

TECHNICAL MANUAL  
OPERATION, MAINTENANCE AND INSTALLATION INSTRUCTIONS  
FOR

MODEL 89D  
MODEL PDT  
2 WIRE DIFFERENTIAL PRESSURE  
TRANSDUCER

**AMETEK**  
U.S. GAUGE DIVISION • PMT PRODUCTS

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MODEL 89D \_\_\_\_\_ 2

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MODEL 89D\_\_\_\_\_2

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## SAFETY SUMMARY

The following warnings appear in the text of this manual and are repeated here for emphasis. Before performing any maintenance or repair of the equipment, personnel must read and understand all applicable warnings.

### WARNING

Observe all precautions given in the calibration technical manual and in Navy precautions for forces afloat OPNAVINST 5100.

Air or nitrogen under pressure is used in the operation of the differential pressure transducer calibration system. Severe injury may result if personnel fail to observe safety precautions.

To prevent injury, insure all connections are properly made before applying air or nitrogen pressure. (Refer to Page 6-3)

### WARNING

To prevent injury, ensure that the pressure is vented from all parts of the calibration system before disconnecting the hose assemblies. (Refer to Page 6-6).

### WARNING

Insure that electrical power is removed from the cable assembly prior to connecting cable to the differential pressure transducer (Refer to Page 7-1).



CAUTION

Do not attempt to adjust the DDI or meter readings by turning the transducer zero or span potentiometer (Refer to Page 4-1).

CAUTION

To prevent equipment damage, do not exceed the pressure rating of the transducer when calibration is performed.

CAUTION

The Sensor Assembly and Component Board Assembly have been tested as a characterized assembly and should be replaced as one assembly to meet MIL-D-24304B (SH).

CAUTION

Do not place any cleaning tools inside the pressure port connection of the sensor. Damage to the diaphragm can result.

The differential pressure transducer is to be fully assembled prior to cleaning. (Refer to Page 6-6)

CAUTION

Do not immerse the differential pressure transducer or MS connector assembly in cleaning solutions. Do not allow cleaning solutions to enter the differential pressure transducer (Refer to Page 6-6).

## CHAPTER 1

### GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1 GENERAL INFORMATION AND SAFETY PRECAUTIONS. Warnings and precautions appear throughout the text of this manual to identify procedures or precautions which if not followed, may result in injury to personnel or damage equipment. Technicians should become thoroughly familiar with these warnings and cautions before servicing or repairing the differential pressure transducer.

1-2 INTRODUCTION. This technical manual provides information from general descriptions to calibration, maintenance and installation procedures for the Model 89D \_\_\_\_\_ 2 differential pressure transducers (Figure 1-1). Information contained in the manual includes:

- a. Physical and Functional Descriptions
- b. Safety Precautions
- c. Operating Procedures
- d. Scheduled (Preventive) and Corrective Maintenance Procedures
- e. Troubleshooting Procedures
- f. Installation Information

1-3 Equipment Description. The Model 89D \_\_\_\_\_ 2 differential pressure transducer (hereafter referred to as differential pressure transducer) is a piezoresistive strain gage transducer which accepts a differential fluid pressure input and produces an electrical DC current output that is proportional to the applied differential pressure. Input differential pressure ranges vary depending on the model of the transducer. Each differential pressure transducer consists of a piezoresistive strain gage sensor assembly, a main board assembly, a RFI board assembly and a housing assembly (Figure 6-3). Internal service points permit the adjustment of the ZERO and SPAN limits of the differential pressure transducer output. Two polarized TEST points on the main board assembly allow the differential pressure transducer output to be monitored during testing and calibration (Figure 2-1). Connection of the input pressure sources are in accordance with MS16142 utilizing 1/4 inch O.D. tubing. Connection to the differential pressure transducer's output is a MS3102R14S-5P and MS3106R14S-5S connector pair supplied with the differential pressure transducer in accordance with MIL-D-24304B(SH) located on one side of the differential pressure transducer housing assembly. A breather plug is located on the bottom side of the differential pressure transducer housing assembly.

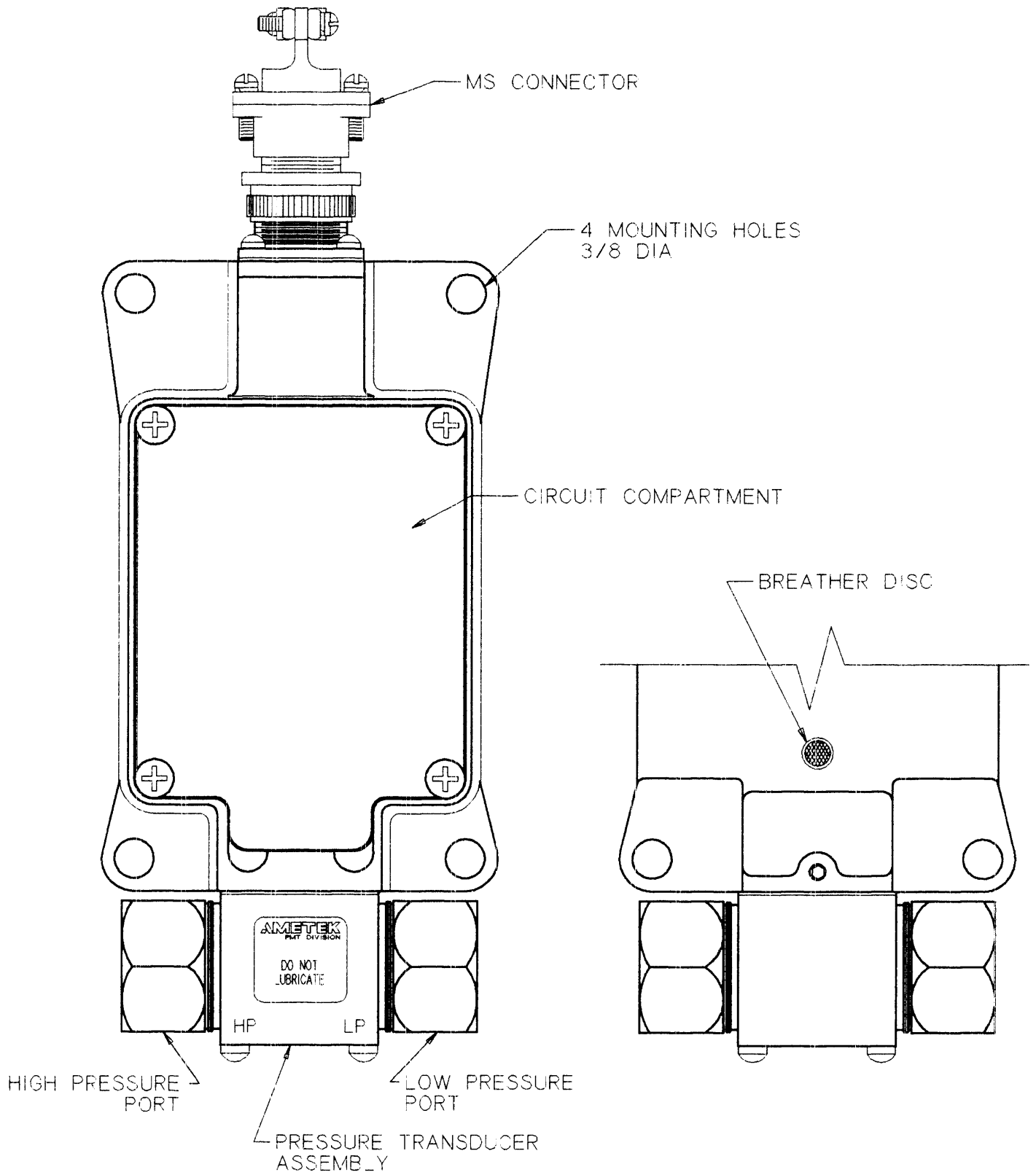


FIGURE 1-1. PRESSURE TRANSDUCER

1-3.1 The differential pressure transducers are available in PSID pressure ranges of 0-15 psi to 0-100 psid with line pressure rating of 150 psi and 0-200 to 0-400 psid with line pressure ratings of 600 psi (Fig. 1-2). The differential pressure transducer conform to the requirements of MIL-D-24304B(SH) including amendments.

1-4 REFERENCE DATA. Reference data for the differential pressure transducer, including leading particulars, equipment functional characteristics, capabilities, limitations and environmental parameters, are listed in Table 1-1.

1-5 EQUIPMENT. Equipment and documents supplied with the differential pressure transducer are listed in Table 1-2.

1-6 SAFETY PRECAUTIONS. Warnings and cautions appear throughout the text of this manual to highlight critical maintenance steps or procedures. Warnings identify procedures which, if not performed properly, may cause personal injury or death. Cautions identify procedures which, if not performed properly, may result in damage to equipment. Warnings and cautions immediately precede the procedure or step to which they apply. Warnings and cautions deemed to be of particular importance to the operator/technician are summarized at the beginning of this manual. Personnel must read and understand all warnings and cautions before operating the equipment and before accomplishing any maintenance or repair of the equipment.

1-6.1 In systems with a high probability for pressure spikes, or large fluctuations, it is recommended that a pulsation dampener or snubber be installed upstream of the differential pressure transducer.

**TABLE 1-1. REFERENCE DATA**

<b>ITEM</b>	<b>SPECIFICATION</b>
Transduction Principle	Strain <b>Gage</b>
Sensing Technique	Diaphragm
Input Power	28 Vdc
Fluid Media	GP, FG, SW, OX
Available Input Pressure Ranges	0-15 PSID through 0-100 PSID with line pressure rating of 150 psi 0-200 PSID through 0-400 PSID with line pressure rating of 600 psi
Electrical Output	4 mA @ 0% full scale input pressure; 20 mA @ 100% full scale input pressure.
Operating Temperature	32 ° F (0°C) to 149 °F (65 °C)
Pressure Input Connector	1/4 inch tube connector per MS16142
Electrical Interface Connector	MS3102R14S-5P & MS3106F14S-5S connector pair
Dimensions:	
Height	2.53 inches
Width	3.74 inches
Depth	7.47 inches
Weight	3 lb. 4 oz.

TABLE 1-2. EQUIPMENT AND DOCUMENTS SUPPLIED

Quantity	Nomenclature	Number
1	Transducer, Pressure	Refer to Fig. 1-2
1	Technical Manual, Operation and Maintenance, Pressure Transducer	

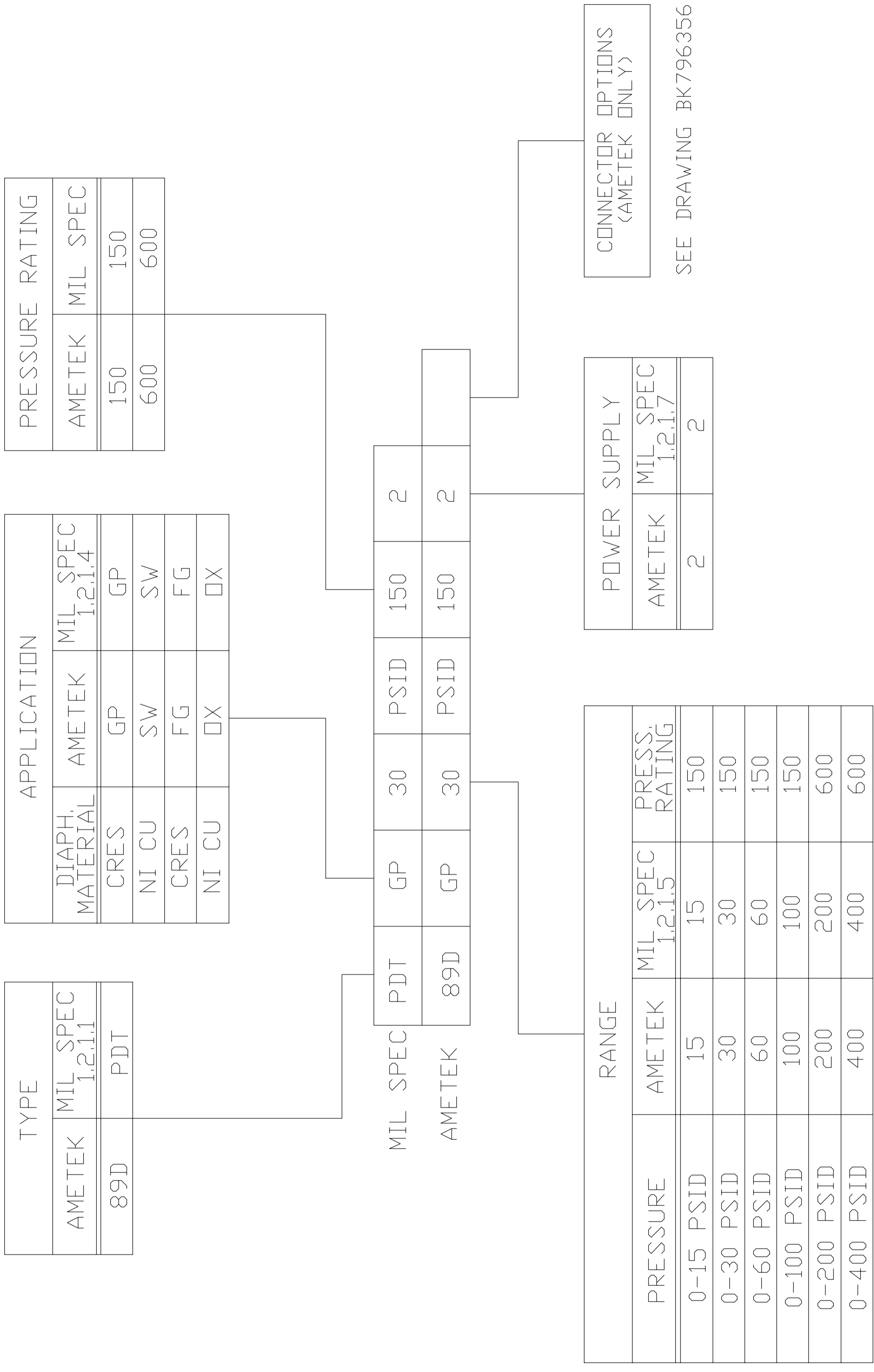


FIGURE 1-2. MODEL DESIGNATION

## Chapter 2

### OPERATING PROCEDURES

2-1 INTRODUCTION. This chapter contains a description of the operator controls and provides general procedures on the use of the differential pressure transducer controls and indicators.

2-2 CONTROLS AND INDICATORS. Operating control and indicators are shown in Figure 2-1.

2-3 OPERATING PROCEDURES. Normal operation of the differential pressure transducer requires no operator input. The following paragraphs provide general instructions for the use of the ZERO and SPAN adjust potentiometers and Calibrating Monitor (connections used during testing and calibrating of the differential pressure transducer.

2-4 ZERO AND SPAN ADJUST POTENTIOMETER OPERATION. ZERO adjustment is for calibrating the 0% full scale output of the differential pressure transducer. The SPAN adjustment is for calibrating the 100% full scale output of the differential pressure transducer. The ZERO and SPAN adjustments are screwdriver adjustments located on the main board assembly inside the circuit compartment. The differential pressure transducer is factory calibrated at the zero and full scale range of the specific model at ambient temperature and barometric pressure.

2-5 CALIBRATION CONNECTIONS. Electrical connections for calibration consists of connecting the electrical portion of the approved calibration monitor to the TEST terminals of the differential pressure transducer in accordance with the instructions for the calibration system in use. Pressure connections for the calibration consists of connecting the pressure monitoring portion of an approved calibration monitor to the high pressure port connection (MS 16142) of the differential pressure transducer in accordance with the instructions for the calibration system in use.



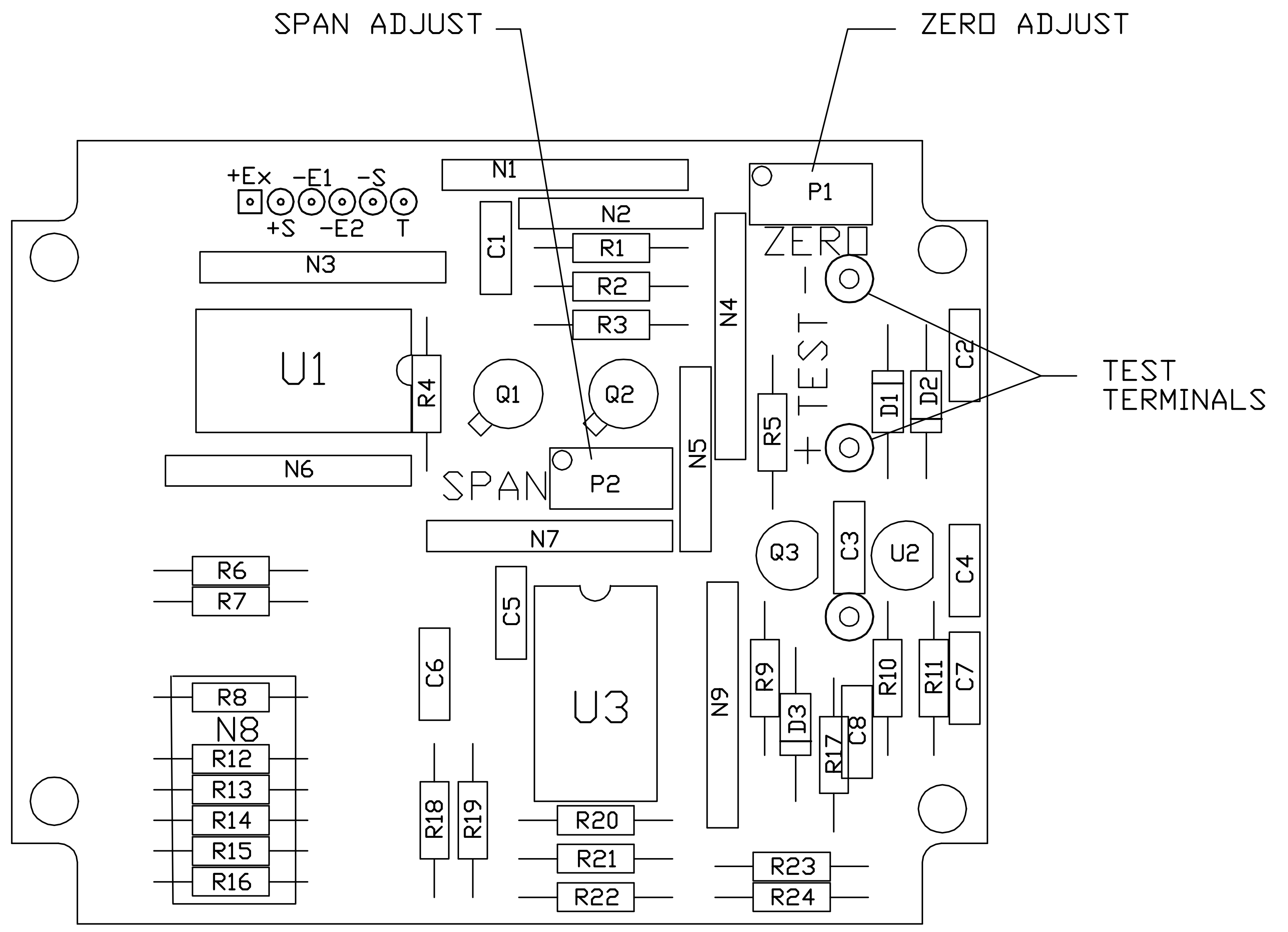


FIGURE 2-1. CONTROLS AND INDICATORS

## CHAPTER 3

### FUNCTIONAL DESCRIPTION

3-1 INTRODUCTION. This chapter contains a functional description of the differential pressure transducer.

3-2 FUNCTIONAL DESCRIPTION. The differential pressure transducer consists of a piezoresistive strain gage differential transducer assembly characterized with an electronic main board assembly. The applied differential pressure is coupled to the sensor by means of a diaphragm/oil system. The sensor assembly and the main electronics assembly are coupled in the transducer housing.

3-2.1 The differential pressure transducer receives a 28 Vdc input power on the pin A (+ signal) and pin B (- signal) on the MS connector. The housing is grounded through pin C on the MS connector.

#### NOTE

The ground wire of the differential pressure transducer, pin C of the MS connector, must be connected to earth ground to insure proper operation of the differential pressure transducer. In order to avoid "Ground Loop" conditions, there should only be one earth ground to a loop.

3-2.2 Input power is EMI protected by two filters and capacitors mounted on the RFI assembly in the transducer housing.

3-2.3 The differential input pressure is applied through the MS 16142, 1/4 inch O.D. connections labeled HP and LP to the internal diaphragms in the sensor assembly. A differential pressure on the diaphragms causes the strain gage to change resistance proportionally to the differential pressure applied. The differential pressure transducer's electronic circuit converts this resistance change into a current (4-20 mA) signal which varies in proportion to the applied differential pressure.

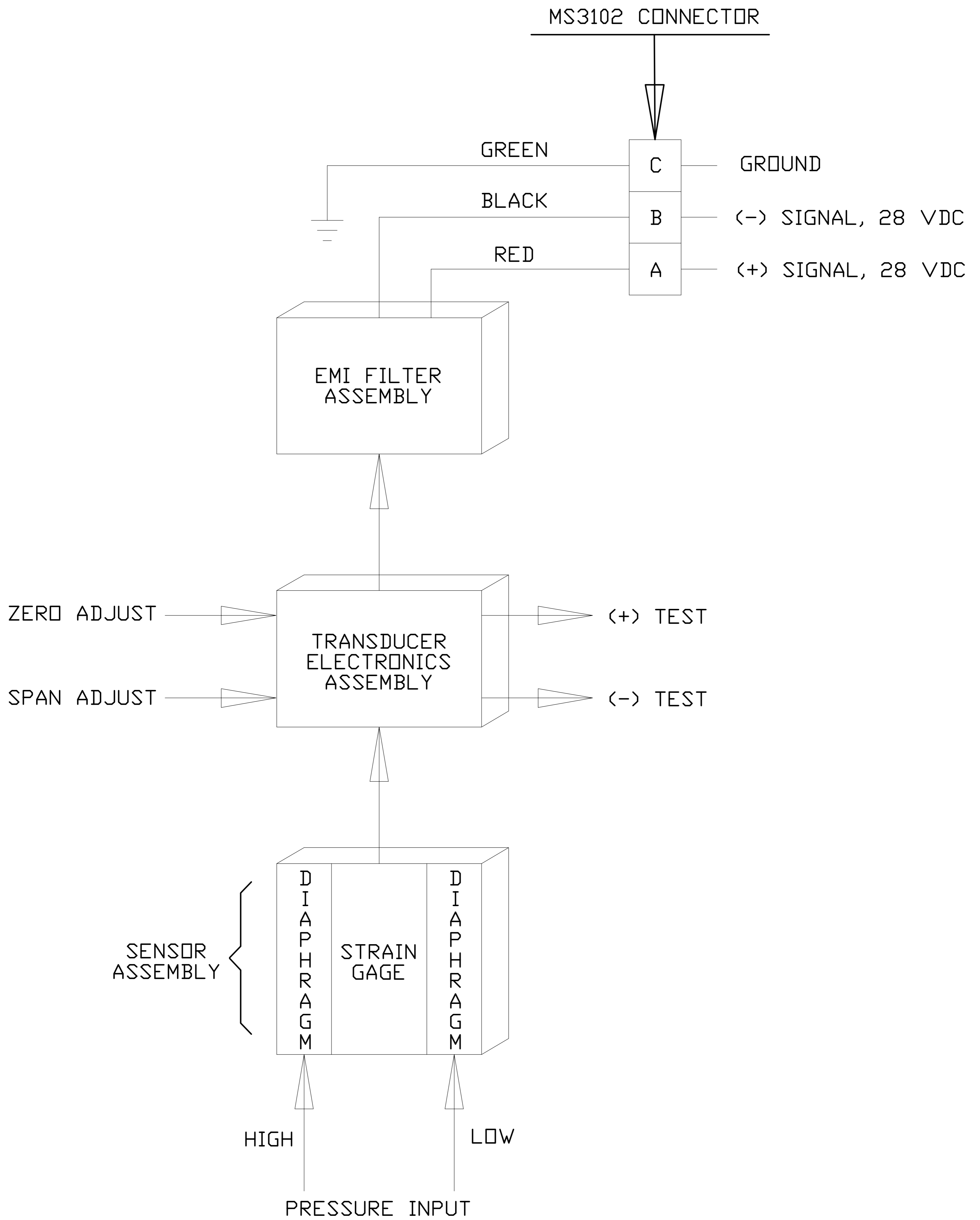


FIGURE 3-1. FUNCTION BLOCK DIAGRAM

## CHAPTER 4

### SCHEDULED MAINTENANCE

4-1 INTRODUCTION. This chapter contains preventive maintenance procedures to be accomplished on a scheduled basis. The scheduled maintenance instructions in this manual are canceled when the Planned Maintenance System (PMS) is implemented for this equipment aboard your ship or station .

4-2 MAINTENANCE PROCEDURES. Correct operation of the differential pressure transducer should be verified every 180 days by performing a check at the system level. This check will consist of verifying the reading of the appropriate Demand Display Indicator (DDI) or meter when the applied pressure is 0 psid and also when the applied pressure is 100% of the transducer's differential range. If the readings are within the tolerances prescribed by the applicable system maintenance requirements, no further action is necessary. If the readings are not within tolerances, the transducer calibration should be verified and adjusted, if necessary. If the differential pressure transducer cannot be adjusted, it should be examined to determine whether there are any loose connections or other repairable discrepancies that might be the cause of the problem. If the differential pressure transducer cannot be adjusted and no repairable discrepancies can be found, it should be replaced.

### CAUTION

Do not attempt to adjust the DDI or meter readings by turning the transducer ZERO or SPAN potentiometer.

## CHAPTER 5

### TROUBLESHOOTING

5-1 TROUBLESHOOTING. This chapter contains information necessary to troubleshoot the differential pressure transducer.

5-2 TROUBLESHOOTING PROCEDURES. Troubleshooting procedures are presented in the form of troubleshooting charts. The charts present troubles which may be encountered, probable cause of the malfunction, and suggested remedies to return the equipment to serviceable condition. Troubleshooting procedures are provided in Table 5-1 as an aid to qualified technicians in the identification and correction of equipment malfunctions and should not be considered sole authority for repair.

Table 5-1. Troubleshooting Chart

Trouble	Probable Cause	Suggested Remedy
<b>CALIBRATION CHECK AND ADJUSTMENT</b>		
Output current indication not as specified	Transducer out of calibration	Recalibrate transducer (Refer to para. 6-3)
Transducer can not be calibrated	Defective connector assembly	Replace connector assembly
	Damaged or defective pressure transducer assembly	Replace pressure transducer assy. Transducer assy. contains no serviceable parts.

## CHAPTER 6

### CORRECTIVE MAINTENANCE

6-1 INTRODUCTION. This chapter provides corrective maintenance procedures for the differential pressure transducer. These procedures include testing, cleaning, inspection, adjustment, and final checkout. Corrective maintenance should be performed as a result of improper performance during operation or malfunctions which may occur during testing and troubleshooting procedures.

6-2 SPECIAL TOOLS AND TEST EQUIPMENT. The required special tools and test equipment for testing and corrective maintenance of the differential pressure transducer are

- a) Approved Calibration System
- b) Approved Adjustable Pressure Source

#### NOTE

Equivalent substitutes may be used.

6-3 PERFORMANCE TEST. Performance testing of the differential pressure transducer is limited to checking and adjusting the differential pressure transducer calibration.

6-3.1 TEST CONDITIONS. All performance tests shall be performed at room ambient conditions (20° C, atmospheric pressure).

6-3.2 CALIBRATION CHECK AND ADJUSTMENT. Check and adjust calibration of the differential pressure transducer as follows:

#### NOTE

For detailed information regarding calibration system setup, operation, and related precautions, refer to the technical manual applicable to the calibration system in use.

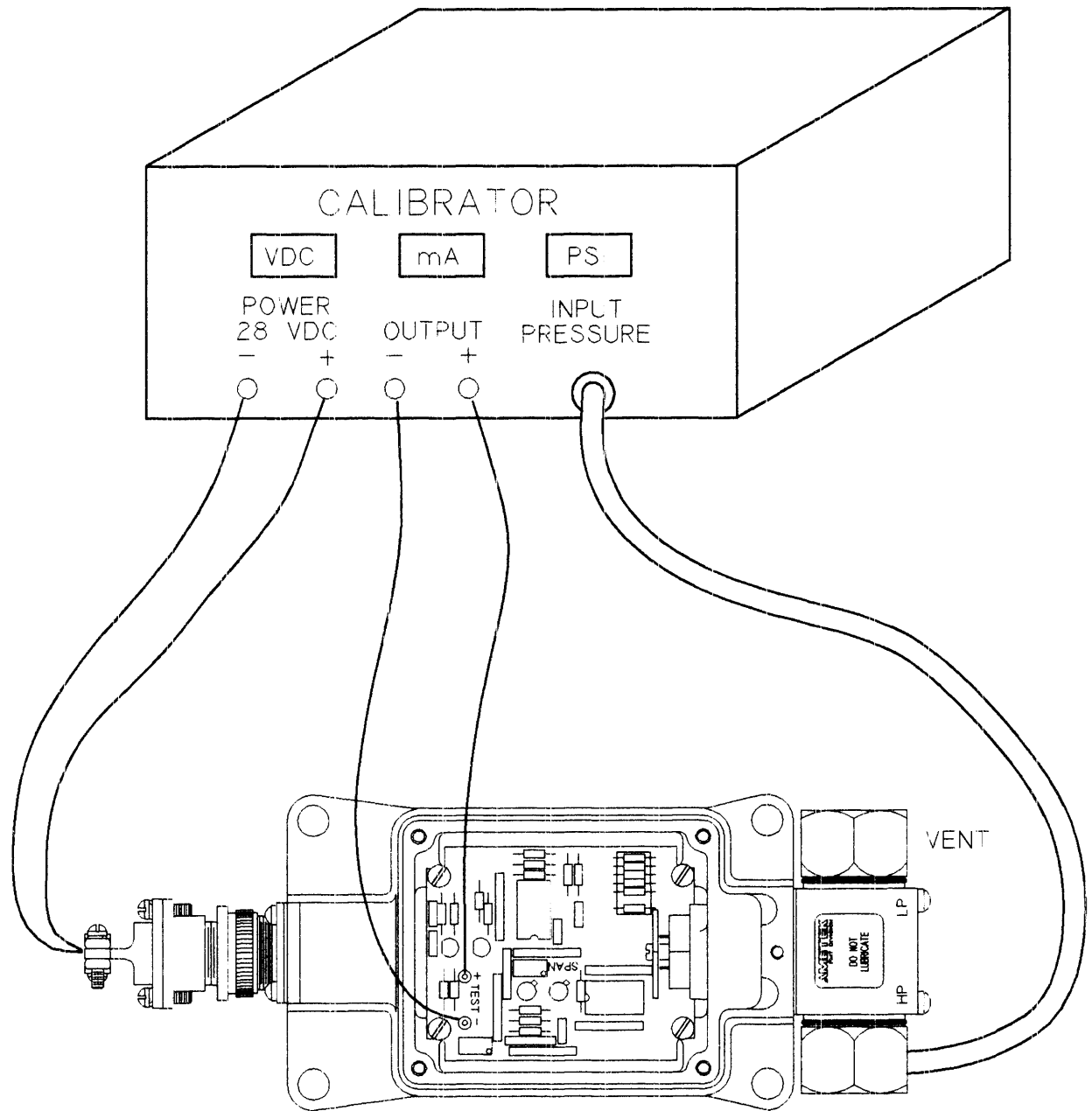


FIGURE 6-1. CALIBRATION TEST SET-JP

- a) Select an approved calibration system in accordance with the range of the differential pressure transducer being calibrated.

WARNING

Observe all precautions given in the calibration technical manual and in Navy precautions for forces afloat OPNAVINST 5100.

Air or nitrogen under pressure is used in the operation of the pressure transducer calibration system. Severe injury may result if personnel fail to observe safety precautions.

To prevent injury, insure all connections are properly made before applying air or nitrogen pressure.

- b) To gain access to the TEST terminals and the ZERO and SPAN adjustments, remove the housing cover (Figure 6-3) by removing the four cover retaining screws and lifting the cover off by placing a screwdriver in the cover access notches supplied in the housing. The electrical connections can now be made to the TEST terminals.
- c) Apply 28 Vdc power to the differential pressure transducer.
- d) Prepare the pressure transducer for ZERO pressure check as follows:
  - 1) Vent the High and LOW side pressure port connection (MS16142) to atmosphere so the transducer will sense zero psid in accordance with the calibration system technical manual.



- e) Verify that the differential pressure transducer output current indication is  $4.0 \pm 0.16$  mA dc. Perform ZERO adjustments to obtain the differential pressure transducer's output as specified. Zero is accomplished by a screwdriver adjustment of the ZERO potentiometer located on the MAIN Board Assembly inside the circuit compartment of the housing (Figure 6-2).

CAUTION

To prevent equipment damage, do not exceed the pressure rating of the transducer when calibration is performed.

- f) If the range is exceeded within the overpressure range of MIL-P-24304B (SH), verify the zero calibration in accordance with step d. before proceeding. If the range is exceeded beyond the overpressure specification, unit may not be serviceable. Verify calibration before returning to service .
- g) Refer to the pressure transducer's nameplate to determine the pressure range. Attach the calibration system and pressure source to the pressure connection in accordance to the calibration system technical manual. Adjust the pressure source to 100% of the pressure transducer's range (Figure 6-1).
- h) Verify that the differential pressure transducer output current indication is  $20.0 \pm 0.16$  mA dc. Perform SPAN adjustments to obtain the pressure transducer's output as specified. Span is accomplished by a screwdriver adjustment of the SPAN potentiometer located on the MAIN Board Assembly inside the circuit compartment of the housing (Figure 6-2).
- i) Repeat steps d. through h. until no further adjustment is required. Should the differential pressure transducer not calibrate in the proper manner, refer to paragraph 5-2 Troubleshooting Procedures.
- j) Insure that the cover gasket is clean and in place. Replace the housing cover (Figure 6-3) by placing the cover on the housing and securing it with the four cover retaining screws.

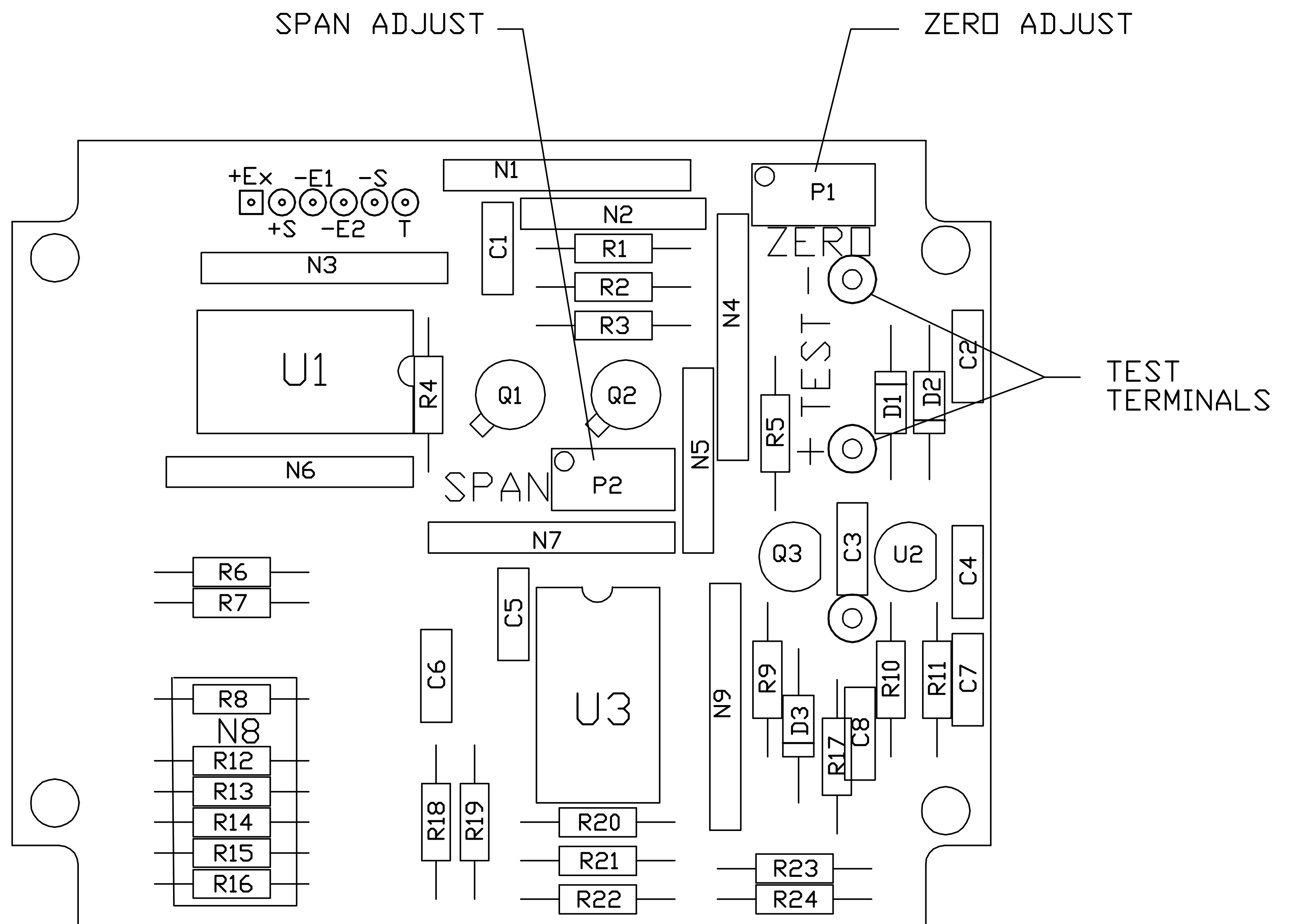


FIGURE 6-2. MAIN BOARD ASSEMBLY-CALIBRATION ADJUSTMENTS

WARNING

To prevent injury, ensure that the pressure is vented from all parts of the calibration system before disconnecting the hose assemblies.

- j) Shut off the nitrogen or air supply and vent all pressures from the system.
- k) Shut off power and disconnect the calibration system from the differential pressure transducer.

CAUTION

Do not place any cleaning tools inside the pressure port connection of the sensor., Damage to the diaphragm can result.

The differential pressure transducer is to be fully assembled prior to cleaning.

6-4 CLEANING Clean the external metal components using approved cleaning solution on a cloth and wipe with a clean, lint free cloth. Remove stubborn accumulations with a nonmetallic, stiff bristle brush.

CAUTION

Do not immerse the differential pressure transducer or MS connector assembly in cleaning solutions. Do not allow cleaning solutions to enter the Differential pressure transducer.

- a) Clean accessible electrical components by wiping with a clean lint free cloth.
- b) Dry metal components by wiping with a clean lint free cloth. Allow electrical components to dry in ambient air.

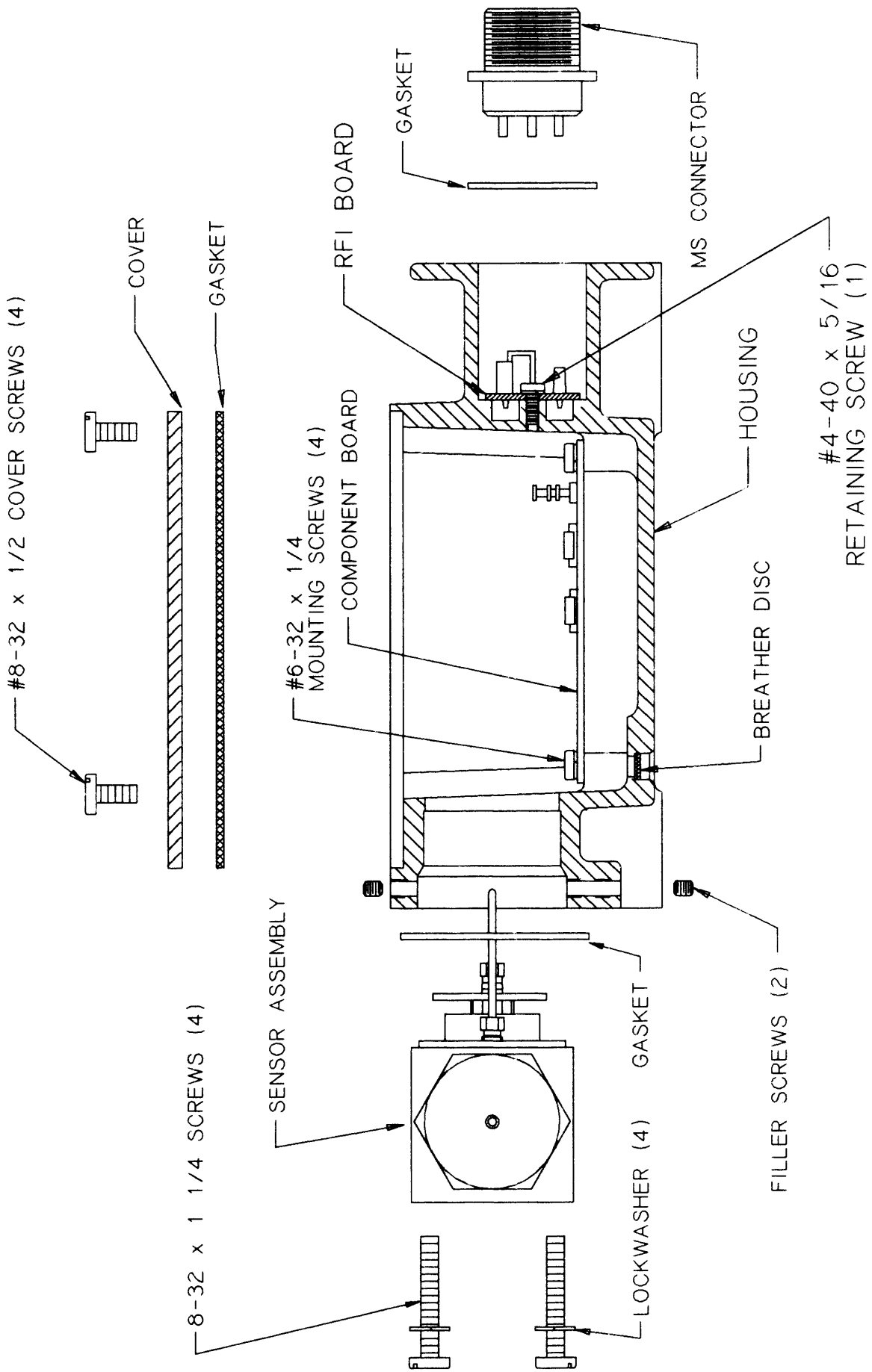


FIGURE 6-3. TRANSDUCER ASSEMBLY

## CHAPTER 7

### INSTALLATION

7-1 INTRODUCTION. This chapter contains the information pertaining to the installation of the differential pressure transducer. This information includes sitting, installation procedures, electrical and pneumatic interface requirements and postinstallation checkout procedures.

7-2 SITE. The differential pressure transducer may be mounted in any orientation. The preferred direction is with the input pressure port facing downward. The differential pressure transducer should be mounted on a structure/panel with sufficient access for maintenance and testing.

7-3 INSTALLATION PROCEDURES. One technician is required to install the differential pressure transducer. Install the differential pressure transducer as follows (Refer to Figure 7-1):

- a) Position the differential pressure transducer on the mounting surface.
- b) Secure the differential pressure transducer to the mounting surface by installing four bolts (5/16 inch), washers and nuts through the mounting holes in the differential pressure transducer housing.

#### WARNING

Insure that electrical power is removed from the cable assembly prior to connecting cable to the differential pressure transducer.

7-4 ELECTRICAL INTERFACE REQUIREMENTS. Connect the cable assembly MS electrical connector to the MS electrical connector on the differential pressure transducer. (+) signal is pin A, (-) signal in pin B, and case ground in pin C of the MS connector. (Refer to Figure 7-1.)

7-5 PNEUMATIC INTERFACE REQUIREMENTS. Connect the high pressure to the MS16142 1/4 inch tube connector labeled HP. . Connect the low pressure to the MS16142 1/4 inch tube connector labeled LP on the differential pressure transducer (Refer to Figure 7-1).

7-6 POSTINSTALLATION CHECKOUT. Postinstallation checkout consists of performing the performance tests specified in paragraph 6-3.

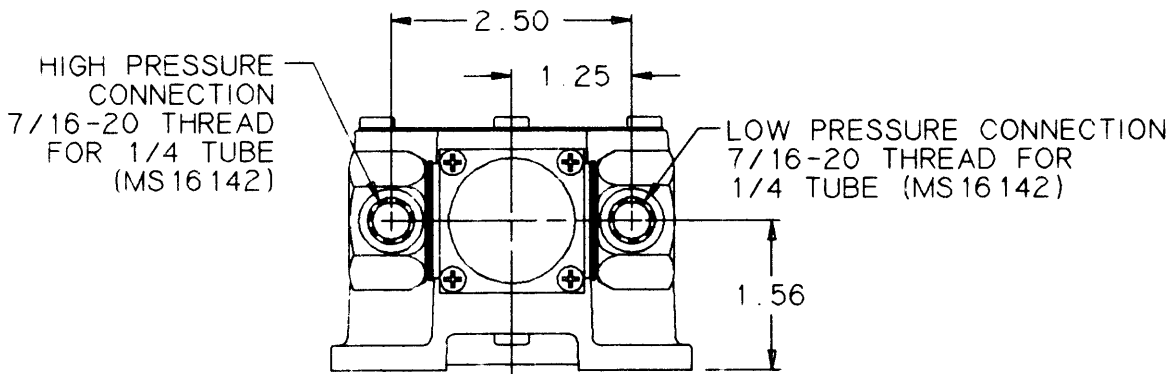
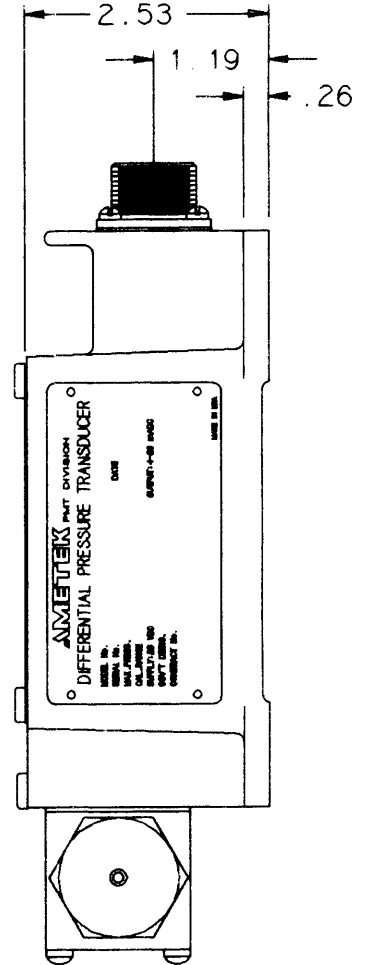
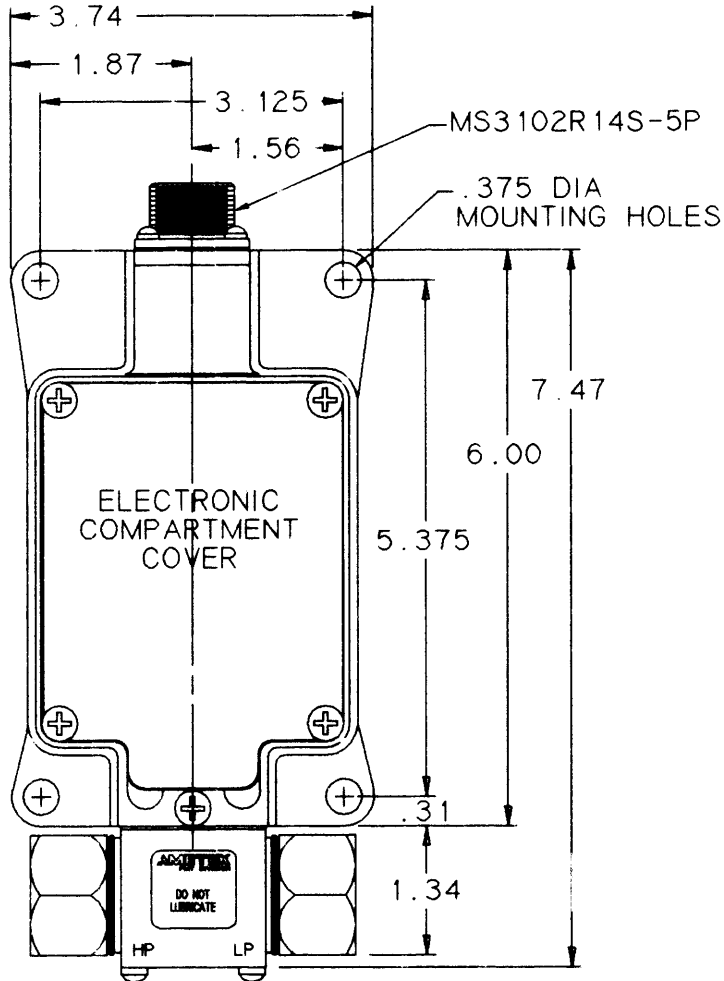
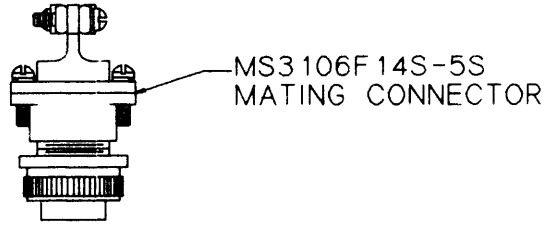


FIGURE 7-1. OUTLINE DIMENSIONS