



Model 88 Series

PRESSURE TRANSMITTER



AMETEK®

Model 88
User Manual
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Model 88 Series

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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 in relation to a particular procedure or condition.

INTRODUCTION

The Model 88 is a series of pressure transmitter products featuring zero and span field adjustability, 5:1 pressure range turndown, all 316 stainless steel construction in a durable and cost effective package. The transmitters provide 4-20mA output, $\pm 0.25\%$ accuracy and agency approvals for intrinsically safe apparatus and explosion proof in hazardous locations.

Model 88C and Model 88F carry agency approval from Factory Mutual and Canadian Standards Association for explosion proof operation in hazardous locations. Canadian Standards Association for intrinsically safe approval is also carried.

AMETEK PMT Products

205 Keith Valley Road
Horsham, PA 19044
U.S.A.

Tel: 215-674-1234

Email: mctpmt.sales@ametek.com



WARRANTY POLICY

AMETEK ["Seller"] warrants the following listed products.

Model 88C	5 Years
Model 88F	1 Year

Ametek warrants these products from the date of shipment and that all products manufactured by the seller are free from defects of material and workmanship when used within the service, range, and purpose for which they were manufactured. Seller will, at its option, repair, replace, or refund the purchase price of parts found by Seller to be defective in material or workmanship provided that written notice of such defect requesting instructions for repair, replacement, or refund is received by Seller at the address below within the warranty period and provided that any instructions thereafter given by Seller are complied with.

This warranty shall not apply (i) to the performance of any system of which Seller's products are a component part, (ii) to deterioration by corrosion or any cause of failure other than defect of material or workmanship, or (iii) to any of Seller's products or parts thereof which have been tampered with or altered or repaired by anyone except Seller or someone authorized by Seller, or subjected to misuse, neglect, abuse or improper use or misapplication such as breakage by negligence, accident, vandalism, the elements, shock, vibration, or exposure to any other service, range, or environment of greater severity than that for which the products were designed.

SELLER MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF FITNESS OR OF MERCHANTABILITY WITH RESPECT TO ITS PRODUCTS, OR ANY PART THEREOF, OTHER THAN AS EXPRESSLY SET FORTH ABOVE. NOR SHALL SELLER HAVE INCURRED ANY OTHER OBLIGATIONS OR LIABILITIES OR BE LIABLE FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHARGES, OR ANY OTHER LOSSES INCURRED IN CONNECTION WITH THE PURCHASE, INSTALLATION, REPAIR, OR OPERATION OF ITS PRODUCTS (INCLUDING ANY PARTS REPAIRED OR REPLACED).

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



SECTION I

SPECIFICATIONS

DESCRIPTION

The Model 88 is a durable and cost effective full featured pressure transmitter. A fully 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. All Model 88 transmitters meet NACE standards for offshore applications.

The small size and lightweight of the Model 88 eliminate the need for bulky mounting hardware and mechanical supports. A lightweight mounting bracket may be all that is required for installation. The integral junction box permits simple field wiring without the need for additional hardware, adding to the speed and ease of installation.

A 4-20mA output is standard with a 12-40VDC power supply. With all 316 stainless steel welded construction, the Model 88 is compatible with corrosive media and hazardous environments.

FUNCTIONAL SPECIFICATIONS

Service: Liquid, Gas or Vapor

Range Limits:

For specific pressure range codes reference model code on preceding pages.

Output: 4-20 mADC, limited to 30 mADC

Power Supply: 12 to 40VDC with reverse polarity protection

Zero Adjust: 10%

Span Adjust: 10%

Turndown: 5:1, (15 PSI = 2.5:1; 30 PSI = 2:1 standard. Consult factory if 30 psi with 5:1 is required.)

Temperature Limits:

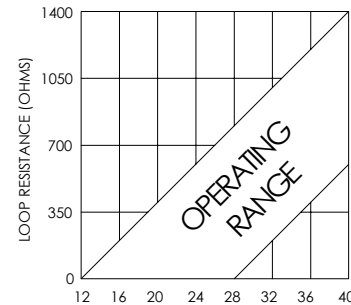
Electronics (Ambient) -40°F to 140°F (-40°C to 60°C).

Over-range: 300% Upper Range Limit (URL)

Humidity Limits: 0-100% RH

Note 1: For intrinsically safe operation reference Barrier Entity Requirements for power supply limits.

Loop Resistance: 1400 ohms max @40 volts



Supply Voltage

PERFORMANCE SPECIFICATIONS

Accuracy: ±0.25% of calibrated span including linearity (BFSL), hysteresis and repeatability (±0.50% on 6 PSI)

Response Time: Time constant of 20 milliseconds

Stability: ±0.5% URL for six months

Temperature Effect:

(includes zero & span)

Compensated -20°F to 180°F (-29°C to 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 URL for 3g to 200Hz.

Overrange Effect: ±0.15% FS per 300% of max range

PHYSICAL SPECIFICATIONS

Materials of Construction

Process Wetted Parts: 316LSS

Non Wetted Parts: 316SS

Cast Head: CF-8M (316 CastSS)

“O”Ring: Buna N

Fill Fluid: DC 200 Silicone (Standard) Mineral (Optional)

Process Connection: Reference Specific Model

Electrical Connction: 1/2” NPT Female

Weight: 1.67 Lbs (.76KG)



Model 88C Series Transmitter

MODEL NUMBERING

Transmitter Type

88 Electronic Pressure Transmitter

Agency Approval

C Approved by Factory Mutual (FM) & Canadian Standards Association (CSA) for Explosion Proof; Approved by CSA for Intrinsic Safety.

Pressure Range

	PSI	BAR
001	3-15 PSIG	0.2 TO 1
002	0-3 TO 0-15 PSIG	0-0.4 TO 0-1
003	0-15 TO 0-30 PSIG	0-1 TO 0-2
004	0-20 TO 0-100 PSIG	0-1.4 TO 0-7
005	0-60 TO 0-300 PSIG	0-4 TO 0-20
006	0-200 TO 0-1000 PSIG	0-14 TO 0-70
007	0-600 TO 0-3000 PSIG	0-41 TO 0-200
008	0-1000 TO 0-5000	0-70 TO 0-350

Other ranges available upon request. Please contact mctpmt.sales@ametek.com or call 215-674-1234.

Material

	BASE MATERIAL	DIAPHRAGM MATERIAL	FILL FLUID	PROCESS CONNECTOR
A	316 SS	316 SS	SILICONE OIL	½" Female NPT
B	316 SS	316 SS	MINERAL OIL *	½" Female NPT
H	316 SS	HASTELLOY C	SILICONE OIL	½" Female NPT

*Contact factory for availability

Output

2 4-20mA

Calibration range (specify)

Will be calibrated at the maximum range in psi if not specified.

88	C	004	A	2	0 to 50 psi
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Example above: Model 88C, 0-20 to 0-100 PSIG, 316 SS Base and Diaphragm, Silicone Fill, 1/2" Female NPT Process Connector, 4-20mA output, calibrated to 50 psi.



Model 88F Series Transmitter

MODEL NUMBERING

Transmitter Type

88F Electronic Pressure Transmitter

Pressure Range

	PSI	BAR
002	= 0-3 to 0-15 PSIG	0-0.2 TO 0-1 BAR
003	= 0-15 TO 0-30 PSIG	0-1.0 TO 0-2 BAR
004	= 0-20 TO 0-100 PSIG	0-1.4 TO 0-7 BAR
005	= 0-60 TO 0-300 PSIG	0-4 TO 0-20 BAR

Other ranges available upon request.

Material

	BASE MATERIAL	DIAPHRAGM MATERIAL	FILL FLUID	PROCESS CONNECTOR
A	316 STN STL HOUSING	HASTELLOY C276	SILICONE	1 ½" Pipe Coupling
B	316 STN STL HOUSING	HASTELLOY C276	MINERAL OIL *	1 ½" Pipe Coupling
F	316 STN STL HOUSING	HASTELLOY C276	FLUOROLUBE	1 ½" Pipe Coupling
L	316 STN STL HOUSING	316 STN STL	MINERAL OIL *	1 ½" Pipe Coupling

*Contact factory for availability

Output

2 4-20mA

Agency Approval

FM Approved by Factory Mutual (FM) for Explosion Proof. This selection also provides option "CS" as defined below.

CS Approved by Canadian Standards Association (CSA) for Intrinsic Safety and Explosion Proof. This selection also provides option "FM" as defined above.

Coupling

SC	316 stainless steel coupling with Teflon® gasket
PC	316 stainless steel plug & coupling with Teflon® gasket
NC	No coupling or gasket

Calibration Range (specify)

Will be calibrated at the maximum range in psi if not specified

88F	004	A	2	CS	PC	(0 to 75 psi)
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Example above: Model 88F pressure transmitter, 100 psi maximum range, 316L stainless steel base, Hastelloy C276 diaphragm, silicone oil fill, 4-20mA ADC output, approved by Canadian Standards Association, 316 stainless steel plug and coupling, calibrated to 0 to 75 psi.

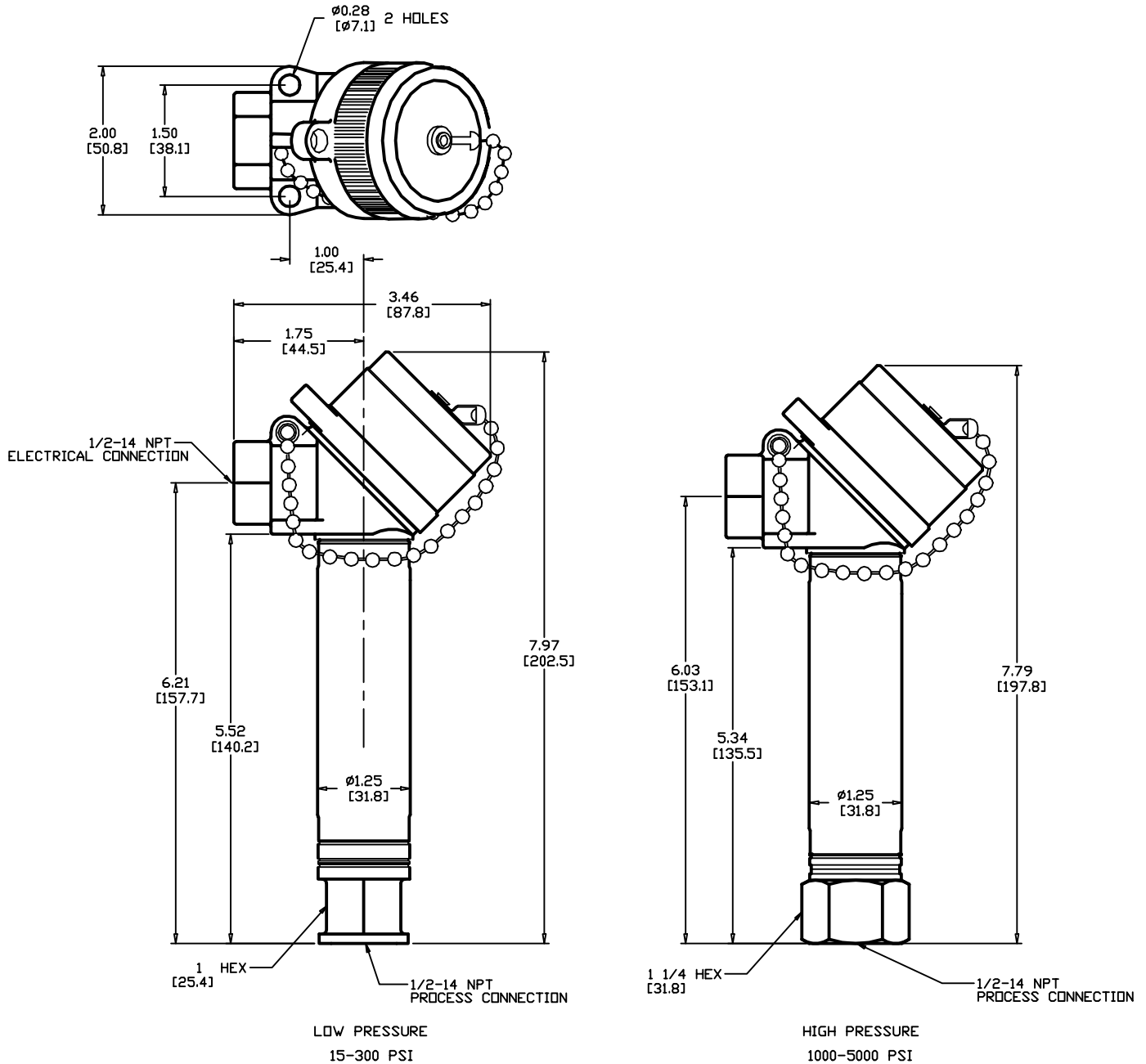


FIGURE 1-1
OUTLINE DIMENSIONS MODEL 88C

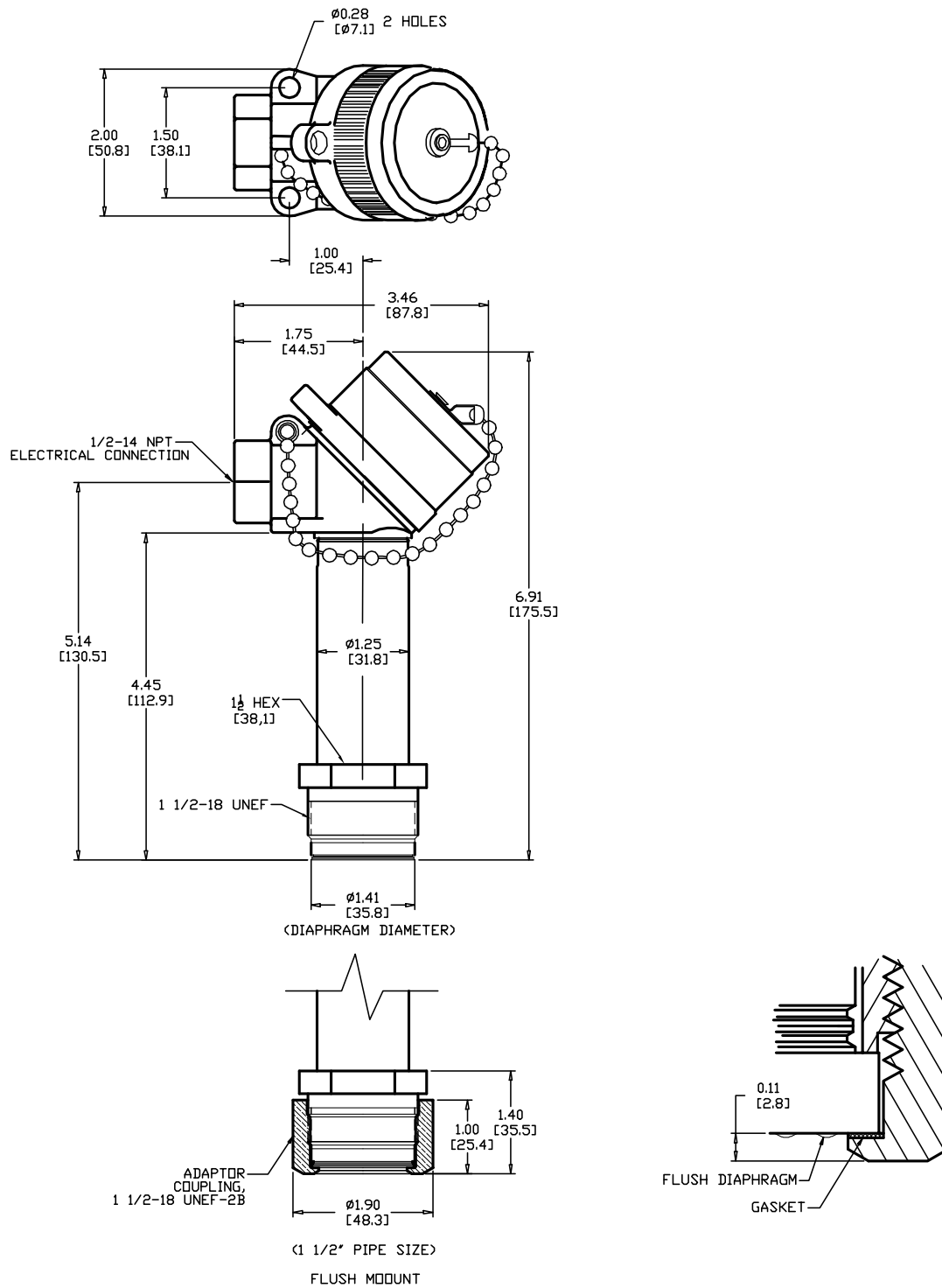


FIGURE 1-2
OUTLINE DIMENSIONS MODEL 88F

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CLASSIFICATION (FM)

All models with a "C" or "F" option are FM approved as Explosion-proof for Class I, Div 1, Groups B, C, D:

Dust-ignition proof for Class II, Div 1, Groups E, F & G and suitable for Class III, Div 1; Hazardous Location, NEMA 4 enclosure. Conduit seal must be within 18 inches of transmitter.

CLASSIFICATION (CSA) CANADIAN STANDARDS ASSOCIATION APPROVALS:

All Models with a "C" or "F" option meet CSA requirements for intrinsically safe operation in Hazardous Locations as designated by Class I, Div. 1 & 2, Groups A, B, C, & D and Class II, Groups E, F & G.

Temperature code T3C.




All models with a "C" or "F" option 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.

BARRIER REMARKS:

- A. Installation of barrier should be in accordance with the manufacturer's instructions.
CSA - Figure 2-4
- 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 Vrms (360 volts peak).

D. Barrier requirements:

CSA - $V_{max}=28$ VDC, $R_{min}=290$ ohms.

MODEL	 205 KEITH VALLEY ROAD HORSHAM, PA 19044 MADE IN USA
SERIAL	
CAL RANGE	
MAX PRESS	
TAG No	
IN 12-40 VDC	OUT 4-20 mADC
DATE	
	EXPLOSIONPROOF FOR CLASS I, II, III, DIV 1, GR B, C, D, E, G FOR HAZARDOUS LOCATIONS CONDUIT SEAL MUST BE WITHIN 18 IN. OF TRANSMITTER MAXIMUM AMBIENT TEMP = 60°C. NEMA 4 ENCLOSURE.
	Exia - INTRINSICALLY SAFE FOR CLASS I, DIV. 1 & 2, GR A, B, C, D: CLASS II, GR E, F, G WHEN CONNECTED PER AMETEK DWG BK750483. TEMP CODE T3C EXPLOSIONPROOF FOR CLASS I, DIV 1, GR B, C, D: CLASS II, GR E, F, G: CLASS III FOR HAZ. LOC. ENCLOSURE 4
LR 50598	
KEEP COVER TIGHT WHILE CIRCUITS ARE ALIVE GARDER LE COUVERCLE BIEN FERME TANT QUE LES CIRCUITS SONT SOUS TENSION	



SECTION 2

INSTALLATION

MODEL 88C PIPING

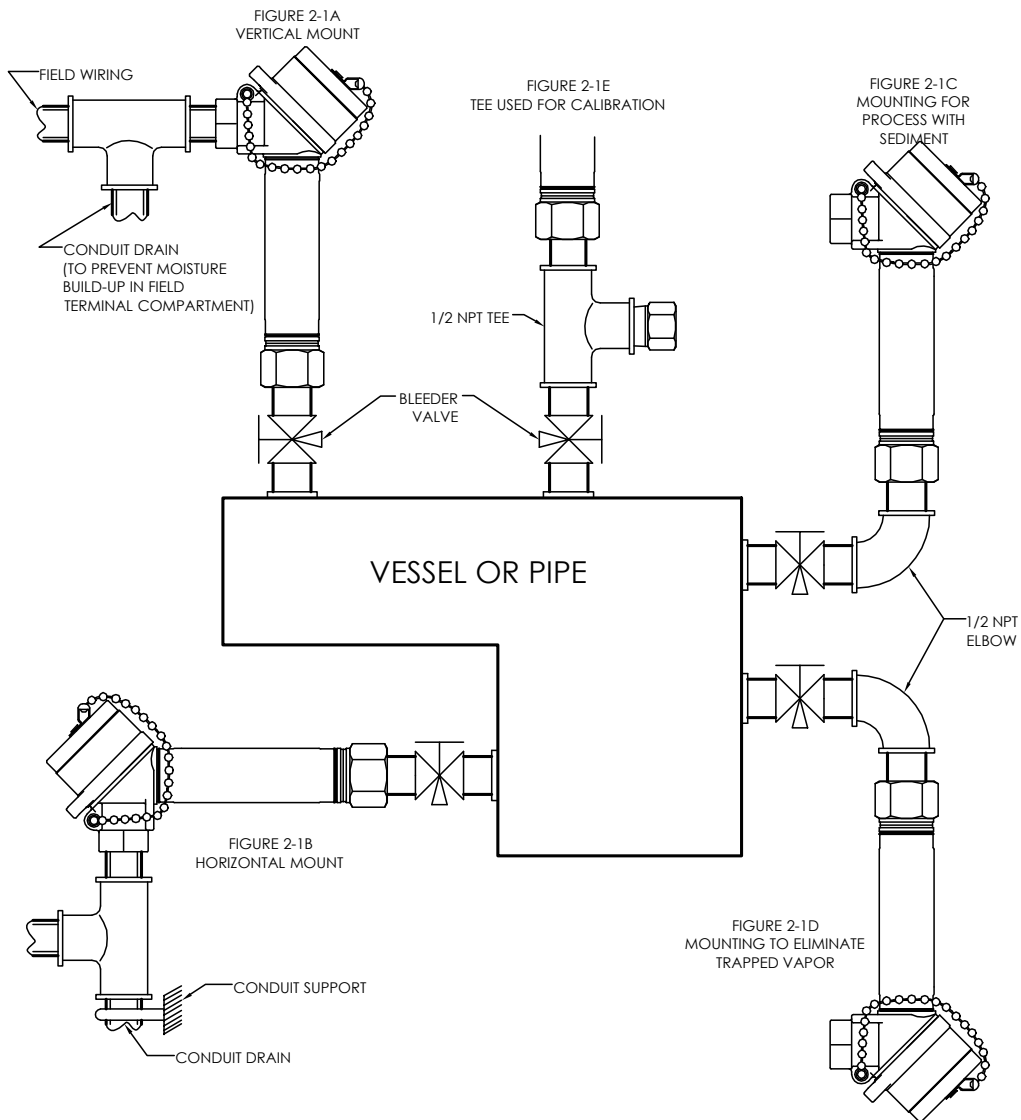
Transmitter mounting is shown in Figure 2-1A and 2-1B of Figure 2-1 below.

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

Figure 2-1C shows a transmitter mounting with an elbow used to prevent sediment in the process from clogging the line.

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

Figure 2-1E shows a tee which can be used for calibration.



**FIGURE 2-1
MODEL 88C PIPING**



MODEL 88F PIPING

CAUTION: The Model 88F is shipped with a protective cover over the flush diaphragm. Do not damage the diaphragm after removing the cover.

To install the Model 88F, the adapter coupling must be welded to the customer's pipe, tank, pipe flange, or other fitting. Figure 2-2 shows some suggested installations and lists suggested pipe sizes. The installation procedure is as follows:

1. Cut hole for adapter coupling.
2. Thread plug into the coupling (Figure 2-2) until it bottoms. Do not use the gasket. (Use of a high temperature anti-seize material is recommended on the plug during welding.)
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 during the welding operation.
5. Remove the plug.
6. Install the gasket into the coupling (Figure 2-2). Insert the Model 88F into the coupling by screwing the threaded retainer (part of the Model 88F) into the coupling until the gasket just starts to compress. Tighten the retainer another 1/6 revolution (one hex flat).

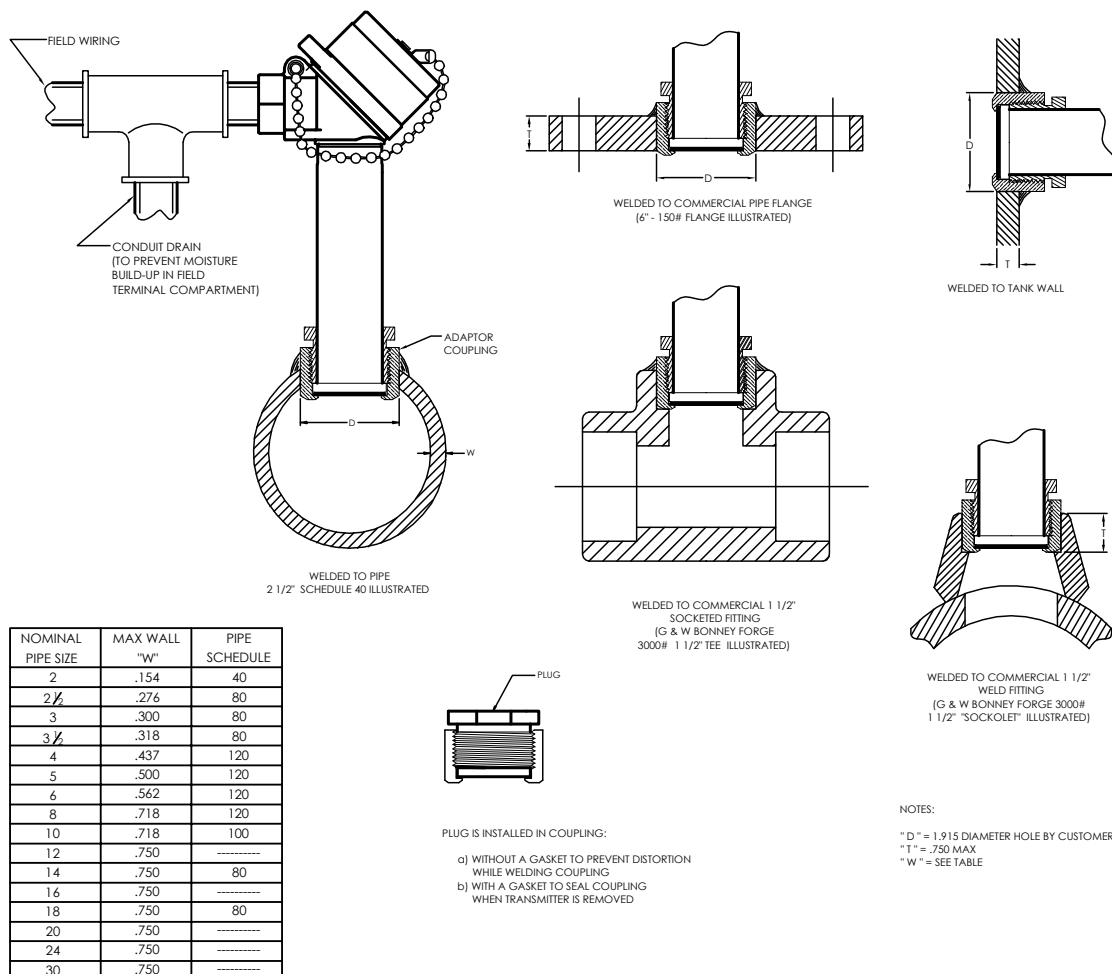


FIGURE 2-2
MODEL 88F PIPING

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WIRING

WARNING: Power must be off while connections are made to the field terminals.

There are two field terminals (+ Signal and - Signal) located on the terminal board in the field terminal compartment. (The circuit is protected from reversing polarity).

To wire the transmitter to receiver and power supply:

1. The field terminal will accept a stripped wire lead from No. 14 AWG to No. 22 AWG.
2. Install wire between the negative terminal of the transmitter and the positive terminal of the receiver, see figure 2-3.
3. Install wire between the positive terminal of the transmitter and the positive terminal of the power supply, see figure 2-3.
4. Install wire between the negative terminal of the receiver and the negative terminal of the power supply, see figure 2-3.

5. The transmitter housing should be connected to earthground for safety reasons. Figure 2-3 shows the case ground screw that is to be used to attach a properly grounded safety wire.

6. Seal wires entering the housing with sealing compound to prevent water from entering the field terminal compartment.

There are two test terminals (TP+ and TP-) located on the terminal board in the field terminal compartment.

Test terminals have the same output signal (4 to 20mA DC) as the signal terminals and are provided as an in-circuit monitor, see Figure 2-3.

NOTE: The cover must be closed tightly to ensure explosion proof design.

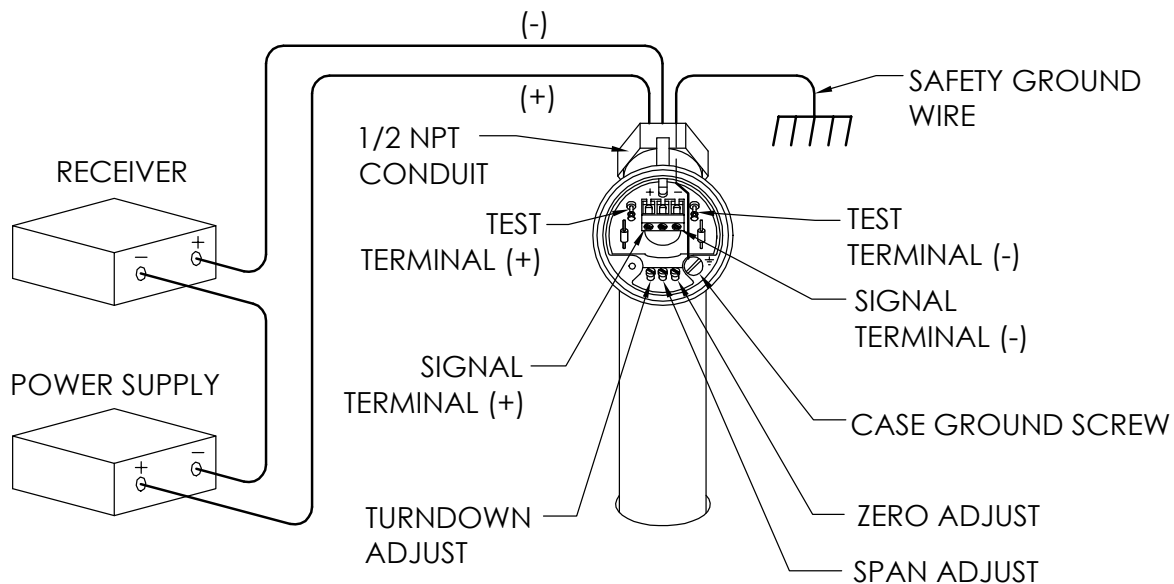
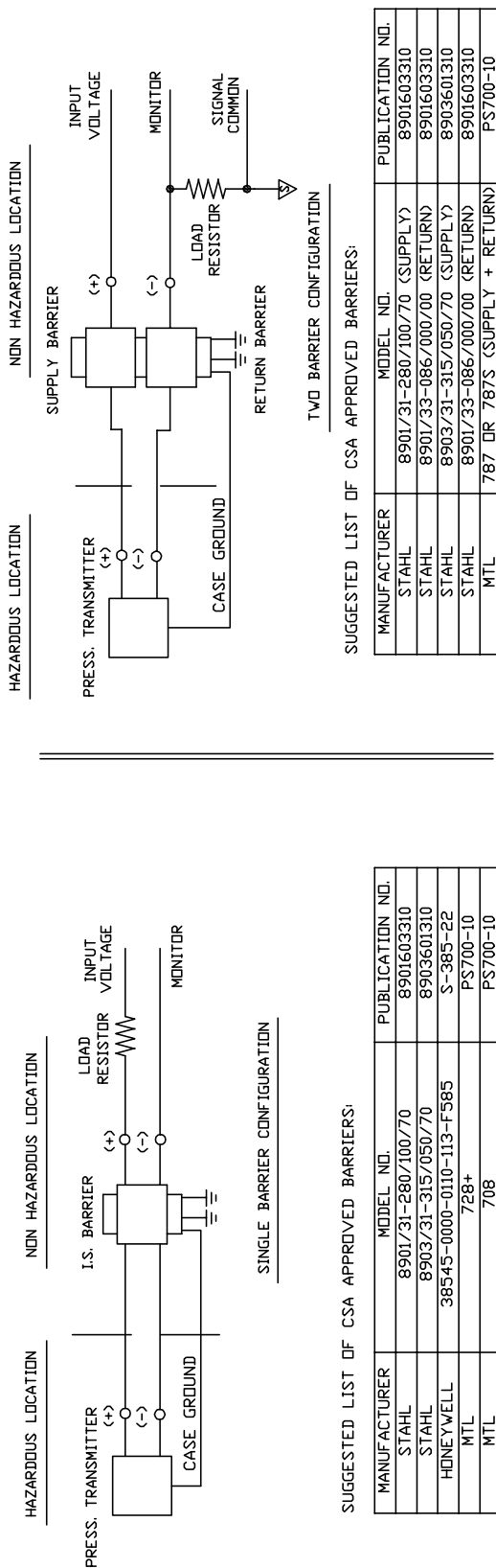


FIGURE 2-3
MODEL 88F WIRING



BASIC INSTALLATION CIRCUIT DIAGRAM



NOTES :

- 1) USE ANY CSA CERTIFIED SINGLE CHANNEL ZENER DIODE BARRIER HAVING SAFETY PARAMETERS OF 28 V MAX/290 OHM MIN FOR THE SINGLE BARRIER CONFIGURATION OR FOR THE SUPPLY BARRIER IN THE 2 BARRIER CONFIGURATION.
- 2) FOR THE RETURN BARRIER IN THE 2 BARRIER CONFIGURATION, USE ANY CSA CERTIFIED DIODE-RETURN BARRIER. THE TRANSMITTER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS.
- 3) INTRINSICALLY SAFE FOR HAZARDOUS LOCATIONS, CLASS I, GROUPS A, B, C, D, CLASS II, GROUPS E, F, G, AND CLASS III

FIGURE 2-4
WIRING INTRINSICALLY SAFE (CSA)



SECTION 3

OPERATION

PRINCIPAL OF OPERATION

The Model 88 Pressure Transmitter series is designed to continuously measure process pressure. The heart of the Model 88 series 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 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 4-20mA 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 compensation, every transmitter is tested a second time for pressure and temperature effects to ensure that it meets performance specifications.

ADJUSTMENTS

There are three adjustment potentiometers (pots) located in the field terminal compartment. These potentiometers (pots) are used to adjust the 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 terminal (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 range of 100psi can be "turned down" to 20psi and still maintain a 4-20mA output.

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



SECTION 4

CALIBRATION

FACTORY CALIBRATION

The Model 88 Transmitters are factory calibrated at maximum range and ambient temperature unless otherwise specified.

CAUTION: Power must be off while connections are made to the field terminals.

PIPING FOR CALIBRATION

The Model 88 Transmitter can be calibrated in-system or out-of-system.

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

Figure 4-3 shows an in-system piping diagram (includes a tee for calibration). The bleeder valve should block the process.

CALIBRATION INSTRUMENTATION

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

The Model 88 Transmitter can be calibrated using an ammeter or voltmeter (Figure 4-3).

Use an ammeter with internal shunt impedance less than 10 ohms. An 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 88 Transmitter can be calibrated using the test terminals or field terminals.

Outputs using an ammeter are in mA with a resolution of 0.01 mA.

Outputs using a voltmeter and a 10 ohm resistor are in mV with a resolution on 0.1 mV.

Calibration procedure setup in Figure 4-3.

1. Apply 0 psi pressure to input.
2. Adjust "Zero" pot to obtain 4mA (40mV)* output.
3. Apply pressure which corresponds to "full scale" pressure to input.
4. Adjust "span" pot to obtain 20mA (200mV)* output.
5. Repeat steps 1 thru 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.

*Using 10 ohm resistor as shown in Figure 4-3

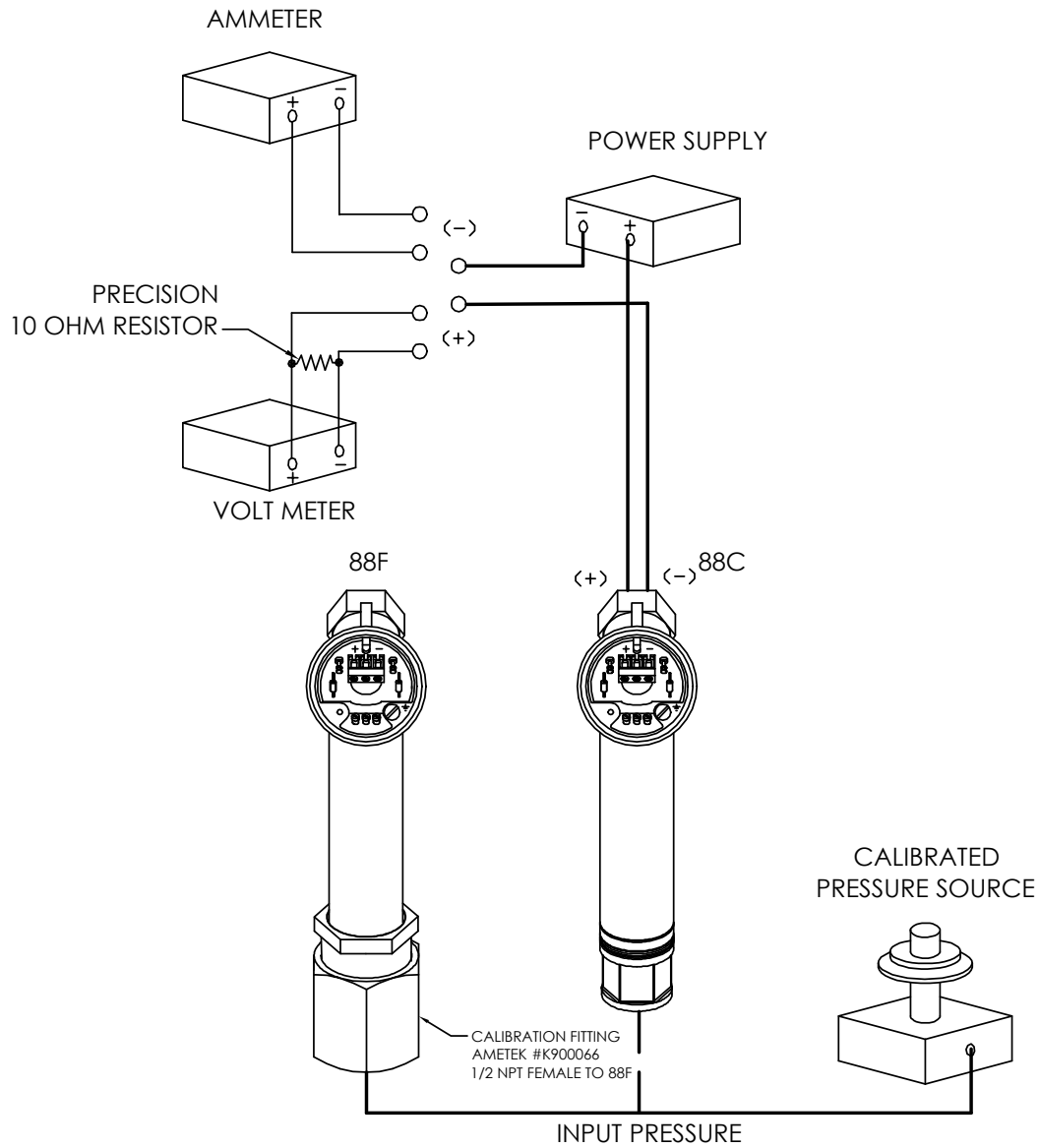


FIGURE 4-2
OUT OF SYSTEM CALIBRATION

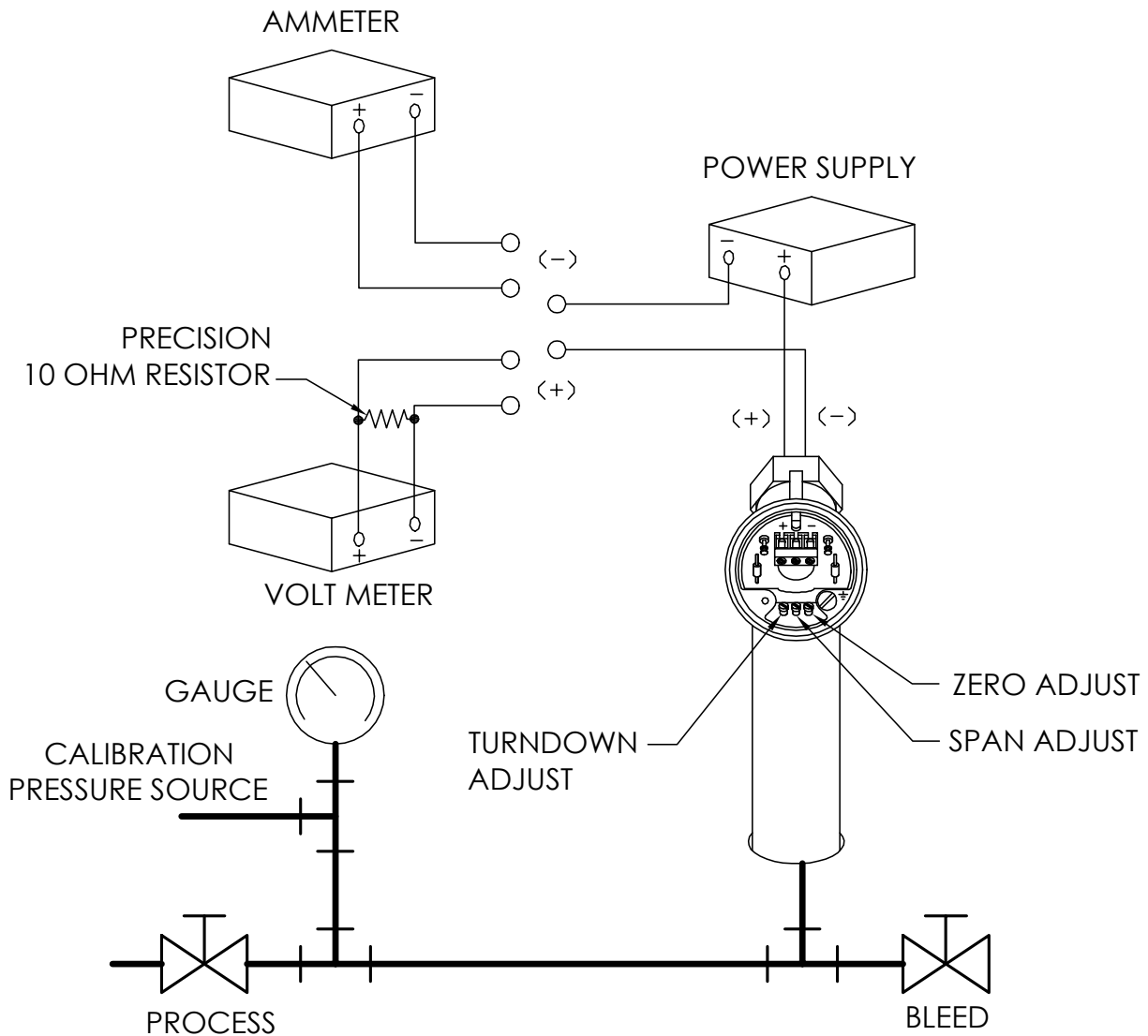


FIGURE 4-3
IN SYSTEM CALIBRATION



SECTION 5

MAINTENANCE

TROUBLESHOOTING

The Model 88 Pressure Transmitter is an all welded unit. There is no access to the electronic circuitry. The zero, span and turndown potentiometers are connected to shafts which are sealed by “O” rings. If turning shafts in either direction does not change output, proceeds as follows:

With a small screwdriver under the head of the shaft, pry shaft upward slightly. Turn shaft with a slight downward pressure to re-engage into potentiometer.

If no output, check wires in the terminal strip.



SECTION 6

SERVICE & PARTS

FACTORY SERVICE

Factory 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: TEL: (215) 674-1234

REPLACEMENT PARTS

PART NUMBER	DESCRIPTION
K240231	COUPLING ADAPTER
K080343	PLUG
K230048	TEFLON GASKET
K680014	ADAPTOR KIT TO MATE WITH PMC ELECTRONIC TRANSMITTER WELD COUPLING
K900066	CALIBRATION FITTING (GASKET K230048 REQUIRED)

PARTS - ORDERING

When ordering replacement parts, supply the following information:

1. Part description and part number.
2. Quantity of each item required.
3. Shipping instructions and address.

Mail, Telephone, or Email Orders to:

AMETEK
205 Keith Valley Road, Horsham, PA 19044

TEL: (215) 674-1234

EMAIL: mctpmt.sales@ametek.com