

Enterprise Control System Series Component Pressure Transmitter

**Models IDP15D, IDP31D, IDP32D, and IGP60G with HART Communication
Installation, Operation, Calibration, Configuration, and Maintenance**



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1. *Introduction*

Enterprise Control System Series Component Pressure Transmitters

Enterprise Control System Series Component Pressure Transmitters includes model variations of these basic pressure measurement types:

- ◆ Differential Pressure, Models IDP15D, IDP31D, and IDP32D
- ◆ Gauge Pressure, Model IGP60G

Transmitter Adjustments

You need a HART communicator to make adjustments to an Enterprise Control System Series Component Pressure Transmitter.

Except for optional zero and span adjustments available with the Enterprise Control System Series Component Pressure Transmitters, these transmitters do not require any physical adjustment.

Parts of the Transmitter

The transmitter consists of a terminal block, an electronics module, a transmitter housing, an optional indicator, and a center body.

Figure 1 shows the structure and parts names of an Enterprise Control System (ECS) Series Component Pressure Transmitter.

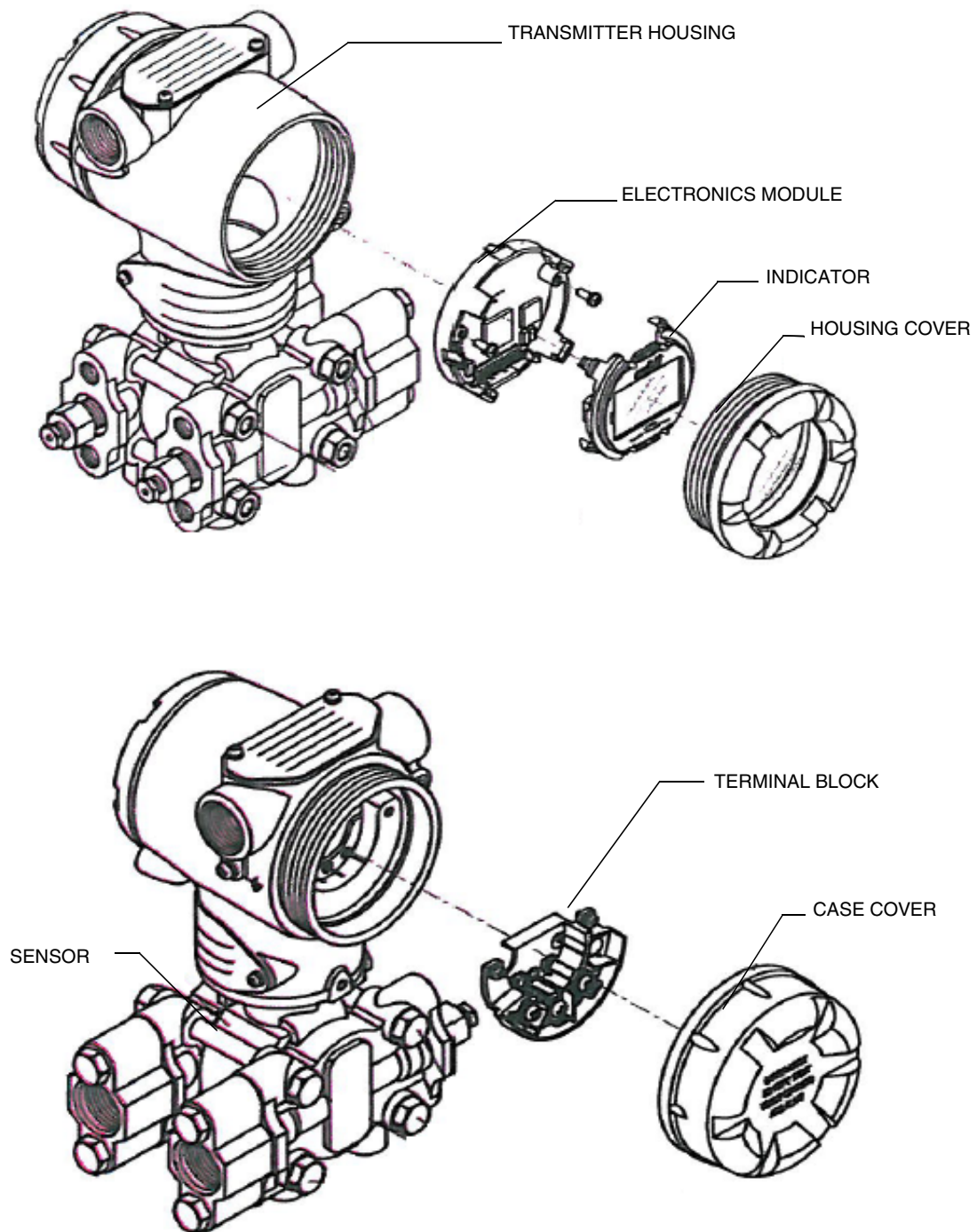


Figure 1. Structure of ECS Series Component Pressure Transmitters

2. Installation

This section provides information about installing the Enterprise Control System Series Component Pressure Transmitter.

It includes procedures for mounting, piping and wiring the transmitter for operation.

Mounting the Enterprise Control System Series Component Pressure Transmitter

You can mount your transmitter to a 2-inch (50 mm) vertical or horizontal pipe using the optional angle or flat mounting bracket or a bracket of your own.

Figure 2 shows typical bracket mounted installations for comparison.

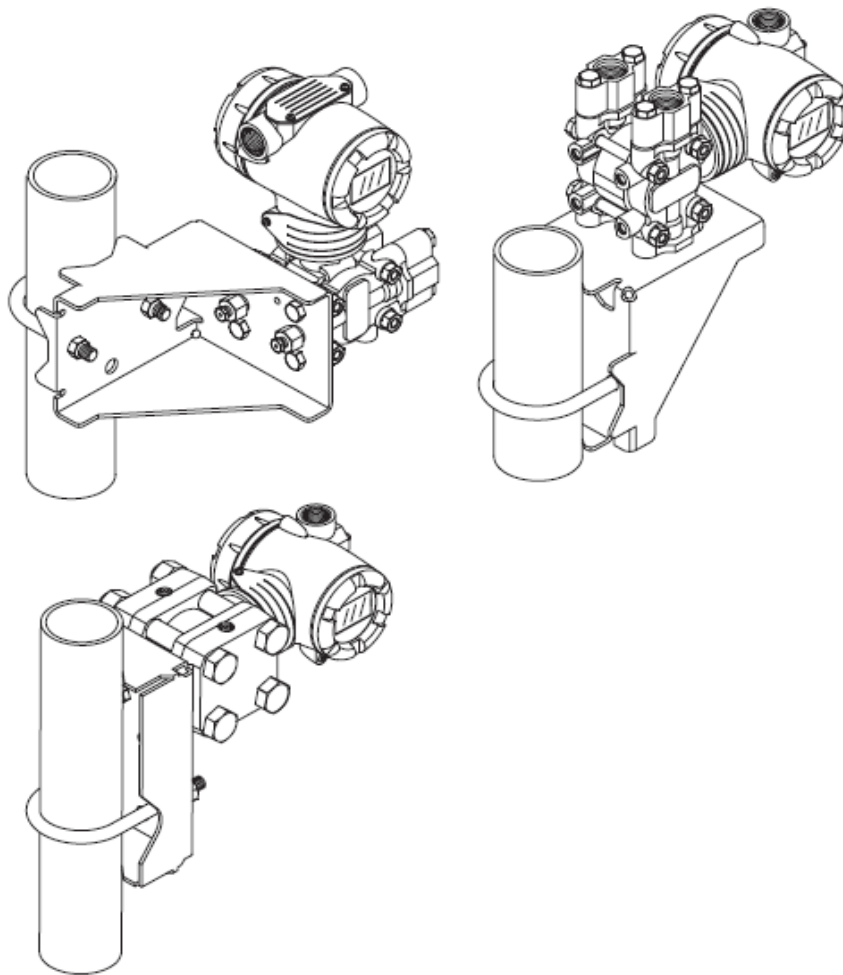


Figure 2. Typical Bracket Mounted and Flange Mounted Installations

To change the direction of the indicator after mounting, proceed as follows:

- a. Rotate electronics housing 90° horizontally.

Loosen the 4 mm set screw on outside neck of transmitter. Rotate electronics housing a maximum of 90 degrees (left or right) from the center to a position you require and tighten the set screw.

- b. Rotate digital display module as indicated in Figure 3.

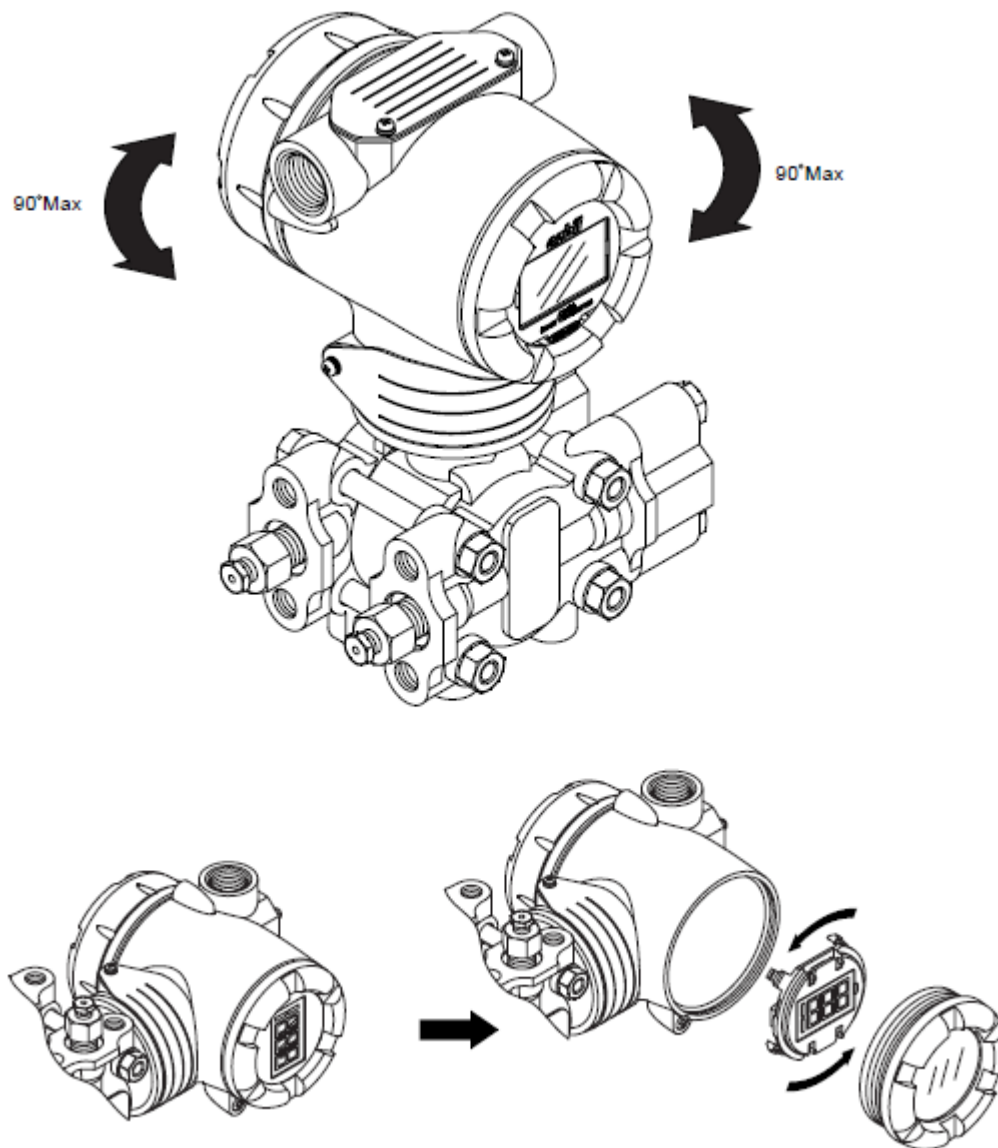


Figure 3. Change Direction of Indicator after Mounting

Piping the ECS Series Component Pressure Transmitter

The actual piping arrangement will vary depending upon the process measurement requirements and the transmitter model. Process connections are made to 1/4 inch NPT female connections in the process cover of the transmitter meter body. For example, a differential pressure transmitter comes with double ended process heads with 1/4 inch NPT connections but they can be modified to accept 1/2 inch NPT through flange adapters.

The most common type of pipe used is 1/2 inch schedule 80 steel pipe.

Many piping arrangements use a three-valve manifold to connect the process piping to the transmitter. A manifold makes it easy to install and remove a transmitter without interrupting the process. It also accommodates the installation of blow-down valves to clear debris from pressure lines to the transmitter.

Figure 4 shows a typical piping arrangement using a three-valve manifold and blow-down lines for a differential pressure transmitter being used to measure flow.

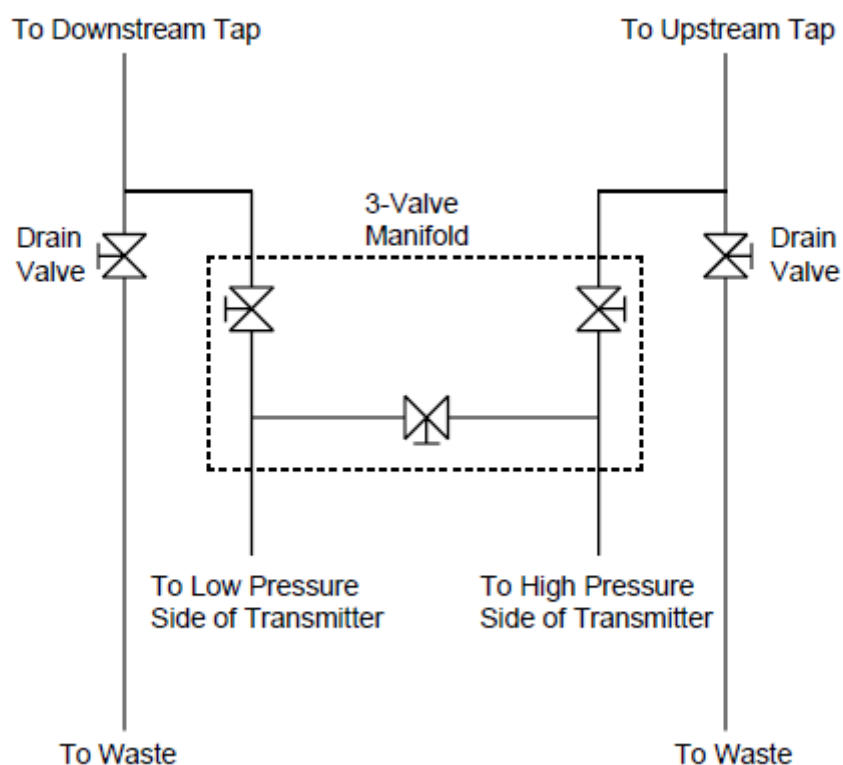


Figure 4. Typical Three-Valve Manifold and Blow-Down Piping Arrangement

Installing the Flange Adapter

Table 1 gives the torque specifications for installing an optional flange adapter on the process cover.

Slightly deforming the gasket supplied with the adapter before you insert it into the adapter may aid in retaining the gasket in the groove while you align the adapter to the process head. To deform the gasket, submerge it in hot water for a few minutes then firmly press it into its recessed mounting groove in the adapter.

To install an optional flange adaptor on the process head, proceed as follows:

1. Carefully seat FEP (white) gasket into adapter groove.
2. Thread adapter onto 1/2 inch process pipe and align mounting holes in adapter with holes in end of process head as required.
3. Secure adapter to process head by hand tightening 7/16-20 UNF hex head bolts.

— NOTE

Apply an anti-seize compound on the stainless steel bolts prior to threading them into the process head.

4. Evenly tighten adapter bolts to the following torque:

Table 1. Torque Specifications

Adapter material	SS	SS
Bolt material	630ss	SS304
Torque N, m	20 ±1	10 ±0.5

Piping for Liquid, Gas or Steam Flow Rate Measurement

Recommended Piping - Example 1

Figure 5 shows a typical example for liquid Flow Rate Measurement. The differential pressure transmitter is located below the differential pressure output port of the process pipe. This minimizes the static head effect of the condensate.

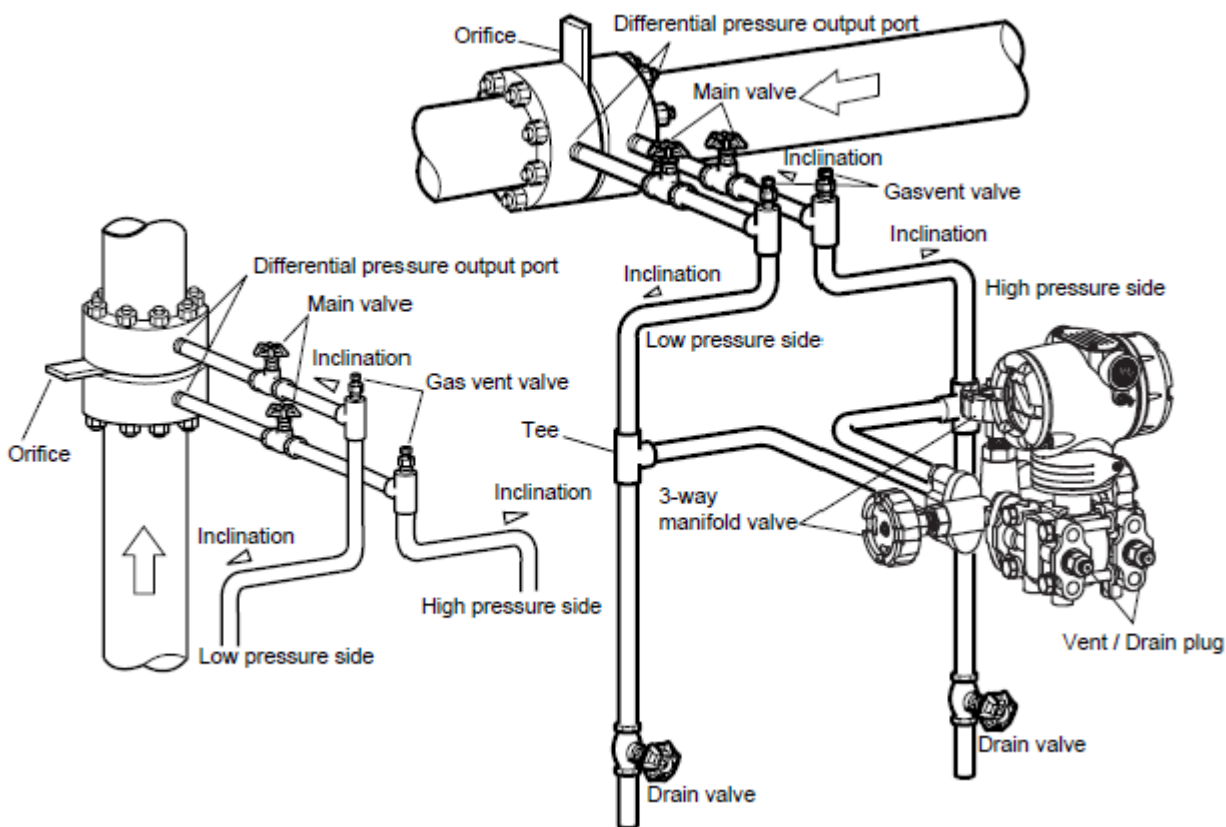


Figure 5. Liquid Flow Rate Measurement

During measurement, ensure the following:

- ♦ Incline the pipe as indicated in Figure 5 at the differential pressure output port.
- ♦ After piping installation, ensure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leaks.

Recommended Piping - Example 2

Figure 6 shows a typical example for Gas Flow Rate Measurement. The differential pressure transmitter is located above the differential pressure output port of the process pipe. The condensate drains away from the transmitter.

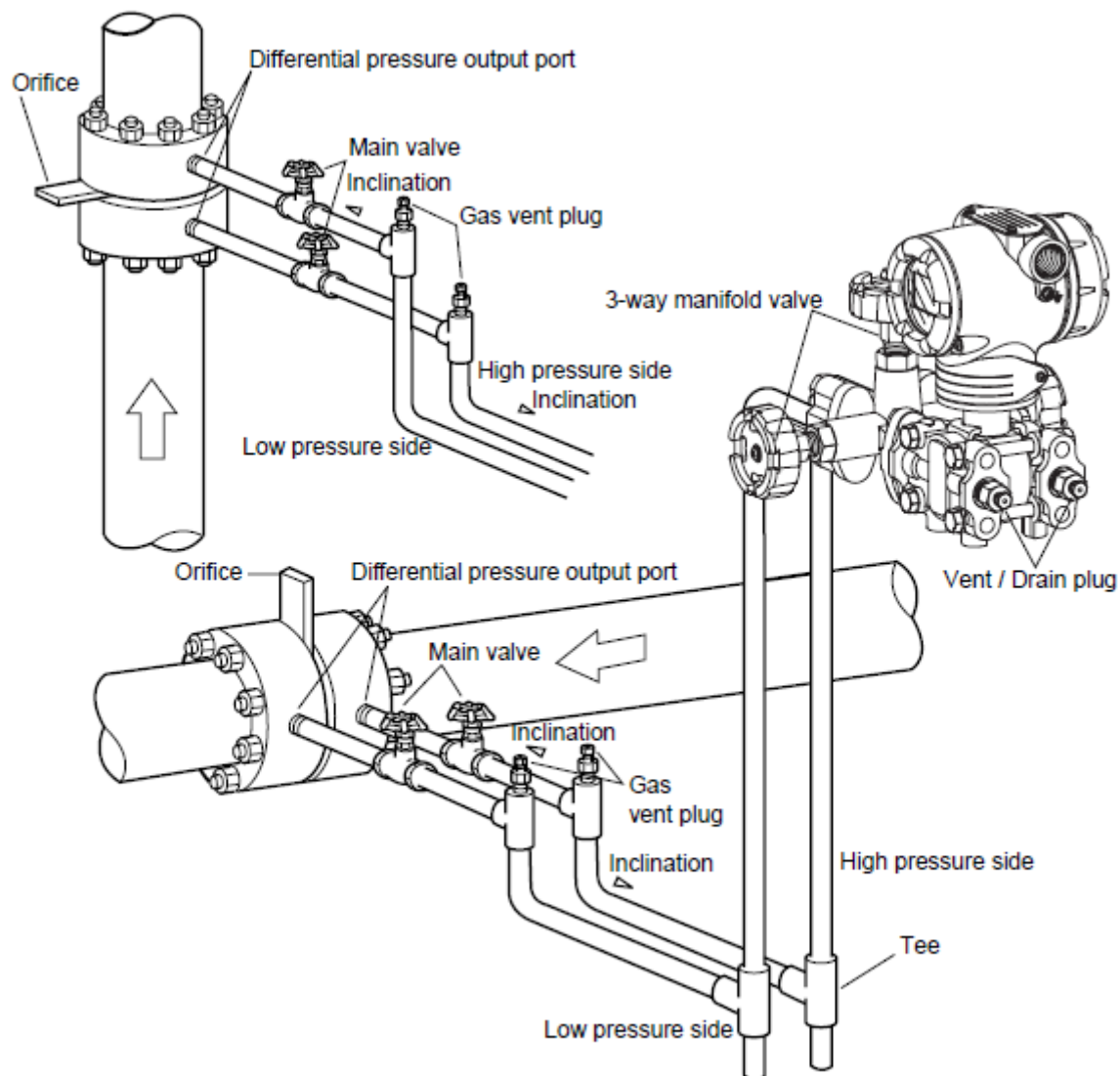


Figure 6. Gas Flow Rate Measurement

During measurement, ensure the following:

- ◆ Incline the pipe as indicated in Figure 6 at the differential pressure output port.
- ◆ After piping installation, ensure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leaks.

Recommended Piping - Example 3

Figure 7 shows a typical example for Steam Flow Rate Measurement. This piping is recommended for a differential pressure transmitter located below the differential pressure output port of the process pipe.

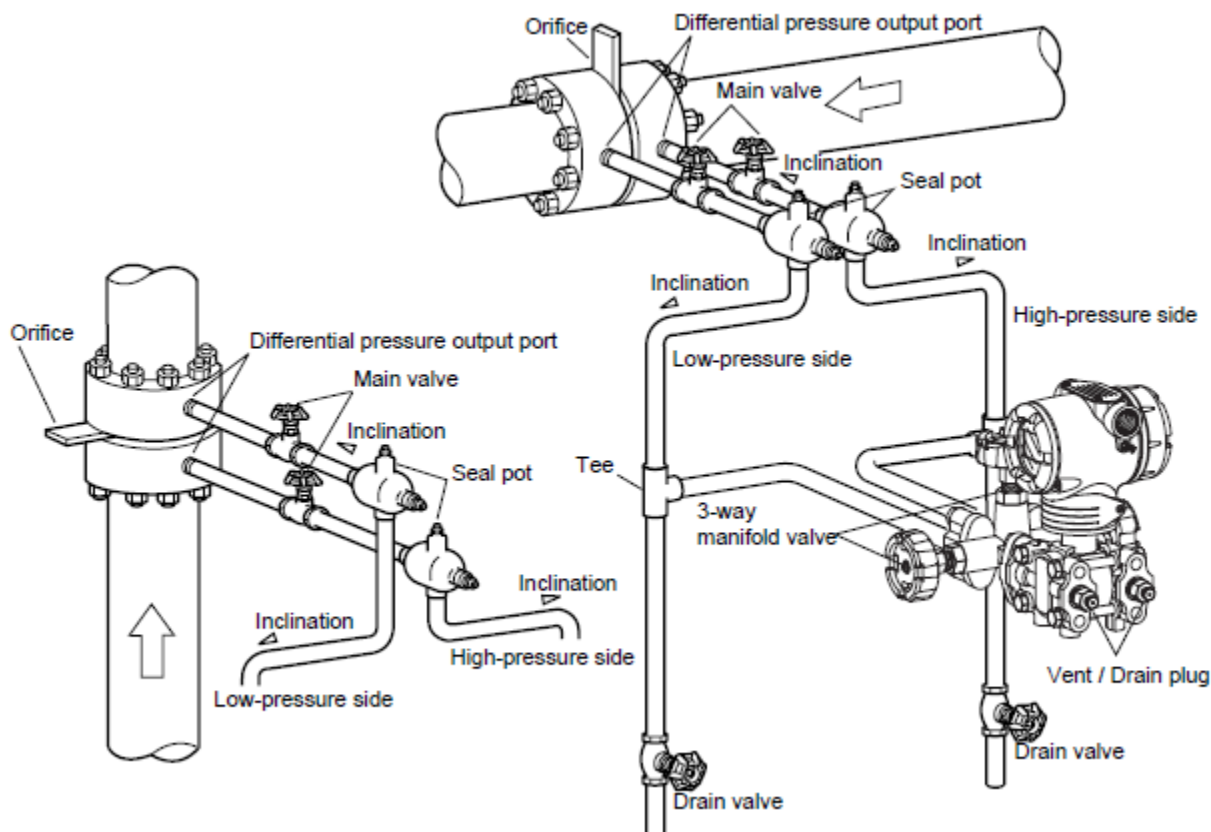


Figure 7. Steam Flow Rate Measurement

During measurement, ensure the following:

- ◆ Incline the pipe as indicated in Figure 7 at the differential pressure output port.
- ◆ After piping installation, ensure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leaks.
- ◆ If the process pipe is vertically mounted, mount seal pots at different levels to prevent zero drift. But in this case, you cannot apply the previously-used zero adjustment procedure (using a 3-way manifold valve). For zero shift occurring at different levels, use a HART communicator.

Pressure Measurement - Piping

Recommended Piping - Example

For gas-pressure measurement, piping should be performed following the typical example as shown in Figure 8.

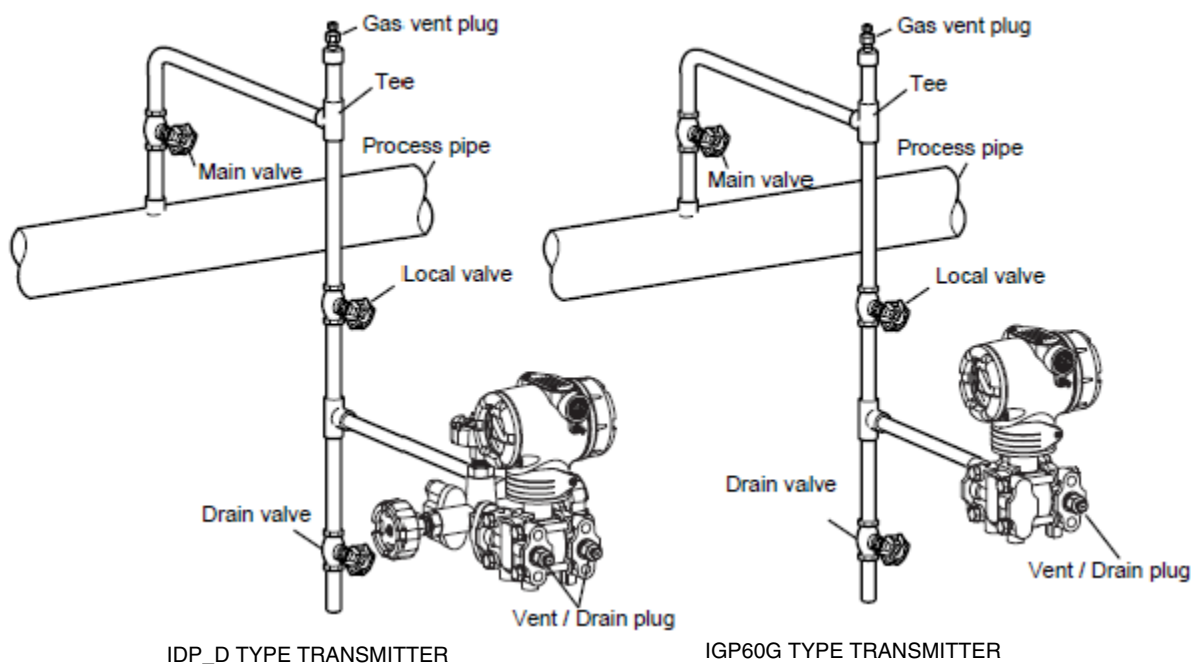


Figure 8. Gas Pressure Measurement - Piping

After completing piping work, always check for pressure leaks around connecting pipe and transmitter.

Piping Method

The piping method for the fluid to be measured depends on the meter installation position and the pipe line state.

Connect pipes using the following procedure:

1. Use a T-shaped joint for the connecting pipeline.
2. Install a main valve between the entrance of the connecting pipe and the T-shaped joint.
3. If the process is a horizontal line, tilt the pipe to allow draining from the pressure line.

— NOTE —

In case of a high pressure process, select a joint of appropriate specification and shape and a pipe of appropriate shape and material.

4. Determine the connecting pipe schedule number and the nominal thickness of the connecting pipe from the process based on conditions such as the process pressure.

Auxiliary Equipment

- ◆ Oil sealing and air purging

In case of medium pressure (such as suspension, high viscosity, and corrosive fluid) ensure that the fluid is not led directly to the element. Various sealing and purging methods are available to prevent it.

- ◆ Preventing pulsations

If the process has serious pulsations or great pressure fluctuations, provide a throttle valve in the middle of the connecting pipe to prevent pulsations.

Liquid Level Measurement - Piping (IDP15D, IDP31D, and IDP32D)

Piping

The piping methods for measurement of liquid level in a tank by a IDP15D, IDP31D, or IDP32D, depends on whether the tank is open or closed. For closed tanks, piping is modified according to whether you use the gas sealing method (dry leg) or the liquid sealing method (wet leg).

H Mark

H, indicating high pressure, is marked on the center body of the transmitter. Check the mark during piping work. The low-pressure side has no mark.

Before You Start

The following parts are required for piping work.

- ◆ 3-way manifold valve
- ◆ Pipe
- ◆ Main valve
- ◆ Union or flange
- ◆ Tee
- ◆ Drain valve
- ◆ Drain plug
- ◆ Seal pot (for closed tank and wet-leg only)

Open Tank - Piping

Recommended Piping - Example

For open tanks:

- ◆ Connect the high-pressure side of the transmitter to the lower part of the tank.
- ◆ Install the transmitter below the lowest liquid level to be measured.
- ◆ Open the low-pressure side to the air.
- ◆ After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. Figure 9 shows a typical installation.

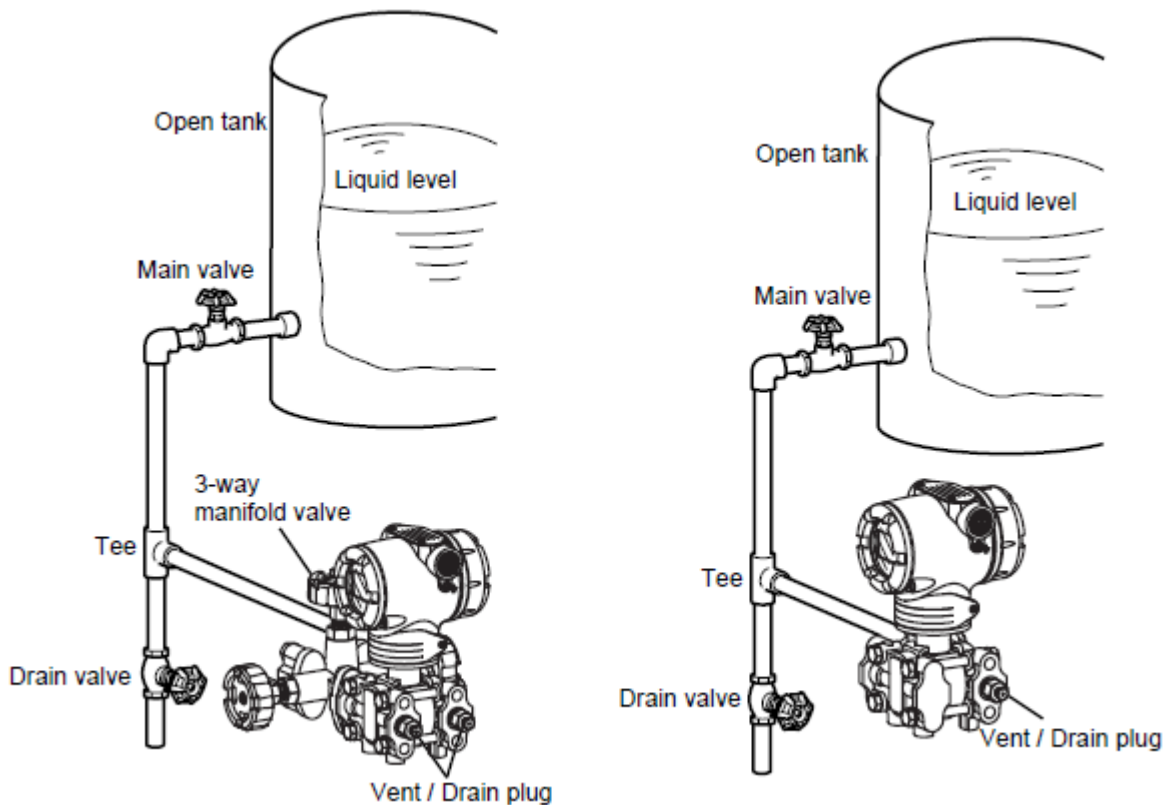


Figure 9. Typical Open Tank Piping Installation

Closed Tank - Piping

Recommended Piping for Dry Leg - Example

When using the dry-leg method:

- ◆ Connect the high-pressure side of the transmitter to the lower part of the tank.
- ◆ Connect the low-pressure side to the gas-sealing pipe of the tank.
- ◆ Install the transmitter below the lowest liquid level to be measured.
- ◆ After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. Figure 10 shows a typical installation.

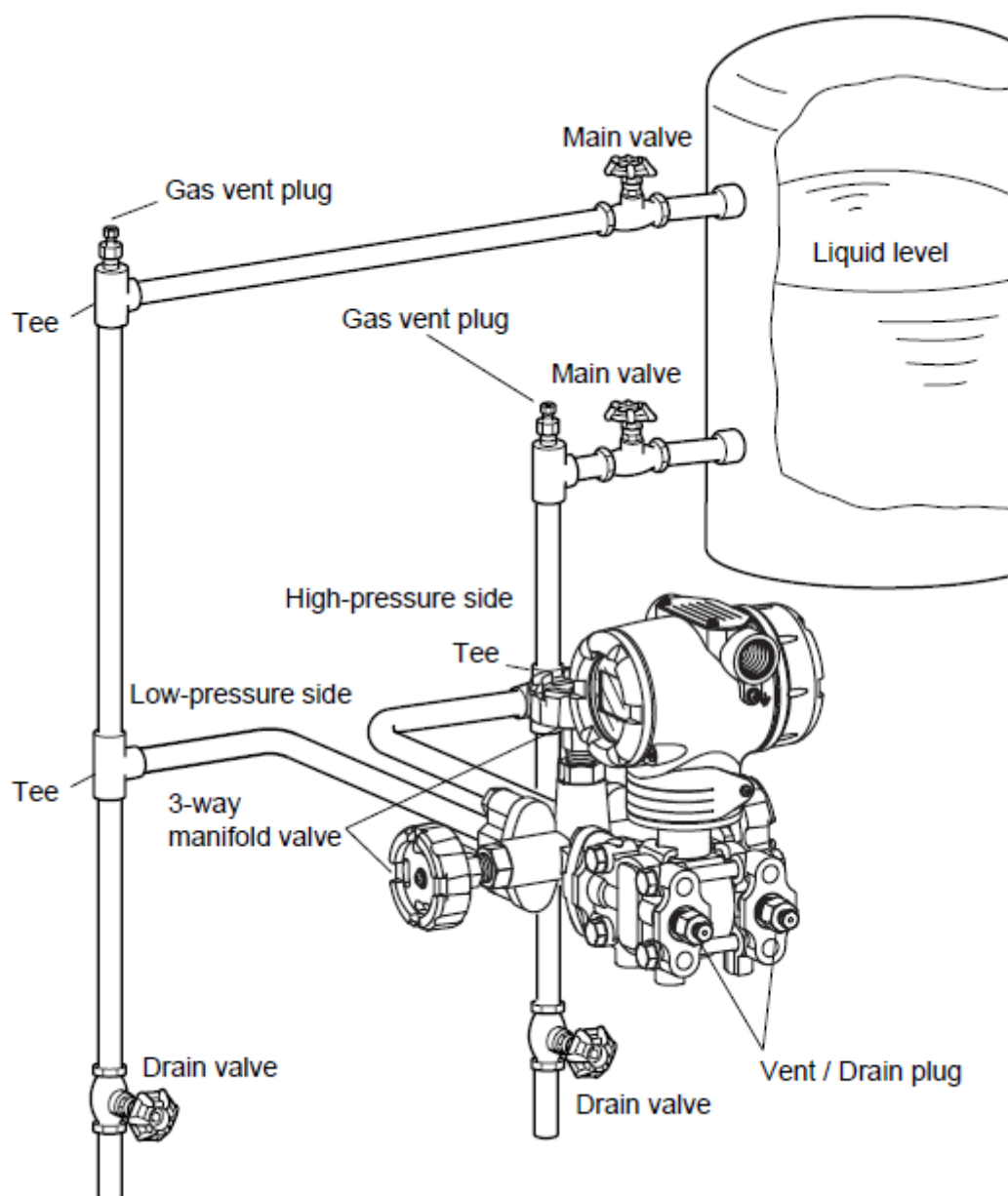


Figure 10. Typical Closed Tank (Dry Leg) Piping Installation

Recommended Piping for Wet Leg - Example

When using the wet-leg method:

- ◆ Connect the high-pressure side of the transmitter to the sealing pipe of the tank.
- ◆ Connect the low-pressure side to the lower part of the tank.
- ◆ Install this transmitter below the lowest liquid level to be measured.
- ◆ After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. Figure 11 shows a typical installation.

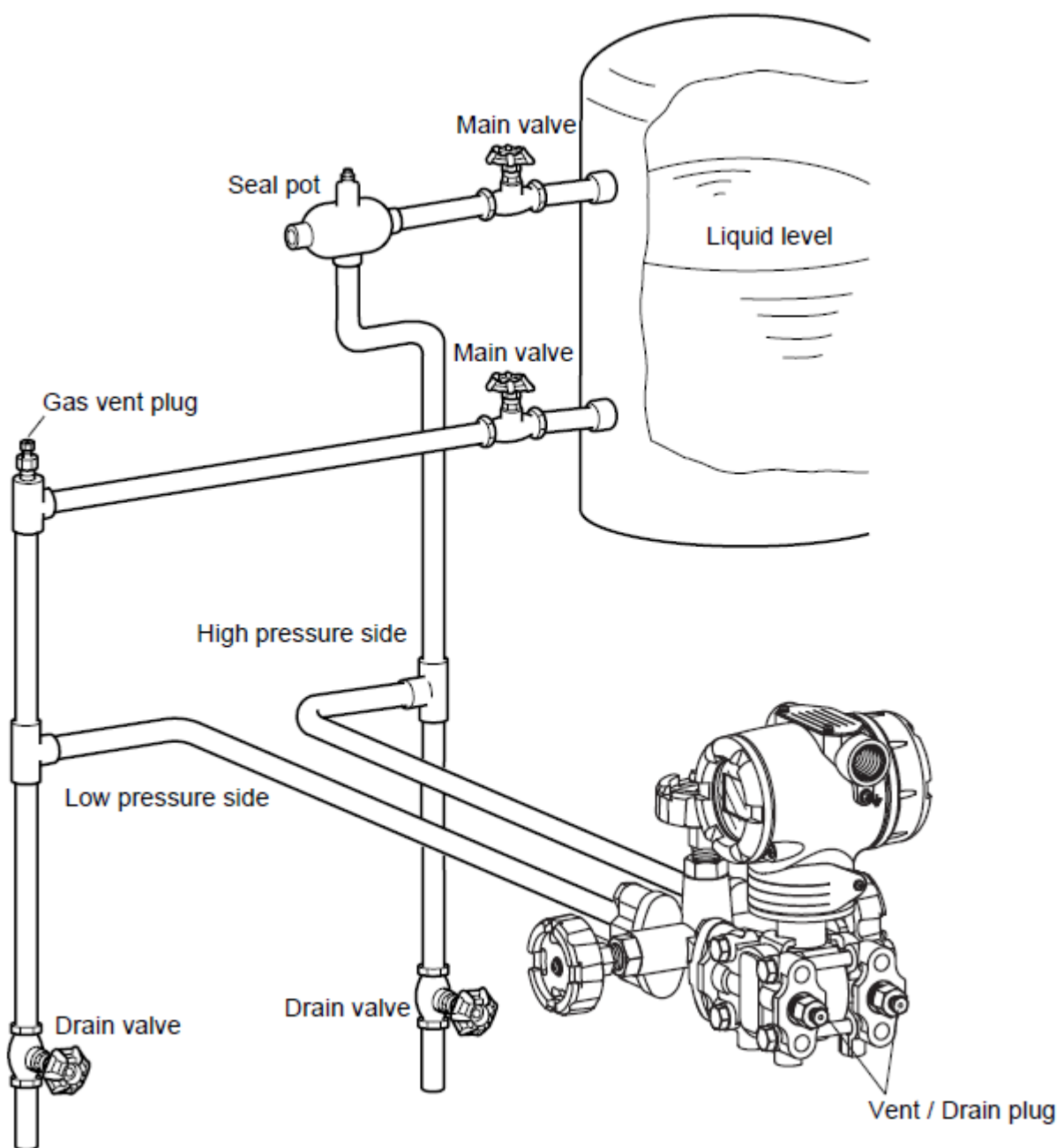


Figure 11. Typical Closed Tank (Wet Leg) Piping Installation

— NOTE

For liquid or steam, the piping should slope a minimum of 25.4 mm (1 inch) per 305 mm (1 foot). Slope the piping down towards the transmitter if the transmitter is below the process connection so the bubbles can rise back into the piping through the liquid. If the transmitter is located above the process connection, the piping should rise vertically above the transmitter, then slope down towards the flowline with a vent valve at the high point.

For gas measurement, use a condensate leg and drain at the low point (freeze protection may be required here).

Wiring Enterprise Control System Series Component Pressure Transmitter

Wiring for Transmitter - Regular Model

Follow the wiring instructions below when no explosion-proof standards apply.

Wire and cable the transmitter as shown in Figure 12 and Figure 13.

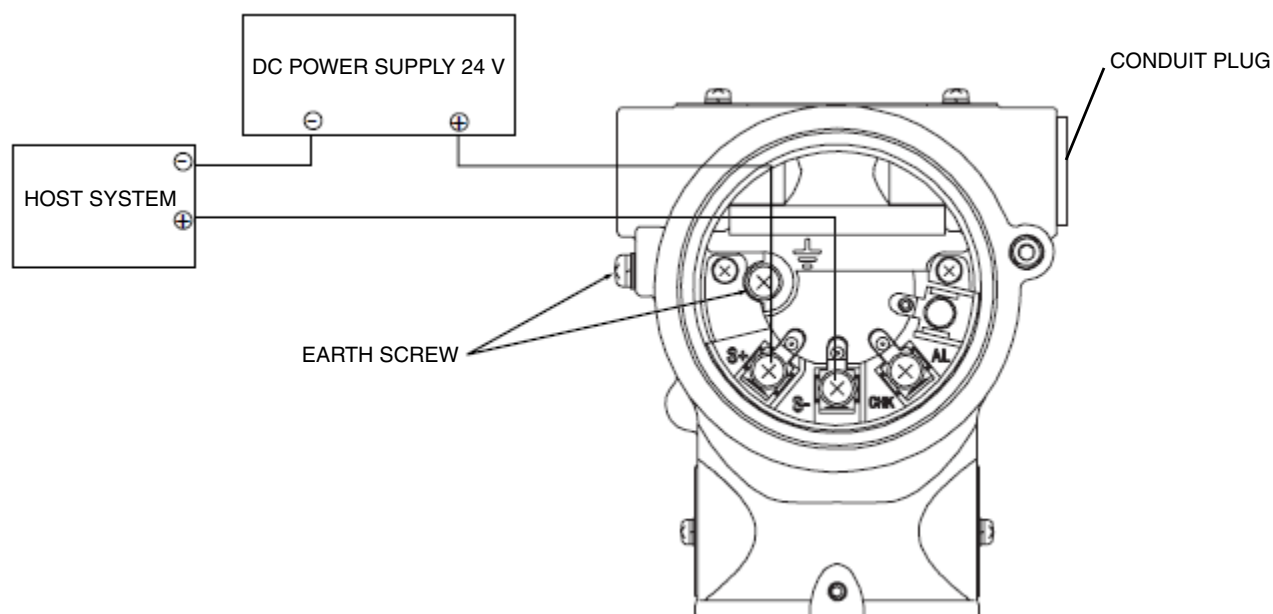


Figure 12. Wiring for Transmitter without Alarm Output

NOTE

1. External load resistance of at least 250 Ω required for communications with a HART communicator. If total load resistance of the receiving instrument is less than 250 Ω insert the necessary resistance to the loop.
 2. A conduit plug may not be used on an adapter or elbow.
-

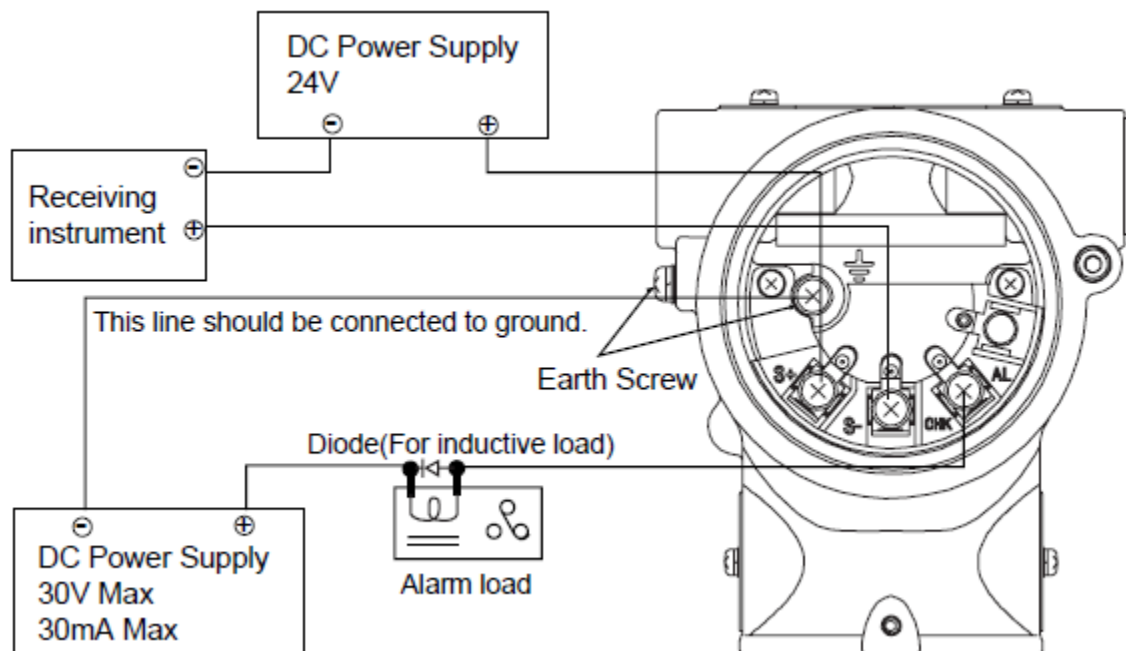


Figure 13. Wiring for a Transmitter with Alarm Output

NOTE

Current cannot be checked for a transmitter with alarm contact output.

Cable Specification

- ◆ Use standard lead wires or cables that are the same as or better than 600 V grade PVC insulated wires.
- ◆ For standard or explosionproof models, use wiring rated for at least 5° C higher than highest expected ambient temperature.
- ◆ For intrinsically safe models, use wiring rated for at least 10° C higher than highest expected ambient temperature.

Conduit Pipe for Cables

Lead cables into the transmitter case, as follows:

- ◆ Mount a conduit pipe in the conduit hole (1/2NPT female thread) provided on the side of a transmitter, and lead cables through the pipe.
- ◆ Seal the part that contacts with the conduit pipe. Use a sealing agent or a seal plug to prevent entry of water.
- ◆ Install transmitter so that the cables lead into it from the bottom.

Grounding

If a shielded cable is used, earth (ground) the shield at the receiver only (single point ground). Connecting the shield to signal ground is recommended to make the electric potential difference lower.

If the transmitter is not grounded through a pipe stanchion, ground the transmitter using an earth terminal in the transmitter.

To ground the transmitter, the ground resistance must be $100\ \Omega$ or lower.

External Earthing or Bonding Connection

The connection of the earthing conductor with the external grounding terminal must comply with the following method, as shown in Figure 14.

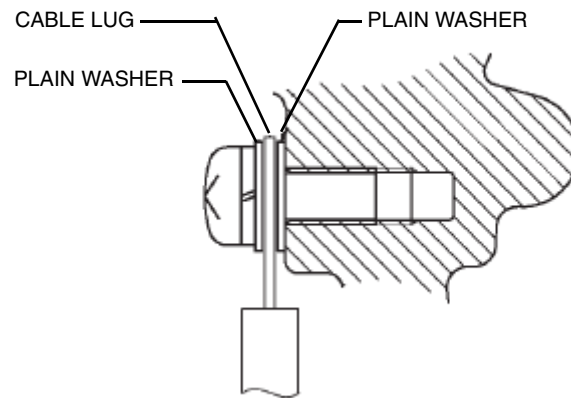


Figure 14. External Grounding or Bonding Connection

Supply Power and external Load Resistance

Confirm the relationship between the external load resistance and the supply voltage. As shown in Figure 15, the relationship should be inside the shaded area.

External resistance: The total resistance connected to the output terminals of a transmitter (includes resistances of all cables in the loop plus the internal resistance of the instruments).

The horizontal axis represents the supply voltage of a transmitter, and the vertical axis represents the external load resistance

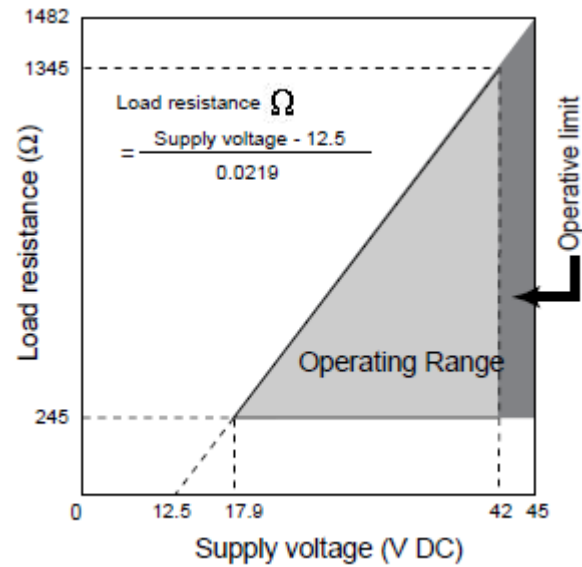


Figure 15. Supply Voltage and External Load Resistance - Relationship

NOTE

1. 45 volt operation is permitted.
 2. For communication with a HART communicator, a load resistance of 250 Ω or more is needed.
-

3. Operation of the Optional Indicator

Display Unit of Indicator

The display unit of an indicator consists of the following:

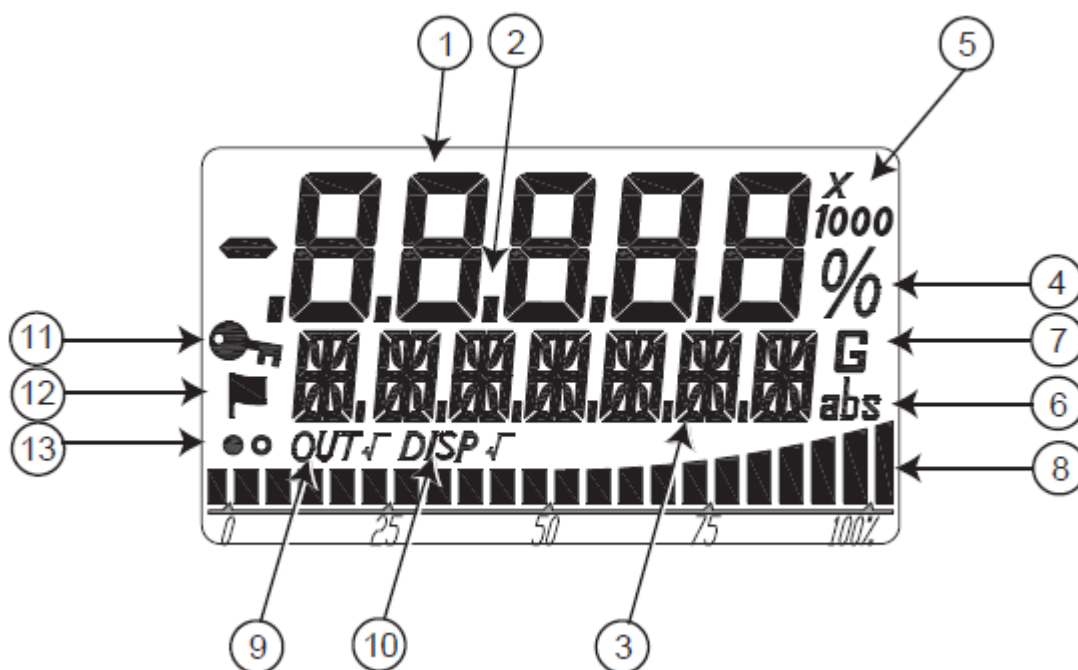


Figure 16. Display Unit of Indicator

No.	Display Mark	Contents of display
1	Digital Numerical Display (5 digits)	Primary Value or Status Number
2	Decimal Display (5 digits)	Decimal point
3	16 segments (7 digits)	Unit, Status
4	%	%
5	Exponent	None, 0, X 10, X 100, X 1000
6	Absolute pressure	abs
7	Gage pressure	G
8	Bar Graph	Bar Graph of output%
9	Output square root extraction	OUT $\sqrt{\quad}$
10	Display square root extraction	DISP $\sqrt{\quad}$

No.	Display Mark	Contents of display
11	Key symbol	Write Protect
12	Flag symbol	Status Record
13	Display update mark	● and ○

Bar Graph Display

The bar graph is shown in 22 segments and represents the percentage of scaled value as shown in Figure 17.

For descriptive purposes let us refer to the 22 segments as, from left to right, S0 - S21. Lighting or blinking of each segment is indicated as follows according to the percentage terms of the indicated value (DISP).



Figure 17. Bar Graph Display

External Zero/Span Adjustment Display

When an external zero or span adjustment is executed using the optional magnetic stick and the range change is complete, one of the following messages is displayed in the 16 segments (7 digits) that display the unit, depending on the adjustment.

- ◆ When an external zero adjustment is complete: ZERO.SET
- ◆ When an external span adjustment is complete: SPAN.SET

The message is displayed for 3 seconds and then it disappears to return to the unit display.

A transmitter with the optional External Zero/Span adjustment function enables zero and span point adjustment without a need for a HART communicator. Refer to Figure 18.

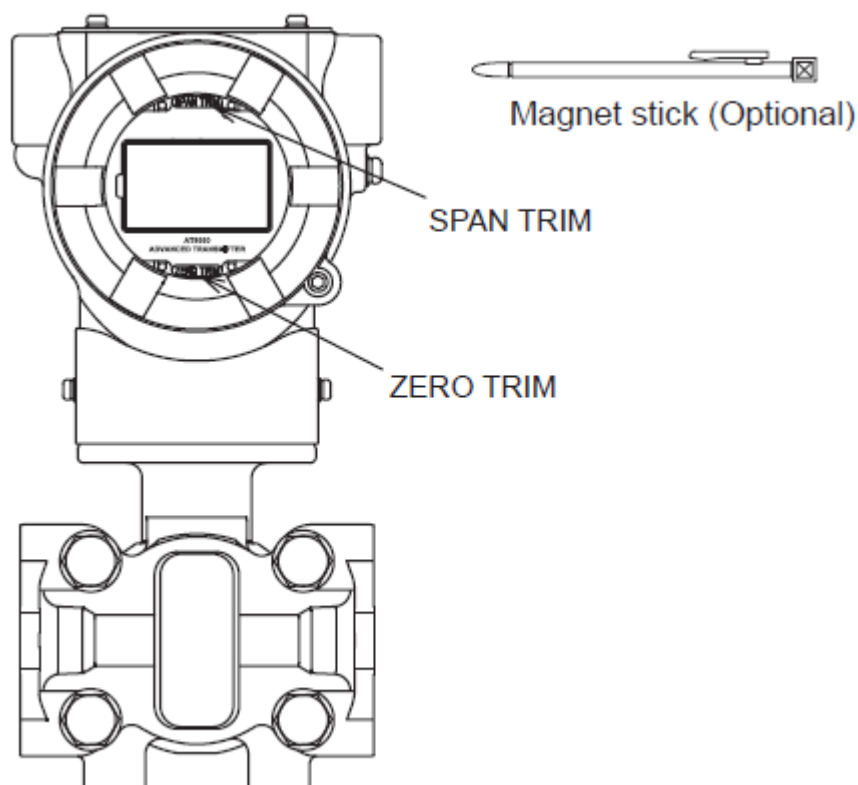


Figure 18. Zero Span Adjustment

To adjust to Zero Point

To adjust to zero point, proceed as follows:

1. Make sure that the zero pressure is applied to the transmitter.
2. Touch the magnet to the glass at the ZERO TRIM point for 3 seconds or more until ammeter reading equals 4 mA.

To adjust Span Point

To adjust span point, proceed as follows:

1. Make sure that the desired upper range value pressure is applied to the transmitter.

2. Touch the magnet to the glass at the SPAN TRIM point for 3 seconds or more until ammeter reading equals 20_mA.

Square Root Extraction Display

The transmitter output and the display output can be set independently for square root extraction. The segments for the square root extraction display are OUT $\sqrt{}$ and DISP $\sqrt{}$.

Each display lights up or goes out according to the output format and square root extraction display settings of the transmitter.

Transmitter setting		Square Root Extraction Display	
Output	Indicator	OUT	DISP
Linear	Linear	Not indicated	Not indicated
Linear	Square root (Flow rate)	Not indicated	Indicated
Square root (Flow rate)		Indicated	Not indicated

Write Protect Display

The indicator for the write protect display is a key mark.

- ◆ The key mark is indicated if the write protect state of the device is active.



Status Record Display

The indicator for the status history display is a flag mark.

- ◆ When the status history exists, the flag symbol appears on the display.
- ◆ When the status history does not exist, the flag symbol does not appear on the display.
- ◆ Indicating the flag mark means that the diagnostic status has been ON in the past.

Display Update Mark

This mark indicates that the transmitter is working.

The  and  marks alternately blink every 0.5 seconds.

Display Update Cycle

The update cycle of the PV display (7 segments, 5 digits) is about 0.5 seconds.

4. Operation Using HART Communicator

Starting Communications

The following sections provide instructions for connecting a HART Communicator to this transmitter and basic instructions for key pad operation.

Connecting the Communicator

You connect the communicator directly to signal terminals on the transmitter's terminal block or at any location in the 4 to 20 mA loop, as shown in Figure 19. (Polarity of the communicator connection does not matter.)

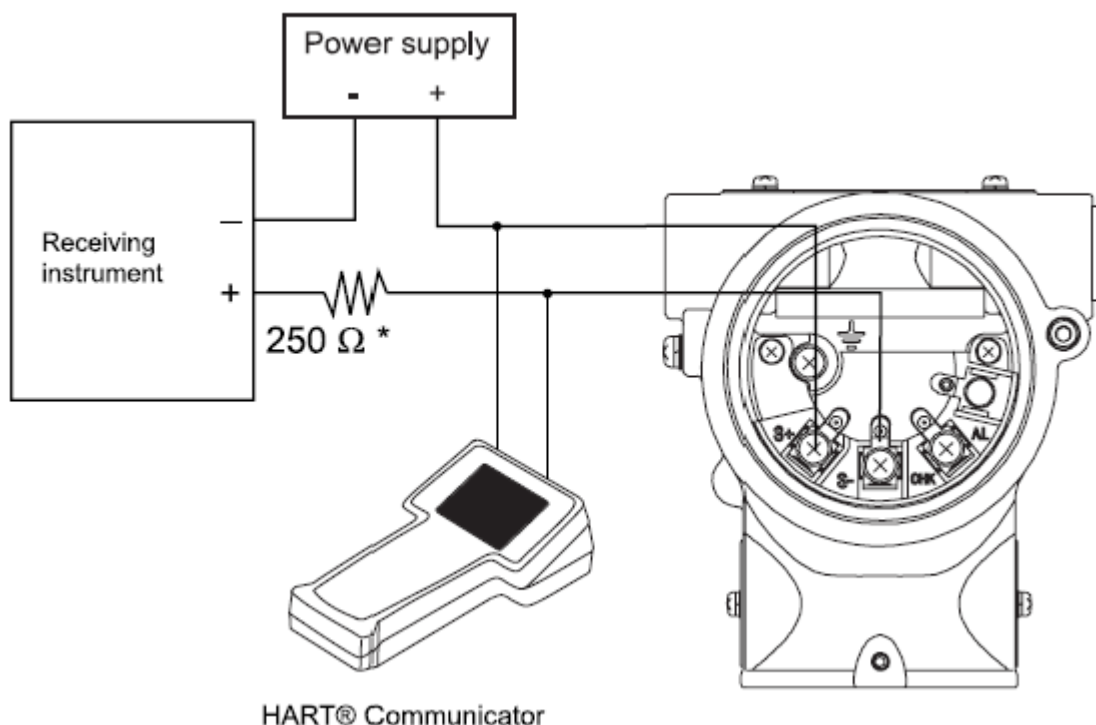


Figure 19. Connecting to the HART Communicator

Process Variables Menu Summary

Process Variables	<>	Process Variables	<>	Pressure
				Output
				Analog Output
				Sensor Temp.
				Lower Range Value (0%)
				Upper Range Value (100%)
	<>	Pressure	<>	Pressure Chart
				Pressure
				Lower Range Value (0%)
				Upper Range Value (100%)
				Analog Output
				Output
	<>	Output	<>	Output Chart
				Output
				Analog Output
				Pressure
				Lower Range Value (0%)
				Upper Range Value (100%)
	<>	Temperature	<>	Temperature Chart
				Sensor Temp.
	<>	All Variables	<>	Pressure Gauge
				Pressure
				Analog Output Gauge
				Analog Output
				Output Gauge
				Output
				Temperature Gauge
				Sensor Temp.

Device Menu Summary

Device	<>	Basic Setup	<>	Tag	<>
				Lower Range Value (0%)	
				Upper Range Value (100%)	
				Upper Range Limit	
				Damping	
				Transfer Function	
	<>	Sensors	<>	Pressure	<>
				Pressure Unit	
				Upper Range Limit	
				Sensor Temp.	
				Temp. Unit	
	<>	Signal Condition	<>	Lower Range Value (0%)	<>
				Upper Range Value (100%)	
				Upper Range Limit	
				Damping	
				Transfer Function	
				Change Cutoff Mode	
				Cutoff Mode	
				Cutoff Point	
				Height	
				Output	
				Contact Output Status	
				Apply Zero Value	
				Apply Span Value	
				Set LRV (Actual)	
	<>	Output Condition	<>	Analog Output	<>
				Output Low Limit	
				Output High Limit	
				Loop Test	
			<>	Fail Safe	<>
				Fail Safe Direction	
			<>	Failure Alarm Simulation Mode	<>
			<>	HART Output	<>
				Polling Address	
			<>	Num Req Preams	<>
				(Continued)	

(Continued from previous page)

Device	<>	Alarm	<>	Alarm Settings	<>	Output Alarm
						Lower Output Alarm
						Upper Output Alarm
						Sensor Temp. Alarm
						Lower Sensor Temp. Alarm
						Upper Sensor Temp. Alarm
						Contact Output Mode
			<>	Contact Output ON/OFF	<>	Output Low I
						Output High
						Sensor Temp. Low
						Sensor Temp. High
			<>	Contact Output Simulation Mode	<>	Open
						Closed
	<>		<>	Alarm Status	<>	Output Alarm Low
						Output Alarm High
						Sensor Temp. Alarm Low
						Sensor Temp. Alarm High
						Contact Output Status
	<>	Display	<>	Display Mode	<>	
				Display Function		
				Transfer Function		
				EULO(0%)		
				EUHI(100%)		
				Disp. Unit		
				User Unit		
				Exponent		

(Continued)

(Continued from previous page)

Device	<>	Device Information	<>	Manufacturer	
				Model	
				Measurement Type	
				Device ID	
				Tag	
				Date	
				Descriptor	
				Message	
				Sensor Serial Number	
				PROM No.	
				Final Assembly Number	
			<>	Revision Numbers	<> Universal Rev
					<> Field Device Rev
					<> Software Rev
			<>	Write Protect	<> Hardware Write Protect
					<> Software Write Protect
					<> Change SW Write Protect
			<>	Software Version	
	<>	Calibration	<>	Correct Input	<> Zero Trim
					<> Correct Input LRV
					<> Correct Input URV
					<> Reset Corrects
					<> Restore Factory Setting
			<>	Output Calibration	<> D/A Trim
					<> Scaled D/A Trim

(Continued)

Device	<>	Review	<>	Model	
			<>	Measurement Type	
			<>	Transfer Function	
			<>	Cutoff Point	
			<>	Cutoff Mode	
			<>	PROM No.	
			<>	Software Rev	
			<>	Damping	
			<>	Lower Range Value (0%)	
			<>	Upper Range Value (100%)	
			<>	Upper Range Limit	
			<>	Fail Safe Direction	
			<>	Display Mode	
			<>	Disp. Unit	
			<>	User Unit	
			<>	EULO (0%)	
			<>	EUHI (100%)	
			<>	Exponent	
			<>	Output Low Limit	
			<>	Output High Limit	
			<>	Output Alarm	
			<>	Lower Output Alarm	
			<>	Upper Output Alarm	
			<>	Sensor Temp. Alarm	
			<>	Lower Sensor Temp. Alarm	
			<>	Upper Sensor Temp. Alarm	
			<>	Contact Output ON/OFF	<> Output Low
					<> Output High
					<> Sensor Temp. Low
					<> Sensor Temp. High
			<>	Alarm Status	<> Output Alarm Low
					<> Output Alarm High
					<> Sensor Temp. Alarm Low
					<> Sensor Temp. Alarm High
			<>	Contact Output Mode	
			<>	Contact Output Status	
			<>	Output	
			<>	Pressure	
			<>	Sensor Temp.	

Diagnostic Menu Summary

Diagnostic	<>	Diagnostic Status	<>	Status
				Critical Status
				Internal Data Inconsistency
				Non-Critical Status
	<>	Status Records	<>	Clear Status Records
				Critical Status Records
				Internal Data Inconsistency Records
				Non-Critical Status Records
	<>	Zero-Error Int. Data	<>	1 (Latest)
				2
				3
				4
				5

Typical Functions using a HART Communicator

Setting Tag Number

To set tag number, proceed as follows:

- ◆ Go to Device > Basic Setup > Tag.
- ◆ Enter the tag number and download the change to the transmitter.

Setting Range

Setting range functions define the lower and upper range values and damping. To set the setting range functions, proceed as follows:

- ◆ Go to Device > Basic Setup > Lower Range Value.
- ◆ Input the lower range value.
- ◆ Go to Device > Basic Setup > Upper Range Value.
- ◆ Input the upper range value.
- ◆ Go to Device > Basic Setup > Upper Range Limit.
This will display the upper range limit for this sensor.

— CAUTION —

The upper range limit may be greater than the advertised sensor limit. This is defined as the limit that can be applied without damage to the sensor. Measurement accuracy beyond the advertised sensor limit is NOT assured.

- ◆ Go to Device > Basic Setup > Damping.
- ◆ Input the damping value in seconds.

Setting the Output Format

The output format defines if the output is linear or square root extraction. To set the output format, proceed as follows:

- ◆ Go to Device > Basic Setup > Transfer Function.
- ◆ Choose Linear or Sq root.

Setting the Indicator Display Format

The indicator display format defines how the optional indicator will display the measurement. The display range can be configured separate from the transmitter output range. To set the indicator display format, proceed as follows:

- ◆ Device > Display > Display Mode.
- ◆ Choose %, Pressure, or Scale.
- ◆ Go to Device > Display > Display Function.
- ◆ Choose Linear or Square root (Square root is for % or scale only).

- ◆ Go to Device > Display > Transfer Function.
It shows the Output Format selected (Linear or Sq root).
- ◆ Go to Device > Display > EULO (0%) (for scale only). |
- ◆ Input the range value to be displayed at 0%.
- ◆ Go to Device > Display > EUHI (100%) (for scale only). |
- ◆ Input the range value to be display at 100%.
- ◆ Go to Device > Display > Disp. Unit (for scale only). |
- ◆ Select from a menu of standard engineering units.
- ◆ Go to Device > Display > User Unit (for scale only). |
- ◆ Define a custom engineering unit to be displayed.
- ◆ Go to Device > Display > Exponent.
- ◆ Choose X1, X10, X100 or X1000.

When in Scale display mode, this will indicate that the measurement should be multiplied by the indicated exponent.

Setting the Sensor Configuration

The sensor configuration menu enables you to set sensor parameters as well as reading sensor output. To set up for sensor configuration, proceed as follows:

- ◆ Go to Device > Sensors > Pressure.
Indicates the output of the sensor in the selected engineering units.
- ◆ Go to Device > Sensors > Pressure Unit.
- ◆ Select from a list of standard pressure engineering units.
- ◆ Go to Device > Sensors > Upper Range Limit.
This displays the upper range limit for this sensor.

— CAUTION —

The upper range limit may be greater than the advertised sensor limit. This is defined as the limit that can be applied without damage to the sensor. Measurement accuracy beyond the advertised sensor limit is NOT assured.

- ◆ Go to Device > Sensors > Sensor Temp.
This displays the temperature of the sensor in the selected engineering units.
- ◆ Go to Device > Sensors > Temp. Unit.
This enables you to set the sensor temperature engineering unit in °C, °F, °R, or Kelvin.

Setting the Signal Condition

The signal condition menu enables you to set device parameters related to the output.

— NOTE —

Many of the functions can be set using other menu selections.

To set signal condition, proceed as follows:

- ◆ Go to Device > Signal Condition > Lower Range Value.
- ◆ Input the lower range value.
- ◆ Device > Signal Condition > Upper Range Value.
- ◆ Input the upper range value.
- ◆ Go to Device > Signal Condition > Upper Range Limit.

This displays the upper range limit for this sensor

— ! CAUTION —

The upper range limit may be greater than the advertised sensor limit. This is defined as the limit that can be applied without damage to the sensor. Measurement accuracy beyond the advertised sensor limit is not assured.

- ◆ Go to Device > Signal Condition > Damping.
- ◆ Input the damping value in seconds.
- ◆ Go to Device > Signal Condition > Transfer Function.
- ◆ Choose Linear or Sq root.
- ◆ Go to Device > Signal Condition > Change Cutoff Mode ^(a).

This enables you to accept the default cutoff of 7.1% or to create a custom cutoff level.

- ◆ Go to Device > Signal Condition > Cutoff Mode ^(a).

This displays the selected cutoff level.

- ◆ Go to Device > Signal Condition > Cutoff Point ^(a).

This displays the current cutoff point.

- ◆ Go to Device > Signal Condition > Output.

This displays the output in % of span.

- ◆ Go to Device > Signal Condition > Contact Output Status.

This displays the condition of the optional contact output (open or closed).

- ◆ Go to Device > Signal Condition > Apply Zero Value.

This enables you to calibrate the 4 mA pressure value.

- ◆ Go to Device > Signal Condition > Apply Span Value.

This enables you to calibrate the 20 mA pressure value.

^(a) These functions can be set when square root is selected in the transfer function.

Setting the Output Condition

The Output Condition menu allows you to set analog and HART communication parameters as well as fail safe direction. To set the output condition, proceed as follows:

- ◆ Go to Device > Output Condition > Analog Output > Analog Output.
This displays the current Analog Output value in mA.
- ◆ Go to Device > Output Condition > Analog Output > Output Low Limit.
This displays the configured low limit of the Analog output in % (% below 4 mA).
- ◆ Go to Device > Output Condition > Analog Output > Output High Limit.
This displays the configured high limit of the Analog output in % (% above 20 mA).
- ◆ Go to Device > Output Condition > Analog Output > Loop Test.
Method that allows for setting the analog output value for loop testing. Settings accommodate 4 mA, 20 mA, stepped 4, 8, 12, 16, 20 or user defined mA output.
- ◆ Go to Device > Output Condition > Fail Safe > Fail Safe Direction.
This displays the factory configured output direction.
- ◆ Go to Device > Output Condition > Fail Safe > Failure Alarm Simulation.
This enables you to simulate a fail safe alarm.
- ◆ Go to Device > Output Condition > HART Output > Polling Address.
This enables you to specify the HART polling address
- ◆ Go to Device > Output Condition > HART Output > Num Req Preams.
This displays the number of request preambles factory configured.

Setting the Alarm Configuration

The Alarm Configuration menu allows you to set limits related to various on-board alarms and to read status.

- ◆ Go to Device > Alarm Settings > Output Alarm.
This will allow you to set an alarm on the output when limits are exceeded. Selections include No Alarm, Lower Limit, Upper Limit and Lower/Upper Limit.
- ◆ Go to Device > Alarm Settings > Lower Output Alarm.
- ◆ Go to Device > Alarm Settings > Upper Output Alarm.
This will allow you to set the upper output alarm limit.
- ◆ Go to Device > Alarm Settings > Sensor Temp. Alarm.
This will allow you to set an alarm on the sensor temperature when limits are exceeded. Selections include No Alarm, Lower Limit, Upper Limit and Lower/Upper Limit.

- ◆ Go to Device > Alarm Settings > Lower Sensor Temp. Alarm.
This will allow you to set the lower sensor temperature limit.
- ◆ Go to Device > Alarm Settings > Upper Sensor Temp. Alarm.
This will allow you to set the upper sensor temperature alarm limit.
- ◆ Go to Device > Alarm Settings > Contact Output Mode.
This will allow you to set the normal state of the optional contact output. Selections include Normally Open and Normally Closed.
- ◆ Go to Device > Contact Output ON/OFF.
This will allow you to turn the optional contact output on or off for various alarm conditions. On/off selections include Output Low, Output High, Sensor Temperature Low and Sensor Temperature High.
- ◆ Go to Device > Contact Output Simulation Mode.
This will allow you to simulate an open or closed contact status for alarm testing.
- ◆ Go to Device > Alarm Status.
This will allow you to display the status of the alarms.

Configuring Device Information

The Device Information menu allows you to configure the device-level information and to read factory-specific information.

- ◆ Go to Device > Device Information > Manufacturer.
This will allow you to view the Invensys brand name.
- ◆ Go to Device > Device Information > Model.
This will allow you to display the Enterprise Control System (ECS) model designation.
- ◆ Go to Device > Device Information > Measurement Type.
This will allow you to display the measurement type (differential or gauge) of the transmitter.
- ◆ Go to Device > Device Information > Device ID.
This will allow you to display the Device ID of the particular transmitter.
- ◆ Go to Device > Device Information > Tag.
This will allow you to set the HART tag identification for the device.
- ◆ Go to Device > Device Information > Date.
This will allow you to set a date in the device in the format of mm/dd/yyyy.
- ◆ Go to Device > Device Information > Descriptor.
This will allow you to set the HART Descriptor for the device.
- ◆ Go to Device > Device Information > Message.
This will allow you to set the message for the device.

- ◆ Go to Device > Device Information > Sensor Serial Number.
This will allow you to display the sensor serial number for the particular device.
- ◆ Go to Device > Device Information > PROM Number.
This will allow you to display the Programmed Read-Only Memory (PROM) serial number.
- ◆ Go to Device > Device Information > Final Assembly Number.
This will allow you to set a final assembly number for the device.
- ◆ Go to Device > Device Information > Revision Numbers > Universal Rev.
This will allow you to display the HART universal revision number (HART 5).
- ◆ Go to Device > Device Information > Revision Numbers > Device Rev.
This will allow you to display the HART device revision of the ECS transmitters.
- ◆ Go to Device > Device Information > Revision Numbers > Software Rev.
This will allow you to display the HART software revision number for the ECS transmitters.
- ◆ Go to Device > Device Information > Write Protect > Hardware Write Protect.
This will allow you to display the hardware write protection state of the device.
- ◆ Go to Device > Device Information > Write Protect > Software Write Protect.
This will allow you to display the software write protection state of the device.
- ◆ Go to Device > Device Information > Write Protect > Change SW Write Protect.
This will allow you to allow you to toggle on/off the software write protection.
- ◆ Go to Device > Device Information > Software Version.
This will allow you to display the software version number of the device.

Calibrating the Transmitter

This menu selection allows you to calibrate the pressure input and the D/A trim.

- ◆ Go to Device > Calibration > Correct Input > Zero Trim.
This will allow you to enable you to zero the transmitter.
- ◆ Go to Device > Calibration > Correct Input > Correct Input LRV.
This will allow you to calibrate the LRV (4 mA) input.
- ◆ Go to Device > Calibration > Correct Input > Correct Input URV.
This will allow you to calibrate the URV (20 mA) input.
- ◆ Go to Device > Calibration > Correct Input > Reset Corrects.
This will allow you to return the zero and span calibration factors to their default values.
- ◆ Go to Device > Calibration > Correct Input > Reset Corrects.
This will allow you to restore to factory settings and erase all user calibration information.

- ◆ Go to Device > Calibration > Output Calibration > D/A Trim.

This will allow you to calibrate analog output at 0% and 100% levels by using the transmitter in the constant current source mode. This will require a precision milliamp meter or volt meter (0.03% accuracy or better) in the loop to check readings.

- ◆ Go to Device > Calibration > Output Calibration > D/A Trim.

This will allow you to view D/A trim.

Reviewing Device Configuration

This menu selection allows you to review the device configuration and measurement information in one screen.

- ◆ Go to Device > Review.

This will allow you to review device configuration.

Device Diagnostics

The device diagnostic menu provides information related to critical, non-critical and internal data consistency status.

- ◆ Go to Diagnostic > Diagnostic Status > Status.

This will show the results of device status check.

- ◆ Go to Diagnostic > Diagnostic Status > Critical Status.

This will show the status of critical device status parameters (8-bit status word). “OFF” means that no fault exists.

- ◆ Go to Diagnostic > Diagnostic Status > Internal Data Inconsistency.

This will allow you to view internal data inconsistencies. This will provide the status of the device data base. “OFF” means no fault exists.

- ◆ Go to Diagnostic > Diagnostic Status > Non-Critical Status.

This will allow you to view non-critical status. This will provide the status of non-critical device status parameters (additional device status word). “OFF” means that no fault exists.

- ◆ Go to Diagnostic > Status Records > Clear Status Records.

This will allow you to clear the status record data.

- ◆ Go to Diagnostic > Status Records > Critical Status Records.

This will allow you to view critical status records. This will provide historical status information related to critical status. “OFF” means that no record exists.

- ◆ Go to Diagnostic > Status Records > Internal Data Inconsistency Records.

To view internal data inconsistency records. This will provide historical status information related to the device data base. “OFF” means that no record exists.

- ◆ Go to Diagnostic > Status Records > Non-Critical Status Records.

This will allow you to view non-critical status records. This will provide historical status information related to non-critical status parameters. “OFF” means that no record exists.

- ◆ Go to Diagnostic > Zero-Error Int. Data.

This will allow you to view zero-error internal data.

|

5. Troubleshooting

The following describes the meaning of the status messages and the related troubleshooting procedures.

If a fault is judged to be internal data inconsistency or critical failure, the output of the transmitter goes to the high or low limit, according to the code selected for Failure Alarm.

	Status Message	Meaning	Required Action	Display of Indicator
Internal data inconsistency	Invalid database	Indicates that the settings stored in EEPROM are not correct at the time the power is turned on. However, after the data is reset correctly the error status will be cleared.	Try communicating again. Verify configuration data and recalibrate the device.	Err.09 CONFIG
Critical failure	Analog/Digital Conversion Fault	Input signals for the A/D converter or its peripheral circuits are abnormal.	Contact appropriate personnel.	Err.01 A-D CNV
	Sensor Characteristic Data Fault	There is an error in the characteristic data for the sensor.	Contact appropriate personnel.	Err.02 PROM
	Suspect Input	Sensor operation failure.	Contact appropriate personnel.	Err.03 INPUT
	CPU Fault	CPU (MPU: Micro processing Unit) operation failure	Contact appropriate personnel.	Err.04 CPU
	NVM Fault	EEPROM failure	Contact appropriate personnel.	Err.05 NVM
	RAM Fault	RAM failure	Contact appropriate personnel.	Err.06 RAM
	ROM Fault	ROM failure	Contact appropriate personnel.	Err.07 ROM
	Output Circuit Fault	Indicates that the output current is abnormal. Note: Fault detection includes a case in which the power voltage supplied to the transmitter dips for 1 second or more. Also, if the supply voltage has been abnormal for about 3 minutes, this alarm is displayed.	Check & Calibrate the output current. Check the power voltage supplied to the transmitter.	Err.08 OUTPUT

	Status Message	Meaning	Required Action	Display of Indicator
Non-critical status	Meter Body Over Temperature	Meterbody temperature is too high. The temperature of sensor in the meterbody exceeds 125 degree C.	Reinstall the device to decrease the temperature to within specifications.	AL.20 M/B.TEMP
	Excess Zero Correct	The zero correction factor is outside the acceptable limits for accurate operation.	Check the input and be sure it matches the calibrated range value.	AL.21 ZERO.CAL
	Excess Span Correct	The span correction factor is outside the acceptable limits for accurate operation.	Check the input and be sure it matches the calibrated range value.	AL.22 SPAN.CAL
	In Output Mode	The device is operating in output mode (Loop test).	Go to the output mode menu to exit the output mode.	Output % OUTMODE
	Meter Body Overload or Meter Body Fault	- The input pressure is more than two times the upper range limit for the device. - Device error.	Check the PV value and replace the device with a larger range model if necessary.	AL.24 OVRLOAD
	Correct Reset	Calibration data is cleared.	Calibrate the lower and upper range values.	AL.26 NO.CALIB
	External Zero/Span Adjustment Fault	External zero/span adjustment error. When external zero/span adjustment is available, this alarm is displayed if the zero or span adjustment switch is turned on for 45 seconds or more, or if both switches are turned on at the same time.	Contact appropriate personnel.	AL.28 SWITCH
	Contact Output Simulation Mode	The device is operating contact output simulation mode.	To exit contact output simulation mode, go to the alarm/contact output menu.	[Blank] DO.SIM
	Output Alarm Detected	The output is going over upper/lower limit of output alarm.	Check the output.	AL.51 OUT%.AL

If the transmitter does not work normally or at all, check the following items.

Phenomenon	Measures
Nothing appears on the display.	<ul style="list-style-type: none"> • Make sure the power supply voltage is correctly applied. • Make sure the wire connection of the power supply is provided.
Output remains zero and does not change.	<ul style="list-style-type: none"> • Make sure the settings are correct. • Make sure the flow rate is within the low flow cut range. • Make sure the pipes are not blocked.
Output is out of alignment.	<ul style="list-style-type: none"> • Make sure that no fluid is leaking from the pipes. • Make sure the fluid is not flowing backward. • Make sure the connection direction of the HP and LP sides is correct. • Make sure the transmitter is not set at a tilt.

Also check the following points:

- ◆ Check the result of self-diagnosis with the Communicator.
- ◆ Check that the connection direction of the HP and LP sides is correct.
- ◆ Check for any leakage at the connections on the pipes.
- ◆ Check for any loosened bolts on the clamping portions of the product.
- ◆ Check for any loosened and/or broken wires.
- ◆ Check for any wrong wiring connections.
- ◆ Check that the power supply voltage and load resistance are in accordance with the specifications.
- ◆ Check that the pressure and temperature are in accordance with the specifications.
- ◆ Check for the presence of any sources of strong magnetism or noise near by.

If even after checking the above items the transmitter still does not work properly, stop using it and unplug it. Then contact us at our branch office, sales office, or your local representative.

6. Maintenance

This section explains the maintenance of the Enterprise Control System Series Component Pressure Transmitter. It offers a range of ways to ensure that the transmitter's performance is not affected during its operating life. Included are instructions for:

- ♦ disassembly and assembly
- ♦ output checking
- ♦ calibration
- ♦ troubleshooting procedures.

At the start of operation or during operation, deal with performance problems by following these procedures. If you cannot fix the problem, it is possible that there is a problem with the product itself and you should contact Invensys immediately.

Disassembly and Assembly

Before You Start

WARNING

Never open the case cover while the transmitter is ON or in a hazardous location.

Handle the explosion-proof transmitter with care. It may lose its explosion-proof performance due to corrosion, deformation, damage to the case cover, or damage to a screw or a joined part.

The explosion-proof performance of the special explosion-proof pressure transmitter is not guaranteed unless it is LOCKED. Always tighten the case cover completely, and lock the case cover.

Opening and Closing the Case Cover

The transmitter has a locking structure, as shown in Figure 20.

- ♦ Before opening the case cover, unlock the mechanism using a 4 mm hexagonal wrench.
- ♦ When closing, insert the case cover fully and lock it, using a 4 mm hexagonal wrench.

CAUTION

After closing the case cover, make sure that no dust or rain gains ingress into the transmitter case.

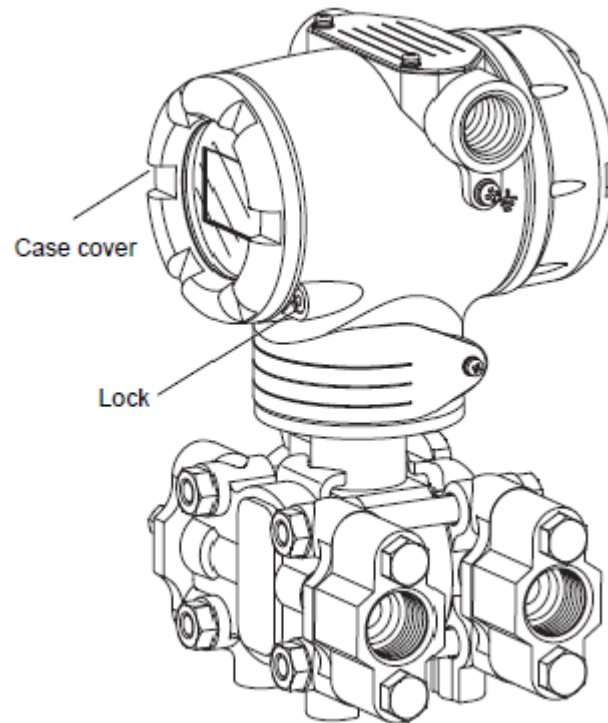


Figure 20. Locking Case Cover

Mount Center Body Cover and Adapter Flange

Remove Covers

To remove body cover, proceed as follows:

1. Remove the four sets of bolts & nuts, shown in Figure 21.
2. After removing, handle the center body cover carefully. Avoid damage to the diaphragm.

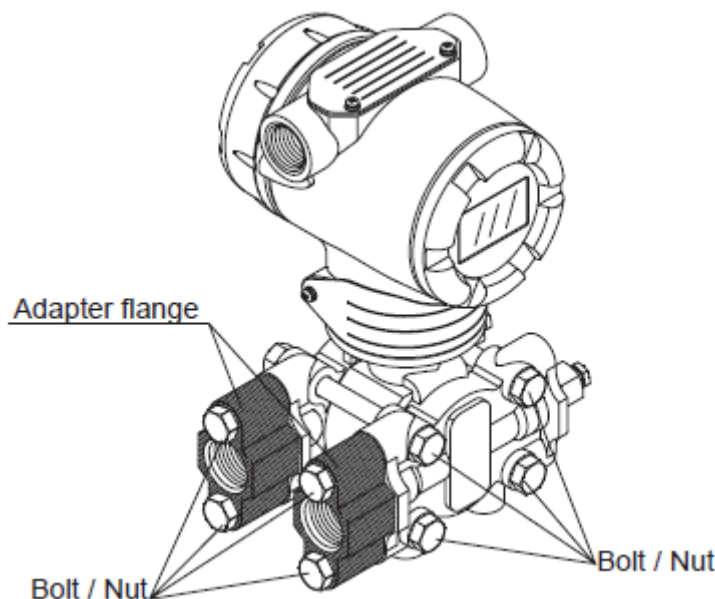


Figure 21. Center Body Cover Fixing Bolts

Mount Covers and Adapter Flanges

When assembling the centers body cover and adapter flanges, tighten the bolts to the following torque.

Replace the seal gasket, if it is damaged.

Table 2. Cover Bolts / Nuts and Tightening Torque

Model No.	Wetted parts material (other than diaphragm)	Bolt/Nut Material	Bolt/Nut tightening torque N-m	
			Cover material Stainless steel	
			When new gasket is used	When existing gasket is reused
IDP15D	SUS316	SUS304	15±1	10±1
IDP31D	SUS316	SUS630	22±2	17±1
	Hastelloy C	SUS304	15±1	10±1

Table 2. Cover Bolts / Nuts and Tightening Torque

Model No.	Wetted parts material (other than diaphragm)	Bolt/Nut Material	Bolt/Nut tightening torque N-m	
			Cover material Stainless steel	
			When new gasket is used	When existing gasket is reused
IDP31D	SUS316L	SUS630	22±2	17±1
		SUS304	15±1	10±1
IDP32D	SUS316	SUS630	90±20	
		SUS304	55±10	
IGP60G	SUS316 Hastelloy C	SUS630	22±2	17±1
		SUS304	15±1	10±1
IGP60G	SUS316L	SUS630	22±2	17±1
		SUS304	15±1	20±1

Table 3. Adapter Flange Bolt / Nut Tightening Torque

Bolt/Nut Material	Bolt/Nut Tightening Torque N-m
	Adapter Flange Material Carbon steel/Stainless steel
SUS630	20±1
SUS304	10±0.5

Washing the Center Body

The transmitter and the pipes must be kept clean to maintain its accuracy and achieve satisfactory performance. Deposits accumulated in the pressure chamber of the transmitter may result in measurement errors.

Rinsing the Center Body (IDP15D, IDP31D, IDP32D/IGP60G)

To rinse the center body, proceed as follows:

1. Remove the hexagon head bolts of the center body and remove the cover.
2. Wash the diaphragm and the inner surface of the cover with a solvent and a soft brush. Take care not to deform or damage the diaphragm.
3. Replace the cover gasket with a new one as necessary.
4. Tighten the cover bolts at the specified tightening torque. (Refer to Table 2)

— NOTE —

If you stop the operation after measuring liquid that can be frozen (such as water) in a cold area, drain the liquid from the center body (by loosening the drain plug).

Maintenance of sensor

The sensor does not need any special routine maintenance/inspection. When the flange is removed for maintenance, wash the diaphragm using a soft brush and solvent. Work carefully without deforming or damaging the diaphragm.

Calibrating Set Range and Output Signals

Some calibration work must be performed by an authorized service provider. Generally, this work requires a high-precision reference input device and highly accurate measuring equipment. Such work is not ordinarily performed by end-users. These instructions are provided for the benefit of users who must perform calibration work themselves.

Calibration includes input calibration (set range) and output calibration (output signals).

Calibrating Set Range Based on Reference Input

Preparation

The low limit (LRV) and the high limit (URV) of the set range are calibrated by inputting reference pressure.

Calibrate the LRV and the URV, in that order.

Equipment

Prepare the following equipment before calibration:

- ◆ Standard pressure generator: Pressure generated must be close to the measurement range of the transmitter. Accuracy requirement: $\pm 0.05\%$ F.S. or $\pm 0.1\%$ setting
- ◆ Power supply: 24V DC
- ◆ Precision resistance: $250\ \Omega \pm 0.005\%$
- ◆ Voltmeter: Digital voltmeter with accuracy $\{(10V\ DC\ range)\ of\ \pm 0.02\%\ rdg + 1\ dgt\}$
- ◆ HART communicator

Calibration Conditions

All of the following conditions must be met, before performing calibration:

- ◆ A laboratory without any air currents. Wind will apply pressure to the pressure receiving unit on the side open to the air, influencing the calibration accuracy.
- ◆ Standard temperature of $23^{\circ}C$ and humidity of 65%. Normal pressure range and the normal humidity range (45%~75%) are allowable, if no sudden changes occur.
- ◆ Accuracy of the measuring equipment must be at least 4 times better than that of the transmitter.

! CAUTION

If damping time constant is set to 0 second, adjust another value to keep the output stable before calibration.

Set Range

Before starting calibration work, use the HART communicator to check that the set range of the transmitter agrees with the specifications. If they do not correspond, use the HART communicator to set the correct range.

Calibrating Low Limit

How to calibrate the low limit value:

It is assumed that the HART communicator and the transmitter have just started normal communications.

The Enterprise Control System Series Component Pressure Transmitter has two-point calibration. This means when you calibrate two points in the range, all the points in that range adjust to that calibration.

(Device) - (Calibration) - (Correct Input)

1. Select, Correct Input LRV.
2. You will be warned to remove the loop from automatic control. After doing so, press OK.
3. When prompted, adjust pressure source to apply pressure equal to LRV (0%) then press OK.
4. When pressure is stable, press OK.
5. When prompted, remove pressure.

Calibrating High Limit

How to calibrate the high limit value:

(Device) - (Calibration) - (Correct Input)

1. Select, Correct Input URV.
2. You will be warned to remove the loop from automatic control. After doing so, press OK.
3. When prompted, adjust pressure source to apply pressure equal to URV (100%) then press OK.
4. When pressure is stable, press OK.
5. When prompted, remove pressure.

Calibrating Output Signals

Before You Start

Output signal calibration (adjustment of the D/A conversion unit) is unnecessary under ordinary operating conditions. Normally, this work is performed by an authorized service provider. For end-users who must perform this work, prepare the following equipment in advance:

Equipment

- ◆ High-precision ammeter with accuracy of 0.03% FS or higher
- ◆ Resistor with a resistance of $250\Omega \pm 0.005\%$
- ◆ HART communicator

Set-up

To calibrate output signals, proceed as follows:

- ◆ Connect the HART communicator and an ammeter.
- ◆ Refer to “Starting Communications” on page 25 and check to ensure that the wiring is correct.
- ◆ Check that the HART communicator and the transmitter are in the normal communication status.

Calibrating Analog Output Signal

You can calibrate the transmitter's analog output circuit by using the transmitter in its constant-current source mode.

(Device) - (Calibration) - (Correct Input) - (D/A trim)

To calibrate analog output signal, proceed as follows:

1. You will be warned to remove the loop from automatic control. After doing so, press OK.
2. When prompt appears, connect a precision milliammeter or volt meter (0.03% accuracy or better) in loop to check readings. Press OK.
3. The following display prompts will appear:
 - a. Setting field device output to 4 mA. Press OK.
 - b. Enter meter value. Key in meter value, then press OK.
 - c. Is field device output 4.000 mA equal to reference meter?
 - ◆ Yes
 - ◆ No
4. If not equal, select No, press ENTER, then key in new meter value. (Returns to, Enter meter value, prompt until field device output equals reference meter). If equal, select Yes, press ENTER.

5. The following display prompts will appear:
 - a. Setting field device output to 20 mA. Press OK.
 - a. Enter meter value. Key in meter value, then press ENTER.
 - a. Is field device output 20.000 mA equal to reference meter?
 - ◆ Yes
 - ◆ No
6. If not equal, select No, press ENTER, then key in new meter value. (Returns to, Enter meter value, prompt until field device output equals reference meter).
If equal, select Yes, press ENTER.
Prompt notifies you that the field device will be returned to its original output.

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