

**MODELS 80-6A AND 80-6B
PRESSURE DISPLAY MODULAR
INSTRUCTION MANUAL**



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PRESSURE DISPLAY MODULAR
INSTRUCTION MANUAL**

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Receiving Inspection Procedure

Your instrumentation was shipped to you fully assembled, in packing that is designed to protect it against all normal shipping hazards. We suggest that you first inspect the exterior of the shipping container for any visible damage. Then verify that your shipment includes all instruments and accessories listed on the packing slip, which also will indicate whether the shipment was partial or complete. Check to see that the equipment received matches the equipment ordered. Then remove the instrumentation from the shipping case and test its functional operation, following the instructions in the applicable portions of this manual. If shipping damage is noted, keep all forms, invoices, and shipping materials, and file a claim with the shipping carrier's claim department, sending a copy to Vacuum General. Be sure to include the instrument's name, model number, and serial number on all correspondence. We will advise you as soon as possible regarding repair or replacement.

If your shipment is not correct for any reason or if you would like to expedite the repair or replacement of damaged equipment, telephone our Customer Service Department at (619) 571-1222.

Product Warranty Policy

Products manufactured by Vacuum General are warranted against defects in workmanship and materials under normal use and service for one year from the date of invoice, with the exception of lamps, fuses, and relays, which are specifically excluded. Special custom-made products may be subject to a different period of warranty.

Vacuum General will repair or replace products that prove defective during the warranty period, provided that failure or damage has not been caused by accident, neglect, misuse, improper installation, abnormal operating conditions, alteration, or repair by any person not authorized by Vacuum General. The only time that component replacement is acceptable is when plug-in provisions have been made.

If a malfunction or any portion thereof is determined by Vacuum General to have been caused by conditions not covered by this warranty, a repair-cost estimate shall be submitted to the purchaser for approval before repair work is started.

Liability under this warranty is limited to servicing, adjusting, or replacing units returned to the factory or to an authorized repair facility.

The foregoing warranties are in lieu of all other warranties and conditions expressed or implied, including, but not limited to, those concerning merchantability and fitness for a particular purpose. Vacuum General is not liable for any special, consequential, or indirect damages, including any caused by failure of the product to perform properly.

If a malfunction develops, notify Vacuum General, giving the name, model number, and serial number of the equipment, and the details of the problem. Service and/or shipping information will be provided on receipt of this information.

Should immediate assistance be desired, contact our Customer Service Department at (619) 571-1222. A customer-service engineer will provide advice to minimize equipment downtime.

80-6 Pressure Display Module

Section I. General Instrument Description

1.1 INTRODUCTION

The 80-6 Pressure Display Module is designed to provide accurate digital display of pressure information, for a single gas, in terms of torr or millitorr. The module is designed to be used with the Vacuum General Capacitance Manometer series of pressure transducers but can be used with a range of other transducers as well. The instrument will display pressure from 1×10^{-6} torr to 1000 torr on a digital voltmeter (dvm) with $4\frac{1}{2}$ digits. For low-torr pressures, expander circuitry provides increased resolution and accuracy of the display.

The 80-6 is not a pressure controller but does incorporate one control feature that is available in two models: the 80-6 model has one settable relay, and the 80-6B model has two relays. The 80-6 features a single-relay set point that will activate a built-in relay when the pressure being monitored goes above or below the adjustable preset level. External circuitry, such as a low- or high-pressure alarm system, thus can be switched on or off automatically. The 80-6B version of the module has two adjustable pressure set points and two relays. This instrument can be set to activate external circuitry when the pressure goes above or below two preset limits.

Either the 80-6 or the 80-6B Pressure Display Module also can be used in a pressure-control system, interfacing with the 80-1 Automatic Pressure Controller or the 80-2 Automatic Throttle Valve Controller for complete closed-loop system control.

1.2 FRONT PANEL FUNCTIONAL DESCRIPTION OF 80-6

NOTE: The front panel of the 80-6 is provided with a digital voltmeter (dvm) with $4\frac{1}{2}$ digits. This will be referred to as the PRESSURE display.



PRESSURE Display

Indicates the pressure in torr or millitorr.

EXPANDER Switch

Increases the resolution of the PRESSURE display reading. Adds one ($\times 10$ position) or two ($\times 100$ position) significant digits with corresponding shifts in the location of the decimal point.

ZERO Adjust Potentiometer

Adjustment for zeroing the PRESSURE display when using the Vacuum General Capacitance Manometer.

TORR and MILLITORR Lights

Indicates whether the reading on the PRESSURE display is in terms of torr or millitorr.

SET POINT PUSH TO READ Switch

When the switch is depressed, the PRESSURE display indicates the relay set-point pressure.

SET POINT ADJUST Potentiometer

Adjusts the pressure set point for the relay. The pressure is displayed on the PRESSURE display when the SET POINT PUSH TO READ switch is depressed. (See Table 2 in Section 3.1 for relay contact conditions.)

RELAY ON Light

Indicates that the system pressure is above the relay set-point pressure and that the relay is energized.

1.3 FRONT PANEL FUNCTIONAL DESCRIPTION OF 80-6B

NOTE: The front panel of the 80-6B is provided with a digital voltmeter (dvm) with 4½ digits. This will be referred to as the PRESSURE display.



PRESSURE Display

Indicates the pressure in torr or millitorr.

EXPANDER Switch

Increases the resolution of the PRESSURE display reading. Adds one ($\times 10$ position) or two ($\times 100$ position) significant digits with corresponding shifts in the location of the decimal point.

ZERO Adjust Potentiometer

Adjustment for zeroing the PRESSURE display when using the Vacuum General Capacitance Manometer.

TORR and MILLITORR Lights

Indicates whether the reading on the PRESSURE display is in terms of torr or millitorr.

SET POINT 1-PRESSURE-2 Switch

Caution: The SET POINT 1-PRESSURE-2 switch is a locking type. To change positions, pull the switch handle away from the panel.

SET POINT 1 The PRESSURE display indicates the relay 1 set-point pressure.

PRESSURE The PRESSURE display indicates the pressure from the pressure transducer (Vacuum General Capacitance Manometer).

SET POINT 2 The PRESSURE display indicates the relay 2 set-point pressure.

SET POINT ADJUST 1 Potentiometer

Adjusts the pressure set point for relay 1. The pressure is displayed on the PRESSURE display when the SET POINT 1-PRESSURE-2 switch is in the SET POINT 1 position. (See Table 2 in Section 3.1 for relay contact conditions.)

SET POINT ADJUST 2 Potentiometer

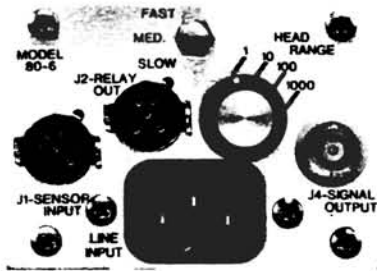
Adjusts the pressure set point for relay 2. The pressure is displayed on the PRESSURE display when the SET POINT 1-PRESSURE-2 switch is in the SET POINT 2 position. (See Table 2 in Section 3.1 for relay contact conditions.)

RELAY ON Lights

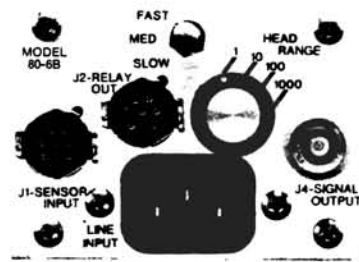
- RELAY ON 1 Indicates that the system pressure is above the relay 1 set-point pressure and that the relay is energized.
- RELAY ON 2 Indicates that the system pressure is above the relay 2 set-point pressure and that the relay is energized.

1.4 REAR PANEL FUNCTIONAL DESCRIPTION OF 80-6 AND 80-6B

NOTE: See Section VIII for pinout information.



80-6



80-6B

FAST/MED/SLOW Filtering Switch

Caution: The FAST/MED/SLOW filtering switch is a locking type. To change positions, pull the switch handle away from the panel.

Filters the incoming signal from the pressure transducer prior to display on the PRESSURE display, to average out fluctuations in the system.

HEAD RANGE Switch

Allows adjustment to match the full scale of the pressure transducer (capacitance manometer) in terms of torr.

J1 SENSOR INPUT

1. Powers the pressure transducer (capacitance manometer) (+ and -15 volts DC).
2. Inputs the pressure signal (0 to +10 volts DC) from the pressure transducer (capacitance manometer).

J2 RELAY OUT

Provides contacts to the internal relay(s) that is (are) energized when the pressure is above the relay set-point pressure. The 80-6 has a five-pin connector, and the 80-6B has a seven-pin connector to accommodate the contacts for the second relay. (See Table 2 in Section 3.1 for relay contact conditions.)

NOTE: There is no J3 connector on the 80-6 or 80-6B.

J4 SIGNAL OUTPUT

Outputs the signal indicating the total pressure being monitored by the 80-6 or 80-6B (0 to +10 volts DC).

LINE INPUT Receptacle

Receives AC power input from 90 to 230 volts. The normal factory setting is 90, 115, or 230 volts. Check the warning label on the instrument's side panel to determine the correct voltage setting.

Section II. Instrument Pre-Installation Checkout

This section contains operation and checkout information for the 80-6 and 80-6B Pressure Display Modules. Before you attempt to operate the instrument, we recommend that you familiarize yourself with its physical features. Paragraphs 1.2, 1.3, and 1.4 of this portion of the manual describe the front- and rear-panel indicators, switches, and connectors, and this section provides procedures to follow on receipt of the instrument in order to verify proper operation before installation into a system.

2.1 INITIAL POWERING

Warning: There is a warning label on the side of your instrument similar to the one shown at right. Verify that the voltage marked on that label corresponds to the AC line voltage that you are using.

WARNING: A.C. LINE POTENTIAL
EXPOSED UPON REMOVAL OF COVER
INTERNALLY SET FOR
() 90VAC () 115VAC () 230VAC

Connect the line cord between the LINE INPUT receptacle and the AC power source.

2.2 INSTRUMENT PRE-INSTALLATION CHECKOUT

- a. After you have connected the instrument to the power line, the 4½-digit PRESSURE display will show a reading, but the numbers are not meaningful at this time. Either the TORR or MILLI-TORR light should be lit, but not both.

NOTE: For checkout procedures for the 80-6, see paragraph b; for checkout procedures for the 80-6B, see paragraph c.

- b. *For the 80-6:* Depress the SET POINT PUSH TO READ switch and turn the SET POINT ADJUST potentiometer fully counterclockwise. The reading on the PRESSURE display will decrease in value as the potentiometer is rotated until it reaches 0. Keeping the SET POINT PUSH TO READ switch depressed, rotate the SET POINT ADJUST pot clockwise. The reading on the PRESSURE display should increase to a value over 10000. Leave the potentiometer in the fully clockwise position and release the SET POINT PUSH TO READ switch.
- c. *For the 80-6B:* Place the SET POINT 1-PRESSURE-2 switch in the SET POINT 1 position and turn the SET POINT ADJUST 1 potentiometer fully counterclockwise. The reading on the PRESSURE display will decrease in value as the potentiometer is rotated until it reaches 0. Now rotate the SET POINT ADJUST 1 potentiometer clockwise. The reading on the PRESSURE display should increase to a value over 10000. Leaving the potentiometer in the fully clockwise position, place the switch in the SET POINT 2 position and, using the SET POINT ADJUST 2 potentiometer, repeat the procedure for relay set point 2.
- d. The EXPANDER switch on the front panel and the HEAD RANGE switch on the rear panel both shift the decimal point on the PRESSURE display according to the settings of the two switches. Using Table 1 as a guide, rotate the EXPANDER and HEAD RANGE switches so that each combination of switch setting verifies the proper positioning of the PRESSURE-display zero and the illumination of the proper TORR or MILLITORR light. A suggested sequence is to set the HEAD RANGE switch to 1 and the EXPANDER switch to X1. Then rotate the EXPANDER switch to X10 and X100, observing the change in the location of the decimal point on the PRESSURE display and the TORR and MILLITORR lights. Reset the HEAD RANGE switch to 10 and repeat the sequence with the EXPANDER switch set at X1, X10, and X100, continuing the sequence with the HEAD RANGE switch in the 100 and 1000 positions.

Table 1. Expander Switch Functioning

HEAD RANGE Switch Setting	EXPANDER Switch Setting					
	X1		X10		X100	
	Decimal	Light	Decimal	Light	Decimal	Light
1	.0000	torr	00.00	millitorr	± 0.000	millitorr
10	0.000	torr	.0000	torr	00.00	millitorr
100	00.00	torr	0.000	torr	.0000	torr
1000	000.0	torr	00.00	torr	0.000	torr

NOTE: It is not possible to make further checks at this time without the pressure transducer being connected.

Section III. System Pre-Installation Checkout

We recommend that the 80-6 or 80-6B Pressure Display Module be bench checked with the capacitance manometer pressure transducer, cables, and, if applicable, any other control instrumentation before it is installed into a system, in order to verify proper hookup and operation of the individual components and cables in the system.

3.1 PRESSURE DISPLAY SYSTEM

To provide pressure display, a system requires an 80-6 or 80-6B Pressure Display Module, a Vacuum General Capacitance Manometer (pressure transducer), and a Vacuum General 0-6C connecting cable. Interconnection of this system is described below and is illustrated in Appendix 1, Figure 12.

COMMENTARY:

- We recommend that you select a capacitance manometer for your use in which the maximum system pressure will be between 10 percent and 90 percent of the manometer's full-scale range. A 10 torr manometer, for example, will provide better performance in a system with a *maximum* pressure of seven torr than either a 100 or 1000 torr transducer. Complete specifications for the Vacuum General Capacitance Manometer series are provided in Appendix 2.4 of this manual.

NOTE: Some of the important features of the 80-6 and 80-6B Modules and the capacitance manometer can be bench checked only when the manometer is in a vacuum environment. We recommend that the manometer be temporarily connected to a vacuum system for the remainder of this checkout. Should such an installation be impractical, the procedures described in paragraphs b through e can be followed with the manometer at atmospheric pressure. The procedure described in paragraph a and the rest of the section can be followed during the system checkout, described in Section V.

- Install the capacitance manometer into the system. Ensure that there is a good seal around the manometer tubing's connection to the system, to prevent pressure leaks. Do *not* begin to pump down the system at this point.

Warning: In order to prevent permanent damage, it is crucial that Vacuum General Capacitance Manometers be wired correctly. Refer to Appendix 2.4 for information on wiring.

- Connect the end of the 0-6C cable with the exposed wires to the capacitance manometer, following the wiring directions given in Appendix 2.4, Figure 1. Then attach the other end of the 0-6C cable to the J1 SENSOR INPUT connector on the rear panel of the 80-6 Display Module.

COMMENTARY:

- All Vacuum General Capacitance Manometers, regardless of their pressure range, produce a full-scale output voltage of +10 volts DC. The 80-6 also has a full-scale input voltage of +10 volts DC, regardless of the pressure range of the Vacuum General Capacitance Manometer that is connected to it.
- c. Set the HEAD RANGE switch on the rear panel of the 80-6 or 80-6B to match the full-scale pressure capability of the manometer. Full-scale value, in torr, is listed on the manometer's label. Because the HEAD RANGE settings of 1, 10, 100, and 1000 also are in torr, select the HEAD RANGE setting that corresponds to the full-scale value of the manometer. A 1 torr manometer, for example, would have a corresponding HEAD RANGE setting of 1, a 10 torr manometer would be set at 10, and 100 torr and 1000 torr manometers would be set at HEAD RANGE switch settings of 100 and 1000, respectively.
- d. Set the EXPANDER switch to the X1 position.
- e. Observe the reading on the PRESSURE display. 1000 torr manometers will read atmospheric pressure (approximately 760 torr at sea level, lower torr at higher elevations). Manometers in the 100 torr range or lower will register an overrange condition, which is indicated by a flashing number on the PRESSURE display.
- f. Begin pumping down the system with the vacuum pump. Continue pumping down to a high vacuum (1×10^{-5} torr, or as low as possible).
- g. Observe the PRESSURE display as the system pressure decreases. The display will register decreasing readings. If you are using a 1, 10, or 100 torr manometer, the display will flash to show an overrange condition until a pressure of 1, 10, or 100 torr is reached — at which time the PRESSURE display should stop blinking and the system pressure should be indicated.

COMMENTARY:

- Accurate readings can be taken to as low as .08 percent of the full-scale range of the manometer. Lower readings can be taken if the temperature conditions *remain unchanged* during measurement. For specifications on temperature variation of Vacuum General capacitance manometers, refer to Appendix 2.4.
- h. Vent the capacitance manometer back to atmospheric pressure. Observe that the readings on the 80-6 or 80-6B PRESSURE display increase and that the display starts to blink when an overrange condition begins if you are using a 1, 10, or 100 torr manometer.
- i. Again pump the capacitance manometer down to a high vacuum (nominally 1×10^{-5} torr). Keep the vacuum pump running this time. Allow the capacitance manometer-80-6 Pressure Display Module to warm up and to stabilize for about 20 minutes before proceeding to the next step.

COMMENTARY:

- It is important to cycle the capacitance manometer two to three times between low system pressure and atmospheric pressure in order to relieve any possible temperature stress in the diaphragm of the manometer. We suggest that such a pressure cycle be completed prior to the following step.
- j. *Zero adjust for the capacitance manometer:* With the system at high vacuum (nominally 1×10^{-5} torr), check the zero of the capacitance manometer by using a digital voltmeter with at least four digits. Connect the voltmeter across the +OUT and -OUT terminals of CM and CMT series manometers and across the OUTPUT and COMMON terminals of CML series manometers. If the voltmeter does not read within a few counts of 0, adjust the ZERO ADJ. potentiometer that is located on the bottom of the CM and CMT series manometers and on the top of the CML series.

k. Set the EXPANDER switch to X100.

l. *Zero adjust:* With the system remaining at high vacuum (nominally 1×10^{-5} torr), adjust the ZERO adjust potentiometer until the PRESSURE display meter reads 0.

NOTE: If the zero shifts erratically and cannot be set satisfactorily, the manometer may need more time to warm up or there may be pressure fluctuations in the work chamber.

COMMENTARY:

- The ZERO adjust potentiometer negates any changes or drift in the signal provided by the manometer (transducer). A clockwise rotation of the potentiometer negates any negative zero drift, while a counterclockwise rotation cancels out any positive shifts in the pressure signal.
- We recommend that you check the 0 setting of the 80-6 or 80-6B on a regular basis and that you be sure to reset it when changing manometers.
- With a capacitance manometer type of pressure transducer, the 0 setting on the 80-6 or 80-6B Pressure Display Module reflects the relatively low pressure of the system rather than the absolute or true zero pressure. However, as long as the zeroing of the manometer is made at a pressure that is significantly lower than the manometer's lowest usable limit, any deviation from the 0 setting and absolute or true zero pressure is not significant.
- For example, because the lowest pressure that can be observed using a 1 torr manometer is 0.001 millitorr, the 0 setting on the 80-6 or 80-6B, when the chamber pressure is 1/10 or less of 0.001 millitorr, is, for all practical purposes, the same as it would be if the 80-6 or 80-6B were zeroed when the chamber pressure was at absolute or true zero. Manometers with full-scale ranges of 10 torr or higher will be even less sensitive to deviations from true zero when the system pressure is 0.01 millitorr or below; therefore, a pressure of 0.001 millitorr or lower can be considered 0 for setting the zero of the 80-6 or 80-6B.
- The closer you bring your system to absolute zero, the more accurately will the 0 setting of the manometer reflect absolute or true zero.

NOTES: The 80-6 has one internal relay and the 80-6B has two internal relays:

1. Refer to the following paragraph m if you are checking an 80-6.
2. Refer to paragraph n if you are checking an 80-6B.

m. *Relay set point for the 80-6:* The 80-6 has an internal relay that can be set for activation at a pre-selected pressure set point. The relay contact connections are shown in Table 2 and in Section VIII, Rear Panel Pinout Information. Bench check the relay set point and relay operation as follows:

1. With the system still at high vacuum (nominally 1×10^{-5} torr), depress the SET POINT PUSH TO READ switch and, using a small screwdriver, turn the SET POINT ADJUST potentiometer until the PRESSURE display reads half of the full-scale range of the capacitance manometer being used. For a 100 torr manometer, for example, adjust the PRESSURE display to read 50. Release the SET POINT PUSH TO READ switch. The PRESSURE display should now indicate the pressure in the system (nominally 0), the RELAY ON light should be off, and the relay should be deenergized.
2. Using an ohmmeter, check that the resistance between Pins B and D on the J2 RELAY OUT connector on the rear panel of the 80-6 is zero. These two pins are internally shorted together when the relay is deenergized. Now check that there is an open connection between Pins A and D, which are internally open when the relay is not energized.
3. Slowly increase the pressure in the system while watching the PRESSURE display. When the pressure exceeds the relay set point, the relay will energize and the RELAY ON light will illuminate. Using an ohmmeter, again check the resistance between the pins on the J2 RELAY OUT connector. With the relay energized, Pins A and D are internally shorted together and there is an open connection between Pins B and D.

COMMENTARY:

- Because the internal relay is a single-pole double-throw switch, with the switch contacts brought out to the J2 RELAY OUT connector, a wide range of external switching circuits can be triggered automatically when the system pressure changes. Depending on the wiring, an external circuit can be activated or deactivated when the system pressure crosses the relay set point.
- For example, if you want to know when your system is pumped down to 5 torr, you could wire an external light so that it would illuminate when the pumpdown reaches 5 torr or you could wire it to be illuminated at atmospheric pressure and to go out when the pressure drops to 5 torr. Similarly, a bell, motor, or other device could be wired for activation or deactivation at the chosen pressure — to sound an alarm, to open or close a valve, to operate recording equipment, or to do many other functions. Detailed information on wiring is provided in Section VIII and in Table 2.

Table 2. 80-6 and 80-6B Relay Contact Conditions

			80-6 J2 RELAY OUT (Pin D is Common)		80-6B J2 RELAY OUT			
					RELAY 1 (Pin C is Common)		RELAY 2 (Pin E is Common)	
PRESSURE	RELAY LIGHT	RELAY STATE	Pin A to Pin D	Pin B to Pin D	Pin A to Pin C	Pin C to Pin H	Pin B to Pin E	Pin E to Pin F
Above Set Point	On	Energized	Short	Open	Short	Open	Short	Open
Below Set Point	Off	Deenergized	Open	Short	Open	Short	Open	Short
Maximum relay contact rating is 1 amp at 125VAC and 2 amps at 30VDC								

NOTE: If you are checking an 80-6, proceed to paragraph o. Paragraph n describes only 80-6B modules.

- n. *Relay set points for the 80-6B:* The 80-6B module has two relays, each of which can be set independently for activation at a preselected pressure set point. The relay contact connections are shown in Table 2 and in Section VIII, Rear Panel Pinout Information. Bench check the relay set point and relay operation as follows:

- Relay 1:*
1. With the system still at high vacuum (nominally 1×10^{-5} torr), place the SET POINT 1-PRESSURE-2 switch at 1 and, using a small screwdriver, turn the SET POINT ADJUST 1 potentiometer until the PRESSURE display reads half of the full-scale range of the capacitance manometer being used. For a 100 torr manometer, for example, adjust the PRESSURE display to read 50. Place the SET POINT switch at PRESSURE. The PRESSURE display now should indicate the pressure in the system (nominally 0), the RELAY ON 1 light should be off, and the relay deenergized.
 2. Using an ohmmeter, check that the resistance between Pins C and H on the J2 RELAY OUT connector on the rear panel of the 80-6B is zero. These two pins are internally shorted together when relay 1 is deenergized. Now check that there is an open connection between Pins A and C, which are internally open when the relay is deenergized.
 3. Slowly increase the pressure in the system while watching the PRESSURE display. When the pressure exceeds the relay set point, the RELAY ON 1 light should illuminate. Using an ohmmeter, again check the resistance between the pins on the J2 RELAY OUT connector. With the relay energized, Pins A and C are internally shorted together and there is an open connection between Pins C and H.

Relay 2: Repeat the preceding checkout procedures for relay 2, using the SET POINT 2 switch position and the SET POINT ADJUST 2 potentiometer. Comparable connections on the J2 RELAY OUT connector are Pins E and F, shorted together when the relay 2 is deenergized and Pins B and E are open. When the relay 2 is energized, the RELAY ON 2 light should illuminate, with Pins B and E internally shorted and Pins E and F open.

COMMENTARY:

- Because the set-point settings of the two relays in the 80-6B are independent of each other, it is possible to wire two independent circuits, each of which will activate when pressure crosses its own set point, or the two relays can be wired in parallel in one circuit to provide process control.
 - As an example of this latter case, if you need the system pressure to be between 4 and 6 torr for your process, and you want an alarm bell to ring when the pressure goes outside this range, you can set the relay 1 to activate at 4 torr and the relay 2 to activate at 6 torr.
 - Because the pressure in the system normally would be above 4 torr, relay 1 normally would be activated, so the alarm system would use the relay 1 contacts, which are open when the relay is energized (Pins C and H on the J2 RELAY OUT connector). Relay 2, set to activate at 6 torr, normally would be deenergized, so the alarm system would use the relay 2 contacts, which are open when the relay is deenergized (Pins B and E on the J2 RELAY OUT connector). Then, if the system pressure goes above 6 torr or below 4 torr, either relay 1 or relay 2 would change its activation state, thus triggering the alarm.
- o.** Change the EXPANDER switch setting from X1 to X10. The reading on the PRESSURE display will shift to the left by one significant digit and may go into overrange (see the Note and Commentary below). Change the EXPANDER switch setting to X100 and observe an additional shift of one significant digit to the left or to overrange.

- NOTES:**
1. The EXPANDER switch increases the resolution of the PRESSURE display reading by adding one (in the X10 position) or two (in the X100 position) significant digits and, at the same time, changing the location of the decimal point on the PRESSURE display to compensate for the increased resolution.
 2. The EXPANDER switch affects only the PRESSURE display. It has no effect on the relay set point or the output signal of the 80-6 or 80-6B.

COMMENTARY:

- The EXPANDER switch is useful when the readings on the PRESSURE display are less than 20 percent of full scale. Because the switch increases the PRESSURE display reading by one or two significant digits, if the display already is reading more than about 20 percent of its full scale with the EXPANDER switch set at X1, the X10 setting of the switch will cause it to go into overrange. (The PRESSURE display is a 2-volt digital voltmeter with 4½ digits. It can display a maximum of 19999 before overranging.)
 - For example, if the PRESSURE display reads 150 with the EXPANDER switch set to X1, it will read 1500 (±10) with the EXPANDER switch at X10 and will overrange with the EXPANDER switch at X100. Conversely, if the PRESSURE reading is 7 with the EXPANDER switch at X1, the display will read approximately 70 and 700 with the EXPANDER switch set at X10 and X100, respectively.
- p.** Move the FAST/MED/SLOW filtering switch on the rear panel to each of its three positions and note the effect on the PRESSURE display reading. Begin with the switch in the FAST position and switch it to MED or SLOW if necessary to stabilize the readings on the PRESSURE display. Leave the switch in the fastest setting commensurate with stable display readings.

NOTE: The FAST/MED/SLOW filtering switch activates one of three filtering networks that filter the incoming signal from the pressure transducer (capacitance manometer) prior to its being shown on the PRESSURE display. The filter averages out system fluctuations to stabilize the PRESSURE display reading. The switch should be set in the FAST position initially. If the last digit on the PRESSURE display changes erratically, move the switch to MED for more filtering or to SLOW for maximum filtering. A SLOW setting is especially desirable for low-vacuum settings, when noise may cause a problem in the readings.

COMMENTARY:

- The circuits that are activated by the FAST/MED/SLOW filtering switch affect only the readings on the PRESSURE display. They have no effect on the relay set point or the output signal of either the 80-6 or 80-6B. The time constants for the FAST, MED, and SLOW positions are approximately 10 milliseconds, 100 milliseconds, and one second, respectively.
- The 80-6 Display Module provides a 0 to +10 volt DC output signal (through the J4 SIGNAL OUTPUT connector) that is proportional to the pressure being measured by the capacitance manometer. Paragraph q describes a method for checking the pressure-output signal.
- q. Using a DC voltmeter, measure the voltage between the center and shield of the J4 SIGNAL OUTPUT (BNC) connector. The voltage should be between 0 and +10 volts DC, proportional to the pressure being measured by the capacitance manometer and displayed on the PRESSURE display. As you vary the pressure to the manometer, the voltage on the J4 (as measured by the voltmeter) should change, proportional to the display on the FLOW display.

- NOTES:**
1. If you are using the 80-6 Display Module in a pressure-control system, refer to Section 3.2 before turning off the vacuum pump and disconnecting your bench-check installation.
 2. If you are not using the 80-6 Display Module in a pressure-control system or in combination with any other Vacuum General instrumentation, turn off the vacuum pump and allow the system to return to atmospheric pressure. Unplug the 80-6 or 80-6B from the power source and remove all connecting cables before removing the components from the bench-check installation.

3.2 PRESSURE DISPLAY SYSTEM COMBINED WITH PRESSURE CONTROL SYSTEM

The 80-6 or 80-6B is used in conjunction with an 80-1 Automatic Pressure Controller or an 80-2 Automatic Throttle Valve Controller to provide a pressure reading display in addition to system pressure control. Instructions for connecting the capacitance manometer and the 80-6 Pressure Display Module with the 80-1 Controller, and checkout procedures for the combined system, are provided in Section 3.1 of the 80-1 division of this manual. A system interconnect diagram is shown in Appendix 1, Figure 2. Instructions for connecting the manometer and 80-6 Display Module with the 80-2 Controller, and checkout procedures for the combined system, are provided in Section 3.1 of the 80-2 division of this manual. A system interconnect diagram is shown in Appendix 1, Figure 4.

Normally, the 80-1 functions as an inlet-pressure control system when connected with a capacitance manometer-80-6 and a control valve, and the 80-2 functions as an exhaust-port conductance, pressure-control system when connected with a capacitance manometer-80-6 and a throttle valve. The manometer-80-6 provides pressure-input data for either control system.

Follow the installation and checkout procedures that are provided in Section 3.1 of the 80-1 and 80-2 divisions of this manual, using whichever is applicable to your system.

COMMENTARY:

- The advantages of using an 80-6 or 80-6B with either an 80-1 or 80-2 control system are:
 1. It provides a zeroing of the capacitance manometer.
 2. It provides a visual display of the pressure in the system, and
 3. It provides a relay-controlled output for a signal light, warning bell, or other external circuitry.

Section IV. Installation Guidelines

- Cautions:**
1. To prevent possible damage to the connecting cables, we suggest that you install the pressure transducer (capacitance manometer) and 80-6 or 80-6B Pressure Display Module without their cables being attached.
 2. **This caution applies if there is radio frequency (RF) used in your system.** All RF immunity circuits in Vacuum General equipment rely on the instrument case being at zero RF potential. To achieve this, it is necessary to have the case connected to the ground side of the RF power supply by a low inductance path. This normally can be achieved by mounting the instrument to the frame of the main system or by using a separate ground strap of suitable perimeter for its length. This caution is especially important when using capacitance manometers with one-half inch outside diameter tubulation and standard compression-mounting fittings.

COMMENTARY:

- When using compression fittings, it is possible to have a nonmetal-to-metal contact or poor grounding of the manometer to the system. Although each manometer does have a ground connection that is adequate when there is no RF in the system, radio frequencies ground better with metal braid. Vacuum General's standard Capacitance Manometers come with one-half inch outside diameter tubulation.

NOTE: The instructions that follow for the pressure transducer apply to the Vacuum General CM, CMT, and CML series of Capacitance Manometers. If you are using other transducers in your system, follow the manufacturer's instructions for installation.

4.1 CAPACITANCE MANOMETER (PRESSURE TRANSDUCER)

Warning: In order to prevent permanent damage, it is crucial that Vacuum General Capacitance Manometers be wired correctly. Refer to Appendix 2.4, Figure 1, for information on wiring.

Install the capacitance manometer as close as possible to the area of the vacuum chamber where you want to monitor pressure. Although the transducer can be installed with the end of the tube inside or flush mounted to the vacuum chamber or remotely on an extension tube, the closer the manometer is to the vacuum chamber, the more responsive it will be to fluctuations in system pressure. Installation *orientation* for this transducer is not critical, as long as the transducer is not mounted with the port facing up. Mounting with the port facing down is preferable, and mounting with the port facing sideways is permissible (see Appendix 2.4). Other recommendations for mounting are:

1. Do not put any strain on the manometer's inlet tubulation.
2. Ensure that there is a leak-proof seal around the inlet tubulation.
3. Keep the end of the manometer's inlet tubulation within 2 inches of the work chamber's wall.
4. If connecting tubing between the chamber and the manometer, keep the tubing diameter equal to or larger than the diameter of the inlet tubulation.
5. Do not put any strain on the manometer's connecting lead wires.
6. Do not use in-line filters between the work chamber and the manometer's port.

COMMENTARY:

- The rationale for the preceding recommendations includes the following:
 1. If particles enter the sensing port, they can affect the manometer's functioning — a condition that is likely to occur if the manometer's port is facing upward. For installations that require a vertical connection to the bottom of a chamber, we suggest that you mount the manometer horizontally and install a 90° elbow between the port and the chamber.
 2. In-line filters and distance between the manometer and the chamber both introduce time delays that will reduce the speed of measurement and system response to fluctuations in pressure. Not using filters and keeping the manometer's port within 2 inches of the chamber will optimize both manometer and system performance.
 3. Using connection tubing of smaller diameter than the manometer's sensing tube is not recommended because it restricts gas movement and may increase response time.

4.2 80-6 OR 80-6B PRESSURE DISPLAY MODULE

Install the module in a rack, on a bench, or in another suitable location. The distance between the module and the capacitance manometer is not critical. If you are using the 80-6 or 80-6B with either the 80-1 or 80-2 Controller, refer to Section IV of the 80-1 or 80-2 division of this manual for further instructions regarding installation.

4.3 CONNECTING CABLE

Connect the 0-6C cable from the J1 SENSOR INPUT on the 80-6 or 80-6B to the capacitance manometer using wiring connections, as is shown in Appendix 2.4, Figure 1, for capacitance manometers.

4.4 CONNECTIONS FOR PRESSURE DISPLAY AND PRESSURE CONTROL

Review Section 3.1 and Section IV in the 80-1 or 80-2 division of this manual, as appropriate, before beginning this installation. The length of the cable between the 80-6 or 80-6B Module and either the 80-1 or 80-2 Controller is not critical.

4.5 INSTALLATION SUMMARY

Make the appropriate control settings for your system, using the information in the preceding sections as a guide. Initially set the EXPANDER switch to X1 and the FAST/MED/SLOW filtering switch to FAST. Be sure that the HEAD RANGE switch matches the full-scale range of the capacitance manometer that you are using. Set the SET POINT ADJUST pot at the desired pressure. When the installation is complete, refer to Section V for the system checkout procedure.

Section V. System Checkout Procedure

Many of the operating checkout instructions already have been covered in Sections II and III of this division of the manual. If you have not already done so, we suggest that you now familiarize yourself with these important sections prior to operating your larger system with our instrumentation. If you are using the 80-6 or 80-6B with either the 80-1 or 80-2 Controller, refer to Section V of the 80-1 or 80-2 division of this manual, as appropriate, for coordinating instructions and then proceed with the system checkout as follows:

- a. Set the EXPANDER switch to X1, the FAST/MED/SLOW filtering switch to FAST, and the HEAD RANGE switch to match your capacitance manometer's full-scale range.

- b. Follow the procedures given in Section III for pre-installation checkout. Be sure to set the SET POINT ADJUST potentiometer for the desired activation pressure as explained in Section 3.1, paragraphs m and n.

NOTE: Two important adjustments that were described in the pre-installation procedure but could not readily be made until now are the setting of the EXPANDER switch and the FAST/MED/SLOW filtering switch, both of which are described below.

- c. Observe the system pressure on the PRESSURE display. If the reading is less than 20 percent of full scale (full scale = 19999) and you would like more resolution, turn the EXPANDER switch to X10 or X100 to increase the resolution.
- d. Beginning with the FAST/MED/SLOW filtering switch set at FAST, observe the PRESSURE meter display. If the right digit fluctuates, experiment by changing the setting of the FAST/MED/SLOW filtering switch to MED or SLOW. Select the switch setting that provides the desired stability of the PRESSURE display.

COMMENTARY:

- Although a MED or SLOW setting of the filtering switch will provide greater stability in the PRESSURE display, it also may dampen out from display some of the fluctuations in the pressure system — a condition that may or may not be desirable. The actual setting of the FAST/MED/SLOW filtering switch, therefore, is discretionary. We suggest that you experiment to determine the best setting for your needs.
- e. Vary the system pressure above and below the relay pressure set point. Observe the PRESSURE display to be sure that the 80-6 or 80-6B Pressure Display Module is tracking the changes in system pressure. Verify that any external circuitry that is activated by the 80-6 or 80-6B relay performs properly when the relay opens and closes. Verify that the relay opens and closes at the desired set point, which should coincide with the actual system pressure as displayed on the PRESSURE display. If necessary, readjust the relay set point in accordance with the instructions given in Section 3.1, paragraph m or n. Then verify that the RELAY ON light does illuminate when the relay is energized.

NOTE: If improper operation is observed during this system checkout, refer to the suggestions for troubleshooting in Appendix 4.

Section VI. Summary

The operating procedures for the Vacuum General 80-6 or 80-6B Pressure Display Module have been covered in previous sections of this manual. It has been our design to introduce you to the instruments and to give you the opportunity to acquire some hands-on experience during the component and system installation checkout procedures, in order that you could become familiar with the controls as well as with the equipment's responses.

As has been mentioned previously, the important settings on the 80-6 or 80-6B system are the PRESSURE display zeroing for the attached capacitance manometer (pressure transducer), the EXPANDER switch and FAST/MED/SLOW filtering switch settings — which affect the PRESSURE display — the correct matching of the HEAD RANGE switch setting with the manometer being used, and the proper setting of the SET POINT ADJUST pot, if you are using that feature.

Should you believe that your system is not functioning properly or should your system installation be more complex than what is covered in this manual, we suggest that you contact your local Vacuum General representative or call our Customer Service Department. We will be pleased to assist you.

Section VII. 80-6 Specifications and Outline Drawings

7.1 POWER AND TEMPERATURE

- | | |
|------------------------|------------------------------------------------------------------|
| a. Input voltage | Nominal 115 volts AC; 90 volts AC and 230 volts AC are available |
| b. Input frequency | 60 Hz |
| c. Input wattage | 20 watts maximum |
| d. Fuse size | 1/8 amp, Slow blow |
| e. Connector type | Corcom |
| f. Ambient temperature | 0° C to +50° C |

7.2 ACCURACY AND RANGE

- | | |
|--------------------|---------------------------------------------------------------------------------------------------------|
| a. Accuracy | .1 percent of full scale of pressure transducer |
| b. Pressure ranges | 0 to 1 torr, 0 to 10 torr, 0 to 100 torr, and 0 to 1000 torr (depending on the range of the transducer) |

7.3 INPUT SIGNALS

- | | |
|---------------------------------------------|-------------------|
| a. Input voltage from pressure transducer | 0 to +10 volts DC |
| b. Input impedance from pressure transducer | 200 kilohms |

7.4 ELECTRICAL OUTPUT SIGNALS

- | | |
|-----------------------------------------|-------------------------------------------------------------|
| a. Output power for pressure transducer | +15 volts DC at 150 milliamp
-15 volts DC at 50 milliamp |
| b. Pressure output signal | 0 to +10 volts DC typical into 1 kilohm maximum |

7.5 VISUAL OUTPUT SIGNALS

- | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------|
| a. TORR and MILLITORR lights | Indicate reading on PRESSURE display in torr or millitorr |
| b. PRESSURE display meter | 4½-digit panel meter ±19999. Indicates pressure in torr or millitorr |
| c. RELAY ON light(s) | Indicates that the system pressure is above the relay set-point pressure and that the relay(s) is (are) energized |

7.6 RELAY OUTPUT SIGNALS

- | | |
|-------------------------------|---------------------------------------------------------------|
| a. Voltage and current rating | 30 volts DC at 2 amp maximum
125 volts AC at 1 amp maximum |
| b. Relay closure adjustment | 0 to 100 percent of full scale of pressure transducer |
| c. Relay hysteresis | 5 percent at half scale |

7.7 INTERNAL POWER SUPPLIES

Voltage–Current–Regulation +15 VDC ±1.3 percent at 180 milliamp maximum, regulated
 -15 VDC ±1.3 percent at 70 milliamp maximum, regulated
 +5 VDC ±1.3 percent at 350 milliamp maximum, regulated

7.8 COMPATIBLE PRESSURE TRANSDUCERS

Vacuum General CM, CML, CMT, and CMTH Series Capacitance Manometers

NOTE: Additional information on pressure transducers is included in Appendix 2.4.

7.9 FAST/MED/SLOW FILTERING SWITCH SETTINGS

- a. FAST 10 millisecond time constant
- b. MED 100 millisecond time constant
- c. SLOW 1 second time constant

NOTE: Switch setting does not affect closed-loop control.

7.10 WEIGHT AND CONNECTOR REFERENCES

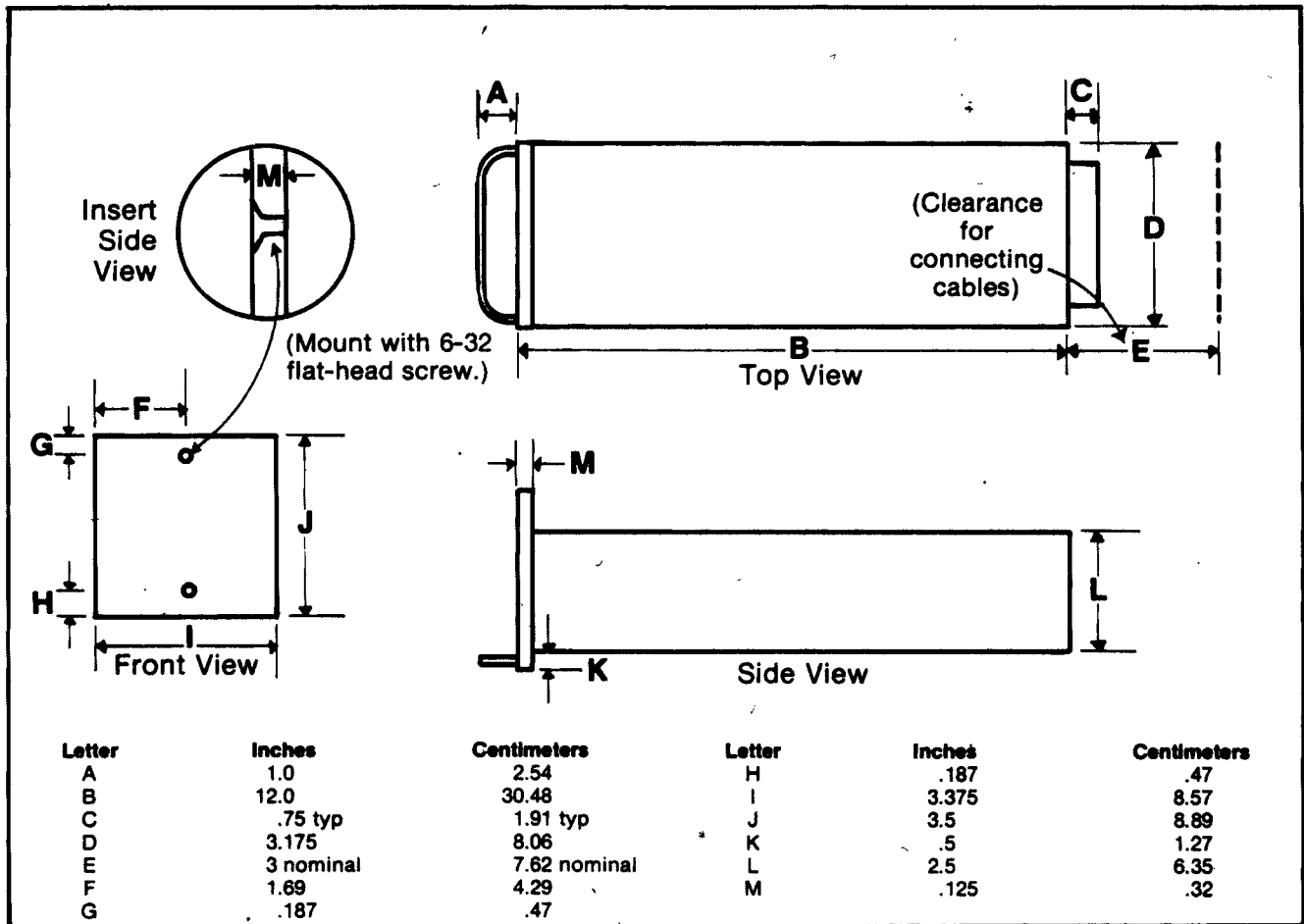
- a. Weight 3 pounds; 1.36 kilograms
- b. Connector reference table

Table 3. Connector References

CONNECTOR NUMBER	INSTRUMENT CONNECTOR		MATING CONNECTOR	
	Vacuum General Part Number	Manufacturer Part Number	Vacuum General Part Number	Manufacturer Part Number
J1	55-040	Amphenol 126-198	55-041	Amphenol 126-195
J2 (80-6)	550-14	Amphenol 126-218	55-015	Amphenol 126-217
J2 (80-6B)	55-035	Amphenol 196-221	55-036	Amphenol 196-220
J4	55-003	Amphenol 31-221	55-020	Amphenol 31-002

NOTES: 1. Connectors are the same for both the 80-6 and the 80-6B except the J2.
 2. There is no J3 Connector.

7.11 80-6 OUTLINE DRAWINGS AND MOUNTING DETAILS



Section VIII. 80-6 Rear Panel Pinout Information

NOTE: See Appendix 2.4, Figure 1, on Capacitance Manometers, for wiring of individual manometers.

J1 SENSOR INPUT

PIN	FUNCTION	SIGNAL TYPE	INPUT OR OUTPUT
A	Power-supply voltage for capacitance manometer	+15 volts DC	Output
B	Power-supply voltage for capacitance manometer	-15 volts DC	Output
C	Circuit ground and power-supply ground for capacitance manometer	—————	Output
D	Pressure signal return from capacitance manometer	—————	Input
E	Pressure signal from capacitance manometer	0 to +10 volts DC	Input
F	Case ground	—————	—————

NOTE: The J2 RELAY OUT connector is wired differently for 80-6 and 80-6B Modules.

J2 RELAY OUT (80-6) (1 relay)

PIN	FUNCTION	SIGNAL TYPE	INPUT OR OUTPUT
A	Relay contact open (to Pin D) when relay is not energized and closed (to Pin D) when relay is energized	Normally open contact	Output
B	Relay contact closed (to Pin D) when relay is not energized and open (to Pin D) when relay is energized	Normally closed contact	Output
C	No connection	-----	-----
D	Relay common. Center of relay's SPDT switch	Common contact	Output
E	Case ground	-----	-----

NOTE: Contact rating for Pins A, B, and D: 1 amp at 125 VAC and 2 amps at 30 VDC.

J2 RELAY OUT (80-6B) (2 relays)

PIN	FUNCTION	SIGNAL TYPE	INPUT OR OUTPUT
A	Relay 1 contact open (to Pin C) when relay is not energized and closed (to Pin C) when relay is energized	Normally open contact	Output
B	Relay 2 contact open (to Pin E) when relay is not energized and closed (to Pin E) when relay is energized	Normally open contact	Output
C	Relay 1 common. Center of relay's SPDT switch	Common contact	Output
D	Case ground	-----	-----
E	Relay 2 common. Center of relay's SPDT switch	Common contact	Output
F	Relay 2 contact closed (to Pin E) when relay is not energized and open (to Pin E) when relay is energized	Normally closed contact	Output
H	Relay 1 contact closed (to Pin C) when relay is not energized and open (to Pin C) when relay is energized	Normally closed contact	Output
J	No connection	-----	-----
K	No connection	-----	-----

NOTE: Contact rating for Pins A, B, C, E, F, and H: 1 amp at 125 VAC and 2 amps at 30 VDC.

NOTE: There is no J3 connector on either the 80-6 or 80-6B.

J4 SIGNAL OUTPUT

PIN	FUNCTION	SIGNAL TYPE	INPUT OR OUTPUT
BNC Center	Signal proportional to pressure being measured by transducer	0 to +10 volts DC	Output
BNC Shield	Circuit ground	—————	—————

Section IX. Circuit Description and Block Diagram

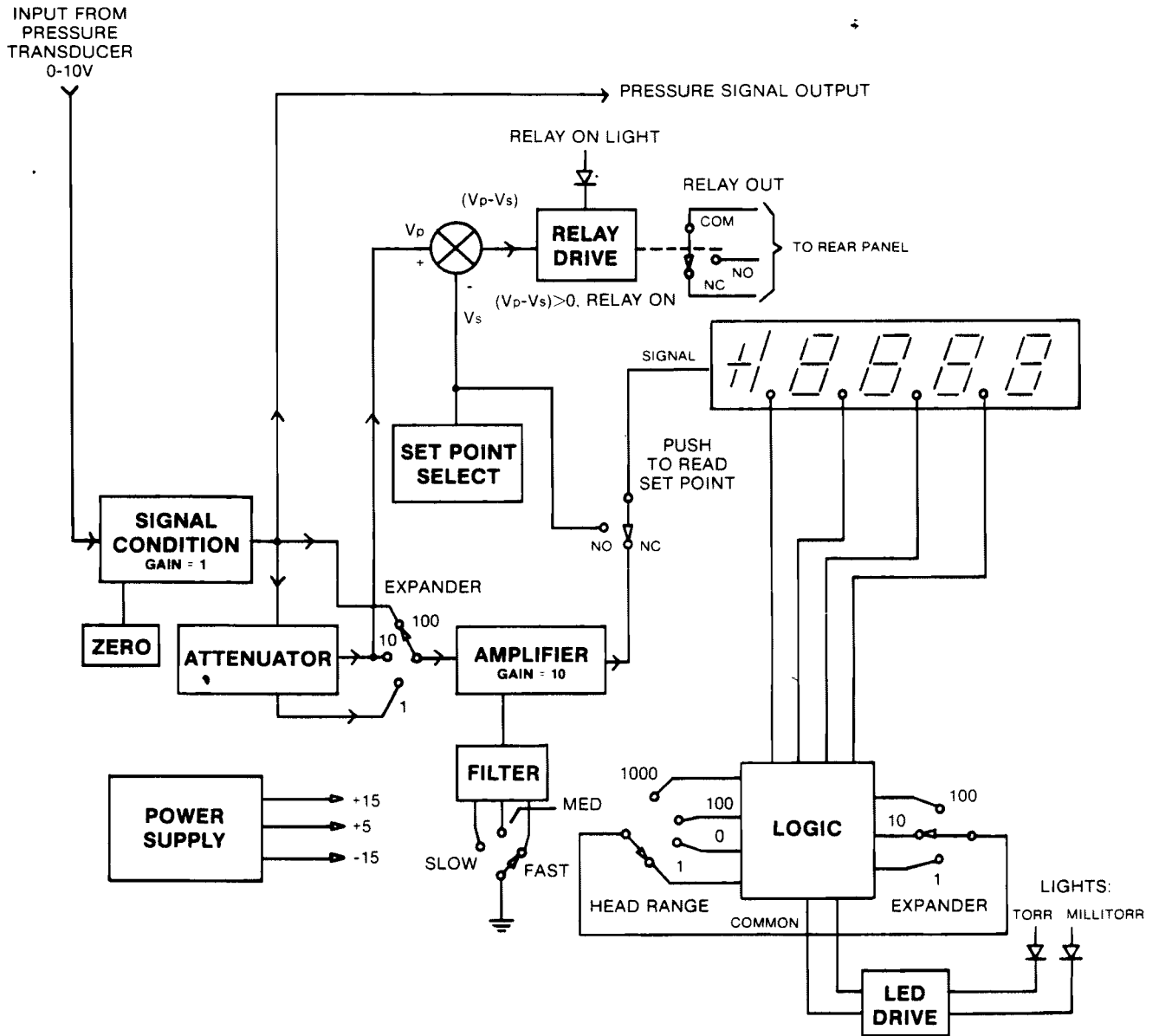
NOTE: The Block Diagram for the 80-6 is on the following page.

The 80-6 Pressure Display Module displays the pressure in a vacuum chamber by receiving a 0 to 10 volt DC signal from a pressure transducer such as a capacitance manometer. The input signal is conditioned for the zero voltage offset of the transducer, by means of the ZERO ADJUST potentiometer, and is sent to the J4 SIGNAL OUT connector on the rear panel, to be used by the 80-1 Automatic Pressure Controller or the 80-2 Automatic Throttle Valve Controller as its input pressure-control signal. The input signal also is filtered (through the FAST/MED/SLOW filtering switch) to eliminate any noise in the signal before it is displayed on the PRESSURE display on the front panel. The HEAD RANGE switch on the rear panel adjusts the 80-6 circuitry to match the full-scale range of the transducer. An EXPANDER switch provides a magnified display of the pressure signal if desired. The 80-6 also contains circuitry that automatically determines the decimal location and the proper TORR or MILLITORR light, based on the selection of the controls mentioned above.

The signal sent to the J4 SIGNAL OUT connector is not affected by the settings of the FAST/MED/SLOW filtering switch or EXPANDER switch or by the filtering circuitry that is used to eliminate noise from the signal sent to the PRESSURE display.

The 80-6 has an internal relay that can be set for activation at a preselected pressure set point. The 80-6B has two such internal relays. Connections for the relay terminals are brought out to the J5 RELAY OUT connector.

80-6 BLOCK DIAGRAM



NOTE: The 80-6B has duplicate relay circuitry

