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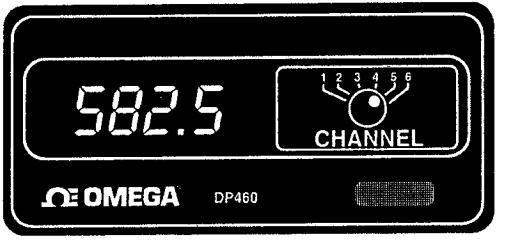
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DP460, DP461, and DP462

Digital Panel Thermometers for Thermocouples and RTDs



OMEGA®

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Operator's Manual

OMEGA
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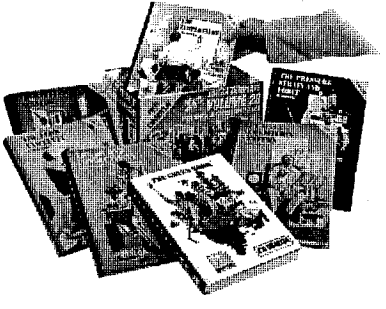
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550-4001-02A

Before Using Your OMEGA ENGINEERING DP460 Series Indicator

Your DP460 Series Indicator measures both thermocouples and RTD sensors. Calibration is required whenever you change between thermocouples and RTDs (see page 12 for information on calibrating your instrument).

Your new DP460 Series Indicator is factory set for either thermocouple use or RTD use, according to your order. The factory set for thermocouples is type "K," °F, and for RTDs is alpha = .00385, °F.

The DP460 Series

Model DP460 is the base digital indicator for the series.
Model DP461 is the Model DP460 with the Alarm Option.
Model DP462 is the Model DP460 with the Multi-Input Option.

The alarm option or multi-input option can be ordered separately, at a later date, from OMEGA ENGINEERING for field installation into a Model DP460, converting your DP460 into a DP461 or DP462.

Service

If you have any difficulty with your DP460 Series Indicator, or if there is any discrepancy upon unpacking your instrument, contact the OMEGA Customer Service Department at 1-800-872-9436 immediately.

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Digital Panel Temperature Indicator

INTRODUCTION

Congratulations! You have purchased the best, value-packed digital temperature indicator available. Your new indicator is a compact panel instrument; designed for accurate, reliable, trouble-free temperature measurement.

It is a single channel, 4-digit instrument. Add-on options include an alarm or multiple inputs.

Unpacking

When unpacking your indicator, compare its configuration to your order by checking the label at the top of the instrument case. Also be sure the power requirement printed on the label matches your power source. Report any discrepancies immediately.

Standards

The indicator accepts National Bureau of Standards (NBS) thermocouple types J, K, T, E,S,R, and B; plus 3-wire platinum resistance temperature detector (RTD) sensors with α = .00385 or .00392. The display auto-ranges between 0.1° and 1° resolution*. An internal switch can be set to disable the autoranging function, fixing the display in 1° resolution for all sensor types.

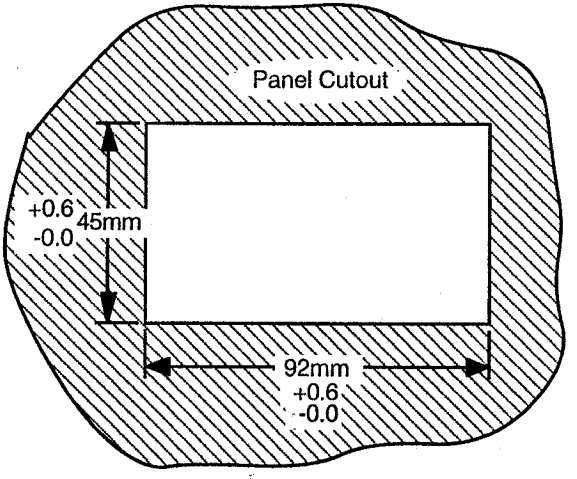
* (R, S and B thermocouples display in 1° resolution only)

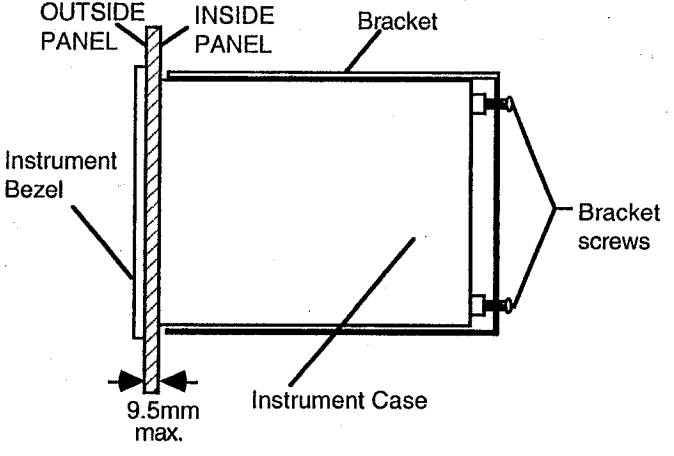
FEATURES

- Microprocessor controlled for accurate measurements and ease of use.
- Auto-ranging display for maximum resolution and accuracy.
- No tools required for removal of lens or electronics assembly.
- Easy sensor selection.
- Switchable °Centigrade/°Fahrenheit display .
- Easy calibration; no complex setups required.
- Compact size to conserve panel place.
- Universal screw terminals for easy connection to signal leads and power.

PANEL INSTALLATION

1. Prepare a mounting panel cut-out by cutting a rectangular hole (92mm +0.6mm/-0.0mm x 45mm +0.6mm/-0.0mm) in the desired location. The maximum panel thickness is 9.5mm (3/8 inches).
2. Remove the mounting bracket from the instrument housing by removing the two bracket screws on the rear of the indicator.
3. Install the indicator in the panel cutout from the front side of the panel. Be sure the instrument is right-side-up.
4. Reinstall the mounting bracket on the indicator. Tighten the bracket screws to achieve a snug fit against the panel. Avoid distorting or cracking the housing by not over-tightening the bracket screws.

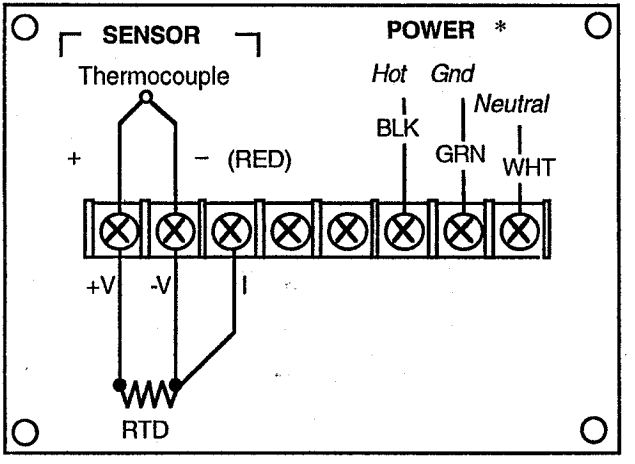

Panel Cutout
+0.6
-0.0
45mm
92mm
+0.6
-0.0


OUTSIDE PANEL
INSIDE PANEL
Bracket
Instrument Bezel
Bracket screws
9.5mm max.
Instrument Case

WIRING

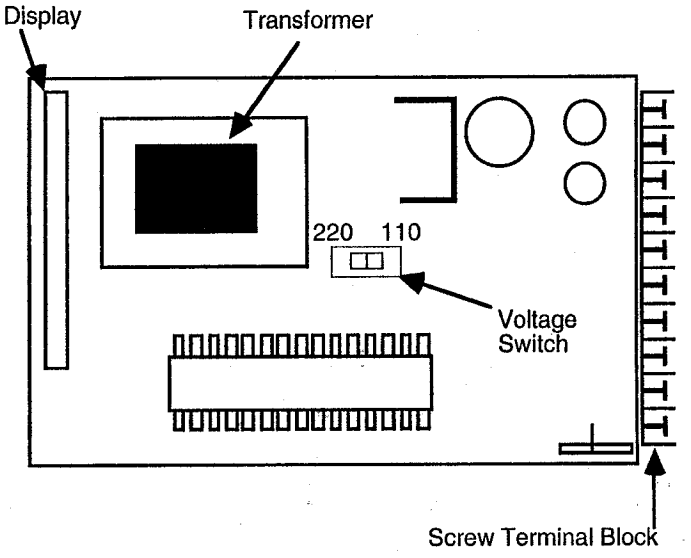
Input Sensor and Power Wiring

Connect the input sensor and power wires to the screw terminals at the back of the instrument as shown below:



* 110VAC or 220VAC is selectable using a switch on the indicator's main circuit board. Check the instrument's tag for the voltage range set at the factory. You may move the switch to match your power source if needed.

Top View of Main Board

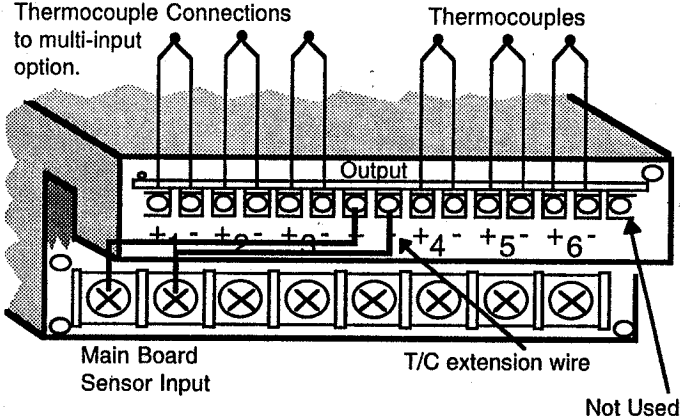


WARNING!

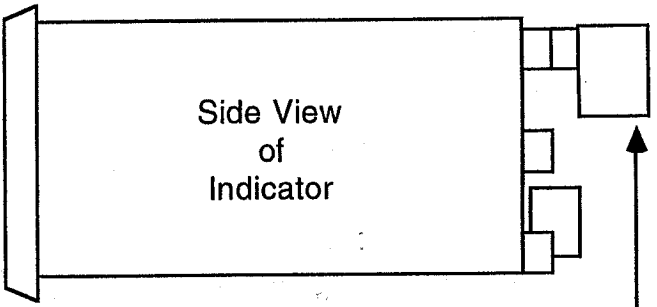
Dangerous voltages are exposed at the screw terminals. Always remove power before working in this area for rewiring, disassembly, and all other activities that involve proximity to electrical circuitry.

Multi-Input Option Wiring

The Multi-Input option uses a quick disconnect terminal block to facilitate input wire changing or servicing. The terminal block engages the printed circuit board (PCB) fingers of the Multi-Input board which is located directly above the screw terminals at the rear. The method of attachment is the same as for a PCB edge connector: push on/pull off. If desired, you can use the two screws that are provided for securing the connector to the instrument case.

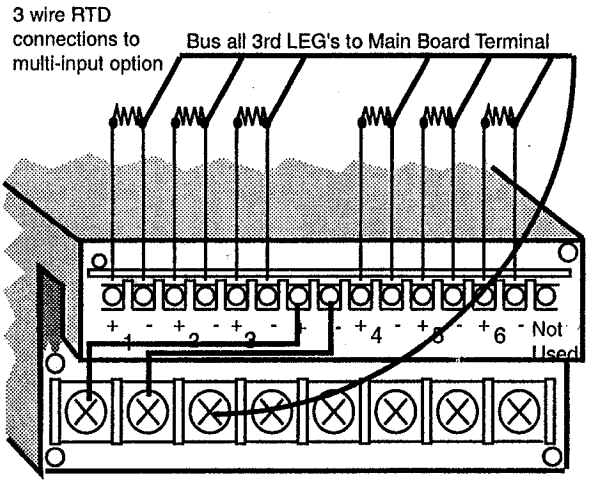


Connect OUTPUT to Indicator input or to INPUT 6 of another multi-input card for a series connection. Observe proper polarity of terminals.



Use screws at bottom to secure or loosen wire connections

To attach a wire to the connector, loosen a terminal clamp screw that is accessible on the bottom of the connector. (**Note:** clamp screws are staggered; however, they are in-line with their respective terminals.) Insert a stripped portion of wire (≈12mm/0.5 in.) into the appropriate terminal. Secure the wire by tightening the clamping screw. See the drawing below for details.



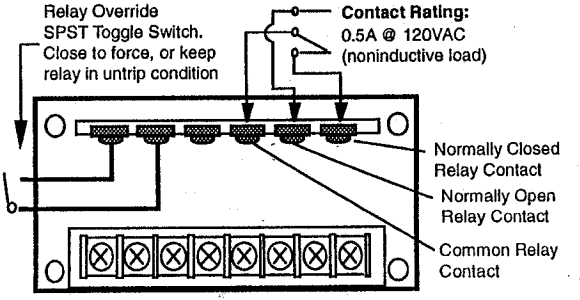
Alarm Option Wiring

Connections to the alarm option are provided by blade terminals accessible at the back of the instrument. Female connectors are supplied to wire the alarm option into your system. (See following drawing.)

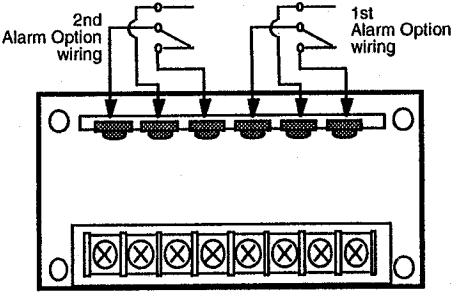
The relay override connection (single alarm version only) is provided to prevent relay closure. A switch closure can be used to acknowledge and silence alarms that otherwise would be maintained by the alarm option relay contacts.

WARNING!

Dangerous voltages are exposed at the screw terminals. Always remove power before working in this area for rewiring, disassembly, and all other activities that involve proximity to electrical circuitry.



Single Alarm Unit Wiring



Dual Alarm Unit Wiring

OPERATION

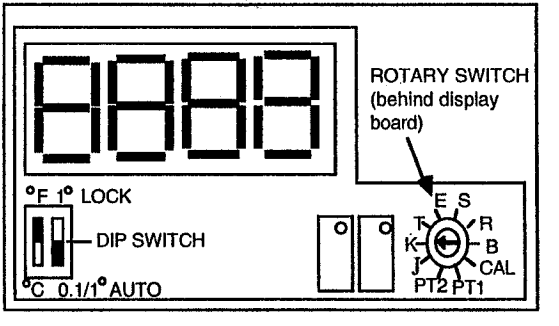
Power

Power is applied to the indicator as long as it is plugged into an active power source. To remove power, turn off the main switch or unplug the instrument. Do NOT unscrew power leads while the instrument is plugged into the main.

Range/Calibration Mode Select, °F/°C Select, and 1° Lock

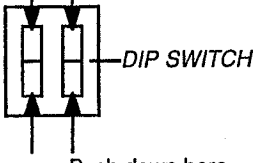
To select a range, °F or °C display, or 1° resolution lock, snap off the front panel lens to gain access to the display board. Behind the display is a rotary switch used to select sensor type/range and to determine the indicators's calibration mode. A 2-pole DIP (dual in-line package) switch on the display board is used to select the °F/°C Readout and 1° Lock.

Note: This switch may be either a rocker type (press down on appropriate end) or a slider type (slide toward appropriate end). The drawings detail the adjustment activities:

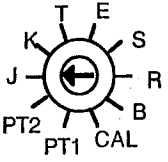


Push down here or slide towards this end for Fahrenheit display

Push down here or slide toward this end to lock instrument in 1° resolution



ROTARY SWITCH



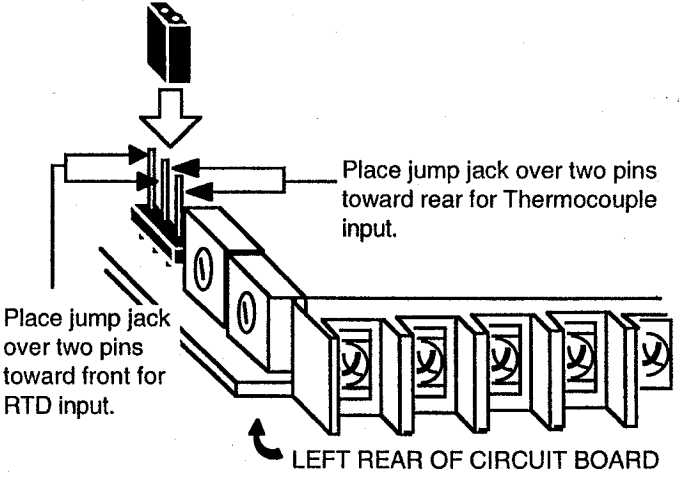
Push down here or slide towards this end for Celsius display

Push down here or slide towards this end for auto-ranging between 0.1° & 1.0° resolution

Insert a small screwdriver or trimmer adjusting tool through the hole in the display board. Align the switch arrow so that it points at the position you have chosen. J, K, T, E, S, R, and B refer to thermocouple type; PT1 and PT2 refer to RTD type. PT1 = α .00385 PT2 = α . 00392

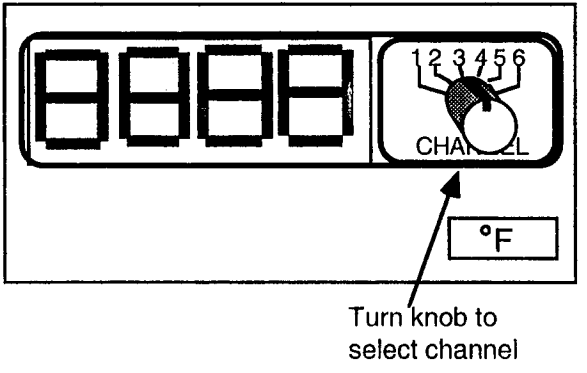
To change between Thermocouple and RTD ranges, you must position an internal jump jack to select the sensor type. Remove the circuit board from the front of the housing (with power off) to access the jump jack:

1. Snap off front panel lens.
2. Slide electronics out from housing by spreading open instrument front while pushing from rear on screw terminals.
3. Locate jump jack at left rear portion of circuit board. The jump jack is installed over a pair of pins. Place jump jack over the pin pair required by the sensor type. See drawing below for details.



Using the Multi-Input Option

Select the input you wish to display by turning the front panel selector switch. The knob's index mark indicates the selected input as labeled on the front panel lens.

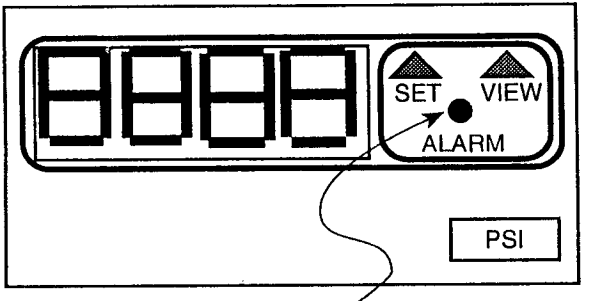


Using the Alarm Options

The Alarm LED indicator will turn on and the corresponding relay output will change state when an alarm condition exists. The LED will turn off and the relay will reset automatically when the alarm limit is no longer exceeded.

The alarm option uses two front panel buttons, **SET** and **VIEW**, to set-up and view the alarm trip point.

To examine the current limit value, press the **VIEW** button. For dual alarm versions, hold the **VIEW** button for 3 seconds to see the second limit value. Releasing the button returns you to the measurement mode.



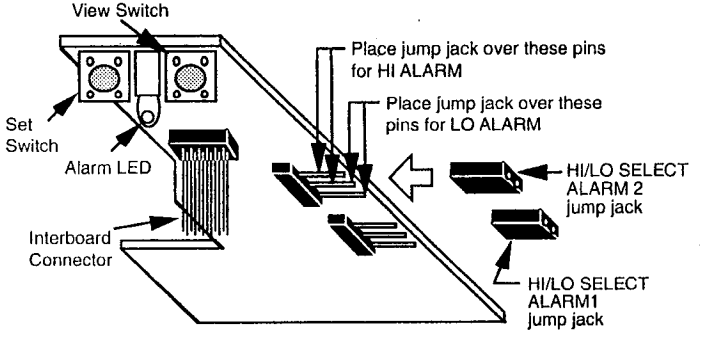
Single alarm unit has one red LED. Dual alarm unit has one yellow and one red.

Programming the Limit Value(s):

1. Press **VIEW** and **SET** buttons at the same time. The current limit value is displayed, ready to be programmed. For dual alarm versions, program the second limit value by holding the "**VIEW**" button for 3 seconds (until the display changes to show second value) then, with the **VIEW** button still held, press the "**SET**" button. Follow steps 2-5 below.(**Note**: During the process of changing the limit value, the instrument is still taking readings and performing alarm checking against the current limit value.)(**Note**: during the process of changing the limit value, the instrument is still taking readings and performing alarm checking against the current limit value.)
2. Select the digit or decimal point to be changed by pressing the **VIEW** button as required. The current selection is indicated by a blinking digit or decimal point.
3. Change the blinking number or decimal point location by pressing the **SET** button.
4. Repeat steps 2 and 3 as necessary to set a new limit value.

To Configure for a HI or LO Alarm:

1. Snap off the front panel lens.
2. Locate the jump jack on the board behind the **VIEW** button.
3. Place the jump jack over the appropriate pair of pins for a desired alarm action. See the drawing below for details.

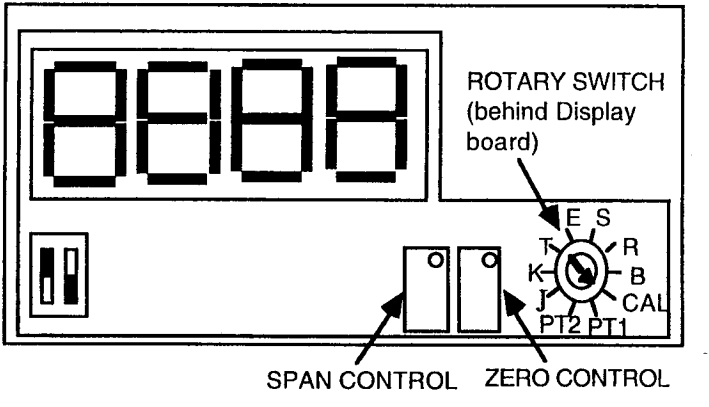


5. After you finish changing the limit value, pressing the **VIEW** and **SET** buttons at the same time to return to the measurement display mode. The newly programmed limit value is now in effect and stored in the non-volatile memory.

CALIBRATION

Calibrating your indicator once a year is recommended to assure specified accuracy. Be sure to calibrate your indicator whenever you change *between* thermocouple and RTD type sensors.

Follow the calibration procedure on the next pages for the respective sensor type. The calibration controls are behind the front panel lens. See the drawing below:



For Thermocouple Input

Equipment Required:

A Precision DC voltage source with a resolution to 1μV; accuracy ±.0.01% (±2μV)

Interconnecting copper wire from the DC source to the unit

Trimmer adjusting tool (blade type)

Procedure:

1. Observing contact polarity, connect the voltage source to the Thermocouple inputs as shown in the wiring diagram on page 4. *(Be sure the power is OFF when making connections.)*
2. Snap off the front panel lens. Set the rotary switch to the CAL position (see page 17). Ensure that the jump jack is set for Thermocouple Input (see page 12).
3. Adjust the voltage source output to 0.00mV.
4. Adjust the **ZERO** control for a display reading of 0.0 (±0.1). (**Note:** display readings take up to 3 seconds to respond to changes in control setting.)
5. Adjust the voltage source output to 39.000mV.
6. Adjust the **SPAN** control for a display reading of 560.0 (±0.1). (**Note:** display readings take up to 3 seconds to respond to changes in control setting.)
7. Reset the rotary switch to the desired thermocouple type and replace the front panel lens. This completes calibration for thermocouple input.

For RTD Input

Equipment Required:

- A precision resistance decade box with a resolution of 0.01Ω and an accuracy of ±.0.02%
- Interconnecting copper wire from the resistance source to the 500T.
- Trimmer adjusting tool (blade type)

Procedure:

1. Connect a decade box to the RTD input (+V,-V and I) as shown in the wiring diagram on page 4. (*Be sure the power is OFF when making connections.*)
2. Snap off the front panel lens. Set the rotary switch to the **CAL** position (see page 17). Ensure the jump jack is set for an RTD input (see page 12).
3. Adjust the decade box to 0.00 Ω.
4. Adjust the **ZERO** control for display reading of 0.0 (±0.1). (**Note:** display readings take up to 3 seconds to respond to changes in control setting.)
5. Adjust the decade box to 265.00 Ω.
6. Adjust the **SPAN** control for a display reading of 543.8 (±0.1). (**Note:** display readings take up to 3 seconds to show changes in control setting.)
7. Set the rotary switch to the desired RTD range (PT1 =α .00385 PT2 =α .00392) and replace the front panel lens. This completes calibration for RTD input.

FUNCTIONAL SPECIFICATIONS

Input Range Table

INPUT TYPE	RANGE (0.1° Resolution)	RANGE (1° Resolution)
J Thermocouple	-99.9 to 761.8°C -99.9 to 999.9°F	-205 to 762°C -337 to 1403°F
K Thermocouple	-99.9 to 999.9°C -99.9 to 999.9°F	-202 to 1377°C -331 to 2510°F
T Thermocouple	-99.9 to 401.4°C -99.9 to 754.6°F	-210 to 401°C -346 to 755°F
E Thermocouple	-99.9 to 999.9°C -99.9 to 999.9°F	-205 to 1002°C -338 to 1835°F
S Thermocouple	----------	0 to 1770°C 32 to 3218°F
R Thermocouple	----------	0 to 1769°C 32 to 3216°F
B Thermocouple	----------	316 to 1829°C 601 to 3325°F
PT100, RTD α .00385, 3 wire	-99.9 to 862.6°C -99.9 to 999.9°F	-200 to 863°C -329 to 1585°F
PT100, RTD α .00392, 3 wire	-99.9 to 850.8°C -99.9 to 999.9°F	-202 to 851°C -332 to 1563°F

Input Impedance:

Thermocouple: 20MΩ (exclusive of break detect current effects)

RTD: 16.9kΩ, V+ input; 16.9kΩ, I- input

Break Detection :

Upscale, ≈50 nanoamps

A/D Read Rate:

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

Reference Junction (Thermocouple):

Internal, automatic

Power:

115VAC ±10%, 50-60Hz; 230VAC ±10%, 50-60Hz Jumper selectable

PERFORMANCE SPECIFICATIONS

Reference Operating Conditions (ROC):

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

Accuracy (at ROC):

±1 count LSD

INPUT TYPE	ACCURACY ±	
	1° RESOLUTION	0.1° RESOLUTION
J, K, T, E Thermocouple	1° plus 0.03% RDG	0.5°C or 0.9°F
S, R, B Thermocouple	1° plus 0.05% RDG	
PTα .00385, α .00392 RTD	1° plus 0.03% RDG	0.5°C or 0.9°F

Multi-Input Option Accuracy

Add ± 0.5 °C/± 1 °F to accuracy specification when Multi-Input option is used.

Noise Rejection:

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

RTD Leadwire Error @ 150 μA excitation current

40 milliOhms per Ohm of equal resistance in V+ and V- leads

1 Ohm per Ohm of unbalance in V+ and V- leads

Overload Protection:

Power lead to ground: 1500VDC or AC RMS

Across inputs—

T/C:Up to 250VDC or VAC for 1 minute, V+ to V-

RTD:Up to 125 VDC or VAC for 1 minute, V+ to V-

Up to 62 VDC or VAC for 1 minute, V- to I

Stability With Temperature:

Zero: 1μV/°C
Span: 0.01% rdg/°C

Thermocouple Reference Junction : 0.03° per degree, 5 - 45 °C

Stability With Time:

1°/year

Repeatability:

±1 count

Accuracy with Multi-Input Option Derating:

Adds ±0.5 °C/±1 °F to instrument accuracy specification

ENVIRONMENTAL/PHYSICAL SPECIFICATIONS

Operating Range:

Temperature: 5 to 45 °C

Relative Humidity: 10-80% RH non-condensing

Storage Range:

-40 to 65 °C

Power:

115VAC ±10%, 50-60Hz

230VAC ± 10%, 50-60Hz

Size:

Bezel: 96mm W x 48mm H

Case: 92mm W x 40mm H x 136mm D

Maximum Weight:

≈454 kg/1 lb

MADE IN THE USA

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our 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. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, buyer will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

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

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

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

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