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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.



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SECTION 1. INTRODUCTION

1.1 DESCRIPTION

The Resistance Temperature Detector meter with Time Proportional is a value packed indicator/ controller. Four full digits allow for an accurate display of your temperature. Select from 2, 3, or 4 wire input configuration. A fully scalable analog output is standard. You may configure this output as a proportional controller, or to follow your display. Dual 5 amp, form C relays outputs are also included with all units for alarm or control of critical processes. Front panel peak detection and memory is also standard. A mechanical lockout has been included to guard against unauthorized changes.

1.2 STANDARD FEATURES

The following is a list of features:

- * 4-digit, red, 14 segment LED Display
- * NEMA 4 / Type 4 Front Bezel
- * ± 0.5 °C accuracy
- * Peak Detection and Memory
- * Dual 5 amp, form C relay outputs
- * Scalable Analog output
- * Analog out proportional or time proportional control
- * Front panel controller tuning
- * Non-volatile memory-no battery backup
- * Easy setup for proportional control
- * 115 or 230 Vac 50/60 Hz power supply or 10-32 Vdc or 26-56 Vdc

SECTION 2. AVAILABLE ACCESSORIES

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

SECTION 3. 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 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



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.

SECTION 4. SAFETY CONSIDERATIONS

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 5. PARTS OF THE METER

Figure 5-1 shows each part of the front of the meter. Table 5-1 gives a brief description of each part.

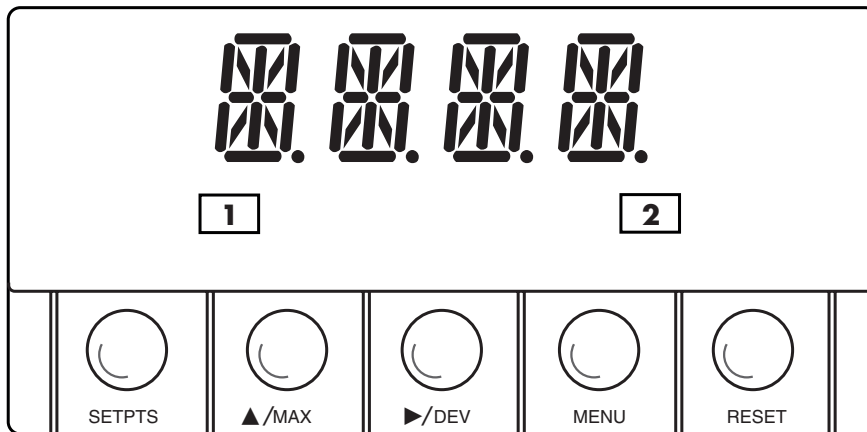


Figure 5-1 Front Panel Illustration

- 1 - Setpoint 1 status
- 2 - Setpoint 2 status

Table 5-1 Front PanelPart Description

ITEM	Description
1	<p>-1.9.9.9. or 9.9.9.9.</p> <p>4-digit 14 segment, 0.54" high LED display with programmable decimal point.</p>
2	<p>SETPOINT LED</p> <p>These LEDs labled 1 and 2 display the status of setpoints 1 and 2.</p>
3	<p>SETPTS Button</p> <p>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.</p> <p>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.</p> <p><i>If the "L.3=1" on the "LK.CF" menu, pressing the SETPTS button will display the meter's firmware version.</i></p>
4	<p>▲/MAX Button</p> <p>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.</p> <p>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.</p>

<p>5</p>	<p>▶/DEV Button</p> <p>During the run mode press the ▶/DEV button to display the deviation from setpoint 1.</p> <p>When configuring your setpoint values, press the ▶/DEV button to scroll to the next digit.</p>
<p>6</p>	<p>MENU Button</p> <p>In the run mode, press the MENU button to terminate the current measuring process and enter you into the configuration mode.</p> <p>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.</p>
<p>7</p>	<p>RESET Button</p> <p>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".</p> <p>In the configuration mode, press the RESET button once to review the previous menu.</p> <p>Pressing the RESET button twice results in a hard reset and returns you to the run mode.</p>

5.2 REAR OF THE METER

Figure 5-2 shows the connector label mounted at the top of the meter housing. Table 5-2 gives a brief description of each connector at the back of the meter.

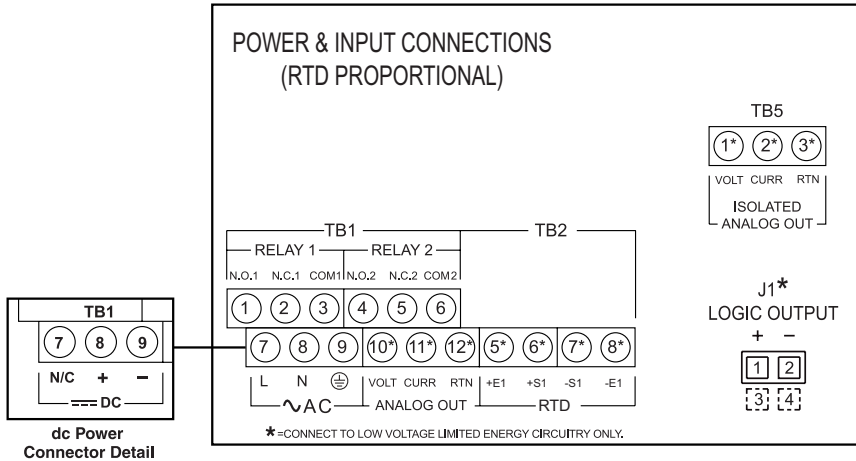


Figure 5-2 Connector Label (ac power with dc detail)

5.2 REAR OF THE METER (Continued)

Table 5-2 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	not used
TB2-2	not used
TB2-3	not used
TB2-4	not used
TB2-5	+E1: Positive excitation (current source)
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
J1-1	Transistor Logic Output (positive)
J1-2	Transistor Logic Output (negative)

SECTION 6. SETUP

6.1 CONDITIONS REQUIRING 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.

6.2 CONDITIONS REQUIRING DISASSEMBLY



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.



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

6.3 RATING/PRODUCT LABEL

This label is located on top of the meter housing (Refer to Figure 6-4).

6.4 MAIN BOARD POWER JUMPERS



Important: If you want to change the Factory preset jumpers, do the following steps; otherwise go to section 6.5.



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 6.2.
2. Locate the solder jumpers W1, W2, and W3 (located near the edge of the main board alongside the transformer - refer to Figure 6-1).
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.**

6.4 MAIN BOARD POWER JUMPERS (continued)

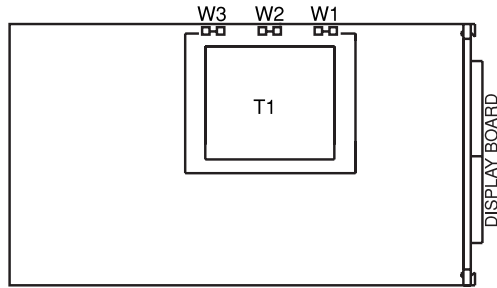


Figure 6-1 Main Board Power Jumpers (W1, W2, W3)

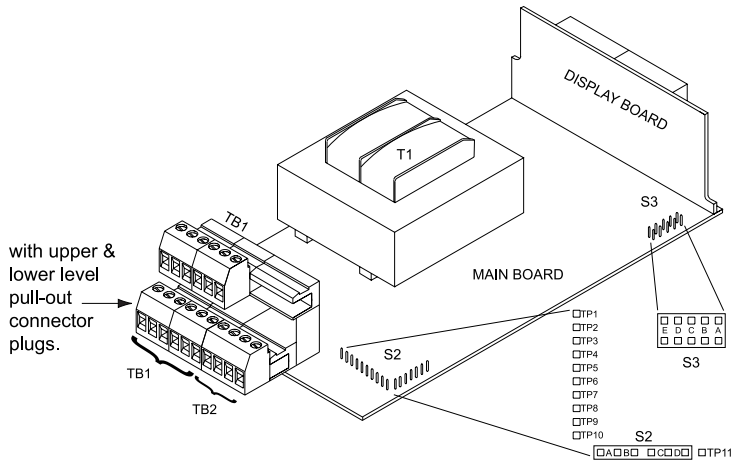


Figure 6-2 Main Board Jumper Positions

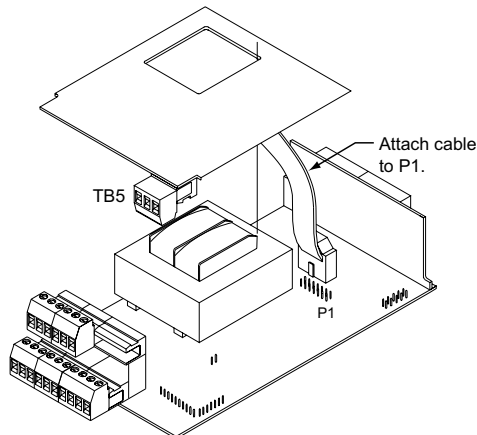


Figure 6-3 Upper Isolated Analog Outlook Option Board Installation

6.4 MAIN BOARD POWER JUMPERS (Continued)

Refer to Figure 6-2.

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 6-1):

- * 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

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

Table 6-1 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".

6.5 PANEL MOUNTING

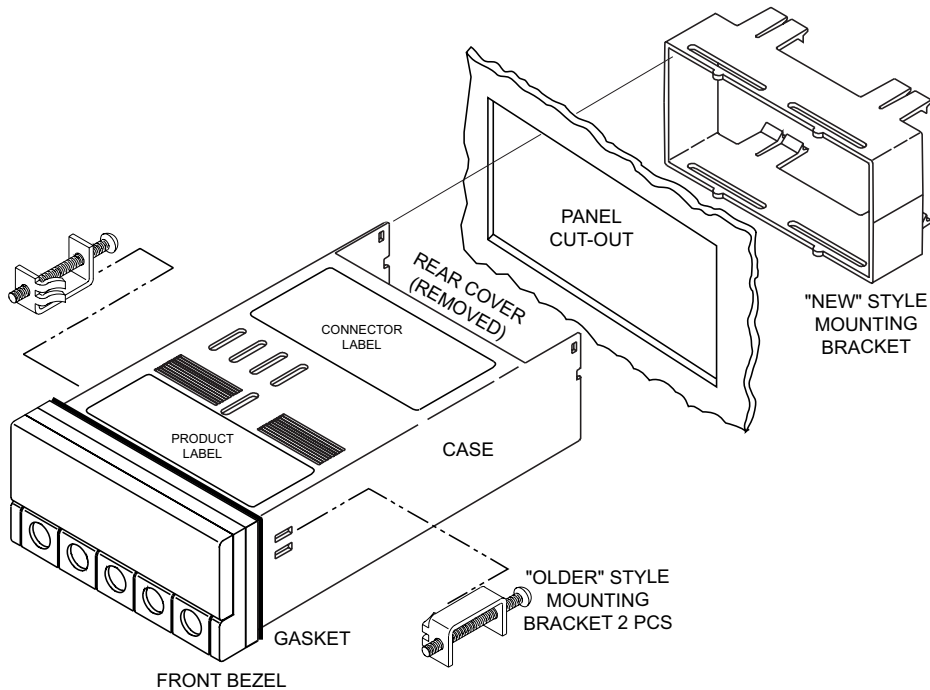


Figure 6-4 Meter - Exploded View

1. Cut a hole in your panel, as shown in Figure 6-4. For specific dimensions refer to Figure 6-5.
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 7 to connect your sensor input and main power.

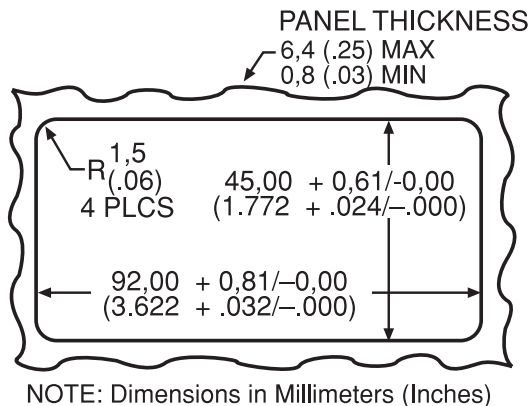


Figure 6-5 Panel Cut-Out

SECTION 7. SENSOR INPUT/ MAIN POWER CONNECTIONS

7.1 SENSOR INPUT CONNECTIONS

Figures 7-1 through 7-3 describe how to connect your sensors.

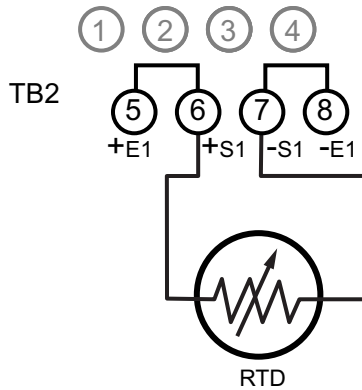


Figure 7-1 2-Wire RTD Input Connection

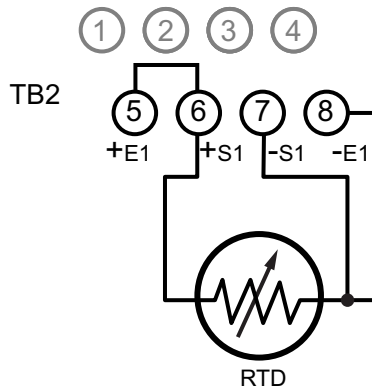


Figure 7-2 3-Wire RTD Input Connection

7.1 SENSOR INPUT CONNECTIONS (continued)

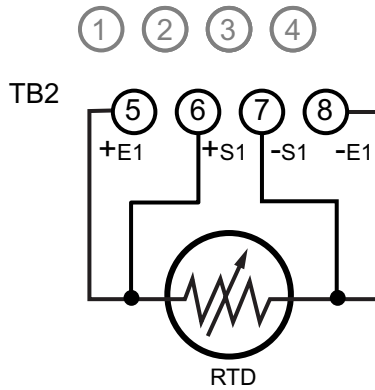


Figure 7-3 4-Wire RTD Input Connection

7.2 MAIN POWER CONNECTIONS

Connect the ac main power connections as shown in Figure 7-4.



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!

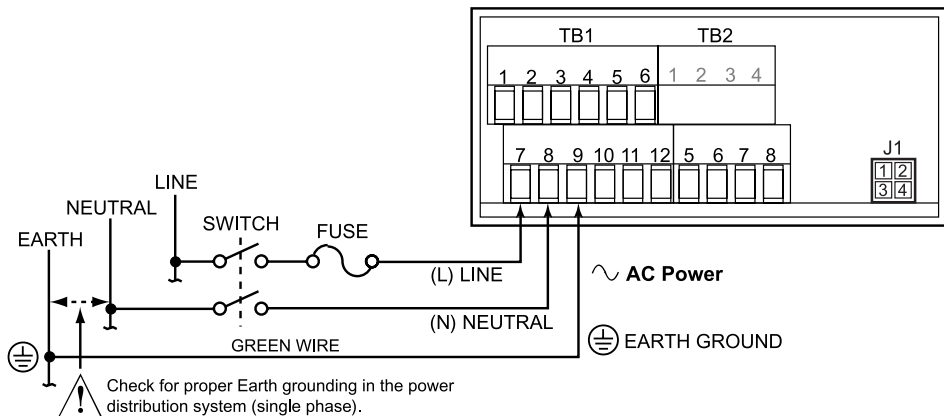


Figure 7-4 Main Power Connection - ac powered unit

7.1 SENSOR INPUT CONNECTIONS (continued)

Table 7-1 shows the wire color and respective terminal connections for both USA and Europe.

Table 7-1 ac Power Connections

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

Connect the dc main power connections as shown in Figure 7-5.

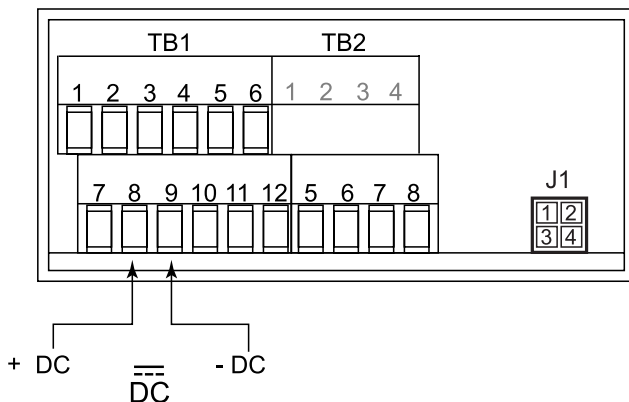


Figure 7-5 Main Power Connection - dc powered unit

7.3 ANALOG AND RELAY OUTPUT CONNECTIONS

Figure 7-6 and 7-7 illustrates how to connect your analog and dual relay outputs at the rear of the meter.

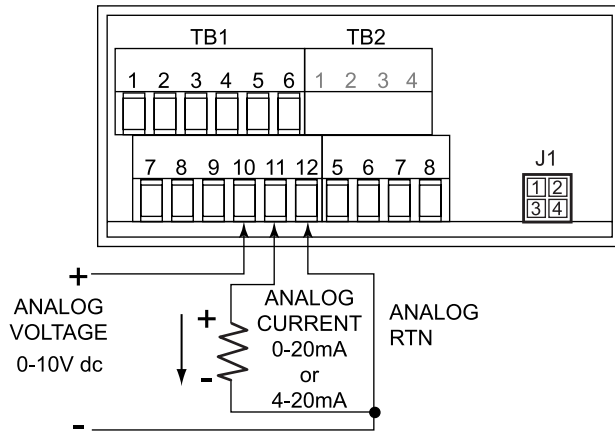


Figure 7-6 Analog Output Connections

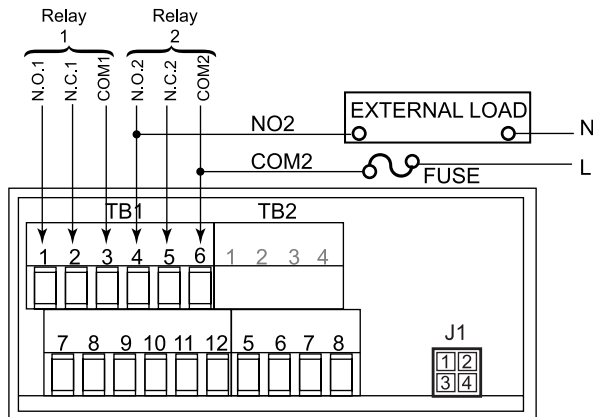


Figure 7-7 Relay Output Connections

7.3 ANALOG AND RELAY OUTPUT CONNECTIONS (continued)

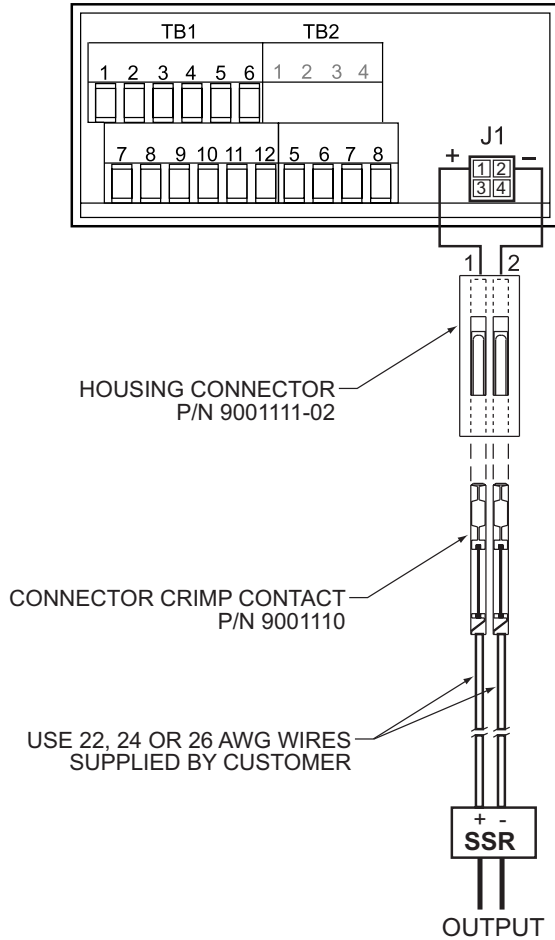


Figure 7-8 Transistor Output Connections

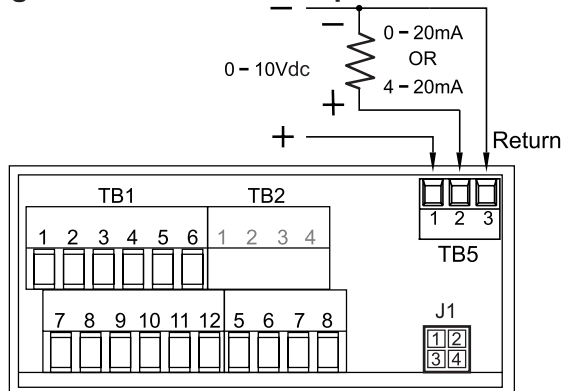


Figure 7-9 Isolated Analog Output Connections (option)

SECTION 8. INPUT TYPE ("INPT")

To select the appropriate input type signal, follow these steps:

1. Press the **MENU** button until **"INPT"** appears.
2. Press the **▶/DEV** button. One of the following flashes:
 - * **"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 selections.
4. Press the **MENU** button to store your selection. **"STRD"** momentarily appears, followed by **"DEC.P"** (Decimal point).

SECTION 9. DECIMAL POINT POSITION ("DEC.P")

To select a decimal point display position.

1. Press the **MENU** button until "**DEC.P**" appears.
2. Press the **▶/DEV** button. One of the following appears:
 - * "**FFFF.**"
 - * "**FFF.F**"
3. Press the **▲/MAX** button to change the decimal point position.
4. Press the **MENU** button to store your selection. "**STRD**" momentarily appears, followed by "**RD.CF**" (Reading Configuration).

Note: 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 overflows, the meter flashes "ER2" when you store a new decimal point position.

SECTION 10. READING CONFIGURATION ("RD.CF")

To determine if the meter displays in °F (Fahrenheit) or °C (Celsius), follow these steps:

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

SECTION 11. SETPOINT 1 CONFIGURATION ("S1.CF")

You may use Setpoint 1 Configuration ("S1.CF") for the following:

- * To set the setpoint's active band above/below your chosen value
 - * To select whether the setpoint operation is latched or unlatched
 - * To select on/off or time proportional control
1. Press the **MENU** button until "**S1.CF**" appears.
 2. Press the **▶/DEV** button. One of the following appears:
 - ****S.1=A**" (Active above the setpoint)
 - ****S.1=B**" (Active below the setpoint)
 3. Press the **▲/MAX** button to toggle between selections (press the **MENU** button only if you want to bypass "S.2" or "S.3" options and go directly to Setpoint 2 Configuration).
 4. Press the **▶/DEV** button again. One of the following appears:
 - ****S.2=L**" (Setpoint 1 to be latched)
 - ****S.2=U**" (Setpoint 1 to be unlatched)
 5. Press the **▲/MAX** button to toggle between selections (press the **MENU** button only if you want to bypass "S.3" options and go directly to Setpoint 2 Configuration).
 6. Press the **▶/DEV** button. One of the following appears:
 - ****S.3=O**" (setpoint 1 on/off control)
 - ****S.3=P**" (setpoint 1 on time proportional control)

SECTION 11. SETPOINT 1 CONFIGURATION ("S1.CF") (Continued)

7. Press the **▲/MAX** button to toggle between available selections.
8. If you selected "**S.3=O**" (factory default), press the **MENU** button to store. "**STRD**" momentarily appears, followed by "**S2.CF**" (Setpoint 2 Configuration). If you selected "**S.3=O**" and press the **▶/DEV** button, the meter returns to **S.1** option.

If you selected "**S.3=P**", press the **▶/DEV** button. One of the following appears:

- *"**S.4=R**" (reverse acting, i.e., for heating)
- *"**S.4=D**" (direct acting, i.e., for refrigeration)

9. Press the **▲/MAX** button to toggle between available selections (press the **MENU** button only if you want to bypass "**S.5**" options and go directly to Setpoint 2 Configuration).
10. Press the **▶/DEV** button. One of the following proportional control options appears:
 - * "**S.5=S**" (slow control, cycle time from 5 to 199 sec)
 - * "**S.5=F**" (fast control, cycle time from .1 to 4.9 sec)
11. Press the **▲/MAX** button to scroll between available selections.
12. Press the **MENU** button to store your selection(s). "**STRD**" momentarily appears, followed by "**S2.CF**" (Setpoint 2 Configuration).

*Note: Transistor logic out is always enabled for either On/Off or Time Proportional control modes. Relay #1 is enabled for On/Off control and for slow Time Proportional control ("**S.5=S**") modes. Relay #1 is disabled if "**S.5=F**" (fast mode).*

SECTION 12. SETPOINT 2 CONFIGURATION ("S2.CF")

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 "S2.CF" appears.
 2. Press the **►/DEV** button. One of the following appears:
 - * "S.1=A" (Active above the setpoint)
 - * "S.1=B" (Active below the setpoint)
 3. Press the **▲/MAX** button to toggle between selections (press the **MENU** button only if you want to bypass "S.2" options and go directly to the "TIME" display).
 4. Press the **►/DEV** button again. One of the following appears:
 - * "S.2=L" (Setpoint 1 to be latched)
 - * "S.2=U" (Setpoint 1 to be unlatched)
 5. Press the **▲/MAX** button to toggle between selections.
 6. Press the **MENU** button to store your selection(s). "STRD" momentarily appears, followed by "S1.DB" (Setpoint 1 Deadband) or "TIME" (Cycle Time).

SECTION 13A. SETPOINT 1 DEADBAND ("S1.DB")

If you have selected "S.3=O" in Setpoint 1 Configuration ("S1.CF" - refer to Section 11), you may set the deadband (hysteresis) of setpoint 1.

1. Press the **MENU** button until "S1.DB" appears.
2. Press the **►/DEV** button. The last previously stored 4-digit number (0000 through 9999) appears 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 appears, followed by "S2.DB" (Setpoint 2 Deadband)

SECTION 13B. CYCLE TIME ("TIME")

If you have selected "S.3=P" in Setpoint 1 Configuration ("S1.CF" - refer to Section 11), you may specify a cycle time for the time proportional outputs.

1. Press the **MENU** button until "TIME" appears.
2. Press the **►/DEV** button. The last stored value appears as follows:

If you have selected "S.5=S" (slow) in "S1.CF", the third digit will flash and you may enter maximum/minimum values from 000.1 through 0199. seconds (unit of measure is second in this mode).

Note: If you have selected "S.5=S" the Transistor and Relay 1 outputs are both enabled.

or

If you have selected "S.5=F" (fast) in "S1.CF", the second digit will flash and you may enter maximum/minimum values from 000.1 through 004.9 seconds (unit of measure is .1 second in this mode).

Note: If you have selected "S.5=F" only the Transistor output is enabled.

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 appears, followed by "S2.DB" (Setpoint 2 Deadband).

SECTION 14. SETPOINT 2 DEADBAND ("S2.DB")

To set the deadband (hysteresis) of setpoint 2, follow these steps:

1. Press the **MENU** button until "**S2.DB**" appears.
2. Press the **►/DEV** button. The last previously stored 4-digit number (0000 through 9999) appears 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 appears, followed by "**OT.CF**" (Output Configuration).

SECTION 15. OUTPUT CONFIGURATION (OT.CF)

Use Output Configuration ("OT.CF") to perform the following tasks:

- * 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)

15.1 To Enable or Disable The Analog Output

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

15.2 To Select Analog Output as Current or Voltage

1. Press the **►/DEV** button. One of the following appears:
 - * **"O.2=V"** (Analog output = voltage)
 - * **"O.2=C"** (Analog output = current)
2. Press the **▲/MAX** button to toggle between selections.
3. Press the **►/DEV** button to select analog output or proportional control or press the **MENU** button to store your selection. **"STRD"** momentarily appears, followed by **"OT.S.O"** (Output Scale and Offset).

15.3 To Select Analog Output or Proportional Control

To determine if the meter is to transmit an analog signal out proportional to your display or proportional to the error (proportional control) (The error is defined as the difference between reading and Setpoint 1 value).

If you have selected **"S.3=P"** in Setpoint 1 Configuration (**"S1.CF"** - refer to Section 11), you cannot program the meter for analog output proportional control. You may, however, use the regular analog output. If you have selected **"S.3=O"** in Setpoint 1 Configuration, then you may select analog output or proportional control as follows:

1. Press the **►/DEV** button. One of the following appears:
 - * **"O.3=A"** (Analog output is retransmission of temperature)
 - * **"O.3=P"** (Analog output is proportional to the error)
2. Press the **▲/MAX** button to toggle between selections.

15.3 To Select Analog Output or Proportional Control (Continued)

3a. If you select "O.3=A", press the **MENU** button to store your selections. "STRD" momentarily appears, followed by "OT.S.O" (Output Scale and Offset).

3b. If you select "O.3=P", press the **▶/DEV** button. One of the following appears:

*"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 selections.

5. Press the **MENU** button to store your selections. "STRD" momentarily display, followed by "P.BND" (Proportional Band).

Additionally, if you select "O.2=V" (Analog output to be voltage), press the **▶/DEV** button. One of the following appears:

* "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 selections.

7. Press the **MENU** button to store your selections. "STRD" momentarily appears, followed by "P.BND" (Proportional Band).

SECTION 16. PROPORTIONAL BAND ("P.BND")

A proportional controller's output is linearly proportional to the change of the error signal, whenever the signal is within 2 prescribed values (Proportional Band).

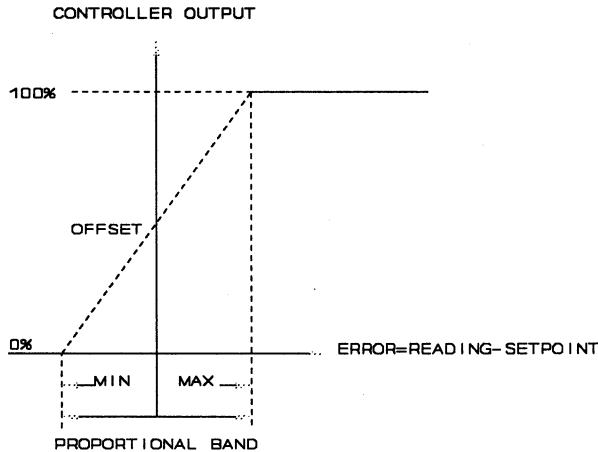


Figure 16-1. Proportional Band

There are three points of interest on the proportional controller transfer curve. The first is the magnitude of the error signal that drives the controller to full on (e.g., 20 mA out for 4-20 mA). The second is the magnitude of the error signal that drives the controller output to full off (e.g., 4 mA out on 4-20 mA). These two points need not be equally spaced on either side of the zero error point. The third is the factor that determines where these two points fall. This factor is called the "Offset" and it is the output value of the controller which causes zero error.

If A is the controller gain then,

$$\text{Proportional Band} = \frac{\text{Max. out} - \text{Min. out}}{A}$$

A

$$\text{CONTROLLER OUT} = A * \text{ERROR} + \text{OFFSET}$$

SECTION 16. PROPORTIONAL BAND ("P.BND") (Continued)

To select the proportional band for your proportional controller, follow these steps:

Note: "P.BND" appears only if you select analog output as proportional.

1. Press the **MENU** button until **"P.BND"** appears.
2. Press the **►/DEV** button. The last previously stored 4-digit number (0000 through 9999) appears 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 appears, followed by **"M.RST"** (Manual Reset).

SECTION 17. MANUAL RESET ("M.RST")

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" appears only if you select analog output as proportional.

1. Press the **MENU** button until **"M.RST"** appears.
2. Press the **►/DEV** button. The last previously stored 4-digit number (-1999 through 9999) appears 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 appears, followed also momentarily by **"RST"** (Reset).

SECTION 18. OUTPUT SCALE AND OFFSET ("OT.S.O")

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" appears only if you select analog output as a retransmission of temperature.

1. Press the **MENU** button until "OT.S.O" appears.
2. Press the **►/DEV** button. "RD 1" (Read 1) appears.

Note: This is your first point of display reading.

3. Press the **►/DEV** button again. The last previously stored 4-digit number (-1999 through 9999) appears 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. "OUT.1" (Output 1) appears.

Note: This starting analog signal corresponds to your Read 1 display.

SECTION 18. OUTPUT SCALE AND OFFSET ("OT.S.O")

(Continued)

7. Press the ►/DEV button. Selected output appears.

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.

11. Press the ►/DEV button. The last previously stored 4-digit number (-1999 through 9999) appears 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) appears.

Note: This analog signal should correspond to your Read 2 display.

SECTION 18. OUTPUT SCALE AND OFFSET ("OT.S.O")

(Continued)

15. Press the ▶/DEV button. Selected output appears.

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 for 0-20 or 4-20 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. "STRD" momentarily appears, followed also momentarily by "RST" (Hard Reset). Meter then returns you to the "RUN" mode.

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

SECTION 19. TUNING PROPORTIONAL CONTROLLER ("TUNE")

This function allows you to tune your controller. Select either time proportional control or analog and proportional control.

Select time proportional control by setting "S.3=P" in Setpoint 1 Configuration ("S1.CF" - refer to Section 11).

or

Select analog and proportional control by setting "O.3=P" in Output Configuration ("OT.CF" - refer to Section 15).

Include the meter in the process loop and turn on the meter. Allow enough time for the system to settle.

1. Press **►/DEV** button. "DEV" momentarily appears, 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 appears, proceed with step 2.
2. Press **RESET** button. "TUNE" appears, tuning your controller and canceling any error. Once tuned, "RST" appears and meter returns to the run mode.
3. Allow enough time for process to settle. Press **►/DEV** button. Verify that blinking value is zero. If blinking value is not zero, repeat step 2.

SECTION 20. LOCKOUT CONFIGURATION ("LK.CF")

Use Lockout Configuration to disable setpoints, thereby allowing you to make changes. Also, to disable the **RESET** button in the run mode.

1. Press the **MENU** button until "**LK.CF**" appears.
2. Press the **►/DEV** button. One of the following appears:
 - * "**SP.=E**" (Setpoint change enabled)
 - * "**SP.=D**" (Setpoint change disabled)

Note: If you set "SP.=D" , you may view setpoints, but cannot change their values.

3. Press the **▲/MAX** button to toggle between available selections.
4. Press the **►/DEV** button. One of the following appears:
 - * "**RS.=E**" (**RESET** button enabled)
 - * "**RS.=D**" (**RESET** button disabled)

*Note: If you set "RS.=D", when you press the **RESET** button "**LOCK**" appears. Meter then enters the Run mode.*

5. Press the **▲/MAX** button to toggle between available selections.
6. Press the **MENU** button to store your selection. Meter appears "**RST**" and enters the run mode.

SECTION 21. DISPLAY MESSAGES

Table 21-1. Display Messages

MESSAGE	DESCRIPTION
"RST"	Hard (power on) reset
"INPT"	Input Type
"DEC.P"	Decimal Point
"RD.S.O"	Reading Scale and Offset
"RD.CF"	Reading Configuration
"S1.CF"	Setpoint 1 Configuration
"S2.CF"	Setpoint 2 Configuration
"S1.DB"	Setpoint 1 Deadband
"TIME"	Cycle time for the time proportional controller
"S2.DB"	Setpoint 2 Deadband
"OT.CF"	Output Configuration
"P.BND"	Proportional Band
"M.RST"	Manual Reset
"LK.CF"	Lockout Configuration
" OPN"	Sensor breaker or temperature outside the range
"9999"	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
"OT.SO"	Output Scale and Offset
"SP.RS"	Reset setpoints
"TUNE"	Tuning proportional controller
"SP1"	Setpoint 1 value
"SP2"	Setpoint 2 value
"ER2"	One or more the following items have overflowed because of decimal point change: setpoint values, setpoint deadbands, proportional bands or manual reset.

SECTION 22. MENU CONFIGURATION

Table 22-1. Configuration Menu (defaults are in bold and italics)

MENU	SUBMENU	DESCRIPTION
"INPT"	RTD.2 <i>RTD.3</i> RTD.4	INPUT TYPE 2-wire RTD 100 Ω PT., DIN standard. <i>3-wire RTD 100 Ω PT., DIN standard</i> 4-wire RTD 100 Ω PT., DIN standard
"DEC.P"	<i>FFFF.</i> FFF.F	DECIMAL POINT POSITION Select to display whole degrees or tenths of a degree.
"RD.CF"	R.1	READING CONFIGURATION Select unit of temp: C: Celsius <i>F: Fahrenheit</i>
"S1.CF"	S.1 S.2 S.3 S.4 S.5	SETPOINT 1 CONFIGURATION: <i>A: Active above</i> B: Active below <i>U: Unlatched</i> L: Latched <i>O: Setpoint 1 on/off control</i> P: Setpoint 1 on time proportional control R: Reverse acting D: Direct acting S: Slow proportional control F: Fast proportional control
"S2.CF"	S.1 S.2	SETPOINT 2 CONFIGURATION: <i>A: Active above</i> B: Active below <i>U: Unlatched</i> L: Latched
"S1.DB"	0000 through 9999	SETPOINT 1 DEADBAND Select from 0000 through 9999

MENU	SUBMENU	DESCRIPTION
"S2.DB"	0000 through 9999	SETPOINT 2 DEADBAND Select from 0000 through 9999
"OT.CF"	0.1 0.2 0.3 0.4 0.5	OUTPUT CONFIGURATION Analog Output: D: Disabled <i>E: Enabled</i> V: Voltage analog out C: Current analog out <i>A: Retransmission of temperature</i> P: Proportional to Setpoint 1 D: Direct acting R: Reverse acting F: 0-10 V proportional H: 0-5 V proportional
"P.BND"	0000 through 9999	PROPORTIONAL BAND Select from 0000 through 9999
"M.RST"	-1999 through 9999	MANUAL RESET Select from -1999 through 9999
"OT.S.O"	-1999 through 9999	OUTPUT SCALE AND OFFSET 2-coordinate format for scaling the analog output
"LK.CF"	SP RS	LOCKOUT CONFIGURATION <i>E: Setpoint change enabled</i> D: Setpoint change disabled <i>E: RESET button enabled</i> D: RESET button disabled

SECTION 23. FRONT PANEL DISPLAYS

Table 23-1. Front Panel Displays (defaults are in bold and italics)

MENU	▶/DEV	▲/MAX	DESCRIPTION
"INPT"	Show input choices	RTD.2 <i>RTD.3</i> RTD.4	SIGNAL INPUT 2-wire RTD <i>3-wire RTD</i> 4-wire RTD
"DEC.P"	Show input choices	FFFF. <i>FFF.F</i>	DECIMAL POINT
"RD.CF"	R.1	F C	READING CONFIGURATION <i>Display in °F</i> Display in °C
"S1.CF"	S.1	A B	SETPOINT 1 CONFIGURATION <i>Active above</i> Active below
	S.2	U L	Unlatched Latched
	S.3	O P	Setpoint 1 on/off ctrl Setpoint 1 on time proportional control
	S.4	R D	Reverse acting Direct acting
	S.5	S F	Slow proportional ctrl Fast proportional ctrl
"S2.CF"	S.1	A B	SETPOINT 2 CONFIGURATION <i>Active above</i> Active below
	S.2	U L	Unlatched Latched
"S1.DB"	Scroll right one digit	Change flashing digit's value	SETPOINT 1 DEADBAND Select from 0000 through 9999. (Factory preset is 0003)
"S2.DB"	Scroll right one digit	Change flashing digit's value	SETPOINT 2 DEADBAND Select from 0000 through 9999. (Factory preset is 0003)

MENU	►/DEV	▲/MAX	DESCRIPTION
"OT.CF"	0.1	D	OUTPUT CONFIGURATION Disable analog output <i>Enable analog output</i>
		E	
	0.2	V	Analog output = voltage <i>Analog output = current</i>
		C	
	0.3	A	<i>Regular analog output</i>
		P	Proportional analog output
0.4	D	Proportional analog output is direct acting	
	R	Proportional analog output is reverse acting	
0.5	F	Analog output is 0-10 V dc	
	H	Analog output is 0-5 V dc	
<p><i>Note: * If you select "0.2=V", you may select your analog output to be 0-10 V or 0-5 V by accessing submenu 0.5.</i></p> <p><i>* If you select "0.3=P", you may select your proportional output analog to be direct or reverse acting (i.e. 4-20 or 20-4)</i></p>			
"OT.S.O"			OUTPUT SCALE AND OFFSET
Enter new value and show "OUT1"	Show RD 1 and prior value entered Scroll right one digit	Change flashing digit's value.	
Enter new value and show "RD 2"	Press to show prior value entered. Scroll right one digit	Change flashing digit's value.	
Enter new value and show "OUT2"	Press to show prior value entered. Scroll right one digit	Change flashing digit's value.	
"PBND"	Scroll right one digit	Change flashing digit's value	PROPORTIONAL BAND Select from 0000 through 9999

MENU	►/DEV	▲/MAX	DESCRIPTION
"M.RST"	Scroll right one digit	Change flashing digit's value	MANUAL RESET Select from -1999 through 9999
"LK.CF"	SP	<i>E</i> <i>D</i>	LOCKOUT CONFIGURATION <i>Setpoint change enabled</i> <i>Setpoint change disabled</i>
	RS	<i>E</i> <i>D</i>	<i>RESET button enabled</i> <i>RESET button disabled</i>

Table 23-2. Run Mode Displays

DISPLAY	▷/DEV	▲/MAX	RESET	DESCRIPTION
"PEAK"		Shows 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
"SP.RS"				LATCHED RESET Pressing the RESET button will reset your setpoints.
"DEV"	Shows the difference between the display reading and the setpoint 1 value.		Tunes the proportional control if 0.3=P. Goes back to "run" mode if 0.3=A	

SECTION 24. SETPOINT CONFIGURATION DISPLAYS

Table 24-1. Setpoint Configuration Displays

MENU	►/DEV	▲/MAX	DESCRIPTION
"SP 1"	Scroll right one digit	Change flashing digit's value	SETPOINT 1 Select from -1999 through 9999
"SP 2"	Scroll right one digit	Change flashing digit's value	SETPOINT 2 Select from -1999 through 9999

SECTION 25. SPECIFICATIONS

SIGNAL INPUT

Isolation:	354 V peak per IEC spacing NMR- 60 dB CMR- 120 dB
Protection:	240 V rms max for RTD input ranges
Display:	LED 14 segment, 13.8 mm (0.54") red
Symbols:	8888

ANALOG TO DIGITAL

Technique:	Dual slope
Internal resolution:	15 bits
Read rate:	3/sec
Polarity:	Automatic
DIN Platinum Temperature range:	-200° to 850°C (-328 to 1562°F)
Alpha =	0.00385 (DIN 43760)

**ACCURACY
AT 25°C** ±0.5°C

**Temperature
Stability:** ±0.04°C/°C

ANALOG TO DIGITAL (Continued)

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

Step

response: 1 second

Warm up to

rated accuracy: 30 min

ALARM

OUTPUTS:

2 Form "C" relays. Maximum rating: 6 AMPS at 28 V dc or 300 Vac. Alarms are configurable for on/off and latch/unlatch. Relay 1 may also be configured for time proportional from 5 seconds to 199 seconds.

TRANSISTOR

LOGIC OUT:

(7 - 11) V \pm .3 V dc. Maximum current: 25 mA. Output may be configured as On/Off or Time Proportional for .1 to 199 seconds.

ANALOG OUTPUT

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.

ANALOG OUTPUT (Continued)

Linearity: 0.2%

4 -20 mA Load

Regulation: 1.1%

Step Response Time: 2 - 3 seconds

PROPORTIONAL CONTROL (TIME OR ANALOG OUT)

Time: Cycle time for .1 second to 199 seconds.
On/off time to 99% of cycle time.
Transistor and /or relay outputs.
Configurable for reverse or direct acting.
Front-panel tuning capability.

Analog: 4-20 mA; 0-10 or 0-5 V out. Configurable
for reverse or direct. Front-panel tuning
capability.

INPUT POWER INFORMATION:

Voltage AC: 115/230 V rms $\pm 15\%$
115/230 V rms $\pm 10\%$
DC: 9.5 to 32 V dc

Frequency: 50-60 Hz

Power: 6 watts

ENVIRONMENT

Operating temperature: 0 to 50°C (115/230 V rms $\pm 15\%$)
0 to 60°C (115/230 V rms $\pm 10\%$)

Storage temperature: -40° to 85°C

ENVIRONMENT (Continued)

Relative humidity: 90% at 40°C (non-condensing)

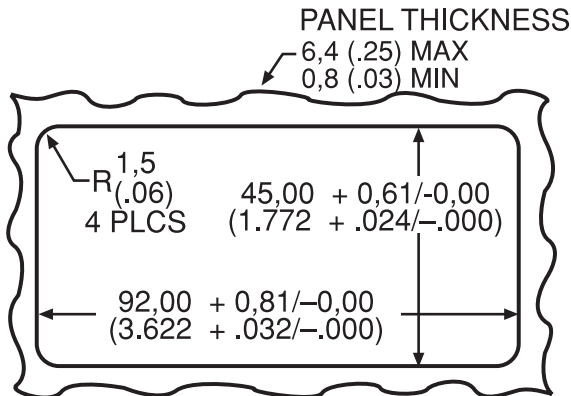
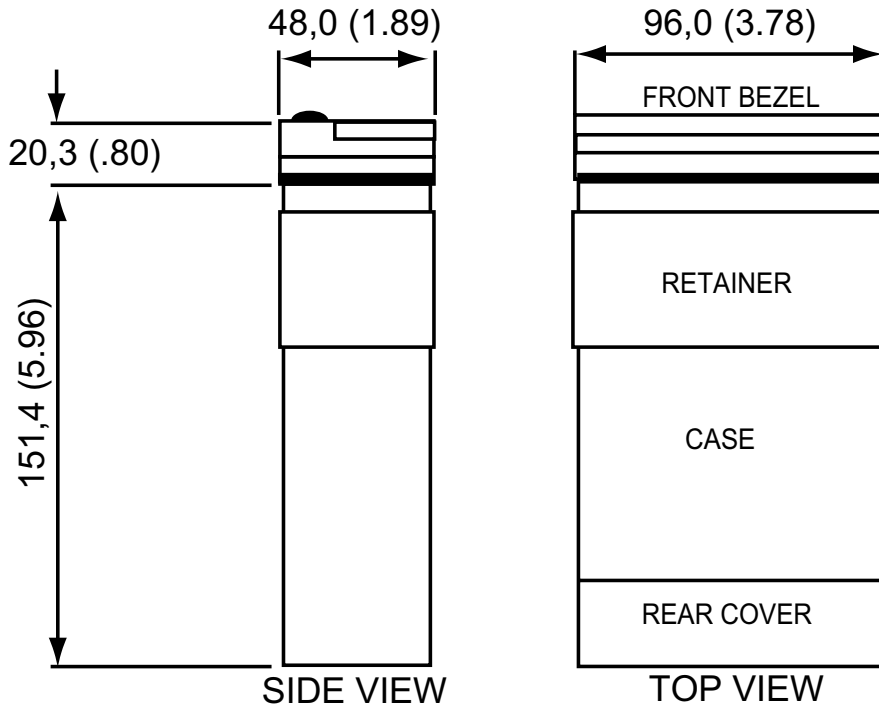
MECHANICAL

Panel cutout: 1/8 DIN 3.62 x 1.8" (45 x 92mm)

Weight: 1.27 lb (574 g)

Case material: Polycarbonate, 94 V-O UL rated

SECTION 25. SPECIFICATIONS (continued)



NOTE: Dimensions in Millimeters (Inches)

Figure 25-1 Meter Dimensions

SECTION 26. FACTORY PRESET VALUES

Table 26-1. 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)
S1.CF	Setpoint 1 Configuration: S.1=A (Setpoint is active above) S.2=U (Setpoint is unlatched) S.3=O (On/Off control)
S2.CF	Setpoint 2 Configuration: S.1=A (Setpoint is active above) S.2=U (Setpoint is unlatched)
S1.DB	Setpoint 1 Deadband: 030.0
S2.DB	Setpoint 2 Deadband: 030.0
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)
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.

NOTES



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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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.

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