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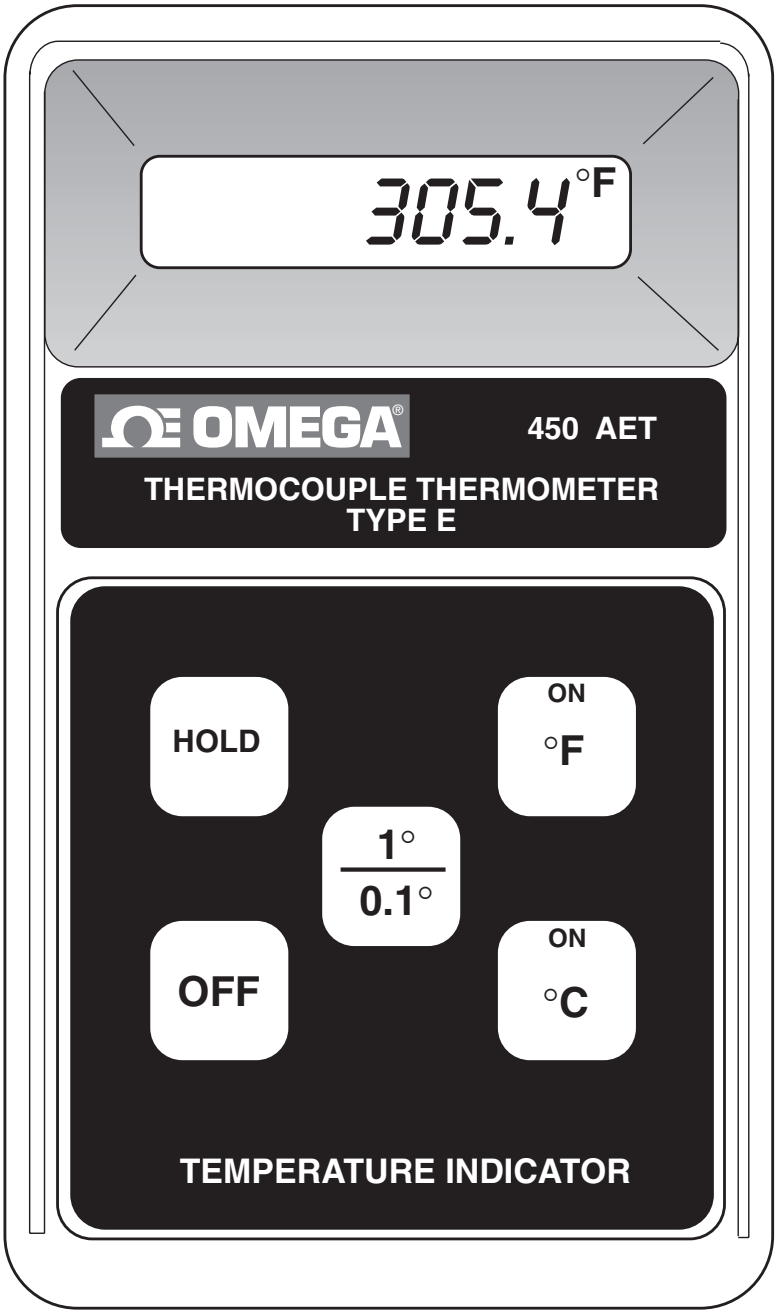
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2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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

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Section 1 Description

1.1 General Description

Your hand-held, battery operated digital temperature indicator is configured for compatibility with one of five temperature transducers, J,K,E,T RTD and Thermister.

Each of the configurations linearizes the analog output from the transducer to produce a stable and accurate digital temperature display. Plug-in type input connectors are used for the transducer input to provide quick connect and disconnect capability. The indicator functions are controlled by the key-board. The liquid crystal display exhibits the value of the measurement, degrees Fahrenheit or Celsius, and the low battery voltage indication.

The use of advanced digital design techniques give the indicator extremely accurate readings and exceptionally long battery life.

1.2 Physical Description

The indicator measures 45 mm (1.8 inches) in Height, 85 mm (3.3 inches) in width, and 145 mm (5.7 inches) in length. Weight is 230 grams (8.0 ounces). The case is constructed of high impact plastic.

1.3 Unpacking

The indicator is supplied with the battery installed. A quick electrical test should be performed to verify that the indicator is operative. See 2.3 in Section 2 for operating instructions.

Contact our Instrument Repair Department immediately if any problems are observed after checking out operation of the unit.

Specifications

Display:
Liquid crystal display, 7.6 mm (0.3 in.) digit Height
Operating temperature:
0 to 50°C (32 to 122°F) 0 to 75% Relative Humidity
Storage Temperature:
-20 to 70°C (-4 to 158°F)
Battery:
NEDA 1604, 9 Volt
Battery Life:
Thermocouple-2000 hours minimum
Platinum RTD-500 hours minimum
Thermistor- 1200 hours minimum
NMRR:
50 dB @ 50±1 Hz, 0.1° range
35 dB @ 50±1 Hz or 60±1Hz, 1° range
CMRR:
140 dB @ 50±1 Hz, 0.1° range
120 dB @ 50±1 Hz or 60±1Hz, 1° range

Maximum Common Mode Voltage:
1000VAC(RMS), ±2000V Peak

Accuracy at 22°C (72°F)

1° range:	±0.8°C±0.1% rdg
	±1.5°F±0.1% rdg
0.1° range:	±0.25°C±0.1% rdg
	±.45°F±0.1% rdg

Stability with time:

90 days:	add ±0.05% rdg.
1 year:	add ± 0.1% rdg.

Stability with temperature:

Thermocouple:

zero: ±0.03°C/°C
span: ±0.02% rdg/°C (max)
reference junction tracking ±1.0°C (±1.8°F)
from 5°C to 45°C (41°F to 113°F)

Platinum RTD: ±0.02°C, ±0.01% rdg/°C

Thermistor: positive- ±0.02°C/°C
negative-±0.04°C/°C

450 Range Table

Type K	1°	-189 C to +1372 C -308 F to +2501 F
	0.1°	-139.8 C to +203.7 C -219.7 F to +398.7 F
Type J	1°	-194 C to +1200 C -318 F to +2192 F
	0.1°	-117.4 C to +203.5 C -179.4 F to +398.7 F
Type E	1°	-212 C to +1000 C -351 F to +1832 F
	0.1°	-137.2 C to +203.5 C -215.0 F to +398.4 F
Type T	1°	-217 C to +400 C -360 F to +752 F
	0.1°	-148.2 C to +203.9 C -234.8 F to +399.0 F
RTD	1°	-233 C to +904 C -388 F to +1660 F
	0.1°	-102.9 C to +203.5 C -153.2 F to +398.3 F
Thermister	0.1°	-25.7 C to +103.2 C -14.4 F to +217.8 F

Section 2 Operation

2.1 Principles of Operation

The temperature indicator uses two ICs to digitize and display the analog input signal.

One IC performs the conversion of the analog input to the digital equivalent via 24 bit delta-sigma analog to digital converter. Battery voltage is also monitored by this IC and a thermistor supplies the reference junction correction signal.

The other IC receives input from the analog to digital converter, linearizes and drives the LCD display. Front panel buttons are also monitored.

2.2 Power

When battery voltage reaches about 6 volts, the display will exhibit a flashing: “LOW BAT” indication. A minimum of 20 hours of operation time remains upon initial appearance of the “LOW BAT” indication. When the battery voltage drops below 5 volts, an overload indications of three columns of dashes will appear on the display in addition to the flashing “LOW BAT” symbol.

The indicator uses a NEDA 1604 (or equivalent) 9 Volt battery. The battery will provide a minimum of 2000 hours of continuous thermocouple operation, 500 hours of RTD operation, or 1200 hours of thermistor operation. To replace the battery, follow these steps.

> *Note: The indicator must be OFF when Replacing the battery.*

Step 1: Place the indicator face down on a flat surface and remove the four screws located in

the recesses or each corner of the case bottom.

Step 2: Carefully pull the case halves straight apart so as not to damage the internal connectors.

Step 3. Install the new battery. Close the case and reinstall the four screws.

2.3 Operation

Step 1: Insert temperature sensor plug into the indicator input jack. Failure to insert a probe results in a overload condition of three columns of dashes showing on the display.

Step 2: Turn the indicator ON by pressing the °F or °C key. The display can be switched to read the temperature in degrees Celsius or Fahrenheit without affecting calibration.

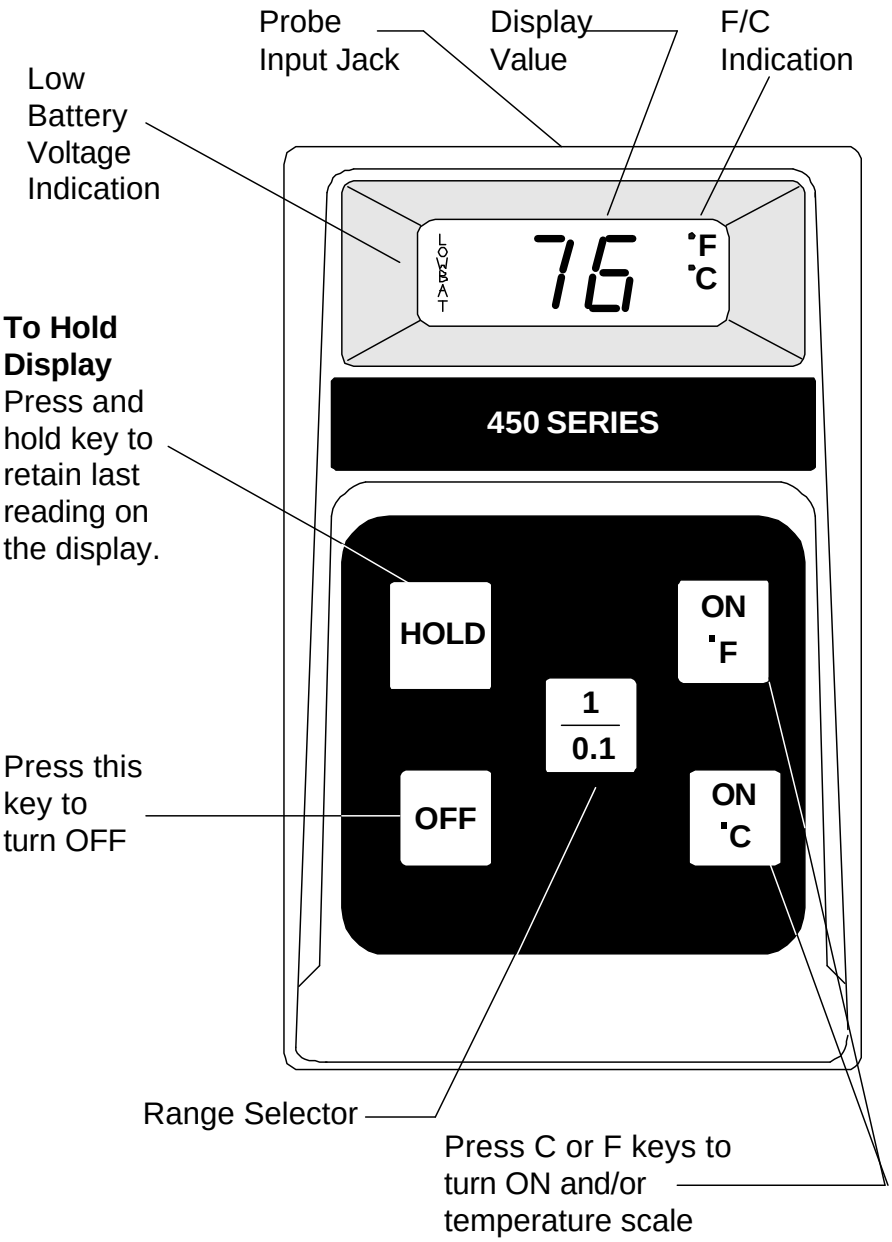
Step 3: Select the display range of 1° (wide range, low resolution) or 0.1° (narrow range, high resolution) with the 1°/0.1° key.

Note: The thermistor unit has a fixed resolution of 0.1°.

Step 4: By pressing and holding the HOLD key, The last reading will be displayed as long as the hold key is depressed. After the hold key is released, the indicator will revert to its normal display mode.

Step 5: Observe and or record the temperature value.

Step 6: Turn instrument off by pressing the OFF key.



Operation Features

2.4 Maintenance

Normal maintenance of the indicator consists of occasional cleaning with a soft, damp cloth, replacement of the battery as required, and calibration as outlined in Section 3.

Section 3 Calibration

3.1 Calibration

Units with serial numbers beginning with the letter N use the calibration procedure outlined below. Older units do not display version numbers and use the calibration procedures on page 19 .

The calibration procedure should be performed by a qualified instrumentation service technician. The indicator may be brought to any instrumentation calibration and repair laboratory (metrology lab) for the service (this manual should accompany the instrument). This procedure should be done at least once a year to guarantee continued performance within the specification.

The instrument should be calibrated at an ambient temperature of 22° C with a thermocouple simulator

with a minimum accuracy of ±0.1 degree Fahrenheit or ±0.2 degree Centigrade.

Step 1. Ensure the unit is turned off. Connect the output of the thermocouple simulator to the input of the indicator using the appropriate thermocouple wire. Set the simulator output to 0°C

Step 2. Locate the calibration switch on the back of the case labeled “Zero”. Remove the black button. Using a small screw drive or flat end of the trimmer pot, press the cal switch once. The display should read version and then switch to ambient temperature; press the switch one more time. The display should indicate .0.0 °C

Step 3. Press the switch one more time, the display should read max calibration temperature (for K type: 13.2.0, for J type: 9.6.0, for T type: 3.5.0, and for E type: 9.5.0) Now, set the simulator output to display temperature as show in table below.

NOTE: If you want to cancel the calibration mode press OFF button in front of the unit.

For T/C type K set simulator @ 1320 °C
J set simulator @ 960 °C
T set simulator @ 350 °C
E set simulator @ 950 °C

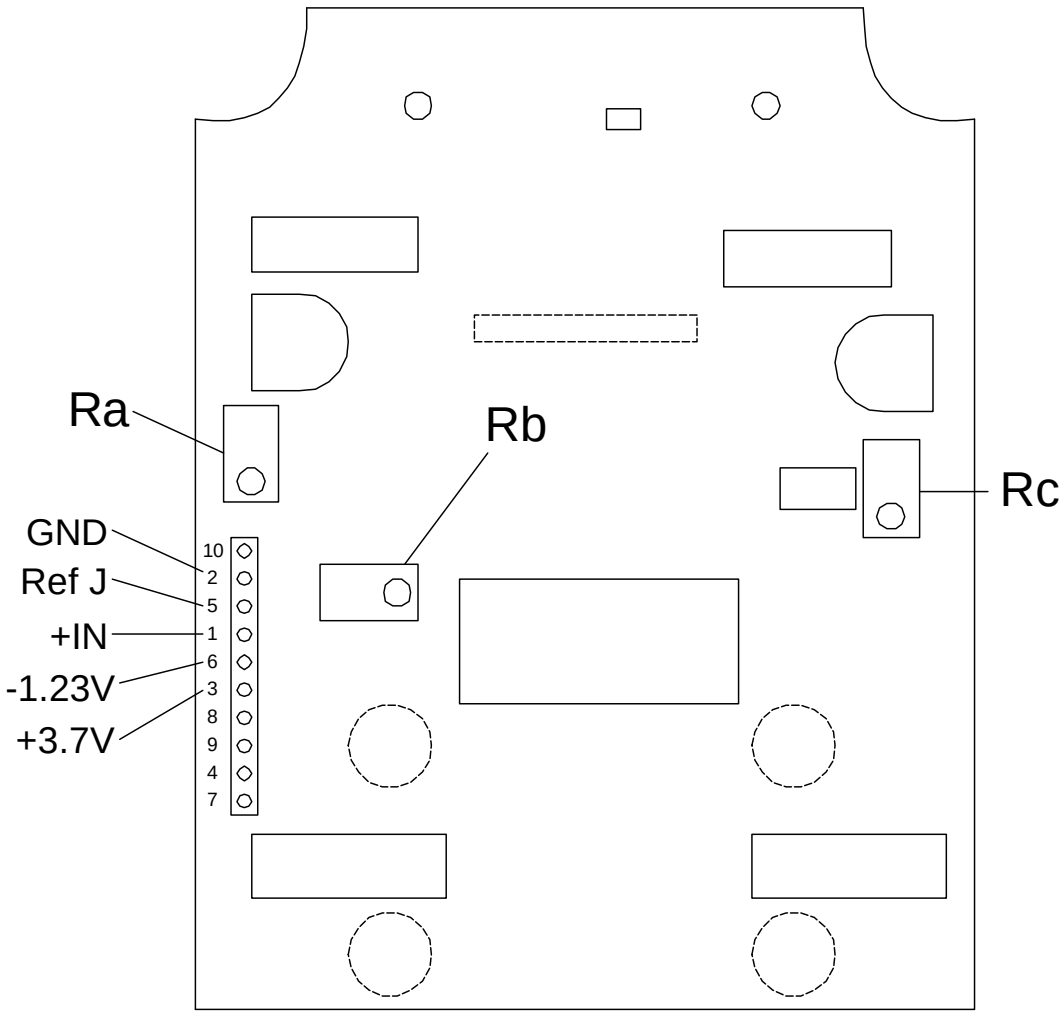
Press the switch one more time and wait for a few seconds until display switches to 0.0 set simulator to 0°C. Press switch one more time. Unit should shut-off.

Step 4. Now, turn the unit on from front panel. Make sure the unit in degree C mode. Verify that the unit is within specification throughout its range.

Step 5. If unit does not meet specification as 0°C then repeat calibration procedure,
Instead of setting simulator as 0°C, set it at the temperature indicated by the unit in measurement mode as 0°C. For example in measure mode, unit may display .2°C with simulator as 0°C. During

calibration procedure, set simulator at .2°C instead of 0 °C. Repeat the calibration procedure again.

Step 6. Verify calibration once finished.



Ra - Full Scale Adj.

Rb Zero Adj.

Rc +Full Scale Adj.

Calibration- Thermocouple Type K, J and T and E

Equipment List

- 4 ½ digit voltmeter
- Voltage Calibrator:
  Resolution, 1uV; accuracy ±0.01% (±2uV)
- Ice Bath, 0.00 °C ± 0.05°C
- Jumper lead terminated in mini-clips

For optimum results, the calibration should be performed with an ambient temperature from 20° 24°C (68° to 75°F). Refer to the figure on the previous page for the locations of all testpoints and adjustments.

a. Turn the indicator ON by pressing the °C key.

b. For types K, J, E and T units only, switch the indicator to the 0.1° range.

c. Remove the bottom case of the indicator.

d. Adjust the voltage calibrator for an output of 0.000mV and connect the minus lead from the calibrator to “GND” and the positive lead from the calibrator to “;+IN”, on the indicator printed circuit board.

e. Disable the reference junction by jumpering together the “REF J” and “GND” testpoints, using a jumper lead terminated in mini-clips.

f. Adjust Rb for an indicator display of 0.0°C.

g. Connect the DVM LO lead to “GND”, on the indicator printed circuit board.

h. Using HI lead of DVM, measure voltage at the “-1.23V” testpoint: disregarding polarity indication, record the voltage.

i. Move the DVM HI lead to the “3.7V” testpoint and record the voltage (disregard

polrity).

j. The voltage measured at the “3.7V” test-point should be 3.007 times larger than the voltage measured at the “-1.23V” test-point. Adjust Rc (which varies the +3.7V line to attain the proper ratio.

k. Switch the indicator to the 1° range.

l. Adjust the voltage calibrator for an output of

+53.782mV for type K; +57.942mV for type J; +75.983mV for type E; +18.824mV for type T;

m. Adjust Ra for an indicator display of +995°C for type E, or 1000°C for type J, or +1340°C for type K, or +367°C for type T.

n. Reassemble the indicator.

o. Perform the zero calibration.

Calibration- Thermistor Type

Equipment List

- 4 ½ digit voltmeter
- Precision decade box:
  Resolution, 0.01 ohm ; accuracy ±0.02%
- Ice Bath, 0.00 °C ± 0.05°C
- Electro Scientific Industries DB-62 or equivalent

a. Turn the indicator ON by pressing the °C key.

b. Remove the bottom case of the indicator.

c. Connect a precision resistance box to the terminals on the phone input jack; set the resistance box to 7,280 ohms.

d. Connect the DVM LO lead to “GND”, on the indicator printed circuit board.

e. Using HI lead of DVM, measure voltage

at the “-1.23V” testpoint: disregarding polarity indication, record the voltage.

f. Move the DVM HI lead to the “3.7V” testpoint and record the voltage (disregard polarity).

g. The voltage measured at the “3.7V” test-point should be 3.007 times larger than the voltage measured at the “-1.23V” test-point. Adjust Rc (which varies the +3.7V line to attain the proper ratio.

h. Adjust Rb for an indicator display of 0.2°C.

i. Set the resistance box to 148.4 ohms.

j. Adjust Ra for an indicator display of +101.0°C.

k. Reassemble the indicator.

l. Perform the zero calibration

Calibration- Platinum RTD

Equipment List

- 4 ½ digit voltmeter
- Precision decade box:
- Resolution, 0.01 ohm ; accuracy ±0.02%
- Ice Bath, 0.00 °C ± 0.05°C
- Electro Scientific Industries DB-62 or equivalent

a. Turn the indicator ON by pressing the °C key.

b. Remove the bottom case of the indicator.

c. Connect a precision resistance box to the terminals on the RTD input jack and set the resistance box to 100.04 ohms.

d. Using HI lead of DVM, measure voltage at the “-1.23V” testpoint: disregarding polarity indication, record the voltage.

e. Move the DVM HI lead to the “3.7V” testpoint and record the voltage (disregard polrity).

f. The voltage measured at the “3.7V” test-point should be 3.007 times larger than the voltage measured at the “-1.23V” test-point. Adjust Rc (which varies the +3.7V line to attain the proper ratio.

g. Adjust Rb for an indicator display of 32.2°F.

h. Adjust Ra for an indicator display of +196.0°C.

i. Reassemble the indicator.

Perform the zero calibration

Zero Calibration

a. Turn the indicator on by pressing the °C key.

b. Set the indicator to the 0.1° range.

c. Connect the ice bath probe to the indicator Input jack.

d. Place the probe in a stable ice bath (0.00C ±0.05°C and adjust the ZERO pot (Rb) located beneath the plug on the rear case for an indicator display of 0.0°C.

e. Replace the rubber plug.

Calibration is complete.

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