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Manual for Omega

DS-350

DP-350

DP-352

DP-354

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The OMEGA® DS-350 Benchtop Pressure Indicator is an OMEGA® DP-350 Pressure Indicator in a rugged benchtop case. The information and specifications in this manual apply also to the DS-350, except for the wiring diagrams. The wiring for the DS-350 is illustrated in Figures 1 and 2.

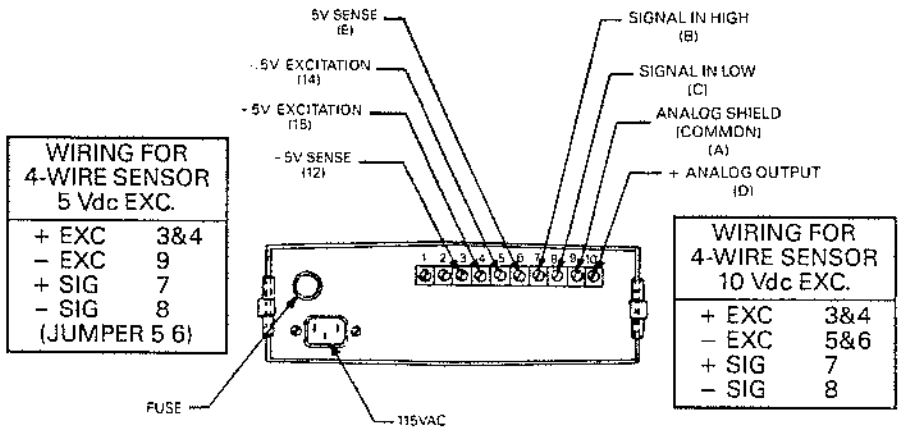


Figure 1. DS-350 Rear Panel

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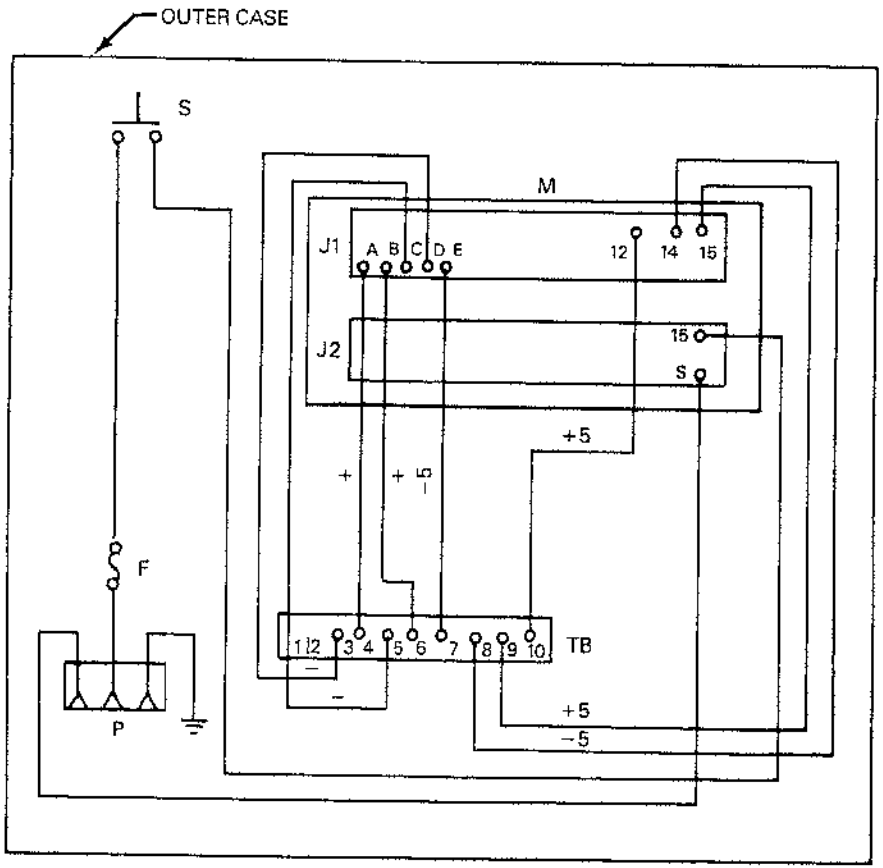


Figure 2. DS-350 Wiring Diagram

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SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

1.1.1 Models DP-350/352

The OMEGA® Models DP-350 and DP-352 are single channel panel mount pressure instruments. These instruments may be used with a variety of strain-gage, bridge-type pressure transducers having signal outputs between 1.1 mV/V and 10 mV/V (11 to 100 mV input). A 200 Ω or higher bridge impedance is required. Pressure is displayed on a high-brightness LED display with a maximum indication of 1999.

In addition, the Model DP-352 instrument is available in a 19" Rack Panel version (Model PC-3500) with one, two or three channels. For more information on the Model PC-3500, refer to Section 7 of this manual.

10 V dc transducer excitation is provided from an internal power supply. Transducer signal outputs accurately represent the pressure being measured by automatic meter compensation for fluctuations in the excitation supply.

The Model DP-352 provides two analog set points with relay outputs. These set points may be used to control pressures for high or low alarms. The DP-350 is identical to the DP-352, except that it does not have analog set-point outputs. Both models provide an analog output voltage of 1 Vdc per 1000 counts displayed. This output may be used to drive a chart recorder or other external device having a minimum impedance of 2000 Ω. Both models also provide external zero (Tare) of −100%, +6% of full scale. External Tare is activated by a LED display board mounted DIP switch.

The DP-350/352 are also available with a dummy zero option (Option Z). The dummy zero is activated by a DIP switch located behind the front lens and gives the instrument an effective "count by ten" capability and provides a 19990 maximum pressure indication.

These instruments are housed in a panel mount enclosure with mounting hardware provided. They may be powered from either 115 V ac or 230 V ac and typically require less than four watts power. Electrical connection is by means of two PCB edge-card type connectors.

1.1.2 Model DP-354

The OMEGA® DP-354 is a single channel panel mount pressure instrument compatible with "high level" voltage output pressure transducers. The DP-354 are 115 Vac 60 Hz powered and include an adjustable pressure transducer excitation power supply. The DP-354 is compatible with pressure transducers having voltage outputs between 5 Vdc and 10 Vdc and requiring excitation voltages between 5 Vdc and 24 Vdc. Field scaling is accomplished by a combination of zero and full scale potentiometers and a DIP switch located behind the front lens.

The DP-354 is also available with the dummy zero option (Option Z), which provides the additional capability of the right-most (LSD) digit being activated as a dummy or "dead" constant zero. The dummy zero is activated by a DIP switch located behind the front lens. This feature gives the DP-354 an effective "count by ten" capability and provides a 19990 maximum pressure indication.

An internal DC pressure transducer excitation supply is provided and is adjustable by removing the front lens. This supply provides a regulated, adjustable DC voltage output from 1.3 to 24 Vdc at 30 mA.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the packing list and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION

Models DP-350/352/354 are panel mountable using a 3.924" by 1.682" rectangular size cutout. To mount the indicator, remove the snap-on bezel, rotate the latch screws located on the sides of the displays several turns counterclockwise to retract the latches. Insert the indicator through the panel cutout and tighten the latch screws and replace the bezel. See Figure 2-1.

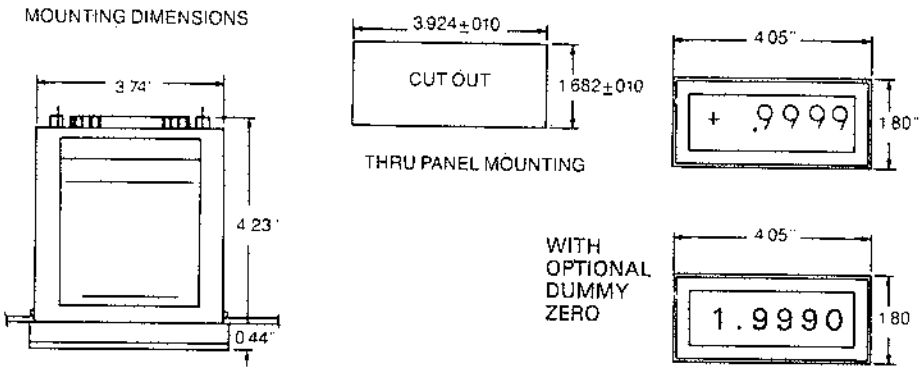


Figure 2-1. Mounting Dimensions

2.3 WIRING

Connect the ac power, transducer signal input, excitation output to the transducer and sense leads (see paragraphs 2.3.1 and 2.3.2). Set point controls, relay outputs, analog outputs, decimal point, hold inputs, and Tare (external zero) need only be connected if required.

Apply ac power. With the pressure transducer properly matched and calibrated to the instrument (see Section 5) accurate pressures will be displayed. The display will read to a maximum of ±1999 (±19990 with optional dummy zero) without displaying the overrange condition (±1---). Since the display may continue to show pressures above the rated full scale of the pressure transducer, caution should be exercised not to exceed the transducer's maximum pressure overload rating. In general, the instrument will only display accurate pressures within the rated full scale pressure, not the overload pressure.

2.3.1 Wiring for Models DP-350 and DP-352

Models DP-350/352 are supplied with two edge card dual 15 pin 0.156" center spacing connectors.

The bottom connector J2 provides ac power to the instrument, decimal point, hold inputs and BCD outputs. The top connector J1 provides the pressure transducer connections as well as set point controls relay outputs, analog outputs and external zero (Tare) connections. See Figure 2-2 for pin designations.

1) Connect ac power. Meter must be internally configured for 115 or 230 V ac power. Three jumpers located near the transformer on the main board determine 115 or 230 Vac operation. For 115 Vac operation, A and C are jumpered and B is open. For 230 Vac operation, B is jumpered and A and C are open.
   J2-15 Power High
   J2-S Power Low

2) Connect the Pressure Transducer

   Connect excitation voltage output (from the instrument to transducer)
   J1-15 Excitation (+) to transducer (+) excitation
   J1-14 Excitation (−) to transducer (−) excitation

   Connect sense terminals (from the instrument to transducer)
   J1-12 Sense (+) to transducer (+) excitation
   J1-E Sense (−) to transducer (−) excitation

NOTE

When using a four lead transducer, jumper sense terminals to excitation terminals on J1 connector.

Connect the transducer signal output (to the instrument)
J1-B signal (+) to transducer signal output (+)
J1-C signal (−) to transducer signal output (−)

3) Connect the Analog Output
J1-D Analog Output (+) to external device (+)
J1-A Analog Output (−) to external device (−)

NOTE

If the pressure transducer is supplied with a shield around the signal and excitation wires, it may be connected to analog common J1-A.

4) The DP-350/352 are shipped with internal zero activated. If external zero is required for customer application, flip the Tare DIP switch to the OFF (down) position (see Figure 5-2). This will deactivate the internal zero. A user supplied 50 KΩ 10 turn pot must then be connected at J1 to pins 6, 10, and K (see Figure 1-1b). Note that the 50 KΩ 10 turn pot must **not** be connected when internal zero is desired.

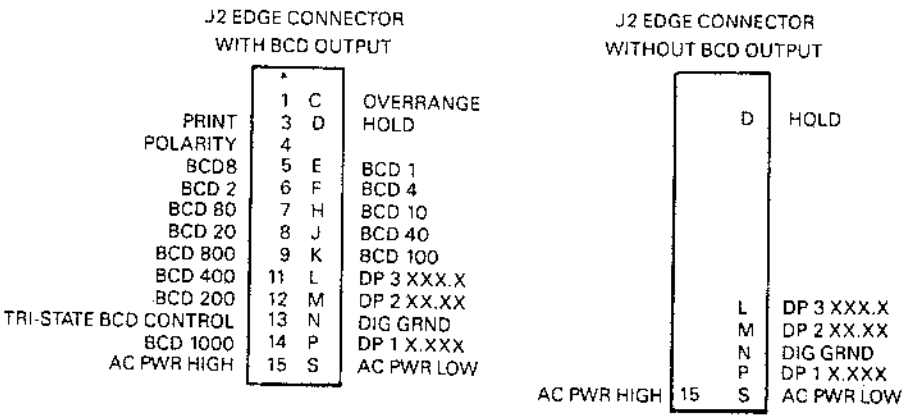
Model DP-352 only (With Dual Setpoints, Dual 0.5A Relays and Analog Output)

In addition to the connections listed above, the following connections must be made to utilize these set point outputs. Refer to Figures 2-2 and 5-1. Either one or two set points may be used.

1) Connect the set-point control pots (20 kΩ 10 turn)
Set point pot 1
Wiper J1-4
CCW J1-L
CW J1-8
Set point pot 2
Wiper J1-3
CCW J1-11
CW J1-9

2) Connect the set-point control switch (SPDT MOM, CENTER OFF)
SP1 J1-2
SP2 J1-5
COMMON J1-15

3) Connect the relay outputs
Set point 1
N.O. J1-N
N.C. J1-M
COMMON J1-13
Set point 2
N.O. J1-S
N.C. J1-R
COMMON J1-P



If decimal point is desired, may be activated by placing a jumper on J2 as follows:

STANDARD DP-350/352

DECIMAL	JUMPER
XXXX.	None
XXX.X	J2-L to J2-N
XX.XX	J2-M to J2-N
X.XXX	J2-P to J2-N

DP-350/352 WITH OPTIONS "Z"

DECIMAL	JUMPER
XXXX☐	None
XXX.☐	J2-L to J2-N snip out R101 from front board
XXX.X☐	J2-L to J2-N snip out R102 from front board
XX.XX☐	J2-M to J2-N
X.XXX☐	J2-P to J2-N

Figure 2-2a. Pin Designations for Models DP-350/352

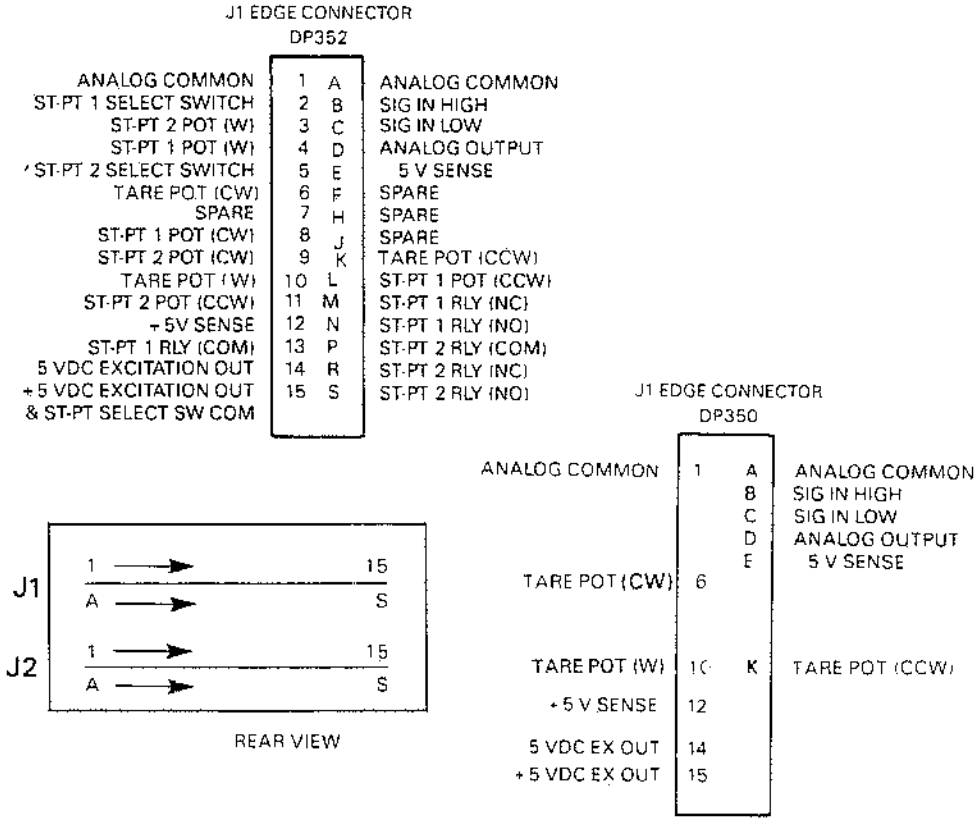


Figure 2-2b. Pin Designations for Models DP-350/352

2.3.2 Model DP-354 Wiring

The DP-354 requires one dual 15 pin (0.156'' contact spacing) edgecard PC connector at J2. (See Figures 2-3 and 2-4). A solder-tail connector is provided.

1. Connect ac power.
   J2-15 Power High
   J2-S Power Low
2. Connect the pressure transducer.
   Connect excitation voltage (from the instrument to transducer), first verifying that the voltage output is correct for the transducer being used (see paragraph 5.2.2, Excitation Voltage Output Adjustment).
   J2-9 Excitation (+) to transducer (+) excitation
   J2-K Excitation (−) to transducer (−) excitation
3. Connect the transducer signal output (to the instrument)
   J2-A signal (+) to transducer signal output (+)
   J2-10 signal (−) to transducer signal output (−)

The DP-354 may be field calibrated (see calibration section) but are shipped as follows:
Excitation Supply: 24 Vdc output
Signal Input: 1 Vdc = 000 displayed
Signal Input: 5 Vdc = 1999 displayed (5 Vdc = 19990 if option Z is ordered and dummy zero activated).

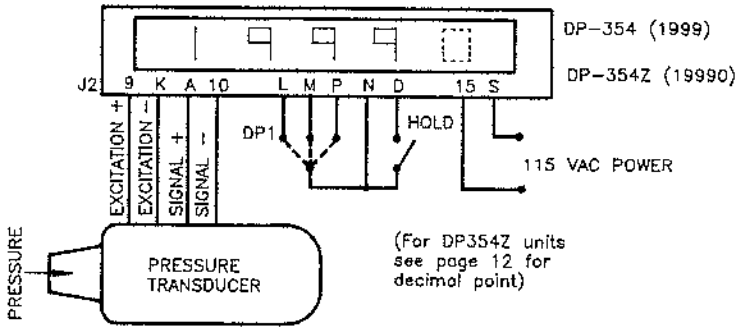


Figure 2-3a. Wiring a 4-Wire Voltage Sensor (DP-354)

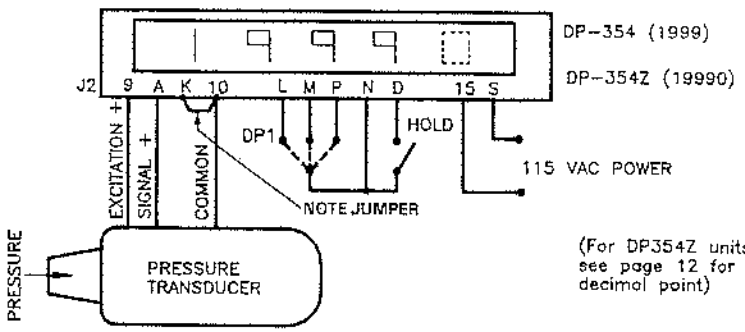


Figure 2-3b. Wiring a 3-Wire Voltage Sensor (DP-354)

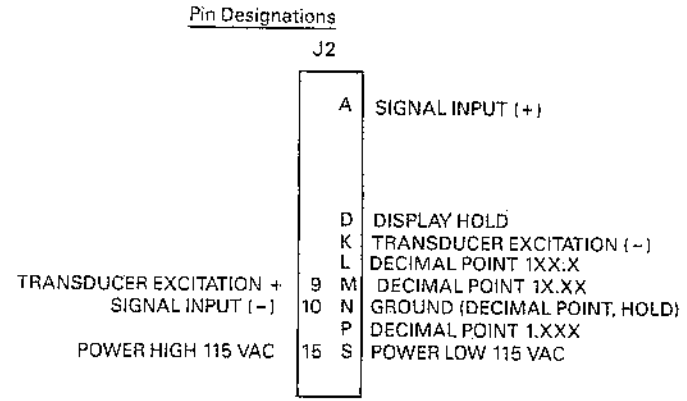


Figure 2-4. Calibration for Model DP-354

If decimal point is desired, may be activated by placing a jumper on the J2 connector as follows:

STANDARD DP-354

DECIMAL	JUMPER
XXXX.	None
XXX.X	J2-L to J2-N
XX.XX	J2-M to J2-N
X.XXX	J2-P to J2-N

DP-354 WITH OPTIONS "Z"

DECIMAL	JUMPER
XXXX□	None
XXXX.□	J2-L to J2-N snip out R101 from front board
XXX.X□	J2-L to J2-N snip out R102 from front board
XX.XX□	J2-M to J2-N
X.XXX□	J2-P to J2-N

The display may be placed in a "hold mode" by placing a jumper or switch between J2-D and J2-N.

2.4 OBSERVATIONS TO BE MADE AFTER POWER TURN-ON

After connecting the instrument and pressure transducer as described in Sections 2.3.1 and 2.3.2, apply ac power.

If the transducer and instrument are properly calibrated, the instrument will show +000 with zero pressure applied to the transducer. As pressure is increased, the instrument should track the increases and remain stable when the pressure is stable. If more pressure is applied to the transducer than its maximum, the indicator will show an overrange condition by displaying +1--- .

SECTION 3 OPERATION

3.1 GENERAL

Strain-gage, bridge-type pressure transducers are devices which convert a pressure to an electrical output. The bridge is typically bonded to the diaphragm. With pressure applied, the diaphragm deflects, causing an unbalance in the resistance of the bridge. This unbalance is detected by the pressure instrument and converted to a display of pressure. The bridge is excited by a voltage supplied from the instrument. When there is no pressure applied, a balance condition exists in the bridge and equal voltages are seen at the high and low signal inputs to the instrument. See Figure 3-1.

1) With no pressure applied R1 = R2 = R3 = R4
   The (+) and (–) signals are equal.
2) With pressure applied R1 = R3 = R4 ≠ R2, therefore a differential voltage is seen at the + and – signal inputs.

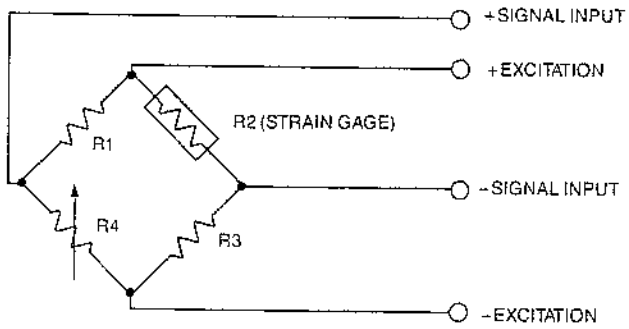


Figure 3-1. Simple Wheatstone Bridge with Strain Gage in One Leg

It can be seen that the signal input voltage to the instrument is a function of both the resistance of R1 through R4 and the excitation voltage applied. It is important that the changes in R2 be only a function of pressure. Compensation for variations in the excitation supply is accomplished by providing a ratiometric signal input. It can be seen in Figure 3-2 that the ratiometric (sense) input is connected directly to the excitation supply output at the connector. In cases where the wire lengths are long, it is desirable to connect the sense leads directly to the transducer.

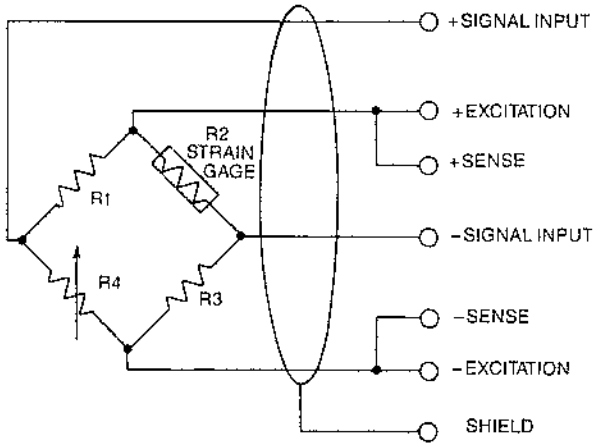


Figure 3-2. Transducer Connection where the Wire Lengths Are Short

In cases where the transducer manufacturer has provided only four wires directly connected, it may not be possible to connect as in Figure 3-3. In these cases, the wire lengths provided are generally short enough that connection as in Figure 3-2 is acceptable. In general, wire lengths should be kept as short as possible. Shielding may be connected to the analog common input J1-A of the instrument.

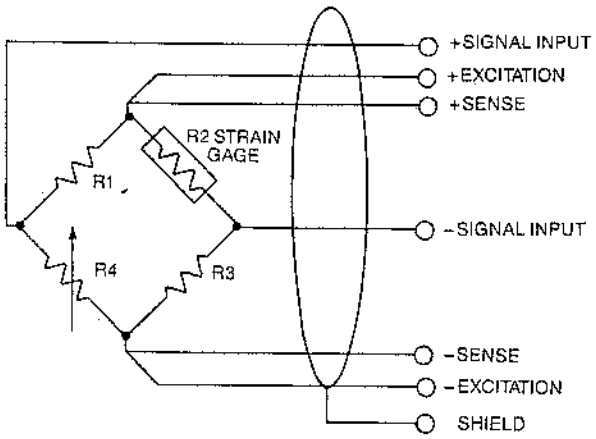


Figure 3-3. Transducer Connection where the Wire Lengths Are Long

SECTION 4 THEORY OF OPERATION

The block diagram, Figure 4-1, shows the system configuration. Models DP-350/352/354 are comprised of the five sections listed below:

1. Signal conditioning
2. Analog output
3. Set point detection, adjustment and zero offset
4. Excitation voltage supply output
5. Analog to digital conversion and display
6. External zero (Tare)

The DP-352 and 350 are identical except that the 350 does not include the set point adjustment and detection circuitry. The following paragraphs cover all models; however, reference to set point circuitry should be disregarded for Model DP-350. The analog output is optional on the DP-354 and External Tare is not available on the DP-354.

4.1 INPUT SIGNAL CONDITIONING

The input section provides the major gain needed to increase the low level strain gage signal to a level acceptable to the A/D converter.

Normally the Models DP-350 and 352 are supplied with true floating differential inputs to be used with a balanced source; however, a single ended transducer may also be used. This is accomplished by connecting a jumper from either pin J1-A or J1-1 to pin J1-C. (See Figure 4-2.) These instruments will allow the use of two and three wire pressure transducers.

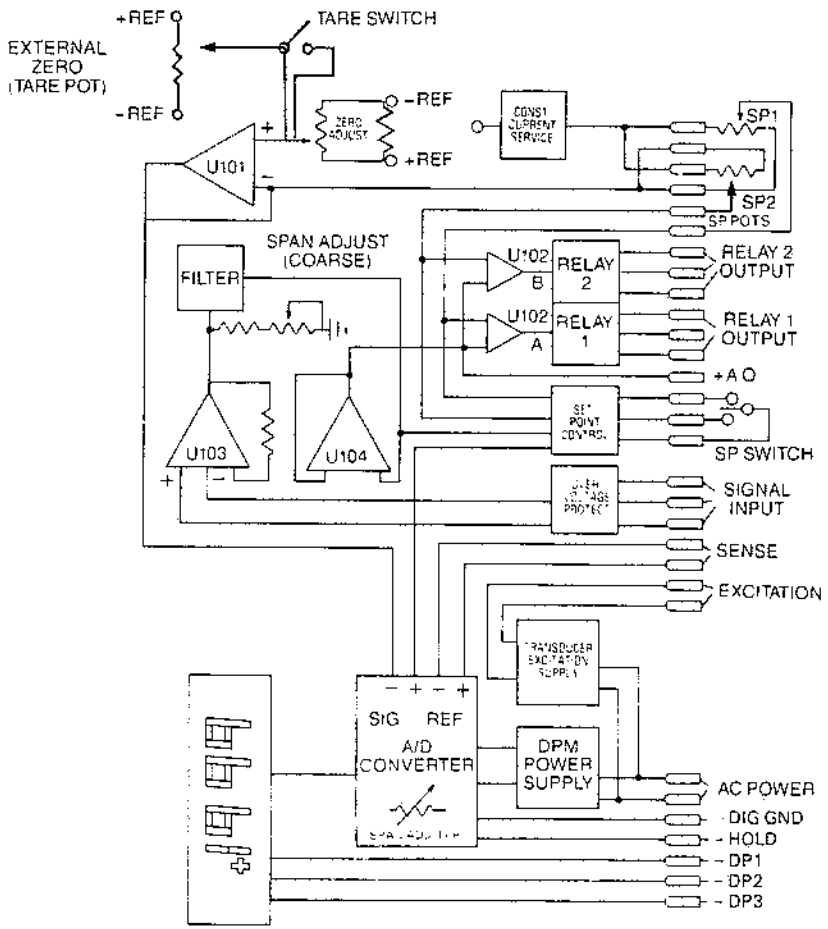


Figure 4-1. System Block Diagram

Overvoltage protection is provided which prevents an overvoltage from causing damage to the amplifier (U103) inputs.

4.1.1 Input Signal Level

For Models DP-350/352, the amount of gain capable in Amplifier U103 is variable from 4.95 to 137 which corresponds to readings between 54 to 1999 counts for an input signal between 11 to 100 millivolts. Since the excitation provided is 10 volts, any transducer rated between 1.1 mV/V to 10 mV/V may be used.

For the model DP-354, the amount of gain is variable from 300 to 1999 counts for an input signal between 4.9 to 10.1 Vdc. The excitation provided is 1.3 to 24 Vdc at 30 mA adjustable. Transducers with voltage outputs of 1-5V, .5 to 5.5 V, 1-6V, 0-5V, 0-10V, 1-10V, may be used.

For Models DP-350/352, span control is accomplished through the use of two potentiometers, one with coarse resolution, the other with fine. Both controls are accessible by removing the bezel/lens assembly from the case. The coarse control is located in the upper right corner of the display board, while the fine control is in the lower left corner. After amplification, the signal is further processed by passing it through a low pass filter designed to remove any frequency components created from the amplifier during its switching from one phase to the next.

4.2 ANALOG OUTPUT (DP350, DP352)

The analog output is supplied from the follower amplifier (U104). The function of U104 is to provide a low impedance not only to be able to drive peripheral equipment, but also to drive the set point comparators. The output drive capability of the analog output is 1 mA with a maximum voltage at full scale (1999) of 2 V dc.

4.3 SET-POINT ADJUSTMENT AND DETECTION (DP352)

In order to provide set-point adjustment, two 20 kΩ 10-turn potentiometers (DP352-kit) must be connected in positions SP1 and SP2 as shown on the block diagram. Also a toggle switch with a central neutral position must be attached to the set-point select inputs with the center or common pin of the switch going to pin J1-15 (+5 V dc out).

Referring to the block diagram, you will notice that the output from the zero adjust control is fed into the positive port of amplifier U101 while the bottom of both set-point controls is attached to the negative port. The output of U101 is then attached to the negative input of the A/D converter. This method allows the set points to float on any zero offset voltage which may be needed to balance the signal from the pressure transducer.

The result is a corrected displayed number for signal and set points which automatically takes into consideration any zero offset voltage which may be needed to compensate for offsets at zero from the pressure transducer. The adjustment range on the internal zero is ±20% of the full scale reading. Each set-point control is completely independent of the other and may be set anywhere from +5 to 1999.

4.4 EXCITATION SUPPLIES

For the DP-350/352 two fixed voltage supplies are provided to power the pressure transducer. One supply provides +5 V dc while the other provides −5 V dc. Together they are capable of approximately 40 mA output. Connection to the sensor is shown on the block diagrammed Figures 4-2, 4-3, 4-4, and 4-5.

For the DP-354 an adjustable 1.3 to 24 Vdc at 30 mA voltage supply is provided to power the transducer. (Refer to Figure 5-5).

4.5 A/D CONVERTER (DP350, DP352)

The A/D converter uses the dual slope conversion technique and operates at approximately three readings per second. The input signal level to the A/D converter will vary in accordance with the span setting used but the maximum input voltage before an overrange condition occurs is 1.999 volts. Since the excitation supplies will vary slightly with temperature, thereby changing the input signal from the pressure transducer by the same ratio, it is necessary to change the A/D converter's reference voltage accordingly.

If this adjustment in the A/D reference is not made, the displayed reading will vary, resulting in incorrect pressure readings. Both of the excitation supplies are monitored by connecting the (+) excitation output to the (+) sense input and the (−) excitation output to the (−) sense input. These connections may be made right on the rear connector when the cable to the transducer is short or the sense inputs may be connected right at the transducer if the cable is long. The sensed signal is then converted to a varying reference voltage which is proportional to the voltage being supplied to the transducer. Additional control inputs for all models are provided as shown below:

a) Hold: When a logic "0" or digital ground is applied, the display will maintain the last reading converted. If left floating, the A/D will continually update at approximately three readings per second. A +5 V dc should never be connected to the hold pin unless a 4.7 kΩ resistor is placed between the hold pin and the +5 V dc.

b) Decimal points on the display may be activated by connecting the required decimal point pin to digital ground J2-N.

c) External zero (Tare) is set by flipping the Tare DIP switch off (down), which disables internal zero, (see Figure 5-2), and then connecting a 50 KΩ 10 turn pot to connector J1 (see Figure 4-2) to pins 6, 10 and K. This provides Tare capability of −100%, +6% of full scale reading. This control is settable to within one count.

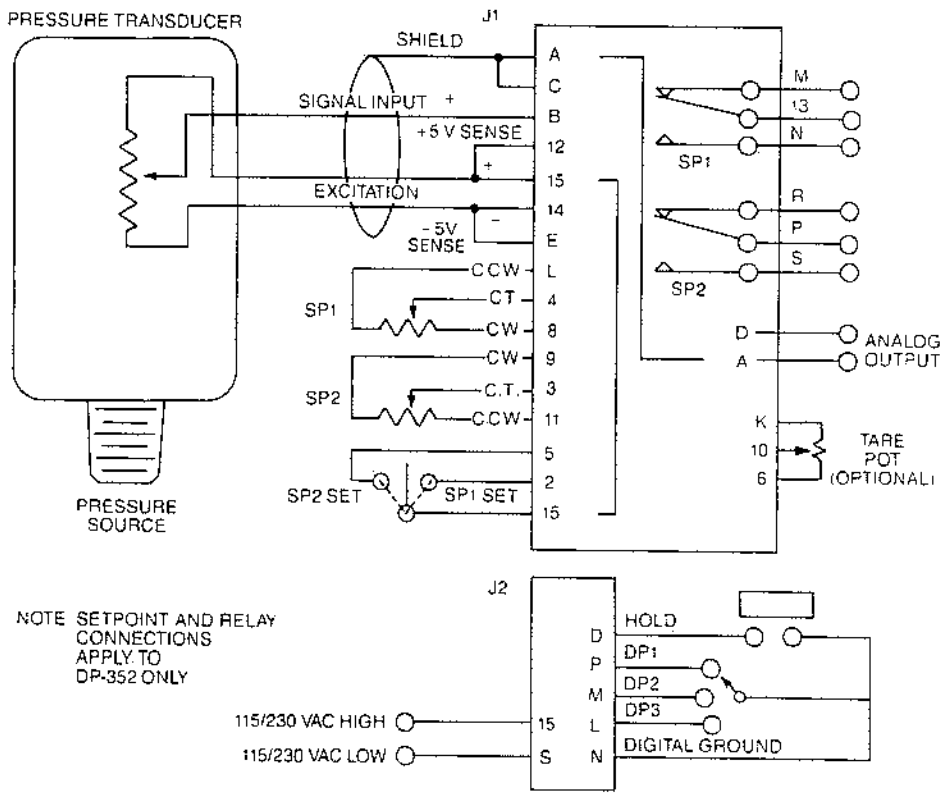


Figure 4-2. Single-ended Input, Sense Leads Connected at J1 (3 Wire), 10 V dc Excitation (DP-350/352)

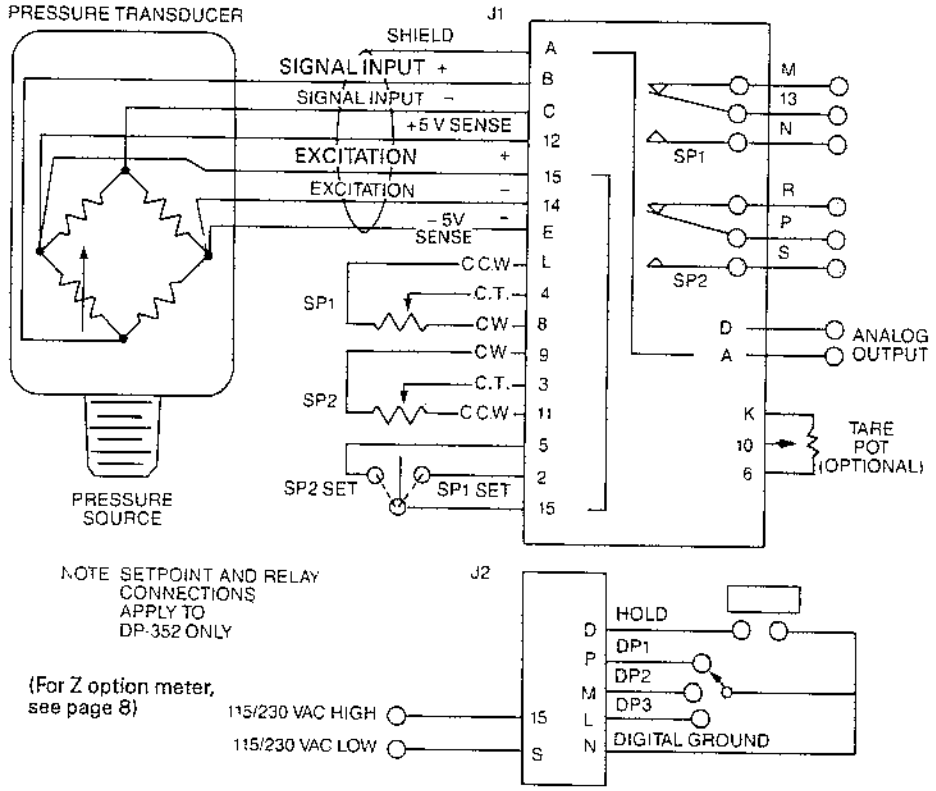


Figure 4-3. Differential Input, Sense Leads Connected at Pressure Transducer (6 wire), 10 V dc Excitation (DP350/352)

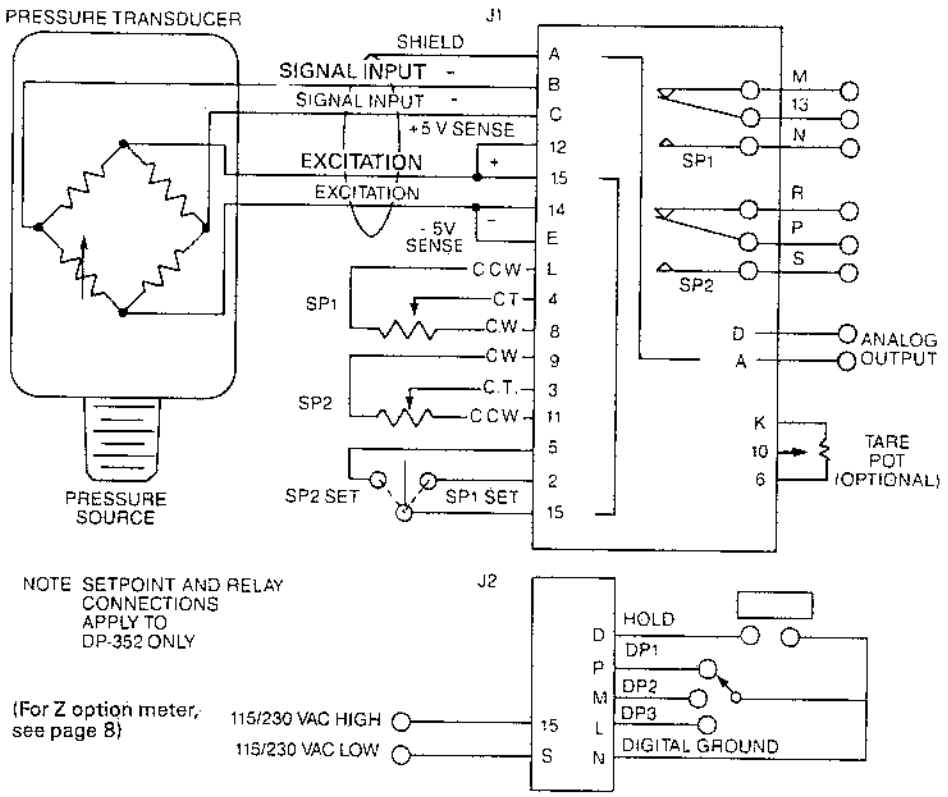


Figure 4-4. Differential Input, Sense Leads Connected at J1 (4 wire), 10 V dc Excitation (DP-350/352)

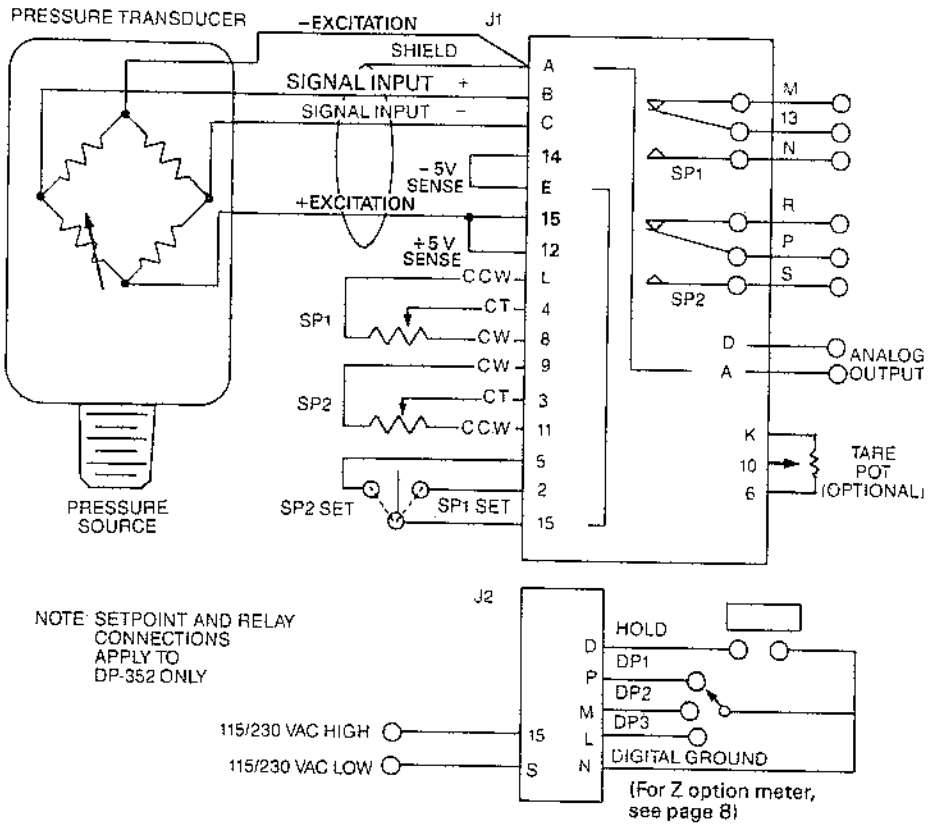


Figure 4-5. Differential Input, Sense Leads Connected at J1 (4 wire), 5 V dc Excitation (DP-350/352)

SECTION 5 SERVICE INFORMATION

5.1 CALIBRATION FOR MODELS DP-350/352

Two methods may be used to calibrate Models DP-350 and DP-352 Pressure Instruments. Of the two methods, the most accurate (Method 1) is to connect the indicator to the actual pressure transducer being used and apply a precision pressure while adjusting the indicator. The second method is to calculate the millivolt output from the transducer and input this voltage to the instrument.

5.1.2 Required Calibration Equipment

1. Wiring harness for connection to indicator at J1 and J2. Model DP-350 does not have set points or relay outputs.
2. Precision pressure source if Method 1 above is used.
3. Precision voltage source and precision multimeter with a resolution of 10 mV or better if Method 2 above is used.

5.1.3 Calibration Procedure for DP350/352

It is first necessary to examine the pressure transducer to be used and determine the millivolt per volt (mV/V) output and the full scale pressure range. A typical transducer will have a nominal and an actual mV/V rating. In all cases, the impedance of the transducer must be 200 ohms or greater to use the indicator's internal transducer excitation supply.

A typical transducer used with the DP-350/352 would have the following ratings:

Impedance: 350 Ω

Nominal Output: 3 mV/V

Calibrated Output: 3.01 mV/V at 1000 PSI

Full Scale Range: 1000 PSI

Required Excitation: 8 to 12 V dc

Method 1 (Using a Known Load)

1. Connect the pressure transducer to the indicator making the connections as shown in Figure 4-3, 4-4 or 4-5. Model DP-350 does not have set points or relay outputs.
2. Apply ac power to the indicator.
3. Apply a zero pressure to the transducer.
4. Remove the indicator's front bezel.
5. Adjust the offset (zero adjust) pot (marked "0") with a small screwdriver to obtain a reading of ±000. See Figure 5-2.
6. Apply a full scale pressure to the transducer (full scale must be less than 1999).
7. Adjust the SPAN (FINE) pot located in the lower left corner (marked "F") to approximately five turns from the end of its adjustment (mid-position). See Figure 5-2.
8. Adjust the SPAN (COARSE) pot located in the upper right corner as close to the desired full scale reading as possible. See Figure 5-2.
9. Slightly readjust the Fine Span pot for an exact reading.

10. Apply ½ scale pressure and verify that the correct pressure is indicated within the pressure transducer's rated accuracy.

    Example: Accuracy: ±¼% F.S.
    F.S.: 1000 PSI
    Max Error: 1000 x +.0025 = ±2.5 PSI

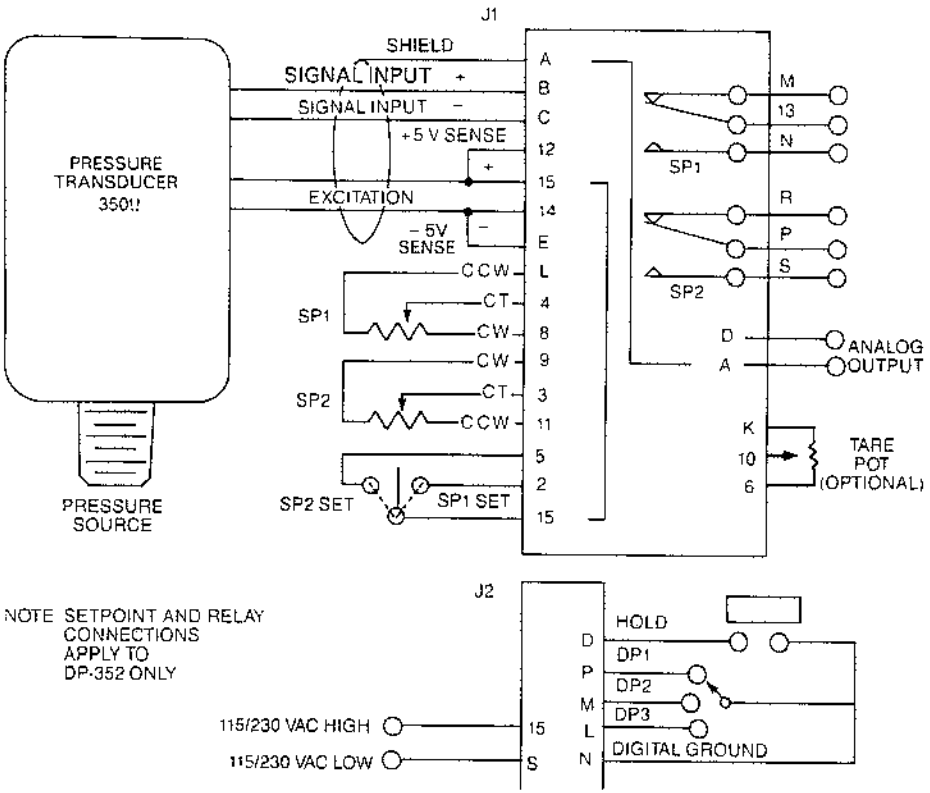
    The midpressure indication should not be off by more than ±2.5 PSI, i.e., 497.5 to 502.5 PSI.

Method 2 (Using a Millivolt Source)

1. Connect the pressure indicators signal inputs to the precision voltage source (PVS) as shown in Figure 5-3.
2. Connect the precision multimeter (PMM) to the ±Excitation outputs from the indicator. Use the lowest range greater than 10 V dc. The meter should have a resolution of at least 10 mV on this range.
3. Apply ac power to the indicator.
4. Apply zero mV or volt from the PVS and adjust the instrument for a reading as in Method 1, step 4 and 5.
5. Input the full scale mV from the PVS as calculated below:
   Calibrated mV/V × Actual Excitation Voltage Output = F.S. (mV)
   (Calib. Cert.) (as indicated on the PMM)

   Example: Calibrated mV/V = 3.01 mV/V dc
   Actual Excitation Output = 9.85 V
   Full Scale Pressure = 1000 PSI

   3.01 mV/V x 9.85 V dc = 29.65 mV at 1000 PSI



Note: Set Point and Relay Connections Apply To Model DP-352 Only

Figure 5-1. Calibration Method 1 for Models DP-350/352

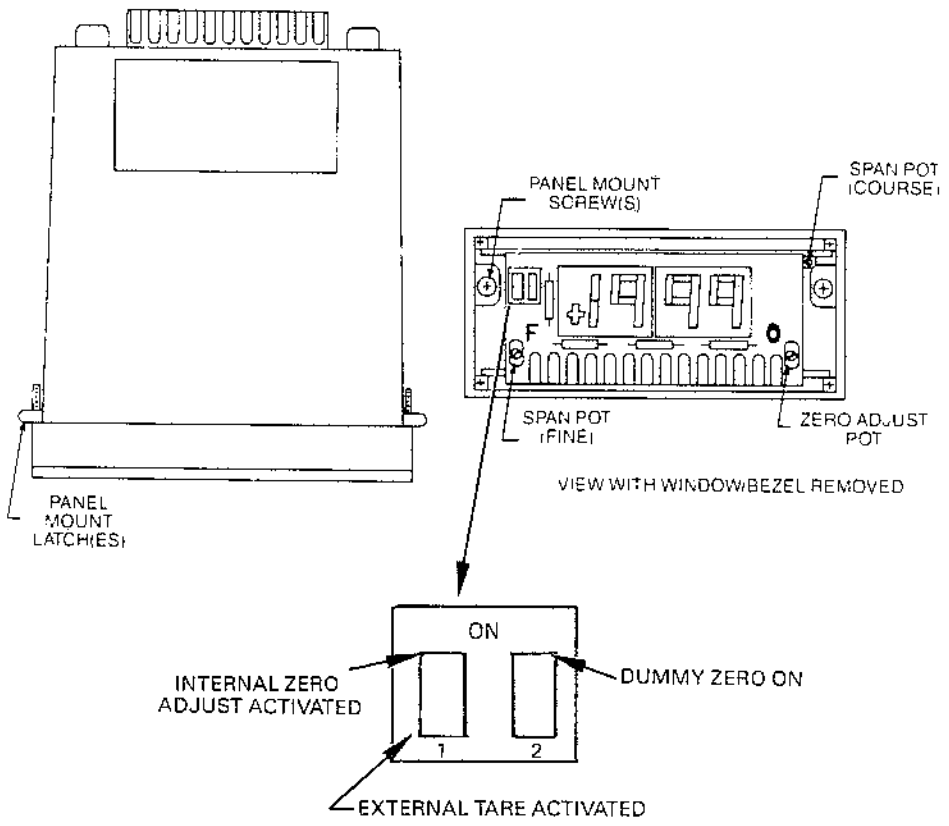


Figure 5-2. Calibration Adjustments for Models DP-350/352

6. With 29.65 mV input from the PVS, the indicator should be adjusted for a reading of 1000 as in Method 1, steps 7, 8 and 9.
7. Calculate the midpoint reading by dividing the full scale mV and the full scale pressure by 2.

   1000 PSI ÷ 2 = 500 PSI

   29.65 mV ÷ 2 = 14.835 mV

   Input 14.835 mV from the PVS and verify that the midpoint indicated pressure is within the rated accuracy of the transducer as the example in Method 1, step 10, i.e., ±2.5 PSI or 497.5 to 502.5 PSI.

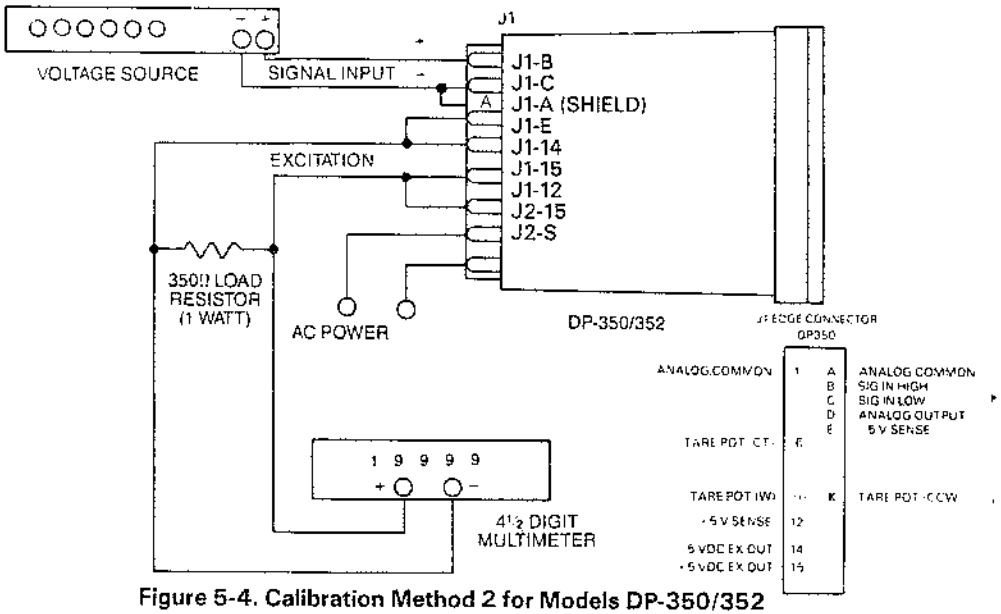


Figure 5-4. Calibration Method 2 for Models DP-350/352

5.2 CALIBRATION FOR MODEL DP-354

5.2.1 General

Model DP-354 is field scalable (see Figure 5-5) by a combination of two potentiometers and Position 1 of a display board mounted DIP switch located behind the front lens. When shipped, the scaling is set as follows: 1Vdc = 000 displayed, 5Vdc = 1999 (19990 with dummy zero Z option) displayed. The calibration (scaling) may be changed in one of two ways. In either case, it is necessary to have a precise calibration standard (pressure or electrical).

Method 1:

The DP-354 indicator is electrically connected to the pressure transducer to be used. (Refer to Figure 2-3). A precise pressure is applied to the transducer and the pressure indicator scaling is adjusted to match the transducer.

Method 2:

The DP-354 indicator is electrically connected to a precise voltage source. The source is set to match the specifications of the transducer to be used, and the pressure indicator scaling is adjusted to match the transducer.

5.2.2 Excitation Voltage Output

The DC excitation voltage output is factory set when shipped. This voltage is adjustable from 1.3Vdc to 24Vdc @ 30 mA. To adjust the excitation voltage, connect the indicator as shown in Figure 5-4. Remove the front lens (window). Adjust the excitation voltage adjustment potentiometer (see Figure 5-5) for the desired voltage as indicated on the DC voltmeter.

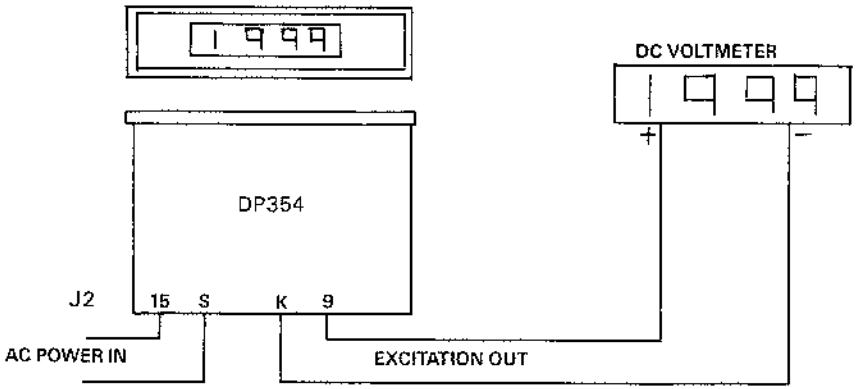


Figure 5-4. Adjusting Excitation Voltage Output, DP-354

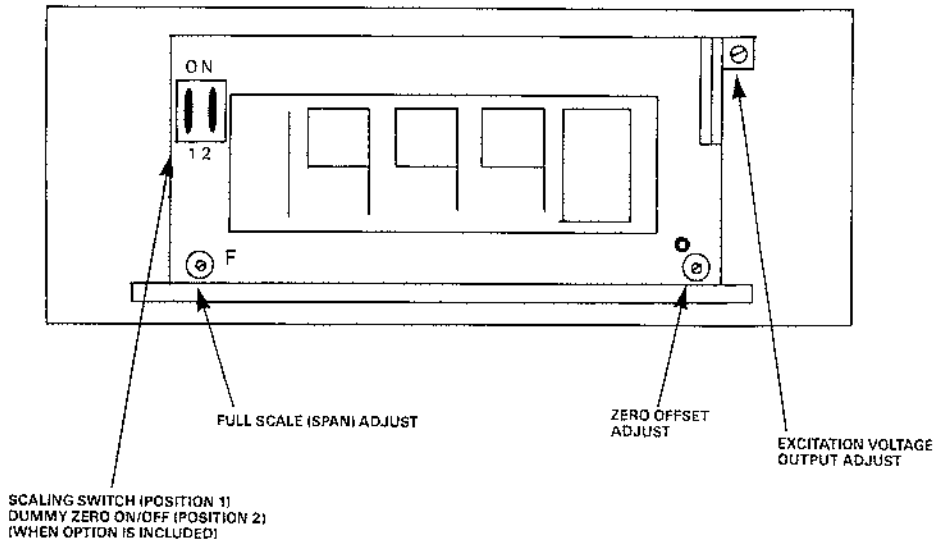


Figure 5-5. Calibration Adjustments for Model DP-354

5.2.3 Calibration Procedure for DP-354

Example: 1Vdc=000, 5Vdc=1500PSI; Excitation required: 12-24Vdc

1) Set the excitation voltage output between 12 and 24 Vdc (per paragraph 5.2.2).

2) Apply power to the DP-354 Indicator. Remove the window (front lens) and allow to warm up five minutes. Two potentiometers and Position 1 of display mounted DIP switch are used for calibration adjustment (refer to Figure 5-5). The DIP switch Position 1 must be in the ON (up) position when the full scale transducer output voltage minus the offset voltage (if any) is less than 7.5Vdc. Place this switch in the OFF (down) position for higher signal inputs (i.e., 1/10Vdc). In the example, 5V—1V=4V, which is less than 7.5Vdc, so the switch must be ON.

3) Turn the offset (zero adjust) pot (marked "O") fully counterclockwise. The display should read some negative number.

4) Input the voltage required for a full scale reading (5Vdc) from a precision voltage source (METHOD 2) or apply full scale pressure, if connected to the transducer (METHOD 1). Adjust Full Scale pot (marked "F") to bring within overrange, if necessary. Note the reading (i.e., 1700).

5) Input the voltage required for a zero reading (1Vdc) from a precision voltage source or input zero pressure. Note the reading (i.e., −200). Algebraically subtract the zero reading from the full scale reading (1700 − (−200) = 1900).

6) If the desired full scale calibration (1500PSI) is less than the computed number from step 5, turn the Full Scale Control ("F") slightly counterclockwise. If the desired full scale calibration is greater than the computed number, turn the "F" control clockwise.

7) Repeat steps 4 through 6 until the computed number from step 5 is equal to the desired full scale pressure (1500PSI). Two or three adjustments may be required.

8) Input the voltage required for a zero reading (or zero pressure) and adjust the offset ("O") control for a reading of 000. Recheck at full scale voltage (pressure) and verify that the display reads the desired pressure (1500).

NOTE

When the transducer produces an offset voltage at zero pressure as in the example, there will be some interaction between "0" and "F" controls.

5.3 ANALOG OUTPUT

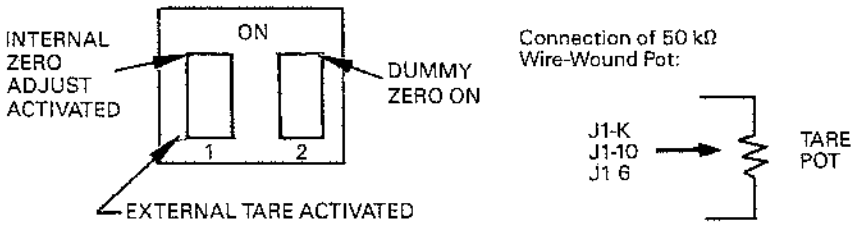
The analog output is factory calibrated to provide a 1 mV per count as displayed on the indicator. (Standard on DP-350/352; optional on DP-354)

Example: Pressure range: 500 PSI
A.O. at 500 PSI: 0.5 V dc
A.O. at 0 PSI: 0 V dc

This output may be used to drive a chart recorder, panel meter, or other indicating device having a minimum impedance of 2000 ohms. The Analog Output voltage is independent of the zero adjust (offset "0") pot on the front of the instrument. If the zero adjust is used to compensate for slight output voltages from the transducer for an indication of zero, the Analog Output will show this voltage. In this case, it is advisable to adjust the transducer for zero output with zero pressure applied. Most external devices like chart recorders have zero adjustment and gain controls. These adjustments may be used to correctly scale the Analog Output. See Figure 5-6.

5.4 TARE (EXTERNAL ZERO) ADJUSTMENT (DP-350 AND DP-352 ONLY)

With the Tare DIP switch in the OFF (down) position, connect a 50 KΩ 10 turn precision wire-wound pot (Beckman 7276R 50 KL.25 or equivalent). The external zero (Tare pot) will allow pressures or weights up to the calibrated full scale to be "tared out." With the pressure/weight transducer connected to the indicator, adjust the external zero (Tare) for a zero reading. This adjustment will not effect the span calibration controls.



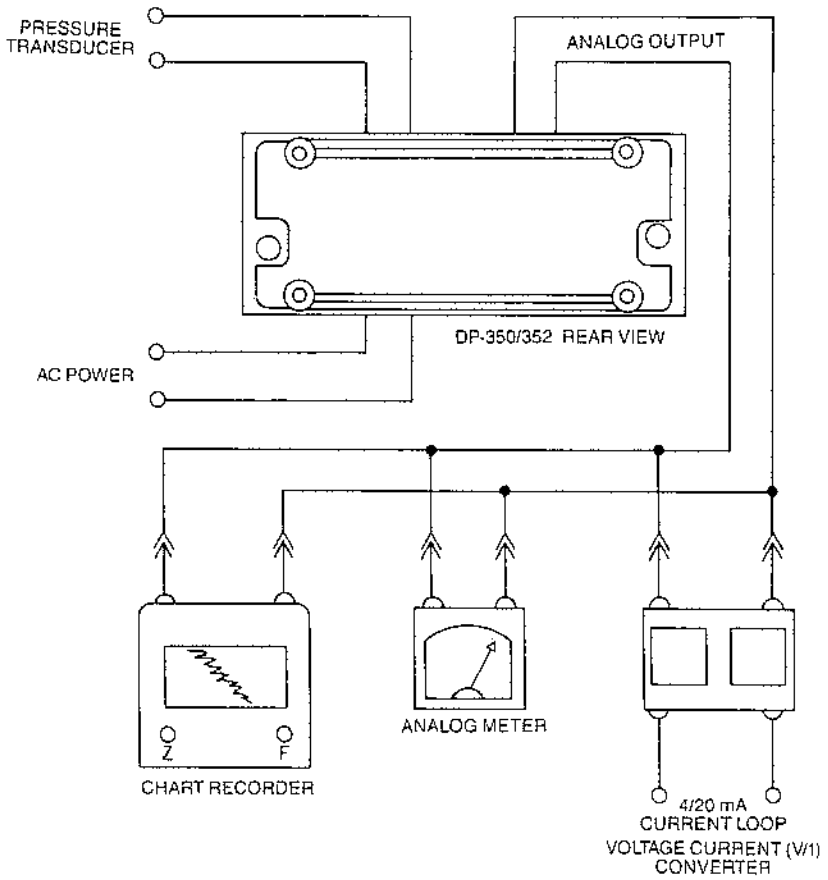


Figure 5-6. Analog Output (Typical Applications)

5.5 SET POINTS AND RELAY OUTPUTS (MODEL DP-352 ONLY)

Model DP-352 is equipped with two analog set points with an SPDT relay for each. The set points are used by connecting two 20 K Ω 10-turn pots and an SPDT center off toggle switch as shown in Figure 5-1. If only one set point is required, it is only necessary to connect one pot and an SPST switch at either set-point position. Both set points will cover the range of +5 counts to greater than full scale (1999). The set points may not be set for (−) indicated pressures. Once the set points are set by positioning the set-point pots, they will remain as long as the pots are not readjusted. Removing and reapplying ac power will not affect the set-point settings. The set-point switch is only to give a displayed indication of the set-point value.

When the signal input voltage from the pressure transducer is greater or equal to the set-point value, the set-point relay will close, giving a normally open and normally closed output. Both set-points operate completely independent of each other.

5.5.1 Set Point Adjustment

1. Position the set-point select switch to set point #1.
2. Turn the set-point pot fully CCW. The reading should be 000, ±5 counts.
3. Turn the set-point pot fully CW. The display should go into +overrange close to the CW end of the pot.
4. Repeat steps 1, 2 and 3 of this section using set point 2.

5.5.2 Set-Point Relay Output Tests

1. Input a signal from the simulator or pressure source to give a displayed reading of approximately 1000 counts.
2. Connect a lead of an ohmmeter to J1-P and the other lead to J1-S.
3. With the set point #1 pot fully CCW, the ohmmeter should read a short.
4. Advance the set point #1 pot in a CW direction. As the set point voltage passes the input signal (1000 counts) the relay should click and the ohmmeter should read an open circuit.
5. Repeat steps 3 and 4 with the ohmmeter lead moved from J1-S to J1-R. In step 3 the meter will read an open when the control is CW and a short circuit when at approximately 1000 counts.
6. Repeat steps 3 through 6 using set point #2 pot and the ohmmeter across J1-13 to N during the first part of the test and J1-13 to M during the last part of the test.

SECTION 6 SPECIFICATIONS

ACCURACY:	±0.05% of reading ±1 count
LINEARITY:	±0.2 cts. typ. ±0.5 cts. max.
TEMPERATURE COEFFICIENT:	Full Scale:0.005% of reading/°C max.; Zero: 1μVolt/°C max.
COMMON MODE REJECTION:	−80 dB @ D.C.

SPECIFICATIONS (cont'd.)

NORMAL MODE REJECTION:	−45 dB @ 60 Hz
COMMON MODE VOLTAGE:	DP-350/352, ±4 volts max; DP-354, ±2.4V
BIAS CURRENT:	DP-350/352, 1.5 NA; DP354, 100 pA max.
MAXIMUM INPUT OVERLOAD:	100V
STEP RESPONSE:	500 ms
READ RATE:	3/sec
BRIDGE EXCITATION:	DP350/352, 10 V dc (+ and −5 V dc) @ 50 mA; DP-354, 1.3 to 24 Vdc @ 30 mA adjustable
SIGNAL INPUT	DP-350/352, 1.1 mV/V to 10 mV/V = 54 to 1999 (adjustable), 54-19990 with option Z; DP-354, zero offset, −0.1 to 1.1 Vdc = 000; scaling, 4.9 to 10.1 Vdc = 20 to 1999 counts (19990 with option Z)
HOLD:	Logic "0" or digital ground holds reading and BCD output. With meter in "hold" a logic "1" pulse (5 V dc through a 4.7 K Ω load resistor) (0.33 sec or greater) will cause the display to update.

SPECIFICATIONS (cont'd.)

DECIMAL POINT:	Selectable at connector by logic "0" or digital ground (J2-N).
TRI-STATE CONTROL (WITH OPTIONAL BCD):	With a logic "1" on pin J2-13, the BCD data lines will be placed in a high impedance state.
ZERO ADJUSTMENT:	For DP-350/352 ±20% F.S.;
ZERO OFFSET:	For DP-354, −0.1 to 1.1 Vdc

DIGITAL OUTPUTS (See Figure 1-1)

BDC (OPTIONAL): Tri-State, parallel, latched positive true.

Drive Capability: 1 TTL load per data line
Print: Logic "0" represents valid data
Overrange: Logic "1" represents overrange
Polarity: Logic "1" represents positive

ANALOG OUTPUT (Std. DP350/352; Optional DP354)

Range: 1 V dc = 1000 counts displayed (1mV/count)
Accuracy: 0.5% reading ±1.0 mV
Load: 2000 Ω min (1 mA max)

SET POINTS (DP352)

Setability: ±1 count
Hysteresis: ±10 counts
Temperature Coefficient: ±0.14 counts/°C
Relay Output: Form C 26 V dc @ 1 amp resistive (SPDT)

SPECIFICATIONS (cont'd.)

POWER ENVIRONMENTAL

Power: 115/230 V ac ±15% 47-400 Hz 4.0 watts typ
Power Line Isolation: 1200 V above the ac power line
Operating Temperature: −10°C to +60°C
Storage Temperature: −40°C to +80°C
Relative Humidity: 0-90% non-condensing

PHYSICAL CHARACTERISTICS

Termination: Two dual 15 pin edge-card type, 0.156" center spacing 1/16" PC thickness
Weight: 16 ounces
Case: Glass filled Cycolac KJB black
Window: Anti-reflection red filter
Display: 0.6'' LED, bright red-orange, 7 segment

GENERAL: Models DP-350 and DP-352 are 3½ digit (1999) digital pressure indicators designed for use with 200 Ω or greater strain gage type pressure transducers. These indicators are panel mountable with hardware supplied. Pressure is displayed on bright red-orange LED digits.

Model DP354 is a 3½ digit (1999) digital pressure indicator designed for use with ''high level'' voltage output pressure transducers.

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