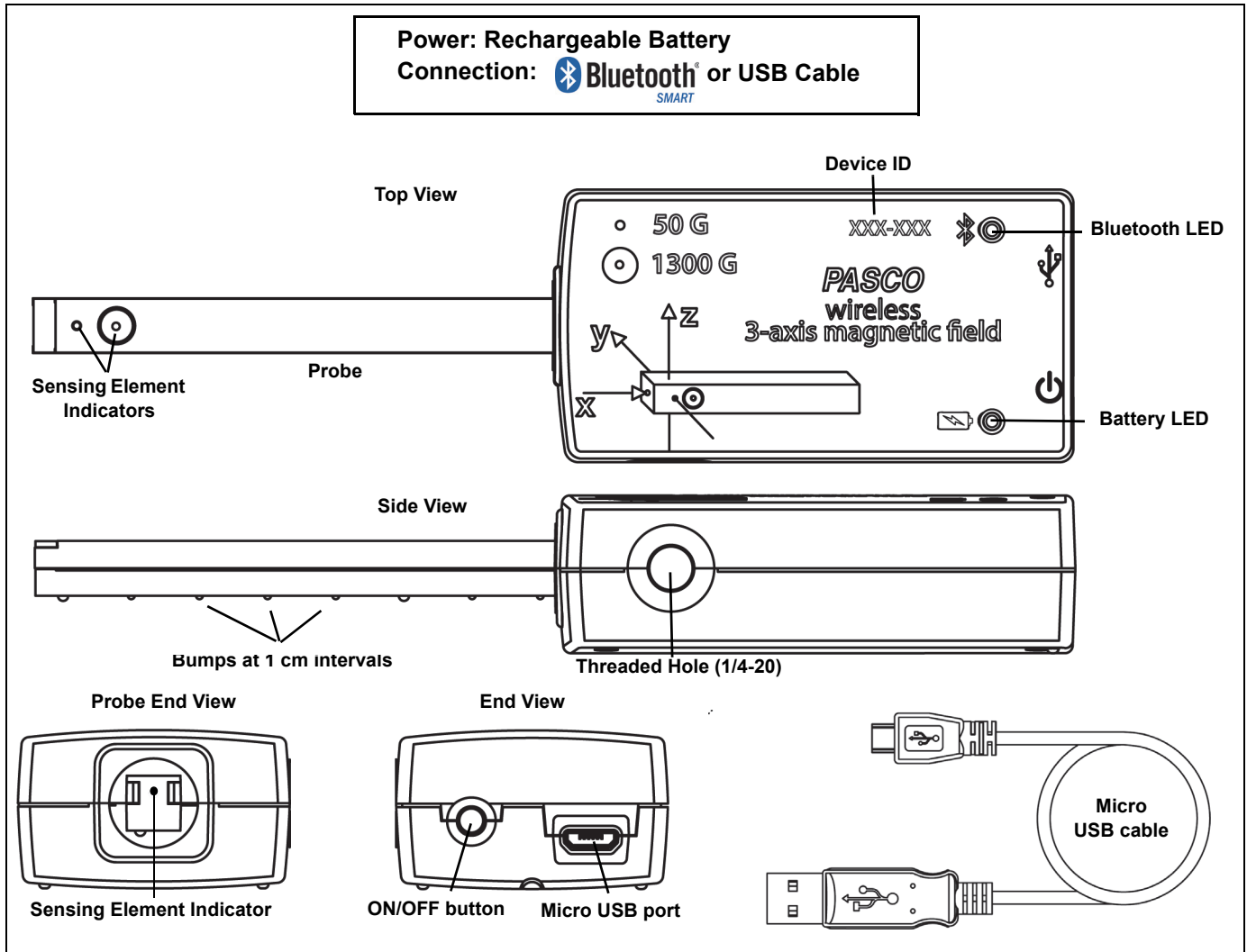


## Wireless 3-Axis Magnetic Field Sensor

PS-3221



### Hardware

Included Equipment
Wireless 3-Axis Magnetic Field Sensor
Micro USB Cable (1 meter)

Required Item*
PASCO Data Collection Software

Other Items*	Other Items*
Rotary Motion Sensor	Air Core Solenoid
Ampere's Law Accessory	Bar Magnet Set
Coil and Cores Set	Helmholtz Coils
Zero Gauss Chamber	Variable Gap Magnet

\*See the PASCO catalog or the PASCO web site at [www.pasco.com](http://www.pasco.com) for more information.

## Introduction

The Wireless 3-Axis Magnetic Field Sensor is a combination wireless *and* USB sensor that connects to a computer or tablet device through Bluetooth, and can also connect to a computer with a USB cable (included). The sensor measures the X, Y, and Z components of the magnetic flux density in tesla, millitesla, and gauss. The arrangement of the X, Y, and Z components is shown on the top label.

The two magnetic field sensing elements are in the end of the probe. One is a three-axis  $\pm 50$  gauss (G) sensor located under the dot on the probe. The other is a three-axis  $\pm 1300$  G sensor located under the dot with the ring around it. The bottom surface of the probe has bumps at one centimeter intervals relative to the sensing element location.

## Using the Sensor

The sensor is designed to work with PASCO data collection software to measure magnetic field strength.

In the software, start data collection to begin recording magnetic field strength along all three axes in units of gauss (G). Position the sensing elements (marked by dots on the end of the probe) at the location to be measured and orient the sensor with the field lines.

## Data Collection Software

### PASCO Capstone



- Mac OS X
- Windows

### SPARKvue



- Mac OS X
- Windows
- iOS
- Android
- Chromebook

See the PASCO web site at

[www.pasco.com/software](http://www.pasco.com/software)

for help in selecting the right PASCO software and to check for the latest versions.

## Software Help

See the SPARKvue Help or PASCO Capstone Help for information about collecting, displaying, and analyzing data.

- In SPARKvue, select the HELP button ( ? ) in any screen including the Home Screen.
- In PASCO Capstone, select **PASCO Capstone Help** from the **Help** menu, or press **F1**.

## Bluetooth<sup>®</sup> Compatibility

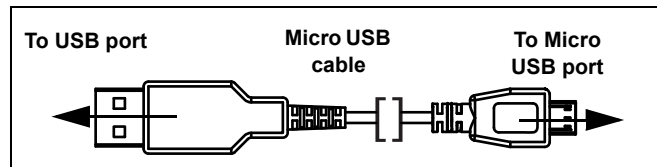
For more information about wireless compatibility, see the PASCO website at:

[www.pasco.com/compatibility](http://www.pasco.com/compatibility)

Platform	Bluetooth SMART Compatibility
iOS	iPad 3 and later iPhone 4S and later iPod touch 5 and later
SPARK LX / LXi	All models
Android	Android 4.4 and later
Chromebook	Chrome OS (requires PS-3500 Adapter*)
Mac OS X	Models introduced July 2011 or later*
Windows	Windows 7 and later (requires PS-3500 Adapter*)

See Appendix A for more information about the PS-3500 Adapter and Mac OS X models.

## Initial Step: Charge the Battery



- **Connect the Cable:** Use the Micro USB Cable to connect the micro USB port on the end of the sensor to a USB **port** or USB **charger** such as the PASCO PS-2575 USB Single Port Charger. Charging begins automatically. The charger circuit inside the sensor turns itself off when the unit is fully charged. The battery status LED will shine yellow as the battery is charging, and will shine green when the battery is charged. The battery is partially charged at the factory. Initial charging time may be three hours or longer depending on the power source and the condition of the battery.

## LED Information

The Bluetooth and the Battery Status LEDs operate as follows:

**For a wireless Bluetooth connection:**

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected
Yellow blink	Logging*

Battery LED	Status
Red blink	Low power

**For a micro USB cable connection to a USB port:**

Bluetooth LED	Status
OFF	--
OFF	--
Yellow blink	Logging*

Battery LED	Status
Yellow ON	Charging
Green ON	Charged

**For a micro USB cable connection to a USB charger:**

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected
Yellow blink	Logging*

Battery LED	Status
Yellow ON	Charging
Green ON	Charged

\***Logging:** PASCO wireless sensors can either stream live data to a compatible device or log data (save it to the sensor's memory). The data can then be uploaded to the device for display and analysis at a later time. Logging capability supports long-term or remote data collection while not connected to the device.

Note: The latest versions of SPARKvue and PASCO Capstone support logging. Check the PASCO Web page at:

[www.pasco.com/software](http://www.pasco.com/software)

for the latest software version.

**ON/OFF Information**

To turn the sensor on, press the ON button. The status LEDs will blink. To turn the sensor off, press and **hold** the ON button for a moment until the status LEDs stop blinking. The sensor puts itself to sleep after 1 hour of inactivity if connected, and after several minutes if not connected.

**Set Up the Software****SPARKvue****Connecting the Sensor to a Tablet or a Computer via Bluetooth**

- For SPARKvue, select the Bluetooth icon. In the **Wireless Devices** list. The sensors are ordered by proximity to the device. Select the correct address that

matches the Device ID XXX-XXX number found on the sensor. Select Done.

**Connecting the Sensor to a Computer with the Micro USB Cable**

- Connect the micro end of the included Micro USB Cable into the micro USB port on the end of the sensor. Connect the other end of the Micro USB Cable to a USB port on the computer, or into a powered USB hub connected to the computer.
- In the SPARKvue Home Screen, select a measurement from the list under the sensor's name. A graph of the measurement versus time opens.

**Collecting Data**

- Select the Start button to begin collecting data.

**PASCO Capstone****Connecting the Sensor to a Tablet or a Computer via Bluetooth**

- For PASCO Capstone, select **Hardware Setup** in the Tools palette. In **Hardware Setup** the sensors are ordered by proximity to the device. Select the address that matches the Device ID XXX-XXX number on the sensor.

Select a display in the main window or from the **Display** palette. In the display, use the **<Select Measurement>** menu to pick a measurement to be shown.

**Connecting the Sensor to a Computer with the Micro USB Cable**

- Connect the micro end of the included Micro USB Cable into the micro USB port on the end of the sensor. Connect the other end of the Micro USB Cable to a USB port on the computer, or into a powered USB hub connected to the computer.
- In PASCO Capstone, select a display in the main window or from the **Displays** palette. In the display, use the **<Select Measurement>** menus to pick the measurement to be shown.

**Collecting Data**

- Select **Record** to begin recording data.

**Troubleshooting the Sensor**

- If the sensor loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly **hold** the button until the status LEDs blink in sequence,

and then release the button. Start the sensor in the usual way.

- If the sensor stops communicating with the computer software or tablet application, try restarting the software or application. If the problem remains, press and **hold** the ON button for 10 seconds and then release. Start the sensor in the usual way.
- Turn Bluetooth off and then back on. Retry.

## About the Battery

The sensor's battery is partially charged at the factory. If the battery status LED blinks red, use the micro USB cable to connect the sensor to a USB port or a USB charger.

### Battery Usage

Battery life is very important to making the sensor simple and always ready to use, so all of the PASCO wireless products are designed for long battery life. For example, the sensor turns itself off after a few minutes of inactivity.

The battery life between charges for the sensor varies depending on the sampling rate. The battery life ranges between 11 hours for high sample rates to more than 70 hours for low sample rates.

In typical classroom/lab use, this would translate to a battery life between charges ranging from one to four weeks or more, because full-day continuous sampling would be unusual. Even in the most extreme case with a high sample rate, the sensor battery would support a full day of use before needing to recharge.

### Maximizing Battery Life

One factor that affects battery life is the storage temperature and the number of charge cycles. Therefore, avoid storing the sensor in very cold or very hot environments.

## Suggested Experiments

See the PASCO Web site at

[www.pasco.com/products/lab-manuals](http://www.pasco.com/products/lab-manuals)

for more information about experiments.

### Measure Magnets and Electromagnets

Study the field strength of various permanent magnets and electromagnets.

### Field Strength of a Solenoid or of Helmholtz Coils

Use the sensor with a PASCO Rotary Motion Sensor to examine the field strength inside a solenoid or between Helmholtz Coils.

## Specifications

Range	±50 G (49.1 G)	±1300G
Accuracy*	±0.01 G	±10 G
Resolution**	0.015 G	1 G
Max. Sample Rate	20 sample/s	20 sample/s
Repeatability	±0.025 G	±5 G
Units	T, mT, G	T, mT G

\*After Zero Gauss Chamber Tare

\*\*Best case disregarding noise (digital bin size)

## Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific  
10101 Foothills Blvd.  
Roseville, CA 95747-7100

Phone: +1 916 462 8384 (worldwide)  
8700-772-8700 (U.S.)

Web: [www.pasco.com](http://www.pasco.com)

Email: [support@pasco.com](mailto:support@pasco.com)

The Reference Guide will be updated periodically. For the latest revision of this Reference Guide, visit the PASCO Web site at

[www.pasco.com/manuals](http://www.pasco.com/manuals)

and enter the product number, PS-3221, in the text window.

## Replacement Parts

For information about possible replacement parts, contact Technical Support:

### Limited Warranty

For a description of the product warranty, see the PASCO catalog. For more information visit [www.pasco.com/legal](http://www.pasco.com/legal).

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**FCC Statement**

This Class A digital 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 Statement**

This device has been tested and found to comply with the essential requirements and other relevant provisions of the applicable EU Directives.

**Product End of Life Disposal Instructions:**

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle/disposal service, or the place where you purchased the product.

The European Union WEEE (Waste Electronic and Electrical Equipment) symbol (to the right) and on the product or its packaging indicates that this product **must not** be disposed of in a standard waste container.



**Battery Disposal Instructions:**

Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where you can drop off your waste battery for recycling, please contact your local waste disposal service, or the product representative.

The Lithium Polymer (Li-Poly) rechargeable battery used in this product is marked with the International symbols to indicate the need for the separate collection and recycling of batteries.



Li-Poly



## Appendix A: Bluetooth Compatibility

Check the PASCO Web page at

[www.pasco.com/compatibility](http://www.pasco.com/compatibility)

for the latest information on Bluetooth SMART compatibility.


Platform	Bluetooth SMART Compatibility
iOS	iPad 3 and later iPhone 4S and later iPod touch 5 and later
SPARK Element	All models
Android	Android 4.3 and later
Chromebook	Chrome OS (requires PS-3500 Adapter*)
Mac OS X <sup>1</sup>	Models introduced July 2011 or later
Windows 7 and 8	Requires PS-3500 Adapter*
Windows 10	Bluetooth SMART compatible

\*The PS-3500 USB Bluetooth 4.0 Adapter, when connected to a USB port, allows up to three Bluetooth SMART devices, such as this PASCO wireless device, to connect to Windows computers, Chromebooks, and older Macintosh computers.



Note: The PS-3500 USB Bluetooth 4.0 Adapter is the only adapter we can currently recommend. Many other Bluetooth 4.0 adapters are available but this adapter has a specific design that enables in-app pairing of Bluetooth SMART sensors.

<sup>1</sup>To check the Mac computer's Bluetooth compatibility, do the following:

- Click the  (Apple) Menu.
- Select *About This Mac*
- Click the *More Info...* button.
- Click the *System Report...* button.
- Select *Bluetooth* from the sidebar on the left, underneath *Hardware*.
- Scan down the list of information until you find "LMP Version".
- If your Mac is equipped with Bluetooth SMART, the LMP Version will show **0x6**. (Anything lower than **0x6**

means an older version of Bluetooth. Your device will need the PS-3500 USB Bluetooth 4.0 Adapter.)

<sup>1</sup>The Mac Mini and MacBook Air were updated with Bluetooth SMART support in 2011. The MacBook Pro was updated in 2012. The Mac Pro that debuted in December 2013 has Bluetooth SMART support.

**Exception:** Before you upgrade to El Capitan (Mac OS X 10.11.x), if you have a Macintosh with LMP version "0x4" that requires the PS-3500 USB Bluetooth 4.0 Adapter, please contact PASCO Technical Support for further instructions.

### What is Bluetooth SMART<sup>®</sup>?

Bluetooth SMART (also known as Bluetooth Low Energy or Version 4.0 of the Bluetooth specification) is the latest protocol of the proprietary open wireless technology standard created by telecoms vendor Ericsson in 1994. It is the power- and application-friendly version of Bluetooth that was built for the Internet of Things (IoT).