

# Go Direct™ 3-Axis Magnetic Field Sensor

(Order Code GDX-3MG)



The Go Direct 3-Axis Magnetic Field Sensor allows you to determine the magnitude and direction of the magnetic field at any point in space. It directly connects wirelessly via Bluetooth® or wired via USB to your platform.

**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 3-Axis Magnetic Field
- Rechargeable battery (included inside unit)
- Micro USB Cable

## Compatible Software

See [www.vernier.com/manuals/gdx-3mg](http://www.vernier.com/manuals/gdx-3mg) for a list of software compatible with the Go Direct 3-Axis Magnetic Field.

## Getting Started

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

[www.vernier.com/start/gdx-3mg](http://www.vernier.com/start/gdx-3mg)

### Bluetooth Connection

1. Install Graphical Analysis 4 on your computer or Chromebook™. See [www.vernier.com/ga4](http://www.vernier.com/ga4) for software availability.
2. Charge your sensor for at least 2 hours before first use.
3. Turn on your sensor by pressing the power button once. The Bluetooth® LED will blink red.
4. Launch Graphical Analysis 4.
5. Click or tap Sensor Data Collection from the New Experiment list.
6. Click or tap your Go Direct sensor from the list of Discovered Wireless Devices. Your sensor's ID is located near the barcode on the sensor. The Bluetooth LED will blink green when it is successfully connected.

### USB Connection

1. Install Graphical Analysis 4 on your computer or Chromebook. See [www.vernier.com/ga4](http://www.vernier.com/ga4) for software availability.
2. Connect the sensor to the USB port.
3. Launch Graphical Analysis 4.
4. Click or tap Device Manager, .
5. In the Connected Devices Sensor Channels list, select the check box next to the Sensor Channel(s) you would like to activate.
6. Click or tap Done to enter data-collection mode.

7. In the Connected Devices Sensor Channels list, select the check box next to the Sensor Channel(s) you would like to activate.
8. Click or tap Done to enter data-collection mode.

## Charging the Sensor

Connect the Go Direct 3-Axis Magnetic Field Sensor to the included Micro USB Cable and any USB device for two hours.

You can also charge up to eight Go Direct 3-Axis Magnetic Field Sensors using our Go Wireless Charging Station, sold separately (order code: GW-CRG).

Charging	Blue LED is on steady and a red LED is flashing 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-3mg](http://www.vernier.com/start/gdx-3mg)

### Connecting via Bluetooth

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

## 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.

### Channels

The Go Direct 3-Axis Magnetic Field Sensor has 6 measurement channels. The channel names are

- X magnetic field
- Y magnetic field
- Z magnetic field
- X magnetic field 130mT
- Y magnetic field 130mT
- Z magnetic field 130mT

The default channel that is active when connected is the X magnetic field channel, which has a maximum range of  $\pm 5$  mT. This range works well for the experiments we have published in our lab manuals.

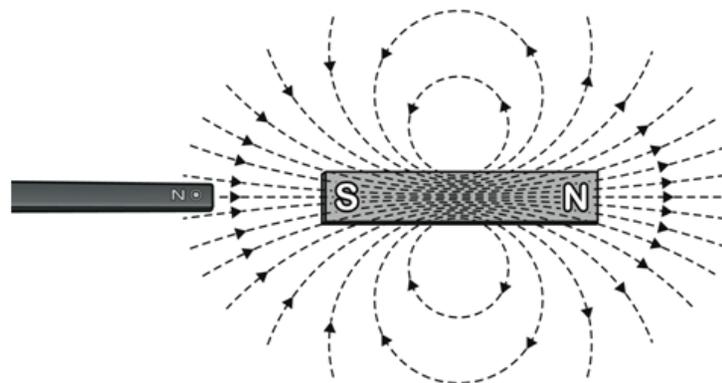
There are two additional channels that use the  $\pm 5$  mT range, Y magnetic field and Z magnetic field. The y- and z-directions are indicated by the dots impressed in the plastic near the end of the wand. These marks also indicate the location of the actual sensor chip within the wand.

When using any of the  $\pm 5$  mT channels, if the sensor is exposed to a magnetic field greater than  $\pm 5$  mT on any axis, the software will display a reading of 5 mT. To measure the field strength of stronger magnetic fields, use the 130 mT channels. The 130 mT channels are measured by a second sensor chip inside the wand, located 5.5 mm toward the handle from the dots in the end of the wand.

### Measuring the X-direction Magnetic Field

Magnetic fields that point in the same direction the wand is pointing are recorded as positive, and fields that point in the opposite direction are recorded as negative. Thus, the magnetic field of the Earth will register as a positive field when the

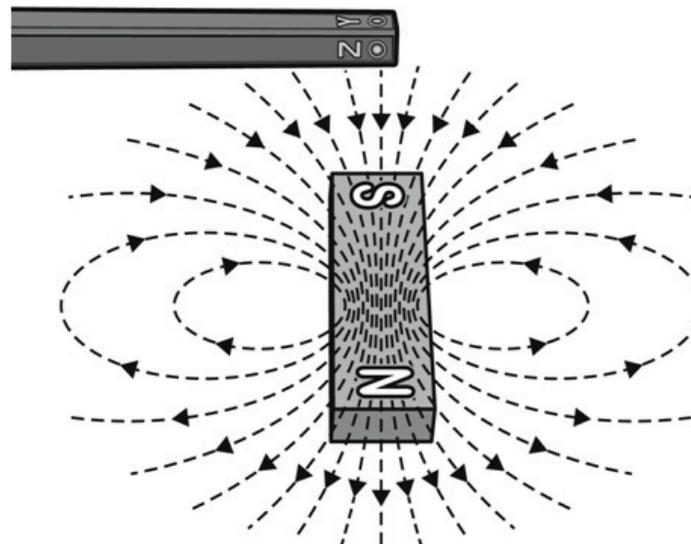
wand is pointed toward the magnetic pole in the Earth's northern hemisphere, which is a South magnetic pole. When the wand is aligned with a permanent magnet and pointed toward the South pole of a magnet it will also record a positive field.



*The x-direction measurement is positive when the wand points toward the South pole of a magnet.*

### Measuring y- and/or z-directions

The marks on the sides of the wand, at the tip, indicate the y- and z-directions of positive magnetic field measurements, as well as marking the location within the housing where the  $\pm 5$  mT magnetic field sensor is located. This is important for consistent placing of the sensor and accurately measuring the distance between the sensor and the source of a magnetic field.



*In this orientation, the z-direction measurement will be positive.*

### Measuring Magnitude

This sensor measures just the vector component of the field along each direction. To determine the total magnetic field strength at a location, you could measure only in the x-direction (the default setting in Graphical Analysis) and point the wand exactly in the direction of the magnetic field in the location you are measuring. Another option is to create a calculated column in software. The magnitude of the field is calculated as the square root of the sum of the squares of the measurements along all three axes. Using this method may be useful with students who have been introduced to vectors in three dimensions.

### Calibrating the Sensor

User calibration is not available for this sensor. We have set the sensor to match our stored calibration before shipping it.

It is useful, however, to zero the Magnetic Field Sensor. Position the sensor and zero it using your data-collection software. Moving the sensor will upset the zero since the background magnetic field in your lab probably varies with position. For experiments measuring the spatial variation of a magnetic field, it is better to zero the sensor and then move the source to various positions.

### Specifications

Measurement range	$\pm 5$ mT and $\pm 130$ mT
Sensor location	$\pm 5$ mT sensor location is indicated by dots on wand, about 5mm from the wand tip. $\pm 130$ mT sensor location is about 10.5 mm from the wand tip.
Maximum data-collection rate	100 Hz
Resolution	0.00015 mT on $\pm 5$ mT range 0.1 mT on $\pm 130$ mT range
USB specification	USB 2.0 full speed
Wireless specification	Bluetooth v4.2
Maximum wireless range	30 m (unobstructed)
Dimensions	19 cm long, wand portion 12.2 cm long Wand tapers from 0.8 cm square at handle to 0.7 cm square at tip. This sensor is designed to be placed inside a solenoid if needed.
Battery	300 mA Li-Poly
Battery life (single full charge)	~24 hours continuous data collection
Battery life (long term)	Several years depending on usage

## Care and Maintenance

### Battery Information

Go Direct 3-Axis Magnetic Field 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 3-Axis Magnetic Field 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 for 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

Go Direct 3-Axis Magnetic Field is water resistant and can be submerged in water for limited periods of time. However, submerging the sensor impacts the radio operation by absorbing much of the energy. This may make it difficult or impossible to connect to the sensor while submerged, particularly if there are electrically noisy signals nearby such as pumps or motors.

### How the Sensor Works

The  $\pm 5$  mT chip in the Go Direct 3-Axis Magnetic Field Sensor uses a device based on anisotropic magnetoresistance. In certain materials, the electrical resistance varies with the external magnetic field strength and the angle between the current and the field. Using this effect one can measure the component of the magnetic field along each axis.

The  $\pm 130$  mT chip in the sensor uses a Hall-effect transducer. It produces a voltage that is linear with magnetic field.

### Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct 3-Axis Magnetic Field Sensor, contact Vernier Technical Support at [support@vernier.com](mailto: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
Replacement Battery	GDX-BAT-300
Micro USB Cable	CB-USB-MICRO
USB-C to Micro USB Cable	CB-USB-C-MICRO

## 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](http://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.



**MEASURE. ANALYZE. LEARN.™**

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Rev. 6/5/17

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