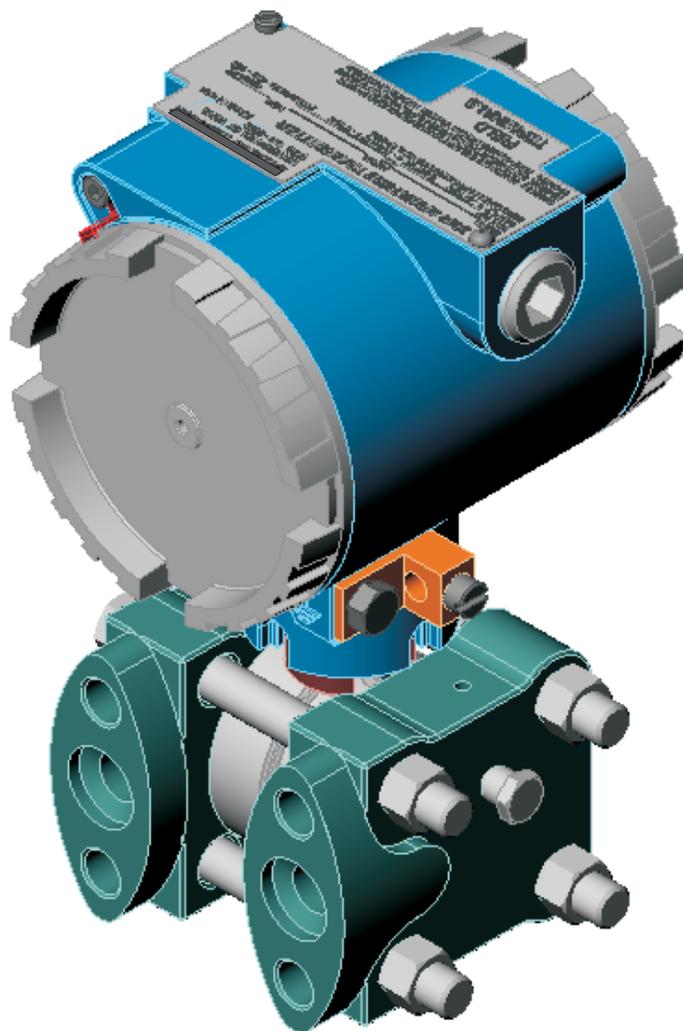




# PX771A

## Differential Pressure Transmitter



Operator's Manual  
M-3602/1101



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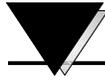
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# M-3602

## DIFFERENTIAL PRESSURE TRANSMITTERS - SERIES PX771A

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# Section 1

## INTRODUCTION

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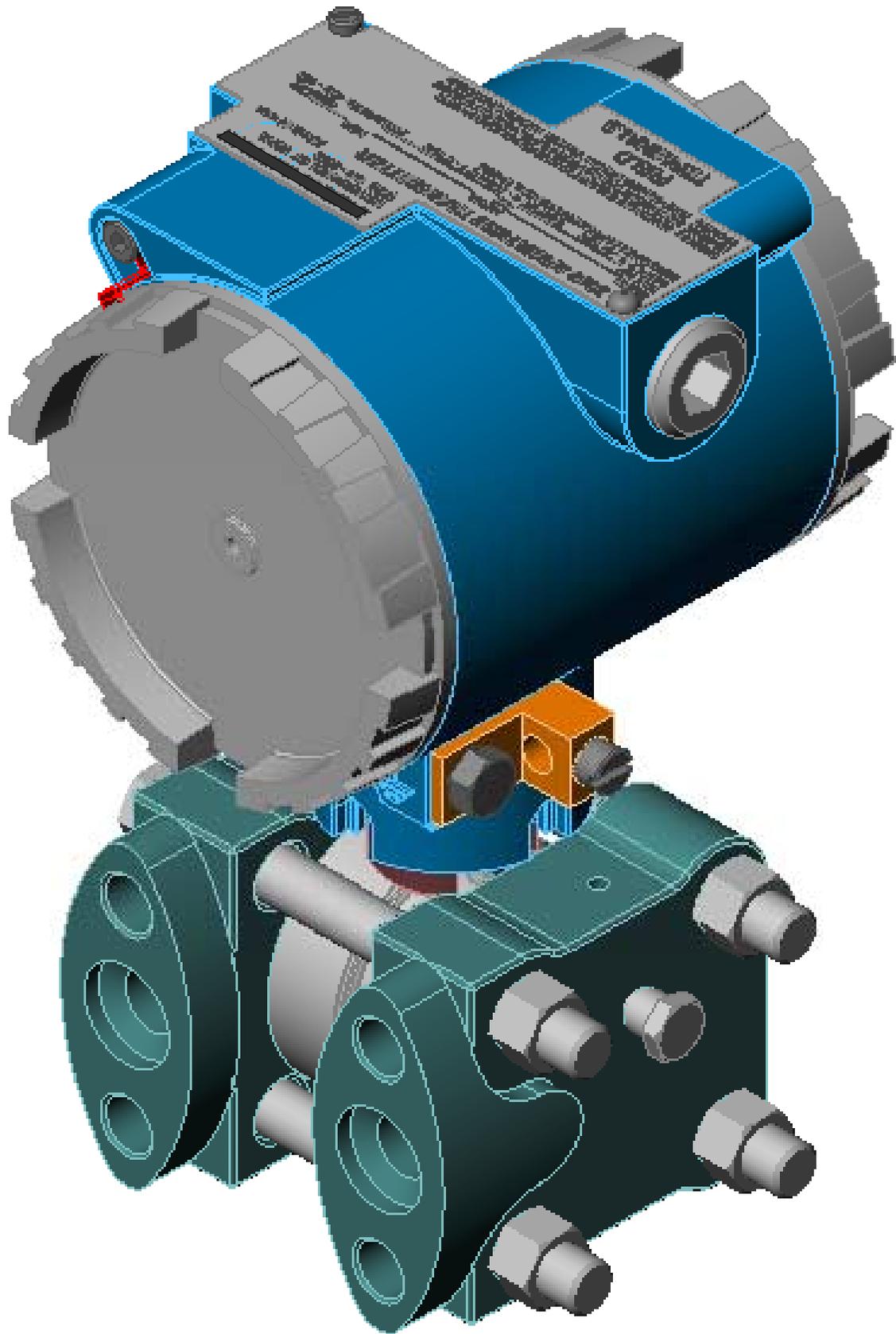
### 1.1 PRODUCT DESCRIPTION

Series PX771A Differential Pressure Transmitters convert pressure measurements into a proportional 4-20 mA or a 1 - 5 Vdc output signal that functions as the input to a controller, recorder, indicator or similar device. These transmitters find application in the gas, water, and process industries that require accurate measurements over a wide range of environmental conditions.

### 1.2 TRANSMITTER FEATURES

The features that follow are common to all transmitter models are described in the following listing:

- ★ **Pressure Sensor.** Strain gauge, piezo-resistive sensors perform pressure measurements.
- ★ **Signal-Power Loop.** The transmitter requires a nominal 24 Vdc power source to operate the signal loop, a 2-wire 4-20 mA output.
- ★ **Available Voltage Output.** For low power applications, a 1-5 Vdc output is user configurable via an internal jumper.
- ★ **Adjustable Ranges.** Transmitters are provided with coarse switch and fine pot adjustments for range calibration. Span is adjustable from 16 to 100% of the upper range limit, while zero is adjustable from -600 to 600% of the lower range limit for elevation and suppression.
- ★ **Damping.** A circuit jumper selects damping periods of .275 sec or 1 ms to control transmitter response to a change of the measured variable.
- ★ **Mechanical Assembly.** The transmitter electronics enclosure is constructed of cast aluminum with an epoxy finish. The materials offered for diaphragms, process connections, flanges, bolts, etc. are given in Section 1A.
- ★ **Fill System.** The transmitter's diaphragm and sensor operate in a sealed fluid system. These systems are furnished with DC 200 as the fill fluid.
- ★ **Electrical Conduit Port.** Two 1/2 inch NPT female ports are provided for electrical conduit.



**Figure 1-1 - PX771A Differential Pressure Transmitter**

## 1.3 MODELS APPROVED FOR HAZARDOUS AREAS

Transmitter models certified for operation in hazardous areas by Underwriters Laboratories (UL) will have the appropriate logo inscribed on the instrument data plate. These models are intended for use in the following hazardous locations:

*Explosion-proof for Class I, Division 1, Groups C and D.*

*Nonincendive for Class I, Division 2, Groups A, B, C and D.*

The National Electric Code, Article 500, defines the above classes and divisions as follows:

***Class I Atmospheres:***     *Contains flammable gases or vapors.*

***Class II Atmospheres:***   *Contains combustible dust particles.*

***Class III Atmospheres:***   *Contains ignitable fibers or flyings.*

***Division 1:***

*Where continuous exposure, or threat of fire or explosion may be present due to accident or uncommon occurrence.*

***Division 2:***

*Where threat of fire or explosion is not normally present, and not likely to result from abnormal occurrence.*

***Groups A through D:***

*Cover various flammable gases and liquids such as ethyl- ether vapor, gasoline, acetone, etc.*

***Groups E through G:***

*Cover various combustible dusts such as dust from metalworking, coal, coke carbon black, grain, etc.*

## 1.4 USING THIS MANUAL

Section 1A provides information relevant to product description, types of mounting, measurement applications, service checks, and specifications.

Sections 2 through 5 describe installation, calibration, service and general specifications. The Loop Powered Indicator option is covered in Appendix B.

# *Section 1A*

## ***DIFFERENTIAL PRESSURE TRANSMITTERS***

### *Series PX771A*

---

#### **1A.1 PRODUCT DESCRIPTION**

The Series PX771A Differential Pressure (DP) Transmitter measures the pressure differential existing across an orifice plate or similar type device and converts it into a proportional 4-20 mA or a 1-5 Vdc signal that can be applied to the input of a device such as a flow computer, controller, recorder, etc. This transmitter is typically used with gas, water and chemical processes to provide accurate measurements under extreme environmental conditions.

The DP transmitter is offered in ranges from 0-100 inH<sub>2</sub>O to 0-300 psi. A listing of ranges for the Series PX771A is given in Table 1A-A.

The transmitter can be installed on a DP pressure manifold or it may be specified with a universal mounting bracket. The bracket permits the unit to be clamped to a two-inch pipe or secured to a support structure.

The transmitter electronics enclosure is constructed of cast aluminum. The diaphragm, flanges, flange bolts and the manifold are offered in two materials; stainless steel, and Hasteloy C.

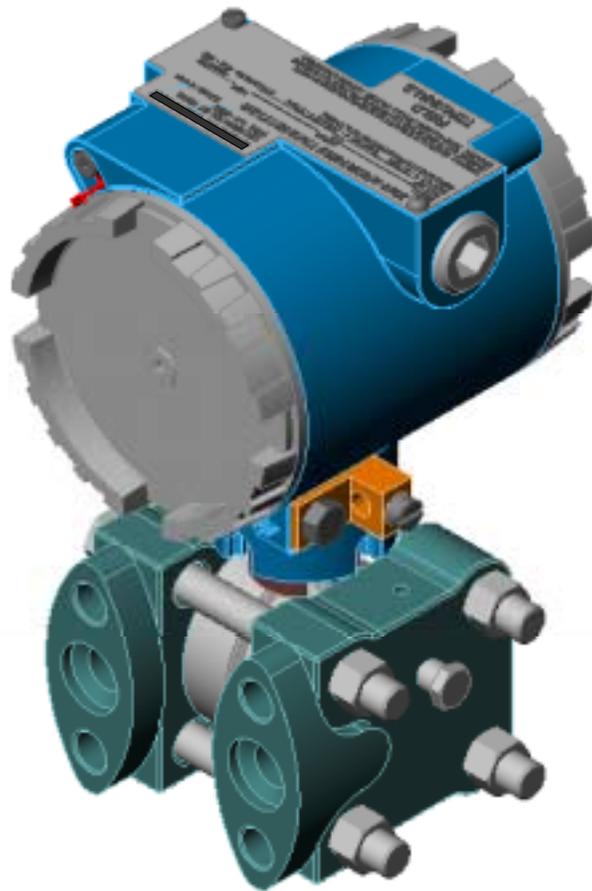
#### **1A.2 THEORY OF OPERATION**

The main assemblies of the DP transmitter are the electronics housing, sensor module and process flanges as noted in Figure 1A-2. The electronics housing encloses the amplifier board and the field wiring terminals as shown in the schematic of Figure 1A-3. The sensor module contains the pressure sensor, two sealed fluid systems, an overpressure diaphragm, and two isolation diaphragms. The flanges provide the HI and LO port connections and also function as the outer wall of the pressure input chambers.

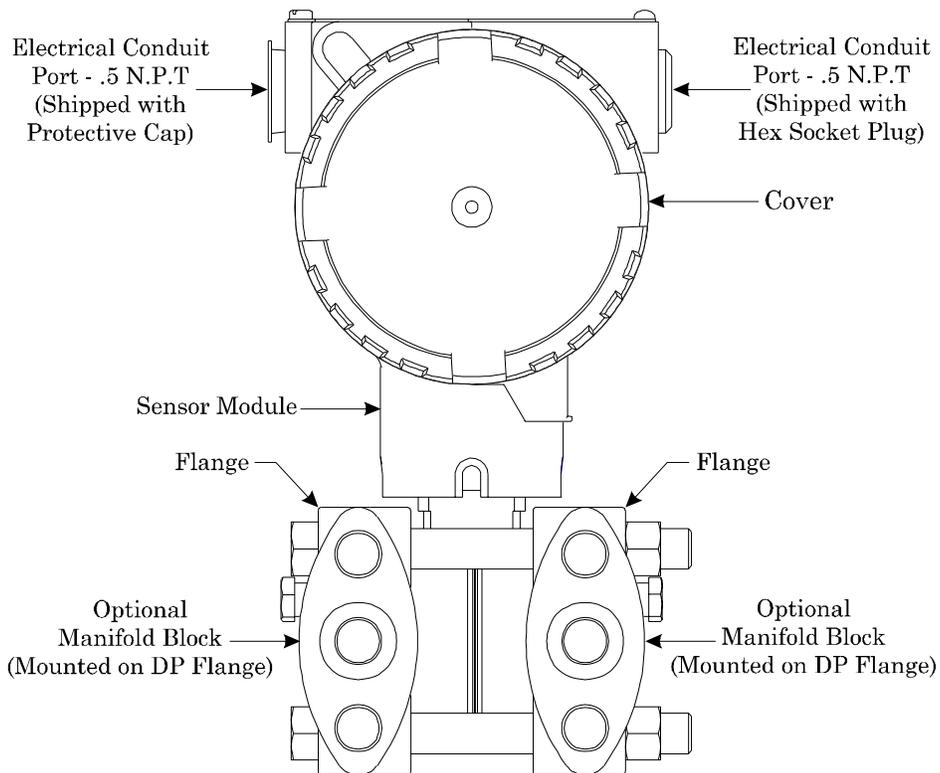
The electronic pressure sensor located at the upper part of the sensor module is mounted on a micro diaphragm that serves as a divider between the two fluid systems. One fluid system corresponds to the HI pressure input, and the other to the LO pressure input. The isolation diaphragm of each system isolates the fluid system from the input pressure.

When a differential pressure is applied across the HI and LO ports, both isolation diaphragms will compress or retract in response to the change of differential. The movement of these diaphragms causes similar pressure changes in each of the sealed fluid systems that are detected by the sensor.

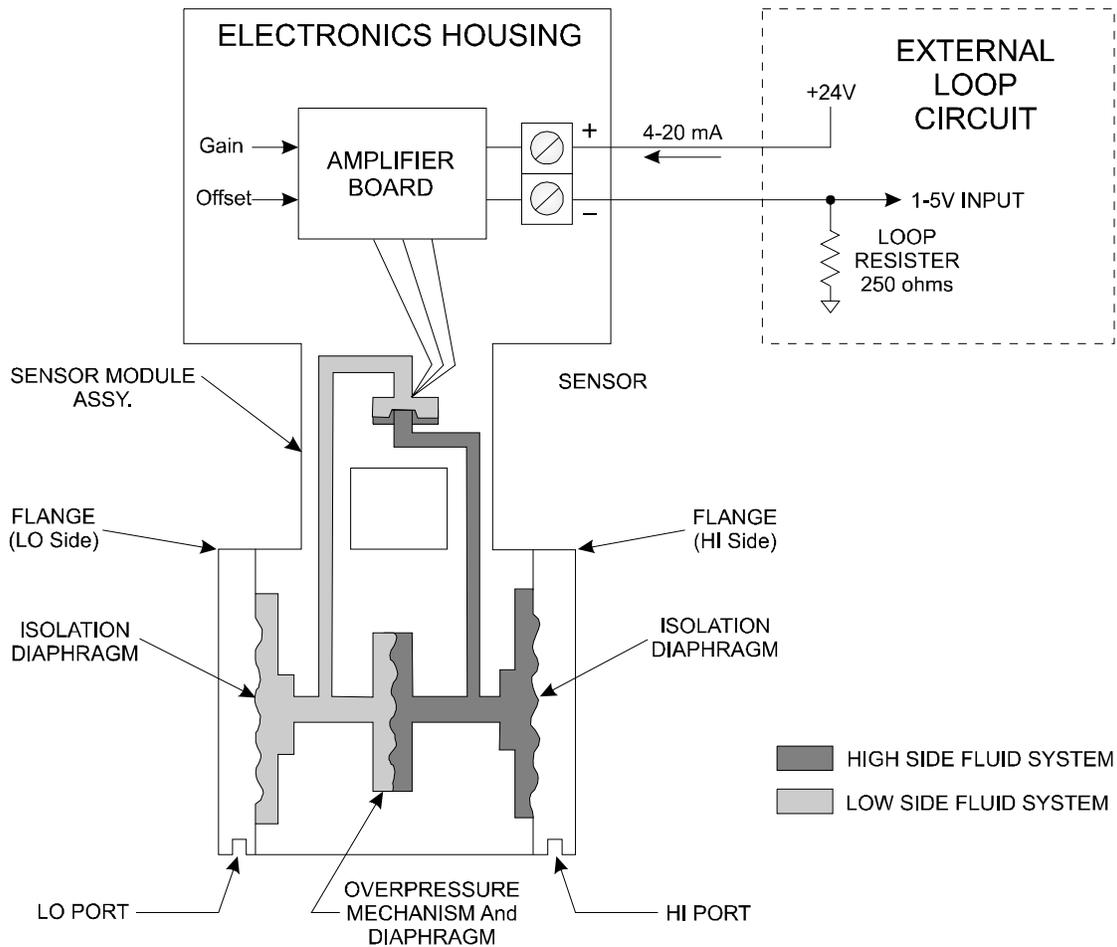
If the differential pressure applied to the HI-LO ports accidentally exceeds the upper limits of the transmitter, an overpressure diaphragm mechanism takes control of the situation. The action of this mechanism prevents the overpressure from reaching the sensor, thereby minimizing the risk of damage.



**Figure 1A-1 - Series PX771A**



**Figure 1A-2 - Transmitter Assemblies**



**Figure 1A-3 - Simplified Diagram**

Implanted on the sensor's micro-machined surface are four strain gauge resistors connected in a bridge configuration. This circuit, which is powered by a constant current supply on the amplifier board, produces a millivolt output that is equal to the difference between the two pressure inputs.

The output of the sensor circuit is wired to a high-gain, linear amplifier that converts the millivolt signals to a 4-20 mA current output. Figure 1B-3 shows the transmitter output wired to a typical external loop circuit. This circuit uses a 250-ohm load resistor and a 24 V dc power source. The 4-20 mA amplifier current flowing through the load resistor produces a 1-5 V input signal for the external device.

The amplifier circuit includes a fine-gain and fine-offset potentiometer for performing minor calibration adjustments. Transmitters also include internal coarse zero and coarse span switches for more extensive range conversion.

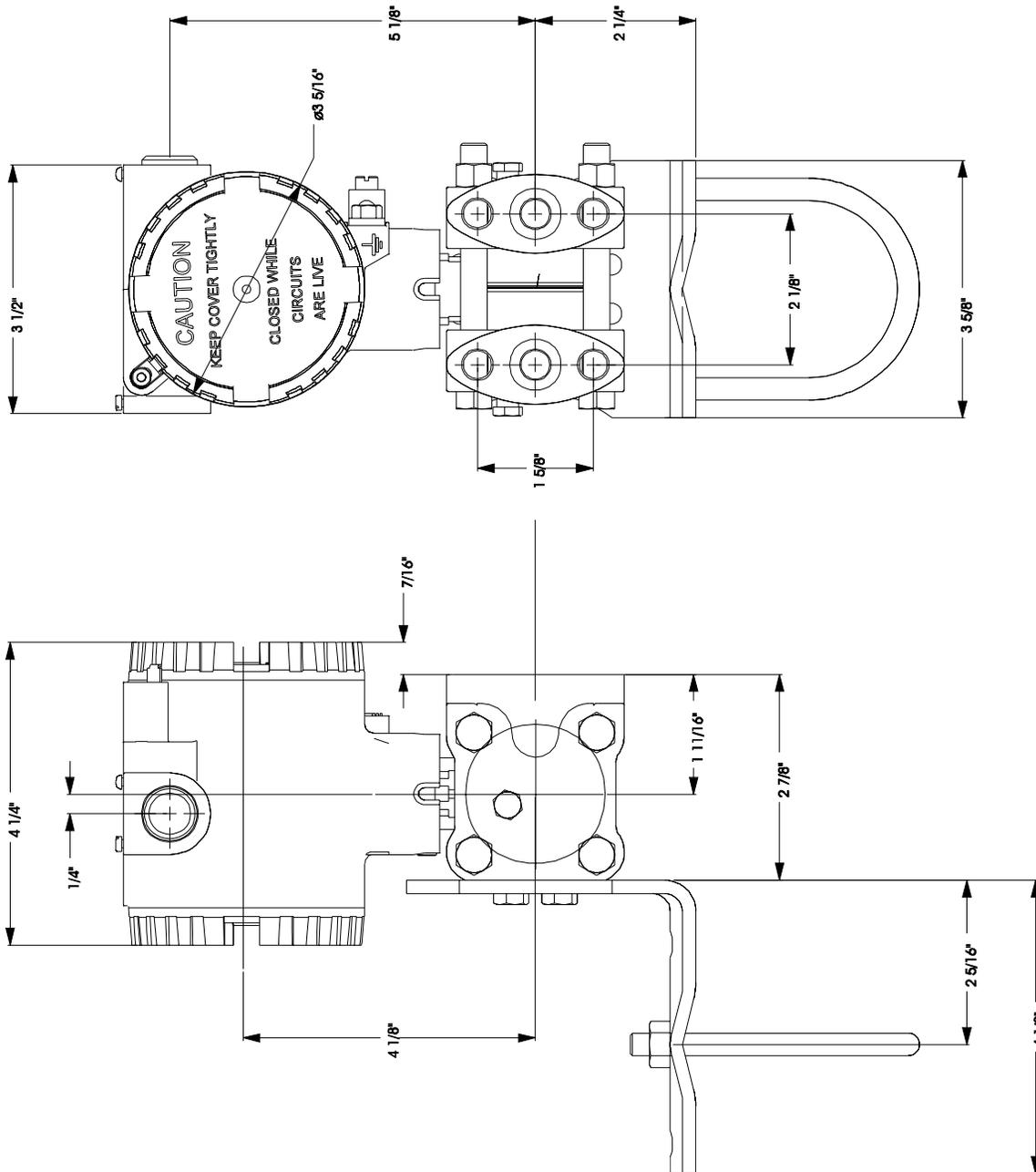
### 1A.3 IDENTIFYING TRANSMITTER OPTIONS

A data plate affixed to the transmitter body lists the model number, serial number, and instrument range. To identify the features and options furnished with your model, refer to the complete model number contained in the sales order. This number includes a sequence of suffix numbers that are identified in Table 1A-A.

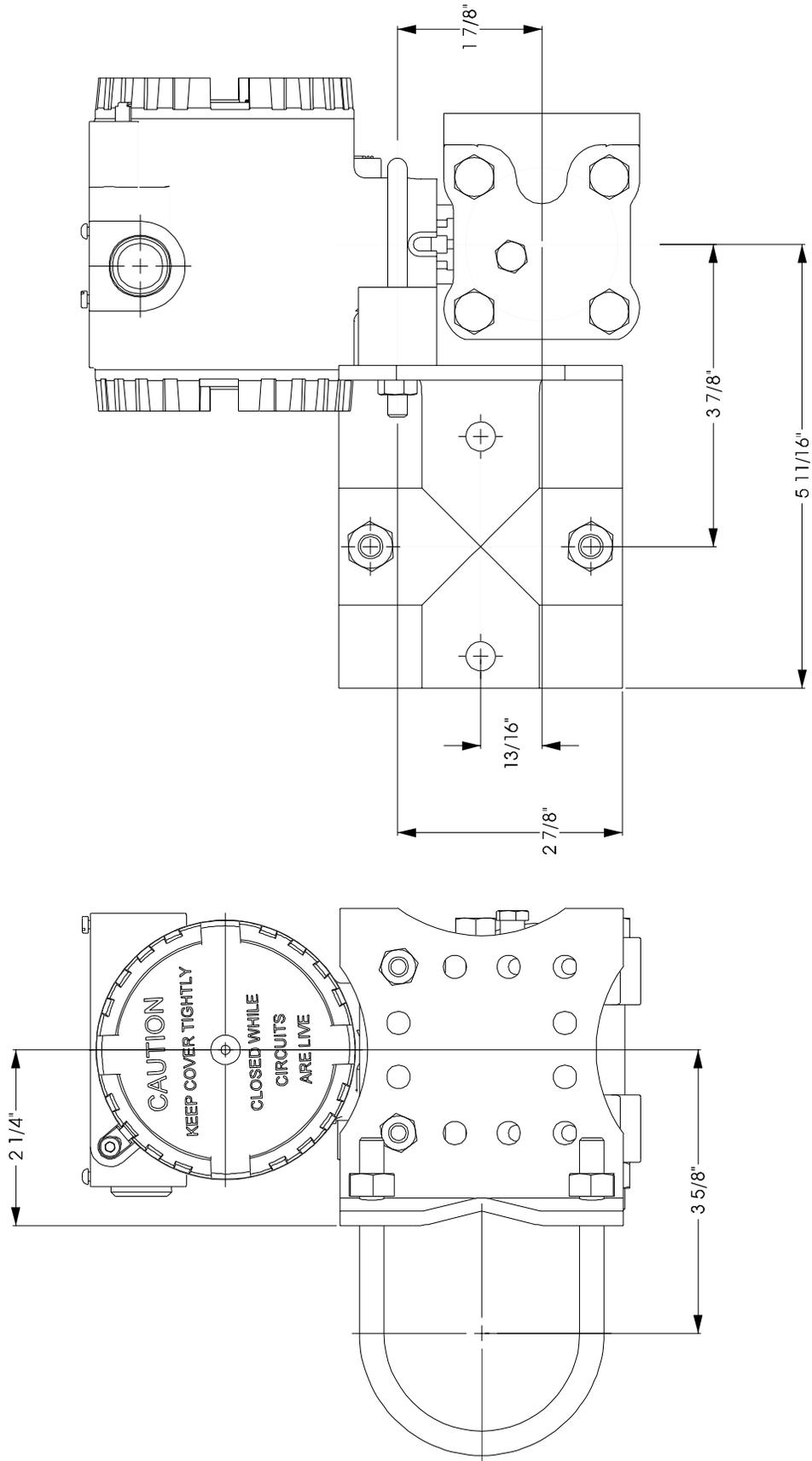
**TABLE 1A-A - MODEL NUMBER BREAKDOWN FOR SERIES PX771A**

**PX771A - (1) - (2) ← (see Codes below)**

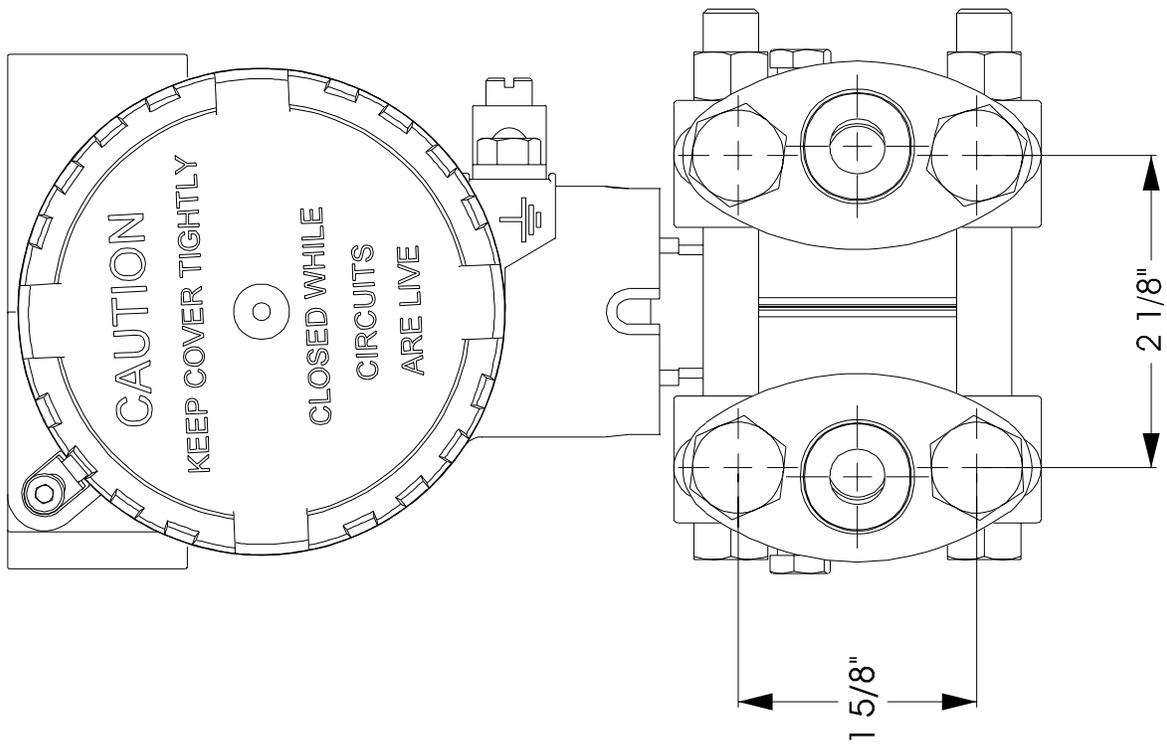
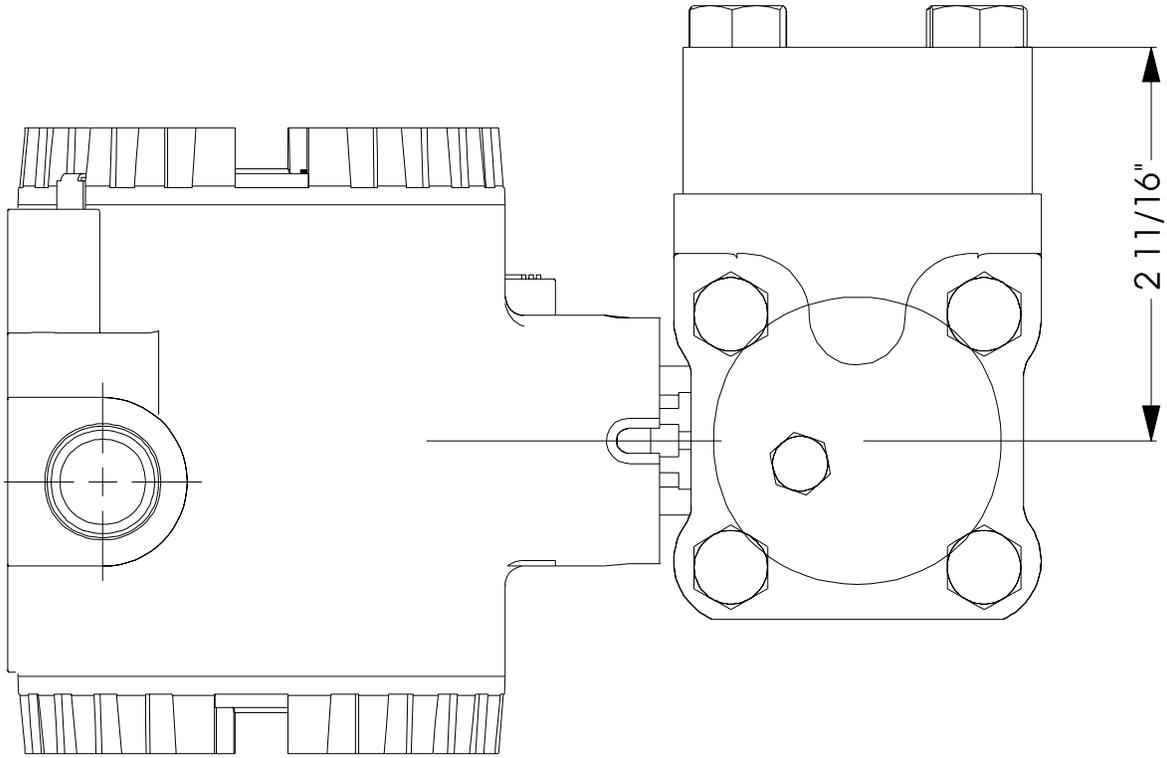
(1) INPUT RANGE		(2) OPTIONS	
CODE	RANGE	CODE	DESCRIPTION
100WCGI	0-17 to 0-100 inH <sub>2</sub> O	MB	Mounting bracket
300WCGI	0-50 to 0-300 inH <sub>2</sub> O	M	Local digital indicator
025GI	0-4 to 0-25 psi	H	Hastelloy C wetted parts
100GI	0-17 to 0-100 psi		
300GI	0-50 to 0-300 psi		



**Figure 1A-4A - Overall Dimensions for Series PX771A Transmitter (With Flange Type Mounting Bracket)**



**Figure 1A-4B - Overall Dimensions for Series PX771A Transmitter  
(With Neck Type Mounting Bracket)**



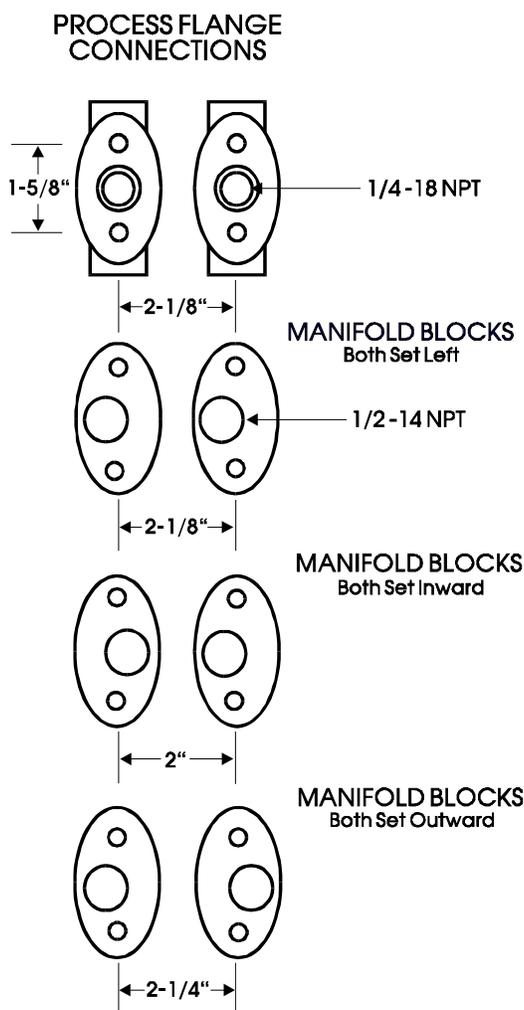
**Figure 1A-4C - Dimensions for Series PX771A Transmitter  
(With Manifold Adapter Option)**

## 1A.4 TRANSMITTER MOUNTING

The transmitter may be mounted in any position. However, when it leaves the factory it is calibrated for operation in the upright position with the electronics enclosure at the top and the DP connections at the bottom as shown in Figure 1B-2. If it is installed in a different position, the transmitter may require a slight zero adjustment. This procedure is described in **Section 3 Calibration**.

The transmitter provides connection ports on the process flange as the standard arrangement. Optional manifold blocks may also be specified. Both arrangements are described as follows:

**Standard Process Flange.** Two process flanges containing the connection ports are assembled to the transmitter. The port designations (L and H) are stamped on the body of the flanges. The ports accept 1/4-18 NPT pipe connections on 2-1/8 in. centers for connection to the orifice taps or a standard three-valve manifold. The process flange connections are illustrated at the top of Figure 1A-5.



**Figure 1A-5 - Process Flange and Optional Manifold Block Connectors**

The two process flange assemblies are held in place by four bolts and nuts. When the bolts are removed, the flanges can be repositioned so that the connections can emanate from the

front, rear or bottom of the transmitter. Care should be taken not to damage the sensor module assembly during this procedure. Once the flange has been positioned, the bolts should be tightened in an alternating sequence to about 20-30 foot-pounds of torque.

**Optional Process Manifold Block.** Process manifold blocks may be installed on the transmitter to permit the use of connector assemblies having different connection centers. The manifold blocks, which are oval in appearance, mate with the transmitter's process flange. The blocks may be installed in several positions to achieve different connection centers as shown in Figure 1A-5.

**Vent Plug.** Each process flange includes a 3/8 inch vent plug to bleed pressure lines. To vent the unit, loosen the inner 5/32" Hex screw 1/4 turn. To perform calibration by applying pressure to the flange, remove the plug with a 7/16" Hex Wrench and install a 1/4" NPT fitting. Be sure to secure both plugs upon completion.

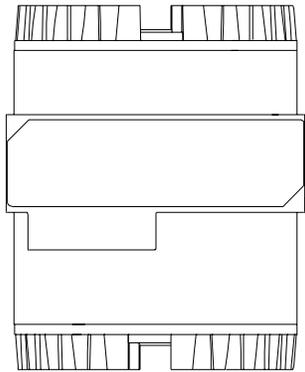
**Warning!** *Both vents may be under high pressure! Never loosen them more than 1/4 turn to bleed the lines. Secure both vents after bleeding is complete.*

### 1A.4.1 Transmitter Housing Rotation

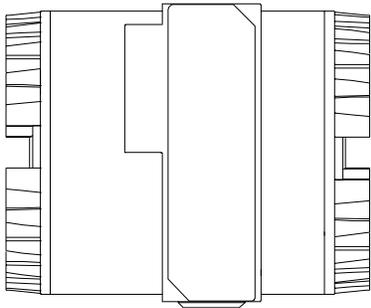
Once mounted, the Transmitter Housing can be rotated up to 180° in either direction, i.e., clockwise or counterclockwise. The Transmitter Housing must not be rotated from its shipped position any more than 180° clockwise or counterclockwise. **CAUTION: Transmitter will be damaged if the Transmitter Housing is rotated more than 180° from its shipped position.**

To rotate the Transmitter Housing, the set screw that locks the Pressure Transducer to the Transmitter Housing must be removed with a 3mm Hex Wrench. Once the Transmitter Housing has been turned to the desired position, be sure to replace and tighten the set screw (see Figure 1A-6).

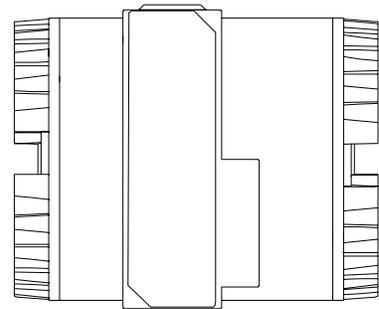
Transmitter Housing  
Rotated 180 Degrees  
(Max. Rotation)



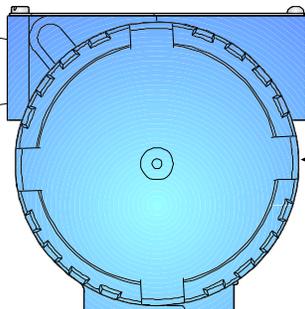
Transmitter Housing  
Rotated 90 Degrees  
Counterclockwise



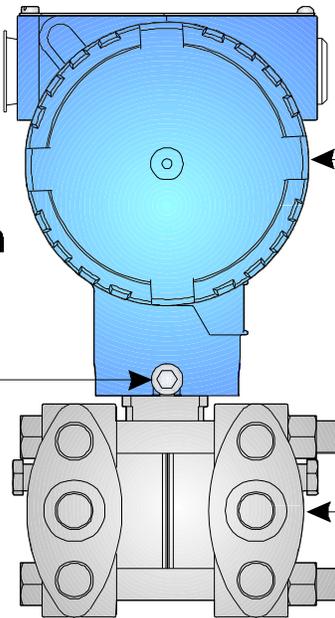
Transmitter Housing  
Rotated 90 Degrees  
Clockwise



Transmitter Housing  
As Shipped



Use a 3mm Hex Wrench  
to Loosen/Tighten  
Pressure Transducer  
Ass'y. Set Screw



Housing  
Assembly



Pressure  
Transducer  
Assembly

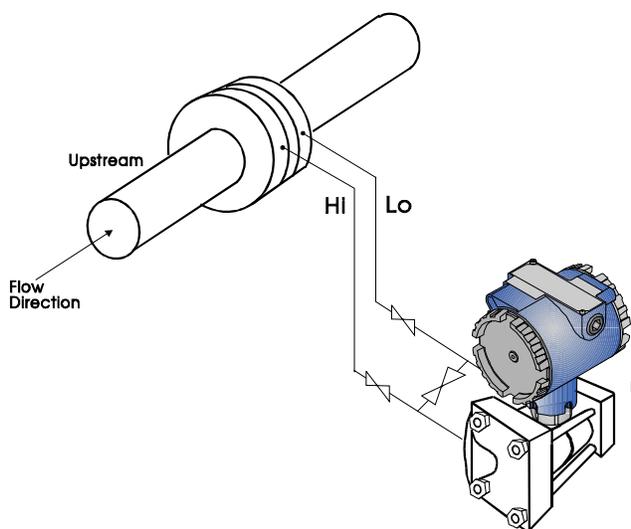


**Figure 1A-6 - Transmitter Housing Rotation Diagram**

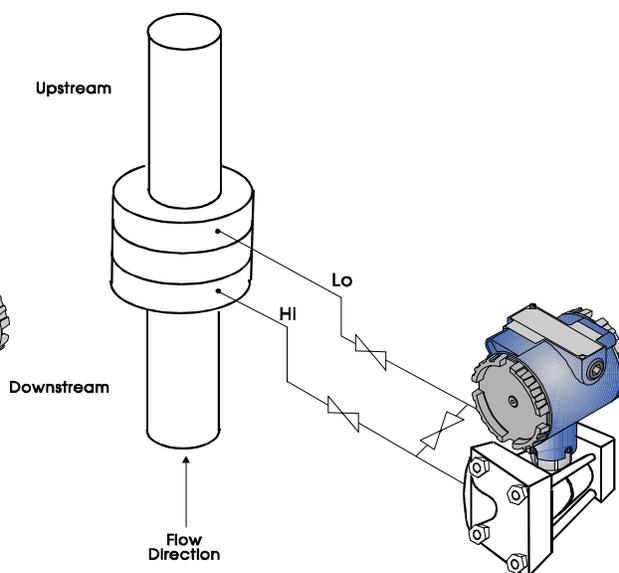
## 1A.5 DP MEASUREMENT APPLICATIONS

The Series PX771A transmitter measures the differential pressure of pressurized liquids, gases, or steam. They can also be used to measure a column of liquid in a tank or vessel. A discussion of some basic applications follows:

**Liquid Application.** When measuring the differential of pressurized liquids, mount the DP transmitter below the orifice plate to minimize entry of air into the transmitter and its connecting lines. As shown in Figures 1A-7 and 1A-8, the HI side of the transmitter must connect to the upstream side of the orifice otherwise transmitter readings will be reversed.



**Figure 1A-7 - Liquid, Horiz. Pipe**



**Figure 1A-8 - Liquid, Vert. Pipe**

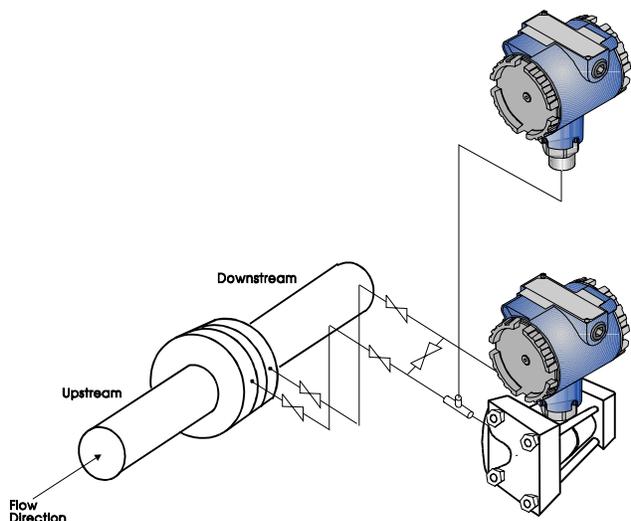
These installations should include process shutoff and bypass valves as shown in the illustrations. For normal transmitter operation, both process valves must be open and the bypass valve closed. The lines are bled by using the vent plugs on both flanges of the transmitter.

When calibrating the transmitter, a zero differential can be generated by opening the bypass valve and closing both shutoff valves. Calibration is covered in Section 3.

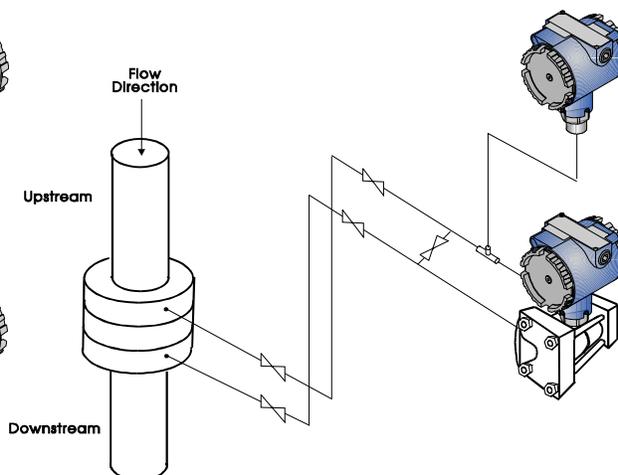
**Gas Application.** The gas industry typically measures differential pressure, static pressure, temperature, and other variables associated with gas flow. Figures 1A-9 and 1A-10 show a Series PX771A Transmitter measuring the differential pressure across an orifice plate. A Series PX725A measures the static pressure at the upstream side of the plate. In both illustrations the transmitters are mounted above the orifice plate so that liquids and sediment drain away by gravity. It is essential that the HI side of the DP Transmitter connect to the upstream side of the plate otherwise the DP readings will be incorrect. Similarly, if the GP Transmitter is connected to the downstream side, SP readings will be incorrect.

These installations should include process shutoff valves and bypass valves. The shutoff valves permit the transmitter to be checked or serviced without disrupting the process. For normal transmitter operation, both process valves are open and the bypass valve is closed. Vent plugs on both flanges of the transmitter may be used to bleed the lines.

An on-site, zero test signal for calibration purposes can be generated by opening the bypass valve and closing both shutoff valves. Calibration information will be found in Section 3.



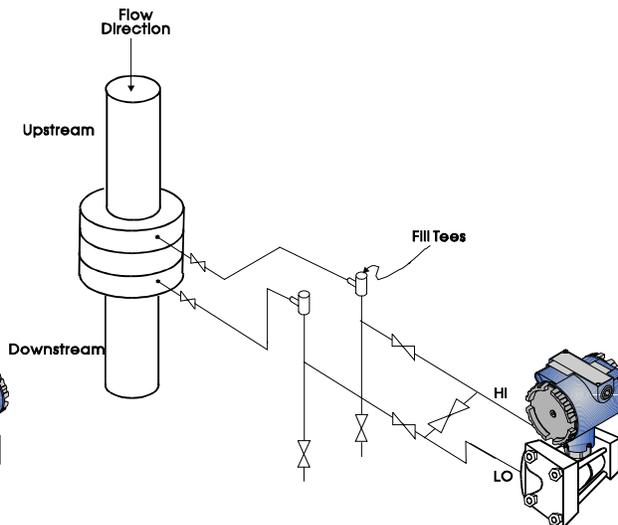
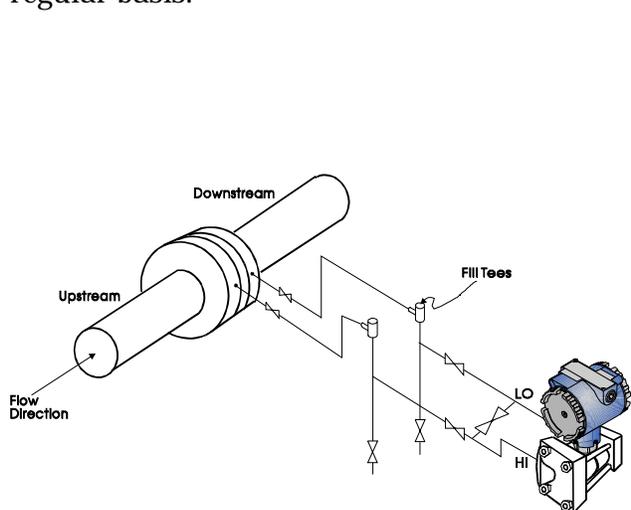
**Figure 1A-9 - Gas, Horiz. Pipe**



**Figure 1A-10 - Gas, Vert. Pipe**

**Steam Application.** When measuring steam pressure, the maximum temperature of the transmitter's electronic circuitry must be strictly observed. Temperatures above the specified limit (see topic 2.1, Environmental Temperature) will cause output errors and possibly result in damage to the transmitter. One method of protecting the transmitter can be achieved by installing an extended, liquid-filled connecting line as shown in Figures 1A-11 and 1A-12. The liquid functions as a buffer and prevents live steam from entering the transmitter.

When using a liquid-filled system, the connecting line must be installed in a descending step so that the transmitter is below the level of the process pipe tap and filling tee; this slope will maintain the liquid in the connecting line and prevent it from being drawn into the process pipe. Liquid-filled lines must also be properly filled and bled, and checked on a regular basis.



**Figure 1A-11 - Steam Process, Horiz. Pipe** **Figure 1A-12 - Steam Process, Vert. Pipe**

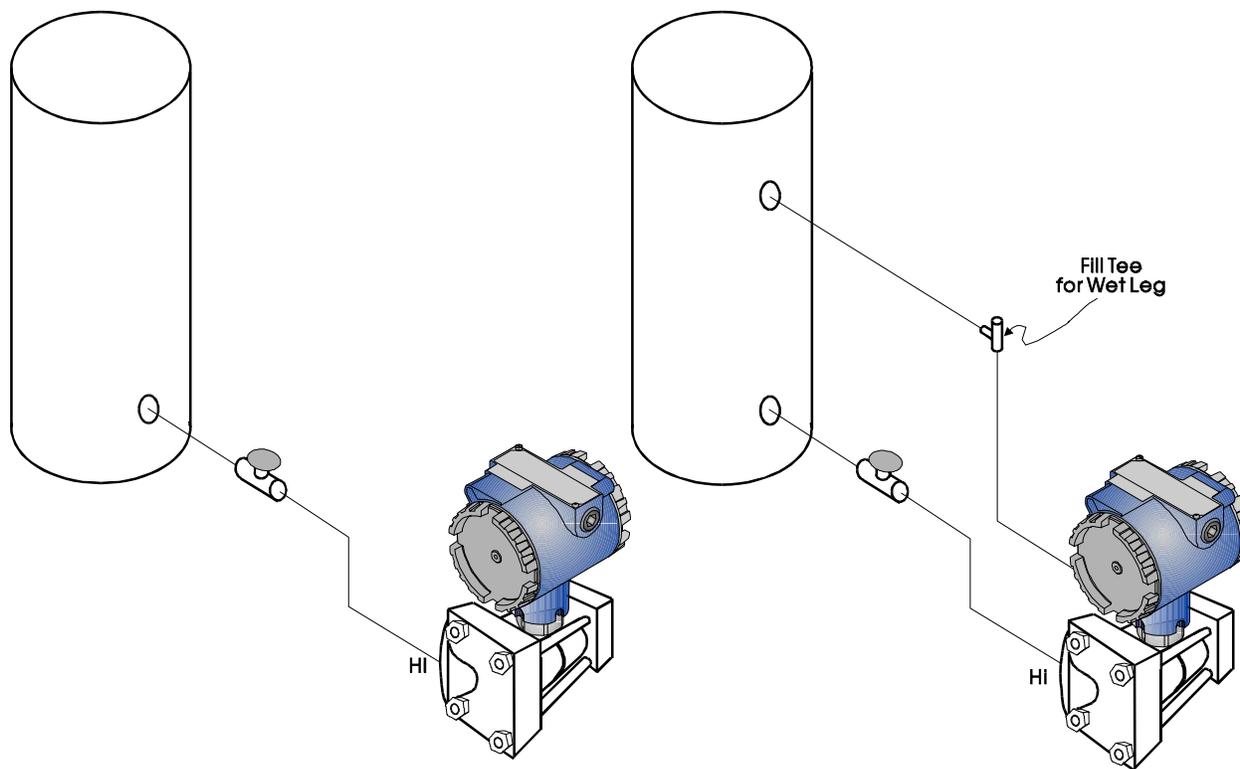
A liquid-filled line is one way to isolate the transmitter from a steam process. As an alternate method, a steam trap may be installed in the connecting line. Several manufacturers offer traps for this application.

**Liquid Level Application.** DP Transmitters can be used to measure the head pressure of a column of liquid in an open tank. Typical tank configurations are shown in Figures 1A-13 to 1A-15.

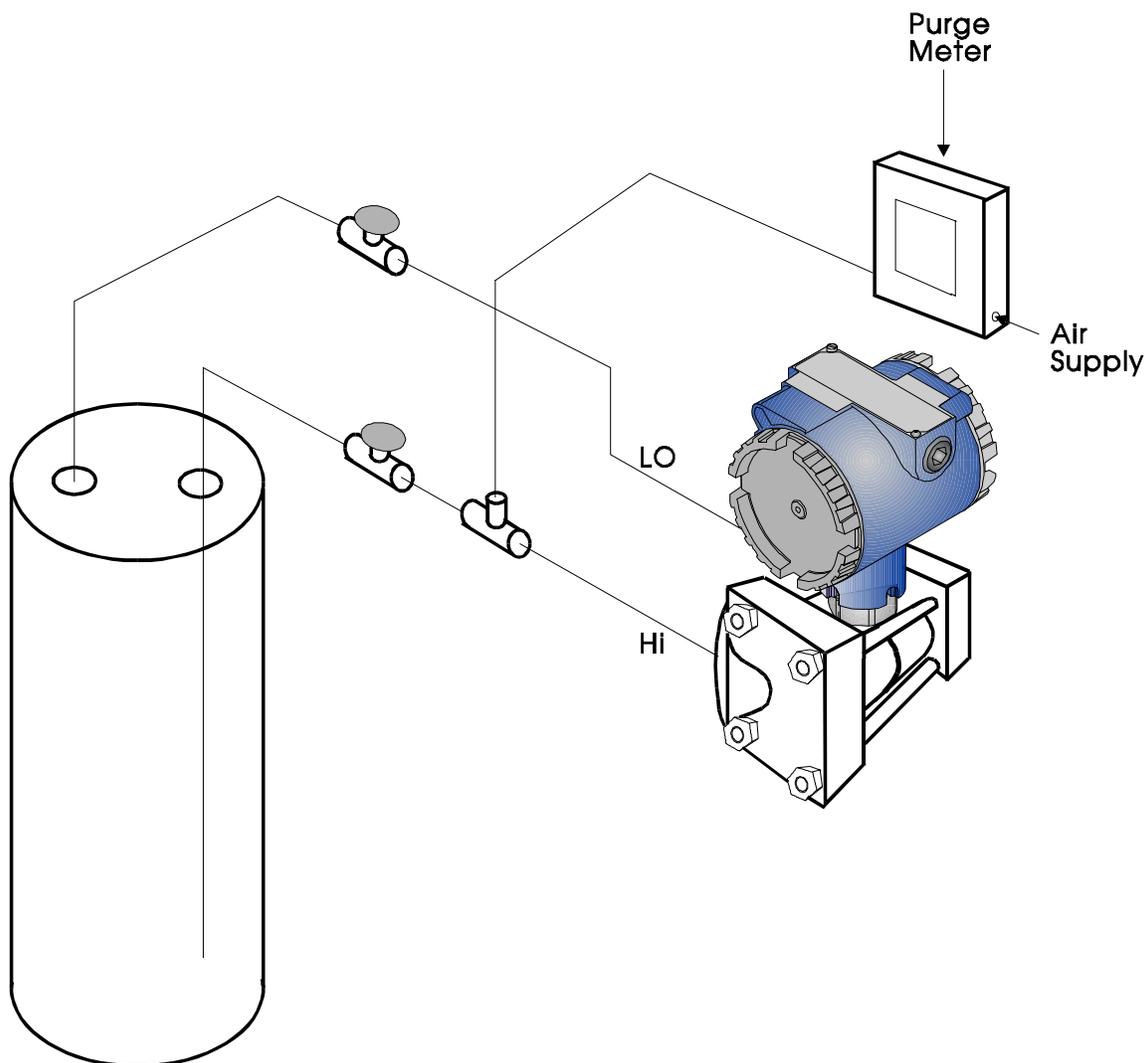
**Open Tank.** For the application of Figure 1A-13, the transmitter is operated as a gauge pressure device. The HI side connects to the bottom of the tank while the LO side is vented to the atmosphere. The span of the transmitter is calibrated to correspond with maximum (100%) and minimum (0%) tank levels.

**Closed Tank.** In the closed tank application, the HI side of the transmitter connects to the bottom of the tank while the LO side connects to the top as shown in Figure 1A-15. The transmitter measures the differential pressure between maximum and minimum tank levels. The wet leg in the upper connection provides a liquid head for all measurements below the maximum tank level.

**Closed Tank w/ Purge Line.** If the process medium contained in a closed tank is a substance that reacts with the transmitter's construction materials, a purge line may be installed as shown in Figure 1A-14. This line consists of a pipe or dip tube that extends from the bottom of the tank to the HI side of the transmitter. The LO side pipe connection is at the very top of the closed tank and is several inches above the maximum (100%) measurement line.



**Figure 1A-13 - Open Tank Measurement    Figure 1A-14 - Closed Tank Measurement**



**Figure 1A-15 - Closed Tank with Air Purge**

The purge meter (pressure regulator) maintains a pressure on the dip tube that is about 5% above the maximum pressure of a full tank. This prevents the liquid from backing up the dip tube into the HI side of the transmitter. For this application, the liquid in the tank should not be allowed to exceed the maximum (100%) measurement level or else it may backflow into the LO side of the transmitter.

**Head Error.** A head error results whenever the transmitter is positioned above or below the minimum (0%) measurement level of the tank. Head errors will add to or subtract from the tank zero readings. These errors can be corrected during range calibration to obtain the proper output readings. See Section 3 for calibration information.

## 1A.6 SERVICE CHECKS

General troubleshooting hints are listed in Table 1A-B. Some of these checks will require a digital multimeter (DMM). The DMM may be connected across the (+) and (V) terminals to measure current directly without opening the current loop. See **Section 4 - Service** for details.

**TABLE 1A-B - TROUBLESHOOTING CHECKS**

SYMPTOM	RECOMMENDED CHECK
Low or no output:	<p>Check power supply for low dc output.</p> <p>Check field wiring for shorts, opens, grounds or excessive resistance.</p> <p>Make sure that shutoff valves in both DP lines are fully open and that any line bypass valve is fully closed.</p> <p>Check for leaks in both DP lines.</p> <p>Check for sediment in both DP lines.</p> <p>Check for gas in liquid lines, or liquid in gas lines.</p> <p>For liquid level applications, make sure that the bottom of the tank is not loaded with sediment or empty.</p>
Consistent Output Errors:	<p>Check calibration adjustments using test setup.</p>
Fixed Output:	<p>Check that shutoff valves are fully open. Pressure may be trapped in the connecting line.</p> <p>Check that any bypass valve is fully closed.</p> <p>Amplifier board may be defective.</p> <p>Check that upstream side of DP device is connected to HI side of transmitter.</p>
Reversed DP Readings	<p>Check loop wiring for shorts, opens, grounds or intermittent connections.</p>
Erratic Output:	<p>Check piping for gas in liquid lines, or liquid in gas lines.</p> <p>Clogged or damaged differential aperture.</p> <p>Process environment conditions (temperature, humidity, vibration, etc.) exceed transmitter specifications.</p> <p>Amplifier board may be defective.</p>

## 1A.7 TRANSMITTER SPECIFICATIONS

This topic contains specifications that pertain to the Series PX771A Transmitter. Specifications that are common to all Series PX771A Transmitters are contained in Section 5.

*Maximum Input Ranges:*

*0-100 inH<sub>2</sub>O to 0-300 psi (see Table BC for details)*

*Lower Body Materials:*

*Diaphragm*

*Stainless Steel, Hastelloy-C*

*Flange*

*Stainless Steel, Hastelloy-C*

*Flange Bolts*

*Carbon Steel, Press. SS (17-4), SS (18-8)*

*Manifold*

*Stainless Steel, Hastelloy-C*

*Electronics Housing:*

*Low copper aluminum, epoxy finish,  
NEMA 4X rating.*

*Mounting Position Effect  
on Transmitter Accuracy:*

*±2.0 inH<sub>2</sub>O which can be corrected by  
calibration*

**TABLE 1A-C - TRANSMITTER RANGES**

<b>Model # Suffix (1) (Code)</b>	<b>Min. Range</b>	<b>Max. Range</b>	<b>Working Pressure psi</b>
100WCGI	0-17 in H <sub>2</sub> O	0-100 in H <sub>2</sub> O	2000
300WCGI	0-50 in H <sub>2</sub> O	0-300 in H <sub>2</sub> O	2000
400WCGI	0-67 inH <sub>2</sub> O	0-400 inH <sub>2</sub> O	2000
025GI	0-4 psi	0-25 psi	2000
050GI	0-8 psi	0-50 psi	2000
100GI	0-17 psi	0-100 psi	2000
30GI	0-50 psi	0-300 psi	2000

*See Table 1A-A for Series PX771A Model Number Codes.*

## *Section 2*

# **INSTALLATION**

---

### **2.1 INSTALLATION NOTES**

Prior to installing the transmitter, factors such as environmental temperature, maintenance access, and transmitter construction materials will require consideration.

*Environmental Temperature:* The temperature operating ranges for the wet end and electronics assemblies of the transmitter are as follows:

- |                                   |                             |
|-----------------------------------|-----------------------------|
| 1. Wet end w/ DC 200 fill:        | -40 to 220°F (-40 to 104°C) |
| 2. Electronic - Amplifier Board   | -25 to 185°F (-32 to 85°C)  |
| 3. Electronic - Digital Indicator | -22 to 158°F (-30 to 70°C)  |

When installing a transmitter, it is important to consider the temperature range of all items listed above as each has different limits. For example, if item 1 were at the upper limit of its range (220°F), item 2 would be 35°F over its limit of 185°F. Likewise, if the same transmitter included a digital indicator, item 3, the indicator would be 62°F above its 158°F limit.

Under no circumstances should the internal temperature of the electronics housing be allowed to go above the upper limits specified above for items 2 and 3. Doing so will cause output errors, and possibly result in damage to the electronic assemblies. Going below the lower temperature limit can also lead to performance or failure problems. If temperature extremes are anticipated, the transmitter should be installed in a more favorable environment or be provided with other means of protection.

*Caution:* The transmitter must always be operated within the temperature range of its wet end and electronic assemblies. Prolonged operation under extreme conditions could result in eventual transmitter damage.

*Maintenance Access:* Select a site that provides ease of access for maintenance and repairs. Inspect the site for any potential hazards that could result in accidental damage to equipment or injury to persons. Clearly post any dangers that may not be apparent to operators.

*Construction Materials:* Prior to mounting the transmitter, check its construction materials to insure that they are compatible with the process medium. Some gases or liquids will react with certain metals and result in permanent damage to the transmitter. This type of damage is not covered under the warranty agreement.

### **2.2 INSTALLATIONS IN HAZARDOUS AREAS**

The information that follows only applies to transmitter models approved for use in hazardous areas. Models without approval must never be used for these installations.

The installation of equipment in hazardous areas must comply with the National Electrical Code ANSI/NFPA-70, and ANSI/ISA S82.01, S82.02, & S82.03 standards. Transmitters certified for use in hazardous areas will have the mark of the certifying agency inscribed on the transmitter data plate.

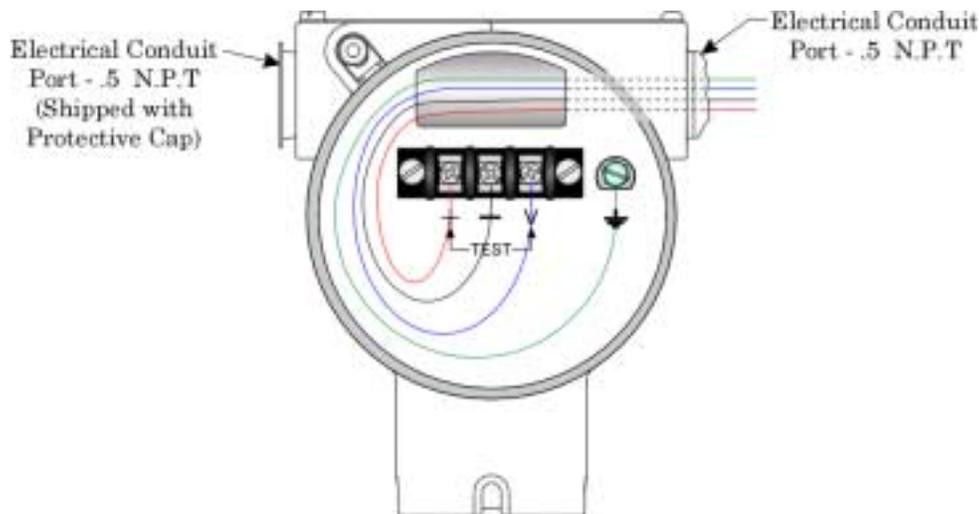
The checklist that follows emphasizes some key points of safety with regard to installations in hazardous areas.

1. All transmitter wiring that passes through hazardous areas must be enclosed in metal conduit. The point where the conduit connection feeds into the transmitter's housing must be properly secured to prevent entry of gases or other ignitable substances into the transmitter. Explosion-proof wiring practices must be followed to prevent flashback through the conduit.
2. The cover of the transmitter must be screwed in hand tight and fully seated. The cover must be replaced if it is damaged or shows stripped threads.
3. The cover of the unit must always be in place and secured when the transmitter is powered. The cover must never be loosened or removed unless the atmosphere is made safe or all electrical power is removed from the transmitter.

**WARNING:** Removing the cover of a transmitter while it is operating in a hazardous area is dangerous and could result in fire or explosion.

**WARNING: EXPLOSION HAZARD**

**Do Not disconnect equipment unless power has been disconnected and the area is known to be nonhazardous.**



**Figure 2-1 - Dressing of Wire Leads**

### **2.3 ELECTRICAL WIRING NOTES**

All wiring connections cited in the text and illustrations must conform to the National Electrical Code, and local authority. Only technically qualified persons should perform wiring procedures.

*Conduit Connection:* The transmitter provides a ½ inch NPT threaded female port for electrical conduit. This port can mate with threaded conduit or an appropriate threaded pipe adapter.

*Note:* The conduit connections must be secured with no less than five threads fully engaged.

In some applications, condensation could form in the conduit, and seep into the transmitter electronics housing. If allowed to continue, moisture build-up will degrade the transmitter performance, and eventually cause damage. Installing the transmitter above the level of the process connection can prevent this condition. Any moisture forming in the conduit will then drain away by gravity.

*Access to Wiring Terminals:* Remove the threaded end cover to access the wiring terminals (see Figure 3-2). If the cover cannot be loosened by hand, insert a flat metal bar or similar tool between the cover protrusions and apply moderate counter-clockwise leverage. Before re-installing the cover, make sure that the threads are clean. Tighten the cover by hand until all threads are engaged, and the gasket is compressed.

*Lead Dress:* When feeding wire through the conduit opening of the transmitter, add about six inches of slack for terminal connections. Dress the leads in a circular path around the terminals as seen in Figure 2-1. The additional slack will make the connections more manageable and prevent mechanical strain on the terminals.

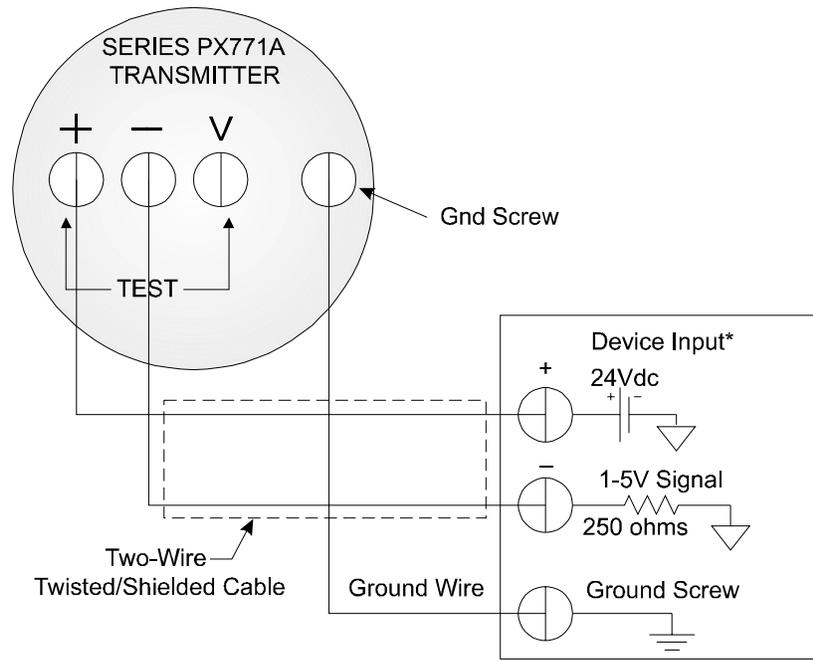
## **2.4 WIRING OF 4-20mA SIGNAL/POWER LOOP**

The 4-20mA signal/power loop can be powered in two ways. Figure 2-2 shows the loop powered by the receiving device (controller, recorder, etc.), while Figure 2-3 shows the loop powered by an external supply. In both instances, the 4-20mA current flows through a 250Ω load resistor and develops a corresponding 1-5V input for the receiving device.

*Signal Shielding:* Use twisted wire, shielded cable covered by insulating material for the signal/power wiring. When properly grounded, this cable will minimize pickup of electromagnetic, and radio frequency interference.

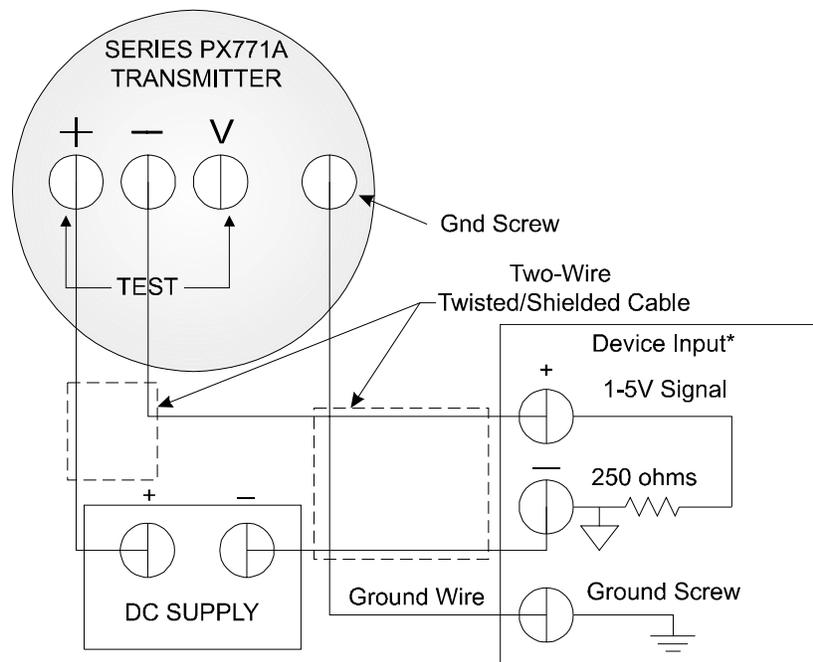
The shield lead of the cable is typically grounded at the input of the receiving device (computer controller, recorder, etc.) as shown in Figures 2-2 and 2-3. Never connect the other end of this shield to the transmitter enclosure or attempt to ground the shield at more than one point along the wire path. Multiple grounds will cause signal errors at the input of the receiving device.

Although it is recommended to connect the cable's shield to the power common return of the receiving device, the actual connection point may differ depending on the design and application of the device. In some instances, better noise immunity can be had by connecting the cable shield to the chassis or a designated shield terminal on the device. Check the instruction manual of the receiving device for the recommended connection points.



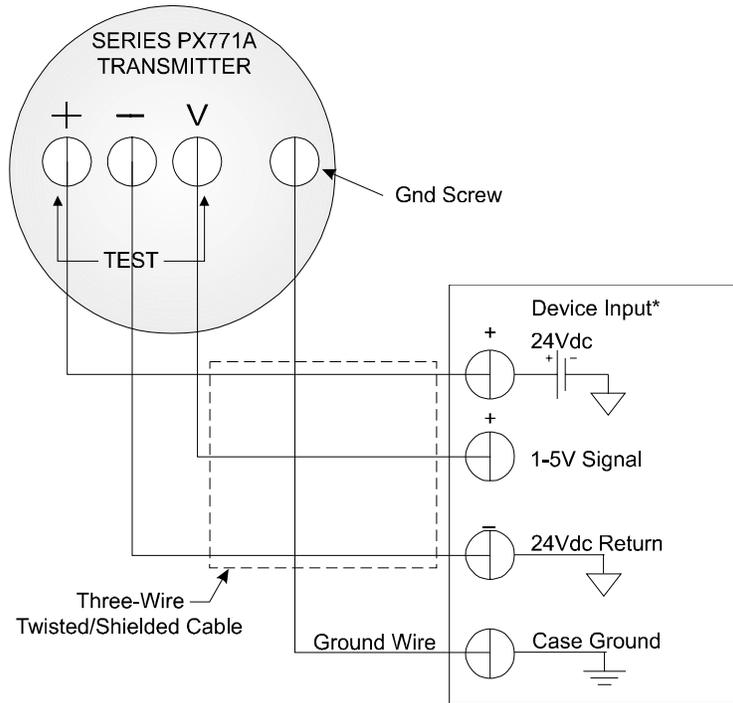
- \* The device may be an indicator, recorder, tone modulator, etc.
- \*1 Connect the shield to earth ground or to a shield terminal on the device, if so equipped.
- \*2 Refer to Figure 3-2 and set the Jumper Block for Current Operation.

**Figure 2-2 - Transmitter Wired to Instrument Supply Source (4-20mA Circuit)**



- \* The device may be an indicator, recorder, tone modulator, etc.
- \*1 Connect the shield to earth ground or to a shield terminal on the device, if so equipped.
- \*2 Refer to Figure 3-2 and set the Jumper Block for Current Operation.

**Figure 2-3 - Transmitter Wired to External DC Supply (4-20mA Circuit)**

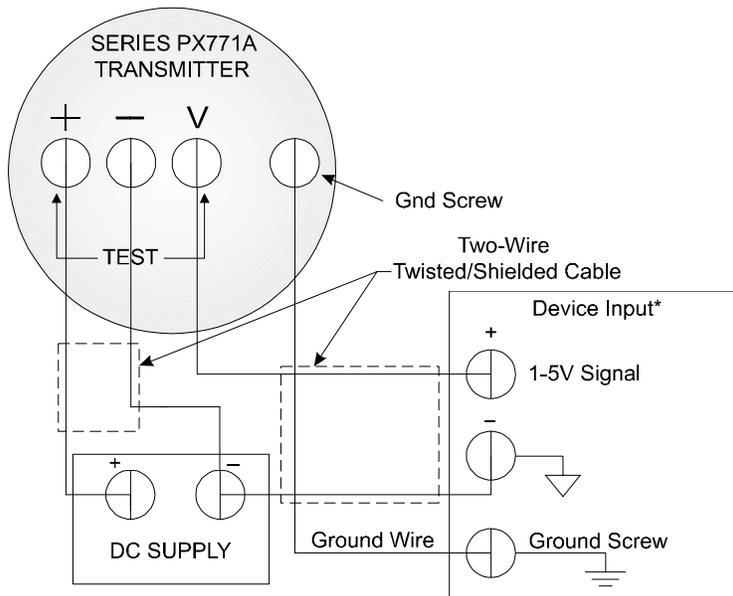


\* The device may be an indicator, recorder, tone modulator, etc.

\*1 Connect the shield to earth ground or to a shield terminal on the device, if so equipped.

\*2 Refer to Figure 3-2 and set the Jumper Block for Current Operation.

**Figure 2-4 - Transmitter Wired to Instrument Supply Source (1-5V Circuit)**



\* The device may be an indicator, recorder, tone modulator, etc.

\*1 Connect the shield to earth ground or to a shield terminal on the device, if so equipped.

\*2 Refer to Figure 3-2 and set the Jumper Block for Current Operation.

**Figure 2-5 - Transmitter Wired to External DC Supply (1-5V Circuit)**

## 2.5 WIRING OF 1-5V SIGNAL/POWER LOOP

The 1-5V signal/power loop can be powered in two ways, by the receiving device (controller, recorder, etc.), or by an external supply. Provide a setup similar to that shown in either Figure 2-4 or 2-5. Apply +24V across the + and - terminals of the transmitter as shown, whether supplied by an external supply, or by the receiving device. Next, connect the 1-5V output, or the terminal block labeled V to the input of the device. Notice: Unlike the current loop, this input must be analog ground referenced, and not passed through a sampling resistor.

*Signal Shielding:* Use twisted, three wire, shielded cable covered by insulating material for the signal/power wiring. For further information regarding signal shielding, consult section 2.4.

## 2.6 EFFECTS OF LEAD & LOAD RESISTANCE & SUPPLY VOLTAGE

The total loop resistance consists of the load (loop resistor) plus the resistance of both conductors in the signal/power loop. For any given power supply voltage, the total loop resistance must be kept within the specified limits. The graphs of Figures 2-6 and 2-7 illustrate the minimum and maximum loop resistance that may be used with various supply voltages for models with and without digital indicators.

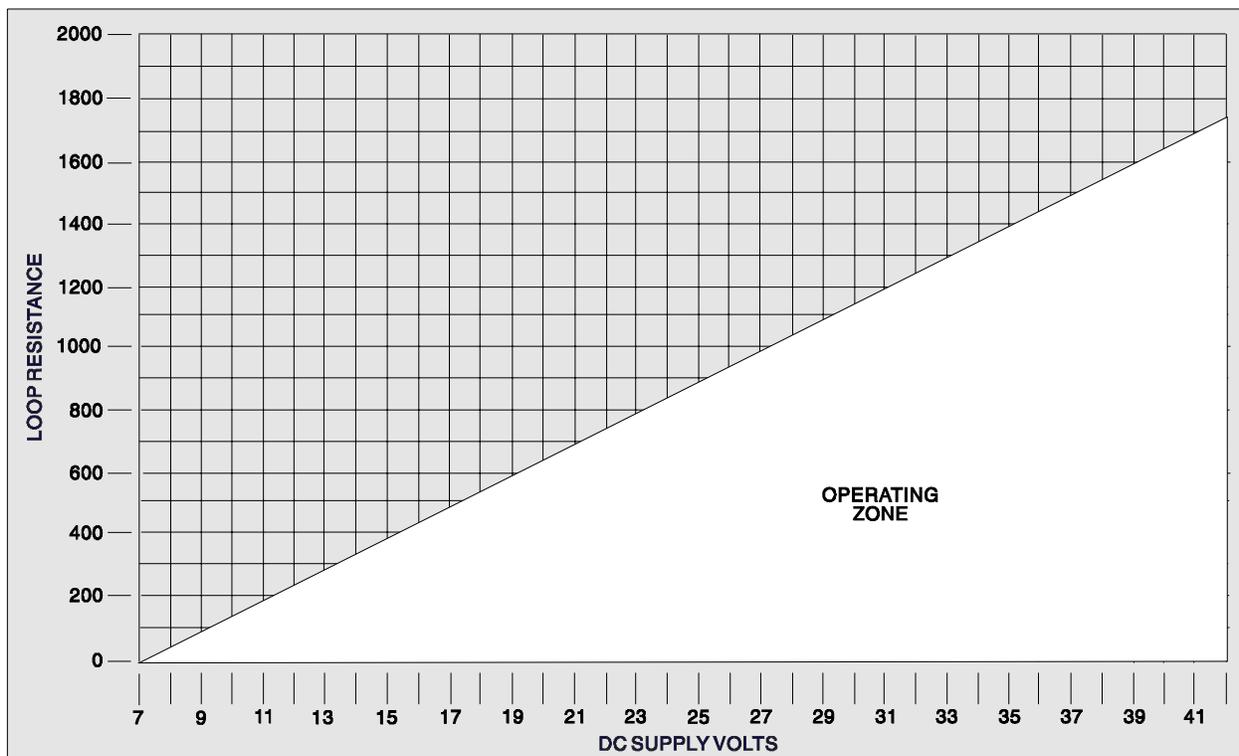
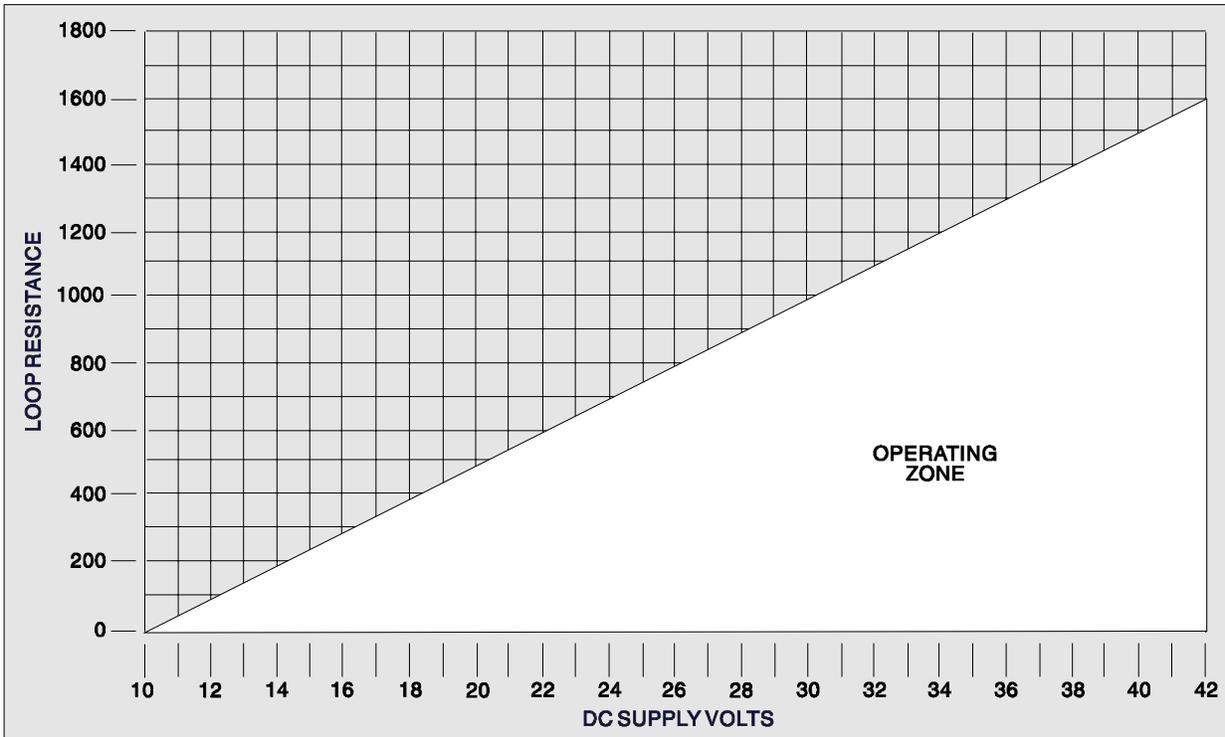
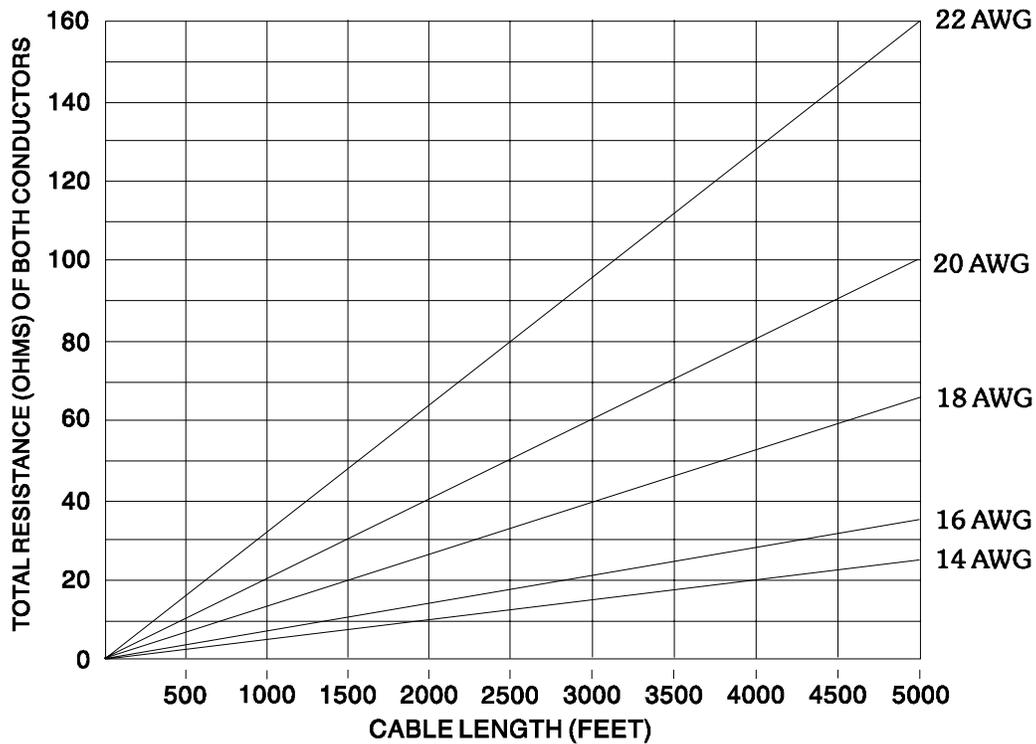


Figure 2-6 - Transmitter without Digital Indicator



**Figure 2-7 - Transmitter with Digital Indicator**

The graph of Figure 2-8 shows the cable length in feet vs. the cable resistance of both conductors for wire gauges between AWG 14 and AWG 22. For cable runs less than 1000 feet, the resistance can be ignored.



**Figure 2-8 - Cable Lead Length Vs. Total Lead Resistance**

## *Section 3*

# **CALIBRATION**

---

### **3.1 CALIBRATION SETUP**

*Equipment Required:* Transmitter calibration requires a laboratory bench setup with the following equipment:

1. Test source capable of generating fixed pressure values equivalent to 0%, and 100% values of transmitter's range (URL).
2. Pressure monitor device to read test source ( $\pm 0.025\%$  accuracy)
3. Electrical supply source capable of producing 24V-DC power to the transmitter.
4. Digital Multimeter (DMM) with a 5-1/2 digit scale ( $\pm 0.005\%$  accuracy)
5. Current Sampling Resistor ( $250\Omega$ ,  $\pm 0.01\%$ , 1/4W)

*Lab Vs. On-Site Setup:* Although it is more convenient and recommended to perform this procedure using a laboratory setup, calibration can also be performed on site providing that the connecting line or flange is equipped with a calibration tap and appropriate shutoff and bypass valves. This added equipment allows you to feed in an external test pressure source or use the process pressure as a reference signal. In the latter setup, the valves are closed to seal a fixed pressure in the connecting line. Only fine calibration using the external adjustments should be attempted in wet, dusty, or hazardous environments.

Before attempting on-site calibration, carefully check the application. If the transmitter is operated in a closed control loop configuration, either the transmitter must be isolated from the process, or the process must be turned off. If this is not done, a critical process could accidentally be driven into a dangerous region causing damage to equipment and property, and injury to persons.

*Note:* Before starting any test procedures, make sure that the transmitter is firmly anchored in its intended operating position. A different mounting position can affect zero calibration for some ranges and necessitate re-calibration.

*Electrical Connections:* The electrical connections for a voltage output calibration setup are made to the transmitter as shown in Figure 3-1a. However, refer to Figure 3-1b if the transmitter is configured for current mode operation. The Current Sampling Resistor will convert the 4-20mA-output signal to a 1-5V signal, which generally allows for a more accurate reading. A series milliammeter may also be used as discussed in Section 4.2.

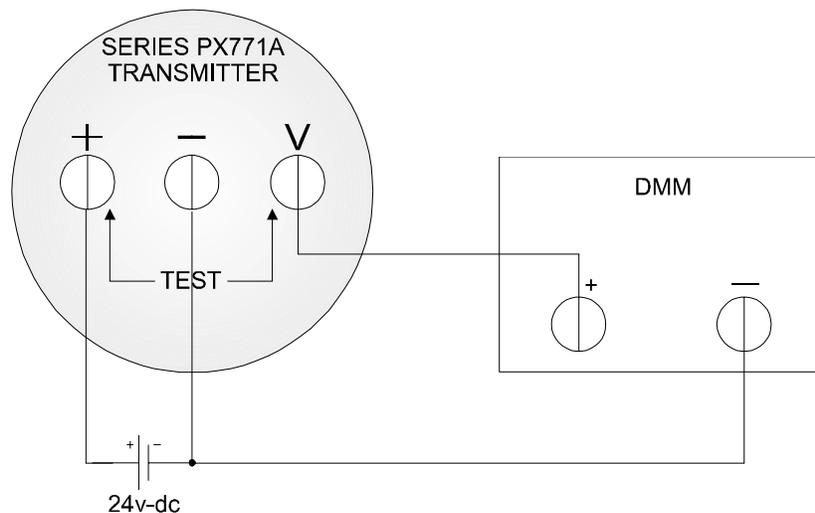
### **3.2 ACCESS TO ADJUSTMENTS**

The external adjustments are for fine offset and fine gain settings. The offset adjustment screw will not affect the gain. That is, adjusting the offset (A1) screw will move both calibration points equally. The gain adjustment will also affect the offset of the instrument. That is, adjusting the gain (A2) screw moves the end point unequally. To minimize the interaction of the gain, it is best to adjust the offset screw for full scale output while full scale pressure is applied and adjust the gain screw for a zero output while minimum pressure is applied.

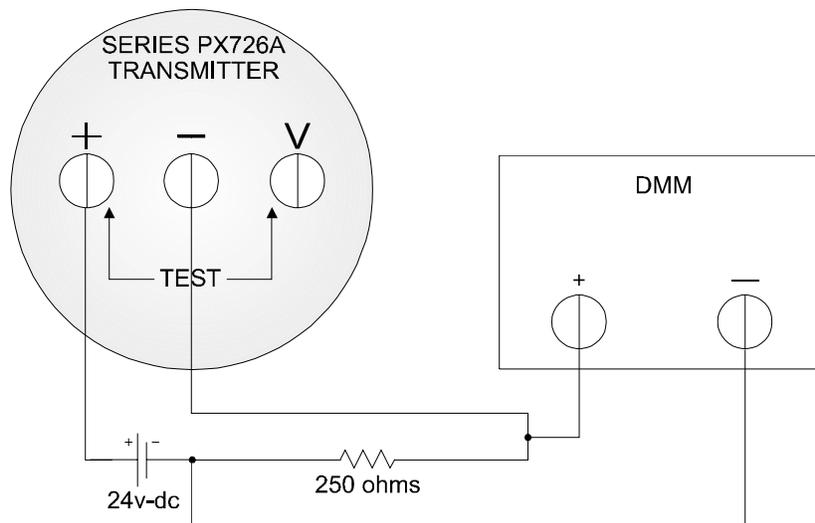
To access the fine offset (A1) and fine gain (A2) adjustment screws, loosen the screw that secures the I.D. Plate to the top of the transmitter housing and pivot the I.D. Plate. The fine offset and gain screws are labeled A1 and A2 respectively. The calibration label that identifies A1 and A2 is affixed to the top of the transmitter housing and will be exposed when the I.D. Plate has been pivoted.

Removing the end cover accesses the transmitter's coarse calibration adjustments. Once the cover is removed, the adjustments appear as shown in Figure 3-2.

The PX771A Series Transmitter can be configured for either voltage, or current output. To change the setting, simply change the position of the voltage/current jumper (JP1-JP8). Note that the field wiring must also change if converting from voltage to current mode.



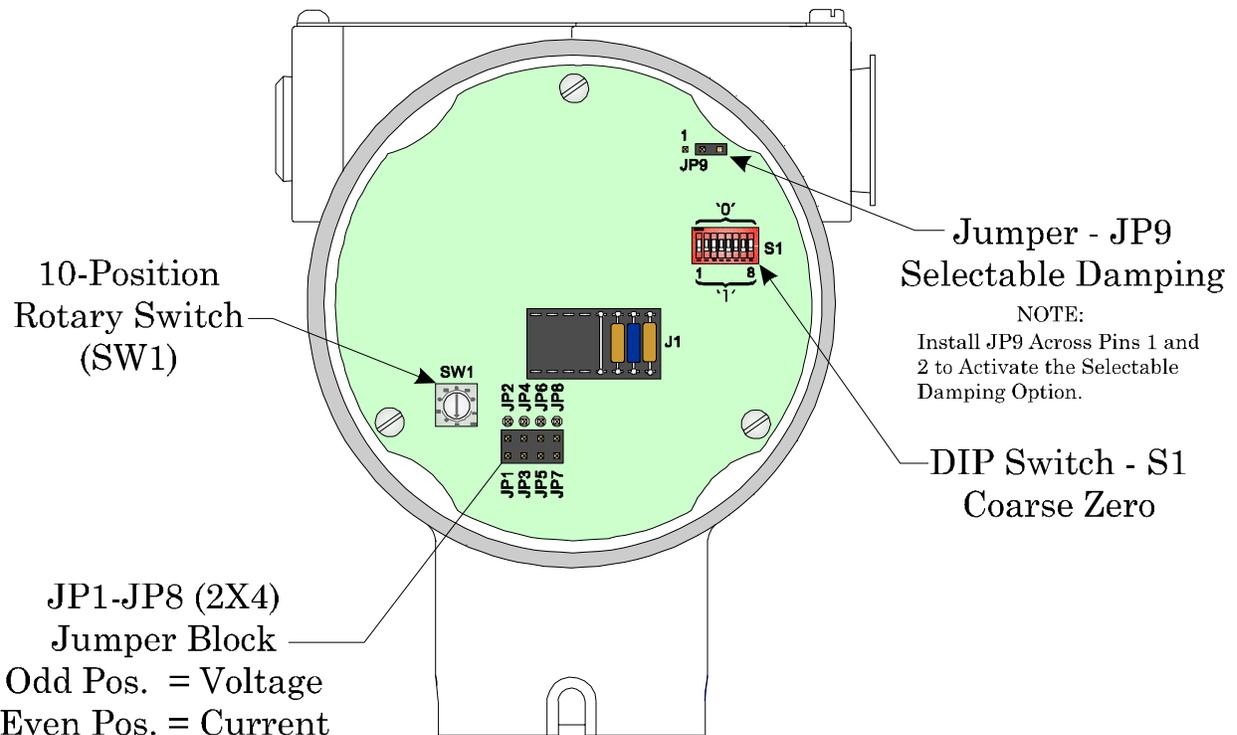
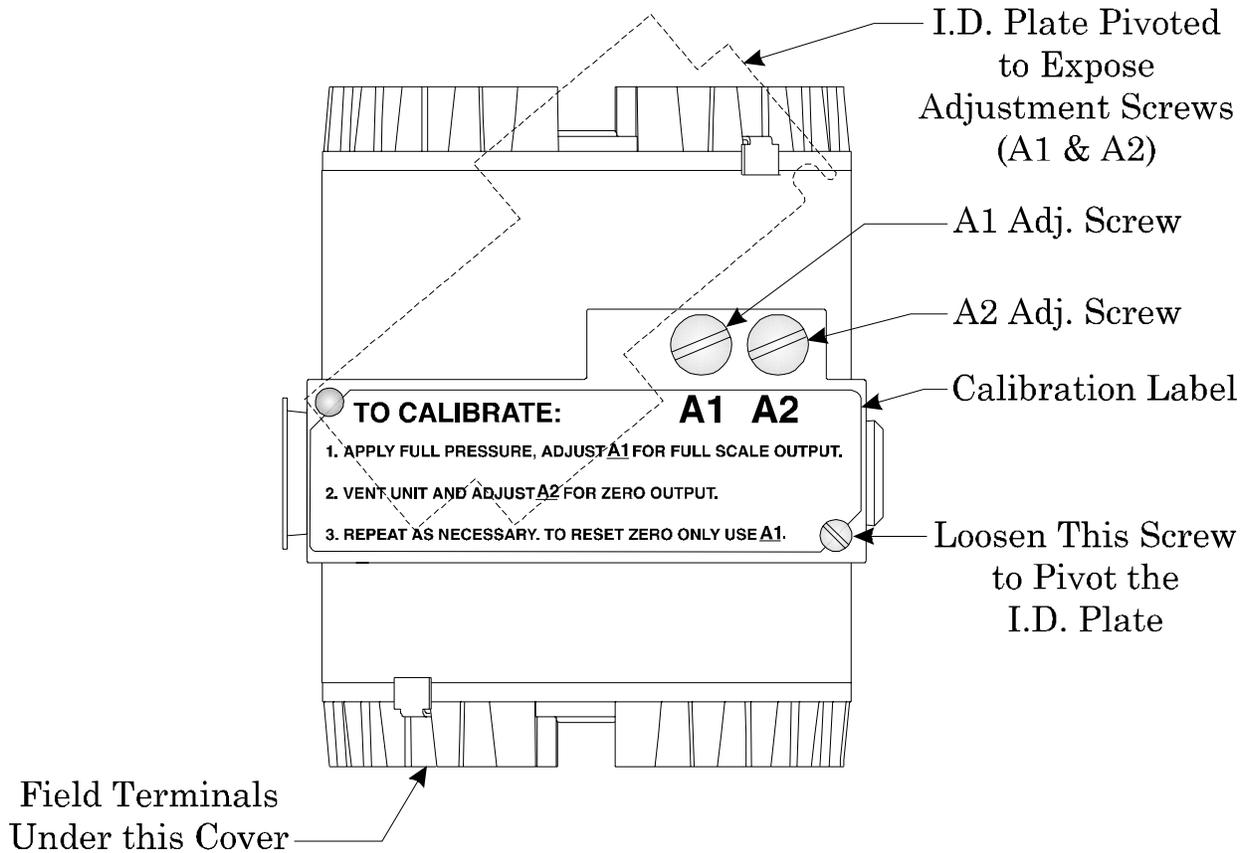
**Figure 3-1a - Calibration Test Setup (Voltage Configuration)**



**Figure 3-1b - Calibration Test Setup (Current Configuration)**

To activate the selectable damping option, the damping jumper (JP9) must be in place on the board.

# TOP VIEW



# END VIEW

Figure 3-2 - Calibration Adjustments

### 3.3 EXTERNAL CHECK PROCEDURE

The general check procedure determines the accuracy of the transmitter at its calibrated operating range. It uses the offset (A1) and the gain (A2) adjustment screws for minor calibration corrections. Proceed as follows:

1. Provide a test setup as shown in Figure 3-1a or 3-1b depending on whether the unit has been configured for current or voltage mode. Make sure that no electrical power is applied to the transmitter while making connections. The Multimeter must be set in "Voltage" mode.
2. Set the DMM to a scale that will cover a 1-5Vdc range.
3. Apply 24Vdc power to the transmitter.
4. Set the pressure test source for a precise 0% range value. The DMM should display  $1.00\text{Vdc} \pm 4\text{mV}$  ( $4\text{mA dc} \pm 0.016\text{mA}$ ).
5. Similarly, adjust the pressure test source for 100% range value. The DMM should read  $5.00\text{Vdc} \pm 4\text{mV}$  ( $20\text{mA dc} \pm 0.016\text{mA}$ ).
6. If the readings of steps 4 to 6 are within tolerance, no calibration is required. Testing is complete. However, if any readings were in error, proceed to step 7.
7. Set the test pressure source to 100%. If this reading is out of tolerance, correct it by turning the A1 adjustment screw (clockwise rotation increases the reading).
8. Reset the test pressure source to 0%. If this reading is out of tolerance, correct it by turning the A2 adjustment screw (clockwise rotation decreases the reading).
9. Recheck the 0%, and 100% readings. Repeat steps 7 and 8 as needed. This may need to be done two or three times. If errors are still present at full-scale pressure, recheck the switch settings. If the DIP Switch is in the correct configuration, proceed to step 10. If errors are encountered at 0%, recheck the Rotary Switch settings. If the switch is in the correct position, proceed to step 10.
10. If the above three readings cannot be brought into proper calibration, the transmitter may require service or replacement. See Section 5, Service, for troubleshooting hints.

### 3.4 CALIBRATION ADJUSTMENTS

The range changing procedure uses the coarse span (SW1) and zero switches (S1:1-8), along with the fine offset (A1), and gain (A2) adjustment screws. The locations of the switches are shown in Figure 3-2. The equipment setup required to perform range changing is the same as that described in topic 3.1. The coarse zero switches are contained in a single DIP switch package, with the switches labeled from 1 to 8, with either a "1" or a "0" silk-screened on the board. The coarse span switch is a 10 position rotary switch.

*Coarse Span:* The coarse span is set, by rotating the switch SW1, such that the desired range of full scale is available. Span can be calculated using the formula below.

$$\text{Coarse Span URL Range} = \frac{P_{\max} - P_{\min}}{\text{URL}} \times 100\%$$

Once span has been calculated the desired switch position can be determined from Table 3-A or Table 3-B.

*Coarse Zero:* Coarse zero adjustments are provided by switches S1:8-1. When these switches are all set to ON, the maximum zero suppression (600%) is provided; when all are set to OFF, the maximum zero elevation (600%) is provided.

The coarse zero is set for the region of full scale that the user desires to be the zero reference. Consequently the possible zero positions are listed in %URL. This is not to be confused with the %URL from the span. Unlike the span this does not represent an actual range, instead it describes a pressure level that the user desires to set as a zero. The following equation shows how to calculate the zero level in %URL:

$$\text{Coarse Zero URL Range} = \frac{P_{\min}}{\text{URL}} \times 100\%$$

Once the zero levels are calculated, the respective coarse zero switch positions can be determined from Table 3-A.

*Fine Adjustments:* At full-scale pressure adjust A1 so that the output is either 5V or 20mA. Then, decrease the unit to zero pressure and adjust A2 so that the output is 1V or 4mA. The adjustment of A1 should be such that the setting is barely 5V or 20mA (i.e. A small rotation in the opposite direction should result in an immediate decrease in the output voltage.). If this is not the case the screw may be over rotated. Repeat this procedure until the output yields the appropriate values for high and low pressure. Once calibrated the output stage is set and should need no further attention besides periodic tweaking.

### 3.5 TYPES OF RANGE CALIBRATION

When selecting a range, one of three types of calibration schemes will be encountered. Each of these three methods refers to the manner in which a 0 psi input signal is referenced to the 1-5V output of the transmitter. The three methods are defined as follows:

*Zero Based Calibration:*

0 psi = 1V (4mA) output

Sample Ranges:

0 to 50 psi

0 to 100 psi

*Elevated Zero Calibration:*

0 psi > 1V (4mA) output [0 psi results in an output greater than 1V (4mA)]

Sample Ranges:

-10 (vacuum) to +20 psi

-30 to 0 inHg

**TABLE 3-A - COARSE ZERO SWITCH SETTINGS (Elevation)**

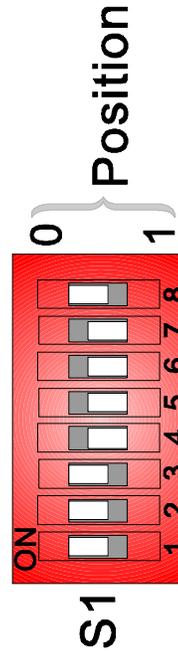
COARSE SPAN % URL ROTARY SWITCH (SW1) SETTINGS										
% Calibrated Span of Zero Reference	SW1-1 84%-113%	SW1-2 64%-84%	SW1-3 50%-64%	SW1-4 40%-50%	SW1-5 33%-40%	SW1-6 27.5%-33%	SW1-7 23%-27.5%	SW1-8 18.5%-23%	SW1-9 14.5%-18.5%	
100	00101111	00110011	00111010	00111110	01000010	01000111	01001011	01001111	01010001	
90	00101011	00101111	00110110	00111010	00111110	01000011	01000111	01001100	01001111	
80	00100110	00101011	00110010	00110111	00111011	01000000	01000100	01001001	01001100	
70	00100011	00101000	00101110	00110011	00111000	00111100	01000001	01000111	01001010	
60	00011111	00100101	00101011	00110000	00110101	00111001	00111110	01000100	01001000	
50	00011100	00100010	00101000	00101101	00110010	00110111	00111011	01000001	01000101	
40	00011001	00011110	00100101	00101010	00101111	00110100	00111001	00111111	01000011	
30	00010111	00011100	00100010	00101000	00101101	00110010	00110110	00111100	01000001	
20	00010100	00011001	00100000	00100101	00101010	00101111	00110100	00111010	00111111	
10	00010010	00010111	00011101	00100011	00101000	00101101	00110010	00111000	00111101	
0	00010000	00010101	00011011	00100001	00100110	00101011	00110000	00110110	00111011	
<b>COARSE ZERO DIP SWITCH (S1) SETTINGS</b>										
↑ Elevation										

**Switch Setting:** The following is an example of how the above binary number can be interpreted as switch positions.

**Example:** A customer has the coarse span switch in position 2 and desires a zero reference at 40% of Calibrated Span (40% zero elevation). The corresponding binary number is found, from the table, to be 00011110. The diagram below displays which digits correspond to the available DIP-switches on the board.

DIP-Switch #	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
Setting	0	0	0	1	1	1	1	0

Note: 0 = ON & 1 = OFF for DIP Switch S1



The rest of the binary numbers in the table follow the same scheme and the same method can be applied to determine other desired switch positions. Once the coarse zero has been set, further adjustments can be made using the fine settings.

**TABLE 3-B - COARSE ZERO SWITCH SETTINGS (Suppression)**

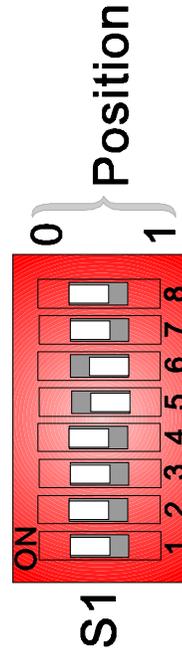
COARSE SPAN % URL ROTARY SWITCH (SW1) SETTINGS									
%URL of Zero Reference	SW1-1 84%-113%	SW1-2 64%-84%	SW1-3 50%-64%	SW1-4 40%-50%	SW1-5 33%-40%	SW1-6 27.5%-33%	SW1-7 23%-27.5%	SW1-8 18.5%-23%	SW1-9 14.5%-18.5%
0	00010000	00010101	00011011	00100001	00100110	00101011	00110000	00110110	00111011
-10	00001110	00010010	00011000	00011100	00100001	00100101	00101001	00101110	00110001
-20	00001100	00010000	00010101	00011000	00011100	00011111	00100011	00100111	00101001
-30	00001011	00001110	00010010	00010101	00011000	00011010	00011101	00100001	00100011
-40	00001001	00001100	00001111	00010010	00010100	00010110	00011000	00011011	00011101
-50	00001000	00001010	00001101	00001111	00010001	00010011	00010101	00010111	00011000
-60	00000111	00001001	00001011	00001101	00001110	00010000	00010001	00010011	00010100
-70	00000101	00000111	00001001	00001010	00001100	00001101	00001110	00001111	00010000
-80	00000100	00000101	00000111	00001000	00001001	00001010	00001011	00001100	00001101
-90	00000011	00000100	00000110	00000111	00000111	00001000	00001001	00001010	00001010
-100	00000010	00000011	00000100	00000101	00000101	00000110	00000111	00000111	00001000

Switch Setting: The following is an example of how the above binary number can be interpreted as switch positions.

Example: A customer has the coarse span switch in position 2 and desires a zero reference at 40% of URL (40% zero suppression). The corresponding binary number is found, from the table, to be 00001100. The diagram below displays which digits correspond to the available DIP-switches on the board.

DIP-Switch #	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
Setting	0	0	0	0	1	1	0	0

Note: 0 = ON & 1 = OFF for DIP Switch S1



The rest of the binary numbers in the table follow the same scheme and the same method can be applied to determine other desired switch positions. Once the coarse zero has been set, further adjustments can be made using the fine settings.

### *Suppressed Zero Calibration:*

0 psi < 1V (4-20mA) output [0 psi results in an output less than 1V (4mA)]

Sample Ranges:

1 to 10 psi

10 to 60 psi

50 to 100 psi

The above procedures are described in topics 3.6, 3.7, and 3.8. Select the procedure you require.

## **3.6 ZERO-BASED CALIBRATION**

This procedure describes the process by which the zero and span settings are obtained for the 1-5V and 4-20mA output stages of the Series PX726A transmitters.

The following parameters relate directly to the calibration process:

*URL:* Upper Range Limit of sensing element. The URL is the maximum input pressure that can be applied without over-pressuring the sensing element.

*Span:* The algebraic difference between the limits of the range ( $P_{\max} - P_{\min}$ ). The desired span must always be less than or equal to the upper range limit (URL) of the sensing element. Span is expressed as a percentage of the upper range limit of the sensing element.

*Zero:* The point within the available pressure range the user defines as a zero pressure reference.

*P<sub>max</sub>:* Maximum input pressure of a desired range, not necessarily the maximum range of the sensing unit.

*P<sub>min</sub>:* Minimum input pressure of a desired range.

*Theory of Operation:* The output stage can potentially take a user defined portion of the 0-100% URL pressure input, and display it as a corresponding 1-5V or 4-20mA output. The range, desired by the user, is obtained by setting the appropriate coarse and fine zero and span settings. Each coarse setting is described in Tables 3-A and 3-B, whereas the fine settings are adjusted manually until the desired output is achieved. Fine adjustments are made with two external adjustment screws. The output stage is designed to yield a Turn Down of better than 6, while the fine adjustment screws should affect the output zero and span by no more than 1.5%/Turn.

## **3.7 ELEVATED ZERO CALIBRATION**

1. Calculate the total span required for the elevated zero range. For example, if the desired elevated zero range is -10 to +30 psi, the total span will be  $30 - (-10) = 40$  psi.

2. Calculate the desired output reading for 0 psi. For this example, 0 psi = 25% of the span from -10 to 30 psi. The output should therefore be 25% of the way from 1-5V, or 2V(8mA). Set the Dip and Rotary switches in accordance with Table 3-A. Elevated zero values are expressed as positive percentages of calibrated span. Zero percent represents zero elevation. If the desired percent elevation is in between values listed in the table, try the next closest setting.
3. Apply a 100% pressure input to the transmitter equivalent to the upper range value (URV). For this example, URV = 30 psi.
4. If transmitter output is not 5.000V (20.00mA), adjust A1 to make a minor correction.
5. Vent the input pressure. Adjust A2 to set the output to the 0 psi reading calculated above.
6. Recheck the transmitter output with the input pressure vented, and 100% inputs. The DMM should provide respective readings of the output calculated above, and 5V (20mA) ( $\pm 0.15\%$  full scale).
7. If necessary, repeat the A1 and A2 adjustment procedures.
8. If problems persist, recheck the DIP switch settings. Try setting the switches to the lower percentage. For instance, if the desired percent elevation is 15%, set the switches for an elevation of 10%.

### 3.7.1 Zero Elevation Example (see Table 3-A)

A DP Sensor is mounted across an orifice plate to measure gas flow. Full-scale differential pressure is 40" H<sub>2</sub>O in either direction ( $\pm 40$ " H<sub>2</sub>O). The span is  $+40$ " -  $(-40)$ " = 80" H<sub>2</sub>O. If a 100" Transmitter is used, the Coarse Span Rotary Switch (SW1) setting is found by dividing the span (80" H<sub>2</sub>O) by the Transmitter's range; in this case 100" H<sub>2</sub>O, i.e.,  $80/100 = 80\%$ . Therefore, the SW1 should be set to position 2 (64% - 84%).

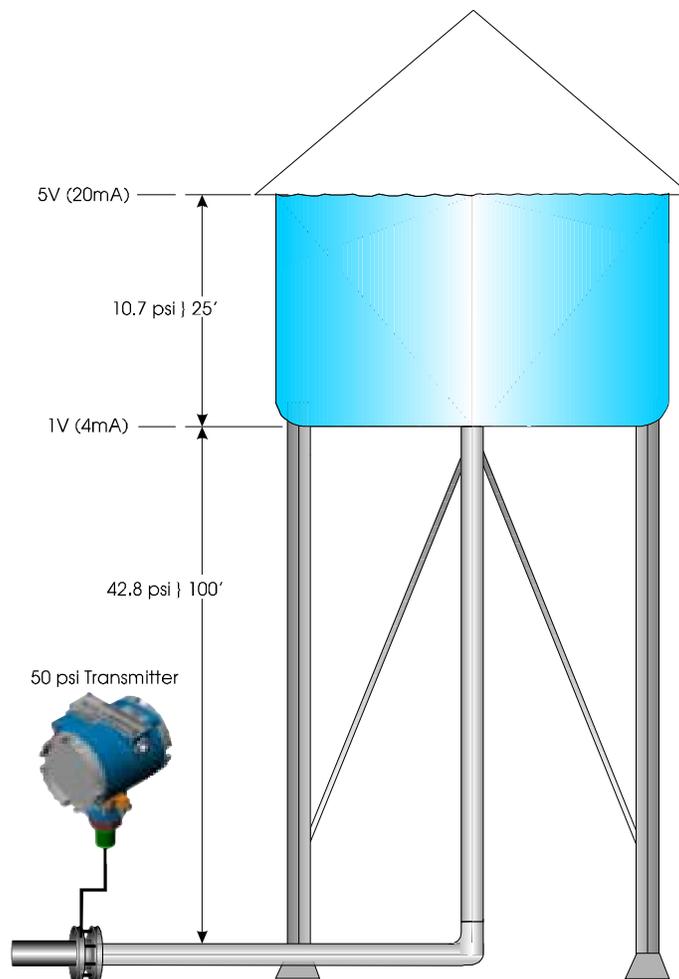
Set the elevation to 50% of the calibrated range (00100010). This will set up the 2808 for calibration of 1.000V (4.00mA) at -40" and 5.000V (20.00mA) at +40". At 0 psid the output will be  $\frac{1}{2}$  scale, i.e., 3V (12mA). Apply +40" H<sub>2</sub>O to the High Side of the Transmitter and use Fine Adjustment Screw A1 to set the output to 5.000V (20.00mA). Vent the unit and use Fine Adjustment Screw A2 to adjust the Transmitter's output to 3V (12mA). Apply +40" H<sub>2</sub>O to the Low Side of the Transmitter and observe the output. Maximum error is the deviation from 1.000V (4.00mA).

**Note: Transmitter factory calibration and compensation is for positive DP pressure only. Negative pressure indication is possible with the above-described method of reduced accuracy. Full-scale negative indication cannot be achieved unless the DP range is at least 2 times the negative range.**

## 3.8 SUPPRESSED ZERO CALIBRATION

1. Calculate the total span required for the suppressed zero range. For example, if the desired suppressed zero range is +15 to +80 psi, the total span will be:  $80 - 15 = 65$  psi.

2. Set the Dip and Rotary switches in accordance with Table 3-B. Suppressed zero values are expressed as negative percentages of upper range limit (URL). Zero percent URL represents no suppression. If the desired percent suppression is in between values, try the next closest setting.
3. Apply a 100% pressure input to the transmitter equivalent to the upper range value (URV). For this example, URV = 80 psi.
4. If transmitter output is not 5.000V (20.00mA), adjust A1 to make a minor correction.
5. Lower the input pressure to  $P_{min}$ . Adjust A2 to set the output to 1.000V (4.00mA).
6. Recheck the transmitter output with 0%, and 100% inputs. The DMM should provide respective readings of 1.000V (4.00mA), and 5.000V (20.00mA) ( $\pm 0.15\%$  full scale).
7. If necessary, repeat the A1 and A2 adjustment procedures.
8. If problems persist, recheck the DIP switch settings. Try setting the switches to the lower percentage. For instance, if the desired percent suppression is -85%, set the switches for a suppression of -90%.



**Figure 3-3 - Water Tower Level Measurement - Zero Suppression**

### 3.8.1 Zero Suppression Example (see Figure 3-3 & Table 3-B)

The full water tower of Figure 3-3, produces 53.5 psi of pressure due to the 125 foot head, i.e 10.7 psi plus 42.8 psi. To determine the Coarse Span Rotary Switch (SW1) setting, divide the pressure produced by the 25 feet of water in the tank by the Transmitter's range; in this case 50 psi, i.e.,  $10.7/50 = 21.4\%$ . Therefore, the SW1 should be set to position 8 (18.5% - 23%).

To determine the zero suppression necessary for this example, divide the pressure produced by 100 feet of water (height of tower to bottom of tank) by the Transmitter's range; in this case 50 psi, i.e.,  $42.8/50 = 85.6\%$ . With the Coarse Span Rotary Switch SW1 set to its SW1-8 position, set the value of the Coarse Zero Switch (S1) to either -80% (00001100) or -90% (00001010), or to a binary value between the two e.g., 00001011 (-85%). Use Fine Adjustment Screw A2 to set 1.000V (4.00mA) @ 42.8 psi and use Fine Adjustment Screw A1 to set 5.000V (20.00mA) @ 53.5 psi.

**Note: When Zero Suppression is used, the maximum applied pressure may be up to 125% of the URL.**

## 3.9 SELECTABLE DAMPING

The damping feature provides compensation for applications with severe pressure pulsation that cause the DC output of the transmitter to seem unstable. Controlling the response time of the transmitter output can minimize this condition. Do not use damping when the application requires dynamic pressure measurement.

Jumper JP9 can be set to apply damping to the output. With jumper JP9 in place, the damping is on. If the jumper does not connect the two pins together, the damping is off.

## ***Section 4***

### ***SERVICE***

---

#### **4.1 GENERAL**

Servicing should only be performed by technically competent persons skilled in the use of pneumatic and electronic test equipment and having knowledge of troubleshooting procedures.

After any service procedures are completed, the transmitter cover must be installed and properly tightened. A failure to secure the cover will result in a loss of the enclosure's dust-tight, water-tight seal and explosion-proof rating.

#### ***Warning***

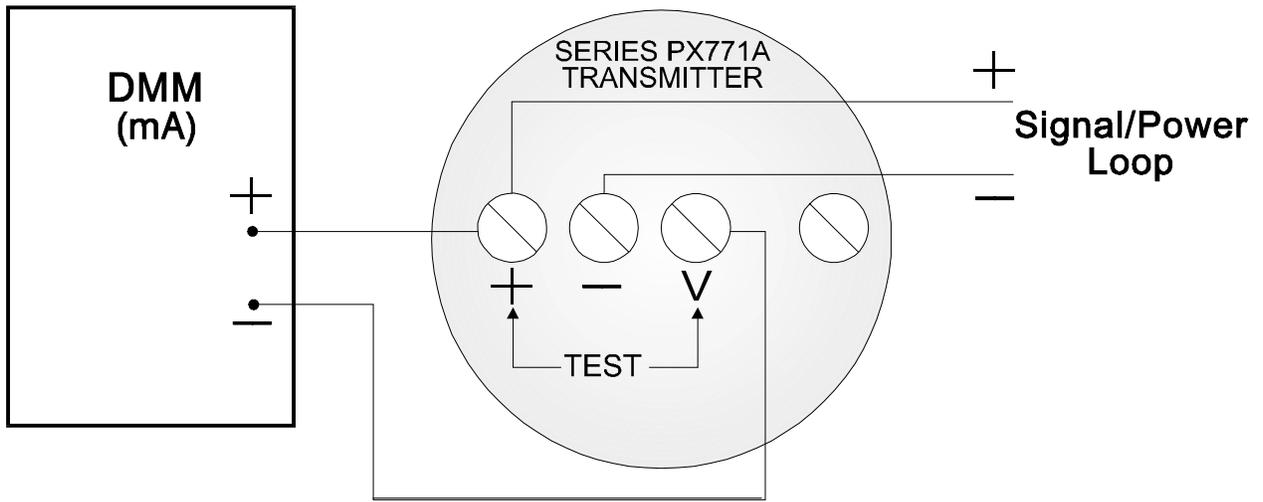
*No attempt should be made to service a transmitter while it is powered and operating in a flammable or explosive environment. Either the area must be made safe or the transmitter must be powered down, disconnected, and taken to a safe, non-hazardous area.*

#### **4.2 TROUBLESHOOTING**

Some troubleshooting procedures will require that you use a digital multimeter (DMM) to measure the loop current. Connect the DMM across the V and (+) terminals of the transmitter as shown in Figure 4-1 and set it to its "milliampere" function. This method of connection will not disturb the signal/power loop. The DMM reading will be proportional to the input pressure and cover a range of 4-20 mA.

#### **4.3 FACTORY REPAIRS**

If you determine that a fault is present in the transmitter's PC board or pressure sensor, do not attempt any service as specialized factory equipment and test procedures will be required. Defective transmitters may be returned to OMEGA for evaluation or repairs. Transmitters in warranty will be repaired or replaced per the warranty agreement contained at the end of this manual.



**Figure 4-1 - Using Internal TEST Terminals to Measure Current**

## *Section 5*

# *SPECIFICATIONS*

---

**NOTE:** The specifications listed here are common to Series PX771A Transmitters described in this manual.

### 5.1 FUNCTIONAL SPECIFICATIONS

#### **Current Loop Mode:**

Supply Voltage	24.0 Vdc nominal 7.00 Vdc min. at transmitter 10.0 Vdc min. with digital indicator option 37.0 Vdc max. at transmitter 42.0 Vdc with external load specified Reverse polarity protection provided
Output	4-20 mA dc output, two wire analog (ISA 50.1 Type, Class U2) Current limited to 28 mA max. Minimum current is 2 to 3.5 mA.

#### **Voltage Mode:**

Supply Voltage	6-42 Vdc Reverse polarity protected to 90 Vdc
Supply Current	1.6 mA nominal
Output	1-5 Vdc (3-wire)

#### **Calibration Adjustments:**

Span Adjustment:	Adj. Range is 16 to 100% URL. Coarse Span set by Rotary switch package. Fine Span set via 25-turn pot.
Zero Adjustment:	Adj. range is -600 to 600% LRL for elevation and suppression. Coarse Zero provided by DIP switch selections. Fine Zero set via 25-turn pot.

#### **Response Time & Damping:**

Time Constant:	(Time required for 63% change in output with a 100% input change) Damping OFF $\cong$ 0.16 ms Damping ON = 50 ms $\pm$ 20%
Damping:	User selectable by jumper circuit

**Recovery:**

Time to steady output after application of 24 volt supply with constant pressure is 5 ms maximum (With No Damping)

**Linearity:**

On low-range models, full vacuum can represent an appreciable percentage of URL. If, on those models, calibration contains 50% of zero elevation, non-linearity errors can be as high as  $\pm 1\%$ .

## 5.2 PERFORMANCE SPECIFICATIONS

**Accuracy:**

(Includes independent linearity, hysteresis and repeatability)  
 $\pm 0.1\%$  of calibrated span

**Resolution:**

Virtually infinite

**Long Term Stability:**

At constant conditions.  $\pm 0.25\%$  of URL/6 mo.

**Ambient Temperature Effect:**

Total including Zero & Span  
 $\pm 0.010\%$  of URL per  $^{\circ}\text{F}$  from  $-25$  to  $75$   $^{\circ}\text{F}$   
 $\pm 0.015\%$  of URL per  $^{\circ}\text{F}$  from  $75$  to  $185$   $^{\circ}\text{F}$   
 $\pm 0.020\%$  of URL per  $^{\circ}\text{F}$  on 100 inH<sub>2</sub>O only

**Power Supply Effect:**

$\pm .005\%$  /Vdc

**Ripple and Noise:**

In accordance with ISA 50.1, Section 4.6

## 5.3 ENVIRONMENTAL SPECIFICATIONS

**Temperature Limits:**

Wet End using DC 200 Fill:  
 $-40$  to  $220$   $^{\circ}\text{F}$  ( $-40$  to  $104$   $^{\circ}\text{C}$ )\*

**Amplifier:**

$-25$  to  $185$   $^{\circ}\text{F}$  ( $-32$  to  $85$   $^{\circ}\text{C}$ )

**Digital Indicator:**

$-22$  to  $158$   $^{\circ}\text{F}$  ( $-30$  to  $70$   $^{\circ}\text{C}$ )

**Storage:**

$-40$  to  $212$   $^{\circ}\text{F}$  ( $-40$  to  $100$   $^{\circ}\text{C}$ )

\* The maximum permissible temperature inside the enclosure (irrespective of sensor temperature) is  $185$   $^{\circ}\text{F}$  ( $85$   $^{\circ}\text{C}$ ) for the amplifier board, and  $158$   $^{\circ}\text{F}$  ( $70$   $^{\circ}\text{C}$ ) for the digital indicator option.

<b>Humidity Limits:</b>	Specified with transmitter electronic housing cover installed. 15-95% RH to 140 °F (60 °C) 15-50% RH to 185 °F (85 °C)
<b>EMI Effect:</b>	±1% of URL @ 10 V/M, 20 MHz to 500 MHz  Meets /SAMA PMC-33-1C with transmitter cover in place and all wiring contained in grounded conduit.
<b>Surge Protection:</b>	Bipolar, differential surge  1000 watts for 1 ms (without digital indicator option)  May be used with purchased surge protector for additional protection (for non-hazardous, non-approved installations only).
<b>Vibration Effect:</b>	Less than ±0.1% of URL for 10 to 500 Hz at 1 g on any axis. Meets SAMA PMC-31-1

## 5.4 PHYSICAL SPECIFICATIONS

<b>Fill Media:</b>	DC 200 Silicone
<b>Electronics Housing:</b>	Low copper aluminum, epoxy finish, NEMA 4X rating
<b>Electrical Connections:</b>	1/2 NPT conduit connection with internal field wiring terminals.

**Series PX771A Transmitter**  
**Special Instructions for Class I, Division 2 Hazardous Locations**

1. The OMEGA Series PX771A Differential Pressure Transmitter is listed by Underwriters Laboratories (UL) as nonincendive and are suitable for use in Class I, Division 2, Groups A, B, C and D hazardous locations or non-hazardous locations. Read this document carefully before installing a nonincendive OMEGA Series PX771A Pressure Transmitter. In the event of a conflict between the Series PX771A Instruction Manual (M-3602) and this document, always follow the instructions in this document.
2. Wiring must be performed in accordance with Class I, Division 2 wiring methods as defined in Article 501-4 (b) of the National Electrical Code, NFPA 70 for installations within the United States, or as specified in Section 18-152 of the Canadian Electrical Code for installation in Canada.
3. Model equipped with the Loop Powered Indicator Option (Appendix B) are approved for use in Class I, Division 2, Groups A, B, C and D hazardous locations.
4. **WARNING: EXPLOSION HAZARD - Substitution of components may impair suitability for use in Class I, Division 2 environments.**
5. **WARNING: EXPLOSION HAZARD - When situated in a hazardous location, turn off power before servicing/replacing the unit and before installing or removing I/O wiring.**
6. **WARNING: EXPLOSION HAZARD - Do Not disconnect equipment unless the power has been switched off or the area is known to be nonhazardous.**

# Appendix B



## LOOP POWERED INDICATOR OPTION

For  
Series PX771A  
Differential Pressure Transmitters



Operator's Manual  
M-3602/1101 - Appendix B

# Appendix B

## LOOP POWERED INDICATOR OPTION

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# *Section 1*

## **INTRODUCTION**

---

### **1.1 INTRODUCTION**

The loop powered indicator (LPI) option is used to provide local indication in engineering units of the measurand represented by a 4-20 mA current loop. The LPI may be installed in a Series PX725A, PX726A or PX771A Transmitter with the Display Cover Assembly or in a stand-alone housing. The LPI is powered by the 4-20 mA current loop using less than 500 uA @ 3 V for the electronic circuitry.

The LPI option is a circuit board assembly with a micro-controller, a liquid-crystal display (LCD) and active electronic circuitry contained on a single board, i.e., the “Meter/Display Board.” The Meter/Display Board plugs into the “Meter Motherboard” that provides the electrical connections from the transmitter interface and allows the display to be rotated in 90-degree increments.

#### **1.1.1 Features**

- Powered by a 4-20 mA current loop using less than 500 uA @ 3V
- Dual Board Set - Meter Motherboard allows the Meter/Display Board to be rotated in 90-degree increments.
- 4½ Digit Display allows display of numeric values as large as 19999.
- Eight selectable unit labels: mA, %, psi, IN H<sub>2</sub>O, bar, kg/cm<sup>2</sup>, °C, and °F.
- One selectable “no-label” position.
- Reverse polarity protection.
- Over current protection

#### **1.1.2 Hardware Circuit Overview**

The LPI option uses a micro-controller with integral LCD display drivers. The current flowing through the LPI is sampled and converted to a corresponding digital word. Based on user-configuration the digital value is displayed in engineering units along with a unit label.

The 4½ digit display can show numeric values as large as 19999. The display contains eight integral unit labels. These are: mA, %, psi, IN H<sub>2</sub>O, bar, kg/cm<sup>2</sup>, °C, and °F.

Calibration is done at the board level by injecting known current levels into the assembly, reading the current and computing correction coefficients that are then stored in the LPI. The coefficients are then used in a correction algorithm to linearize the current signal and achieve a minimum accuracy of 0.1%FS at room temperature. The circuit uses precision resistors to sample the current. The Meter/Display Board is burned-in for long-term stability and reliability. Operating temperature is limited by the LCD display to -30 to +70 °C. Calibration is done once at the factory, but unit display selection may be done as often as required by the user (see Section 2.3.1).

Reverse polarity protection is achieved by shunting the entire circuit with a diode. A 250 mA fuse provides overcurrent protection. A shunt capacitor is also included to minimize EMI effects and provide secondary transient protection.

The two-board assembly is designed for field retrofit in Series PX725A, PX726A and PX771A pressure transmitters.

### 1.1.3. Adjustments

Adjustment potentiometers are unnecessary in the LPI. The indicator is always scaled to 4-20mA. The user configures the LPI in engineering units of their choice, i.e., mA, %, psi, IN H<sub>2</sub>O, bar, kg/cm<sup>2</sup>, °C, °F or Custom.

### 1.1.4 Connectors

The LPI Assembly comes in two parts: The Meter Motherboard and the Meter/Display Board. The Meter Motherboard is assembled into the Series PX725A, PX726A or PX771A Transmitter by connecting the transmitter's terminal block to the spade fingers integral to the Meter Motherboard and installing the mounting screws through the Meter Motherboard to the cast-in mounting bosses in the transmitter housing. The customer cable is then connected to the compression-type terminals of Terminal Block TB1 on the Meter Motherboard. Finally, the Meter/Display Board plugs into the Meter Motherboard in any one of four positions depending on the desired meter rotation; this is through a set of two-conductor "Berg" connectors. The Meter/Display Board is also secured to the Meter Motherboard with four screws.



**Figure 1-1 - PX725A, PX726A or PX771A Transmitter with Loop Powered Indicator**

## Section 2

# **INSTALLATION, OPERATION & SERVICE**

## **2.1 INSTALLATION & REMOVAL/REPLACEMENT OF THE LPI**

### **2.1.1 Installation/Removal of the Loop Powered Indicator**

The following parts are provided for field installation of the Loop Powered Indicator option:

One (1) - O-Ring, Size - 149  
Two (2) - Standoffs, #4 M/F Shoulder  
Two (2) - Standoffs, 4-40 x .750 M/F  
One (1) - Meter Motherboard Ass'y.  
One (1) - Meter/Display Board Ass'y.  
Two (2) - Standoffs, 4-40 x .375 M/F  
Four (4) - Screws, 4-40 x ¼ Pan Head  
One (1) - 2808 Display Cover Ass'y.

#### **WARNING**

***Never attempt to service a Series PX725A, PX726A or PX771A Transmitter while it is operating in a hazardous environment. Either the area must be made safe or the unit must be unwired, unmounted, and taken to a safe, non-hazardous area.***

#### **WARNING**

***Never attempt to install or remove any components (PCBs or Field Wiring.) while the unit is running. Doing so can cause sudden electrical transients or imbalances that are capable of causing damage to the module or component in question, as well as other associated circuit boards. Always turn off ANY Transmitter to Instrument circuits (at the instrument or External DC Power Source) before changing or adding any components.***

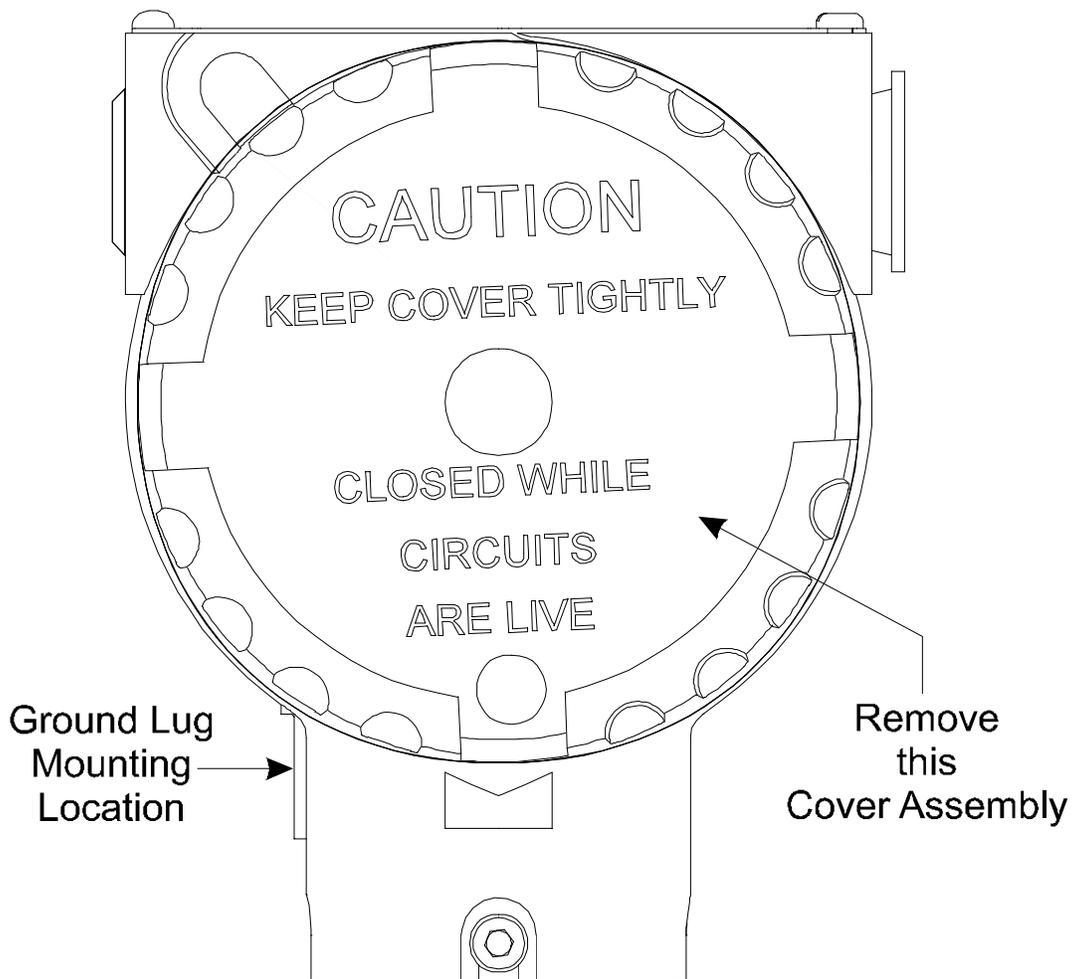
#### **CAUTION**

***Place any related critical processes under manual or auxiliary control prior to shutting down or performing any of the steps discussed herein.***

To install the Loop Powered Indicator (LPI) option into a Series PX725A, PX726A or PX771A Transmitter, follow steps 1 through 9 below. To remove the LPI see step 10. *Note: The LPI is loop powered and may only be used with Transmitters configured in the "4-20mA" mode.*

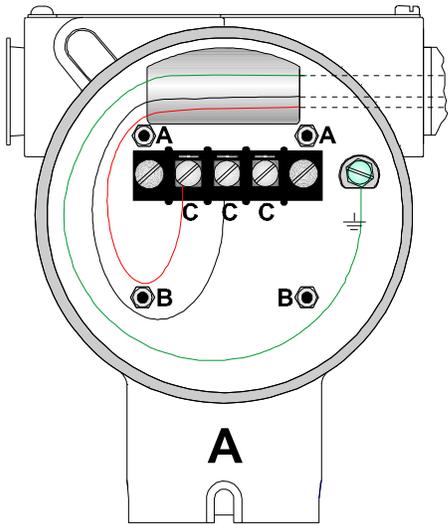
1. Remove the appropriate Cover Assembly from the instrument (see Figure 2-1). The Cover Assembly is factory installed "hand tight," i.e., there is no torque required.

2. Referring to Figure 2-2, install the two (2) 4-40 x .759 Standoffs into the Transmitter at location A.

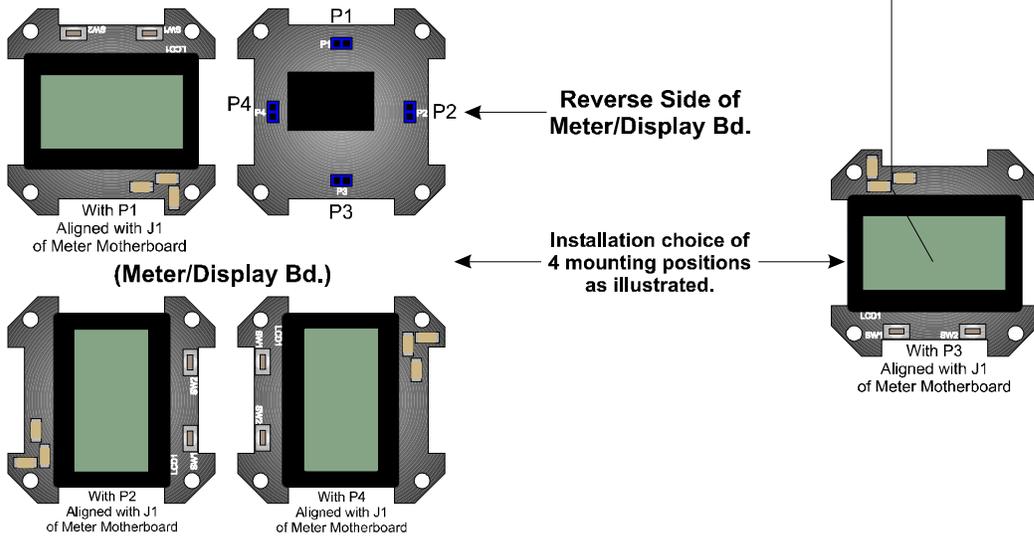
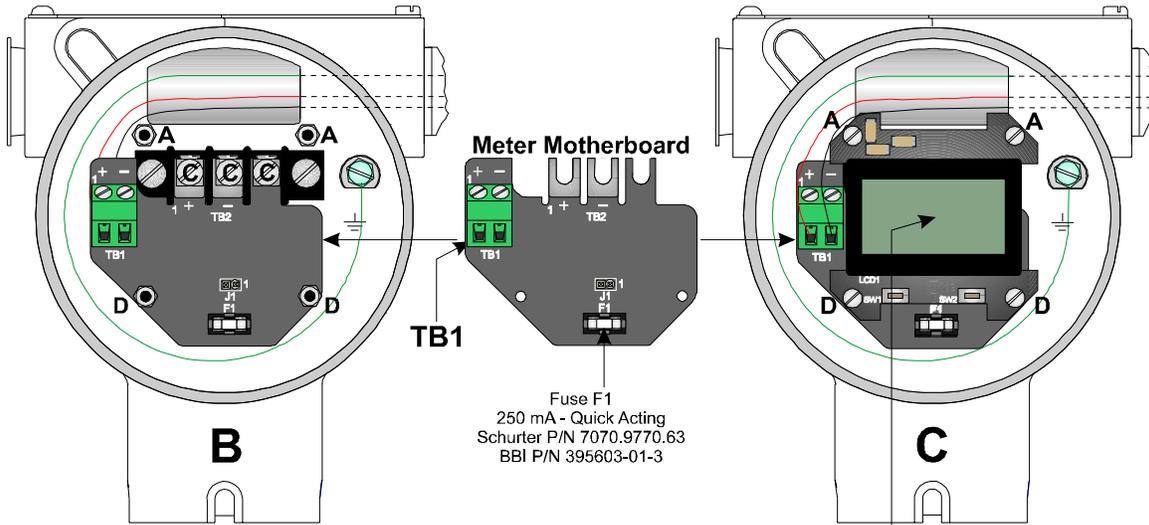


**Figure 2-1 - Transmitter Cover Assembly Removal**

3. Referring to Figure 2-2, install the two (2) 4-40 x .375 Standoffs into the Transmitter at location B.
4. Disconnect the Field Wires (if installed) from the Transmitter's Terminal Block.
5. Remove the three (3) Field Wiring Screws/Clamps from the Transmitter's Terminal Block.
6. Secure the Meter Motherboard to the Transmitter via the three (3) Field Wiring Screws/Clamps removed in step 5. Using two (2) #4 M/F Shoulder Standoffs, secure the Motherboard to the Standoffs installed in step 3.
7. Install the Meter/Display Board onto the Meter Motherboard after aligning the appropriate Meter/Display Board Interface Connector (P1 through P4) with J1 of the Meter Motherboard. Secure the Meter/Display Board to the four standoffs (Locations A & D of Figure 2-2) via four (4) 4-40 x ¼ Pan Head Screws.

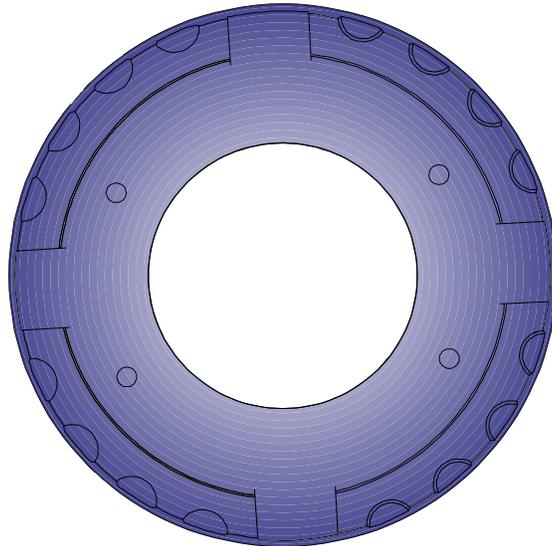


1. Install (2) 4-40 x .759 M/F Standoffs - Location (A) (Figures A & B).
2. Install (2) 4-40 x .375 M/F Standoffs - Location (B) (Figure A).
3. Disconnect Field Wires at Term. Block. - Location (C) (Figure A).
4. Remove (3) TB Wiring Screws/Clamps - Location (C) (Figure A).
5. Secure Meter Motherboard to Transmitter via Term. Blk. Wiring Screws/Clamps - Location (C) & (2) #4 M/F Shoulder Standoffs - Location (D) (Figure B).
6. Install the Meter/Display Bd. Align the appropriate Meter/Display Bd. Intf. Connector (P1 through P4) with J1 of the Meter Motherboard. Secure the Meter/Display Bd. to four standoffs via (4) 4-40 x 1/4 Pan Head Screws - Locations A & D (Figures B & C).
7. Connect Field Wires to Meter Motherboard Terminal Block TB1 (Figures B & C).
8. Install Transmitter Display Cover Ass'y. with size 149 O-Ring.



**Figure 2-2 - Loop Powered Indicator Installation Diagram**

8. Connect the field wires to the compression-type terminals of Meter Motherboard Terminal Block TB1 (see Section 2.2 & Figure 2-5). Configure the LPI for operation (see Section 2.3.1).
9. Install the Transmitter Display Cover Assembly (with size 149 O-Ring) onto the Transmitter (see Figures 2-3 & 2-4). Lubricate O-Ring with Dow Corning Silicone Grease (Compound 4) or equivalent prior to assembly. Lubricate threads with “NEVER-SEEZ” “Pure Nickel Special” or equivalent prior to assembly. Tighten until Cover contacts the Transmitter Housing (no torque required).



**Figure 2-3 – Series PX725A, PX726A & PX771A Display Cover Assembly**

Display as it appears momentarily  
when power is applied.



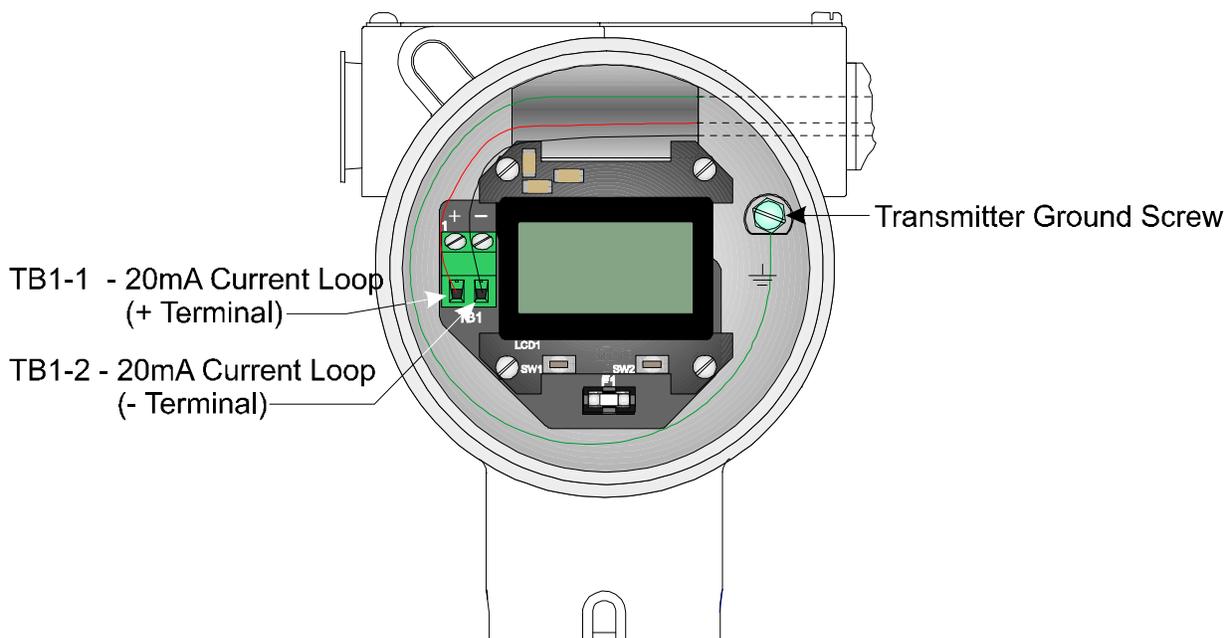
**Figure 2-4 - Transmitter with Loop Powered Indicator Option Installed**

10. To remove the LPI Option from a Series PX725A, PX726A or PX771A Transmitter, follow steps 7 through 9 in reverse order, removing rather than installing the item in question.

## 2.2 FIELD WIRING

The LPI uses compression-type terminals that accommodate up to #14 AWG wire. A connection is made by inserting the bared end (1/4 inch Max.) into the Meter Motherboard Connector (TB1) clamp beneath the screw and then securing the screw. Insert the bared end fully to prevent short circuits.

Allow some slack in the wires when making terminal connections. The slack makes the connections more manageable and minimizes mechanical strain on the Meter Motherboard and the wiring harness (see Section 2.4 of M3600, M3601, M3602 and Figure 2-5 below).



**Figure 2-5 - Transmitter LPI Option Field Wiring**

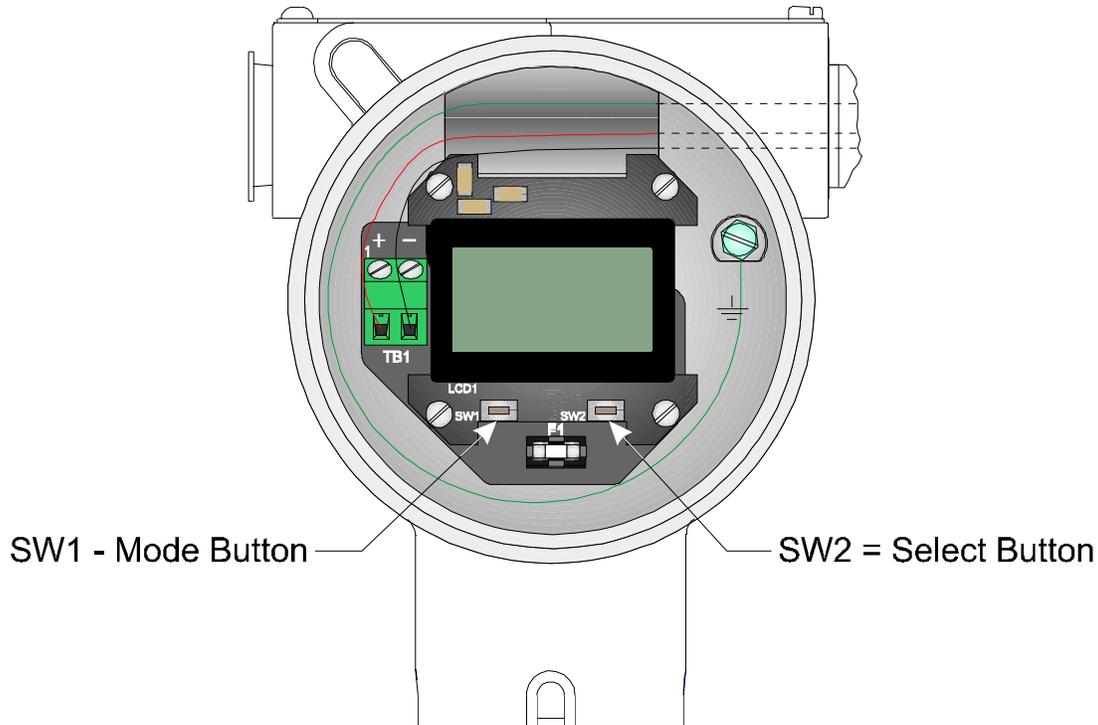
## 2.3 OPERATIONAL DETAILS

### 2.3.1 Configuring the Loop Powered Indicator

Configuration involves selecting an engineering unit (called the Base Unit or BU) and then establishing Zero and Full-scale values to be used when converting current into that unit. The Mode (left-hand) and Select (right-hand) buttons are used to configure the LPI. The LPI ships from the factory with a configuration that displays the flowing current in a BU of percent (%). During configuration the Mode button is used to move through the configuration sequence and the Select button is used to choose a particular setting from those available at a particular point in the sequence.

Configuration begins with the selection of an engineering-unit followed by the choices for the zero; minus sign, ten-thousandths half-digit, four full digits (thousands to units), then the decimal point. Next is the Full-scale; minus sign, ten-thousandths half-digit,

thousandths to units, and decimal point. The final press of the Mode button causes an exit from configuration mode to run mode. At any point in the sequence pressing the Mode button selects the next item in the order i.e., to leave a previously configured item as is, press Mode to skip over it. When configuration is started a one-minute timer is loaded; it is reloaded whenever a Mode or Select button is pressed. If no button activity occurs for one minute the timer will expire and restore the previously active configuration.



**Figure 2-6 - Loop Powered Indicator - Mode (SW1) and Select (SW2) Buttons**

During configuration any previously configured engineering unit, minus sign, ten-thousandths digit and decimal point are ignored; the user **MUST** select them if they are to be active in the new configuration. Configuration proceeds as follows:

1. Press and hold the Mode (left-hand) button until one of the unit labels begins blinking; this typically takes 5 seconds. The display will be all blank except for a small lower-case letter 'u' located in the upper half of the rightmost digit. The label of the previously configured engineering unit will be blinking. Remember that the previous engineering unit label is only blinking as a convenient starting point - in order to remain in effect it must be selected again unless another unit will be chosen. If the previously configured BU was 'Custom,' the 'u' will be blinking.
2. Press the Mode button to change the displayed blinking engineering-unit label, then press Select to make the selected unit active and move to minus sign selection. A unit selection **MUST** be made otherwise repeated Mode presses will only cycle through the unit selections. If the integral unit labels do not match the application unit, press the Mode button until the small letter 'u' is blinking. This is the Custom unit selection, meaning that the display will not show a unit label. In this case an external label should be used. A Custom unit might be used where the reading will be in feet of water or millimeters of mercury, or Pascals. Once a unit is selected the display changes.

If the selected unit is mA or % no further configuration is allowed and configuration mode ends. For other units the following occurs.

The SET LO legend appears with the minus sign blinking, and the previously configured digits for the Zero appear without a decimal point. Previously configured minus sign and ten-thousandths half-digit choices are cancelled, and new selections must be made. Press Select to make the minus active, press Mode to skip over it. The ten-thousandths digit (a one) begins blinking after the minus sign has been configured. Again, press Select to make it active, press Mode to skip over it.

After the ten-thousandths digit is selected the thousands (leftmost) full digit will begin blinking.

3. Press the Select button to increment the digit (zero to nine) or press Mode to leave the digit as it is and activate the next digit location to the right. Repeat until all digits have been set.

When Mode is pressed while the units (rightmost) digit location is blinking decimal point locations 2 and 5 will start blinking. As with units, a selection **MUST** be made or the Mode button will just cycle through all decimal point choices. When decimal point locations 2 and 5 are blinking simultaneously this indicates a “no decimal” choice, meaning that the decimal point is “hidden” on the far right of the display.

4. Press the Mode button to display the next decimal point choice, which will be the location to the left of the rightmost digit. As the Mode button is pressed the blinking decimal point will shift to the left in the display and eventually wrap-around to repeat the simultaneous display of locations 2 and 5. Press the Select button to make the blinking decimal point location active and move to the configuration of Full-scale.

When the Zero decimal point is selected the SET LO legend will disappear and the SET HI legend will appear. The minus sign location will be blinking, and the digit locations will contain previously configured Full-scale values.

5. Use the Mode and Select buttons to configure the minus sign, ten-thousandths digit, thousandths to units, and decimal point. When the decimal point is selected configuration is complete. The SET HI legend will disappear, blinking will stop and the unit will exit Configuration mode and enter Run mode.
6. Upon exit from configuration mode the selected configuration (Base Unit, BU) is stored in an EEPROM where it remains until another configuration occurs. Current is always converted to and displayed in the selected BU henceforth.

If the selected unit is mA or % only the unit selection itself is stored.

If the selected unit is one of the four pressure units (psi, inH<sub>2</sub>O, bar, kg/cm<sup>2</sup>) then the zero and full scale of the other pressure units are converted to be proportional to the BU and then stored. This means that the zero and full scale of a selected BU of psi are converted to the other pressure units and saved along with the BU zero and full scale.

If the selected BU is one of the two temperature units (Celsius, Fahrenheit) then the other temperature unit zero and full scale are converted and then saved.

If the selected BU is Custom, no other units are affected.

Upon power-up the MPU makes all display segment elements active for 5 seconds; this allows a visual check for non-functioning elements. After 5 seconds the LPI begins displaying values in the unit (BU) that was active before power-down.

### 2.3.2 Accuracy and Decimal Point Settings

The LPI has a stated accuracy of  $\pm 0.1\%$  of the milliamper span, equivalent to  $\pm 0.016$  mA at reference conditions. The accuracy is further affected by temperature at a rate of  $\pm 0.01\%$  per  $^{\circ}\text{C}$ . When units other than mA or % are used the LPI automatically positions the displayed decimal point to give the best reading consistent with the stated accuracy but not a reading that is misleading. Decimal point movement in the display thus depends on the configured span as follows.

**Table 2-1 - Span versus Decimal Point Position**

SPAN	$\pm .1\%$	Value	Display Reading
10000 Up	$\pm 10$	10000 Up	1.0 to 19999
1000 Up	$\pm 1$	1000 Up	1.0 to 9999
100 Up	$\pm .1$	100 Up	0.1 to 1999.9
10 Up	$\pm .01$	10 Up	0.01 to 199.9
1 Up	$\pm .001$	1 Up	0.001 to 19.999
.1 Up	$\pm .0001$	.1 Up	0.0001 to 1.9999

As indicated in Table 2-1, the display will suppress leading zeros but always show one zero to the left of the decimal point where possible.

### 2.3.3 Displaying Current Using the LPI

In Run mode the LPI converts the flowing current into a value displayed in the selected Base Unit (BU). The Mode (left-hand) button is used to temporarily display the current in one of the other units; the Select (right-hand) button has no effect. When the Mode button is pressed the next available unit will appear for 10 seconds, after which the display will revert to displaying the selected BU. The number of units available for viewing depends on the selected BU as follows.

**Table 2-2 - Units Temporarily Displayed versus Selected Base Unit (BU)**

Base Unit	Available Units
mA	mA, %
%	mA, %
psi	mA, %, psi, inH2O, bar, kg/cm2
InH2O	mA, %, psi, inH2O, bar, kg/cm2 *
Bar	mA, %, psi, inH2O, bar, kg/cm2
kg/cm2	mA, %, psi, inH2O, bar, kg/cm2
Celsius	mA, %, Celsius, Fahrenheit
Fahrenheit	mA, %, Celsius, Fahrenheit
Custom	mA, %

\* Conversion into inches of water (inH2O) from pounds per square inch (psi) uses the constant 27.7066 inH2O per psi at 60 $^{\circ}$  F.

As the Mode button is pressed the display will change to the next available unit in the order shown above starting with the BU. With a BU of inH<sub>2</sub>O for example, the order would be bar, kg/cm<sup>2</sup>, mA, %, psi, then back to inH<sub>2</sub>O.

### **2.3.4 Error Conditions**

LPIs that have not been factory calibrated will alternately show a reading and UCUC (for Uncalibrated) in the display for four seconds. Customers should never see this indication unless the EEPROM has completely lost its contents.

The LPI reads an EPROM checksum every second and compares it to a checksum calculated on the RAM area holding the data read from the EEPROM. If there is a difference the EEPROM is reread and the checksums are tested again.

An invalid checksum causes a reset and reread, during which the display will show a blinking EErr message. Reset occurs every 250 milliseconds.

If a write of the EEPROM (only occurs during configuration or calibration) fails because the EEPROM did not acknowledge the write the same EErr message is displayed but is not blinking because the LPI has been halted on the condition of the failure.

#### **2.3.4.1 Conversion and Display Error Conditions**

During operation three error conditions can occur that cause “dashes” to be displayed.

The first is a “cannot display” condition that can occur when the number to be shown is too large to fit in the LCD display. This can occur, for example, if the Full-scale value was set as 19,999 (equivalent to 20 mA). When the input current exceeds 20 mA a value of 20,000 or larger cannot be displayed – in this case the display will show four dashes “----”.

The second and third conditions occur when the input current has exceeded the valid conversion range and a numeric display value would be meaningless and possibly misleading. If the current exceeds 21.6 mA to the point where internal conversions are not valid the display will show two “dashes” right-justified in the display e.g., “--”. If current drops below 2.4 mA to the point where internal conversions are not valid then two left-justified “dashes” are displayed e.g., “--”.

## **2.4 SERVICE**

Series PX725A, PX726A & PX771A Loop Powered Indicators are equipped with a 250 mA Quick Acting Fuse (F1) that is situated on the Meter Motherboard Assembly. Check the following items if Loop Powered Indicator operation is faulty:

1. Check wiring at TB1 of the Meter Motherboard.
2. Check field wiring at the field device.
3. Check Fuse F1 and replace it if it is defective (see Figure 2-2).
4. Make sure that the Meter Motherboard is properly secured to the transmitter.
5. Make sure that the Meter/Display Board is properly mated with the Meter Motherboard.

## *Section 3*

# ***SPECIFICATIONS***

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### **3.1 ENVIRONMENTAL SPECIFICATIONS**

<b>Temperature Limits:</b>	Operating: -30°C to +70°C (-22°F to +158°F) Storage: -40°C to +85°C (-40°F to +185°F)
<b>Humidity Limits:</b>	15% to 95% RH (Non-condensing)
<b>Vibration:</b>	10 to 500 Hz at 2g on any axis per SAMA PMC-31-1 without damage or impairment.
<b>ESD Susceptibility:</b>	Field connected circuits are designed to meet the requirements of IEC 801-2 for ESD withstand capability up to 10KV.
<b>EMI Compatibility:</b>	Designed to coexist inside the aluminum housing with the Series PX725A, PX726A or PX771A Transmitter electronics. EMI radiation is insignificant and susceptibility is comparable or superior to associated electronics.
<b>Approvals:</b>	UL approved for use in the following hazardous locations: <ul style="list-style-type: none"><li>- Nonincendive for Class I, Div. 2, Groups A, B, C &amp; D.</li><li>- Explosion-proof for Class I, Div. 1, Groups C &amp; D.</li><li>- Suitable for Class III, Div. 1.</li></ul>
<b>Transient Susceptibility:</b>	Field connected circuits are designed to meet the requirements of ANSI/IEEE C37.90.1-1989 (Formally IEEE 472) for surge withstand capability.

## **Series PX771A Transmitters Material Safety Data Sheets**

Material Safety Data Sheets are provided herein to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. This standard must be consulted for specific requirements.

Material Safety Data Sheets are provided in the order listed in Table Z-1 below.

**TABLE Z-1 - MSDS for Series PX771A Transmitters Instruction Manual M-3602**

<b>Manufacturer</b>	<b>General Description</b>	<b>OMEGA ENGINEERING Part Number or Media Notes</b>
Dow Corning	Silicone 200(R) Fluid, 100 CST	Pressure Transducer Media Fill

**DOW CORNING CORPORATION  
MATERIAL SAFETY DATA SHEET**

**DOW CORNING 200(R) FLUID, 100 CST.**

**SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Dow Corning Corporation South Saginaw Road Midland, Michigan 48686	24 Hour Emergency Telephone: (517) 496-5900 Customer Service: (517) 496-6000 Product Disposal Information: (517) 496-5813 Transportation Information: (517) 496-8577 CHEMTREC: (800) 424-9300
MSDS No: 01013190 <span style="float: right;">Current Version: 05/15/95</span>	
Generic Description: Silicone Physical Form: Liquid Color: Colorless Odor: Odorless NFPA Profile: Health 1 Flammability 1 Reactivity 0	
Note: NFPA = National Fire Protection Association	

**SECTION 2. OSHA HAZARDOUS COMPONENTS**

<u>CAS Number</u>	<u>Wt%</u>	<u>Component</u>	<u>Exposure Limits</u>
None Known			
Comments: None present. This is not a hazardous material as defined in the OSHA Hazard Communication Standard.			

**SECTION 3. EFFECTS OF OVEREXPOSURE**

Acute Effects

Eye: Direct eye contact may cause temporary discomfort with mild redness and dryness similar to windburn.

Skin: A single prolonged exposure (24 to 48 hours) causes no known adverse effect.

Inhalation: No irritation to eyes and respiratory passages. No injury is likely from relatively short exposures of less than 8 hours.

Oral: Small amounts transferred to the mouth by fingers during use, etc., should not injure. Swallowing large amounts may cause digestive discomfort.

Repeated Exposure Effects

Skin: None Known.

Inhalation: None Known.

Oral: None Known.

Special Hazards

This material contains the following components with the special hazards listed below.

Carcinogens

None Known

Teratogens

None Known

Mutagens

None Known

Reproductive Toxins

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**DOW CORNING 200(R) FLUID, 100 CST.**

None Known

Sensitizers

None Known

Comments: When heated to temperatures above 150 degrees C in the presence of air, product can form formaldehyde vapors. Formaldehyde is a potential cancer hazard; a known skin and respiratory sensitizer; and an irritant to the eyes, nose, throat, skin, and digestive system. Safe handling conditions may be maintained by keeping vapor concentrations within the OSHA Permissible Exposure Limit for formaldehyde. Please read the additional information below.

The above listed potential effects of overexposure are based on actual data, results of studies performed upon similar compositions component data and/or expert review of the product.

**SECTION 4. FIRST AID MEASURES**

Eye: Immediately flush with water.  
Skin: No first aid should be needed.  
Inhalation: No first aid should be needed.  
Oral: No first aid should be needed.  
Comments: Treat symptomatically.

**SECTION 5. FIRE FIGHTING MEASURES**

Flash Point (Closed Cup): > 213.98 DEGREE F / 101.10 DEGREE C  
Autoignition Temperature: Not Determined  
Flammability Limits in Air: Not Determined  
Extinguishing Media: Carbon dioxide (CO2). Water. Water fog (or spray). Dry chemical. Foam.  
Unsuitable Extinguishing Media: None  
Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.  
Unusual Fire Hazards: None

Hazardous Decomposition Products:

Thermal breakdown of this product during fire or very high heat conditions may evolve the following hazardous decomposition products: Silicon dioxide. Carbon oxides and traces of incompletely burned carbon compounds. Formaldehyde.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

Containment/Clean-up: Disposal of collected product, residues, and cleanup materials may be governmentally regulated. Observe all applicable local, state, and federal waste management regulations. Mop up, or wipe up, or soak up with absorbent and contain for salvage or disposal. For large spills, provide diking or other appropriate containment to keep material from spreading. Clean any remaining slippery surfaces by appropriate techniques, such as: several moppings or swabbings with appropriate solvents; washing with mild, caustic detergents or solutions; or high pressure steam for large areas. For nonsilicones, use typical industrial cleaning materials. Observe any safety precautions applicable to the cleaning material being used. Observe all personal protection equipment recommendations described in Sections 5 and 8. Local, state, and federal reporting requirements may apply to spills or releases of this material into the environment. See applicable regulatory compliance information in Section 15.

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MATERIAL SAFETY DATA SHEET**

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**DOW CORNING 200(R) FLUID, 100 CST.**

NOTE: See Section 8 for Personal Protective Equipment for Spills

**SECTION 7. HANDLING AND STORAGE**

Handling: No special precautions.

Storage: No special precautions. Use reasonable care.

**SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

Engineering Controls

Local exhaust: None should be needed  
General Ventilation: Recommended

Personal Protective Equipment For Routine Handling

Eyes: Use proper protection - safety glasses as a minimum.

Skin: Washing at mealtime and end of shift is adequate.

Suitable Gloves: No special protection needed.

Inhalation: No respiratory protection should be needed.

Suitable Respirator: None should be needed.

Personal Protective Equipment For Spills

Eye: Use proper protection - safety glasses as a minimum.

Skin: Washing at mealtime and end of shift is adequate.

Inhalation/  
Suitable Respirator: No respiratory protection should be needed.

Precautionary Measures: Avoid eye contact. Use reasonable care.

Comments: None

Note: These precautions are for room temperature handling. Use at elevated temperature, or aerosol/spray applications, may require added precautions.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

Physical form: Liquid  
Color: Colorless  
Odor: Odorless  
Specific Gravity @ 25C: 0.96  
Viscosity: 100.00 CST  
Freezing/Melting Point: Not Applicable.  
Boiling Point: Not Determined.  
Vapor Pressure @ 25C: Not Determined.  
Vapor Density: Not Determined.  
Solubility in Water: None.  
pH: Not Applicable.  
Volatile content: Not Determined.

Note: The above information is not intended for use in preparing product specifications. Contact Dow Corning before writing specifications.

**SECTION 10. STABILITY AND REACTIVITY**

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MATERIAL SAFETY DATA SHEET**

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**DOW CORNING 200(R) FLUID, 100 CST.**

Chemical Stability:	Stable.
Hazardous Polymerization:	Hazardous polymerization will not occur.
Conditions to Avoid:	None.
Materials to Avoid:	Oxidizing material can cause a reaction.
Comments:	None

**SECTION 11. TOXICOLOGICAL INFORMATION**  
OPTIONAL SECTION - Complete information not yet available.

**SECTION 12. ECOLOGICAL INFORMATION**  
OPTIONAL SECTION - Complete information not yet available.

**SECTION 13. DISPOSAL INFORMATION**  
RCRA Hazard Class (40CFR 261)  
When a decision is made to discard this material, as received, is it classified as a hazardous waste? N  
Federal Hazardous Waste Code: NA  
Characteristic Waste: Ignitable: NA      Corrosive: NA      Reactive: NA  
TCLP: NA  
State or local laws may impose additional regulatory requirements regarding disposal.  
NA = Not Applicable  
Call Dow Corning Corporate Environmental Management, (517)496-6315, if additional information is required.

**SECTION 14. TRANSPORT INFORMATION**  
DOT Information (49CFR 172.101)  
Proper Shipping Name: Not Applicable  
Hazard Technical Name: Not Applicable  
Hazard Class: Not Applicable  
UN/NA Number: Not Applicable  
Packing Group: Not Applicable  
Call Dow Corning Transportation, (517)496-8577, if additional information is required.

**SECTION 15. REGULATORY INFORMATION**  
Contents of this MSDS comply with the OSHA Hazard Communication Standard 29CFR 1910.1200  
TSCA Status: All chemical substances found in this product comply with the Toxic Substances Control Act inventory reporting requirements.  
EPA SARA Title III Chemical Listings:  
Section 302 Extremely Hazardous Substances:  
None  
Section 304 CERCLA Hazardous Substances:  
None  
Section 312 Hazard Class:  
Acute: N  
Chronic: N

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DOW CORNING 200(R) FLUID, 100 CST.

Fire: N  
Pressure: N  
Reactive: N

Y = Yes N = No

Section 313 Toxic Chemicals:  
None present or none present in regulated quantities.

Supplemental State Compliance Information

CAS Number                      Wt%                      Component

**California**

Warning: This product contains the following chemical(s) listed by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as being known to cause cancer.

None Known.

Warning: This product contains the following chemical(s) listed by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as being known to cause birth defects or other reproductive harm.

None Known.

**Massachusetts**

No ingredient regulated by MA Right-to-Know Law present.

**New Jersey**

063148629                      100                      Polydimethylsiloxane

**Pennsylvania**

063148629                      100                      Polydimethylsiloxane

**SECTION 16. OTHER INFORMATION**

Prepared by: Dow Corning Corporation

This information is offered in good faith as typical values and not as a product specification. No warranty, expressed or implied, is hereby made. The recommended industrial hygiene and safe handling procedures are believed to be generally applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate.

(R) indicates Registered or Trademark

\* \* \* \* \* This is the last page. \* \* \* \* \*



## WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **25 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **two (2) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

**OMEGA is glad to offer suggestions on the use of its various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.**

**OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.**

**LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

## RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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# Where Do I Find Everything I Need for Process Measurement and Control? **OMEGA...Of Course!**

## **TEMPERATURE**

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

## **PRESSURE / STRAIN FORCE**

- Transducers & Strain Gages
- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

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- Totalizers & Batch Controllers

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- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
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- Immersion & Band Heaters
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- Laboratory Heaters

## **ENVIRONMENTAL MONITORING AND CONTROL**

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments