

**RoHS 2 Compliant**



# User's Guide



***<http://www.omega.com>***  
***[e-mail: info@omega.com](mailto:info@omega.com)***

## **DP119**

# **Thermocouple Miniature Panel Thermometer**

# Where Do I Find Everything I Need for Process Measurement and Control? **OMEGA...Of Course!**

## **TEMPERATURE**

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

## **PRESSURE, STRAIN AND FORCE**

- ☑ Transducers & Strain Gauges
- ☑ Load Cells & Pressure Gauges
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

## **FLOW/LEVEL**

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

## **pH/CONDUCTIVITY**

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

## **DATA ACQUISITION**

- ☑ Data Acquisition & Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

## **HEATERS**

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

## **ENVIRONMENTAL MONITORING AND CONTROL**

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments

# TABLE OF CONTENTS

<b>SECTION</b>		<b>PAGE</b>
	Preface . . . . .	ii
	Models Available . . . . .	iii
Section 1	Introduction . . . . .	1
1.1	Unpacking . . . . .	1
1.2	Safety Considerations . . . . .	2
Section 2	About the Meter . . . . .	3
2.1	Front of the Meter . . . . .	3
2.2	Back of the Meter . . . . .	4
2.3	Description . . . . .	4
Section 3	Getting Started . . . . .	5
3.1	Main Board Power Jumpers . . . . .	5
3.2	Converting °F to °C (vice versa) . . . . .	7
3.3	Installation and Panel Mounting . . . . .	8
3.4	Sensor Input Connections . . . . .	10
3.5	Analog Output Connections . . . . .	12
3.6	Display Hold Connections . . . . .	13
3.7	Main Power Connections . . . . .	14
3.8	Disassembly/Assembly . . . . .	16
Section 4	Operation and Calibration . . . . .	18
4.1	Equipment Required . . . . .	18
4.2	Calibration Procedure . . . . .	19
Section 5	Specifications . . . . .	28
Section 6	Glossary . . . . .	32

## PREFACE

Manual Objectives: This manual shows you how to set up and use the Panel Thermometer.

This meter is an economical Thermocouple Miniature Panel Thermometer featuring a large display with a linearized analog output that is supplied as a standard feature.

Each of the models\* can be converted by the user to display in degrees Fahrenheit or Celsius. ***However, due to the internal design of the meter, the input type and resolution CANNOT be changed on any J, K, T, or E unit.***

The meter is available in many different styles. All of the Thermocouple models listed in Table 1-1 come standard with red LEDs, and can be ordered with a green LED display as an option. The part numbers would then end with “-GR”.

Also, these thermocouple meters can be ordered with different power configurations. Refer to Table 1-3 for available choices.

\*Refer to Table 1-1 for the complete listing of models available.

**TABLE 1-1****TC MODELS AVAILABLE**

The following 3-1/2 digit mini thermocouple panel thermometers are discussed in this operator's manual.

<b>MODEL</b>	<b>TYPE</b>	<b>°C or °F</b>	<b>RESOLUTION</b>
DP119-JF1	J	F	1.0°F
DP119-JF2	J	F	0.1°F
DP119-JC1	J	C	1.0°C
DP119-JC2	J	C	0.1°C
DP119-KF1	K	F	1.0°F
DP119-KF2	K	F	0.1°F
DP119-KC1	K	C	1.0°C
DP119-KC2	K	C	0.1°C
DP119-TF1	T	F	1.0°F
DP119-TF2	T	F	0.1°F
DP119-TC1	T	C	1.0°C
DP119-TC2	T	C	0.1°C
DP119-EF1	E	F	1.0°F
DP119-EF2	E	F	0.1°F
DP119-EC1	E	C	1.0°C
DP119-EC2	E	C	0.1°C

**Note**

The accuracies and ranges are listed in Section 5.

**Table 1-2****Other Models Available**

The following 3-1/2 digit mini RTD panel meters are available and discussed in a separate RTD Operator's Manual.

<b>MODEL</b>	<b>TYPE</b>	<b>°C or °F</b>	<b>RESOLUTION</b>
DP119-MF1	RTD	F	1.0°F
DP119-MF2	RTD	F	0.1°F
DP119-MC1	RTD	C	1.0°C
DP119-MC2	RTD	C	0.1°C

**Table 1-3****Power Options Available**

<b>MODEL</b>	<b>POWER</b>
DP119-TC type	115 Vac, 49-63 Hz
DP119-TC type-230	230 Vac, 49-63 Hz
DP119-TC type-9/26	9-26 Vdc, non-isolated. Use ungrounded Thermocouples to avoid ground loops.
DP119-TC type-100	100 Vac, 50-60 Hz
DP119-TC type-24	24 Vac, 50-60 Hz

## NOTES, WARNINGS and CAUTIONS

Information that is especially important to note is identified by these labels:



**NOTE:** provides you with information that is important to successfully setup and use the Programmable Digital Meter.



**CAUTION or WARNING:** tells you about the risk of electric shock.



**CAUTION, WARNING or IMPORTANT:** tells you of circumstances or practices that can effect the meter's functionality and must refer to accompanying documents.

## SECTION 1 INTRODUCTION

### 1.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, use the phone numbers listed on the back cover to contact the Customer Service Department nearest you.

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



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

Verify that you received the following items in the shipping box:

#### QTY DESCRIPTION

- 1 Panel Thermometer with 3 small connectors plugged into the rear of the meter.
- 1 Operator's Manual



## 1.2 SAFETY CONSIDERATIONS



This device is marked with the international Caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

### Unpacking & Inspection



Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

This instrument is a panel mount device protected in accordance with Class I of EN 61010 (115/230 AC power connections). Installation of this instrument should be done by Qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has no power-on switch. An external switch or circuit-breaker shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall not interrupt the Protective Conductor (Earth wire), and it shall meet the relevant requirements of IEC 947-1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the mains supply cord.

Furthermore, to provide protection against excessive energy being drawn from the mains supply in case of a fault in the equipment, an overcurrent protection device shall be installed.



- The **Protective Conductor** must be connected for safety reasons. Check that the power cable has the proper Earth wire, and it is properly connected. It is not safe to operate this unit without the Protective Conductor Terminal connected.



- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

### EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

## SECTION 2 ABOUT THE METER

### 2.1 Front of the Meter

Figure 2-1 shows the panel thermometer.



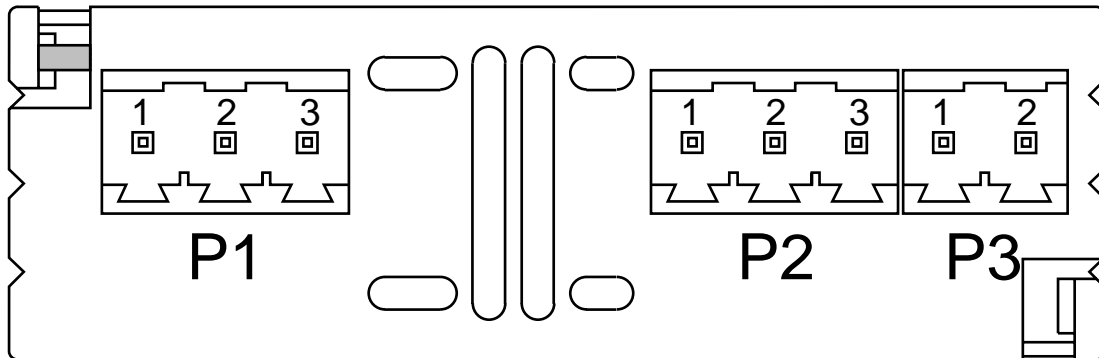
**Figure 2-1. Panel Thermometer**

#### Features:

- Display: 3 1/2 Digit, 7-Segment Red or Green LED
- Full-size 14.2 mm (0.56") LED Display
- Analog Output Standard
- 1/8 DIN Standard Panel Cutout
- Removable Screw-Clamp Cable Connector
- Display Hold Capability

## 2.2 Back of the Meter

Figure 2-2 illustrates the rear of the meter.



**Figure 2-2. Rear View Showing P1, P2, P3 Connectors**

## 2.3 Connector Description

Connector Description	Connector	PIN #
(AC) Earth Ground	P1	1
(AC) Neutral	P1	2
(AC) Line	P1	3
(DC) -DC Return	P1	1
(DC) +DC	P1	2
(DC) No Connection (Not used)	P1	3
Display Hold (Active Low)	P2	1
Return	P2	2
Analog Output	P2	3
-TC (Neg. Lead) †	P3	1
+TC (Pos. Lead) †	P3	2

† For wire colors, refer to Table 3-1

## SECTION 3 GETTING STARTED

### 3.1 Main Board Power Jumpers



**Caution:** The meter has no power-on switch, so it will be in operation as soon you apply power.

The meter can be configured to operate on 115VAC or 230VAC by the proper combination of the soldered wire jumpers that are located on the printed circuit board. The meter is set at the factory to be powered by the voltage specified at the time of ordering. The same transformer is used for either configuration, so all you need to do is to select the jumpers as described in this section.



**Important:** These changes must be performed by a qualified technician.

To change the Factory preset jumpers, do the following steps:



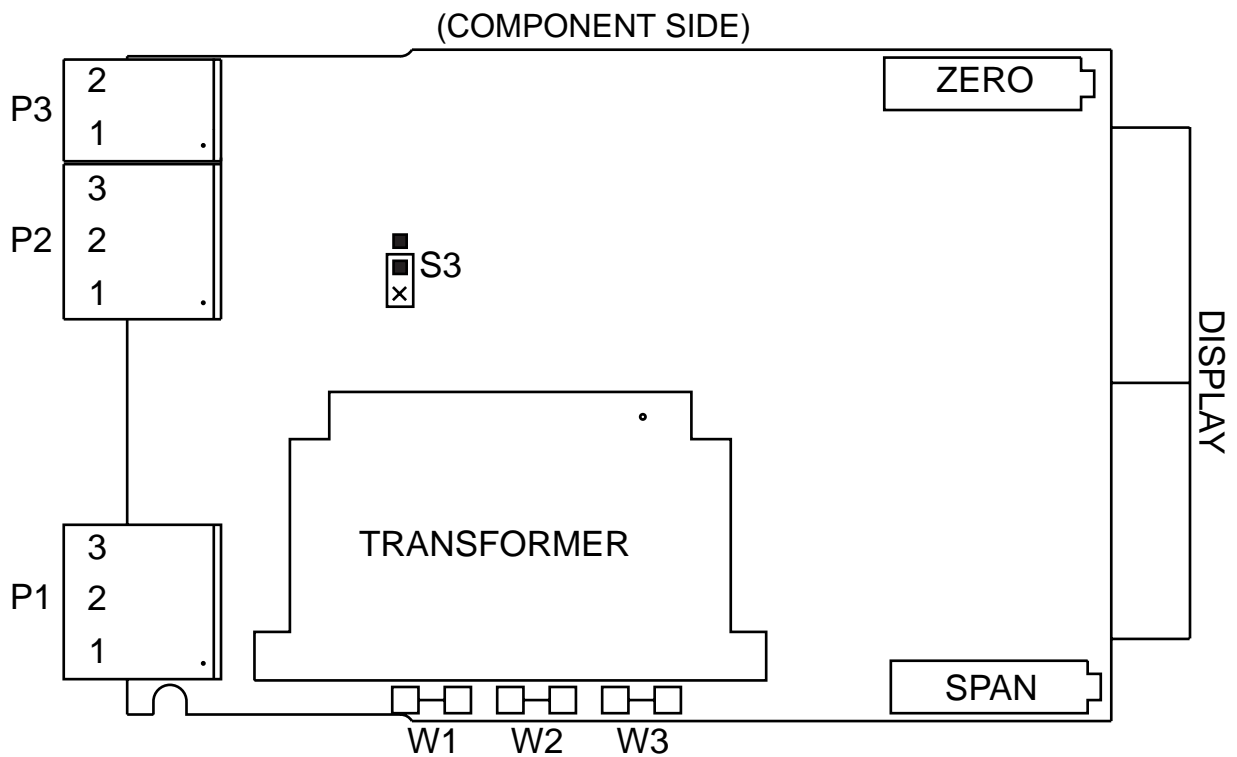
**Note** Disconnect the power from the unit before proceeding.

1. Remove the main board from the case. Refer to Disassembly/Assembly Section 3.8.
2. Locate the solder jumpers W1, W2, and W3 (located near the edge of the main board alongside the transformer).
3. If your power requirement is 115 V ac, solder jumpers W1 and W3 should be wired, but jumper W2 should not. If your power requirement is 230 V ac, solder jumper W2 should be wired, but jumpers W1 and W3 should not.

## Voltage Jumper Pin Settings

AC VOLTAGE	INSTALL	REMOVE
115VAC	W1, W3	W2
230VAC	W2	W1, W3

Figure 3-1 shows the location of solder jumpers W1 through W3.



**Figure 3-1. PC Board Jumper Locations**

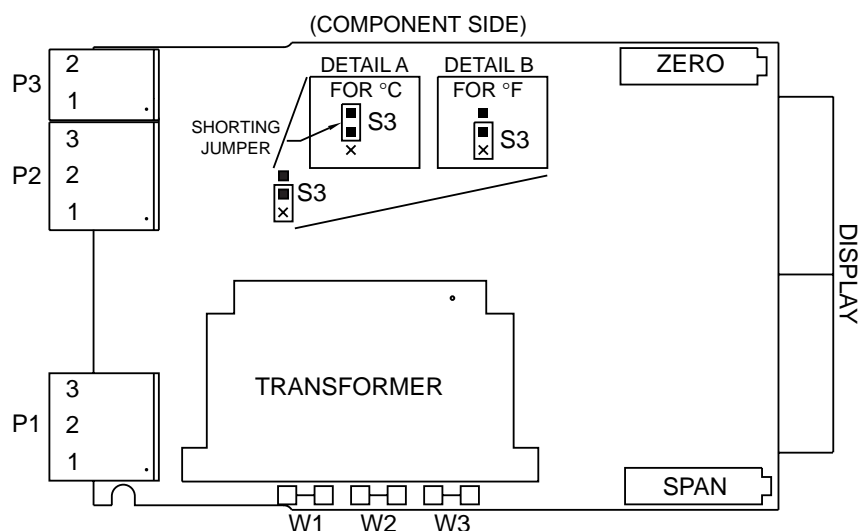
## 3.2 Converting °F to °C (vice versa)



*You must remove the printed circuit board from the case in order to change from the Fahrenheit to Celsius (or vice versa). This change must be performed by a qualified technician in order to avoid damage to the unit. Disconnect the power from the unit before proceeding.*

Degrees Fahrenheit and degrees Celsius are selectable parameters. All you need to do is change the location of the shorting jumper at S3, using needle-nose pliers.

1. Disconnect all wires and move the unit from the panel (if installed).
2. Remove the printed circuit board from the case as described in **Section 3-8**.



**Figure 3-2. S3 Jumper**

3. Follow the instructions to convert to:

### **Celsius:**

The unit will display degrees Celsius when the shorting jumper is connected to both pins at S3. Refer to **Figure 3-2**, Detail A.

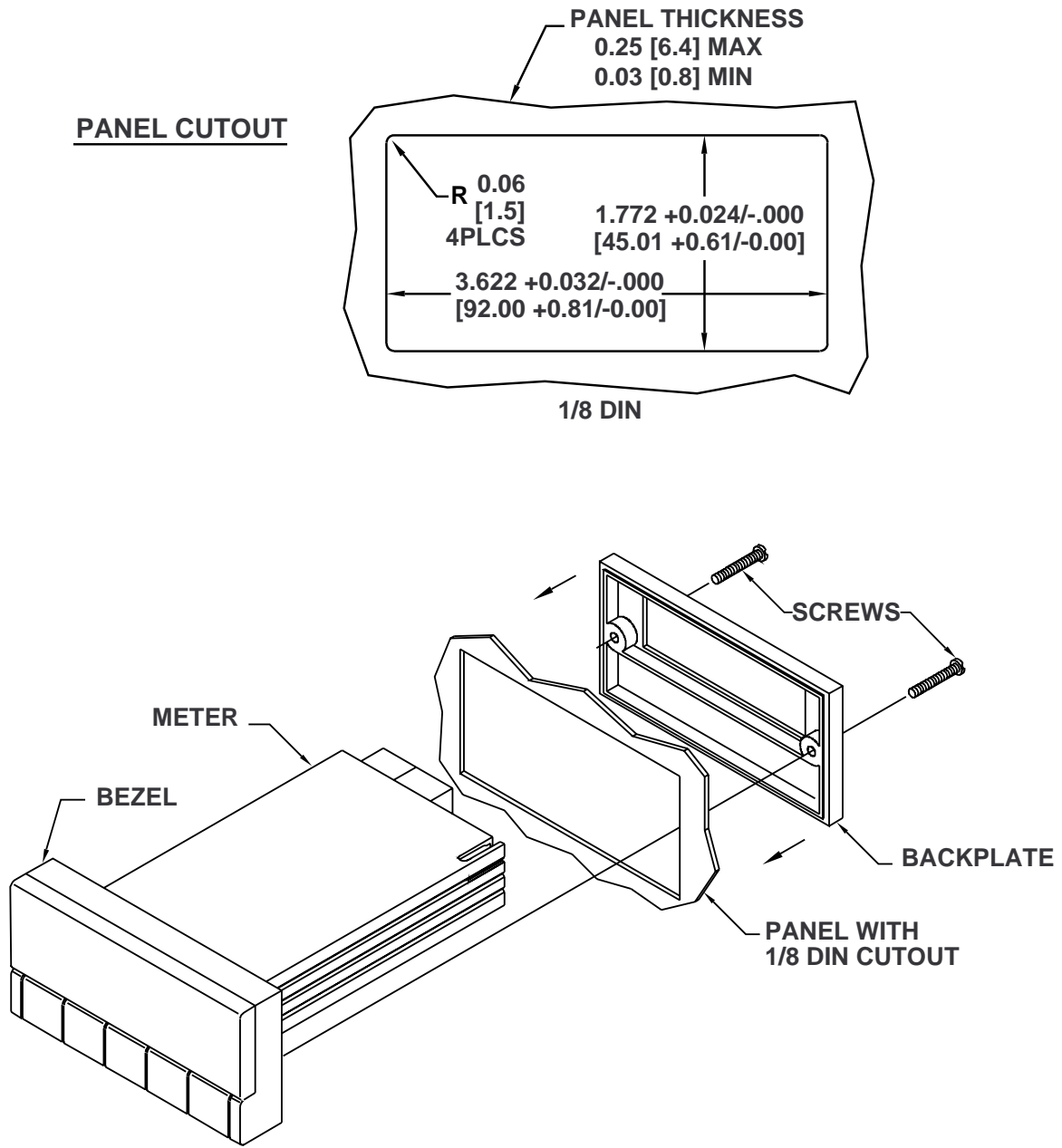
### **Fahrenheit:**

The unit will display degrees Fahrenheit if the shorting jumper at S3 is NOT connecting the 2 pins. Refer to **Figure 3-2**, Detail B. By keeping the shorting jumper on one pin, you are keeping it handy in case you want to change the display back to degrees C.

### **Section 3.3 Installation and Panel Mounting**

Figure 3-3 shows the panel cutout dimensions, the dimensions for the panel thickness, and the backplate for mounting the unit in a panel. **Connections will be done after mounting the unit.**

1. Remove the 2 phillips screws from behind the display (you don't have to go inside the meter) holding the rectangular backplate to the meter. Remove the backplate and set aside.
2. Cut or punch a hole in the panel where you want the meter to go. The panel can be as thick as 0.25" (6.4mm) to as thin as 0.03" (0.8mm).
3. Insert the meter into the panel cutout.
4. From the rear of the panel, slide the backplate over the case (smooth side out).
5. Install the 2 phillips screws to secure the meter in 1/8 DIN mount. Center the meter in hole prior to tightening screws.



**Figure 3-3. Installation Information**




### 3.4 Sensor Input Connections

**Table 3-1. AMERICAN (USA) THERMOCOUPLE WIRE COLORS**

T/C TYPE	"+" LEAD WIRE ALLOY/WIRE COLOR	"-" LEAD WIRE ALLOY/WIRE COLOR
J	Iron (white)	Constantan (red)
K	Chromel (yellow)	Alumel (red)
T	Copper (blue)	Constantan (red)
E	Chromel (purple)	Constantan (red)

The meter is configured at the factory for the desired thermocouple type (J, K, T, E) and the desired units of measure ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ ), as defined by the customer at the time of purchase.

The meter configuration is defined in the part number. For example, a Type T meter that reads in degrees Fahrenheit would have a "-TF2" in the part number. The "1" at the end of the part number indicates a 1 degree resolution and "2" at the end of the part number indicates a 0.1 degree resolution. See **Table 1-1** for model number listing.

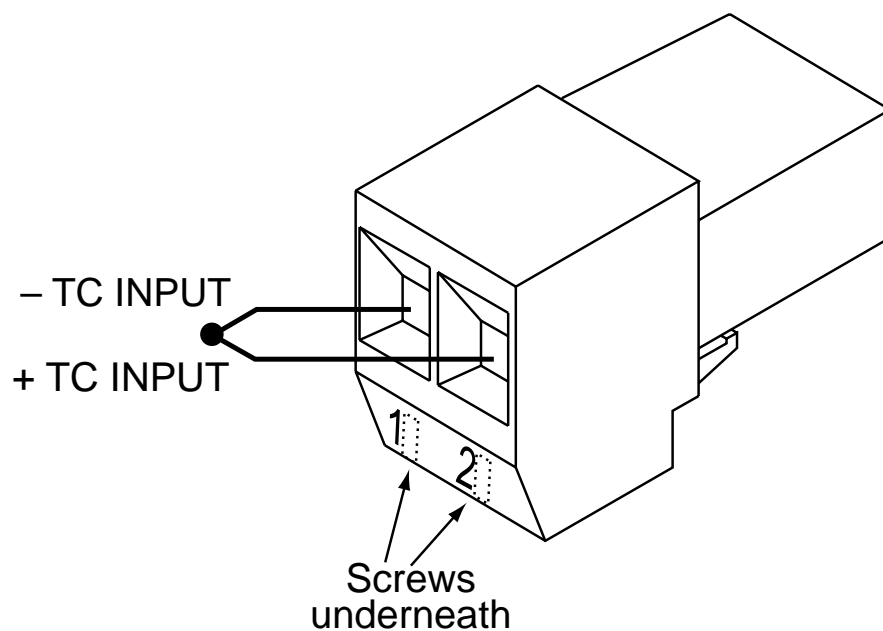
 **Note** Once the meter is configured for a particular thermocouple type, it CANNOT be changed to accept any other input type. It becomes dedicated to that thermocouple type as ordered.

### 3.4 Sensor Input Connections (Continued)

To connect the input to the unit, attach the thermocouple probe to the 2-pin female connector that is supplied with the unit. Refer to **Figure 3-4** for wiring instructions and **Table 2-1** for wire colors.

Plug the female connector into the P3 male connector at the rear of the meter.

**Figure 2-2** shows the location of the P3 connector on the meter.



**Figure 3-4. Thermocouple Connector Wiring (P3)**

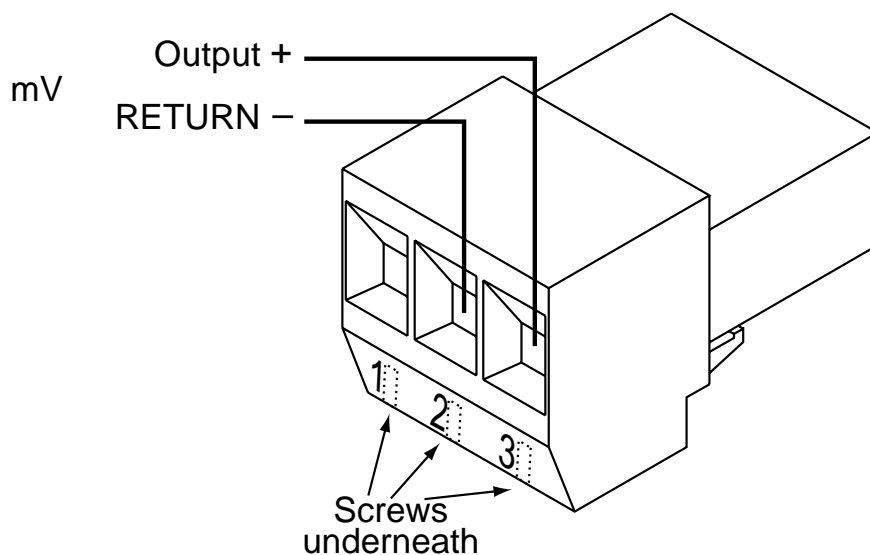
### 3.5 Analog Output Connections

The analog output is a linearized millivolt signal that is equivalent to the displayed temperature. It comes as a standard feature with every unit. The resolution of the analog output is no greater than the resolution of the display.

**Note** The analog output is a non-isolated signal, therefore, it is recommended that an ungrounded thermocouple probe be used to prevent ground loop problems.

To access the analog signal, attach copper wire to the 3-pin female connector that is supplied with the meter. Refer to **Figure 3-5** for wiring instructions. Plug the female connector into the P2 (male) connector at the rear of the meter.

**Figure 2-2** shows the location of the P2 connector on the meter. Note that this connector shares a common return with the “Display Hold” function.

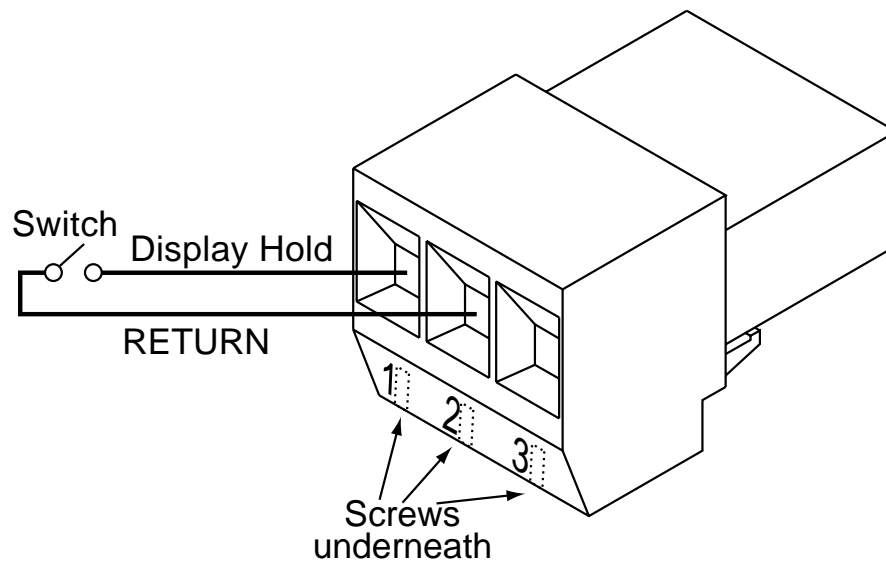


**Figure 3-5. Analog Output Connections (P2)**

### 3.6 Display Hold Connections

The “Display Hold” function can be used to freeze the display. Connect a single pole, single throw (SPST) switch between pins 1 and 2 on the P2 connector. The display will stop updating when this switch is on. When this switch is off, the display will update itself 2.5 times per second.

To access the “Display Hold” function, attach copper wire to the 3-pin female connector that is supplied with the meter. Refer to **Figure 3-6** for wiring instructions. This connector shares a common return with the Analog Output. Plug the female connector into the P2 connector at the rear of the meter. **Figure 2-2** shows the location of the P2 connector on the meter.



**Figure 3-6. Display Hold Connections**

### 3.7 Main Power Connections

Connect the ac main power connections as shown below.



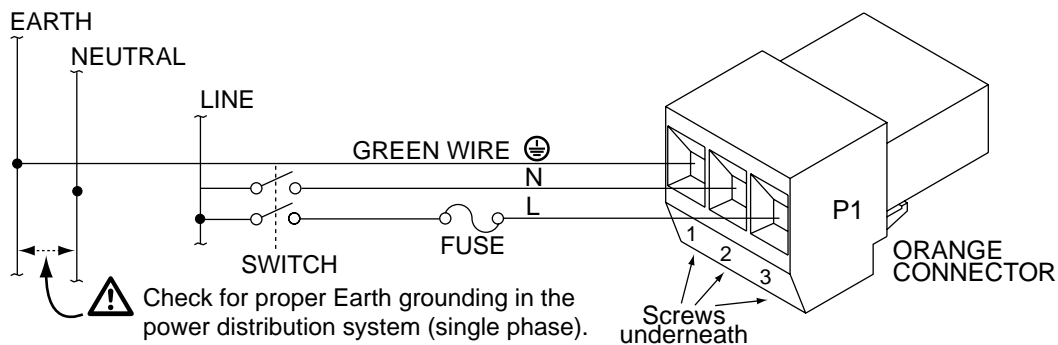
**WARNING:** Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury! This device must only be installed electrically by specially trained electrician with corresponding qualifications. The main power input to the unit as well as the AC input signal to be measured must agree with the wiring instruction.

The meter is factory set to the power specified by the customer at the time of ordering. The voltage is printed on the Label under Input power.



Refer to **Section 3-2** to convert from one configuration to another.

To connect power to the unit, attach wires from the ~AC power cord to the orange 3-pin female connector that is supplied with the meter. Refer to **Figure 3-7** for wiring instructions. Plug the female connector into the orange P1 (male) connector at the rear of the meter. **Figure 2-2** shows the location of P1 on the meter.



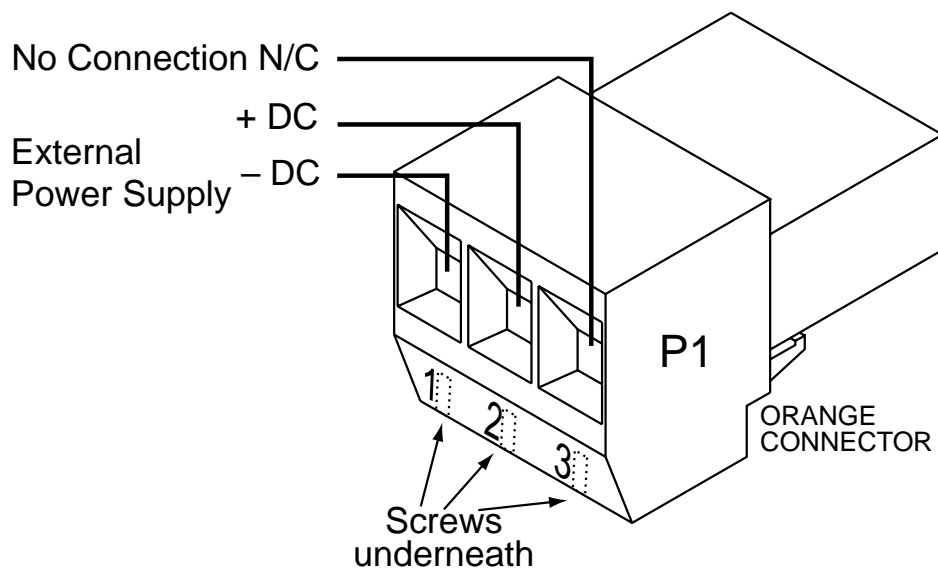
**Figure 3-7. ~AC Connector Wiring (P1)**

## DC WIRING

The meter can be configured at the factory to operate on a 9–26 VDC non-isolated power. The DC voltage option is specified at the time of ordering. See **Table 1-3** for model number listing. An AC powered meter cannot be converted to a DC powered meter or vice versa.

To connect power to the unit, attach the DC power wires to the orange 3-pin female connector that is supplied with the meter. Refer to **Figure 3-8** for wiring instructions. Plug the female connector into the orange P1 (male) connector at the rear of the meter. **Figure 2-2** shows the location of P1 on the meter.

**Note** -TC input (P3-1) is internally connected to 9–26Vdc –DC Return (P1-1), therefore, it is recommended that an ungrounded thermocouple probe be used to prevent ground problems.



**Figure 3-8. =DC Power Connector Wiring (P1)**

## 3.8 Disassembly/Assembly

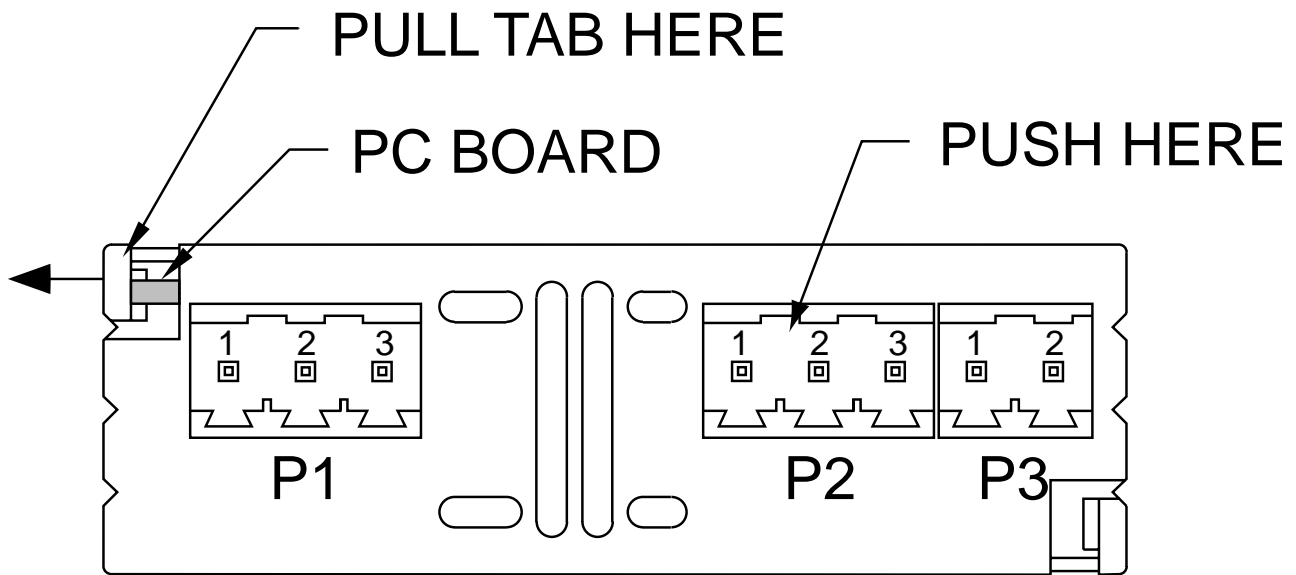


You must go through the following steps in order to remove the printed circuit board from the case if you want to change from 115VAC to 230VAC (or vice versa) or to change from Fahrenheit to Celsius (or vice versa). These changes must be performed by a qualified technician in order to avoid damage to the unit.



**WARNING:** Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury!

1. Remove power and all wire connections from the unit.
2. Unplug the three connectors (P1, P2, and P3) from the back of the meter. Grasp them firmly on the top and bottom of the connector and pull. **Figure 3-9** shows the location of the three connectors.
3. Remove the friction fit lens by prying down and forward from the top of the meter. Remove the mounting screws from the rear of the panel backplate. Slide the unit out of the panel (if it is installed in a panel).
4. The printed circuit board is held in place by a tab and notch system located next to the P1 connector, pin 1 (refer to **Figure 3-9**). The tab is on the case and the notch is on the edge of the PC Board. Hold the meter with the display facing away from you. Gently pry the tab (on the back corner of the case) out with the edge of your finger, while pushing the back of the PC Board out through the front of the meter. The PC Board will slide out the front, free from the case.



**Figure 3-9. Removing the PC Board from the Case**

When re-installing the printed circuit board:

1. Hold the case (with the two mounting holes facing upwards and to the right side of the case) in the left hand.
2. Hold the printed circuit board with the components showing (soldered side down) in the right hand.
3. Slip the component board into the case and slide in as far as it will go. You will also have to release the tab at the rear on the other side of the case (turn case over) to allow the board to fit all the way inside the case.
4. Go through steps 3 thru 5 in Section 3.3 in order to re-install the backplate and screws, and also install the lens.



## SECTION 4 OPERATION AND CALIBRATION



**Important:** These changes must be performed by a qualified technician.



**WARNING:** Do not connect ac power to your meter until you have completed all input and output connections. Failure to do so may result in injury!

1. Wire the meter according to the wiring section. This includes power, thermocouple and analog signal connections.
2. Apply power to the meter and the display will show the temperature of the probe.

The meter is shipped from the factory calibrated to the accuracy as specified. No re-calibration is necessary. In the event that there is a desire to check the calibration, the following procedure is given.

### 4.1 EQUIPMENT REQUIRED

- Meter
- Extension grade thermocouple wire
- a small screwdriver
- a precision Thermocouple Calibrator

**OR**

- a precision Millivolt Source (0.001 resolution) used in conjunction with an Electronic Ice Point
- copper wire

**OR**

- a precision Millivolt Source (0.001 resolution) used in conjunction with an ice bath
- copper wire



Meter calibration must be performed using a thermocouple calibrator. If a millivolt source is used instead, be sure to connect the output of the millivolt source to an Omega MCJ Electronic Ice Point (or equivalent) of the appropriate thermocouple type (or an ice bath). Doing this will compensate for the cold junction errors.

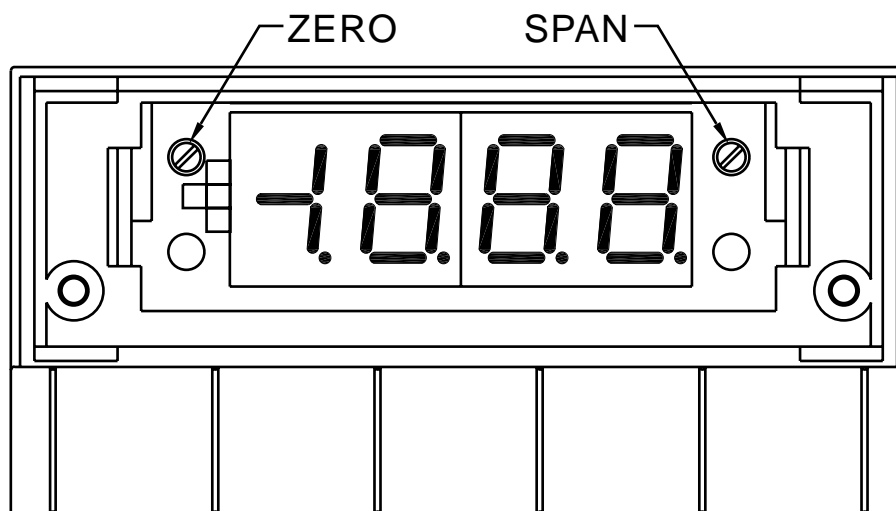
## 4.2 CALIBRATION PROCEDURE

Refer to Section 4.2.1 for details on how to calibrate the meter using the Thermocouple Calibrator. Refer to Section 4.2.2 for details on how to calibrate the meter using the Millivolt Source.

### 4.2.1 Thermocouple Calibrating

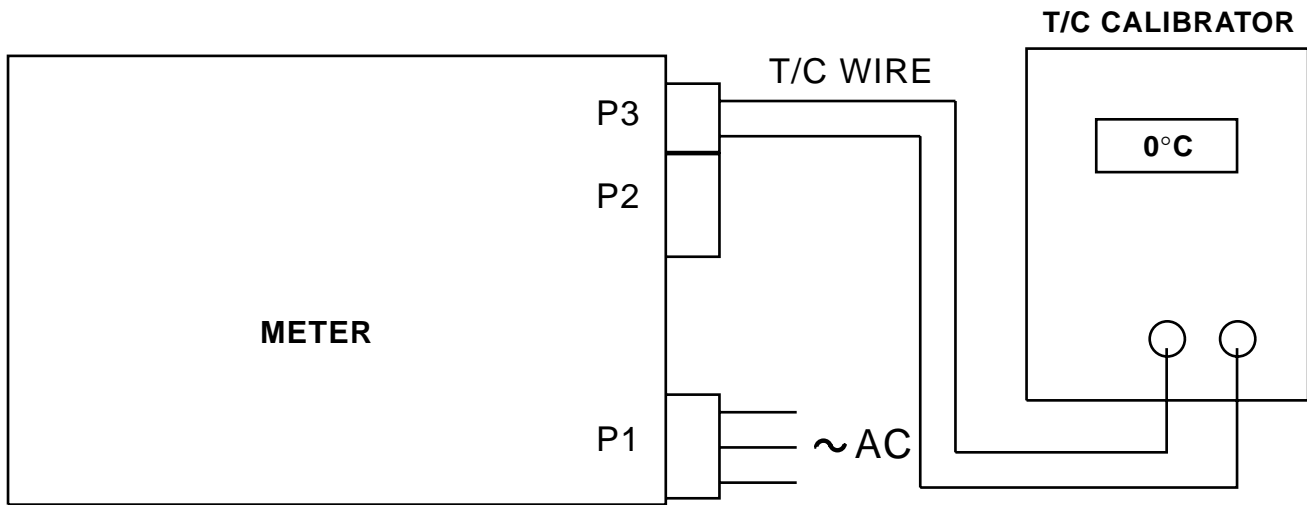
1. **Disconnect the power from the meter.** Remove the front lens. Notice the the zero potentiometer (pot) is located to the left of the display and the span potentiometer is located to the right of the display.

Refer to **Figure 4-1** for the location of the calibration pots.



**Figure 4-1. Calibration Potentiometers**

2. Connect the thermocouple calibrator output signal to the thermocouple input connector P3 as shown in Figure 4-2. Connect the negative (red) thermocouple wire to connector P3, Pin 1. Connect the positive thermocouple wire to connector P3, Pin 2. Be sure to observe polarity and use the correct thermocouple wire (Type J wire for Type J meter).



**Figure 4-2. Calibration a Thermocouple Calibrate**

3. Connect the power to the meter. Allow 30 minute warm up before calibration of 0.1° resolution meters. Refer to the appropriate model number in **Table 4-1** for the proper calibration points for your particular meter.

4. Set the thermocouple calibrator to match the thermocouple type of your meter. Adjust the thermocouple calibrator to output the temperature shown in the first line of column 2. Check to see that the unit displays the temperature shown in column 3. If not, adjust the zero potentiometer until it reads that simulated value. For example, if the meter has a "-JC2" in the model number, set the calibrator for 0.0°C and the unit display should show -0.2°C.
5. Adjust the thermocouple calibrator to output the temperature shown in the second line of column 2. Check to see that the unit displays the temperature shown in column 2. If not, adjust the span pot until it reads that simulated value. For example, if the meter has a "-JC2" in the model number, set the calibrator for 170.0°C and the meter display should show 170.0°C.
6. After adjusting the pots, go back and verify both temperature readings. Repeat steps 4 and 5 as required.

**TABLE 4-1****CALIBRATION VALUES WHEN USING  
THERMOCOUPLE CALIBRATOR**

<b>MODEL OPTION</b>	<b>T/C CALIBRATOR DISPLAY</b>	<b>METER DISPLAY</b>	<b>POT TO ADJUST</b>
*-JF1	32°F 1346°F	32°F 1346°F	Zero Span
*-JF2	32.0°F 167.0°F	31.6°F † 167.0°F	Zero Span
*-JC1	0°C 730°C	0°C 730°C	Zero Span
*-JC2	0.0°C 170.0°C	-0.2°C † 170.0°C	Zero Span
*-KF1	32°F 1794°F	31°F † 1794°F	Zero Span
*-KF2	32.0°F 160.0°F	32.0°F 160.0°F	Zero Span
*-KC1	0°C 1335°C	0°C 1335°C	Zero Span
*-KC2	0.0°C 190.0°C	0.0°C 190.0°C	Zero Span

† Look at the end of Table 4-1 for the explanation of †.

\* Look at Table 1-1, for complete models (preface section).

**TABLE 4-1 (Cont'd)**

<b>MODEL OPTION</b>	<b>T/C CALIBRATOR DISPLAY</b>	<b>METER ADJUST</b>	<b>POT TO DISPLAY</b>
*-TF1	32°F 716°F	31°F † 716°F	Zero Span
*-TF2	32.0°F 185.0°F	32.0°F 185.0°F	Zero Span
*-TC1	0°C 380°C	0°C 380°C	Zero Span
*-TC2	0.0°C 185.0°C	0.0°C 185.0°C	Zero Span
*-EF1	32°F 1769°F	31°F † 1769°F	Zero Span
*-EF2	32.0°F 180.0°F	33.0°F † 180.0°F	Zero Span
*-EC1	0°C 965°C	0°C 965°C	Zero Span
*-EC2	0°C 185.0°C	0.5°C † 185.0°C	Zero Span

† The best MID-RANGE accuracy is obtained when the meter is calibrated to the exact values shown in column 3, even though a small error may occur at 32°F (0°C).

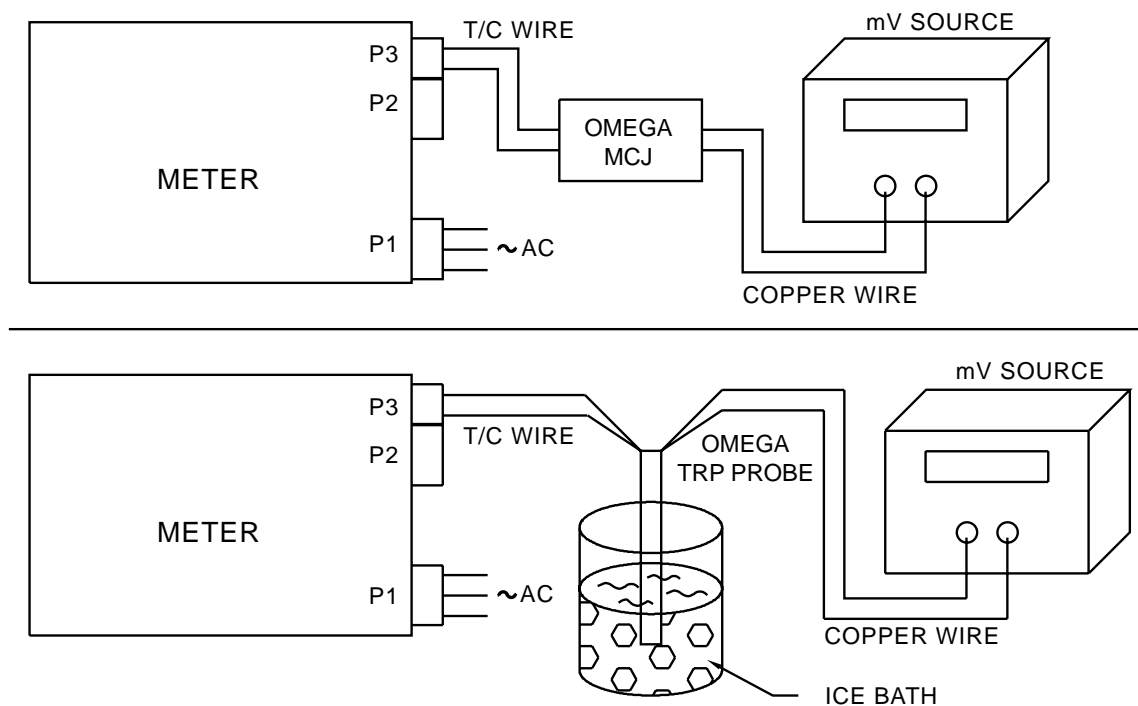
\* Look at Table 1-1, for complete models (preface section).

## 4.2.2 Calibrating using a Millivolt Source

1. **Disconnect the power from the meter.** Remove the front lens. Notice the the zero potentiometer is located to the left of the display and the span potentiometer is located to the right of the display.

Refer to **Figure 4-1** for the location of the calibration pots.

2. Connect the millivolt source to the MCJ Electronic Ice Point or ice bath which in turn connects to the thermocouple input connector P3 as shown in Figure 4-3. Connect the negative (red) thermocouple wire to connector P3, Pin 1. Connect the positive thermocouple wire to connector P3, Pin 2. Be sure to observe polarity and use the correct thermocouple wire (Type J wire for Type J meter).



**Figure 4-3. Calibration with a Millivolt Source**

3. **Connect the power to the meter.** Refer to the appropriate model number in Table 4-2 for the proper calibration points for your particular meter.
4. Adjust the millivolt source to output the millivolt value shown on the first line of column 2. Check to see that the meter displays the temperature indicated in column 3. If not, adjust the zero potentiometer until it reads that simulated value. For example, if the meter has a "-JC2" in the model number, set the millivolt source for 0.0 and the meter display should show 0°C.
5. Adjust the millivolt source to output the millivolt value shown on the second line of column 2. Check to see that the meter displays that same value. If not adjust the span pot until it reads that simulated value. For example, if the meter has a "-JC1" in the model number, set the millivolt source for 41.013 and the meter display should show 730°C.



**TABLE 4-2**  
**CALIBRATION VALUES**  
**WHEN USING A MILLIVOLT SOURCE**

MODEL OPTION	MILLIVOLT VALUE FROM MILLIVOLT SOURCE	METER DISPLAY	POT TO ADJUST
*-JF1	0.0 41.013	32°F 1346°F	Zero Span
*-JF2	0.0 3.917	31.6°F † 167.0°F	Zero Span
*-JC1	0.0 41.013	0°C 730°C	Zero Span
*-JC2	0.0 9.113	-0.2°C † 170.0°C	Zero Span
*-KF1	0.0 40.449	31°F † 1794°F	Zero Span
*-KF2	0.0 2.896	32.0°F 160.0°F	Zero Span
*-KC1	0.0 53.611	0°C 1335°C	Zero Span
*-KC2	0.0 7.737	0.0°C 190.0°C	Zero Span

† Look at the end of Table 4-2, for the explanation of †.

\* Look at Table 1-1, for complete models (preface section).

**TABLE 4-2 (Cont'd)**

<b>MODEL OPTION</b>	<b>MILLIVOLT VALUE FROM MILLIVOLT SOURCE</b>	<b>METER DISPLAY</b>	<b>POT TO ADJUST</b>
*-TF1	0.0 19.638	31°F † 716°F	Zero Span
*-TF2	0.0 3.584	32.0°F 185.0°F	Zero Span
*-TC1	0.0 19.638	0°C 380°C	Zero Span
*-TC2	0.0 8.495	0.0°C 185.0°C	Zero Span
*-EF1	0.0 73.727	31°F † 1769°F	Zero Span
*-EF2	0.0 5.130	33.0°F † 180.0°F	Zero Span
*-EC1	0.0 73.727	0°C 965°C	Zero Span
*-EC2	0.0 12.314	0.5°C † 185.0°C	Zero Span

† The best MID-RANGE accuracy is obtained when the meter is calibrated to the exact values shown in column 3, even though a small error may occur at 32°F (0°C).

\* Look at Table 1-1, for complete models (preface section).

## SECTION 5 SPECIFICATIONS

### INPUT TYPE

Thermocouple: .....J,K,T, or E (Chromel-Constantan)  
Calibration:.....IEC 584-1 (IPTS-68)  
Configuration: .....Single-ended (-TC lead connected to Analog Return)  
Polarity:.....Bipolar  
Cold-junction Tempco†: .....±0.1 deg/deg  
Sensor-wire resistance effect per conductor:  
Type E: 50 µdeg/deg/Ω, up to 2000Ω  
Sensor-break Current:.....333 nA  
Sensor-break Indication: .....Meter displays positive overrange (upscale)

### NOISE REJECTION

NMR†, SIG HI to SIG LO: .....70 dB, 50/60 Hz  
CMR†, Analog RTN to PWR GND: .....120 dB, DC to 60 Hz  
CMV†, Analog RTN to PWR GND: .....Dielectric strength to 1500 V  
transient per 260 Volt rms or  
DC working voltage.

### ACCURACY at 25°C

Range for rated accuracy:  
Thermocouple Type: .....Refer to Table 5-1  
Maximum Error: .....Refer to Table 5-1  
Resolution: .....Refer to Table 5-1  
Span Tempco: .....±0.02% of reading/°C  
Full-Scale Step Response: ..... 1 s  
Warmup to Rated Accuracy: ..... 30 min.

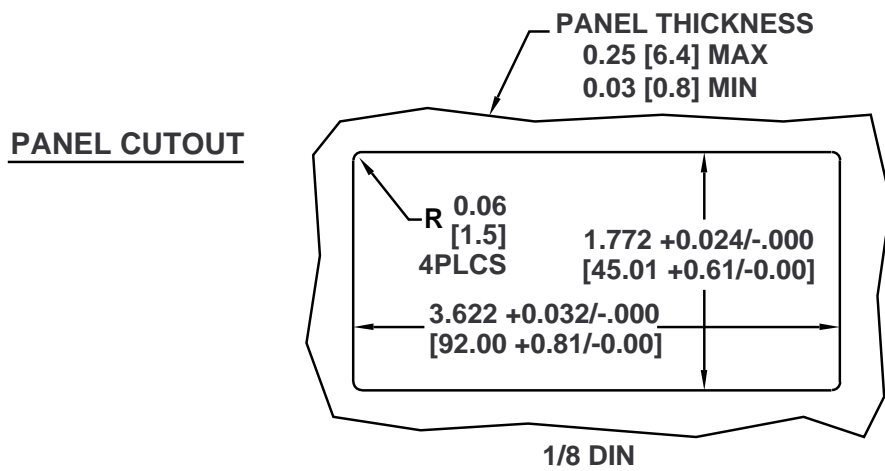
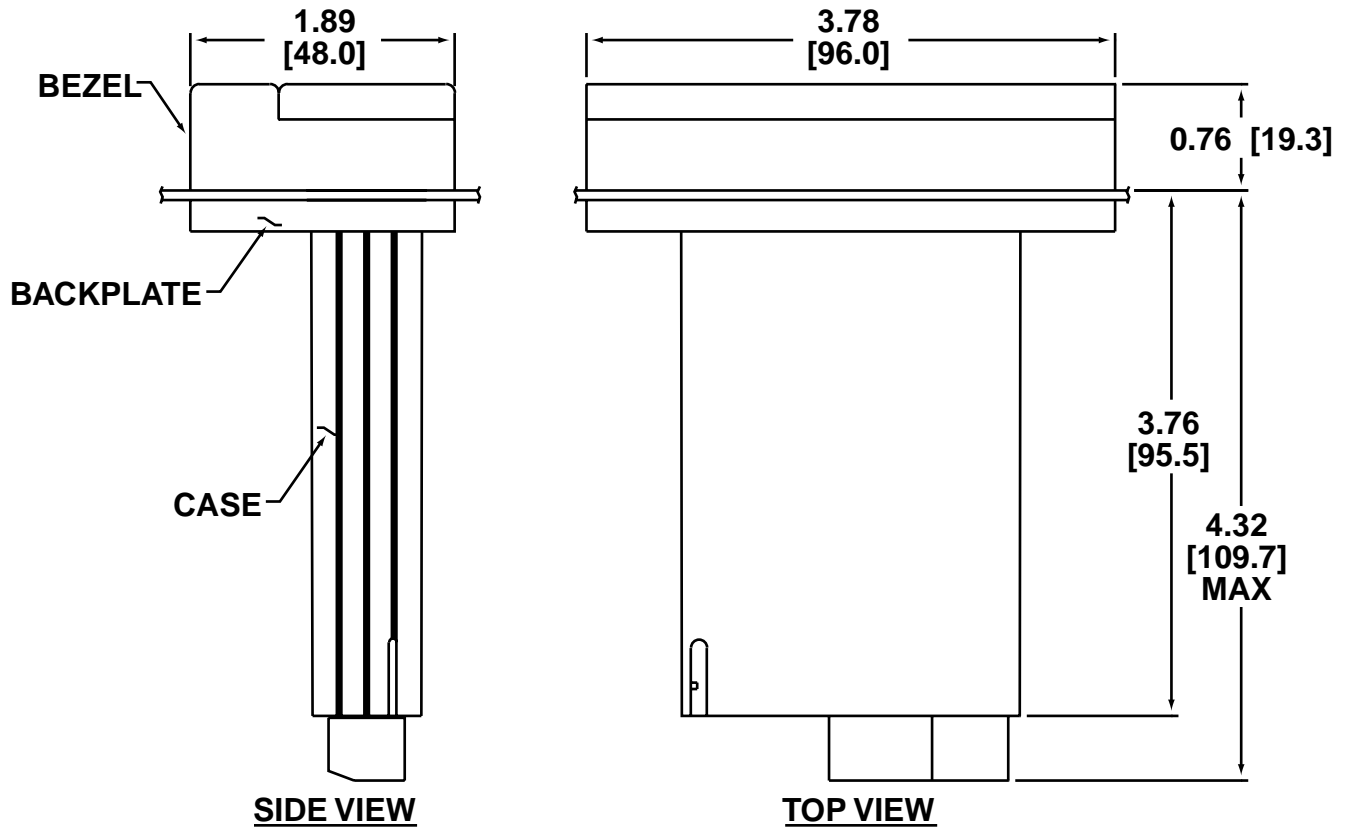
### ANALOG OUTPUT (linearized)

Voltage:.....1mV/count  
Calibration Error:..... ±1% of reading ± 1.0mV  
on °C, ± 1.8mV on °F  
Source Resistance:.....100Ω

### ANALOG TO DIGITAL CONVERSION

Technique:.....Dual-slope, average value  
Signal Integration Period: .....100 ms  
Read Rate:.....2.5/s





**Figure 5-1 Dimensions**

**TABLE 5-1****ACCURACY/RANGE TABLE**

<b>MODEL OPTION</b>	<b>MAXIMUM ERROR</b>	<b>RANGE</b>	<b>RESOLUTION</b>
*-JF1	2.7°F	-346 to +1400°F	1.0°F
*-JF2	1.8°F	-199.9 to +199.9°F	0.1°F
*-JC1	1.5°C	-210 to +760°C	1.0°C
*-JC2	1.0°C	-199.9 to +199.9°C	0.1°C
*-KF1	2.7°F	-157 to +1999°F	1.0°F
*-KF2	1.8°F	-199.9 to +199.9°F	0.1°F
*-KC1	1.5°C	-105 to +1372°C	1.0°C
*-KC2	1.0°C	-199.9 to +199.9°C	0.1°C
*-TF1	2.7°F	-157 to +752°F	1.0°F
*-TF2	1.8°F	-199.9 to +199.9°F	0.1°F
*-TC1	1.5°C	-105 to +400°C	1.0°C
*-TC2	1.0°C	-199.9 to +199.9°C	0.1°C
*-EF1	2.7°F	-157 to +1832°F	1.0°F
*-EF2	1.8°F	-199.9 to +199.9°F	0.1°F
*-EC1	1.5°C	-105 to +1000°C	1.0°C
*-EC2	1.0°C	-199.9 to +199.9°C	0.1°C

\* Look at Table 1-1, for complete models (preface section).

## SECTION 6 GLOSSARY

COMMON MODE REJECTION (CMR) - a measure of the affect of a voltage on the indicated display. It is the ratio of the common mode voltage to the measured voltage due to a common mode voltage.

COMMON MODE VOLTAGE (CMV) - the average of the voltage applied to both wires of a two wire or differential input.

NORMAL MODE REJECTION (NMR) - a measure of the rejection of unwanted signal due to a voltage applied between the wires of a two wire or differential input (shown as normal mode voltage). NMR is the ratio of the normal mode voltage to the measured voltage due to the normal mode voltage.

TEMPCO - abbreviation for temperature coefficient. It is the effect of changes in ambient temperature on a particular parameter, such as zero or span settings.



## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 1998 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of OMEGA ENGINEERING, INC.





OMEGAnet<sup>SM</sup> On-Line Service  
<http://www.omega.com>

Internet e-mail  
[info@omega.com](mailto:info@omega.com)

### Servicing North America:

**USA:**

ISO 9001 Certified

One Omega Drive, Box 4047  
Stamford, CT 06907-0047  
Tel: (203) 359-1660  
e-mail: [info@omega.com](mailto:info@omega.com)

FAX: (203) 359-7700

**Canada:**

976 Bergar  
Laval (Quebec) H7L 5A1  
Tel: (514) 856-6928  
e-mail: [info@omega.ca](mailto:info@omega.ca)

FAX: (514) 856-6886

### For immediate technical or application assistance:

**USA and Canada:**

Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA<sup>SM</sup>  
Customer Service: 1-800-622-2378 / 1-800-622-BEST<sup>SM</sup>  
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN<sup>SM</sup>  
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

**Mexico and**

**Latin America:**

Tel: (95) 800-TC-OMEGA<sup>SM</sup>  
En Español: (203) 359-7803

FAX: (95) 203-359-7807  
e-mail: [espanol@omega.com](mailto:espanol@omega.com)

### Servicing Europe:

**Benelux:**

Postbus 8034, 1180 LA Amstelveen, The Netherlands  
Tel: (31) 20 6418405  
Toll Free in Benelux: 0800 0993344  
e-mail: [nl@omega.com](mailto:nl@omega.com)

FAX: (31) 20 6434643

**Czech Republic:**

ul.Rude armady 1868, 733 01 Karvina - Hranice  
Tel: 420 (69) 6311899  
e-mail: [czech@omega.com](mailto:czech@omega.com)

FAX: 420 (69) 6311114

**France:**

9, rue Denis Papin, 78190 Trappes  
Tel: (33) 130-621-400  
Toll Free in France: 0800-4-06342  
e-mail: [france@omega.com](mailto:france@omega.com)

FAX: (33) 130-699-120

**Germany/Austria:**

Daimlerstrasse 26, D-75392 Deckenpfronn, Germany  
Tel: 49 (07056) 3017  
Toll Free in Germany: 0130 11 21 66  
e-mail: [germany@omega.com](mailto:germany@omega.com)

FAX: 49 (07056) 8540

**United Kingdom:**

ISO 9002 Certified

One Omega Drive,  
River Bend Technology Centre  
Northbank, Irlam,  
Manchester, M44 5EX, England  
Tel: 44 (161) 777-6611

FAX: 44 (161) 777-6622

Toll Free in England: 0800-488-488

e-mail: [info@omega.co.uk](mailto:info@omega.co.uk)

---

It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, patient connected applications.



This device is marked with the international hazard symbol. It is important to read the Setup Guide before installing or commissioning this device as it contains important information relating to safety and EMC.