

Advanced Performance Pressure Transmitters

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

Product Specification Sheet

PSS 2A-1S10 A

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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 ms
- SIL 2 as standard (HART)
- Robust Design: 5-year warranty (optional 17-year warranty)
- DP and Biplanar AP/GP response time: < 125 ms
- FoxCal™ technology
- In-service time tracking
- High Turndown Capability¹ (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 ms
- SIL 2 as standard (HART)
- Robust Design: 5-year warranty (optional 17-year warranty)
- DP and Biplanar AP/GP response time: < 125 ms
- FoxCal™ technology
- In-service time tracking
- High Turndown Capability¹ (up to 400:1)

1. 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 or FOUNDATION Fieldbus communication.

Key Features

The Advanced Performance pressure transmitters offer the following features:

- Absolute, Gauge, and Differential Pressure transmitters
- HART digital outputs, FOUNDATION Fieldbus digital outputs, 4 to 20 mA outputs
- 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 transmitters
- 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 and FOUNDATION Fieldbus transmitters
- High Turndown Capabilities² (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
- 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 alloy³, Co-Ni-Cr, Monel™, or Tantalum™
- ½ NPT male, ½ NPT female, or M20 male 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 12.27.01-2003 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 for all process wetted parts; optional NACE approved bolt material available
- 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

2. Turndown capability refers to Maximum span/Minimum span

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

- Multi-marking protection concepts available for ATEX, 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 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 or IECEx), Pressure Transmitters with HART communication offer standard SIL 2 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. SIL 2 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
1113 FIT	698 FIT	356 FIT	58 FIT	94.76%

The PFD_{AVG} value for a single pressure transmitter is $2.6E-4$ per year.

Certification Data

- SIL 2 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 94.76% (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.
- 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 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, 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 alloy⁴ and sensor diaphragms available in 316L ss, nickel alloy⁴, 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 alloy⁴, 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 alloy⁴ 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.

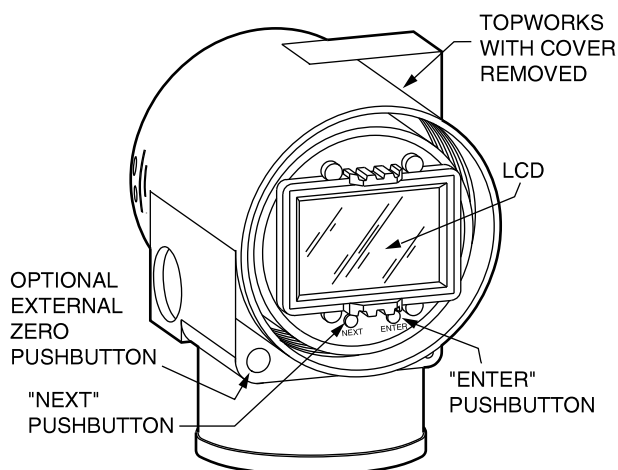
4. Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

Design Specifications

Digital Liquid Crystal Display (LCD)

A two-line local digital display with on-board pushbuttons is provided as an option with HART 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.

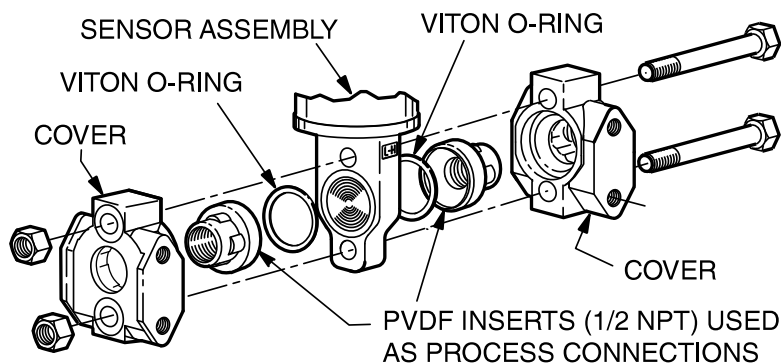
Figure 2 - Digital LCD with On-Board Pushbuttons



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.

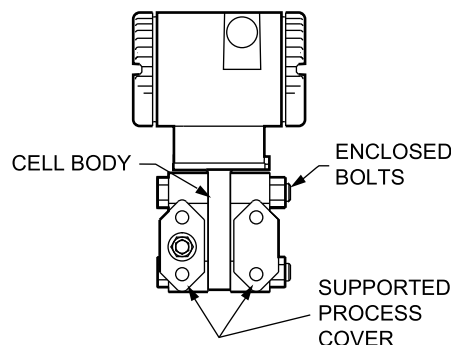
Optional Mounting Bracket Sets for DP and Biplanar AP/GP Transmitters

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 62.

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.

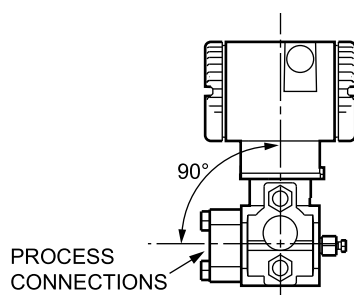
Transmitter Structures for DP and Biplanar AP/GP Transmitters

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

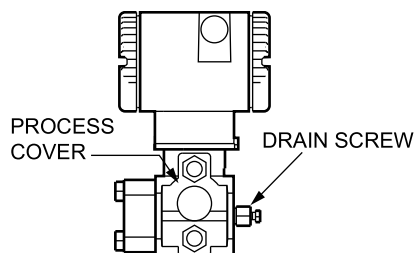


Figure 7 - Horizontal Mounting – Cavity Venting, and Self-Draining into Process Line

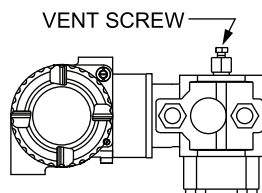
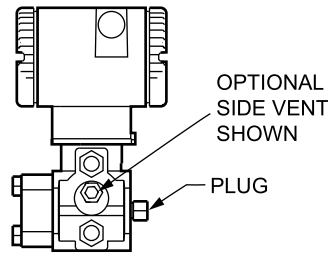
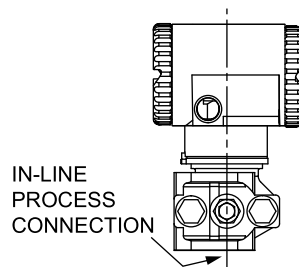
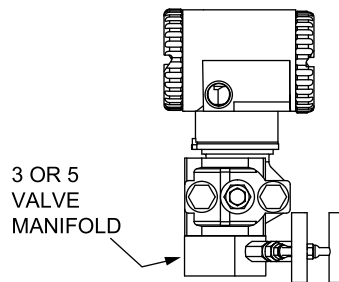


Figure 8 - Vertical Mounting – Cavity Venting, and Self-Draining into Process Line

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

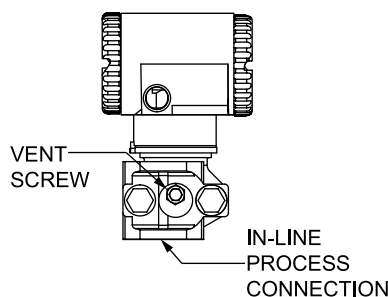
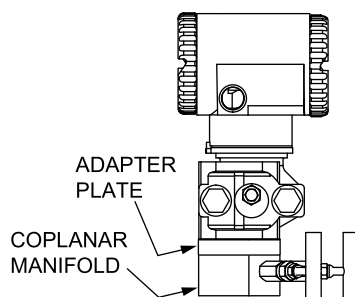


Figure 12 - Low Profile (LP1) Transmitter – Mounted to a Coplanar Manifold using an Optional Intermediate Adapter Plate



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

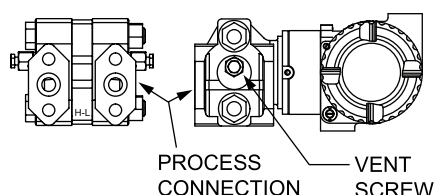
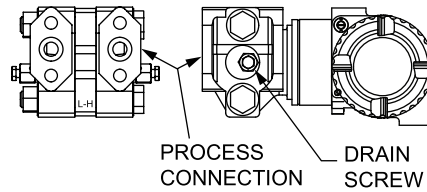
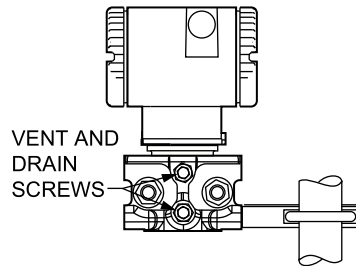
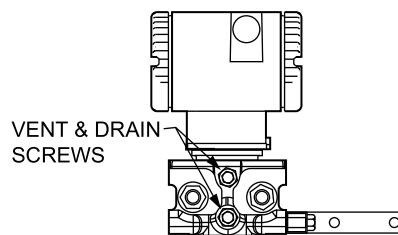
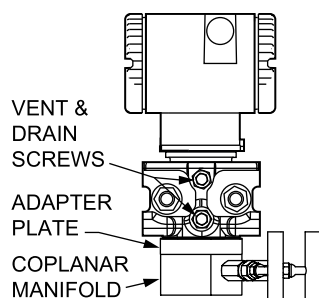


Figure 14 - Low Profile (LP1) Transmitter – Horizontal Mounting with Drain Screw**Low Profile Structure LP2 – Bracket or Direct Mount**

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 ⁵	inH ₂ O
LRV	per sales order ⁶	0
URV	per sales order ⁷	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 ⁸	gal/m
Range (DP)	per sales order ⁷	0 to 500 gal/m
Output	4 to 20 mA ⁹	4 to 20 mA ⁹
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 ⁸	gal/m
Range (DP)	per sales order ⁷	0 to 500 gal/m

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

Parameter	Standard (Default) Configuration	Example of Custom Factory Calibration (Option -C1)
Calibrated Range		
Pressure Engineering Units (EGUs)	per sales order ⁵	inH ₂ O
Engineering units at 0% of range (EU_0)	per sales order ⁶	0
Engineering units at 100% of range (EU_100)	per sales order ⁷	100

5. 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.

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

7. Same as Calibrated Range.

8. 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.

9. Fixed current is used for multidrop applications.

Measurement #1		
Linear (pressure units)	Linear	Linear
Pressure Engineering Units (EGUs)	per sales order ¹⁰	inH ₂ O
Range (DP)	per sales order ¹¹	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 ¹²	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 ¹¹	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 ¹⁵	gal/m
Range (DP)	per sales order ¹¹	0 to 500 gal/m
Output	4 to 20 mA ¹⁶	4 to 20 mA ¹⁶
Measurement #2		
Linear (pressure units, AP or GP) or Square Root (flow units, DP only)	Linear	Square Root

10. 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.

11. Same as Calibrated Range.

12. 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.

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. 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.

16. Fixed current is used for multidrop applications.

Pressure EGU (AP, GP, DP) or Flow EGU (DP only)	per sales order ¹⁷	gal/m
Range (DP)	per sales order ¹⁸	0 to 500 gal/m

Table 4 - Example Parameters: Factory Configuration Option -C2 for a FOUNDATION Fieldbus 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 ¹⁹	inH ₂ O
Engineering units at 0% of range (EU_0)	per sales order ²⁰	0
Engineering units at 100% of range (EU_100)	per sales order ¹⁸	100
Measurement #1		
Linear (pressure units)	Linear	Linear
Pressure EGU	per sales order ¹⁹	inH ₂ O
Range (DP)	per sales order ¹⁸	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 ¹⁷	inH ₂ O
Range (DP)	per sales order ¹⁸	0 to 100

Pressure Seals

Pressure 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.

Pressure 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 pressure 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 pressure 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 pressure seal model codes and specifications.

-
17. 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.
18. Same as Calibrated Range.
19. 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.
20. Within Span and Range Limits for selected sensor code.

Table 5 - Pressure Seals

Model	Description	Process Connections	Used with Transmitters
Direct Connect Pressure Seal Assemblies			
PSFLT	Flanged, Direct Connect (Flanged Level), Flush or Extended Diaphragm	ANSI Class 150/300/600 flanges and IEC 61518 PN 10/40, 10/16, 25/40 flanges	Biplanar AP, Biplanar GP, DP
PSFAD	Flanged, Direct Connect, Recessed Diaphragm	ANSI Class 150/300/600/1500 flanges	Direct Connect AP, Direct Connect GP
PSFFD	Flanged, Direct Connect, Flush Diaphragm	ANSI Class 150/300/600 and PN 10/40	Direct Connect AP, Direct Connect GP
PSTAD	Threaded, Direct Connect, Recessed Diaphragm	¼, ½, ¾, 1, or 1½ NPT internal thread	Direct Connect AP, Direct Connect GP
PSISD	In-Line Saddle Weld, Direct Connect, Recessed Diaphragm	Lower housing of seal is in-line saddle welded to nominal 3- or 4-inch (or larger) pipe	Direct Connect AP, Direct Connect GP
PSSCT	Sanitary, Direct Connect (Level Seal), Flush Diaphragm	Process Connection to Sanitary Piping with 2- or 3-inch Tri-Clamp	Biplanar AP, Biplanar GP, DP
PSSST	Sanitary, Direct Connect (Level Seal), Extended Diaphragm	Process Connection to 2-inch Mini Spud or 4-inch Standard Spud; Tri-Clamp	Biplanar AP, Biplanar GP, DP
Remote Mount, Capillary-Connected Pressure Seal Assemblies			
PSFPS	Flanged, Remote Mount, Flush Diaphragm	ANSI Class 150/300/600 flanges and IEC 61518 PN 10/40 flanges	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSFES	Flanged, Remote Mount, Extended Diaphragm	ANSI Class 150/300/600 flanges and IEC 61518 PN 10/40, 10/16, 25/40 flanges	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSFFR	Flanged, Remote Mount, Flush Diaphragm	ANSI Class 150/300/600 flanges and IEC 61518 PN 10/40	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP
PSFAR	Flanged, Remote Mount, Recessed Diaphragm	ANSI Class 150/300/600/1500 flanges	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSTAR	Threaded, Remote Mount, Recessed Diaphragm	¼, ½, ¾, 1, or 1½ NPT internal thread	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSISR	In-Line Saddle Weld, Remote Mount, Recessed Diaphragm	Lower housing of seal is in-line saddle welded to nominal 3- or 4-inch (or larger) pipe	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSSCR	Sanitary, Remote Mount, Flush Diaphragm	Process connection fastened to a 2- or 3-inch pipe with a Tri-Clamp	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP
PSSSR	Sanitary, Remote Mount, Extended Diaphragm	Process connection to 2-in mini spud or 4-in standard spud; Tri-Clamp	Direct Connect AP, Direct Connect GP, Biplanar AP, Biplanar GP, DP

Figure 18 - Typical Pressure 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 ²¹
Biplanar AP/GP	316 ss, carbon steel, Monel, PVDF, or nickel alloy ²¹
DP ²²	316 ss, carbon steel, Monel, nickel alloy CW2M ²³ , 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 ²¹
Biplanar AP/GP	316 ss, gold-plated 316L ss, Co-Ni-Cr, Monel, tantalum, or nickel alloy ²¹
DP ²⁴ ²⁵	316L ss, gold-plated 316L ss, Co-Ni-Cr, Monel, tantalum, or nickel alloy ²¹ for transmitters with traditional structures; and 316L ss or nickel alloy ²¹ 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

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

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

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

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

25. 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.

NOTE:

- 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 pressure 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, <u>without</u> Process Connectors	3.5 kg (7.8 lb)
Biplanar or Traditional DP Structure, Aluminum, <u>with</u> 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 AP/GP Direct Connect Transmitters

Table 10 - Span Limits for Direct Connect Transmitters with HART Communication (Electronics Version -T)

Code	Span Limits ²⁶
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) ²⁷

Table 11 - Span Limits for Direct Connect Transmitters with FOUNDATION Fieldbus Communication (Electronics Version -F)

Code	Span Limits ²⁶
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) ²⁷

Table 12 - Range Limits for Direct Connect Transmitters with HART or FOUNDATION Fieldbus Communication (Electronics Versions -T or -F)

Code	Range Limits — AP	Range Limits — GP
D	0 and 1400 kPa _a (0 and 200 psia)	0 and 1400 kPa _g (0 and 200 psig)
E	0 and 14 MPa _a (0 and 2000 psia)	0 and 14 MPa _g (0 and 2000 psig) ²⁸
F	n/a	0 and 42 MPa _g (0 and 6000 psig) ²⁸

Limits for AP/GP Biplanar Transmitters

Table 13 - Span Limits for Biplanar Transmitters with HART Communication (Electronics Version -T)

Code	Span Limits ²⁶
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) ²⁹
E	0.26 and 20.7 MPa (37.5 and 3000 psi) ²⁹
F	1.1 and 34.5 MPa (165 and 5000 psi) ^{27 29}

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

27. Available for gauge pressure transmitters only.

28. Direct connect GP transmitters with Span Code E or F can tolerate vacuum down to -0.1 MPa (-14.7 psi). However, to measure vacuum accurately with a GP transmitter, a biplanar Structure Code is required.

29. 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 14 - Span Limits for Biplanar Transmitters with FOUNDATION Fieldbus Communication (Electronics Version -F)

Code	Span Limits ³⁰
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) ³¹
E	0.26 and 20.7 MPa (37.5 and 3000 psi) ³¹
F	1.1 and 34.5 MPa (165 and 5000 psi) ^{32 31}

Table 15 - Range Limits for Biplanar Transmitters with HART or FOUNDATION Fieldbus Communication (Electronics Versions -T or -F)

Code	Range Limits — AP	Range Limits — GP
B	0 and 50 kPaa (0 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 (-401 and +1000 inH ₂ Og)
D	0 and 2070 kPaa (0 and 300 psia) ³¹	-100 and +2100 kPag (-14.7 and +300 psig) ³¹
E	0 and 20.7 MPaa (0 and 3000 psia) ³¹	-0.1 and +21 MPag (-14.7 and +3000 psig) ³¹
F	n/a	-0.1 and +35 MPag (-14.7 and +5000 psig) ³¹

Limits for DP Transmitters

Table 16 - Span Limits for DP Transmitters with HART Communication (Electronics Version -T)

Code	Span Limits
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; 6.2 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 17 - Span Limits for DP Transmitters with FOUNDATION Fieldbus Communication (Electronics Version -F)

Code	Span Limits
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; 6.2 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

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

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.

32. Available for gauge pressure transmitters only.

Table 18 - Range Limits for DP Transmitters with HART or FOUNDATION Fieldbus Communication (Electronics Versions -T or -F)

Code	Range Limits
B	-50 and +50 kPa (-200 and +200 inH ₂ O)
C	-250 and +250 kPa (-1000 and +1000 inH ₂ O)
D	-0.10 and +2.07 MPa (-14.7 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.

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 19 - HART Communication (Electronics Version -T)

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 psi)	165 MPa (24,000 psi)

Table 20 - FOUNDATION Fieldbus Communication (Electronics Version -F)

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 psi)	165 MPa (24,000 psi)

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

34. Available for gauge pressure transmitters only.

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 21 - HART Communication (Electronics Version -T)

Transmitter Configuration ³⁵	Maximum Static ³⁶ and Overrange Pressure ³⁷	Maximum Proof Pressure ³⁸
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 ³⁹	40 MPa (5,800 psi)	100 MPa (14,500 psi)
Option -B3 (B7M), -P4, or -P8	20 MPa (2,900 psi)	70 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 ⁴⁰	10 MPa (1,500 psi)	40 MPa (6,000 psi)
Option -D9 (17-4 PH ss) or -Y ⁴¹	40 MPa (5,800 psi)	100 MPa (14,500 psi)
With Structure Code 78 or 79 (PVDF insert) ⁴²	2.1 MPa (300 psi)	8.4 MPa (1,200 psi)

Table 22 - FOUNDATION Fieldbus Communication (Electronics Version -F)

Transmitter Configuration ³⁵	Maximum Static ³⁶ and Overrange Pressure ³⁷	Maximum Proof Pressure ³⁸
Standard (B7 steel) with Span Codes B 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 ³⁹	40 MPa (5,800 psi)	100 MPa (14,500 psi)
Option -B3 (B7M), -P4, or -P8	20 MPa (2,900 psi)	70 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 ⁴⁰	10 MPa (1,500 psi)	40 MPa (6,000 psi)
Option -D9 (17-4 PH ss) or -Y ⁴¹	40 MPa (5,800 psi)	100 MPa (14,500 psi)
With Structure Code 78 or 79 (PVDF insert) ⁴²	2.1 MPa (300 psi)	8.4 MPa (1,200 psi)

Elevated Zero and Suppressed Zero

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

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

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

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

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

39. Available for gauge pressure transmitters only.

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

41. Differential pressure transmitters only.

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

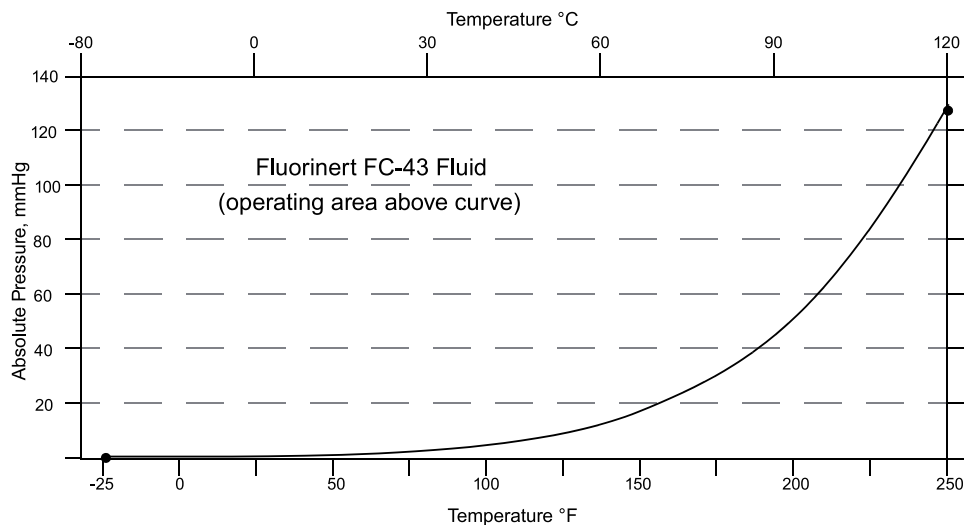
Output Signal

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, square root (for DP only) or 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.

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



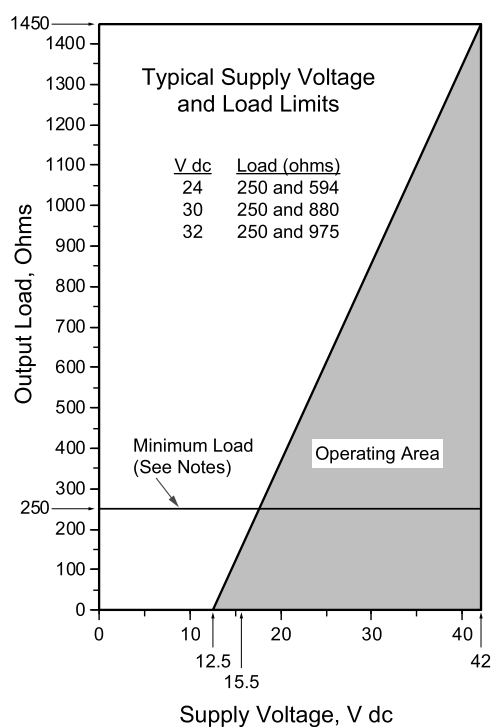
Supply Voltage

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**NOTES:**

1. The minimum voltage for HART communication is 15.5 V dc.
2. The minimum load for the HART Communicator is 250 ohms.
3. The transmitter can function with an output load less than the minimum, but using a remote configurator while operating in this area will result in output and/or communication disturbances.

	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

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

HART (-T) Transmitters:

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

NOTE: Selecting a value of **DAMP 0** in the Damping menu provides the fastest response.

FOUNDATION Fieldbus (-F) Transmitters:

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

NOTE: Selecting a value of **DAMP1/4** in the Damping menu provides the fastest response.

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.

NOTE: 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.

FOUNDATION Fieldbus (-F) Transmitters:

The field wiring is polarity insensitive. 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.

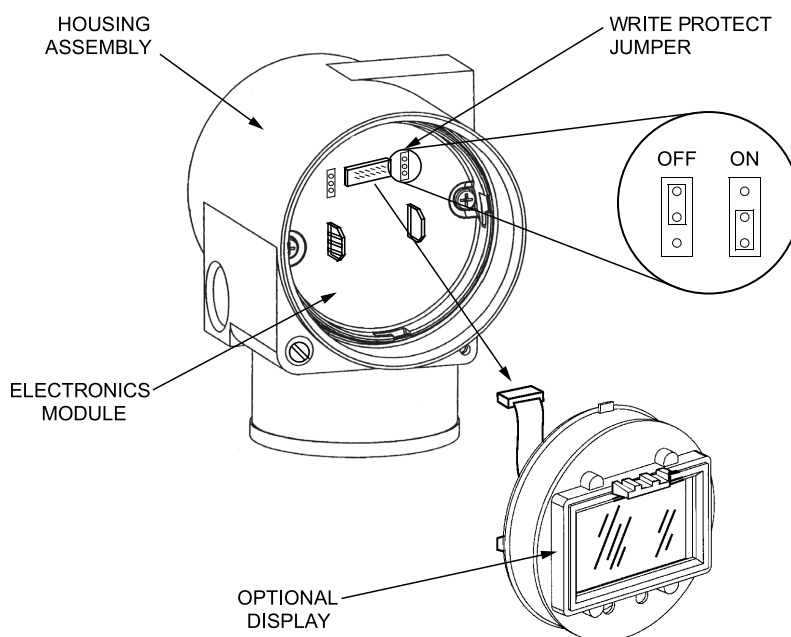
Simulation Jumper for FOUNDATION Fieldbus Transmitters

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, 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 transmitters⁴³ in square root mode are provided in *Units*, page 34.

Output Measurement #2 – Digital Secondary Variable

Mode: Linear or Square Root

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 23 - Allowable Units for Transmitters in Linear and Square Root Mode

Communication Protocol and Transmitter Mode	Units ⁴⁴
Pressure Units for HART 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 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. With HART (-T) Communication only

44. 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)]. 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 URL).
- URL = Upper Range Limit

Table 24 - IGP10S Direct Connect Accuracy⁴⁵

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than URL
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 ⁴⁶ , accuracy = ±[0.000625 (URL/Span)]%
F		> 33% URL	±0.05% of span For turndowns greater than 5:1, accuracy = ±[0.01 (URL/Span)]%

Table 25 - IGP10S Biplanar Accuracy⁴⁵

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than URL
B	±0.05% of reading	> 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)]%

Table 26 - IAP10S Direct Connect Accuracy⁴⁵

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than URL
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 ⁴⁶ , accuracy = ±[0.000625 (URL/Span)]%

45. This table is for digital accuracy; add 0.01% span for analog accuracy.

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

Table 27 - IAP10S Biplanar Accuracy⁴⁷

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than URL
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 28 - IDP10S Accuracy⁴⁷

Span Code	Reference Accuracy (% of Reading)	% of Reading Range	Reference Accuracy for Spans Less than URL
B	±0.05% of reading	> 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		> 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:

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

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.

47. This table is for digital accuracy; add 0.01% span for analog accuracy.

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 Codes C, D, E, and F, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.03\% \text{ URL} + 0.06\% \text{ Span})$.

For biplanar AP/GP transmitters with Span Codes B, C, and D, the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.04\% \text{ URL} + 0.050\% \text{ Span})$.

For biplanar AP/GP transmitters with Span Codes E and 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 (all Span Codes), the total effect for a 28°C (50°F) change within normal operating conditions is $\pm(0.04\% \text{ URL} + 0.050\% \text{ Span})$.

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).

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:

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

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
B	±0.07% of URL
C	±0.02% of URL
D and E	±0.50% URL ⁴⁸

Span Shift

Span Shift is ±0.15% of reading.

48. Per 3.5 MPa (500 psi) for Span Code D

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 39 and *Multidrop Communications (Fixed Current)*, page 40.

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

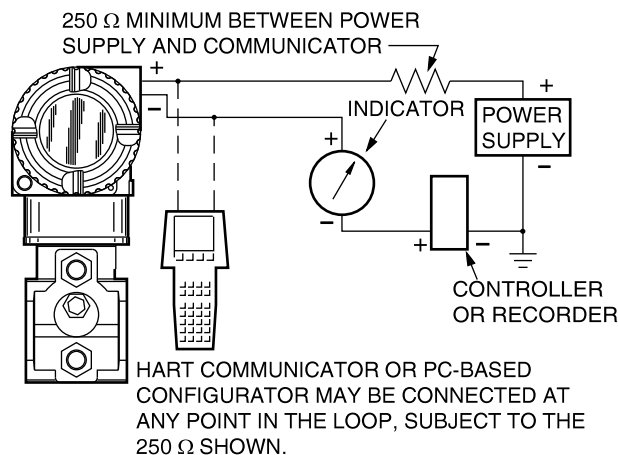
Measurements and diagnostics are available from the HART communicator connected to the two-wire loop carrying the 4 to 20 mA measurement signal by using a bidirectional digital signal superimposed on the 4 to 20 mA current signal.

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

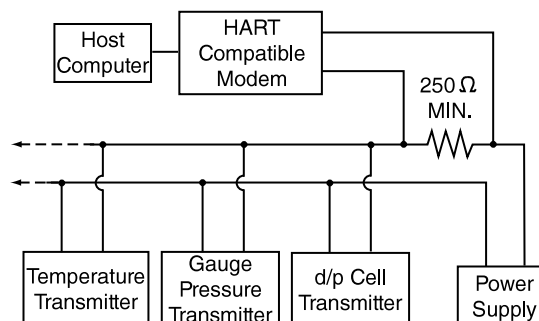


Multidrop Communications (Fixed Current)

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 29 - 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 30 - Fieldbus Characteristics

Parameter	Specification	
	No	Yes
Intrinsically Safe	No	Yes
Maximum No. of Devices ⁴⁹	32	6
Maximum Total Bus Length ⁵⁰	1900 m (6235 ft)	
Maximum Spur Length ⁵¹	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.

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

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

50. 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.

51. 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)

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.

Operating Conditions

Description	Reference Operating Conditions	Normal Operating Conditions ⁵²	Operative Limits ⁵²
Sensor Body Temperature ⁵³			
Silicone	24 ± 2°C (75 ± 3°F)	-29 to +82°C (-20 to +180°F) ⁵⁴	-46 and +121°C (-50 and +250°F) ^{55 56}
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) ⁵⁷	-40 and +85°C (-40 and +185°F) ^{58 59}
With display	24 ± 2°C (75 ± 3°F) ⁶⁰	-20 to 82°C (-4 to +180°F) ⁶¹ _{62 60}	-40 and +85°C (-40 and +185°F) ^{58 59 63 60}
Relative Humidity	50 ± 10% ⁶⁴	0 to 100% ⁶⁴	0 and 100% ⁶⁴
Ambient Pressure (DP HART)	860 to 1060 mbar	Atmospheric	Atmospheric
Supply Voltage, dc (HART) ⁶⁵	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 ⁶⁶	0 and 1,450 Ω ⁶⁶
Mounting Position			
AP and GP	Upright	Upright	No limit
DP	Upright or Horizontal ⁶⁷	Upright or Horizontal ⁶⁷	
Vibration			
Aluminum Housing	1 m/s ² (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/s ² (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	

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

53. 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).

54. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters

55. 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.

56. -46 and +50°C (-50 and +122°F) for biplanar AP transmitters.

57. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters.

58. -40 and +75°C (-40 and +167°F) for transmitters with ATEX flameproof classification.

59. -40 and +50°C (-40 and +122°F) for biplanar AP transmitters.

60. 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.

61. -20 to +50°C (-20 to +122°F) for biplanar AP transmitters.

62. Refer to *Electrical Certifications*, page 45 for a restriction in ambient temperature limits with certain electrical approvals/certifications.

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

64. 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.

65. Refer to *Supply Voltage*, page 30.

66. 250 Ω minimum load is required for communication with a HART communicator.

67. 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) ⁶⁸
Electronics Temperature	-20 to +82°C (-4 to +180°F) ^{69 70 68}
Relative Humidity	0 to 100% Noncondensing ⁷¹
Ambient Pressure (DP HART)	Atmospheric

68. -29 to +50°C (-20 to +122°F) for biplanar AP transmitters.

69. -20 to +50°C (-4 to +122°F) for biplanar AP transmitters.

70. Refer to *Electrical Certifications*, page 45 for a restriction in ambient temperature limits with certain electrical approvals/certifications.

71. 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 47* for the availability of electrical safety design codes with specific transmitter structures.

Table 31 - Electrical Certifications

Agency Certification, Types of Protection, and Area Classification	Application Conditions ⁷²	Model Code Option
ATEX intrinsically safe, Ex ia IIC	Temperature Class T4, Ta= -40°C to +80°C	AA
ATEX flameproof, Ex d IIC	Temperature Class T6, T85°C, Ta= -40°C to +75°C	AD
ATEX multiple certifications (includes ATEX Codes AA and AN)	Applies to Codes AA and AN	AM ⁷³
ATEX protection type n, Ex ic IIC, or Ex nA	Temperature Class T4, Ta= -40°C to +80°C	AN
ATEX multiple certifications (includes ATEX Codes AA, AD and AN)	Applies to Codes AA, AN, and AD	AP ⁷³
INMETRO intrinsically safe, Ex ia IIC	Temperature Class T4, Ta= -40°C to +80°C	BA
INMETRO flameproof, Ex d IIC	Temperature Class T6, T85°C, Ta= -40°C to +75°C	BD
INMETRO multiple certifications (includes INMETRO Codes BA and BD)	Applies to codes BA and BD	BP ⁷³
CSA intrinsically safe, Zone certified Ex ia	Temperature Class T4A at 40°C and T3C at 85°C maximum ambient	CA
CSA zone certified flameproof Ex d IIC; also explosion proof, dust ignition-proof	T6, Maximum Ambient Temperature 75°C	CD
CSA multiple certifications (includes CSA Codes CA and CN)	Applies to codes CA and CN	CM ⁷³
CSA non-incendive, Zone certified Ex nA IIC	Temperature Class T4A at 40°C and T3C at 85°C maximum ambient	CN
CSA multiple certifications (includes CSA Codes CA, CD and CN)	Applies to codes CA, CD, and CN	CP ⁷³
Multi-marked ATEX and IECEx intrinsically safe, Ex ia IIC	Temperature Class T4, Ta = -40°C to +80°C	DA
Multi-marked ATEX and IECEx flameproof, Ex d IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	DD
Multi-marked ATEX and IECEx multiple certifications, ia, ic	Applies to codes DA and DN	DM ⁷³
Multi-marked ATEX and IECEx protection type n, Ex ic IIC	Temperature Class T4, Ta = -40°C to +80°C	DN
Multi-marked ATEX and IECEx multiple certifications, ia, ic, and d	Applies to codes DA, DD, and DN	DP ⁷³
IECEx intrinsically safe, Ex ia IIC	Temperature Class T4, Ta= -40°C to +80°C	EA
IECEx flameproof, Ex d IIC	Temperature Class T6, Ta= -40°C to +75°C	ED
IECEx multiple certifications, ia, ic, nA	Applies to Codes EA and EN	EM ⁷³
IECEx protection type n, Ex ic IIC, or Ex nA	Temperature Class T4, Ta= -40°C to +80°C	EN
IECEx multiple certifications, ia, ic, nA, and d	Applies to Codes EA, EN, and ED	EP ⁷³
FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC	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 d IIC	Temperature Class T6 at 75°C and T5 at 85°C maximum ambient	FD
FM multiple certifications (includes FM Codes FA or FN)	Applies to codes FA or FN	FM ⁷³

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

73. 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 (ia, d, n, IS, NL, or XP). Do not change this mark once it has been applied.

Agency Certification, Types of Protection, and Area Classification	Application Conditions ⁷⁴	Model Code Option
Classes I, II and III FM Division 2 non-incendive, Zone approved AEx nA IIC	Temperature Class T4, Ta= -40°C to +80°C	FN
FM multiple certifications (includes FM Codes FA, FD or FN)	Applies to codes FA, FD, or FN	FP ⁷⁵
EAC intrinsically safe, Ex ia	Temperature Class T4, Ta= -40°C to +80°C	RA
EAC flameproof, Ex d	Temperature Class T4, Ta= -40°C to +75°C	RD
EAC protection type n, Ex ic IIC or Ex nA	Temperature Class T4, Ta= -40°C to +80°C	RN
Multi-marked for ATEX, CSA, and FM Intrinsically Safe Application	Applies to codes FA, CA, and AA	MA ⁷⁶
No certification	n/a	ZZ

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

75. 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 (ia, d, n, IS, NL, or XP). Do not change this mark once it has been applied.

76. When selecting Electrical Safety Design Code MA, you must permanently mark (check off in the rectangular block on the data plate) intrinsically safe certifications for ATEX, CSA, or FM, as applicable. Do not change this mark once it has been applied.

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

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
Structure Codes	
Structure — Direct Connect⁷⁸	
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 ⁷⁹
35	316L ss Process Sensor; Co-Ni-Cr Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁷⁹
36	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁷⁹
37	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁷⁹
38	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁷⁹
39	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁷⁹
E2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only ⁷⁹
E3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only ⁷⁹
E4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁷⁹
E5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁷⁹
E6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁷⁹
E7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁷⁹

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 option codes -V1, -V2, -V3, and -V4.

Code	Description
Structure — Direct Connect Gold-Plated⁸⁰	
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

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

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

Code	Description
Structure — Direct Connect Flameproof	
52	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT External Conn. Only
53	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT External Conn. Only
60	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT External Conn. Only
61	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT External Conn. Only
62	C276 Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT External Conn. Only
63	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT External Conn. Only
90	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸²
91	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸²
92	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only ⁸²
93	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only ⁸²
F2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only ⁸²
F3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only ⁸²
F4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸²
F5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸²
F6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only ⁸²
F7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only ⁸²
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
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 ⁸³
79	PVDF Insert; Tantalum Diaphragm; Inert Fill ⁸³

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

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

Code	Description
Structure — LP1 Biplanar (Not Available with Pressure 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 Pressure 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 — Direct Connect, Prepared for Schneider Electric Model Coded Pressure Seals⁸⁴	
D1	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁸⁵
D2	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁸⁵
S3	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁸⁶
S4	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁸⁶
Structure — Direct Connect, Prepared for Non-Schneider Electric Model Coded Pressure Seals^{84 87}	
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 — Biplanar, Prepared for Schneider Electric Model Coded Pressure Seals^{88 89}	
P1	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁹⁰
P2	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁹⁰
P3	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁸⁶
P4	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁸⁶
Structure — Biplanar, Prepared for Non-Schneider Electric Model Coded Pressure Seals^{87 89}	
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
Structure — Direct Connect Flameproof, Prepared for Schneider Electric Model Coded Pressure Seals	
D5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal ⁸⁵
D6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal ⁸⁵
S5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal ⁸⁶
S6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal ⁸⁶

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

85. Specify direct connect seal PSFFD, PSFAD, PSISD, or PSTAD.

86. Specify remote mount seal PSFFR, PSFAR, PSFES, PSFPS, PSISR, PSSCR, PSSSR, or PSTAR.

87. These structures are prepared for attachment of pressure seals by others. Do not specify a Schneider Electric seal model code.

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

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

90. Specify biplanar, direct connect seal PSFLT, PSSST, or PSSCT.

Code	Description	
Structure — Direct Connect Flameproof, Prepared for Non-Schneider Electric Model Coded Pressure Seals ⁹¹		
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 ^{92 93}		
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)	
Span Limits		
Code	Transmitters with Direct Connect Structures	Transmitters with Biplanar Structures
B	n/a	0.12 and 50 kPa (0.5 and 200 inH ₂ O)
C	n/a	0.62 and 250 kPa (2.49 and 1000 inH ₂ O)
D	3.4 and 1380 kPa (0.5 and 200 psi)	26 and 2070 kPa (3.75 and 300 psi) ^{94 95}
E	0.034 and 13.8 MPa (5 and 2000 psi)	0.26 and 20.7 MPa (37.5 and 3000 psi) ^{94 95}
F	0.52 and 41.4 MPa (75 and 6000 psi) ⁹⁶	1.1 and 34.5 MPa (165 and 5000 psi) ^{96 94 95}
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	

91. These structures are prepared for attachment of pressure seals by others. Do not specify a Schneider Electric seal model code.

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

93. Available with Span Limit codes C and D only.

94. 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.

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

96. Available for gauge pressure transmitters only.

Code	Description
Electrical Certifications	
AA	ATEX intrinsically safe, Ex ia IIC
AD	ATEX flameproof, Ex d IIC ⁹⁷
AM	ATEX multiple certifications (includes ATEX Codes AA and AN)
AN	ATEX protection type n, Ex ic IIC, or Ex nA
AP	ATEX multiple certifications (includes ATEX Codes AA, AD and AN) ⁹⁷
BA	INMETRO intrinsically safe, Ex ia IIC
BD	INMETRO flameproof, Ex d IIC ⁹⁷
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD) ⁹⁷
CA	CSA intrinsically safe, Zone certified Ex ia
CD	CSA zone certified flameproof Ex d IIC; also explosion proof, dust ignition-proof ⁹⁷
CM	CSA multiple certifications (includes CSA Codes CA and CN)
CN	CSA non-incendive, Zone certified Ex nA IIC
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN) ⁹⁷
DA	Multi-marked ATEX and IECEx intrinsically safe, Ex ia IIC
DD	Multi-marked ATEX and IECEx flameproof, Ex d IIC ⁹⁷
DM	Multi-marked ATEX and IECEx multiple certifications, ia, ic
DN	Multi-marked ATEX and IECEx protection type n, Ex ic IIC
DP	Multi-marked ATEX and IECEx multiple certifications, ia, ic, and d ⁹⁷
EA	IECEx intrinsically safe, Ex ia IIC
ED	IECEx flameproof, Ex d IIC ⁹⁷
EM	IECEx multiple certifications, ia, ic, nA
EN	IECEx protection type n, Ex ic IIC, or Ex nA
EP	IECEx multiple certifications, ia, ic, nA, and d ⁹⁷
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx d IIC ⁹⁷
FM	FM multiple certifications (includes FM Codes FA or FN)
FN	Classes I, II and III FM Division 2 non-incendive, Zone approved AEx nA IIC
FP	FM multiple certifications (includes FM Codes FA, FD or FN) ⁹⁷
RA	EAC intrinsically safe, Ex ia
RD	EAC flameproof, Ex d ⁹⁷
RN	EAC protection type n, Ex ic IIC or Ex nA
MA	Multi-marked for ATEX, CSA, and FM Intrinsically Safe Application
ZZ	No certification

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

Code	Description
Optional Mounting Bracket Sets	
-M1	Painted Steel Bracket, Plated Steel Bolts, 1/2 NPT, Direct Connect Only ^{98 99 100}
-M2	Stainless Steel Bracket, Stainless Steel Bolts, 1/2 NPT, Direct Connect Only ^{98 99 100}
-M3	Universal Stainless Steel Mounting Bracket Set, Stainless Steel Hardware, Biplanar Only
-M5	Painted Steel Bracket, Plated Steel Bolts, M20, Direct Connect Only ^{98 99 101}
-M6	Stainless Steel Bracket, Stainless Steel Bolts, M20, Direct Connect Only ^{98 99 101}
-M7	Stainless Steel Bracket for Flameproof Direct Connect Sensor Structures ¹⁰²
-M8	Painted Steel Bracket for Flameproof Direct Connect Sensor Structures ¹⁰²
-M9	Painted Steel Bracket, Plated Steel Bolts, Biplanar Only
-M0	Stainless Steel Bracket, Stainless Steel Bolts, Biplanar Only
Optional Vent Screw and Block and Bleed Valve	
-V1	316 ss Vent Screw in Process Connection ^{98 103 104}
-V2	Block and Bleed Valve, Carbon Steel ^{98 103 105}
-V3	Block and Bleed Valve, 316 ss ^{98 103 105}
-V4	Block and Bleed Valve, 316 ss w/ Monel Trim, NACE Approved ^{98 103 105}
-V5	Vent Screw in Side of Process Cover ^{106 107 108}
-V6	Omit Vent Screw ¹⁰⁹
Optional Biplanar Process Connector Type (same material as Process Cover)^{106 110}	
-F1	1/4 NPT ¹¹¹
-F2	1/2 NPT
-F3	RC 1/4 ¹¹¹
-F4	RC 1/2
-F6	1/2 Schedule 80 Weld Neck ¹¹¹
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover

98. Not available with biplanar structures.

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

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

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

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

103. Not available with option -G.

104. Available only with 1/2 NPT 316L ss Structure codes 20, 21, 22, 23, 30, 31, 52, 53, 60, 61, 70, 71, 72, 73, 80, and 81.

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

106. Available with biplanar structures only.

107. Not available with Structure codes LL, LM, LC, LD, CC, CD, L2, L3, L6, or L7. A vent screw in the side of the process cover is standard with these structures.

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

109. Available only for transmitters with biplanar LP1 or LP2 structures.

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

111. Not available with biplanar C276 structures.

Code	Description
Optional IEC 61518 Construction^{112 113}	
-D1	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=2320 psi ¹¹⁴
-D2	Double-Ended Process Cover ¹¹⁵ with B7 Steel Bolt; Size M10 Steel Connector Screw; MWP=1500 psi ^{116 117 118}
-D3	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=3626 psi ¹¹⁴
-D4	Double-Ended Process Cover ¹¹⁵ with B7 Steel Bolt; Size 7/16 Steel Connector Screw; MWP=1500 psi ^{116 117 118}
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi ¹¹⁴
-D6	Double-Ended Process Cover ¹¹⁵ with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi ^{116 117 118}
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi ¹¹⁴
-D8	Double-Ended Process Cover ¹¹⁵ with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi ^{116 117 118}
-D9	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=5800 psi ¹¹⁴
Optional Cleaning and Preparation	
-X1	Unit Degreased – for Silicone Fill Sensors Only ¹¹⁹
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only ¹²⁰
-X3	Cleaned and Prepared for Chlorine Service ^{120 121}
Optional Bolting (Process Covers and Process Connectors)^{112 122 123 124}	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi) ¹²⁵
-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, Class II; MWP derated to 2900 psi) ¹²⁵
Optional Conduit Thread Adapters^{126 127}	
-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)

112. 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.

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

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

115. Blind connector supplied.

116. 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.

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

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

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

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

121. 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.

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

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

124. Available with biplanar structures only.

125. See *Maximum Static, Overrange, and Proof Pressure Ratings*, page 28 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.

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

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

Code	Description
Optional Electronics Housing Features	
-Z1	External Zero Adjustment ¹²⁸
-Z2	Custody Transfer Lock and Seal ¹²⁹
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal ^{128 129}
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector ¹³⁰
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector ¹³¹
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 Selections¹³²	
-S1	Yellow Cover for SIL2 on Electronics/Indicator Side of Housing
-S2	Red Cover for SIL2 on Electronics/Indicator Side of Housing
Miscellaneous Optional Selections	
-F	Autoclave F-250-C (GP transmitters only)
-G	G 1/2 B Manometer Process Connection ¹³³
-G1	Metal O-Ring for Pressure Seals in Vacuum Service ¹³⁴
-H	1/2 NPT External Thread (GP transmitters only)
-J	Low Temperature Operative Limit -50°C (-58°F) ^{135 136 137}
-K2	FoxDoc DVD-ROM (instead of "Getting Started" Guide)
-R	R 1/2 Process Connection (1/2 NPT to R 1/2 Adapter) ¹³⁸
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)

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

129. 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.

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

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

132. Available only with Electronics Version -T.

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

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

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

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

137. 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.

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

Differential Pressure Transmitters

Code	Description
Model¹³⁹	
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
Structure Codes	
Structure — Traditional¹⁴⁰	
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) ¹⁴¹
79	PVDF Insert; Tantalum Diaphragm; Inert Fill; Max Static Pressure=2.07 MPa (300 psi) ¹⁴¹
Structure — LP1 Direct Mount (Not Available with Pressure Seals); Maximum Static Pressure=25 MPa (3626 psi)¹⁴⁰	
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 Bracket Mount or Direct Mount (Not Available with Pressure Seals); Maximum Static Pressure=25 MPa (3626 psi)¹⁴⁰	
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

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

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

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

Code	Description
Structure — Prepared for Schneider Electric Model Coded Pressure Seals (Static Pressure Rating Limited by Seal)^{142 143}	
S1	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seals, Both Sides ¹⁴⁴
S2	316 ss Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seals, Both Sides ¹⁴⁴
S3	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, High Side ¹⁴⁴
S4	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, High Side ¹⁴⁴
S5	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, Low Side ¹⁴⁴
S6	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, Low Side ¹⁴⁴
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 Non-Schneider Electric Model Coded Pressure Seals (Static Pressure Rating Limited by Seal)¹⁴²	
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	
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; 6.2 and 2500 mbar
D	0.026 and 2.07 MPa; 3.75 and 300 psi; 0.26 and 20.7 bar
E ¹⁴⁵	0.26 and 20.7 MPa; 37.5 and 3000 psi; 2.6 and 207 bar
Process Connector Type (Same Material as the Process Cover)	
0	None
1	1/4 NPT ^{145 146 147}
2	1/2 NPT ^{145 146}
3	RC 1/4 ^{145 146 147}
4	RC 1/2 ^{145 146}
6	1/2 Schedule 80 Weld Neck ^{145 146 147}
7	None; PVDF insert tapped for 1/2 NPT process inlet located on side of process cover ¹⁴⁸

¹⁴². Not available with options -X1, -X2, or -X3.

¹⁴³. Both transmitter and pressure seal model numbers are required. See PSS 2A-1Z11 B for pressure seal model codes.

¹⁴⁴. Remote seal models that may be specified are PSFPS, PSFES, PSFAR, PSTAR, PSISR, PSSCR, and PSSSR.

¹⁴⁵. Not available with Structure codes 78 and 79 (PVDF process covers).

¹⁴⁶. Not available with structures that have seals on both sides.

¹⁴⁷. Not available with structures that have C276 process covers.

¹⁴⁸. Available only with Structure codes 78 and 79 (PVDF process covers).

Code	Description
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 intrinsically safe, Ex ia IIC
AD	ATEX flameproof, Ex d IIC
AM	ATEX multiple certifications (includes ATEX Codes AA and AN)
AN	ATEX protection type n, Ex ic IIC, or Ex nA
AP	ATEX multiple certifications (includes ATEX Codes AA, AD and AN)
BA	INMETRO intrinsically safe, Ex ia IIC
BD	INMETRO flameproof, Ex d IIC
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD)
CA	CSA intrinsically safe, Zone certified Ex ia
CD	CSA zone certified flameproof Ex d IIC; also explosion proof, dust ignition-proof
CM	CSA multiple certifications (includes CSA Codes CA and CN)
CN	CSA non-incendive, Zone certified Ex nA IIC
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN)
DA	Multi-marked ATEX and IECEx intrinsically safe, Ex ia IIC
DD	Multi-marked ATEX and IECEx flameproof, Ex d IIC
DM	Multi-marked ATEX and IECEx multiple certifications, ia, ic
DN	Multi-marked ATEX and IECEx protection type n, Ex ic IIC
DP	Multi-marked ATEX and IECEx multiple certifications, ia, ic, and d
EA	IECEx intrinsically safe, Ex ia IIC
ED	IECEx flameproof, Ex d IIC
EM	IECEx multiple certifications, ia, ic, nA
EN	IECEx protection type n, Ex ic IIC, or Ex nA
EP	IECEx multiple certifications, ia, ic, nA, and d
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx d IIC
FM	FM multiple certifications (includes FM Codes FA or FN)
FN	Classes I, II and III FM Division 2 non-incendive, Zone approved AEx nA IIC
FP	FM multiple certifications (includes FM Codes FA, FD or FN)
RA	EAC intrinsically safe, Ex ia
RD	EAC flameproof, Ex d
RN	EAC protection type n, Ex ic IIC or Ex nA
MA	Multi-marked for ATEX, CSA, and FM Intrinsically Safe Application
ZZ	No certification

Code	Description
Optional Mounting Bracket Sets^{149 150}	
-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^{151 152 153}	
-P1	Adapter Set for MC Coplanar Manifolds, B7 Bolts ¹⁵⁴
-P2	Adapter Set for MC Coplanar Manifolds, 316 ss Bolts ¹⁵⁵
-P3	Adapter Set for MC Coplanar Manifolds, 17-4 ss Bolts ¹⁵⁶
-P4	Adapter Set for MC Coplanar Manifolds, B7M Bolts ¹⁵⁷
-P5	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7 Bolts ¹⁵⁴
-P6	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 316 ss Bolts ¹⁵⁵
-P7	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 17-4 ss Bolts ¹⁵⁶
-P8	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7M Bolts ¹⁵⁷
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover
Optional IEC 61518 Construction^{153 158 159}	
-D1	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=2320 psi
-D2	Double-Ended Process Cover ¹⁶⁰ with B7 Steel Bolt; Size M10 Steel Connector Screw; MWP=1500 psi ^{161 162}
-D3	Single-Ended Process Cover with B7 Steel Bolt; No Connector Screw; MWP=3626 psi
-D4	Double-Ended Process Cover ¹⁶⁰ with B7 Steel Bolt; Size 7/16 Steel Connector Screw; MWP=1500 psi ^{161 162}
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi
-D6	Double-Ended Process Cover ¹⁶⁰ with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi ^{161 162}
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi
-D8	Double-Ended Process Cover ¹⁶⁰ with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi ^{161 162}
-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 ¹⁶³
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only ¹⁶⁴
-X3	Cleaned and Prepared for Chlorine Service ^{164 165}

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

150. Not available with Low Profile (LP1 and LP2) structures.

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

152. Not available with structures prepared for pressure seals.

153. Available only with Process Connector Type code 0.

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

155. Available only with option -B1.

156. Available only with option -B2.

157. Available only with option -B3.

158. See *Maximum Static, Overrange, and Proof Pressure Ratings, page 28* for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.

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

160. Blind connector supplied.

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

162. 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.

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

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

165. 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.

Code	Description
Optional Bolting (Process Covers and Process Connectors) ^{166 167 168 169}	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi) ¹⁷⁰
-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, Class II; MWP derated to 2900 psi) ¹⁷⁰
Optional Conduit Thread Adapters ^{171 172}	
-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
-Z2	Custody Transfer Lock and Seal ¹⁷³
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal ¹⁷³
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector ¹⁷⁴
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector ¹⁷⁵
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 Selections ¹⁷⁶	
-S1	Yellow Cover for SIL2 on Electronics/Indicator Side of Housing
-S2	Red Cover for SIL2 on Electronics/Indicator Side of Housing

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

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

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

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

170. See *Maximum Static, Overrange, and Proof Pressure Ratings*, page 28 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.

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

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

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

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

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

176. Available only with Electronics Version -T.

Code	Description
Miscellaneous Optional Selections	
-G1	Metal O-Ring for Pressure Seals in Vacuum Service ^{177 178}
-GP	Gold Plated Diaphragm ^{179 180}
-J	Low Temperature Operative Limit -50°C (-58°F) ^{181 182 183}
-K2	FoxDoc DVD-ROM (instead of "Getting Started" Guide)
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)
-V	Supply Vent Screw in Side of Each Process Cover ¹⁸⁴
-V1	Omit Vent Screw in Side of Each Process Cover ¹⁸⁵
-Y	Static Pressure Rating to 40 MPa (5800 psi) and 17-4 ss Bolts and Nuts ^{181 186 187 188}

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

178. Available only with structure codes for pressure seals.

179. Available only with Structure code 22.

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

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

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

183. Not available with Traditional, LP1, or LP2 structures with inert fill fluid.

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

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

186. Not available with structures prepared for pressure seals.

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

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

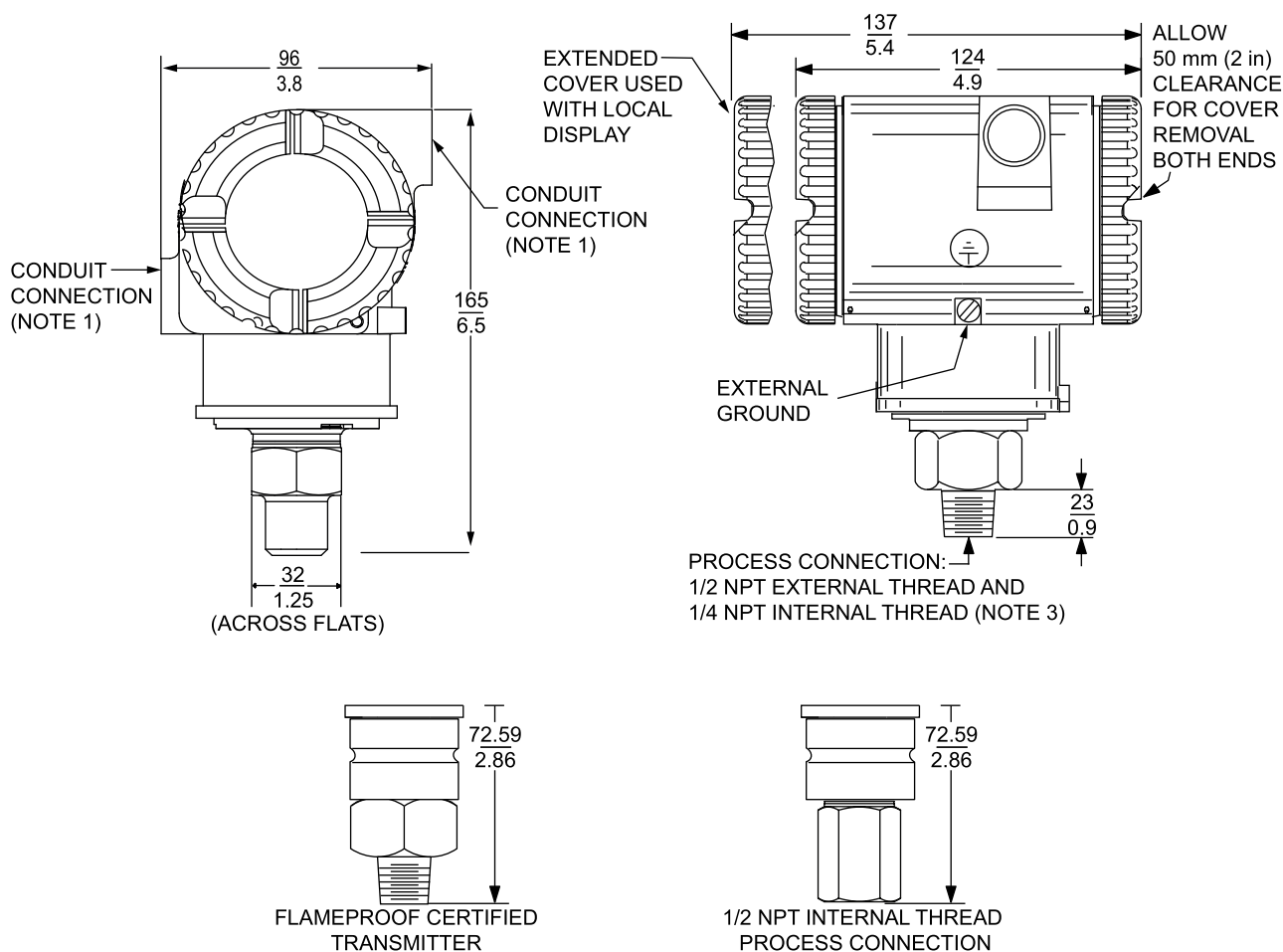
Dimensions

NOTE: For information on pulp and paper connection and sanitary pressure transmitters, see:

- DP 020-217, *Gauge and Absolute Pressure Transmitters With Pulp and Paper Process Connections*
- DP 020-218, *Sanitary Pressure Transmitters with 1½-, 2-, and 3-inch Tri-Clamp Process Connection*
- DP 020-219, *Sanitary Gauge or Absolute Pressure Transmitters with Mini Tank Spud Seal*

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.

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

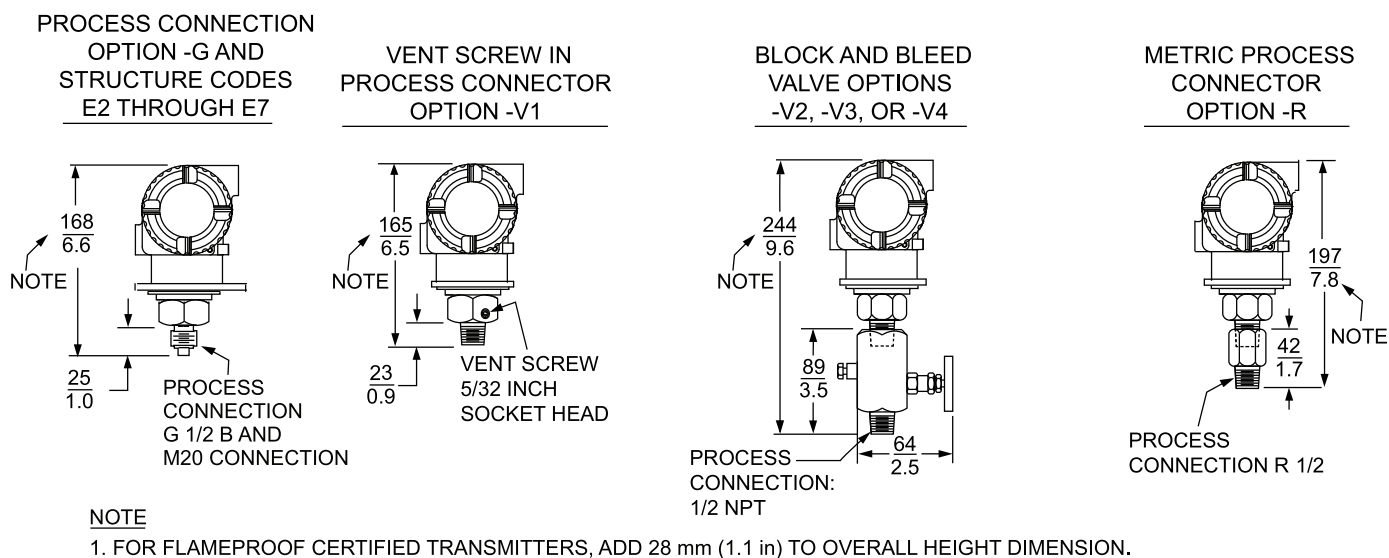


Figure 25 - Direct Connect AP/GP Transmitters with Options -M1, -M2, -M5, and -M6

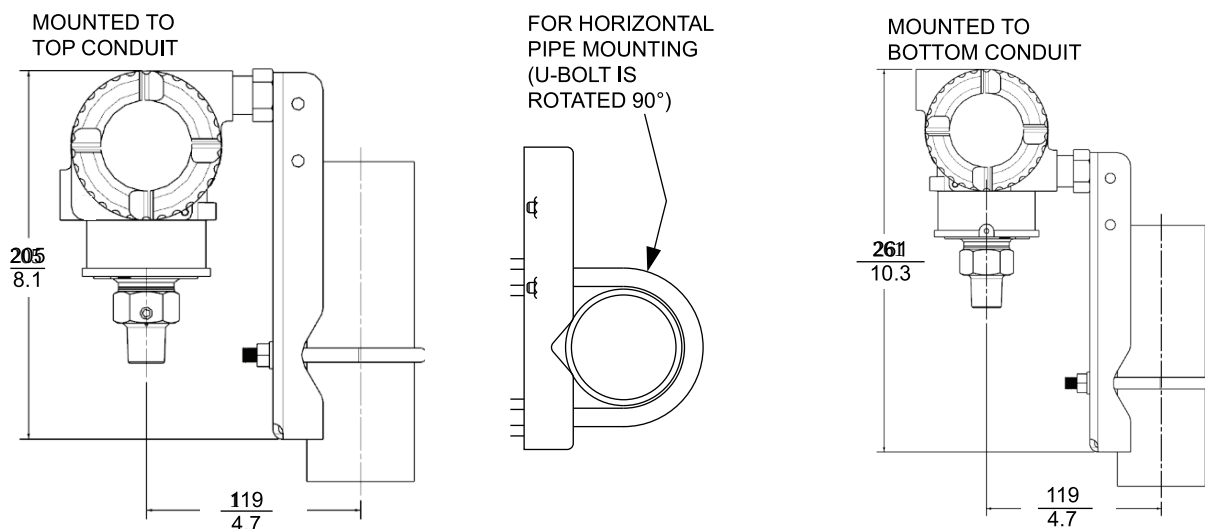
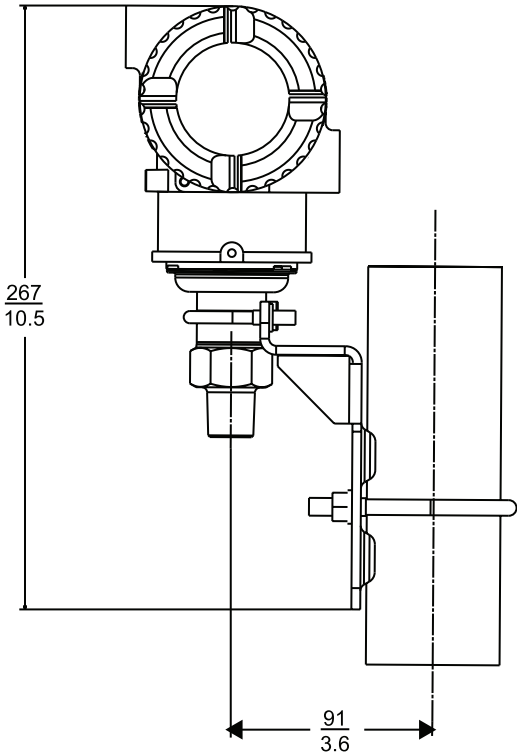
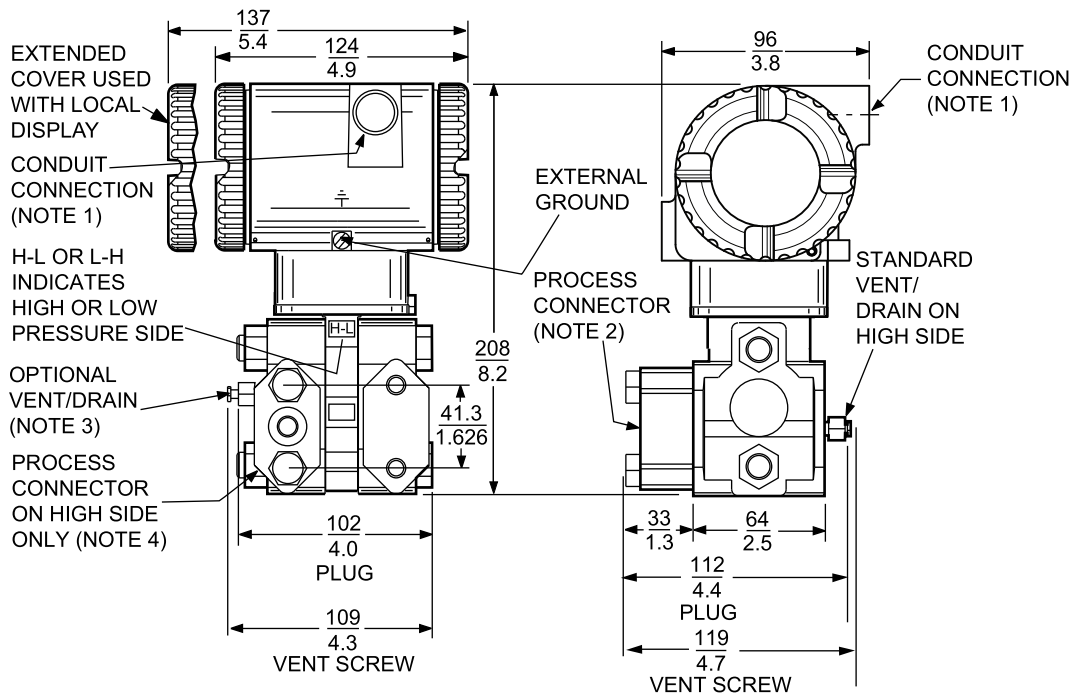


Figure 26 - Flameproof Direct Connect AP/GP Transmitters with Options -M7 and -M8



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

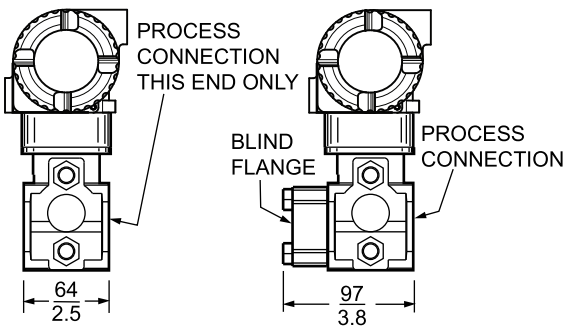


Figure 29 - Biplanar AP/GP Transmitters with Options -M0 and -M9 (Standard Stainless Steel or Painted Steel Bracket)

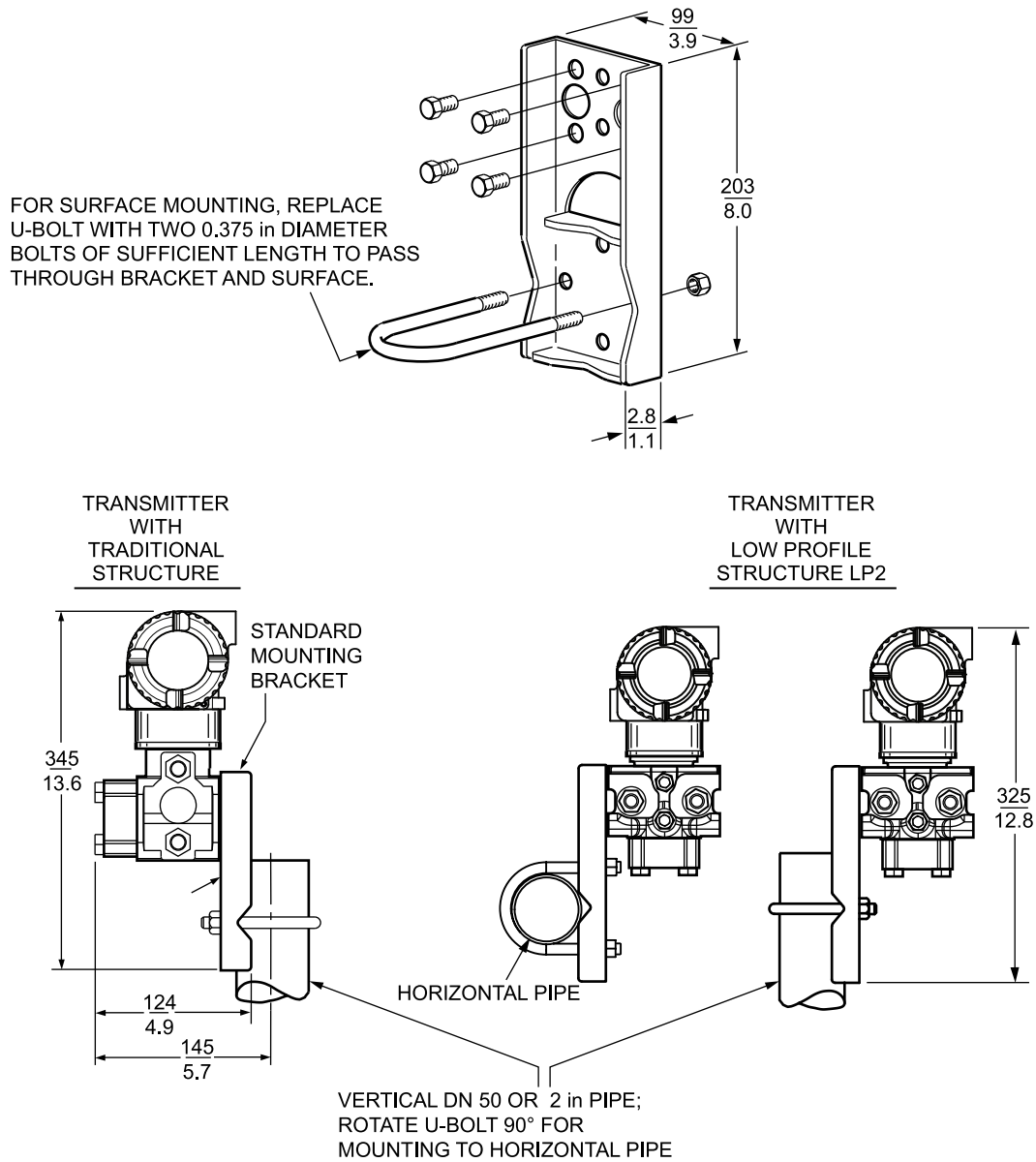
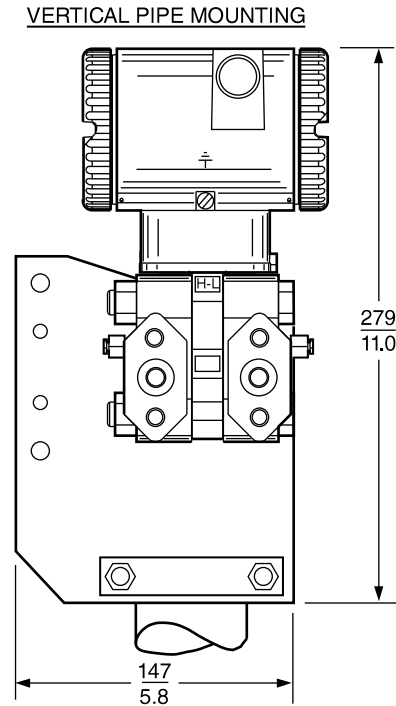
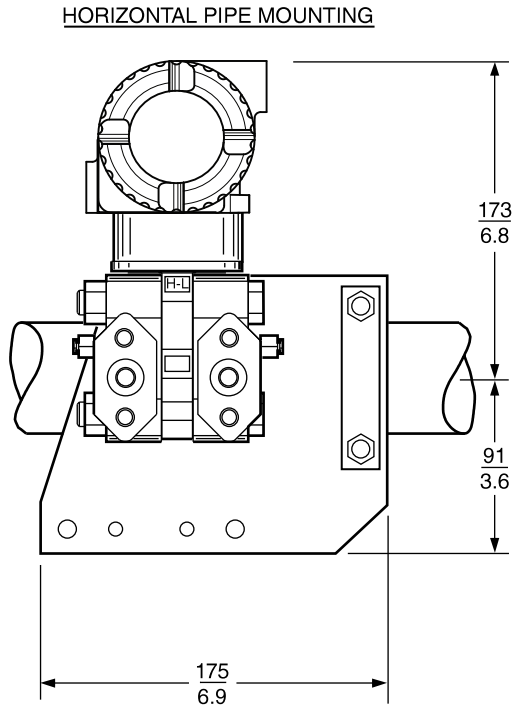
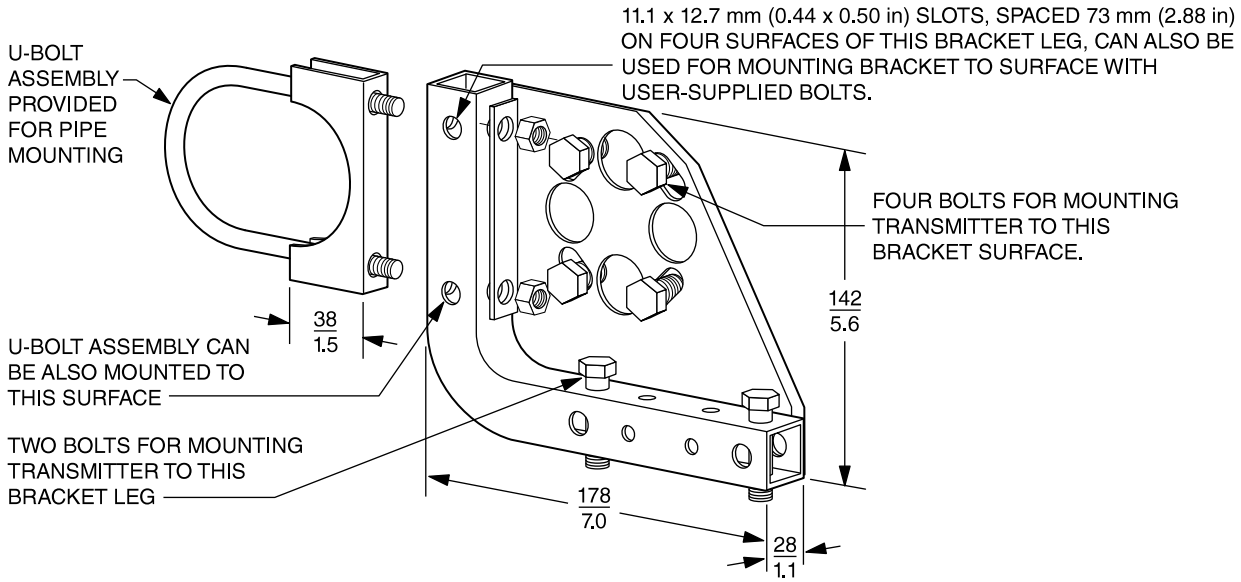
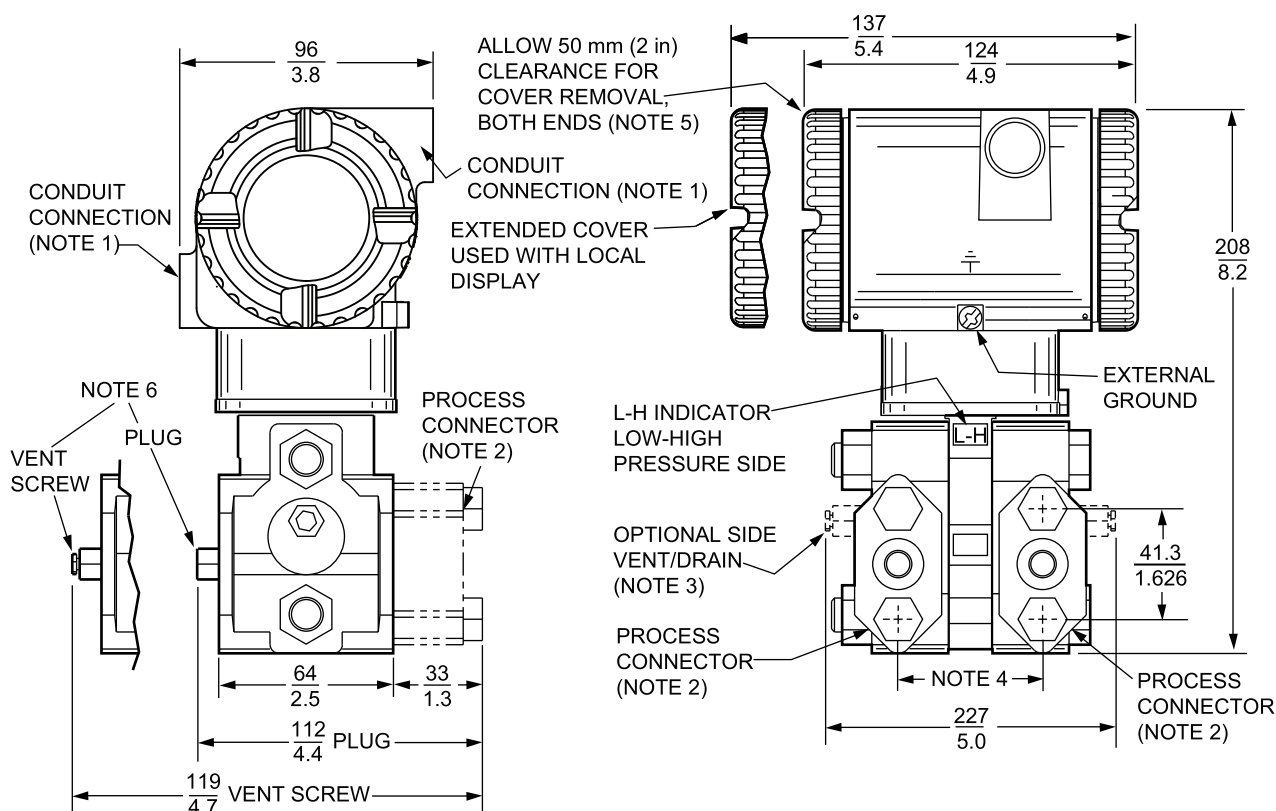


Figure 30 - Biplanar AP/GP Transmitters with Option -M3 (Universal Bracket)



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.

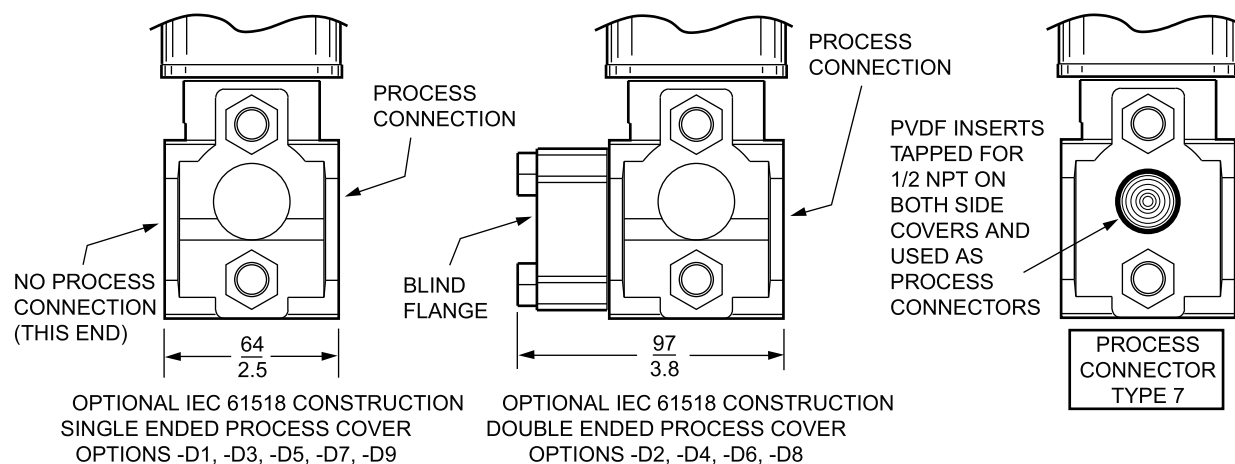
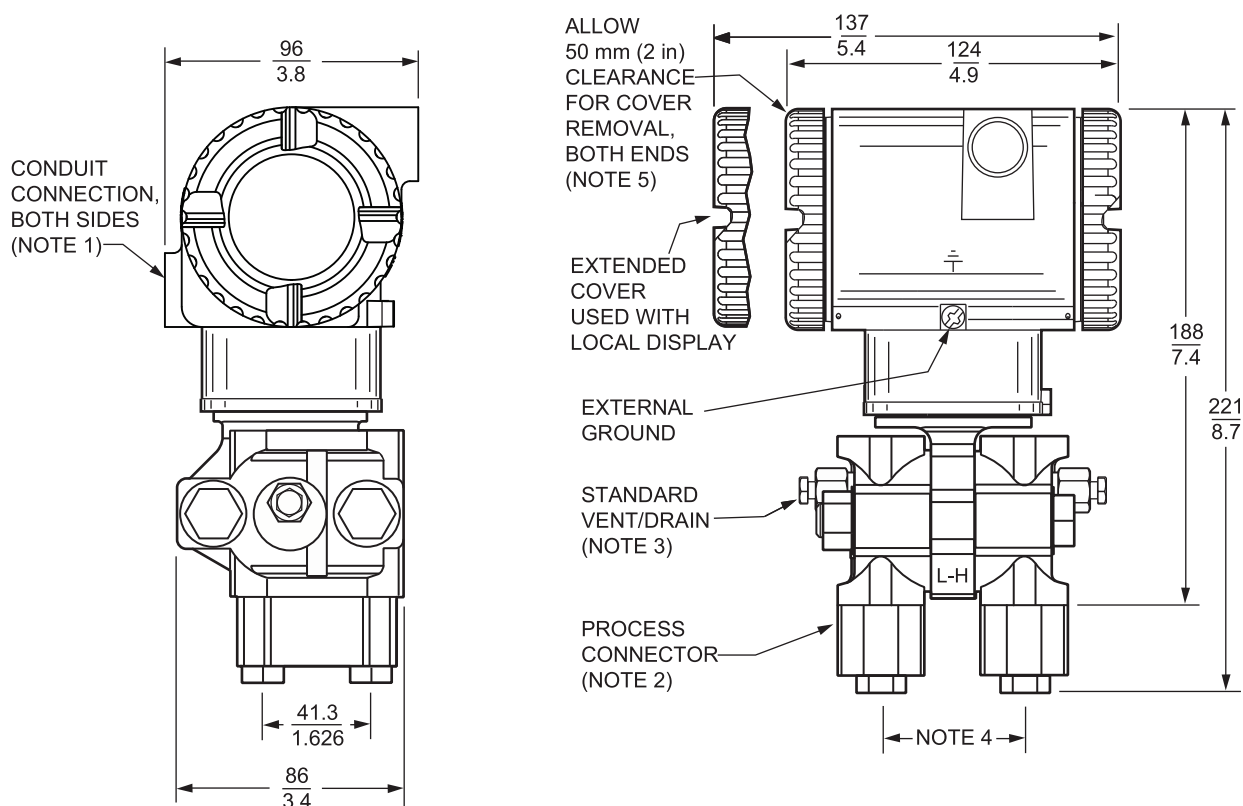


Figure 32 - DP Transmitters with Low Profile 1 (LP1) Structure**NOTES:**

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.

Technical drawings of the 1500 Series Process Analytical Instrumentation (PAI) showing front, side, and top views with dimensions and labels.

Front View (Left):

- Overall width: 96 (3.8)
- Bottom width: 41.3 (1.626)
- Overall bottom width: 99 (3.9)
- Label: CONDUIT CONNECTION, BOTH SIDES (NOTE 1)

Side View (Top Right):

- Overall height: 188 (7.4)
- Overall width: 137 (5.4)
- Internal width: 124 (4.9)
- Label: ALLOW 50 mm (2 in) CLEARANCE FOR COVER REMOVAL, BOTH ENDS (NOTE 5)
- Label: EXTENDED COVER USED WITH LOCAL DISPLAY
- Label: EXTERNAL GROUND

Top View (Bottom Right):

- Overall width: 160 (6.3)
- Overall height: 221 (8.7)
- Label: STANDARD VENT/DRAIN (NOTE 3)
- Label: PROCESS CONNECTOR (NOTE 2)
- Label: NOTE 4
- Label: L-H

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)

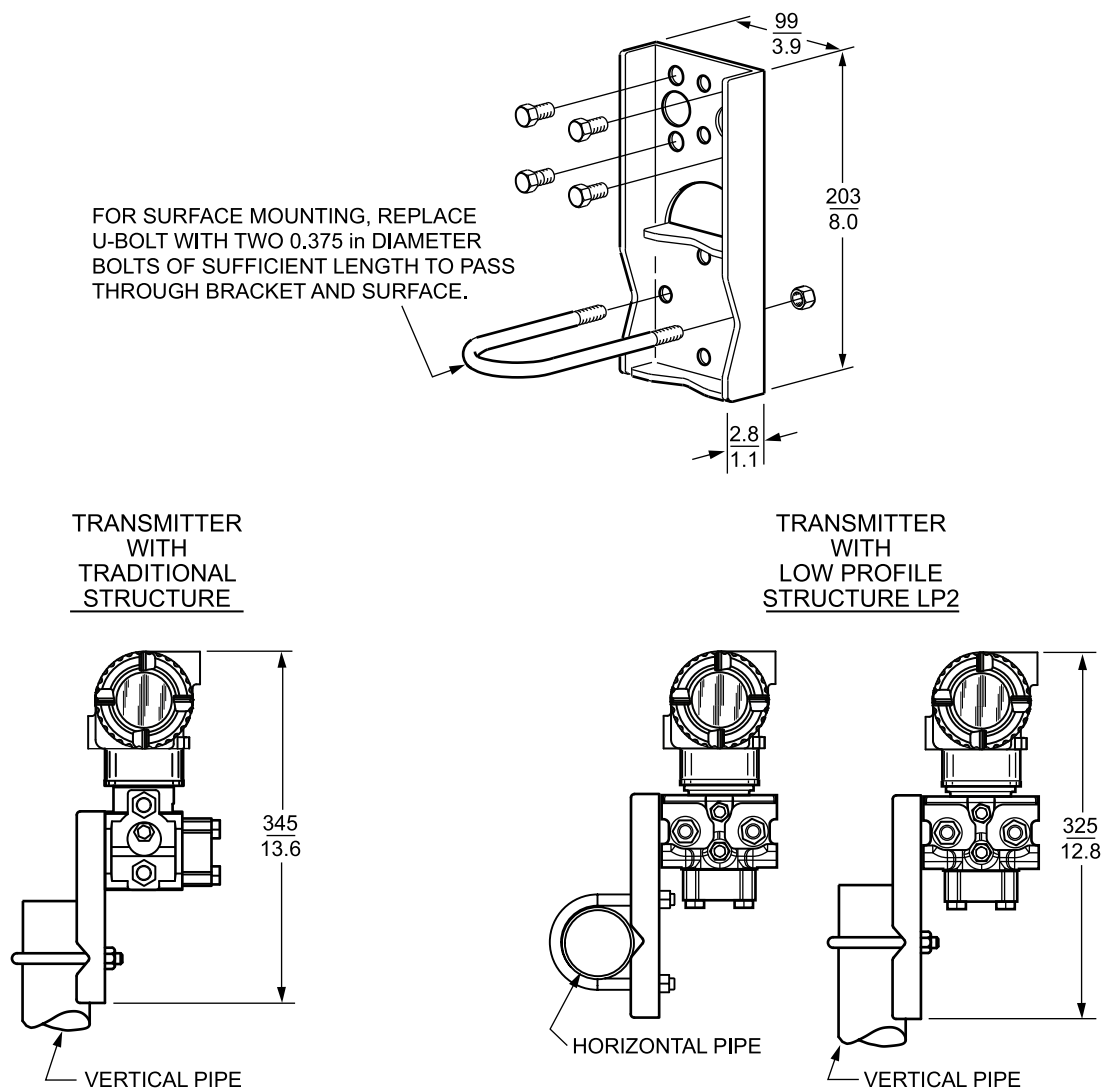
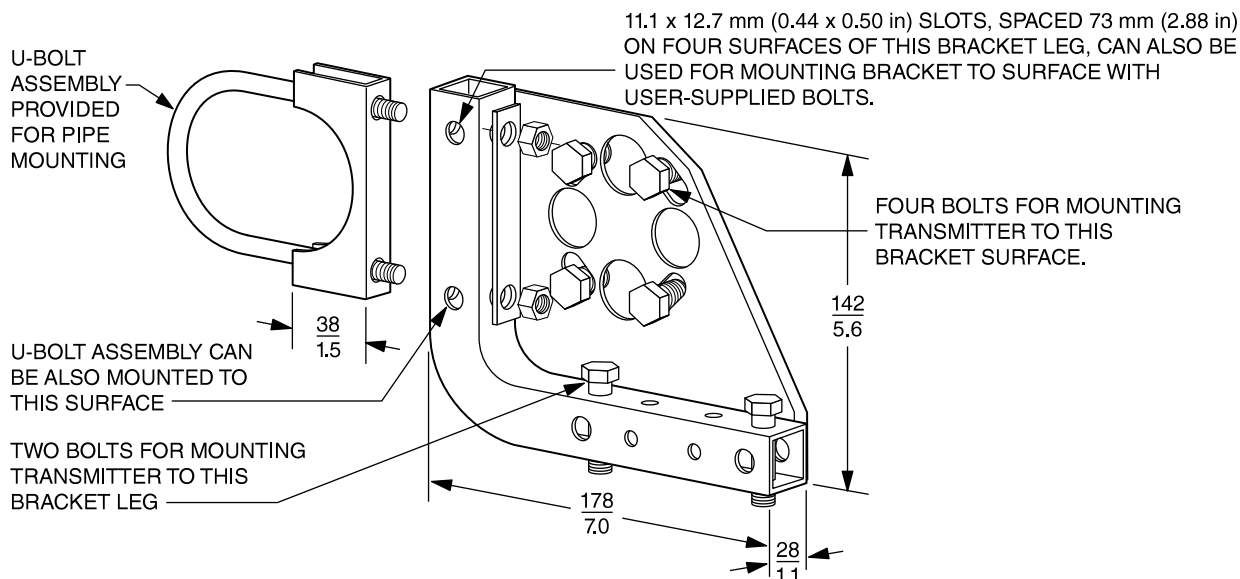
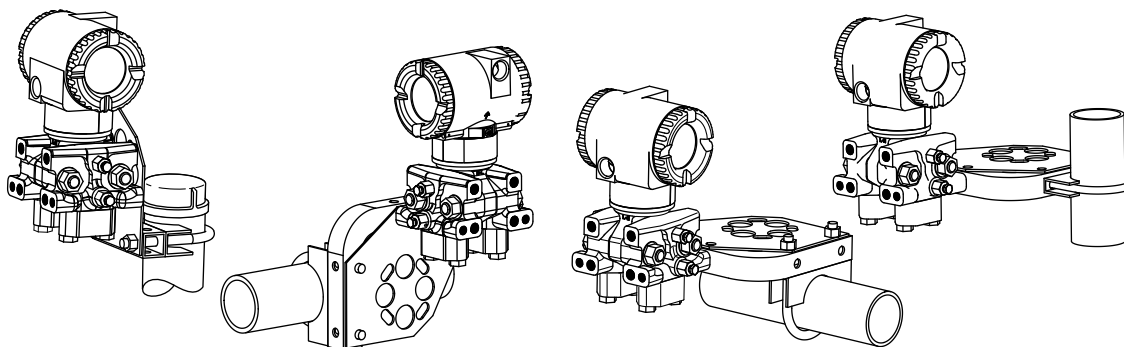


Figure 35 - DP Transmitters with Traditional, LP1, or LP2 Structure and Option -M3 (Universal Style Mounting Bracket Kit)

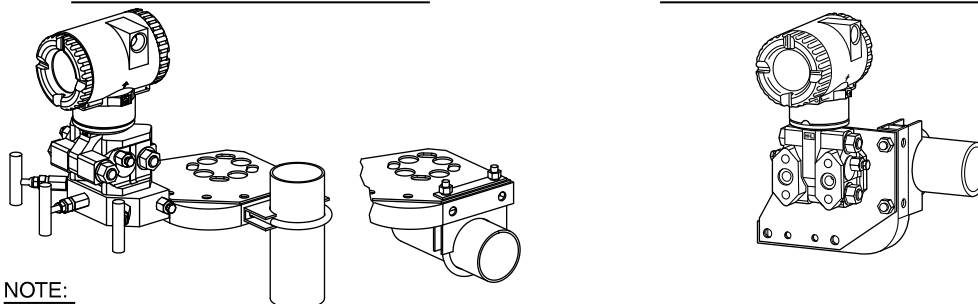


TYPICAL PIPE MOUNTING WITH LOW PROFILE STRUCTURE LP2



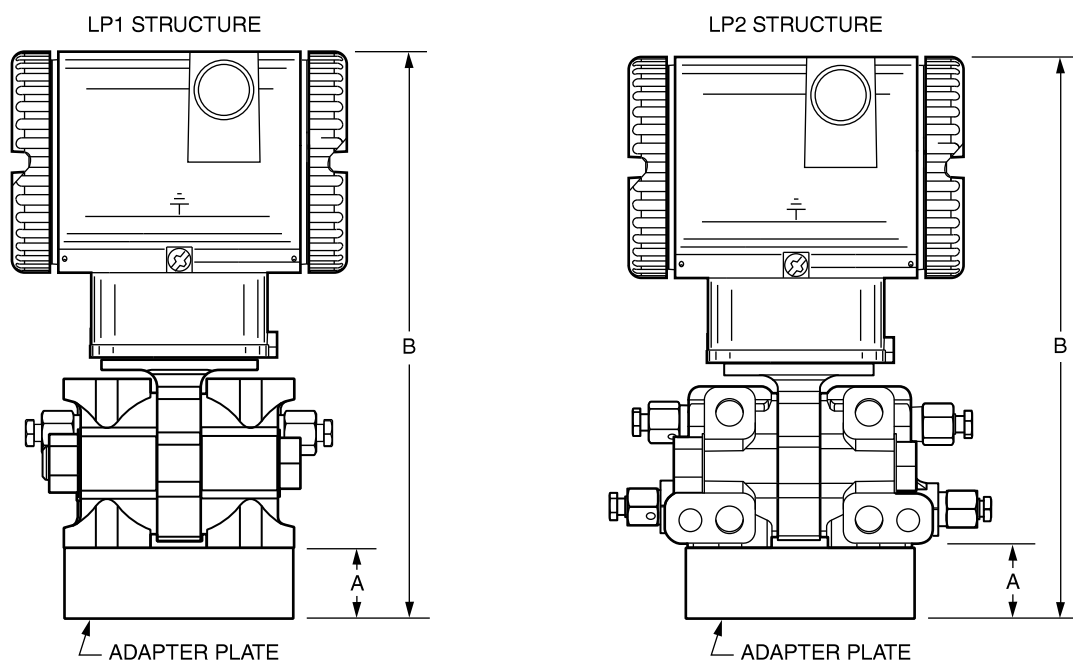
TYPICAL PIPE MOUNTING
LOW PROFILE STRUCTURE LP1

TYPICAL PIPE MOUNTING
WITH TRADITIONAL STRUCTURE

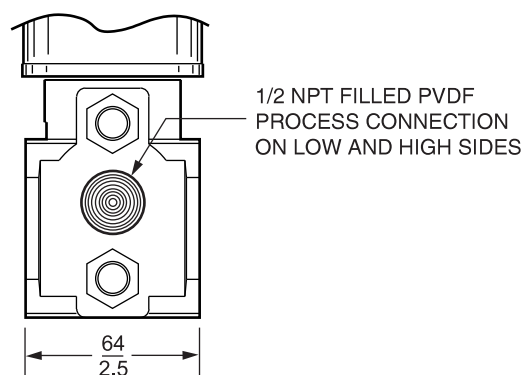
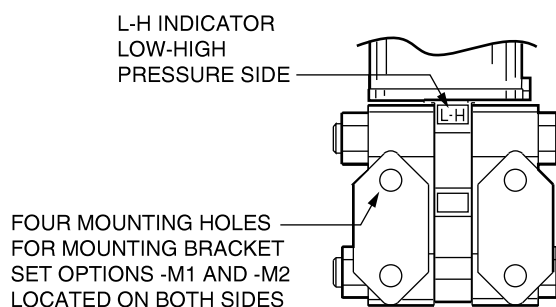


NOTE:

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, -D2, -D3, -D4, -D5, -D6, -D7, -D8, and -D9**

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