

Go Direct[®] Optical Dissolved Oxygen (Order Code GDX-ODO)



Go Direct Optical Dissolved Oxygen is a luminescence-based dissolved oxygen probe that can also measure water temperature and atmospheric pressure. It is actively temperature and pressure compensated, and there is no need for calibration. This probe can be used in experiments to test water samples in the field or in the laboratory.

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 Optical Dissolved Oxygen
- Electrode Storage Bottle
- Micro USB Cable

Compatible Software

See www.vernier.com/manuals/gdx-odo for a list of software compatible with Go Direct Optical Dissolved Oxygen.

Getting Started

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

www.vernier.com/start/gdx-odo

Bluetooth Connection

1. Install Graphical Analysis 4 on your computer, Chromebook™, or mobile device. If using LabQuest 2, make sure LabQuest App is up to date. See www.vernier.com/ga4 for Graphical Analysis 4 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 power button once. The LED will blink red.
4. Launch Graphical Analysis 4 or turn on LabQuest 2.
5. If using Graphical Analysis 4, click or tap Sensor Data Collection. If using LabQuest 2, 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.
8. This is a multi-channel sensor. To change the default channel selections, see www.vernier.com/start/gdx-odo

USB Connection

1. If using a computer or Chromebook, install Graphical Analysis 4. If using LabQuest 2, make sure LabQuest App is up to date. See www.vernier.com/ga4 for Graphical Analysis 4 availability or www.vernier.com/downloads to update LabQuest App.
2. Connect the sensor to the USB port.
3. Launch Graphical Analysis 4 or turn on LabQuest 2. You are now ready to collect data.
4. This is a multi-channel sensor. To change the default channel selections, see www.vernier.com/start/gdx-odo

Charging the Sensor

Connect Go Direct Optical Dissolved Oxygen to the included Micro USB Cable and any USB device for two hours.

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

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

Powering the Sensor

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-odo

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	Green LED solid when sensor is connected to Graphical Analysis via USB and the unit is fully charged. Green LED flashing when sensor is connected to Graphical Analysis via Bluetooth wireless technology.
Charging via USB, connected via Bluetooth wireless technology	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

1. Connect the probe following the steps in the Getting Started section of this user manual.
2. Remove the storage bottle from the probe by unscrewing the lid and removing the bottle and lid.
3. Place the tip of the probe into the water sample. The sample needs to be deep enough that the metal ring on the tip is submerged. **Note:** If your water sample is not at room temperature it can take a few minutes for the reading to equilibrate.

4. When you are finished making measurements, rinse the probe with distilled water.
5. Slide the lid onto the body of the probe, and then screw the lid onto the storage bottle.

Channels

Go Direct Optical Dissolved Oxygen has five measurement channels:

- DO Concentration
- DO Saturation
- Temperature
- Pressure
- DO Salinity

DO Concentration

This channel measures the dissolved oxygen concentration in a water sample. This is an absolute measurement of dissolved oxygen concentration expressed as milligrams of oxygen gas dissolved per liter of water. Units can be changed from milligrams per liter (mg/L) to parts per million (ppm). The readings are automatically temperature (water temperature) and pressure (atmospheric) compensated regardless of whether the temperature and/or pressure channels are activated. This is the default channel that is active when the probe is connected.

DO Saturation

This channel measures the percent saturation of dissolved oxygen in a water sample. Percent saturation is a relative measurement in which the dissolved oxygen concentration is expressed as a percentage of the maximum amount of oxygen that water can hold at a give temperature and pressure. This channel is not active by default when the probe is connected.

Temperature

This channel measures water temperature of the sample. Units can be changed from °C to °F, or K. This channel is not active by default when the probe is connected, however it is always in use internally to temperature compensate the dissolved oxygen readings.

Pressure

This channel measures the atmospheric pressure. Units can be changed from kPa to mmHg, inHg, mbar, psi, atm, or torr. This channel is not active by default when the probe is connected, however it is always in use internally to pressure compensate the dissolved oxygen readings.

DO Salinity

This channel should be used when measuring dissolved oxygen in highly saline environments (> 1 ppt). In these cases, a correction must be made to account for the effect of salinity on dissolved oxygen concentration. Salinity is not actually measured by the probe, but it can be manually entered once this channel has been selected. If no value is entered, a default salinity concentration of 35 ppt, the typical salinity of ocean water, is used to make the correction. Units can be changed from milligrams per liter (mg/L) to parts per million (ppm). This channel is not active by default when the probe is connected.

Calibrating the Sensor

DO Concentration

This channel is factory calibrated and does not require calibration by the user. If the probe is not reading accurately, a reset can be done using a one-point calibration. To do a reset

1. Fill the storage bottle to the top of the sponge with distilled water.
2. Insert the probe into the storage bottle and make sure it is positioned vertically so that the tip is not in contact with the sponge or water.
3. Start the software and identify your probe, if necessary.
4. Keep the probe in a vertical position for a minimum of 60 seconds.
5. Click or tap the meter, choose calibrate, and follow the instructions on the screen.

DO Saturation

This channel is factory calibrated and does not require calibration by the user. If the probe is not reading accurately a reset can be done using a one-point calibration. To do a reset

1. Fill the storage bottle, to the top of the sponge, with distilled water.
2. Insert the probe into the storage bottle and make sure it is positioned vertically so that the tip is not in contact with the sponge or water.
3. Start the software and identify your probe, if necessary.
4. Keep the probe in a vertical position for a minimum of 60 seconds.
5. Click or tap the meter, choose calibrate, and follow the instructions on the screen.

Temperature

This channel is factory calibrated and can not be calibrated by the user.

Pressure

This channel is factory calibrated and can not be calibrated by the user.

DO Salinity

This channel is factory calibrated and does not require calibration by the user. The salinity correction is automatically set for 35 ppt. The correction can be changed by entering the actual salinity concentration, in ppt, in the field provided on that channel.

Specifications

Range (mg/L)	0 to 20 mg/L
Range (%)	0 to 300%
Accuracy (mg/L)	±0.2 mg/L below 10 mg/L ±0.4 mg/L above 10 mg/L
Accuracy (%)	±2% below 100% ±5% above 100%
Accuracy with calibration reset (mg/L)	±0.1 mg/L below 10 mg/L ±0.2 mg/L above 10 mg/L
Accuracy with calibration reset (%)	±1% below 100% ±5% above 100%
Type	Luminescent
Response time	90% of final reading in 40 seconds
Temperature compensation	automatic from 0 to 50°C
Pressure compensation	automatic from 228 mmHg to 1519 mmHg
Minimum sample flow	none required
Wireless specification	Bluetooth 4.2
Maximum wireless range	30 m
Battery	650 mA Li-Poly
Battery life (single full charge)	~24 hours
Battery life (long term)	~500 full charge cycles (several years depending on usage)

Care and Maintenance

Battery Information

Go Direct Optical Dissolved Oxygen contains a small lithium-ion battery. 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-650).

Storage and Maintenance

When you have finished using Go Direct Optical Dissolved Oxygen, rinse it off with distilled water and blot it dry using a paper towel or lab wipe. Insert the probe back into the storage bottle containing the sponge, dampened with distilled water.

The tip of the probe is a replaceable screw-on cap called the Go Direct Optical Dissolved Oxygen Replacement Cap. This cap is warranted to be free from defects of a period of two years from the date of purchase; it is possible that you can get longer use than the warranty period. If you notice a reduced response, it is probably time to replace the cap (order code GDX-ODO-CAP). To extend the lifetime of the cap, do not expose it to direct sunlight for an extended period of time.

To store Go Direct Optical Dissolved Oxygen 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.

This probe should be used in aqueous solutions only. Do not place the probe in viscous, organic liquids, such as heavy oils, glycerin (glycerol), ethylene glycol, or alcohols. Do not place the probe in acetone or non-polar solvents, such as pentane or hexane.

Water Resistance

Go Direct Optical Dissolved Oxygen is designed so that the tip of the probe can be submerged in an aquatic environment for extended periods of time. For best results keep the pressure-sensing element out of water so as not to interfere with the active pressure compensation. **This probe is not designed for long-term immersion applications.**

The included micro USB cable is not waterproof.

How the Sensor Works

Go Direct Optical Dissolved Oxygen operates on the principle of reversible luminescence quenching of a luminophore by oxygen as it passes through the cap. The cap is coated with a luminescent compound encased in a matrix for protection. Blue light from an LED is transmitted to the cap and excites the luminophore.

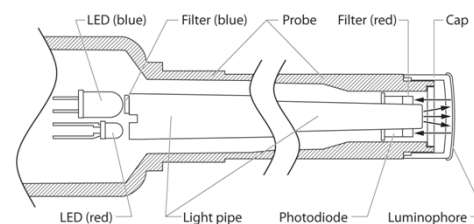
A collision of an oxygen molecule with the luminophore in its electronic excited state results in energy transfer from the luminophore to oxygen. As the luminophore relaxes it emits red light. The time from when the blue light is transmitted and the red light is emitted is measured by a photodiode. The more oxygen that is present, the shorter the time it takes for the red light to be emitted.

This time is measured and correlated to the oxygen concentration. Between the flashes of blue light, a red LED is flashed onto the probe and used as an internal reference to help validate each measurement. This process is described by the Stern-Volmer equation

$$\tau_0 / \tau = 1 + K_{sv}[\text{DO}]$$

where τ_0 and τ are the luminescence lifetimes in the absence and presence of oxygen, respectively, $[\text{DO}]$ is the dissolved oxygen concentration, and K_{sv} is the Stern-Volmer quenching constant.

The Stern-Volmer constant (K_{sv}) depends directly upon the rate constant for the diffusion of oxygen, the solubility of oxygen, and the natural lifetime of the electronic excited state of the luminophore. Lifetime measurements have an advantage over intensity measurements since they are not usually affected by processes which result in loss of the complex, such as bleaching or photodegradation.



Interior schematic of the Optical Dissolved Oxygen Probe

Troubleshooting

If the probe seems to be giving incorrect values:

- Give the probe a few minutes to equilibrate in the sample, especially if the water is not at room temperature.
- Reset the calibration using the instructions above in the Calibrating the Sensor section.

For troubleshooting and FAQs, see www.vernier.com/til/4227

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct Optical Dissolved Oxygen, 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 650 mAh Replacement Battery	GDX-BAT-650
Go Direct Optical Dissolved Oxygen Replacement Cap	GDX-ODO-CAP
Optical DO Probe Metal Guard	ODO-GRD
Electrode Storage Bottle	BTL-ES

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. This warranty covers educational institutions only. The cap is covered by a two-year 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.

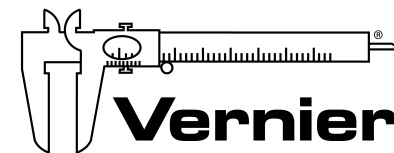
Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel interférent-brouilleur: "Appareils Numériques," NMB-003 édictée par Industrie Canada. L'utilisation est soumise aux deux conditions suivantes:

- (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 émis (e.i.r.p.) n'est pas plus grand que celui permis pour une communication établie.

Avertissement d'exposition RF: L'équipement est conforme aux limites d'exposition aux RF établies pour un environnement non supervisé. L'antenne (s) utilisée pour ce transmetteur ne doit pas être jumelée ou fonctionner en conjonction avec toute autre antenne ou transmetteur.

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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