

**ennoLogic**

## High Temperature Laser Infrared Thermometer eT1600S



**User Manual**

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Thank you for purchasing the ennoLogic® High Temperature Laser Infrared Thermometer eT1600S, a high-quality instrument with many advanced features. The thermometer accurately measures temperatures of surfaces by sensing the emitted thermal radiation of the surface. It is also capable of making contact temperature measurements with the included Type K thermocouple. In this manual you will find detailed operating instructions and descriptions of each of the advanced features of the ennoLogic infrared thermometer.

## Important Notes, Safety Considerations and Disclaimer – Please Read

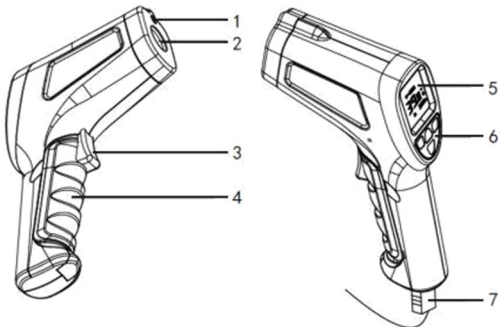


This thermometer is equipped with a Class 2 infrared laser. Use extreme caution when the laser pointer is on. Do not stare into the beam. Never point the laser beam at anyone's eyes, it can cause permanent damage to the eyes. Do not reflect the laser beam off a reflective surface and into someone's eyes. Do not allow children to use the instrument as a toy. Do not use the instrument in an environment with steam, dust, or explosive gases or fumes. Do not expose the unit to temperatures above 122°F (50°C) or less than -4°F (-20°C.) Keep the unit away from electromagnetic fields from arc welders and induction heaters. This thermometer is not suitable for medical purposes. **Note: This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to**

**Laser Notice No. 50, dated June 24, 2007. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

**Important Note: Limited Liability:** Cascadia Innovations is the exclusive distributor of all ennoLogic® products. Except as explicitly stated, Cascadia Innovations is not liable for direct, indirect, incidental, or other types of damages arising out of, or resulting from the use of this product. By using this product, you agree to hold ennoLogic® and Cascadia Innovations harmless for any and all consequences of the use of this product or application of data from the use of this instrument.

## Instrument Description

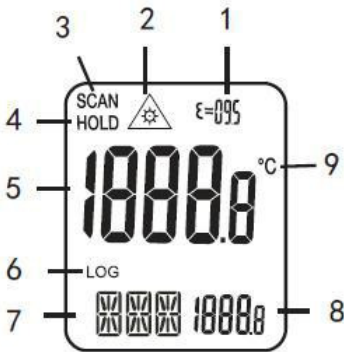


### Main User Elements

1. Laser Pointer (**AVOID EXPOSURE - Laser radiation is emitted from this aperture**)
2. Infrared Sensor
3. Trigger Button
4. Battery Cover
5. LCD Display
6. Keypad
7. Type K Thermocouple Probe

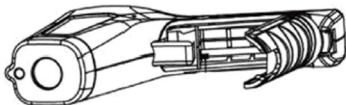
## LCD Display

1. Selected Emissivity
2. Laser pointer ON indicator
3. SCAN: continuous measurement
4. HOLD: last value is displayed
5. Temperature display
6. LOG mode indicator
7. MODE indicator
8. Numeric display for mode functions and Thermocouple temperature display
9. Celsius or Fahrenheit



## **Battery**

The unit is powered by a 9V battery (NEDA 1604A or IEC 6LR61, or equivalent). The battery compartment is located inside the handle, covered by a black lid that is hinged at the base of the unit. To open the lid, find the two indents adjacent to the trigger button and slide a fingernail behind the lid at the indent to pull it open. Attach the 9V battery to the wired clip and slide the battery into the battery compartment. (Tuck the wire in next to the battery; otherwise the lid may not close properly.)



## **How to Use Your IR Thermometer**

Aim the IR thermometer at the surface you want to measure. Make sure there are no obstructions between the unit and the target surface. Steam, dust, and smoke can affect the measurement. Do not attempt to measure through glass. Thermal shock can cause inaccurate readings as well, make sure to let the unit warm up to room temperature before using it. Press the trigger button to turn the instrument on, the temperature reading will appear. As long as the trigger button is pressed, the temperature will continuously update, and the SCAN icon will flash. The selected emissivity will be displayed above the temperature reading. If the Mode is set to MIN, MAX,



dIF or AVG, the small numeric display in the bottom right corner will also update. See MODE Functions for more detail. When you release the trigger button, the last reading will remain on the display. The SCAN icon will change to HOLD.


### **Switching Temperature Units**

To switch between °F and °C, press and hold the red MODE button until you hear a beep.

### **Auto Shut Off and Lock**

After approximately 7 seconds of non-use the thermometer will automatically turn off, unless the lock feature has been enabled. To enable the lock feature, press and hold the Laser/Backlight button until you hear a beep. To disable it, press and hold the red MODE button until SCAN changes to HOLD. The Lock feature can be used if hands-free operation for long periods of time is desired.

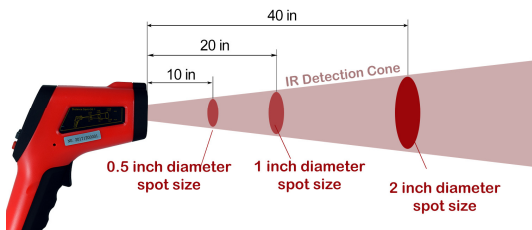
### **Laser Pointer and Backlight**

To turn the laser pointer and backlight on and off, first press and release the trigger button to turn the thermometer on. Then press the Laser/Backlight button to cycle through combinations of laser and backlight settings: 1. Laser OFF, backlight OFF, 2. Laser OFF, backlight ON, 3. Laser ON, backlight OFF, 4. Laser ON, backlight ON. When the laser is enabled, the  icon appears on the LCD display. The last laser/backlight setting chosen will be

remembered after the thermometer turns off. Both laser and backlight reduce the battery lifetime.

### Distance to Spot Size Ratio

The distance-to-spot ratio of the infrared thermometer is 20:1. This means that the spot diameter at a distance of 20 inches is 1 inch (25.4 mm). To measure a smaller spot area, move the thermometer closer to the target and use the distance-to-spot ratio of 20:1 to estimate the spot size. For instance, at a target distance of 10 inches, the spot size is 0.5 inch (12.7 mm). The further away the target, the greater the spot size. Make sure the target area you want to measure is larger than the spot size.



## MODE Functions

The red MODE button can be used to cycle through a number of advanced features of the instrument. These features are explained below.

### **Maximum, Minimum, and Average Temperature (MAX, MIN, and AVG) and MAX-MIN Difference (dIF)**

While the trigger button is held down for scanning the temperature of various surfaces, the thermometer continuously tracks and updates the maximum (MAX), minimum (MIN), and average (AVG) temperatures, as well as the difference between MAX and MIN (dIF). These values can be recalled in HOLD mode by pressing the red MODE button several times and are retained in memory until a new measurement is taken.

### **High and Low Alarms (HAL and LAL)**

Two temperature alarm set points can be programmed: High Alarm (HAL) and Low Alarm (LAL). While temperatures are being scanned (trigger button held down), if the temperature is lower than the LAL value or higher than the HAL value, the instrument will beep. The alarm set points can be programmed by pressing the MODE button until HAL or LAL appear on the LCD display. Use the UP and DOWN buttons to select the desired temperature for each set point. Holding the UP or DOWN button pressed will change the displayed temperature set point at increasing increments.

## **Emissivity (EMS)**

The emissivity  $\epsilon$  is displayed in the top right corner of the LCD display (e.g.  $\epsilon=0.95$ ). To change it, press the MODE button until the mode indicator changes to EMS. Then use the UP and DOWN buttons to select the desired emissivity in 0.01 unit increments (range 0.10 to 1.00.)

Emissivity of a material is the ability of its surface to emit thermal radiation. More accurately, it is the ratio of the energy radiated from a material's surface to that radiated from a perfect emitter (black body) at the same temperature and under the same conditions. The emissivity of a surface depends on the material and on the nature of its surface. For instance, a polished metal surface has a lower emissivity than an oxidized metal surface.

Since IR thermometers calculate the surface temperature of an object by sensing its emitted thermal radiation it is important to take emissivity into account. A polished metal object will emit less thermal radiation than an object with a flat black finish at the same temperature, and thus appear colder. The temperature displayed by the IR thermometer for the polished metal object would therefore be inaccurate, unless the instrument's emissivity setting is adjusted to match the emissivity of the object.

Emissivity of a material surface is difficult to estimate since it depends on its texture, color, and temperature. The table provided here should only be used as a guideline. A good default setting is  $\epsilon=0.95$ , which is also used by IR thermometers that do not allow the emissivity to be adjusted. If you need to take accurate readings for a specific material often, you can measure the material

surface with an accurate contact thermometer (or the included Type K probe) and then adjust the emissivity setting of your IR thermometer until its reading matches the temperature reported by the contact thermometer. You can then use the emissivity for subsequent measurements of the same material. Alternatively, you can cover materials with low emissivity with masking tape or flat black paint. Make sure to allow the tape or paint to reach the temperature of the material before taking a measurement.

<b>Material</b>	<b>Emissivity</b>
Aluminum Foil	0.04
Asphalt	0.93
Black Body, matte	1.00
Brick, red	0.75 - 0.93
Chrome, polished	0.05
Concrete	0.85 - 0.94
Copper, polished	0.02 - 0.05
Fabric	0.87 - 0.98
Galvanized Pipe	0.46
Glass	0.92 - 0.95
Granite	0.45
Gypsum	0.85
Ice	0.97
Iron, polished	0.14 - 0.38
Iron, rusted red	0.61
Marble, white	0.95
Paper, white	0.68
Plastic	0.84 - 0.95

Quartz Glass	0.93
Rubber, black	0.95
Sand	0.90
Skin, human	0.98
Snow	0.80
Soil	0.92 - 0.95
Steel, oxidized	0.75
Steel, polished	0.07
Tape, electrical, black	0.97
Tile	0.97
Water	0.95 - 0.98
Wood	0.86 - 0.90

### Log Feature (LOG)

The thermometer can store up to 20 readings in memory. This feature is useful when multiple measurements are taken that need to be recorded for future review.

To store a single reading, first make sure the thermometer is in HOLD mode (not scanning.) Press the MODE button multiple times until the LOG symbol appears in the bottom left corner of the LCD display. Then use the UP and DOWN buttons to select the memory location (01 to 20). Press the Laser/Backlight button to store the currently displayed temperature value in the selected memory location. Pressing it again will clear the location. Press the UP and DOWN buttons to access additional memory locations to recall previously stored values or update them with new values.

### **Measurements with Type K Thermocouple Probe (TK)**

Insert the Type K thermocouple probe into the socket at the base of the instrument. Bring the thermocouple probe tip into contact with the object to be measured. Turn on the instrument by pressing the trigger button. Press the MODE button until TK appears on the display. The temperature measured by the thermocouple probe will be displayed in the bottom right corner of the LCD display.

## Specifications

Temperature Range	
Infrared Measurements	-50°C to 1600°C (-58°F to 2912°F)
Thermocouple Measurements	-50°C to 800°C (-58°F to 1472°F)
Temp. Resolution	0.1°C (0.1°F)
Optical Resolution	20:1 Distance to Spot Size Ratio
Accuracy of IR Temperature Measurements	<0°C: $\pm 3^{\circ}\text{C}/5.5^{\circ}\text{F}$ 0°C .. 600°C: $\pm 2\%$ of reading or $\pm 2^{\circ}\text{C}/3.5^{\circ}\text{F}$ (whichever is greater) >600°C: $\pm 3\%$
Accuracy of Type K Thermocouple Measurements	$\pm 1\%$ or $\pm 1^{\circ}\text{C}/2^{\circ}\text{F}$
Emissivity	Adjustable 0.10 to 1.00
Spectral Response	8 to 14 $\mu\text{m}$
Response Time	< 1 second
Laser Power	Class 2 (<1mW)
Laser Wavelength	675 nm
Power	9V battery (included), auto power off after 7sec., lock feature
Battery Lifetime	~40 hours without backlight, ~15 hours with backlight



Advanced Features	Hi/Lo audible alarms (adjustable), Min/Max/Average display, stores last settings in between uses, 20-value log, Type K Thermocouple Probe
Operating Conditions	Temp. 0°C to 50°C, RH 10% to 90%
Storage Conditions	Temp. -20°C to 50°C, RH 10% to 90%
Size	179 x 91 x 42 mm (7.0 x 3.6 x 1.6 in.)
Weight	162g (5.7oz.)





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