Go Direct® Spirometer
(Order Code GDX-SPR)

Go Direct Spirometer is designed to make human respiratory measurements. This sensor is a multi-channel device that reports respiratory air pressure, flow rate, volume, and respiration rate. Measure tidal volumes and other lung function parameters with channels that automatically adjust for baseline drift. With both USB and wireless capabilities, student can monitor human respiratory patterns anywhere using any compatible device.

Go Direct Spirometer can be used in a variety of experiments, including

- Comparing respiratory patterns
- Measuring tidal volumes and other lung volume parameters
- Analyzing lung function

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 Spirometer
- Disposable mouthpieces (3)
- Disposable bacterial filter (3)
- Nose clips (3)
- Micro USB Cable

Compatible Software
See **www.vernier.com/manuals/gdx-spr** for a list of software compatible with Go Direct Spirometer.

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

www.vernier.com/start/gdx-spr

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. You are now ready to collect data.
8. This is a multi-channel sensor. To change the channel selections, see www.vernier.com/start/gdx-spr

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 channel selections, see www.vernier.com/start/gdx-spr

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

You can also charge up to eight Go Direct Spirometers using our Go Direct Charge Station, sold separately (order code: GDX-CRG). An LED on each Go Direct Spirometer 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-spr

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

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

Go Direct Spirometer can be used for inspiratory and expiratory experiments.

Use a mouthpiece and a disposable bacterial filter with the Go Direct Spirometer for all experiments. According to the manufacturer's specs, the MicroGard® filters out more than 99% of bacterial and viral aerosols.

Note: Every person must use their own bacterial filter and mouthpiece—do not share these.
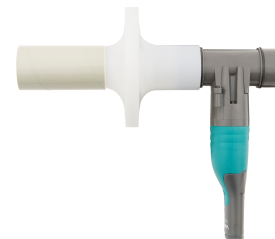
1. Use a nose clip to ensure that the subject is only breathing through their mouth.
2. Connect a disposable bacterial filter and a disposable mouthpiece to the Flow Head of the sensor on the side labeled "Inlet."
3. Hold the Go Direct Spirometer vertically and still during use.

Channels

Go Direct Spirometer has six measurement channels:

- Flow Rate
- Volume
- Adjusted Volume
- Cycle Volume
- Respiration Rate
- Differential Pressure

Flow Rate

This channel reports the flow rate (L/s) of air moving through the flow head. During the ventilation cycle, inhalation will produce negative flow rates while exhalation produces positive flow rates. This channel is active by default when the sensor is connected.

Volume

This channel reports the volume of air (L) passing through the flow head. During the ventilation cycle, inhalation will increase volume while exhalation decreases volume. This channel is active by default when the sensor is connected.

Adjusted Volume

This channel reports the volume or air (L) passing through the flow head. The volume is returned to zero after each ventilation cycle. Use this channel to minimize baseline drift. This channel is not active by default when the sensor is connected.

Cycle Volume

This channel reports the peak volume (L) of each ventilation cycle. Use this channel for long experiments and to minimize baseline drift. This channel is not active by default when the sensor is connected.

Differential Pressure

This channel measures the pressure differential (Pa) across the screen inside the flow head. This channel is not active by default when the sensor is connected.

Respiration Rate

This channel detects inhalations and calculates the number of breaths per minute (BPM). The sample window for the calculation is 30 seconds. The advance interval is 10 seconds. The value will update every 10 seconds. Use this channel for long experiments. This channel is not active by default when the sensor is connected.

Calibrating the Sensor

Go Direct Spirometer is factory calibrated and should not require calibration by the user.

For the most accurate measurements, we recommend adjusting the volume channel using a 2 L syringe (not included). This is a simple process that takes only a few minutes.

For further calibration information, see **www.vernier.com/til/3353**

Specifications

Pressure	Type: Differential
	Range: ±500 Pa
	Accuracy: ±1 Pa or 3% of reading
	Resolution: 0.02 Pa
Flow rate range	±10 L/s
Flow head	Volume: 41 mL
	Dimensions: 29.5 mm (diameter) × 82 mm (length)
	Mass: 69 g
	Construction: ABS plastic
Adjusted volume calculation	Returns volume to zero after each ventilation cycle
Cycle volume calculation	Reports the peak volume for each ventilation cycle
Respiration rate calculation	Sample Window: 30 s
	Advance Window: 10 s
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)
Normal operating temperature range	20ºC to 40ºC
Operating humidity range	5–95% (non-condensing)

Care and Maintenance

Every person must use their own bacterial filter and mouthpiece—do not share these.

The flow head is not designed to be removed or sterilized by the user. The flow head can be replaced to extend the life of the product. For more information, contact Vernier Technical Support at support@vernier.com or call 888-837-6437.

The nose clips should be wiped clean between uses and soaked in a mild detergent after each experiment.

Battery Information

Go Direct Spirometer 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

To store the Go Direct Spirometer 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 use.

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

Important: Go Direct Spirometer 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

In the center of the flow head is a plastic screen. As air is forced through the flow head a slight difference in pressure occurs between the front and the back of the screen. A tube in front of the screen and a tube behind the screen pass the pressures to a differential pressure transducer. The greater the airflow passing through the screen, the greater the pressure differential. Airflow rate (L/s) is calculated by applying a factory derived calibration equation to the pressure data. Volume (L) is then calculated by integrating the flow rate (L/s).

Troubleshooting

- Use a nose clip to ensure that the subject is only breathing through their mouth.
- Hold the Go Direct Spirometer vertically and still during use.
- Use the Adjusted Volume channel if baseline drift in volume is an issue.
- Naturally fitting plastic mouthpieces may give more accurate measurements. For more information see **www.vernier.com/til/3409**
- Use the Cycle Volume and Respiration Rate channels instead of Flow Rate and Volume channels for long experiments. Do not adjust the sampling rate

For troubleshooting and FAQs, see **www.vernier.com/til/4455**

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct Spirometer, 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
Disposable Bacterial Filter (pkg. of 10)	SPR-FIL10
Disposable Mouthpiece (pkg. of 30)	SPR-MP30
Noseclip (pkg. of 10)	SPR-NOSE10

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 warrenty.

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 disfonctionnement du dispositif.

Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisie 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 jumelés 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.
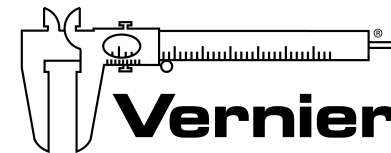
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