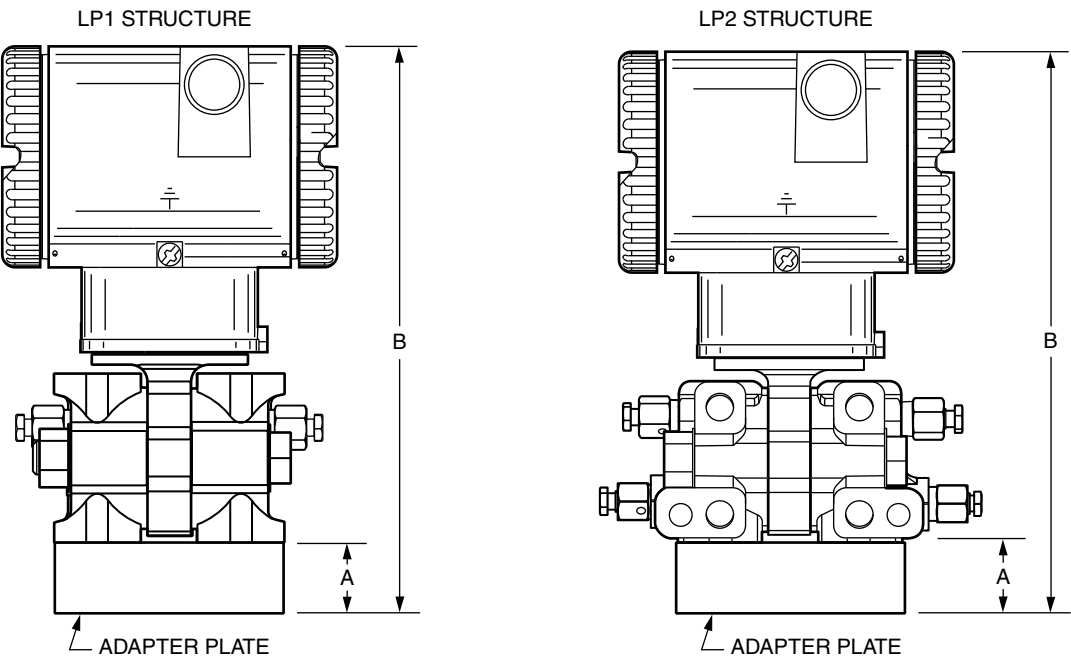


Figure 35 - DP Transmitters with Option -M3 (Universal Style Mounting Bracket Kit)**TYPICAL PIPE MOUNTING WITH LOW PROFILE STRUCTURE LP2****TYPICAL PIPE MOUNTING
LOW PROFILE STRUCTURE LP1****TYPICAL PIPE MOUNTING
WITH TRADITIONAL STRUCTURE****NOTE:**

FOR SURFACE MOUNTING CONFIGURATIONS, USE THE U-BOLT MOUNTING HOLES FOR ATTACHING THE BRACKET TO A SURFACE RATHER THAN TO THE U-BOLT ASSEMBLY. SURFACE MOUNTING BOLTS FOR ATTACHING THE BRACKET TO A SURFACE ARE USER SUPPLIED.

Figure 36 - DP Transmitters with LP1 or LP2 Structure Mounted on a Coplanar™ Manifold



Manifold	Dimension A	Dimension B
MC	11 mm (0.5 in)	199 mm (7.9 in)
MT3	22 mm (0.9 in)	210 mm (8.3 in)

Figure 37 - DP Transmitters with Traditional Structure and Structure Codes -78 and -79 (Filled PVDF Connection)

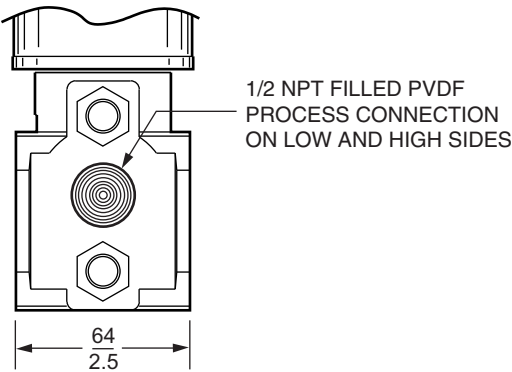
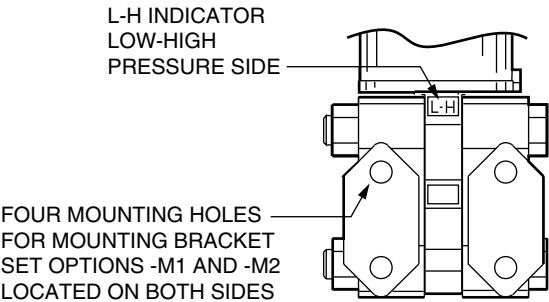


Figure 38 - DP Transmitters with Traditional Structure and Options -D1 to -D9



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