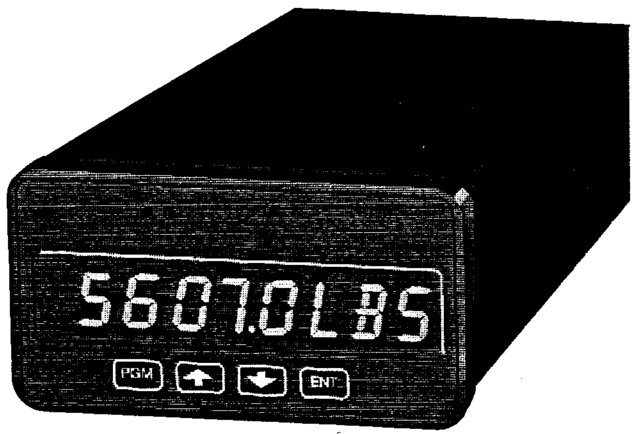
DP87 and DP88

Digital Strain Indicators



OMEGA®

An OMEGA Technologies Company

Operator's Manual

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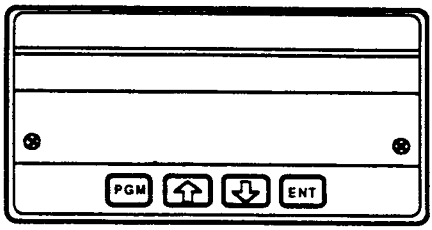
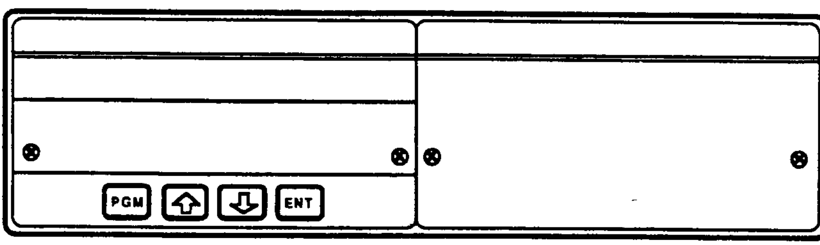


Model DP 88



SECTION 1
INTRODUCTION

1.1 INTRODUCTION

Your new DP87/DP88 digital strain gage transducer indicator is a microprocessor based, panel instrument that accepts a strain gage type transducer input to measure physical phenomena such as pressure, torque, force, load, weight or thrust.

Microprocessor power makes your DP87/DP88 indicator easy to use. Programming is a matter of pressing a few keys. And to help you along the programming sequence, your DP87/DP88 indicator prompts you on the display for the appropriate entry or response.

Model DP87 and Model DP88 digital transducer indicators feature 5-digit display/data output resolution for precise readings. A brief model summary is given in the table below.

Model Tabulation

MODEL	OPTION CAPACITY	BUILT-IN TRANSDUCER EXCITATION?
DP87	1	Yes: 5/10/15 Volts. Can drive two 350Ω transducers max. in parallel @ 15 V (90 mA).
DP88	4	Yes: 5/10/15/20 Volts. Can drive eight 350Ω transducers max. in parallel @ 15 V (350 mA).

Here are some of the features designed into your DP87/DP88 indicator:

- Menu driven display prompts you for easy programming (configuration) and calibration of the indicator.
- Front panel water-resistant membrane switches for reliable operation in a wide range of operating environments.
- Highly accurate integrating voltage-to-frequency converter (VFC).
- Easy to install optional plug-in cards expand instrument capability.

- Switchable dual display—primary display shows basic measurement value; secondary display shows an equivalent measurement derived from the primary display value.

- Automatic or manual Zeroing and Tare Offset capabilities.

- Easy to read, 14-segment, alphanumeric LED display reads out engineering units of up to three characters.

- Easy to calibrate—no mechanical adjustments needed.

- Rugged aluminum case protects components and shields against electrical interference for a long and reliable service life.

For your reference, refer to the appendix section in this manual for technical specifications.

1.2 OPTIONS

Optional plug-in cards enable a DP87/DP88 indicator to be used in many different applications. To give you an idea of what your indicator is capable of, here's a brief summary of the plug-in option cards:

Alarm Option. This option card allows you to monitor the measured variable with two programmable alarm limits. Each alarm limit has a corresponding Form C relay to actuate an external device upon alarm. The alarm option card is also programmable for hysteresis, alarm delay, and automatic or manual reset.

Analog Output Option. This option card gives you a scalable analog output which corresponds to a display value as determined by your programming. The analog output card is available in 0-10 V and 4-20 mA output versions.

Math Option. This option card performs mathematical computations on the basic measurement value to read out its maximum value, minimum value, time average, or rate of change.

Serial Output Option. This option card processes the information shown on the indicator's display readout into serial ASCII data. The data can be given to any computer or peripheral device with a serial I/O port.

BCD Output Option. This option card processes the information shown on the indicator's display readout into parallel BCD data. With handshake signals and tri-state controlled data lines, the BCD output option offers flexibility in data transmission to accommodate most BCD processors.

Other available options include the Gross/Net option for switchable display of gross and net values, the R Cal option for easy calibration check using a front panel pushbutton, and two versions of DC power cards (for operating DP87 on DC power). All options are field-installable. If you ordered your indicator and option separately, refer to Section 2 in this manual for instructions on how to install that option.

1.3 UNPACKING AND TESTING YOUR INDICATOR

After carefully unpacking your indicator, inspect it for possible shipping damage. Also check the shipment for correct accessories and options, then test the indicator for proper operation before placing it in service. *Promptly report physical damage, missing items, or improper operation to the factory.*

To test your indicator, apply power (refer to 2.4 for instructions on power connections). Now watch the readout for the start-up display routine which takes about 3-4 seconds to complete. If your indicator is OK, the display will show the word...

...*SELFTEST*, then the word...

...*PROCESS*, followed by...

...a floating display value (open input).

If your indicator is not OK, a diagnostic message will be displayed indicating the area of trouble. Refer to 3.2 for the list of diagnostic messages and descriptions.

SECTION 2
INSTALLATION/WIRING

2.1 INTRODUCTION

This section includes basic installation instructions in the areas of mounting, power hookup, and input sensor hookup.

Also included in this section are instructions for the various options (as required, configuration, installation, and/or hookup). Refer to these instructions if your indicator uses options or if you've an option or add-on accessory that was ordered separately.

2.2 PANEL MOUNTING

Follow these step-by-step instructions to mount your indicator in a panel. Refer to Figure 2-1 on the next page for panel mounting details.

STEP 1. Prepare panel in which indicator is to be installed. See the outline drawing for your indicator model in the appendix section for the panel cutout dimensions. Note that the maximum panel thickness is 9.5 mm (3/8 in.).

STEP 2. Remove retainer bar brackets from rear of indicator (two screws). Slide retainer bar out from both sides of housing.

STEP 3. Install indicator in panel cutout from outside.

STEP 4. Reinstall indicator retainer bars.

STEP 5. Reinstall retainer bar brackets..

STEP 6. Clamp retainer bars to inside of panel by tightening retaining bar bracket screws (these screws push bracket against retainer bar). Tighten screws just enough so that indicator is firmly supported—be careful not to overtighten to avoid stripping threads.

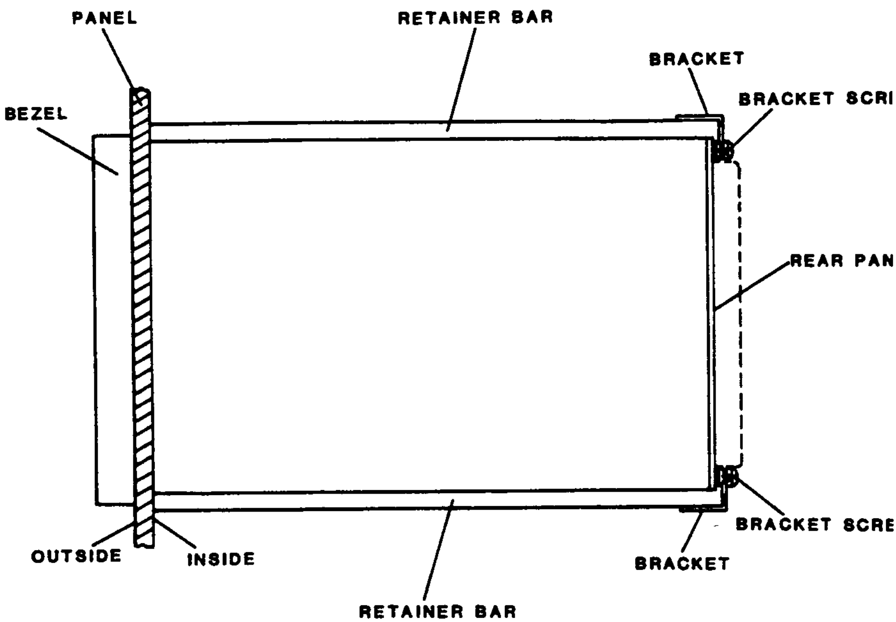


FIGURE 2-1. ***PANEL MOUNTING THE INDICATOR***

2.3 RACK MOUNTING

Rack mounting adapters 90 mm x 483 mm (3.5" x 19") are available with cutouts for one, two, or three DP87 indicators. For a DP88 indicator, a rack mounting adapter with the same dimensions above is available with one cutout. All rack mounting adapters use 76.2 mm (3") hole centers.

Follow the instructions for panel mounting to install your indicator(s) into a rack mounting adapter's cutout(s). You will have to supply your own hardware to install the adapter into your rack system.

2.4 CONNECTING POWER

2.4.1 *AC Power*

We supply a 1.8 meter (6') polarized AC power cord assembly as standard for your indicator (2 ea. for DP88). Plug the mating connector end of the cord(s) into the indicator's AC power receptacle(s) in the lower rear panel. (See the drawing of the indicator rear panel on page 2-5.) If you need a custom length power cord, the drawing below shows you how to make your own. The AC power cord mating connector—as well as the standard supplied AC power cord—is available from the factory as a spare/replacement part item.

WARNING!

To prevent shock hazard and to minimize electrical noise, you must always use a 3-prong grounded power cord for the indicator. If you must use an adapter, always connect the green lead of the adapter to earth ground. This can be the socket housing, conduit, water pipe, etc.

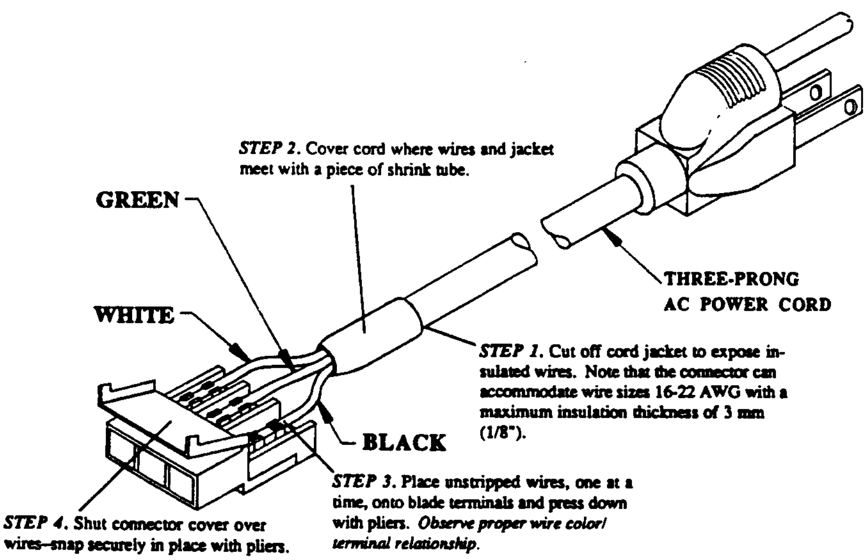


FIGURE 2-2. ***INSTALLING THE AC POWER CORD MATING CONNECTOR***

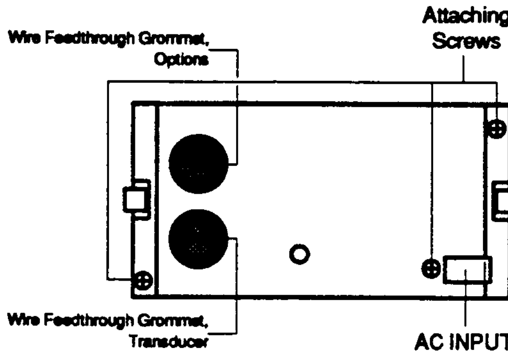
2.4.2 *DC Power*

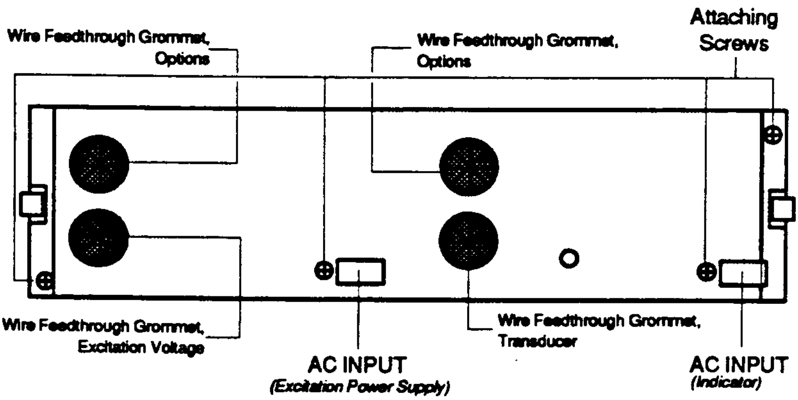
(Not applicable)

2.5 TRANSDUCER HOOKUP/SELECTING EXC. VOLTAGE

A 4-terminal barrier strip on the main board is used to connect the transducer's signal output and the excitation voltage sense. A 2-terminal barrier strip on the indicator's excitation power supply board provides the connection to supply the transducer's excitation voltage.

Remove the indicator's rear panel (three screws/lockwashers for Model DP87; four screws/lockwashers for Model DP88) to gain access to the terminals and excitation power supply board. See the drawing of the rear panel layout on the nest page. Select the excitation voltage as described in 2.4.1 (DP87) and 2.5.2 (DP88).

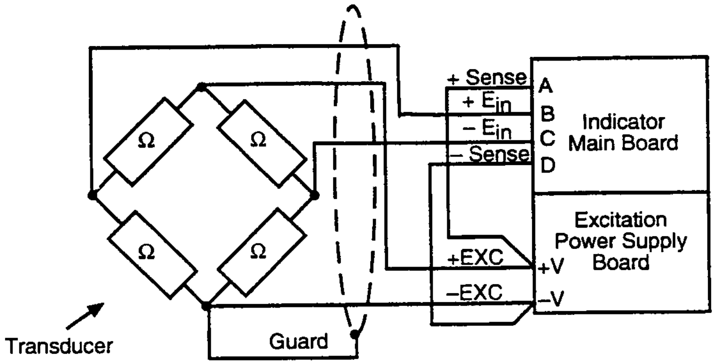




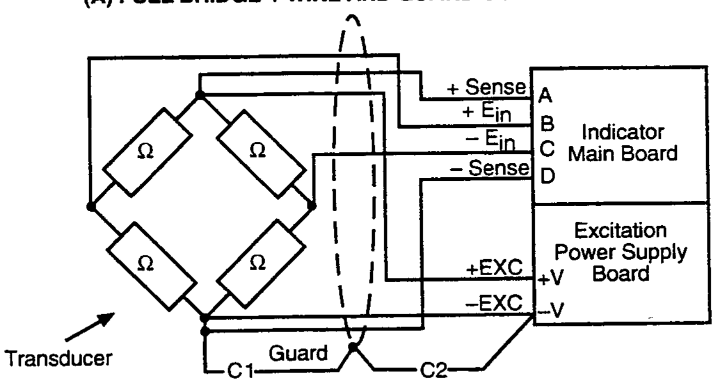
After removing the rear panel, route the transducer leads (and transducer excitation leads if applicable) through the rear panel grommets and connect to the indicator's screw terminals as diagrammed in Figure 2-4. (Terminate all wires in lugs to make the installation and removal of wires easier.)

The full bridge, 4-wire configuration shown in Figure 2-4 (a) is satisfactory if: (1) the cable length isn't too long, (2) the system is operated under a stable temperature environment, and (3) extreme accuracy is not a requirement.

The full bridge, 6-wire configuration shown in Figure 2-6 (b) avoids measurement errors inherent in the 4-wire system. With the sense leads connected to the excitation voltage terminals of the bridge, a cable's wire resistance and bridge resistance variations due to temperature have negligible effect on accuracy since the transducer measurement is based on the exact voltage provided at the bridge rather than at the supply terminals.



(A) FULL BRIDGE 4-WIRE AND GUARD CONFIGURATION



NOTE: The cable's shield should be connected to the −EXC line at the transducer (C1) or at the meter (C2) but not at both points.

(B) FULL BRIDGE 6-WIRE AND GUARD CONFIGURATION

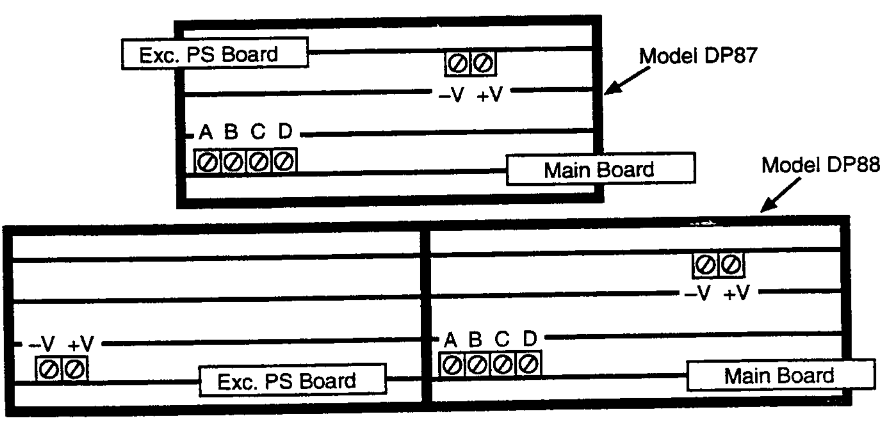
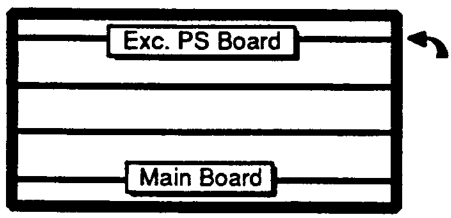


FIGURE 2-4. TRANSDUCER CONNECTION DIAGRAMS

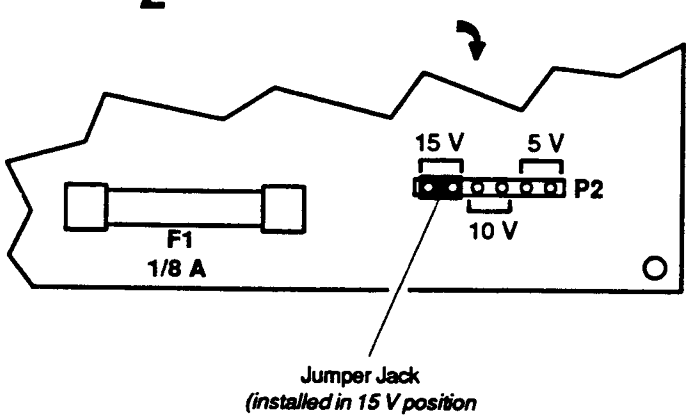
2.5.1 *Setting the Excitation Voltage, Model DP87*

With Model DP87, a jumper jack on the excitation power supply board is used to set the excitation voltage to 5, 10, or 15 Volts. Set the voltage as required for your application by following the instructions below:



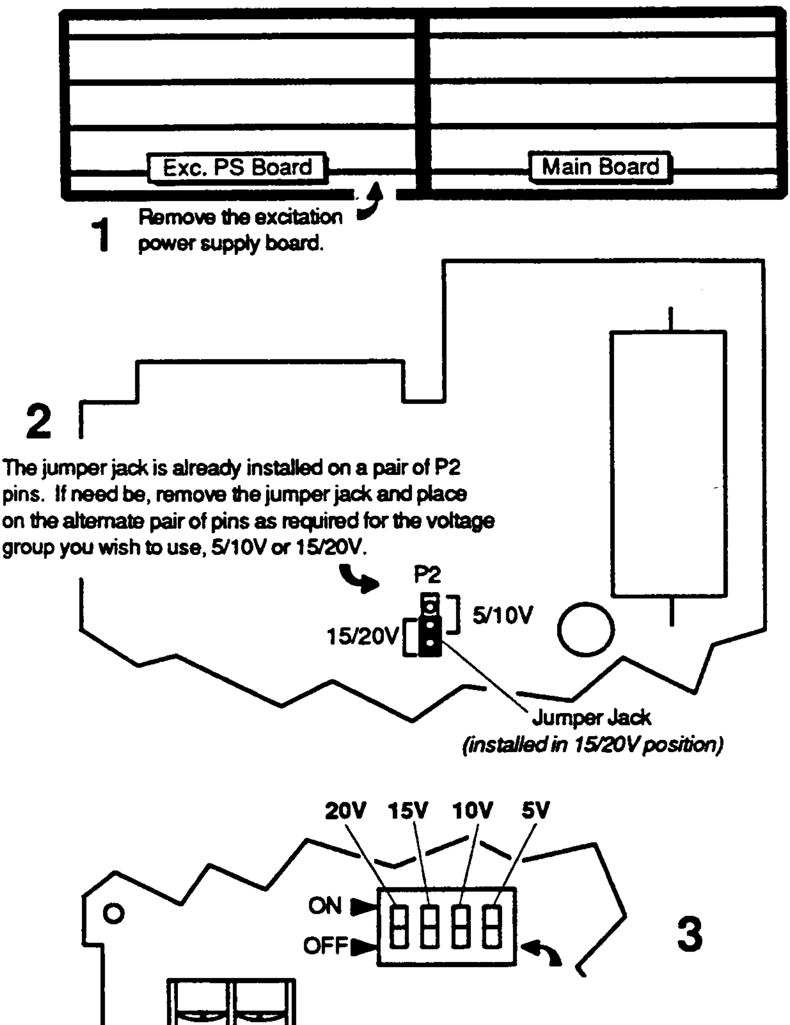
1

2



2.5.2 *Setting the Excitation Voltage, Model DP88*

With Model DP88, a jumper jack and a 4-position DIP switch on the excitation power supply board is used to set the excitation voltage to 5, 10, 15, or 20 Volts. Set the voltage as required for your application by following the instructions below:



2.6 OPTION INSTALLATION

Various options are offered which may be installed by the factory or by you. If you've ordered an option separately, refer to its installation instructions in this section.

The indicator's slot locations are shown below for reference.

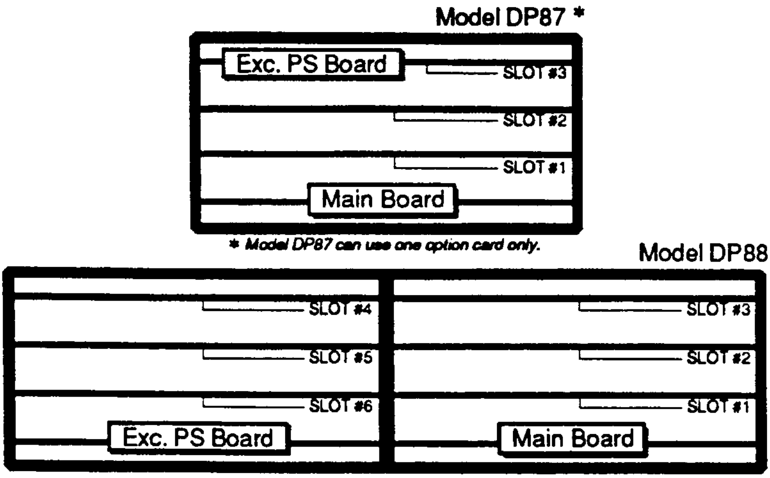


FIGURE 2-5. ***INDICATOR CARD SLOTS AS SEEN FROM REAR***

POINTS TO CONSIDER WHEN INSTALLING OPTIONS

- Install all option cards, except the R Cal (Resistor Calibration) and Gross/Net switch cards, component side up. An R Cal or Gross/Net switch card (for use in Model DP88 only) must be installed component side down.

- The Alarm card and Serial Output card require configuration before use.

- For Model DP88, you can only use slot #3—the uppermost slot above the main board—for an R Cal or Gross/Net switch card.

- If an R Cal or Gross/Net switch card is installed in slot #3, the slot below it (slot #2) must be left empty.

- A DC power supply card can only be installed in slot #1 (Model DP87 only).

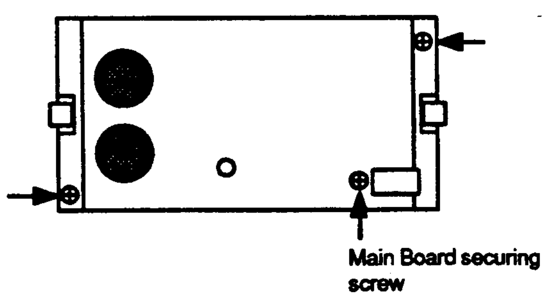
2.6.1 *Disassembling Your Indicator*

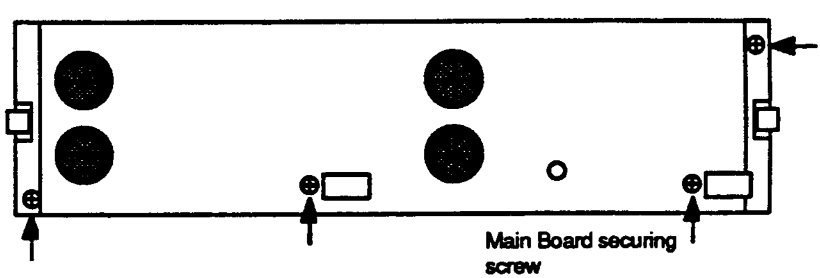
You will need to partially disassemble your indicator in order to trouble-shoot and/or replace the transducer input card or main board assembly. This section describes the disassembly of key indicator components.

WARNING!

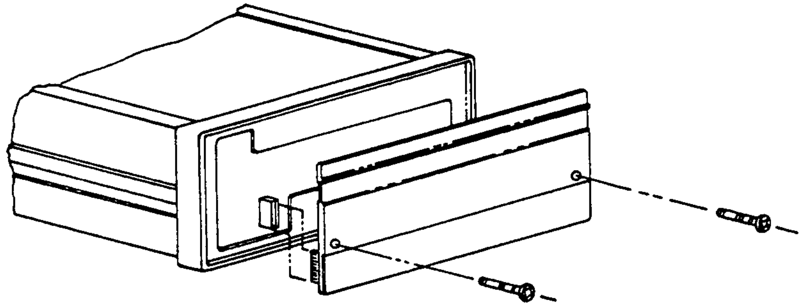
To prevent shock hazard and possible instrument damage, always remove power from the indicator before disassembling the instrument.

REAR PANEL. Remove attaching screws. Three screws with lock-washers attach the rear panel of DP87. Four screws with lockwashers attach the rear panel of DP88.

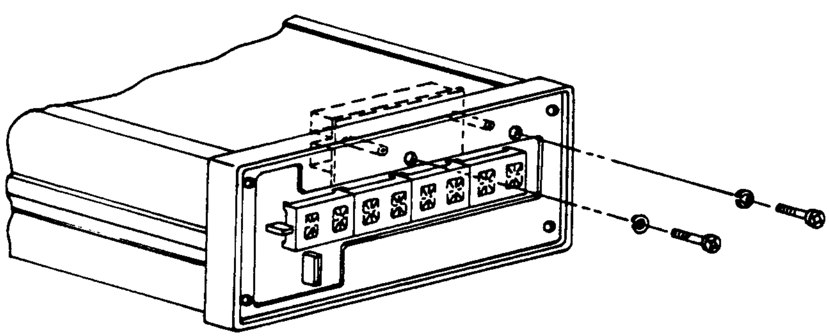




FRONT PANEL LENS. Two screws attach the front panel lens to the bezel. On Model DP88, the right half of the bezel is covered by a plastic facing which is also secured by two screws. Remove the lens (and facing if applicable) to access the motherboard and bezel attachment screws. Free the lens completely from the indicator, if need be, by pulling its flat cable off of the socket on the display board (this is the vertical board with the display readout).



MOTHERBOARDS. The main motherboard assembly attaches to the bezel with two screws and lockwashers (illustrated with a DP87 unit below). Model DP88's expansion housing motherboard assembly attaches to the bezel with four screws and lockwashers.



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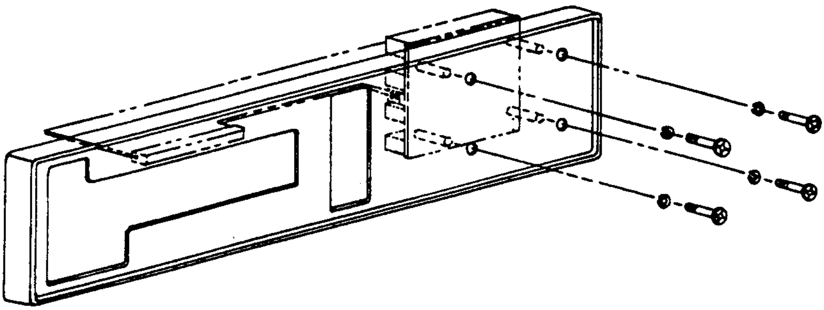
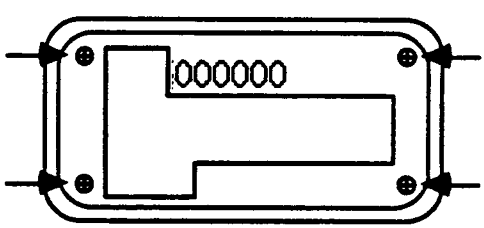


BEZEL. The bezel is attached to the housing with four screws for DP87 and eight screws for DP88. For DP88, follow the bolting sequence (as shown by the numbers in the drawing below) when reinstalling the bezel. This will make it easier to install the screws. It will also reduce the chance of damaging the tapped holes in the housing due to cross threading.



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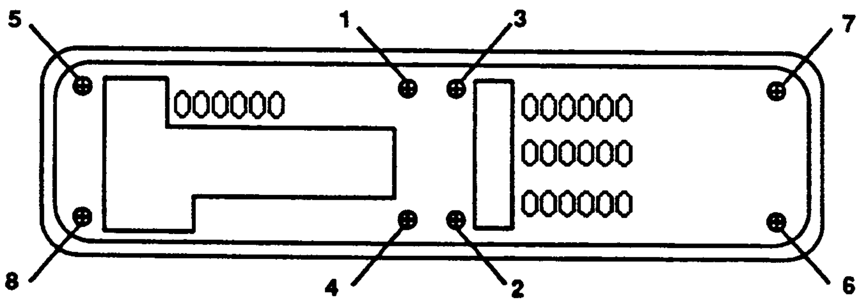


2.6.2 *Alarm Card, Configuration/Installation/Wiring*

Alarm Card Configuration

The alarm card is configurable for:

- Address
- Relay mode of operation

Configure the alarm card to your application before placing it in service in your indicator. Configuration is set by three removable jumper jacks which plug onto terminal pins on the card. See the drawing below for the location of the alarm card's terminal pins.

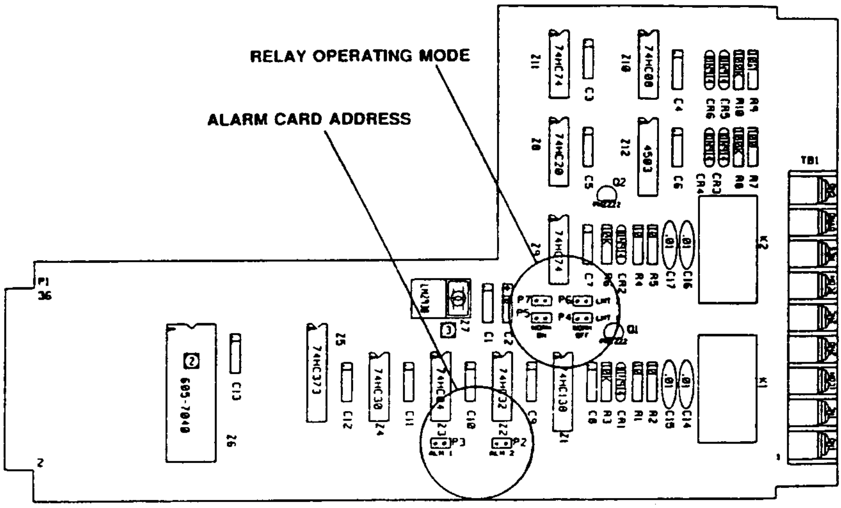


FIGURE 2-6. ***CONFIGURATION TERMINAL PINS, ALARM CARD***

Configuring the Alarm Card for Address

Two pair of pins, P2 and P3, are used to set the card address. A removable jumper jack is installed on one of these pairs (typically the P3 location):

- Place the jumper jack over the pins in the P3 location to configure the card for alarm card #1. The relays on the alarm card, K1 and K2, will then respond to limits #1 and #2 respectively.

- Place the jumper jack over the pins in the P2 location to configure the card for alarm card #2. The relays on the alarm card, K1 and K2, will then respond to limits #3 and #4 respectively.

If you are going to use only one alarm card, configure that card as alarm card #1. Your indicator allows use of a single alarm card only with the alarm card #1 address. To allow your indicator to use two alarm cards, configure one alarm card for alarm card #1 and the other for alarm card #2. The use of two alarm cards requires that you always configure one alarm card—and one only—as alarm card #1.

With factory installed alarm card(s), it isn't necessary for you to configure for address. However, if you have two factory installed alarm cards in your indicator, verify the address configuration in order to determine the relay/limit number relationship.

Configuring the Alarm Card for Relay Operating Mode

You have the choice to have one or both relays on the alarm card to either energize or de-energize when tripped. A relay that de-energizes when tripped operates in the fail-safe mode. In the fail-safe mode, an unwanted loss of power naturally causes the relay contacts to drop out which in turn registers as an alarm trip by the system.

Two pin pairs (P4, P5 and P6, P7) are associated with each relay (K1 and K2 respectively). The operating mode of a particular relay is selected by jumpering one of the pin pairs with a jumper jack. The pin terminals and the associated relay operating mode is tabulated below:

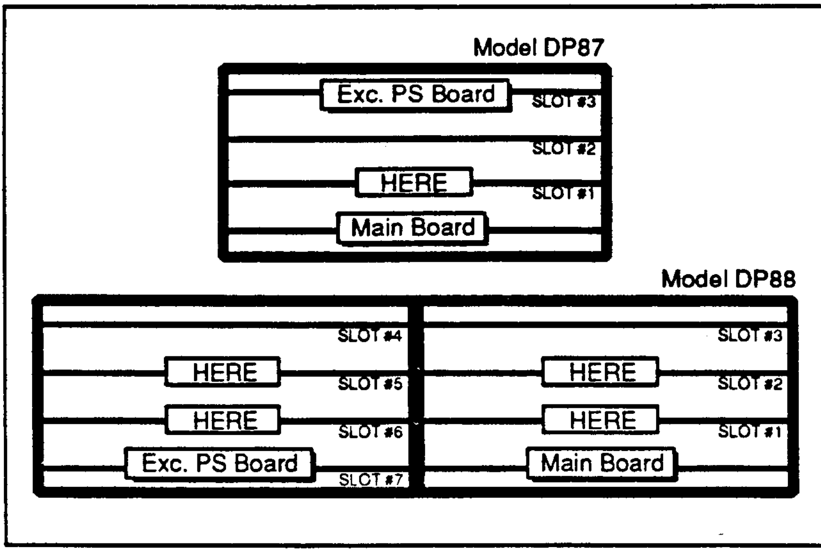
	Relay Pins	
Relay Status	*K1*	*K2*
Energize w/Trip	P4	P6
De-energize w/Trip	P5	P7

Let's say, for example, that you want both relays to de-energize when tripped (this means of course that both relays will be energized when not tripped). Looking at the table above, you can see that jumper jacks need to be installed on the P5 and P7 pins in order for both relays to de-energize on alarm.

The alarm card is supplied with the relay mode jumper jacks already on a pair of pin terminals. If you want to change the current relay mode configuration, pull the jumper jack(s) off the pins and reinstall on the alternate pair of pins as indicated in the table above.

Alarm Card Installation

The drawing below shows the possible indicator slots in which the alarm card may be inserted. Your indicator accommodates up to two (2) alarm cards (DP88 only).



Installing the Alarm Card

To install the alarm card, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

STEP 2. Plug the card(s) into the desired slot(s) with components facing up. See the drawing above for possible slot locations. Keep in mind that a particular combination of option cards may limit the number of slots in which a given option can be installed. Review the "Points to Consider" information in 2.6. *(Is the Alarm card already configured to your application?*

Configure this card first—refer to the instructions above—before the final installation.)

STEP 3. Wire the alarm card. The discussion on wiring follows these installation steps.

STEP 4. After wiring, reinstall rear panel to complete the installation if no other cards are to be installed. This completes installation of this option. Removal of the option card is the reverse of installation.

Alarm Card Wiring

The alarm card uses a screw terminal barrier strip for the hook up. Remove the rear panel to gain access to these terminals. We recommend that you terminate all wires in lugs to make the installation and removal of wires easier. See the drawing below for the number/function assignment of the alarm card's screw terminals. Route all wires to/from the indicator through the rear panel grommets (see drawing on page 2-5).

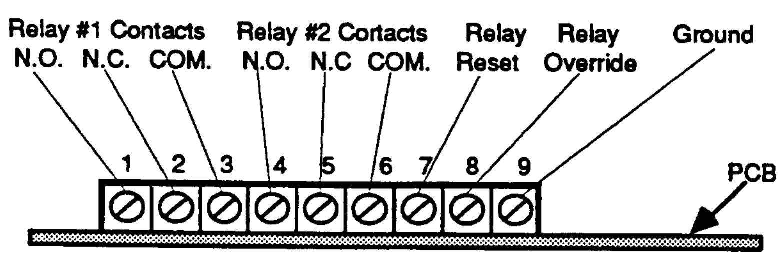


FIGURE 2-7. ***ALARM CARD TERMINALS***

Wiring the Alarm Card

Relay Contacts

WARNING!

Lethal AC power voltages may be present on barrier terminals (relay contact wiring). Always exercise caution when working in this area.

The alarm card has two Form C relays that actuate on alarm. Each relay has a common contact, a normally closed (N.C.) contact, and a normally open (N.O.) contact. You can use the relay contacts to operate alarm annunciating devices such as lights and audio alarms or to electrically actuate a valve or a switch.

Wire your alarm relay circuit to the relay contacts at the appropriate screw terminals as shown in the drawing above. Before you hook up the relay contacts, make sure that the circuit will not exceed the relay's contact rating of:

1 Amp @ 120 VAC (non-inductive load)

Relay Reset

The alarm card's relay reset terminal accepts an external switch closure (to ground) which is needed to reset a tripped relay when the manual reset mode is selected. (A full discussion on the reset modes is found in the operation section of the manual.)

To hook up the relay reset switch, connect a normally open, momentary contact switch between terminal #7 (relay reset) and terminal #9 (ground) using a twisted pair cable. A push of this switch will reset the relay(s) to the untripped condition only if the associated alarm limit is no longer exceeded. If you actuate the relay reset switch with a limit still exceeded, there will be no effect on the relays. This switch will also have no effect on the relays if the automatic reset mode is selected.

Relay Override

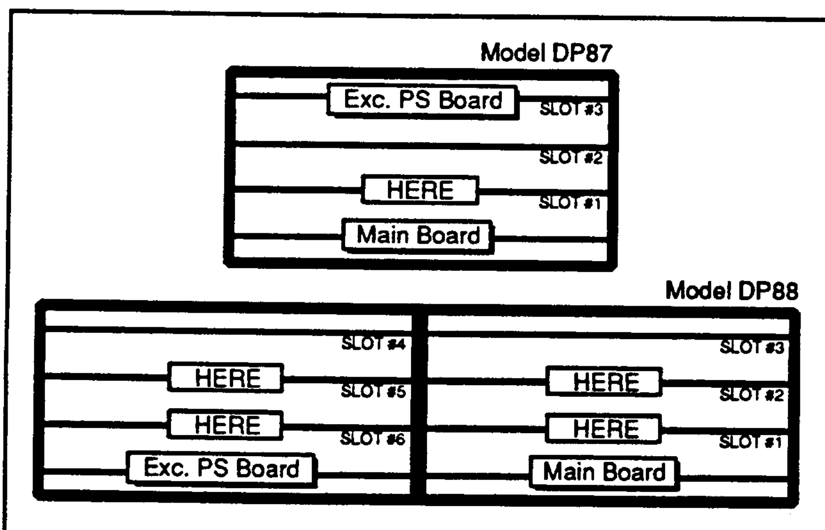
The alarm card has a relay override feature which allows you to (1) prevent relays from being tripped or to (2) force tripped relays to the untripped state. You can use relay override to prevent unnecessary tripping of the alarm relays when performing system tests. You can also use relay override to kill an alarm annunciating device–a 120 dB klaxon let's say–after it has gotten your attention. Relay override does not affect the indication of alarms on the front panel display.

To use relay override, connect a SPST toggle or rocker switch between terminal #8 (relay override) and terminal #9 (ground) using a twisted pair cable. Close the switch whenever you want the relays in the untripped state. Note that both relays will remain in the untripped state regardless of alarm condition as long as this switch is closed.

2.6.3 *Analog Output Card, Installation/Wiring*

Analog Output Card Installation

The drawing below shows the possible slots in which the analog output card may be inserted. The indicator can use only one (1) analog output card.



Installing the Analog Output Card

To install the analog output card, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

STEP 2. Plug the card into the desired slot with components facing up. Keep in mind that a particular combination of option cards may limit the number of slots in which a given option can be installed. Review the "Points to Consider" information in 2.6.

STEP 3. Wire the analog output card. The discussion on wiring follows these installation steps.

STEP 4. After wiring, reinstall the rear panel to complete the installation if no other cards are to be installed. This completes installation of this option. Removal of the option card is the reverse of installation.

Wiring the Analog Output Card

A pair of screw terminals on terminal strip TB1 provides the output connection from the analog output card. Remove the rear panel to gain access to these terminals. See the drawing below for the polarity assignment of the analog output card's output terminals. Route all wires to/from the indicator through the rear panel grommets (see drawing on page 2-5).

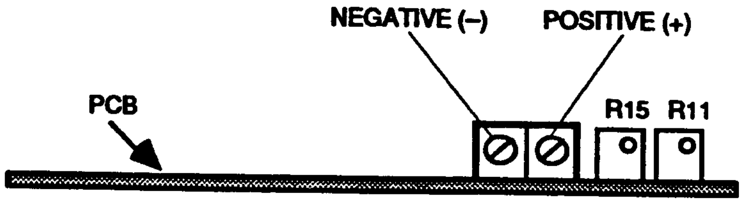


FIGURE 2-8. ***ANALOG OUTPUT CARD OUTPUT TERMINALS***

Use a twisted pair cable for connecting the analog output to the external device input—this will minimize noise pickup. In order to provide the proper output, the analog output card must be used with devices having an input impedance of:

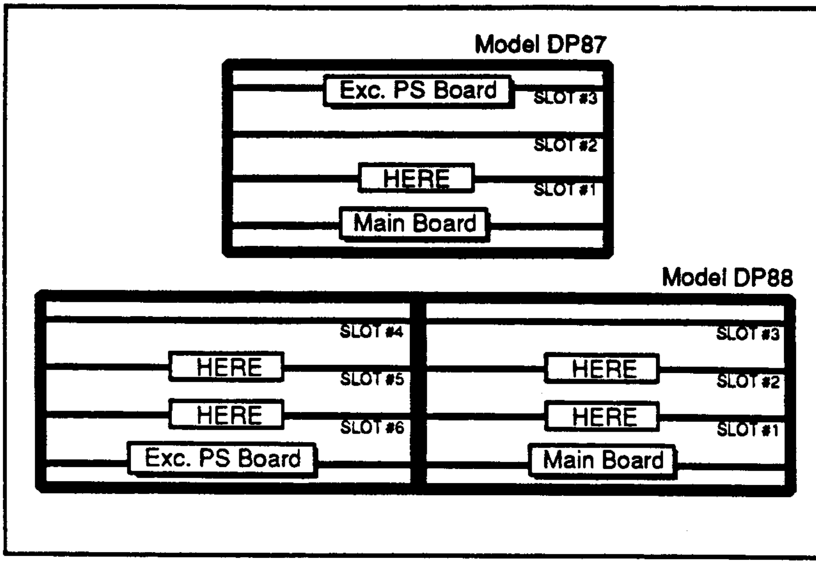
- 1 kΩ or greater for a 0-10 V analog output card
- 600 Ω or less for a 4-20 mA analog output card

Make sure that the external device to be used has an allowable input impedance before proceeding with the hook up.

2.6.4 *Math Card, Installation*

The Math card requires no configuration or wiring. The following describes how this card is installed in the indicator.

The drawing below shows the possible indicator slots in which the Math card may be inserted.



To install the Math card, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

STEP 2. Plug the card into the desired slot with components facing up. See the drawing above for possible slot locations. Keep in mind that a particular combination of option cards may limit the number of slots in which a given option can be installed. Review the "Points to Consider" information in 2.6.

STEP 3. If no other cards are to be installed, reinstall the rear panel to complete the installation. (Route all wires to/from the indicator through the rear panel grommets.) This completes installation of this option. Removal of the option card is the reverse of installation.

2.6.5 *Serial Output Card, Configuration/Installation/Wiring*

Serial Output Card Configuration

The serial output card is configurable for:

- Operating mode: RS-232C or 20 mA current loop (Active or Passive)
- Baud rate
- Character format
- Device number
- Termination characters

Configure the serial output card to your application before placing it in service in your indicator. Configuration is set by two removable jumper jacks (which plug onto terminal pins on the card) and two miniature DIP switch assemblies. See the drawing below for the location of the serial output card's terminal pins and DIP switches.

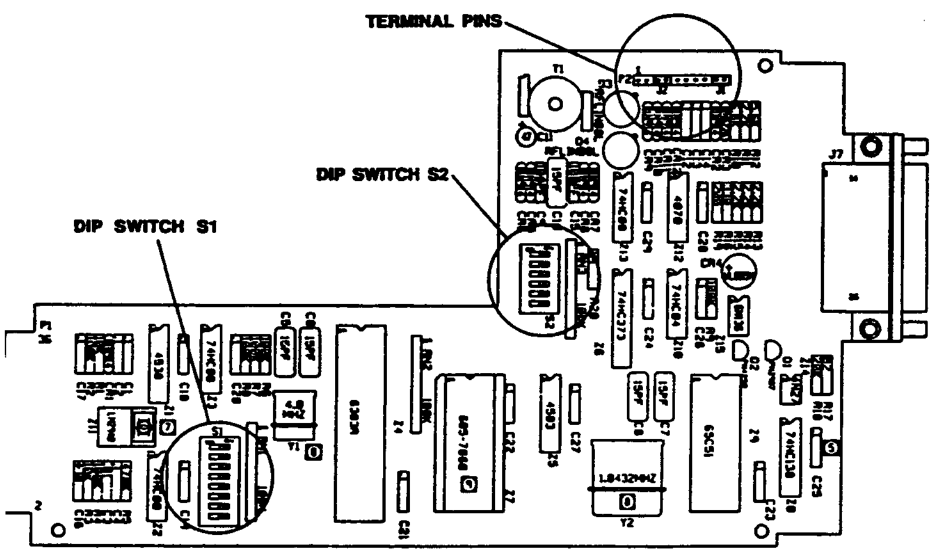


FIGURE 2-9. ***TERMINAL PINS AND DIP SWITCHES, SERIAL OUTPUT CARD***

Configuring the Serial Output Card for Operating Mode

Ten pins (J2) are used to determine the serial output card's operating mode. In the drawing above, pin 1 is the leftmost pin, so the order is one through ten left to right. Select the desired operating mode by placing two jumper jacks over two pair of pins as indicated in the table below:

To Select:	Place Jumpers on Pin Pairs
20 mA, Passive	9,10 3,4
20 mA, Active	5,6 1,2
RS-232C	7,8 1,2

Configuring the Serial Output Card for Baud rate/Character format/Device number/Termination characters

The serial output card uses two DIP switch assemblies for configuration. These DIP switches will be one of two general types, a *rocker* switch or *slide* switch. At any rate, each individual switch will have two positions. Look at the face of the switch assembly right side up (lettering and/or numbering clearly readable):

- To set a switch to the **CLOSED/ON** position...

  ...push the switch down at the top (rocker switch)

  ...or slide the switch towards the top (slide switch).

- To set a switch to the **OPEN/OFF** position...

  ...push the switch down at the bottom (rocker switch)

  ...or slide the switch towards the bottom (slide switch).

Switch S1–Baud Rate and Character Format

Set switch S1 for the baud rate and character format as required for your application per the tables below. Note that an "X" indicates an OPEN/OFF switch and an "O" indicates a CLOSED/ON switch.

S1	1 2 3	4 5	6	7 8
	baud	*word*	*stop*	*parity*

BAUD RATE

1	2	3	Rate
O	O	O	300
X	O	O	600
O	X	O	1200
X	X	O	1800
O	O	X	2400
X	O	X	3600
O	X	X	4800
X	X	X	9600

WORD

4	5	Bit Size
O	O	8 bits
X	O	7 bits
O	X	6bits*
X	X	5 bits*

STOP BITS

6	Qty Bits
O	1 bit
X	2 bits

PARITY

7	8	Condition
O	O	no parity
X	O	odd parity
O	X	no parity
X	X	even parity

* *These bit sizes aren't normally used since it results in truncated characters. Data is transmitted out the serial port using 7-bit ASCII characters.*

NOTE

If a word size of 8 is selected at 300 baud, the data is forced to *no parity* and *1 stop bit* regardless of the DIP switch settings. This is done to meet the transfer rate required to keep up with the reading's 1/2 second conversion time.

Switch S2–Device Address and Termination Characters

Your indicator must be assigned a unique address–a number between 00 and 16–in order to identify the data. Termination characters are used to control a cursor or printing mechanism at the end of the transmitted data.

Set switch S2 for the device address and data termination characters as required for your application per the tables below. Note that an "X" indicates an OPEN/OFF switch and an "O" indicates a CLOSED/ON switch.

S2 1 2 3 4 (*device*) 5 6 (*terminator*)

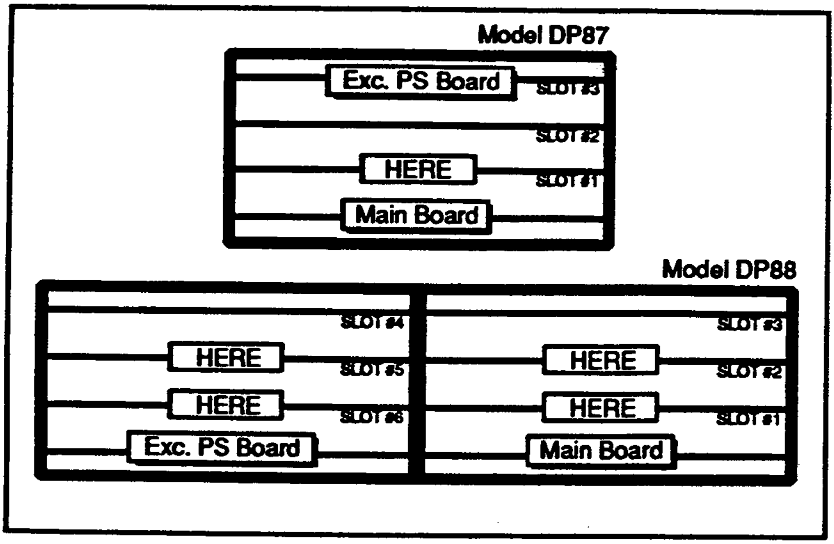
Device Address				
1	2	3	4	#
O	O	O	O	01
X	O	O	O	02
O	X	O	O	03
X	X	O	O	04
O	O	X	O	05
X	O	X	O	06
O	X	X	O	07
X	X	X	O	08

Device Address				
1	2	3	4	#
O	O	O	X	09
X	O	O	X	10
O	X	O	X	11
X	X	O	X	12
O	O	X	X	13
X	O	X	X	14
O	X	X	X	15
X	X	X	X	16

Termination Characters		
5	6	Characters
O	O	Space, Space
X	O	Space, CR (return)
O	X	CR, LF (line feed)
X	X	Space, LF

Serial Output Card Installation

The drawing below shows the possible indicator slots in which the serial output card may be inserted. Your indicator can use only one (1) serial output card.



Installing the Serial Output Card

To install the serial output card, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

STEP 2. Plug the card into the desired slot with components facing up. See the drawing above for possible slot locations. Keep in mind that a particular combination of option cards may limit the number of slots in which a given option can be installed. Review the "Points to Consider" information in 2.6.

STEP 3. Peel off the foil cover sticker on the rear panel to expose the panel cutout. For DP88, peel off the left or right sticker according to the serial output card's slot location. After peeling off the foil sticker—and if no other cards are to be installed—reinstall the rear panel. *(Is the serial* *output card already configured to your application? Configure this card first—refer to the instructions above—before the final installation.)*

STEP 4. With the serial output card in its slot and the rear panel in place, cover the rear panel cutout with one of the two self-adhesive foil cover plates supplied with the option.

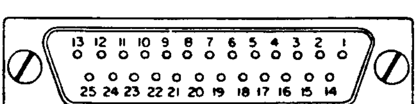
NOTE

Both cover plates have a cutout for the serial output card connector. One plate, however, is used for an upper slot card. The other plate is used for a lower slot card.

After removing the backing, place the appropriate cover plate over the Serial Output card connector and stick it onto the rear panel. This completes installation of this option. Removal of the option card is the reverse of installation.

Wiring the Serial Output Card

The indicator connects to the external serial device via the serial output card's cable connector (J7). The required mating connector is a 25-pin, male "D" type connector. Shown below is a drawing of the serial output card's connector as seen from the rear of the indicator. The table next to it lists the function of the pin sockets by pin number. Use this information to make the interconnecting cable.



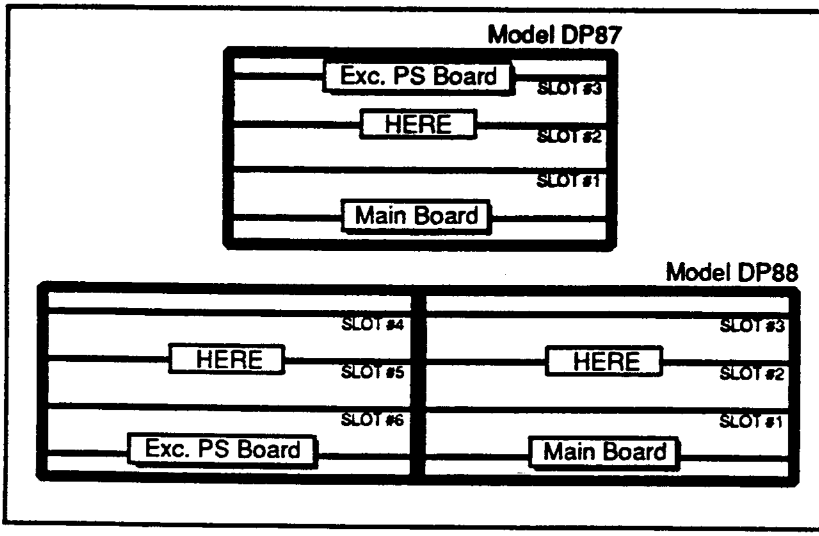
J7 PIN #	FUNCTION
RS-232C	
1	chassis ground
2	transmit data
4*	request to send
5	clear to send
7	signal ground
20*	data terminal ready
20 mA Current Loop	
11	transmit (+)
25	transmit (-)

* These pins supply +14V for use as a pull up if required.

2.6.6 *BCD Output Card, Installation/Wiring*

BCD Output Card Installation

The drawing below shows the possible indicator slots in which the BCD output card may be inserted. Your indicator can use only one (1) BCD output card.



<u>Installing the BCD Output Card</u>

To install the BCD output card, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

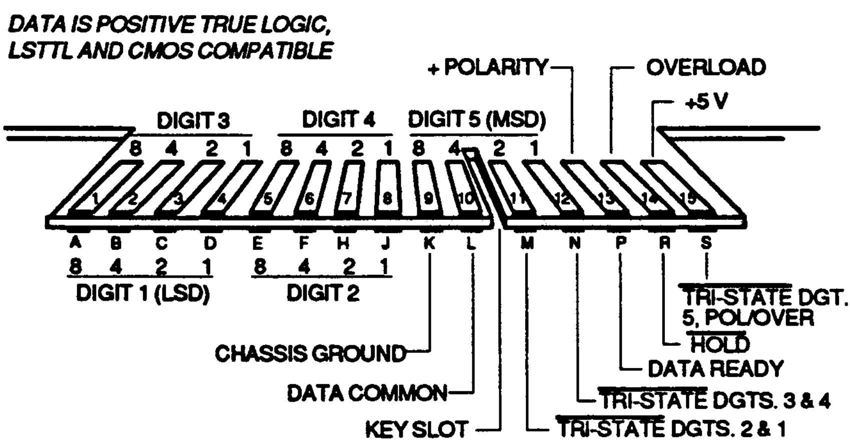
STEP 2. Plug the card into the desired slot with components facing up. See the drawing above for possible slot locations. Keep in mind that a particular combination of option cards may limit the number of slots in which a given option can be installed. Review the "Points to Consider" information in 2.6.

STEP 3. Peel off the foil cover sticker on rear panel to expose the panel cutout. For DP88, peel off the left or right sticker according to the BCD output card's location. After peeling off the foil sticker—and if no other cards are to be installed—reinstall the rear panel.

STEP 4. With the BCD output card in its slot and the rear panel in place, cover the rear panel cutout with the self-adhesive cover plate supplied with the option. After removing the backing, center the cover plate cutout over the BCD card's contact fingers and stick it onto the panel. This completes installation of this option. Removal of the option card is the reverse of installation.

Wiring the BCD Output Card

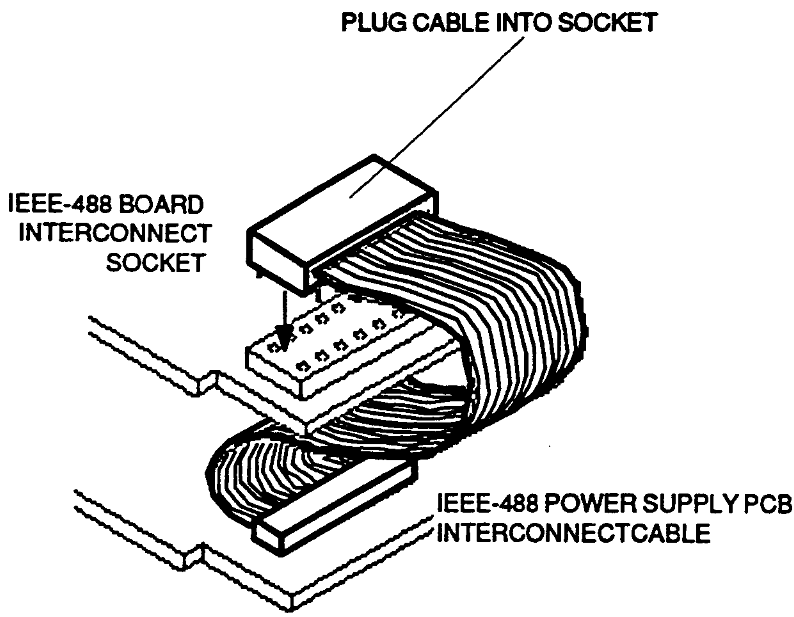
External connections to the BCD output card are made via the 30-pin mating connector provided with the option. Use this connector to make an interconnecting cable as required for your application. Cable connections are shown in the drawing below.



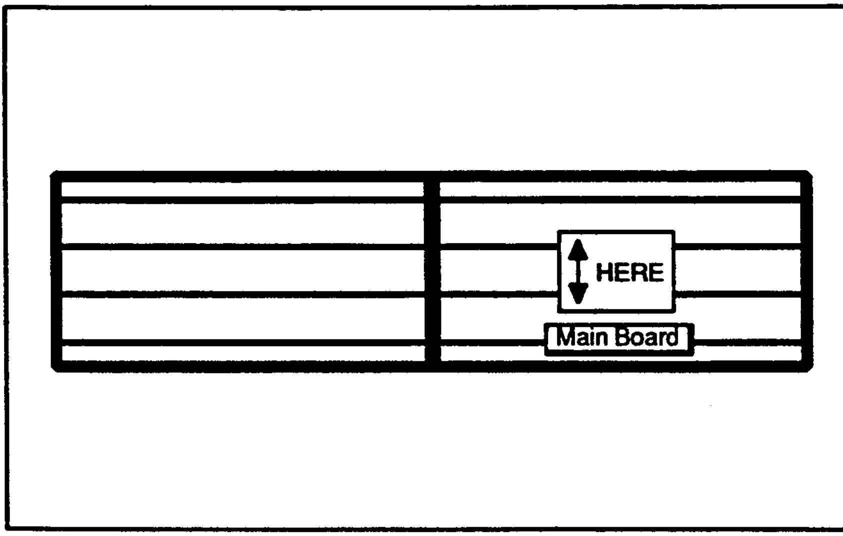
2.4.7 IEEE-488 Option, Installation and Wiring

Installing the IEEE-488 Option

Two plug-in circuit boards make up the IEEE-488 option. Before installing the option, connect the two boards together by plugging the bottom board's (IEEE-488 Power Supply PCB) ribbon cable connector to the top board's socket as shown in the drawing below.



The drawing below shows the option slot in the DP88 which the IEEE-488 option cards may be installed. Your DP88 indicator can use only one (1) IEEE-488 option.



To install the IEEE-488 option, follow these steps:

CAUTION

To ensure proper operation of your indicator, always remove power before removing or installing any card.

STEP 1. Remove the rear panel.

STEP 2. Plug the cards into the indicator with components facing up—the card with the IEEE-488 connector goes on top. See the drawing above for slot location. Keep in mind that a particular combination of option cards may limit the number of slots in which other options can be installed. Review the "Points to Consider" information in 2.7.

STEP 3. Peel off the foil cover sticker on the rear panel to expose the panel cutout. If the rear panel is from a unit with the expansion housing (double-width), peel off the left or right sticker according to the IEEE-488 option's location. After peeling off the foil sticker—and if no other cards are to be installed—reinstall the upper rear panel.

STEP 4. With the IEEE-488 option cards installed in the indicator and the rear panel in place, cover the rear panel cutout with the self-adhesive cover plate supplied with the option. After removing the backing, center the cover plate cutout over the IEEE-488 connector and stick it onto the panel. This completes installation of this option. Removal of the option cards is the re-verse of installation.

Wiring the IEEE-488 Option

Connect your indicator to other IEEE-488 devices with a IEEE-488 interconnecting cable. Contact assignments for the IEEE-488 option's
24-pin connector are shown in the table below as specified by the IEEE-488 specification.

Contact	Signal Line	Contact	Signal Line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)	17	REN (24)
6	DAV	18	Gnd (6)
7	NRFD	19	Gnd (7)
8	NDAC	20	Gnd (8)
9	IFC	21	Gnd (9)
10	SRQ	22	Gnd (10)
11	ATN	23	Gnd (11)
12	SHIELD	24	Gnd LOGIC

NOTE: Gnd (n) refers to the signal ground return of the referenced contact. EOI and REN return on contact 24.

2.7 INSTALLING THE DC POWER OPTION

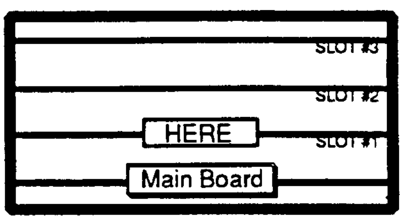
The field-installable DC power option allows your Model DP87 indicator to operate from a DC power source. As shown in the drawing below, card slot #1 is the only slot in which the DC power option card is accepted.

NOTE

Your indicator has dual power capability with the DC power option installed. In case the primary (AC) power fails, the DC power option can take over to keep your indicator operating.

CAUTION

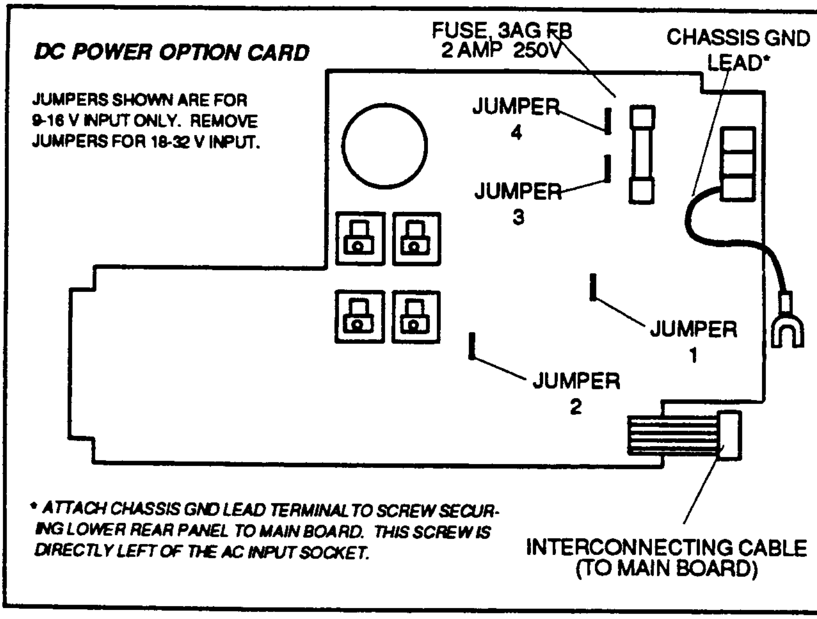
To ensure proper operation of your indicator, always remove power before removing or installing any card.



To install the DC power option, follow these steps:

STEP 1. Remove the rear panel. Make sure that the DC power option card is correctly configured for the voltage to be applied. To operate with a DC input in the range of 9–16 volts, the DC power option card must have jumpers installed in four places as shown in the drawing below. If the card is to be used with an input in the range of 18–32 volts, these jumpers must not be on the card.

STEP 2. Plug the DC power option card into slot number #1 only, components facing up. With the card fully seated in its socket, bring the interconnecting cable (see drawing next page) straight down over the rear edge of the card. Plug the cable connector to the pins behind the input screw terminals on the main board. Make sure the connector engages all pins.



STEP 3. Attach chassis ground lead terminal to rear panel screw per instructions in figure above.

STEP 4. Hook up the DC power option card as explained in 2.4.2. If no other cards are to be installed, reinstall the rear panel. If you are using DC power exclusively, cover the AC connector opening in the lower rear panel with the self-adhesive cover plate supplied in the kit. This completes installation of this option. Removal of the option card is the reverse of installation.

CAUTION

When replacing the fuse, use the same fuse type (3AG Fast-Blo) and rating (250 V @ 2 Amps) to avoid potential electrical damage and fire hazard.

SECTION 3

OPERATION

3.1 INTRODUCTION

This section gives you the instructions on how to operate your indicator. Unless otherwise specified, the discussion applies to all models. Before placing your instrument in service, we recommend that you first read this section in order to familiarize yourself with its operation.

3.2 APPLYING POWER TO THE INSTRUMENT

Power is applied to your indicator as long as it is plugged into an active power source. There is no power ON/OFF switch. To remove power, unplug the power cord either from the instrument or power source outlet.

WARNING!

To eliminate shock hazard and/or possible instrument damage, always remove power before adding or removing any plug-in cards, and before rewiring the input.

When power is applied to the indicator, it will test itself for a few seconds to check the integrity of its memory and configuration. The indicator shows you this test-in-progress by displaying *SELFTEST*. If the indicator fails selftest, it will display one of these diagnostic messages:

SELFTEST DIAGNOSTIC MESSAGES
RAM BAD – RAM memory bad, indicator cannot be used—requires repair.
ROMx BAD – ROM memory bad, indicator cannot be used—requires repair. Variable "x" is some hex number (4, 5, 6, 7, 8, 9, A, B) which pinpoints the faulty ROM chip (consult factory). *continued...*

RAM OUT – Ran out of RAM memory for the option cards installed, indicator cannot be used unless an option card is removed.

NVR OUT – Ran out of non-volatile RAM memory for the option cards installed, indicator cannot be used unless an option card is removed.

NO ALM 1 – Alarm option installed but no alarm card #1 address is detected. The Alarm option cannot be used unless you configure an alarm card for the alarm card #1 address.

NVR FAIL – Non-volatile RAM memory failed test. This is a result of one of two things, (1) the indicator has not been programmed, or (2) the NVR chip or circuit is not working properly to retain data. If the former is the case, program the indicator and use as normal. If the latter is the case, the indicator may be used but it will not retain programming or calibration data. Have the unit repaired as soon as possible.

BAD IRC – Input range card not installed, installed incorrectly, or has broken pin(s). The indicator cannot be used without a properly installed input range card.

3.3 DISPLAY AND MAIN FRONT PANEL KEYS

3.3.1 *The 14-segment LED Display*

Your indicator shows numerical and alphabetical data with its 14-segment LED display. Some of the information that can be displayed include:

- Selftest Errors
- Menu Items for Programming
- Programming Acknowledgement (pass/fail/accepted)
- Measurement Value (with 3-character unit of measure)
- Input Faults
- Alarm Conditions

We already mentioned above some of the messages the indicator can display in the selftest phase of operation. Other important display messages are:

OVERLOAD

The "OVERLOAD" message is given whenever the input (transducer signal) exceeds your selected gain range. A positive overload message is shown above. A negative overload is similar with the exception that it is given with the negative sign (*–OVERLOAD*).

EXCV ERR

When the indicator is in the process (measuring) mode, the "EXCV ERR" message will flash on the display about every seven seconds when a loss of transducer excitation voltage is sensed. This can be caused, for example, by an open or short in the lines supplying the transducer's excitation voltage.

3.3.2 *The Main Front Panel Keys*

Your indicator's major functions are controlled by 4 front panel keys below the display. See Figure 3-1. Here's a brief description of the key functions:

PGM (Program) key — toggles the instrument between the program and process modes. Use the program mode to set or review the instrument's operating parameters. Use the process mode to process the input for display readout. Refer to 3.5 for the complete discussion on how to program the indicator.

UP Arrow key — generally used to increment a program selection. This key is also used in the process mode to toggle between primary and secondary displays.

DOWN Arrow key — generally used to decrement a program selection. This key is also used in the process mode for some options.

ENT (Enter) key — generally used to enter a program selection or response. This key is also used in the process mode for some options.

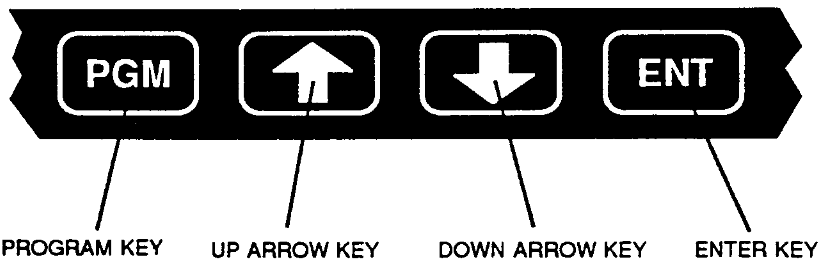


FIGURE 3-1. ***MAIN FRONT PANEL KEYS***

3.4 PROGRAMMING YOUR INDICATOR

3.4.1 *Introduction*

Your indicator is programmed by a menu-driven display which is operated by the four main front panel keys; you will be prompted on the display readout for some action to which you reply by pressing an arrow key or ENT key. You program the indicator by addressing main menu items as required. The main menu items that can be displayed are as follows:

1. **DISP-ONE**
2. **DISP-TWO**
3. **COUNT-BY**
4. **AUTOZERO**
5. **ALARM***
6. **ANALOG***
7. **MATH***
8. **SETUP**

The asterisked items are given only when the appropriate option card is installed in the indicator: alarm card, analog output card, math card. The addition (or subtraction) of any of these option cards automatically puts that option into (or out of) the main menu for programming.

WARNING!

You must observe the cardinal rule of power OFF before removing or adding any plug-in cards to avoid shock hazard and possible electrical damage. Observing this rule will also ensure correct indicator configuration whenever cards are added or removed.

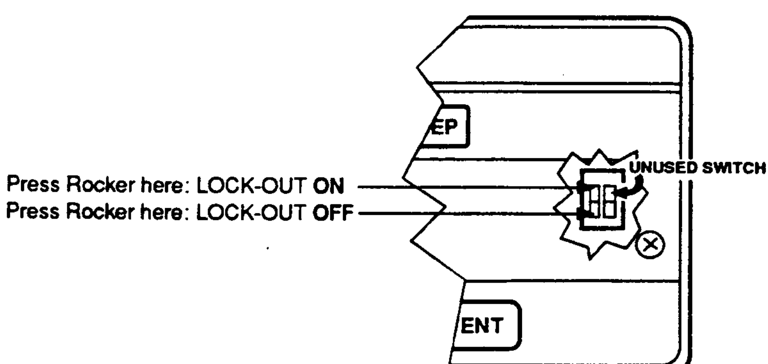
Additional programmable option cards will be available in the future, so the main menu item list above is subject to change.

3.4.2 *Program Lock-out Switch*

Your indicator has a program lock-out switch which is accessible behind the front panel lens (remove 2 screws). This switch is shown in Figure 3-2.

- Set program lock-out switch ON to *inhibit programming.*
- Set program lock-out switch OFF to *permit programming.*

Setting this switch ON will prevent unwanted change in the indicator's programming. With programming inhibited, the display will momentarily flash *PGM LOCK* whenever you place the indicator in the program mode. This is a reminder that the lock-out switch is set ON. You can make changes to the programming under this condition; however, the changes will not take effect unless the switch is set OFF (program unlocked) prior to re-entering the process mode.open for programming, any changes made to that menu item are discarded.



Note that even with the lock-out switch set ON, you can still review the indicator's programming by stepping through the menu selections. All you have to do is enter the program mode and press the ENTER key repeatedly while observing the display. After completing review of the menu selections, press the PGM key to display again the input value. The indicator will show *PROCESS* for two seconds, then the measured value.

3.4.3 Overview—Programming Procedure

Here's an overview on how to program the indicator:

STEP 1. Press PGM key. The indicator will show *PROGRAM* for about two seconds, then the first main menu item (*DISP-ONE*).

STEP 2. Step display to show main menu item you wish to program by using UP or DOWN arrow keys. By using only the arrow keys at this stage, you will be stepping through the main menu.

STEP 3. With desired main menu item on display, press ENT key to open item for programming.

STEP 4. Respond to prompt message by pressing UP or DOWN arrow key as required.

- To quit (cancel) in the middle of programming a main menu item, press both arrow keys simultaneously—changes that were made to that main menu item will be cancelled as the indicator returns to the first main menu item (*DISP-ONE*) for programming. Changes made to other main menu items are unaffected by the cancel operation.

STEP 5. Press ENT key to enter your response. Depending on the menu item being programmed, you will then be given further prompting on the current menu item, or you will be presented with the next main menu item itself:

- Whenever you are prompted for an *entry*, you have the option of using the arrow keys to change the programming or pressing the ENT key to keep the existing programming.
- Whenever you are prompted with a *main menu item*, you have the option to open it for programming by pressing the ENT key, or bypassing it by pressing any arrow key.

When programming is finished for a main menu item, you may get a particular pass or fail message depending on what was programmed. The pass or fail message is shown for about two seconds. After a pass message is shown, the next main menu item is displayed for programming. If a fail message is shown, the indicator will (depending on the item programmed)...

...exit the menu item (the previously programmed information for that particular menu item will remain unchanged) and give you the next menu item for programming, or it will...

...loop back to the point in the menu programming where you can start over. If you want to leave the programming loop—that is, to get out of the menu without resolving the fail message—press both arrow keys simultaneously.

Similar to a fail message, an error message (i.e., *INPUT ERR*, *SENS ERR*, etc.) is given if an input or response gives an invalid program condition. With an error message, the indicator will loop back to a point in the program where programming can start over, or it will wait (with the error message displayed) until the proper input is given and the ENT key is pressed. If you want to leave the menu without resolving the error, press both arrow keys simultaneously.

STEP 6. After programming is finished, press PGM key to get out of program mode. You will then be given a 2-second display of...

...*ACCEPTED* if the indicator accepts the programming. Or...

...*REFUSED* if the program lock-out switch is ON. Or...

...*PROCESS* if no changes were made in programming.

The input value then follows the display message on the readout.

NOTE

If a menu item is open for programming when the indicator is switched to the process mode, any changes made to that menu item are discarded.

TERMINATING TIMED MESSAGES: Indicator programming time can be shortened by manually terminating the timed (2-second) messages. These messages include *PROGRAM, FAIL CAL, EXC VOLT, SENS, ZERO =, FULLSCL=, SCL ERR, SETUP OK, MID PNT?, 4 MA =, 0 V =, 20 MA =, 10 V =, ALG PASS, ALG FAIL, INPUT1, DISPLAY1, INPUT2,* and *DISPLAY2*. To terminate a timed message, just press any arrow key or the ENT key.

Note that the *ACCEPTED, BUSY*, and *PROCESS* messages cannot be manually terminated.

3.4.4 *Setting up for the Transducer*

Before you can use the indicator with a transducer, you must first set up the indicator to accommodate the transducer and its excitation voltage and to define the measurand (i.e., pounds/kilograms, pounds per square inch/ kilopascals, etc). This is done by programming items (as required) in the *SETUP* main menu.

The first item to program in the *SETUP* menu is the gain range (*GAIN RNG*). Then you program the primary display using either the 3-point calibration (*3PT CAL*) or scaling (*SCALING*) method.

The instrument calibration (*INST CAL*) item, also in the SETUP menu, is used to calibrate the indicator. This is done at the factory—you need not concern yourself with this item when initially programming the indicator for your application. (However, we recommend that you calibrate the indicator once a year to maintain optimum accuracy. Calibration is discussed in 3.4.6.)

Follow these steps to set up your indicator for the transducer being used:

STEP 1. Press PGM to enter program mode.

STEP 2. Use arrow keys as required to display *SETUP*—press ENT key to open this main menu item for programming.

STEP 3. The menu item *GAIN RNG* will now be displayed—press ENT key to open for programming. You'll be programming the indicator to use a certain gain range. This is the first step in setting up for the transducer.

Before selecting the gain, first calculate the full scale indicator input by multiplying the applied excitation voltage (in volts) times the transducer sensitivity (in volts).

For example, with 10 Volts applied to a 3mV/V transducer, the full scale indicator input is 30 mV (10 V x .003 V = .030 V or 30 mV).

STEP 4. Now press any arrow key to step the display through the gain range selections: 100 mV, 200 mV, 500 mV, 1 V. Choose the minimum gain that can accommodate the full scale indicator input—for our example of 30 mV full scale, we use 100 mV as the gain range. You can also choose gain as determined by a desired display resolution (though at the expense of a narrower measurement span):

100 mV = 1 µV/count	200 mV = 2 µV/count
500 mV = 5 µV/count	1 V = 10 µV/count

With the desired gain range on display, press ENT to enter the selection. You will then be given the next main menu item for programming (*DISP-ONE*).

If the indicator is switched to the process mode at this point (assuming that the primary display has yet to be programmed or is set off), it will function only as a millivolt meter.

In order to function as a transducer indicator, you must define (program) the *primary display*—this is your main or basic measurement display. After selecting the gain range, go back to the *SETUP* menu and define the primary display by programming either the *3PT CAL* (3-point calibration) menu item or *SCALING* menu item depending on your application:

Use the *3PT CAL* method to define the primary display if...

....you can apply at least 2 calibrated loads or forces (i.e., NBS weight standards) to the transducer(s).

Use the *SCALING* method to define the primary display if...

...a calibration standard for a particular measurand cannot be easily applied to the transducer (for example, air or fluid pressure, very heavy weights, etc.).

HOW TO DEFINE THE PRIMARY DISPLAY: 3PT CAL

The 3-point calibration method requires that you supply at least two known loads or forces to the transducer. The indicator displays these two points as *PNT1* (point 1) and *PNT2* (point 2). An optional midpoint (*MID PNT*) can also be specified for better accuracy. The midpoint load or force need not be exactly midpoint of the scale, but it must be greater than *PNT1* and less than *PNT2*. The applied load/forces for *3PT CAL* must bear a mathematical relationship as follows:

PNT1 < MID PNT < PNT2

Wire the indicator using the actual system transducer(s) before you begin programming the primary display. Refer to paragraphs 2.4 and 2.5 for instructions on power and transducer wiring respectively.

Follow these steps to define the primary display using the 3PT CAL method:

STEP 1. Open *SETUP* menu item for programming.

STEP 2. Press arrow keys as required to display *3PT CAL*, then press ENT key to open this menu item for programming.

STEP 3. The display will now show *BUSY* as the indicator measures the excitation voltage. If the excitation voltage is outside the window of 1-50 Volts, the display will indicate an error in the excitation voltage with the message: *EXCV ERR*. If this happens, check the excitation voltage level at the indicator's EXC sense input with a voltmeter. Make sure that the excitation voltage sense connections are secure and are of the right polarity. After resolving the error, press ENT to resume programming.

STEP 4. After a valid excitation voltage is measured, the indicator will display *SET PNT1* which is the prompt to begin programming the first point. Apply a known (calibrated) quantity of load or force to the transducer (for example, place a 10-gram weight on the scale). The first point load/ force must be less than the mid- or second point load/force.

STEP 5. Press the ENT key. You will now program a measurement value (display) as given by the applied first point load/force to the transducer. The first item to program is...

..Polarity.

Initially, the polarity is assigned positive so you will see "+" on the display. Press an arrow key to toggle between "+" and "–". With your + or – choice on display, press the ENT key to continue on to the...

..Numerical Value.

You must set a number for each digit left to right as indicated by a blinking digit to make up the PNT1 value. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. After all digits are entered, you are then prompted for the...

..Display Readout Decimal Point Placement.

This is shown by a blinking digit *and* decimal point to its right. If this decimal point position is fine with you, just press the ENT key. If you want to change the position of the decimal point, press any arrow key to move the blinking digit/decimal point tandem as required, then press ENT to set your selected decimal point position. Continue now to program the...

...3-character Unit of Measure (Engineering Units) or Dead Zeroes.

Three alphanumeric display characters to the right of the numerical value are programmable to show a unit of measure such as LBS, KG, or PSI. You may also program these characters to display dead (fixed) zeroes in order to make a lower decade display read out as a higher decade value. For example, two zeroes can be added to a hundreds value (i.e., 500) so that the display readout shows a ten thousands value (i.e., 50000).

After you set the decimal point, the first of three programmable characters will be blinking on the display. Press any arrow key to set a character. You have the numbers 0-9, a blank (displayed as an underscore "_" when programming) and all 26 upper case letters of the alphabet from which to choose. Once a character is chosen, press the ENT key, then go on to the next blinking character and set a letter or number for it. Continue on until all characters are entered. After the last character is set, the indicator will show *BUSY* as it enters the transducer signal as the first point.

At this point, if the indicator detects an input overload or a loss of excitation voltage, you will get an error message of *INPT ERR* or *EXCV ERR* respectively. If this happens, check the appropriate items as required, then press ENT to resume.

STEP 6. After successfully plotting the first point, the indicator will then ask if you want to program the optional midpoint by displaying a 2-second message of *MID PNT?* after which *YES* is displayed. If you want to program a midpoint, press the ENT key (YES on display)—go to step 7 for instructions on the midpoint programming. If you want to skip midpoint programming, press an arrow key to display NO, then press the ENT key—go to step 9 for instructions on programming the second point.

The mid- and second points are programmed in a similar manner as the first point. However, programming doesn't involve the decimal point and unit of measure since these are already set when the first point was programmed.

STEP 7. After you enter YES, the indicator will display *SET MID* which is the prompt to start programming the midpoint. Apply a known (calibrated) load or force to the transducer (for example, place a 20 gram weight on the scale). The midpoint load/force must be greater than the first point load/ force but less than the second point load/force.

STEP 8. Press the ENT key. You will now program a measurement value (display) as given by the applied midpoint load/force to the transducer. The first item to program is...

..Polarity.

Set the midpoint polarity the same way you did the first point polarity. After setting the polarity, set the...

..Numerical Value.

Set the numerical value the same way you did the first point numerical value. After all digits are entered, the indicator will show *BUSY* as it enters the transducer signal as the midpoint.

At this point, if the indicator detects an input overload or loss of excitation voltage, you will get an error message of *INPT ERR* or *EXCV ERR* respectively. If this happens, check the appropriate items as required, then press ENT to resume.

If the applied load/force for the midpoint is equal to or less than that provided for the first point, a scaling error will result. This is shown by a 2-second display message of *SCL ERR*, after which the *SET PNT1* prompt is given. If this happens, start over and make sure that the applied load/force follows the relationship: ***PNT1 < MID PNT***. A scaling error can also be given if the entries result in an out-of-bounds computation—try an alternate input/display relationship if this occurs.

STEP 9. After successfully plotting the first- or midpoint, the indicator will display *SET PNT2* which is the prompt to start programming the second point. Apply a known (calibrated) load or force to the transducer (for example, place a 30 gram weight on the scale). The second point load/force must be greater than the first- and midpoint load/force.

STEP 10. Press the ENT key. You will now program a measurement value (display) as given by the applied second point load/force to the transducer. The first item to program is...

...Polarity.

Set the second point polarity the same way you did the first point polarity. After setting the polarity, set the...

...Numerical Value.

Set the numerical value the same way you did the first point numerical value. After all digits are entered, the indicator will show *BUSY* as it plots the transducer signal as the second point.

At this stage, if the indicator detects an input overload or a loss of excitation voltage, you will get an error message of *INPT ERR* or *EXCV ERR* respectively. If this happens, check the appropriate items as required, then press ENT to resume.

If the second point programming is OK, the indicator will display *SETUP OK* for two seconds after which the first main menu item is shown—this completes the 3PT CAL procedure. However, if the applied load/force for the second point is equal to or less than that provided for either the first point or midpoint, a scaling error will result. This is shown by a 2-second display message of *SCL ERR*, after which the *SET PNT1* prompt is given. If this happens, start over and make sure that the applied load/force follows the relationship: ***PNT1 < MID PNT < PNT2***. A scaling error can also be given if the entries result in an out-of-bounds computation—try an alternate input/display relationship if this occurs.

HOW TO DEFINE THE PRIMARY DISPLAY: SCALING

Connect the transducer excitation voltage to the indicator's EXC sense input and to the transducer before programming the primary display using the scaling method. Refer to paragraphs 2.4 and 2.5 for instructions on power and transducer wiring respectively.

Since the scaling method involves internal mathematical calculations to scale the display (using the theoretical sensitivity of a transducer), the indicator must be fully calibrated prior to programming to yield the most accurate measurements. Calibration is performed at the factory so you need not concern yourself with this when you are initially programming your indicator. If, for some reason, inaccurate measurements are observed after using the scaling method of programming, calibrate the indicator by programming through the INST CAL menu item (refer to 3.4.6). Then redo the scaling programming.

Follow these steps to define the primary display using the scaling method:

STEP 1. Open *SETUP* menu item for programming.

STEP 2. Press arrow keys as required to display *SCALING*, then press ENT key to open this menu item for programming.

STEP 3. You are now prompted to enter the value of the excitation voltage to the nearest tenth of a volt. The prompt for the excitation voltage entry is a 2-second display message of *EXC VOLT* followed by a 3-digit value (*xx.xVOLTS*) of which the first digit is blinking. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key, then go on to the next blinking digit and set a number for it. After all 3 digits are entered, the display will show *BUSY* as the the entry is processed.

If your entry is not within 1-50 V or if the difference between the measured and entered values exceeds ±15%, the indicator will show an error in the excitation voltage by displaying *EXCV ERR*. If this happens, check the excitation voltage level at the indicator's EXC sense input with a voltmeter.

Make sure that the excitation voltage sense connections are secure and are of the right polarity. After resolving an excitation voltage fault, press ENT to resume programming. Also make sure that you are keying in the correct value. To rekey the excitation voltage, get out of the SETUP menu (press both arrow keys) then go back to the SETUP menu and start over.

STEP 4. After a valid excitation voltage is entered, you are then prompted to enter the transducer's sensitivity specification. Consult the transducer's specifications to obtain the sensitivity spec you need to enter (sensitivity is expressed as so many millivolts per volt or mV/V). The sensitivity entry prompt is a 2-second display message of *SENS* followed by a display of *xxx.xMV/V* of which the first digit is blinking. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key to set that digit. Program the remaining digits the same way.

Note that a valid entry for sensitivity ranges from 1 mV/V to 200 mV/V. Entering a number outside this range results in a *SENS ERR* message, after which the sensitivity entry prompt is given so that you can re-enter the number.

STEP 5. After a valid transducer sensitivity is entered, you are prompted to program what the indicator display should be at zero input. This is shown by a 2-second display message of *ZERO* = followed by a prompt for the polarity. Initially, the polarity is assigned positive so you will see "+" on the display. Press an arrow key to toggle between "+" and "–". With your + or – choice on display, press the ENT key to continue on to the...

...Numerical Value.

You must set a number for each digit left to right as indicated by a blinking digit to make up the zero display value. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. After all digits are entered, you are then prompted for the...

..Display Readout Decimal Point Placement.

This is shown by a blinking digit *and* decimal point to its right. If this decimal point position is fine with you, just press the ENT key. If you want to change the position of the decimal point, press any arrow key to move the blinking digit/decimal point tandem as required, then press ENT to set your selected decimal point position. Continue now to program the...

..3-character Unit of Measure (Engineering Units) or Dead Zeroes.

Three alphanumeric display characters to the right of the numerical value are programmable to show a unit of measure such as LBS, KG, or PSI. You may also program these characters to display dead (fixed) zeroes in order to make a lower decade display read out as a higher decade value. For example, two zeroes can be added to a hundreds value (i.e., 500) so that the display readout shows a ten thousands value (i.e., 50000).

After you set the decimal point, the first of three programmable characters will be blinking on the display. Press any arrow key to set a character. You have the numbers 0-9, a blank (displayed as an underscore "_" when programming) and all 26 upper case letters of the alphabet from which to choose. Once a character is chosen, press the ENT key, then go on to the next blinking character and set a letter or number for it. Continue on until all characters are entered.

STEP 6. After programming the engineering units, you are prompted to program what the indicator display should be at full scale input. This is shown by a 2-second display message of *FULLSCL* = followed by a prompt for the polarity—set the polarity the same way you did for the zero display. The full scale input is computed as follows: *Full scale input = excitation voltage (volts) x transducer sensitivity (mV/volt).*

STEP 7. After setting polarity, you are prompted to program the numerical value of the full scale display. Set the numerical display the same way you did for the zero display.

If the your scaling programming is OK, the indicator exits the menu item as it displays *SETUP OK* for two seconds, then the first main menu item (*DISP-ONE*). This completes the SCALING procedure. If you get *SCL ERR* instead, your entries resulted in an out-of-bounds computation—try an alternate input/display relationship if this occurs.

3.4.5 *Introduction to the Secondary Display Feature*

The secondary display feature is used to show an alternate (equivalent) measurement based on the primary display. For example, if the primary display reads in pounds, you can use the secondary display to show the equivalent kilograms or the equivalent ounces instead. Similarly, if the primary display reads kilopascals, you can display the equivalent pound/sq. inch as an alternative. Set up the secondary display per the steps below.

With the indicator in the process mode, *select the secondary display by pressing the up arrow key*. Each press of the up arrow key toggles to the alternate display.

The secondary display is totally dependent on the primary display. Note that if the primary display is set OFF (*DISP-ONE* menu, refer to 3.5), the secondary display is also turned off.

3.4.5.1 *Programming the Secondary Display*

The secondary display is derived by applying scaling and offset to the primary display reading. This is a linear function which is expressed by the equation: $mx + b = y$.

Programming the secondary display is easy—all you have to do is specify the primary display (x variable) and equivalent secondary display (y variable) at two known and convenient points or coordinates. These points are:

- a **low scale** primary display (X1) and the equivalent secondary display (Y1) and...

- a high scale primary display (X2) and the equivalent secondary display (Y2).

Your indicator does the rest by calculating the required slope (variable m, or gain) and Y intercept (variable b, or offset). See Figure 3-3. When converting measurements, refer to a table of weights and measures (consult a dictionary) to obtain the appropriate conversion factor. You will find for example: 1 lb = .454 kg; thus, you can extrapolate that 10 lb = 4.54 kg. These are two possible points you can use for a pound to kilogram conversion.

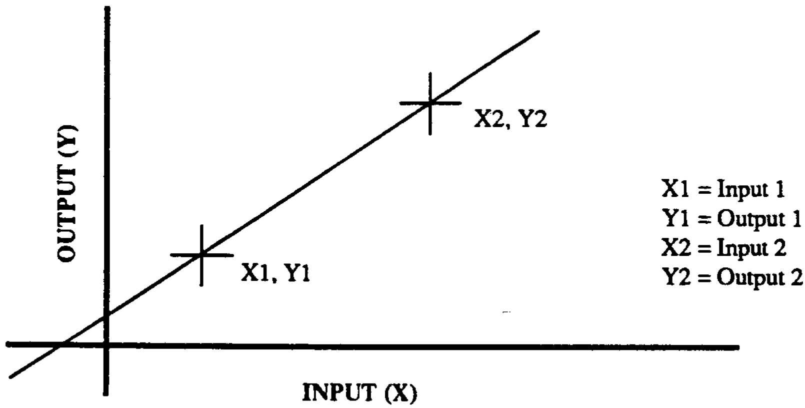


FIGURE 3-3. *X AND Y COORDINATES FOR SCALING AND OFFSET*

Follow these steps to program the secondary display:

STEP 1. Press PGM to enter program mode.

STEP 2. Press arrow keys as required to display *DISP-TWO*, then press ENT key to open this menu item for programming.

STEP 3. You are now prompted to enter a **primary display reading** of your choice for *one of the coordinate points* by a 2-second *INPUT1* message.

NOTE

Your entry here may be that of the lower scale coordinate or upper scale coordinate. Normally, one would specify the lower scale coordinates first (X1,Y1) then the upper scale coordinates next (X2,Y2). However, you can also enter the coordinates into the indicator in reverse order (X2,Y2, then X1,Y1). Just be aware that the first point entry sets the resolution of the secondary display—if the upper scale coordinate is entered first, the lower scale display resolution may be compromised. Specify an upper scale coordinate, if entered first, with the greatest resolution possible. For example, instead of "00454", enter "454.00".

The first item to program is the...

...Polarity of the Primary Display—First Point.

Initially, the polarity is assigned positive so you will see "+" on the display. Press any arrow key to toggle between "+" and "-". With your + or – choice on display, press the ENT key to continue on to the...

...Numerical Value of the Primary Display—First Point.

You must set a number for each digit left to right as indicated by a blinking digit to make up the value of the arbitrary primary display reading. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. Continue on until ALL digits are entered.

STEP 4. After programming the first point primary display value (INPUT1), you are prompted to enter its **corresponding secondary display value** by a 2-second *DISPLAY1* message. Proceed to program the...

...Polarity of the Secondary Display—First Point.

Set the polarity the same way you did the first point primary display (INPUT1). After setting the polarity, set the...

...Numerical Value of the Secondary Display—First Point.

Disregarding the decimal point shown, set the numerical value the same way you did the first point primary display (INPUT1). (Read note on page 3-20.) After *all* digits are entered, you are prompted for the...

...Secondary Display Decimal Point Placement.

This is shown by a blinking digit *and* decimal point to its right. The decimal point is initially in the same position as the primary display. If this decimal point position is fine with you, just press the ENT key. If you want to change the position of the decimal point, press any arrow key to move the blinking digit/decimal point tandem as required. With the decimal point in the desired position as indicated by the blinking digit/decimal point, press the ENT key. This step sets the decimal point position for the secondary display readout. The other coordinate's display value will reflect the decimal point placement as set here.

STEP 5. After setting the secondary display decimal point position, program the *3-character unit of measure* (engineering units) for the secondary display readout. You are prompted for this by the first of 3 programmable characters blinking on the display. Press any arrow key to set the character—you have the numbers 0-9, a blank (shown as an underscore "_" when programming) and all 26 letters of the alphabet from which to choose. Once a character is chosen, press the ENT key, then go on to the next blinking character and set a letter or number for it. Continue on until *all* characters are entered.

STEP 6. After setting the unit of measure for the secondary display, you are then prompted for the primary display reading of the *other coordinate point* by a 2-second *INPUT2* message. Proceed to program the...

...Polarity of the Primary Display—Second Point.

Set the polarity the same way you did the first point primary display (INPUT1). After setting the polarity, set the...

..Numerical Value of the Primary Display—Second Point.

Set the numerical value the same way you did the first point primary display (INPUT1).

STEP 7. After programming the second point primary display value (INPUT2), you are prompted to enter its **corresponding secondary display value** by a 2-second *DISPLAY2* message. Proceed to program the...

..Polarity of the Secondary Display—Second Point.

Set the polarity the same way you did the first point primary display (INPUT1). After setting the polarity, set the...

..Numerical Value of the Secondary Display—Second Point.

Set the numerical value the same way you did the first point primary display (INPUT1). After entering this value...

...the indicator will exit the menu item and show the next main menu item (*COUNT-BY*) if the secondary display programming is OK. This completes programming of the secondary display.

However, if the secondary display programming is unsuccessful, the indicator shows a scaling error by displaying *SCL ERR* for 2 seconds. The indicator then loops back to the beginning of the menu (*INPUT1*) so that you can try again. A scaling error can be caused by:

(1) Entering one of the coordinates twice (maybe thinking that you entered the other one first).

(2) Entering coordinates that result in an out-of-bounds calculation—that is, the magnitude of the computed slope or offset exceeds the capacity of the software registers used for computing scaling and offset. In this case, redefine the relationship between the primary and secondary displays.

EXAMPLES

Primary display reads ***pounds****, secondary display to read* ***ounces****:*

The primary display reads out pounds to the nearest tenth (0.0 lbs). We want to read the equivalent ounces, also to the nearest tenth (0.0 oz). Since 1.0 lb is equivalent to 16.0 oz, the data that you would have to enter for the conversion is as follows:

DISPLAY MESSAGE		YOUR INPUT
INPUT1	*Note that secondary display*	**+0001.0** (LBS)
DISPLAY1	*resolution is set here*	**+0016.0 OZ**
INPUT2		**+0010.0** (LBS)
DISPLAY2		**+0160.0** (OZ)

Primary display reads ***pounds****, secondary display to read* ***kilograms****:*

The primary display reads out pounds to the nearest hundreth (0.00 lbs). We want to read the equivalent kilograms to the nearest tenth (0.0 kg). Since 100.00 lb is equivalent to 45.4 kg, the data that you would have to enter for the conversion is as follows:

DISPLAY MESSAGE		YOUR INPUT
INPUT1	*Enter desired value...*	**+100.00** (LBS)
DISPLAY1	*...then enter decimal point position and units*	**+004.54** (LBS)
		+0045.4 KG
INPUT2		**+200.00** (LBS)
DISPLAY2		**+0090.8** (KG)

3.4.6 *Instrument Calibration*

We recommend that you calibrate the indicator once a year to maintain its accuracy. If your application doesn't need the millivolt meter mode, and the indicator is setup exclusively with *3PT CAL*, perform the *3PT CAL* procedure once a year as calibration. If the millivolt meter mode is used and/or if the indicator is setup with *SCALING*, perform the calibration via the *INST CAL* item (instructions below).

Here's a list of equipment needed for *INST-CAL* calibration:

- Precision voltage source: resolution, 1 mV; accuracy ±1% (±1 mV)
- Interconnecting leads

Follow these steps for INST-CAL calibration:

NOTE

The indicator will give a FAIL CAL message if the measured input exceeds the nominal (requested) value by 15%. It will then ask you again for the input. If you get the FAIL CAL message, make sure that you are setting the calibrator for the correct voltage. Also check that all connections are secure and of proper polarity. Press the ENT key whenever you are ready to have the indicator measure the input.

INST-CAL CALIBRATION TABLE

RANGE	ZERO (shorted input)	SPAN
100 mV	0.00 mV	60.0 mV
200 mV	0.00 mV	120.0 mV
500 mV	0.00 mV	300.0 mV
1 V	0.00 mV	600.0 mV

STEP 1. Observing correct polarity, hook up calibrator source to indicator signal input terminals. (These are the two inside terminals of the main board's 4-terminal connector. See diagram in Figure 2-4.)

STEP 2. Enter program mode—open *SETUP* for programming.

STEP 3. Use arrow key to display *INST-CAL*—press ENT to open this item for programming. You are given a 2-second display message showing that the 100 mV range being is being calibrated (*100MV RNG*). You are then asked to set the calibrator for zero millivolts (*SET 0MV*).

STEP 4. Set the calibrator for zero millivolts (short the input), then press the ENT key. The indicator will show *BUSY* as it measures the input. If the calibration is unsuccessful, you are shown a 2-second *FAIL CAL* message after which you prompted again for the input. Check for proper calibrator settings and indicator connections. Press ENT to try again.

STEP 5. After successfully calibrating for zero, you are asked to set the calibrator for 60 millivolts (*SET 60MV*). This is the ranges's span input. Set the calibrator for this value, then press the ENT key. The indicator will show *BUSY* as it measures the input. If the calibration is unsuccessful, you are shown a 2-second *FAIL* CAL message after which you prompted again for the input. Check for proper calibrator settings and indicator connections. Press ENT to try again.

STEP 6. After successfully calibrating for 60 mV, the **200 mV range** is next for calibration as a 2-second display message of *200MV RNG* is shown. Repeat steps 4 and 5 for this and the remaining ranges. Refer to the table at the head of this procedure for a summary of the calibration procedure.

STEP 7. Upon successful completion of the *INST-CAL* calibration, a 2-second display message of *PASS CAL* is shown. You are then given the first main menu for programming (*DISP-ONE*). If the primary display was defined with 3PT CAL prior to performing this calibration procedure, you must also perform the 3PT CAL procedure as part of the calibration if you wish to continue using the indicator with that display setup. This completes the *INST-CAL* calibration.

3.5 SWITCHING PRIMARY DISPLAY ON/OFF (mV Meter, Primary Display Scaling Review)

***DISP-ONE* main menu**

The primary display is automatically enabled (turned on) whenever you program the indicator's primary display (*3PT CAL* or *SCALING*). You can also *manually* switch the primary display on or off by opening the *DISP-ONE* menu item, selecting *ON* or *OFF* with an arrow key, then pressing the ENT key.

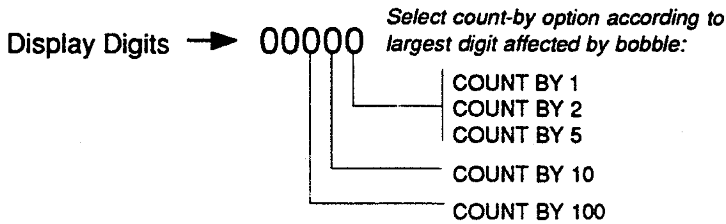
The indicator functions as a millivolt meter when you turn off the primary display—the unit of measure on display automatically changes to mV as the secondary display becomes disabled. The measurement range of the millivolt meter is determined by the gain range selection (*SETUP* menu). The accuracy of the millivolt reading is dependent on the calibration as set by the *INST CAL* procedure (also in *SETUP* menu).

The *DISP-ONE* menu item can also be used to review the primary display programming if set with scaling—just select *DISP-ONE*'s ON option and the programmed *ZERO* and *FULLSCL* values will be shown on the display. The display sequence takes about ten seconds. (Press the ENT key or an arrow key to terminate each message as required to lessen the time.) After the display sequence, the next menu item (*DISP-TWO*) is shown.

3.6 STABILIZING THE DISPLAY VALUE

***COUNT-BY* main menu**

In some applications, the measurement display will show a fluctuating value (display bobble) due to the transducer experiencing mechanical oscillations or external vibrations. If need be, you can stabilize the display by using the COUNT-BY menu to round the display reading to the nearest 1, 2, 5, 10, or 100 display counts:



To set the count-by option for display rounding, open *COUNT-BY* menu for programming, select count-by option (1, 2, 5, 10, or 100) with arrow key, then press ENT with your choice on display.

The count-by feature works on the *primary and secondary indicator displays* only. If you turn off the primary display, the count-by programming will not affect the millivolt reading. Count-by display rounding is applied to the measurement *after* being processed by the alarm, math, and/ or analog output options. Data given by a communications option (i.e., serial, BCD, etc.) reflects the rounded display value as set by the count-by option.

3.7 USING AUTOZERO/TARE OFFSET

AUTOZERO main menu

Autozero and tare offset are related functions which involve a deduction from the gross measurement.

With no load or force applied to the transducer(s), zero the meter reading if need be by pressing the down arrow and ENT keys simultaneously (indicator in process mode). This electronic adjustment remains only for as long as power is applied. If, however, you want the autozero adjustment in non-volatile memory...

Open *AUTOZERO* menu item for programming, then...

...press the ENT key with *SAVE* on display.

Tare programming can be done either automatically or manually. To program the tare *automatically*, apply the tare force or weight (i.e. container, crate, packaging, etc.) to the scale. Then, with the indicator in the process mode, press the down arrow and ENT keys simultaneously. The tare offset is now programmed as the display shows a zero reading. Any measurement shown is now a net value since the tare offset is automatically subtracted. At this point, the programmed tare remains only for as long as power is applied. If, however, you want the tare offset in non-volatile memory...

...Open the *AUTO-ZERO* menu item for programming, then...

...press the ENT key with *SAVE* on display.

If you want to *manually* program or review the tare offset (or an autozero value for that matter)...

...Open the *AUTOZERO* menu item for programming, then...

...use an arrow key to display *VIEW/CHG*. Press ENT to open this item for programming. The first item to program/view is the...

..Polarity.

Note that a positive (+) value is subtracted from the reading while a negative (–) value is added to the reading. Press any arrow key to toggle between "+" and "–". (Press ENT key instead to view.) With your + or – choice on display, press the ENT key to continue on to the...

..Numerical Value.

At this point, the autozero/tare value is on display. If you are just viewing the value, press both arrow keys simultaneously to escape the *AUTOZERO* menu option. If you want to make a value change, you must set a number for each digit left to right as indicated by a blinking digit to make up the value of the autozero/tare offset display reading. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. After all digits are entered, you are given the next main menu for programming.

3.8 USING THE ALARM OPTION

The alarm option monitors the primary display value for an alarm condition by continuously comparing the primary display value with alarm limit values that you've programmed. (There are two limits per alarm card, two alarm cards max. per indicator for a total of four limits.) Each alarm limit has an associated relay which can be used to actuate various types of annunciating devices. Refer to the installation section of the manual for full details on the alarm card installation and hook-up.

When an alarm condition is detected, the appropriate relay is tripped and an alarm message alternates with the measurement value on the display. The alarm message is in the form:

ALRM ssx

where *ss* is either *HI* or *LO* and *x* is the limit number (1-4).

When more than one alarm condition is present, the alarms are given the priority of 1, 2, 3, and 4, with limit 4 being the highest and limit 1 being the lowest. Thus, the highest priority alarm will always be shown on the display.

Alarm option programming also includes your choice of an automatic or manual reset of the alarm card's relays. With automatic reset, a relay resets by itself once its associated limit is no longer exceeded. With manual reset, a relay is reset manually through a remote switch. The relay's alarm limit, however, must no longer be exceeded in order for the relay to be reset.

Note that alarm checking is only done in the process mode. As soon as you put your indicator in the program mode, alarm checking is stopped— any relays which were tripped because of an alarm will now become untripped.

To recap the discussion on the alarm option in the installation section:

- A maximum of two alarm cards can be installed in your indicator.
- If you are using two alarm cards, set the moveable jumper on the alarm card as required to configure one card as alarm card #1 (for limits #1 and #2) and the other as alarm card #2 (for limits #3 and #4).
- If you are using only one alarm card, you must set the moveable jumper to the alarm card #1 position to allow your indicator to function.
- There are two Form C relays per alarm card. The relay contacts are available at the screw terminals at the edge of the alarm card.
- When using the manual reset mode, connect your relay reset switch to the alarm card's screw terminals #7 and #9 (gnd). A momentary closure of this switch resets a tripped relay for which the alarm limit is no longer exceeded.
- Connect your relay override switch to the alarm card's screw terminals #8 and #9 (gnd). Both relays are overridden (untripped) regardless of alarm condition as long as this switch is closed.

Follow these steps to program the alarm option:

STEP 1. Press PGM to enter program mode.

STEP 2. Press arrow keys as required to display *ALARM*, then press ENT key to open this menu item for programming.

STEP 3. You are then prompted for a limit number to program (i.e. *LIMIT1*, *LIMIT2*, etc.). Press any arrow key to display your limit number choice, then press ENT key to open that limit number for programming.

STEP 4. Once you've selected a limit number you enable or disable that limit by defining it as *OFF*, *HI*, or *LO*: *(If the math option is installed in your indicator, the alarm limit programming will have expanded menu choices for alarming on true input data or math data. Refer to the math option discussion in 3.10 for further information).*

- Without prior programming, the limit is initially set OFF. A programmed limit will be saved if you set the limit OFF (a limit is ignored when set OFF). To re-enable a limit, just select HI or LO as appropriate (see below), then press the ENT key throughout the menu sequence.
- Select HI for a high alarm—a display value equal to or greater than the limit value will cause an alarm.
- Select LO for a low alarm—a display value equal to or lesser than the limit value will cause an alarm.

Press any arrow key to select (display) *OFF*, *HI*, or *LO*. Then press the ENT key to continue.

STEP 5. You are then prompted for the polarity of the alarm limit value. Initially, the polarity is assigned positive so you will see "+" on the display. Press any arrow key to toggle between "+" and "–". With your + or – choice on display, press the ENT key to continue.

STEP 6. After specifying polarity, set the alarm limit value itself. To make up the limit value, you will set a number for each digit left to right as indicated by a blinking digit. Press any arrow key to increment or decrement the blinking digit. Once a number is chosen, press the ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. Continue on until *all* digits are entered.

***STEP** 7.* After setting the limit value, use an arrow key to display your choice of an automatic reset (*AUTO RES*) or manual reset (*MAN RES*) for the alarm relays:

- With automatic reset, a relay will untrip by itself once the alarm limit is no longer exceeded.

- With manual reset, a relay will untrip only with a momentary closure of the alarm card's relay reset switch and only if the alarm limit is no longer exceeded.

With your choice of relay reset on display (*AUTO RES* or *MAN RES*), press the ENT key...

...If you selected *AUTO RES*, you will then be prompted for hysteresis. Go to the "Using Hysteresis" section of the manual for the discussion on how hysteresis works and its programming instructions.

...If you selected *MAN RES*, you will then be prompted for alarm delay. Go to the "Using Alarm Delay" section of the manual for the discussion on how alarm delay works and its programming instructions.

USING HYSTERESIS

Hysteresis (or deadband) is used to delay the return-to-normal condition of a tripped relay. Hysteresis is specified for your indicator's alarm limits in display count units. These units range 00-99 (a zero value specifies no hysteresis). Since hysteresis is given in display counts, the effective hysteresis value depends on your primary display programming. For example, with a measurement range with tenths resolution (i.e. 00.0), a limit with a hysteresis of "08" means that the display value must return within the exceeded limit by over 0.8 units—not 8 whole units—before the alarm is cleared (relay reset).

Hysteresis units automatically assume negative values for HI limits and positive values for LO limits. To get a better idea on what hysteresis can do for you, refer to the table below. This table shows you how a hysteresis value of "60" would affect the alarm condition for HI and LO alarm limits:

Hysteresis set at 60

ALARM LIMIT	READING	ALARM
HI +0100.0	(decrease ▼) 100.0 99.9–94.0 93.9	YES YES NO
LO +0100.0	(increase ▲) 100.0 100.1–106.0 106.1	YES YES NO

Setting Hysteresis

You are prompted for hysteresis with *HYST xx* on the display—where *x* is some number between zero and nine. Enter the hysteresis value (00-99 as appropriate) the same way you did the limit value (use an arrow key to set a number for the blinking digit). Once you enter your hysteresis value, you will then be prompted for the alarm delay. Go to the "Using Alarm Delay" section of the manual for the discussion on how alarm delay works and its programming instructions.

USING ALARM DELAY

Alarm delay holds off an alarm trip until the alarm condition exists for a specified period of time (in seconds). Use alarm delay whenever you have a noisy or unstable transducer signal. By filtering out short duration alarm conditions, alarm delay will prevent annoying and unnecessary alarm indications from occurring.

Setting Alarm Delay

You are prompted for alarm delay with *DELAY x* on display—where *x* is some number between zero and nine, representing time in seconds. Use an arrow key to select a number (0-9) for the blinking digit, then press the ENT key to enter the value. Give a value of zero (0) if you want no alarm delay. Programming for a particular limit number is complete after setting the alarm delay. Follow steps 2 through 7 to program additional alarm limits as required.

3.9 USING THE ANALOG OUTPUT OPTION

The analog option card allows you to translate your indicator's display reading to a proportional analog output signal. There are two versions of the analog output option card. One is a current output device and the other is a voltage output device. Both are programmed in the same manner.

Note that the analog output is given only in the process mode. As soon as you put your indicator in the program mode, the analog output goes to its zero value output.

Follow these steps to program the analog output option:

STEP 1. Press PGM to enter program mode.

STEP 2. Press arrow keys as required to display *ANALOG*, then press ENT key to open this menu item for programming.

STEP 3. After opening the menu item, the display will show:

...*ON* (analog output option enabled) or...

...*OFF* (analog output option disabled) or...

...*FULL SCL* (fixed full scale analog output)

Initially, the analog output option is disabled so you will see *OFF* on the display when the *ANALOG* item is first opened for programming. Press any arrow key to display the desired option status.

NOTES

Previous analog output option programming is saved any time you disable the option (select *OFF*). To re-enable the scaling and offset, select *ON*, then press the ENT key throughout the *ANALOG* menu sequence. *Also...*

If you have the math option installed in your indicator, the analog output programming will have expanded menu choices for having the output scaled either on the true input data or math data. Refer to the math option discussion in 3.10 for further information.

Selecting *FULL SCL* causes the analog output option to give a fixed full scale output signal once the indicator is in the process mode. This signal is used to calibrate the analog option's full scale output and also to calibrate the device to which the analog output option is connected. Refer to the ANALOG OUTPUT CALIBRATION discussion.

STEP 4. With your choice of *ON*, *OFF*, or *FULL SCL* on display, press the ENT key. You will get the next main menu item for programming if you chose *OFF* or *FULL SCL*. If you chose ON...

STEP 5. A 3-second message will be given prompting you for the display value that gives the minimum output:

4 MA = (for current analog output option)

or

0 V = (for voltage analog output option)

Note that you can scale the analog output with a ±99999 display counts range regardless of the input range used. This gives you the capability to provide a portion of the 4-20 mA or 0-10 V span as the minimum and maximum output values. After the 2-second message, you are prompted for the...

..Polarity of the Display Value giving Minimum Output.

Initially, the polarity is assigned positive so you will see "+" on the display. Press any arrow key to toggle between "+" and "–". With your + or – choice on display, press the ENT key to continue on to the...

..Numerical Value of the Display giving Minimum Output.

You must set a number for each digit left to right as indicated by a blinking digit to make up the desired display value which gives the minimum output. Press any arrow key to increment or decrement the blinking digit. Once a number is chosen, press ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. Continue on until *all* digits are entered.

STEP 6. A 2-second message will then be given prompting you for the display value that gives the maximum output:

20 MA = (for current analog output option)

or

10 V = (for voltage analog output option)

After this message, you are prompted for the...

..Polarity of the Display Value giving Maximum Output.

Set the polarity of the display value giving maximum output the same way you did the display value giving minimum output. After setting the polarity, set the...

..Numerical Value of the Display giving Maximum Output.

This is the display value that will correspond to the 20 mA or 10 V analog output. The display value can be your choice of a high scale or low scale display reading within the input range. Set this display value the same way you did the display value giving minimum output.

After entering the value of the maximum display, you will be shown a 2-second message of either...

...*ALG PASS* if the programming was valid, or...

...*ALG FAIL* if the programming was invalid.

If you make the mistake of entering a display value twice, you will get a fail message at the end of the analog output programming. You will also get a fail message if your entered display values result in an out-of-bounds calculation (i.e. an offset or gain that the indicator can't accommodate).

Note that if the analog output programming attempt fails, its previous programming remains intact. After the pass or fail message, the next main menu item is presented on the display for programming. Your programmed analog output takes effect once your indicator is in the process mode.

ANALOG OUTPUT CALIBRATION

You should check the analog output periodically to see whether calibration is required. Follow these steps to check and adjust (if required) the analog output:

STEP 1. With power off, remove the indicator rear panel.

STEP 2. Apply power to the indicator and place it in the program mode.

STEP 3. Connect a 4 1/2 digit DVM to the analog output terminals (observe correct polarity). Select the proper DVM range (volts or milliamps) as required.

STEP 4. The DVM should read 0.000 V ±0.002 V for the voltage output or 4.000 mA ±0.004 mA for the current output. If the output is out of tolerance, adjust R11 (see Figure 2-8) for the correct reading on the DVM. This takes care of the zero output.

STEP 5. Now select the *ANALOG* menu option and enter the *FULL SCL* menu option, then place the indicator in the process mode (press PGM key).

STEP 6. The DVM should read 10.000 V ±0.027 V for the voltage output or 20.000 mA ±0.044 mA for the current output. If the output is out of tolerance, adjust R15 (see Figure 2-8) for the correct DVM reading. This takes care of the full scale output.

Use the calibrated full scale signal to calibrate, as required, the device receiving the analog output signal (refer to the manufacturer's instructions).

3.10 USING THE MATH OPTION

The math option processes the measurement value with one of the four available mathematical functions—the result is displayed on the readout. The available math functions are:

- Maximum
- Minimum
- Time Average
- Rate of Change

The following discussion explains the process involved for each of the math functions:

Maximum. The maximum (max) computation monitors the measurement value and holds the maximum reading on display. The displayed max value is computed by continuously comparing the current input value against the existing (displayed) max value. If the current value is greater than the existing max value, the existing max value is replaced with the current value. This value then becomes the new displayed max value.

The displayed max value can be the maximum value since:

- the indicator was reset (i.e. power fail or watch dog) or...
- the math option was reprogrammed for MAX or...

- the math option was reset (the math option has a manual reset feature which is used to start the math process anew—this is explained after the discussion on rate of change).

If the max computation is used, *MAX* is shown on the display as the engineering units for the maximum value.

Note that a positive overload (displayed as *OVERLOAD*) is not considered a maximum value. Your indicator will display positive overload if it is indeed in that state. However, it will not store a positive overload value as a max value. Thus, with the max computation, the maximum non-overload value will be displayed when the input returns from a positive overload condition.

Minimum. The minimum (min) computation monitors the input value and holds the minimum reading on display. The displayed min value is computed by continuously comparing the current input value against the existing (displayed) min value. If the current value is less than the existing min value, the existing min value is replaced with the current value. This value then becomes the new displayed min value.

The displayed min value can be the minimum value since:

- the indicator was reset (i.e. power fail or watch dog) or...
- the math option was reprogrammed for MIN or...
- the math option was reset (the math option has a manual reset feature which is used to start the math process anew—this is explained after the discussion on rate of change).

If the min computation is used, *MIN* is shown on the display as the engineering units for the minimum value.

Note that a negative overload (displayed as *–OVERLOAD*) is not considered a minimum value. Your indicator will display negative overload if it is indeed in that state. However, it will not store a negative overload value as a min value. Thus, with the min computation, the minimum non-overload value will be displayed when the input returns from a negative overload condition.

Time Average. The time average computation gives you a running average of the measured value over a selected time interval (1-60 seconds). The mathematical transfer function is:

$$\frac{i_1 + i_2 + i_3 + i_4 + \ldots i_T}{T} = A$$

Where: i = measurement reading
T = number of readings within the specified time interval
A = average input value over the specified time interval

To illustrate how this works, let's say that we want to have the average measured value shown over a 30-second period of time. There are typically 60 readings in a 30-second period. In this case then, our displayed average will be the sum of the 60 readings (4520, let's say) divided by the number of readings, 60:

$$4520 \div 60 = 75.333 \text{ (average reading)}$$

For our example, the indicator's average reading over a 30-second period is 75.333. The average values are rounded to accommodate the indicator's measurement resolution. This means that our example result might be displayed as *75.3 AVG*. (When the time average computation is used, *AVG* is shown on the display as the engineering units for the time average value.)

When time average is first used or reset, the display will show the average reading up to the maximum number of readings in the specified time period. In other words, using our example above, the display will first show the average of two readings, then the average of three readings, then the average of four readings, etc.... continuing on to the average of 59 readings after which the average shown is always made up of 60 readings.

Note that the displayed average is a running average. When the maximum number of readings in the specified time interval is accumulated, the newest reading is always added to the average while the oldest reading is discarded.

The math option has a manual reset feature which is used to start the math process anew. This is explained after the rate of change discussion below.

Rate of Change. Instead of averaging readings over a period of time as explained in TIME AVERAGE above, the rate of change computation averages the *difference* between consecutive readings over a selected time interval (1-60 seconds) to yield the rate of change per minute or second. The mathematical transfer function is:

$$\frac{(i_2 - i_1) + (i_3 - i_2) + (i_4 - i_3) + \ldots(i_{T+1} - i_T)}{T} \times F = R$$

Where: i = measurement reading
T = number of readings within the specified time interval
F = normalizing factor (varies depending on sec/min selection)
R = Rate of Change

To illustrate how this works, let's say that we want to have the measurement rate of change shown over a 5-second interval, displayed in units per second. There are typically 10 readings in a 5-second period. In this case then, our displayed rate of change will be the sum of 10 difference readings (33, let's say) divided by 10 readings multiplied by a normalizing factor which happens to be 2:

33 + 10 x 2 = 6.6 (rate of change reading)

For our example, the indicator's average change over a 5-second period is 6.6. The average values are rounded to accommodate the indicator's measurement resolution. For example, a computed value of "7.395" might be displayed as *7.4 /SC*. (For the rate of change value, */SC* or */MN* is shown on the display as per second or per minute units respectively.)

When rate of change is first used or reset, the value will reflect readings up to the maximum number of readings in the specified time period. In other words, using our example above, the display will first show the rate of change over two readings, then the rate of change over three readings, then the rate of change over four readings, etc... continuing on to the rate of change over 9 readings after which the rate of change shown is always made up from 10 readings.

Note that the displayed rate of change uses a running average. When the maximum number of readings in the specified time interval is accumulated, the newest reading is always added to the average while the oldest reading is discarded.

The math option has a manual reset feature which is used to start the math process anew. This is explained next.

Resetting the Math Option

A running math computation can be made to start anew at any time by manually resetting it. With the indicator in the process mode, reset the math function by pressing the two front panel arrow keys simultaneously. The reset function is also available as a menu item when setting up the math option.

Switching the Display Between Math Value and True Measured Value

When the math option is enabled and the indicator is in the process mode, the display normally shows a value as determined by the math function you selected. Press the ENT key to switch the display between the math processed value and the true (unprocessed) measured value. Each press of the ENT key will toggle the display to the alternate mode. (Math computations are not interrupted when toggling the display.)

Follow these steps to program the math option:

STEP 1. Press PGM to enter program mode.

STEP 2. Press arrow keys as required to display *MATH*, then press ENT key to open this menu item for programming.

STEP 3. The first item you will be prompted for is your choice of having the math option enabled, disabled, or reset. This is represented by the words *ON*, *OFF*, and *RESET* respectively. Initially, this option is disabled so you will see *OFF* on the display when the *MATH* item is first opened for programming. Press any arrow key to choose between *ON*, *OFF*, or *RESET*. With your choice on display, press the ENT key to continue.

NOTE

Previous math programming is saved any time you disable the option (select *OFF*). To re-enable the math, select *ON*, then press the ENT key throughout the menu sequence.

STEP 4. If the option was disabled or reset, you will be given the next main menu item for programming. If you enabled the option, the display prompts you with one of the four math functions available: (1) *MAX*, (2) *MIN*, (3) *TIME AVG*, or (4) *RATE CHG*. Press any arrow key to display the math function you wish to use. Then press the ENT key to enter that selection.

STEP 5. If *MIN* or *MAX* was entered, you will be given the next main menu item for programming. If you entered *TIME AVG* or *RATE CHG*, the display prompts you for a 2-digit time interval (in seconds)...

...You must set a number for each digit left to right as indicated by a blinking digit to make up the time interval value–a valid interval is in the range 01-60. Press an arrow key to increment or decrement the blinking digit. Once a number is chosen, press ENT key, then go on to the next blinking digit and set a number for it. If a digit is already what you want it to be, just press the ENT key and go on to the next digit. Continue on until *all* digits are entered.

STEP 6. If the rate of change function was selected, the display will show */SEC* or */MIN* (per second or per minute) after entering the time interval. This is your prompt to select the rate of change units. Press any arrow key to toggle to the alternate selection as required. With your */SEC* or */MIN* choice on display, press the ENT key.

STEP 7. After entering the time interval digits or rate of change units, you will be given a 2-second display message of *MATHPASS* or *MATHFAIL*, then the next main menu item for programming:

- The *MATHPASS* message is given when a valid time interval is entered, i.e., within the range 01-60.
- The *MATHFAIL* message is given when an invalid time interval is entered, i.e., a value of zero or a value over 60.

Note that if the math option programming attempt fails, its previous programming remains intact. Your math programming takes effect once your indicator is in the process mode.

Using the Math Option with the Alarm and/or Analog Out-put Option(s)

With the math option installed in your indicator, you can choose either the ***math value*** or the ***true data*** as the basis for (1) alarm limit comparison and/or (2) output scaling for the analog output option. As such, the menu prompts for setting the alarm limits and enabling the analog output option are as follows:

ALARM OPTION: Enable a limit by choosing...

HI DATA (a true data value equal to or greater than the limit value will cause an alarm) or...

LO DATA (a true data value equal to or lesser than the limit value will cause an alarm) or...

HI MATH (a math value equal to or greater than the limit value will cause an alarm) or...

LO MATH (a math value equal to or lesser than the limit value will cause an alarm).

Note that limits are individually assigned as operating on math data or true input data.

If the math option is turned off via menu programming, any alarm limit operating on math is still compared to the last math value prior to being turned off. For example if the math option is turned off with a math alarm limit exceeded, that limit will still be in alarm even if the displayed data is within the limit. If you turn the math option off, we suggest that you turn off the math alarm limits, or else change the math alarm limits to data alarm limits as required.

If the math card is removed, any alarm limit operating on math data is automatically turned off. The programmed numerical value still *remains* but the limit will be on *data* if turned on.

ANALOG OUTPUT OPTION: Enable the analog output option by choosing...

ON DATA—to scale the analog output on the true data value—or...

ON MATH—to scale the analog output on the math value.

If the math option is turned off via menu programming, the analog output, if selected for math, will be at a fixed level as determined by the math value prior to being disabled.

If the math card is removed, the analog output, if selected for math, will be turned off automatically.

NOTES

(1) With the math card not installed in the indicator, the menu prompts for the alarm and/or analog output options will be presented as described in the

basic option programming instructions—in other words, no choices for math or data are given.

(2) An input in overload is not a valid input for math processing since it doesn't contribute to any math computation. However, if the input is in overload, it is indicated as such on the display. In an overload condition, an alarm limit assigned to math will default to data—an alarm may trip or un-trip on overload depending on the HI/LO limit assignment and the polarity of the overload. Similarly, the analog output scaling will default to data if assigned for math—the output will go full scale, the direction depending on the polarity of the overload. When the input comes out of overload, math processing picks up where it left off before the overload condition occurred. The alarm option and/or the analog output option then operate on the math or data selection as appropriate.

3.11 USING THE SERIAL OUTPUT OPTION

INTRODUCTION

The serial output option provides serial data transmission of the indicator's display data to any computer or peripheral device with an RS-232C or 20 mA current loop I/O port. A hardware watch dog circuit checks the serial output operation continuously. Should the serial data flow be interrupted due to a hardware or software fault, the system will restart itself automatically.

Configure the serial output card to your application before use. Refer to 2.6.5 for configuration instructions.

The RS-232 data output is controlled by changing the state of the serial output card's CTS line (see pinout diagram of connector in 2.6.5). Drive the CTS line low to cease data transmission from the serial output card. Note that partial transmission of the character may occur when CTS is driven low, causing garbage to be received by the receiving device. If the CTS line is brought high again within 1/2 second, transmission will continue with the next character. If more than 1/2 second has passed, transmission will resume at the first character of the current reading.

Serial output data is transmitted in fixed format 15-character ASCII packets. Each data packet is transmitted as follows:

- The first two characters are the tens and ones digits which form the device address (01 to 16—see serial output card configuration instructions).
- The third character is always a space.
- The following ten characters vary according to content (this is illustrated below).
- The last two characters are the termination characters (see serial output card configuration instructions).

NORMAL DATA

Here's how normal data is output (datastream):

←

READING #2

##bsddddddeeett##bsddddddeeett##bsddddddeeett... etc.

READING #1 READING #3

Where:

# = device address digit
b = space (blank)
s = polarity sign: positive (blank) or negative (–)
d = digit data (with embedded decimal point)
e = engineering units character
t = terminator character

Example Data:

| 01 234.56 KG(cr)(lf) | ...indicator #1 has a reading of 234.56 kilograms; each reading is terminated with a CR/LF (carriage return/linefeed).

| 14 -0.013 MV(sp)(cr) | ...indicator #14 has a reading of -0.013 mV; each reading is terminated with a space and CR.

OVERLOAD DATA

Here's how overload data is output (datastream):

←

READING #2

##bsOVERLOADbtt##bsOVERLOADbtt##bsOVERLOADbtt... etc.

READING #1 READING #3

Where:

# = device address digit
b = space (blank)
s = polarity sign: positive (blank) or negative (-)
t = terminator character

Example Data:

| 09 -OVERLOAD (sp)(lf) | ...indicator #9 has a negative overload reading; each reading is terminated with a space and LF (linefeed).

| 12 OVERLOAD (sp)(sp) | ...indicator #12 has a positive overload reading; each reading is terminated with two spaces.

ALARM DATA

Here's how alarm data is output (datastream):

READING #2

##bALARMbabsstt##bALARMbabsstt##bALARMbabsstt... etc.

READING #1 READING #3

Where:

# = device address digit
b = space (blank)
a = alarm number (1-4)
s = sense (HI or LO)
t = terminator character

Example Data:

16 ALARM 2 HI(cr)(lf) ...indicator #16 has a high alarm reading with limit #2 exceeded; each reading is terminated with a carriage return/line feed.

07 ALARM 1 LO(sp)(sp) ...indicator #7 has a low alarm reading with limit #1 exceeded; each reading is terminated with two spaces.

3.12 USING THE BCD OUTPUT OPTION

The BCD output option gives you BCD data of the indicator's display readout. This new output option requires no programming; thus, no special BCD menu prompts are given with this option installed.

To use the BCD option, just plug it in and connect to your BCD processor. You will have to make a cable to interface the BCD output card to the external device. A mating connector for the BCD output card is provided for this purpose. Refer to 2.6.6 for details on installation and wiring.

All output lines, except for DATA READY, are tri-state controlled. The following summarizes operation of the BCD lines:

INPUT LINES:

$\overline{\text{TRI-STATE}}$: Three active low inputs provide independent tri-state control of portions of the data. These inputs can be tied together for tri-state control of all data output lines at once. They can also be used selectively in conjunction with $\overline{\text{HOLD}}$ for data output in 8-bit bytes.

$\overline{\text{HOLD}}$: This line, when low, holds the BCD data at its current value if the data is also valid (DATA READY high). If the data is not valid when $\overline{\text{HOLD}}$ goes low, the data will be held once the data is valid.

OUTPUT LINES:

DIGIT DATA: A single digit of data is represented by four lines with binary weighting of 8-4-2-1. A total of five digits of data (20 lines) is provided. Data output is positive true logic.

+ POLARITY: This line indicates polarity of the data: high for positive readings and low for negative readings.

OVERLOAD: This line, when high, indicates an input overload condition (overrange or open thermocouple).

DATA READY: This line, when high, indicates that valid data is present at the output lines.

3.13 USING THE GROSS/NET SWITCH OPTION

The Gross/Net switch option allows you to instantly switch between the gross measurement display (measurement with no deduction) and the net measurement display (measurement with tare deduction/offset). Refer to 3.7 for the discussion on how the tare offset is programmed.

The Gross/Net option's front panel STEP key and LED indicators are shown below. Press the STEP key to show the gross or net measurement on the display readout as indicated by the lit LED.

NOTE

All option processing is based on the net value regardless of the Gross/Net option display selection.

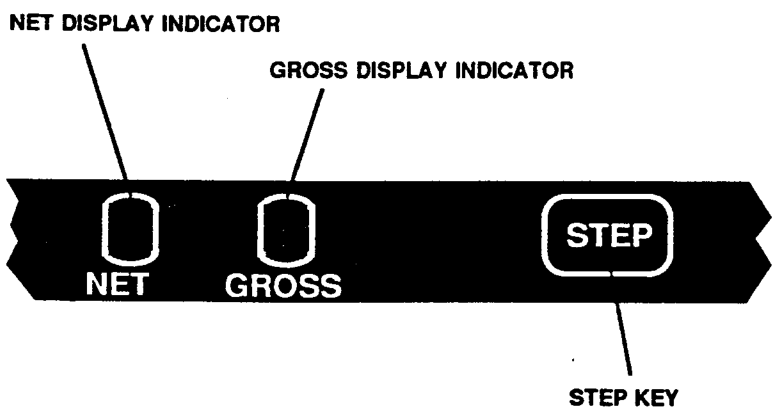
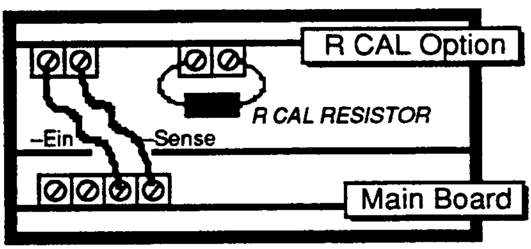


FIGURE 3-4. *FRONT PANEL, GROSS/NET STEP KEY AND LED INDICATORS*

3.14 USING THE R CAL SWITCH OPTION

The R Cal (Resistor Calibration) option allows you to switch in a fixed precision resistor shunt across one leg of the bridge with a simple press of a key. This shunt produces an electrical imbalance in the bridge which results in a display reading that can be considered *equivalent to a known* *physical or mechanical load*—use this reading as a reference for future checks of calibration. You can also use the R Cal bridge imbalance as a stimulus for 3-point calibration (refer to 3.4.4). However, for optimum accuracy, we recommend that calibration be performed using actual forces or weights.

To use the R Cal option, install a precision, wire-wound resistor (with a temperature coefficient of 10 ppm/°C) onto screw terminals on the R Cal option card. If not already done, you must also interconnect the R Cal card to the main board input terminals. See the drawing below for details on the interconnection wiring and for the location of the screw terminals to which the R Cal resistor is installed.



The R Cal value (or actual resistor) is frequently supplied with the transducer by the manufacturer. Occasionally, however, a user will have to calculate the value of R Cal. If this is the case with you, calculate the R Cal value using the following formula:

$$R\ Cal = \frac{25000 \times R_b}{K \times E} - (.5 \times R_b)$$

Where: K = The transducer sensitivity at full scale (i.e., where full scale sensitivity is 4 mV/V, use K = 4).

E = the electrical equivalent, % of full scale load desired for a full scale readout (i.e., if a fully loaded transducer is to be used as the full scale readout, then E = 100. Half loaded as full scale readout, use E = 50).

R_b = bridge resistance in ohms.

Example

Let's say that K = 4 mV/V, E = 40%, and R_b = 350Ω.

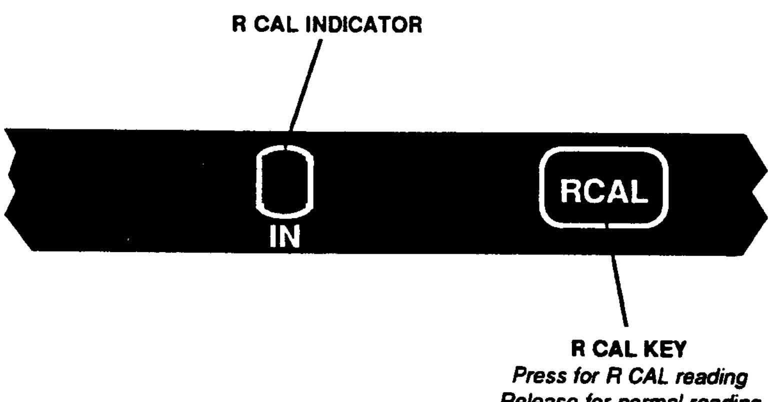
$$R\ Cal = \frac{25000 \times 350}{4 \times 40} - (.5 \times 350)$$

$$R\ Cal = \frac{8750000}{160} - 175$$

$$R\ Cal = 54687.5 - 175 = 54512.5\Omega$$

With the R Cal value computed, install a precision, wire-wound resistor with that value (or one very close to it) across the R Cal resistor screw terminals.

The R Cal option's front panel select key and LED indicator is shown below. Press the RCAL key to switch in the R Cal resistor—the IN indicator will light and the display readout will show the R Cal reading. Release the RCAL key to revert to normal readings (IN indicator OFF).



APPENDIX

General Specifications
Outline Drawings

DP87/DP88 GENERAL SPECIFICATIONS

Input Ranges, all models:

Range	*Sensitivity* max.	min.
-15 to 100 mV	1 µV/ct	.10 cts/mV
-30 to 200 mV	2 µV/ct	.05 cts/mV
-75 to 500 mV	5 µV/ct	.02 cts/mV
-150 to 1000 mV	10 µV/ct	.61 cts/mV

Zero Offset: Full Input Range

Accuracy:
0.01% of full scale range, ±1 digit

Reference Operating Conditions:
±10% line voltage, 25°C
±2°C ambient temperature,
<80% RH non-condensing

Repeatability: ±1 digit

Stability with Ambient Temperature:
Zero 0.5µV/°C
Span 0.005% of rdg./°C

Stability with Time:
Zero: No measurable drift w/time.
Span: 0.1% of reading per year

Noise Rejection:
NMRR≥60dB @ 50/60 Hz ±.1 Hz
CMRR≥120dB @ 50/60 Hz ±.1 Hz

Input Impedance:
500MΩ

Overload Protection (CMV):
Power lead to ground:
1500V dc or ac RMS
Input to ground:
270V dc or ac RMS
Across Inputs:
270V dc or ac RMS continuous
4-20 mA range: 80 mA
10-50 mA range: 200 mA

Ambient Operating Range:
Temperature: 0 to 50°C
Relative Humidity: 0 to 90%, non-condensing

Storage Temperature:
-40 to 65°C

Input Connections:
Transducer: screw terminal blocks
AC Power: quick connect plug
DC Power: screw terminal blocks

Display:
8-digit, 14-segment alphanumeric LED; 0.54" digit height.
Also includes one negative (–) LED at left of LED array.

Display Count Range:
±100,000 active counts

Point Update Rate:
2 readings per second

Case Construction:
Metal, black anodized, extruded aluminum.

Reliability:
40,000 hours MTBF

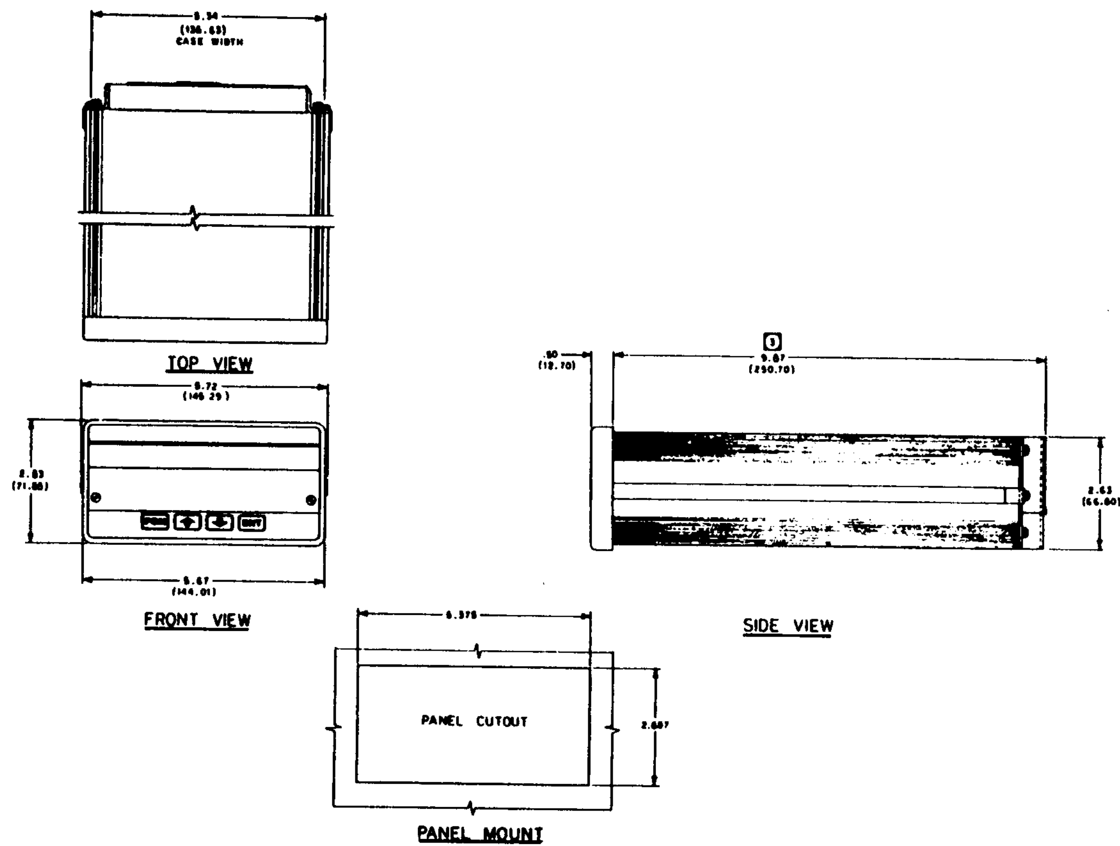
Installation:
Panel Mounting from front, secured at sides by clamps.

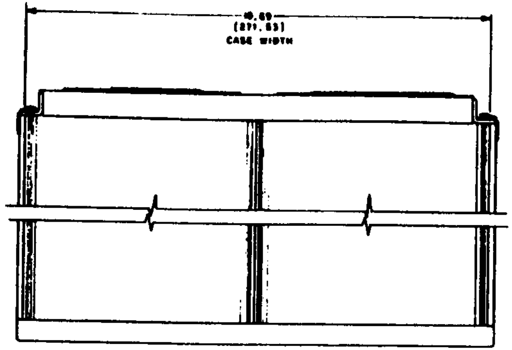
Size:
Model DP87:
Case: 67mm H x 136mm W x 250mm D
Bezel: 72mm H x 144mm W
Pnl. Cutout: 68mm H x 138mm W
Model DP88:
Case: 67mm H x 272mm W x 250mm D
Bezel: 72mm H x 280mm W
Pnl. Cutout: 68mm H x 274mm W

Weight (without options):
DP87: 1800 grams
DP88: 2800 grams

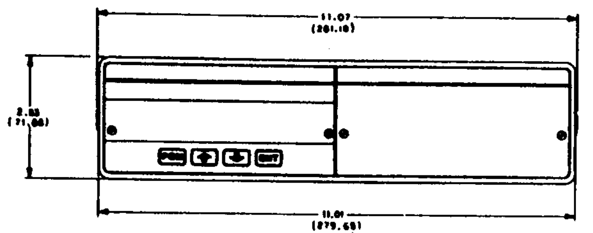
Warranty:
1 year

Power:
Jumper selectable ac power:
90 to 132V, 48 to 400 Hz
190 to 262V, 48 to 400 Hz
8.0 W typical (without options)
Jumper selectable dc power option: 9 to 16V or 18 to 32V

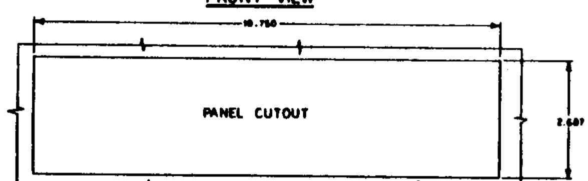

5.34
CASE WIDTH
TOP VIEW
5.72
(145.29)
2.83
(71.88)
5.67
(144.01)
FRONT VIEW
.50
(12.70)
3
9.87
(250.70)
2.63
(66.80)
SIDE VIEW
5.375
PANEL CUTOUT
2.687
PANEL MOUNT



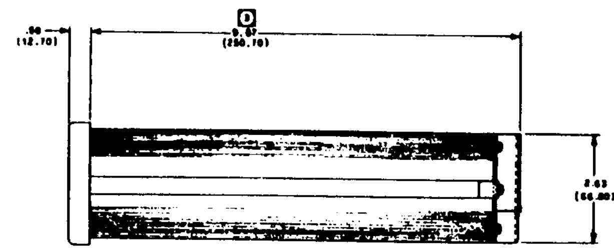
TOP VIEW



FRONT VIEW



PANEL MOUNT



SIDE VIEW

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