PMT pressure SENSORS

K796341 REV E
2/2023
EDO # 1-23-109

# MODEL 851 SERIES
# ELECTRONIC PRESSURE TRANSMITTERS

## INSTRUCTIONS FOR INSTALLATION, OPERATION, AND CALIBRATION




851F Flushmount

851T with conduit adaptor for Explosion Proof rating

851T std with nut for I.S rating




Flushmount model shown mounted in weld coupling on pipe

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This warranty does not extend to anyone other than the original Buyer from Seller



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# INTRODUCTION

The Model 851 line is a series of pressure transmitter products featuring zero and span adjustability, 5:1 range turndown, all 316 stainless steel construction in a durable and cost effective package. The transmitters provide 4-20 mA output, 0.25% accuracy and agency approvals for intrinsically safe apparatus and explosion proof in hazardous locations.

**Model 851T** provides as standard a 1/2" NPT female process connection for direct mounting to existing piping systems. It is available with a nut/grommet cable connection with 22 AWG wire or with a 1/2" NPT female conduit connection for explosion proof applications.

**Model 851F** provides flush mount capability in a customer welded connection assembly. It is also available in both electrical connection options.

**NOTE:** This unit is not designed for submersible applications.

## SAFETY SUMMARY

This instrument is designed to prevent accidental shock to the operator when properly used. However, no design can ensure the safety of an instrument improperly installed or used negligently. Read this manual carefully and completely before operating the instrument. Failure to read this manual in its entirety could result in damage to the instrument or injury to the operator. Standard safety precautions must be used during installation and operation. Important messages located throughout this manual are as follows:

| | |
|---|---|
| **WARNING -** | Denotes a hazardous procedure or condition which, if ignored, could result in injury or death to the operator. |
| **CAUTION -** | Denotes a hazardous procedure or condition which, if ignored, could result in damage or destruction to the instrument. |
| **IMPORTANT-** | Denotes a procedure or condition which is essential to the correct operation of the instrument. |
| **NOTE-** | Specifies supplementary and perhaps essential information inrelation to a particular procedure or condition. |



# MODEL 851 TRANSMITTER MODEL NUMBER CODE

**851 ELECTRONIC PRESSURE TRANSMITTER PROCESS CONNECTION**

**PROCESS CONNECTION**
**T** = 1/2- NPT FEMALE
**F** = FLUSH (see note 1)

**PRESSURE TYPE**
**G** = GAUGE

**PRESSURE RANGE**
**3015** = 3-15 PSI
**0015** = 0/3 To 0/15 PSI
**0030** = 0/6 To 0/30 PSI
**0100** = 0/20 To 0/100 PSI
**0300** = 0/60 To 0/300 PSI
**1000** = 0/200 To 0/1000 PSI
**3000** = 0/600 To 0/3000 PSI
**5000** = 0/1000 To 0/5000 PSI

**ELECTRICAL CONNECTION**
**N** = STANDARD NUT/CABLE* (see note 4)
**C** = 1/2" NPT FEMALE CONDUIT CONNECTION/CABLE

**DIAPHRAGM**
**L** = 316L STAINLESS STEEL
**H** = HASTELLOY C (see note 2)

**FILL**
**S** SILICONE

**AGENCY APPROVAL**
**A** = FM & CSA, EXP. PROOF (see note 3) PLUS CSA, IS
**C** = CSA, IS ONLY

**COUPLING (FLUSH ONLY)**
**S** = 316 SS COUPLING; TEFLON GASKET
**P** = 316 SS PLUG, COUPLING; TEFLON GASKET
**N** = NO COUPLING; TEFLON GASKET

**( ) CALIBRATED RANGE**

**851 T G 0015 C L S A S (0-15 PSI) EXAMPLE**

1. Flush Connection only available up to 300 PSI.
2. Available on Flush Connection Only.
3. Explosion Proof Approval requires "C" electrical connection option.
4. Not available with agency approval "A", FM & CSA explosion-proof.

* Cable length is 24" (22 AWG) standard.



## SECTION I

## SPECIFICATIONS

### DESCRIPTION

The Model 851 is the most durable, accurate and cost-effective pressure transmitter presently available. An adjustable all stainless steel transmitter, it is designed for years of stable performance in even the toughest environmental and media conditions. Approvals include ratings for CSA, for both intrinsic safety and explosion-proof, and FM for explosion-proof only. The Model 851also meets NACE standards for offshore applications.

The small size and light weight of the Model 851 transmitter eliminate the need for complicated mounting hardware and mechanical supports, thereby reducing installation time substantially. The in-line connection permits simple field wiring without the need for additional hardware, adding to the speed and ease of installation. Its slim profile allows for mounting, in places too tight for most other transmitters.

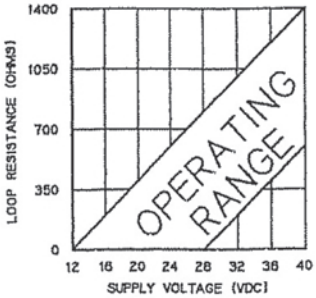
A 4-20 mA output is standard with a 12-40 Vdc power supply. With all 316 stainless steel welded construction, the Model 851 is compatible with corrosive media and hazardous environments. With the cover sealed Double-O-Ring assembly, this transmitter is weather proof and capable of a direct spray.

### SPECIFICATIONS

#### FUNCTIONAL SPECIFICATIONS

**Service:** Liquid, Gas or Vapor
**Range Limits:**
0/6 to 0/15 psi (0/0.4 to 0/1 bar)
0/6 to 0/30 psi (O/.4 to 0/2 bar)
0/20 to 0/100 psi (0/1.4 to 0/7 bar)
0/60 to 0/300 psi (0/4 to 0/20 bar)
0/200 to 0/1000 psi (0/14 **to** O/'70 bar)
0/600 to 0/3000 psi (0/40 to 0/200 bar)
0/1000 to 0/5000 psi (O/'70 to 0/350 bar)
**Overrange:** 300% upper range limit (URL)
**Output:** 4-20 mAdc, limited to 30 mAdc
**Power Supply:** 12 to 40 Vdc with reverse polarity protection.

Loop Resistance: 1400 ohms max. @ 40 volts



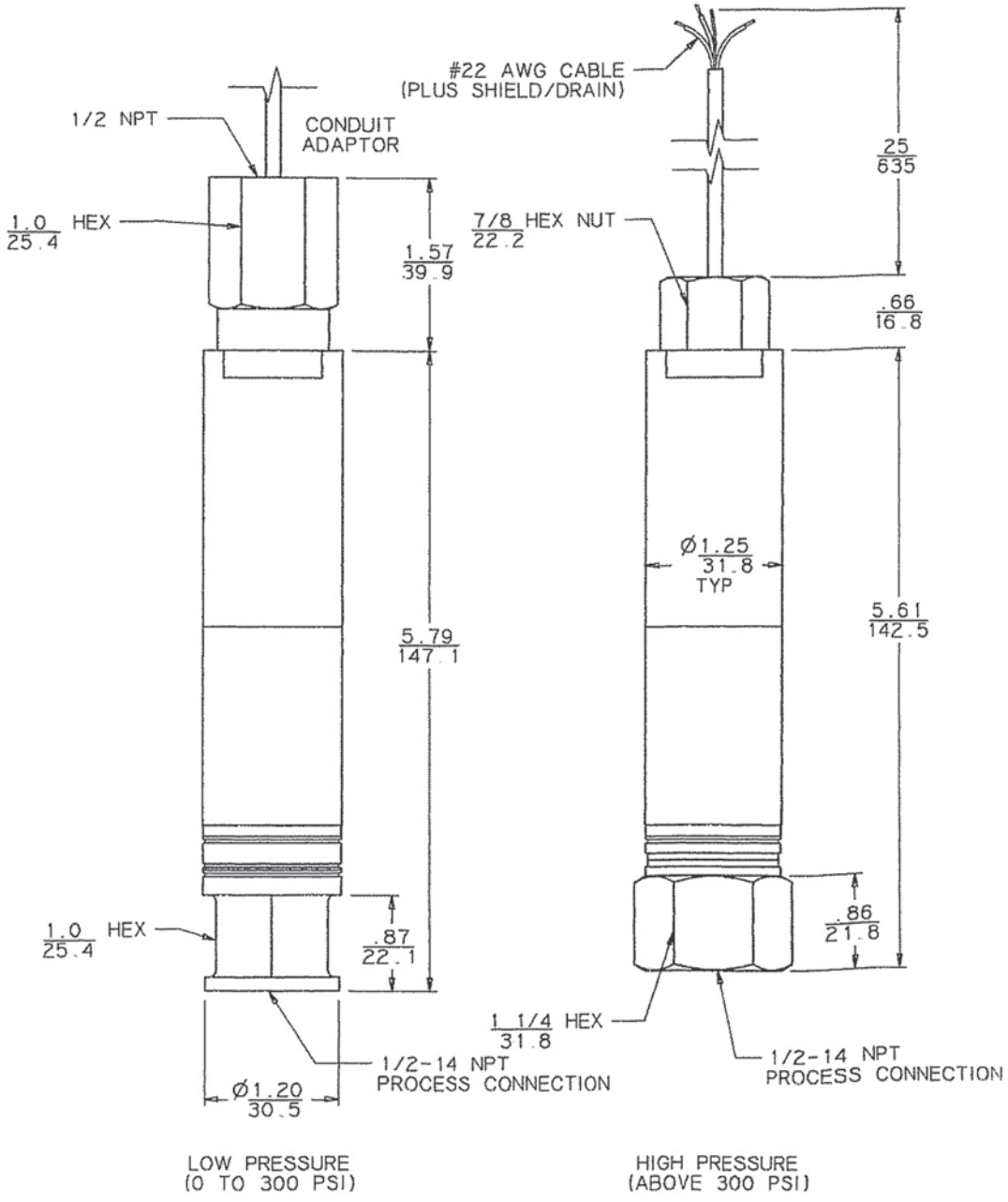

**Turndown:** 5:1 (15 psi = 2.5:1; 30 psi = 2:1 Consult factory if 30 psi with 5:1 is required)
**Zero Adjust:** ±10%
**Span Adjust:** ±10%
**Temperature Limits:**
Electronics (Ambient) -40°F to 140°F (-40"C to 60'C)
Process Interface -40°F to 212°F (-40°C to 100°C)
Storage -40"F to 212'F (-40°C to 100°C)
**Humidity Limits:** 0-100% RH

PERFORMANCE SPECIFICATIONS
**Accuracy:** ± 0.25% of calibrated span including linearity (BFSL), hysteresis and repeatability.
**Response Time:** Time constant of 20 msec.
**Stability:** ± 0.5% of upper range limit for six months.
**Temperature Effect:**
(includes zero & span)
Compensated -20°F to 180'F (-29°C & 82°C)
Between -30°F and 130'F (-1°C & 54°C): ±1% of URL per 50'F (28'C)
Between -20°F and 180'F (-29°C & 82°C): ±1.6% of URL per 50'F (28'C)
**Power Supply Effect:** ± 0.005% FS per volt
**Surge Protection:** Standard
**Vibration Effect:** +-0.1% of upper range @t for 3g to 200 Hz.
**Position Effect:** Zero shifts up to 0.01 psi.
**Overrange Effect:** ± 0.15% FS per 300% of max range

**PHYSICAL SPECIFICATIONS**
**Materials of Construction**
Process Wetted Parts: 316L SS
Diaphragm (Model 85 IF): HASTELLOY C
Non Wetted Parts: 316SS, Buna N "O" Ring Seal
Fill Fluid: DC 200 Silicone (Standard)
Process Connection: Reference Model Code
Electrical Connection: Reference Model Code
Weight: 1 lb.
Cable Length: 24 inches (61 cm), 22 AWG

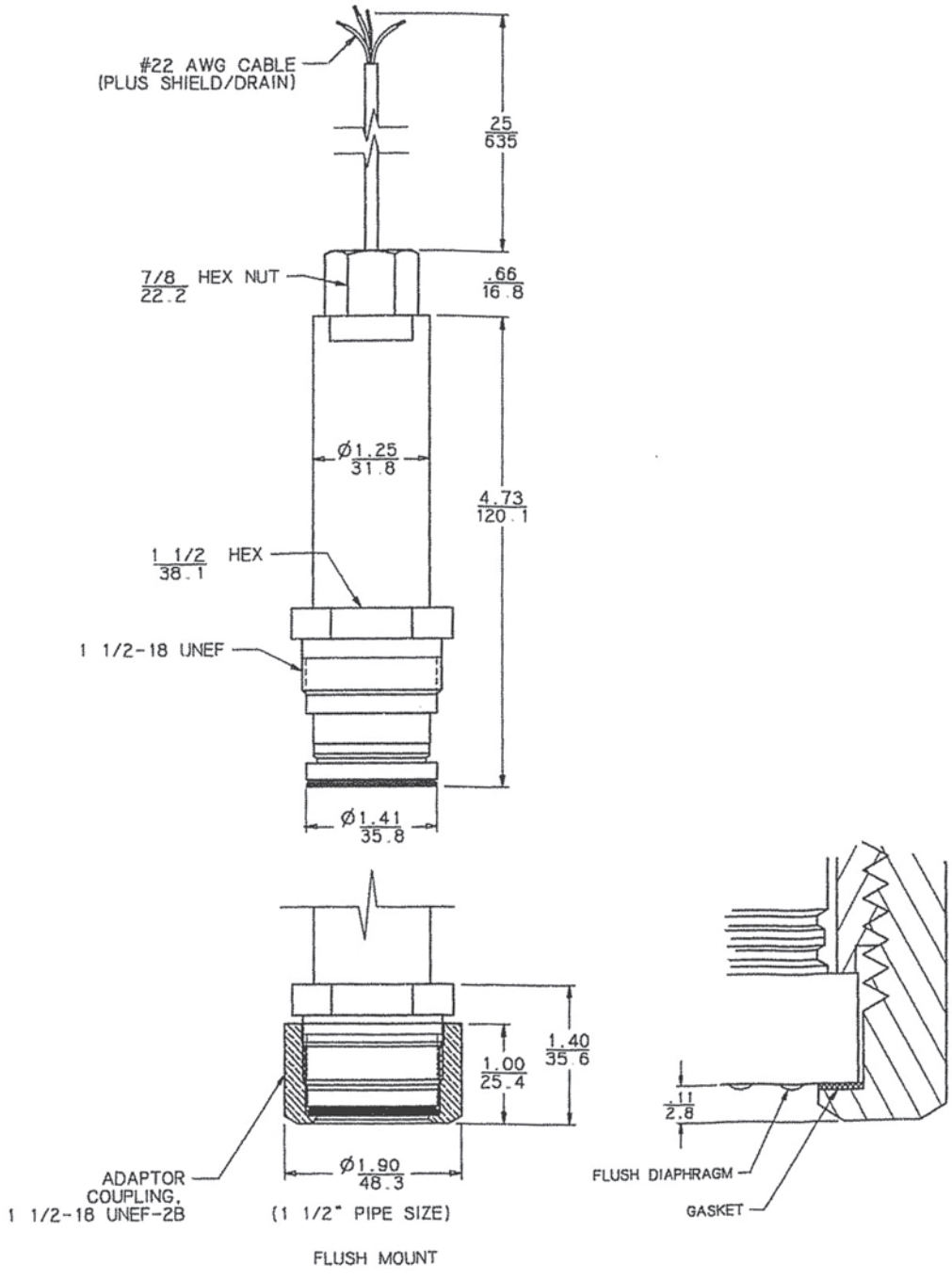


## SECTION I SPECIFICATIONS





## SECTION I SPECIFICATIONS





## SECTION I SPECIFICATIONS

### CLASSIFICATION (FM & CSA)

**FACTORY MUTUAL APPROVALS:**
Models with conduit electrical connection (Option 'C") are FM approved as Explosion-proof for Class 1, Div. 1, Groups C & D; Dust-ignition proof for Class 11, Div. 1, Groups E & G and suitable for Class III, Div. 1; Hazardous Locations, NEMA 4 enclosure. Conduit seal must be within 18 inches of transmitter.

**CANADIAN STANDARDS**

**ASSOCIATION (CSA) APPROVALS:**
All models meet CSA requirements for intrinsically safe operation in Hazardous Locations as designated by Class 1, Div. 1, Groups A,B,C, & D and Class II, Groups F,E, & G.

Models with conduit electrical connection (Option "C") meet CSA requirements for Explosion-proof in Hazardous Locations as designated by Class I, Div. 1, Groups B,C, & D, Class II, Groups E,F, &.G and Class III. The enclosure meets CSA requirements for Enclosure 4.

**NOTE:** "Exia" is defined as Intrinsically Safe Securite Intrinseque.

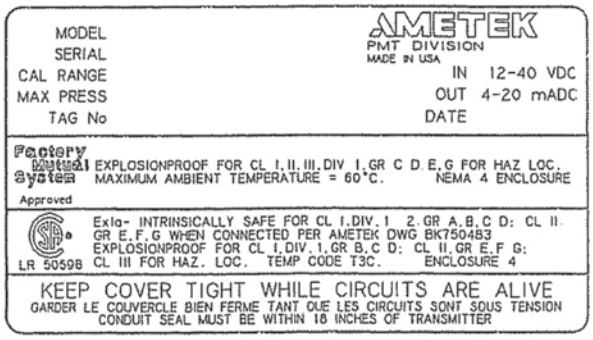
**BARRIER REMARKS:**

A. Installation of barrier should be in accordance with the manufacturer's instructions.

CSA - Figure 2-5.

B. Barrier output terminals should not be exposed without de-energizing all system input power.

C. Resistance from barrier to ground should not exceed one ohm, and non-hazardous location equipment associated with this system shall not employ or generate in excess of 250 V rms (360 volts peak).





## SECTION II INSTALLATION

### PIPING FOR THE MODEL 851T

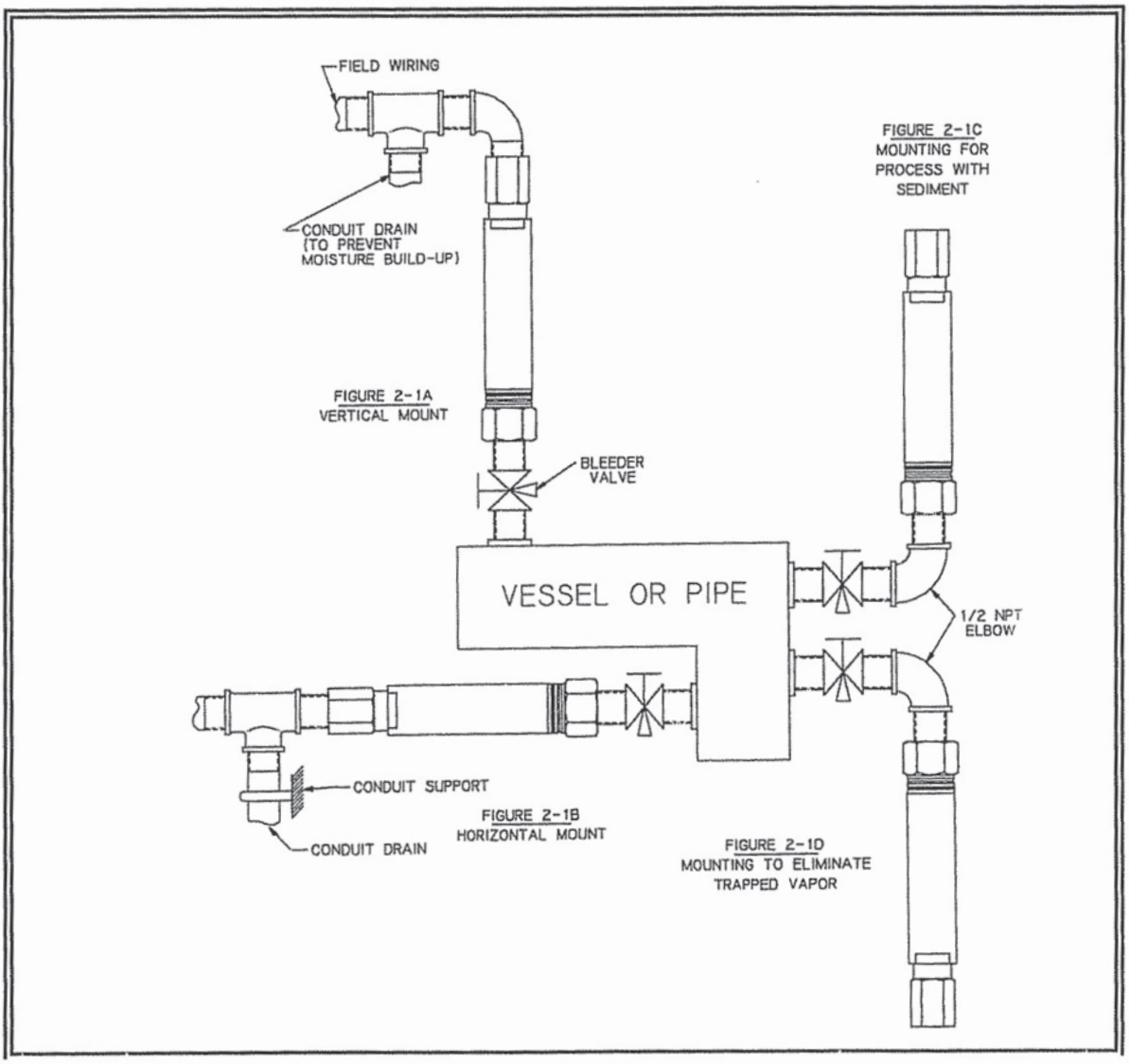
Transmitter mounting is shown in Figure 2-lA and 2- 1B, of Figure 2-1, below.

Conduit drain should be provided to prevent moisture buildup in the conduit compartment

Figure 2- IC shows a transmitter mounting with an elbow used to prevent sediment in process from clogging the line.

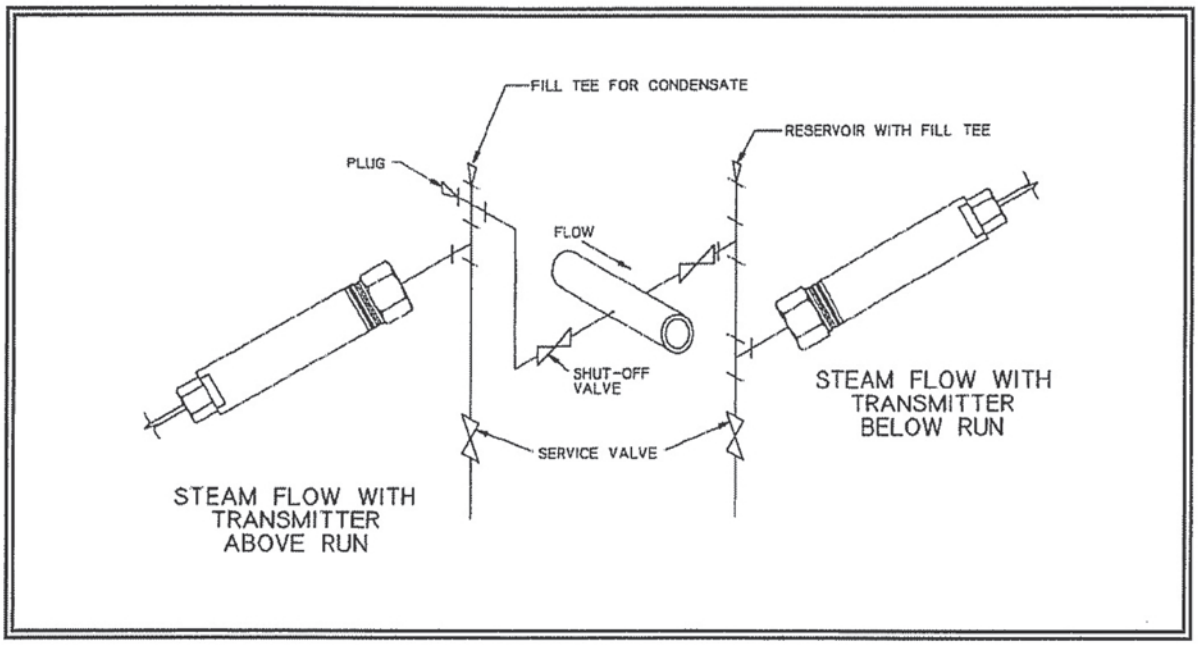
Figure 2-1D shows a transmitter mounting with an elbow used to eliminate trapped vapor.

Figure 2-2 shows steam piping diagrams.





## SECTION II INSTALLATION





## SECTION II INSTALLATION

### PIPING FOR THE MODEL 851F

**CAUTION** – The Model 851F is shipped with a Protective cover over the flush diaphragm. Do not damage the diaphragm after removing the cover.

To install the Model 851F, the adapter coupling must be welded to the customer's pipe @ pipe flange, or other fitting. Figure 2-3 shows some suggested installations and lists suggested pipe sizes, wall and flange thicknesses and hole sizes. The installation procedure is as follows:

1. Cut hole for adaptor coupling.

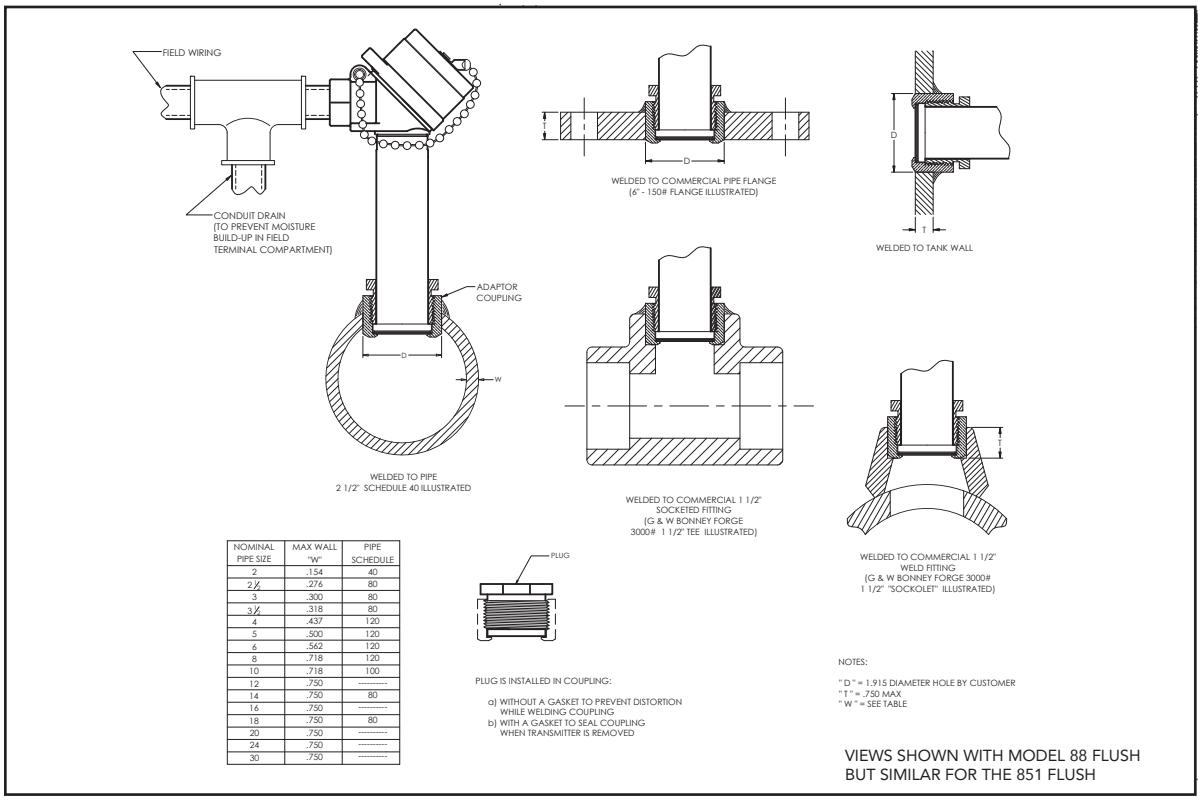
2. Thread plug into the coupling (Figure 2-3) until it bottoms. Do not use the gasket.

3. Position the coupling so that the inside face is approximately flush with the inside surface of the customer's pressure vessel and tack weld the coupling to hold in place.

4. With the plug still in the coupling, weld a 1/8" fillet all around the coupling. The plug minimizes the distortion of the coupling due to the welding operation.

5. Remove the plug.

6. Install the gasket into the coupling (Figure 2-3). Insert the Model 851F into the coupling by screwing the threaded retainer (part of the Model 851F) into the coupling until the gasket just starts to compress. Tighten the retainer another 1/6 revolution (one hex flat).




| NOMINAL PIPE SIZE | MAX WALL "W" | PIPE SCHEDULE |
|---|---|---|
| 2 | .154 | 40 |
| 2½ | .276 | 80 |
| 3 | .300 | 80 |
| 3½ | .318 | 80 |
| 4 | .437 | 120 |
| 5 | .500 | 120 |
| 6 | .562 | 120 |
| 8 | .718 | 120 |
| 10 | .718 | 100 |
| 12 | .750 | ---------- |
| 14 | .750 | 80 |
| 16 | .750 | ---------- |
| 18 | .750 | 80 |
| 20 | .750 | ---------- |
| 24 | .750 | ---------- |
| 30 | .750 | ---------- |



## SECTION II INSTALLATION

### WIRING

**NOTE** - An optional 1/2 NPT female conduit connection on the Model 851 provides entry for customer's wires and conduit fitting. It is suggested that a conduit drain be installed to keep moisture out. Explosion proof applications require that the explosion proof conduit seal be installed within eighteen inches of the transmitter.

**CAUTION** - Power must be off while connections are made to the terminals.

There are three terminals ( + signal, - signal and ground) located on the terminal board in the terminal compartment. The transmitter housing is normally grounded. The circuit is protected from reversing Polarity. The connection terminals of the transmitter will accept a stripped wire lead from No. 14 AWG to No. 22 AWG.

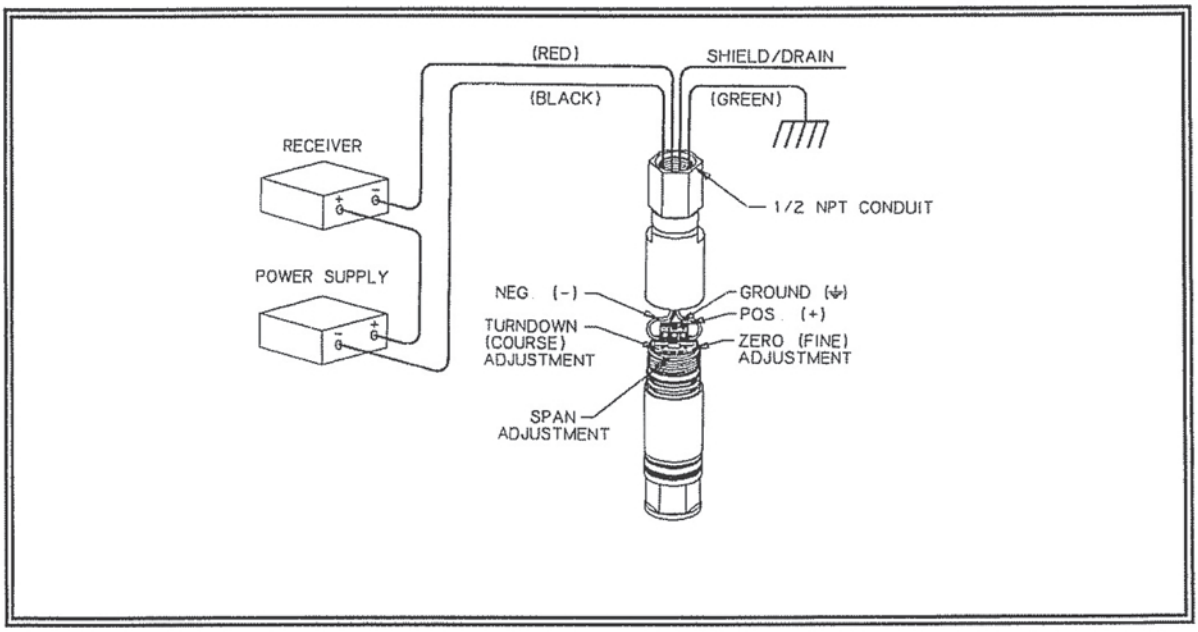
To wire the transmitter to a receiver and power supply:

1. Install a wire between the negative terminal (black wire) of the transmitter and the negative terminal of the power supply. (see Figure 2-4)
2. 2.Install a wire between the positive terminal (red wire) of the transmitter and the negative terminal of the receiver. (see Figure 2-4).
3. 3.Install a wire between the positive terminal of the power supply and the receiver.
4. 4.If the case is to be grounded, use the ground position (green wire) on terminal provided for this purpose. (see Figure 2-4).

**NOTE** - In order to avoid 'Ground Loop" conditions, there should be only one ground in a loop.

**NOTE** - The split body and conduit adapter must be closed tightly to ensure explosion proof design.

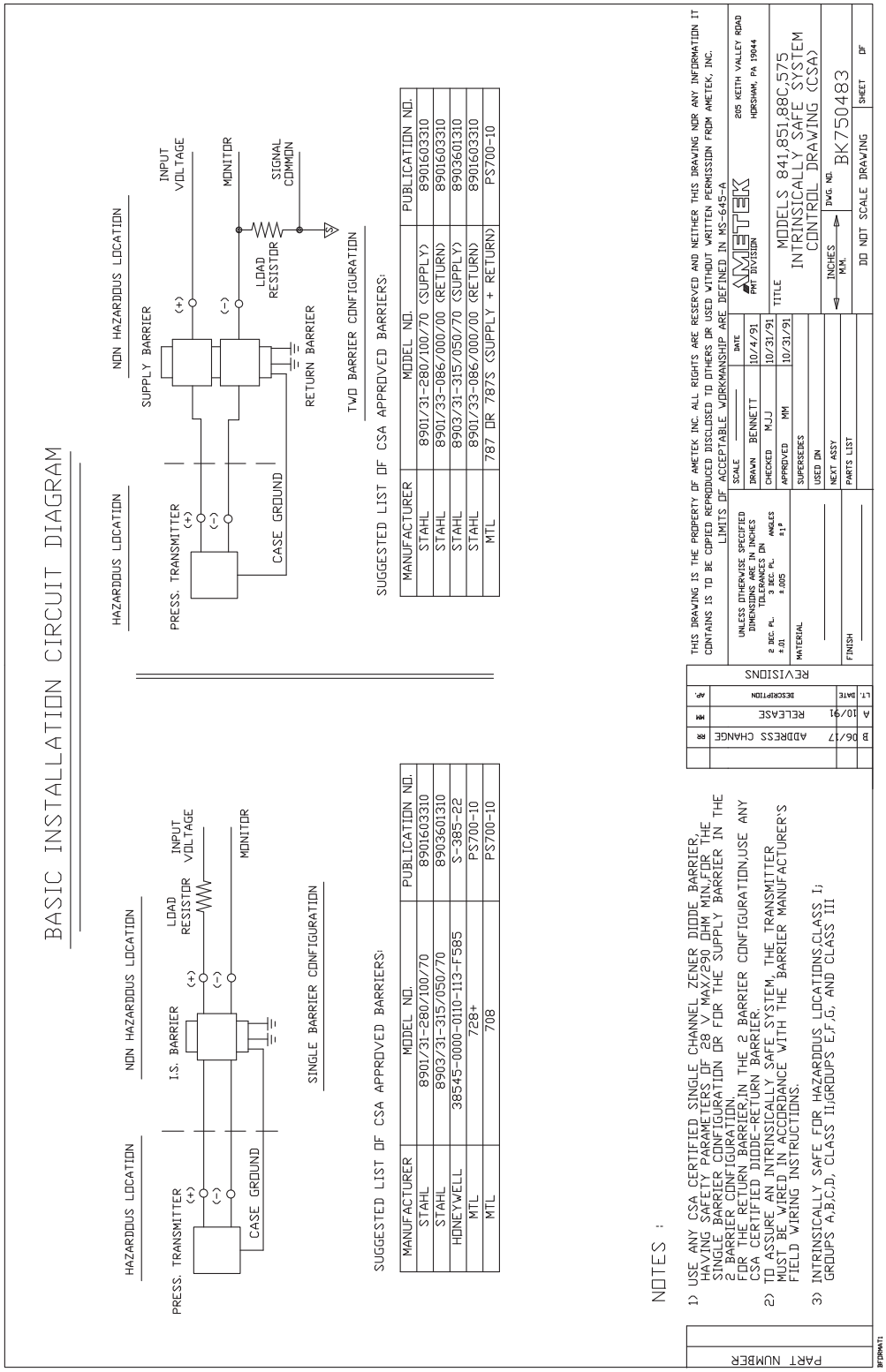
**NOTE** - The Shield/Drain is normally tied to ground at the receiver for optimal noise rejection.





## SECTION II

## INSTALLATION







# OPERATION

## PRINCIPLE OF OPERATION

The Model 851 Pressure Transmitter series is designed to continuously measure process pressure. The heart of the Model 851 pressure transmitter is a silicon piezoresistive sensing chip. This miniature microetched semiconductor gives a voltage output proportional to the applied pressure. This chip is isolated from the process media terminal by a stainless steel diaphragm. A silicone oil ). or other specified fill fluid is used to transmit the process pressure to the sensor.

A surface mount amplifier board, enclosed in a sealed chamber, is used to convert the millivolt signal from the sensor to a calibrated 4-20 mA transmitter output. Transmitter electronics are completely surge protected.

Each transmitter is tested over both pressure and temperature ranges. A thick film compensator circuit is used to bring the output of the sensor into specification. After range compensation, every transmitter is tested a second time for pressure and temperature effects to ensure that it meets performance specifications.

## ADJUSTMENTS

There are three adjustments which are located in the terminal compartment; zero, span, and turndown.

### Zero Adjustment (Z)

Offsets due to elevation or suppression of approximately 10% full scale can be adjusted using the zero adjustment (pot).

### Span Adjustment (S)

Span can be adjusted approximately 10% full scale using the span adjustment terminal (pot).

The span adjustment terminal (pot) is used as a fine span adjustment.

### Turndown Adjustment (T) *5:1*

Range turndown of approximately 80% full scale can be reached using the turndown (T) adjustment terminal. For example a transmitter with a full scale pressure of 100 psi can be "turned down" to 20 psi and still maintain a 4-20 mA output.

The turndown adjustment terminal (pot) can be used as a coarse span adjustment.



# SECTION IV CALIBRATION

## FACTORY CALIBRATION

The Model 851 Transmitters are factory calibrated at maximum range and ambient temperatures unless otherwise specified.

**NOTE** - Power must be off while connections are made to tile terminals.

## PIPING FOR CALIBRATION

The Model 851 Transmitter can be calibrated out-of-system.

Figure 4-2 shows an out-of -system piping diagram.

## CALIBRATION INSTRUMENTATION

**NOTE** – Calibration equipment should be accurate to five times the accuracy of the transmitter.

The Model 851 Transmitter can be calibrated using an ammeter or voltmeter Figure 4-3.

Use an ammeter with internal shunt impedance greater than 10 ohms will give erroneous readings.

Use a voltmeter with a 10 ohm precision resistor connected as shown in Figure 4-3.

## CALIBRATION PROCEDURE

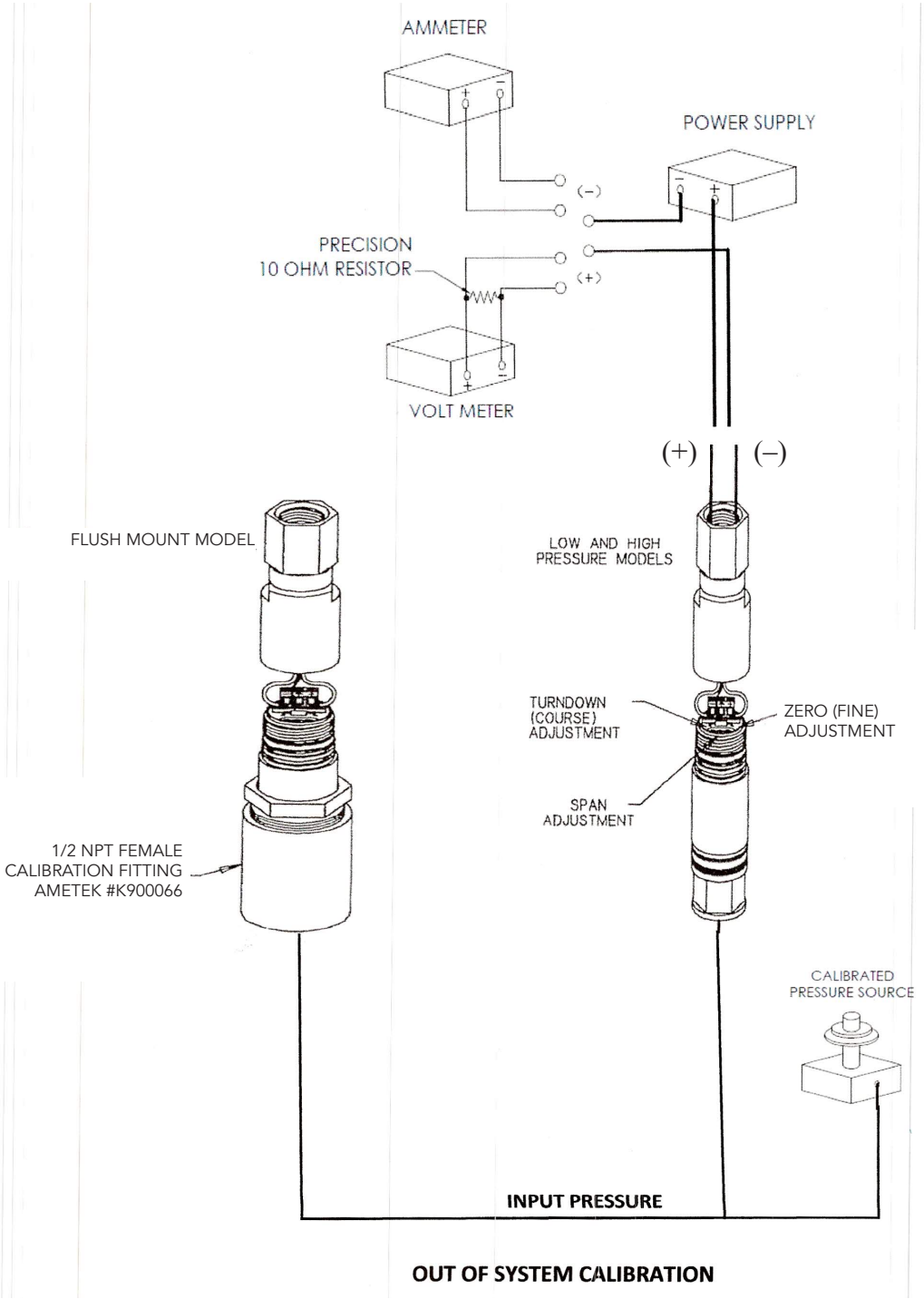
The Model 851 Transmitter can be calibrated using the standard 24" cable supplied with the transmitter.

**NOTE** - Model 851F calibration requires calibration fittings (Ametek Part No. K900066) or an adapter coupling welded into a fitting to which the customer can apply pressure.

1. Apply 0 psi pressure to input.
2. Adjust “Zero” pot to obtain 4mA (40 mV) output.
3. Apply pressure which corresponds to “full scale” pressure to input.
4. Adjust “span” pot to obtain 20 mA (200 mV) output
5. Repeat steps 1 through 4 until output values are achieved.
6. If “span” required differs from previous span by more than 10%, adjust “turndown” pot prior to “span” pot and proceed to step 4.



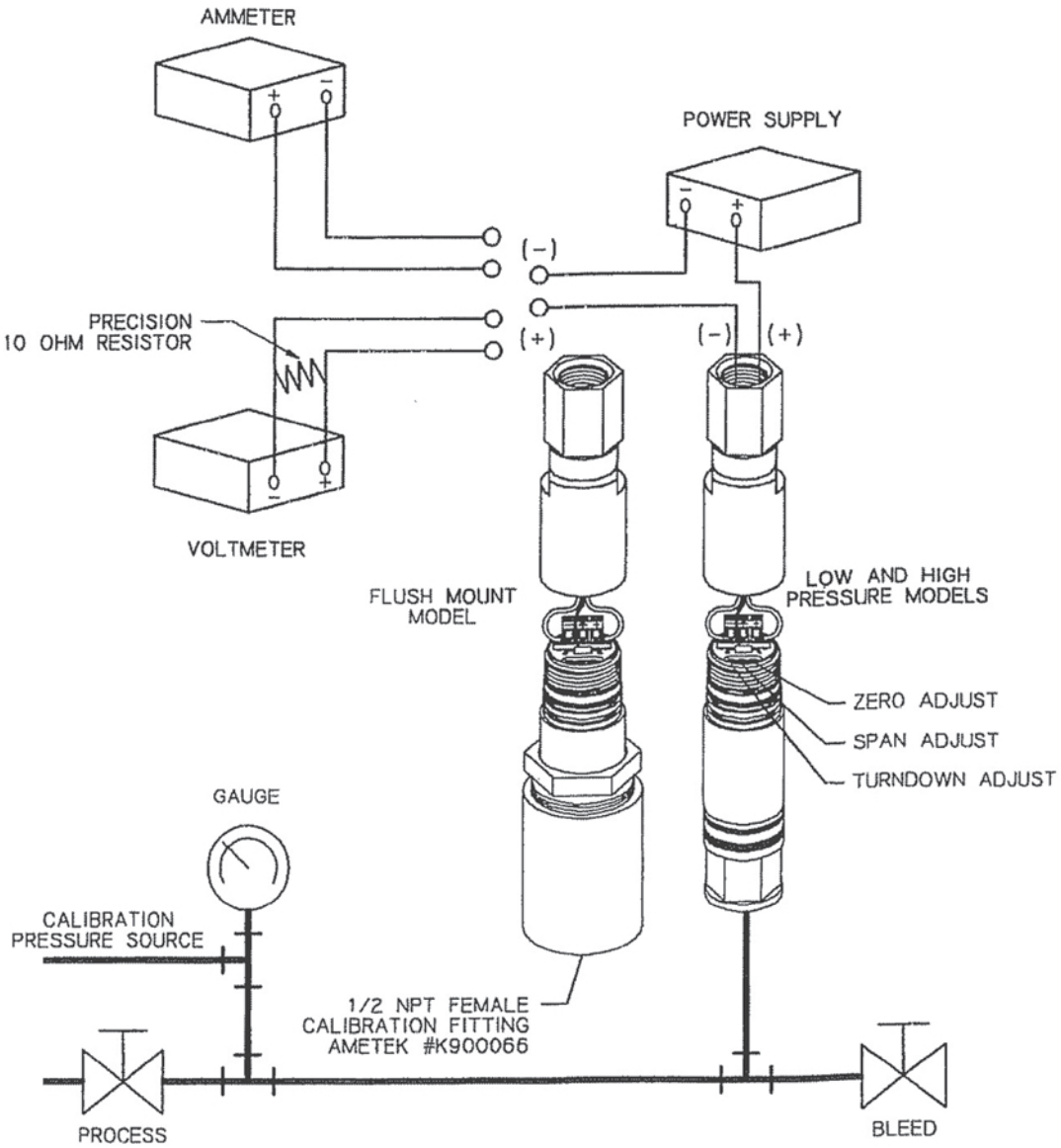
## SECTION IV CALIBRATION




**OUT OF SYSTEM CALIBRATION**



## SECTION IV CALIBRATION





## SECTION V

## SERVICE & PARTS

### FACTORY SERVICE

Factory or field service is available by contacting the Customer Service Department. Supply the following information:

1. Instrument Model Number and Serial Number as shown on the Instrument Data Tag.
2. Description of the problem being experienced.
3. Description and location of the Installation.

For service:

TELEPHONE: (215) 674-1234
E-MAIL: mctpmt.sales@ametek.com

### PARTS - ORDERING

When ordering replacement parts, supply the following information:

1. Part description and part number.
2. Quantity of each item required.

Mail, Telephone, Fax or Email orders to:
AMETEK
PMT PRODUCTS
205 KEITH VALLEY ROAD
HORSHAM, PA 19044

TELEPHONE: (215) 674-1234
E-MAIL: mctpmt.sales@ametek.com

### ACCESSORIES AND SPARE PARTS (851F ONLY)

| Part No. | Description |
|---|---|
| K240231 | 316 Stn. Stl. Adaptor Coupling |
| K080343 | Plug |
| K230048 | Teflon Gasket |
| K900066 | Calibration Fitting for 851F flush models |



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