Pressure

Pressure Transmitters with HART Communication and SIL 2

User Guide

MI 020-611, Rev K

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https://www.se.com

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Important Safety Instructions

Read these instructions carefully and look at the equipment to become familiar with it before trying to install, operate, service, or maintain it. The following safety messages might appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety message indicates that an electrical hazard exists that results in personal injury if the instructions are not followed.



This safety alert symbol that lets you know about potential personal injury hazards. Obey all safety messages with this symbol to avoid possible injury or death.

⚠DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

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

⚠WARNING

WARNING indicates a hazardous situation that, if not avoided, **could result in** death or serious injury.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠CAUTION

CAUTION indicates a hazardous situation that, if not avoided, **could result in** minor or moderate injury.

Failure to follow these instructions can result in injury or equipment damage.

NOTICE

NOTICE is used to address practices not related to physical injury.

Failure to follow these instructions can result in equipment damage.

Please Note

Electrical equipment should only be installed, operated, serviced, and maintained by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Proposition 65

WARNING: This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

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Preface

These pressure transmitters measure pressure by applying the pressure to a piezoresistive silicon microsensor within the sensor assembly. The microsensor converts the pressure to a change in resistance, and the resistance change is converted to a 4 to 20 mA signal that is proportional to the pressure.

- 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.

The 4 to 20 mA or digital measurement signals are transmitted to remote receivers over the same two wires that supply power to the transmitter electronics. These wires also carry two-way data signals between the transmitter and remote communication devices. The transmitter allows direct analog connection to common receivers while still providing full intelligent transmitter digital communication using a HART Communicator.

The pressure transmitter can be supplied with direct-connect or remote diaphragm seals to isolate the measuring element from corrosive or viscous fluids.

General Cybersecurity Information

In recent years, the growing number of networked machines and production plants has seen a corresponding increase in the potential for cyber threats, such as unauthorized access, data breaches, and operational disruptions. You must, therefore, consider all possible cybersecurity measures to help protect assets and systems against such threats.

To help keep your Schneider Electric products secure and protected, it is in your best interest to implement the cybersecurity best practices as described in the Recommended Cybersecurity Best Practices document.

Schneider Electric provides additional information and assistance:

- Subscribe to the Schneider Electric security newsletter.
- Visit the Cybersecurity Support Portal web page to:
  - Find Security Notifications
  - Report vulnerabilities and incidents
- Visit the Schneider Electric Cybersecurity and Data Protection Posture web page to:
  - Access the cybersecurity posture
  - Learn more about cybersecurity in the Cybersecurity Academy
  - Explore the cybersecurity services from Schneider Electric

Environmental Data

For product compliance and environmental information, see the Schneider Electric Environmental Data Program.

Revision Information

This revision of the document includes these changes:

Throughout	Removed structure codes and other model code options that are no longer available.
Introduction	Updated to reflect that process cover nuts and bolts are not process wetted.

Related Documents

Document	Description
Instructions	
MI 020-611	Absolute, Gauge, and Differential Pressure Transmitters with HART Communication and SIL 2
MI 020-612	Absolute, Gauge, and Differential Pressure Transmitters with FOUNDATION Fieldbus Communication
MI 020-613	Absolute, Gauge, and Differential Pressure Transmitters with Low Power
MI 020–614	Absolute, Gauge, and Differential Pressure Transmitters with Modbus Communication
MI 020-328	Bubble Type Installation for Liquid Level
MI 020-329	High Accuracy Flow Measurement
MI 020-369	Diaphragm Seals
MI 020-501	PC50 Intelligent Field Device Tool (Installation and Parts List)
MI 020-520	PC50 Intelligent Field Device Tool with Advanced DTM Library
MI 020-543	FM/CSA Safety Information
MI 020-544	ATEX/UKEX/IECEx Safety Information
MI 022-138	Bypass Manifolds - Installation and Maintenance
MI 022-335	Model CO Compact Orifice
Dimensional Prints	
DP 022-335	Model CO Compact Orifice
Parts List	
PL 006-172	Model CO Compact Orifice
Technical Information	
TI 1-50a	Liquid Density Measurement
TI 001-051	Liquid Interface Measurement
TI 001-052	Liquid Level Measurement

Document	Description
TI 37-75b	Transmitter Material Selection Guide
TI 037-097	Process Sealing of Pressure Transmitters for Use in Class I, Zone 0, 1, and 2 Hazardous Locations

Global Customer Support

For support, visit https://pasupport.se.com (registration required).

We Welcome Your Comments

To help us improve documentation, we want to know about any corrections, clarifications, or further information you would find useful. Send us an email at systemstechpubs@se.com.

This email address is only for documentation feedback. If you have a technical problem or question, contact Global Customer Support, page 11.

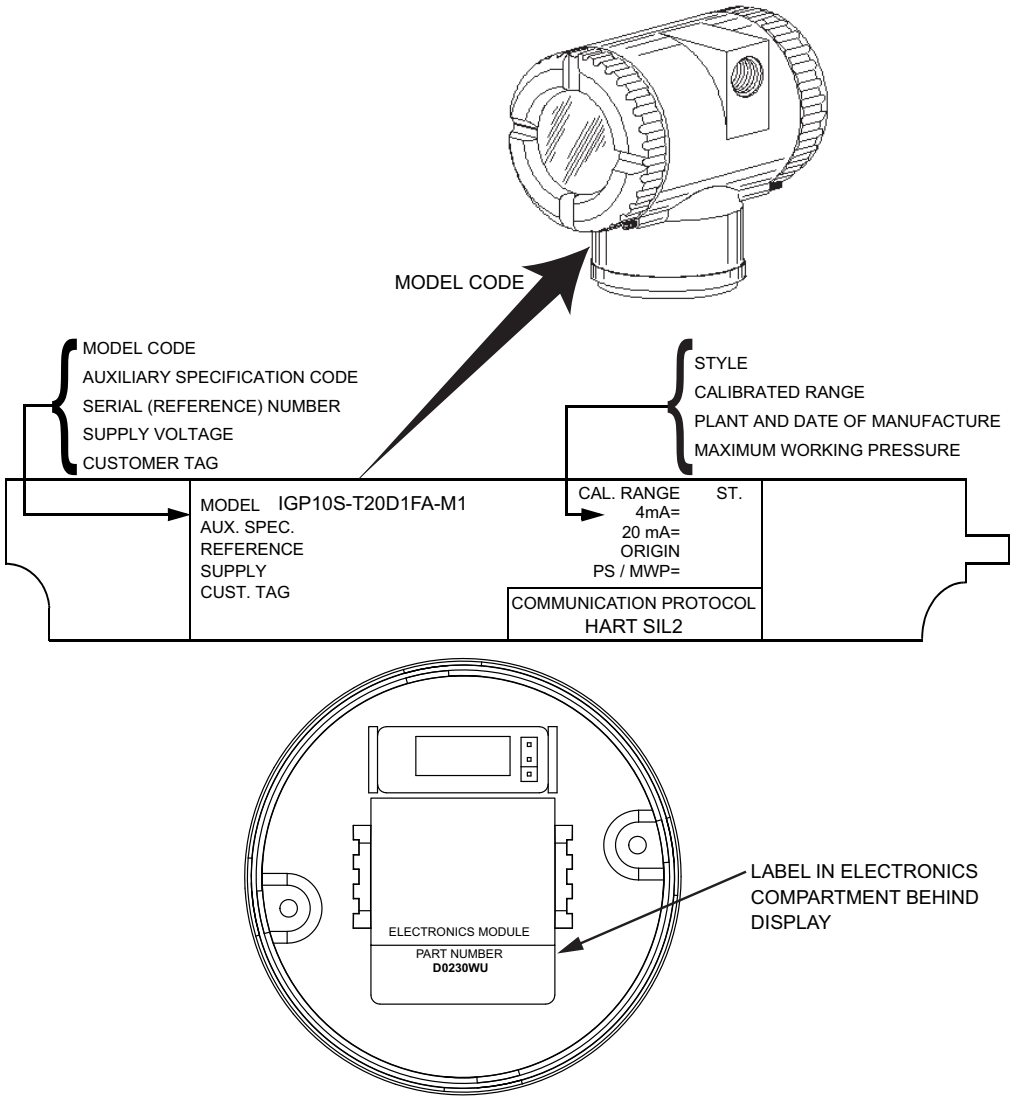
Introduction

Transmitter Identification

The diagram shows a sample transmitter data plate. This example is for an IGP10S transmitter; the details may be slightly different for other transmitter models.

- For a complete explanation of the model code, refer to Model Codes, page 104.
- The firmware version is identified on the top line of the display when you select **VIEW DB** in the top level menu (Top Level Menu, page 53).

Figure 1 - Data Plate Contents



Standard Specifications

Operative Limits

Influence	Operative Limits[1]
Sensor Body Temperature	
Silicone fill fluid	-46 and +121°C (-50 and +250°F)[2] [3]
Fluorinert fill fluid	-29 and +121°C (-20 and +250°F)[4]
NEOBEE® fill fluid	-18 and +121°C (0 and 250°F)
Electronics Temperature	
Without LCD	-40 and +85°C (-40 and +185°F)[5] [6]
With LCD	-40 and +85°C (-40 and +185°F)[5] [6] [7]
Relative Humidity	0 and 100%[8]
Supply Voltage	12.5 V dc and 42 V dc
Output Load	0 and 1,450 Ω[9]
Mounting Position	No limit
Vibration	
Aluminum Housing	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
Stainless Steel Housing	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

(1) Normal Operating Conditions and Operative Limits are defined per ANSI/ISA 51.1-1979 (R1993).
(2) 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.
(3) -46 and +50°C (-50 and +122°F) for biplanar AP transmitters.
(4) -18°C (0°F) for J range (IGP05S transmitters only).
(5) -40 and +75°C (-40 and +167°F) for transmitters with flameproof classification.
(6) -40 and +50°C (-40 and +122°F) for biplanar AP transmitters.
(7) Display updates are slowed and readability is decreased at temperatures less than -20°C (-4°F).
(8) 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.
(9) 250 Ω minimum load is required for communication with a HART communicator.

Span and Range Limits

Limits for Direct Connect (AP or GP) Transmitters

Table 1 - Span Limits for Direct Connect Transmitters

Code	Span Limits[10]
C	6.9 and 207 kPa (1 and 30 psi)[11]
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)[12]
J	6.9 and 69 MPa (1000 and 10000 psi)[12] [13]

Table 2 - Range Limits for Direct Connect Transmitters

Code	Range Limits — AP	Range Limits — GP
C	0 and 210 kPaa (0 and 30 psia)	0 and 210 kPag (0 and 30 psig)
D	0 and 1400 kPaa (0 and 200 psia)	0 and 1400 kPa (0 and 200 psig)
E	0 and 14 MPaa (0 and 2000 psia)[14]	0 and 14 MPag (0 and 2000 psig)[14]
F	n/a	0 and 42 MPag (0 and 6000 psig)[14]
J	n/a	0 to 69 MPag (0 to 10000 psig)[14]

Limits for Biplanar (AP or GP) Transmitters

Table 3 - Span Limits for Biplanar Transmitters

Code	Span Limits[10]
A	0.12 and 7.5 kPa (0.5 and 30 inH_2O)[12]
B	0.12 and 50 kPa (0.5 and 200 inH_2O)
C	0.62 and 250 kPa (2.49 and 1000 inH_2O)
D	26 and 2070 kPa (3.75 and 300 psi)
E	0.26 and 20.7 MPa (37.5 and 3000 psi)[15]
F	1.1 and 34.5 MPa (165 and 5000 psi)[12] [15]

(10) Values listed are in absolute or gauge pressure units, as applicable.
(11) Available only with the Value (05S) transmitter.
(12) Available for gauge pressure transmitters only.
(13) Not available with the Premium (50S) transmitter.
(14) This direct connect range can withstand and indicate a vacuum condition down to a full vacuum, but cannot be ranged to that condition.
(15) 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 -D7 and -B2. Options -D5 and -B1 are derated to 2175 psi. Options -D6 and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

Table 4 - Range Limits for Biplanar Transmitters

Code	Range Limits — AP	Range Limits — GP
A	n/a	-7.5 and +7.5 kPag (-30 and +30 inH_2Og)
B	0 and 50 kPaa (0 and 200 inH_2Oa)(16)	-50 and +50 kPag (-200 and +200 inH_2Og)
C	0 and 250 kPaa (0 and 1000 inH_2Oa)	-100 and +250 kPag (-400 and +1000 inH_2Og)
D	0 and 2100 kPaa (0 and 300 psia)(17)	-100 and +2100 kPag (-14.7 and +300 psig)(17)
E	0 and 21 MPaa (0 and 3000 psia)(17)	-0.1 and +21 MPag (-14.7 and +3000 psig)(17)
F	n/a	-0.1 and +35 MPag (-14.7 and +5000 psig)(17)

Limits for DP Transmitters

Table 5 - Span Limits for DP Transmitters

Code	Span Limits
A	0.12 and 7.5 kPa; 0.5 and 30 inH_2O; 1.2 and 75 mbar
B	0.12 and 50 kPa; 0.5 and 200 inH_2O; 1.2 and 500 mbar
C	0.62 and 250 kPa; 2.5 and 1000 inH_2O; 6.22 and 2500 mbar
D	0.026 and 2.07 MPa; 3.75 and 300 psi; 0.26 and 20.7 bar
E	0.26 and 20.7 MPa; 37.5 and 3000 psi; 2.6 and 207 bar

Table 6 - Range Limits for DP Transmitters

Code	Range Limits
A	-7.5 and +7.5 kPa (-30 and +30 inH_2O)
B	-50 and +50 kPa (-200 and +200 inH_2O)
C	-250 and +250 kPa (-1000 and +1000 inH_2O)
D	-0.103 and +2.1 MPa (-30 and +300 psi)
E	0 and 21 MPa (0 and 3000 psi)

Maximum Static, Overrange, and Proof Pressure Ratings

⚠DANGER

HAZARD OF EXPLOSION

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

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

(16) For Value (05S) transmitters only. For Advanced (10S) and Premium (50S) transmitters with HART: 5 and 50 kPaa (20 and 200 inH_2Oa).
(17) 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 -D7 and -B2. Options -D5 and -B1 are derated to 2175 psi. Options -D6 and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.

NOTICE

POTENTIAL EQUIPMENT DAMAGE

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

Failure to follow these instructions can result in equipment damage.

Ratings for Direct Connect AP and GP Transmitters

Table 7 - Maximum Overrange and Proof Pressure for Direct Connect Transmitters

Span Limit Code	Maximum Overrange Pressure	Maximum Proof Pressure(18)
C	0.38 MPa (54 psi)	0.99 MPa (144 psi)
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(19)	59.1 MPag (8,580 psig)	165 MPa (24,000 psig)
J(20)	99 MPag (14,300 psig)	180 MPa (26,015 psig)

Ratings for DP Transmitters and Biplanar AP and GP Transmitters

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

Table 8 - Maximum Static/Overrange and Proof Pressure for DP and Biplanar Transmitters

Transmitter Configuration(21)	Maximum Static(22) and Overrange Pressure(23)	Maximum Proof Pressure (18)
Standard (B7 steel) with Span Codes A to E, or with Option -B2 (17-4 PH ss), -D7, -P3, or -P7	25 MPa (3,626 psi)	100 MPa (14,500 psi)
Standard with Span Code F(19)	40 MPa (5,800 psi)	100 MPa (14,500 psi)
Option -B3 (B7M), -P4, or -P8	20 MPa (2,900 psi)	77 MPa (11,150 psi)
Option -B1 (316 ss), -D5, -P2, or -P6	15 MPa (2,175 psi)	60 MPa (8,700 psi)
With Option -D6 or -D8(24)	10 MPa (1,500 psi)	40 MPa (6,000 psi)
Option -D9 (17-4 PH ss) or -Y(25)	40 MPa (5,800 psi)	100 MPa (14,500 psi)

(18) Meets ANSI/ISA Standard S82.03-1988.
(19) Available for gauge pressure transmitters only.
(20) Available for gauge pressure transmitters or with the -G option (G 1/2 B Manometer Process Connection) only.
(21) Refer to the model code for option descriptions, and for applications and restrictions related to the items listed in the table.
(22) Static pressure is relevant only for differential pressure transmitters.
(23) Either side can be at higher pressure during overrange.
(24) Limited to operating temperatures ranging from -10 to +80°C (14 to 176°F).
(25) Differential pressure transmitters only.

Elevated Zero and Suppressed Zero

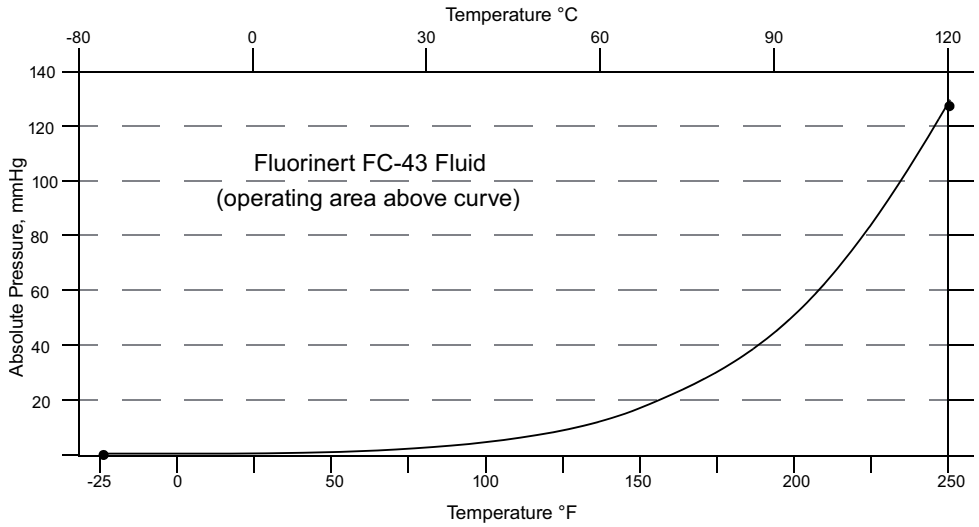
For applications requiring an elevated or suppressed zero, it is not possible to exceed the maximum span and the upper and lower range limits of the transmitter.

Sensor Fill Fluid

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

Minimum Allowable Absolute Pressure vs Process Temperature

- With silicone fill fluid: up to 121°C (250°F) at full vacuum(26)
- With inert fill fluid: refer to the graph(26) (27)



Mounting Position

The transmitter can be mounted in any orientation with considerations specified in Installation, page 24. The housing can be rotated up to one full turn to any desired position for access to adjustments, display, or conduit connections. Refer to Positioning the Housing, page 41.

The display (if applicable) can also be rotated at 90° increments within the housing. Refer to Positioning the Display, page 42.

- 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.

(26) For direct connect IGP50S transmitters with Span Code D, the minimum allowable pressure is 0 psig.
(27) For biplanar IAP50S transmitters, up to 50°C (120°F) at full vacuum.

Approximate Mass

Transmitter mass does not include diaphragm seals.

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

Process Connections

- AP and GP transmitters with direct connect structures can be connected directly to the process using their 1/2 NPT external/internal thread, M20 external thread, or optional G 1/2 B connection.
  - If an optional mounting bracket is used, the transmitter can be connected to the process via the 1/2 NPT external/internal thread, M20 external thread, 1/4 NPT internal thread, or G 1/2 B (model code option -G) connection.
  - Transmitters with a sanitary process connection connect to the process with a Tri-Clamp process connector or a mini tank spud seal.
  - Transmitters with a pulp and paper process connection connect to the process with a threaded or sleeve type connection.
- DP transmitters, and AP or GP transmitters with biplanar stuctures, connect to the process via a 1/4 NPT thread or an optional process connector.

Process Wetted Materials

Process wetted parts compatible with NACE MR0175 and MR0103 are available.

Part	Material(s)
Diaphragm	316L ss, nickel alloy(28), Monel, or gold-plated 316L ss
Process Connections(29) and Covers	316 ss, nickel alloy(28), or Monel

Process Cover Nut and Bolt Materials

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.

(28) Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.
(29) Includes sanitary and pulp and paper process connections.

Reference (Low) Pressure Side Materials

Silicone, Pyrex™, RTV silicone, or 316L ss.

Electrical Connections

Field wires enter through 1/2 NPT or M20 threaded entrances on either side of the electronics housing. Leads terminate under screw terminals and washers on the terminal block in the field terminal compartment.

⚠⚠WARNING

EXPLOSION HAZARD

To help prevent possible explosions and to maintain flameproof, explosionproof, and dust-ignitionproof protection, observe applicable wiring practices. Plug the unused conduit openings with approved conduit plugs. Both plug and conduit must engage a minimum of five full threads for 1/2 NPT connections; eight full threads for M20 connections.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Switching and Indirect Lightning Transients

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

Field Wiring Reversal

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

NOTICE

RISK OF EQUIPMENT DAMAGE

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

Failure to follow these instructions can result in equipment damage.

Adjustable Damping

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

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

Output Signal

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.

External Zero Adjustment

An optional external self-contained moisture-sealed pushbutton allows you to locally reset to zero without removing the housing cover.

Supply Voltage

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. This is detailed in Wiring the Transmitter to a Control Loop, page 46.

The following table summarizes the requirements.

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

Electrical Ground Connections

The transmitter is equipped with an internal ground connection within the field wiring compartment and an external ground connection at the base of the electronics housing. To minimize galvanic corrosion, place the wire lead or contact between the captive washer and loose washer on the external ground screw.

To help prevent ground loop potentials, if shielded cable is used, ground the shield at the field enclosure only. Do not ground the shield at the transmitter.

HART Communicator Connection Points

The HART communicator can be connected in the loop as shown in Accessing Transmitter Field Terminals, page 45. It can also be connected directly to the transmitter at the two upper banana plug receptacles.

Test Points

The two lower banana plug receptacles (designated **CAL**) can be used to check transmitter output when configured for 4 to 20 mA. Measurements should be 100 to 500 mV dc for 0 to 100% transmitter output. See Accessing Transmitter Field Terminals, page 45.

Remote Communication

The transmitter communicates bidirectionally over the 2-wire field wiring to a HART Communicator.

Communication is based upon the FSK (Frequency Shift Keying) technique. The frequencies are superimposed on the transmitter power/signal leads.

4 to 20 mA Output

The transmitter sends its pressure measurement to the loop as a continuous 4 to 20 mA dc signal. It also communicates digitally with the HART Communicator at distances up to 3,000 m (10,000 ft). Communication between the remote configurator and the transmitter does not disturb the 4 to 20 mA output signal. Other specifications are:

Data transmission rate	1200 baud
4 to 20 mA update rate	30 times/second
Output for Low Alarm	≤ 3.60 mA
Output for High Alarm	≥ 21.00 mA
Output when underrange	3.8 mA
Output when overrange	20.5 mA
Output when offline	User-configurable to a constant value between 3.6 mA and 21.0 mA

Agency Certifications

⚠⚠WARNING

EXPLOSION HAZARD

To help prevent possible explosions and to maintain flameproof, explosionproof, and dust-ignitionproof protection, observe applicable wiring practices. Plug the unused conduit openings with approved conduit plugs. Both plug and conduit must engage a minimum of five full threads for 1/2 NPT connections; eight full threads for M20 connections.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠WARNING

RISK OF MOISTURE INGRESS

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.

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

Wiring restrictions required to maintain electrical certification of the transmitter are provided in these instructions. Refer to Wiring, page 44.

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 104 for the availability of electrical safety design codes with specific transmitter structures.

⚠⚠DANGER

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

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

Table 9 - Electrical Certifications

Agency Certification, Types of Protection, and Area Classification	Application Conditions[30]	Model Code Option
ATEX/UKEX intrinsically safe, Ex ia IIC	Temperature Class T4, Ta = -40°C to +80°C	AA
ATEX/UKEX flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	AD
ATEX/UKEX multiple certifications (includes Codes AA and AN)	Applies to Codes AA and AN	AM
ATEX/UKEX protection type n, Ex ic IIC, or Ex nA	Temperature Class T4, Ta = -40°C to +80°C	AN
ATEX/UKEX multiple certifications (includes Codes AA, AD and AN)	Applies to Codes AA, AN, and AD	AP
INMETRO intrinsically safe, Ex ia IIC	Temperature Class T4, Ta = -40°C to +80°C	BA
INMETRO flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = -40°C to +75°C	BD
INMETRO multiple certifications (includes INMETRO Codes BA and BD)	Applies to codes BA and BD	BP
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 db 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
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
Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC	Temperature Class T4, Ta = –40°C to +80°C	DA
Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = –40°C to +75°C	DD
Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC	Temperature Class T4, Ta = –40°C to +80°C	DN
IECEx intrinsically safe, Ex ia IIC	Temperature Class T4, Ta = -40°C to +80°C	EA
IECEx flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = –40°C to +75°C	ED
IECEx multiple certifications, ia, ic, nA	Applies to Codes EA and EN	EM
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 db	Applies to Codes EA, EN, and ED	EP
FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC	Temperature Class T4, Ta = -40°C to +80°C	FA

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

Table 9 - Electrical Certifications (Continued)

Agency Certification, Types of Protection, and Area Classification	Application Conditions[31]	Model Code Option
FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC	Temperature Class T6 at 75°C and T5 at 85°C maximum ambient	FD
FM multiple certifications (includes FM Codes FA or FN)	Applies to codes FA or FN	FM
FM Classes I, II and III, 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
KC Certification Ex db	Temperature Class T6, T85°C, Ta = –40°C to +75°C	KD
NEPSI intrinsically safe	Temperature Class T4, Ta = -40°C to +80°C	NA
NEPSI flameproof, Ex db IIC	Temperature Class T6, T85°C, Ta = –40°C to +75°C	ND
No certification	n/a	ZZ

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

Installation

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The main electronics enclosure for some models is manufactured from an aluminum alloy. In rare cases, ignition sources due to impact and friction sparks could occur. This must be considered during installation, particularly if the equipment is installed in a Zone 0 location.

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

⚠⚠WARNING

RISK OF ELECTROSTATIC CHARGE AND DUST INGRESS

- When installed in a flammable dust zone, under certain extreme circumstances an incendive electrostatic charge may build up on the painted surfaces, which are non-conducting. Therefore, take precautions to prevent the build-up of electrostatic charge; for example, place the equipment in a location where a charge-generating mechanism (such as wind-blown dust) is unlikely to be present, and clean with a damp cloth.
- When installed in a flammable dust zone, ensure that the cable entry maintains the dust-tightness (IP6X) of the enclosure.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTICE

POTENTIAL EQUIPMENT DAMAGE

To avoid damage to the transmitter sensor, do not use any impact devices, such as an impact wrench or stamping device, on the transmitter.

Failure to follow these instructions can result in equipment damage.

Transmitter Mounting

All transmitters can be mounted to a vertical or horizontal pipe or surface using the optional mounting set. See Pipe Mounting, page 25 and Surface Mounting, page 26.

In addition, direct connect (non-biplanar) absolute and gauge pressure transmitters can be connected directly to the process; see Direct Connected AP and GP Transmitter Mounting, page 26. Differential pressure transmitters can be supported by the process piping; see Process Mounting of a DP Transmitter Supported by Process Piping, page 27.

Refer to Dimensions, page 146 for dimensional information.

When mounting the transmitter, take these considerations into account:

- 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.
- To help prevent damage, do not mount the transmitter directly to the process using the 1/4 NPT internal thread. Use this thread only to connect to the process when the transmitter is mounted with an optional mounting set (Options -M1 through -M8).

- Do not mount the transmitter using the conduit connection and optional mounting set (-M1 through -M6) when vibration conditions exceed 20 m/s^2 (2 “g”).
- If the transmitter is not installed in the vertical position, readjust the zero output to help eliminate the position zero effect.

  NOTE: An absolute pressure transmitter cannot be zeroed by venting the transmitter to atmosphere.
- Where necessary, intrinsically safe equipment may be connected and disconnected while the circuits are energized.
- When used in a dust zone with flammable dusts, fibers, and flyings in groups IIIA, IIB, or IIC, the layer auto-ignition temperature must be at least 75°C greater than the maximum surface temperature marked in the dust coding.
- The equipment is certified for use only in the ambient temperatures marked on the equipment. Do not use it outside this range.
- Do not exceed the maximum process pressure indicated on the marking.
- There are no special checking or maintenance conditions. Periodically inspect all explosion-protected equipment in accordance with the applicable code of practice.

Figure 2 - Pipe Mounting

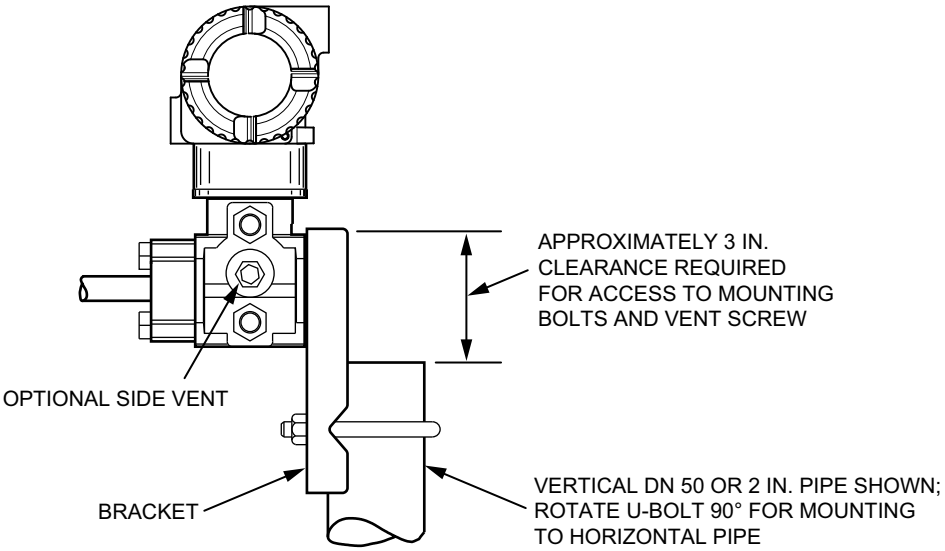


Figure 3 - Surface Mounting

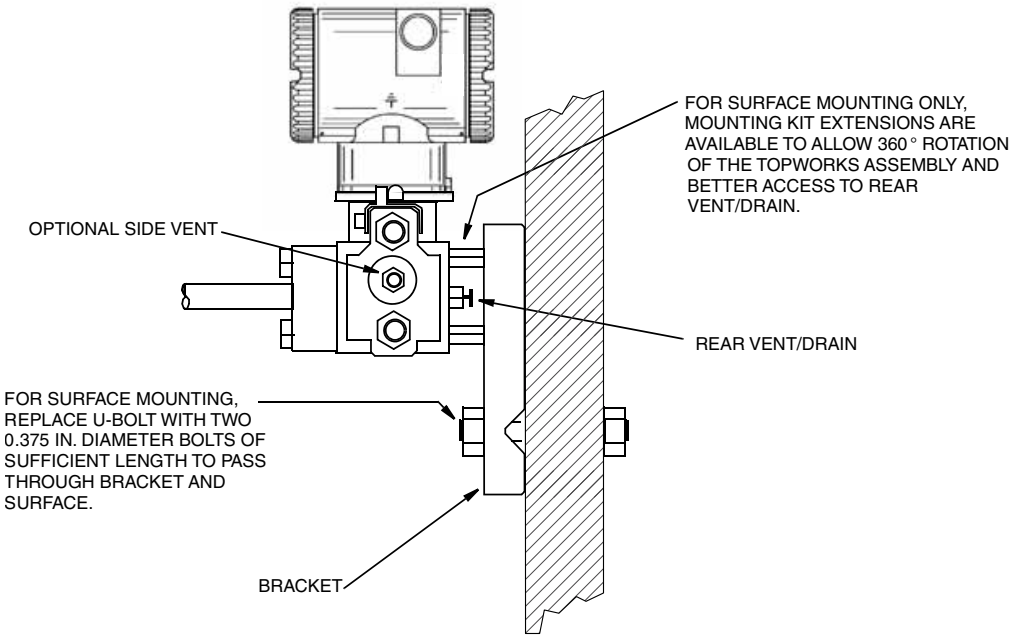


Figure 4 - Direct Connected AP and GP Transmitter Mounting

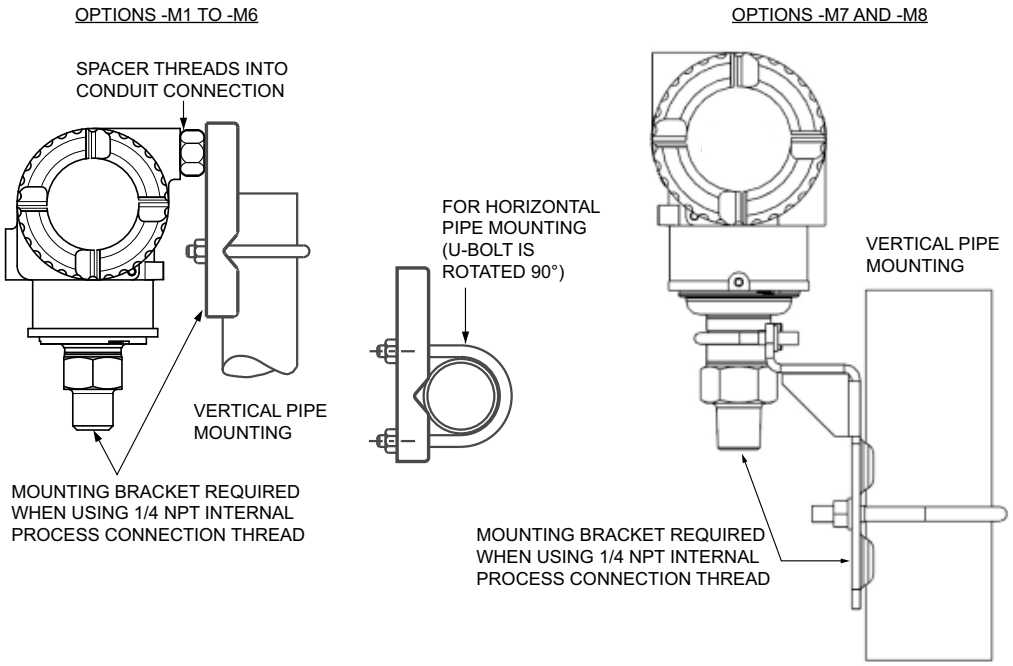
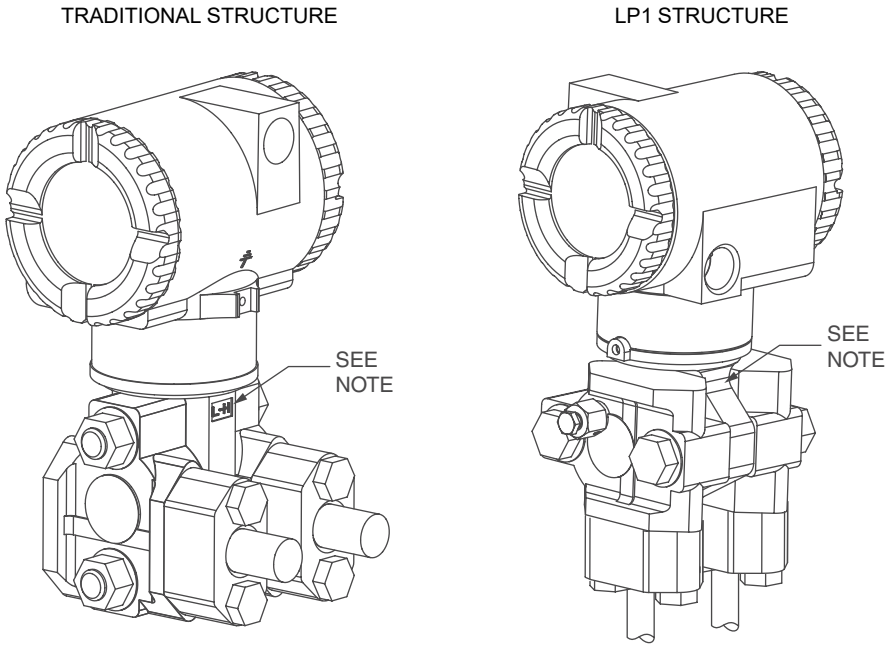


Figure 5 - Process Mounting of a DP Transmitter Supported by Process Piping



NOTE: MARK INDICATING LOW AND HIGH PRESSURE SIDES OF TRANSMITTER

Sanitary Process Connections

Transmitters with a sanitary process connector employ a Tri-Clamp type connection or a mini tank spud seal. Install the transmitter as shown.

For dimensional information, refer to the following documents:

- Tri-Clamp Type Connectors: DP 020-218
- Mini Tank Spud Connectors: DP 020-219

Figure 6 - Mounting a Transmitter with a Sanitary Tri-Clamp Type Connection

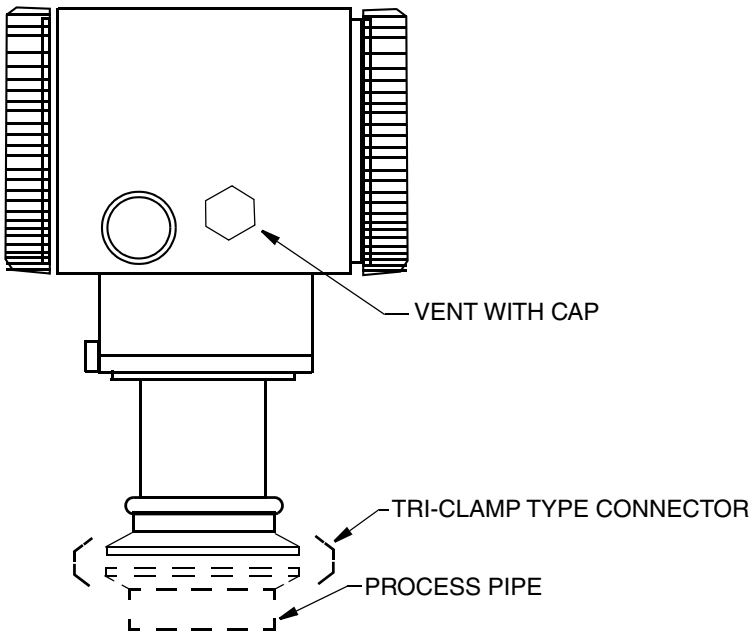
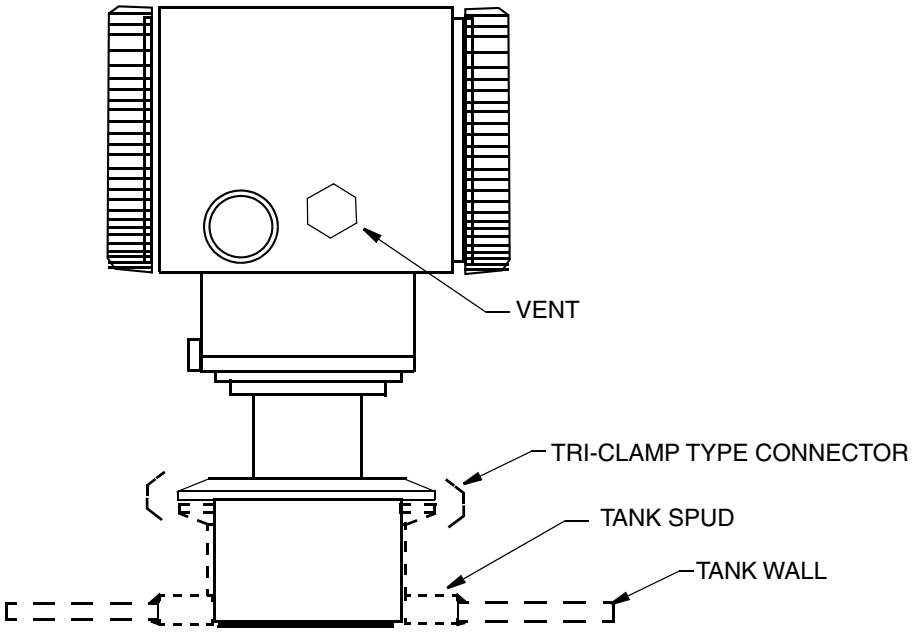


Figure 7 - Mounting a Transmitter with a Sanitary Mini Tank Spud Seal



- If the transmitter is to be mounted horizontally (side of a tank), orient the housing so that the vent is self-draining. For proper measurement, **do not mount the vent facing up.**
- If the vent faces downward, remove the protective cap.
- If the vent clogs, replace it with Part Number D0186DQ (W.L.Gore part number PMF200444). Stock vents and replace them at a predetermined interval as part of preventive maintenance. When installing a new vent, apply torque of 0.6 to 0.8 N-m (5 to 7 lbf-in).
- If the transmitter is subject to routine washdown such as in typical sanitary applications and the vent is oriented so that it is self-draining, the vent will stay clear, and longer intervals between preventive maintenance may be realized.
- If the vent becomes clogged, the resulting pressure measurement error may be as much as 1.5 inH2O per degree C change in temperature. This value is positive with decreasing temperature, and negative with increasing temperature.

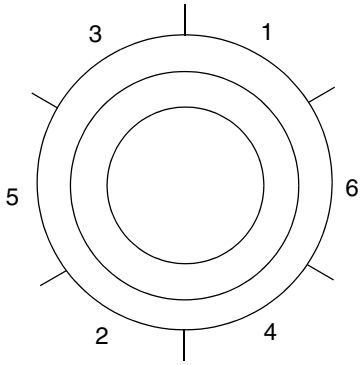
Welding the Tank Spud

Weld the tank spud into a hole cut in the tank as follows:

1. Cut a hole into the process vessel to accept the spud. The spud should fit snugly and uniformly. The nominal diameter of the spud is 3.73 inch (94.7 mm). To assure that the seal is always covered by process fluid, the top of the hole should be below the minimum measurement level.
2. Position the spud mounting ring so that it aligns as closely as possible with the inside wall of the tank, and the weep hole is at the bottom.
3. Tack weld the spud mounting ring to the outside of the tank in four places.
4. Weld the spud mounting ring to the inner surface of the tank:
   a. Spud is 316 stainless steel. Use a compatible welding rod. Do not distort the spud mounting ring by using excessive heat.
   b. Weld the spud mounting ring in sections as indicated in the diagram.
   c. After each section is welded, cool right away with water until the temperature is less than 370°C (700°F) before welding the next section.

5. Grind the weld smooth so the surface is free from irregularities where dirt can lodge.
6. After completing the inner weld, the outer surface can also be welded if desired.

Figure 8 - Welding Procedure



Pulp and Paper Process Connections

Transmitters with pulp and paper process connectors are available in two designs — sleeve type and threaded type. For dimensional information, refer to DP 020-217.

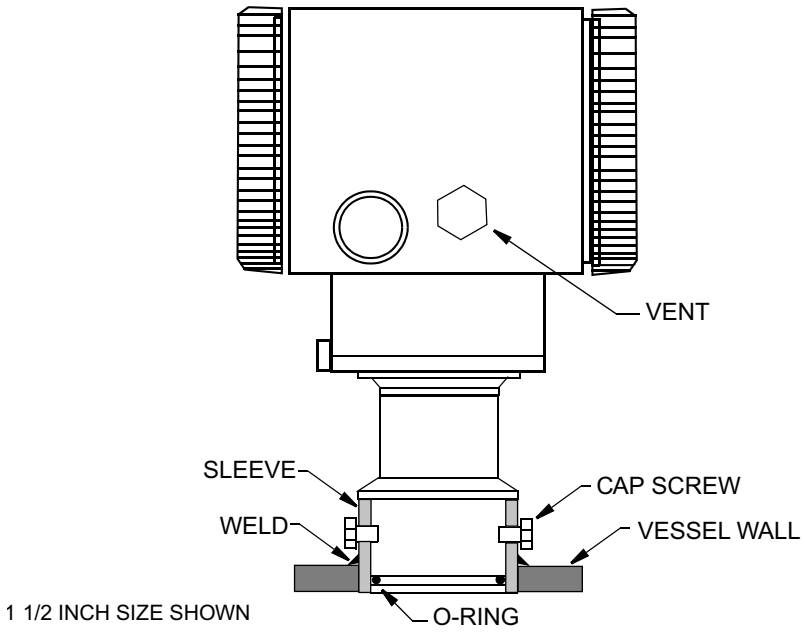
Sleeve-Type Connectors

1. Cut a hole into the process vessel to accept the weld spud. The spud should fit snugly and uniformly. The nominal diameter of the spud is:
   - Nominal 1 inch connector: 33.4 mm (1.32 inch)
   - Nominal 1 1/2 inch connector: 48.3 mm (1.90 inch)
2. Position the sleeve into the hole so that it aligns as closely as possible with the inside wall of the vessel.
3. Tack weld using the welding sequence shown in Welding Procedure, page 29. Cool each section with water until the temperature is below 370°C (700°F) before proceeding to the next section.
4. Weld the circumference of the sleeve using a compatible stainless steel welding rod.

   NOTE: The welder should meet the requirements of ANSI B31.3, ASME Section IX, or other codes, if applicable.
5. Lubricate the o-ring with appropriate lubricant and install it into the sleeve, ensuring that it is properly seated.

   NOTE: If the gasket is not properly seated, a process leak may occur.
6. Insert the transmitter sensor into the sleeve and hold it in place with cap screws.

Figure 9 - Mounting a Transmitter with a Sleeve-Type Pulp and Paper Process Connection



Threaded-Type Connectors

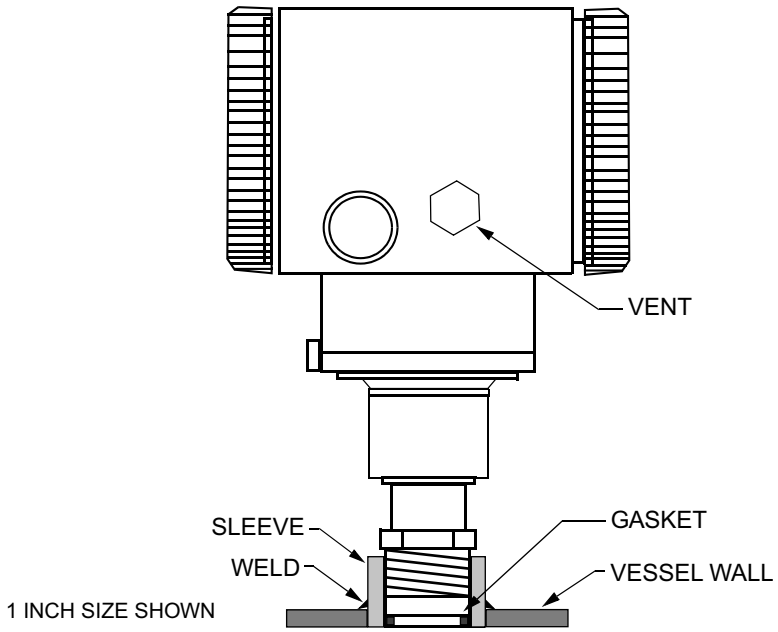
1. Cut a hole into the process vessel to accept the weld spud. The spud should fit snugly and uniformly. The nominal diameter of the spud is:
   - Nominal 1 inch connector: 38.1 mm (1.50 inch)
   - Nominal 1 1/2 inch connector: 60.3 mm (2.38 inch)
   - Nominal 1 1/2 inch connector for Ametek spud: 50.5 mm (1.99 inch)
2. Position the connector into the hole so that it aligns as closely as possible with the inside wall of the vessel.
3. Tack weld using the welding sequence shown in Welding Procedure, page 29. Cool each section with water until the temperature is below 370°C (700°F) before proceeding to the next section.

   NOTE: Use a heat sink during this operation.
   - 1 inch size: Part Number N1214YS
   - 1 1/2 inch size: Part Number N1214YR
4. Weld the circumference of the connector using a compatible stainless steel welding rod.

   NOTE: The welder should meet the requirements of ANSI B31.3, ASME Section IX, or other codes, if applicable.
5. After the connector has cooled, remove the heat sink.
6. Lubricate the gasket with an appropriate lubricant and install it into the connector, ensuring that it is properly seated.

   NOTE: If the gasket is not properly seated, a process leak may occur.
7. Thread the sensor into the connector hand-tight. Then tighten approximately 1/8 turn more.

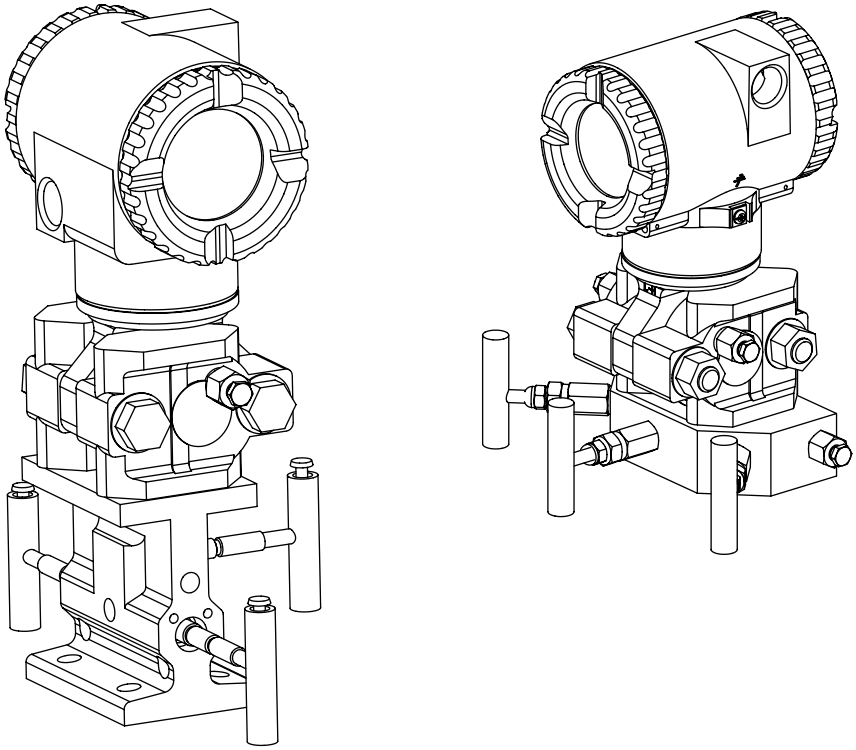
Figure 10 - Mounting a Transmitter with a Threaded-Type Pulp and Paper Process Connection



Manifold Mounting of Differential Pressure Transmitters

With manifold mounting, the transmitter is mounted to and supported by a bypass manifold. The bypass manifold can be mounted to a DN 50 or 2 inch pipe with an optional mounting bracket.

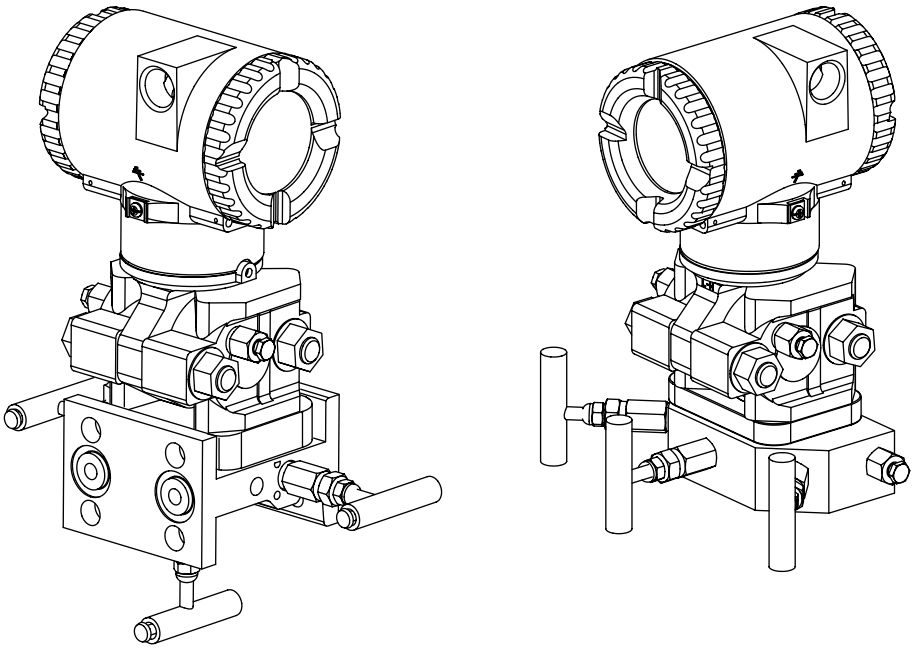
Figure 11 - Typical Mounting of a DP Transmitter Supported by a Bypass Manifold



M4A MANIFOLD

MB3 MANIFOLD

Figure 12 - Typical Mounting of a DP Transmitter on a Coplanar™ Manifold



MT3 MANIFOLD

MC3 MANIFOLD

Mounting a Differential Pressure Transmitter Using a Bracket

To mount a DP transmitter to a pipe or surface, use the Standard Mounting Bracket Set (Model Code Option -M1 or -M2), or the Universal Bracket Mounting Set (Model Code Option -M3).

Standard Mounting Bracket

A DP transmitter with traditional structure can be mounted to a vertical or horizontal DN 50 or 2 in pipe using a standard bracket. See the following figures for details and examples.

Secure the mounting bracket to the transmitter using the four screws provided. Mount the bracket to the pipe. The mounting bracket can also be used for wall mounting by securing the bracket to a wall using the U-bolt mounting holes.

Figure 13 - Pipe or Surface Mounted DP Transmitter Using a Standard Bracket

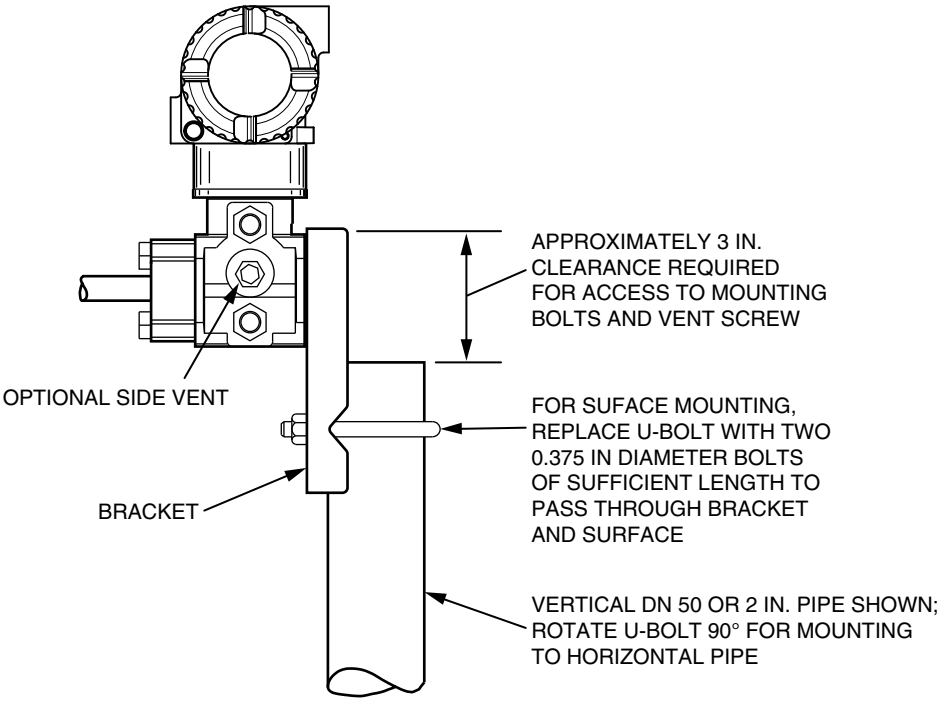
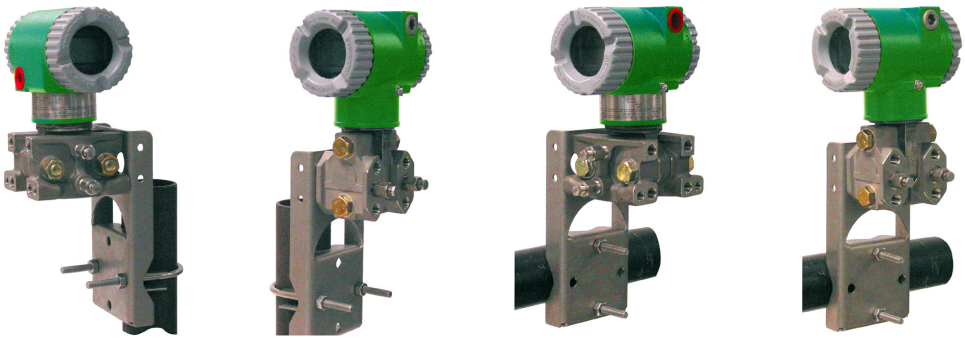


Figure 14 - Examples of DP Transmitters Mounted with a Standard Bracket



Universal Mounting Bracket

A DP transmitter with traditional structure can be mounted in a myriad of positions to a vertical or horizontal DN 50 or 2 in pipe using a universal bracket. See the following figures for details and examples.

Secure the mounting bracket to the transmitter using the two long or four short screws provided. Mount the bracket to the pipe. The mounting bracket can also be used for wall mounting by securing the bracket to a wall using the U-bolt mounting holes.

Figure 15 - Universal Bracket Detail

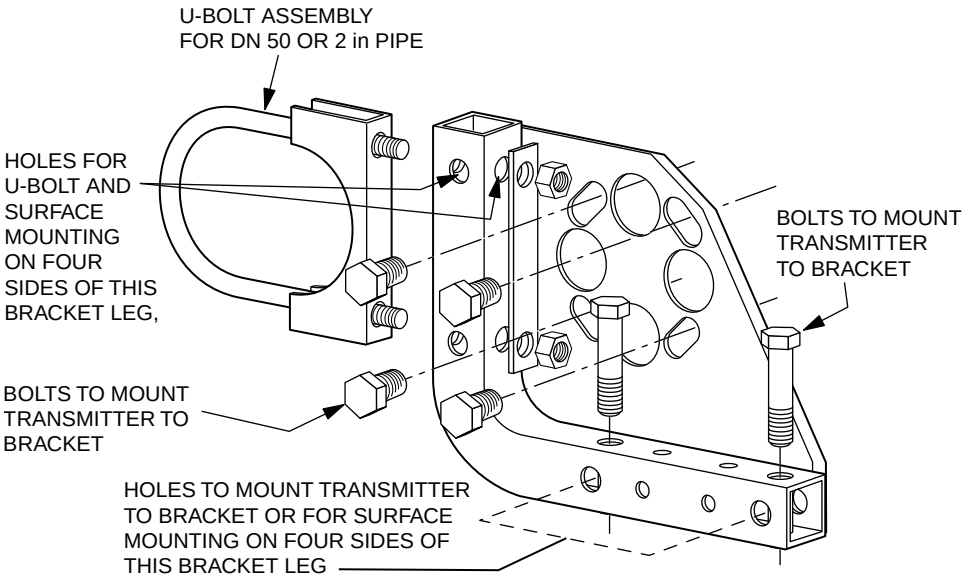
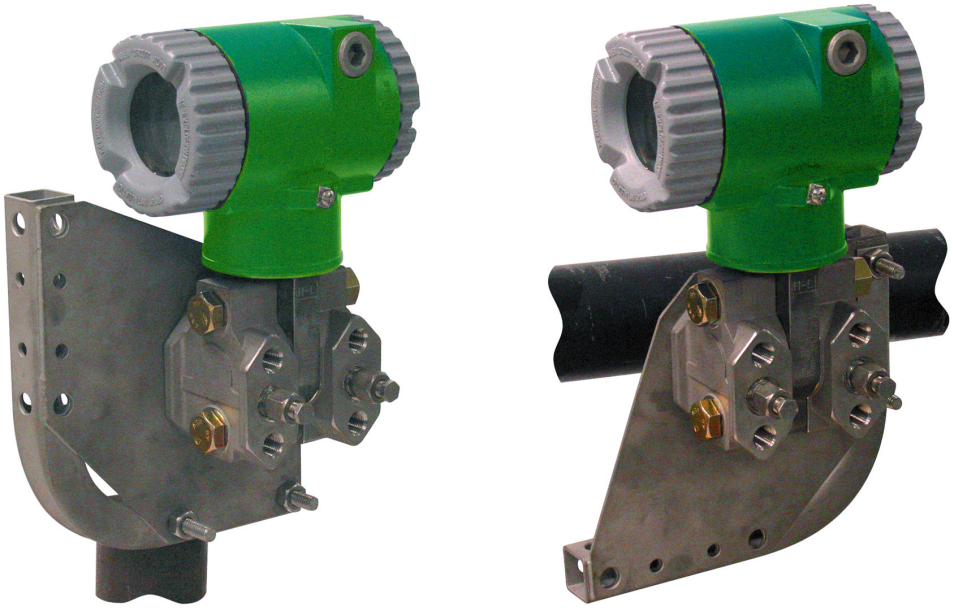


Figure 16 - Mounting a Traditional Structure DP Transmitter with a Universal Bracket



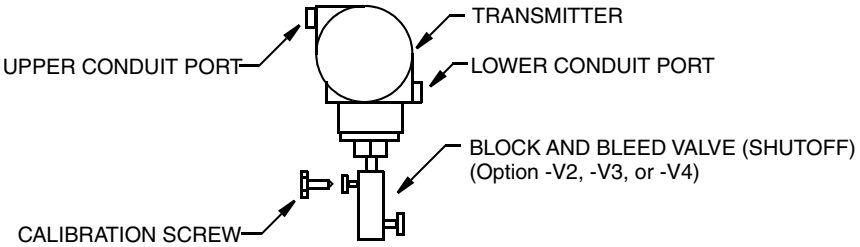
Typical Piping for Absolute and Gauge Pressure Transmitters

Piping for Direct Connect AP and GP Transmitters

The next figure shows a typical piping application for direct connected transmitters. Calibration supply pressure can be applied via a calibration screw. The lower conduit port can be used as a drain for moisture buildup in terminal compartment.

- The use of snubbers is recommended in installations that are prone to high levels of fluid pulsations.
- Pressure transmitters mounted directly to process piping or a pressure vessel may require the use of a shutoff valve (shown) to comply with the requirements of ASME Power Piping Code B31.1 and Chemical and Petroleum Piping Code B31.3.

Figure 17 - Typical Direct Connect Transmitter Piping



- Block and bleed valve maximum pressure:

  40 MPa (6,000 psi) at 38°C (100°F)

  25 MPa (4,000 psi) at 250°C (400°F)
- Calibration screw maximum pressure

  0.7 MPa (100 psi) with Poly-Flo fitting (F0101ES)

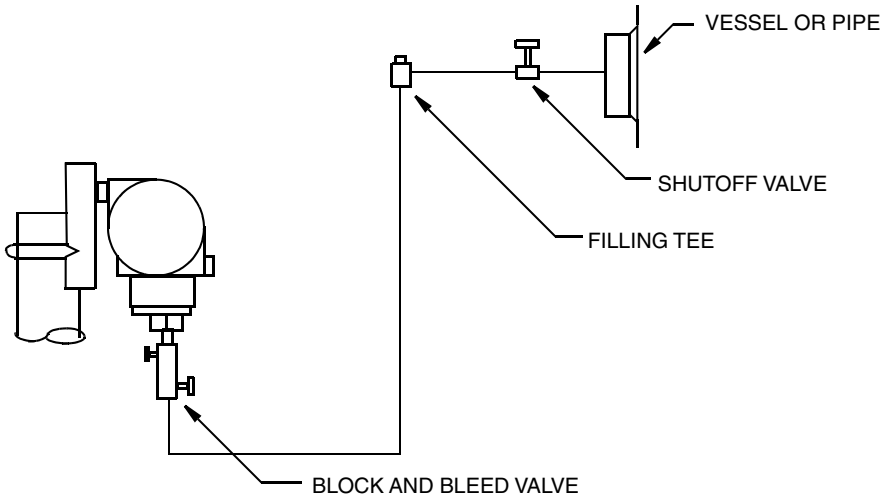
For hot process applications greater than the operative limits of your transmitter(32) — such as steam — additional piping is required to help protect the transmitter from the hot process as shown in the diagram. The piping is filled with water or process fluid. Mount the transmitter below the pressure connection at the pipe.

Although the transmitter is shown mounted vertically, you can also mount it horizontally unless sediment is present. The calibration tee is not required if a calibration screw is used for field calibrations.

If trapped vapor pockets cannot be tolerated in a liquid service and a horizontal process connection is used, install a pipe elbow and vertically position the transmitter with the housing *below* the process connection.

(32) 121°C (250°F) for silicone fill fluid, or 82°C (180°F) for Fluorinert fill fluid

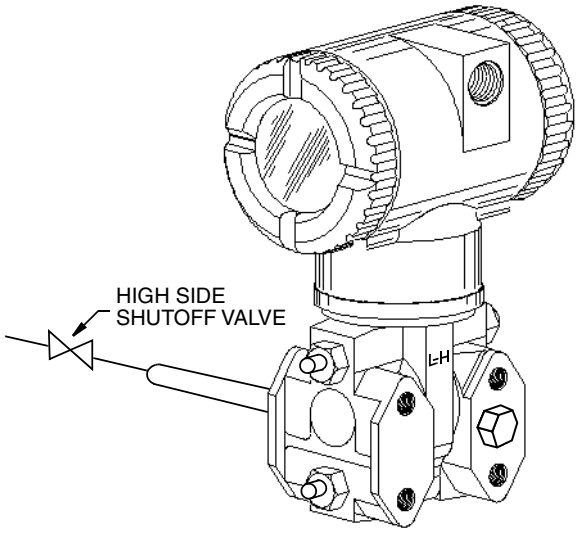
Figure 18 - Hot Process Piping for Direct Connect Transmitters



Piping for Biplanar AP and GP Transmitters

The next figure shows a typical piping application for biplanar transmitters.

Figure 19 - Typical Biplanar Transmitter Piping



To achieve pressure-tight joints, tighten NPT thread one-half to three turns past hand-tight.

Tighten bolts, plugs, and screws to approximately the following torque values:

- Process connector bolts: 61 N-m (45 lbf-ft)
- Drain plugs: 47 N-m (35 lbf-ft)
- Vent and drain screws: 6.8 N-m (5 lbf-ft)

NOTE: The use of snubbers is recommended in installations that are prone to high levels of fluid pulsations.

For hot process applications greater than the operative limits of your transmitter(33) — such as steam — additional piping is required to help protect the transmitter from the

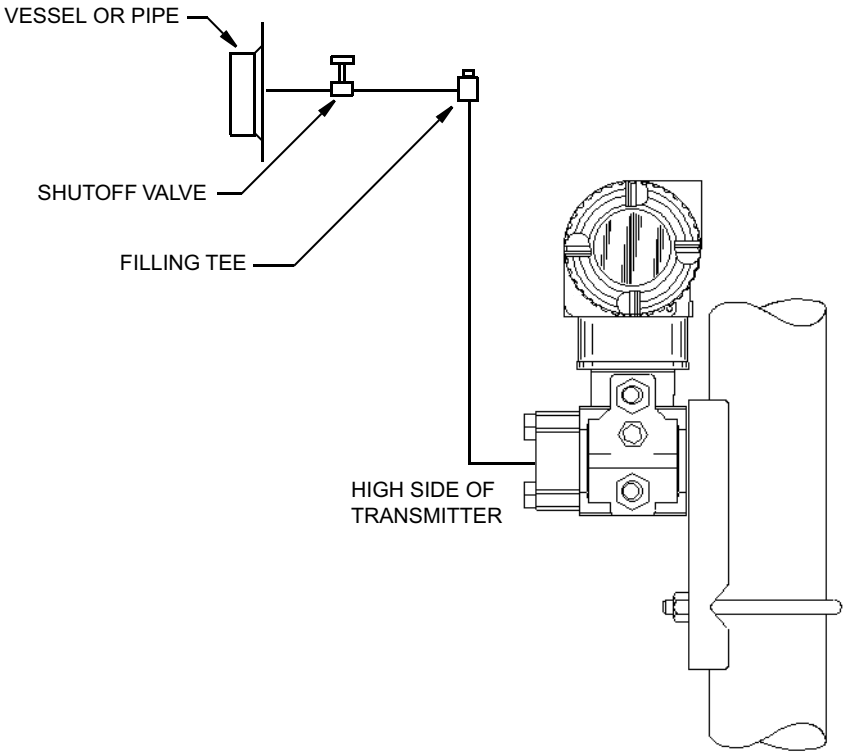
(33) 121°C (250°F) for silicone fill fluid, or 82°C (180°F) for Fluorinert fill fluid.

hot process as shown in the diagram. The piping is filled with water or process fluid. Mount the transmitter below the pressure connection at the pipe.

Although the transmitter is shown mounted vertically, you can also mount it horizontally unless sediment is present. The calibration tee is not required if a calibration screw is used for field calibrations.

If trapped vapor pockets cannot be tolerated in a liquid service and a horizontal process connection is used, install a pipe elbow and vertically position the transmitter with the housing *below* the process connection.

Figure 20 - Hot Process Piping for Biplanar Transmitters



Additional Steps for Differential Pressure Transmitter Installation

Venting and Draining — Traditional Structure

Sensor cavity venting and draining is provided for both vertical and horizontal mounting.

- For vertically mounted units, draining is via a vent and drain screw. Venting is possible with side vents (option -V).
- For horizontally mounted units, the unit is self-draining. Venting is via a vent and drain screw.

Figure 21 - Vertical Mounting — Cavity Draining

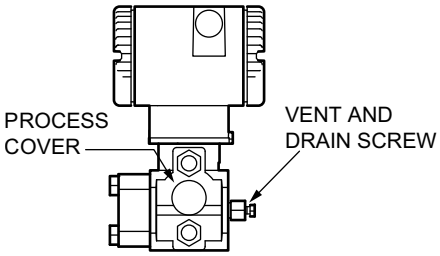


Figure 22 - Vertical Mounting — Cavity Venting

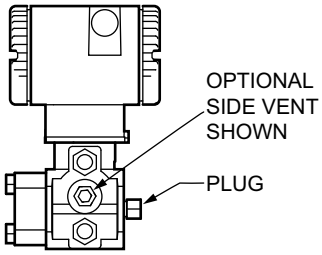
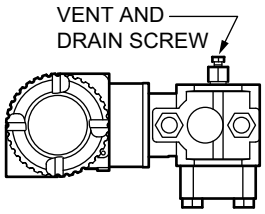


Figure 23 - Horizontal Mounting — Cavity Venting



Venting and Draining — LP1 Low Profile Structure

Sensor cavity venting and draining is provided for both vertical and horizontal mounting.

- For vertically mounted units, the transmitter is self-draining. Venting is via a vent and drain screw.
- For horizontally mounted units, the transmitter can simply be turned over (rotated 180 degrees) to orient the high and low pressure sides in the preferred locations. There is no need to unbolt the process covers.

If the transmitter is connected with a length of impulse piping, such piping should slope up to the transmitter for gas applications, or down for liquid applications.

Figure 24 - Vertical Mounting — Cavity Venting

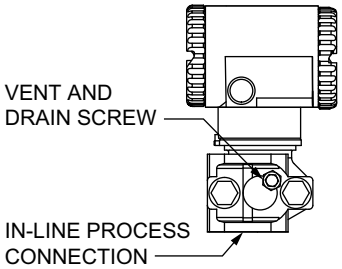
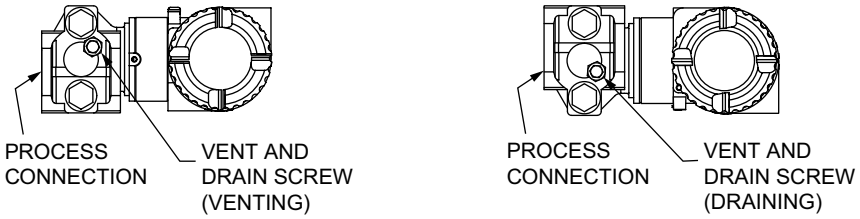


Figure 25 - Horizontal Mounting — Cavity Venting and Draining



Installation of Flow Measurement Piping

Refer to the diagrams for typical installations with horizontal and vertical process pipes.

The transmitters are shown below the level of the pressure connections at the pipe (usual arrangement, except for gas flow without a seal liquid), and with filling tees in the lines to the transmitter (for a seal liquid).

If the process fluid being measured must not come into contact with the transmitter, the transmitter lines must be filled with a suitable seal liquid as described in Filling the System with Seal Liquid, page 41. In such a case, mount the transmitter below the level of the pressure connections at the pipe. With steam flow, the lines are filled with water to help protect the transmitter from the hot steam. The seal liquid (or water) is added to the lines through the filling tees. To help prevent unequal heads on the transmitter, the tees must be at the same elevation, and the transmitter must be mounted vertically as shown. If a seal liquid is not required, elbows can be used in place of the tees.

Tighten drain plugs and optional vent screws to 20 N-m (15 lbf-ft). Tighten the four process connector bolts to a torque of 61 N-m (45 lbf-ft).

The low and high pressure sides of the transmitter are identified by an L-H marking on the side of the sensor above the label.

With medium viscosity seal liquids and/or long transmitter lines, use larger valve sizes.

- With a **horizontal** line, pressure connections at the pipe should be at the side of the line. However, with gas flow without a seal liquid, connections should be at the top of the line.
- With a **vertical** line, flow should be upwards.
- For **liquid** or **steam** flow, the transmitter should be mounted lower than the pressure connections at the pipe.
- For **gas** flow *without* a seal liquid, the transmitter should be mounted higher than the pressure connections at the pipe.
- For **gas** flow *with* a seal liquid, the transmitter should be mounted lower than the pressure connections.
- It is recommended to use snubbers in installations prone to high levels of fluid pulsations.

Figure 26 - Example of Horizontal Process Line Installation

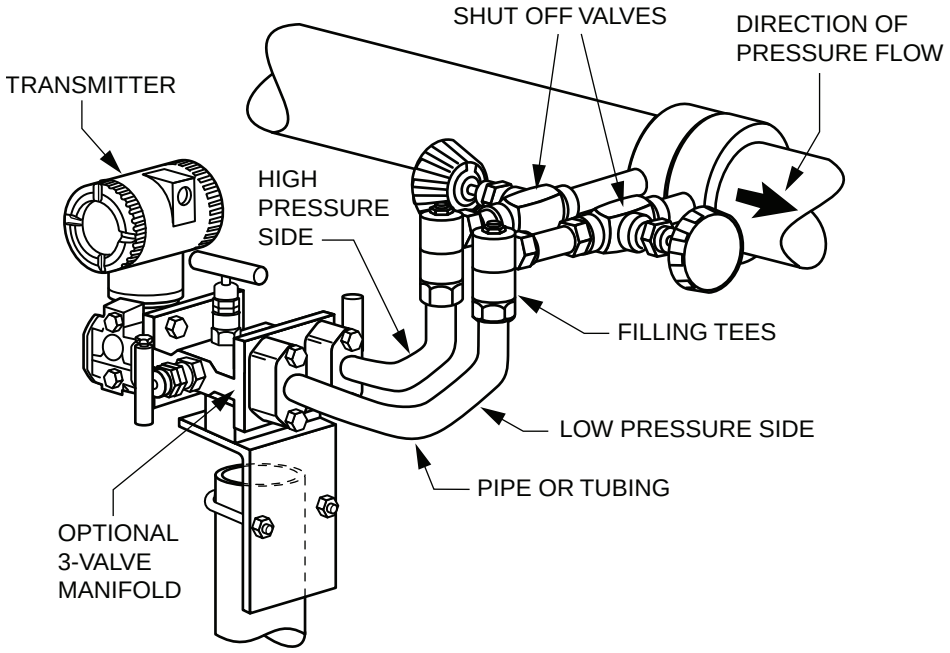
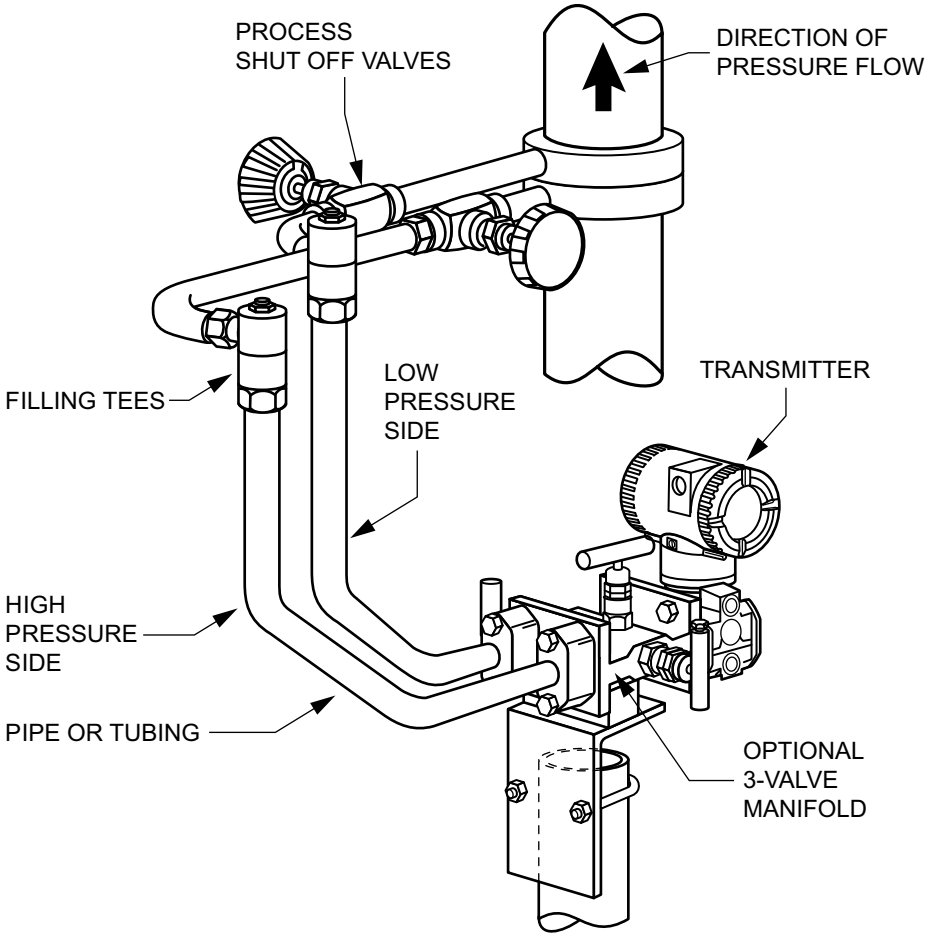


Figure 27 - Example of Vertical Process Line Installation



Filling the System with Seal Liquid

If the process fluid being measured must not come into contact with the transmitter, the transmitter lines must be filled with a suitable seal liquid as follows:

NOTICE
POTENTIAL EQUIPMENT DAMAGE AND PROCESS FLUID CONTAMINATION To help prevent loss of seal liquid and contamination of process fluid, never open both process shutoff valves and manifold shutoff valves if the bypass valve is open. **Failure to follow these instructions can result in equipment damage and process fluid contamination.**

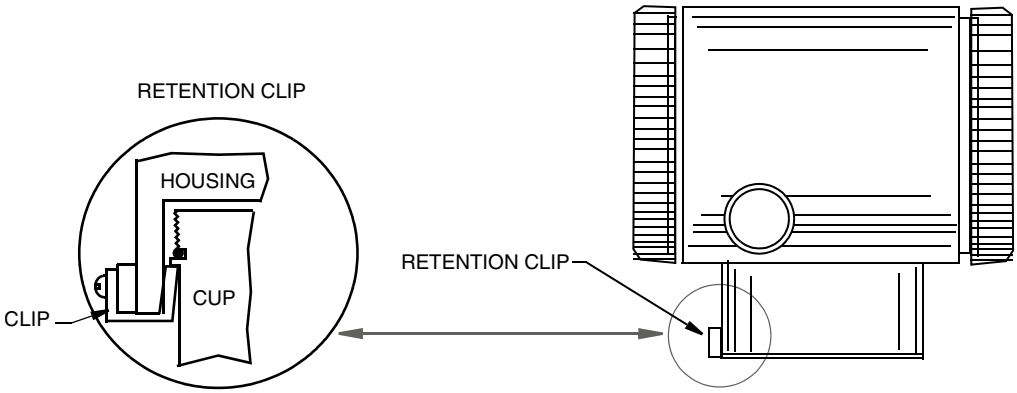
1. If the transmitter is in service, follow the procedure in Taking a Differential Pressure Transmitter out of Operation, page 50.
2. Close both process shutoff valves.
3. Open all three valves on the 3-valve manifold.
4. Partially open the vent screws on the transmitter until all air has been forced out of the transmitter body and lines. Close the vent screws.
5. Refill the tee connections. Replace the plugs and close the bypass valve. Check for leaks.
6. Follow the procedure in Putting a Differential Pressure Transmitter into Operation, page 50.

Positioning the Housing

The transmitter housing (topworks) can be rotated up to one full turn in the counterclockwise direction when viewed from above for optimum access to adjustments, display, or conduit connections. The housing has a retention clip that helps prevent rotating the housing to an excessive depth of housing/sensor thread engagement.

NOTICE
POTENTIAL VIBRATION EFFECTS If you remove the housing for maintenance, do not over-tighten it upon reassembly. Hand-tighten it to the bottom of the threads, then back off a half-turn counterclockwise to avoid bottoming out the housing to the sensor. **Failure to follow these instructions can result in amplified vibration effects.**

Figure 28 - Housing Clip Location



Positioning the Display

The optional display can be rotated within the housing at 90° increments to any of four positions. To do this, grasp the two tabs on the display and rotate it about 10° in a counterclockwise direction. Pull out the display. Ensure that the o-ring is fully seated in its groove in the display housing. Turn the display to the desired position, reinsert it in the electronics module, aligning the tabs on the sides of the assembly, and twist it in the clockwise direction.

NOTICE
POTENTIAL EQUIPMENT DAMAGE Do not turn the display more than 180° in any direction. Doing so can damage its connecting cable. **Failure to follow these instructions can result in equipment damage.**

Setting the Write Protect Jumper

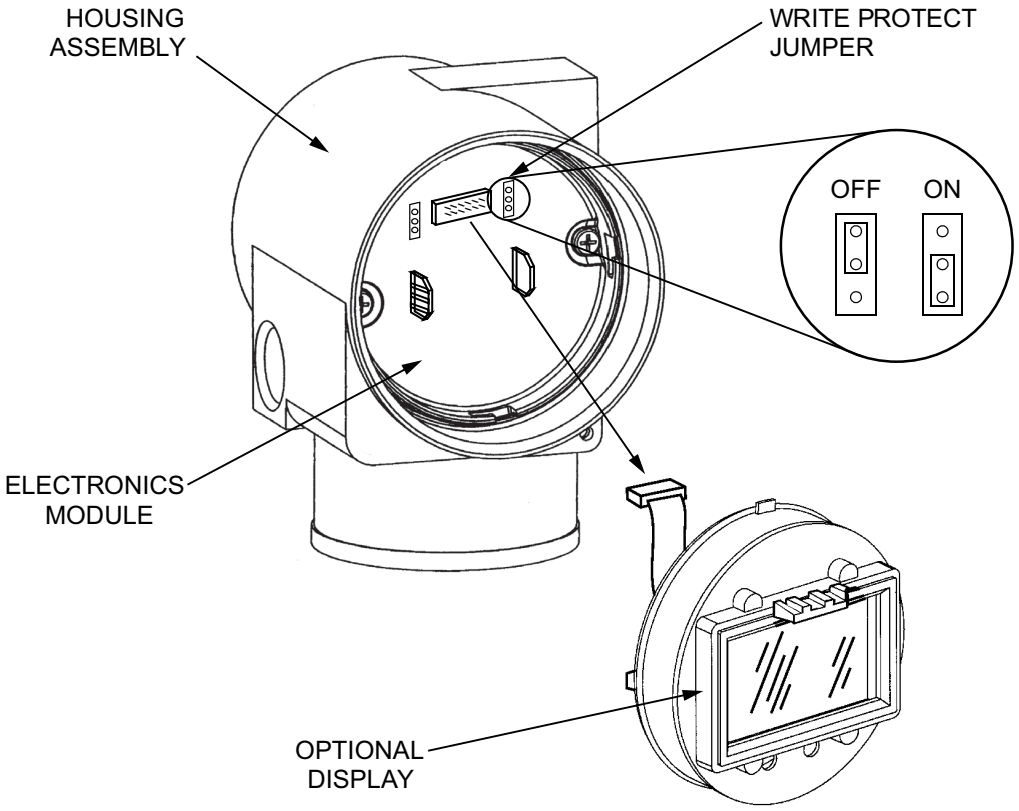
Your transmitter has write protection capability. This means that the external zero button, local display, and remote communications can be prevented from writing to the electronics. Enable write protection by moving a jumper that is located in the electronics compartment behind the optional display.

To activate write protection, remove the display as described in Positioning the Display, page 42, then remove the jumper or move it to the lower position as shown on the exposed label. Replace the display.

NOTICE
RISK OF BEING LOCKED OUT If you remove the jumper, do not misplace it. You cannot configure the transmitter without it. **Failure to follow these instructions can result in equipment damage.**

NOTE: There is another switch to the left of the connector for the optional display. This switch is not used.

Figure 29 - Write Protect Jumper

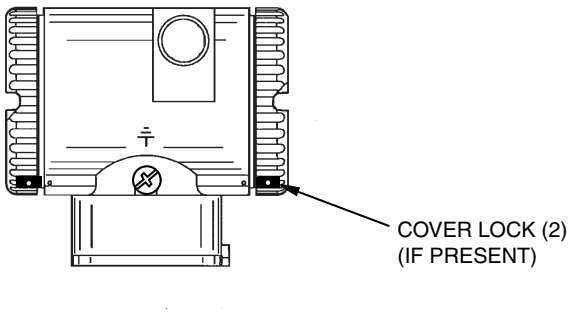


Cover Locks

Housing cover locks are provided as standard with certain agency certifications and as part of the Custody Transfer Lock and Seal option. To lock the covers, unscrew the locking pin until approximately 6 mm (0.25 in) shows, lining up the hole in the pin with

the hole in the housing. Insert the seal wire through the two holes, slide the seal onto the wire ends, and crimp the seal.

Figure 30 - Cover Lock Location



Wiring

The installation and wiring of your transmitter must conform to local code requirements.

⚠WARNING

EXPLOSION HAZARD

Flameproof certification requires that when equipment is intended to be used in an explosive atmosphere caused by the presence of combustible dust, cable entry devices and blanking elements must provide a degree of ingress protection of at least IP6X. They must be suitable for the conditions of use and correctly installed.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTICE

HAZARD OF ELECTRICAL TRANSIENT OR SURGE

Use transient/surge protection in installations prone to high levels of electrical transient and surges.

Failure to follow these instructions in installation can result in equipment damage.

NOTICE

POTENTIAL EQUIPMENT DAMAGE

The Transmitter DC Power Port must be connected to a local power source and must not be connected to a DC Power Distribution Network.

Failure to follow these instructions in installation can result in equipment damage.

Conduit/Cable Gland Connections

The electronics housing has two conduit/cable gland connections to allow access from either side of the housing. These connections are 1/2 NPT or M20 threads per your order. Use the correct threaded devices when making the connections. You can verify the type of thread with the ninth character after the dash in the model code on the data plate. The letter 1 or 3 indicate a 1/2 NPT thread; 5 or 6, an M20 thread. Refer to “Conduit Connection and Housing Material” in Absolute and Gauge Pressure Transmitters, page 104 or Differential Pressure Transmitters, page 114.

The housing comes with an agency approved threaded metal plug in one of the conduit holes and a plastic plug in the other. After you connect the conduit or cable gland, plug the unused hole with the metal plug.

⚠⚠WARNING

EXPLOSION HAZARD

To help prevent possible explosions and to maintain flameproof, explosionproof, and dust-ignitionproof protection, observe applicable wiring practices. Plug the unused conduit openings with approved conduit plugs. Both plug and conduit must engage a minimum of five full threads for 1/2 NPT connections; eight full threads for M20 connections.

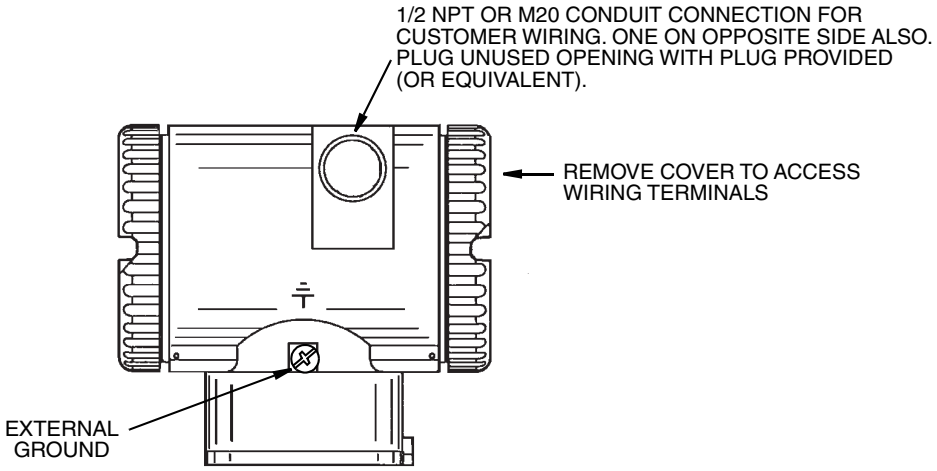
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: In North America, a seal is not required when installed with rigid conduit per requirements of the applicable electrical code. When using instrument cable approved for the hazardous location, a seal must be made with an approved cable gland or conduit seal per the requirements of the applicable electrical code.

Accessing Transmitter Field Terminals

For access to the field terminals, thread the cover lock (if present) into the housing to clear the threaded cover, and remove the cover from the field terminals compartment as shown.

Figure 31 - Accessing Field Terminals



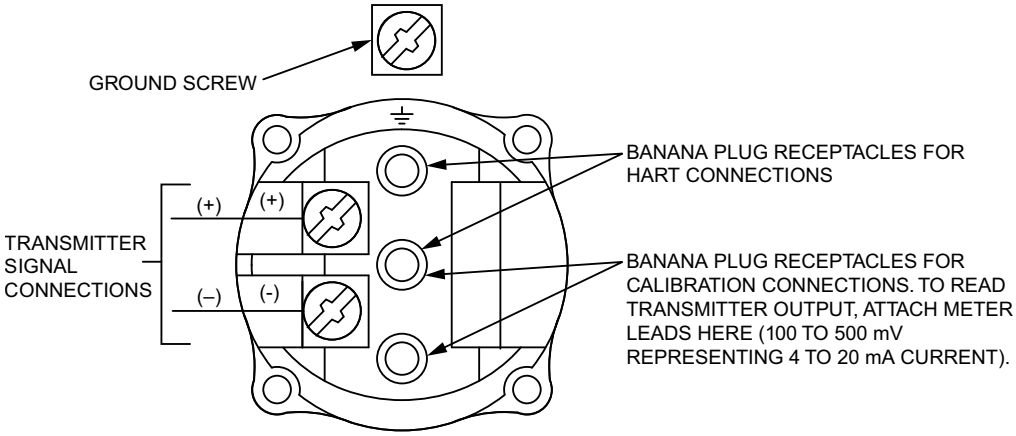
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

ATEX and UKEX require that when equipment is intended to be used in an explosive atmosphere caused by the presence of combustible dust, cable entry devices and blanking elements must provide a degree of ingress protection of at least IP6X. They must be suitable for the conditions of use and correctly installed.

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

Figure 32 - Identification of Field Terminals

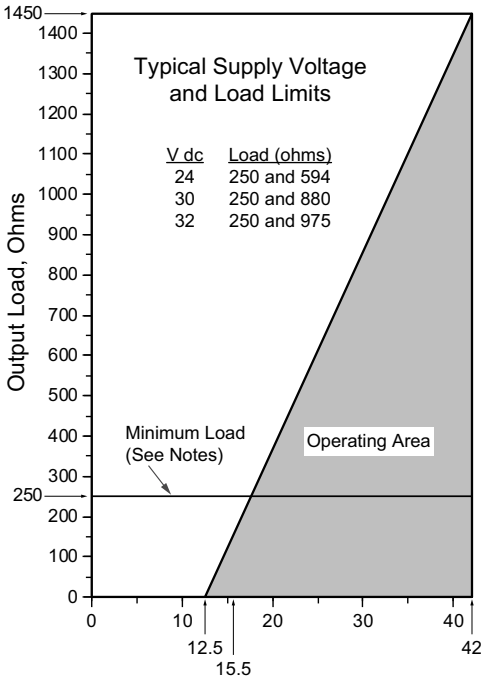


Wiring the Transmitter to a Control Loop

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

You can use any combination of supply voltage and loop load resistance in the shaded area shown in Supply Voltage and Loop Load, page 47. To determine the loop load resistance (transmitter output load), add the series resistance of each component in the loop, excluding the transmitter. The power supply must be capable of supplying 22 mA of loop current.

Figure 33 - Supply Voltage and Loop 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.

Examples:

- For a loop load resistance of 880 Ω, the supply voltage can be any value from 30 to 42 V dc.
- For a supply voltage of 24 V dc, the loop load resistance can be any value from 250 to 594 Ω (0 to 594 Ω without a HART communicator or PC-based configurator connected to the transmitter).

To wire one or more transmitters to a power supply, follow these steps:

1. Remove the cover from the transmitter field terminals compartment.
2. Run signal wires (0.50 mm^2 or 20 AWG, typical) through one of the transmitter conduit connections. Use twisted single pair to help protect the 4 to 20 mA output and/or remote communications from electrical noise. The maximum recommended length for signal wires is:
   - 3,050 m (10,000 ft) using single pair cable and adhering to the requirements of the HART physical layer implementation defined in HART Document HCF_SPEC-53. Use CN=1 when calculating maximum lengths.
   - 1,525 m (5,000 ft) in multidrop mode. Shielded cable could be required in some locations.

     NOTE: Do not run the transmitter wires in the same conduit as the mains (ac power) wires.
3. If shielded cable is used, ground the shield at the power supply only. Do not ground the shield at the transmitter.

4. Plug the unused conduit connection.

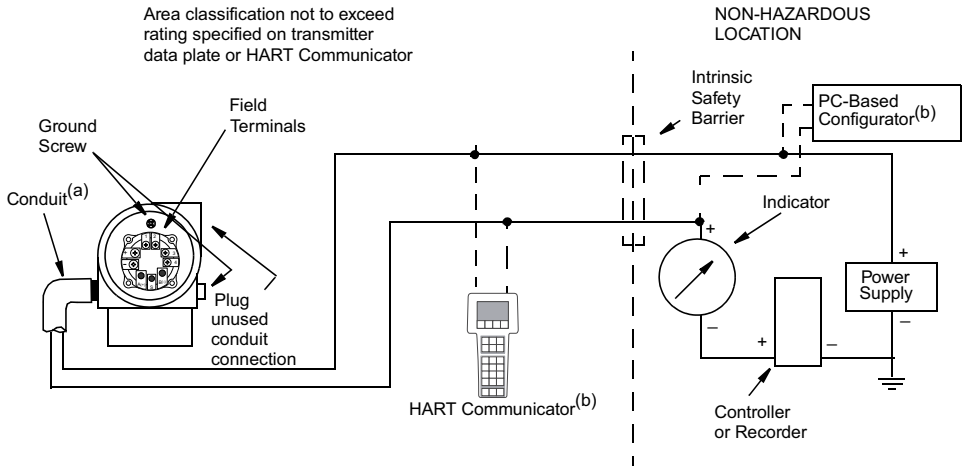
> **⚠⚠WARNING**
>
> **EXPLOSION HAZARD**
>
> To help prevent possible explosions and to maintain flameproof, explosionproof, and dust-ignitionproof protection, observe applicable wiring practices. Plug the unused conduit openings with approved conduit plugs. Both plug and conduit must engage a minimum of five full threads for 1/2 NPT connections; eight full threads for M20 connections.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

5. Connect a ground wire to the ground terminal in accordance with local practice.

> ***NOTICE***
>
> **POTENTIAL REDUCED PERFORMANCE OR EQUIPMENT DAMAGE**
>
> If the signal circuit must be grounded, it is preferable to ground it at the negative terminal of the dc power supply. To avoid errors resulting from ground loops or the possibility of short-circuiting groups of instruments in a loop, there should be only one ground in a loop.
>
> **Failure to follow these instructions can result in reduced performance or equipment damage.**

6. Connect the power supply and receiver loop wires to the “+” and “–” terminal connections.
7. Connect receivers (such as controllers, recorders, indicators) in series with the power supply and transmitter as shown in the diagram.

Figure 34 - Loop Wiring Transmitters

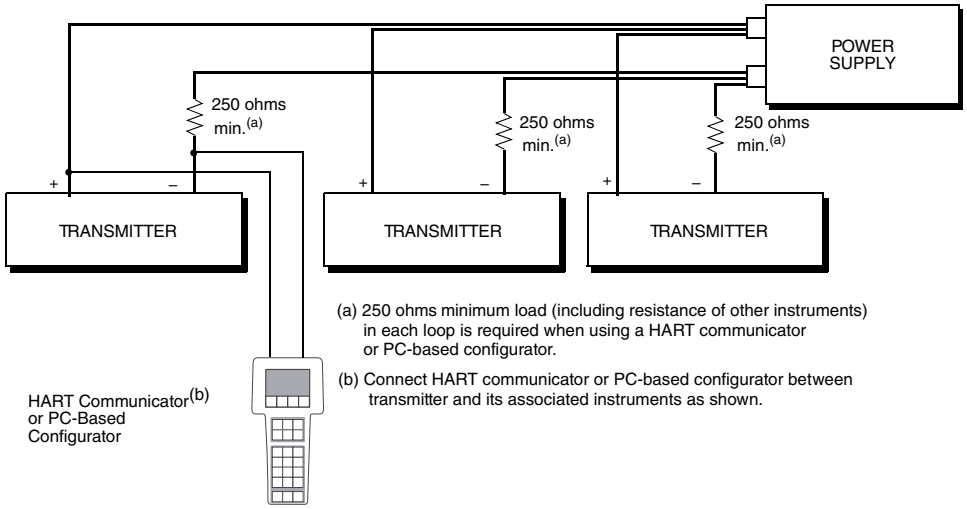


(a) Run conduit down to avoid moisture buildup in terminals compartment.
(b) There must be at least 250 ohms total resistance between the HART Communicator or PC-based configurator and the power supply.

8. Reinstall the cover onto the housing by rotating it clockwise to seat the o-ring into the housing, then continue to hand-tighten until the cover contacts the housing metal-to-metal. If cover locks are present, lock the cover as described in Cover Locks, page 43.

9. To wire additional transmitters to the same power supply, repeat these steps for each transmitter. The setup for multiple transmitters connected to a single power supply is shown in the next diagram.

Figure 35 - Wiring Several Transmitters to a Common Power Supply



10. A HART communicator or PC-based configurator can be connected in the loop between the transmitter and the power supply as shown in Loop Wiring Transmitters, page 48 and Wiring Several Transmitters to a Common Power Supply, page 49. A minimum of 250 Ω must separate the power supply from the HART communicator and PC-based configurator.

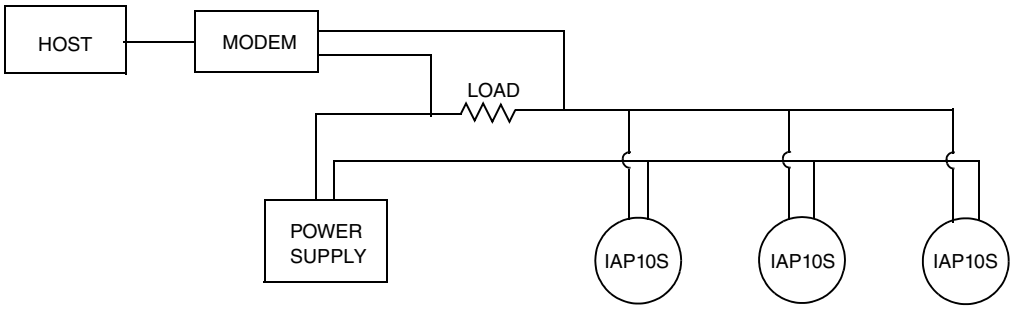
Multidrop Communication

“Multidrop communication” refers to the connection of several transmitters to a single communications transmission line. Communications between the host computer and the transmitters takes place digitally with the analog output of the transmitter deactivated. With the HART communications protocol, up to 64 transmitters can be connected on a single twisted pair of wires or over leased telephone lines.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Communication with the transmitters can be accomplished with any HART compatible modem and a host implementing the HART protocol. Each transmitter is identified by a unique address (0 through 63) and responds to the commands defined in the HART protocol.

Typical Multidrop Network, page 49 shows a typical multidrop network. Do not use this figure as an installation diagram. Contact the FieldComm Group (http://www.fieldcommgroup.org) for specific requirements for multidrop applications.

Figure 36 - Typical Multidrop Network



The HART Communicator can operate, configure, and calibrate pressure transmitters with HART communication protocol the same way it can in a standard point-to-point installation.

NOTE:

The transmitters are shipped from the factory with a poll address of 0 and with the loop current mode set to “enabled” (active), allowing the transmitters to operate in a standard point-to-point manner with a 4 to 20 mA output signal.

To activate multidrop communication, assign each transmitter a unique address (0 through 63) on each multidrop network. However, changing the transmitter poll address does not automatically deactivate the 4 to 20 mA analog output.

Only one device per multidrop network can be configured with loop current enabled. To fix the mA output value, set the loop current mode to “disabled.”

Connecting the Transmitter to a Schneider Electric Distributed Control System

The transmitter can also send its measurement to a Schneider Electric distributed control system as a digital signal via an FBM214/215. Wiring terminations at the transmitter are the same as described in this section. For other system wiring details, refer to the installation instructions provided with the DCS.

Putting a Differential Pressure Transmitter into Operation

This procedure explains how to sequence the valves in your flow measurement piping or optional bypass manifold to help ensure that your transmitter is not overranged and that seal liquid is not lost. Refer to the diagrams in Installation of Flow Measurement Piping, page 39.

NOTE: This procedure assumes that the process shutoff valves are open.

1. Close both the upstream and downstream transmitter connection valves.
2. Open the bypass valve.
3. Slowly open the upstream transmitter connection valve. Allow the transmitter’s output to stabilize.
4. Close the bypass valve.
5. After installing the transmitter, slowly open the upstream transmitter connection valve.

Taking a Differential Pressure Transmitter out of Operation

This procedure explains how to sequence the valves in your flow measurement piping or optional bypass manifold to help ensure that your transmitter is not overranged and that seal liquid is not lost. Refer to the diagrams in Installation of Flow Measurement Piping, page 39.

NOTE: This procedure assumes that the process shutoff valves are open.

1. Close both the upstream and downstream transmitter connection valves.
2. Open the bypass valve.

3. Slowly open the downstream side vent screw on the transmitter to release pressure before disconnecting lines.

> **⚠ WARNING**
>
> **RISK OF EXPOSURE**
>
> When venting pressure from the transmitter, wear suitable protective equipment to prevent possible injury from process material, temperature, or pressure.
>
> **Failure to follow these instructions can result in death or serious injury.**

4. Remove the transmitter, if applicable.

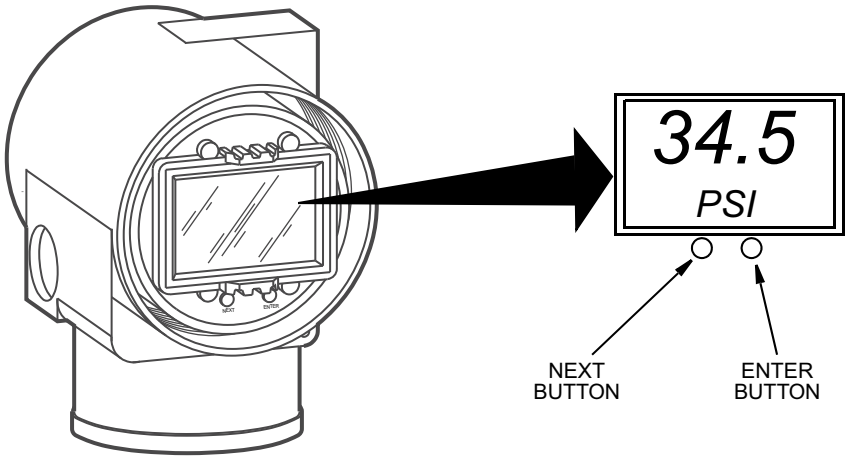
Operation with the Local Display

The local display provides local indication of measurement information on two lines. The upper line displays five digits (four digits when a minus sign is needed); the lower line displays seven alphanumeric characters.

During normal transmitter operation, the display shows either the primary measurement (M1) or secondary measurement (M2), depending on how you configure the transmitter.

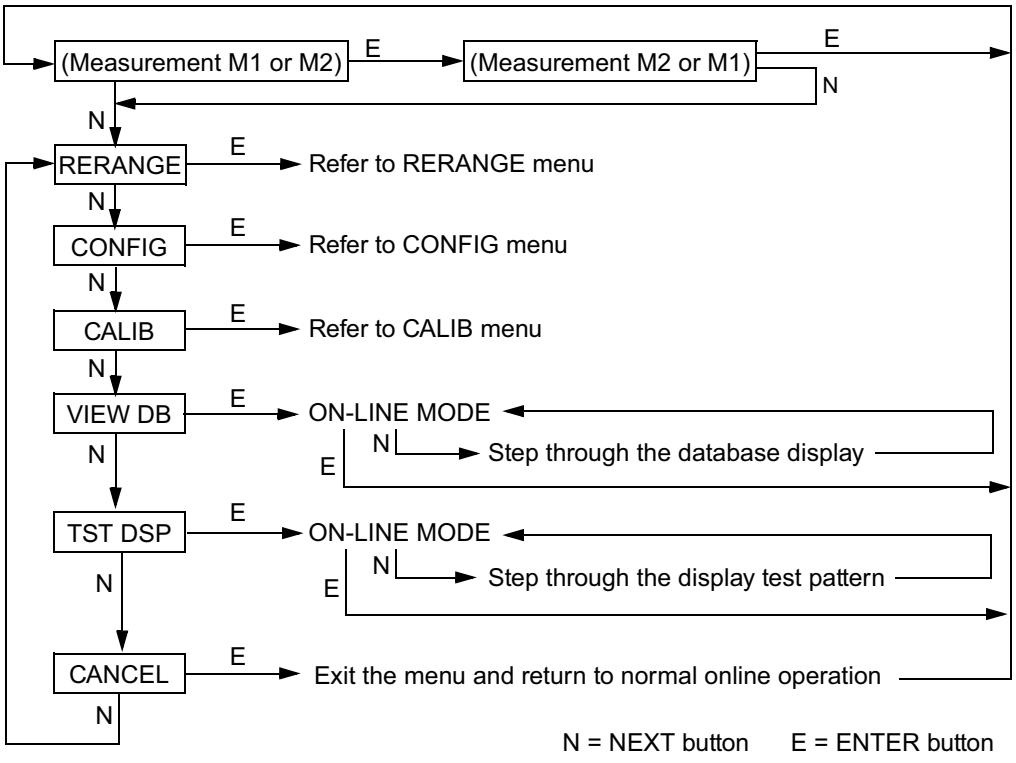
- If configured as **Show M1**, the display shows the primary measurement value (M1) and the configured units.
- If configured as **Show M2**, the display shows the secondary measurement value (M2) and the configured units.
- To temporarily view the alternate measurement, press the **ENTER** button. The alternate measurement briefly appears on the display, and then the display reverts to the configured measurement.
- If configured as **Toggle**, the display toggles between the primary (M1) and secondary (M2) measurements.
- If the displayed measurement is more than five digits, "**99999**" flashes on the display. Selecting different units (EGUs) may result in a shorter measurement that can fit on the display.
- For AP transmitters, "**a**" is typically added to the unit name on the display (for example, **psia** or **mmHga**). However, if the unit name is six characters long, the "**a**" is not added.

Figure 37 - Local Display



The display and two-button keypad on the front of the transmitter also provide access to calibration, configuration, and other functions. You can access these operations by means of a menu system. To access the multi-level menu from the transmitter's normal operating mode, press **NEXT**. To exit this menu, cancel your calibration or configuration, and return to the normal operating mode at any time, navigate to **Cancel** and press **ENTER**.

Figure 38 - Top Level Menu



Entering Strings and Numeric Values

To enter strings or numeric values, follow these steps:

1. At the appropriate prompt, press the **ENTER** button. The display shows the last (or default) value with the first character flashing.
2. Use the **NEXT** button to select the first character, then press **ENTER**.

   Your selection is entered. The next character flashes.
3. Repeat the previous step until you have entered all five characters. If your string or value has fewer than five characters, use leading or trailing zeroes in the remaining positions, if required.

   When you have entered the fifth character, the display prompts you to place the decimal point.
4. Select the desired decimal point location by pressing **NEXT** until the decimal point is placed as desired. Press **ENTER**.

   NOTE:

   - You cannot place the decimal point immediately after the first digit. For example, you cannot enter a value as 1.2300; you must enter it as 01.230.
   - The decimal position is identified by flashing, except at the position after the fifth digit. At that position, a whole number is represented, and the decimal point is assumed.

   The display advances to the next menu item.

Table 10 - Permitted Characters for the Local Display

Alphanumeric Characters		Numeric Characters
A-Z (uppercase)	*	- (minus sign)
a-z (lowercase)	+	.
[	- (hyphen)	0
]	. (period)	1
\	/	2
^	0-9	3
_ (underscore)	<	4
(space)	>	5
%	=	6
		7
		8
		9

Reranging

Since the transmitter continuously determines an internal digital value of the measured pressure from the lower range limit (LRL) to the upper range limit (URL), the 4 and 20 mA output points can be assigned to any pressure values within the span and range limits, without the application of pressure.

- Reranging does not affect the calibration of the transmitter; that is, it does not affect the optimization of the internal digital value of pressure over a specific calibrated range.
- If the reranged LRV and URV are not within the calibrated range, the measured values may not be as accurate as when the LRV and URV are within the calibrated range.
- If you need to perform a span calibration after reranging the transmitter, be sure to perform an offset calibration (**Cal LRV**) before performing the span calibration (**Cal URV**) operation. If you do not perform the offset calibration, you may get a **BADSPAN** message.
- For DP transmitters, if **M1 MODE** is in a square root mode, regardless of engineering units selected, **RERANGE** is done in the following pressure units:
  - **inH2O**, if **M2 MODE** is a type of square root with span range code B or C.
  - **psi**, if **M2 MODE** is a type of square root with span range code D or E.
  - **M2_EGU** units, if **M2 MODE** is linear with all span range codes.

  During **RERANGE**, the bottom line of the display indicates the units that are in use. After **RERANGE**, the display automatically returns to the configured engineering units.

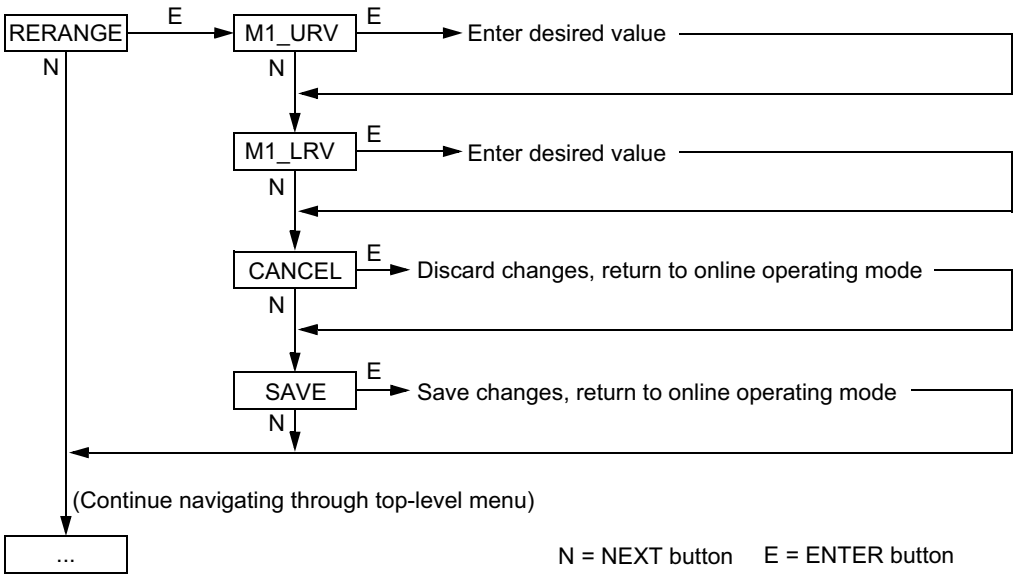
You can rerange the transmitter by entering new database values for the LRV and URV.

1. With the transmitter in normal operating mode, press the **NEXT** button to access the transmitter's top level menu. The first menu item is **RERANGE**. Press **ENTER** to select it.

2. Use the procedure in Entering Strings and Numeric Values, page 53 to adjust **M1_URV** and/or **M1_LRV** as desired.
   - To edit the upper range value, press **ENTER** at the **M1_URV** prompt.
   - To edit the lower range value, press **ENTER** at the **M1_LRV** prompt.

   NOTE: For DP transmitters, **M1_LRV** is bypassed if **M1 MODE** is configured as square root, because **M1_LRV** must be zero.

Figure 39 - Rerange Menu Diagram



Viewing the Database

You can view the database using the multi-level menu system.

1. From the transmitter's normal operating mode, press the **NEXT** button to access the transmitter's top level menu.
2. Navigate to **VIEW DB**, then press **ENTER**. The display shows the first item in the database, **FMW REV**.
3. Continue stepping through the database by pressing **NEXT**, or exit the database view by pressing **ENTER**.

The following diagram shows the VIEW DB menu. The database items are described in Transmitter Database Items, page 56.

Figure 40 - VIEW DB Menu

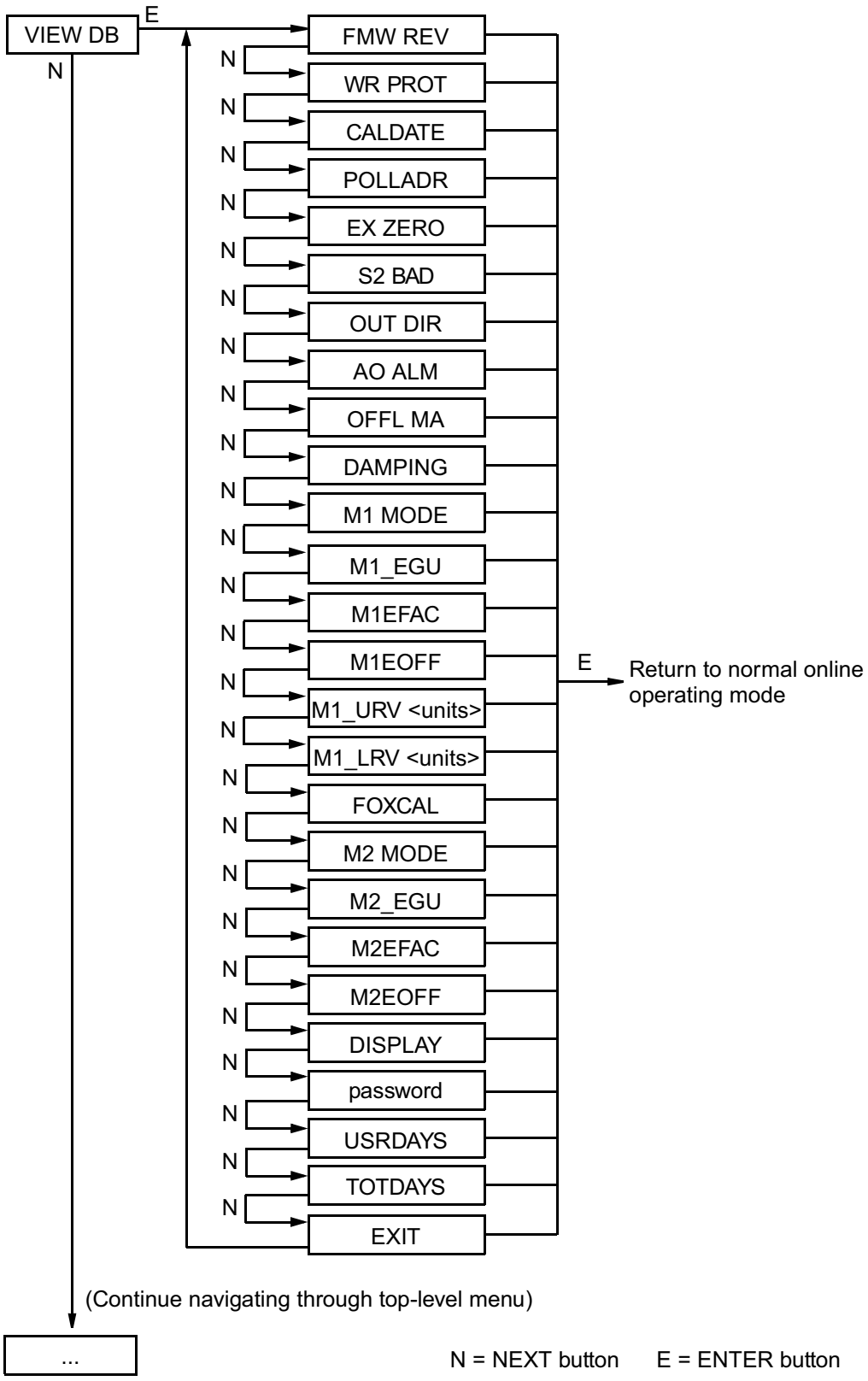


Table 11 - Transmitter Database Items

Database Item	Available Settings or Example
Firmware Revision (**FMW REV**)	**2.0** (example)
Write Protection Status (**WR PROT**)	**WP DISA** (disabled); **WP ENA** (enabled)

Table 11 - Transmitter Database Items (Continued)

Database Item	Available Settings or Example
Date of Last Calibration (**CALDATE**)	**01JAN18** (example)
Poll Address (**POLLADR**)	0 through 63
External Zero Status (**EX ZERO**)	**EXZ ENA** (enabled); **EXZ DIS** (disabled)
Temperature Sensor Strategy (**S2 BAD**)	**AO ALM**; **USE DEF**
4 to 20 mA Output Direction (**OUT DIR**)	**OUT FWD** (forward); **OUT REV** (reverse)
4 to 20 mA Output Alarm Mode (**AO ALM**)	**LO ALM** (low); **HI ALM** (high)
4 to 20 mA Output in Offline Mode (**OFFL MA**)	**LAST_MA** (last); **4.000** (user-set example)
Damping, in Seconds (**DAMPING**)	**DAMP 0**; **DAMP1/4**; **DAMP1/2**; **DAMP 1**; **DAMP 2**; **DAMP 4**; **DAMP 8**; **DAMP 16**; **DAMP 32**
M1 Mode Output (**M1 MODE**)	Linear: **M1 LIN** Type of square root:(34) **M1SQ<1C**, **M1SQ<4L**, **M1SQ<nC**
Engineering Units for M1 (**M1_EGU**)	Linear: 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 Square root:(34) gal/s, gal/m, gal/h, gal/d, Mgal/d, ft3/s, ft3/m, ft3/h, ft3/d, Igal/s, Igal/m, Igal/h, Igal/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
M1 Engineering Factor (**M1EFAC**)	**30.000**; ; (example)
Offset Applied to the Primary Value (**M1EOFF**)	**0.000** (example)
Primary Upper Range Value (**M1_URV** <units>)	**30.000** (example)
Primary Lower Range Value (**M1_LRV** <units>)	**0.000** (example)
Status of FoxCal™ Multiple Calibration (**FOXCAL**)(35)	**FCALON** (FoxCal™ on); **FCALOFF** (FoxCal™ off)
M2 Mode Output (**M2 MODE**)	Linear: **M1 LIN** Type of square root flow calculation:(34) **M2SQ<1C** (cutoff below 1% of the calibrated differential *pressure* range) **M2SQ<4L** (linear extrapolation below 4% of the calibrated differential *pressure* range) **M2SQ<nC** (user-defined cutoff specified between 0 and 20% of the *flow* upper range value, **M2EFAC**)
Engineering Units for M2 (**M2_EGU**)	Linear: 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 Square root:(34) gal/s, gal/m, gal/h, gal/d, Mgal/d, ft3/s, ft3/m, ft3/h, ft3/d, Igal/s, Igal/m, Igal/h, Igal/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
M2 Engineering Factor (**M2EFAC**)	**1000.0** (example)(34)
Offset Applied to the Secondary Value (**M2EOFF**)	**0.000** (example)
Measurement(s) shown on the display (**DISPLAY**)	**SHOW M1** (primary measurement); **SHOW M2** (secondary measurement) **TOGGLE** (toggle between primary and secondary measurements)
Current Password Setting	**NO PWDS** (no passwords); **ENA PWD** (enable password); **CFGONLY** (configuration only); **CFG+CAL** (configuration and calibration)

(34) Differential pressure transmitters only.
(35) FoxCal™ is available with the Advanced (10S) and Premium (50S) Performance tiers only.

Table 11 - Transmitter Database Items (Continued)

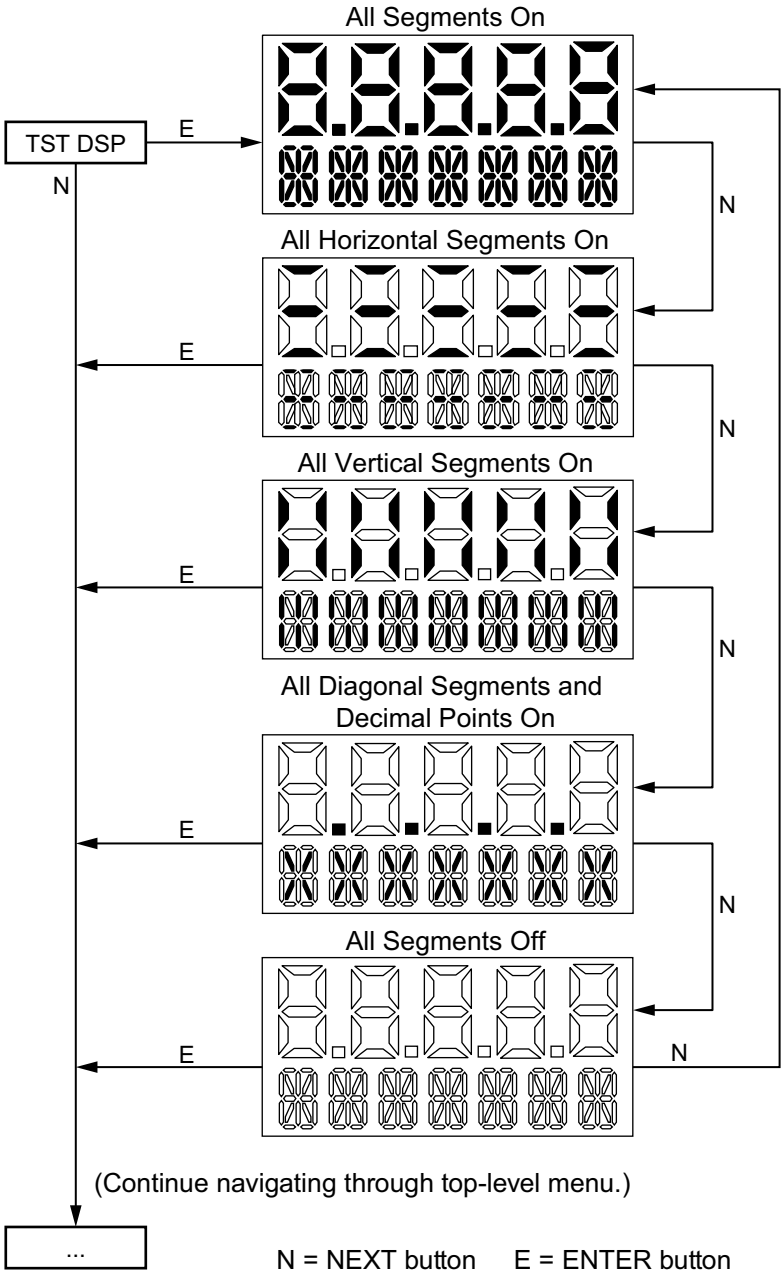
Database Item	Available Settings or Example
Number of days the transmitter has been running since the Time In Service Meter was reset (**USRDAYS**)	**7** (example)
Number of days the transmitter has been running since it was installed (**TOTDAYS**)	**61** (example)

Testing the Display

You can use the multi-level menu system to test the transmitter display. Follow these steps:

1. From the transmitter's normal operating mode, press **NEXT** to access the transmitter's top level menu.
2. Press **NEXT** to navigate to **TST DSP** and press **ENTER**. The display shows the first test segment pattern.
3. Step through the five test patterns by pressing **NEXT** repeatedly. Refer to the diagram.
4. Exit the display test by pressing **ENTER**.

Figure 41 - Display Test Segment Patterns



Messages

The following operation-related messages may appear on the display.

Status	Condition Tested	Message	Description
Startup	Database corruption	INITBAD	Perform a SET GDB procedure.
Normal operation	Write protection enabled	WR PROT	Displays periodically to notify that unit is write protected.
	Any non-online condition	OFFLINE	Notifies of a non-online condition.

Status	Condition Tested	Message	Description
Measurement outside of limits	Pressure	IN1 BAD	• Extreme overrange or underrange input; correct input condition. • Bad calibration; recalibrate transmitter. • Bad sensor connection; check electronics module to sensor. • Inoperative sensor.
	Electronics temperature	IN2 BAD	• Bad sensor connection; check electronics module connection to sensor. • Inoperative sensor.
	Sensor (process) temperature	IN3 BAD	

Configuration

You can configure the transmitter by accessing the menu system using the **ENTER** and **NEXT** buttons on the local display, or by using a remote configurator.

If your transmitter was ordered with optional feature -C2, the factory default values were customized.

Configuration Using the Optional Local Display

To access configuration mode from normal operating mode, repeatedly press the **NEXT** button until the display reads **CONFIG**. Press the **ENTER** button to select **CONFIG**. The display shows the first item in the Configuration menu.

NOTE:

- The standard factory default configuration is not used if model code option -C2 was specified for the order. Option -C2 is a custom factory configuration to user specifications.
- You can configure most parameters using the local display. For more complete configuration capability, use a HART communicator or PC-based configurator.
- During configuration, a single change could affect several parameters. For this reason, if you make a mistake, review the entire database. Or, use the **CANCEL** feature to restore the transmitter to its starting configuration and begin again.

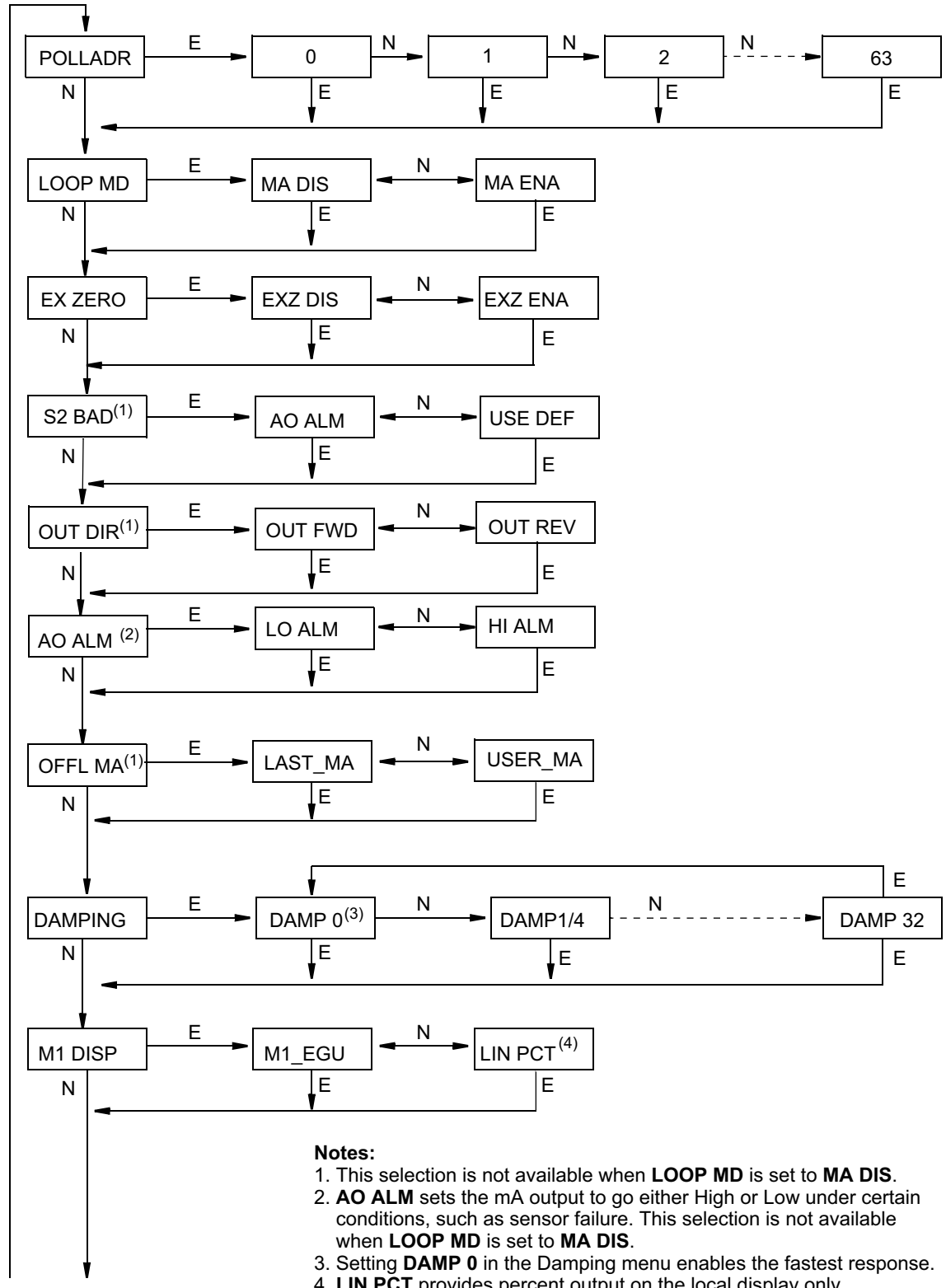
Proceed to configure your transmitter by using the **NEXT** and **ENTER** buttons to make your selections. Refer to the menu structure diagrams and accompanying table for guidance.

At any time during the configuration, you can **CANCEL** your changes and return to online mode, or **SAVE** your new configuration.

NOTE: During configuration, the transmitter is in offline mode, and output is set to offline mA.

Configuration Menu Structure — AP and GP Transmitters

Figure 42 - Configuration Menu Structure, AP and GP Transmitters (1 of 3)

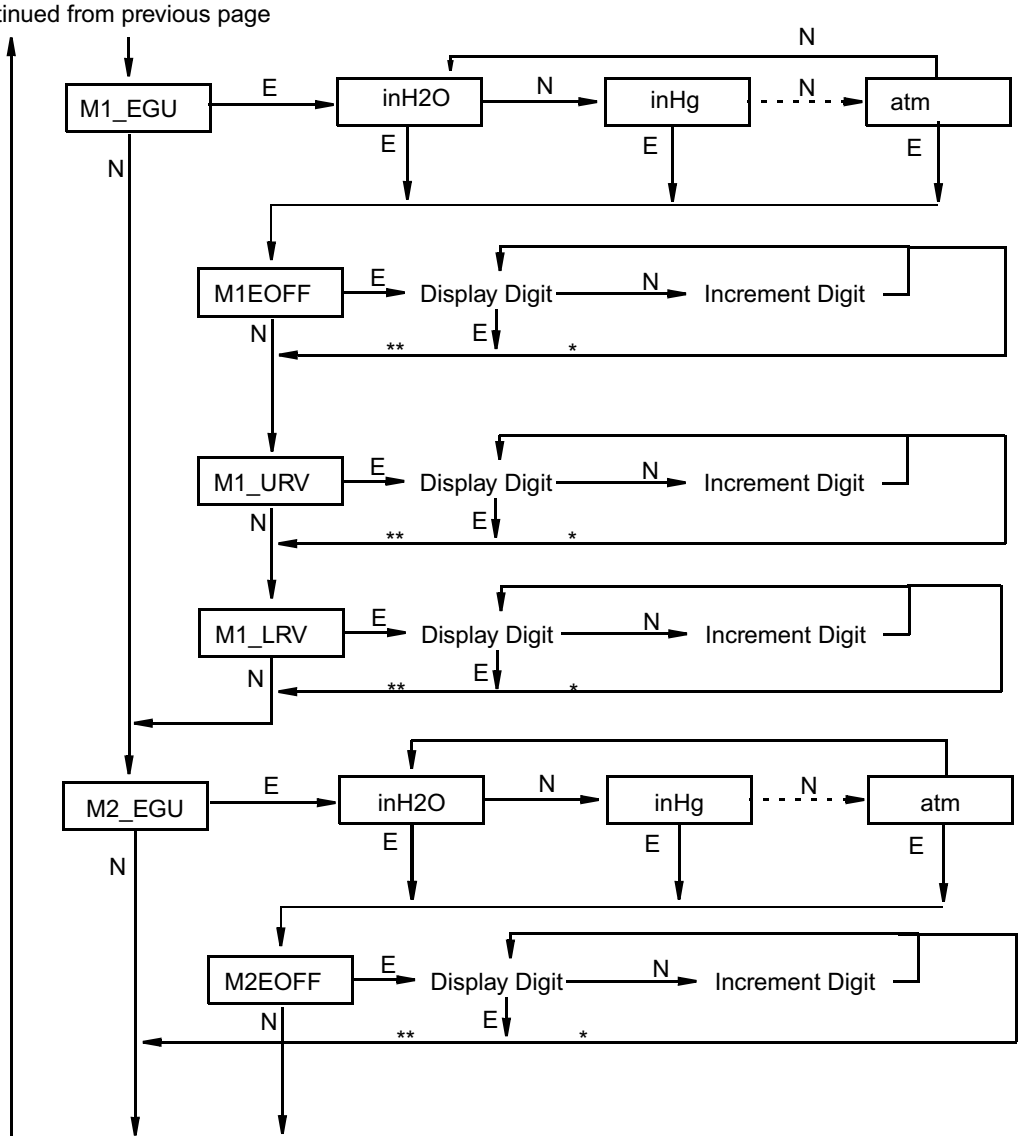


Notes:
1. This selection is not available when **LOOP MD** is set to **MA DIS**.
2. **AO ALM** sets the mA output to go either High or Low under certain conditions, such as sensor failure. This selection is not available when **LOOP MD** is set to **MA DIS**.
3. Setting **DAMP 0** in the Damping menu enables the fastest response.
4. **LIN PCT** provides percent output on the local display only.

Continued on next page

Figure 43 - Configuration Menu Structure, AP and GP Transmitters (2 of 3)

Continued from previous page



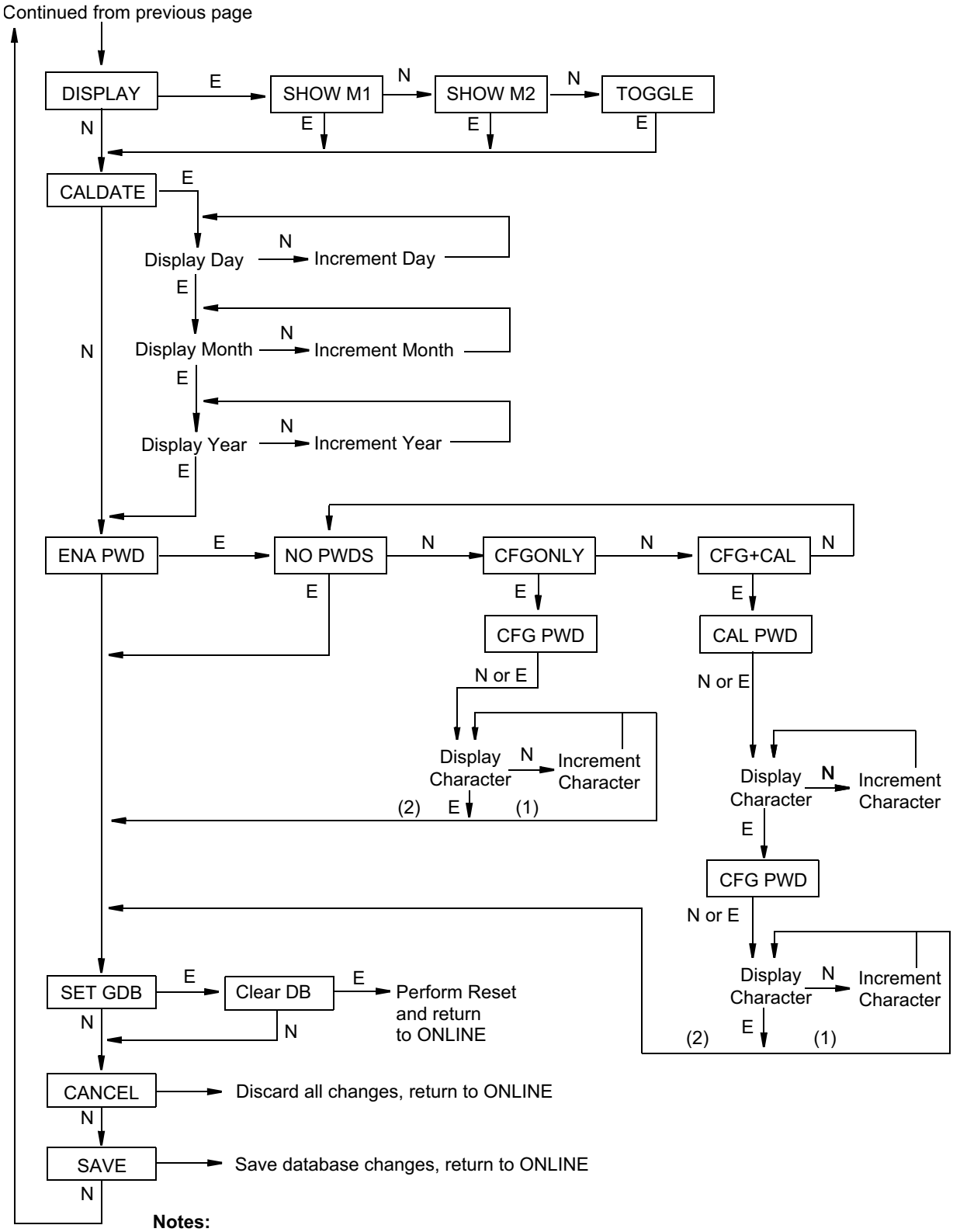
Continued on next page

Notes:

* If character is not the last position on the display line, advances to the next character.

** If character is the last position on the display line, advances to the next menu item.

Figure 44 - Configuration Menu Structure, AP and GP Transmitters (3 of 3)

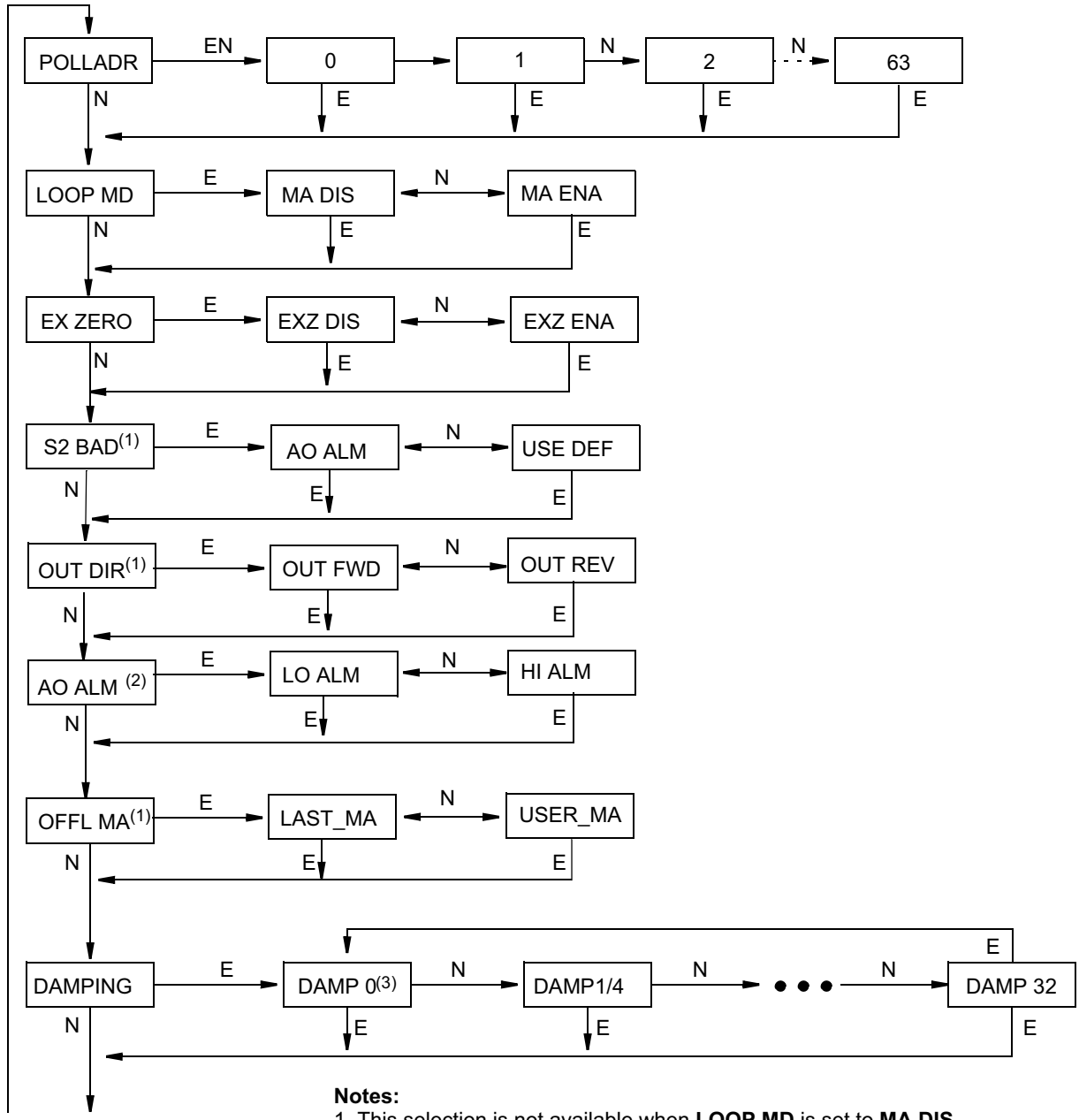


Notes:

1. If character is not the last position on the display line, advances to the next character.
2. If character is the last position on the display line, advances to the next menu item.

Configuration Menu Structure — DP Transmitters

Figure 45 - Configuration Menu Structure, DP Transmitters (1 of 4)

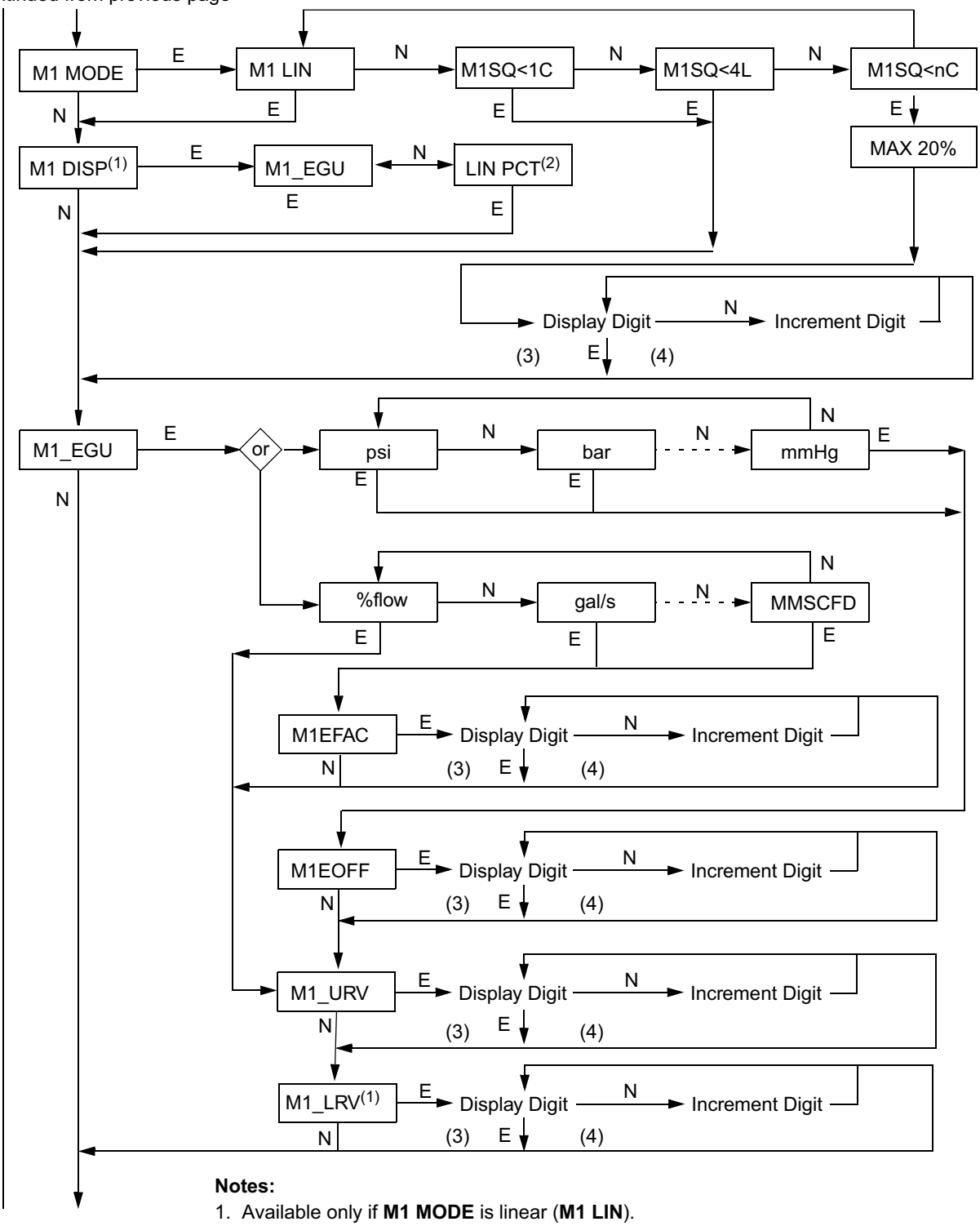


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Notes:
1. This selection is not available when **LOOP MD** is set to **MA DIS**.
2. **AO ALM** sets the mA output to go either High or Low under certain conditions, such as sensor failure. This selection is not available when **LOOP MD** is set to **MA DIS**.
3. Setting **DAMP 0** in the damping menu enables the fastest response.

Figure 46 - Configuration Menu Structure, DP Transmitters (2 of 4)

Continued from previous page



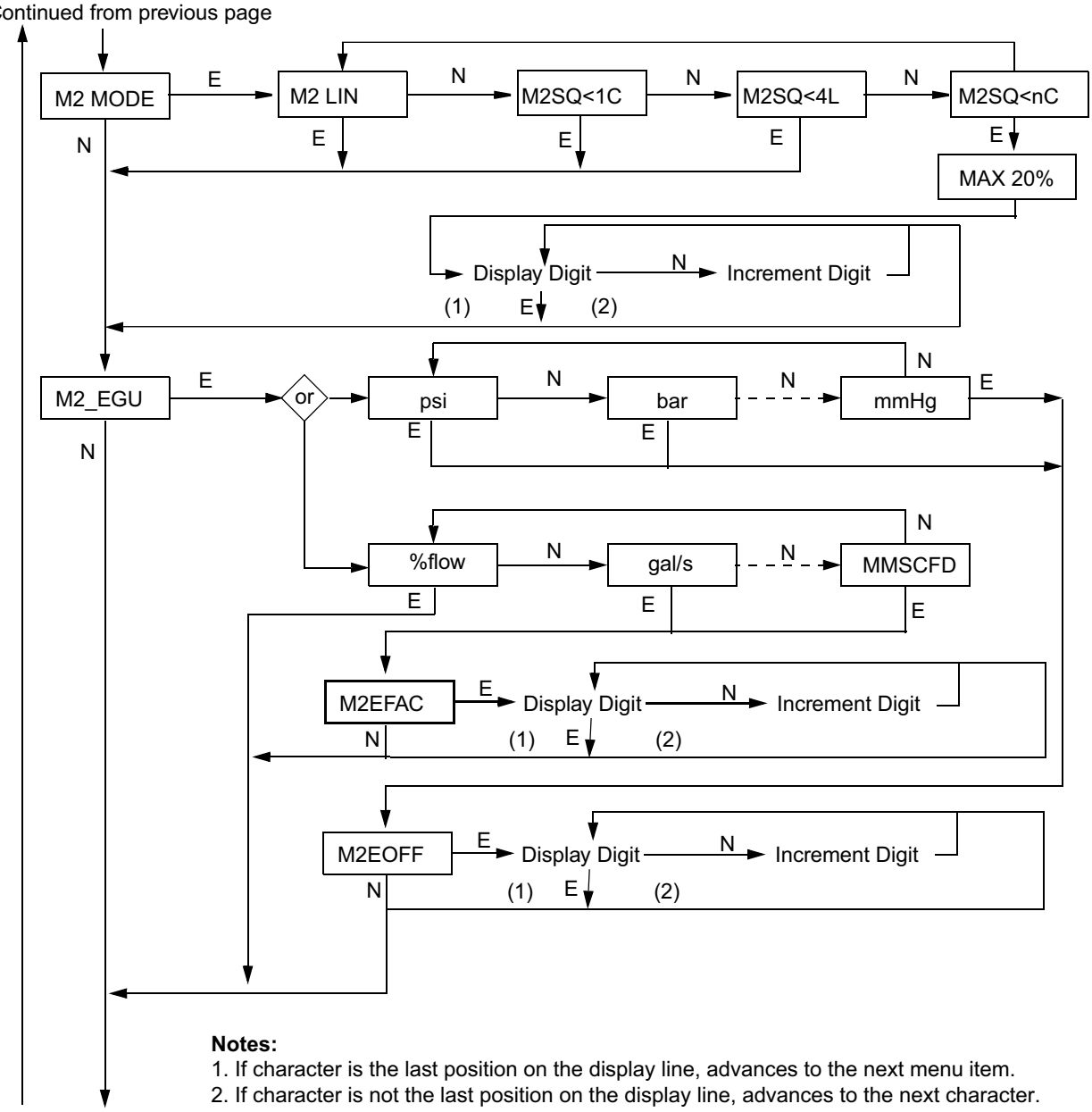
Notes:

1. Available only if **M1 MODE** is linear (**M1 LIN**).
2. **LIN PCT** provides percent output on local display only (linear mode).
   Percent flow in square root is selectable under **M1_EGU**.
3. If character is the last position on the display line, advances to the next menu item.
4. If character is not the last position on the display line, advances to the next character.

Continued on next page

Figure 47 - Configuration Menu Structure, DP Transmitters (3 of 4)

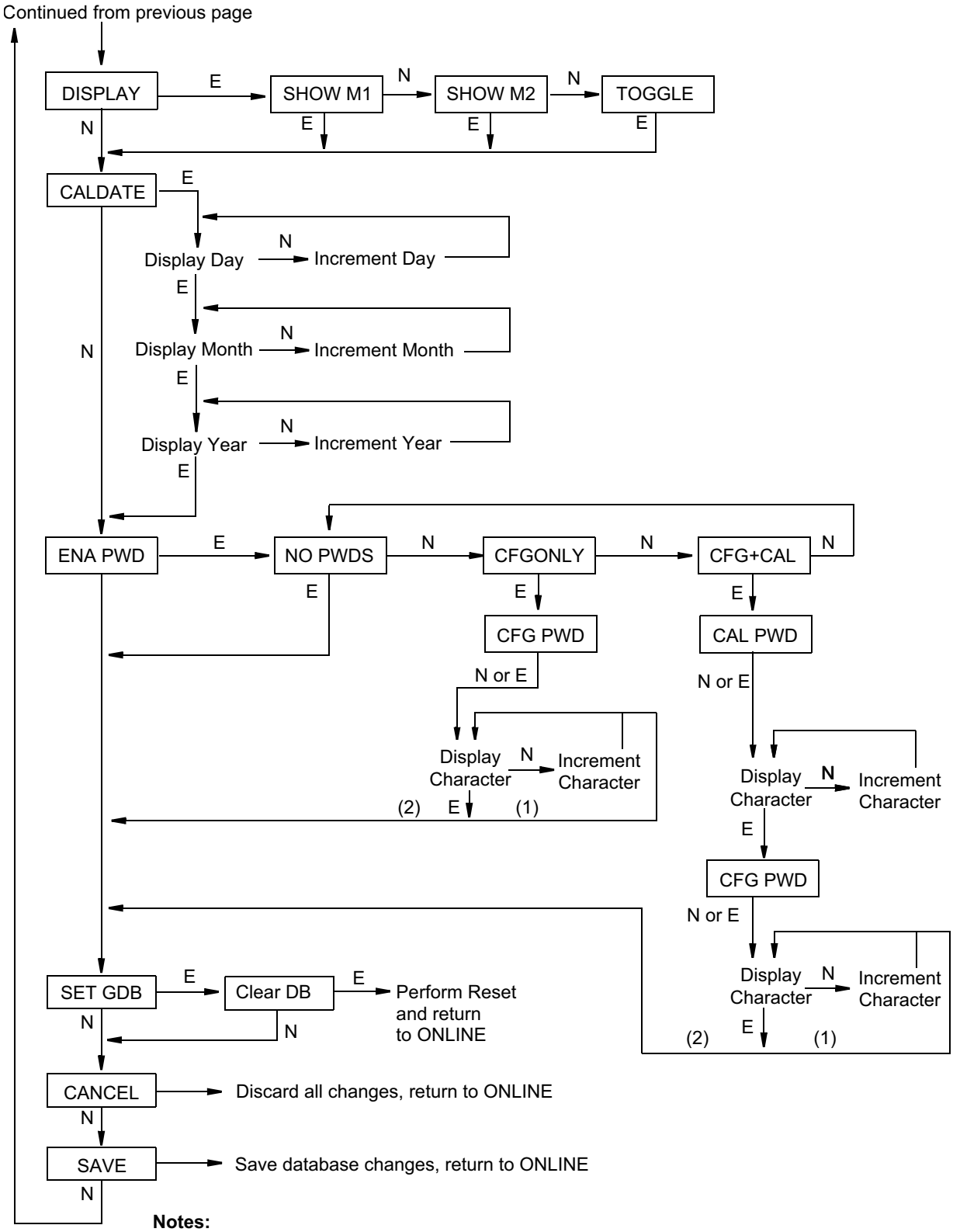
Continued from previous page



Notes:
1. If character is the last position on the display line, advances to the next menu item.
2. If character is not the last position on the display line, advances to the next character.

Continued on next page

Figure 48 - Configuration Menu Structure, DP Transmitters (4 of 4)



Notes:

1. If character is not the last position on the display line, advances to the next character.
2. If character is the last position on the display line, advances to the next menu item.

Configuration Menu Items

In general, use the **NEXT** button to advance to the next item, and the **ENTER** button to select the current item.

Table 12 - Configuration Menu Items

Item	Description	Default
POLLADR	The transmitter poll address can be set to a value of 0 through 63. To configure the transmitter poll address, press **ENTER** at the **POLLADR** prompt. Use the **NEXT** button to select an address between 0 and 63, then press **ENTER**.	0
LOOP MD	mA Loop Current Mode can be set to Enabled (active 4 to 20 mA), or Disabled (fixed value of 4.0 mA). To configure mA Loop Mode, navigate to the **LOOP MD** menu selection and press **ENTER**. Use the **NEXT** button to select **MA DIS** to disable mA Loop Mode, or **MA ENA** to enable mA Loop Mode. By default, the **LOOP MD** parameter is set to enabled (**MA ENA**), which allows the transmitter to operate with a 4 to 20 mA output signal. To lock the transmitter's milliamp output at a fixed value of 4.0 mA, set **LOOP MD** to disabled (**MA DIS**). When loop mode is disabled, the **AO ALM**, **OUT DIR**, **OFFL MA**, and mA adjustment selections will not be available from the menu structure after you save the configuration.	Enabled (Active 4 to 20 mA)
EX ZERO(36)	The External Zero feature allows you to enable or disable the optional external zero pushbutton. Navigate to the **EX ZERO** menu selection and press **ENTER**. Use the **NEXT** button to select **EXZ DIS** (disable) or **EXZ ENA** (enable), and press **ENTER**.	Disabled
S2 BAD	The temperature sensor compensates for changes in temperature in the transmitter electronics. A bad sensor can cause a 4 to 20 mA accuracy change of up to 0.25%. The **S2 BAD** feature allows you to specify action (or no action) if such a condition occurs. To configure this feature, navigate to the **S2 BAD** menu selection and press **ENTER**. Use the **NEXT** button to select **AO ALM** if you want the output go to the value configured in **AO ALM**, or select **USE DEF** to continue operation with a potentially bad temperature sensor. This menu option is not available when the milliamp output is fixed at 4.0 mA (that is, when **LOOP MD** is set to **MA DIS**), and is bypassed if either **M1 MODE** or **M2 MODE** is configured as square root.	**USE DEF**(37)
OUT DIR	The 4 to 20 mA output direction can be set to forward or reverse. To configure the output direction, navigate to the **OUT DIR** menu selection and press **ENTER**. Use the **NEXT** button to select **OUT FWD** (4 to 20 mA) or **OUT REV** (20 to 4 mA), and press **ENTER**. This option is not available when the current output is fixed at 4.0 mA (that is, when **LOOP MD** is set to **MA DIS**).	Forward
AO ALM	The 4 to 20 mA alarm mode can be configured so that the transmitter's output will be set to either the high value or low value under specific conditions. Navigate to the **AO ALM** menu selection and press **ENTER**. Use the **NEXT** button to select **LO ALM** or **HI ALM** and press **ENTER**. This option is not available when the current output is fixed at 4.0 mA (that is, when **LOOP MD** is set to **MA DIS**).	**HI ALM**

(36) For transmitters that have the External Zero option.
(37) Select **AO ALM** for additional SIL diagnostics.

Table 12 - Configuration Menu Items (Continued)

Item	Description	Default
OFFL MA	This parameter allows you to configure the 4 to 20 mA output in offline mode. **OFFL MA** can be configured so that the transmitter's output will be set to either the last output value or to a user-specified value if the transmitter goes offline. To configure the offline output, press **ENTER** at the prompt **OFFL MA**. • To use the last good output value, press **NEXT** to select **LAST MA**, then press **ENTER**. • To specify a different value, navigate to **USER MA** by pressing **NEXT**, then press **ENTER**. Enter the desired value (see Entering Strings and Numeric Values, page 53), then press **ENTER**. The display advances to the next menu item. This menu option is not available when the milliamp output is fixed at 4.0 mA (that is, when **LOOP MD** is set to **MA DIS**).	**USER MA**
DAMPING	Damping can be set to 0, 0.25, 0.5, 1, 2, 4, 8, 16, or 32 seconds. To configure damping, navigate to the **DAMPING** menu selection and press **ENTER**. Use the **NEXT** button to select the desired damping value, then press **ENTER**. **NOTE:** Selecting a value of **DAMP 0** provides the fastest response.	**DAMP1/4**
M1 MODE	For DP transmitters, the mode of the primary output can be set to linear or a type of square root. To configure the mode of the primary output, press **ENTER** at the prompt **M1 MODE**, then use the **NEXT** button to select one of the following: • **M1 LIN**: Linear (pressure units) • **M1SQ<1C**: Square root flow calculation with cutoff below 1% of calibrated *pressure* range • **M1SQ<4L**: Square root flow calculation with linear extrapolation below 4% of calibrated *pressure* range • **M1SQ<nC**: Square root flow calculation with a user-configured cutoff specified between 0 and 20% of the *flow* upper range value, **M1EFAC**	Linear
M1 DISP	If the primary output is in linear mode, this parameter allows you to configure the display to show engineering units or percent of span. (If the primary output is a square root flow calculation, **M1 DISP** is not available.) To configure the display to show engineering units or percent, navigate to the **M1 DISP** menu selection and press **ENTER**. Use the **NEXT** button to select **M1_EGU** or **LIN PCT** and press **ENTER**.	Engineering units
M1_EGU	This parameter allows you to set the engineering units for the primary measurement. • If **M1 MODE** is set to **M1 LIN**: 1. Select one of the following pressure engineering units for your display and transmission: 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 2. The transmitter then adjusts **M1EFAC** (engineering factor), **M1_URV** (upper range value), **M1_LRV** (lower range value), and defaults the **M1EOFF** parameter to zero. • For DP transmitters only, when **M1 MODE** is set to any of the square root settings (**M1SQ<1C**, **M1SQ<4L**, or **M1SQ<nC**): 1. Select one of the following flow engineering units for your display and transmission: 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. 2. Check the **M1EFAC** (M1 engineering factor) and adjust it if necessary.	inH_2O or psi
M1EOFF	This parameter allows you to configure an offset value to apply to the primary measurement. You can introduce an offset by entering a nonzero value for **M1EOFF**. The offset affects the value of the M1 that is transmitted in engineering units, transmitted as an analog mA signal, and shown on the display. This feature can be used in applications such as an elevated water storage tank where the transmitter is at grade level but the output corresponds to the level of the tank. An offset value can also be used for a grade level water storage tank where the transmitter is installed above the bottom of the tank where the output should correspond to the level in the tank.	0

Table 12 - Configuration Menu Items (Continued)

Item	Description	Default
M1EFAC	For DP transmitters, the **M1EFAC** parameter is the numerical relationship between the measured span in pressure units vs. the displayed (and transmitted) span in flow units. It is the displayed URV in flow units (which is also the span in flow units, since flow ranges must be zero-based). For example, for a 200 inH_2O transmitter with a measured range of 0 to 100 inH_2O and displayed range of 0 to 500 gal/m, set **M1EFAC** to 500. **NOTE:** Actual flow rates in the process are dependent upon your specific installation (pipe diameter, for example). Be sure to use values for **M1EFAC** and **M2EFAC** that correspond to your installation and process conditions. To edit the span in your configured flow units, navigate to the **M1EFAC** menu selection and press **ENTER**. (See Entering Strings and Numeric Values, page 53.)	n/a
M1_URV	This parameter allows you to configure the upper range value of the primary measurement. To edit the upper range value of the primary measurement, navigate to the **M1_URV** menu selection and press **ENTER**. Define your URV. (See Entering Strings and Numeric Values, page 53.)	URL
M1_LRV	This parameter allows you to configure the lower range value of the primary measurement. To edit the lower range value of the primary measurement, navigate to the **M1_LRV** menu selection and press **ENTER**. Define your LRV. (See Entering Strings and Numeric Values, page 53.)	0
M2 MODE	M2 is a secondary measurement that is read by the HART communicator and can be shown on the display. You might use this feature to display M1 in your primary pressure units, and M2 in a different set of pressure units. For AP and GP transmitters, the secondary output is in linear mode, which corresponds to pressure units. For DP transmitters, M2 can also be configured to a square root mode, which corresponds to flow units. To configure the mode of the secondary output, press **ENTER** at the **M2 MODE** prompt, and then use the **NEXT** button to select one of the following: • **M2 LIN**: Linear (pressure units) • **M2SQ<1C**: Square root flow calculation with cutoff below 1% of calibrated differential *pressure* range • **M2SQ<4L**: Square root flow calculation with linear extrapolation below 4% of calibrated differential *pressure* range • **M2SQ<nC**: Square root flow calculation with a user-configured cutoff specified between 0 and 20% of the *flow* upper range value, **M2EFAC**	Linear
M2_EGU	This parameter allows you to set the engineering units for the secondary measurement. • When **M2 MODE** is set to **M2 LIN**: 1. Select one of the following pressure engineering units for your display and transmission: 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. 2. The transmitter then automatically adjusts **M2EFAC** (engineering factor), **M2_URV** (upper range value), **M2_LRV** (lower range value), and defaults the **M2EOFF** parameter to zero. • For DP transmitters only, when **M2 MODE** is set to any of the square root settings (**M2SQ<1C**, **M2SQ<4L**, or **M2SQ<nC**): 1. Select one of the following flow engineering units for your display and transmission: gal/s, gal/m, gal/h, gal/d, Mgal/d, ft3/s, ft3/m, ft3/h, ft3/d, Igal/s, Igal/m, Igal/h, Igal/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. 2. Check the **M2EFAC** (M2 engineering factor) and adjust it if necessary.	Same as **M1_EGU**

Table 12 - Configuration Menu Items (Continued)

Item	Description	Default
M2EFAC	For DP transmitters, the **M2EFAC** parameter is the numerical relationship between the measured span in pressure units and the displayed (and transmitted) span in flow units. It is the displayed URV in flow units (which is also the span in flow units, since flow ranges must be zero-based). For example, for a 200 inH_2O transmitter with a measured range of 0 to 100 inH_2O and displayed range of 0 to 500 gal/m, set **M2EFAC** to 500. **NOTE:** Actual flow rates in the process are dependent upon your specific installation (pipe diameter, for example). Be sure to use values for **M1EFAC** and **M2EFAC** that correspond to your installation and process conditions. To edit the span in your configured flow units, navigate to the **M2EFAC** menu selection and press **ENTER**. (See Entering Strings and Numeric Values, page 53.)	n/a
M2EOFF	This parameter allows you to configure an offset value to apply to the secondary measurement. You can introduce an offset by entering a nonzero value for **M2EOFF**. The offset affects the value of the M2 that is transmitted in engineering units, transmitted as an analog mA signal, and displayed. This feature can be used in applications such as an elevated water storage tank where the transmitter is at grade level but the output corresponds to the level of the tank. An offset value can also be used for a grade level water storage tank where the transmitter is installed above the bottom of the tank where the output should correspond to the level in the tank.	0
DISPLAY	This parameter allows you to configure whether the display shows M1, M2, or toggles between M1 and M2. To configure the display value, navigate to the **DISPLAY** menu selection and press **ENTER**. Use the **NEXT** button to select **SHOW M1**, **SHOW M2**, or **TOGGLE** and press **ENTER**.	M1
ENA PWD	This parameter allows you to enable or disable password(s). By default, passwords are disabled. **NOTE: CAL PWD** allows access to calibration mode only; **CFG PWD** allows access to both configuration and calibration. To set a password for configuration only, or for both configuration and calibration: 1. Navigate to **ENA PWD** and press **ENTER**. 2. Navigate to **CFGONLY** or **CFG+CAL** and press **ENTER**. • If you selected **CFG+CAL**, the **CAL PWD**prompt appears. • If you selected **CFGONLY**, the **CFG PWD** prompt appears. 3. Use the **NEXT** button to step through the library of characters to select the desired first character, then press **ENTER**. Your selection is entered, and the second character flashes. Repeat this procedure until you have created your password. • If the password has fewer than six characters, use blanks for the remaining positions. 4. When you have configured the sixth position, the display advances to the next menu item. 5. Record your new password before saving changes to the database. To disable passwords: 1. Navigate to the **ENA PWD** menu selection and press **ENTER**. 2. Navigate to the **NO PWDS** menu selection and press **ENTER**. • If a configuration password was previously set, you are prompted to enter it.	**NO PWD**
CFG PWD	User-set configuration password (six characters).	None
CAL PWD	User-set calibration password (six characters).	None
SET GDB	**SET GDB** allows you to rewrite calibration values (slope and offset) with default values. It resets M1 and M2 units to psi. If your transmitter database becomes corrupted and you receive an **INITBAD** message upon startup, this function enables you to rewrite the calibration values with default values. **NOTE:** Any user calibration values you have entered will be lost. Therefore, do not select **SET GDB** if your transmitter is functioning normally.	n/a

Messages

The following configuration-related messages may appear on the optional display.

Parameter	Condition Tested	Message	Description
Password Protection	Password	**BAD PWD**	Bad password entered; use another.
Write Protection	Write Protection Enabled	**REJECT**	User attempted an action that is write-protected.
M1 MODE(38)	**M1_LRV**≠0	**LRVnot0**	Square root mode with nonzero LRV is not valid. Change **M1_LRV** to 0.
	M1_URV<0	**URV<LRV**	Square root mode with negative URV is not valid. Change **M1_URV** to a positive value.
	OUT DIR is OUT REV	**URV<LRV**	Square root mode with URV less than LRV is not valid. Change **M1_LRV** to 0 and **M1_URV** to a positive value.
	M1EFAC<0 or M2EFAC<0	**-M1EFAC** **-M2EFAC**	**M1EFAC** and **M2EFAC** cannot be negative. Change to a positive value.
	M1EFAC=0 or M2EFAC=0	**0M1EFAC** **0M2EFAC**	**M1EFAC** and **M2EFAC** cannot be zero. Change to a positive value.
	M1EOFF≠0 or M2EOFF≠0	**BADEOFF**	Square root mode with nonzero **M1EOFF** and **M2EOFF** is not valid. Change **M1EOFF** and **M2EOFF** to 0.
M1EFAC(38)	M1EFAC<0	**-M1EFAC**	Negative **M1EFAC** is not valid. Change **M1EFAC** to a positive value.
	M1EFAC=0	**0M1EFAC**	**M1EFAC**=0 is not valid. Change **M1EFAC** to a positive value.
M1_URV	M1_URV>max pressure in EGU	**URV>FMX**	Entered pressure is greater than maximum rated pressure of transmitter. Check entry. Verify EGUs.
	M1_URV<min pressure in EGU	**URV<FMN**	Entered pressure is less than the minimum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_URV=M1_LRV	**LRV=URV**	Cannot set span to 0. Check entry. Check **M1_LRV**.
	M1 turndown exceeds limit	**BADTDWN**	Check entry. Check **M1_LRV**.
	URV<0 with M1 or M2 SqRt	**URV<LRV**(38)	Square root mode with nonzero LRV is not valid. Change **M1_LRV** to 0.
M1_LRV	M1_LRV>max pressure in EGU	**LRV>FMX**	Entered pressure is greater than the maximum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_LRV<min pressure in EGU	**LRV<FMN**	Entered pressure is less than the minimum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_URV=M1_LRV	**LRV=URV**	Cannot set span to 0. Check entry. Check **M1_URV**.
	M1 turndown exceeds limit	**BADTDWN**	Check entry. Check **M1_URV**.
M2 MODE(38) (being changed to square root)	M1_LRV≠0	**LRVnot0**	Square root mode with nonzero LRV is not valid. Change **M1_LRV** to 0.
	M1_URV<0	**URV<LRV**	Square root mode with negative URV is not valid. Change **M1_URV** to a positive value.
	OUT DIR is OUT REV	**URV<LRV**	Square root mode with URV less than LRV is not valid. Change **M1_LRV** to 0 and **M1_URV** to a positive value.
	M1EFAC<0 or M2EFAC<0	**-M1EFAC** **-M2EFAC**	**M1EFAC** and **M2EFAC** cannot be negative. Change to a positive value.
	M1EFAC=0 or M2EFAC=0	**0M1EFAC** **0M2EFAC**	**M1EFAC** and **M2EFAC** cannot be zero. Change to a positive value.
	M1EOFF≠0 or M2EOFF≠0	**BADEOFF**	Square root mode with nonzero **M1EOFF** and **M2EOFF** is not valid. Change **M1EOFF** and **M2EOFF** to 0.

(38) DP transmitters only.

Parameter	Condition Tested	Message	Description
M2EFAC(39)	M2EFAC<0	**-M2EFAC**	Negative **M2EFAC** is not valid. Change **M2EFAC** to a positive value.
	M2EFAC=0	**0M2EFAC**	**M2EFAC**=0 is not valid. Change **M2EFAC** to a positive value.

Configuration Using a PC50

To configure the transmitter using a PC50 Configurator, follow the procedures in MI 020-501 and MI 020-520.

Configuration Using a HART Communicator

To configure the transmitter using a HART communicator, follow the procedures in Using the HART Communicator, page 91.

(39) DP transmitters only.

Calibration

You can calibrate the transmitter by accessing the menu system using the **ENTER** and **NEXT** buttons on the optional local display, by using the optional external zero button, or by using a remote configurator.

FoxCal™ Multiple Calibration Technology

% Reading Accuracy

Transmitters in the Advanced (10S) and Premium (50S) performance tiers offer FoxCal™ technology, a patented multiple calibration feature that helps eliminate the need for a traditional single-span calibration at an application-specific pressure range. Transmitters with the FoxCal™ feature enabled use multiple calibrated ranges that are stored in on-board memory. The calibrated ranges are preset in the factory and cover the full pressure range of the transmitter. During operation, a real-time, seamless transition from one factory-calibrated range to another maintains digital accuracy as a percent of reading from 100% to as low as 4% of the upper range limit (URL).

% Rerange Span Accuracy

The FoxCal™ feature also supports rerange accuracy. Factory calibration and field calibration for specific applications are not required for zero-based ranges up to 30:1 turndown. Simply configure or rerange the URV without performing a recalibration at the URV. You will only need to perform a zero adjustment after installation to obtain performance to the specified reference accuracy.

Refer to Span and Range Limits, page 14.

Enabling and Disabling FoxCal™

The transmitter can be shipped with or without the FoxCal™ feature enabled. If you select the -C1 option in the model code, FoxCal™ is not enabled, and the transmitter is factory calibrated over the specified range. If you do not select the -C1 option in the model code, FoxCal™ is enabled.

The FoxCal™ calibration feature can be enabled or disabled by selecting **FOXCAL** from the **CALIB** menu on the LCD and selecting **FCALON** or **FCALOFF**.

When FoxCal™ is disabled, the last two-point calibration is enabled. As shipped, the last two-point calibration defaults to a calibration from 0 to URL; or, for transmitters ordered with the -C1 option, the two-point Custom Factory Calibration range. If a two-point field calibration is performed later, the last calibration becomes the last field calibration.

If you perform a two-point calibration on a transmitter with FoxCal™ enabled, the new calibration is used, and FoxCal™ is disabled. Re-enable FoxCal™ by selecting **FOXCAL** from the **CALIB** menu and selecting **FCALON**.

NOTICE

POTENTIAL REDUCED PERFORMANCE

When disabling FoxCal™, the last two-point calibrated range may not match the current configuration of the Lower Range Value and Upper Range Value. For optimal performance, avoid large mismatches.

Failure to follow these instructions can result in reduced performance.

One-Point Calibration at LRV

A one-point offset calibration at LRV can be performed with either FoxCal™ or the last two-point calibration enabled.

When a one-point calibration at LRV is performed, the offset adjustment applies to both the last two-point calibration and all the multiple calibrations. The calibrated accuracy at the LRV point is adjusted and maintained for both calibrations, regardless of which selection is enabled at the time of the adjustment. This allows you to enable or disable FoxCal™ without also performing two independent offset adjustments.

Two-Point Field Calibration

The transmitters, including those shipped with the FoxCal™ feature enabled, can be recalibrated to a specific LRV and URV.

NOTE: The calibration at the LRV point applies to transmitters with the FoxCal™ feature enabled as well as transmitters calibrated with a two-point calibration. However, the calibration at the URV point applies only to the two-point calibration. Multiple calibrations stored in the transmitter in the factory do not change when a URV calibration is performed. Instead, as with a custom factory calibration, a field calibration at URV automatically disables the FoxCal™ feature and enables a single two-point calibration.

NOTICE

POTENTIAL REDUCED PERFORMANCE

The accuracy of the input pressure for field span calibration should be a minimum of four times better than the transmitter's reference accuracy specification. An inaccurate span pressure input typically results in degradation of transmitter performance from the factory calibrated state.

Failure to follow these instructions can result in reduced performance.

Calibration Notes

- If you perform a two-point calibration when the FoxCal™ feature is enabled, the new calibration is used and FoxCal™ is disabled.
- For best results in applications where high accuracy is required, rezero the transmitter output once it has stabilized at the final operating temperature.
- Zero shifts resulting from position effects can be eliminated by rezeroing the transmitter output.

- After calibrating, check the underrange and overrange output values to ensure that they extend beyond 4 and 20 mA, respectively.
- (DP transmitters only) When checking the zero reading of a transmitter operating in the square root mode, return the output to the linear mode. This eliminates an apparent instability in the output signal. Return the transmitter output to the square root mode after the zero check is complete.
- The internal digital value of pressure can be shown on the optional local display, converted to a 4 to 20 mA analog output signal, and transmitted digitally.
- The transmitter database has configurable values for both lower range value (LRV) and upper range value (URV). You can display the LRV and URV in pressure units by selecting the **RERANGE** function on the LCD. These values are used for two functions:
  - Defining the calibrated range when using the pushbuttons for calibration:
    - When either **CAL LRV** or **CAL URV** is initiated from the pushbuttons, the transmitter expects that the pressure applied at the time the button is pressed is equal to the LRV or URV value, respectively.
    - This function trims the internal digital value of pressure; that is, it performs a calibration based on the application of accurate pressures equal to the values entered for LRV and URV in the transmitter database.
    - This function also sets the 4 and 20 mA output points; that is, the 4 and 20 mA points that correspond to the values of LRV and URV in the database.
    - The value of LRV can be larger than the value of URV.
  - Reranging without the application of pressure:
    - Since the transmitter continually determines an internal digital value of the measured pressure from the lower range limit (LRL) to the upper range limit (URL), the 4 and 20 mA output points can be assigned to any pressure values within the span and range limits without application of pressure.
    - The reranging function is accomplished by entering new database values for LRV and URV.
    - Reranging does not affect the calibration of the transmitter; that is, it does not affect the optimization of the internal digital value of pressure over the calibrated range.
    - If FoxCal™ is disabled and the reranged LRV and URV are not within the calibrated range, the measured values may not be as accurate as when they are within the calibrated range.
- (DP transmitters only) If the transmitter is in square root mode for flow rate measurement, the URV in the database is displayed as the flow rate URV when the view database (**VIEW DB**) function is used. However, the LRV and URV in pressure units can be displayed by selecting the **RERANGE** function.
- (DP transmitters only) LRV is always zero when the transmitter is configured for square root mode.
- When the local display is used, the internal digital value of pressure is sent directly to the display.
  - The display can show any measured pressure in selected units regardless of the calibrated range and the values of LRV and URV (within the limits of the transmitter and display).
  - If the measured pressure is outside the range established by the LRV and URV values in the database, the display shows the measurement but also continually blinks to indicate that the measurement is out of range. The signal is saturated at either the low or high overrange limit, respectively, but the display continually shows the pressure.

- The internal digital value of pressure is converted to an analog signal.
  - The transmitter sets the output at 4 mA for the LRV and 20 mA for the URV.
  - There is an independent trim on the digital-to-analog conversion stage. This trim allows for slight adjustment of the 4 and 20 mA outputs. This compensates for any small difference between the transmitter output and an external reference device which is measuring the current.
    - The trim does not affect the calibration or the reranging of the transmitter and does not affect the internal digital value of pressure or the transmission or display of measured pressure.
    - The trim can be done with or without pressure applied to the transmitter.
- Zeroing from the local display does not affect the span.

  When the transmitter is zeroed to compensate for installed position effect, the transmitter can have either LRV pressure applied (**CAL LRV**) or zero pressure applied (**CAL AT0**). If the range is zero-based, either method produces the same result. However, if the range is not zero-based, it is advantageous to have both methods available.

  For example, consider a pressure transmitter having a range of 50 to 100 psig. If it is not feasible to vent the transmitter to atmosphere (or bypass the high and low sides) for zeroing, it can be adjusted while the LRV pressure of 50 psi is applied by using the **CAL LRV** function on the LCD.

  On the other hand, if the transmitter has been installed but there is no pressure in the process line yet (or if the high and low sides can be connected by a bypass valve), it can be zeroed while open to atmosphere by using the **CAL AT0** function on the LCD.
  - Zeroing with LRV pressure applied (**CAL LRV**):
    - Before using this zeroing function, apply a pressure to the transmitter equal to the value of LRV stored in the transmitter database.
    - When you zero the transmitter, the internal digital value of the pressure is trimmed to be equal to the value of LRV stored in the database, and the output set to 4 mA.
    - If zeroing is done when the applied pressure is different from the LRV pressure value in the database, the internal digital value of pressure is biased by the difference in the values, but the output is still set at 4 mA.
    - Use the **CAL LRV** and **CAL URV** functions when calibrating a transmitter for a specific range with known input pressures applied for the LRV and URV. FoxCal™ is automatically disabled by the **CAL URV** function.
  - Zeroing a gauge or differential pressure transmitter with zero pressure applied (**CAL AT0**)(40):
    - Make sure that the applied pressure is at zero. This means venting the transmitter to atmosphere, or opening a bypass valve to connect the high and low sides.
    - When you zero the transmitter, the internal digital value of the pressure is trimmed to be equal to zero, and the current output is set to an appropriate value such that the output is a nominal 4 mA when the LRV pressure is applied later.
  - Zeroing an absolute pressure transmitter: Temporarily set the LRV to the barometric pressure, and perform a **CAL LRV** function with the transmitter vented to atmosphere. Then, set the LRV back to the proper value.

(40) The **CAL AT0** function is not applicable with an absolute pressure transmitter. If an absolute pressure transmitter is vented to atmosphere, it does not have zero pressure applied. Instead, it has barometric pressure applied (approximately 14.7 psia at sea level).

Calibration Setup

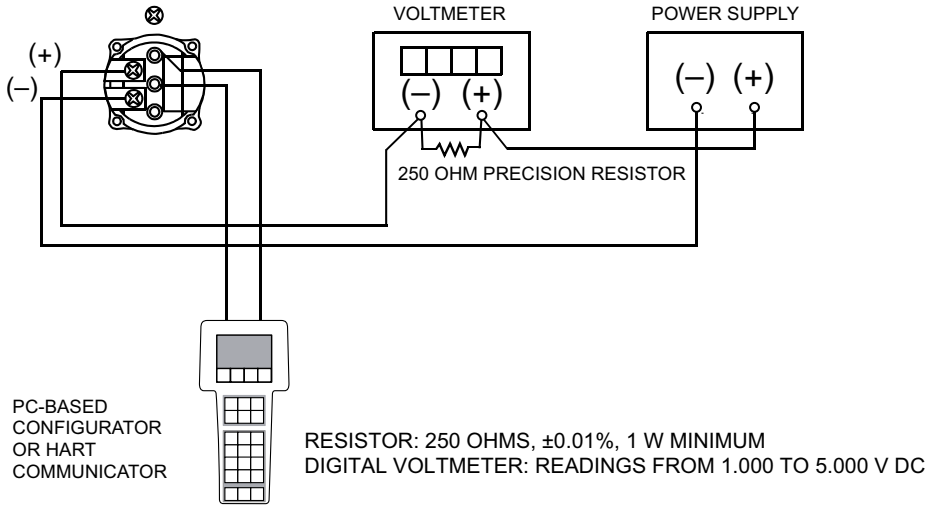
The following sections show setups for field and bench calibration. Use test equipment that is at least four times as accurate as the specified accuracy of the transmitter; otherwise, measurement inaccuracy may be introduced.

NOTICE
POTENTIAL REDUCED PERFORMANCE For both field calibration and bench calibration procedures, using a pressure source that is less accurate than the transmitter's reference accuracy specification typically results in degradation of transmitter performance from the factory calibrated state. The accuracy of the input pressure should be a minimum of four times better than the transmitter's reference accuracy specification. **Failure to follow these instructions can result in reduced performance.**

NOTE: Calibration is not necessary to rerange the transmitter to a different range. You can accurately rerange the transmitter by changing the lower and upper range values, which are stored in the transmitter database.

Electronic Calibration Equipment

Figure 49 - Setup of Electronic Calibration Equipment



Field Calibration Setup

Field calibration is performed without disconnecting the process piping. If the transmitter is to be removed from the process for calibration, see Bench Calibration Setup, page 82.

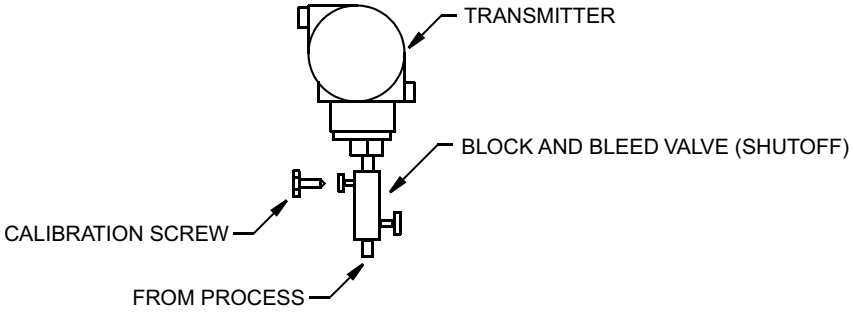
An adjustable air supply and a pressure measuring device are required. For example, a deadweight tester or an adjustable clean air supply and pressure gauge can be used.

Field Calibration — Direct Connect AP and GP Transmitters

Field calibration is possible only if the transmitter is piped as shown in the diagram.

If you are calibrating the output signal, also connect equipment as shown in Electronic Calibration Equipment, page 79.

Figure 50 - Field Calibration Setup for Direct Connect Transmitters



Block and Bleed Valve Maximum Pressure:

- 40 MPa (6000 psi) at 38°C (100°F)
- 25 MPa (4000 psi) at 250°C (400°F)

Calibration Screw Maximum Pressure:

- 0.7 MPa (100 psi) with Poly-Flo Fitting (F0101ES)

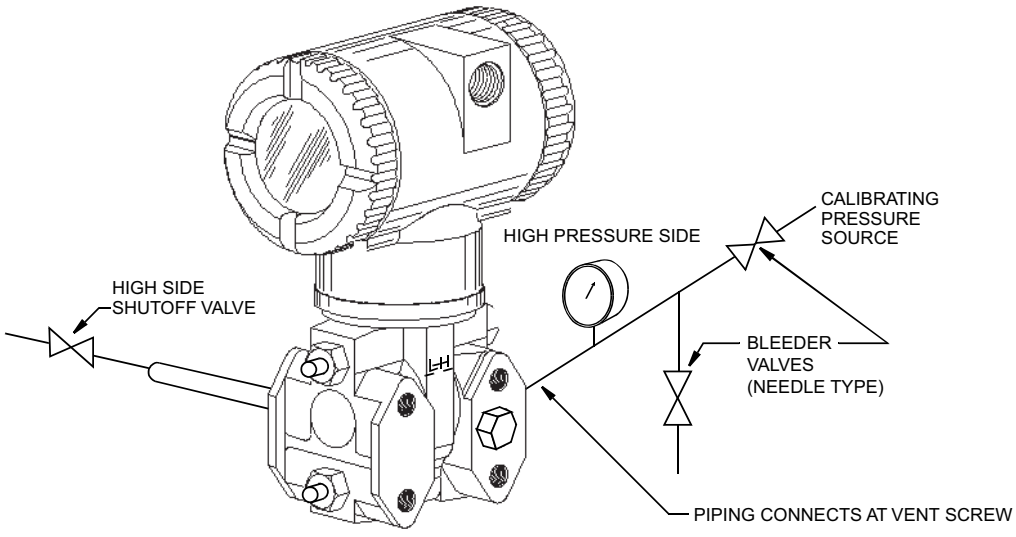
Field Calibration — Biplanar AP and GP Transmitters

Field calibration is possible only if you have a shutoff valve between the process and the transmitter, and the process covers vent screw option (-V1).

The pressure source can be connected to the transmitter with pipe fittings, or it can be connected to the vent screw assembly using a calibration screw. The calibration screw has a PolyFlo fitting and can be used for pressures up to 700kPa (100psi). It is available as Part Number F0101ES.

To set up the equipment, refer to the diagram and the following procedure:

Figure 51 - Field Calibration Setup for Biplanar Transmitters



1. Close the shutoff valve between the process and the transmitter.

2. Take the appropriate step:
   a. If a calibration screw **is** being used, remove the vent screw and replace it with the calibration screw. Connect the pressure source to the calibration screw using 6x1mm or 0.250inch tubing.
   b. If a calibration screw is **not** being used, remove the drain plug or the entire vent screw assembly (as applicable) from the high pressure side of the transmitter. Connect calibration tubing using a suitable thread sealant.
3. If you are calibrating the output signal, also connect equipment as shown in Electronic Calibration Equipment, page 79.

Field Calibration — DP Transmitters

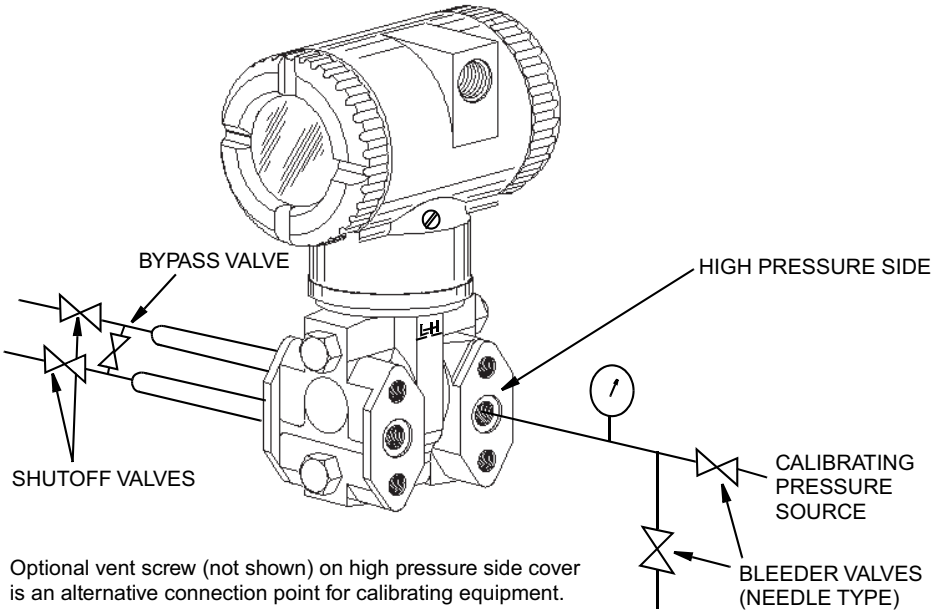
Field calibration is possible only if you have a bypass and shutoff valves between the process and the transmitter, and one of the following:

- Access to the process connections on the nonprocess side of the transmitter
- The optional vent screw in the side of the process covers

The pressure source can be connected to the transmitter with pipe fittings, or it can be connected to the vent screw assembly using a calibration screw. The calibration screw has a PolyFlo fitting and can be used for pressures up to 700 kPa (100 psi). It is available as Part Number F0101ES.

To set up the equipment, refer to the diagram and the following procedure:

Figure 52 - Field Calibration Setup for DP Transmitters



1. If the transmitter is in operation, follow the steps described in Taking a Differential Pressure Transmitter out of Operation, page 50.

NOTICE
POTENTIAL REDUCED PERFORMANCE
With liquid service, drain both sides of the transmitter to avoid calibration errors.
Failure to follow these instructions can result in reduced performance.

2. Take the appropriate step:
   a. If a calibration screw **is** being used, remove the vent screw and replace it with the calibration screw. Connect the pressure source to the calibration screw using 6 x 1 mm or 0.250 inch tubing.
   b. If a calibration screw is **not** being used, remove the drain plug or the entire vent screw assembly (as applicable) from the high pressure side of the transmitter. Connect calibration tubing using a suitable thread sealant.
3. Close the bypass valve that was opened in Step 1.
4. Complete the setup shown in the diagram.

   NOTE: For vacuum applications, connect the calibrating pressure source to the low pressure side of the transmitter.
5. If you are calibrating the output signal, also connect equipment as shown in Electronic Calibration Equipment, page 79.

Bench Calibration Setup

Bench calibration requires disconnecting the process piping. For calibration without disconnecting the process piping, see Field Calibration Setup, page 79.

For DP transmitters and biplanar AP and GP transmitters, connect the input piping to the high pressure side of the transmitter. Vent the low pressure side of the transmitter.

NOTE: For vacuum applications, connect the calibrating pressure source to the low pressure side of the transmitter.

See the following diagrams for the correct setup for each transmitter type. If you are calibrating the output signal, also connect equipment as shown in Electronic Calibration Equipment, page 79.

Figure 53 - Bench Calibration — Direct Connect AP and GP Transmitters

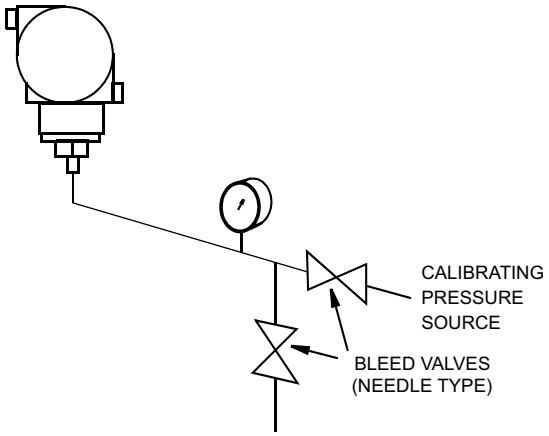


Figure 54 - Bench Calibration — Biplanar AP and GP Transmitters

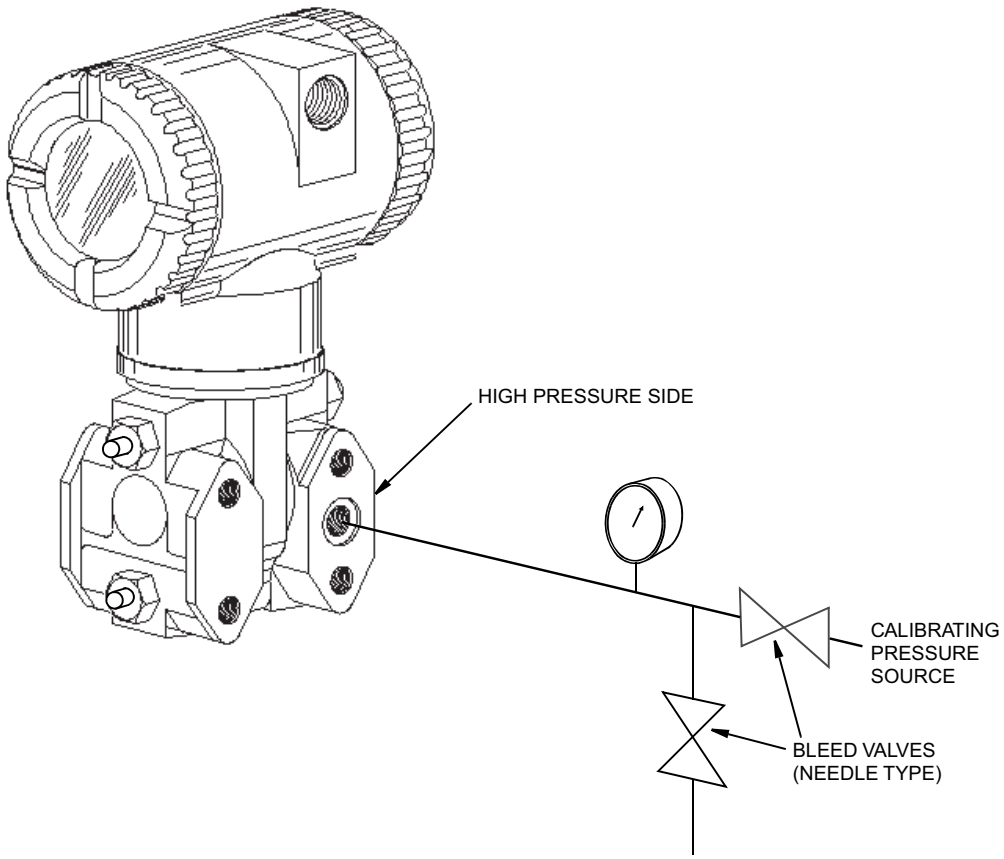
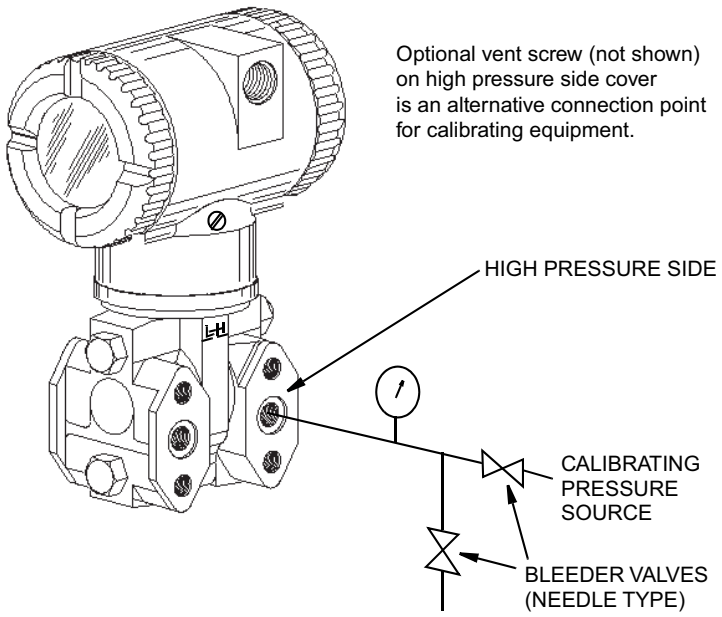


Figure 55 - Bench Calibration — DP Transmitters



Calibration Using the Optional Local Display

From the display, you can:

- Zero the transmitter at zero pressure

- Calibrate the lower range value (LRV or 0% range value)
- Calibrate the upper range value (URV or 100% range value)
- Rerange your transmitter by adjusting the 0% and 100% range values

To access calibration mode from normal operating mode, press the **NEXT** button repeatedly until the display reads **CALIB**. Press the **ENTER** button to select **CALIB**. The display shows the first item in the Calibration menu.

- During calibration, a single change could affect several parameters. For this reason, if you make a mistake, review the entire database. Or, use the **CANCEL** feature to restore the transmitter to its starting configuration and begin again.
- During adjustment of 4 and 20 mA in the Calibration menu, the mA output does not reflect live measurement values.
- If your transmitter is write protected, you cannot write your calibration to the electronics without disabling write protection.

Proceed to calibrate your transmitter by using the **NEXT** and **ENTER** buttons to make your selections. Refer to the menu structure diagrams and accompanying table for guidance.

At any time during the calibration, you can **CANCEL**, restore your prior calibration and return to online mode, or **SAVE** your new calibration.

Figure 56 - Calibration Menu Structure (1 of 2)

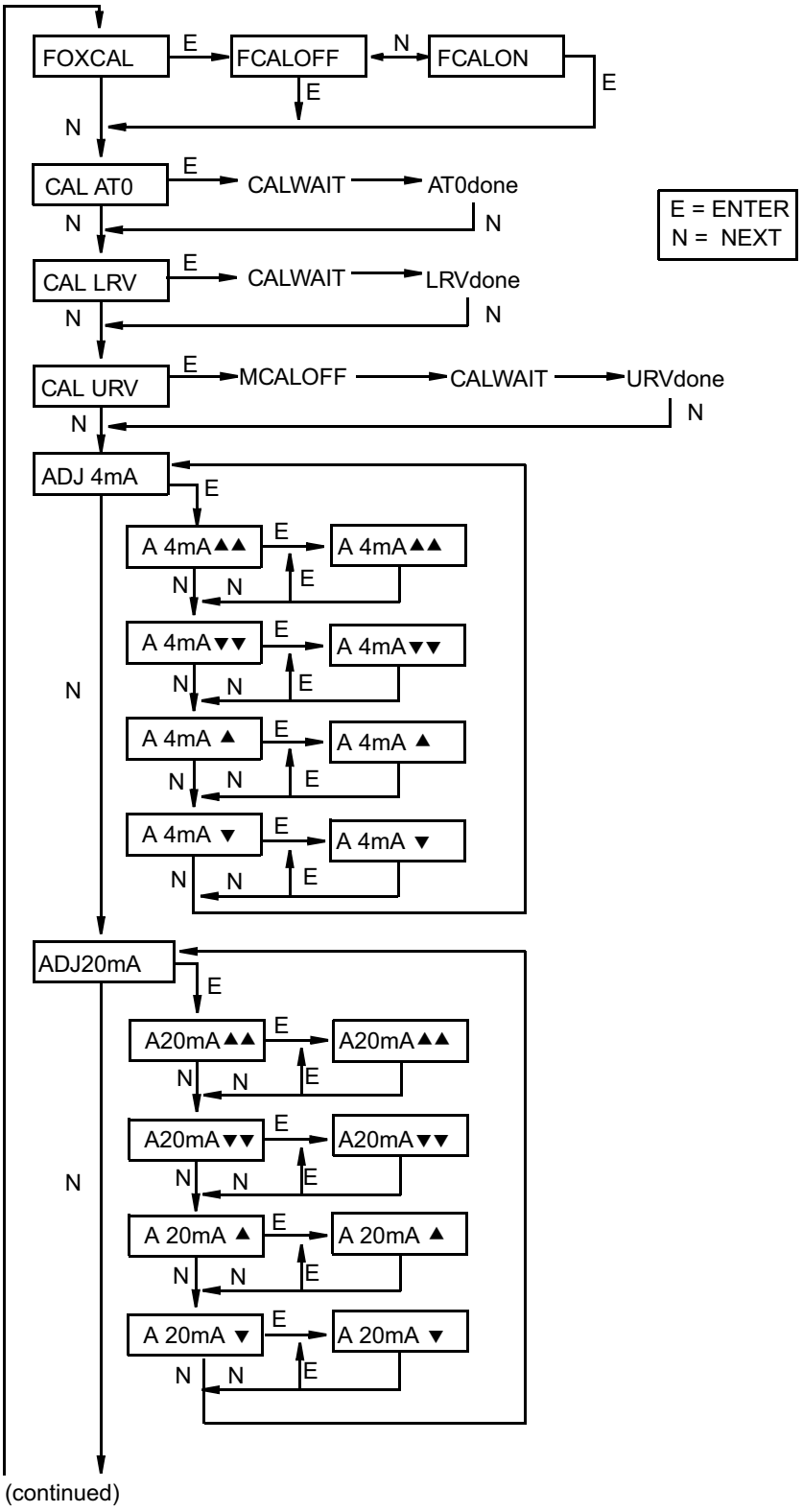


Figure 57 - Calibration Menu Structure (2 of 2)

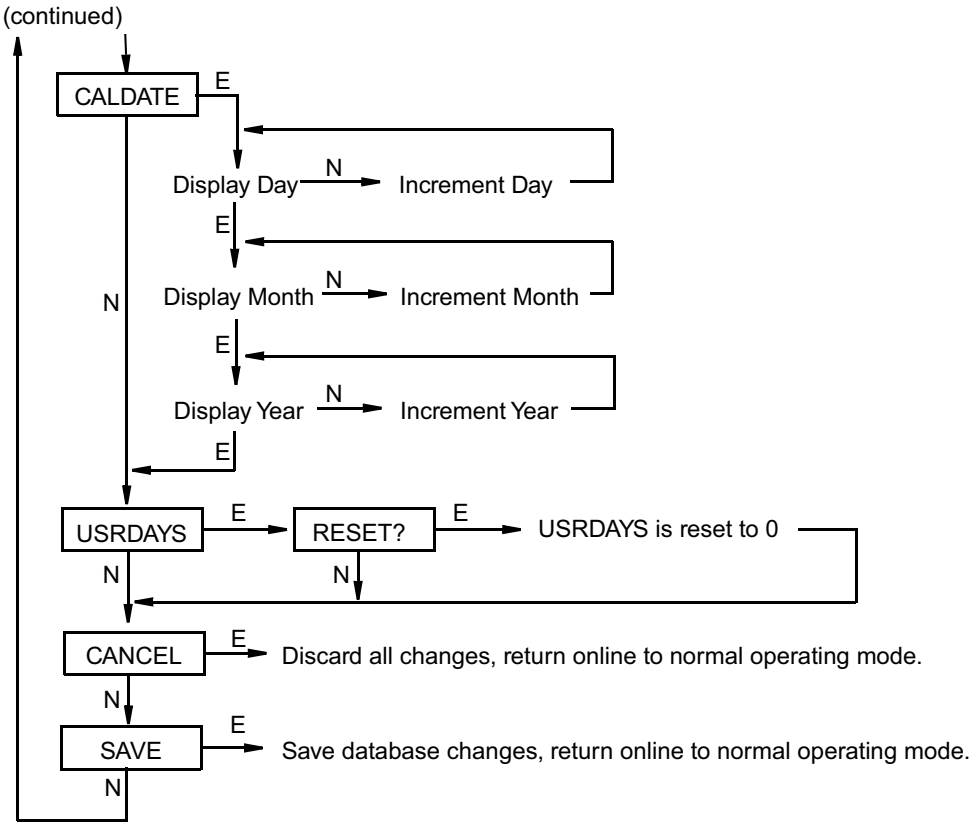


Table 13 - Calibration Menu Items

Item	Description
FOXCAL	This menu option allows you to enable or disable the FoxCal™ multiple calibration feature. To enable FoxCal™ calibrations, select **FOXCAL** from the **CALIB** menu, and then select **FCALON**. Similarly, to disable FoxCal™, select **FCALOFF**.
CAL AT0(41)	This menu option calibrates the transmitter at zero pressure. To set or reset the zero point at zero pressure, apply zero pressure to the transmitter. When **CAL AT0** appears on the display, press **ENTER**. This can be done whether LRV is zero or not. When the process is complete, **Done** appears on the display.
CAL LRV	This menu option calibrates the transmitter at 0% of the transmitter's range (LRV). To set or reset 0% of range input, apply pressure to the transmitter equal to the lower range value (LRV) in the transmitter database. When **CAL LRV** appears on the display, press **ENTER**. **Done** appears on the display when the process is complete.
CAL URV	This menu option calibrates the transmitter at 100% of the transmitter's upper range value (URV). To set or reset 100% of range input, apply pressure to the transmitter equal to the upper range value (URV) in the transmitter database. When **CAL URV** appears on the display, press **ENTER**. **NOTE:** If FoxCal™ was enabled prior to starting the calibration, the **CAL URV** process will disable it and display **FCALOFF**. **Done** appears on the display when the process is complete.

(41) This function is not applicable to absolute pressure transmitters.

Table 13 - Calibration Menu Items (Continued)

Item	Description
ADJ 4mA(42)	This menu option adjusts the nominal 4 mA output. If you configured your transmitter operating mode as 4 to 20 mA, you can adjust the 4 mA output by going to **ADJ 4mA** using the **NEXT** button and pressing **ENTER**. These adjustment menu options are not available when the output is fixed at 4 mA (that is, when **LOOP MD** is set to **MA DIS**).
A 4mA▲▲	Increases 4 mA output by a large (0.095 mA) step.
A 4mA▼▼	Decreases 4 mA output by a large (0.095 mA) step.
A 4mA ▲	Increases 4 mA output by a small (0.003 mA) step.
A 4mA ▼	Decreases 4 mA output by a small (0.003 mA) step.
ADJ20mA(42)	This menu option adjusts the nominal 20 mA output. If you configured your transmitter operating mode as 4 to 20 mA, you can adjust the 20 mA output by going to **ADJ20mA** using the **NEXT** button and pressing **ENTER**. These adjustment menu options are not available when the output is fixed at 4 mA (that is, when **LOOP MD** is set to **MA DIS**).
A20mA▲▲	Increases 20 mA output by a large (0.095 mA) step.
A20mA▼▼	Decreases 20 mA output by a large (0.095 mA) step.
A20mA ▲	Increases 20 mA output by a small (0.003 mA) step.
A20mA ▼	Decreases 20 mA output by a small (0.003 mA) step.
CALDATE	This menu option allows you to enter the calibration date. This entry is not required, but it can be used for record-keeping or plant maintenance purposes. To edit the calibration date, go to **CALDATE** with the **NEXT** button and press **ENTER**. You then can change the day, month, and year. Use the **NEXT** button to step through the menu of digits to select the desired day, then press **ENTER**. Repeat this process for the month and year.
USRDAYS	The Time in Service meter tracks the number of days the pressure transmitter has been in service since the last Time in Service meter reset. For example, you can reset the Time in Service meter to 0 when the transmitter is calibrated. Reset the number of days the transmitter has been in service by navigating to **USRDAYS** with the **NEXT** button.

Messages

The following calibration-related messages may appear on the optional display.

Parameter	Condition Tested	Message	Description
Password Protection	Password	**BAD PWD**	Bad password entered; use another.
Write Protection	Write protection enabled	**REJECT**	User attempted an action that is write protected.
ZERO	Internal offset too large	**BADZERO**	Check applied pressure, configured **M1_LRV**, and configured **M1EOFF**.
SPAN	Slope too large or too small	**BADSPAN**	Check applied pressure, configured **M1_LRV**, and configured **M1EFAC**.

(42) It is not necessary to use the **ADJ 4mA** and **ADJ20mA** menu selections (also known as “trim”) unless there is a plant requirement to make the 4 and 20 mA output values exactly match the readings on certain plant calibration equipment, and the calibration operations result in a small but unacceptable difference between the transmitter’s output values and the test equipment’s readout values.

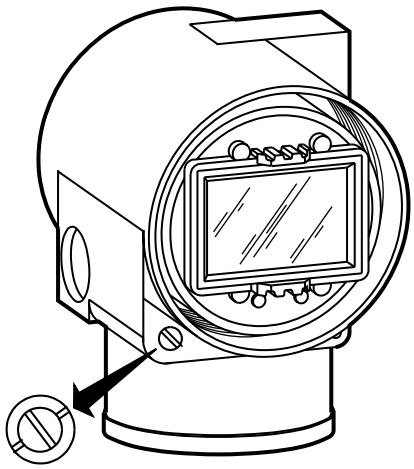
Parameter	Condition Tested	Message	Description
M1_URV	**M1_URV**>max pressure in EGU	**URV>FMX**	Entered pressure is greater than the maximum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_URV<min pressure in EGU	**URV<FMN**	Entered pressure is less than the minimum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_URV=**M1_LRV**	**LRV=URV**	Cannot set span to 0. Check entry. Check **M1_LRV**.
	M1 turndown exceeds limit	**BADTDWN**	Check entry. Check **M1_LRV**.
	URV<0 with **M1 SqRt** or **M2 SqRt**	**URV<LRV** (43)	Square root mode with nonzero LRV is not valid. Change LRV to 0.
M1_LRV	**M1_LRV**>max pressure in EGU	**LRV>FMX**	Entered pressure is greater than the maximum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_LRV<min pressure in EGU	**LRV<FMN**	Entered pressure is less than the minimum rated pressure of the transmitter. Check entry. Verify EGUs.
	M1_LRV=**M1_URV**	**LRV=URV**	Cannot set span to 0. Check entry. Check **M1_URV**.
	M1 turndown exceeds limit	**BADTDWN**	Check entry. Check **M1_URV**.

Using the External Zero Button

Transmitters with HART offer an optional external zero adjustment mechanism in the electronics housing. This mechanism allows calibration at zero pressure (the **CAL AT0** function, for GP and DP transmitters) or at the lower range value pressure (the **CAL LRV** function) without removing the electronics compartment cover. The mechanism is magnetically activated through the housing wall to help prevent moisture from entering the enclosure.

NOTE: Do not use **CAL AT0** if the diaphragm seals are at different elevations than the transmitter.

Figure 58 - Optional External Zero Button



EXTERNAL ZERO BUTTON
LATCHED (NONACTIVATING) POSITION

(43) DP transmitters only.

Zero Adjustment for Transmitters with the Optional Display

1. Unlatch the external zero button by turning it 90 degrees in a counterclockwise direction so that the screwdriver slot lines up with the two holes in the face of the adjacent part. Do not push the button with the screwdriver while doing this.
2. To set or reset using the optional display:
   a. To set or reset the zero point at zero pressure, apply zero pressure to the transmitter or (for DP transmitters) use a bypass valve to equalize pressure on both sides of the transmitter. Press the external zero button until the display reads **CAL AT0**. Release the button. The display reads **CALWAIT**.

      When the display reads **Done**, calibration is complete.

   b. To set or reset the 0% of range input, apply the lower range value (LRV) pressure to the transmitter and press and hold the external zero button until the display reads **CAL LRV** (it reads **CAL AT0** first). Release the button. The display reads **CALWAIT**.

      When the display reads **Done**, calibration is complete.

   c. If additional rezeroing is required, repeat this step.

   Other possible messages are:

   - **DISABLD**, if **EX ZERO** is configured as **EXZ DIS**.
   - **EXZ DIS IGNORED**, if the transmitter is not in the on-line mode.
   - **WP ENAB**, if the write protection jumper is in the write protect position.
   - **BAD PWD**, if you have set a password.
3. Relatch the external zero button by turning it 90 degrees in a clockwise direction to avoid pressing the button accidentally. Do not push the button with the screwdriver while doing this.

Zero Adjustment for Transmitters without the Optional Display

If the optional display is not present, you can accomplish zeroing by pressing the external zero button for different lengths of time. Pressing the button for 1 to 3 seconds allows you to execute a **CAL AT0**; pressing the button for 5 or more seconds allows you to execute a **CAL LRV**.

NOTICE

POTENTIAL MISCONFIGURATION

Use care when using the external zero button without the optional display. You must rely strictly on the length of time you press and hold the external zero button to distinguish between **CAL AT0** and **CAL LRV**.

Failure to follow these instructions can result in misconfiguration.

1. Verify the following:
   - External zero is enabled.
   - The transmitter is online.
   - The write protect jumper is in the WP Disable position.
   - The calibration password (**CAL PWD**) has not been set.
2. Unlatch the external zero button by turning it 90 degrees in a counterclockwise direction so that the screwdriver slot lines up with the two holes in the face of the adjacent part. Do not push the button with the screwdriver while doing this.

3. To set or reset using only the external zero button:
   a. To set or reset the zero point at zero pressure, apply zero pressure to the transmitter or (for DP transmitters) use a bypass valve to equalize pressure on both sides of the transmitter. Press the external zero button for 1 to 3 seconds, then release the button.
   b. To set or reset 0% of range input, apply the lower range value (LRV) pressure to the transmitter. Press and hold the external zero button for at least 5 seconds, then release the button.
   c. If additional rezeroing is required, repeat this step.
4. Relatch the external zero button by turning it 90 degrees in a clockwise direction to avoid pressing the button accidentally. Do not push the button with the screwdriver while doing this.

Calibration Using a PC50

To calibrate the transmitter using a PC50 Configurator, follow the procedures in MI 020-520.

Calibration Using a HART Communicator

To calibrate the transmitter using a HART Communicator, follow the procedures in Using the HART Communicator, page 91.

Using the HART Communicator

You can use a HART Communicator to configure, operate, and calibrate these pressure transmitters.

Connecting the Communicator to the Transmitter

Connect the HART communicator to the transmitter as described in Calibration Setup, page 79. Also refer to the manual supplied with the communicator.

Operation

The value of the primary variable in engineering units (**PV**), the output value of the primary variable in mA (**PV Loop Current**), the primary variable lower range value (**LRV**), and the primary variable upper range value (**URV**) are displayed in the main menu.

Valid Characters for the HART Communicator

Alphanumeric Characters		Numeric Characters
@	'	
, (comma)	(	- (minus sign)
A-Z (uppercase)	)	. (decimal point)
[	*	0
]	+	1
\	- (hyphen)	2
^	. (period)	3
_ (underscore)	/	4
(space)	0-9	5
!	:	6
"	;	7
#	<	8
$	>	9
%	=	
&	?	

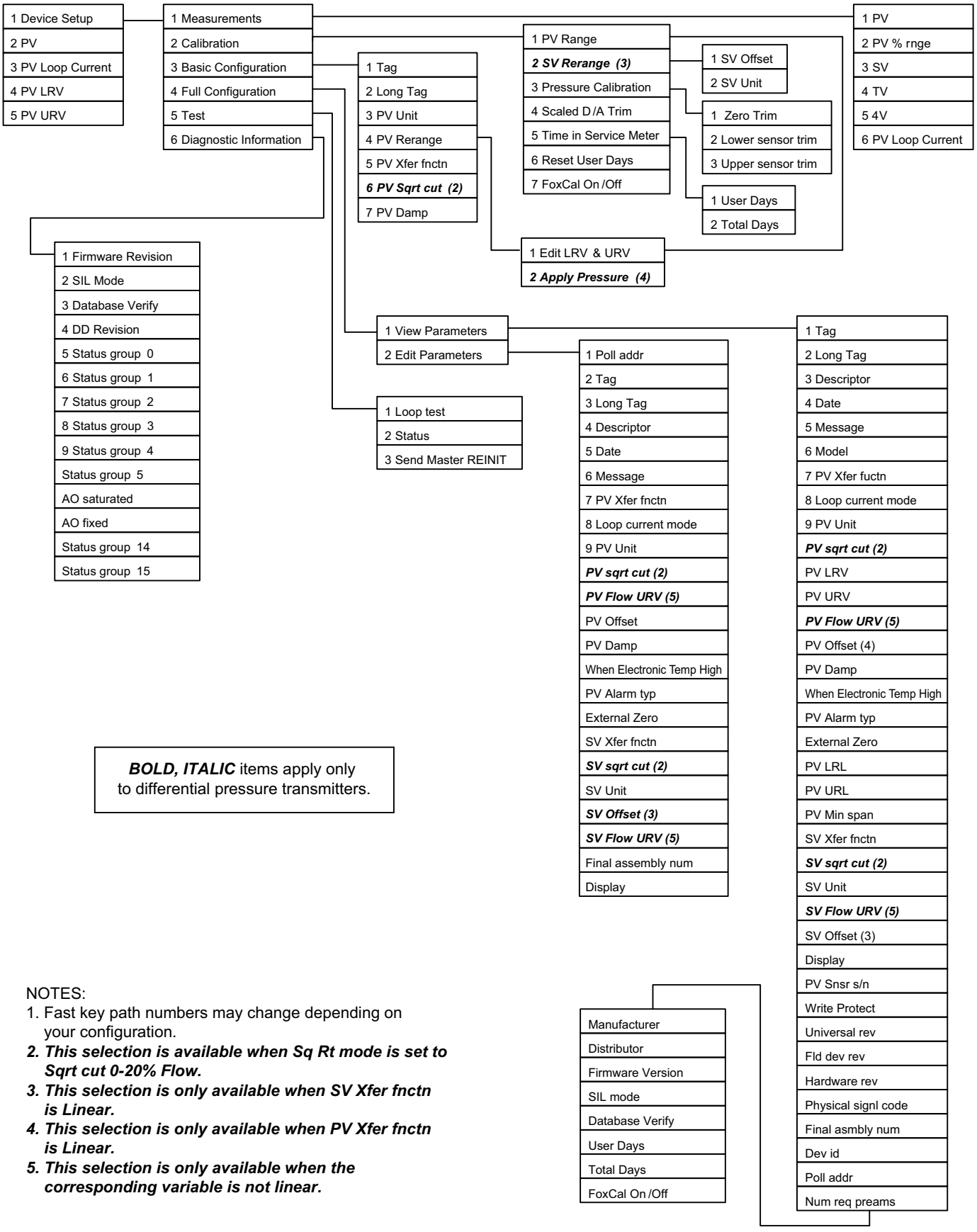
Online Configuration

To configure your online transmitter with the communicator:

1. Connect the HART Communicator to the transmitter loop.
2. Select **1 Device Setup** from the Online menu.

3. Select **3 Basic Configuration** or **4 Full Configuration** from the next menu.
4. If you selected **4 Full Configuration**, select **1 View Parameters** to view existing parameters, or **2 Edit Parameters** to edit one or more parameters.

Figure 59 - Online Configuration Flowchart



BOLD, ITALIC items apply only to differential pressure transmitters.

NOTES:

1. Fast key path numbers may change depending on your configuration.
2. ***This selection is available when Sq Rt mode is set to Sqrt cut 0-20% Flow.***
3. ***This selection is only available when SV Xfer fnctn is Linear.***
4. ***This selection is only available when PV Xfer fnctn is Linear.***
5. ***This selection is only available when the corresponding variable is not linear.***

Table 14 - Online Parameters

Parameter	Description
AO Fixed	Analog Output is set to fixed value (4 mA) when Loop Current Mode is set to fixed (multidrop mode).
AO Saturated	The mA current signal is saturated at either the low or high overrange limit (3.8 mA or 20.5 mA, respectively).
Apply Pressure	This reranging function requires the application of pressure. The purpose of this function is to allow the transmitter to determine and change the values of the LRV and URV based on applied pressures.
Database Verify	Indicates whether the device is performing database verification actions that are required for SIL compliance.
Date	Date entered in the format mm/dd/yyyy.
DD Revision	Revision level of the device description.
Descriptor	The factory default is **DESCRIPTOR**. This parameter is normally configured as the tag name. The description is limited to 16 characters.
Dev id	Uniquely identifies the transmitter when combined with the manufacturer identification and device type.
Display	This feature allows you to select whether the optional local display will show **M1 EGU** (the primary measurement), **M2 EGU** (the secondary measurement), or **TOGGLE** between the two.
Distributor	The company responsible for the distribution of the transmitter to customers.
External Zero	The External Zero feature allows you to enable the optional external zero pushbutton or disable the button. The default is **Disabled**.
Final asmbly num	Number associated with the overall transmitter.
Firmware version	Version of the transmitter firmware.
Fld dev rev	Revision level of the specific transmitter description.
FoxCal On/Off	Enables/disables the FoxCal™ calibration feature.
Hardware rev	Revision level of the hardware.
Long tag	The factory default is blank. This parameter is normally configured to the plant tag number. The long tag identifies the transmitter when using the HART communicator. The tag is limited to 32 characters.
Loop current mode	Loop current mode can be **Active** or **Fixed**. When this parameter is set to **Active**, the transmitter operates in a standard point-to-point manner with a 4 to 20 mA output signal. When this parameter is **Fixed**, the transmitter's milliamp output is locked at a fixed value of 4.0 mA. If loop mode is fixed, the **AO ALM**, **OUT DIR**, **OFFL MA**, and mA adjustment selections will not be available from the menu structure after you save the configuration.
Loop test	Procedure to use the transmitter as a calibration source to check other instruments in the loop.
Lower sensor trim	Lower sensor trim is for calibrating pressure at 0% of transmitter range (LRV).
Manufacturer	The company responsible for the manufacture of the transmitter.
Message	The factory default is **MESSAGE**. This parameter is normally configured as the instrument location. The message is limited to 32 characters.
Model	The model number of the transmitter.
Num req preams	Number of preambles to be sent in a request message from the transmitter to the host.
Physicl signl code	The type of physical layer that has been implemented in the hardware that is responsible for the HART communication port.
Poll addr	A number from 0 through 63.
Pressure Calibration	Calibration procedure using applied pressures.
PV	The primary variable is a dynamic digital value representing the process measurement in selected engineering units.
PV % rnge	This is a variable that tracks digital value representation with regard to the range defined by the LRV and URV in normal operating modes.
PV Alrm typ	The user selection for the 4 to 20 mA output setting when a device alarm occurs, which can be either **Hi** (21.0 mA) or **Lo** (3.55 mA).

Table 14 - Online Parameters (Continued)

Parameter	Description
PV Damp	Output damping in seconds. Damping can be set to 0, 0.25, 0.5, 1, 2, 4, 8, 16, or 32 seconds.
PV Flow URV(44)	If **PV Xfer fnctn** is set to square root, this parameter shows the maximum flow rate value corresponding to the PV URV.
PV Loop Current	The PV Loop Current value tracks the digital value representation under normal operating mode.
PV LRL	Minimum usable value for PV LRV (lower sensor range limit).
PV LRV	Primary Lower Range Value in PV units.
PV Min span	Also known as the lower span limit, this is the smallest allowable difference between the URV and the LRV.
PV Offset	PV offset (does not change LRV and URV).
PV Rerange	Allows adjustment of 0 and 100% range values for the Primary Variable.
PV Snsr s/n	Serial number of the sensor from which the digital value representation or transmitter variable is primarily derived.
PV Sqrt Cut(44)	Set value of *n* if **PV Xfer fnctn** is **Sqrt cut 0-20% Flow**. This is a user entered value.
PV URL	Maximum usable value for PV URV (upper sensor range limit).
PV Unit	PV units (pressure units) when **PV Xfer fnctn** is linear: 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 PV units (flow units) when **PV Xfer fnctn** is square root:(44) gal/s, gal/m, gal/h, gal/d, Mgal/d, ft3/s, ft3/m, ft3/h, ft3/d, Igal/s, Igal/m, Igal/h, Igal/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
PV URV	Primary Upper Range Value in PV units.
PV Xfer fnctn	Primary Variable Transfer Function (**Linear**, **Sqrt cut<1% DP**, **Sqrt lin<4% DP**, or **Sqrt cut 0-20% Flow**).
Reset User Days	Allows you to reset User Days (the number of days the transmitter has been powered up since the last Time in Service meter reset) back to zero.
Scaled D/A trim	Calibration procedure to match the 4 to 20 mA output to the calibration of the receiving device.
Send Master REINIT	Procedure to send a command to re-initialize the transmitter.
SIL Mode	Read-only status that indicates whether the device is performing the verification activities that are required for SIL compliance: • **SIL Required and Active**: The electronics support SIL operation. • **SIL Available and Active**: The electronics support SIL operation even though the transmitter's model code indicates that SIL is not required. • **SIL Required but not Active**: The electronics do not support SIL operation even though the transmitter's model code indicates that SIL is required. Contact Global Customer Support if this message is displayed. • **SIL Not Available**: The electronics do not support SIL operation. Contact Global Customer Support if this message is displayed.
Status	Indicates whether the device has detected abnormal operating conditions within the hardware or related to the validity of internal variables.
Status group 0-5	Status groups 0, 1, 2, 3, 4, and 5 consist of conditions related to communications, various device modes, diagnostic messages, input range messages, hardware messages, and alarms.
Status group 14-15	Status groups 14 and 15 consist of conditions related to communications, database verification, SIL mode, verification, etc.
SV	The secondary variable is an alternate value representing the process measurement in selected engineering units.
SV Flow URV(44)	If **SV Xfer fnctn** is set to square root, this parameter shows the maximum flow rate value corresponding to the PV URV.
SV Offset	SV offset. This is a user-entered value.
SV Rerange	Allows adjustment of SV Offset and SV Unit for Secondary Variable.

(44) Differential pressure transmitters only.

Table 14 - Online Parameters (Continued)

Parameter	Description
SV Sqrt Cut(45)	Set value of n if **SV Xfer fnctn** is **Sqrt cut 0-20% Flow**. This is a user entered value.
SV Unit	SV units (pressure units) when **SV Xfer fnctn** is linear: 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 SV units (flow units) when **SV Xfer fnctn** is square root:(45) 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
SV Xfer fnctn	Secondary Variable Transfer Function (**Linear**, **Sqrt cut<1% DP**, **Sqrt lin<4% DP**, or **Sqrt cut 0-20% Flow**).
Tag	The factory default is **TAG**. This parameter is normally configured to the plant tag number. The Tag is the primary identifier when communicating with a transmitter using the HART communicator. It is limited to eight characters.
Time in Service Meter	There are two ways to track the time that a transmitter has been in service. **Total Days** is a non-configurable value that represents the number of days the transmitter has been powered up in the field over its lifetime; **User Days** is the number of days the transmitter has been powered up since the last Time in Service Meter reset.
Total Days	This parameter allows you to view the number of days that a transmitter has been powered up in the field in its entire lifetime.
TV	The tertiary (third) value is a digital representation of the approximate sensor temperature, which is used internally to compensate pressure calculations.
Universal rev	Revision level of the Universal Device Description that the transmitter conforms to.
Upper sensor trim	Upper sensor trim is for calibrating pressure at 100% of transmitter range (URV).
User Days	The number of days the transmitter has been powered up since the last **Time in Service Meter** reset.
When Electronic Temp High	The “bad sensor strategy” for the electronics temperature sensor can be set to **AO Alarm** or **Use Default**.
Write protect	**No** or **Yes**. Indicates whether variables can be written to the transmitter, and whether commands that cause actions to be performed in the transmitter can occur.
Zero trim	Calibration procedure to make the sensor input the new zero input reference. Zero trim does not affect span.
4V	The fourth value is a digital representation of the approximate electronics module temperature.

Calibration

PV Rerange

PV Rerange sets new values for the LRV and URV, which correspond to the 4 mA and 20 mA output values, respectively. The 4 to 20 mA output signal is always linked to the primary value (PV).

Two selections are provided for reranging the PV. Neither selection affects the calibration of the transmitter.

(45) Differential pressure transmitters only.

- **Edit LRV URV**

  This function allows you to enter new known values for the LRV and URV. For example, use this function to change the range from “0 to 200 inH_2O” to “0 to 100 inH_2O.” The LRV and URV can be edited independently:

  - Changing the LRV does not affect the URV; changing the URV does not affect the LRV.
  - Changing either value alone changes the span.

  This reranging function does not require the application of pressure. If the transmitter has pressure applied, this pressure is not used for the rerange function and does not affect the result.

- **Apply Pressure**

  This function allows the transmitter to determine and change the values of the LRV and URV based on applied pressures. Use this function if the range of the transmitter is to be reset to unknown values. For example, if the liquid level in a tank is brought to the minimum level that will correspond with the new LRV (4 mA point), this function enables the transmitter to rewrite its LRV and provide a 4 mA output at that level. Similarly, if the level is brought to the maximum level, this function enables the transmitter to rewrite its URV and provide a 20 mA outputs at that level.

  - Changing the LRV automatically changes the URV by the same amount, keeping the span unchanged.
  - Changing the URV has no effect on the LRV; thus, the span is changed.

    NOTE: For DP transmitters, the **Apply Pressure** reranging option pertains to linear mode only.

PV Offset

When PV is in linear (pressure) mode, the **PV Offset** function is accessible from **1 Device Setup** > **4 Full Configuration** > **1 View Parameters** or **2 Edit Parameters**. Editing **PV Offset** causes both the PV and mA output to have an offset without changing either the LRV or URV.

For example, if a transmitter has a range of 0 to 100 inH_2O (LRV=0 and URV=100), entering a value of -10 for **PV Offset** causes the transmitter to provide a PV reading of 10 inH_2O and a current output of 5.6 mA when applied pressure is 0 inH_2O.

PV Flow URV

PV Flow URV(46) allows the entry of the maximum flow rate value corresponding to the PV URV and the 20 mA output.

When PV is in square root mode, the **PV Flow URV** function is accessible from **1 Device Setup** > **4 Full Configuration** > **2 Edit Parameters**. It is also automatically displayed in square root mode when PV units are changed.

SV Rerange

A DP transmitter that has PV in square root mode can have SV in linear mode; a DP transmitter that has PV in linear mode can have SV in square root mode. This allows easy checking of the measured differential pressure when a transmitter is configured for square root operation.

(46) Differential pressure transmitters only.

SV Rerange does not function like **PV Rerange**. Instead, it allows you to perform the **SV Offset** and **SV Flow URV** functions. **SV Offset** and **SV Flow URV** are similar to the corresponding PV functions. Refer to PV Offset, page 97 and PV Flow URV, page 97 for details.

Pressure Calibration

These transmitters are factory characterized and calibrated. There is usually no need to do a pressure calibration. Use the **Zero Trim** function to correct for position effects (see Zero Trim, page 98), or use **Rerange** to change the range (see PV Rerange, page 96 and SV Rerange, page 97). Your transmitter uses its factory entered and stored characterization and calibration data to convert any input pressure within range limits to a digital value of pressure which can be transmitted, displayed, and converted into a current signal.

However, if a pressure calibration is desired, use the **Pressure Calibration** function to trim the internal digital values of the interpreted pressures based on the precise values of the applied lower and upper range pressures. Apply a pressure to your transmitter that is equal to or near the LRV. Enter that pressure as the pressure for the lower trim point when requested. Similarly, apply a pressure equal to or near the URV, and enter that pressure for the upper trim point.

Also, it may sometimes be desirable to perform a single point calibration (zeroing) with a nonzero pressure input without affecting the span. For example, to zero an absolute pressure transmitter at a measured atmospheric pressure, use a trim point within the **Pressure Calibration** to achieve a single point calibration that does not change the span.

NOTICE

POTENTIAL REDUCED PERFORMANCE

The accuracy of the input pressure for field span calibration should be a minimum of four times better than the transmitter's reference accuracy specification. An inaccurate span pressure input typically results in degradation of transmitter performance from the factory calibrated state.

Failure to follow these instructions can result in reduced performance.

Zero Trim

Use this procedure to adjust the lower trim point to compensate for positioning effects. Set up the calibration equipment per your transmitter instruction (see Calibration Setup, page 79).

Zero Trim requires the application of zero pressure (or equal pressures on both sides of a differential pressure transmitter). The LRV does not have to be zero.

Do not use **Zero Trim** on an absolute pressure transmitter unless the transmitter has full vacuum applied.

Zero Trim has no effect on the LRV.

Scaled D/A Trim

You can trim the 4 to 20 mA output at 4 mA and 20 mA, or at other values by connecting a digital voltmeter and precision resistor in the output loop and adjusting

the output with this procedure. Set up the calibration equipment as described in Calibration Setup, page 79.

Application of pressure is not required. This adjustment has no effect on the internal digital interpretation of pressure, nor on the displayed and transmitted digital values representing the applied pressures. It only trims the conversion of the digital values of pressure to the transmitted 4 to 20 mA analog signal.

NOTE: It is usually not necessary to use this procedure. However, in special cases, it can be used to eliminate minor differences between the transmitter mA output and plant test equipment mA readings.

Time in Service Meter

These transmitters have two ways of tracking the time that a transmitter has been in service:

- **Total Days** is a nonconfigurable value that represents the number of days the transmitter has been powered up in the field over its lifetime.

  To view the number of days that a transmitter has been in the field, use the **1 Device Setup** > **2 Calibration** > **Time in Service Meter** menu selection.
- **User Days** is the number of days the transmitter has been powered up since the last Time in Service meter reset.

  You can reset the number of user days to zero at any time. For example, you may want to reset this value to zero when the transmitter is calibrated or reset.

  To reset the number of days that the transmitter has been in service since the last Time in Service meter reset, use the **1 Device Setup** > **2 Calibration** > **Reset User Days** menu selection.

Enabling and Disabling the FoxCal™ Calibration Feature

For the Advanced (10S) and Premium (50S) performance tiers, transmitters can be shipped with the FoxCal™ feature enabled. Refer to FoxCal™ Multiple Calibration Technology, page 75 for more information on this feature.

To turn FoxCal™ on or off, use the **1 Device Setup** > **2 Calibration** > **FoxCal On/Off** menu selection.

NOTICE

POTENTIAL REDUCED PERFORMANCE

When disabling FoxCal™ calibration, the last two-point calibrated range may not match the current configuration of the Lower Range Value and Upper Range Value. For optimal performance, avoid large mismatches.

Failure to follow these instructions can result in reduced performance.

NOTE:

1. For best results in applications where high accuracy is required, rezero the transmitter output once it has stabilized at the final operating temperature.
2. Zero shifts that result from position effects can be eliminated by rezeroing the transmitter output.

After calibrating transmitters operating with a 4 to 20 mA output signal, check that the underrange output value is less than 4 mA and the overrange output value is greater than 20 mA.

Maintenance

⚠⚠WARNING

EXPLOSION HAZARD

- For nonintrinsically safe installations, to help prevent a potential explosion in a Division 1 hazardous area, de-energize transmitters before you remove the threaded housing covers.
- For explosion proof and non-incendive installations, do not disconnect equipment when a flammable or combustible atmosphere is present.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Parts Replacement

For optimum transmitter performance, send the transmitter to the factory to replace parts. Removing the process covers may require recalibration of the transmitter.

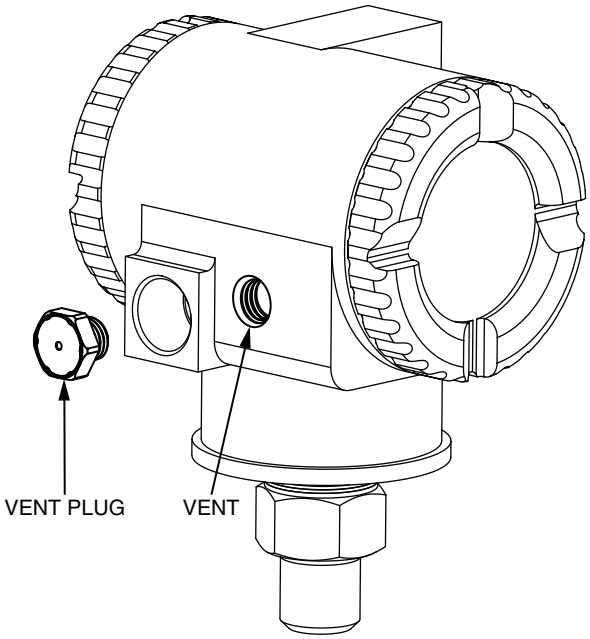
Replacing the Terminal Block Assembly

To replace the terminal block assembly, follow these steps:

1. Turn off the transmitter power source.
2. Turn the cover lock screw (if applicable) clockwise to disengage the lock.
3. Remove the covers from the field terminals and electronics compartments by rotating the covers counterclockwise.
4. Remove the digital display (if applicable) by grasping the two tabs on the display and rotating it about 10° in a counterclockwise direction.
5. Remove the electronics module from the housing by loosening the two captive screws that fasten it to the housing. Then pull the module out of the housing far enough to gain access to the cable connectors on the rear of the module.
6. Remove the four socket head screws fastening the terminal block.
7. Disconnect the terminal block cable connector from the electronics module.
8. Remove the terminal block and the gasket under it.
9. Connect the new terminal block cable connector to the electronics module.
10. Install the new terminal block and new gasket. Reinstall the four screws and tighten them to a torque of 0.67 N-m (6 lbf-in) in several even increments.
11. Reinstall the electronics module (and digital display, if applicable).
12. Reinstall the covers onto the housing by rotating them clockwise to seat the o-ring into the housing. Continue to hand-tighten until each cover contacts the housing metal-to-metal.
13. If cover locks are present, lock the cover per the procedure described in Cover Locks, page 43.
14. Turn on the transmitter power source.

Replacing the Vent Plug

Figure 60 - Replacing the Vent Plug

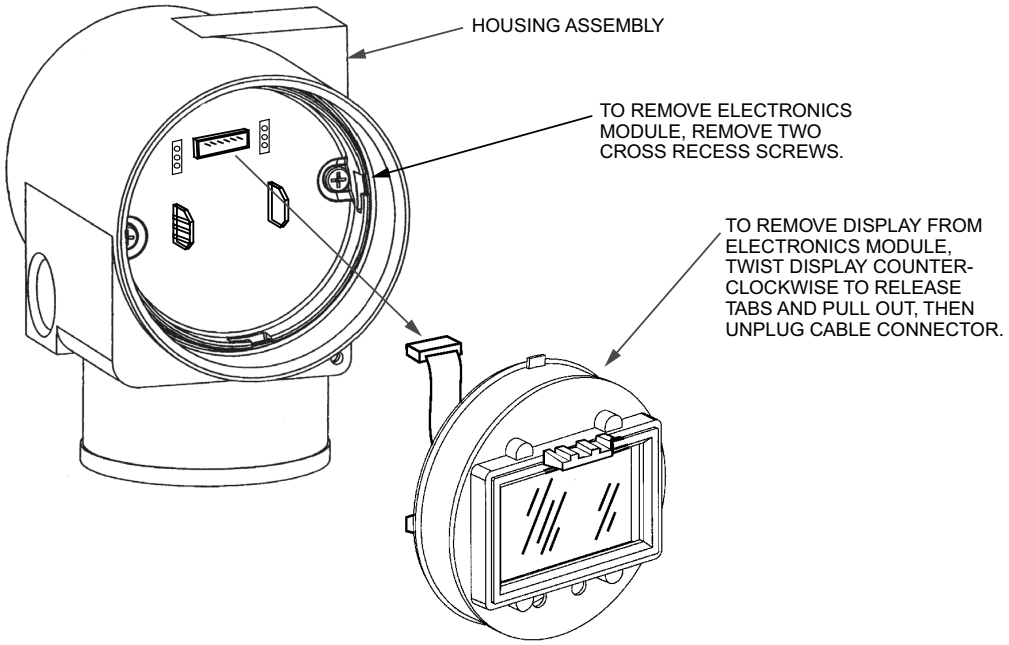


To replace the vent plug (gauge pressure transmitters only), refer to the diagram and follow these steps:

1. Remove the vent plug by unscrewing it counterclockwise.
2. Clean the angled sealing surface on the housing.
3. Lubricate the o-ring and the threads on the new plug with silicone lubricant (part number 0048130 or equivalent).
4. Install the new plug (part number X0179ME) into the housing by screwing it clockwise. Torque to 0.9 ±0.02 N-m (8 ±0.2 lbf-in).

Adding the Optional Display

Figure 61 - Adding the Optional Display



To add the optional display, refer to the diagram and follow these steps:

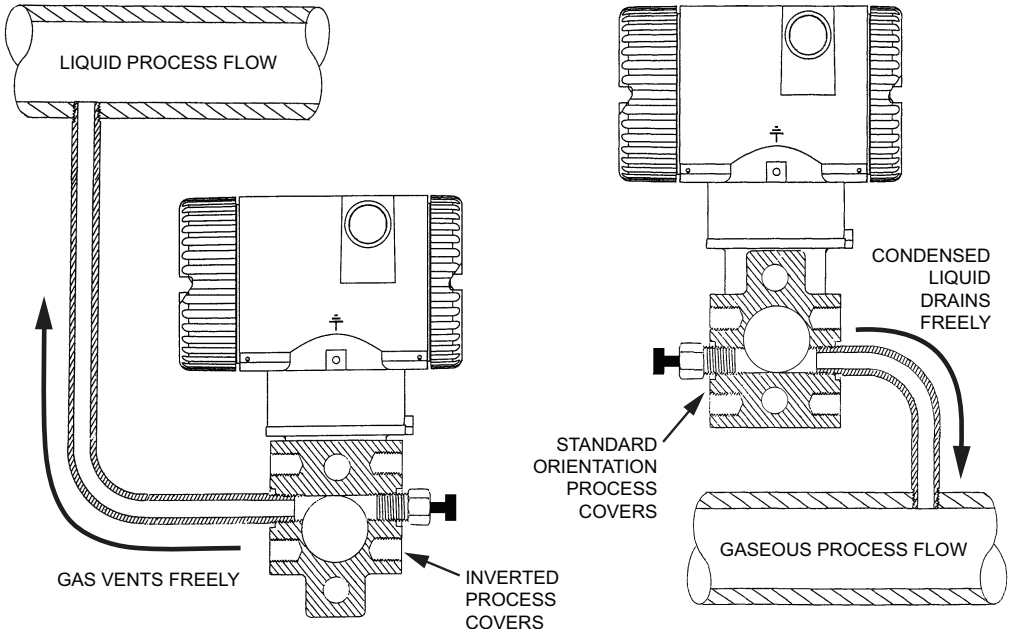
1. Turn off the transmitter power source.
2. Turn the cover lock screw (if applicable) clockwise to disengage the lock.
3. Remove the electronics compartment cover by rotating it counterclockwise.
4. Plug the display into the receptacle at the top of the electronics assembly.
5. Ensure that the o-ring is seated in its groove in the display housing. Then insert the display into the electronics compartment by grasping the two tabs on the display and rotating it about 10° in a clockwise direction.
6. Install the new, windowed cover onto the housing by rotating it clockwise to seat the o-ring into the housing. Continue to hand-tighten until the cover contacts the housing metal-to-metal.
7. If cover locks are present, lock the cover as described in Cover Locks, page 43.
8. Turn on the transmitter power source.

Rotating Process Covers for Venting

Your transmitter provides sensor cavity draining without the need for side drain connections, regardless of whether the transmitter is mounted vertically or horizontally. Sensor cavity venting is provided by mounting the transmitter horizontally or with the optional vent screw (option -V). If you do not have a vent screw, you can achieve venting (instead of draining) with vertical mounting by rotating the process covers.

NOTE: This procedure involves removing the process covers. You may need to recalibrate the transmitter afterwards.

Figure 62 - Sensor Cavity Venting and Draining



To rotate the process covers, refer to the diagram and follow these steps:

1. Turn off the transmitter power source and remove the transmitter from the process.
2. Remove the process covers from the sensor by removing two hex head bolts.
3. Replace the gaskets in the process covers.
4. Rotate the process covers so that the longer tab is at the bottom.
5. Reinstall the process covers and bolts. Torque cover bolts to 100 N-m (75 lbf-ft) in several even increments. Torque values are 68 N-m (50 lbf-ft) for 316 ss bolts; 75 N-m (55 lbf-ft) for B7M bolts.
6. Pressure test the sensor and process cover assembly by applying a hydrostatic pressure of 150% of the maximum static and overrange pressure (see Maximum Static, Overrange, and Proof Pressure Ratings, page 15) to both sides of the process cover/sensor assembly simultaneously through the process connections. Hold pressure for one minute. There should be no leakage of the test fluid through the gaskets. If leakage occurs, re-tighten the cover bolts or replace the gaskets and retest.

⚠CAUTION

RISK OF POTENTIAL INJURY AND/OR REDUCED PERFORMANCE

Perform a hydrostatic test with a liquid, and follow proper hydrostatic test procedures.

Failure to follow these instructions can result in injury or reduced performance.

Parts

Model Codes

These tables list all of the available options, including other protocols, for the Absolute, Gauge, and Differential Pressure Transmitters.

Absolute and Gauge Pressure Transmitters

Table 15 - Absolute and Gauge Pressure Transmitters

Code	Description
Model	
IAP	Absolute Pressure Transmitter
IGP	Gauge Pressure Transmitter
Tier	
05S	Value Performance(47)
10S	Advanced Performance(48) with FoxCal™
50S	Premium Performance(49) with FoxCal™
Electronics Versions/Output Signals	
-T	HART and 4 to 20 mA with SIL 2
-F	FOUNDATION Fieldbus H1 Digital Communications(50)
-M	Modbus RTU(51)
-V	Low Power Electronics, 1 to 5 Volts(52)
Structure Codes	
Structure — Direct Connect(53) (54)	
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.(50)
33	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(50)
36	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(55)
37	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(55)
38	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(55)
39	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(55)

(47) Refer to PSS 2A-1S05 A for accuracy specifications.
(48) Refer to PSS 2A-1S10 A for accuracy specifications.
(49) Refer to PSS 2A-1S50 A for accuracy specifications.
(50) Not available with the Value (05S) transmitter.
(51) Not available with the Premium (50S) transmitter.
(52) Available only with the Value (05S) transmitter.
(53) Not available with Electrical Certification codes that end in D or P.
(54) Not available with Electronics Version -M.
(55) Not available with option codes -V1, -V2, -V3, and -V4.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
E2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only(56)
E3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only(56)
E4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(56)
E5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(56)
E6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(56) (57)
E7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(56) (57)
Structure — Direct Connect Gold-Plated(58) (59) (60)	
44	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(56)
45	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(56)
46	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(56)
47	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(56)
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(56)
G3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only(56)
G4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(56)
G5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(56)
G6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(56)
G7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(56)

(56) Not available with option codes -V1, -V2, -V3, and -V4.
(57) Not available with the IAP05S transmitter.
(58) Not available with Electrical Certification codes that end in D or P.
(59) Not available with Electronics Version -M.
(60) Not available with the Value (05S) transmitter.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Structure — Direct Connect Flameproof	
52	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
5G	316L ss Process Sensor; 316L ss/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(61)
53	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
60	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
6G	316L ss Process Sensor; C276/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(61)
61	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.
62	C276 Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(62)
6P	C276 Process Sensor; C276/Gold Plated Diaphragm; Silicone Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(61)
63	C276 Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Ext. Conn.; 1/4 NPT Int. Conn.(62)
90	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(63)
91	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(63)
92	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; 1/2 NPT Internal Conn. Only(63)
93	316L ss Process Sensor; C276 Diaphragm; Inert Fill; 1/2 NPT Internal Conn. Only(63)
F2	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; M20 External Conn. Only(63)
F3	316L ss Process Sensor; 316L ss Diaphragm; Inert Fill; M20 External Conn. Only(63)
F4	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(63)
F5	316L ss Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(63)
F6	C276 Process Sensor; C276 Diaphragm; Silicone Fill; M20 External Conn. Only(63) (62)
F7	C276 Process Sensor; C276 Diaphragm; Inert Fill; M20 External Conn. Only(63) (62)
Structure — Direct Connect, Prepared for Diaphragm Seals — Diaphragm Seals Provided(64) (65)	
D1	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal(66)
D2	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal(66)
S3	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal(67)
S4	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal(67)
Structure — Direct Connect, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided(64) (68) (65)	
SC	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal
SD	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal
Structure — Direct Connect Flameproof, Prepared for Diaphragm Seals — Diaphragm Seals Provided	
D5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal(66)
D6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal(66)
S5	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal(67)
S6	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal(67)

(61) Not available with the Value (05S) transmitter.
(62) Not available with the IAP05S transmitter.
(63) Not available with option codes -V1, -V2, -V3, and -V4.
(64) Not available with Electrical Certification codes that end in D or P.
(65) Not available with Electronics Version -M.
(66) Specify direct connect seal DS-F, DS-G, DS-H, DS-K, DS-L, DS-M, or DS-N.
(67) Specify remote mount seal DS-C, DS-F, DS-G, DS-H, DS-J, DS-K, DS-L, DS-M, or DS-N.
(68) These structures are prepared for attachment of diaphragm seals by others. Do not specify a seal model code.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Structure — Direct Connect Flameproof, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided(69)	
SH	316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal
SJ	316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal
Structure — Direct Connect, Prepared for Sanitary or Pulp and Paper Seals (Vented Housing)(70) (71) (72)	
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)(73)
PB	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Threaded Type 1" (nominal)(73)
PC	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Sleeve Type 1.5" (nominal)(73)
PD	316L ss Process Sensor; 316L ss Diaphragm; Silicone Fill; Threaded Type 1.5" (nominal)(73)
PE	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Sleeve Type 1" (nominal)(73)
PF	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1" (nominal)(73)
PG	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Sleeve Type 1.5" (nominal)(73)
PH	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1.5" (nominal)(73)
PJ	316L ss Process Sensor; C276 Diaphragm; Silicone Fill; Threaded Type 1.5" (fits Ametek spud)(73)
Structure — Biplanar (Vented Low Side Process Cover and Diaphragm)	
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(73)
B4	316 ss Cover; Monel Diaphragm; Silicone Fill(73)
B5	316 ss Cover; Monel Diaphragm; Inert Fill(73)
B6	316 ss Cover; C276 Diaphragm; Silicone Fill
B7	316 ss Cover; C276 Diaphragm; Inert Fill
N4	Monel Cover; Monel Diaphragm; Silicone Fill(73)
N5	Monel Cover; Monel Diaphragm; Inert Fill(73)
C6	C276 Cover; C276 Diaphragm; Silicone Fill(73)
C7	C276 Cover; C276 Diaphragm; Inert Fill(73)

(69) These structures are prepared for attachment of diaphragm seals by others. Do not specify a seal model code.
(70) Not available with Electrical Certification codes that end in D or P.
(71) Available with Span Limit codes C and D for -V and -T electronics, and available only with Span code D for -F electronics.
(72) Not available with Electronics Version -M.
(73) Not available with the Value (05S) transmitter.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Structure — LP1 Biplanar (Not Available with Diaphragm Seals)	
LL	316 ss Cover; 316L ss Diaphragm; Silicone Fill
LM	316 ss Cover; 316L ss Diaphragm; Inert Fill
LC	316 ss Cover; C276 Diaphragm; Silicone Fill
LD	316 ss Cover; C276 Diaphragm; Inert Fill
CC	C276 Cover; C276 Diaphragm; Silicone Fill(74)
CD	C276 Cover; C276 Diaphragm; Inert Fill(74)
Structure — Biplanar, Prepared for Diaphragm Seals — Diaphragm Seals Provided(75) (76) (77)	
P1	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Direct Connect Seal(78)
P2	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Direct Connect Seal(78)
P3	316 ss Cover; 316L ss Process Sensor and Diaphragm; Silicone Fill; Prepared for Remote Mount Seal(79)
P4	316 ss Cover; 316L ss Process Sensor and Diaphragm; Inert Fill; Prepared for Remote Mount Seal(79)
Structure — Biplanar, Prepared for Diaphragm Seals — Diaphragm Seals Not Provided(75) (76) (77) (80)	
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

(74) Not available with the Value (05S) transmitter.
(75) Not available with optional Biplanar Process Connector (codes -F1 through -F4).
(76) Not available with options -X1, -X2, or -X3.
(77) Span Limit code A not available for biplanar structures P1, P2, P3, P4, P5, and P6.
(78) Specify direct connect seal DS-C, DS-F, DS-G, DS-H, DS-K, DS-L, DS-M, DS-N, or DS-P.
(79) Specify remote mount seal DS-C, DS-F, DS-G, DS-H, DS-J, DS-K, DS-L, DS-M, or DS-N.
(80) These structures are prepared for attachment of diaphragm seals by others. Do not specify a seal model code.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Span Limits	
Transmitters with Direct Connect Structures	
C(81)	With -T Electronics: 6.9 and 207 kPa (1 and 30 psi) With -V Electronics: 6.9 and 207 kPa (1 and 30 psi)
D	With -T, -M, or -F Electronics: 3.4 and 1380 kPa (0.5 and 200 psi) With -V Electronics: 69 and 1380 kPa (10 and 200 psi)
E	With -T, -M, or -F Electronics: 0.034 and 13.8 MPa (5 and 2000 psi) With -V Electronics: 0.69 and 13.8 MPa (100 and 2000 psi)
F(82)	With -T, -M, or -F Electronics: 0.52 and 41.4 MPa (75 and 6000 psi) With -V Electronics: 13.8 and 41.4 MPa (2000 and 6000 psi)
J(83)	6.9 and 69 MPa (1000 and 10000 psi)(84)
Transmitters with Biplanar Structures	
A(82)	With -T, -M, or -F Electronics: 0.12 and 7.5 kPa (0.5 and 30 inH_2O) With -V Electronics: 0.12 and 7.5 kPa (0.5 and 30 inH_2O)
B	With -T, -M, or -F Electronics: 0.12 and 50 kPa (0.5 and 200 inH_2O) With -V Electronics: 0.87 and 50 kPa (3.5 and 200 inH_2O)
C	With -T, -M, or -F Electronics: 0.62 and 250 kPa (2.49 and 1000 inH_2O) With -V Electronics: 6.9 and 250 kPa (27.8 and 1000 inH_2O)
D	With -T, -M, or -F Electronics: 26 and 2070 kPa (3.75 and 300 psi) With -V Electronics: 69 and 2070 kPa (10 and 300 psi)
E	With -T, -M, or -F Electronics: 0.26 and 20.7 MPa (37.5 and 3000 psi) With -V Electronics: 0.69 and 20.7 MPa (100 and 3000 psi)
F(82)	With -T, -M, or -F Electronics: 1.1 and 34.5 MPa (165 and 5000 psi) With -V Electronics: 1.38 and 34.5 MPa (200 and 5000 psi)
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

(81) Not available with Electronics Version -M.
(82) Available for gauge pressure transmitters only.
(83) Available for gauge pressure transmitters or with the -G option (G 1/2 B Manometer Process Connection) only.
(84) Available only with Direct Connect structures that have 1/2 NPT external diameter and either 316L ss or C276 diaphragm material.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Electrical Certifications	
AA	ATEX/UKEX intrinsically safe, Ex ia IIC(85) (86)
AD	ATEX/UKEX flameproof, Ex db IIC(87)
AM	ATEX/UKEX multiple certifications (includes Codes AA and AN)(88) (86)
AN	ATEX/UKEX protection type n, Ex ic IIC, or Ex nA(85) (86)
AP	ATEX/UKEX multiple certifications (includes Codes AA, AD and AN)(85) (87)
BA	INMETRO intrinsically safe, Ex ia IIC(85) (86)
BD	INMETRO flameproof, Ex db IIC(87)
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD)(85) (87)
CA	CSA intrinsically safe, Zone certified Ex ia(85)
CD	CSA zone certified flameproof Ex db IIC; also explosion proof, dust ignition-proof(87)
CM	CSA multiple certifications (includes CSA Codes CA and CN)(85)
CN	CSA non-incendive, Zone certified Ex nA IIC(85)
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN)(85) (87)
DA	Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC(85) (86)
DD	Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC(87)
DM	Multi-marked ATEX/UKEX and IECEx multiple certifications, ia, ic(85) (86)
DN	Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC(85) (86)
DP	Multi-marked ATEX/UKEX and IECEx multiple certifications, ia, ic, and db(85) (87)
EA	IECEx intrinsically safe, Ex ia IIC(85) (86)
ED	IECEx flameproof, Ex db IIC(87)
EM	IECEx multiple certifications, ia, ic, nA(85) (86)
EN	IECEx protection type n, Ex ic IIC, or Ex nA(85) (86)
EP	IECEx multiple certifications, ia, ic, nA, and db(85) (87)
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC(85)
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC(87)
FM	FM multiple certifications (includes FM Codes FA or FN)(85)
FN	FM Classes I, II and III, Division 2 non-incendive, Zone approved AEx nA IIC(85)
FP	FM multiple certifications (includes FM Codes FA, FD or FN)(85) (87)
KD	KC Certification Ex db(87)
NA	NEPSI intrinsically safe(85) (86)
ND	NEPSI flameproof, Ex db IIC(87)
ZZ	No certification(85)

(85) Not available with Electronics Version -M.
(86) Not available with Structure codes TA, T2, T3, TB, T4, T5, M1, M6, M9.
(87) Available with all biplanar structures and only the following Direct Connect Structure codes: 52, 5G, 53, 60, 6G, 61, 62, 6P, 63, 90, 91, 92, 93, F2, F3, F4, F5, F6, F7, D5, D6, S5, S6, SH, SJ.
(88) Not available with Electronics Version -M.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional Mounting Bracket Sets	
-M1	Painted Steel Bracket, Plated Steel Bolts, 1/2 NPT, Direct Connect Only(89) (90) (91)
-M2	Stainless Steel Bracket, Stainless Steel Bolts, 1/2 NPT, Direct Connect Only(89) (90) (91)
-M3	Universal Stainless Steel Mounting Bracket Set, Stainless Steel Hardware, Biplanar Only
-M5	Painted Steel Bracket, Plated Steel Bolts, M20, Direct Connect Only(89) (90) (92)
-M6	Stainless Steel Bracket, Stainless Steel Bolts, M20, Direct Connect Only(89) (90) (92)
-M7	Stainless Steel Bracket for Flameproof Direct Connect Sensor Structures(93)
-M8	Painted Steel Bracket for Flameproof Direct Connect Sensor Structures(93)
-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(89) (94) (95)
-V2	Block and Bleed Valve, Carbon Steel(89) (94) (96)
-V3	Block and Bleed Valve, 316 ss(89) (94) (96)
-V4	Block and Bleed Valve, 316 ss w/ Monel Trim, NACE Approved(89) (94) (96)
-V5	Vent Screw in Side of Process Cover(97) (98)
-V6	Omit Vent Screw(99)
Optional Biplanar Process Connector Type (same material as Process Cover)(100)	
-F1	1/4 NPT(101)
-F2	1/2 NPT(102)
-F3	RC 1/4(101)
-F4	RC 1/2(102)
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover(103)
-L2	Substitute Solid Cover over Digital Display(104)

(89) Not available with biplanar structures.
(90) Not available with Electrical Certification codes that end in D or P.
(91) Available with Conduit Connection and Housing Material codes 1 and 3 only.
(92) Available with Conduit Connection and Housing Material codes 5 and 6 only.
(93) Available only with flameproof Direct Connect Structure codes, excluding D5 and D6.
(94) Not available with option -G.
(95) Available only with 1/2 NPT 316L ss Structure codes 22, 23, 30, 31, 52, 5G, 53, 60, 6G, and 61. Structure Codes 72, 73, 80, and 81 also available for -T and -F electronics only.
(96) Available only with structures that have 1/2 NPT external connections.
(97) Available only with biplanar Structure codes B2, B3, BG, B4, B5, B6, B7, N4, N5, C6, C7.
(98) Not available with optional IEC 61518 Construction codes -D5 through -D9.
(99) Available only for transmitters with LP1 structures.
(100) Process Connectors not available with Structure codes LL, LM, LC, or LD when Optional Mounting Bracket option -M3, -M9, or -M0 is selected.
(101) Available with all biplanar structures that have 316L ss or Monel process covers.
(102) Available with all biplanar structures.
(103) Not available with Electronics Version -V.
(104) Available only with Electronics Version -V.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional IEC 61518 Construction(105) (106)	
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi(107)
-D6	Double-Ended Process Cover(108) with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi(109) (110) (111)
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi(107)
-D8	Double-Ended Process Cover(108) with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi(109) (110) (111)
-D9	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=5800 psi(107)
Optional Cleaning and Preparation	
-X1	Unit Degreased – for Silicone Fill Sensors Only(112)
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only(113) (114)
-X3	Cleaned and Prepared for Chlorine Service(113) (115)
Optional Bolting (Process Covers and Process Connectors)(105) (116) (117)	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi)(118)
-B2	17-4 PH ss Bolts and Nuts (bright acid tin coated corrosion protection with no pressure derating)
-B3	B7M Bolts and 2HM Nuts (conforms to NACE MR0175/MR0103, Class II; MWP derated to 2900 psi)(118)
Optional Conduit Thread Adapters(119) (120) (121)	
-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)(122)
-C2	Custom Factory Configuration (requires Configuration Form to be filled out)
Optional Electronics Housing Features	
-Z1	External Zero Adjustment(123) (124)
-Z2	Custody Transfer Lock and Seal(125)
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal(123) (124) (125)

(105) 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 -D7 and -B2. Options -D5 and -B1 are derated to 2175 psi. Options -D6 and -D8 are derated to 1500 psi. Option -B3 is derated to 2900 psi.
(106) Not available with optional Biplanar Process Connector (codes -F1 through -F4).
(107) Available with Biplanar Structure codes B2, B3, BG, B4, B5, B6, B7, LL, LM, LC, and LD.
(108) Blind connector supplied.
(109) Temperature limits are derated to -10 and +80°C (14 and 176°F) for optional IEC 61518 Construction codes -D6 and -D8 only.
(110) Available only with Structure codes B2, B3, BG, B4, B5, B6, and B7.
(111) Not available with optional Mounting Bracket Sets -M3, -M9, and -M0.
(112) Available only with structures that have silicone fill and are not prepared for seals.
(113) Available only with structures that have inert fill and are not prepared for seals.
(114) After units are cleaned and reassembled for oxygen service, they are not rechecked for accuracy. This may affect performance for DP and biplanar GP transmitters.
(115) 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.
(116) Not available with optional IEC 61518 Construction codes -D5 through -D9.
(117) Available with biplanar structures only.
(118) See Maximum Static, Overrange, and Proof Pressure Ratings, page 15 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.
(119) Not available with Electrical Certification codes that end in D or P.
(120) Available with Conduit Connection and Housing Material codes 1 and 3 only.
(121) Available only with -ZZ (no extra certification).
(122) Not available as a selection for the Value (05S) transmitter because it is standard for these models.
(123) Not available with Electronics Version -V.
(124) Not available for structures with sanitary or pulp and paper seals.
(125) 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.

Table 15 - Absolute and Gauge Pressure Transmitters (Continued)

Code	Description
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector(126)
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector(127)
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(128)	
-S1	Yellow Cover for SIL 2 on Electronics/Indicator Side of Housing(129)
-S2	Red Cover for SIL 2 on Electronics/Indicator Side of Housing(129)
Miscellaneous Optional Selections	
-G	G 1/2 B Manometer Process Connection(130)
-G1	Metal O-Ring for Diaphragm Seals in Vacuum Service(131)
-J	Low Temperature Operative Limit -50°C (-58°F)(132) (133)(134)
-R	R 1/2 Process Connection (1/2 NPT to R 1/2 Adapter)(135)
-S7	Ra 15 Sanitary Seal Finish(136)
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)

(126)Available only with Biplanar Structure codes B2, B3, BG, B4, B5, B6, and B7, and Optional Biplanar Process Connector Type code -F1.
(127)Available only with Biplanar Structure codes B2, B3, BG, B4, B5, B6, and B7, and Optional Biplanar Process Connector Type code -F2.
(128)Available only with Electronics Version -T.
(129)Not available with Electronics Version -M.
(130)Available with non–gold-plated 316L ss direct connect structures with 1/2 NPT external connections.
(131)Available only with Structure codes P1, P2, P3, P4, P5, and P6.
(132)Not available with Electronics Version -V.
(133)Not available with Optional IEC 61518 Construction codes -D6 and -D8.
(134)Not available with Direct Connect Structure codes 23, 31, 33, 37, 39, E3, E5, E7, 45, 47, 73, 81, 83, G3, G5, G7, 53, 61, 63, 91, 93, F3, F5, F7; Biplanar Structure codes B1, B3, B5, B7, N5, C7, LM, LD, CD, D2, S4, SD, P2, P4, P6, D6, S6, SJ; and all Sanitary/Pulp and Paper structures.
(135)Available with 316L ss direct connect structures with 1/2 NPT external connections.
(136)Only available with Structure codes TA, T2, T3, TB, T4, T5, M1, M6, M9.

Differential Pressure Transmitters

Table 16 - Differential Pressure Transmitters

Code	Description
Model	
IDP	Differential Pressure Transmitter
Tier	
05S	Value Performance(137)
10S	Advanced Performance(138) with FoxCal™
50S	Premium Performance(139) with FoxCal™
Electronics Versions/Output Signals	
-T	HART and 4 to 20 mA with SIL 2
-F	FOUNDATION Fieldbus H1 Digital Communications(140)
-M	Modbus RTU(141)
-V	Low Power Electronics, 1 to 5 Volts(142)
Structure Codes	
Structure — Traditional(143)	
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)(140)
25	316 ss Cover; Monel Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)(140)
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)(140)
35	Monel Cover; Monel Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)(140)
46	C276 Cover; C276 Diaphragm; Silicone Fill; Max Static Pressure=25 MPa (3626 psi)(140)
47	C276 Cover; C276 Diaphragm; Inert Fill; Max Static Pressure=25 MPa (3626 psi)(140)
Structure — LP1 Direct Mount (Not Available with Diaphragm Seals); Maximum Static Pressure=25 MPa (3626 psi)(143)	
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(140)
CD	C276 Cover; C276 Diaphragm; Inert Fill(140)

(137)Refer to PSS 2A-1S05 A for accuracy specifications.
(138)Refer to PSS 2A-1S10 A for accuracy specifications.
(139)Refer to PSS 2A-1S50 A for accuracy specifications.
(140)Not available with the Value (05S) transmitter.
(141)Not available with the Premium (50S) transmitter.
(142)Available only with the Value (05S) transmitter.
(143)Maximum static pressure can be derated by optional selections.

Table 16 - Differential Pressure Transmitters (Continued)

Code	Description
Structure — Prepared for Diaphragm Seals — Diaphragm Seals Provided (Static Pressure Rating Limited by Seal)(144) (145) (146)	
S1	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seals, Both Sides
S2	316 ss Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seals, Both Sides
S3	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, High Side
S4	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, High Side
S5	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, Low Side
S6	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, Low Side
F1	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Direct Connect Seal, High Side
F2	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Direct Connect Seal, High Side
F3	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Direct Connect Seal, High Side and Remote Mount Seal, Low Side
F4	316 ss Cover; 316L ss Diaphragm; Inert Fill; Direct Connect Seal, High Side and Remote Mount Seal, Low Side
Structure — Prepared for Diaphragm Seals — Diaphragm Seals Not Provided (Static Pressure Rating Limited by Seal)(144) (146)	
SA	316 ss Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seals, Both Sides
SB	316 ss Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seals, Both Sides
SC	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, High Side
SD	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, High Side
SE	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Silicone Fill; Remote Mount Seal, Low Side
SF	316 ss, 1/2 NPT Cover; 316L ss Diaphragm; Inert Fill; Remote Mount Seal, Low Side
Span Limits	
A(147)	With -T, -M, or -F Electronics: 0.12 and 7.5 kPa; 0.5 and 30 inH_2O; 1.2 and 75 mbar With -V Electronics: 0.12 and 7.5 kPa; 0.5 and 30 inH_20; 1.2 and 75 mbar
B	With -T, -M, or -F Electronics: 0.12 and 50 kPa; 0.5 and 200 inH_2O; 1.2 and 500 mbar With -V Electronics: 0.87 and 50 kPa; 3.5 and 200 inH_2O; 8.7 and 500 mbar
C	With -T, -M, or -F Electronics: 0.62 and 250 kPa; 2.5 and 1000 inH_2O; 6.22 and 2500 mbar With -V Electronics: 7 and 250 kPa; 28 and 1000 inH_2O; 70 and 2500 mbar
D	With -T, -M, or -F Electronics: 0.026 and 2.07 MPa; 3.75 and 300 psi; 0.26 and 20.7 bar With -V Electronics: 0.069 and 2.07 MPa; 10 and 300 psi; 0.69 and 20.7 bar
E	With -T, -M, or -F Electronics: 0.26 and 20.7 MPa; 37.5 and 3000 psi; 2.6 and 207 bar With -V Electronics: 0.69 and 20.7 MPa; 100 and 3000 psi; 6.9 and 207 bar

(144)Not available with options -X1, -X2, or -X3.
(145)Both transmitter and diaphragm seal model numbers are required. See PSS 2A-1Z11 B for diaphragm seal model codes.
(146)Available only with Process Connector Type code 0.
(147)Span limit code A is not available with diaphragm seals, except for sanitary spud seal model DS-P4.

Table 16 - Differential Pressure Transmitters (Continued)

Code	Description
Process Connector Type (Same Material as the Process Cover)	
0	None
1	1/4 NPT(148) (149)
2	1/2 NPT(148)
3	RC 1/4(148) (149)
4	RC 1/2(148)
Conduit Connection and Housing Material	
1	1/2 NPT Conduit Connection, Both Sides, Aluminum Housing
3	1/2 NPT Conduit Connection, Both Sides, 316 ss Housing
5	M20 Conduit Connection, Both Sides, Aluminum Housing
6	M20 Conduit Connection, Both Sides, 316 ss Housing
Electrical Certifications	
AA	ATEX/UKEX intrinsically safe, Ex ia IIC(150)
AD	ATEX/UKEX flameproof, Ex db IIC
AM	ATEX/UKEX multiple certifications (includes Codes AA and AN)(150)
AN	ATEX/UKEX protection type n, Ex ic IIC, or Ex nA(150)
AP	ATEX/UKEX multiple certifications (includes Codes AA, AD and AN)(150)
BA	INMETRO intrinsically safe, Ex ia IIC(150)
BD	INMETRO flameproof, Ex db IIC
BP	INMETRO multiple certifications (includes INMETRO Codes BA and BD)(150)
CA	CSA intrinsically safe, Zone certified Ex ia(150)
CD	CSA zone certified flameproof Ex db IIC; also explosion proof, dust ignition-proof
CM	CSA multiple certifications (includes CSA Codes CA and CN)(150)
CN	CSA non-incendive, Zone certified Ex nA IIC(150)
CP	CSA multiple certifications (includes CSA Codes CA, CD and CN)(150)
DA	Multi-marked ATEX/UKEX and IECEx intrinsically safe, Ex ia IIC(150)
DD	Multi-marked ATEX/UKEX and IECEx flameproof, Ex db IIC
DN	Multi-marked ATEX/UKEX and IECEx protection type n, Ex ic IIC(150)
EA	IECEx intrinsically safe, Ex ia IIC(150)
ED	IECEx flameproof, Ex db IIC
EM	IECEx multiple certifications, ia, ic, nA(150)
EN	IECEx protection type n, Ex ic IIC, or Ex nA(150)
EP	IECEx multiple certifications, ia, ic, nA, and db(150)

(148)Not available with structures that have seals on both sides.
(149)Not available with structures that have C276 process covers.
(150)Not available with Electronics Version -M.

Table 16 - Differential Pressure Transmitters (Continued)

Code	Description
FA	FM Classes I, II and III Division 1 intrinsically safe, AEx ia IIC(151)
FD	FM Classes I, II and III Division 1 explosion proof, dust-ignition proof, Zone approved AEx db IIC
FM	FM multiple certifications (includes FM Codes FA or FN)(151)
FN	FM Classes I, II and III, Division 2 non-incendive, Zone approved AEx nA IIC(151)
FP	FM multiple certifications (includes FM Codes FA, FD or FN)(151)
KD	KC Certification Ex db
NA	NEPSI intrinsically safe(151)
ND	NEPSI flameproof, Ex db IIC
ZZ	No certification(151)
Optional Mounting Bracket Sets(152) (153)	
-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(154) (155) (156)	
-P1	Adapter Set for MC Coplanar Manifolds, B7 Bolts(157)
-P2	Adapter Set for MC Coplanar Manifolds, 316 ss Bolts(158)
-P3	Adapter Set for MC Coplanar Manifolds, 17-4 ss Bolts(159)
-P4	Adapter Set for MC Coplanar Manifolds, B7M Bolts(160)
-P5	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7 Bolts(157)
-P6	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 316 ss Bolts(158)
-P7	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 17-4 ss Bolts(159)
-P8	Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7M Bolts(160)
Options for Digital Indicator with Pushbuttons	
-L1	Digital Display, Pushbuttons and Window Cover(161)
-L2	Substitute Solid Cover over Digital Display(162)

(151)Not available with Electronics Version -M.
(152)Not available with Structure codes F1, F2, F3, and F4 (direct connect seal).
(153)Requires Process Connection 0 for LP1 structures LL, LM, LC, LD, CC, and CD.
(154)Not available with optional IEC 61518 Construction codes -D5 through -D9.
(155)Available only with Process Connector Type code 0.
(156)Only available with LP1 structures that have 316 ss process covers.
(157)Not available with Bolting Options -B1, -B2, or -B3.
(158)Available only with option -B1.
(159)Available only with option -B2.
(160)Available only with option -B3.
(161)Not available with Electronics Version -V.
(162)Available only with Electronics Version -V.

Table 16 - Differential Pressure Transmitters (Continued)

Code	Description
Optional IEC 61518 Construction(163) (164) (165)	
-D5	Single-Ended Process Cover with 316 ss Bolt; No Connector Screw; MWP=2175 psi
-D6	Double-Ended Process Cover(166) with 316 ss Bolt; Size 7/16 316 ss Connector Screw; MWP=1500 psi(167) (168)
-D7	Single-Ended Process Cover with 17-4 PH Bolt; No Connector Screw; MWP=3626 psi
-D8	Double-Ended Process Cover(166) with 17-4 PH Bolt; Size 7/16 17-4 PH Connector Screw; MWP=1500 psi(167) (168)
-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(169)
-X2	Cleaned and Prepared for Oxygen Service – for Inert Fill Sensors Only(170) (171)
-X3	Cleaned and Prepared for Chlorine Service(170) (172)
Optional Bolting (Process Covers and Process Connectors)(173) (174) (175)	
-B1	316 ss Bolts and Nuts (high corrosion protection; MWP derated to 2175 psi)(164)
-B2	17-4 PH ss Bolts and Nuts (bright acid tin coated corrosion protection with no pressure derating)
-B3	B7M Bolts and 2HM Nuts (conforms to NACE MR0175/MR0103, Class II; MWP derated to 2900 psi)(164)
Optional Conduit Thread Adapters(176) (177) (178)	
-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)(179)
-C2	Custom Factory Configuration (requires Configuration Form to be filled out)
Optional Electronics Housing Features	
-Z1	External Zero Adjustment(180)
-Z2	Custody Transfer Lock and Seal(181)
-Z3	External Zero Adjustment and Custody Transfer Lock/Seal(180) (181)

(163) Available only with Process Connector Type code 0.
(164) See Maximum Static, Overrange, and Proof Pressure Ratings, page 15 for pressure deratings when certain IEC 61518 options and Bolting Options -B1 or -B3 are specified.
(165) Available only with Structure codes 22 through 27. Not available with options -V and -V1.
(166) Blind connector supplied.
(167) Not available with Mounting Bracket Set options -M1, -M2, and -M3.
(168) Temperature limits are derated to -10 and +80°C (14 and 176°F) for optional IEC 61518 Construction codes -D6 and -D8 only.
(169) Available only with structures that have silicone fill and are not prepared for seals.
(170) Available only with structures that have inert fill and are not prepared for seals.
(171) After units are cleaned and reassembled for oxygen service, they are not rechecked for accuracy. This may affect performance for DP and biplanar GP transmitters.
(172) 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.
(173) Not available with optional IEC 61518 Construction codes -D5 through -D9.
(174) For stainless steel bolts with IEC 61518 construction, specify -D5 to -D9, as required, instead of -B1 or -B2.
(175) Not available with structures that have Monel process covers.
(176) Not available with Electrical Certification codes that end in D or P.
(177) Available with Conduit Connection and Housing Material codes 1 and 3 only.
(178) Available only with -ZZ (no extra certification).
(179) Not available as a selection for the Value (05S) transmitter because it is standard for these models.
(180) Not available with Electronics Version -V.
(181) Cover locks are provided as standard with Electrical Certification codes that end in D or P (flameproof).

Table 16 - Differential Pressure Transmitters (Continued)

Code	Description
Optional Ermeto Connectors	
-E3	316 ss for Connecting 6 mm Tubing to 1/4 NPT Process Connector(182)
-E4	316 ss for Connecting 12 mm Tubing to 1/2 NPT Process Connector(183)
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(184)	
-S1	Yellow Cover for SIL 2 on Electronics/Indicator Side of Housing(185)
-S2	Red Cover for SIL 2 on Electronics/Indicator Side of Housing(185)
Miscellaneous Optional Selections	
-G1	Metal O-Ring for Diaphragm Seals in Vacuum Service(186) (187)
-GP	Gold Plated Diaphragm(188) (189) (190) (191)
-J	Low Temperature Operative Limit -50°C (-58°F)(192) (193)(194)
-T	Supplemental Customer Tag (Stainless Steel Tag Wired onto Transmitter)
-V	Supply Vent Screw in Side of Each Process Cover(195)
-V1	Omit Vent Screw in Side of Each Process Cover(196)
-Y	Static Pressure Rating to 40 MPa (5800 psi) and 17-4 ss Bolts and Nuts(197) (198) (199)

(182)Available only with Structure codes 22 to 27, and Process Connector codes 0 and 1.
(183)Available only with Structure codes 22 to 27, and Process Connector code 2.
(184)Available only with Electronics Version -T.
(185)Not available with Electronics Version -M.
(186)When the diaphragm seal is used in vacuum applications, -G1 is required. This selection substitutes a vacuum service metal gasket for the standard PTFE process cover gasket.
(187)Available only with structure codes for diaphragm seals.
(188)Available only with Structure code 22.
(189)Not available with options -X1, -X2, or -X3.
(190)Not available with the Value (05S) transmitter.
(191)Not available with the Premium (50S) transmitter.
(192)Not available with Electronics Version -V.
(193)Not available with Optional IEC 61518 Construction codes -D6 and -D8.
(194)Not available with structures that have inert fill fluid.
(195)Available only with Traditional Structure codes 22 to 47.
(196)Available only with LP1 Direct Mount structures with 316 ss process covers.
(197)Not available with structures prepared for diaphragm seals.
(198)Not available with Bolting Options -B1, -B2, or -B3.
(199)Not available with structures that have Monel process covers.

Transmitter Parts

Warning

⚠WARNING

RISK OF MOISTURE INGRESS

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.

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

Parts for Direct Connect AP and GP Transmitters

Figure 63 - Direct Connect Transmitters

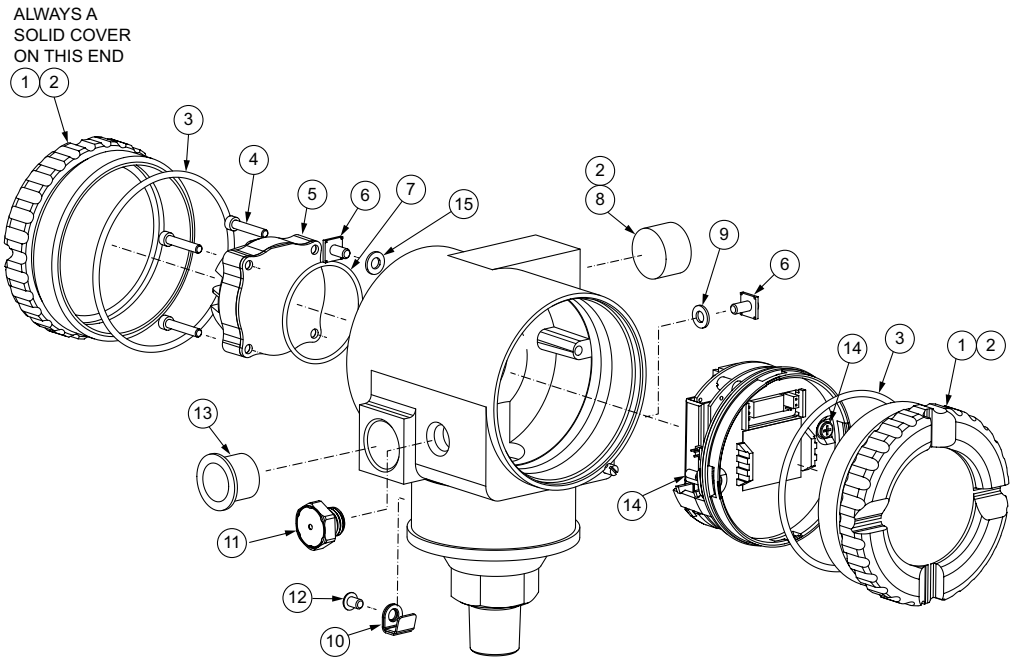


Table 17 - Parts for Direct Connect Transmitters

Item	Part No.	Qty.	Part Name
1	Cover, Electronics Housing; see Housing Covers, page 133. Also see LCD Indicator (Digital Display) Assembly (Option -L1), page 140.		
2	**Below**	1	**Grease, 1.75 oz. Tube**
	X0180JB		Lubit-8 for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
3	**Below**	2	**O-Ring, Cover**
	X0201FC		without -J Option
	X0201QH		with -J Option

Table 17 - Parts for Direct Connect Transmitters (Continued)

Item	Part No.	Qty.	Part Name
4	**Below**	4	**Screw, Terminal Block Assembly, 0.138-32 x 0.750**
	X0133UW		Steel Screw - used with Aluminum Housing
	X0133VP		316 ss Screw - used with 316 ss Housing
5	D0149YB	1	Terminal Block Assembly (Electronics Version -T)
6	D0162VJ	2	Screw Assembly, Ground, 0.164-32 x 0.750
7	**Below**	1	**O-Ring**
	X0144KR		without -J Option
	X0201QR		with -J Option
8	**Below**	1	**Pipe Plug for Unused Conduit Connection – see** **Warning, page 120**
	B0139CA		Aluminum, 1/2 NPT; with Housing Code 1
	B0139SK		316 ss, 1/2 NPT; with Housing Code 3
	X0178MC		Aluminum, M20; with Housing Code 5
	X0178MB		316 ss, M20; with Housing Code 6
9	X0173YA	1	Washer, Ext. Ground, 0.196 ID, 0.383 OD
10	D0197PS	1	Retention Clip
11	X0179ME	1	Vent Plug; for GP Transmitter with sanitary or pulp and paper seals only
12	X0174EK	1	Screw, Button Head; 0.164-32 x 0.25 long
13	S0102BT	1	Plug, Poly (remove prior to Transmitter installation)
14	**Below**	2	**Screw, Captive, Pan Head, 0.138-32 x 0.615**
	D0162VM		Steel Screw - used with Aluminum Housing
	D0166CY		316 ss Screw - used with 316 ss Housing

Parts for Biplanar AP and GP Transmitters

Figure 64 - Biplanar Transmitter Topworks

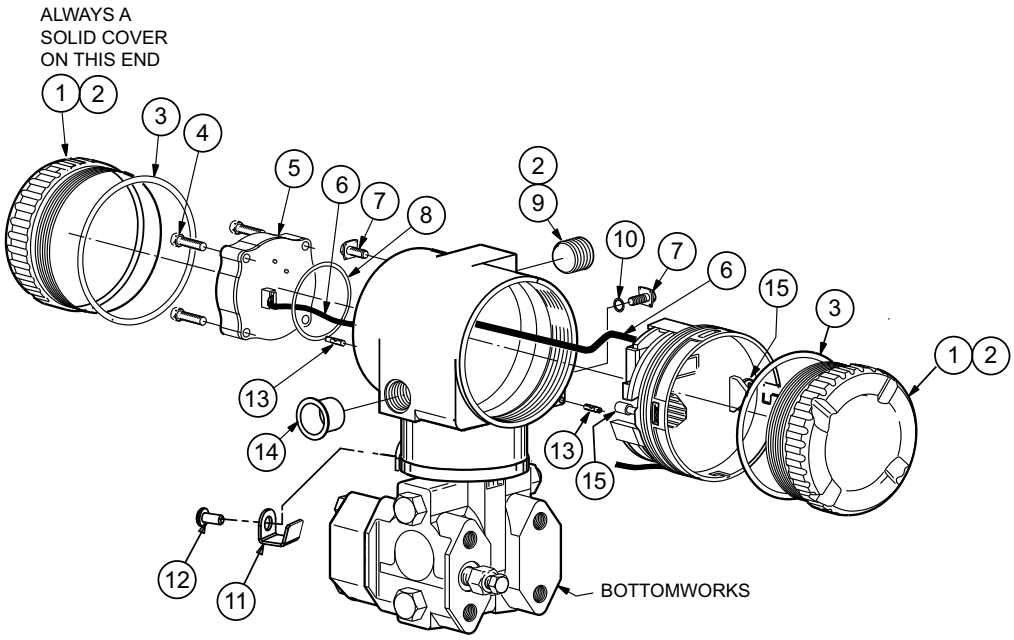


Table 18 - Parts for Biplanar Transmitter Topworks

Item	Part No.	Qty.	Part Name
1	Cover, Electronics Housing; see Housing Covers, page 133 Also see LCD Indicator (Digital Display) Assembly (Option -L1), page 140.		
2	**Below**	1	**Grease, 1.75 oz. Tube**
	X0180JB		Lubit-8 for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
3	**Below**	2	**O-Ring, Cover**
	X0201FC		without -J option
	X0201QH		with -J option
4	**Below**	4	**Screw, Terminal Block Assembly, 0.138-32 x 0.750**
	X0133UW		Steel Screw - used with Aluminum Housing
	X0133VP		316 ss Screw - used with 316 ss Housing
5	D0149YB	1	Terminal Block Assembly with Power Cable (Electronics Version -T)
6	n/a	n/a	Power Cable, included with Terminal Block Assembly
7	D0162VJ	4	Screw Assembly, Ground, 0.164-32 x 0.375
8	**Below**	1	**O-Ring**
	X0144KR		without -J option
	X0201QR		with -J option

Table 18 - Parts for Biplanar Transmitter Topworks (Continued)

Item	Part No.	Qty.	Part Name
9	**Below**	1	**Pipe Plug for Unused Conduit Connection – see Warning, page 120**
	B0139CA		Aluminum,1/2 NPT; with Housing Code 1
	B0139SK		316 ss, 1/2 NPT; with Housing Code 3
	X0178MC		Aluminum, M20; with Housing Code 5
	X0178MB		316 ss, M20; with Housing Code 6
10	X0173YA	1	Washer, Ext. Ground, 0.196 ID, 0.383 OD
11	D0197PS	1	Retention Clip
12	X0174EK	1	Screw, Button Hd; 0.164-32 x 0.25
13	D0162WM	2	Screw, Lock, 0.164-32; part of Optional Selection -Z2; see Custody Transfer Lock and Seal (Option -Z2), page 141
14	S0102BT	1	Plug, Poly (remove prior to Transmitter installation)
15	**Below**	2	**Screw, Captive, Pan Head, 0.138-32 x 0.615**
	D0162VM		Steel Screw - used with Aluminum Housing
	D0166CY		316 ss Screw - used with 316 ss Housing

Figure 65 - Biplanar Transmitter Bottomworks for Use with Traditional Structures

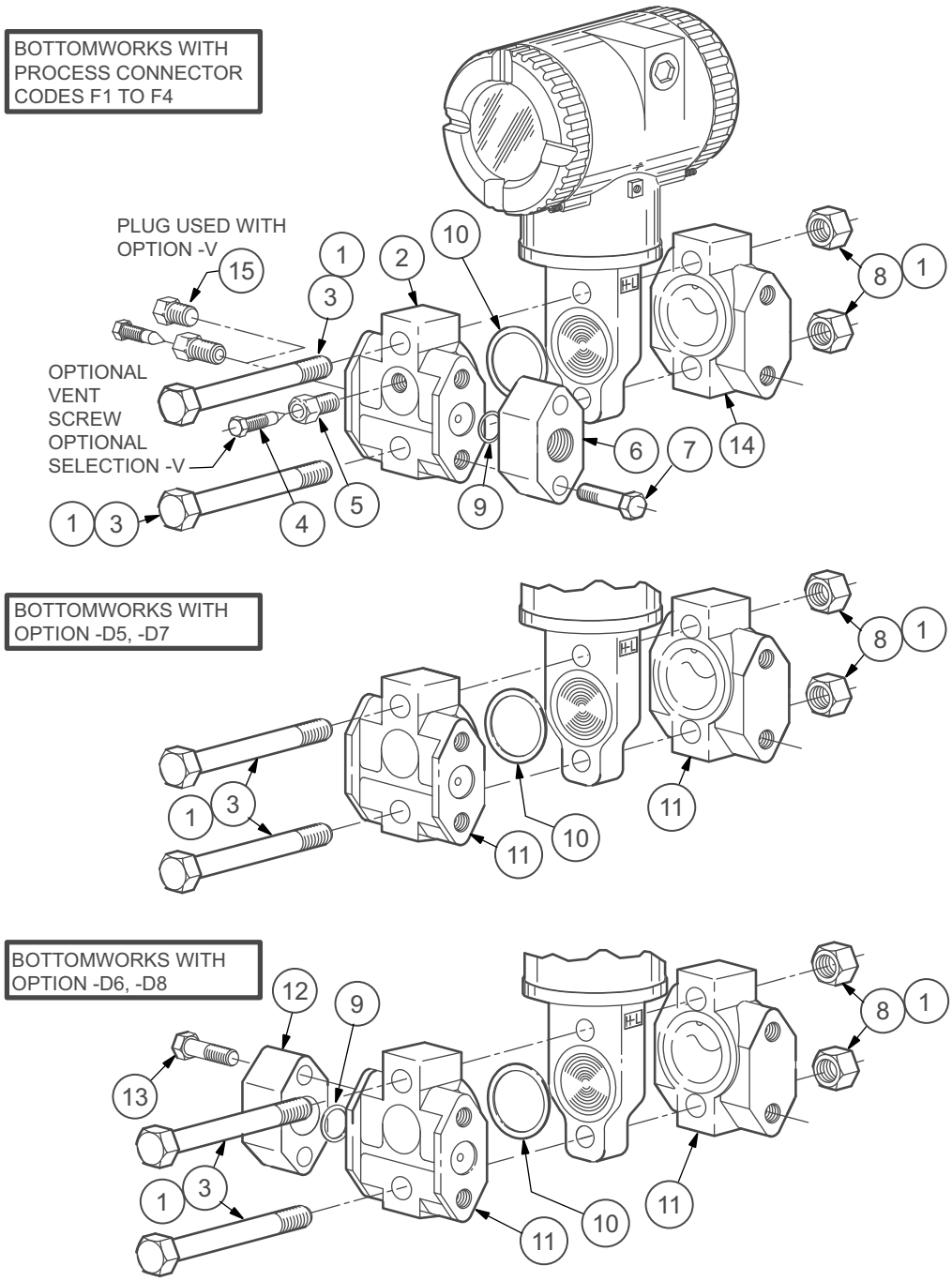


Table 19 - Parts for Biplanar Transmitter Bottomworks for Use with Traditional Structures

Item	Part No.	Qty.	Part Name
1	**Below**	1	**Grease, 1.75 oz. Tube**
	X0118CC		Lubriplate for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
2	**Below**	1	**Process Cover (Process Connector Type codes F1 - F4)** (200)
	D0161NA		High Side, 316 ss
	D0161NC		High Side, Nickel Alloy(201)
	D0161ND		High Side, Monel
	D0161NE		Side Vent, 316 ss
	D0161NG		Side Vent, Nickel Alloy(201)
	D0161NH		Side Vent, Monel
3	**Below**	2	**Screw, hex head, 0.500-13 x 3.5**
	X0173RP		2H (ASTM A193, Gr. B7 [std])
	X0173TQ		316 ss (ASTM F593, Group 2) (Options -B1. -D5, -D6)
	X0173UK		ASTM A193, Gr. B7M (Option -B3)
	X0173TD		17-4 ss (ASTM A564, Type 630) (Options -B2, -D7, -D8)
4	**Below**	2	**Vent Screw**
	B0138MJ		316 ss (std)
	B0138MK		Monel(200)
	D0175PQ		Nickel alloy(200) (202)
5	**Below**	1	**Vent Plug**(203)
	D0161QT		316 ss (std)
	D0161QU		Monel(200)
	D0175PP		Nickel alloy(200) (202)
6	1 Process Connector (see Process Connectors for Biplanar Transmitters with Traditional Structures, page 126)		
7	**Below**	2	**Screw, hex head, 0.438-20 x 1.5 (for threaded connectors, Codes F1 - F4)**
	X0100MN		ASTM A193 Gr. B7 (std)
	X0171VP		ASTM A193, Gr. B7M (Option -B3)
	X0118AX		17-4 Stainless Steel (Options -B2, -D7, -D8)
	N1205RQ		316 ss (Options -B1, -D5, -D6)

(200)Metallic process wetted material conforming to NACE Standard MR0175 and MR0103.
(201)Equivalent to Hastelloy® C. Hastelloy is a registered trademark of Haynes International, Inc.
(202)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.
(203)For simplified calibration, install F0101ES screw for pressure up to 0.7 MPa (100 psi).

Table 19 - Parts for Biplanar Transmitter Bottomworks for Use with Traditional Structures (Continued)

Item	Part No.	Qty.	Part Name
8	**Below**	2	**Nut, hex head, 0.500-13**
	X0173RN		Nut, hex head, 0.500-13
	X0173UL		ASTM A194, Gr. 2HM (Option -B3)
	X0173UJ		17-4 ss (ASTM F594, Group 2) (Options -B2, -D7, -D8)
	X0173TR		316 ss (ASTM F594, Group 2) (Options -B1, -D5, -D6)
9	D0114RB	1	Gasket, PTFE
10	D0161QQ	1	Glass-filled PTFE (standard)
11	**Below**	1	**Cover, 316 ss**
	D0161NM		High Side, Single Ended Process Connection 7/16, ss (Options -D5, -D7)
	D0161NA		Double Ended Process Connection 7/16, ss (Options -D6, -D8)
12	D0153RK	1	Kidney Flange, Blind, 316 ss - for use with Options -D6, -D8 (for double-ended process cover)
13	X0100MN	4	Screw, Hex Head, Steel, for Blind Kidney Flange, 0.437-20 x 1.5 in, for Options -D6, -D8
14	**Below**	1	**Cover, Low Side - for Process Connector Codes F1 - F4**
	D0161NR		M10, ss
	D0161NP		7/16, ss
15	**Below**	1	**Pipe Plug**
	D0161LU		316 ss (std)
	D0161LV		Monel
	D0161LW		Nickel alloy(204)

Process Connectors

Table 20 - Process Connectors for Biplanar Transmitters with Traditional Structures

Process Connector Code	Connector Description	Used with Cover Material		
		Stainless Steel	Nickel Alloy(205)	Monel
F1	1/4 NPT	N0141XT	–	N0141XK
F2	1/2 NPT	N0141XN	B0139JW	N0141XL
F3	Rc 1/4	B0139BD	–	N0139BC
F4	Rc 1/2	B0139BG	B0139JV	B0139BF

(204)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.
(205)Equivalent to Hastelloy® C. Hastelloy is a registered trademark of Haynes International, Inc.

Parts for DP Transmitters

Figure 66 - DP Transmitter Topworks

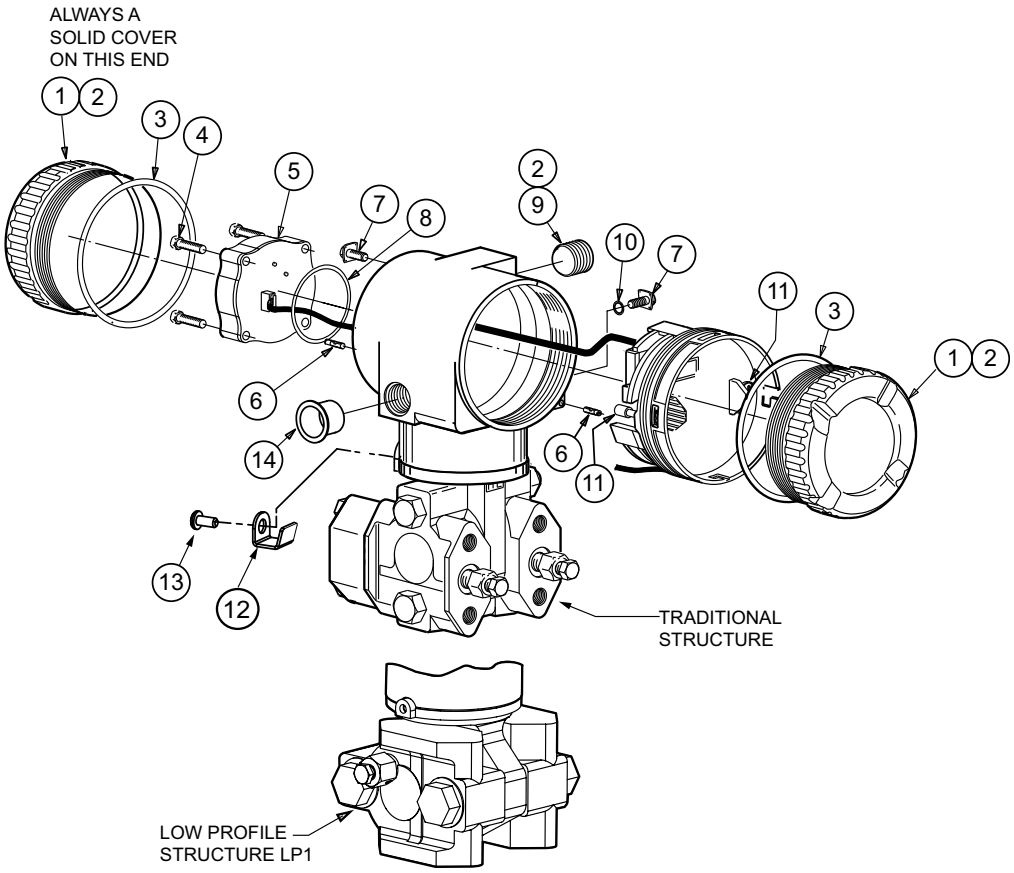


Table 21 - Parts for DP Transmitter Topworks

Item	Part No.	Qty.	Part Name
1	Cover, Electronics Housing; see Housing Covers, page 133. Also see LCD Indicator (Digital Display) Assembly (Option -L1), page 140.		
2	**Below**	1	**Grease, 1.75 oz. Tube**
	X0180JB		Lubit-8 for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
3	**Below**	2	**O-Ring, Cover**
	X0201FC		without -J option
	X0201QH		with -J option
4	**Below**	4	**Screw, Terminal Block Assembly, 0.138-32 x 0.750**
	X0133UW		Steel Screw - used with Aluminum Housing
	X0133VP		316 ss Screw - used with 316 ss Housing
5	D0149YB	1	Terminal Block Assembly with Power Cable (Electronics Version -T)
6	D0162WM	2	Screw, Lock, 0.164-32; part of Optional Selection -Z2; see Custody Transfer Lock and Seal (Option -Z2), page 141
7	D0162VJ	4	Screw Assembly, Ground, 0.164-32 x 0.375

Table 21 - Parts for DP Transmitter Topworks (Continued)

Item	Part No.	Qty.	Part Name
8	**Below**	1	**O-Ring**
	X0144KR		without -J option
	X0201QR		with -J option
9	**Below**	1	**Pipe Plug for Unused Conduit Connection – see** **Warning, page 120**
	B0139CA		Aluminum,1/2 NPT; with Housing Code 1
	B0139SK		316 ss, 1/2 NPT; with Housing Code 3
	X0178MC		Aluminum, M20; with Housing Code 5
	X0178MB		316 ss, M20; with Housing Code 6
10	X0173YA	1	Washer, Ext. Ground, 0.196 ID, 0.383 OD
11	Below	2	**Screw, Captive, Pan Head, 0.138-32 x 0.615**
	D0162VM		Steel Screw - used with Aluminum Housing
	D0166CY		316 ss Screw - used with 316 ss Housing
12	D0197PS	1	Retention Clip
13	X0174EK	1	Button Head Screw; 0.164-32 x 0.25 long
14	S0102BT	1	Poly Plug (remove prior to Transmitter installation)

Figure 67 - DP Transmitter Bottomworks for Use with Traditional Structures

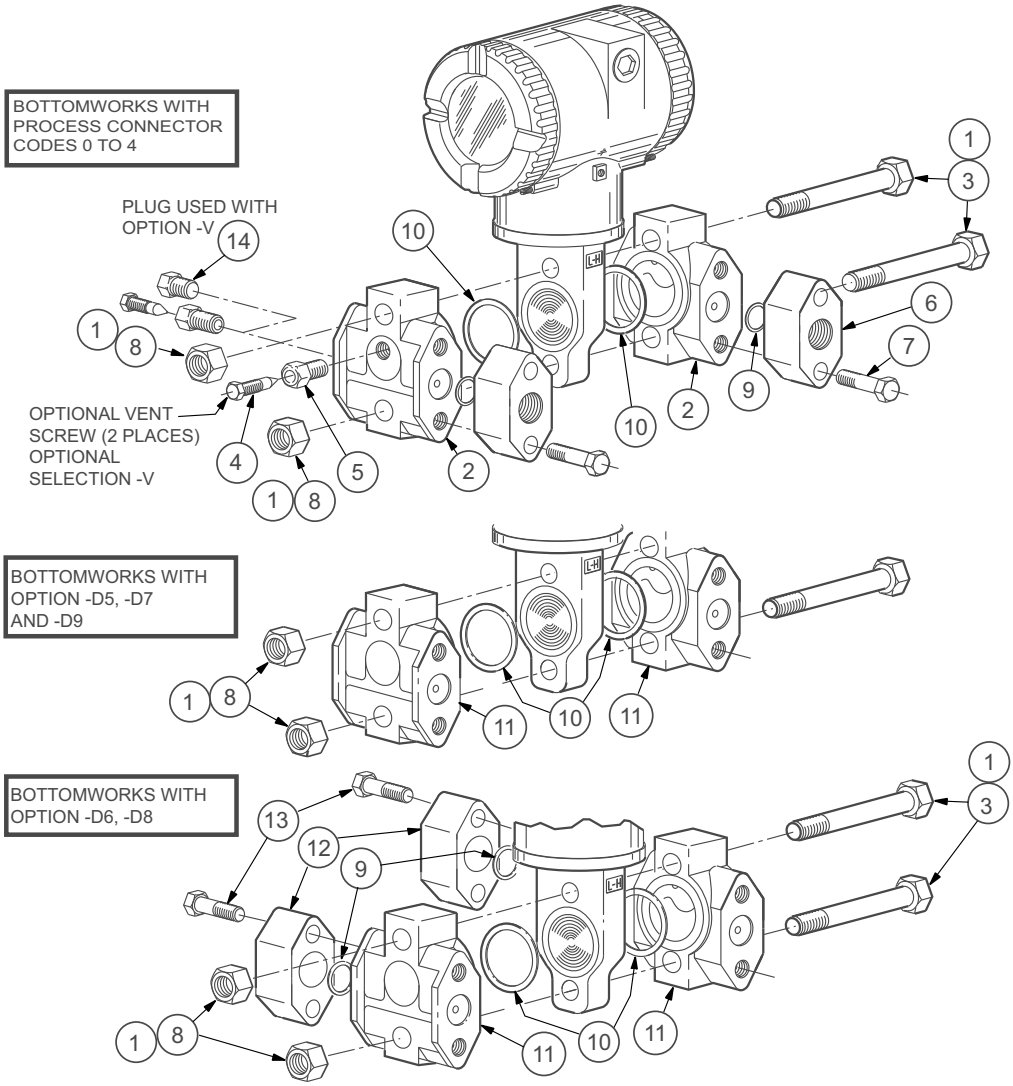


Table 22 - Parts for DP Transmitter Bottomworks for Use with Traditional Structures

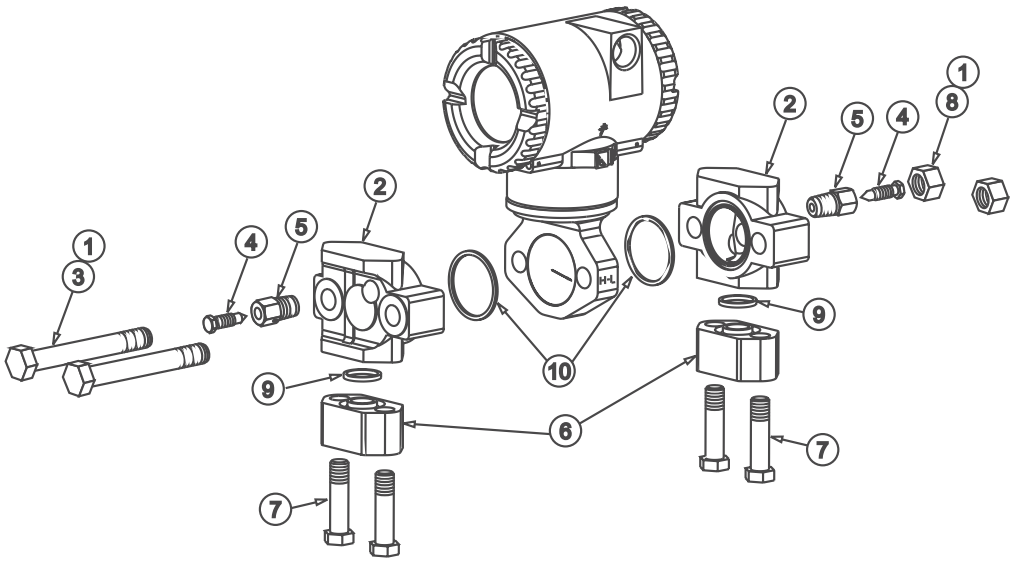
Item	Part No.	Qty.	Part Name
1	**Below**	1	**Grease, 1.75 oz. Tube**
	X0118CC		Lubriplate for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
2	**Below**	2	**Process Cover for use with Process Connection Codes 0–4** (206)
	D0161NA		316 ss
	D0161NC		Nickel Alloy(207)
	D0161ND		Monel
	Below		**Side Vent Process Cover for use with Process Connection Codes 0–4**(206)
	D0161NE		316 ss
	D0161NG		Nickel Alloy(207)
	D0161NH		Monel
3	**Below**	2	**Screw, Hex Head, 0.500-13 x 3.5**
	X0173RP		2H (ASTM A193, Gr. B7 [standard])
	X0173TQ		316 ss (ASTM F593, Group 2) (Options -B1, -D5, -D6)
	X0173UK		ASTM A193, Gr. B7M (Option -B3)(206)
	X0173TD		17-4 ss (ASTM A564, Type 630) (Options -B2, -D7, -D8, -D9)
4	**Below**	2	**Vent Screw**
	B0138MJ		316 ss (standard)
	B0138MK		Monel(206)
	D0175PQ		Nickel Alloy(206) (208)
5	**Below**	2	**Vent Plug**(209)
	D0161QT		316 ss (standard)
	D0161QU		Monel(206)
	D0175PP		Nickel Alloy(206) (208)
6	2 Process Connectors (see Process Connectors for Biplanar Transmitters with Traditional Structures, page 126)		
7	**Below**	4	**Screw, Hex Head, 0.438-20 x 1.5 (for threaded connectors, Codes 1-4)**
	X0100MN		ASTM A193 Gr. B7 (standard)
	X0171VP		ASTM A193, Gr. B7M (Option -B3)
	X0118AX		17-4 Stainless Steel (Options -B2, -D7, -D8, -D9, -Y)
	N1205RQ		316 ss (Options -B1, -D5, -D6)

(206)Metallic process wetted material conforming to NACE Standard MR0175 and MR0103.
(207)Equivalent to Hastelloy® C. Hastelloy is a registered trademark of Haynes International, Inc.
(208)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.
(209)For simplified calibration, install F0101ES screw for pressure up to 0.7 MPa (100 psi).

Table 22 - Parts for DP Transmitter Bottomworks for Use with Traditional Structures (Continued)

Item	Part No.	Qty.	Part Name
8	**Below**	2	**Nut, Hex Head, 0.500-13**
	X0173RN		2H (ASTM A193, Gr. B7) (standard) option
	X0173TR		316 ss (ASTM F594, Group 2) (Options -B1, -D5, -D6)
	X0173UJ		17-4 ss (ASTM F594, Group 2) (Options -B2, -D7, -D8, and -D9)
	X0173UL		ASTM A194, Gr. 2HM (Option -B3)
9	D0114RB	2	Gasket, PTFE
10	D0161QQ	2	Gasket, Process Cover, Glass-filled PTFE (Standard)
11	**Below**	1	**Cover, 316 ss**
	D0161NM		Single-ended process connection 7/16 (Options -D5, -D7) (High Side)
	D0161NL		Single-ended process connection 7/16 (Options -D5, -D7) (Low Side)
	D0174BU		Single-ended process connection 7/16 (Option -D9) (High Side)
	D0174BT		Single-ended process connection 7/16 (Option -D9) (Low Side)
	D0161NA	2	Cover, 316 ss - for use with double-ended process connection 7/16 (Options -D6, -D8)
12	D0153RK	2	Kidney Flange, Blind, 316 ss - for use with Options -D6, -D8 (for double-ended process cover)
13	X0100MN	4	Screw, Hex Head, steel, 0.437-20 x 1.5 in, for Options -D6, -D8
14	**Below**	2	**Pipe Plug, Hex Head, 1/4 NPT**
	D0161LU		316 ss
	D0161LV		Monel
	D0161LW		Nickel Alloy(210)

Figure 68 - DP Transmitter Bottomworks for Use with Low Profile Structures LP1



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

Table 23 - Parts for DP Transmitter Bottomworks for Use with Low Profile Structures LP1

Item	Part No.	Qty.	Part Name
1	**Below**	1	**Grease, 1.75 oz. Tube**
	X0118CC		Lubriplate for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
2	**Below**	1	**Process Cover with Process Connection Codes 0–4**(211)
	D0170WW		with LP1; High Side Cover; 316 ss
	D0170WY		with LP1; Low Side Cover; 316 ss
3	**Below**	2	**Screw, Hex Head, 0.500-13 x 3.5**
	X0173RP		2H (ASTM A193, Gr. B7 [standard])
	X0173UK		ASTM A193, Gr. B7M (Option -B3)
	X0173TQ		316 ss (ASTM F593, Group 2) (Option -B1)
	X0173TD		17-4 ss (ASTM A564, Type 630) (Options -B2)
4	**Below**	2	**Vent Screw**
	B0138MJ		316 ss
	D0175PQ		Nickel Alloy(211) (212)
5	**Below**	2	**Vent Plug, 316 ss**(213)
	D0161QT		316 ss
	D0175PP		Nickel Alloy(211) (212)
6	**Below**	2	**Process Connectors, used with stainless steel cover**
	N0141XT		Tapped for 1/4 NPT, Process Connector Code 1
	N0141XN		Tapped for 1/2 NPT, Process Connector Code 2
	B0139BD		Tapped for R 1/4, Process Connector Code 3
	B0139BG		Tapped for R 1/2, Process Connector Code 4
7	**Below**	4	**Screw, Hex Head, 0.438-20 x 1.5 for threaded connectors, Codes 1-4**
	X0100MN		ASTM A193 Gr. B7 (Standard)
	X0171VP		ASTM A193, Gr. B7M (Option -B3)
	N1205RQ		316 ss (Option -B1)
	X0118AX		17-4 Stainless Steel (Option -B2)
8	**Below**	1	**Nut, 0.500-13**
	X0173RN		2H, ASTM A193, Gr. B7 (standard)
	X0173UL		ASTM A194, Gr. 2HM (Option -B3)
	X0173TR		316 ss, ASTM F594, Group 2 (Option -B1)
	X0173UJ		17-4 ss, ASTM F594, Group 2 (Option -B2)
9	D0114RB	2	Gasket, PTFE; Sensor Assembly to Process Cover
10	D0161QQ	2	Gasket, Glass-Filled PTFE; Process Connector to Process Cover

(211)Metallic process wetted material conforming to NACE Standard MR0175 and MR0103.
(212)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.
(213)For simplified calibration, install F0101ES screw for pressure up to 0.7 MPa (100 psi).

Housing Covers

Description	Aluminum Housing		Stainless Steel Housing	
	without -J Option	with -J Option	without -J Option	with -J Option
Solid Standard Cover	D0162AP		D0162VD	
Electronics End, Extended Window Cover over Digital Display (Option -L1)	D0162LH	D0219EB	D0162VH	D0219ED
Electronics End, Solid Yellow Cover for SIL 2 (Option -S1)	D0219FB		D0219FD	
Electronics End, Yellow Extended Window Cover for SIL 2 (Option -S1) with Digital Display (Option -L1)	D0219FM	D0219FR	D0219FK	D0219FP
Electronics End, Solid Red Cover for SIL 2 (Option -S2)	D0219FA		D0219FC	
Electronics End, Red Extended Window Cover for SIL 2 (Option -S2) with Digital Display (Option -L1)	D0219FL	D0219FQ	D0219FJ	D0219FN

Optional Selections

Refer to Model Codes, page 104 for available options for each transmitter model.

Mounting Bracket Sets for Direct Connect Transmitters

Figure 69 - Mounting Bracket Sets for Non-Flameproof Direct Connect Transmitter Structures (Options -M1, -M2, -M5, and -M6)

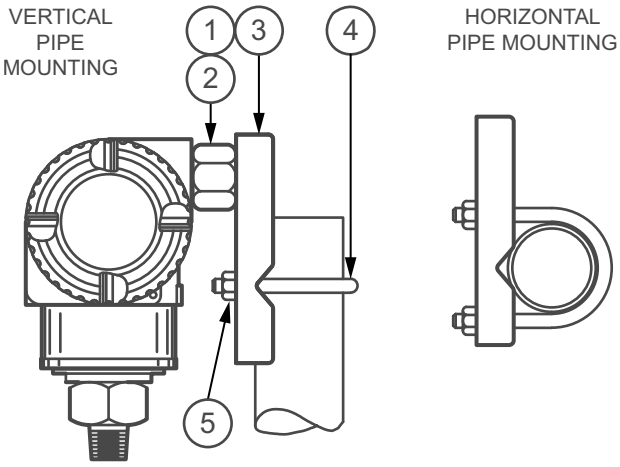


Table 24 - Parts for Mounting Bracket Sets with Painted Steel, for Aluminum Housing (Option -M1)

Item	Part No.	Qty.	Part Name
Set	B0188DL	1	Mounting Bracket Set; for Aluminum Housing; 1/2 NPT Connections (includes items 1–5 below)
1	X0116FB	1	Screw, Hex Head, Plated cs, 0.375-24 x 0.625
2	B0188DN	1	Adapter Plug, 1/2 NPT to 0.375-24, ss

Table 24 - Parts for Mounting Bracket Sets with Painted Steel, for Aluminum Housing (Option -M1) (Continued)

Item	Part No.	Qty.	Part Name
3	N0141ZW	1	Mounting Bracket, Painted Steel
4	D0114SM	1	U-Bolt, Steel
5	0011962	2	Nut, Hex Head, Plated cs, 0.312-18

Table 25 - Parts for Mounting Bracket Sets with Stainless Steel, for Stainless Steel Housing (Option -M2)

Item	Part No.	Qty.	Part Name
Set	N1207AE	1	Mounting Bracket Set; for 316 ss Housing; 1/2 NPT Connections (includes items 1–5 below)
1	P0120RM	1	Screw, Hex Head, ss, 0.375-24 x 0.625
2	B0188DN	1	Adapter Plug, 1/2 NPT to 0.375-24, ss
3	N1205MF	1	Mounting Bracket, ss
4	N1205MX	1	U-Bolt, ss
5	Z1217HV	2	Nut, Hex Head, ss, 0.312-18

Table 26 - Parts for Mounting Bracket Sets with Painted Steel, for Aluminum Housing (Option -M5)

Item	Part No.	Qty.	Part Name
Set	D0179FN	1	Mounting Bracket Set; for Aluminum Housing; M20 Connections (includes items 1–5 below)
1	X0116FB	1	Screw, Hex Head, Plated cs, 0.375-24 x 0.625
2	D0179FM	1	Adapter Plug, M20 to 0.375-24, ss
3	N0141ZW	1	Mounting Bracket, Painted Steel
4	D0114SM	1	U-Bolt, Steel
5	0011962	2	Nut, Hex Head, Plated cs, 0.312-18

Table 27 - Parts for Mounting Bracket Sets with Stainless Steel, for Stainless Steel Housing (Option -M6)

Item	Part No.	Qty.	Part Name
Set	D0179FP	1	Mounting Bracket Set; for 316 ss Housing; M20 Connections (includes items 1–5 below)
1	P0120RM	1	Screw, Hex Head, ss, 0.375-24 x 0.625
2	D0179FM	1	Adapter Plug, M20 to 0.375-24, ss
3	N1205MF	1	Mounting Bracket, ss
4	N1205MX	1	U-Bolt, ss
5	Z1217HV	2	Nut, Hex Head, ss, 0.312-18

Figure 70 - Mounting Bracket Sets for Flameproof Direct Connect Transmitter Structures (Options -M7 and -M8)

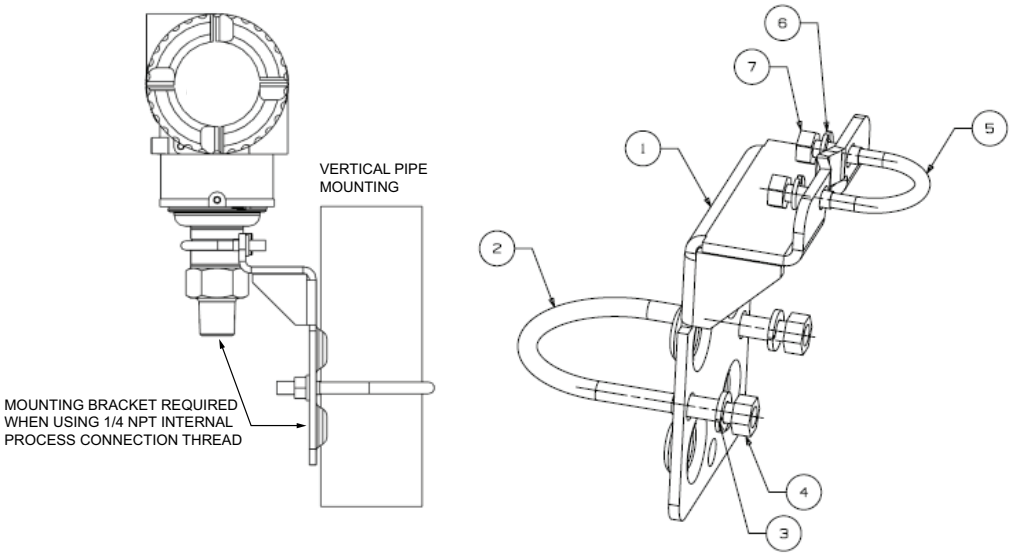


Table 28 - Parts for ATEX/UKEX Mounting Bracket Sets, Stainless Steel (Option -M7)

Item	Part No.	Qty.	Part Name
Set	D0170ZQ	1	Mounting Bracket Set; ATEX/UKEX (includes items 1–7 below)
1	D0170ZR	1	Mounting Bracket
2	N1205MX	1	U-Bolt, 5/16-18 ss
3	A2015AB	2	Lock Washer, 5/16-18 ss
4	X0142BW	2	Nut, Hex Head, 5/16-18 ss
5	D0170ZU	2	U-Bolt, 1/4-20 ss
6	0036504	2	Lock Washer, 1/4 ss
7	X0142BL	2	Nut, Hex Head, 1/4-20 ss

Table 29 - Parts for ATEX/UKEX Mounting Bracket Sets, Carbon Steel (Option -M8)

Item	Part No.	Qty.	Part Name
Set	D0170ZT	1	Mounting Bracket Set; ATEX/UKEX (includes items 1–7 below)
1	D0197WF	1	Mounting Bracket
2	D0186MA	1	U-Bolt, 5/16-18 Steel
3	A2004WP	2	Lock Washer, 5/16-18 Steel
4	X0142BV	2	Nut, Hex Head, 5/16-18 Steel
5	D0170ZV	2	U-Bolt, 1/4-20 Steel
6	0042965	2	Lock Washer, 1/4 Steel
7	X0142BK	2	Nut, Hex Head, 1/4-20 Steel

Mounting Bracket Sets for DP and Biplanar Transmitters

Figure 71 - Standard Style Mounting Bracket Sets and Optional Standoff Kits for DP Transmitters (Options -M1 and -M2) and Biplanar Transmitters (Options -M9 and -M0)

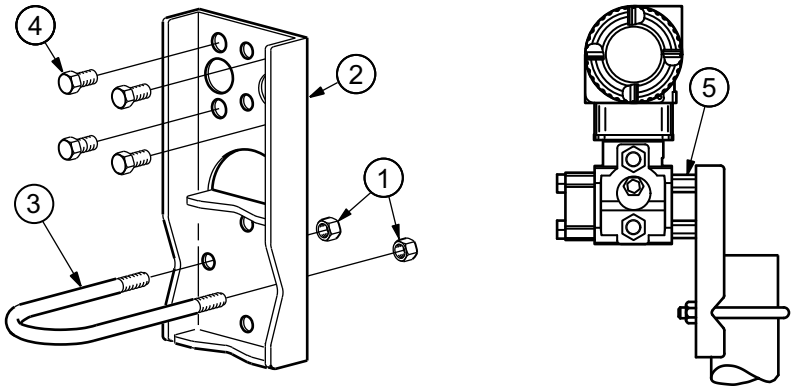


Table 30 - Parts for Standard Style Mounting Bracket Set with Painted Steel (DP Option -M1; Biplanar Option -M9)

Item	Part No.	Qty.	Part Name
Set	N0141ZT	1	Mounting Bracket Set (includes items 1–4 below)
1	0011962	2	Nut, Hex Head, Plated cs, 0.312-18
2	N0141ZW	1	Mounting Bracket, Painted Steel
3	D0114SM	1	U-Bolt, Steel
4	X0100NW	4	Screw, Hex Head, Steel, 0.437-20 x 0.625

Table 31 - Parts for Standard Style Mounting Bracket Set with Stainless Steel (DP Option -M2; Biplanar Option -M0)

Item	Part No.	Qty.	Part Name
Set	N1205YD	1	Mounting Bracket Set (includes items 1–4 below)
1	Z1217HV	2	Nut, Hex Head, ss, 0.312-18
2	N1205MF	1	Mounting Bracket, ss
3	N1205MX	1	U-Bolt, ss
4	P0120RN	4	Screw, Hex Head, ss, 0.437-20 x 0.625

Table 32 - Parts for Optional Standoff Kits (Not Included in -M1/M9 or -M2/M0 Options)

Item	Part No.	Qty.	Part Name
5	D0170ME	1	Kit with Four Steel Standoffs, for use with Option -M1 (DP) or Option -M9 (Biplanar)
	D0170MJ	1	Kit with Four 316 ss Standoffs, for use with Option -M2 (DP) or Option -M0 (Biplanar)

Figure 72 - Universal Style Mounting Bracket Set for DP and Biplanar Transmitters (Option -M3)

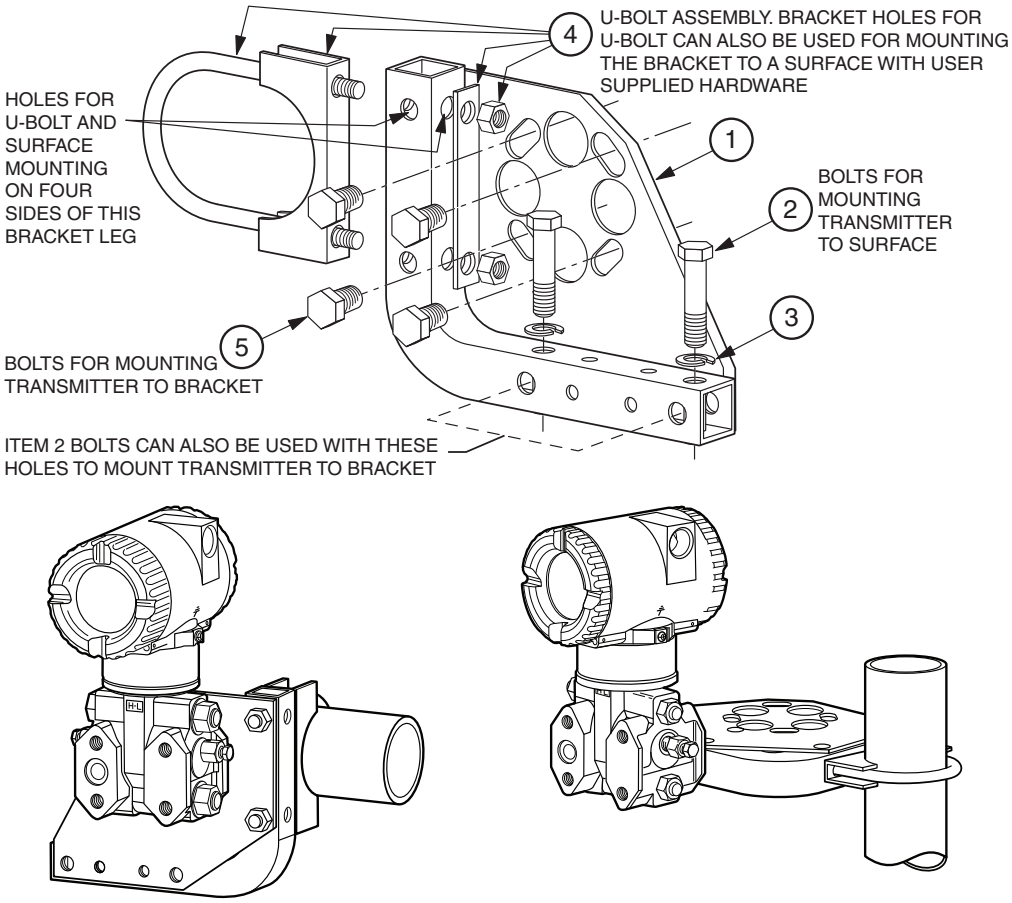


Table 33 - Parts for Universal Style Mounting Bracket Set (Option -M3)

Item	Part No.	Qty.	Part Name
Set	D0170XH	1	Universal Pipe Mounting Set (includes items 1–5 below)
1	D0170VJ	1	Mounting Bracket, ss
2	X0173UR	1	Screw, Hex Head, 0.375-16 x 1.5, , ss
3	A2012TZ	2	Lock Washer, 0.382 I.D., ss
4	D0170VM	1	U-Bolt Assembly, ss, with U-Bolt, 0.312-18; Saddle Clamp; Washer Plate; Nut, Hex Head, 0.312-18
5	P0120RN	4	Screw, hex head, 0.437-20 x 0.625, ss

Vent Screw (Option -V1)

Figure 73 - Vent Screw (Option -V1)

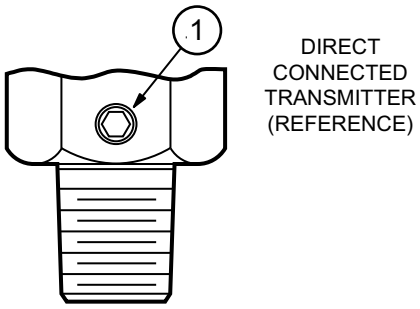


Table 34 - Parts for Vent Screw (Option -V1)

Item	Part No.	Qty.	Part Name
1	D0161SW	1	Vent Screw, 316 ss

Block and Bleed Valve (Options -V2, -V3, and -V4)

Figure 74 - Block and Bleed Valve (Options -V2, -V3, and -V4)

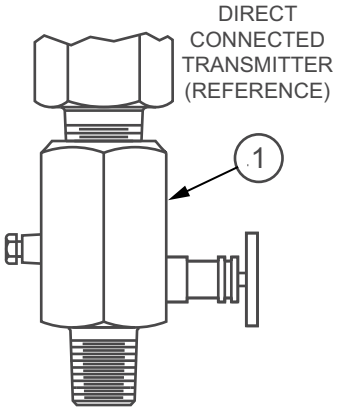


Table 35 - Parts for Block and Bleed Valve (Options -V2, -V3, and -V4)

Item	Part No.	Qty.	Part Name
1	X0172BU	1	Block and Bleed Valve, Carbon Steel (Option -V2)
	X0172BV		Block and Bleed Valve, 316 ss (Option -V3)
	X0172BW		Block and Bleed Valve, 316 ss Body, Monel Trim, NACE Approved (Option -V4)

Adapter Plates (Options -P1 to -P8) for Direct Mounting to Coplanar Manifolds

Figure 75 - Adapter Plates (Options -P1 to -P8) for Direct Mounting to Coplanar Manifolds

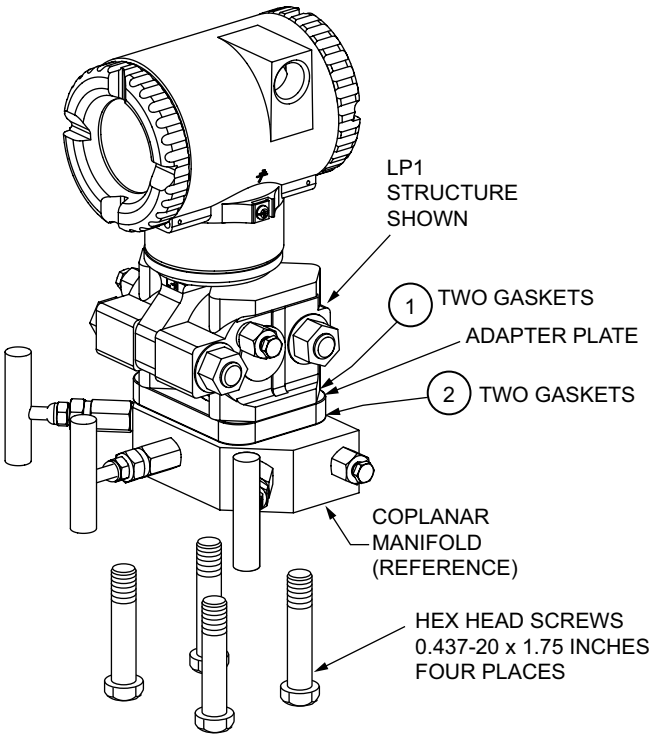


Table 36 - Parts for Adapter Plate Kits -P1 to -P4, Used with "MC" Manifold

Item	Part No.	Qty.	Part Name
n/a	D0170XJ	1	Adapter Plate Kit; B7 Screws; Option -P1
	D0170XM		Adapter Plate Kit; 316 ss Screws; Option -P2
	D0170XN		Adapter Plate Kit; 17-4 ss Screws; Option -P3
	D0170XP		Adapter Plate Kit; B7M Screws; Option -P4

Table 37 - Parts for Adapter Plate Kits -P5 to -P8, Used with "MT3" Manifold

Item	Part No.	Qty.	Part Name
n/a	D0170XQ	1	Adapter Plate Kit; B7 Screws; Option -P5
	D0170XR		Adapter Plate Kit; 316 ss Screws; Option -P6
	D0170XS		Adapter Plate Kit; 17-4 ss Screws; Option -P7
	D0170XT		Adapter Plate Kit; B7M Screws; Option -P8

Table 38 - Gaskets (Included in Kits)

Item	Part No.	Qty.	Part Name
1	D0114RB	2	Gasket, Transmitter to Adapter Plate
2	D0170XK	2	Gasket, Manifold to Adapter Plate

LCD Indicator (Digital Display) Assembly (Option -L1)

Figure 76 - LCD Indicator Assembly (Option -L1)

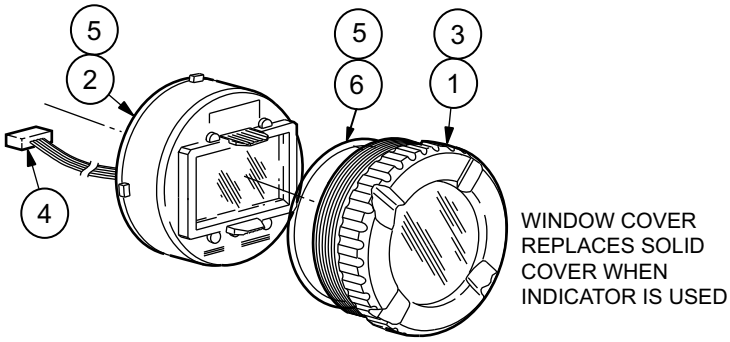


Table 39 - Parts for LCD Indicator Assembly (Option -L1)

Item	Part No.	Qty.	Part Name
1	1 Cover with Window; see Housing Covers, page 133		
2	D0162LQ	1	LCD Indicator Module
3	**Below**	1	**Grease, 1.75 oz. Tube**
	X0180JB		Lubit-8 for Transmitters with Aluminum Housing
	X0114AA		Never-Seez for Transmitters with Stainless Steel Housing
4	P0177HB	1	Indicator Cable
5	0048130	1	Grease, Silicone (150 gram tube)
6	**Below**	2	**O-Ring, Cover**
	X0201FC		for Transmitter without -J option
	X0201QH		for Transmitter with -J option

Conduit Connections (Options -A1 and -A3)

Figure 77 - Conduit Connections (Options -A1 and -A3)

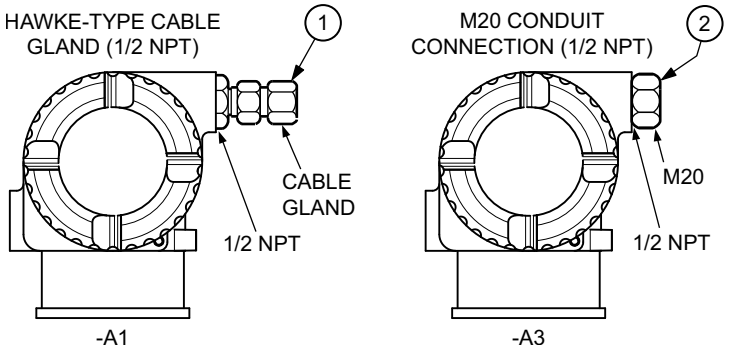


Table 40 - Parts for Conduit Connections (Options -A1 and -A3)

Item	Part No.	Qty.	Part Name
1	N7141HX	1	Hawke-Type 1/2 NPT Brass Cable Gland (Option -A1)
2	N7141DX	1	M20 Connector (Option -A3)

Custody Transfer Lock and Seal (Option -Z2)

Figure 78 - Custody Transfer Lock and Seal (Option -Z2)

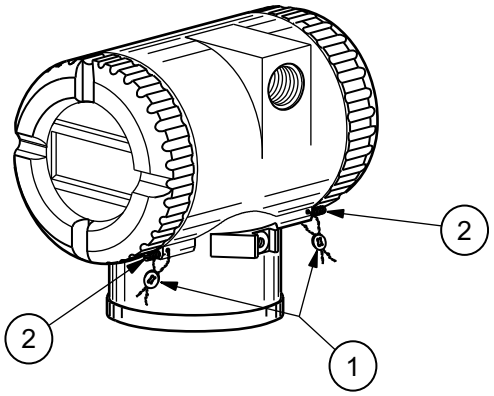


Table 41 - Parts for Custody Transfer Lock and Seal (Option -Z2)

Item	Part No.	Qty.	Part Name
1	S001806	2	Kit with Lock-Out Seal, Wire, and Instructions
2	D0162WM	1	Lock Screw, 0.164-32

Ermeto Connectors (Options -E3 and -E4)

Figure 79 - Ermeto Connectors (Options -E3 and -E4)

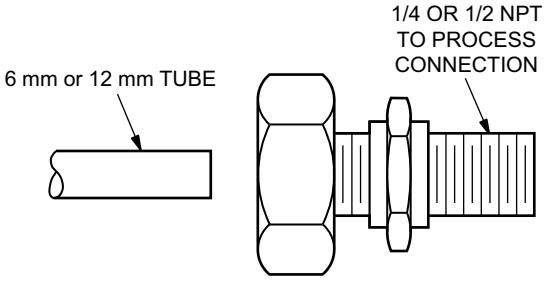


Table 42 - Parts for Ermeto Connectors (Options -E3 and -E4)

Item	Part No.	Qty.	Part Name
n/a	U7002AS	1	Process Connector, 316 ss, 640 bar, 1/4 NPT x 6 mm, Option -E3
	U7002AP		Process Connector, 316 ss, 640 bar, 1/2 NPT x 12 mm, Option -E3

Metric Process Connection (Option -R)

Figure 80 - Metric Process Connection (Option -R)

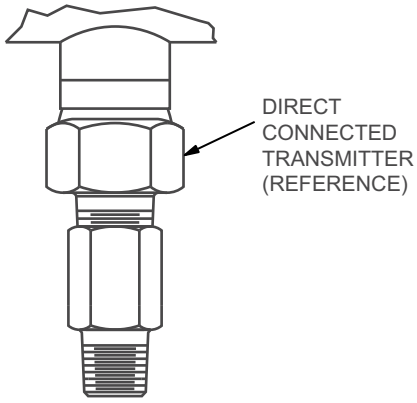


Table 43 - Parts for Metric Process Connection (Option -R)

Item	Part No.	Qty.	Part Name
n/a	X0171ZX	1	Pipe Adapter, 316 ss, 1/2 NPT to Rc 1/2

Recommended Spare Parts

Table 44 - Spare Parts for Direct Connect AP and GP Transmitters

Item No.	Part Number	Part Name	Number of Parts Recommended for		
			1 Inst.	5 Inst.	20 Inst.
See Direct Connect Transmitters, page 120					
3	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	without -J option			
	X0201QH	with -J option			
10	D0197PS	Retention Clip	1	2	4
11	X0179ME	Vent Plug; for Direct Connect GP with sanitary or pulp and paper seals only	1	2	4
12	X0174EK	Button Head Screw	1	2	4
See LCD Indicator (Digital Display) Assembly (Option -L1), page 140					
2	D0162LQ	LCD Indicator Module	0	1	1
3	**Below**	**Grease, 1.75 oz. Tube**	1	2	4
	X0180JB	Lubit-8 for Transmitters with Aluminum Housing			
	X0114AA	Never-Seez for Transmitters with Stainless Steel Housing			
5	0048130	Grease, Silicone (150 gram tube)	0	2	4
6	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	for Transmitter without -J option			
	X0201QH	for Transmitter with -J option			

Table 45 - Spare Parts for Biplanar AP and GP Transmitters

Item No.	Part Number	Part Name	Number of Parts Recommended for		
			1 Inst.	5 Inst.	20 Inst.
See Biplanar Transmitter Topworks, page 122					
3	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	without -J option			
	X0201QH	with -J option			
11	D0197PS	Retention Clip	1	2	4
12	X0174EK	Button Head Screw	1	2	4
See Biplanar Transmitter Bottomworks for Use with Traditional Structures, page 124					
4	**Below**	**Vent Screw**	0	2	4
	B0138MJ	316 ss (standard)			
	B0138MK	Monel(214)			
	D0175PQ	Nickel alloy(215) (to NACE Standard MR0175/MR0103)			
5	**Below**	**Vent Plug**	0	2	4
	D0161QT	316 ss (standard)			
	D0161QU	Monel(214)			
	D0175PP	Nickel alloy(215) (to NACE Standard MR0175/MR0103)			
9	D0114RB	Gasket, PTFE	1	2	4
10	D0161QQ	Glass-filled PTFE (Standard)	1	2	4
See LCD Indicator (Digital Display) Assembly (Option -L1), page 140					
2	D0162LQ	LCD Indicator Module	1	2	4
3	**Below**	**Grease, 1.75 oz. Tube**	1	2	4
	X0180JB	Lubit-8 for Transmitters with Aluminum Housing			
	X0114AA	Never-Seez for Transmitters with Stainless Steel Housing			
5	0048130	Grease, Silicone (150 gram tube)	0	2	4
6	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	for Transmitter without -J option			
	X0201QH	for Transmitter with -J option			

(214)Metallic process wetted material conforming to NACE Standard MR0175 and MR0103.
(215)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

Table 46 - Spare Parts for DP Transmitters

Item No.	Part Number	Part Name	Number of Parts Recommended for		
			1 Inst.	5 Inst.	20 Inst.
See DP Transmitter Topworks, page 127					
3	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	without -J option			
	X0201QH	with -J option			
12	D0197PS	Retention Clip	1	2	4
13	X0174EK	Screw, Button Head	1	2	4
See DP Transmitter Bottomworks for Use with Traditional Structures, page 129					
4	**Below**	**Vent Screw**	0	2	4
	B0138MJ	316 ss (standard)			
	B0138MK	Monel(216)			
	D0175PQ	Nickel alloy(217) (to NACE Standard MR0175/MR0103)			
5	**Below**	**Vent Plug**	0	2	4
	D0161QT	316 ss (standard)			
	D0161QU	Monel(216)			
	D0175PP	Nickel alloy(217) (to NACE Standard MR0175/MR0103)			
9	D0114RB	Gasket, PTFE	2	2	4
10	D0161QQ	Gasket, Process Cover, Glass-filled PTFE (Standard)	2	4	8
See DP Transmitter Bottomworks for Use with Low Profile Structures LP1, page 131					
4	**Below**	**Vent Screw**	0	2	4
	B0138MJ	316 ss			
	D0175PQ	Nickel alloy(217)			
5	**Below**	**Vent Plug**	0	2	4
	D0161QT	316 ss			
	D0175PP	Nickel alloy(217)			
9	D0114RB	Gasket, PTFE	2	4	8
10	D0161QQ	Gasket, Glass-Filled PTFE	2	4	8
See LCD Indicator (Digital Display) Assembly (Option -L1), page 140					
2	D0162LQ	LCD Indicator Module	0	1	1
3	**Below**	**Grease, 1.75 oz. Tube**	1	2	4
	X0180JB	Lubit-8 for Transmitters with Aluminum Housing			
	X0114AA	Never-Seez for Transmitters with Stainless Steel Housing			
5	0048130	Grease, Silicone (150 gram tube)	0	2	4
6	**Below**	**O-Ring, Cover**	0	2	4
	X0201FC	for Transmitter without -J option			
	X0201QH	for Transmitter with -J option			

(216)Metallic process wetted material conforming to NACE Standard MR0175 and MR0103.
(217)Equivalent to Hastelloy® C-276. Hastelloy is a registered trademark of Haynes International, Inc.

Table 46 - Spare Parts for DP Transmitters (Continued)

Item No.	Part Number	Part Name	Number of Parts Recommended for		
			1 Inst.	5 Inst.	20 Inst.
See Adapter Plates (Options -P1 to -P8) for Direct Mounting to Coplanar Manifolds, page 139					
1	D0114RB	Gasket - Transmitter to Adapter Plate	2	4	8
2	D0170XK	Gasket - Manifold to Adapter Plate	2	4	8

Dimensions

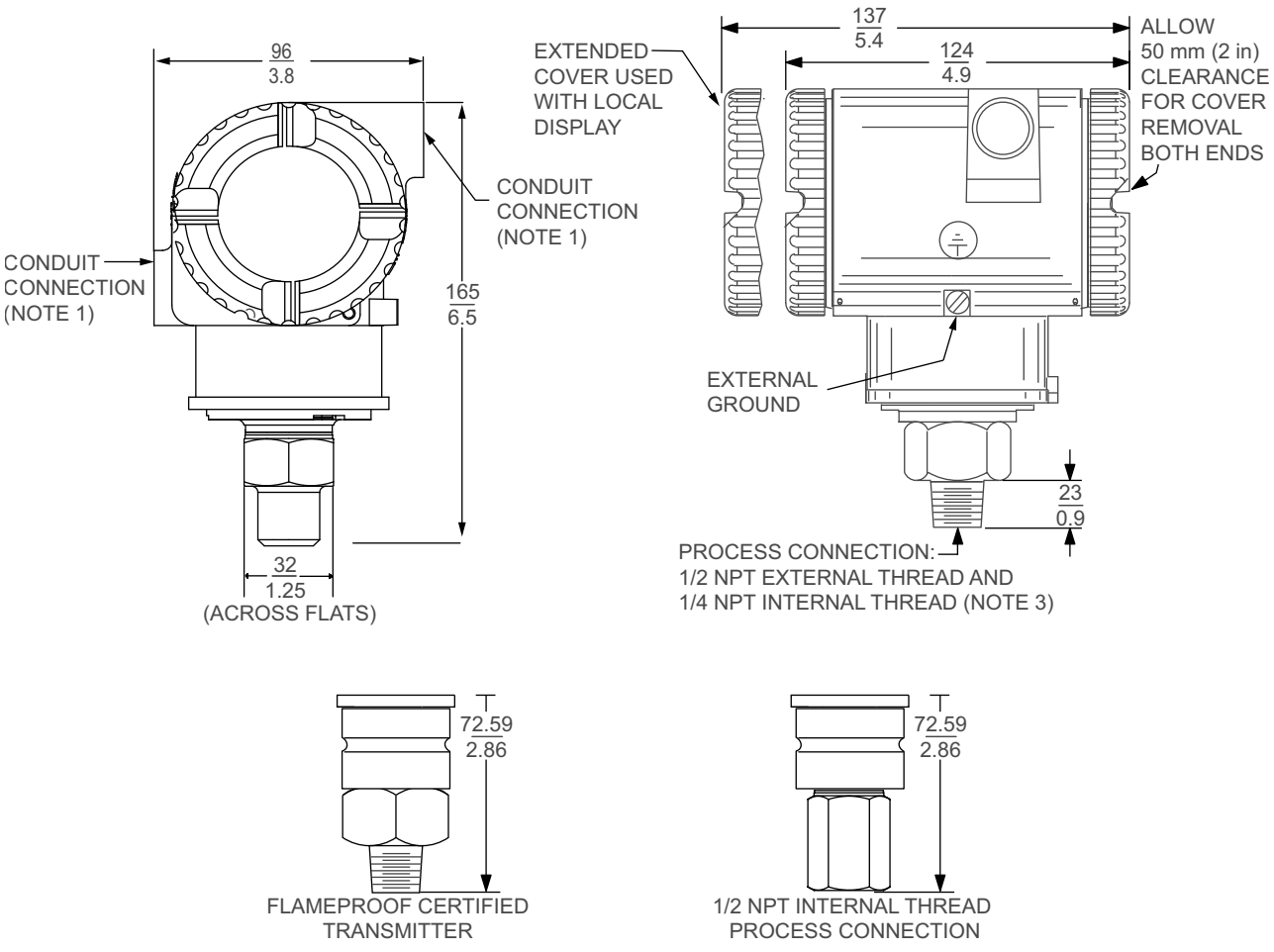
For dimensional information specific to your sales order, contact your sales representative to order a Certified Dimensional Print (CDP).

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

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

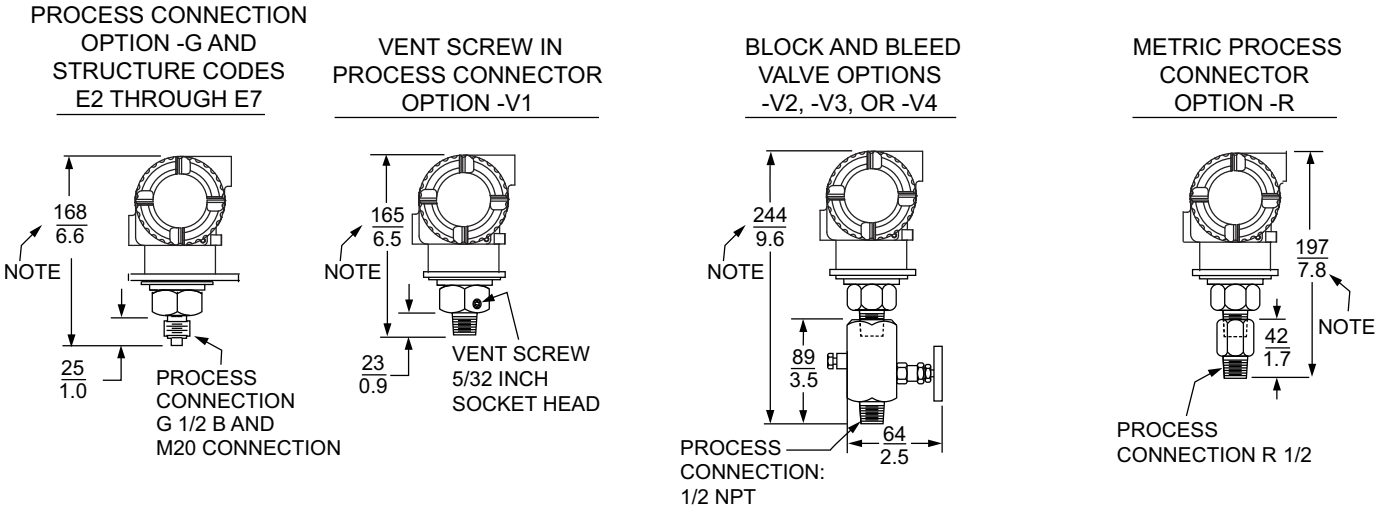
Direct Connect AP and Direct Connect GP Transmitters

Figure 81 - Direct Connect AP/GP Transmitters



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

Figure 82 - Direct Connect AP/GP Transmitters with Options -G, -V1, -V2, -V3, -V4, and -R



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

Figure 83 - Direct Connect AP/GP Transmitters with Options -M1, -M2, -M5, and -M6

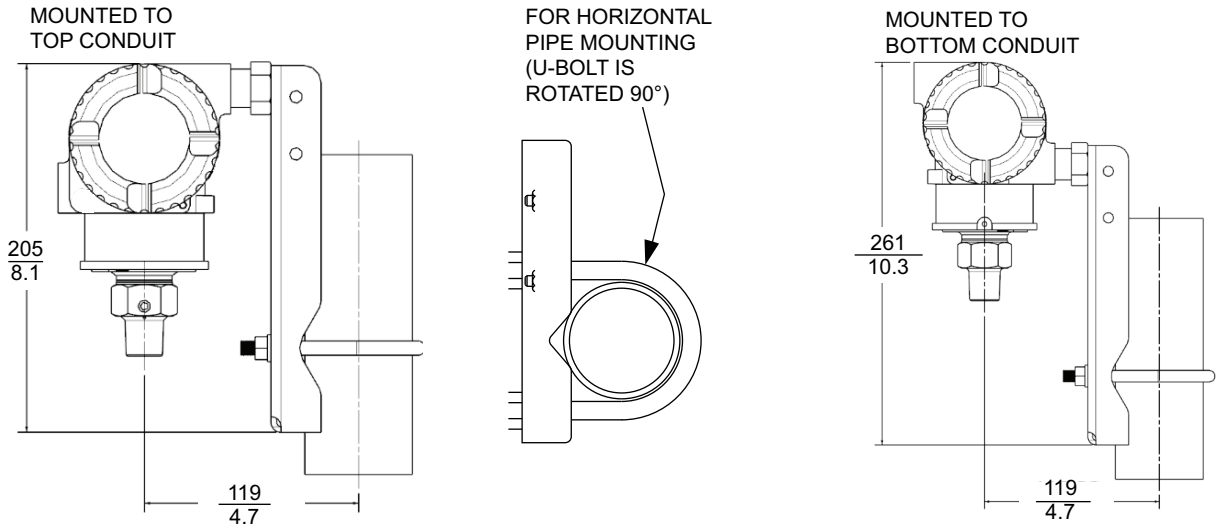
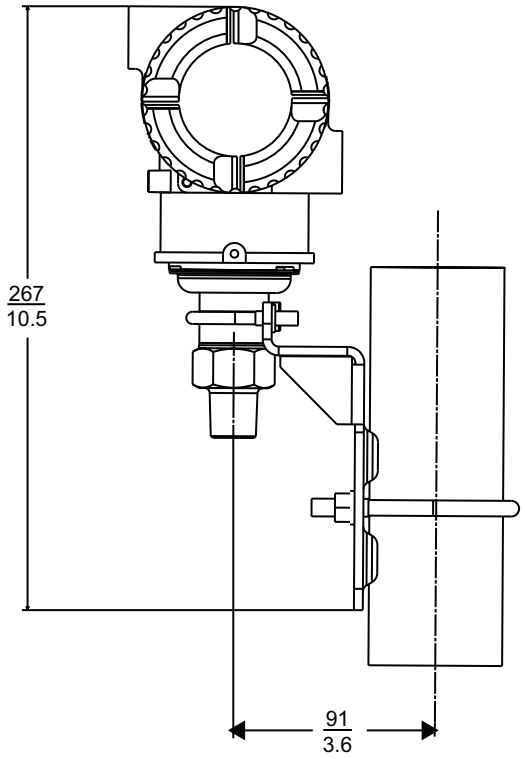
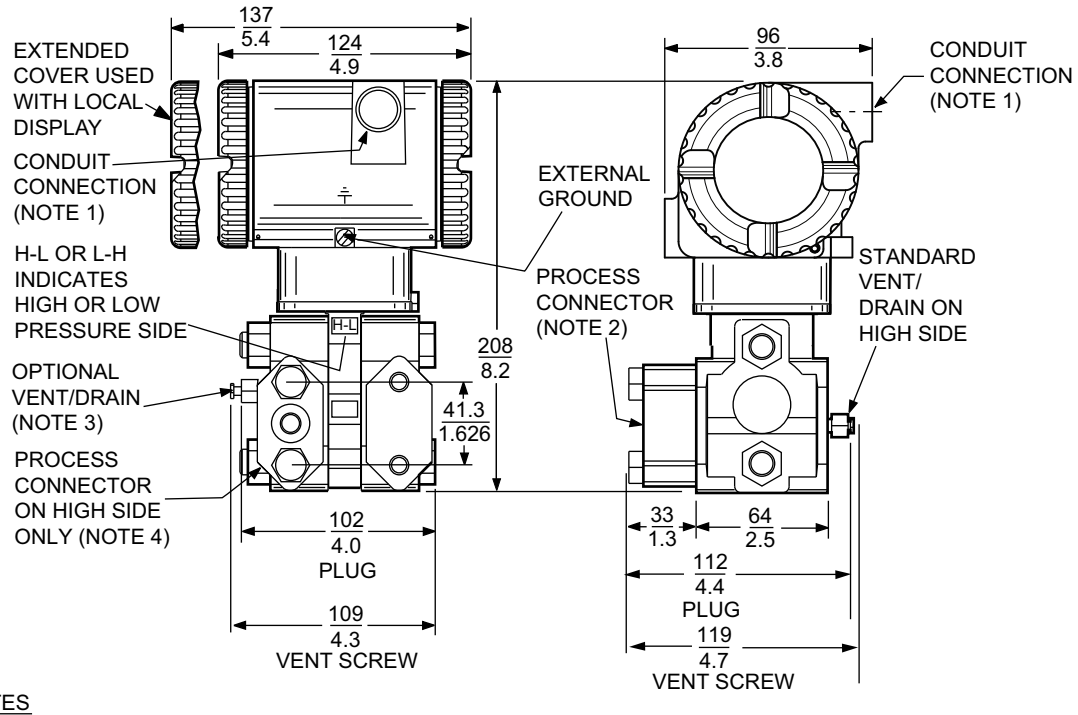


Figure 84 - Flameproof Direct Connect AP/GP Transmitters with Options -M7 and -M8



Biplanar AP and Biplanar GP Transmitters

Figure 85 - 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 86 - Biplanar AP/GP Transmitters with Options -D5, -D6, -D7, -D8, and -D9

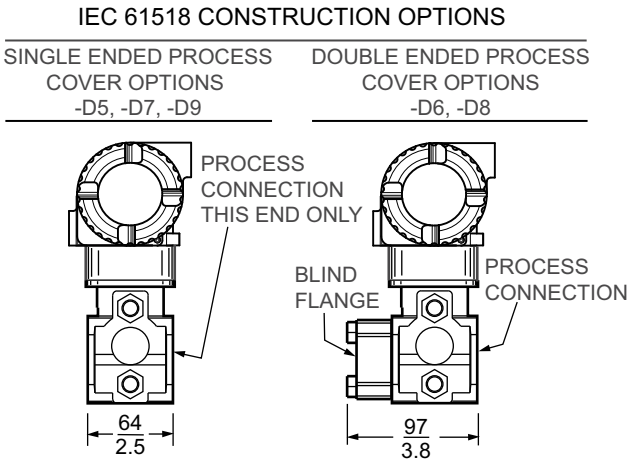
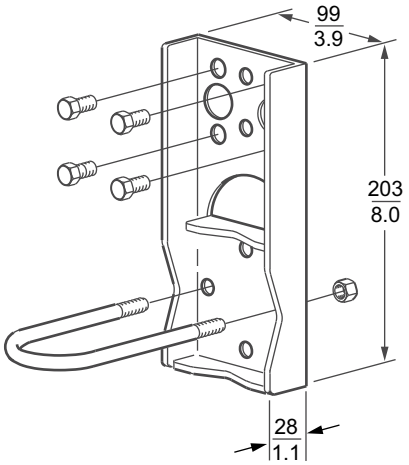
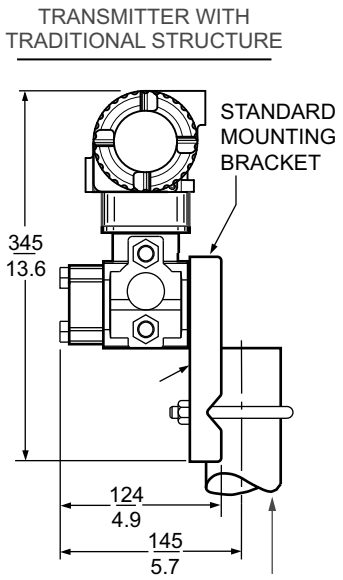


Figure 87 - Biplanar AP/GP Transmitters with Options -M0 and -M9 (Standard Stainless Steel or Painted Steel Bracket)

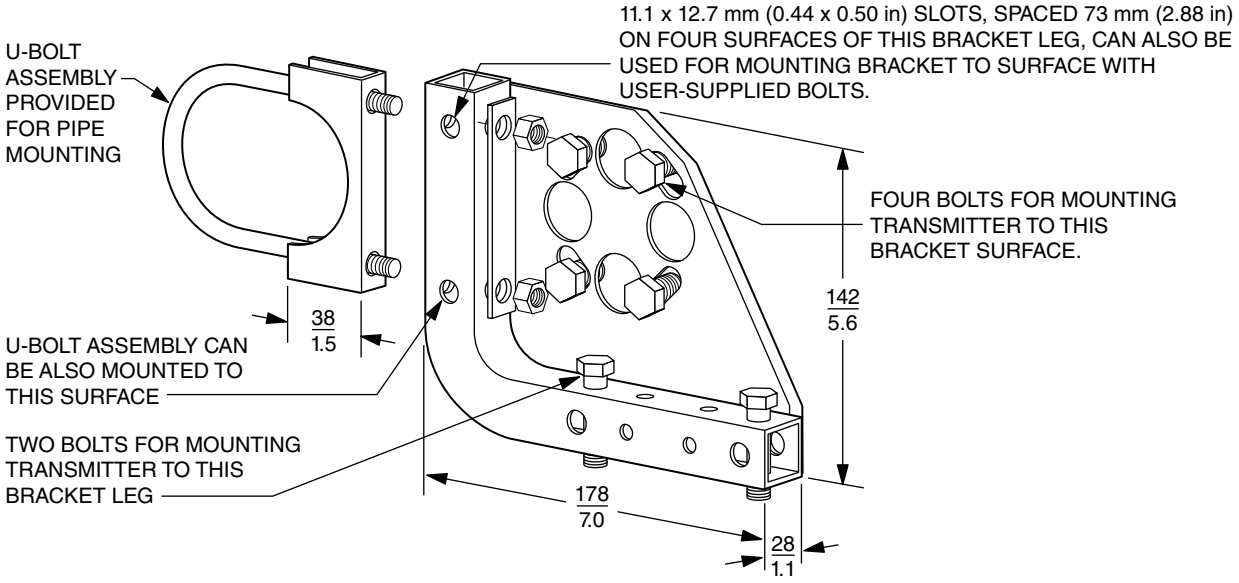


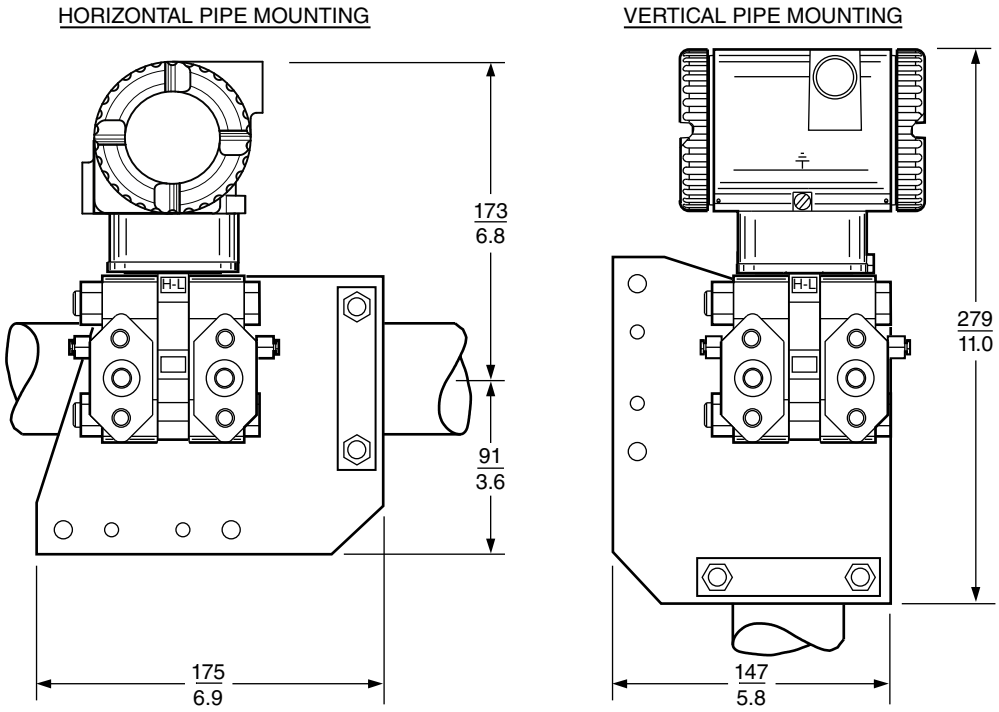
FOR SURFACE MOUNTING, REPLACE U-BOLT WITH TWO 0.375 in DIAMETER BOLTS OF SUFFICIENT LENGTH TO PASS THROUGH BRACKET AND SURFACE.



VERTICAL DN 50 OR 2 in PIPE; ROTATE U-BOLT 90° FOR MOUNTING TO HORIZONTAL PIPE

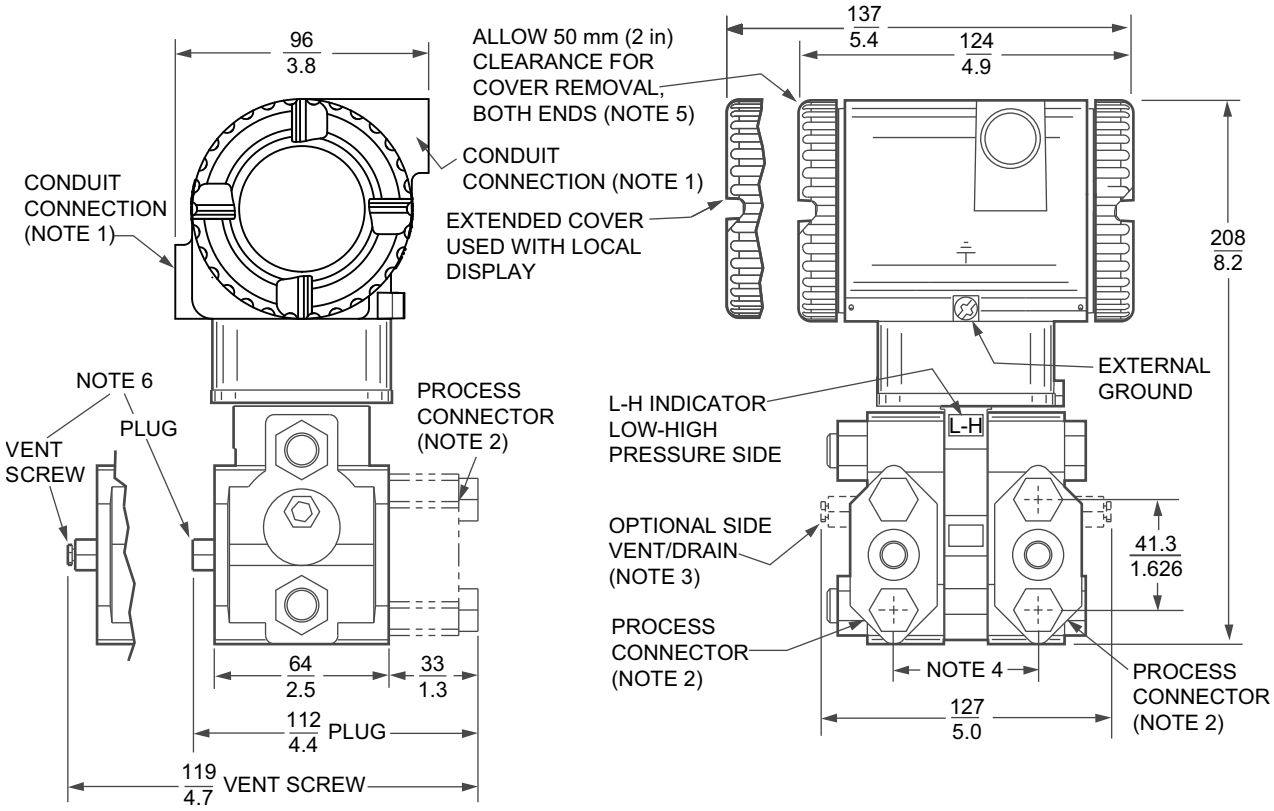
Figure 88 - Biplanar AP/GP Transmitters with Option -M3 (Universal Bracket)



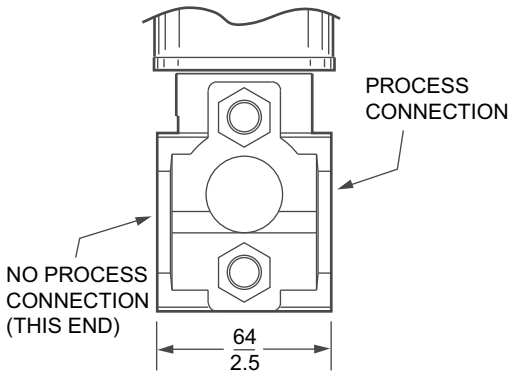


DP Transmitters

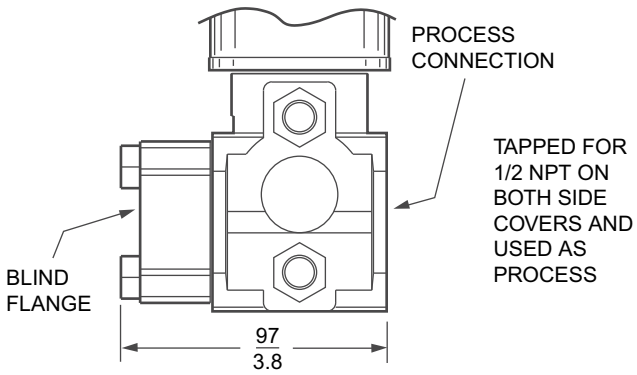
Figure 89 - DP Transmitters with Traditional Structure



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.

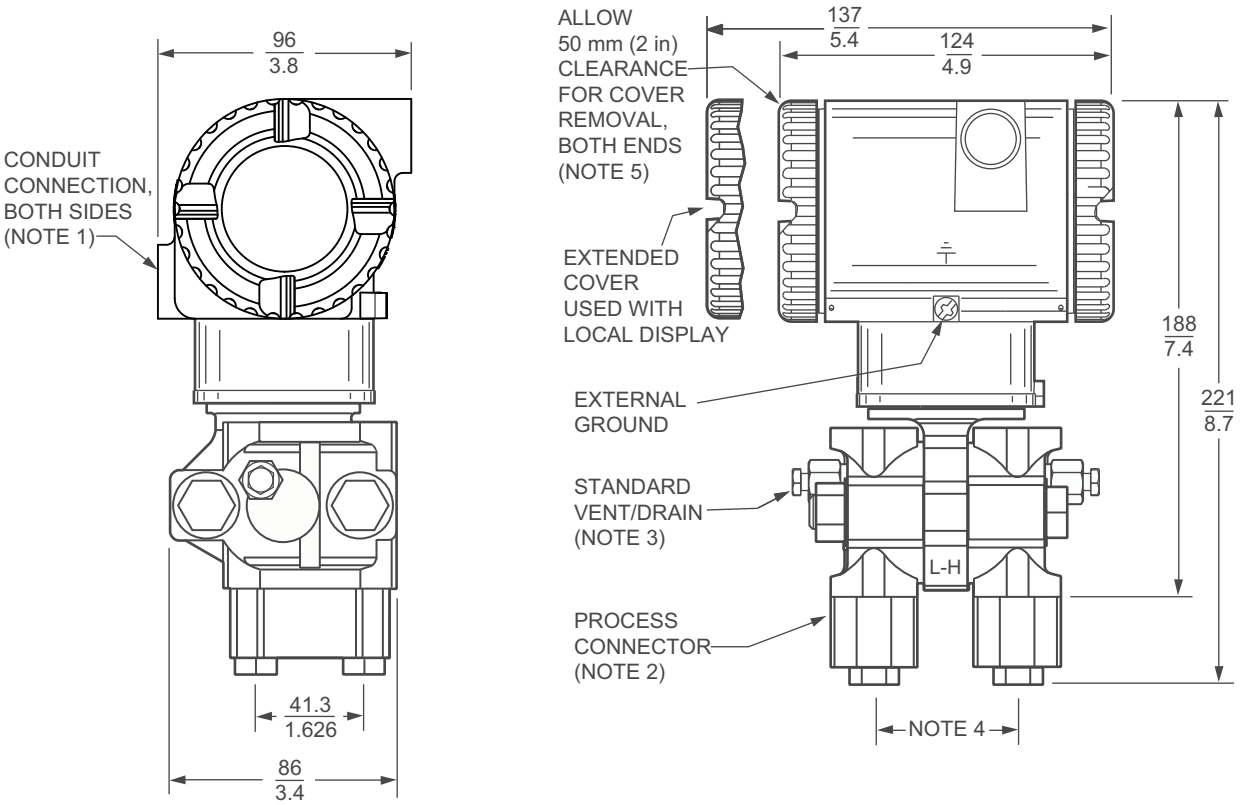


OPTIONAL IEC 61518 CONSTRUCTION
SINGLE ENDED PROCESS COVER
OPTIONS -D5, -D7, -D9



OPTIONAL IEC 61518 CONSTRUCTION
DOUBLE ENDED PROCESS COVER
OPTIONS -D6, -D8

Figure 90 - DP Transmitters with Low Profile 1 (LP1) Structure



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

Figure 91 - DP Transmitters with Traditional Structure and Options -M1 and -M2 (Standard Style Mounting Bracket)

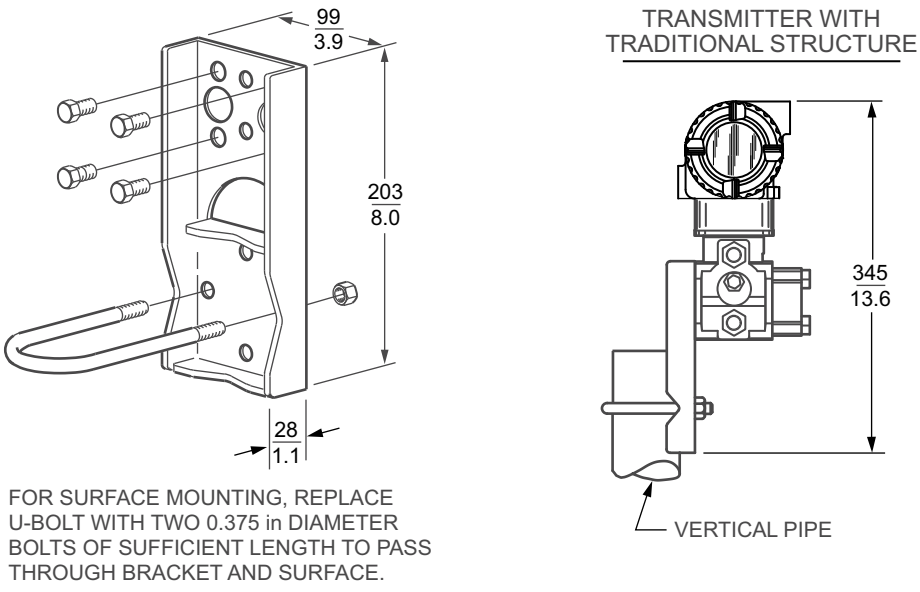
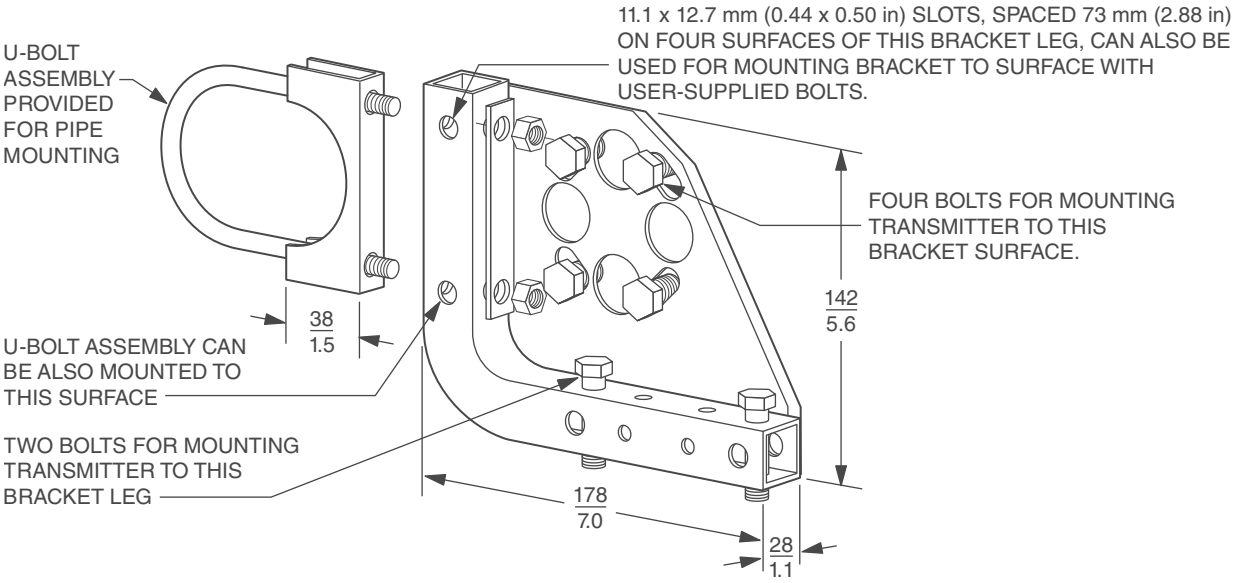
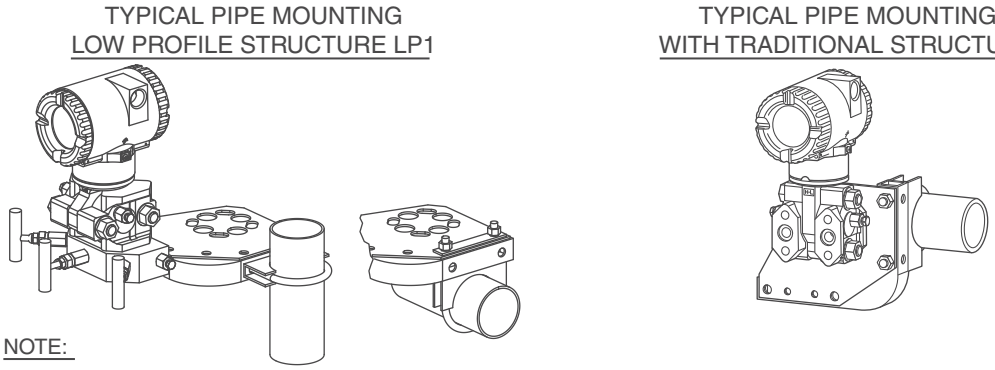


Figure 92 - DP Transmitters with Option -M3 (Universal Style Mounting Bracket Kit)

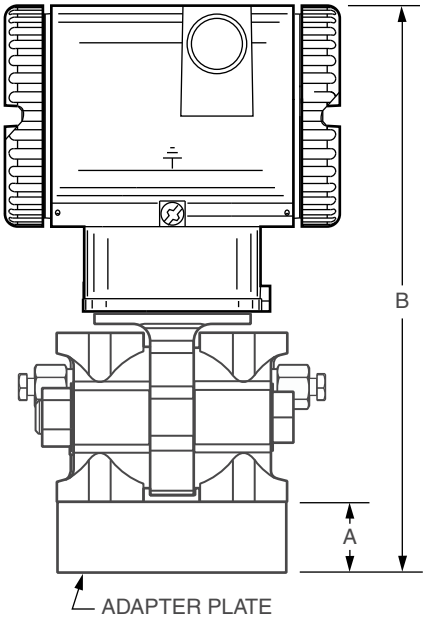




NOTE:

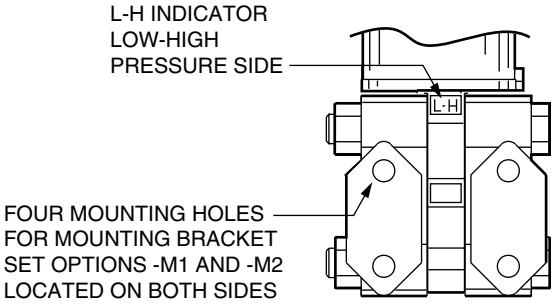
FOR SURFACE MOUNTING CONFIGURATIONS, USE THE U-BOLT MOUNTING HOLES FOR ATTACHING THE BRACKET TO A SURFACE RATHER THAN TO THE U-BOLT ASSEMBLY. SURFACE MOUNTING BOLTS FOR ATTACHING THE BRACKET TO A SURFACE ARE USER SUPPLIED.

Figure 93 - DP Transmitters with LP1 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 94 - DP Transmitters with Traditional Structure and Options -D5 to -D9



Appendix A: Functional Safety Information

Purpose

This appendix describes the user responsibilities for installation and operation of these pressure transmitters in a Safety Instrumented Function (SIF). In order to ensure the safe usage of this product, all procedures in this appendix must be followed. This appendix should be read in addition to the appropriate sections of this instruction document for the transmitter being installed.

Scope

The information in this appendix applies to the following products if they have a green housing, a firmware version of 2.0 or greater, and “SIL 2” on the data plate.

- IAP**S-T Absolute Pressure Transmitter with HART Communication
- IDP**S-T Differential Pressure Transmitter with HART Communication
- IGP**S-T Gauge Pressure Transmitter with HART Communication

See Product Identification, page 158 for the location of the model code.

Acronyms and Definitions

Acronym	Definitions
DCS	Distributed Control System
DD	Dangerous Detected
DU	Dangerous Undetected
FIT	Failures in Time (failures per 1E09 hours)
FTA	Fault Tree Analysis
HFT	Hardware Fault Tolerance
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
LT	Product Lifetime
MPa	megaPascals
MTTR	Mean Time to Repair
PFD_{AVG}	Average Probability of Failure on Demand
PFH	Probability of Failure per Hour
psi	Pounds per square inch
PTI	Proof Test Interval
SD	Safe Detected
SFF	Safe Failure Fraction
SFRS	Safety Requirements Specification

Acronym	Definitions
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SU	Safe Undetected

SIL 2 Reference Documents

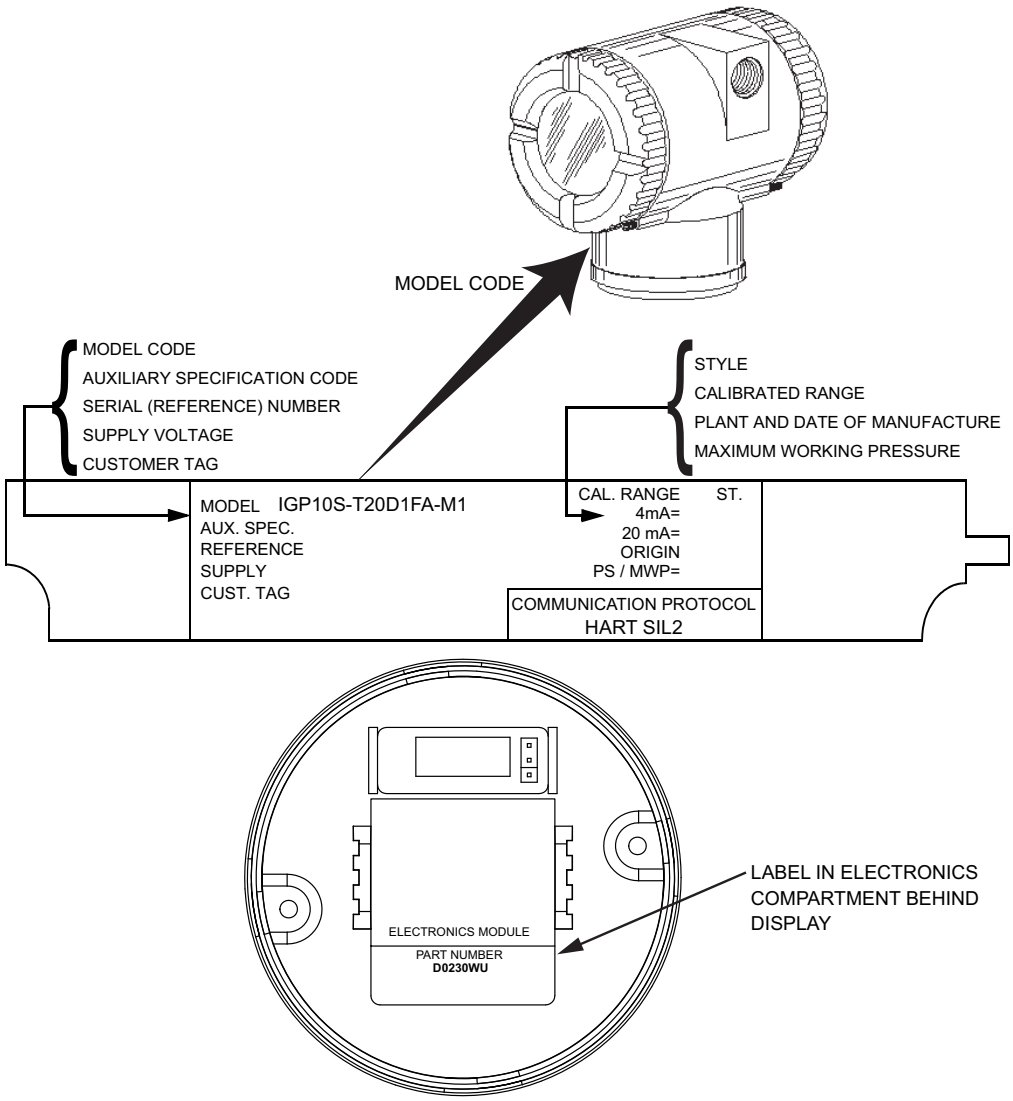
The following documents are referenced by this appendix, or define or constrain its contents. Where the contents of this appendix conflict with those of a referenced document, the contents of the most recent document shall take precedence. Additional related documents are listed in Related Documents, page 10.

Document Number	Description
PSS 2A-1S05 A	Product Specification Sheet, Value Performance Pressure Transmitters
PSS 2A-1S10 A	Product Specification Sheet, Advanced Performance Pressure Transmitters
PSS 2A-1S05 A	Product Specification Sheet, Premium Performance Pressure Transmitters
MI 020-611	Instruction, Pressure Transmitters with HART Communication and SIL 2
MI 020-366	Instruction, Pressure Transmitters Operation, Configuration, and Calibration Using a HART Communicator
MI 020-501	Instruction, PC50 Intelligent Field Device Tool, Installation and Parts List
MI 020-505	Instruction, PC50 Intelligent Field Device Tool, Operation Using HART Communication Protocol
IEC 61508-2010	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems

Safety Specifications

Product Identification

Figure 95 - Sample Transmitter Data Plate



Safety Related Parameters

The following variables and interfaces can be used as part of a Safety Instrumented Function:

Variables:	Pressure
Interfaces:	4 to 20 mA analog current
	Use in absolute, gauge, or differential pressure measurement applications as indicted by the model code
Safety Accuracy:	2%

⚠WARNING

HAZARD OF OPERATION OUTSIDE OF TEMPERATURE SPECIFICATION

- The Safety Accuracy specification applies when the temperature of the device electronics is within the normal operating temperature range of -40 to +85°C (-40 to +185°F). Outside of this temperature range, the milliamp output may experience greater drift and may not remain within the 2% Safety Accuracy specification.
- For applications that may encounter temperatures beyond the normal operating range, configure the Temperature Sensor Fail Strategy to set the device to Failsafe when the operating temperature limit is exceeded, and ensure that the DCS can recognize Failsafe settings outside of the Safety Accuracy range.
- With the local display or DTM, the Failsafe setting is **AO ALM**. With the DD, the Failsafe setting is **AO Alarm**.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Safety Response Time:	750 ms maximum (with Damping set to 0 s)
Measurement Updates:	Every 250 ms
Low Alarm:	In rare cases, certain extreme conditions are signaled within the Low Alarm range independent of the configured setting for the failsafe strategy. For example, a bad processor may result in a 3.6 mA output even if the device is configured to fail to the high MI setting.

⚠WARNING

HAZARD OF IMPROPER MONITORING

To ensure safe fault monitoring, the DCS must be capable of recognizing both the High Alarm and Low Alarm conditions as malfunction indicators.

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

- The HART interface and/or the local interface (if present) may be used to examine data, but are not to be used as a safety critical means of communication.
- The write protect jumper must be in the Protect position during normal operation as detailed in the configuration and operation section.
- The user can verify that the transmitter is operating in the secured (SIL) mode using a HART Communicator as follows:
  1. From the Top Level **Online** menu, select **Device Setup** and then **Diagnostic Info**.
  2. Verify that the **SIL Mode** item indicates **OK: Required + Active**.
- The transmitter model code offers red or yellow replacement covers to identify that the transmitter is part of a safety loop.
- Pressure transmitters can be used in SIL 2 safety functions in 1oo1 single mode, or in SIL 3 safety functions in 1oo2 dual mode.

Reliability Data

These data are valid with the following requirements:

- The logic solver (user SIF) must detect both out of range currents, both over and under, and must act upon their detection to bring the system to a safe state.

- The system operates in a low demand mode. (The frequency of demands for operation made on the system is no greater than one per year and no greater than twice the proof test frequency.)

Failure Data According to IEC 61508

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

The PFD_{AVG} value for a single pressure transmitter is 2.7E-4 per year. The PFD_{AVG} values shown in the following table support a Proof Test Interval of up to five years. It is the responsibility of the end user to select a Proof Test Interval that satisfies the requirements of the application. Refer to Periodic Proof Testing, page 165.

Time (Years)	Time (Hours)	PFD_{AVG}	% of SIL 2
0.25	2190	6.8E-05	1.9%
0.5	4380	1.4E-04	3.9%
1	8760	2.7E-04	7.8%
2	17520	5.4E-04	15.5%
5	43800	1.4E-03	38.8%

The PFH value for a single pressure transmitter is 6.2E-8.

The transmitter performs internal diagnostic functions to detect random faults of its hardware. All internal diagnostics are executed to detect faults within the diagnostic test interval of 11 minutes. The transmitter detects and mitigates systematic faults that could result in failure on demand prior to a demand occurring.

Environmental Limits

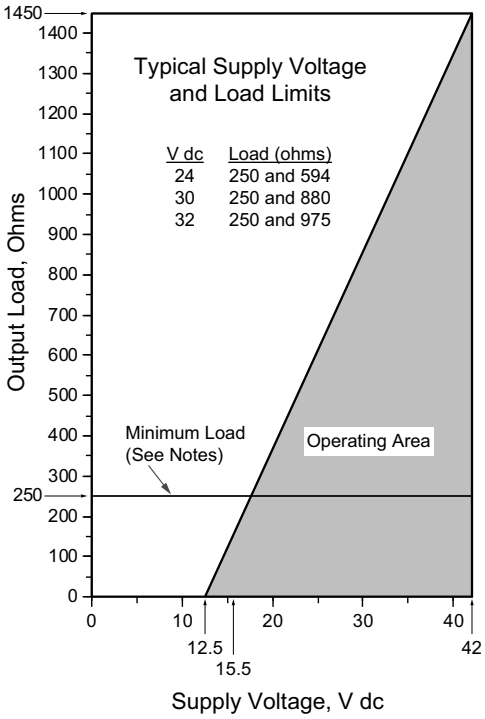
Parameter	Limits
Sensor Body Temperature	
Silicone fill fluid	-46 and +121°C (-50 and +250°F)(218) (219)
Fluorinert fill fluid	-29 and +121°C (-20 and +250°F)(220)
NEOBEE® fill fluid	-18 and +121°C (0 and 250°F)
Electronics Temperature	
Without LCD	-40 and +85°C (-40 and +185°F)(221) (222)
With LCD	-40 and +85°C (-40 and +185°F)(221) (222) (223)
Relative Humidity	0 and 100%(224)

(218) 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.
(219) -46 and +50°C (-50 and +122°F) for biplanar AP transmitters.
(220) -18°C (0°F) for J range (IGP05S transmitters only).
(221) -40 and +75°C (-40 and +167°F) for transmitters with flameproof classification.
(222) -40 and +50°C (-40 and +122°F) for biplanar AP transmitters.
(223) Display updates are slowed and readability is decreased at temperatures less than -20°C (-4°F).
(224) 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.

Parameter	Limits
Terminal Voltage	The loop must be designed to provide a minimum of 15.5 V dc at the transmitter terminals to allow for SIS operation up to 21 mA with a safe margin and allowance for HART communication. Refer to the Supply Voltage and Loop Load for SIF Applications, page 161 graph.
Vibration	
Aluminum Housing	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
Stainless Steel Housing	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
Weatherproofing	Dusttight and weatherproof per IEC IP66 and NEMA 4X

Figure 96 - Supply Voltage and Loop Load for SIF Applications

This SIF supply voltage vs load curve allows for a Safety Margin to comply with SIL certification.



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.

⚠⚠WARNING

HAZARD OF OPERATION WITH INSUFFICIENT POWER SUPPLY VOLTAGE

The Safety Accuracy specification applies when the voltage supplied to the terminals of the transmitter is within the normal operating range of 15.5 V dc to 42V. To be assured of operation within the safety accuracy specification, the installation must include power supply monitoring or other means to ensure that the transmitter is supplied with a supply voltage that is no lower than 12.5 V dc.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Application Limits

For span range limits, refer to Span and Range Limits, page 14.

For maximum static, overrange, and proof pressure limits, refer to Maximum Static, Overrange, and Proof Pressure Ratings, page 15.

Electromagnetic Compatibility

This pressure transmitter conforms to the following EMC requirements:

- NAMUR NE21 (August 1998 German and May 1999 English)
- EMC directive 2004/108/EC per EN 61326-3-1
- IEC 61000-4 (parts 2, 4, 5, 8, and 11)
- CISPR16

Lifetime Limits

According to section 7.4.9.5 of IEC 61508-2, a useful lifetime, based on experience, should be assumed.

Although a constant failure rate is assumed by the probabilistic estimation method, this only applies provided that the useful lifetime of components is not exceeded. Beyond their useful lifetime the result of the probabilistic calculation method is therefore meaningless, as the probability of failure significantly increases with time. The useful lifetime is highly dependent on the component itself and its operating conditions - temperature in particular (for example, electrolyte capacitors can be very sensitive).

This assumption of a constant failure rate is based on the bathtub curve, which shows the typical behavior for electronic components. Therefore it is obvious that the PFD_{AVG} calculation is only valid for components that have this constant domain and that the validity of the calculation is limited to the useful lifetime of each component.

This table identifies the components that are contributing to the dangerous undetected failure rate and therefore to the PFD_{AVG} calculation and their estimated useful lifetime.

Table 47 - Useful Lifetime of Components Contributing to λ_{DU}

Type	Useful Life at 40°C
Capacitor (electrolytic) — Tantalum electrolytic, solid electrolyte	Approximately 500,000 hours

As there are no aluminum electrolytic capacitors used, the tantalum electrolytic capacitors are the limiting factors with regard to the useful lifetime of the system. The tantalum electrolytic capacitors that are used in the transmitter have an estimated useful lifetime of about 50 years.

When plant experience indicates a shorter useful lifetime than indicated in this appendix, the number based on plant experience should be used.

Certification Data

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

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

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

  NOTE: Per Table 3 of IEC 61508-2:2010 section 7.4.4.2.2, the preceding information allows the Pressure Transmitter, when used in a 1 of 2 system architecture, to be used as a SIL 3 application with an HFT of 1.
- All Pressure Transmitter diagnostics have a maximum Diagnostic Test Interval of 11 minutes.

Personnel

It is the responsibility of the user organization to ensure that personnel involved in the use and maintenance of the product are properly trained and qualified to carry out their activities.

Installation

The Pressure Transmitter is to be installed per this instruction manual. Related documents are listed in the SIL 2 Reference Documents, page 157 section.

Configuration and Setup

Pressure transmitter configuration and setup are described in this instruction manual. Related documents are listed in SIL 2 Reference Documents, page 157. The configuration parameters are repeated here for convenience.

Table 48 - Configuration Parameters

Parameter	Capability	Factory Default	Configurable with		Application Requirement
			Integral Indicator (if applicable)	Remote Configurator (225)	
Descriptors					
Tag	8 characters maximum	TAG	No	Yes	
Long Tag	32 characters maximum	[blank]	No	Yes	
Descriptor	16 characters maximum	DESCRIPTOR	No	Yes	
Message	32 characters maximum	MESSAGE	No	Yes	
Input					
Calibrated Range	LRV to URV in linear units (listed at the end of this table)	See Span and Range Limits, page 14	Yes	Yes	

(225)Remote configurator provides a noninterfering means for the user to perform some setup, configuration, and maintenance activities. See Additional Restrictions, page 164.

Table 48 - Configuration Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with		Application Requirement
			Integral Indicator (if applicable)	Remote Configurator (226)	
Output					
Meas #1 Output	4 to 20 mA or Fixed Current	4 to 20 mA	Yes	Yes	
Meas #1 Mode	AP or GP: Linear DP: Linear or type of square root	Linear	Yes	Yes	
Meas #1 EGUs	See the end of this table for a list of linear units and square root units	Same units as Calibrated Range	Yes	Yes	
Meas #2 Mode	AP or GP: Linear DP: Linear or type of square root	Linear	Yes	Yes	
Meas #2 EGUs	See the end of this table for a list of linear units and square root units	Same units as Calibrated Range	Yes	Yes	
Electronics Temperature Sensor Alarms Strategy	Normal operation or failsafe	Normal operation (227)	Yes	Yes	
Failsafe	High or Low	High	Yes	Yes	
External Zero	Enabled or Disabled	Disabled	Yes	Yes	
Damping	0 to 32 seconds	0.25 seconds	Yes	Yes	
Poll Address	0 to 63	0	Yes	Yes	
Loop Current Signaling	On (active/live current) or Off (fixed current)(228)	On	Yes	Yes	
LCD Indicator	Meas #1 EGU or % Lin(229)	Meas # 1 EGU	Yes	No	
Linear Units: 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					
Square Root Units: 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					

Additional Restrictions

- The write protect jumper shall be in the **Protect** position during normal operation (that is, whenever the safety function must be active). To activate write protection, power down the transmitter and remove the display. Then remove the jumper or move it to the lower position as shown on the exposed label. Replace the display and restore power to the transmitter. Refer to Setting the Write Protect Jumper, page 43.
- At any time the write protect jumper is not in the **Protect** position, the configuration can be altered by means of the local display or HART Communicator. In this state, the transmitter output is not to be considered to be reliable. Other means of determining whether the safety variable has exceeded its limit shall be implemented for the duration of this state. The jumper shall be returned to the **Protect** position when the calibration and/or configuration activity is complete using the procedure described above.

(226)Remote configurator provides a noninterfering means for the user to perform some setup, configuration, and maintenance activities. See Additional Restrictions, page 164.
(227)Select the failsafe (non-default) setting for additional SIL diagnostics.
(228)Device is not safety compliant if in multidrop mode.
(229)Measurement 2 can be displayed at any time by pressing the **ENTER** button, regardless of the local display's configuration.

- The protective function provided by the milliampere output is not available when the local interface (if present) is used to perform manual configuration or calibration operations.
- With user configurable damping set to 0 seconds damping, the pressure transmitter has a worst-case response time of less than 750 ms for a 63% response to a pressure step change. For damping settings other than 0, the user is responsible for performing the worst case response time calculations and for verifying that the resulting response time is appropriate for the application.
- Each configuration change must be verified after it is made. The verification procedure varies depending on the configurator that is used to make the change.
  - When a HART Communicator is used, the user must verify that the transmitter's internal verification process completes as follows:
    1. From the top-level **Online** menu, select **Device Setup** and then **Diagnostic Info**.
    2. The **Database Verify** item changes from **Idle** to **Verifying** when new configuration data is sent to the transmitter. The transmitter then performs internal checks to verify the changes, which takes up to two minutes. The display then changes to **Verify Complete**.
    3. The user must then power cycle the HART Communicator and verify the value shown in each changed parameter.
  - When any other HART device (for example, a PC-Based Configurator) is used, the user must terminate the program, power cycle the transmitter, and restart the program. The user must then verify the value shown in each changed parameter.
  - When the local interface is used, the user must use the **View** menu to verify the value shown in each changed parameter.
- In order to validate the entire configuration before placing the transmitter into service, perform a proof test on the transmitter.

Startup

There are no safety-specific requirements for startup.

Preventive Maintenance

Periodic Proof Testing

The following proof tests are recommended. The simpler Partial Proof Test verifies that the milliamp output is fully functional and that no problems exist with the wiring, loop resistance, and power supply levels. The Comprehensive Proof Test also verifies the input circuitry, ensuring that the device responds to process pressure changes within the specified safety accuracy.

Partial Proof Test

The Partial Proof Test satisfies the Proof Test requirements, and will detect more than 61% of all DU failures that are not detected by the automatic diagnostics and supporting electronics.

Required tools: Either a HART Master, HART Communicator, or an optional local display module and a milliamp meter.

1. Follow the required protocol to remove the device from online operation.
2. Override the milliamp output to the High Failsafe setting of 21.0 mA.
3. Use the milliamp meter to confirm that the mA output corresponds to the entered value.
4. Override the milliamp output to the Low Failsafe setting of 3.6 mA.
5. Use the milliamp meter to confirm that the mA output corresponds to the entered value.
6. Return the device to normal operation.
7. Document the test results per the requirements of the application.

Comprehensive Proof Test

The Comprehensive Proof Test, when combined with the Partial Proof Test, satisfies the Proof Test requirements and will detect more than 89% of all DU failures that are not detected by the automatic diagnostics and supporting electronics.

Required tools: Either a HART Master, HART Communicator, or an optional local display module plus a reference milliamp meter and pressure calibration equipment.

1. Follow the required protocol to remove the device from online operation.
2. Perform a minimum two-point sensor calibration check at the 4 to 20 mA lower and upper range points (as a minimum). Refer to Two-Point Field Calibration, page 76.
3. Using the reference milliamp meter, verify that the milliamp output corresponds to the applied pressure within the safety accuracy.
4. Trim the calibration if necessary to match the calibration points.
5. Return the device to normal operation.
6. Document the test results per the requirements of the application.

Periodic Inspection

Other than the proof test, no periodic inspection is required.

Periodic Parts Replacement

No periodic parts replacement is required.

Firmware Updates

The firmware is not field upgradable. For firmware updates, return the transmitter to the factory. Contact Global Customer Support at 1-866-746-6477 for a return authorization and shipping instructions.

Other Preventive Maintenance

No other preventive maintenance is required.

Required Maintenance Documentation

A record of the configuration should be maintained, including the configuration password.

A maintenance log shall be kept. Each log entry shall contain:

- The cause for the maintenance activity (scheduled maintenance such as proof test, error code, other anomaly) and its date and time
- The maintenance action taken
- The personnel performing the maintenance
- The date(s) on which the maintenance was initiated and concluded

Fault Handling

How to Detect a Fault

Faults can be detected via:

- Observation
- Analog current output going to the alarm state resulting from internal diagnostics check
- Fault code being annunciated via the HART interface

Repair and Replacement

Parts replacement is generally limited to the terminal block assembly, cover o-rings, vent plug (if applicable), and optional display. A proof test must be performed after any field repair. Repair in the field at a finer level should not be attempted; the transmitter should be returned to the factory for repair. Contact Global Customer Support at 1-866-746-6477 for a return authorization and shipping instructions.

Revalidation Procedures

When returning the transmitter to service after repair or replacement, the proof test will provide validation of proper configuration and operation.

Fault Reporting Requirements

Faults should be recorded in the maintenance log and reported to Global Customer Support at 1-866-746-6477.

Demand Reporting Requirements

To verify the mode of operation, contact Global Customer Support.

Shutdown

No special procedure is necessary when removing power to the transmitter. All configuration data are retained through loss of power.

Tools

Tools Necessary for Maintenance

- PC-Based Configurator or HART Communicator. (The transmitter can be configured without one of these, but the process is considerably more involved.)
- Means to provide pressure to perform a two-point calibration check of the transmitter.
- An independent means of measuring the pressure. This means should have an accuracy at least ten times better than the safety accuracy of the transmitter.

Tools Necessary for Revalidation

- PC50 Configurator or HART Communicator. (The transmitter can also be configured with the local display, but the process is more involved.)
- Means to provide pressure to perform a two-point calibration check of the transmitter.
- An independent means of measuring the pressure. This means should be accurate to at least ten times better than the safety accuracy of the transmitter.

Procedures for Tools Maintenance

Not applicable.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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