

Go Direct[®] Surface Temperature

(Order Code GDX-ST)



Go Direct Surface Temperature is designed for use in situations in which low thermal mass or flexibility is required. Special features include an exposed thermistor that results in an extremely rapid response time.

Typical uses for Go Direct Surface Temperature include the following:

- Skin temperature measurements
- Human respiration studies
- Specific heat experiments
- Heat transfer experiments
- Friction and energy studies

Note: Vernier products are designed for educational use. Our products are not designed nor are they 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.

What's Included

- Go Direct Surface Temperature
- Micro USB Cable

Compatible Software

See www.vernier.com/manuals/gdx-st for a list of software compatible with Go Direct Surface Temperature.

Getting Started

Please see the following link for platform-specific connection information:

www.vernier.com/start/gdx-st

Bluetooth Connection

1. Install Vernier Graphical Analysis™ on your computer, Chromebook™, or mobile device. If using LabQuest®, make sure LabQuest App is up to date. See www.vernier.com/ga4 for Graphical Analysis availability or www.vernier.com/downloads to update LabQuest App.
2. Charge your sensor for at least 2 hours before first use.
3. Turn on your sensor by pressing the

USB Connection

1. Install Graphical Analysis on your computer or Chromebook. If using LabQuest, make sure LabQuest App is up to date. See www.vernier.com/ga4 for software availability or www.vernier.com/downloads to update LabQuest App.
2. Connect the sensor to the USB port.
3. Launch Graphical Analysis or turn on LabQuest. You are now ready to

power button once. The LED will blink red.

4. Launch Graphical Analysis or turn on LabQuest.
5. If using Graphical Analysis, click or tap Sensor Data Collection. If using LabQuest, choose Wireless Device Setup > Go Direct from the Sensors menu.
6. Select your Go Direct sensor from the list of Discovered Wireless Devices. Your sensor's ID is located near the barcode on the sensor. The LED will blink green when it is successfully connected.
7. Click or tap Done to enter data-collection mode.

collect data.

Note: This sensor does not work with the original LabQuest. It works with LabQuest 2 or LabQuest 3.

Charging the Sensor

Connect Go Direct Surface Temperature to the included Micro USB Cable and any USB device for two hours.

You can also charge up to eight Go Direct Surface Temperature Sensors using our Go Direct Charge Station, sold separately (order code: GDX-CRG). An LED on each Go Direct Surface Temperature indicates charging status.

| | |
|---------------|---|
| Charging | Blue LED on steady while sensor is connected to the Charging Cable or Charging Station. |
| Fully charged | Blue LED is off when charging is complete. |

Providing Power

| | |
|----------------------------------|---|
| Turning on the sensor | Press button once. Red LED indicator flashes when unit is on. |
| Putting the sensor in sleep mode | Press and hold button for more than three seconds to put into sleep mode. Red LED indicator stops flashing when sleeping. |

Connecting the Sensor

See the following link for up-to-date connection information:

www.vernier.com/start/gdx-st

Connecting via Bluetooth

| | |
|------------------|--|
| Ready to connect | Red LED flashes when sensor is awake and ready to connect via Bluetooth. |
| Connected | Green LED flashes when sensor is connected via Bluetooth. |

Connecting via USB

| | |
|---|--|
| Connected and charging | Blue and Green LED solid when sensor is connected to Graphical Analysis via USB and unit is charging. (Green LED is obscured by the blue one.) |
| Connected, fully charged | Green LED solid when sensor is connected to Graphical Analysis via USB and the unit is fully charged. |
| Charging via USB, connected via Bluetooth | Blue LED is solid and green LED is flashing, but the green flashing LED looks white because it is overwhelmed by the blue. |

Identifying the Sensor

When two or more sensors are connected, the sensors can be identified by tapping or clicking Identify in Sensor Information.

Using the Product

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

Important: Go Direct Surface Temperature is for use in air and water only. For temperature measurements in harsher environments that require a more durable probe, we recommend our Go Direct Temperature (order code GDX-TMP).

Calibration

It should not be necessary to perform a calibration when using this sensor. It is calibrated before it ships.

Specifications

| | |
|---|--|
| Temperature range | -25°C to 125°C (-13°F to 275°F) |
| Maximum temperature that the sensor can tolerate without damage | 150°C |
| Temperature sensor | 20 kΩ NTC Thermistor |
| Accuracy | ±0.5°C or better |
| Response time from 25°C to 100°C in water | 5 seconds |
| Probe dimensions: probe length (handle plus body) | Handle: 7 cm high, 3.5 cm wide, 2 cm deep Cable: 1 m Submersible section: 7 cm |

Care and Maintenance

Battery Information

Go Direct Surface Temperature contains a small lithium-ion battery in the handle. The system is designed to consume very little power and not put heavy demands on the battery. Although the battery is warranted for one year, the expected battery life should be several years. Replacement batteries are available from Vernier (order code: GDX-BAT-300).

Storage and Maintenance

To store Go Direct Surface Temperature for extended periods of time, put the device in sleep mode by holding the button down for at least three seconds. The red LED will stop flashing to show that the unit is in sleep mode. Over several months, the battery will discharge but will not be damaged. After such storage, charge the device for a few hours, and the unit will be ready to go.

Exposing the battery to temperatures over 35°C (95°F) will reduce its lifespan. If possible, store the device in an area that is not exposed to temperature extremes.

Water Resistance

The body of the Go Direct Surface Temperature Sensor is not water resistant and should never be immersed in water.

If water gets into the device, immediately power the unit down (press and hold the power button for more than three seconds). Disconnect the sensor and charging cable, and remove the battery. Allow the device to dry thoroughly before attempting to use the device again. Do not attempt to dry using an external heat source.

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).

Troubleshooting

First check that the sensor is responding: Connect the sensor and start the data-collection program. Hold the tip of the sensor in your hand to warm it and check that the temperature changes.

For additional troubleshooting and FAQs, see www.vernier.com/til/4052

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct Surface Temperature, 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.

Accessories/Replacements

| Item | Order Code |
|---------------------------------------|----------------|
| Micro USB Cable | CB-USB-MICRO |
| USB-C to Micro USB cable | CB-USB-C-MICRO |
| Go Direct 300 mAh Replacement Battery | GDX-BAT-300 |

Warranty

Warranty information for this product can be found on the Support tab at www.vernier.com/gdx-st

General warranty information can be found at www.vernier.com/warranty

Disposal

When disposing of this electronic product, do not treat it as household waste. Its disposal is subject to regulations that vary by country and region. This item should be given to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring that this product is disposed of correctly, you help prevent potential negative consequences on human health or on the

environment. The recycling of materials will help to conserve natural resources. For more detailed information about recycling this product, contact your local city office or your disposal service.

Battery recycling information is available at www.call2recycle.org

Do not puncture or expose the battery to excessive heat or flame.



The symbol, shown here, indicates that this product must not be disposed of in a standard waste container.

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

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

RF Exposure Warning

The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Industry Canada - Class B This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and

- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

RF exposure warning: The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'appareil doit accepter toute interférence radioélectrique, même si cela résulte à un brouillage susceptible d'en compromettre le fonctionnement.

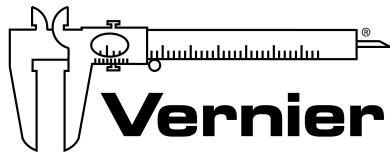
Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel interférant-brouilleur: "Appareils Numériques," NMB-003 édictée par Industrie Canada. L'utilisation est soumise aux deux conditions suivantes:

- (1) cet appareil ne peut causer d'interférences, et
- (2) cet appareil doit accepter toutes interférences, y comprises celles susceptibles de provoquer un dysfonctionnement du dispositif.

Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisis de telle façon que l'équivalent de puissance isotrope émise (e.i.r.p.) n'est pas plus grand que celui permis pour une communication établie.

Avvertimento d'esposizione RF: L'equipamento è conforme alle limitazioni di esposizione alle RF stabilite per un ambiente non supervisionato. L'antenna (s) utilizzata per questo trasmettitore non deve essere accoppiata o funzionare in congiunzione con qualsiasi altra antenna o trasmettitore.

Note: This product is a sensitive measurement device. For best results, use the cables that were provided. Keep the device away from electromagnetic noise sources, such as microwaves, monitors, electric motors, and appliances.



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