

Go Direct[®] PAR (Order Code GDX-PAR)



The Go Direct PAR (Photosynthetically Active Radiation) Sensor measures photosynthetic light levels in both air and water. The sensor responds to visible light in the spectral range that is used by plants in photosynthesis (400–700 nm). It features a waterproof sensor head and connector and reports the Photosynthetic Photon Flux Density (PPFD), which is measured in $\mu\text{mol m}^{-2} \text{s}^{-1}$ (micromoles of photons per meter squared per second). The sensor is calibrated for use in sunlight, but can also be used to measure PPFD from electric light sources. This sensor is ideal for experiments that investigate photosynthesis and primary productivity and can also be used in many agricultural and environmental science applications. The Go Direct PAR Sensor has a 5 m cable.

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 PAR
- Micro USB Cable
- Cover for the lens of the Go Direct PAR sensor

Compatible Software

See www.vernier.com/manuals/gdx-par for a list of software compatible with Go Direct PAR.

Getting Started

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

www.vernier.com/start/gdx-par

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/ga for Graphical Analysis Pro availability or www.vernier.com/downloads to update LabQuest App.
2. Charge your sensor for at least 2 hours before first use.

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/ga 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

3. Turn on your sensor by pressing the power button once. The LED will blink red. collect data.
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.

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

Charging the Sensor

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

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

Charging	Orange LED next to the battery icon is solid while the sensor is charging.
Fully charged	Green LED next to the battery icon is solid when the sensor is fully charged.

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-par

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	Orange LED next to the battery icon is solid when the sensor is connected to Graphical Analysis via USB and the unit is charging. LED next to Bluetooth icon is off.
Connected, fully charged	Green LED next to the battery icon is solid when the sensor is connected to Graphical Analysis via USB and fully charged. LED next to Bluetooth icon is off.
Charging via USB, connected via Bluetooth	Orange LED next to the battery icon is solid when the sensor is charging. Green LED next to the Bluetooth icon flashes.

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.

Channels

Go Direct PAR has two measurement channels:

- PPFD
- PPFD - CF

PPFD

This channel is calibrated for sunlight and for electric light sources that do not use LEDs. It reports the Photosynthetic Photon Flux Density (PPFD), which is measured in $\mu\text{mol m}^{-2} \text{s}^{-1}$ (micromoles of photons per meter squared per second). This is the default channel that is active when the sensor is connected.

PPFD - CF

This channel is used when you need to use a correction factor to measure PPFD in conditions where the standard calibration will not be accurate. This would include LED based light sources, measuring PAR underwater, or in certain field conditions. This channel is not active by default when the sensor is connected. For information on correction factors please see (<https://www.vernier.com/til/3102>).

Sensor Orientation

Sensor orientation is important for getting the best results from the sensor. When measuring PAR outdoors, the sensor head should be level, with the white lens pointing straight up toward the sky and with the cord pointing toward the north (in the Northern Hemisphere) or toward the south (in the Southern Hemisphere).

When measuring PAR from an artificial light source, the sensor head should be placed with the lens of the sensor facing the center of the light path.

Calibrating the Sensor

PPFD

This channel is factory calibrated and does not require calibration by the user. The calibration can be verified using the Clear Sky Calculator (www.clearskycalculator.com). The Clear Sky Calculator for Quantum Sensors reports the theoretical PPFD at any time of day at any location in the world on a cloudless day. The application is most accurate at solar noon in the spring and summer.

PPFD - CF

This channel is factory calibrated and does not require calibration by the user. The correction factor is automatically set to 1. To change the correction factor, click or tap the meter, choose calibrate, and enter the correction factor for your condition. Click or tap Keep, then done. Note: The correction factor for measuring PAR underwater is 1.15. For information on correction factors please see (<https://www.vernier.com/til/3102>).

Specifications

PAR range	0 to 2500 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (PPFD) in full sun
Absolute accuracy	$\pm 5\%$ (full scale)
Repeatability	$\pm 1\%$
Long-term drift	Less than 2% per year
Cosine response	
45° zenith angle	$\pm 2\%$
75° zenith angle	$\pm 5\%$
Wavelength range	370–650 nm
Typical Resolution	1 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (PPFD)
Sensor dimensions	2.4 cm diameter 3.3 cm height 5 m cable length

Materials	Anodized aluminum with case acrylic lens
Operating environment	<p>–10 to 60°C</p> <p>0–100% relative humidity</p> <p>Sensor head and cable can be submerged in water to sensor box</p>

Care and Maintenance

Cleaning the Go Direct PAR Sensor

Debris on the Go Direct PAR Sensor lens will partially block the optical path and will lead to low readings. Dust and other organic deposits are best removed using water or window cleaner. Never use an abrasive cleaner on the lens. Salt deposits can also accumulate on the sensor lens over time due to evaporation from sea spray, sprinkler irrigation water, or wave splash. Salt deposits should be dissolved with vinegar and then removed using soft cloth or cotton swabs.

Go Direct PAR Sensor Head Connector

The head of the Go Direct PAR Sensor is attached to the main cable using a P68-rated stainless-steel marine grade (M8) connector. This connector is located 25 cm from the sensor head. The connector is used for removing the sensor head during routine calibration, replacement, or maintenance by the manufacturer. Please do not remove the sensor head from the main cable. For the connector to be waterproof, confirm that the cables are firmly connected and the threaded connectors are finger tight.

Battery Information

The Go Direct PAR Sensor contains a small lithium-ion battery in the sensor box. 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 the Go Direct PAR Sensor 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 sensor head and main cable for the Go Direct PAR are waterproof and can be fully submerged up to the box containing the electronics (approximately 5 meters). The sensor box is not waterproof and should never be immersed in water. If any liquid 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. **Note:** Damage due to liquid is not covered under warranty.

Troubleshooting

For troubleshooting and FAQs, see www.vernier.com/til/17351

Repair Information

If you have watched the related product video(s), followed the troubleshooting steps, and are still having trouble with your Go Direct PAR, 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.

Related Products

Item	Order Code
Go Direct Optical Dissolved Oxygen	GDX-ODO
Go Direct CO ₂ Carbon Dioxide Gas	GDX-CO2
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Conductivity	GDX-CON
Water Quality Bottles (8)	WQ-BTA

Warranty

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

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 tout 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 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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