

Mesa 801 Reference

Cal Thermometer

Users Manual

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Introduction

The Mesa 801 Reference Cal Thermometer (the Product) is a precision digital thermometer that can be used as an alternative to mercury liquid-in-glass (LIG) thermometers. It can also be used as a reference standard for other types of digital or analog thermometers.

When you receive the Product, check that it is intact. The batteries are factory installed. Keep the shipping materials until you have made sure that there is no concealed damage.

Features

This section tells you about the features of the Product.

- The Product contains a fast-responding thin-film sensor that makes accurate measurements quickly and with minimal immersion depth. The Probe is available in three versions:
 - 4.8 mm x 229 mm (3/16 in. x 9 in.)
 - 6.35 mm x 305 mm (1/4 in. x 12 in.)
 - 6.35 mm x 508 mm (1/4 in. x 20 in.)

A rotatable probe mount lets the display module be turned horizontally or vertically.

A unique feature of the Product is the trend indication arrows. You can configure the arrows to show when the measurements are adequately stable to record a result.

The auto-off feature gives extended battery life of 300 hours maximum. The typical user may only have to change the batteries a few times a year.

Added features let you tailor the Product for specific applications.

These features include:

- ± 0.05 °C accuracy over full range
- Display temperature in °C or °F
- Temperature trend indicator
- User-selectable resolution (0.1, 0.01, 0.001)
- Large LCD with backlight
- 300 hour battery life
- Percent battery life and low-battery indicator
- NVLAP accredited calibration (NIST traceable)

How to Contact Mesa Labs

To contact Mesa Labs, use one of the following methods:

- Phone: 1-303-987-8000
- Email: datatrace@mesalabs.com
- Web: datatrace.mesalabs.com

Safety

A **Warning** identifies conditions and actions that pose hazard(s) to the user. A **Caution** identifies conditions and procedures that could cause Product damage, equipment under test damage, or permanent loss of data.

Symbols used on the Product and in this manual are explained in Table 1.

Warning

To prevent possible electrical shock, fire, or personal injury:

- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Do not use the Product to measure the temperature of hazardous live components.
- Do not use and disable the Product if it is damaged.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- The Product is intended for installation only in locations providing adequate protection against the entry of solid foreign objects or water capable of impairing safety.

Caution

To prevent possible damage to the Product or to equipment under test:

- If the display message changes to “OL,” the range limit is exceeded and the Product must immediately be removed from the heat source to prevent damage.
- Do not immerse the Probe beyond its maximum immersion depth. This may damage its internal electronics. See “Immersion Depth and Usage” later in this manual.
- **DO NOT drop or strike the Probe in any way. Mechanical shock damages the Probe internally and affects its calibration.**

If the Product overheats or is exposed to sudden physical shock, examine it for damage that can cause a safety risk. If possible, compare the displayed temperature to a known reference before Product use. If not sure, send the Product to Mesa Labs. Refer to “How to Contact Mesa Labs”.

Symbols

International symbols used on the Product and in this manual are explained in Table 1.

Table 1. Symbols

Symbol	Meaning	Symbol	Meaning
	Earth ground		Battery
	Risk of Danger. Important information. See Manual.		Hazardous Voltage
	Do not dispose of this product as unsorted municipal waste. Go to Mesa Labs' website for recycling information.		Conforms to relevant European Union directives.

Operation

Immersion Depth and Usage

Caution

To prevent possible damage to the Product or to equipment under test, do not immerse the Probe beyond the maximum immersion depth. This may damage its internal electronics.

Allow enough time for the Probe to stabilize before recording measurements. Use the Stability Display to determine when the Probe has stabilized.

Probe sensor length is shown in Figure 1.

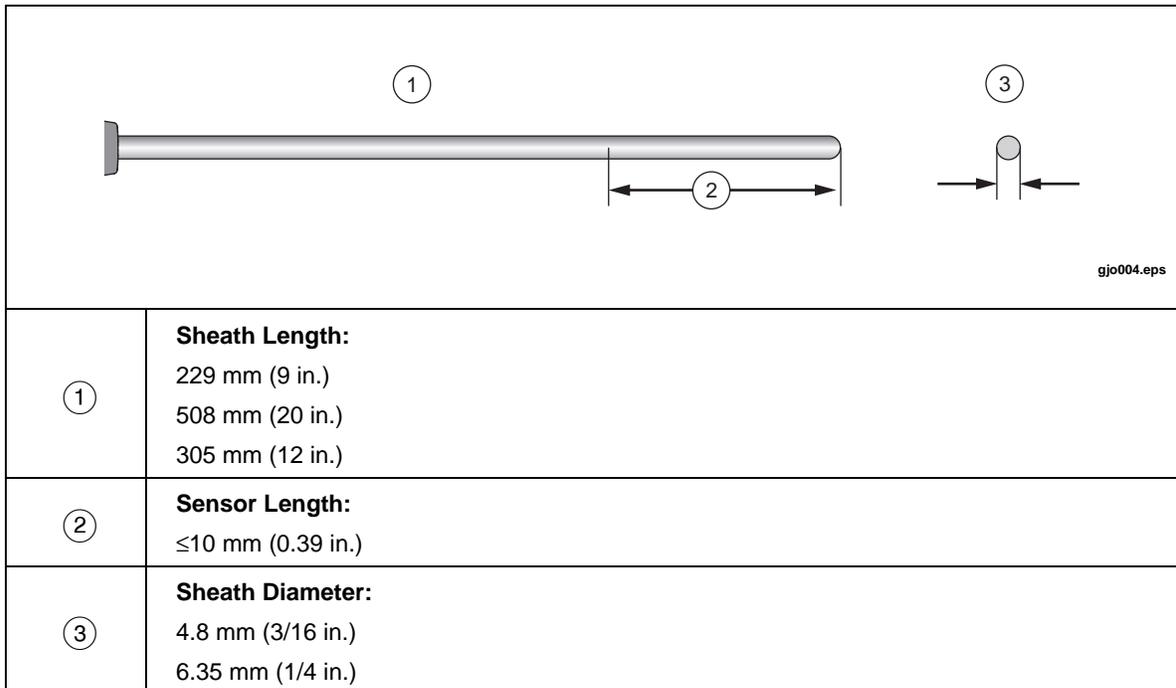


Figure 1. Probe Measurements

The minimum immersion depth for the Probe is 3.5 inches in a stirred fluid heat source. It is recommended that you make sure of the minimum immersion depth for the specific application. See Figure 2.

- The maximum immersion depth for the The Product Reference is 2 inches less than the total length. Make sure the last 2 inches of Probe, nearest to the internal electronics of the device, are not put into the heat source.

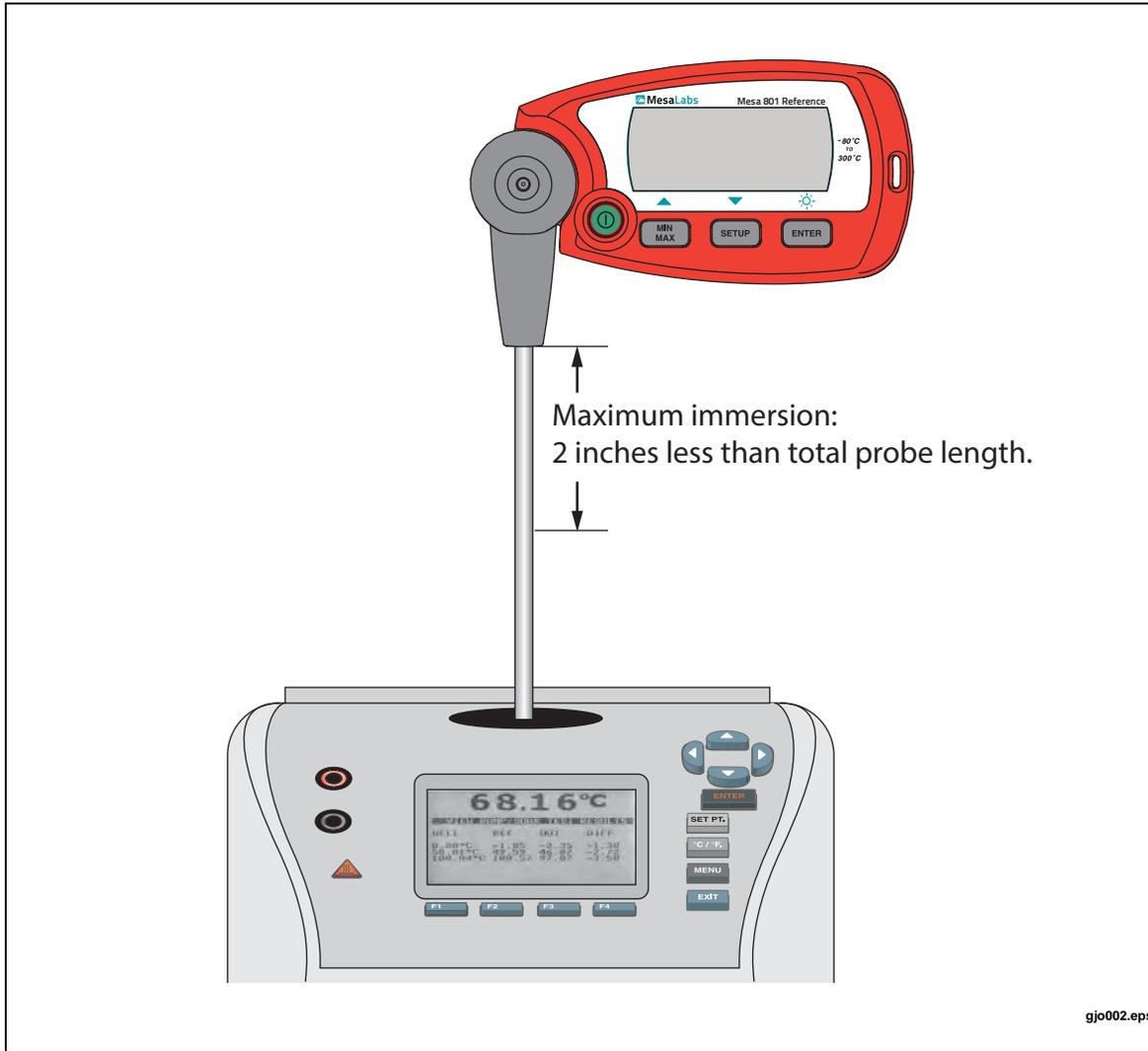
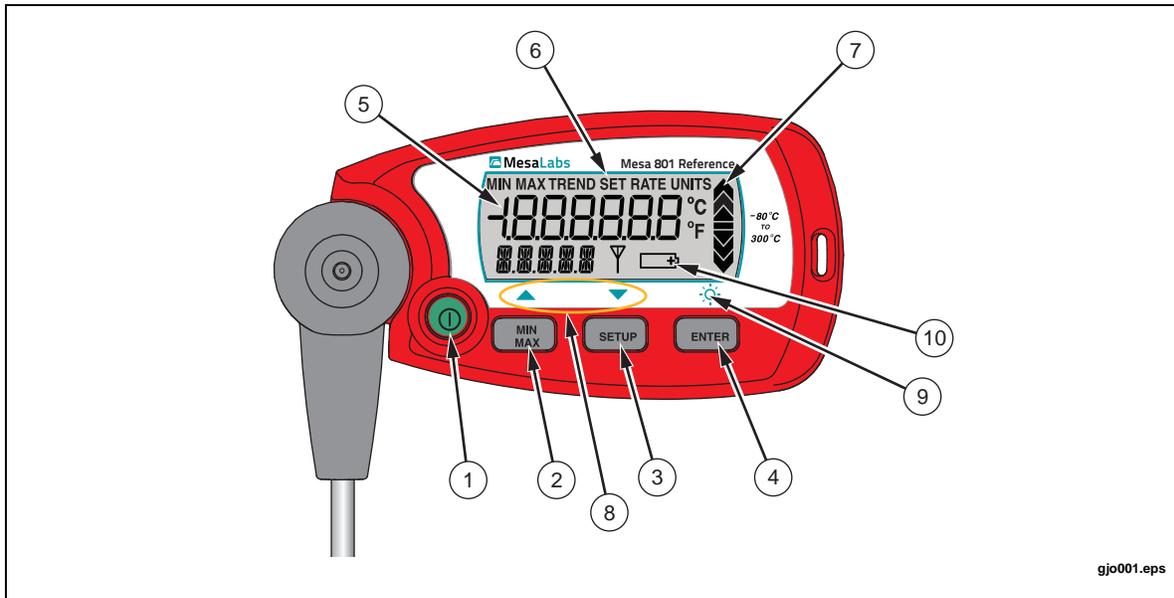


Figure 2. Immersion Depth

Display and Controls

The Display and Controls are explained below and in the Setup and Configuration section. See Figure 3.



Number	Item	Description
①	Ⓜ	Push to power the Product on and off. Hold the button down at power-up to check the display to see that all display segments are shown.
②	MIN MAX	Push to toggle the main display value between min, max, and trend modes.
③	SETUP	Push to change the various set-up parameters of the Product.
④	ENTER	Push to enter data in set-up modes. When the Product is displaying temperature, push ENTER to activate the backlight.
⑤	Primary Display	Shows the temperature values in °C or °F. Also used in set-up mode.
⑥	Icon area	Used in regular and setup modes.
⑦	Stability Display	Shows the trend and stability of data.
⑧	Arrow Buttons	Secondary functions of MIN MAX and SETUP . Enter data in the setup modes.
⑨	☀	Backlight symbol.
⑩	🔋+	Flashes when the batteries need to be changed.

Figure 3. Display and Controls

Primary Display

Push **MIN MAX** to toggle the numeric display between the current reading, minimum, maximum, and 1-minute trend values in °C or °F as calculated since power up or since the last reset of values. Push and hold the **MIN MAX** button for 2 seconds until "CLR" shows to reset the MIN/MAX/TREND values.

Stability Display

The Stability Display shows the general stability level relative to a user-configurable stability limit. There are four presets for stability shown in °C or °F (0.01, 0.1, 1.0, or 10.0). When the limit is exceeded, it also shows the general direction in which the readings are presently moving. The stability level is calculated from a moving sample window of 6 seconds, with the value extrapolated to a 1-minute time base.

Segments are turned on to indicate the stability level as follows:

- Center only (stable) - when half of the 1-minute trend value is less than or equal to the stability limit, i.e. maximum deviation -limit to +limit.
- Center plus one arrow up or down (depending on the trend) - when half of the 1-minute trend value is greater than the stability limit and is less than or equal to twice the stability limit.
- Center plus two arrows up or down (depending on the trend) - when half of the 1-minute trend value is greater than twice the stability limit and is less than or equal to three times the stability limit.
- Center plus three arrows up or down (depending on the trend) - when half of the 1-minute trend value is greater than three times the stability limit.

Setup and Configuration

Push **SETUP** to enter the setup modes. Inside the setup modes the buttons work as follows:

- MIN MAX** Exit to the main display.
- SETUP** Step to the next menu item, exit to the main display after the last item.
- ENTER** Enter the data-edit mode for the present menu item.

During the data-edit mode, use ▲ and ▼ to scroll through the values. Push **ENTER** to save and exit back to the menu item.

The following sections describe the setup items in the order in which they appear.

Temperature Unit Selection

The Temperature Unit Selection Menu lets you choose the unit used when showing the primary variable.

- ▲ Change the unit °C or °F.
- ▼ Change the unit °C or °F.
- ENTER** Exit back to menu item

Stability Limit

The stability limit setting is used to find when the secondary display will show that the reading is stable. There are four preset settings for stability (0.01, 0.1, 1.0, or 10.0) expressed in the presently selected units.

- ▲ Change the unit-stability limit setting to the next greater setting.
- ▼ Change the unit-stability limit setting to the next lesser setting.
- ENTER** Exit back to menu item

Auto-Off Selection

The Auto-off parameters control when the Product automatically turns off after inactivity on the keypad.

- ▲ Increase the auto-off setting and the primary data field from "OFF" to 1 minute and stopping at 20 minutes.
 - ▼ Decrease the auto-off setting and the primary data field from 1 minute to "OFF" and stopping at "OFF".
- ENTER** Exit back to menu item.

Battery Life

Initially, the primary data field shows the percentage of remaining battery life. This display can be toggled to show the battery voltage and is constantly updated to show current battery capacity.

Push **ENTER** to toggle between the two data displays.

Operating Temperature

This selection shows the operating temperature of the internal electronics in °C or °F.

- ▲ Change the unit °C or °F.
 - ▼ Change the unit °C or °F.
- ENTER** Exit back to menu item.

Note

An “**Overtemp**” warning is shown if the internal electronics temperature is more than 50 °C (122 °F).

Damping

The Damping function is a running average of readings used to filter "noisy" temperature sources. The selections are OFF, 2, 5, or 10 sample average.

- ▲ Change the damp setting to the subsequent item in the list, cycling from the last to the first.
 - ▼ Change the damp setting to the previous item in the list, cycling from the first to the last.
- ENTER** Exit back to menu item.

Sampling Rate

The sampling rate calculates how often the Product samples data. The settings are 0.5, 1.0, or 2.0, shown in samples per second.

- ▲ Change the rate setting to the subsequent item in the list, cycling from the last to the first.
 - ▼ Change the rate setting to the previous item in the list, cycling from the first to the last.
- ENTER** Exit back to menu item.

Display Resolution

Display resolution is the number of digits to the right of the decimal point. The settings are 0.1, 0.01, or 0.001.

- ▲ Change the resolution setting to the subsequent item in the list, cycling from the last to the first.
- ▼ Change the resolution setting to the previous item in the list, cycling from the first to the last.

ENTER Exit back to menu item.

RS232 Communication

The baud rate can be set to 2400 or 9600.

- ▲ Change the RS232 communication setting in the list, cycling from the last to the first.
- ▼ Change the RS232 communication setting to the previous item in the list, cycling from the first to the last.

ENTER Exit back to menu item.

Ohms Display

The Primary Display shows the resistance of the sensor. The secondary data field displays “OHMS”. **ENTER** is inactive.

Note

The Data Logging functions that follow are only functional in Products that were purchased with option Data Logging configuration (e.g. 155X-D-X).

Start or Stop Data Logging

Logging status messages are:

FULL the data logging memory is full

OFF not presently logging data

ON presently logging data

Push **ENTER** to change the logging status.

Push ▲ and ▼ if not currently logging data, to choose between **START** and **OFF**. If presently logging data, choose between **STOP** and **ON**. The current data logging mode is not changed until **ENTER** is pushed.

ENTER Stop or start data logging.

Display Free Log Memory

Initially, the primary data field shows the percentage of log memory. This display can be toggled to show the number of free records and is updated continually during data logging to show the current memory capacity.

Push **ENTER** to toggle between the two data displays.

Logging Interval

Push  to enter the data edit mode. ENTER is ignored if presently logging data.

- ▲ Change the logging interval setting to the subsequent item in the list, cycling from the last to the first.
 - ▼ Change the logging interval setting to the previous item in the list, cycling from the first to the last.
-  Return to the corresponding menu item.

Send Logged Data

Push  to:

- ▲ or ▼ Confirm or cancel the choice to send data.
-  Send or cancel data.
-  is ignored if presently logging data.

Erase Logged Data

Push  to:

- ▲ or ▼ Confirm or cancel the choice to erase logged data.
-  Erase or cancel data erase.
-  is ignored if presently logging data.

Maintenance

Clean the Product

Caution

To prevent possible damage to the product or to equipment under test, do not use abrasive cleaners. They will damage the case.

To clean the Product, use a cloth with a mild cleaning solution.

Battery Replacement

Warning

To prevent possible fire or personal injury:

- **Replace the batteries when the low battery indicator shows to prevent incorrect measurements.**

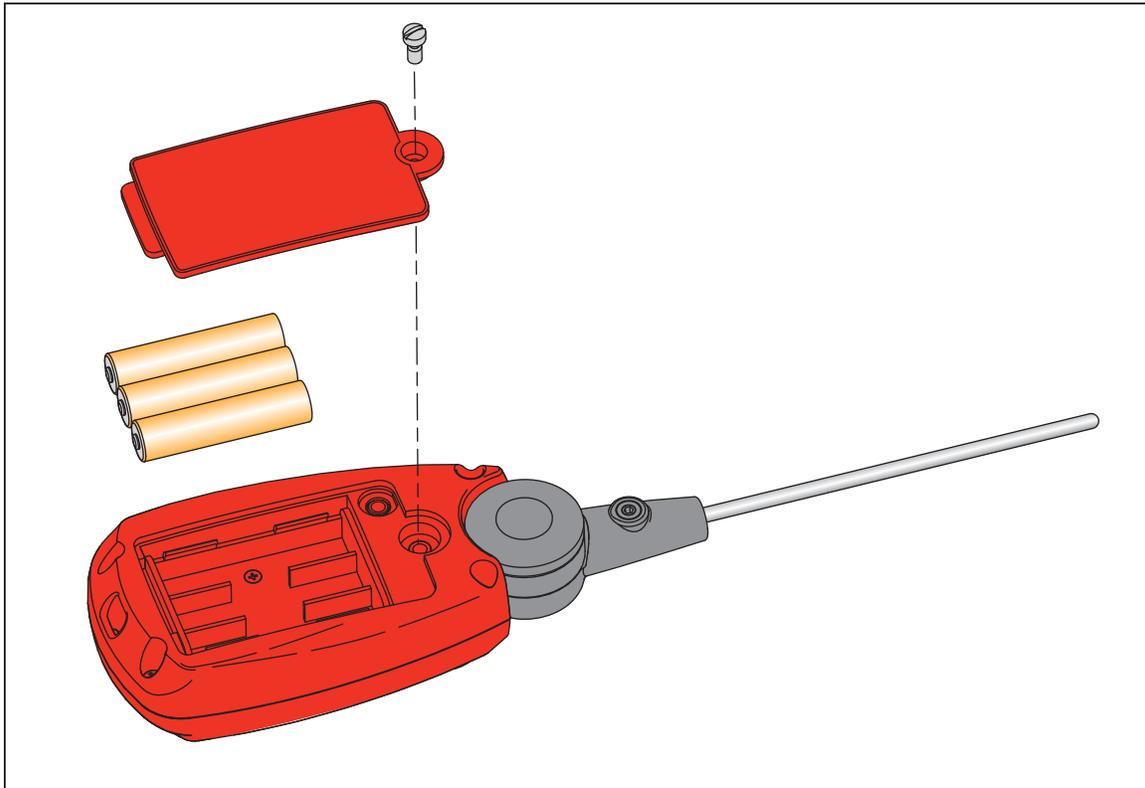
Caution

To prevent possible damage to the Product or to equipment under test:

- **Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.**
- **Be sure that the battery polarity is correct to prevent battery leakage.**

To change the batteries, see Figure 4:

1. Use a flat-blade screwdriver to remove the battery door screw.
2. Remove the battery door to access the three AAA batteries.
3. Make sure the battery polarity is correct.
4. Replace the battery door and install the screw.



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Figure 4. Battery Replacement

Battery Life

Battery life is approximately 300 hours (12.5 days) of continuous operation with the backlight off. A low-battery icon () shows in the lower right of the display when battery level is low. Replace batteries per recommendations found in the specifications section of this manual.

Calibration

For calibration information, refer to the document on the documentation CD.

SCPI Commands

For a list of the SCPI commands, refer to the document on the documentation CD.

RS-232 Interface

An RS-232 interface is standard on the Product. Serial communication can be used for configuration, calibration, and to move measurement data from the Product. An RS-232 cable is included with data logging software purchase.

 **Warning**

To prevent possible electrical shock, fire, or personal injury, the RS-232 interface must not be used in hazardous areas.

Specifications

(Ambient: 23 °C ±5 °C)

Measurement Range	-50 °C to 160 °C (-58 °F to 320 °F)
Accuracy (1 year)	±0.05 °C (0.09 °F)
Resolution	Selectable (0.1, 0.01, 0.001) factory default is 0.01
Sample Rate	User selectable 0.5/sec, 1/sec or 2/sec factory default is 1/sec
Operating Temperature Range of Readout:	-10 °C to 50 °C (14 °F to 122 °F)
Probe Response Time	Approximately 20 seconds
EMC Compliance	EN61326:2006 Annex C CISPR 11, Edition 5.0-2009 Class "B"
Humidity Range	0 to 95 % RH Non-condensing
Storage Temperature Range	-20 °C to 60 °C (-4 °F to 140 °F)
Enclosure Rating	IP50
Readout Temperature Coefficient	Add ±10 ppm/°C of full scale temperature from -10 °C to 18 °C and 28 °C to 50 °C
Probe Temperature Coefficient	0.00385 Ω/Ω/°C nominal
Nominal Probe Resistance at 0 °C	100 Ω
Probe Hysteresis	±0.01 °C
Power	3 AAA alkaline batteries

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Battery Life	Approximately 300 hours without back light
Battery Save (auto-off) Range	Selectable from 1 to 30 minutes or can be disabled
Size (readout only)	Approximately 4 in. x 2 in. x 1 in.
Probe Size	4.8 mm x 229 mm (3/16 in. x 9 in.)
	6.35 mm x 305 mm (1/4 in. x 12 in.)
	6.35 mm x 508 mm (1/4 in. x 20 in.)
Weight	6.9 oz