



1140 - Wireless Magnetic Field Sensor

Revision: 0 | DS161

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Introduction

Thank you for purchasing the Smart Wireless Magnetic Field Sensor. We pride ourselves on producing high quality products that meets with the demands of the busy classroom environment. If you have any problems using this sensor, please read this documentation in full before contacting the Data Harvest support team.



Overview

The Smart Wireless Magnetic field sensor is used to explore the magnitude and direction of a magnetic field in three dimensions lying at right angles (X, Y and Z) at two magnitudes of magnetic field (± 5 or ± 130 mT).

Use to explore the nature and strength of the magnetic field in a solenoid or permanent magnet.

The sensor is both USB and Bluetooth compatible. Using Bluetooth the sensor can wirelessly connect to mobile devices such tablets and mobile phones as well as desktop or laptop computers giving students the ability to run experiments independently without being tethered to a traditional data logger. See the EasySense2 user manual system requirements for further details.

The sensor is supplied with a mini USB lead (1 m standard A to standard mini B) and the X magnetic field channel as its default range.

Note: Charge the Magnetic field sensor fully before first use.

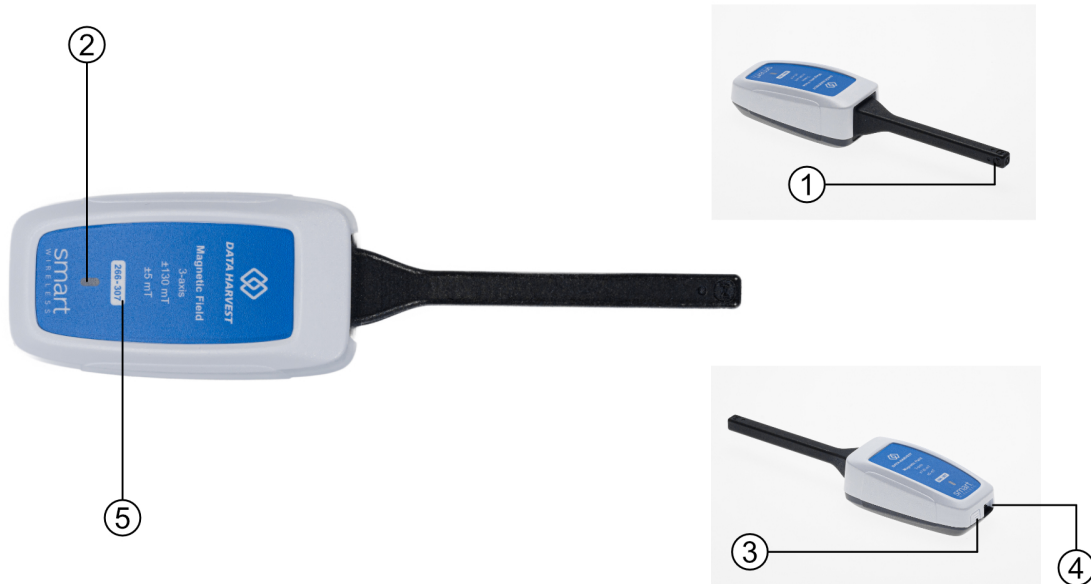
Pack Contents

This product is supplied with the following items:

- [1 x Smart Wireless Magnetic Field Sensor](#)
 - 1 x USB Connecting Lead
-

Operational Overview

The diagram below shows the specific parts of the sensor. Read further to explore the functionality of each part of the sensor.



- 1. Sensor End Cap
- 2. Status Indicator
- 3. On/Off Switch
- 4. USB Port
- 5. Unique ID Number

Sensor End Cap (1)

Most Smart Wireless Sensors feature an end cap that is specific to the requirements of the device's internal sensor. The sensor's end cap is the direct interface between the device's internal sensor and your experiment.

The Status Indicators (2)

The sensor features a single status indicator that changes colour and flashes. See the table below for further information.

| Status Light | Indicates |
|-----------------|---|
| No light | Sensor is Off. Short press the On/Off switch |
| Blue flashing | Sensor On and Bluetooth advertising |
| White flashing | Charging via USB mains charger or USB port |
| Green flashing | Communication with the EasySense2 app (via USB or Bluetooth) has been established |
| Orange flashing | Recording data |

Red flashing

Battery is low

On/Off Switch (3)

The sensor's on/off switch allows you to turn the sensor on, off or perform a hard reset.

To switch the sensor off

- Press and hold down the On/Off switch until the white light shows, then release.
- If not communicating with the EasySense2 app, the sensor will turn off after a period of one hour of inactivity.

Hard resetting the sensor

- If necessary, attach the sensor to power.
- Press and hold down the On/Off button for at least 8 seconds until the status LED gives a flash of blue light, then release.
- If the sensor fails to respond, contact Product Support at Data Harvest. Please provide details of:
 - The computer platform it is being used with and the EasySense2 app's version number.
 - A description of the problem being encountered.

USB Port (4)

Use to connect to a computer or a charging unit.

For specific USB or Bluetooth connectivity instructions, please see the 'Connectivity' section of this documentation.

For instructions on charging your device, see the section on 'Charging the Sensor'.

Unique ID Number (5)

All Smart Wireless Sensors are labelled with a unique ID number. This number is used in the EasySense2 app, so that you can identify each sensor when making a connection wirelessly.

Connectivity

The sensor is both USB and Bluetooth compatible. Install the EasySense2 app, if it is not already on your device. For details of how to operate the EasySense2 app, please refer to the EasySense2 documentation.

USB Connectivity

Quick Steps

1. Connect the sensor to the computer's USB port using the USB cable supplied.
2. The computer will automatically detect a new device and depending on your operating system, will install any applicable device drivers.
3. Start EasySense 2 app.
4. Within the EasySense2 app, the Devices icon will change to green to show that the sensor is connected, and the status light on the sensor will also turn green.
5. Begin your practical investigations.

Bluetooth Connectivity

Using Bluetooth, the sensor can wirelessly connect to mobile devices such tablets and mobile phones, as well as desktop or laptop computers, giving students the ability to run experiments independently without being tethered to a device.

See the EasySense2 app user manual system requirements for further details.

Quick Notes on Bluetooth Connectivity

Only use with the EasySense2 app, you do not need to pair the device. If paired, the sensor will not be available to the EasySense2 app.

Computers or devices will need to support Bluetooth Low Energy (BLE). For further information refer to the instructions provided for the EasySense2 app.

Quick Steps

1. Short press the on/off switch to turn the sensor on, blue LED will flash.
 2. Open the EasySense2 app.
 3. Select the Devices icon.
 4. Select your sensor from the list of available sensors to connect to the device. Your sensor is identified by its unique ID in the list.
 5. Click on connect at the side of your sensor in the list.
 6. The Devices icon will change to green and the status light on the sensor will flash green to indicate a connection has been established.
 7. Begin your practical investigations.
-

Charging the Sensor

The Smart Wireless sensors are fitted with a rechargeable lithium-ion battery and can be charged via the USB port. Use the supplied USB lead to connect the sensor either directly to a USB port on your computer, a powered USB hub or a USB mains charger that outputs 5 V at 500 mA or more.

A full charge can take up to 4 hours.

Additional Information

Whenever the sensor is connected to the USB port on the computer or to a USB mains charger (output 5 V at 500 mA or more), it will automatically recharge the battery (LED status flashing white).

When connected to a computer, the computer should be turned on and not in sleep or standby mode, as the battery may drain instead of charge.

The sensor will stay awake for 60 mins when Bluetooth advertising (LED status flashing blue).

Lithium-ion batteries are 'memory-free' and prefer a partial rather than a full discharge. Constant partial discharges with frequent recharges will not cause any harm. Frequent full discharges should be avoided whenever possible. Ideally the sensor should be stored at about 40% or more charge.

The speed at which a lithium-ion battery will age is governed by both its storage temperature (preferably less than 40 C) and state-of-charge.

Firmware Updates

Occasionally Data Harvest may release updated firmware which will contain improvements or new features.

Updates will take place when you connect your sensor to the EasySense2 app. You will be given the option to decline an update.

Updates can be performed over USB or Bluetooth and will typically take less than one minute. Updating firmware over USB will be quicker than Bluetooth.

Do not disconnect the sensor, or power off during the update.

If you have a wireless connection to the EasySense2 app, the sensor will have to be reconnected after performing the update.

Usage Information

- The Magnetic field sensor be used is used to explore the direction of a magnetic field (X, Y and Z), it can also measure the magnitude in two ranges, ± 5 mT or ± 130 mT.
 - The ± 5 mT range is suitable for lower magnitude magnetic fields such as the magnetic field of the earth, solenoid investigations and for investigating the field round permanent magnets.
 - The ± 130 mT range is suitable for investigating the field round strong permanent magnets

Note: Strong magnetic fields can leave a small offset on the ± 5 mT range zero position. Use the Tare Feature in EasySense2 to remove this if it is critical to the experiment.

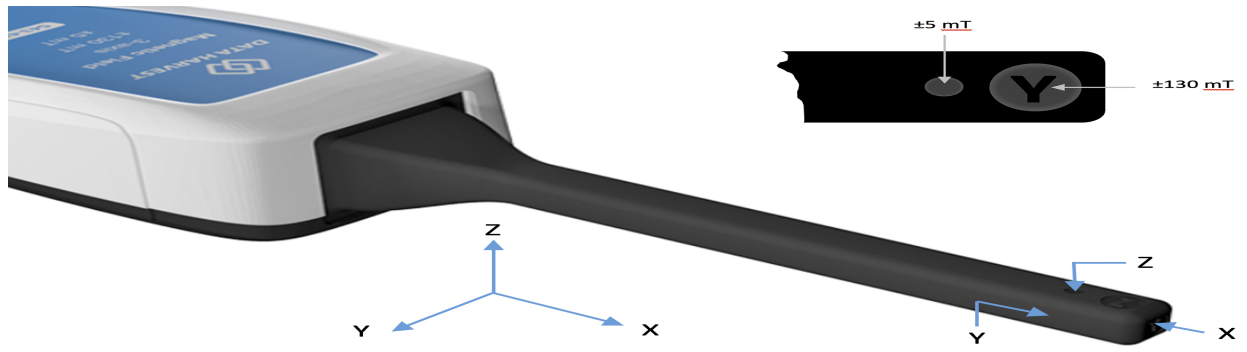
- As the values obtained will be sensitive to the position in the field, and the orientation of the sensor to the field direction, it can be useful to: -
 - a. Fix either or both the source and the sensor in one position.
 - b. Use a non-magnetic ruler or metre rule as a guide to move the sensor.
 - c. Use a non-magnetic clamp and stand to secure the sensor so it is kept facing at the same angle and in the same direction during the investigation.

Note: A false low value could be achieved if the direction of magnetic field is not at 90° to the plane of the sensor i.e. perpendicular to the relevant circle or letter.

- The position of the sensing device with ± 5 mT range is directly behind the dot near the end of the sensor's wand. The ± 130 mT range device is positioned directly behind the letter. This needs to be taken into account when positioning the sensor on a measuring device e.g. a ruler.
- The Hall voltage and internal resistance have low temperature coefficients. The effect of temperature can therefore be ignored in the normal school laboratory situation.
- Check how smooth low voltage units are before using them for electromagnetic field experiments. Many DC low voltage supplies are not very smooth and will therefore vary the field with the ripple voltage.
- There should be no ferrous metals or magnetic alloys in the vicinity of magnetic field experiments. Such materials will become magnetised and distort the magnetic field. Benches and equipment should be made from non-magnetic materials e.g. wood, plastic or aluminium. Please note that many clamp stands have aluminium rods and clamps, but their bases are made of iron.
- The safest coils to use for solenoid experiments are commercially wound coils that are marked with a rating.
- If home made coils are used take care to avoid overheating. Do not switch on except when taking measurements. It may be useful to add a contact switch (which is normally open) to the circuit. Insert an ammeter or current sensor in the circuit to monitor the current, to ensure that it is at a safe level. Too high a current may cause damage through overheating, and will probably cause the resistance to rise.
- Fields in excess of $\pm 1,000$ mT (1 T) may cause permanent damage.
- The module part of this sensor is not waterproof, it has an operating range of 0 to 95% RH (non-condensing). Do not place the sensor in an environment in which high humidity levels are possible as this may result in damage or malfunction.
- If the sensor has been left in the cold, let it warm to near room temperature before waking it from sleep.

Positioning the Sensor

The sensor uses two 3D Hall sensing devices positioned near the end of the wand that measure magnetic field in the X, Y and Z direction. The ± 5 mT device is positioned directly behind the dot mark, the ± 130 mT device is located directly behind the letter.



Practical Investigations

The Smart Wireless Magnetic Field Sensor can be used to investigate a number of scientific experiments such as:

- Comparison of the field strength of different types of magnet, induced and permanent
- Investigating materials that a magnetic field will pass through
- Change of magnetic field strength with distance
- Change in magnetic field strength between magnets
- Directly measuring the field due to a magnet or coil
- Relationship between magnetic field strength and the number of turns in a coil per unit length e.g. use a Slinky spring toy to investigate whether the field depends on the number of turns in the coil by stretching or compressing the coil
- Investigating magnetic field patterns around magnets and coils e.g. use a Slinky spring toy to investigate the field within the coil, how it varies along its axis and how the field in the centre compares with that at its ends
- Relationship between the magnetic field strength and the current in the coil, variation of the field of an AC current
- The variation of the magnetic field of Helmholtz coils
- Variation of the field of a solenoid along its axis

Online Videos

Learn how to use data logging in the classroom with our Secondary Science Academy demonstration videos, which will walk you through using the new EasySense2 app and show you how to get hands-on with the latest Bluetooth wireless sensors. The video experiments will show you how to get the best out of your science lessons.

New online content is being continuously uploaded onto our YouTube channel, including practical worksheets as well as videos.

See our website for further information and links.



Explore Bluetooth Sensors

Are you looking to make the jump to our smart wireless sensors? Or have you recently purchased them and want to know more about how they work?

[View video playlist](#)

Explore EasySense2

The core of our science platform is our EasySense2 software. In these videos you will learn everything from the basics of our software to the most in-depth features.

[View video playlist](#)



Explore Science Practicals

See our Smart Wireless Sensors in action with a range of practical experiments. This is the best way to get started with the new Bluetooth sensors!

[View video playlist](#)

Sensor Specifications

Please read the following table for sensor specifications.

| Feature | Detail |
|---------------------------------------|--|
| Measurement Ranges | <p>± 5 mT and ± 130 mT</p> <p>3 channels, for the measurement of magnetic field in X, Y and Z direction</p> <p>Note: The ± 5mT range has an absolute measurement span of ± 4.6mT to ± 5.2mT. This is unique to each sensor and cannot be adjusted.</p> |
| Accuracy | $\pm 5\%$ of reading |
| Resolution | <p>0.1 mT on ± 130 mT device</p> <p>0.15 μT sensitivity on ± 5 mT device</p> |
| Maximum magnetic field stress rating: | 1,000 mT (1 T), above this level may cause permanent damage |
| Fastest logging speed | <p>± 5 mT range: interval of 10 ms = 100 samples per second</p> <p>± 130 mT range: interval of 1 ms = 1,000 samples per second</p> |
| Connectivity | <p>Wired via USB</p> <p>Wireless via Bluetooth</p> |
| Bluetooth Specifications | <p>Bluetooth 4.2 low energy radio, single mode compliant</p> <p>Transmit (TX) power: 0 dBm</p> <p>Receiver (RX) sensitivity: - 90 dBm</p> <p>Usable transmission range: up to 10 m in open air</p> <p>Frequency Range: 2.402 to 2.480 GHz operation</p> |
| Internal Battery | <p>Rechargeable internal lithium-ion 3.7 V, 1300 mAh</p> <p>Operating range: 0 - 85°C and 0 to 95% RH (non-condensing)</p> <p>Power specification: 5 V at 500 mA</p> |
| Storage/Operating Temperature | 0 - 40 C |
| Humidity | 0 to 95% RH (non-condensing) |
| Physical Specifications | <p>Weight: approx. 85 g</p> <p>External dimensions: approx. height 33 mm x width 50 mm x length 195 mm</p> |

Limited Warranty

For information about the terms of the product warranty, see the Data Harvest website at: <https://data-harvest.co.uk/warranty>

Product Repairs

When returning goods to Data Harvest, please download and complete the repair return [form](#) to ensure you have sent us all the information we require, and send it to us alongside the item to be repaired. The second page of this form includes a return address label.

If you have purchased a Data Harvest manufactured product via a different company, please also supply proof of purchase.

Postage Charges

- In the event of a fault developing, the product must be returned in suitable packaging to Data Harvest for repair or replacement at no expense to the user other than postal charges.
- There will be no postal charge for the return of repaired goods to any mainland UK address (for other areas, additional shipping charges may apply).

Out of Warranty Repairs

Please visit <https://data-harvest.co.uk/repairs> for the most up to date charges for out of warranty repairs.

Warranty on Repaired Items

Once an item has been serviced and repaired, the product will have 1 year warranty against further failure of the component repaired.

International Returns

Please contact the authorised Data Harvest representative in your country for assistance in returning equipment for repair.

Compliance

This product complies to the following standards

Waste Electrical and Electronic Equipment Legislation

Data Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as 'life expired' and we will dispose of them for you.

FCC Details

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.

CE

This product conforms to the CE specification. It has been assessed and deemed to meet EU safety, health and environmental protection requirements as required for products manufactured anywhere in the world that are then marketed within the EU.



Troubleshooting

If you experience any problems with your product, please try the following troubleshooting tips before contacting the Data Harvest support team.

| Feature | Detail |
|--------------------------------|--|
| Loss of Bluetooth Connectivity | <p>If the sensor loses Bluetooth connection and will not reconnect try:</p> <p>Closing and reopening the EasySense 2 app.</p> <p>Switching the sensor Off and then On again.</p> <p>If you are using a Bluetooth Smart USB Adaptor on your computer, unplug the adaptor, plug back in again and try to reconnect.</p> <p>Hard reset the sensor and then try to reconnect.</p> |

Notices

Please read the following notices with regards to using your sensor

1. The sensor is much smarter than traditional Bluetooth sensors and you are not required to pair the device. If paired, the sensor will not be available to the EasySense 2 app.
 2. When the sensor is connected to a computer, the computer should be turned on and not in sleep or standby mode or the battery may drain instead of charge.
 3. Data Harvest products are designed for educational use and are not intended for use in industrial, medical or commercial applications.
 4. Charge the Magnetic field sensor fully before first use.
 5. The sensor is not waterproof.
 6. Plastic parts may fade or discolour over time if exposed to UV light. This is normal and will not affect the operation of the sensor.
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Contact Information

To contact Data Harvest directly, please use any of the following channels

Traditional Communications

Data Harvest Group Ltd.
1 Eden Court, Eden Way,
Leighton Buzzard,
Bedfordshire,
LU7 4FY
United Kingdom

Tel: +44 (0) 1525 373666

Fax: +44 (0) 1525 851638

Sales email: sales@data-harvest.co.uk

Support email: support@data-harvest.co.uk

Online Communications

We have active social media support channels using the following platforms

- [Facebook](#)
- [Twitter](#)
- [YouTube](#)

Office Opening Hours

Monday to Thursday - 08:30 to 16:45

Friday - 08:30 to 13:30

Saturday & Sunday & UK Bank Holidays - Closed

PDF Translations

The PDF formatted download of this manual is by default provided in the English (United Kingdom) language. If an alternative translation is available, it will be listed here.

We have for your convenience included a webpage translation feature to the online documentation which will allow you to translate and print individual pages of this documentation.
