

Stainless Steel Temperature Probe

(Order Code TMP-BTA)



The Stainless Steel Temperature Probe can be used as a thermometer for experiments in chemistry, physics, biology, Earth science, environmental science, and more.

Note: Vernier products are designed for educational use. Our products are not designed nor recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

Compatible Interfaces and Software

See www.vernier.com/manuals/tmp-bta for a list of interfaces and software compatible with the Stainless Steel Temperature Probe.

Getting Started

1. Connect the sensor to the interface (LabQuest Mini, LabQuest 2, etc.).
2. Start the appropriate data-collection software (Logger Pro, Logger Lite, LabQuest App) if not already running, and choose New from File menu.

The software will identify the sensor and load a default data-collection setup. You are now ready to collect data.

If you are collecting data using a Chromebook™, mobile device such as iPad® or Android™ tablet, or a Vernier wireless sensor or interface, please see the following link for up-to-date connection information:

www.vernier.com/start/tmp-bta

Using the Product

Connect the sensor following the steps in the Getting Started section of this user manual.

Here are some general guidelines for usage:

- The probe handle is constructed of molded plasticized Santoprene®. While this material is very chemical resistant, we recommend that you avoid submerging the probe beyond the stainless steel portion.
- Always wash the probe thoroughly after use.

Videos

View videos related to this product at www.vernier.com/tmp-bta

Specifications

Temperature range	−40 to 135°C (−40 to 275°F)
Maximum temperature that the sensor can tolerate without damage	150°C
13-bit resolution	0.09°C (−40 to 0°C)
	0.02°C (0 to 40°C)
	0.05°C (40 to 100°C)
	0.13°C (100 to 135°C)
12-bit resolution	0.17°C (−40 to 0°C)
	0.03°C (0 to 40°C)
	0.1°C (40 to 100°C)
	0.25°C (100 to 135°C)
10-bit resolution	0.68°C (−40 to 0°C)
	0.12°C (0 to 40°C)
	0.4°C (40 to 100°C)
	1.0°C (100 to 135°C)
Temperature sensor	20 kΩ NTC Thermistor
Accuracy	±0.2°C at 0°C, ±0.5°C at 100°C
Response time (time for 90% change in reading)	10 seconds (in water, with stirring)
	400 seconds (in still air)
	90 seconds (in moving air)
Probe dimensions	Probe length (handle plus body): 15.5 cm
	Stainless steel body: length 10.5 cm, diameter 4.0 mm
	Probe handle: length 5.0 cm, diameter 1.25 cm

How the Sensor Works

This probe uses the 20 kΩ NTC Thermistor, which is a variable resistor. When the temperature increases, the resistance decreases non-linearly. The best-fit approximation to this nonlinear characteristic is the Steinhart-Hart equation. At 25°C, the resistance is approximately 4.3% per °C. The interface measures the resistance value, R , at a particular temperature, and converts the resistance using the Steinhart-Hart equation:

$$T = [K_0 + K_1(\ln 1000R) + K_2(\ln 1000R)^3]^{-1} - 273.15$$

where T is temperature (°C), R is the measured resistance in kΩ, $K_0 = 1.02119 \times 10^{-3}$, $K_1 = 2.22468 \times 10^{-4}$, and $K_2 = 1.33342 \times 10^{-7}$. Our

programs perform this conversion and provide readings in °C (or other units, if you load a different calibration).

Calibration

In most cases, the Stainless Steel Temperature Probe will not need to be calibrated. It is calibrated before it ships. However, you can calibrate the sensor using Logger Pro 3.3 or newer. **Note:** Calibration can only be done on computers running Logger Pro. For more information, see www.vernier.com/til/1310

Care and Maintenance

The most common causes for this sensor to break are

1. Twisting the cable. Sometimes students twist or crimp the wire near the handle of the sensor. Over time, this can cause the wires to come loose and make the sensor stop working.
2. Overheating the sensor. When used in chemistry labs, students will sometimes lay the sensor on a hot plate and effectively "cook" the unit.
3. The unit is not waterproof! Water can seep into the hilt of the sensor and damage the electronics. Only submerge the stainless steel portion the sensor into water when collecting data.

Unfortunately, these causes of breakage are considered misuse and are not covered by our warranty. In our experience, repair is not possible for this type of damage.

The Stainless Steel Temperature Probe body is constructed from grade 316 stainless steel, which provides a high level of corrosion resistance for use in the science classroom. Here are some general guidelines for usage:

- The probe can be left continuously in water at temperatures within the range of -40 to 150°C. Continuous usage in saltwater will cause only minor discoloration of the probe, with no negative effect on performance.
- You can leave the probe continuously in most organic compounds, such as methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, n-hexane, lauric acid, paradichlorobenzene, phenyl salicylate, and benzoic acid. The probe should not be left in n-pentane for more than one hour.
- The probe can be left in strong basic solutions, such as NaOH, for up to 48 hours, with only minor discoloration. We do not recommend usage in basic solutions that are greater than 3 M in concentration.
- The chart provides the maximum length of time recommended for probe exposure to some common acids. Probes left in an acid longer than these times may bubble and/or discolor, but will still be functional. We do not recommend probes be left to soak in any acid longer than 48 hours.

Maximum acid exposure time	
1 M HCl	20 min
2 M HCl	10 min
3 M HCl	5 min
1 M H ₂ SO ₄	48 hours
2 M H ₂ SO ₄	20 min
3 M H ₂ SO ₄	10 min
1 M HNO ₃	48 hours
2 M HNO ₃	48 hours
3 M HNO ₃	48 hours
1 M CH ₃ COOH	48 hours
2 M CH ₃ COOH	48 hours
3 M CH ₃ COOH	48 hours
1 M H ₃ PO ₄	48 hours
2 M H ₃ PO ₄	48 hours
3 M H ₃ PO ₄	48 hours

Troubleshooting

Primary Test

Follow the steps in the Using the Product section. Hold the tip of the sensor in your hand and check for a change in the temperature readings.

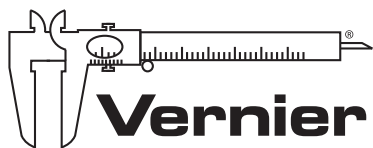
For additional troubleshooting and FAQs, see www.vernier.com/til/1392

Repair Information

If you have watched the related product video(s), followed the troubleshooting steps, and are still having trouble with your Stainless Steel Temperature Probe, contact Vernier Technical Support at support@vernier.com or call 888-837-6437. Support specialists will work with you to determine if the unit needs to be sent in for repair. At that time, a Return Merchandise Authorization (RMA) number will be issued and instructions will be communicated on how to return the unit for repair.

Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use. Broken clips do not compromise the performance of the sensor. For proper storage, see www.vernier.com/til/2377



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