MODEL AG-200

Digital Pressure Indicator

SENSOTEC

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Series AG-200 User's Guide
Sensotec Part Number: 008-0267-00
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Chapter 1

INTRODUCTION

SENSOTEC's AG-200 Series instruments combine a high-quality transducer with a precision signal conditioner/ indicator in a attractive DIN-size cases. They will measure pressure accurately and display the results in engineering units.

1.1 Standard Features

- Full 4-1/2 digit, 0.56-inch display
- Display in any engineering unit desired
- Full 20,000 count resolution
- 0 - 5 volt analog output at full-scale pressure
- 110 VAC, 60Hz. power (Optional: 220VAC 50Hz)
- Zero-tracking
- Tare capability
- Attractive extruded aluminum case
- 3/8 or "panel-meter style" case
- 1/4-18 NPT input fitting
- 15 pressure ranges to 30,000 psi

1.2 Optional Features

- Panel-mounting adapter
- Bench-mount adapter
- RS-232C Digital Output

Chapter 2

DESCRIPTION

2.1 Configuration

Within the AG-200's enclosure are housed the transducer, mounted on the inside of the rear panel, and five printed circuit boards.

1. The Main Board contains the circuitry for the power supply, analog-to-digital converter, a portion of the display hardware, and the SCALING potentiometer.

2. The Display Board solders to the Main Board and contains the displays and the necessary circuitry to drive them.

3. The Amplifier Board contains the excitation circuit for the transducer, the signal conditioning amplifier, and referencing circuits. Adjustments of the analog circuitry are located on this board, and may be reached by removal of the front panel (2 screws).

4. The Microprocessor Board contains the microprocessor and its associated clock and port circuitry.

5. The Interface Board contains circuits to permit interaction between the analog amplifier circuits and the microprocessor circuitry.

2.2 Specifications

Environmental:

Temperature, Storage	-20° F to 200° F
Temperature, Operating	60° F to 130° F

Amplifier Characteristics:

Full-scale Output	5 volts
Output Impedance	< 2 ohms
Accuracy	+/- 0.10% bfsl
Frequency Response	0 - 250 Hz.
Tare Range	20% of full scale

Display Characteristics:

No. of Characters Displayed	4-1/2
Conversions per second	3
Scaling Range	0 - 19999
Scaling Method	Potentiometer
Decimal Point Selection	Plug-in Jumper
Display Size	0.56"
Overrange Indication	Flashing Display
Resolution	1/20,000
Type	LED

Physical Characteristics:

Case Material	Extruded Aluminum
Weight	3 lbs.
Mounting	Bench, Panel or Rack
DIN Size	3/8 DIN
Size	5.6" width
	2.8" height
	8.5" depth

Power Requirements:

115VAC/220VAC (factory set)

Chapter 3

INSTALLATION

The AG-200 is shipped in a single container. Inspect the unit for shipping damage, and gently shake and listen for loose components prior to energizing it. Report shipping damage to the carrier; it is his responsibility to safely transport the unit. If there is transportation damage and you have difficulty getting the problem resolved, contact SENSOTEC at (614) 486-7723. We will attempt to assist in resolving the situation.

3.1 Mounting the Unit

For panel mounting, cut a rectangular hole 5.35" in width by 2.68" in height. Using a small Allen wrench, remove the panel- mounting jack screws from the case. These screws are reached by inserting the Allen wrench through the slots in the rear panel located directly behind the panel jacks. After the screws are removed, the jacks may be moved toward the rear, and out of the slots in the case. The case may then be inserted through the panel cutout, the jacks reinserted into the slots, and the screws inserted and tightened to force the instrument bezel to contact the panel. Figure 3-1 gives dimensions and panel cutouts for the 3/8 DIN case. Recommended panel thickness is 0.090 to 0.250 inches.

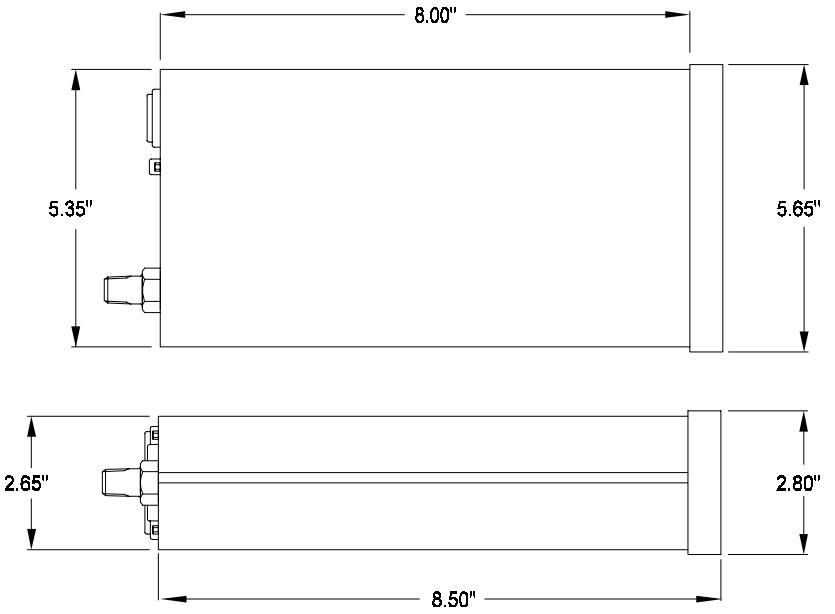

Figure 3-1 -- Dimensions

3.2 Pressure Connection

The fitting supplied on the rear panel for pressure connection is a 1/4-18 NPT connection. The use of Teflon thread tape is recommended. Flexible tubing may be used in connecting to the pressure source; care must be used to insure that the flexible tubing has a pressure rating at least twice the expected pressure. Figure 3-2 is a sketch of the AG-200 rear panel.

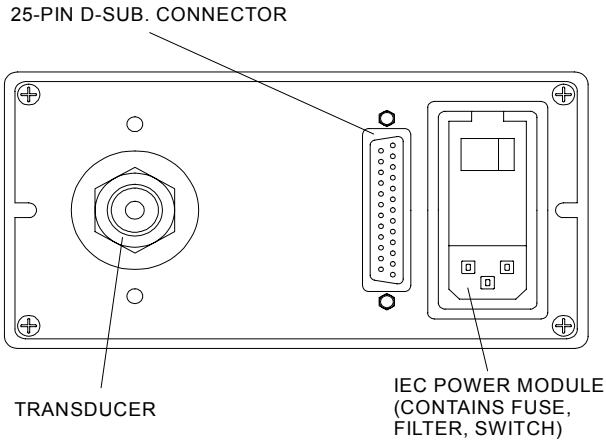

Figure 3-2 -- Rear Panel

3.3 Power Connections

AC power for the AG-200 is applied by plugging in the power cord to a 110 volts, 60 Hz. power source.

Note: 220 volts, 50 Hz. may be used if proper jumpering is done on the Main Board. If you desire to change the AG-200 to work with this power choice, contact SENSOTEC, (614) 486-7723, for instructions regarding modification.

3.4 Using the Analog Output

The analog output voltage of the AG-200 may be found on pins 24 and 25 of the RS-232 (D-subminiature) connector. Pin 24 is "hot" and pin 25 is the reference.

Chapter 4

INITIAL ADJUSTMENTS

The AG-200 has been carefully calibrated at the factory, and should require no initial setup. However, if you wish to check the initial setup or make small changes in it, this section will guide you through them.

4.1 Amplifier Adjustments

Amplifier adjustments include "tweeking" the FINE ZERO and FINE SPAN controls.

FINE ZERO Adjustment

Because of ambient temperature changes, transducers may exhibit some small amount of zero shift. The AG-200 employs a Zero Tracking circuit which cancels this shift every ten seconds. This circuit may be shut off, and a true zero reestablished in the following manner:

1. Remove the front panel (lens) from the AG-200 by unscrewing the two screws in the panel's sides.
2. Referring to Figure 4-1, move the ZERO TRACKING switch to its upper (off) position. If the TARED light is on, press the TARE switch, so that the light goes off.
3. Remove all pressure from the pressure input to the AG- 200. There will likely be a small count displayed on the AG-200. This is the zero offset of the system.

4. Adjust the FINE ZERO potentiometer so that the display reads 0000.

5. Return the ZERO TRACKING switch to its lower (on) position.

If further adjustments are to be made, do not replace the lens yet. Otherwise, it may be returned to the front of the AG-200 and secured in place.

FINE SPAN Adjustment

After the FINE ZERO has been adjusted and zero tracking reestablished, press the SHUNT CAL switch to determine if the number displayed is the same as that given on the Unit Calibration Record. If it is not, "tweek" the FINE SPAN to give this number.

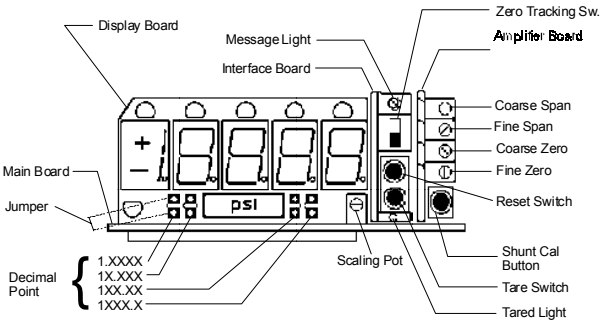

Figure 4-1 -- Adjustment Locations

Chapter 5

RECALIBRATION

The AG-200 is normally ready to use as received because setup has been performed at the factory. The adjustments in this section are usually not performed, and are for making a completely new setup (like a "major field overhaul").

5.1 Microprocessor and Interface Board Adjustments

Set up the Interface Board adjustments first. There are three potentiometer adjustments to be made on the Interface Board if recalibration is performed. Refer to Figure 5-1 to locate the Interface Board, and to Figure 5-2 for the location of the potentiometers and test points on the Interface Board.

Output Interface Amplifier Gain Adjust

The Interface Board output amplifier must have a gain of 2. (Its output voltage must be twice its input voltage.) This adjustment is made with the OUTPUT GAIN potentiometer, while monitoring the voltage on TP-1.

1. Put the reference (ground) lead of the voltmeter on the reference (ground) side of the analog output (see Section 3.4).

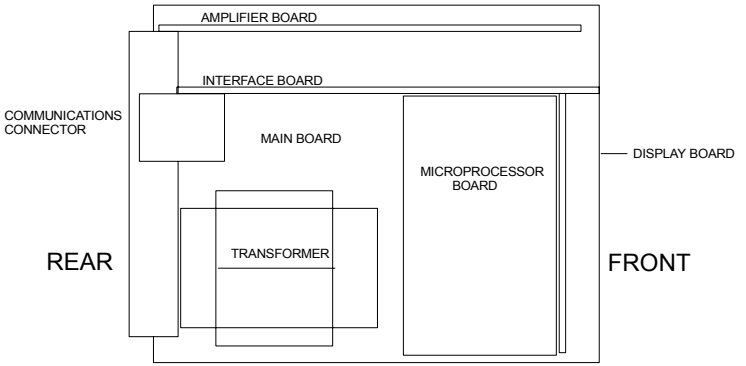

Figure 5-1 -- Main Unit Board Locations

2. Locate TP-1 on the Interface Board. This point is difficult to use, so care must be exercised to be certain that the voltmeter lead is on this terminal (Pin 1 of an LT1013), and that the voltmeter lead is not shorting this point to another. Attach (or hold) the voltmeter lead on this point.

3. Apply a pressure or use the SHUNT CAL switch to get a voltage of at least 1 volt at TP-1. Record this voltage.

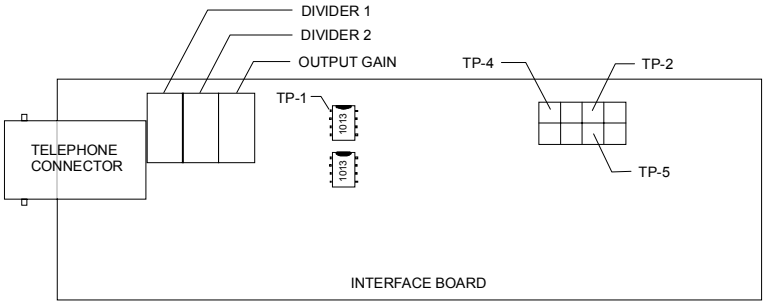

Figure 5-2 -- Interface Board Adjustments

4. Adjust the OUTPUT GAIN potentiometer so that the analog output voltage of the AG-200 is exactly twice that which was noted in Step 3. For this step, connect the voltmeter to the analog output of the AG-200.

5. Remove the voltmeter leads.

Divider 1 Adjustment

It is necessary for the uncorrected analog output voltage from the Amplifier Board to be twice as much as the voltage going to the microprocessor's A/D converter input.

1. Put the reference (ground) lead of the voltmeter on the reference (ground) side of the analog output.

2. With the voltmeter, measure the voltage on TP-4. If this voltage is not at least two volts, apply sufficient pressure to the AG-200 to get two or more volts here. Record this voltage.

3. Move the voltmeter lead to TP-5. Adjust the DIVIDER 1 potentiometer to give a voltage exactly half that measured in Step 2.

Divider 2 Adjustment

The DIVIDER 2 adjustment establishes a voltage of 1.024 volts at TP-2.

1. Put the reference (ground) lead of the voltmeter on the reference (ground) side of the analog output.

2. With the voltmeter, measure the voltage on TP-2. Adjust the DIVIDER 2 potentiometer to give 1.024 volts at TP-2.

Setting up the Amplifier

The following instructions will serve to zero and recalibrate the amplifier circuits, located on the Amplifier Board. See Figure 5-1, then Figure 4-1.

5.2 ZERO Adjustment

The adjustment of the no-signal zero indication is made first. For all of the adjustments in this section, the transducer has no pressure applied. If the AG-200 is an absolute pressure (psia) unit, a vacuum must be applied. Otherwise, the unit will read the present local barometric pressure (approximately 14.7 psia) and adjustment cannot be made using the ZERO adjustment only.

1. Remove the front panel (lens) and bezel. Remove the four screws at the corners of the rear panel. Then slide the case off.

2. Apply power to the AG-200, and allow about 10 minutes warmup.

3. Connect a digital voltmeter to read the analog output voltage of the AG-200.

4. Adjust the COARSE ZERO potentiometer (see Figure 4-1) to give an output voltage of about 0 volts. Then adjust the FINE ZERO potentiometer to bring this value exactly to 0 volts.

Full-Scale (Span) Adjustments

Span adjustment calibrates the gain of the amplifier section of the Amplifier Board to provide the proper voltage output for a given pressure. The shunt calibration feature of SENSOTEC instruments facilitates this adjustment.

A Calibration Record is shipped with each AG-200, listing the amplifier output voltage when the SHUNT CAL switch is pressed. This record also lists the displayed value under the same condition. Locate the Calibration Record for the AG-200.

1. Again connect the digital voltmeter to the analog output voltage terminals.

2. Depress the SHUNT CAL switch.

3. Adjust the COARSE SPAN control to give the approximate shunt calibration output voltage as shown on the Calibration Record.

4. Adjust the FINE SPAN control to give the exact value given for shunt calibration output voltage on the Calibration Record.

5.3 Scaling Adjustment

Scaling adjustment permits the AG-200 to display values in engineering units desired by the customer. Scaling adjustment establishes the ratio between the voltage output of the AG-200 and its displayed value. The SCALING potentiometer is located on the Main Board, as shown in Figure 4-1. The engineering units to be displayed are given on the Calibration Record.

1. Depress the SHUNT CAL switch.

2. Adjust the SCALING potentiometer to yield the displayed value from the Calibration Record.

5.4 Miscellaneous Adjustments

Decimal Point Selection

Figure 4-1 shows jumper location for decimal point selection. Move the jumper to the desired position.

Chapter 6

IN OPERATION

The normal operating condition of the AG-200 is with the ZERO TRACKING switch in its down (on) position, and untared (TARE light out). These conditions have been established by the factory, but could be changed by field personnel. Some explanation of the function of these switches may be helpful.

6.1 Zero Tracking Function

The Zero Tracking function is designed to cancel temperature shift in the sensor and circuits.

The AG-200 assumes that any displayed value under 10 counts is due to temperature shift, and periodically (once each 10 seconds) will zero such a count. Signals above this level are assumed to be valid changes in pressure, and automatic zero tracking is disabled. Occasionally, some applications may require that zero tracking be disabled. If so, the ZERO TRACKING switch (see Figure 4-1) can be moved to its upward (off) position.

6.2 Tare Function

The Tare Function permits cancellation of a base-level pressure which is up to 20% of the full-scale transducer range of the AG- 200. When the AG-200 is first energized, or immediately after the RESET switch is pressed, the count momentarily displayed is the maximum value in engineering units that can be tared out by the AG-200's Tare circuit.

To activate the Tare, perform the following steps:

1. Remove the front panel (lens).

2. With the pressure applied that it is desired to tare (electronically zero), press the TARE switch. The display should now count down to zero (0000).

3. Replace the front panel (lens).

Chapter 7

OPTIONS

7.1 The RS-232 Option

Signals

As in RS-232, a signal level of -3 volts or less is considered to be a “1” while a signal level of +3 volts or greater is a logic “0”. These levels will be about +/- 12 volts in the AG-200.

The DTR (Data Terminal Ready) signal serves to indicate that the AG-200 is up and running. A logic “1” here (which is -12 volts) indicates that the AG-200 is ready to transmit data.

The DSR (Data Set Ready) signal serves to indicate that the equipment to which the AG-200 is connected is ready to receive data. If this terminal is more positive than +3 volts (logic “0”) the data terminal is ready to receive data. When the AG-200 is ready to transmit data, the DTR signal will become more positive than +3V (logic “0”), indicating that data will be transmitted upon command. If a jumper is installed interconnecting the DSR and DTR signals, data will be transmitted once each second continuously.

The analog output has a separate return pin in order to keep it from being affected by noise on the RS-232 ground.

Checking and Changing Baud Rates

A unique system for changing baud rate has been devised, so that the user can alter this rate at the front panel of the AG-200.

To determine the current baud rate setting, follow these steps:

1. Remove the AG-200's lens.

2. Depress and hold down the TARE switch, while momentarily pressing the RESET switch. Continue to hold down the TARE switch for about 10 seconds. After the TARE switch is released, the TARED light will blink on and off. Count the blinks. You may now determine the baud rate at which the AG-200 is set from TABLE 7-2.

TABLE 7-1 -- RS-232 CONNECTOR WIRING

Function	Connector - Pin #
Data Out	**2**
Data Terminal Ready	**20**
Data Signal Ground	**7**
Data Set Ready	**6**
Analog Output	**24**
Analog Output Return	**25**

TABLE 7-2 -- BAUD RATES

Blinks	Baud Rate
1	9600
2	4800
3	2400
4	1200
5	600
6	300

To change the baud rate setting, follow these steps:

1. Move the ZERO TRACKING switch to its lower (on) position and back the number of times indicated in TABLE 7- 2 for your desired baud rate. Each time you move this switch, the MESSAGE light will blink.

2. Again depress the TARE switch. The AG-200 will now move to its Decimal Point Setup mode.

Changing Transmitted Decimal Point Location

1. The MESSAGE light will now blink, indicating the decimal point location now being transmitted by the RS-232 circuitry. Count the blinks again. TABLE 7-3 translates the message.

TABLE 7-3 -- DECIMAL POINT LOCATION

Blinks	Decimal
1	1.XXXX
2	1X.XXX
3	1XX.XX
4	1XXX.X
5	No point

Note: If you do not desire to change the transmitted decimal point location, press the TARE switch again, and skip to step 3. If you wish to change it,

2. Move the ZERO TRACKING switch to its lower (on) position and back the number of times indicated in TABLE 7-3 for your desired decimal point location. Each time you move this switch, the MESSAGE light will blink.

3. Again press the TARE switch. The TARED light will now blink the setting for baud rate (TABLE 7-2), followed by the MESSAGE light blinking the decimal point location (TABLE 7-3). After the MESSAGE light quits blinking, the AG-200 returns to its operating mode.

RS-232 Configuration

The configuration transmitted is as indicated in TABLE 7-4.

TABLE 7-4 -- RS-232 CONFIGURATION

Start Bits	**1**
Data Bits	**8**
Stop Bits	**1**
Parity	**none**

The most significant digit of the AG-200 is transmitted first, followed by the other digits in order. The decimal point is transmitted at the desired fixed location, using ASCII character hex 2E.

Chapter 8

WARRANTY AND REPAIR POLICY

8.1 Limited Warranty on Products

Any of our products which, under normal operating conditions, proves defective in material or in workmanship within one year from the date of shipment by SENSOTEC, will be repaired or replaced free of charge provided that you obtain a return material authorization from SENSOTEC and send the defective product, transportation charges prepaid with notice of the defect, and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage. Replacement or repaired product will be shipped F.O.B. our plant. The terms of this warranty do not extend to any product or part thereof which, under normal usage, has an inherently shorter useful life than one year. The replacement warranty detailed here is the buyer's exclusive remedy, and will satisfy all obligations of SENSOTEC whether based on contract, negligence, or otherwise. SENSOTEC is not responsible for any incidental or consequential loss or damage which might result from a failure of any SENSOTEC product. This express warranty is made in lieu of any and all other warranties, express or implied, including implied warranty of merchantability or fitness for particular purpose. Any unauthorized disassembly or attempt to repair voids this warranty.

8.2 Obtaining Service Under Warranty

Advance authorization is required prior to the return to SENSOTEC. Before returning the items, either write to the Customer Service Department, c/o SENSOTEC, Inc., 2080 Arlingate Lane, Columbus, Ohio 43228, or call (614) 850-5000 with: 1) a part number; 2) a serial number for the defective product; 3) a technical description (with information to assist us in understanding the application and the observed difficulty) of the defect; 4) a no- charge purchase order number (so products can be returned to you correctly); and 5) ship and bill addresses. Shipment to SENSOTEC shall be at buyer's expense and repaired or replacement items will be shipped F.O.B. our plant in Columbus, Ohio. Non-verified problems or defects may be subject to an evaluation charge. Please return the original calibration data with the unit.

8.3 Obtaining Non-Warranty Service

Advance authorization is required prior to the return to SENSOTEC. Before returning the item either write to the Customer Service Department, c/o SENSOTEC, Inc., 2080 Arlingate Lane, Columbus, Ohio 43228, or call (614) 850-5000 with: 1) a part number; 2) a serial number for the defective product; 3) a technical description (with information to assist us in understanding the application and the observed difficulty) of the defect; 4) a purchase order number to cover SENSOTEC's repair cost; and 5) ship and bill addresses. After the product is evaluated by SENSOTEC, we will contact you to provide the estimated repair costs before proceeding. Shipment to SENSOTEC shall be at buyer's expense and repaired items will be shipped to you F.O.B. our plant in Columbus, Ohio. Please return the original calibration data with the unit.

8.4 Repair Warranty

All repairs of SENSOTEC products are warranted for a period of 90 days from date of shipment. This warranty applies only to those items which are found defective and repaired, and does not apply to products in which no defect was found and returned as is or merely recalibrated. Out-of-warranty products may not be capable of being returned to the exact original specifications or dimensions.

Chapter 9

GLOSSARY OF SIGNAL CONDITIONING TERMS

ACCURACY -- The combined error of nonlinearity, repeatability, and hysteresis expressed as a percent of full-scale output.

CHARACTERS DISPLAYED -- The number of digits in a display. Some of the digits may be active (part of the quantizing process), and some may be passive (displaying a constant zero).

COMMON-MODE REJECTION -- The ability of an instrument to reject the effects of signals such as noise, that appear on all signal lines. Expressed as a logarithmic ratio at a particular maximum voltage.

CONVERSIONS PER SECOND -- The number of times per second that an analog-to-digital converter ranges and quantizes a given input.

COUNTS -- The total number of steps of resolution of an instrument.

dB -- 20 times the log to the base 10 of the ratio of two numbers.

DIN (DEUTSCHE INDUSTRIE NORM) -- A set of German standards, now being recognized throughout the world. A 1/8 DIN standard specifies an outer bezel dimension of 96 mm (3.78") x 48 mm (1.89").

EXCITATION -- The voltage applied to the strain-gage transducer or amplified cell by the signal conditioning device.

FREQUENCY RESPONSE -- The range of frequencies over which the output voltage will follow the sinusoidally-varying stimulus input within the specified accuracy of the instrument.

FULL-SCALE OUTPUT -- The maximum output derived from the signal conditioner when the transducer is at its full scale value. For example, a 100 psi pressure applied to a 100 psi transducer will cause a full-scale output from the signal conditioner. Full-scale output is usually 5 volts.

GAIN RANGE -- The range of signal multiplication factors for a given signal conditioner.

INPUT IMPEDANCE -- The resistance of the input circuit of a signal conditioner. If this value is large, the signal conditioner will not load the transducer output excessively.

LINEARITY -- The maximum deviation of a calibration curve from the best-fit straight line calibration curve, expressed as a percentage of full-scale value.

LSD (LEAST SIGNIFICANT DIGIT) -- The rightmost active digit in a display.

MSD (MOST SIGNIFICANT DIGIT) -- The leftmost

digit in a display.

NOISE AND RIPPLE -- Noise is randomly-occurring low-level signal not related to the stimulus. Ripple is periodic noise, usually associated with the signal conditioner power supply. Both noise and ripple limit the ability of a signal conditioner to handle small signals.

RESOLUTION -- The smallest change in input signal which produces a one-digit change in the display.

SHUNT-CAL -- The change in electrical output of a transducer which is caused by momentarily placing a fixed, known resistance between one leg of a strain-gage transducer and one of the excitation leads. This causes the bridge to become unbalanced by a precise, known amount, and permits the verification of proper gain in the signal conditioning system.

SIGNAL CONDITIONER -- An instrument which provides precise electrical drive to a transducer, and accepts and amplifies the transducer output. It may also digitize and display the output in engineering units.

SPAN ADJUSTMENT -- The ability to adjust the gain of a signal conditioner so that a specified display span in engineering units corresponds to a specified signal span.

ZERO ADJUSTMENT -- The adjustment of the displayed value to zero when no output signal is being issued by the transducer.