HH911T, HH912T
Thermocouple Thermometer

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# Instrument Description

## 1.1 Specifications

<table>
<thead>
<tr>
<th>General Specifications:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Accuracy</strong></td>
<td>±(0.04%</td>
</tr>
<tr>
<td><strong>Conformity</strong></td>
<td>ITS-90</td>
</tr>
<tr>
<td><strong>Temperature Ranges</strong></td>
<td>°C</td>
</tr>
<tr>
<td>K</td>
<td>-200 to 1372</td>
</tr>
<tr>
<td>J</td>
<td>-210 to 1200</td>
</tr>
<tr>
<td>T</td>
<td>-250 to 400</td>
</tr>
<tr>
<td>E</td>
<td>-250 to 1000</td>
</tr>
<tr>
<td><strong>Connector Type</strong></td>
<td>One (1) Mini-TC (HH911T)</td>
</tr>
<tr>
<td><strong>Probe Zero Function</strong></td>
<td>Resolution 0.1 °C/°F/K</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>Four (4) digit LCD, with Temperature, Units, Function, Trend, Polarity, Battery, and Decimal Indicators</td>
</tr>
<tr>
<td><strong>Display Backlight</strong></td>
<td>Four (4) LED Backlight with 30-second timeout</td>
</tr>
<tr>
<td><strong>Display Resolution</strong></td>
<td>0.1° &lt;1000°</td>
</tr>
<tr>
<td><strong>Reading Rate</strong></td>
<td>3 / Second for Readings and Trend Indicators</td>
</tr>
<tr>
<td><strong>Battery Type</strong></td>
<td>3 AA (IEC LR6, ANSI 15) Alkaline</td>
</tr>
<tr>
<td><strong>Battery Life</strong></td>
<td>2000 Hours Typical</td>
</tr>
<tr>
<td><strong>Battery Indicator</strong></td>
<td>Four (4) Stage Battery Charge Indicator</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>Minimum Reading</td>
</tr>
<tr>
<td></td>
<td>Maximum Reading</td>
</tr>
<tr>
<td></td>
<td>Average Reading</td>
</tr>
<tr>
<td><strong>Keypad</strong></td>
<td>Eight (8) momentary switches with audible and tactile feedback</td>
</tr>
<tr>
<td><strong>Clock</strong></td>
<td>Elapsed Statistics Run Time</td>
</tr>
<tr>
<td><strong>Power Cycle Configuration Retention</strong></td>
<td>Instrument retains last selected:</td>
</tr>
<tr>
<td></td>
<td>- Sensor Type</td>
</tr>
<tr>
<td></td>
<td>- Temperature Unit</td>
</tr>
<tr>
<td></td>
<td>- Offset Values</td>
</tr>
<tr>
<td><strong>Input Current</strong></td>
<td>±50 nA</td>
</tr>
<tr>
<td><strong>Maximum Common Mode Voltage</strong></td>
<td>42 V peak to earth</td>
</tr>
</tbody>
</table>
### Compliance:
CE (2014/30/EU) / RoHS2 (2011/65/EU)

### ESD:
IEC 61000-4 2:2009, Class B

### EMC:
- EN 55022:2010+A1:2015, Class A; EN 61000-4 3:2006+A2:2010, 10 V/m (80 MHz to 1 GHz)
- MIL-PRF-28800F, Class 2

### Environment:

<table>
<thead>
<tr>
<th>Standards</th>
<th>Operating Temp</th>
<th>Temperature Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-PRF-28800F, Class 2</td>
<td>-20 to 55 °C</td>
<td>For specification variances due to ambient operating temperature, see the Expanded Instrument Uncertainty charts in Appendix B of this manual. For ambient operating temperatures not shown in Appendix B, accuracies shall be interpolated linearly.</td>
</tr>
<tr>
<td>UL 60079-0 § 26.4.2</td>
<td>-4 to 131 °F</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 °C (50 °F): Non-condensing</td>
</tr>
<tr>
<td>10 to 30 °C (50 to 86 °F): 5 to 95% RH</td>
</tr>
<tr>
<td>30 to 40 °C (86 to 104 °F): 5 to 85% RH</td>
</tr>
<tr>
<td>40 to 55 °C (104 to 131 °F): 5 to 60% RH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4600 m</td>
</tr>
<tr>
<td>0 to 15,092 ft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random 10 – 500 Hz, 0.03 g²/Hz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>30g Half Sine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Drops from 1 m to Concrete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to 71 °C</td>
</tr>
<tr>
<td>-40 to 159 °F</td>
</tr>
</tbody>
</table>

### Physical Characteristics:

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Weight (incl. Batteries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>193 x 84 x 28 mm</td>
<td>HH911T: 300.9 g (10.6 oz.) HH912T: 303.2 g (10.7 oz.)</td>
</tr>
<tr>
<td>7.6 x 3.3 x 1.1 in</td>
<td></td>
</tr>
</tbody>
</table>

1 For complete instrument accuracies, see the Expanded Instrument Uncertainty charts in Appendix B of this manual.

### Optional Accessories and Ordering Information

<table>
<thead>
<tr>
<th>Product</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M5610/0918</td>
<td>Operation Manual</td>
</tr>
</tbody>
</table>

### Omega Family of Thermometers

<table>
<thead>
<tr>
<th>Thermocouple Thermometers</th>
<th>HH911T</th>
<th>Thermocouple Thermometer, Single Input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HH912T</td>
<td>Thermocouple Thermometer, Dual Input</td>
</tr>
<tr>
<td></td>
<td>HH931T</td>
<td>Data Thermometer, Single Input</td>
</tr>
<tr>
<td>Data Thermometers</td>
<td>HH932T</td>
<td>Data Thermometer, Dual Input</td>
</tr>
</tbody>
</table>
2. **PREPARATION FOR USE**

2.1 **General Information**

The Omega HH911T and HH912T Thermocouple Thermometers are high-accuracy handheld digital thermometers that provide accurate temperature readings in a wide range of manufacturing and service applications. These full-featured, durable, and versatile instruments simplify the process of temperature measurement through the intuitive user-interface. They are compatible with the four most popular NIST traceable thermocouple types, K, J, T, and E.

2.2 **Feature Overview**

- Keypad with audible and tactile feedback;
- 2000-hour battery life;\(^1\);
- Four (4) digit dual LCD with LED Backlight;
- Four (4) NIST-traceable thermocouple types: J, K, T, and E;
- Comprehensive real-time statistics: MIN, MAX, AVG, RNG, STDEV, and T1-T2;\(^2\);
- Easy to clean
- Probe offset function to minimize probe error;
- 0.1° / 1 ° display resolution;
- °F, °C, and K temperature units;
- Reading HOLD mode;
- Conforms to ITS-90 thermocouple tables;
- Durable: Meets MIL-PRF-28800F, Class 2 requirements;
- Tilt Stand/Magnet/Hanger
- User-friendly operation;
- Retains measurement parameters, even when turned off;
- Self-diagnostic routine to identify fault conditions;
- Low battery and open sensor indications;

---

\(^1\) Typical battery life under normal use conditions in laboratory environment. Continuous or repeated use of features such as the backlight or use or storage at high or low temperature extremes may reduce battery life.

\(^2\) T1-T2 is available on model HH912T only.
2.3 Safety Notices and Information

Symbols and Terms

Safety Notices denote hazards. They indicate an operating procedure, instruction, or practice that, if not correctly performed or followed, could result in damage to equipment, or injury or death to personnel. Do not proceed beyond a Safety Notice until all conditions and instructions are fully understood and complied with.

**WARNING**
WARNING denotes a hazard that could result in injury to personnel or death.

**CAUTION**
CAUTION denotes a hazard that could result in damage to the unit or other equipment.

**REMINDER**
REMINDER denotes important information about instrument functions, menus, and measurements.

Instrument Safety Notices

**WARNING**
MAINTENANCE INSTRUCTIONS WITHIN THIS MANUAL ARE FOR USE BY QUALIFIED SERVICE PERSONNEL ONLY. DO NOT ATTEMPT TO SERVICE THIS UNIT UNLESS YOU ARE QUALIFIED TO DO SO.

SHOCK HAZARD

Disconnect all temperature probes and turn the unit off before removing the battery cover.

Never connect thermocouple leads to any source where more than 42 Volts (peak) could exist between the lead and ground. If it is necessary to make measurements of an object at elevated electrical potential, the user is responsible for obtaining and properly using a probe that provides adequate insulation between the surface with elevated potential and the thermocouple wiring.

Always disconnect probe leads before opening the battery door or the instrument housing. Internal circuits can present a shock hazard if leads are connected to a source of elevated potential.

Do not use this instrument if the housing, probe wiring, probe, or probe handle are damaged or distorted. Housings and wire insulation are part of the personnel protection system, and if damaged could expose users to elevated potentials.

EXPLOSION HAZARD

Never use or store this product with batteries installed, or change batteries, in an environment where explosive or flammable vapors or dust suspensions may exist.

Do not attempt to recharge alkaline batteries.

Do not put batteries into bags designed to protect parts from electrostatic discharge (ESD). These bags are specially designed with metal shielding which can short circuit a battery.

Do not expose batteries to extreme heat or fire. Observe all regional laws and regulations when disposing batteries.

Never use this instrument or any temperature probe or sensor inside a microwave oven.

BURN HAZARD

Do not touch a temperature probe sheath that has been exposed to toxic substances or extremely high or low temperatures.
Do not attempt to measure temperatures beyond the range of the temperature probe. Probe damage or personal injury could result from exceeding a probe’s maximum temperature rating.

**CAUTION**

**RISK OF INCORRECT READING**

Do not use when AC or DC voltages in excess of 1V exist between thermocouple channels (on instruments with more than one channel). Excessive voltage could result in an incorrect reading, or in more extreme cases, a blown fuse that will result in incorrect readings and need for repair.

**RISK OF INSTRUMENT DAMAGE**

**Only replace batteries with size AA (IEC LR6, ANSI 15).** Observe proper polarity when installing batteries. Do not mix old and new batteries.

**Do not apply voltages across thermocouple leads in excess of normal thermocouple voltage for the selected range.** Excessive input voltage could result in blown fuse, component damage, or fire. Application of excessive voltage is not covered by the warranty.

**Avoid making sharp bends in probe or sensor lead wires.** Bending lead wires at sharp angles can damage the wire and cause probe failure.

**When using both thermometer inputs and a voltage differential exists between the two measurement points, at least one probe should be electrically insulated.** If not, a ground-loop current can flow through the thermocouple leads causing measurement error or instrument damage.

**Static discharge through a connected temperature probe may cause instrument damage.** Use care to avoid static discharge when handling the instrument or connected probes.
2.4 Unpacking and Inspection
Each instrument is electrically and mechanically inspected before shipment. Upon receiving your new Omega digital thermometer, unpack all items from the shipping container and check for any obvious damage that may have occurred during transit. Use the original packing materials if reshipment is necessary.

If any dents, broken, or loose parts are seen, do not use the equipment. Notify Omega immediately.

Check that all items are present. If any items are missing, notify Omega immediately.

The following items are included with every new instrument:
- One (1) Thermocouple Thermometer;
- One (1) Quick Start Guide;
- Statement of Traceability;
- Three (3) AA, 1.5 V batteries; and
- Optional accessories (if purchased).

2.5 Battery Installation and Replacement
Three (3) AA 1.5 V batteries are supplied with the instrument, but not installed. Read the following battery replacement instructions before attempting to install or remove the batteries.

**CAUTION** Always turn the instrument off and disconnect any input connections before replacing the batteries. Re-install the battery compartment cover before resuming use of the instrument.

**CAUTION** The battery compartment is sealed with a rubber gasket. Use care to not damage the gasket when removing or installing the battery compartment cover.

**CAUTION** Remove the batteries when storing the instrument for an extended period of time or in a high temperature environment to prevent battery leakage and possible damage to the instrument.

All measurement parameters may be reset to factory default if batteries are removed while the instrument is powered on. Always turn the instrument off before changing batteries.

To install or replace batteries:

**Required Tools:** Phillips Head Screwdriver

1. Identify the battery compartment located on the back of the instrument (see Figure 1 below);
2. Remove the two (2) battery compartment retaining screws;
3. Remove the battery compartment cover;
4. If present, carefully remove old batteries being careful to not damage the battery contacts;
5. Observing proper polarity, install three (3) new, AA alkaline (IEC LR6, ANSI 15) batteries;
6. Re-install the battery cover and two (2) retaining screws;
7. At initial power on after battery replacement, allow approximately 30 seconds for instrument to stabilize.

### Making Your First Temperature Measurement

Omega’s 900 Series Digital Handheld Thermometers are designed for easy operation, while still providing a feature-rich experience via the intuitive user interface.

To get started making temperature measurements right away, follow these steps:

1. Perform Section 2.5, Battery Installation and Replacement;
2. Connect a compatible temperature probe to the Channel 1 and/or Channel 2 input connector located at the top of the instrument;

   To ensure best measurement accuracy, allow several minutes for the thermocouple probe and connector to thermally stabilize after connection to the instrument.

3. The instrument will immediately display a temperature measurement for the connected channels. However, to ensure valid and best accuracy measurements, continue to Step 4 below;
4. Set the desired measurement parameters as follows:
   a. Enter the Setup Menu by pressing \( \text{SET} \), hold the key down for approximately 1.5 seconds, and then release it;
   b. The active thermocouple type is flashing on the display. Use \( \text{ Up Arrow } \) to select the thermocouple type of the connected temperature probe (E, J, K, or T);
   c. Momentarily (do not hold) press \( \text{SET} \) to save your selection and move to the next parameter;
d. The active temperature unit is flashing on the display. Use \( \uparrow \downarrow \) to select the desired temperature unit (°C, °F, or K);

e. Momentarily press SET to save your selection and move to the next parameter;

f. Channel 1 probe offset value is flashing on the display. If the temperature probe’s offset value is known, press \( \uparrow \downarrow \) to set the Channel 1 probe offset to the probe’s offset value. See Section 3.10, *Probe Offset*, for more information.

g. Momentarily press SET to save your selection and move to Channel 2 probe offset (if equipped);

h. If desired, repeat Step (f) above for Channel 2;

i. Momentarily press SET VIEW to save your selection and exit the setup menu.

Congratulations! You’re now ready to make accurate and reliable temperature measurements, wherever and whenever you may need to.

We know you are eager to begin using your new thermometer, but this overview is just the beginning. Please take a moment to familiarize yourself with this Operation Manual to learn about all the features and benefits of your new Omega Thermocouple Thermometer.
3. **OPERATING INSTRUCTIONS**

### 3.1 Keypad Functions
The instrument keypad is an eight (8) key, sealed membrane keypad. Each key provides audible and tactile user feedback when pressed. Key functions are described in Figure 2 below.

The , , , and keys have multiple functions which can be accessed by momentarily pressing the key, or alternatively, by pressing and holding the key for approximately 1.5 seconds. Throughout this Operation Manual, the press and hold sequence is indicated by the key designator followed by the subscript (1.5s). For instance, indicates that the key should be pressed and held for 1.5 seconds, then released to access the desired function.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power instrument ON or OFF</strong></td>
<td>Power instrument ON or OFF</td>
</tr>
<tr>
<td><strong>(1.5s)</strong></td>
<td>Disable auto-power OFF while instrument is on</td>
</tr>
<tr>
<td><strong>(1.5s)</strong></td>
<td>Enter instrument Setup Menu</td>
</tr>
<tr>
<td><strong>SET (1.5s)</strong></td>
<td>While in Setup Menu, save current value and step to next parameter</td>
</tr>
<tr>
<td><strong>HOLD (1.5s)</strong></td>
<td>Hold currently displayed measurement</td>
</tr>
<tr>
<td><strong>CLR (1.5s)</strong></td>
<td>Reset all statistics currently stored in memory</td>
</tr>
<tr>
<td><strong>CLR</strong></td>
<td>While in Setup Menu, discard all unsaved changes and exit menu</td>
</tr>
<tr>
<td><strong>VIEW</strong></td>
<td>Cycle through view modes and statistics</td>
</tr>
<tr>
<td></td>
<td>While in Setup Menu, save changes and exit menu</td>
</tr>
<tr>
<td><strong>↑</strong></td>
<td>While in Setup Menu, advance or reverse selected setting</td>
</tr>
<tr>
<td><strong>↓</strong></td>
<td>While viewing saved data, advance or reverse displayed measurement</td>
</tr>
<tr>
<td><strong>↑</strong></td>
<td>While in Calibration mode and when pressed simultaneously for 1.5 seconds, resets active calibration factor to default.</td>
</tr>
</tbody>
</table>

*Figure 2: Keypad Button Functional Description*

### 3.2 LCD Display
The display is a large, easy to read, dual LCD display, with an LED backlight for clear viewing in low-light conditions. It simultaneously displays temperature measurements for Channel 1 and Channel 2, current thermocouple type and temperature unit, trend indicators for both Channel 1 and Channel 2, and a battery voltage indicator.
In Statistics View, the display substitutes the Channel 2 temperature measurement with the active statistic result and displays an active statistic mode indicator and the elapsed time of the current statistic session. See Figure 3 below for further description of each display indicator.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOLD function is active</td>
</tr>
<tr>
<td>2</td>
<td>T1 and/or T2 OFFSET is active¹</td>
</tr>
<tr>
<td>3</td>
<td>Channel 1 temperature measurement</td>
</tr>
<tr>
<td>4</td>
<td>The active thermocouple type</td>
</tr>
<tr>
<td>5</td>
<td>Remaining battery life</td>
</tr>
<tr>
<td>6</td>
<td>Active temperature unit</td>
</tr>
<tr>
<td>7</td>
<td>Channel 2 temperature measurement², T1-T2</td>
</tr>
<tr>
<td></td>
<td>measurement result², or active statistic result²</td>
</tr>
<tr>
<td>8</td>
<td>Active statistic</td>
</tr>
<tr>
<td>9</td>
<td>Open Wire Detection Off</td>
</tr>
<tr>
<td>10</td>
<td>Setup Menu active</td>
</tr>
<tr>
<td>11</td>
<td>When viewing statistics, time elapsed since start</td>
</tr>
<tr>
<td></td>
<td>of statistics collection</td>
</tr>
<tr>
<td>12</td>
<td>Channel 2 trend indicators²</td>
</tr>
<tr>
<td>13</td>
<td>Channel 2 minus indicator</td>
</tr>
<tr>
<td>14</td>
<td>Channel 2 indicator²</td>
</tr>
<tr>
<td>15</td>
<td>T1-T2 temperature measurement indicator²</td>
</tr>
<tr>
<td>16</td>
<td>Channel 1 trend indicators</td>
</tr>
<tr>
<td>17</td>
<td>Channel 1 minus indicator</td>
</tr>
<tr>
<td>18</td>
<td>Channel 1 indicator</td>
</tr>
</tbody>
</table>

¹ T2 Probe Offset available on model HH912T only.
² Models HH912T only.
Operating Instructions

Figure 3: LCD Display Description

The LCD can display error information about the current measurement, as shown in Figure 4.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
<td>No thermocouple probe is connected or making connection</td>
</tr>
<tr>
<td>-Or-</td>
<td>Over range: The applied temperature is greater than the maximum temperature for the selected thermocouple type</td>
</tr>
<tr>
<td>-Ur-</td>
<td>Under range: The applied temperature is less than the minimum temperature for the selected thermocouple type</td>
</tr>
</tbody>
</table>

Figure 4: LCD Error Indications

3.3 Setup Menu

Key designators followed by (1.5s), e.g. \( \text{SET}(1.5\text{s}) \), indicate that the key should be pressed and held for 1.5 seconds, then released to access the desired function.

Measurement settings are configured in the Setup Menu. Press \( \text{SET}(1.5\text{s}) \) to access the Setup Menu. The SET annunciator will appear at the bottom of the display and the currently selected thermocouple type will begin to flash.

From within the Setup Menu, press \( \text{SET} \) to step through the user-definable parameters and the \( \uparrow \downarrow \) keys to advance or reverse the selected value for the active parameter. The active parameter value will flash on the display.

Press \( \text{SET} \) to save a setting and step to the next parameter. Press \( \text{VIEW} \) to save a setting and exit the Setup Menu. Press \( \text{CLR} \) to disregard unsaved changes and exit the Setup Menu. If no key is pressed for ten (10) seconds, the current configuration is saved and the instrument will exit the Setup Menu.

Figure 5 below lists the user-definable parameters and the available values for each parameter.

To set a parameter value:

1. Press \( \text{SET}(1.5\text{s}) \) to enter the Setup Menu;
2. Press \( \text{SET} \) to cycle through parameters as shown in Figure 5 until the desired parameter is reached;
3. To change the value of the current parameter, press \( \uparrow \downarrow \);
4. To save the current parameter value and cycle to the next parameter, press \( \text{SET}(1.5\text{s}) \).

5. To save the current parameter value and exit the Setup Menu, press \( \text{VIEW} \).

6. To disregard changes made to the current parameter value and exit the Setup Menu, press \( \text{C} \).

If no key is pressed for ten (10) seconds, the instrument will save the current configuration and exit the Setup Menu.

### 3.4 View Modes and Statistics

The instrument features multiple view modes including a variety of real-time statistics, all available at the touch of a button. Figure 6 below describes each view mode.

<table>
<thead>
<tr>
<th>VIEW MODE</th>
<th>DISPLAY INDICATOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1–T2</td>
<td>T1-T2</td>
<td>Current Channel 1 measurement – current Channel 2 measurement</td>
</tr>
<tr>
<td>Minimum</td>
<td>MIN</td>
<td>Minimum temperature recorded during current session</td>
</tr>
<tr>
<td>Maximum</td>
<td>MAX</td>
<td>Maximum temperature recorded during current session</td>
</tr>
<tr>
<td>Average</td>
<td>AVG</td>
<td>Average of all temperatures recorded during current session</td>
</tr>
<tr>
<td>Range</td>
<td>RNG</td>
<td>Maximum - Minimum</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>STDEV</td>
<td>Standard deviation of all temperatures recorded during the current session¹.</td>
</tr>
</tbody>
</table>

¹ Standard Deviation is calculated using the population formula: \( \sigma = \sqrt{\frac{\sum(x-\mu)^2}{N}} \).

Press \( \text{VIEW} \) to change view modes. For each mode, the active measurement or statistic result is displayed on the second line of the display.

The T1–T2 view mode displays the current Channel 1 measurement minus the current Channel 2 measurement. The display indicates \( \text{T1-T2} \) at the left side of the display. If either
Operating Instructions

channel is not connected to a probe, or the current measurement on either channel is over- or under-range, T1-T2 view mode is not available.

When viewing statistics, the active statistic is indicated directly below the result. The elapsed time of the current statistics session is displayed in the lower-left corner of the display.

Statistics are calculated continuously, beginning when the instrument is powered on or when \( (1.5s) \) is pressed. To pause statistics collection temporarily, press \( \text{HOLD} \). To resume statistics collection, press \( \text{HOLD} \) again.

It is important to note that changing parameter values or temperature probes will invalidate the current statistics session. When using statistics, always begin by pressing \( (1.5s) \) to delete existing statistics data and initiate a new statistics session.

Press \( \text{VIEW} \) to step through the available statistics. Statistics are displayed in the order shown in Figure 7 below. For dual-channel models, the LCD T1 or T2 indicators are lit to identify the channel’s statistics currently being displayed.

<table>
<thead>
<tr>
<th>Model</th>
<th>Channel</th>
<th>Statistic View Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH911T</td>
<td>T1</td>
<td>MIN, MAX, AVG, RNG, STDEV</td>
</tr>
<tr>
<td>HH912T</td>
<td>T1</td>
<td>MIN, MAX, AVG, RNG, STDEV</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>MIN, MAX, AVG, RNG, STDEV</td>
</tr>
</tbody>
</table>

*Figure 7: Statistics Sequence*

If the instrument records invalid measurement data during the statistics session such as an over-range, under-range, or open input value, \( \text{———} \) will be displayed for each affected statistic result.

To return to the active measurement mode, press \( \text{VIEW} \) repeatedly to step through the remaining view modes, or cycle power.

3.5 Auto-Power Off

Key designators followed by \( (1.5s) \), e.g. \( (1.5s) \), indicate that the key should be pressed and held for 1.5 seconds, then released to access the desired function.
To conserve battery life, the instrument automatically turns off if no key is pressed for 20 minutes. To disable this feature, press \( \text{（1.5s）} \). The remaining battery life indicator will flash once, indicating auto-power off is disabled.

Auto-power off will remain disabled until instrument power is cycled. At next power on, auto-power off returns to the default enabled condition.

### 3.6 Backlight and Backlight Timeout

The instrument includes an LED backlight feature to ensure measurement data can be easily read in low-light conditions. To activate the backlight, press \( \) .

Once the backlight is activated, it will automatically turn off after 30 seconds if no key is pressed to preserve battery life. To disable the backlight timeout feature, press \( \text{（1.5s）} \). The backlight will flash to indicate the timeout feature has been disabled. To re-enable the backlight timeout feature, turn the backlight off then on by pressing \( \) twice.

### 3.7 Hold Function

Press \( \) to hold the current reading and/or statistics result, and to pause statistics accumulation. \( \text{HOLD} \) is displayed at the top-left of the LCD display. New measurements are not displayed, trend indicators are not refreshed, and statistics are not calculated while the hold function is active.

To disable the hold function and resume normal operation and statistics data accumulation, press \( \) again.

### 3.8 Trend Indicators

Trend indicators provide a visual representation of the measurement’s stability, and separate indicators are provided for each channel. An up arrow indicates that the current measurement is trending upwards, while a down arrow indicates the measurement is trending downwards. Neither arrow is visible when the measurement is stable. For best accuracy, always allow the measurement to stabilize before evaluating or recording the measured temperature. This feature can be turned on and off in the Setup menu. See section 3.3 above.

### 3.9 Battery Indicator

Battery depletion or battery replacement will reset all measurement parameters to their default values and deletes all existing statistics data. After battery replacement, set measurement parameters as required.

<table>
<thead>
<tr>
<th>BARS</th>
<th>APPROX. BATTERY LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>100% - 50%</td>
</tr>
<tr>
<td>2</td>
<td>50% - 20%</td>
</tr>
<tr>
<td>1</td>
<td>20% - 5%</td>
</tr>
<tr>
<td>0</td>
<td>0% - Shutdown Initiated</td>
</tr>
</tbody>
</table>
The battery voltage indicator provides a visual representation of approximate remaining battery life. It is located at the top-right of the display.

The battery voltage indicator uses three bars to represent remaining battery life. Figure 8 shows the approximate battery life for each bar.

At zero (0) bars, the instrument will momentarily display bATT and initiate a shutdown sequence. To prevent disruption of the measurement process and statistics collection, the batteries should be replaced before the battery voltage indicator reaches zero (0) bars. See Section 2.5, Battery Installation and Replacement.

### 3.10 Probe Offset

The probe offset feature compensates for temperature probe errors, significantly improving overall measurement uncertainty. Probe offset can be set for Channel 1 and 2 individually. Once set, the probe offset is automatically applied to all subsequent measurements and statistics on the offset channel.

| ![Reminder] | Current statistics will be invalidated after changing settings such as probe offset. Press (CLR) (1.5s) to delete existing statistics data and initiate a new statistics session. |
| ![Reminder] | Probe offset rounding errors may occur if temperature units are changed while a probe offset is active. When using a probe offset, verify and if necessary correct the programmed probe offset after changing temperature units. |}

To set the probe offset when using an un-calibrated temperature probe:

1. Connect the temperature probe to Channel 1 or Channel 2 (as desired) of the instrument;
2. Place the probe into a known temperature reference such as a thermowell or ice bath;
3. Allow the temperature probe to stabilize in the ice bath or thermowell by observing the instrument trend indicators for the appropriate channel;
4. Press (SET) (1.5s) to enter the Setup Menu;
5. Press SET three (3) times to cycle to the Channel 1 Offset parameter;
6. Observe the current Channel 1 temperature measurement displayed on the top measurement line of the display, and current offset value displayed on the second line of the display;
7. Press (↑) (↓) to set the offset in 0.1 ° increments until the displayed temperature equals the known temperature reference value;
8. Press SET to save the offset value and proceed to Channel 2 offset (HH912T only), or press VIEW to save the offset value and exit the Setup Menu.

---

³ Probe offset measurement using an ice bath or thermowell should only be performed by personnel trained and qualified in the use of such instruments and related metrology methods.
Operating Instructions

9. **OFFSET** is displayed at the top-left of the LCD display.

To set the probe offset when using a calibrated temperature probe with a known offset:

1. Press \( \text{SET}(1.5s) \) to enter the Setup Menu;
2. Press \( \text{SET} \) three (3) times to cycle to the Channel 1 Offset parameter;
3. Observe the current offset value displayed on the second line of the display;
4. Press \( \text{ } \uparrow \text{ } \downarrow \) to set the offset in 0.1 ° increments until the displayed offset value equals the calibrated probe offset value;
5. Press \( \text{SET} \) to save the offset value and proceed to Channel 2 offset (HH912T only), or press \( \text{VIEW} \) to save the offset value and exit the Setup Menu.
   a. Alternatively, to disregard the new offset value and exit the Setup Menu, press \( \text{CLR} \).
6. **OFFSET** is displayed at the top-left of the LCD display.

3.11 **Open Wire Detection On/Off**

Open Wire Detection allows the unit to detect if a thermocouple probe is connected to the thermometer. This feature is not compatible with some thermocouple calibrators and can result in measurement instability.

Turning Off Open Wire Detection in these situations can significantly improve reading stability. Once off, Open Wire Detection will remain off until changed by following the below steps, or the instrument is powered off.

If no thermocouple probe is connected and Open Wire Detection is disabled, the unit will not indicate "OPEN" and may display erratic readings.

To change the Open Wire Detection setting:

1. Press \( \text{SET}(1.5s) \) to enter the Setup Menu;
2. Press \( \text{SET} \) four (4) times for HH911T, five (5) times for HH912T, to cycle to the Open Wire Detection Off/On parameter;
3. “OWD OFF” is flashing near the bottom of the LCD display, and the current Open Wire Detection status is displayed on Line 2.
4. Press \( \text{ } \uparrow \text{ } \downarrow \) to change the Open Wire Detection setting as shown on Line 2 of the display;
   a. ON indicates that Open Wire Detection is enabled;
   b. OFF indicates that Open Wire Detection is disabled;
5. Press \( \text{VIEW} \) or \( \text{SET} \) to save the Open Wire Detection setting and exit the Setup Menu.
a. Alternatively, to disregard the Open Wire Detection setting and exit the Setup Menu, press CLR.

6. While Open Wire Detection is off, the “OWD OFF” annunciator will be shown during active measurement mode.

### 3.12 Clear Function

From active measurement or hold mode, press CLR (1.5s) to clear the statistics registers and begin a new statistics session. The LCD display will indicate CLR to confirm the action and return to active measurement mode.

Pressing CLR (1.5s) deletes all measurement data currently saved in the instrument’s internal memory. To prevent data loss, connect to the Thermometer Link mobile app and TEGAM Cloud to upload saved data before performing this action.

From the Setup Menu, press CLR to disregard changes to the current parameter value and exit the Setup Menu.

### 3.13 Invalid Measurement Indications

The LCD display indicates when a measurement or statistic is invalid, as shown in Figure 9 below.

<table>
<thead>
<tr>
<th>INDICATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Or -</td>
<td>The current measurement or statistic is over-range for the selected thermocouple type</td>
</tr>
<tr>
<td>- Ur -</td>
<td>The current measurement or statistic is under-range for the selected thermocouple type</td>
</tr>
<tr>
<td>OPEn</td>
<td>No probe is connected, or the probe sensor is faulty</td>
</tr>
<tr>
<td>————</td>
<td>Cannot compute a valid statistical result</td>
</tr>
</tbody>
</table>

**Figure 9: Invalid Measurement Indications**

### 3.14 Resolution and Rounding Functions (Serial Number 2148 and later)

This feature allows the user to select between four rounding methods or modes. These modes are Automatic (Auto), Normal (nOrL), Ceiling (CEIL) and Truncate (trnC). In these modes the rounding methods are different, but the resolution, (except Auto), are all set at a 1° increment and cannot be changed.

Two functions, ceiling (CEIL) and truncate (trnC) have special algorithms designed to assure that the target temperature is fully achieved depending upon the direction you are approaching the target temperature.

The nOrL function provides standard rounding, round down <0.5° and round up ≥ 0.5°

The CEIL function provides 1° resolution and is used when approaching the target temperature moving towards zero in either direction, up or down.
The Trunc function provides 1° resolution and is used when approaching the target temperature moving away from zero in either direction, up or down.

See detailed descriptions below.

rndG
1. AutO: 0.1° Resolution for readings <1000° and 1°>999.9°. AutO is the default setting.
2. CEIL: 1° Resolution with ceiling rounding is used for a decreasing positive temperature to assure the lower temperature is fully reached or an increasing negative temperature to assure a higher temperature is fully reached.

For Example: A decreasing (cooling) temperature 20.4° actual temperature will display 21° until 20.0° is reached. An increasing (thawing) temperature -20.6° will display -21° until -20.0° is reached.

3. nOrL: 1° Resolution with normal rounding, 20.4° displays 20°, 20.5° displays 21°
4. trnC: 1° Resolution with truncate rounding is used to assure that an increasing positive temperature is fully reached or a decreasing negative temperature to assure the lower temperature is fully reached.

For Example: An increasing temperature (heating) 20.6° will display 20° until 21.0° is reached.
A decreasing temperature (cooling) -20.6° will display -20° until -21.0° is reached.

This is for data on the instrument display only. Data transferred via the TEGAM Thermometer link to the TEGAM Cloud or via Bluetooth from the instrument will not have any rounding applied.
4. Service Information

4.1 Inspection and Cleaning

To extend the life of the instrument, inspect and clean the instrument regularly. Inspect the instrument for any significant abrasions, cuts, cracks, dents, or other signs of damage on the case, keypad, and display lens. Inspect the connectors for breaks, dirt, or corrosion. Ensure all screws are securely fastened, and if equipped, that the tilt stand/magnet/hanger is in good condition and locks into position properly.

With all screws securely fastened and the battery compartment cover in place, use a damp cloth or towel to wipe down the instrument. Use care to avoid scratching the display lens. Mild, non-abrasive detergents may be used providing the instrument is then wiped down with a clean damp cloth or towel.

4.2 Calibration

4.2.1 Verification Procedure

1. This procedure shall be performed within environmental conditions of 23 ±1 °C and 5% to 95% RH.

2. The unit under test ("UUT") shall be acclimated to the controlled environment for a minimum of four (4) hours.

3. The equipment listed in Appendix A is required to fully verify the UUT to the expanded instrument uncertainties specified in Appendix B.

4. Refer to Appendix C for standard measurement points and tolerances for each thermocouple type.

5. One, several, or all the available thermocouple types may be verified as necessary. In the steps below, use the appropriate Thermocouple Cable and Thermocouple Calibrator settings as appropriate for the desired thermocouple type.

6. For two channel UUTs, both channels may be verified concurrently.

7. Set the UUT parameters as shown in Figure 10 below. Refer to Section 3.3, Setup Menu as necessary for UUT parameter setup instructions.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple Type</td>
<td>As Desired</td>
</tr>
<tr>
<td>Temperature Units</td>
<td>°C</td>
</tr>
<tr>
<td>Offset Ch. 1</td>
<td>0.0 °C</td>
</tr>
<tr>
<td>Offset Ch. 2 (HH912T only)</td>
<td>0.0 °C</td>
</tr>
<tr>
<td>Open Wire Detection On/Off</td>
<td>As Needed (see Section 3.11, Open Wire Detection On/Off)</td>
</tr>
</tbody>
</table>

Figure 10: UUT Verification Parameter Settings

8. Connect the miniature thermocouple connector of the Thermocouple Cable to Channel 1 of the UUT.

   a. For two channel UUTs using the Split Thermocouple Cable, connect the miniature thermocouple connector of one leg to the UUT Channel 1 input, and the miniature thermocouple connector of the other leg to the Channel 2 input.
9. Connect the opposite end of the Thermocouple Cable (or the single-connector end of the Split Thermocouple Cable) to the Thermocouple Calibrator thermocouple output.

10. Set the Thermocouple Calibrator thermocouple type to the desired thermocouple type.

11. Allow at least five minutes for this connection to stabilize.

12. Set the calibrator to output to the first Standard Value in Appendix C for the desired thermocouple type.

13. Record the UUT measurement in the Reading column of Appendix C for the appropriate Standard Value.

14. Record the cable correction value for the Thermocouple cable in the Cable Correction column of Appendix C.

15. Subtract the Cable Correction value from the Reading and record the result as the Corrected Reading \((\text{Reading} \ - \ \text{Cable Correction} = \text{Corrected Reading})\) in Appendix C.

16. Compare the Corrected Reading to the tolerances stated in the 2-Sigma Tolerance column of Appendix C to determine whether the UUT measurement is within published specifications.

17. Repeat Steps 12 through 16 for each remaining Standard Value in Appendix C for the current thermocouple type.

18. Repeat Steps 7 through 17 for each desired thermocouple type.

19. If Open Wire Detection was off in Step 7 above, enable the feature as shown in Section 3.11, Open Wire Detection On/Off.

### 4.2.2 Alignment Procedure

#### Preparation

1. This procedure shall be performed within environmental conditions of 23 ±1 °C and 5% to 95% RH.

2. The unit under test ("UUT") shall be acclimated to the controlled environment for a minimum of four (4) hours.

3. The equipment listed in Appendix A is required to align the UUT to the expanded instrument uncertainties specified in Appendix B.

4. Remove the UUT battery door housing to expose the alignment access hole.

5. Press UUT \(\text{UUT} \quad \text{CLR}\) to turn the UUT on.

6. Set the UUT parameters as shown in Figure 11 below. Refer to Section 3.3, Setup Menu as necessary for UUT parameter setup instructions.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple Type</td>
<td>Type E¹</td>
</tr>
<tr>
<td>Temperature Units</td>
<td>°C</td>
</tr>
</tbody>
</table>
Table:

<table>
<thead>
<tr>
<th>Offset Ch. 1</th>
<th>0.0 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset Ch. 2 (HH912T only)</td>
<td>0.0 °C</td>
</tr>
</tbody>
</table>

1 Other thermocouple types may be used in this procedure as desired. For instance, if the UUT is used primarily with Type J applications, Cold Junction Compensation may be aligned using Type J. Note however that the expanded instrument uncertainties provided in Appendix B assume alignment using Type E.

**Figure 11: UUT Alignment Parameter Settings**

7. Insert the Straightened Paper Clip through the alignment access hole and gently press the calibration enable switch located on the circuit board. See Figure 12 for location.

**Voltage Gain and Offset Alignment**

8. The UUT display will indicate as follows:
   a. Line 1: CAL1
   b. Line 2: mV portion of Channel 1 voltage reading
   c. Line 3: nV portion of Channel 1 voltage reading

9. Connect the miniature thermocouple connector of the Copper Mini-TC Cable to the Channel 1 input of the UUT.
   a. For two channel UUTs using the Split Copper Mini-TC Cable, connect one miniature thermocouple connector to the Channel 1 input of the UUT, and the other connector to the Channel 2 input.

10. Connect the opposite end of the Copper Mini-TC Cable (or Split Copper Mini-TC Cable) to the appropriate output connectors of the DC Voltage Source.

11. Allow at least three minutes for the connections to temperature stabilize before proceeding.

   **CAUTION**
   Do not apply voltages greater than 80 mV DC to the UUT inputs. Voltages greater than 80 mV may damage the instrument.

12. Set the DC Voltage Source to output the first Applied Voltage value in Figure 13 below.

13. Allow the DC Voltage source output to stabilize before proceeding.

14. The UUT will display the current voltage reading.

15. Allow the UUT displayed voltage to stabilize before proceeding.

16. Press UUT \( \text{HOLD} \) to automatically adjust the UUT voltage reading to the Applied Voltage, ±0.001 mV.
   a. If the UUT displayed voltage is not within ±0.001 mV of the Applied Voltage, press \( \text{HOLD} \) until the UUT displayed voltage is within ±0.001 mV, adjusting as close to the Applied Voltage as possible.
   b. If the UUT displayed voltage is too far from nominal, \( \text{HOLD} \) may not function as expected. The UUT will typically indicate 8999 or -999 in this
17. Press UUT \textit{View}. The display will change to \texttt{rES1 [2, 3 \ldots]} showing the actual measured value saved in the previous step.

18. Press UUT \textit{View} again. This will increment to the next CAL value.

19. Repeat Steps 12 through 18 for each remaining value in \textit{Figure 13} below. For single channel UUTs, omit Channel 2 values.

   a. For two channel UUTs using the single-ended Copper Mini-TC Cable, disconnect the cable from the UUT Channel 1 input, and reconnect the cable to the Channel 2 input after completing CAL4 in \textit{Figure 13} below. Repeat Step 11.

   \begin{center}
   \begin{tabular}{|c|c|c|}
   \hline
   \textbf{CHANNEL} & \textbf{UUT DISPLAY} & \textbf{APPLIED VOLTAGE (mV)} \\
   \hline
   1 & CAL1 & -10 \\
   & CAL2 & 75 \\
   & CAL3 & -10 \\
   & CAL4 & 30 \\
   \hline
   2 & CAL5 & -10 \\
   & CAL6 & 75 \\
   & CAL7 & -10 \\
   & CAL8 & 30 \\
   \hline
   \end{tabular}
   \end{center}

\textit{Figure 13: Gain Alignment Values}

20. Remove the copper cable from the DC Voltage Source and UUT.

\textbf{Cold Junction Compensation Alignment}

21. Connect one end of the Type E$^4$ Thermocouple Cable to the UUT Channel 1 input.

   a. For two channel UUTs using the Split Thermocouple Cable, connect the miniature thermocouple connector of one leg to the UUT Channel 1 input, and the miniature thermocouple connector of the other leg to the Channel 2 input.

22. Connect the opposite end of the Thermocouple Cable (or the single-connector end of the Split Thermocouple Cable) to the Thermocouple Calibrator thermocouple output.

   The UUT display will indicate as follows:

   a. Line 1: CALA

\textsuperscript{4} If substituting another thermocouple type, use the appropriate Thermocouple Cable for the selected thermocouple type.
b. Line 2: temperature in °C

c. Line 3: temperature in tenths of °C (out to 1 μ or 0.000001 °C)

23. Set the Thermocouple Calibrator thermocouple type to Type E.

24. Set the calibrator to output 0.0 °C.

25. Allow at least five minutes for this connection to stabilize.

26. Press UUT to set the UUT display equal to the Thermocouple Cable calibrated correction value ± 0.02 °C.

27. Press UUT.

28. The display will change to rESA showing the actual measured value saved in the previous steps.

29. For single channel UUTs, skip to Step 35 below.

30. For two channel UUTs, continue with Step 31.

   a. For two channel UUTs using the single-ended Thermocouple Cable, disconnect the cable from the UUT Channel 1 input, and reconnect the cable to the Channel 2 input. Repeat Step 25.

31. Press UUT.

32. The UUT display will indicate as follows:

   a. Line 1: CALb

   b. Line 2: temperature in °C

   c. Line 3: temperature in tenths of °C (out to 1 μ or 0.000001 °C)

33. Repeat Steps 26 and 27.

34. The display will change to rESb showing the actual measured value saved in the previous steps.

35. Press UUT to save the current alignment values and return the UUT to normal operation.

### 4.3 Troubleshooting

Omega’s digital handheld thermometers are designed and built to provide years of uninterrupted use. In the event the instrument malfunctions or does not perform as expected, helpful troubleshooting tips are provided below. Figure 14 below lists some of the more common issues and their resolutions.

---

5 If substituting another thermocouple type, set the Thermocouple Calibrator as appropriate for the selected thermocouple type.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexpected reading on Line 2 of Display</td>
<td>Statistics View Mode is active</td>
<td>Press VIEW to cycle through statistics views until active measurement is displayed (see Section 3.4 View Modes and Statistics)</td>
</tr>
<tr>
<td>Unexpected or Erroneous Measurement</td>
<td>Probe offset is active</td>
<td>Set probe offset to correct value for connected temperature probe (see Section 3.10, Probe Offset)</td>
</tr>
<tr>
<td></td>
<td>Temperature probe has not stabilized</td>
<td>Observe display trend indicators and wait for stable measurement (see Section 3.8 Trend Indicators)</td>
</tr>
<tr>
<td></td>
<td>Instrument is set to the wrong thermocouple type for the attached probe</td>
<td>Set the thermocouple type as appropriate for the attached probe (see Section 3.3, Setup Menu)</td>
</tr>
<tr>
<td></td>
<td>When sourcing from a thermocouple simulator, Open Wire Detection is enabled.</td>
<td>See Section 3.11, Open Wire Detection On/Off to disable.</td>
</tr>
<tr>
<td>Unresponsive</td>
<td>Hold Mode is active</td>
<td>Press HOLD, and verify that the HOLD indicator is not active (see Section 3.7, Hold Function)</td>
</tr>
<tr>
<td></td>
<td>Static discharge through connected probes</td>
<td>Press ( \text{CLR} ) to cycle instrument power</td>
</tr>
<tr>
<td></td>
<td>Batteries are low or depleted</td>
<td>Replace batteries (see Section 2.5, Battery Installation and Replacement)</td>
</tr>
</tbody>
</table>
4.4 Diagnostic Routines and Error Codes

The instrument momentarily activates all display annunciators and segments during startup to allow for visual inspection of the LCD. Observe the LCD and verify all segments activate.

Internal diagnostic routines are also executed during startup. If any diagnostic routine detects a malfunction, an error will be displayed as shown in Figure 15 below.

<table>
<thead>
<tr>
<th>ERROR CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Err ADC</td>
<td>Analog to digital converter error</td>
</tr>
<tr>
<td>Err CJC</td>
<td>Cold junction compensation error</td>
</tr>
<tr>
<td>Err FLSH</td>
<td>Flash memory error</td>
</tr>
<tr>
<td>Err InP</td>
<td>Stuck key or other keypad error</td>
</tr>
</tbody>
</table>

Figure 15: Diagnostic Routine Error Codes

4.5 Memory Sterilization

To erase all locally stored measurement data and reset accumulated statistics, press \( \text{CLF}(1.5s) \). See section 3.12 Clear Function for instructions.

Instrument parameters will be retained. Refer to Section 3.3, Setup Menu to set instrument parameters as desired.
## A. REQUIRED EQUIPMENT

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>FUNCTION</th>
<th>RANGE</th>
<th>SPECIFICATION (2-SIGMA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltage Source</td>
<td>DC Voltage Output</td>
<td>-10 to 75 mV</td>
<td>± (30 ppm of output + 2 µV)</td>
</tr>
<tr>
<td>Thermocouple Calibrator¹, ²</td>
<td>Thermocouple Type E</td>
<td>-250 to -201 °C</td>
<td>± 0.26 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-200 to -101 °C</td>
<td>± 0.13 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-100 to -1 °C</td>
<td>± 0.11 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 599 °C</td>
<td>± 0.10 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600 to 1000 °C</td>
<td>± 0.12 °C</td>
</tr>
<tr>
<td></td>
<td>Thermocouple Type J</td>
<td>-210 to -101 °C</td>
<td>± 0.15 °C</td>
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<td></td>
<td></td>
<td>-100 to 799 °C</td>
<td>± 0.11 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>800 to 1200 °C</td>
<td>± 0.12 °C</td>
</tr>
<tr>
<td></td>
<td>Thermocouple Type K</td>
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<td>± 0.17 °C</td>
</tr>
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<td></td>
<td>-100 to 799 °C</td>
<td>± 0.12 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>800 to 1372 °C</td>
<td>± 0.14 °C</td>
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<tr>
<td></td>
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<td>± 0.17 °C</td>
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<td>-100 to -1 °C</td>
<td>± 0.12 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 400 °C</td>
<td>± 0.11 °C</td>
</tr>
</tbody>
</table>

**Thermocouple Cables**

Thermocouple Cables must be calibrated to a 2-Sigma uncertainty of 1 µV or less. Calibrated Thermocouple Cables with recorded correction values shall be used throughout this procedure to adhere to the expanded instrument uncertainties provided in Appendix B.

Thermocouple Cables are only required for each desired thermocouple type. The thermocouple cables must be terminated at one end with a male miniature thermocouple connector for connection to the UUT. The opposite end should be terminated as appropriate for the thermocouple calibrator.

For two channel UUTs, a split or “Y” cable may be used, terminated with two (2) male miniature thermocouple connectors. Correction values must be established for each leg of the Split Thermocouple Cable.

**Copper Mini-TC Cable**

Copper Mini-TC Cable is required for Voltage Gain and Offset alignment only. This cable does not require calibration.

One end shall be terminated with a male miniature thermocouple connector for connection to the UUT. The opposite end shall be terminated with copper connections appropriate for the DC Voltage Source.

For two channel UUTs, a split or “Y” cable may be used, terminated with two (2) male miniature thermocouple copper connectors.

**Straightened Paper Clip**

Required to access the calibration enable switch. Any rigid wire, approximately 0.8 mm in diameter, may be used.

¹ Fluke 7526A meets the Thermocouple Calibrator specifications of Appendix A.
² All “Specification (2-Sigma)” column values rounded up to nearest hundredth.
B. EXPANDED INSTRUMENT UNCERTAINTIES

Thermocouple Type E

![Graph showing uncertainty in readings for different temperatures]
Thermocouple Type J

J Type Thermocouple

Uncertainty of Reading 95% Confidence (Degrees C)

Reading (Degrees C)

18 - 28 C  -20 C  50 C
Thermocouple Type K

![Graph showing uncertainty of reading 95% confidence (Degrees C) vs. reading (Degrees C) for different temperatures (-28 C, -20 C, 50 C).]
Thermocouple Type T

![Thermocouple Type T Graph](image-url)
### C. Instrument Verification Data Sheet

<table>
<thead>
<tr>
<th>Thermo-Couple Type</th>
<th>Standard Value (°C)</th>
<th>Reading (°C)</th>
<th>Cable Offset (°C)</th>
<th>Corrected Reading (°C)</th>
<th>2-Sigma Tolerance (± °C)</th>
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</table>

*Appendix C: Instrument Verification Worksheet*
OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 37 months from date of purchase. OMEGA’s WARRANTY adds an additional three (3) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA’s customers receive maximum coverage on each product.

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 in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a “Basic Component” under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA’S 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.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA’s policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

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- Air Velocity Indicators
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- Totalizers & Batch Controllers

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- Benchtop/Laboratory Meters
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- Industrial pH & Conductivity Equipment

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- Communications-Based Acquisition Systems
- Data Logging Systems
- Wireless Sensors, Transmitters, & Receivers
- Signal Conditioners
- Data Acquisition Software

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- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL
- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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