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User's Guide

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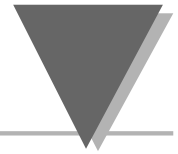
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The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

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 caution symbol. It is important to read the Setup Guide before installing or commissioning this device as the guide contains important information relating to safety and EMC.



PREFACE

Manual Objectives

This manual shows you how to set up and use the Programmable Digital RTD Meter.

Standard Procedures:

- * Checking voltage jumpers, or changing voltage power
- * Mounting the panel
- * Selecting the input type
- * Selecting a decimal point position
- * Setting the setpoint's active band
- * Selecting a latched or unlatched operation
- * Setting setpoint deadbands
- * Enabling/disabling setpoint changes
- * Enabling/disabling the RESET button in the run mode

Optional Procedures:

- * Setting input resolution
- * Enabling/disabling analog output
- * Selecting analog output as current or voltage
- * Selecting analog output or proportional control
- * Selecting proportional band
- * Using manual reset (offsetting setpoint errors)
- * Scaling analog output



For first-time users: Refer to the QuickStart Manual for basic operation and set-up instructions.



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NOTES, WARNINGS and CAUTIONS

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

- **NOTE**
- **WARNING**
- **CAUTION**
- **IMPORTANT**



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.



TIP: Provides you helpful hints.

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.

**Note**

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 receive the following items in the shipping box:

QTY	DESCRIPTION
1	Indicator/controller with all applicable connectors attached.
1	Owner's Manual
1	Set Mounting brackets
1	QuickStart Manual

**Note**

If you ordered any of the available options (except the "BL" Blank Lens option), they will be shipped in a separate container to avoid any damage to your indicator/controller.

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).

This instrument is a **panel mount** device protected in accordance with EN 61010-1:2001, electrical safety requirements for electrical equipment for measurement, control and laboratory. 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 main supply cord.



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

- 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.

Failure to follow all instructions and warnings may result in injury!

SECTION 2. ABOUT THE METER

2.1 DESCRIPTION

The Resistance Temperature Detector (RTD) meter is a value packed indicator/controller. Four full digits accurately display your temperature. Select from 2, 3 or 4 wire input configuration. Your meter may be a basic indicator or it may include analog output or dual relay output. Analog or dual relay output must be ordered at time of purchase. Analog output is fully scalable and may be configured as a proportional controller, or to follow your display. Dual 5 amp, form C relays control critical processes. Front panel peak detection and memory is also standard. A mechanical lockout has been included to guard against unauthorized changes.

2.2 STANDARD FEATURES

The following is a list of features:

- * 4-digit, three color programmable “Big” LED display or 4-digit, Standard LED Display
- * NEMA 4/Type 4 Front Bezel
- * $\pm 0.5^{\circ}$ C accuracy
- * Peak detection
- * Non-volatile memory-no battery backup
- * 115 or 230 V ac 50/60 Hz power supply or 10-32 Vdc or 26-56 Vdc

The following is a list of optional features

- * Dual 5 amps, form C relay outputs
- * Scalable analog output
- * Proportional control
- * Front-panel deviation correction
- * Easy setup for proportional control



Features with  are for the “B” version which has three-color programmable “Big” LED display - All segment characters shown are for the “B” version.

2.3 AVAILABLE ACCESSORIES

Table 2-1. Accessories and Add-Ons

Add-On Options

FS	Special Calibration/Configuration
SPC4	NEMA-4 Splash Proof Cover
SPC18	NEMA-4 Splash Proof Cover, NEW

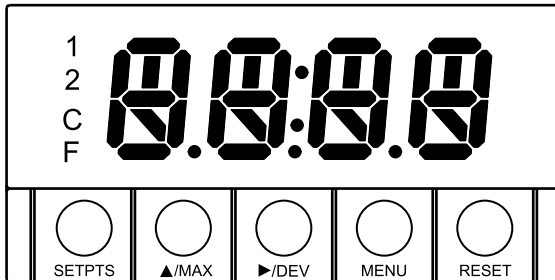
Accessories

TP1A	Trimplate panel adaptor. Adapts DIN1A/DIN2A cases to larger panel cutouts
RP18	19-In. Rack Panel for one (1) 1/8 DIN instrument
RP28	19-In. Rack Panel for two (2) 1/8 DIN instrument
RP38	19-In. Rack Panel for three (3) 1/8 DIN instrument

2.4 FRONT OF THE METER



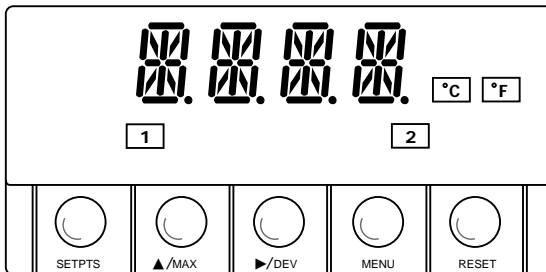
Figure 2-1 shows each part of the front of the three-color programmable “Big” LED display meter (Version B).



Digital LED Display:
 -1.9.9.9 or 9.9.9.9 4-digit
 three color programmable,
 21 mm (0.83") high LED
 display with programmable
 decimal point.

Figure 2-1. Front-Panel with Big Display

Figure 2-2 shows each part of the front of the standard LED display meter.



Digital LED Display:
 -1.9.9.9 or 9.9.9.9
 14 segment, 13.8 mm
 (0.54") high LED display
 with programmable
 decimal point.

Figure 2-2. Front-Panel with Standard Display

These meter display windows (both versions) light when appropriate:

- 1 - Setpoint 1 status
- 2 - Setpoint 2 status
- C - °C unit indicator
- F - °F unit indicator

5 Pushbuttons for programming the meter.

2.4 FRONT OF THE METER (Continued)

METER BUTTONS

SETPTS Button

This button functions only in the run mode. When the meter is in the run mode, press this button to sequentially recall the previous setpoint settings. After using the **▲/MAX** and **▶/DEV** buttons to alter these settings as desired, press the **SETPTS** button to store these new values.



Unless you press the **SETPTS** button within 20 seconds to store your input, the meter will scroll to setpoint 2 and retain the last value stored.

*If the dual relay option is not installed or if the "L.3=1" on the "LK.CF" menu, pressing the **SETPTS** button will display the meter's firmware version.*

▲/MAX Button

During the run mode, press the **▲/MAX** button to recall the PEAK reading since the last press of the **RESET** button. To return to the current readings without resetting the PEAK reading, press the **▲/MAX** button. To reset the PEAK reading, press the **RESET** button.

During the configuration mode, use the **▲/MAX** button to change the values of the flashing digit shown on the display and/or toggle between menu choices, such as "R.1=F" or "R.1=C". When configuring your setpoint values, press the **▲/MAX** button to increment the flashing digit from 0 to 9 by 1's.

▶/DEV Button

During the run mode press the **▶/DEV** button to display the deviation from setpoint 1.

When configuring your setpoint values, press the **▶/DEV** button to scroll to the next digit.

2.4 FRONT OF THE METER (Continued)

MENU Button

In the run mode, press the **MENU** button to terminate the current measuring process and enter you into the configuration mode.

In the configuration mode, press the **MENU** button to store changes in the non-volatile memory and then advance you to the next menu item.

RESET Button

If you hard reset or power off/on the meter, it shows "**RST**" followed by "**RTD**".

In the run mode, press the **RESET** button to reset the setpoints and display "**SP.RS**". If display shows peak value, press the **RESET** button to reset peak value. Display shows "**PK.RS**".

In the configuration mode, press the **RESET** button once to review the previous menu. Pressing the **RESET** button twice results in a hard reset and returns you to the run mode.

About The Meter

2.5 REAR OF THE METER

Figure 2-3 shows the connector label mounted at the top of the meter housing. Table 2-2 gives a brief description of each connector at the rear of the meter.

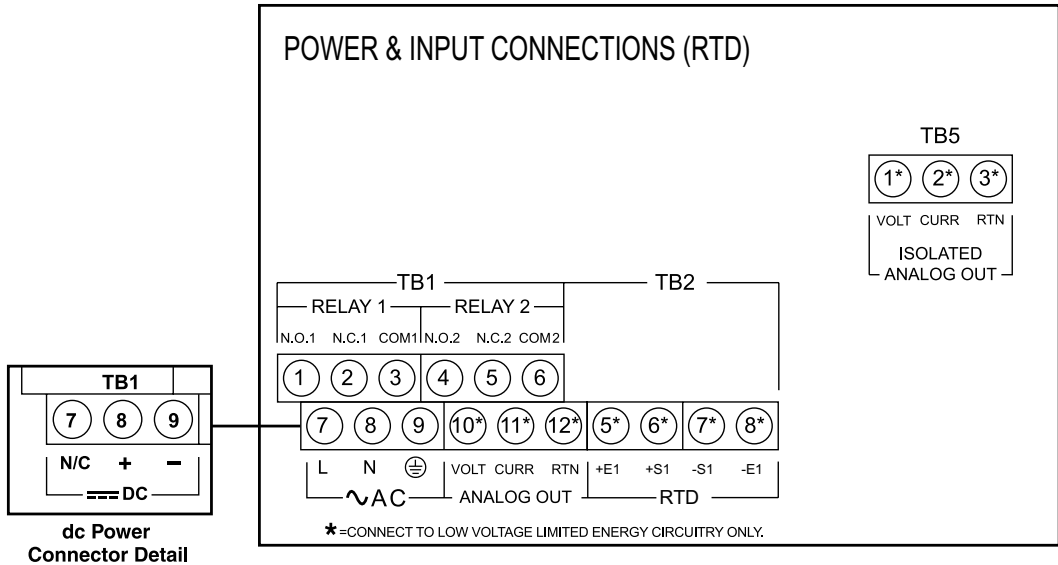


Figure 2-3. Connector Label (AC Powered and DC Powered Detail)

2.5 BACK OF THE METER (Continued)

Table 2-2. Rear Connector Description

Connector Description	
TB1-1	Setpoint 1: Normally open (N.O.1) connection
TB1-2	Setpoint 1: Normally closed (N.C.1) connection
TB1-3	Setpoint 1: Common (COM1) connection
TB1-4	Setpoint 2: Normally open (N.O.2) connection
TB1-5	Setpoint 2: Normally closed (N.C.2) connection
TB1-6	Setpoint 2: Common (COM2) connection
TB1-7	ac line connection (no connections on dc-powered units)
TB1-8	ac neutral connection (+ Input on dc-powered units)
TB1-9	ac Earth ground (-dc-power return on dc-powered units)
TB1-10	Analog 1 voltage output
TB1-11	Analog 2 current output
TB1-12	Analog 3 return
TB2-1	+E2: not used
TB2-2	+S2: not used
TB2-3	-S2: not used
TB2-4	-E2: not used
TB2-5	+E1: Positive excitation
TB2-6	+S1: Positive signal input
TB2-7	-S1: Negative signal input
TB2-8	-E1: Negative excitation
TB5-1	Isolated Analog Voltage Output
TB5-2	Isolated Analog Current Output
TB5-3	Isolated Analog Output Return

2.6 DISASSEMBLY

You may need to open up the meter for one of the following reasons:

- To check or change the 115 or 230 Vac power jumpers.
- To install or remove jumpers on the main board.

 **Note**

Disconnect the power supply before proceeding.

To remove and access the main board, follow these steps:

- Disconnect the main power from the meter.
- Remove the back case cover.
- Lift the back of the main board upwards and let it slide out of the case.

SECTION 3. GETTING STARTED



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

If you power off/on the meter, or perform a hard reset (press the **RESET** button twice), the meter shows "RST", followed by "RTD".

3.1 RATING/PRODUCT LABEL

This label is located on top of the meter housing (Refer to Figure 3-4).

3.2 MAIN BOARD POWER JUMPERS



Important: If you want to change the Factory preset jumpers, do the following steps; otherwise go to section 3.3.



Warning: Disconnect the power from the unit before proceeding. This device must only be reconfigured by a specially trained electrician with corresponding qualifications. Failure to follow all instructions and warnings may result in injury!

To check voltage jumpers, or to change from 115 V to 230 V ac:

1. Remove the main board from the case. Refer to Section 2.6.
2. Locate the solder jumpers W1, W2, and W3 (located near the edge of the main board alongside the transformer - refer to Figure 3-1).
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**.

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

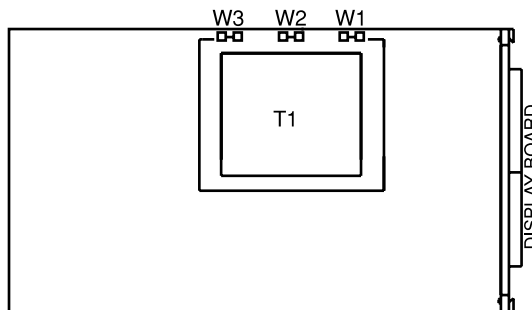


Figure 3-1. Main Board Power Jumpers (W1, W2, W3)

3.2 MAIN BOARD POWER JUMPERS (Continued)

Figure 3-2 shows the main board jumpers.

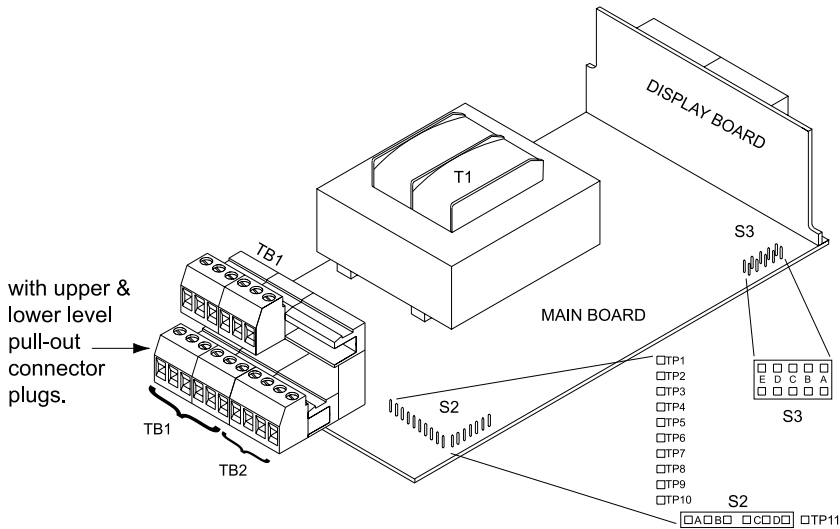


Figure 3-2. Main Board Jumper Positions (6 S2 Pins)

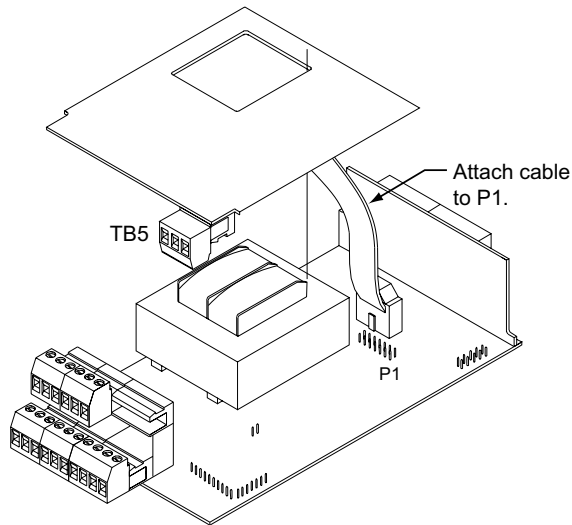


Figure 3-3. Upper Option Board Installation

3.2 MAIN BOARD POWER JUMPERS (Continued)

S2 jumpers are for sensor break indications:

- * S2A jumper is not used
- * S2B jumper is for positive sensor break (i.e. heating)
- * S2C & S2D are not used

S3 jumpers are used for the following (refer to Table 3-1):

- * To enable or disable the front panel push-buttons
- * To allow for an extremely low resistance load for analog output
- * To disable the **MENU** button
- * To perform calibration procedure

Test pins TP1 - TP11 are for testing purposes. Do not use as reading errors may result.

Table 3-1. S3 Jumper Functions

Jumper	Description
S3-A	Install to enable front panel push-buttons. Remove to disable all front panel push-buttons
S3-B	Removed. Install for factory calibration only.
S3-C	Normally removed. Install for analog voltage output when load is less than 1 KW impedance. Care should be taken when installing this jumper.
S3-D	Removed. Not used.
S3-E	If installed without S3-B, the MENU button locks out. If you press the MENU button, the meter shows "LOCK".

3.3 PANEL MOUNTING

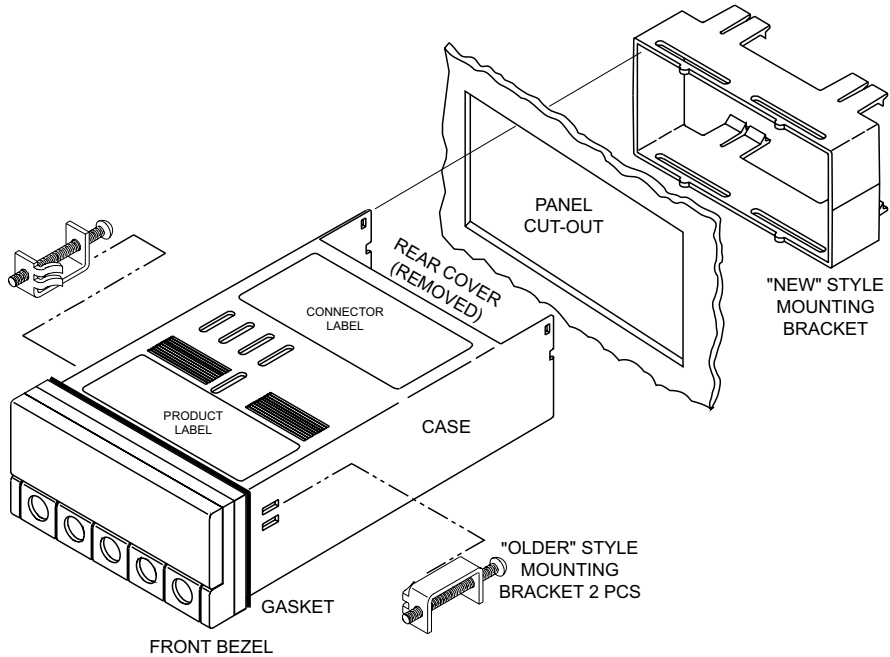
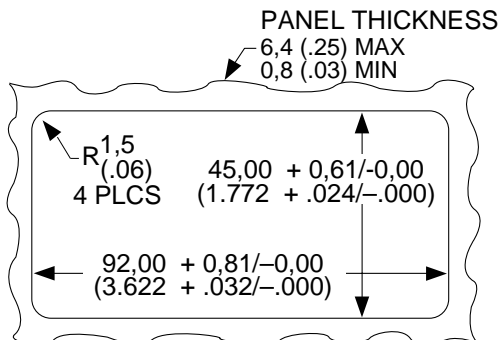


Figure 3-4. Meter - Exploded View

1. Cut a hole in your panel, as shown in Figure 3-4. For specific dimensions refer to Figure 3-5.
2. Insert the meter into the hole. Be sure the front bezel gasket is flush to the panel.
3. Slide on mounting bracket to secure.
4. Proceed to Section 3.4 to connect your sensor input and main power.



NOTE: Dimensions in Millimeters (Inches)

Figure 3-5. Panel Cut-Out

3.4 CONNECTING SENSOR INPUT

Figures 3-6 through 3-8 describe how to connect your sensors.

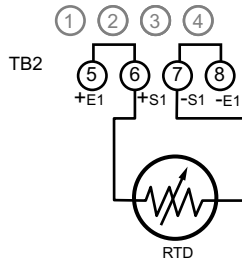


Figure 3-6. 2-Wire RTD Input Connection

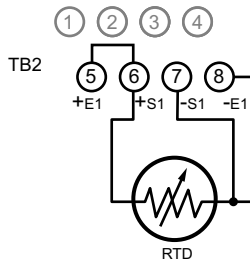


Figure 3-7. 3-Wire RTD Input Connection

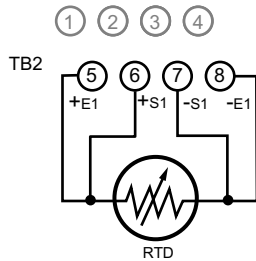


Figure 3-8. 4-Wire RTD Input connection

3.5 CONNECTING MAIN POWER

Connect the ac main power connections as shown in Figure 3-8.



Warning: Do not connect AC power to your device until you have completed all input and output connections. This device must only be installed by a specially trained electrician with corresponding qualifications. Failure to follow all instructions and warnings may result in injury!

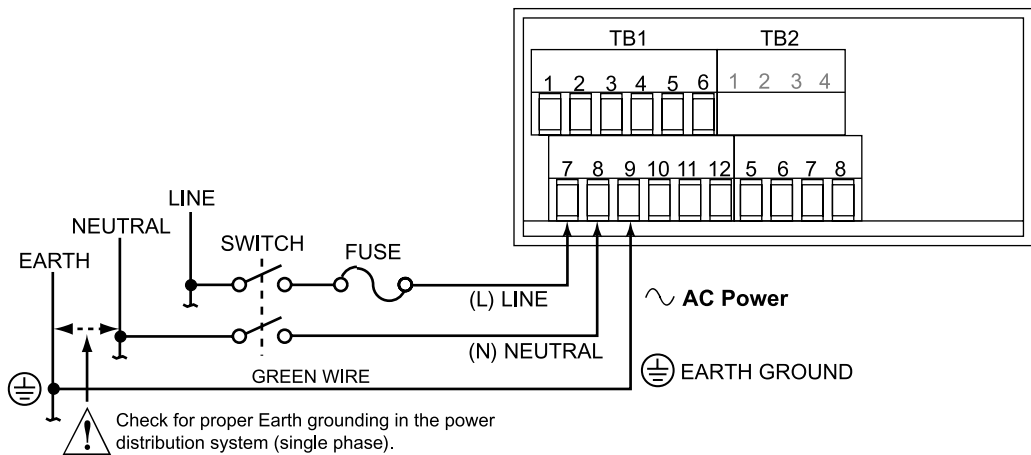


Figure 3-9. Main Power Connections - AC Powered Unit

Table 3-2 shows the wire color and respective terminal connections for both USA and Europe.

Table 3-2. Main Power Connection - AC Powered Unit

TB1	AC POWER	WIRE COLORS	
		EUROPE	USA
7	~ ac Line	Brown	Black
8	~ ac Neutral	Blue	White
9	~ ac Earth	Green/Yellow	Green

3.5 CONNECTING MAIN POWER (Continued)

Connect the dc main power connections as shown in Figure 3-10.

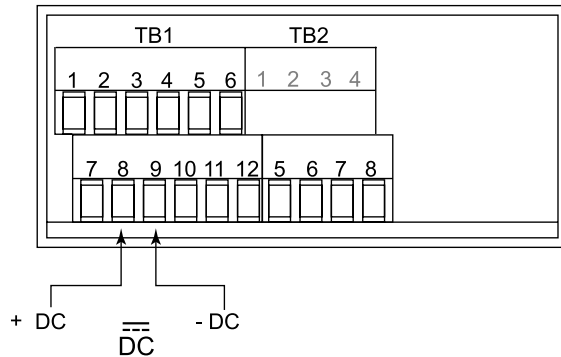


Figure 3-10. Main Power Connections - DC Powered Unit

3.6 ANALOG AND RELAY OUTPUT CONNECTIONS

If you have purchased a meter with analog or dual relay or isolated analog output, refer to the following figures for output connections.

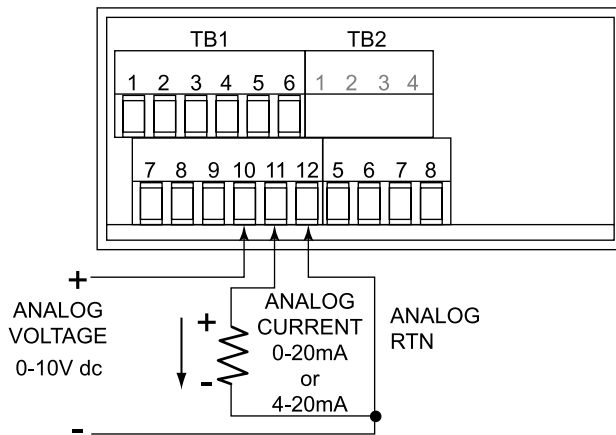


Figure 3-11. Analog Output Connections

3.6 ANALOG AND RELAY OUTPUTS (Continued)

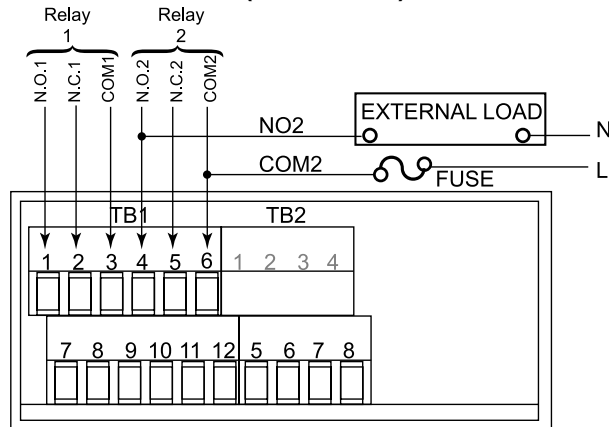


Figure 3-12. Relay Output Connections.

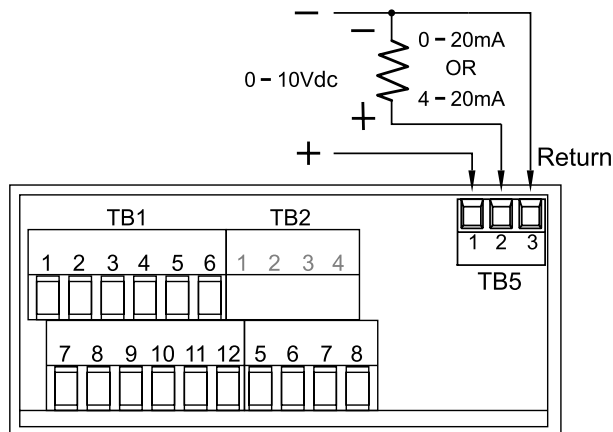


Figure 3-13. Isolated Analog Output Connections.

SECTION 4. CONFIGURING THE METER

Note USA

Refer to Table 6-1 for a summary list of menu configuration.

4.1 SELECTING THE INPUT TYPE (INPT)

To select your appropriate input type signal.

1. Press the **MENU** button until the meter shows "INPT" .
2. Press the **▶/DEV** button. The meter shows one of the following:
 - * "RTD.2" (2-wire RTD input)
 - * "RTD.3" (3-wire RTD input)
 - * "RTD.4" (4-wire RTD input)
3. Press the **▲/MAX** button to scroll through available choices.
4. Press the **MENU** button to store your choices. The meter momentarily shows "STRD", followed by "DEC.P" (Decimal point).

4.2 DECIMAL POINT POSITION (DEC.P)

To select a decimal point display position.

1. Press the **MENU** button until the meter shows "DEC.P".
2. Press the **▶/DEV** button. The meter shows one of the following:
 - * FFFF.
 - * FFF.F
3. Press the **▲/MAX** button to scroll between choices.
4. Press the **MENU** button to store your choices. The meter momentarily shows "STRD", followed by "RD.CF" (Reading Configuration).

Note USA

When you change the decimal position the meter adjusts setpoints, deadbands, proportional band, and manual reset values. These adjustments are made according to the new decimal point. If one or more of these values overflow the meter flashes "ER2" when you store a new decimal point position.

AUTOMATIC DECIMAL POINT ADJUST

If you select 0.1 degree resolution the decimal point automatically adjusts itself to 1 degree if the temperature reading is above 999.9 or below -199.9.

4.3 READING CONFIGURATION ("RD.CF")

To determine if your meter shows in °F (Fahrenheit) or °C (Celsius).

1. Press the **MENU** button until the meter shows "**RD.CF**".
2. Press the **▶/DEV** button. The meter shows one of the following:
 - * "R.1=F" (°F)
 - * "R.1=C" (°C)
3. Press the **▲/MAX** button to toggle between choices.
4. Press the **MENU** button to store your selection. The meter momentarily shows "**STRD**", followed by "**S1.CF**" (Setpoint 1 Configuration).

4.4 COLOR CONFIGURATION ("COLR")

Note

Refer to Table 6-1 for a summary list of menu configuration.

Selecting "Display Color" is not active unless your meter is a Version "B".

To select a display color, follow these steps:

1. Press the **MENU** button until the meter shows "**COLR**".
2. Press the **▶/DEV** button. The meter shows one of the following:
 - "GRN"
 - "REd"
 - "AMbR"
3. Press the **▲/MAX** button to scroll between available choices.
4. Press the **MENU** button to store your choice. The meter momentarily shows "**StRd**", followed by the next menu "**S1.CF**" (Setpoint 1 Configuration). Or you can press the **RESET** button to abort and go back to the "**Rd.CF**" menu.

Configuring The Meter

4.5 SETPOINT 1 CONFIGURATION (S1.CF)

Setpoint 1 is not active unless your meter has dual relay output capabilities. The LED's will display whether the (S1.CF) is active or not. You may use Setpoint 1 Configuration (S1.CF) for the following:

- * To set the setpoint's active band above or below your chosen value
 - * To select whether the setpoint operation is latched or unlatched
1. Press the **MENU** button until the meter shows "**S1.CF**".
 2. Press the **▶/DEV** button. The meter shows one of the following:
 - * "S.1=A" (Active above the setpoint)
 - * "S.1=B" (Active below the setpoint)
 3. Press the **▲/MAX** button to toggle between choices.
 4. Press the **▶/DEV** button again. The meter shows one of the following:
 - * "S.2=L" Setpoint 1 to be latched
 - * "S.2=U" Setpoint 1 to be unlatched
 5. Press the **▲/MAX** button to toggle between choices.
 6. Press the **MENU** button to store your choices. The meter momentarily shows "**STRD**", followed by "**S2.CF**" (Setpoint 2 Configuration).

4.6 SETPOINT 2 CONFIGURATION (S2.CF)

Setpoint 2 is not active unless your meter has dual relay output capabilities. The LED's will display whether the (S2.CF) is active or not. You may use Setpoint 2 Configuration (S2.CF) for the following:

- * To set the setpoint's active band above or below your chosen value
 - * To select whether the setpoint operation is latched or unlatched
1. Press the **MENU** button until the meter shows "**S2.CF**".
 2. Press the **▶/DEV** button. The meter shows one of the following:
 - * "S.1=A" (Active above the setpoint)
 - * "S.1=B" (Active below the setpoint)
 3. Press the **▲/MAX** button to toggle between choices.
 4. Press the **▶/DEV** button again. The meter shows one of the following:
 - * "S.2=L" Setpoint 1 to be latched
 - * "S.2=U" Setpoint 1 to be unlatched
 5. Press the **▲/MAX** button to toggle between choices.
 6. Press the **MENU** button to store your choices. The meter momentarily shows "**STRD**", followed by "**S1.DB**" (Setpoint 1 Deadband).

4.7 SETPOINT 1 DEADBAND (S1.DB)

Setpoint 1 Deadband is not active unless your meter has dual relay output capabilities. The LED's will display whether the (S1.DB) is active or not. To set the deadband (hysteresis) of Setpoint 1, follow these steps:

1. Press the **MENU** button until the meter shows "**S1.DB**".
2. Press the **▶/DEV** button. The meter shows the last previously stored 4-digit number (0000 through 9999) with flashing 4th digit.
3. Press the **▲/MAX** button to change the value of the flashing digit. If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
4. Press the **▶/DEV** button to scroll to the next digit.
5. Press the **MENU** button to store value. The meter momentarily shows "**STRD**", followed by "**S2.DB**" (Setpoint 2 Deadband)

Configuring The Meter

4.8 SETPOINT 2 DEADBAND (S2.DB)

Setpoint 2 Deadband is not active unless your meter has dual relay output capabilities. The LED's will display whether the (S2.DB) is active or not. To set the deadband (hysteresis) of Setpoint 2, follow these steps:

1. Press the **MENU** button until the meter shows "**S2.DB**".
2. Press the **▶/DEV** button. The meter shows the last previously stored 4-digit number (0000 through 9999) with flashing 4th digit.
3. Press the **▲/MAX** button to change the value of the flashing digit. If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
4. Press the **▶/DEV** button to scroll to the next digit.
5. Press the **MENU** button to store your selection. "**STRD**" momentarily displays, followed by cold junction offset if you have a standard meter (refer to Section 4.13) or "**OT.CF**" (Output Configuration) if you have analog output capabilities (refer to Section 4.9).

4.9 OUTPUT CONFIGURATION (OT.CF)

Output Configuration is not active unless your meter has analog output capabilities. The menu will display whether analog output is present or not. Use Output Configuration (OT.CF) to select the following:

- * To enable or disable the analog output
- * To determine if the analog output is current or voltage
- * To determine if the analog output is a retransmission of the display or proportional to the error (the difference between reading and setpoint value)

4.9.1 To Enable or Disable The Analog Output

1. Press the **MENU** button until the meter shows "**OT.CF**".
2. Press the **▶/DEV** button. The meter shows one of the following:
 - * "O.1=D" (Analog output disabled)
 - * "O.1=E" (Analog output enabled)
3. Press the **▲/MAX** button to toggle between choices.
4. Press the **▶/DEV** button to select analog output as current/voltage or press the **MENU** button to store your choice. The meter momentarily shows "**STRD**", followed by "**OT.S.O**" (Output Scale and Offset - refer to Section 4.12).

Configuring The Meter

4.9.2 To Select Analog Output as Current or Voltage

1. Press the **▶/DEV** button. The meter shows one of the following:
 - * "O.2=V" (Analog output = voltage)
 - * "O.2=C" (Analog output = current)
2. Press the **▲/MAX** button to toggle between choices.
3. Press the **▶/DEV** button to select analog output/proportional or press the **MENU** button to store your choice. The meter momentarily shows "**STRD**", followed by "**OT.S.O**" (Output Scale and Offset - refer to Section 4.12) or "**P.BND**" (Proportional Band - refer to Section 4.10).

4.9.3 To Select Analog Output or Proportional Control

To determine if the meter is to transmit an analog signal out (proportional to your display), or serve as a proportional controller (proportional to the error = display - setpoint 1).

1. Press the **▶/DEV** button. The meter shows one of the following:
 - * "O.3=A" (Analog output is retransmission of temperature)
 - * "O.3=P" (Analog output is proportional)

Note 

This will only display if Relay and Analog Output Options are purchased.

2. Press the **▲/MAX** button to toggle between choices.
- 3a. If you select O.3 to equal A, press the **MENU** button to store your choice. The meter momentarily shows "**STRD**", followed by "**OT.S.O**" (Output Scale and Offset- refer to Section 4.12).
- 3b. If you select O.3 to equal P, press the **▶/DEV** button. The meter shows one of the following:
 - * "O.4=D" (Proportional analog output is DIRECT ACTING)
 - * "O.4=R" (Proportional analog output is REVERSE ACTING).
4. Press the **▲/MAX** button to toggle between choices.
5. Press the **MENU** button to store your choice. The meter momentarily shows "**STRD**", followed by "**P.BND**" (Proportional Band).

Additionally, if you select O.2 to equal V (Analog output to be voltage), press the **▶/DEV** button. The meter shows one of the following:

 - * "O.5=F" (Proportional 0-10 V analog output)
 - * "O.5=H" (Proportional 0-5 V analog output)
6. Press the **▲/MAX** button to toggle between choices.
7. Press the **MENU** button to store your choice(s). The meter momentarily shows "**STRD**", followed by "**P.BND**" (Proportional Band).

Configuring The Meter

4.10 PROPORTIONAL BAND (P.BND)

Proportional controls are designed to eliminate the cycling associated with on-off control. A proportional controller decreases the average power being supplied to the heater, as the temperature approaches setpoint. This has the effect of slowing down the heater, so that it will not overshoot the setpoint, but will approach the setpoint and maintain a stable temperature. This proportioning action can be accomplished by turning the output on and off for short intervals. This "time proportioning" varies the ratio of "on" time to "off" time to control the temperature.

The time period between two successive turn-ons is known as the "cycle time" or "duty cycle". The proportioning action occurs with a "proportional band" around the setpoint temperature. Outside this band, the controller functions as an on-off unit, with the output either fully on (below the band) or fully off (above the band). However, within the band, the output is turned on and off in the ratio of the measurement difference from the setpoint. At the setpoint (the midpoint of the proportional band), the output on-off ratio is 1:1 that is, the on-time and off-times vary in proportion to the temperature difference. If the temperature is below setpoint, the output will be on longer. If the temperature is too high, the output will be off longer.

The proportional band is usually expressed as a percent of full input range scale, or in degrees. It may also be referred to as gain, which is the reciprocal of the band. In many units, the cycle time and/or proportional bandwidth are adjustable, so that the controller may be better matched to a particular process.

Proportional controllers have a manual reset (trim) adjustment, which may be used to adjust for an offset between the steady state temperature and the setpoint.

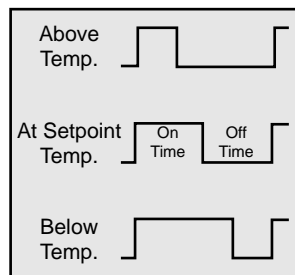


Figure 4.1 Proportional Band

In addition to electromechanical and solid state relay outputs, proportional controllers are also available with proportional analog signal outputs, such as 4 to 20mA or 0 to 5 Vdc. With these outputs, the actual output level amplitude is varied, rather than the proportion of on and off times.

To select the proportional band for your proportional controller.

Note

"P.BND" only shows if you select analog output as proportional.

1. Press the **MENU** button until the meter shows "**P.BND**".
2. Press the **▶/DEV** button. The meter shows the last previously stored 4-digit number (0000 through 9999) with flashing 4th digit.
3. Press the **▲/MAX** button to change the value of the flashing digit.
If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
4. Press the **▶/DEV** button to scroll to the next digit.
5. Press the **MENU** button to store your selection. The meter momentarily shows "**STRD**", followed by "**M.RST**" (Manual Reset).

4.11 MANUAL RESET (M.RST)

Manual Reset (M.RST) is not active unless your meter has analog output capabilities. The menu will display whether analog output is present or not. This feature allows you to offset the error that may occur within your setpoint. In order to determine the amount of error, you must compare your display value to the setpoint 1 value. The difference between these two values is the amount of error that you may want to enter into Manual Reset (M.RST).

**Note**

"M.RST" only shows if you select analog output as proportional.

1. Press the **MENU** button until the meter shows "**M.RST**".
2. Press the **▶/DEV** button. The meter shows last previously stored 4-digit number (-1999 through 9999) with flashing 4th digit.
3. Press the **▲/MAX** button to change the value of the flashing digit.
If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
4. Press the **▶/DEV** button to scroll to the next digit.
5. Press the **MENU** button to store your selection. The meter momentarily shows "**STRD**", followed also momentarily by "**RST**" (Reset).

Always choose the value of "**M.RST**" less than "**P.BND/2**". meter will not accept larger values and displays with flashing "**ER 4**".

Configuring The Meter

4.12 OUTPUT SCALE AND OFFSET (OT.S.O)

Output Scale and Offset (OT.S.O) is not active unless your meter has analog output capabilities. The menu will display whether analog output is present or not. Output Scale and Offset (OT.S.O) scales your analog output to be equal to the meter's display and/or any engineering units you require. You may scale the output for direct (4-20 mA, 0-10 V, etc) or reverse acting (20-4 mA, 10-0 V, etc).

Note

"OT.S.O" only shows if you select analog output as a retransmission of temperature.

1. Press the **MENU** button until the meter shows "**OT.S.O**".
2. Press the **▶/DEV** button. The meter shows "**RD 1**" (Read 1).

Note

This is your first point of display reading.

3. Press the **▶/DEV** button again. The meter shows the last previously stored 4-digit number (-1999 through 9999) with flashing 4th digit.
4. Press the **▲/MAX** button to change the value of Read 1.
5. Press the **▶/DEV** button to scroll to the next digit.
6. Press the **MENU** button to store your selection. The meter shows "**OUT.1**" (Output 1).

Note

This starting analog signal corresponds to your Read 1 display.

7. Press the **▶/DEV** button. The meter shows selected output.

Note

*If you select "**O.2=V**" for voltage, the maximum signal you may select is 10.00 for an 0-10 V dc signal output. If you select "**O.2=C**" for current, the maximum signal you may select is 19.99.*

8. Press the **▲/MAX** button to enter the output 1 signal selection. If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
9. Press the **▶/DEV** button to scroll to the next digit.
10. Press the **MENU** button to store your selection. The display shows "**RD 2**" (Read 2).

Note

This is your second point of display reading.

4.12 OUTPUT SCALE AND OFFSET (OT.S.O) (Continued)

11. Press the **▶/DEV** button. The last previously stored 4-digit number (-1999 through 9999) displays with flashing 4th digit.
12. Press the **▲/MAX** button to change the value of the flashing digit. If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
13. Press the **▶/DEV** button to scroll to the next digit.
14. Press the **MENU** button to store your selection. "OUT.2" (Output 2) displays.

Note

This analog signal should correspond to your Read 2 display.

15. Press the **▶/DEV** button. Selected output displays.

Note

If you select "O.2=V" for voltage, the maximum signal you may select is 10.00 for an 0 to 10 V dc signal output. If you select "O.2=C" for current, the maximum signal you may select is 19.99 for a 0 to 20 or 4 to 20 mA dc signal output.

16. Press the **▲/MAX** button to change the value of the flashing digit. If you continue to press the **▲/MAX** button, the flashing digit's value continues to change.
17. Press the **▶/DEV** button to scroll to the next digit.
18. Press the **MENU** button to store your selection. The meter momentarily shows "STRD", followed also momentarily by "RST" (Hard Reset). Meter then returns you to the "RUN" mode.



WARNING: *If the meter displays all flashing values on any item, the value has overflowed. Press the **▲/MAX** button to start new values.*

4.13 RTD TEMPERATURE OFFSET (T.OFF)

A new item has been added to calibrate for any offset error due to the RTD. This item will enable you to compensate any temperature offset due to the RTD transducer:

OFFSET = ACTUAL TEMPERATURE - DISPLAY TEMPERATURE

1. Press the **MENU** button until "**T.OFF**" displays.
2. Press the **▶/DEV** button. Previous offset value with digit 4 flashing will be displayed.
3. Press the **▶/DEV** button again. Reading temperature will be displayed (with no digit flashing).
4.
 - a. If the value is okay, then press the **MENU** button. Display will show "**STRD**" and 0 value will be entered at the offset.
 - b. If the value is not okay, then enter the actual temperature using the **▶/DEV** and the **▲/MAX** buttons.
5. Press the **MENU** button to store the changes.

Note

- a. *Temperature unit is either celsius or fahrenheit and will always be displayed at 0.1 degree resolution. The meter flashes corresponding LED.*
- b. *MAX/MIN offset value will be $\pm 25.0^{\circ}\text{C}$ or 45.0°F . If offset the limit, the meter will flash "**ER 3**" and previous offset will not be changed.*

4.14 LOCK OUT CONFIGURATION (LK.CF)

Use Lock Out Configuration (LK.CF) for the following:

- * To enable or disable setpoint changes
- * To enable or disable the **RESET** button in the run mode.

4.14.1 To Enable or Disable the RESET button in the Run Mode

1. If accessing this function from the main menu, press the **MENU** button until the meter shows "LK.CF". Otherwise, proceed to step 2.
2. Press the **▶/DEV** button until the meter shows "SP.=E" .
3. Press the **▶/DEV** button again. The meter shows "RS.=E" .
4. Press the **▲/MAX** button to toggle between:
"RS.=E" To enable the **RESET** button in the run mode
"RS.=D" To disable the **RESET** button in the run mode
5. Once desired mode shows, press the **MENU** button to store the change. The meter returns to the run mode.

4.14.2 To Enable or Disable Setpoint Changes

1. Press the **MENU** button until the meter shows "LK.CF" (after "O.T.S.O").
2. Press the **▶/DEV** button. The meter shows "SP.=E".
3. Press the **▲/MAX** button to toggle between:
"SP.=E" To enable setpoint changes
"SP.=D" To disable setpoint changes
4. Once desired mode shows, press the **MENU** button to store the change.

4.14.3 To Enable Display's Program Version

1. Press the **▶/DEV** button. The meter shows one of the following:
 - * "L.3=0" **"SETPTS"** button will display setpoint values.
 - * "L.3=1" **"SETPTS"** button will display "v.-03" which is the meter's current software version.
2. Press the **▲/MAX** button to toggle between the choices above.
3. Press the **MENU** button to store the changes.

Note 

*If your meter does not have the relay option, setpoint menu items above will not be available and **SETPTS** button will always display the meter's software version. These units will have **+OL** (overload) or **+OPEN** memory indicated by Alarm 1 & 2 LED displays. LEDs can be reset by pressing **MENU** then **RESET** button or by power **OFF** then **ON**. These units can not use analog output proportional to error from setpoint 1, under menu OT.CF, 0.3=P.*

Configuring The Meter

4.15 BRIGHTNESS CONFIGURATION (bRit)

Note 

Refer to Table 6-1 for a summary list of menu configuration.

Changing “Display Brightness” is not active unless your meter is a Version “B”.

1. Press the **MENU** button until the meter shows “bRit” (after “LK.CF”).
2. Press the **▶/DEV** button from “bRit”. The meter shows one of the following:
 - “M.brt” Medium Brightness
 - “L.brt” Low Brightness
 - “H.brt” **High Brightness** (Default)
3. Press the **▲/MAX** button to toggle between available choices.
4. Press the **MENU** button to store your selection. The meter momentarily shows “StRd” followed by “StRd”, “RSt”, “Rtd”, then measured value.

4.16 TUNING PROPORTIONAL CONTROLLER (TUNE)

The Proportional Controller is not active unless your meter has analog output capabilities. The menu will display whether analog output is present or not. This function allows you to tune your controller. Select proportional on Output Configuration (refer to Section 4.9.3) prior to tuning your controller. Include the meter in the process loop and turn on the meter. Allow enough time for the system to settle.

1. Press the **▶/DEV** button. The meter momentarily shows “DEV” followed by a blinking value. This value is the deviation (error) between Reading and Setpoint 1 values. If this error is zero, your controller is tuned. If a value other than zero shows, proceed with step 2.
2. Press **RESET** button. The meter shows “TUNE”, tuning your controller and canceling any error. Once tuned, the meter shows “RST” and returns to the run mode.

Note 

“TUNE” will be active if your meter has analog output and/or relay output capabilities.

3. Allow enough time for process to settle. Press the **▶/DEV** button. Verify that blinking value is zero. If blinking value is not zero, repeat step 2.

SECTION 5. DISPLAY MESSAGES

Table 5-1. Display Messages

MESSAGE	DESCRIPTION
RTD	RTD Meter
RST	Hard (power on) reset
INPT	Input type
DEC.P	Decimal point
ER2	One or more the following items have overflowed because of decimal point change: setpoint values, setpoint deadbands, proportional bands or manual reset.
RD.CF	Reading configuration
COLR	Display color
S1.CF	Setpoint 1 configuration
S2.CF	Setpoint 2 configuration
S1.DB	Setpoint 1 deadband
S2.DB	Setpoint 2 deadband
OT.CF	Output Configuration
P.BND	Proportional band
M.RST	Manual reset
ER4	Manual reset error
OT.S.O	Output scale and offset
T.OFF	RTD temperature offset
ER3	RTD temperature offset limit
LK.CF	Lock out configuration
+OL	+ Overload signal
-OL	- Overload signal
TUNE	Tuning proportional controller
OPN	Sensor breaker or temperature outside the range
bRit	Display brightness
+999	Value overflow in setpoint/menu peak deviation routines
-1999	Value overflow in setpoint/menu peak deviation routine
ER1	2 coordinate format programming error
PEAK	Peak value
PK.RS	Peak reset
SP.RS	Reset setpoints
TUNE	Tuning proportional controller
SP1	Setpoint 1 value
SP2	Setpoint 2 value
v.- θ . θ	Firmware version (where θ is 0~9)

Menu Configuration

SECTION 6. MENU CONFIGURATION

Not all menu items display on standard meters.

Table 6-1. Menu Configuration

(Defaults in Bold and Italics)



MENU	▶/DEV	▲/MAX
INPT Input Type	Shows input choices:	RTD.2 2-wire RTD 100 Ω PT., DIN standard RTD.3 3-wire RTD 100 Ω PT., DIN standard RTD.4 4-wire RTD 100 Ω PT., DIN standard
DEC.P Decimal Point	Shows decimal point position	FFFF FFF.F
RD.CF Reading Configuration	R.1	C: Celsius F: Fahrenheit
 COLR Display Color Selection	Shows input choices:	GRN (Green) RED (Red) AMBR (Amber)
S1.CF Setpoint 1 Configuration	S.1	A: Active above B: Active below
	S.2	U: Unlatched L: Latched
S2.CF Setpoint 2 Configuration	S.1	A: Active above B: Active below
	S.2	U: Unlatched L: Latched
S1.DB Setpoint 1 Deadband	Press to scroll to the next digit to the right	Press to change the value of the flashing digit
S2.DB Setpoint 2 Deadband	Press to scroll to the next digit to the right	Press to change the value of the flashing digit

Table 6-1 Continued

(Defaults in Bold and Italics)

MENU	▶/DEV	▲/MAX
OT.CF Output Configuration Analog Output	0.1	D: Disabled E: Enabled
	0.2	V: Voltage analog out C: Current analog out
	0.3	A: Retransmission of temperature P: Proportional to error
	0.4	D: Proportional analog output is direct reading R: Proportional analog output is reverse acting
	0.5	F: 0-10 V proportional H: 0-5 V proportional
	 Note	*If you select 0.2=V, you may select your analog output to be 0-10 V or 0-5V by accessing sub-menu 0.5=F or 0.5=H *If 0.3=P, you may select your proportional output analog to be direct 0.4=D (4-20 mA, 0-5 V, 0-10 v) or reverse acting 0.4=R (20-4 mA, 5-0 V, 10-0 V) .
P.BND Proportional Band shown if 0.3 = P	Shows prior value entered. Scrolls to the next digit to the right	Changes the value of the flashing digit
M.RST Manual Reset shown if 0.3 = P	Shows prior value entered. Scrolls to the next digit to the right	Changes the value of the flashing digit

Menu Configuration

Not all menu items display on standard meters.

Table 6-2. Front Panel Displays

(Defaults in Bold and Italics)

MENU	►/DEV	▲/MAX
OT.S.O Output Scale & Offset Enter new value & show " OUT1 " Enter new value & show " RD 2 " Enter new value & show " OUT2 "	Show "RD 1" & prior value Scroll right one digit Show prior value Scroll right one digit Show prior value Scroll right one digit Show prior value	Change flashing digit's value Change flashing digit's value Change flashing digit's value Change flashing digit's value
T.OFF RTD Temperature Offset	Show actual or prior value	Change flashing digit's value
LK.CF Lock Out Configuration	RS= SP= L3=	<i>E</i> (<i>Enable RESET button in run mode</i>) <i>D</i> (<i>Disable RESET button in run mode</i>) <i>E</i> (<i>Enable setpoint changes</i>) <i>D</i> (<i>Disable setpoint changes</i>) <i>0</i> (<i>SETPTS button display setpoint values</i>) <i>1</i> (<i>SETPTS button display firmware version v.-B.B where B is 0~9</i>)
bRlt Brightness Configuration		<i>M.brt</i> (Medium Brightness) <i>L.brt</i> (Low Brightness) <i>H.brt</i> (<i>High Brightness</i>)



Menu Configuration

Not all menu items display on standard meters.

Table 6-2. Front Panel Displays (Continued)



DISPLAY	▶/DEV	▲/MAX	RESET	DESCRIPTION
PEAK Peak Reading		Displays the peak reading and must be pressed again to return to the normal operating mode without resetting.	Reset the peak reading when in this mode.	Peak Reading Displays the highest reading since last reset.
DEV	Press to activate		Tare proportional controller or exit deviation mode	Shows deviation value.
SP.RS				LATCHED RESET Press RESET button to reset your setpoints. WARNING! This resets your tare if you are using this mode.

Table 6-3. Run Mode Displays

MENU	▶/DEV	▲/MAX	DESCRIPTION
SP 1 Setpoint 1	Press to scroll to the next digit to the right	Press to change the value of the flashing digit	SETPOINT 1 Select from -1999 through 9999
SP 2 Setpoint 2	Scroll right one digit	Press to change the value of the flashing digit	SETPOINT 2 Select from -1999 through 9999

SECTION 8. SPECIFICATIONS

SIGNAL INPUT

Input:	RTD 100 ohm Pt (DIN Platinum)
Temperature range:	-200° to 850°C (-328 to 1562°F)
Alpha:	0.00385 (DIN 43760)
Lead Resistance for Specified Accuracy:	2 Wire Up to 100 milliohm/lead 3 Wire Up to 10 ohms/lead balanced 4 Wire Up to 20 ohms/total unbalanced
Isolation:	Dielectric strength to 2500V transient per 3mm spacing based on EN 61010 for 260Vrms or dc working voltage
Noise Rejection:	Normal Mode Rejection (NMR) = 60dB Common Mode Rejection (CMR) = 120dB
Protection:	240 V rms max for RTD input ranges
“Big” Display:	4-digit, three color programmable 9-segment LED 21 mm (0.83”)
Symbol:	 (-1.9.9.9~9.9.9.9)
Standard Display:	4-digit, 14-segment LED, 13.8 mm (0.54”)
Symbol:	 (-1.9.9.9.~9.9.9.9.)

ANALOG TO DIGITAL

Technique:	Dual slope
Internal resolution:	15 bits
Read rate:	3/sec
Polarity:	Automatic

ACCURACY AT 25°C

Accuracy:	±0.50°C after 30 minute warm-up
Step response:	1-2 seconds

Specifications

ANALOG OUTPUT (if applicable)

Signal type:	Current or voltage
Signal level:	Current: 10 V max compliance at 20 mA output Voltage: 20 mA max for 0-10 V output
Function:	May be assigned to a display range or proportional control output with setpoint #1 when used as a control output.
Linearity:	0.2%
Load Regulation:	1.1%
Line Regulation:	0.02% /V ac
Step Response Time:	2 - 3 seconds to 99% of the final value

INPUT POWER INFORMATION:

~ AC units	115/230 V~(AC) $\pm 10\%$, 50/60 Hz 7 W max, power consumption (Non-Isolated Analog Output) 8 W max, power consumption (Isolated Analog Output)
== DC units	10-32 Vdc 6 W max, power consumption (Non-Isolated Analog Output) 7 W max, power consumption (Isolated Analog Output)

External Fuse Required:

IEC 127-2/III	
Power	Fuse
115 V	125 mA @ 250 (T)
230 V	63 mA @ 250 (T)
UL 248-14 (Listed Fuse)	
Power	Fuse
115 V	175 mA @ 250 V Slow-Blow
230 V	80 mA @ 250 V Slow-Blow

ENVIRONMENT

Operating temperature:	0 to 50°C (32° to 122°F)
Storage temperature:	-40° to 85°C (-40° to 185°F)
Relative humidity:	90% at 40°C (non-condensing)

MECHANICAL

Panel cutout:	1/8 DIN 3.62 x 1.78" (92 x 45 mm)
Weight:	1.27 lb (574 g)
Case material:	Polycarbonate, 94 V-O UL rated
Protection:	NEMA-4/Type 4 Front Bezel

ALARM OUTPUTS (if applicable)

2 Form "C" on/off relays. Configurable for latched and unlatched by software.

Max current: 5 AMPS, resistive load.

Max voltage: 250 V ac or 30 V dc

ISOLATED ANALOG OUTPUT (TB5, if applicable)

Same as non-isolated analog output except isolated to 1000 Vdc.

Signal Type: Current or voltage

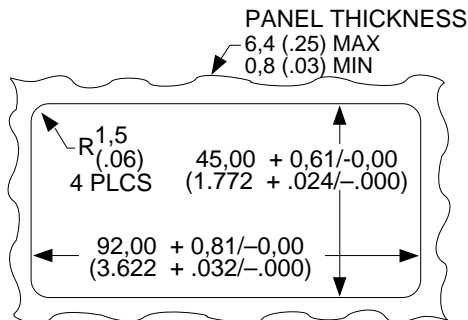
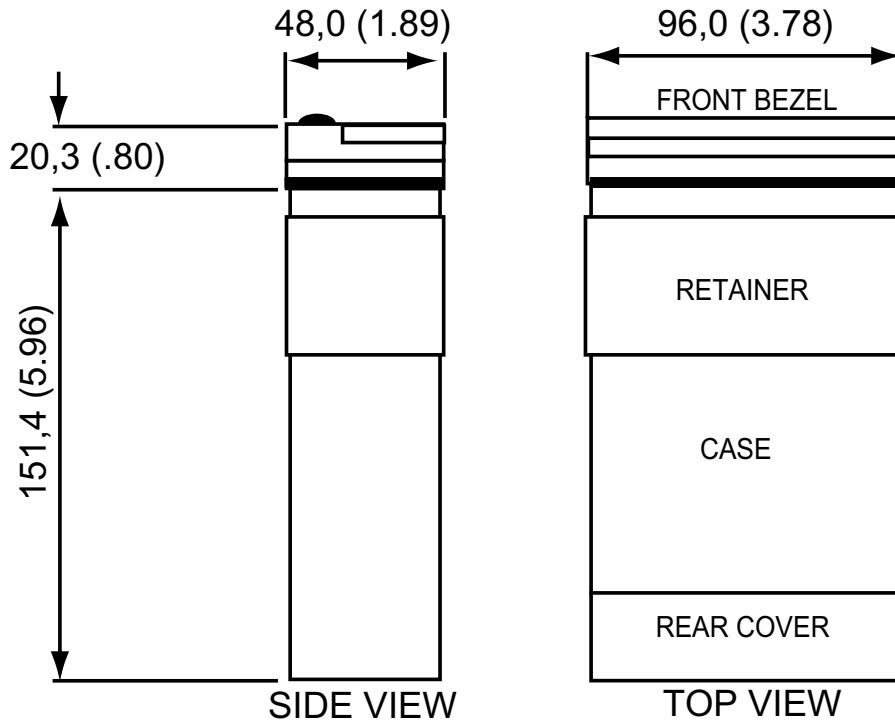
Signal Level: Current: 10 V max compliance at 20 mA output
Voltage: 20 mA max for 0-10 V output

Function: May be assigned to a display range or proportional control output with setpoint #1 when used as a control output.

Linearity: 0.2%

Step Response Time: 2 - 3 seconds to 99% of the final value

Only one analog output is available on each unit and it must be factory installed.



NOTE: Dimensions in Millimeters (Inches)

Figure 8-1. Meter Dimensions

SECTION 9. FACTORY PRESET VALUES

Table 9-1. Factory Preset Values

MENU ITEM	FACTORY PRESET VALUES
INPT	Input Type: RTD.3
DEC.P	Decimal Point Position: FFFF
RD.CF	Reading Configuration: R.1=F (Fahrenheit)
COLR	Normal Color Display: REd or GRN (Note: Depending how it was ordered)
S1.CF	Setpoint 1 Configuration: S.1=A (Setpoint is active above) S.2=U (Setpoint is unlatched)
S2.CF	Setpoint 2 Configuration: S.1=A (Setpoint is active above) S.2=U (Setpoint is unlatched)
S1.DB	Setpoint 1 Deadband: 0003
S2.DB	Setpoint 2 Deadband: 0003
OT.CF	Output Configuration: O.1=E (Analog output is enabled) O.2=C (Analog output is current) O.3=A (Analog output follows the display value)
OT.S.O	Output Scale and Offset: 0-1000 = 4-20 mA dc
LK.CF	Lock Out Configuration RS=E (Enable the RESET button in the run mode) SP=E (Enable setpoint changes) L3=0 (SETPTS button display setpoint values)
bRit	H.brt (Brightness Level)
SP1	Setpoint 1 Value: 0000
SP2	Setpoint 2 Value: 0000



CE APPROVALS INFORMATION

 This product conforms to the EMC directive 89/336/EEC amended by 93/68/EEC, and with the European Low Voltage Directive 72/23/EEC.

Electrical Safety EN61010-1:2001

Safety requirements for electrical equipment for measurement, control and laboratory.

Double Insulation

Pollution Degree 2

Dielectric withstand Test per 1 min

- Power to Input/Output: 2300 Vac (3250 Vdc)
- Power to Input/Output: 500 Vac (720 Vdc)
(Low Voltage dc Power Option*)
- Power to Relays Output: 2300 Vac (3250 Vdc)
- Relay 1 to Relay 2: 2300 Vac (3250 Vdc)
- Isolated Analog to Inputs: 1000 Vac (1420 Vdc)
- Analog to Inputs: No Isolation

Measurement Category I

Category I are measurements performed on circuits not directly connected to the Mains Supply (power). Maximum Line-to-Neutral working voltage is 50 Vac/dc. This unit should not be used in Measurement Categories II, III, IV.

Transients Overvoltage Surge (1.2 / 50uS pulse)

- Input Power: 2500 V
- Input Power: 500 V
(Low Voltage dc Power Option*)
- Isolated Analog: 500 V
- Input/Output Signals: 500 V

Note: *Units configured for external low power dc voltage, 10-32 Vdc (Basic Insulation)

EMC EN61326:1997 + and A1:1998 + A2:2001

Immunity and Emissions requirements for electrical equipment for measurement, control and laboratory.

- EMC Emissions Table 4, Class B of EN61326
- EMC Immunity** Table 1 of EN61326

Note: **I/O signal and control lines require shielded cables and these cables must be located on conductive cable trays or in conduits. Furthermore, the length of these cables should not exceed 30 meters



Refer to the EMC and Safety installation considerations (Guidelines) of this manual for additional information.



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **one (1) year** from the date of purchase. In addition to OMEGA's standard warranty period, OMEGA Engineering will extend the warranty period for **four (4) additional years** if the warranty card enclosed with each instrument is returned to OMEGA.

If the unit malfunctions, 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 having been 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.

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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. Purchase Order 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. Purchase Order 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.

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