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# User's Guide



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# CL542

## Thermocouple Calibrator

### J, T, E, K, R, S, B, N, mV



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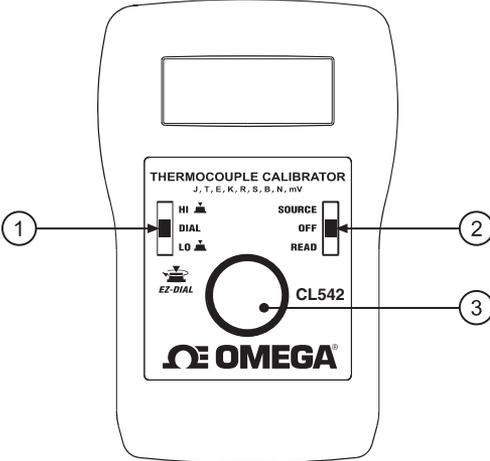
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**WARNING:** These products are not designed for use in, and should not be used for, human applications.

## Basic Keypad Operations

### 1 EZ-Check™ Switch

**SOURCE mode:** Slide the switch to select from three user-stored values for the desired calibration points. The user can select HI, DIAL and LO positions. These values can easily be changed to suit the calibration requirements.

**READ mode:** Slide the switch to recall minimum and maximum readings. Press the **EZ-Dial™ Knob** to clear the stored values.



### 2 SOURCE/OFF/READ Switch

Slide the **SOURCE/OFF/READ Switch** to **SOURCE** to output a voltage corresponding to the temperature on the display for the selected thermocouple type. Use the **READ** position to directly convert thermocouple input to temperature.

### 3 EZ-Dial™ Knob

Turn the knob to change temperature in 0.1° increments. Push and turn for faster dialing. Push without turning to store new EZ-Check™ HI/LO points in SIMULATE mode, or to clear EZ-Check™ HI/LO points in READ mode.

## CL542 Configuration

### Instructions for Enabling and Disabling the Configuration Options

1. Turn the CL542 on with the SOURCE/OFF/READ Switch.
2. Press the EZ-Dial™ Knob while the "PRESS EZ-DIAL KNOB FOR CONFIGURATION" message is displayed.
3. Select options by turning the EZ-Dial™ Knob until the arrow points to the desired option.
4. The option can be enabled or disabled by tapping the EZ-Dial™ Knob.

The CL542 configuration menu will exit automatically after 5 seconds of inactivity and go to normal operation with the options selected. These options are saved even when the unit is turned off.

PRESS EZ-DIAL KNOB  
FOR CONFIGURATION

AUTO OFF      ON  
DISPLAY UNITS °C  
T/C              TYPE K

## CL542 Configuration

Double-click the EZ-Dial™ Knob while in source or READ mode to enter the configuration menu.

Hold the EZ-Dial™ Knob while turning the unit on to bypass the "PRESS EZ-DIAL KNOB FOR CONFIGURATION" message altogether.

### CL542 Configuration Menu

**Auto Off** **ON/OFF**

If Auto Off is ON, the unit will turn off after 30 minutes to save battery life, if there is no user activity. If Auto Off is OFF the unit will stay on until it is turned off from the keypad. This is typically useful for manual loading or continuous use.

**Display Units** **°C/°F**

Pressing the EZ-Dial™ Knob to toggles between °C or °F

**T/C** **B, E, J, K, N, R, S, T, or mV**

To change T/C type, press the **EZ-Dial™ Knob**. Turn the **EZ-Dial™ Knob** to scroll through the list of available types. Press again to save and return to the configuration menu.

## READ Mode

Slide the **SOURCE/OFF/READ Switch** to **READ** for direct thermocouple input. The CL542 displays temperature corresponding to input for the selected thermocouple type.

Connect the T/C sensor. "OPEN T/C" will be displayed until properly connected.

Slide the EZ-Check™ Switch to HI and LO to recall maximum and minimum saved readings. Press and hold the EZ-Dial™ Knob to clear saved readings. The display flashes "CLEARED" as a confirmation.

Double-click the EZ-Dial™ Knob to return to the configuration menu.

Turning the EZ-Dial™ Knob has no effect in READ mode.

Other Display Indications:

<b>OVERRANGE</b> or <b>UNDERRANGE</b>	The millivoltage input exceeds the selected thermocouple type's range.
<b>OPEN T/C</b>	No thermocouple is connected, or the connected thermocouple exhibits > 10 kΩ.

## SOURCE Mode

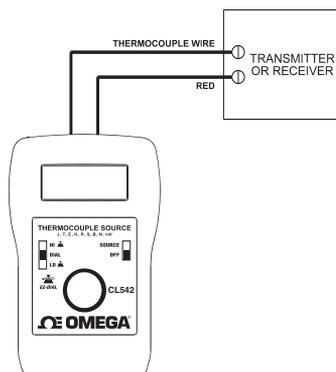
Slide the **SOURCE/OFF/READ Switch** to **SOURCE** for direct thermocouple output. The CL542 outputs voltage corresponding to temperature for the selected thermocouple type.

Slide the EZ-Check Switch to HI or LO to recall stored settings. While in the HI or LO position, dial a new setting and press the EZ-Dial™ Knob to store. The DIAL position always holds the last setting dialed there.

Turn the EZ-Dial™ Knob to change temperature, push and turn for faster dialing.

Double-click the EZ-Dial™ Knob to return to the configuration menu.

## Connection Diagram



### Two Wire Connection to Transmitter

## Specifications

### General Specifications:

Unless otherwise indicated all specifications are rated from a nominal 23 °C, 70 % RH for 1 year from calibration.

Temperature Range	-25 to 60 °C (-10 to 140 °F)
Relative Humidity Range	10 % ≤RH ≤90 % (0 to 35 °C), Non-condensing 10 % ≤RH ≤ 70 % (35 to 60 °C), Non-condensing
Overall Size	4.9 X 3.15 X 1.82 inches (125.5 X 80 X 46.2 mm)
Overall Weight (including 9V battery)	7.2 oz (204 grams)
Battery	9V Alkaline provides 45 hours of continuous use
Miscellaneous	Low battery indication with nominal 1 hour of operation left Overload protected to 60 volts for 30 seconds or less High-contrast graphic liquid crystal display with 0.357" (9.07 mm) high digits
Accuracy:	
Millivolt Accuracy	±(0.008 % of mV Setting + 0.006 mV)
Temperature Coefficient of mV Source	50 ppm/°C of output range
Cold Junction Calibration Accuracy	±0.1 °C (0.2 °F)
Cold Junction Sensor Temperature Coefficient	±0.025 %/° in ambient temperature (°C or °F)
General Temperature Accuracy	±(0.008 % of mV setting + 0.006 mV) ± 0.1 °C (0.2 °F)
Resolution	0.1 °C or 0.1 °F

### SOURCE Thermocouple Specifications:

Output Range	-13.000 to +80.000 mV
Output Noise	±5 μV pp from 0.1 Hz to 10 Hz
Output Impedance	0.2 Ω (200 nV/μA)
Source Current	< 8 mA

READ Thermocouple Specifications:

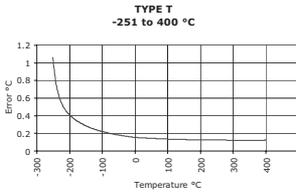
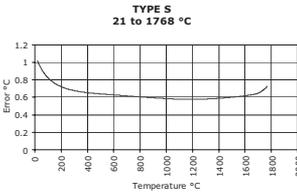
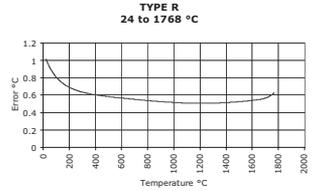
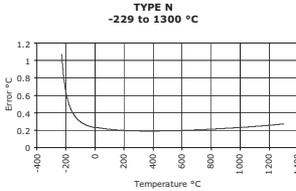
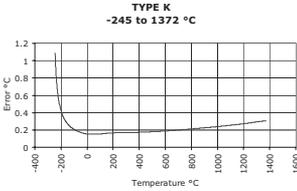
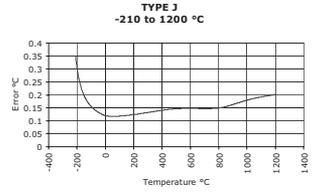
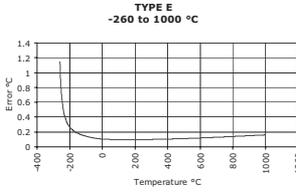
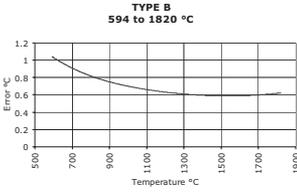
Input Noise	< ±1 LSD from 0.1 Hz to 10 Hz
Input Impedance	> 1 M $\Omega$
Open T/C Test Pulse	< 1 $\mu$ A for 300 ms
Open T/C Response Time	< 3 seconds
Open T/C Threshold	10 k $\Omega$ nominal

Available Options:

Carrying Case	Part Number: SC-540
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## Temperature Accuracy

The following charts give worst-case temperature accuracy based on stated millivolt accuracy of  $\pm(0.008\% + 0.006)$ . Temperature is uncompensated on the horizontal axis, referenced to 0 °C. Cold Junction calibration accuracy of 0.1 °C is not included in the temperature error.



# CL542 Field Calibration Procedure

## Equipment Needed:

1. Precision Voltage Meter with an accuracy of 0.0039% at 80.000mV.
2. Precision Voltage Source with an accuracy of 0.0039% at 80.000mV.
3. Precision Thermistor probe with accuracy of  $\pm 0.025^{\circ}\text{C}$  or better (YSI 46046)  
OR
4. A stable ice bath or Thermocouple ice point calibrator and a NIST traceable thermocouple wire stable to within  $\pm 0.025^{\circ}\text{C}$ .

Omega recommends using a direct junction temperature measurement technique for the most accurate and reliable calibrations of our equipment. This technique uses accurate RTD or thermistor probes to measure the reference junction (cold junction) temperature. While measuring the junction voltage with a DVM and ice bath technique will work. This method is less reliable due to complexity and is generally less accurate due to cumulative errors.

## Precautions:

Avoid touching thermocouple connections, as this will cause temperature errors in calibration. It is recommended that the CL542 be handled as little as possible during calibration to reduce errors. The heat from your body may cause uneven heating of temperature sensitive components.

## Enabling Calibration:

Place in a fresh battery and allow 15 minutes for the CL542 to stabilize to the ambient temperature. Remove the EZ-Dial™ Knob, battery cover and the four black Phillips head screws. While holding the CL542 face down in one hand, carefully separate the top and bottom of the housing. Place the units into calibration mode by shorting the calibration via located on the bottom right side of the PCB with tweezers and turn the UUT on. Verify the CL542 is in calibration mode by viewing the bottom of the LCD for the word “CAL”.

## Source mV Calibration:

Connect the Model 522 terminals to a Voltage Meter.

## LO Calibration:

1. Slide the EZ-Check™ Switch to the LO position indicated by displaying a “LO” on the left side of the LCD.
2. Dial the CL542 so the meter reads 0.000 mV.
3. Press the EZ-Dial™ Knob down.
4. The display will flash “STORED” to confirm that the value was stored.

## HI Calibration:

1. Slide the EZ-Check™ Switch to the HI position indicated by displaying a “HI” on the left side of the LCD.
2. Dial the CL542 so the meter reads 80.000 mV.
3. Press the EZ-Dial™ Knob down.
4. The display will flash “STORED” to confirm that the value was stored.

## Cold Junction Calibration:

Double click the EZ-Dial™ Knob to enter the Cold Junction Calibration Mode. “Cal CJ” will appear on the top left of the LCD.

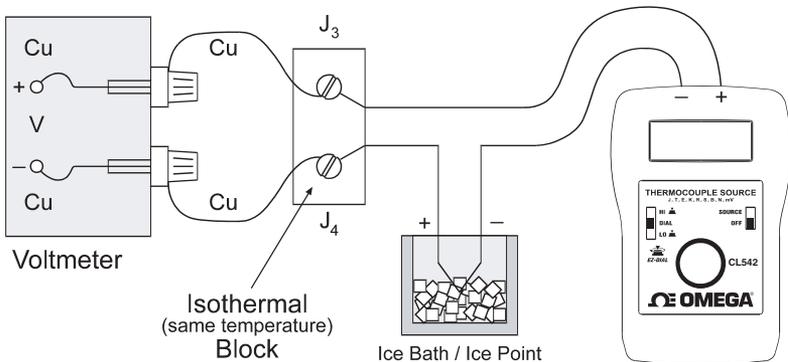
### Using a Thermistor Probe:

1. Connect the thermistor probe to the + side of the T/C connector.
2. Connect the other side of the thermistor probe to the OHM meter.
3. Let the temperature settle for 15 minutes.
4. Check the Cold Junction Temperature on the top right of the LCD with the temperature reading of the thermistor probe.
5. If the reading is out of specification then dial the EZ-Dial™ to the temperature reading from the thermistor probe.
6. Press the EZ-Dial™ Knob down.
7. The display will flash “STORED” to confirm that the value was stored.
8. Verify the UUT (top right side of the LCD) Cold Junction Temperature is tracking with the temperature reading of the thermistor probe.

### Using an Ice Bath or Ice Point Calibrator:

1. Connect the CL542 as shown in Figure 1.
2. Let the temperature settle for 15 minutes.
3. Check the Cold Junction Temperature on the top right of the LCD to the voltage reading on the DVM and T/C chart.
4. If the reading is out of Specification then dial the EZ-Dial™ to the correct reading from the DVM and T/C chart.
5. Press the EZ-Dial™ Knob down.
6. The display will flash “STORED” to confirm that the value was stored.
7. Verify the UUT (top right side of the LCD) Cold Junction Temperature is tracking with the temperature reading of the DVM and T/C Table

**Figure 1**



### **Read mV Calibration:**

Connect the CL542 terminals to a DC Voltage Source.

### LO Calibration:

1. Slide the EZ-Check™ switch to the LO position indicated by displaying “LO” on the left side of the LCD.
2. Set the voltage source to 0.000 mV.
3. Press the EZ-Dial™ Knob down
4. The display will flash “STORED” to confirm that the value was stored.

**HI Calibration:**

1. Slide the EZ-Check™ switch to the HI position indicated by displaying “HI” on the left side of the LCD.
2. Set the voltage source to 80.000 mV.
3. Press the EZ-Dial™ Knob down
4. The display will flash “STORED” to confirm that the value was stored.

**Completion of Calibration:**

Turn the CL542 OFF. Next time the unit is turned on the CL542 will be calibrated and in normal operational mode.

# NOTES



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