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M-4247/1005
410B manual

SECTION 1 DESCRIPTION

1.1 DESCRIPTION.

This manual contains the description, installation, operation, calibration and specification information for Series 400 and 410 digital panel indicators. The instruments are ordered with either high (Model 410) or standard (Model 400) resolution. Instruments with thermocouple or RTD input ranges provide a resolution of 1 degree (°F or °C) with 0.1-degree resolution available for applications where higher sensitivity is required. Transmitter input ranges either voltage or current are available with 4 or 5 digit resolution. All thermocouple instruments feature reference junction compensation, and a large 0.8" (20mm) easy-to-read 4-digit LED display.

The displays are in-line, uniplanar, 7-segment RED LEDS, easy to read through the front Plexiglas panel. A single dash (-) displayed at the left of the read-out indicates a negative polarity. Positive readings are inferred (no sign displayed). All dashes (----) across the display indicate an overload, over- range, or open thermocouple condition. Break detect is upscale. Zeros to the left of the decimal point or most significant digit are suppressed. The indicator accepts NBS(ITS-90) thermocouple types J, K, T, E, S, R, and B; or 3 or 4 wire platinum resistance temperature detectors (RTD)

with α of .00385 or .00392, 0-10 Volts DC, or 4-20mA current. Model 400 has 4-digit resolution. Model 410 has 5 digits of resolution. The instrument can be easily converted between degrees C or degrees F by changing dip switch position located behind front panel lens (see page 14).

All units operate from 100, 120, 220, or 240VAC 50-60 Hz power source. A power connector and ground screw for shield are located at the rear of the instrument. The instrument case is made of solid die-cast aluminum, which is rugged enough to withstand the most hostile environments. It is designed to mount in a panel. The optional rack mount can accommodate up to 3 units. Bench mount option 400-W5 provides for convenient bench top use.

Multiple Input Options, Models 402, 412 and 405

Model 402 and 412 can accept five inputs of the same input type thermocouple. Buttons numbered 1-5 are located below the display. Individual input is selected by pressing the appropriate button.

The Model 405 provides 10-switchable inputs to a single indicator. The Model 405 is housed in the same rugged case design as the basic indicator. Each unit may be rack-mounted beside another 405A or indicator. Pushbuttons are in two rows of five and are numbered 1-10, 11-20, etc. Each horizontal row is interlocked to prevent simultaneous input selection.

However, top and bottom rows are not interlocked and errors will occur if buttons on the top and bottom rows are pushed at the same time. Model 405 is used for thermocouple ranges.

SECTION 2 SPECIFICATIONS

Operating Range:

Temperature: 0 to 50°C
Relative Humidity: 10-80% RH non-condensing

Storage Range:

-40 to 65°C

Power:

115VAC ± 10%, 50-60 Hz
230VAC ± 10%, 50-60 Hz
30mA Max input current @ 115VAC

Size:

Case: 144mm W x 72mm H x 173 mm D
(5.768" x 2.84" x 6.82")

Maximum Weight:

1.7 kg / 2.5 lb

Panel cutout:

68mm H x 138mm W
2.68" H x 5.44" W

Input Impedance:

Thermocouple: 20MΩ (exclusive of break detect current effects)
RTD: Open Circuit, V+ input; 2.2MΩ, I – input

Break Detection:

Upscale, microprocessor based

A/D Read Rate:

2 per second nominal, 1° reading; 1 per second nominal, 0.1° readings

Reference Junction (Thermocouple):

Internal, automatic

Error: 0.05°C/°C above ambient

Input Range Table

INPUT TYPE	RANGE (0.1 degree resolution)	RANGE (1.0 degree resolution)
J Thermocouple	-99.9 to 761.8 C -99.9 to 999.9 F	-205 to 762 C -337 TO 1403 F
K Thermocouple	-99.9 to 999.9 C -99.9 to 999.9 F	-202 to 1377 C -331 to 2510 F
T Thermocouple	-99.9 to 401.4 C -99.9 to 754.6 F	-210 to 401 C -346 to 755 F
E Thermocouple	-99.9 to 999.9 C -99.9 to 999.9 F	-205 to 1002 C -338 to 1835 F
S Thermocouple	————	0 to 1769 C 32 to 3218 F
R Thermocouple	————	0 to 1769 C 32 to 3216 F
B Thermocouple	————	316 to 1829 C 601 to 3325 F
PT 100 RTD .00385	-99.9 to 862.6 C -99.9 to 999.9 F	-200 to 863 C -329 to 1585 F
PT 100 RTD .00392	-99.9 to 850.8 C -99.9 to 999.9 F	-202 to 851 C 332 to 1563 F

FUNCTIONAL SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

Reference Operating Conditions (ROC):

±10% line voltage
23 ±2 °C ambient temperature
<80% RH non- condensing

Accuracy (at ROC): +/- 1 count LSD

Thermocouple ranges:
+/- 1 degree F +/- 1 count
Linear Ranges:
+/- 0.01% reading +/- 1 count

Noise Rejection:

NMRR: ≥ 60 db @ 50/60 Hz, ± 0.1Hz
CMRR: ≥ 120 db@ 50/60 Hz, ± 0.1Hz with 250Ω unbalance.

RTD Leading Error @ 125 μA excitation current:

Stability With Temperature:

Zero: 1μV/°C
Span: 0.01% rdg /°C
Thermocouple Reference Junction: 0.03° per degree, 5 - 45°C

Stability With Time:

1°/year

Repeatability:

±1 count

SECTION 3 INSTALLATIONS

3.1 UNPACKING / REPACKING

The Series 400 indicators are rugged, but they must be properly packed. Instruments are shipped in a custom-designed carton for shipping, but damage may occur. When you receive your instrument, look for evidence of transit damage. If damage is found, ask the carrier to prepare a Damage Inspection Report and notify our Instrument Repair Department immediately.

REPACKING AND RETURNING THE INSTRUMENT

The original shipping container should be retained in case the instrument must be returned for repair or modification. When returning an instrument for any reason, advise us of the model number, serial number, your name, billing address, shipping address, phone number and a description of the problem. This information will enable our Instrument Repair Department to expedite the return of your instrument. Instruments being returned to the factory are required to be shipped freight prepaid.

Instruments being returned for warranty service must also refer to the original purchase date on packing lists and purchase orders. Instruments without this information will be processed as a non-warranty repair at current service rates.

If the original shipping container has been discarded, pack your instrument for shipping as follows:
Select a strong cardboard box of sufficient size to allow an inch of packing material around all sides of the unit.

a. Ensure that the printed circuit boards are secured and front and rear panels are firmly in place.
b. Wrap the instrument in plastic or strong paper. Place it centrally in the shipping container, and pack poly foam, bubble pack, or rubberized hair around all six sides of the instrument.
c. Tape the carton flaps securely and label the container "FRAGILE, DELICATE INSTRUMENT". Ship the instrument, freight prepaid (do not ship by U.S mail)

3.2 CONFIGURING THE INSTRUMENT

3.2.1 GENERAL

The instrument is configured at the factory for various power, range sensor type, and display requirements as stated on the initial order. However, the instrument can easily be reconfigured to accommodate any future changes as required by the user.

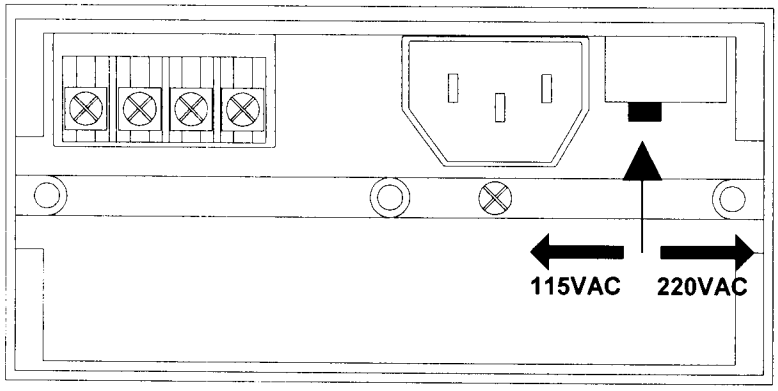
The following paragraphs describe input voltage selection, sensor type (T/C or RTD), °C/°F selection, and reference junction enable/disable.

REMOVING THE ELECTRONICS FROM THE ENCLOSURE

1- Make sure to disconnect power from the unit
2- Remove the three back cover screws and remove the rear panel
3- Remove the screw located directly above the AC plug
4- Remove two screws from the front panel lens and remove lens
5- Remove two screws from the front holding the Board assembly and pull it out of the case.
6- Reinstall the assembly when finished.

Input Voltage Selection
Input voltage 115 or 220VAC, is selectable by a slide switch accessible behind the indicator rear panel.

WARNING- DO NOT CHANGE INPUT POWER SELECTOR SWITCH POSITION WHILE POWER IS APPLIED TO THE INSTRUMENT.

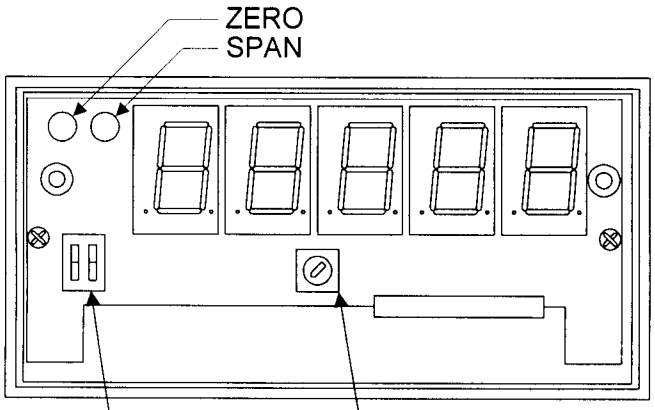


Changing Input Sensor Type (Temperature Units)

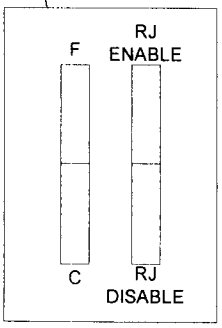
Although the Series 400 comes pre-configured from the factory, you may change the input sensor to one of 7 thermocouple input types for thermocouple units or one of 2 RTD types for RTD input units. To change sensor type, remove the front panel lens by removing the two screws (one on each side) to gain access to the display board. Behind the lens in the center of the display board beneath the numeric LEDs is a small rotary switch. To change sensor type insert a small screwdriver or trimmer adjusting tool and align the switch arrow so that it points to a numerical position for the sensor outlined in the table below.

0.	E	5.	CAL
1.	R	6.	392 RTD*
2.	S	7.	J
3.	B	8.	K
4.	382 RTD*	9.	T

* RTD UNITS ONLY



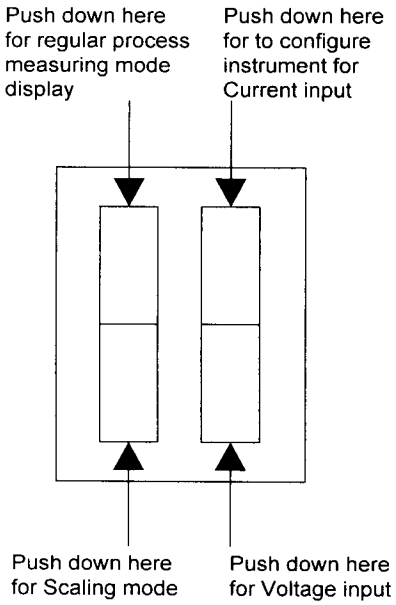
SENSOR SELECTOR
SWITCH POSITIONS



Swich Positions	
0	E
1	R
2	S
3	B
4	385 RTD
5	CAL
6	392 RTD
7	J
8	K
9	T

Configuring Voltage or Current Units

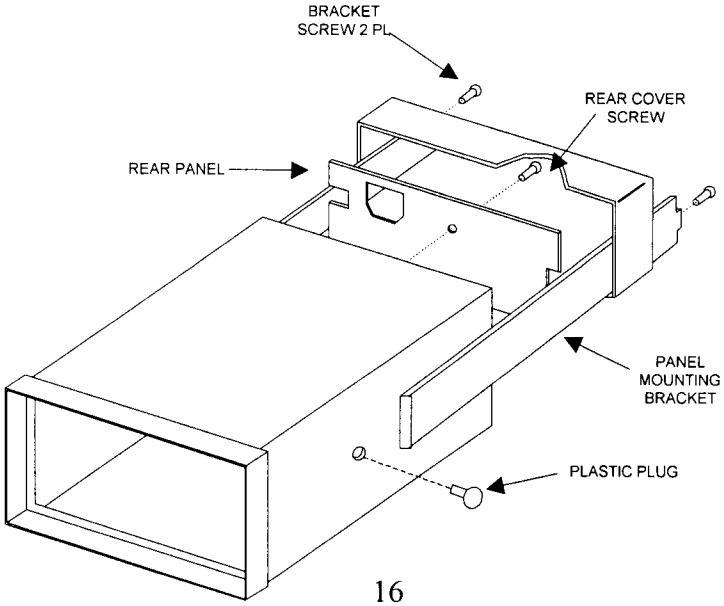
To select between Current or Voltage input mode, remove the front panel lens by removing the two screws located on the front panel lens (one on each side) to gain access to the display board. Behind the lens on the left hand side is a DIP Switch used to set the indicator's input measuring mode.



3.3 INSTALLATION

Panel Mounting

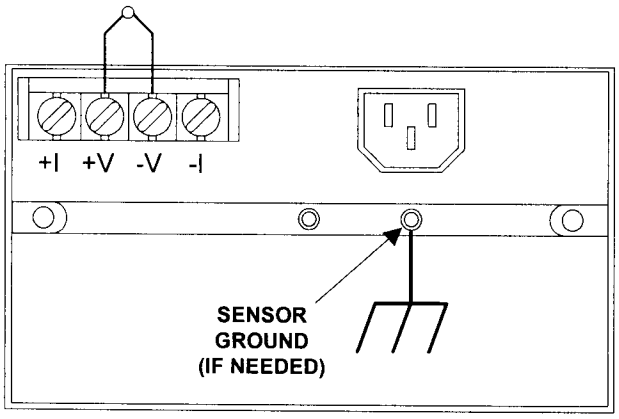
Panel mounting hardware is supplied standard with the instrument. The instrument bezel butts against the front of the mounting panel; the mounting bracket fits over the instrument rear panel. The bracket screws force it against the rear of the mounting panel, locking the instrument in place. Panel cutout dimensions are 68mm x 138mm (2.68" x 5.44").



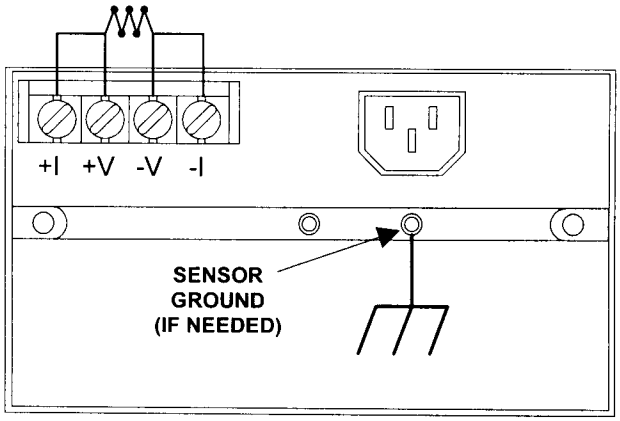
3.4 WIRING THERMOCOUPLES

All signal input connections are made to the instrument using screw terminals. To gain access to the recessed terminal strip, the rear cover panel must be removed. The four signal input terminals are located in the upper-left corner, and are labeled +I, +V, -V, and -I.

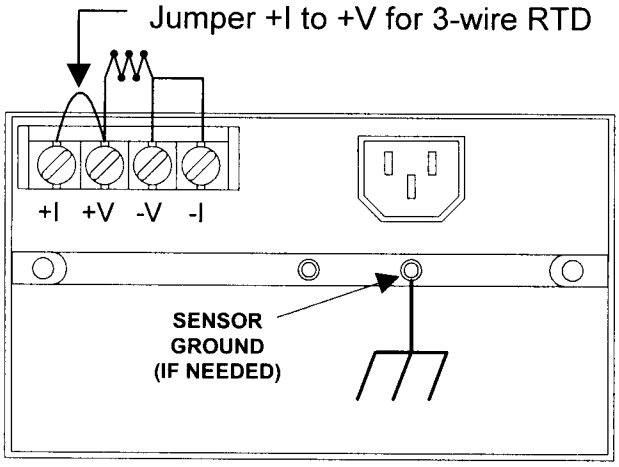
WARNING:REMOVE THE POWER CORD BEFORE WIRING



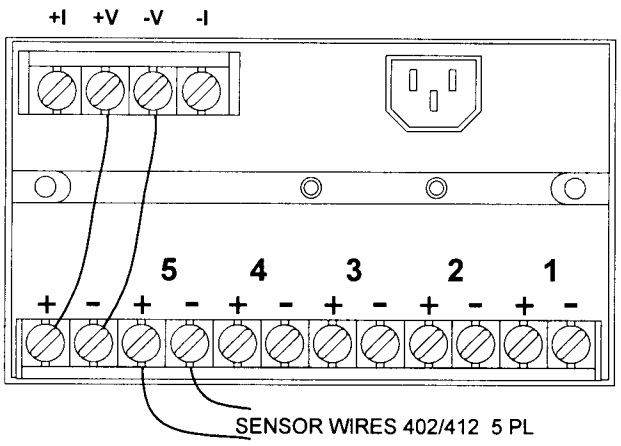
Basic Single Channel Thermocouple Wiring



4-Wire RTD Wiring

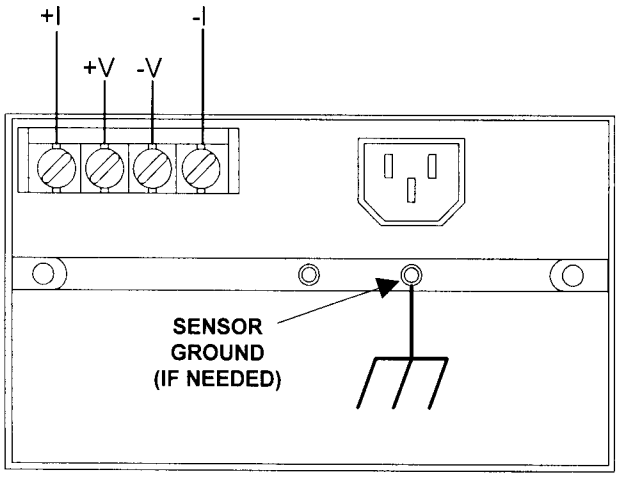


3-Wire RTD Wiring



402/412 Multiple Input Wiring

Note: Bus from +/- V connectors to switchboard below with thermocouple wire for thermocouple units and copper wire for all other models.



Process Indicator Voltage or Current Wiring

SECTION 4 OPERATION

4.1 APPLYING POWER TO THE INSTRUMENT

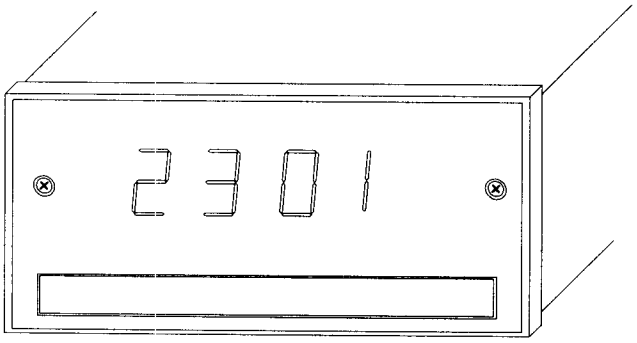
Power is applied to the instrument as long as the instrument is plugged into an active source. To remove power, unplug the power cord from the instrument or AC outlet.

To eliminate shock hazard or possible instrument damage, always remove the power cord either from the instrument or power source before calibrating or configuring the indicator.

4.2 USING BASIC UNITS MODELS 400

Models 400 indicators are single range indicators with a single input. Once the instrument is configured for the desired range, connecting the appropriate sensor to the rear input terminals can make measurements

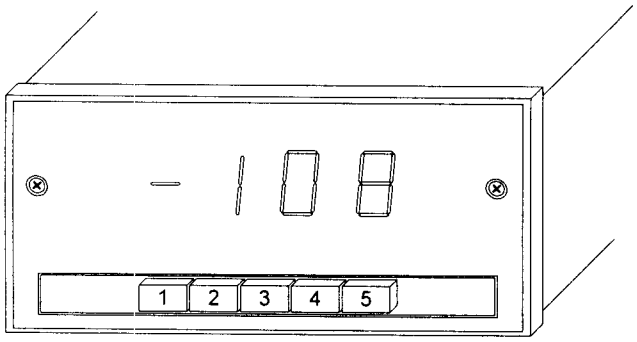
Front Panel Model 400 Basic indicator



4.3 USING THE 5 INPUT SWITCHING UNITS MODELS 402

The 5 input switching units accommodate five inputs of the same range as determined by the analog program model. Inputs are selected by a row of pushbuttons directly below the display. The pushbuttons are number 1-5 Pressing a particular pushbutton selects that input point for display. The pushbuttons are interlocked so that only one pushbutton is selected at one time.

FRONT PANEL, 5 INPUT UNIT (MODEL 402 SHOWN)



SECTION 5 CALIBRATION

PROCEDURE: Thermocouple Input

Equipment Required:

A Precision DC voltage source with a resolution to 1μV; accuracy ±0.01%(±2μV)
Interconnecting copper wire from the DC source to the unit
Trimmer adjusting tool (blade type)
Make sure the AC power to the unit is turned OFF

1- Observing contact polarity, connect the voltage source to the Thermocouple inputs as show in the wiring diagram on page 20.
Turn power ON.
Locate the Zero and Span control pot on the display board.
2- Adjust the voltage source output to 0.00mV.
3- Adjust the ZERO control for a display reading of 0.0(±0.1).
(Note: display readings take up to 3 seconds to respond to change in control setting.)
4- Adjust the voltage source output to 60.000mV.

5- Adjust the SPAN control for a display reading of 60.000 (±0.1) (Note: display reading take up 3 second to respond to changes in condition setting.)
6- Turn OFF the AC power. Move sensor selector switch to the desired thermocouple type and install the front panel lens. This completes calibration for thermocouple input.

If the unit will still not meet specification it may be necessary to adjust the reference junction compensation potentiometer located behind the rear panel. Simply set the sensor selector switch to type K thermocouple and with the power off, remove the rear panel and connect with type K thermocouple wire the+/- V input terminals to a thermocouple simulator. Power up the unit and wait approximately ten minutes. Input 32.0 degrees F and adjust the reference junction potentiometer (located on the main board facing rear) for a front panel reading of 32.0 (32 for 400 Series units). Remove power and install rear panel.

PROCEDURE: RTD Input For RTD (3 or 4) wire Input

Equipment Required:

A precision resistance decade box with a resolution of 0.01Ω and an accuracy of ±0.02%

Interconnecting copper wire from the resistance source to the unit

Trimmer adjusting tool (blade type)

1- Connect a decade resistance box to the RTD input as shown in the wiring diagram on page. (Be sure the power is OFF when making connection.)
2- Adjust the decade box to 0.00Ω.
3- Adjust the ZERO control for a display reading of 0.0(±0.1).
   (Note: display readings take up to 3 seconds to respond to change in control setting.)
4- Adjust the decade box to 500.00Ω.
5- Adjust the SPAN control for a display reading of 1500.0 (±0.1). (Note: display readings take up 3 seconds to show changes in control setting.)
6- Turn OFF the AC power. Set the sensor selector switch to the desired RTD range (PT1=α. 00385 PT2=α. 00392) and install the front panel lens. This completes calibration for RTD input.

Calibrating and Scaling the Process Indicator

Scaling the indicator to display in your desired engineering units requires simulation of two different input VALUES (typically the lowest input and highest input) and using the two "SET" and "ENTER" buttons to scroll the digital display.

With the front lens removed and the mA/V switch
In the position compatible with your input...

Step 1: Hook up a DC milliamp or Voltage source Calibrator or actual transducer, capable of supplying a low scale and full scale input, to the appropriate rear panel screw terminals on the indicator.

Step 2: Set the "PROCESS/SCALING" switch to the SCALING position. The word "**Lo**" will appear on the display.

Step 3: a) Simulate the low scale input (e.g. 4 mA)

b) Push the "ENTER" button.

c) Use the "SET" button to change the value of the flashing digit. When the flashing digit is correct, push the "ENTER" button. The flashing digit will

now move to the next right hand digit. Continue until all digits are correct with the right most digit still flashing.

d) Push both "SET" and "ENTER" buttons at the same time to program in this scale factor. In other words, when the indicator receives a process input signal identical to the simulated (calibration) one it will display the same value shown now. (e.g. 4mA=0000)

NOTE: While the indicators calibrating itself "oo" will appear in the display. After a few seconds it will return to display "**Hi**" (go to step 4) or "ERR" (see error message table).

Step 4: With "**Hi**" displayed change the input to simulate +Full scale (High e.g. 20mA).

Step 5: Repeat steps as shown in Steps 3b, 3c, 3d changing the digits to represent the Full Scale desired display (e.g. 7500). When complete, the indicator will then go to the decimal point position.

Step 6: With decimal points displayed...

a) Push "SET" button until desired position is displayed

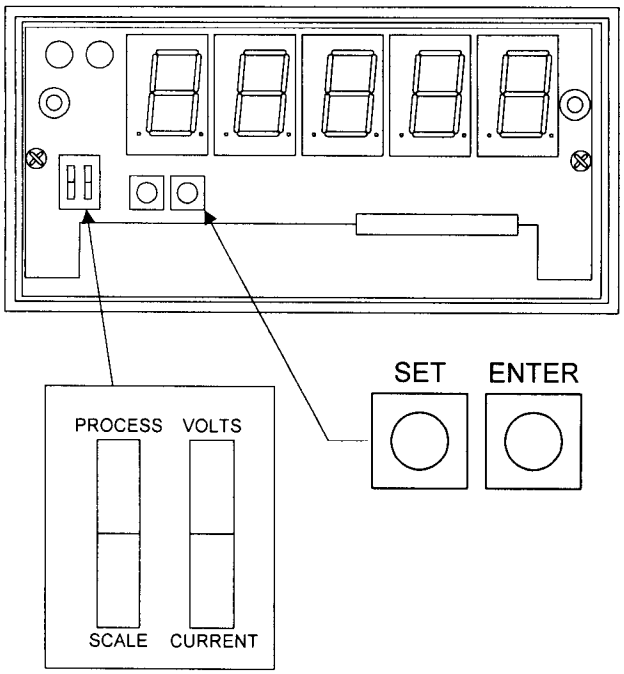
b) Push "SET" and "ENTER" buttons at the same time to program into memory

Step 7: Return the "PROCESS/SCALING" switch to the PROCESS position. Replace the front lens. Remove the calibrator from the input terminals.

NOTES:

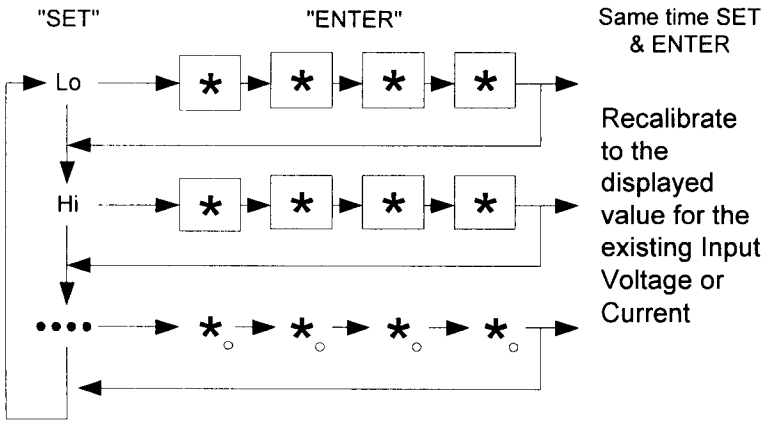
1) Pushing both the SET and ENTER buttons at the same time always causes the indicator to recalibrate itself to the given input at that moment. As a protective measure, if scaling changes are made and not terminated this way no recalibration will occur, previous values will remain.

2) As a further protective measure, the "SET" and "ENTER" buttons are not functional unless the PROCESS/SCALING switch is in the SCALING position.


SET
ENTER
PROCESS
VOLTS
SCALE
CURRENT

Button Function Legend

Use "SET" key to change value of flashing digit or decimal point



ERROR MESSAGE TABLE

Message Displayed	DURING CALIBRATION/ SCALING MODE		DURING NORMAL PROCESS MEASURING MODE	
	CAUSE	CURE	CAUSE	CURE
Err1	Slope error Same values entered for both Hi and Lo	"Lo" and "Hi" values must be different. Push "set" button and re-enter for "Lo" and "Hi" values	N/A	
Err2	Slope error. Too many display counts for too little input	Push "SET" button. Reduce number of counts for given input.	N/A	
OL-OL	Overloaded input or display. Input exceeds specification.	Check input voltage or current. Must be within 0-10 VDC 0-20mA	Input exceeds maximum specifications or display is beyond -999 or 9999	Check input voltage or current for over range or open circuit
----	Internal A/D overload	Turn power off, wait 25 seconds, and turn power on again.	Internal A/D overload	Turn power off, wait 25 seconds, and turn power on again.