

# Magnetic Field Sensor

## (Order Code MG-BTA)



The Vernier Magnetic Field Sensor measures a vector component of the magnetic field near the sensor tip. The tip can be adjusted, allowing the user to measure fields that are parallel or perpendicular to the long axis of the sensor. The Magnetic Field Sensor can be used for a variety of interesting experiments involving magnetic fields.

- Measure and study the Earth's magnetic field.
- Determine the direction of magnetic north.
- Study the magnetic field near a permanent magnet.
- Measure the field near a current-carrying wire.
- Measure the field at the opening of a solenoid.

**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.

### Compatible Software and Interfaces

See [www.vernier.com/manuals/mg-bta](http://www.vernier.com/manuals/mg-bta) for a list of interfaces and software compatible with the Magnetic Field Sensor.

### Getting Started

1. Connect the sensor to the interface (LabQuest Mini, LabQuest 3, etc.).
2. Start the appropriate data-collection software (Graphical Analysis, LabQuest App, Logger Pro) if not already running, and choose New from File menu. The software will identify the sensor and load a default data-collection setup. You are now ready to collect data.

If you are collecting data using a Chromebook™, mobile device such as iPad® or Android™ tablet, or a Vernier wireless sensor or interface, please see the following link for up-to-date connection information:

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

### Using the Sensor

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

Use the switch on the sensor shaft to select an appropriate range.

- The 6.4 mT range is used to measure relatively strong magnetic fields around permanent magnets and electromagnets.
- The 0.32 mT range is used mainly to measure the magnetic field of the Earth and very weak fields. It can be used for other magnets, but the sensor must

remain in one position so that the reading is not affected by the background field of the Earth.

### Videos

View videos related to this product at [www.vernier.com/mg-bta](http://www.vernier.com/mg-bta)

### Calibration

You should not have to perform a new calibration when using the Magnetic Field Sensor. We have set the sensor to match our stored calibration before shipping it.

It is not practical to calibrate the Magnetic Field Sensor without reference to a known source of magnetic field. It is useful, however, to zero the Magnetic Field Sensor. Position the sensor and zero it using your data-collection software. Move the magnetic field source, and not the sensor, to explore the spatial variations of the field.

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

Sensor location	~1 cm from the wand tip with the white dot as indicated by the white line on newer sensors
13-bit resolution	±0.32 mT range: 0.0001 mT ±6.4 mT range: 0.002 mT
12-bit resolution	±0.32 mT range: 0.0002 mT ±6.4 mT range: 0.004 mT
10-bit resolution	±0.32 mT range: 0.0008 mT ±6.4 mT range: 0.016 mT
Stored calibration value (±0.32 mT range in millitesla)	slope: 0.160 mT/V intercept: -0.320 mT
Stored calibration value (±6.4 mT range in millitesla)	slope: 3.225 mT/V intercept: -8.063 mT
Stored calibration value (±0.32 mT range in gauss)	slope: 1.6 gauss/V intercept: -3.2 gauss
Stored calibration value (±6.4 mT range in gauss)	slope: 32.25 gauss/V intercept: -80.625 gauss

## How the Sensor Works

The sensor uses a Hall-effect transducer. It produces a voltage that is linear with magnetic field. The sensor measures the component of the magnetic field that is perpendicular to the white dot on the end of the sensor tip. The reading is positive when the white dot on the sensor points toward a magnetic south pole.



The switch on the sensor shaft is used to select the range. On the 6.4 mT range, each volt measured by the transducer represents 32 gauss ( $3.2 \times 10^{-3}$  tesla). The range of the sensor is  $\pm 64$  gauss or  $\pm 6.4 \times 10^{-3}$  tesla. On the 0.3 mT range, each volt measured represents 1.6 gauss ( $1.6 \times 10^{-4}$  tesla). The range of the sensor is  $\pm 3.2$  gauss or  $\pm 3.2 \times 10^{-4}$  tesla.

If the sensor tube is held vertically with the tip horizontal, and rotated until the maximum voltage is found, the tip with the white dot will point to magnetic north. The magnetic inclination in your area can be found by holding the tube so that the white dot is facing north, and rotating the sensor end of the tube down until the voltage reaches a maximum. The angle of the tip from the vertical position is the magnetic inclination. Note that the north pole of a freely suspended magnet points north, since the magnetic pole of the Earth in the northern hemisphere is a south magnetic pole.



## Troubleshooting

If you are getting unexpected or unusual readings from the Magnetic Field Sensor, first confirm that the range setting is appropriate for the experiment. The  $\pm 6.4$  mT range is used to measure relatively strong magnetic fields around permanent magnets and electromagnets; the  $\pm 0.32$  mT range is used to measure the magnetic field of the Earth and very weak fields. If you are using the  $\pm 0.32$  mT range for investigating permanent magnets, make sure that the sensor remains in one position so that the reading is not affected by the background field of the Earth.

For other troubleshooting tips and FAQs, see [www.vernier.com/til/1420](http://www.vernier.com/til/1420)

## Repair Information

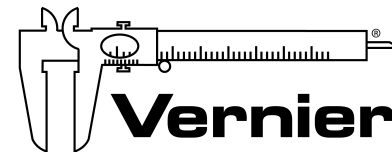
If you have watched the related product video(s), followed the troubleshooting steps, and are still having trouble with your Magnetic Field Sensor, contact

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.

## Warranty

Warranty information for this product can be found on the Support tab at [www.vernier.com/mg-bta](http://www.vernier.com/mg-bta)

General warranty information can be found at [www.vernier.com/warranty](http://www.vernier.com/warranty)



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