

Go Direct[®] Blood Pressure (Order Code GDX-BP)



Go Direct Blood Pressure is a non-invasive sensor that measures human blood pressure. It measures systolic, diastolic, and mean arterial pressure via the oscillometric method. Go Direct Blood Pressure can also report pulse rate and display both individual pressure pulses and peak-to-peak pulse amplitudes. The sensor indicator light provides immediate user feedback, letting students know when blood pressure parameters have been reported. With both USB and wireless capabilities, students can monitor blood pressure anywhere using almost any device.

Go Direct Blood Pressure can be used in a variety of experiments, such as

- Measuring and compare blood pressure and heart rate
- Measuring how exercise changes blood pressure
- Observing how the "fight or flight" response changes blood pressure

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 Blood Pressure
- Standard adult size adjustable cuff (27 cm to 39 cm)
- Bulb pump (with release valve)
- Micro USB Cable

Compatible Software

See www.vernier.com/manuals/gdx-bp for a list of software compatible with Go Direct Blood Pressure.

Getting Started

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

www.vernier.com/start/gdx-bp

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.

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. Charge your sensor for at least 2 hours before first use.
2. Connect the sensor to the USB port.
3. Turn on your sensor by pressing the power button once. The LED will blink red.
3. Launch Graphical Analysis 4 or turn on LabQuest 2. You are now ready to collect data.
4. Launch Graphical Analysis 4 or turn on LabQuest 2.
4. This is a multi-channel sensor. To change the channel selections, see www.vernier.com/start/gdx-bp
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-bp

Charging the Sensor

Connect Go Direct Blood Pressure to the included USB Charging Cable and any USB device for two hours.

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

Powering the Sensor

Turning on the sensor	Press button once. Red LED indicator next to the Bluetooth icon flashes when the 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 next to Bluetooth icon stops flashing when sleeping.

Connecting the Sensor

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

www.vernier.com/start/gdx-bp

Connecting via Bluetooth

Ready to connect	Red LED next to the Bluetooth icon flashes when sensor is awake and ready to connect.
Connected	Green LED next to the Bluetooth icon 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

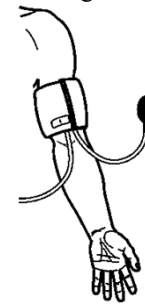
When two or more sensors are connected, the sensors can be identified by tapping or clicking Identify in Sensor Information.

Using the Product

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

When performing blood pressure measurements, it is best to work with a partner. Follow these general procedures when using Go Direct Blood Pressure:

1. Attach the rubber hose from the cuff to the connector on the sensor.
2. Wrap the cuff firmly around the subject's arm, approximately 2 cm above the elbow as shown below. The two rubber hoses from the cuff should be positioned over the bicep muscle (near the brachial artery) and not under the arm. **Important:** The arm should rest at the level of the heart, and remain relaxed throughout data collection. A desk or table can be used to support the arm. The subject must remain still during data collection—no movement of the arm or hand should occur during measurements.



3. Find the sensor indicator light. It is located in the top right corner of the sensor label next to the check mark.
4. Begin data collection. Quickly and repeatedly squeeze the bulb to inflate the cuff. Continue inflating the cuff to a pressure between 150 and 170 mmHg. The sensor indicator light will flash red as the cuff is inflated. When the light flashes green, an appropriate pressure has been reached. **Note:** A meter in the data-collection software will also display the live pressure readings from the sensor.
5. When the light flashes green, set the bulb pump down on the table. The built-in pressure release valve will slowly deflate the cuff. The sensor indicator light will flash green as the pressure decreases.
6. When the pressure drops to 50 mmHg, you may press down on the pressure release valve to release any air remaining in the cuff.
7. When the sensor indicator light turns solid green, blood pressure parameters have been reported. Stop data collection. Results will be displayed in the meters at the bottom of the graph. Results can also be found in the data table and will be reported on the meter screen.

Note: If the sensor indicator light turns solid red, blood pressure parameters were not reported by the sensor. Repeat data collection.

Note: If the cuff pressure does not reach 50 mmHg after 90 seconds, adjust the exhaust rate of the pressure release valve according to the directions listed under “Adjusting the Pressure Release Valve.”

Channels

Go Direct Blood Pressure has seven measurement channels:

- Cuff Pressure
- Mean Arterial Pressure
- Systolic Pressure
- Diastolic Pressure
- Pulse Rate
- Oscillations
- Envelope

Cuff Pressure

This channel measures the pressure applied to the cuff. This channel is active by default when the sensor is connected.

Mean Arterial Pressure

This channel reports the estimated mean arterial blood pressure using the oscillometric method. The value is reported at the end of the run after the pressure has fallen below 50 mmHg. This channel is active by default when the sensor is connected.

Systolic Pressure

This channel reports the estimated systolic blood pressure using the oscillometric method. The value is reported at the end of the run after the pressure has fallen below 50 mmHg. This channel is active by default when the sensor is connected.

Diastolic Pressure

This channel reports the estimated diastolic blood pressure using the oscillometric method. The value is reported at the end of the run after the pressure has fallen below 50 mmHg. This channel is active by default when the sensor is connected.

Pulse Rate

This channel reports the pulse rate of the subject in beats per minute (bpm). The sample window for the calculation is the last 30 seconds of data collection. The value is reported at the end of the run after the pressure has fallen below 50 mmHg. This channel is active by default when the sensor is connected.

Oscillations

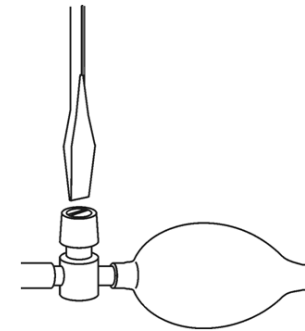
This channel displays the pulses found during cuff deflation. This channel is not active by default when connected to the sensor.

Envelope

This channel graphs the peak-to-peak amplitudes of all pulses detected during cuff deflation. The resulting graph is the "envelope" used to calculate blood pressure parameters using the oscillometric method. This channel is not active by default when connected to the sensor.

Adjusting the Pressure Release Valve

The pressure release valve is set to release at a rate of 3.0 mmHg/s on an arm that is 32 cm in circumference. For arms much larger or much smaller it may be necessary to adjust the valve so that the exhaust rate stays in the range of 2.0 to 4.0 mmHg/s. With the bulb in hand and the hose leading away from you, place a screwdriver into the metal slot on the top of the release valve. To increase the rate of exhaust, turn the screwdriver clockwise. To decrease the rate of exhaust, turn the screwdriver counter-clockwise. The larger a subject's arm the slower the release valve will exhaust.



Using Go Direct Blood Pressure at High Altitudes (above 6,000 ft)

To record proper measurements at altitudes above 6,000 ft (0.8 atm or 609 mmHg) the pressure release valve will need to be readjusted. The pressure release valve is set to release at a rate of 3.0 mmHg/s at sea level, where atmospheric pressure is 1 atm or 760 mmHg. At higher altitudes, the pressure release valve will exhaust at a slower rate. To use Go Direct Blood Pressure at altitudes above 6,000 ft, open the pressure exhaust valve by turning it a half turn clockwise. See the instructions above. Verify that the exhaust rate is now in the range of 2.0–4.0 mmHg/s after making the adjustment.

Calibrating the Sensor

The sensor is factory calibrated and cannot be calibrated by the user.

Specifications

Type	Differential pressure
Range	0 to 300 mmHg
Resolution	0.001 mmHg
Accuracy	± 0.75 mmHg
Response time	5 ms
Maximum pressure without damage	3100 mmHg
Systolic pressure coefficient	57% of MAP
Diastolic pressure coefficient	74% of MAP
Pulse rate calculation	Sample window: Last 30 s of data collection
Maximum sampling rate	200 samples/s
USB specification	2.0
Wireless specification	Bluetooth 4.2
Maximum wireless range	30 m
Battery	300 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 Blood Pressure 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-300).

Storage and Maintenance

To store the Go Direct Blood Pressure 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

Important: Go Direct Blood Pressure 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

The sensor determines the blood pressure of the subject using the oscillometric method, a non-invasive means of measuring blood pressure. This method is based on the principle that blood pumped through the arteries by the heart causes the arterial walls to flex. When a cuff (placed around the upper arm to occlude the brachial artery) is inflated and then slowly deflates at a constant rate, an arterial pressure pulse forms. These pressure pulses pass from the arteries, through the arm, and into the pressure cuff itself.

When the artery is fully compressed by the cuff, blood flow stops, along with the pulsations. As the pressure in the cuff slowly decreases, the arterial blood pressure increases to the point that blood is forced through the artery in short pulses. As the pressure in the cuff decreases, more blood flows through the occluded artery and the pulses become larger until maximum amplitude is reached. Further decreases in cuff pressure minimize the occlusion of the artery and the pulses decrease in size until the occlusion is removed.

The peak-to-peak amplitudes of all of the pulses during cuff deflation form a bell-shaped curve of pulse amplitudes that is referred to as an "envelope". Within this envelope, the amplitude of each pulse increases through systolic blood pressure until the mean arterial pressure (MAP) is reached. The cuff pressure corresponding to the point with the maximum pulse amplitude approximates the mean arterial pressure of the subject. Systolic blood pressure is calculated by finding a point along the envelope prior to MAP that corresponds to a known percentage of the maximum amplitude. Diastolic blood pressure is calculated using a different percentage of maximum amplitude for the portion of the envelope following MAP. For more information on this method see www.vernier.com/til/2027

Troubleshooting

Go Direct Blood Pressure will not report blood pressure parameters until the sensor indicator light turns solid green. Do not stop data collection prematurely. Allow the sensor to complete the process of calculating blood pressure parameters.

Blood pressure readings will differ from person to person and even between measurements on the same individual. Do not expect to receive the same measurements on each trial since there are many factors that cause a person's

blood pressure to increase or decrease. Use the following tips to take accurate measurements.

Helpful Tips

- The subject's arm and hand must remain still during measurements.
- The arm should rest at the level of the heart and remain relaxed during measurements. A desk or table can be used to support the arm.
- Proper placement of the pressure cuff will increase the accuracy of your blood pressure measurements. The rubber hoses from the cuff should exit over the bicep muscle (near brachial artery) and 2 cm above the crease in the elbow.
- Accurate blood pressure readings depend on the use of a cuff of appropriate size for the arm. For younger students, a smaller cuff (18 cm to 27 cm) is available (order code CUFF-SM). A large cuff (39 cm to 50 cm) is also available (order code CUFF-LG).
- Do not touch or move the exhaust valve during measurements.
- Remove any clothing that may cover or constrict the portion of the arm being measured.
- For most individuals it is not necessary to inflate the pressure cuff higher than 170 mmHg. Over inflation of the cuff may cause pain and/or injury.
- If the pressure release valve is exhausting slower than 2.0 mmHg/s or faster than 4.0 mmHg/s, then adjust the exhaust rate of the pressure valve.

For more information see www.vernier.com/til/4454

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct Blood Pressure, 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
Blood Pressure Cuff (Standard)	CUFF-STD
Blood Pressure Cuff (Large)	CUFF-LG
Blood Pressure Cuff (Small)	CUFF-SM

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.

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:

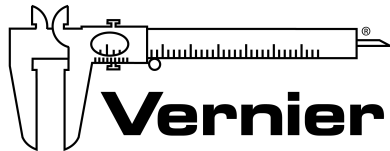
(1) cet appareil ne peut causer d'interférences, et

(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 émise (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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