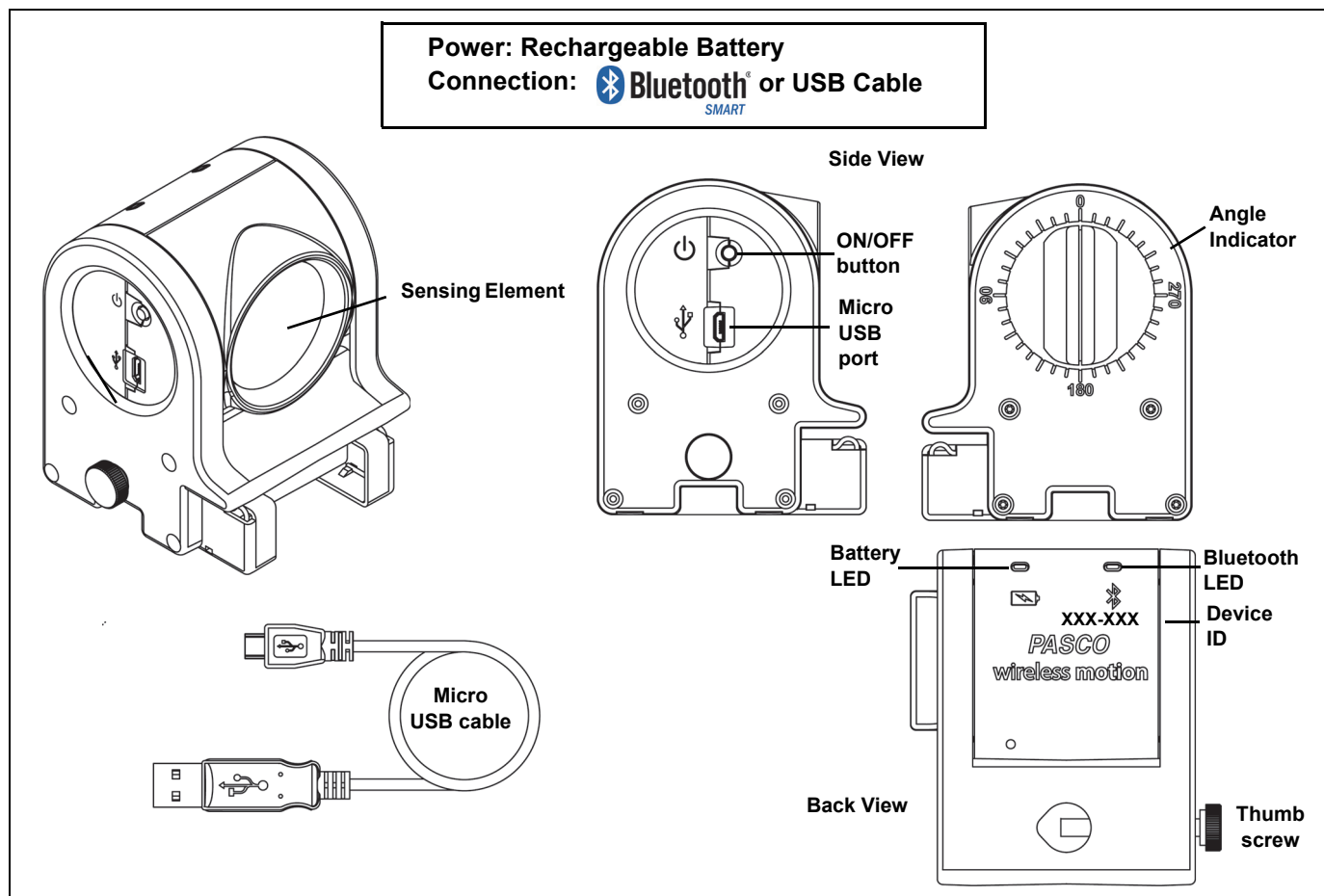


# Wireless Motion Sensor

PS-3219



## Hardware

### Included Equipment

Wireless Motion Sensor

Micro USB Cable (1 meter)

### Required Item\*

PASCO Data Collection Software

### Other Items\*

PASCO Cart and Track Dynamics System

Motion Sensor Guard

Motion Sensor Bracket

Cart Adapter Accessory

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

## Introduction

The Wireless Motion Sensor is a combination wireless *and* USB sensor that connects to a computer or a tablet device

through Bluetooth, and can also connect to a computer with a USB cable (included). The sensor measures distances to an object from 15 centimeters to 4 meters. The sensing element can be rotated 180 degrees. The sensor can be mounted on the end of any PASCO track or on a support rod up to 12.5 millimeters in diameter. Use the Cart Adapter Accessory to mount the sensor on any PASCO Dynamics Cart. (See “Equipment Mounting”.)

## How It Works

An electrostatic transducer in the face of the Wireless Motion Sensor transmits a burst of sixteen ultrasonic pulses with a frequency of about 49 kHz. This burst of pulses can be heard as a single click. The ultrasonic pulses reflect off the target and return to the face of the sensor.

Sound intensity decreases with distance; to compensate, the sensor increases the gain of the receiver amplifier as it waits for the echo. The increased gain allows the sensor to detect an object up to 4 m away. The lower gain at the beginning of the cycle reduces the circuit's sensitivity to echoes from false targets

The sensor measures the time between the outgoing pulses and the returning echoes. It uses this time and the speed of sound to calculate the distance to the target. To determine velocity, the software uses consecutive position measurements to calculate the rate of change of position. Similarly, the software determines acceleration by using consecutive velocity measurements.

## Using the Sensor

The sensor is designed to work with PASCO data collection software to measure distances to an object in front of the sensing element. The software displays position, velocity, and acceleration.

## 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

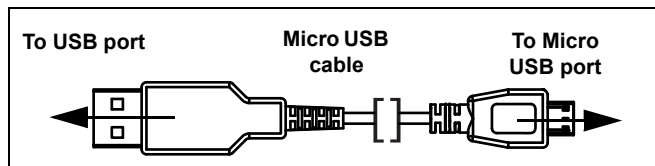
For more information about wireless compatibility, see the PASCO website at:

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

| Platform       | Bluetooth SMART Compatibility                                     |
|----------------|-------------------------------------------------------------------|
| iOS            | iPad 3 and later<br>iPhone 4S and later<br>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.

## Equipment Mounting

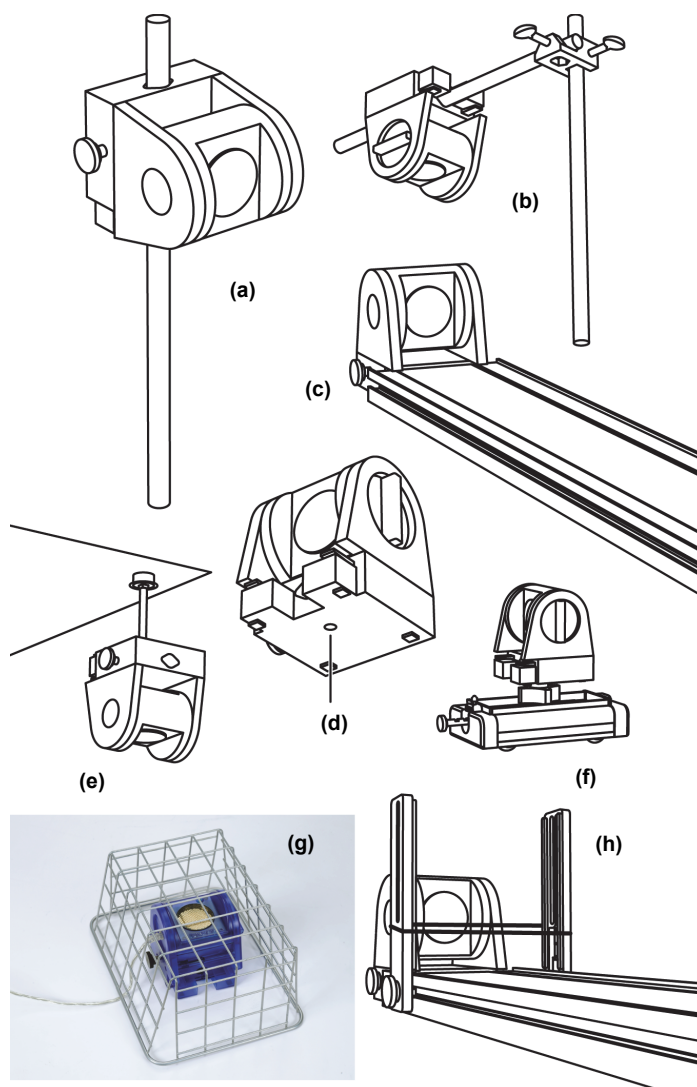
Mount the Wireless Motion Sensor as illustrated on a vertical rod (a) or a horizontal rod (b).

Integrated clips on the lower front end of the sensor allow it to be attached to the end of a PASCO track (c).

A threaded hole in the bottom of the unit (d) is provided for attachment to the Motion Sensor Bracket (e), the Cart Adapter Accessory (f), and other 1/4-20 threaded mounting devices such as a camera tripod.

To protect the Wireless Motion Sensor from being hit by an object, use a device such as the Motion Sensor Guard (g) or Photogate Brackets with a rubber band (h).

The sensor can “see through” a wire screen or rubber band placed close to the transducer.



## 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.

### Specifications

| Item                | Value  |
|---------------------|--------|
| Minimum Range:      | 15 cm  |
| Maximum Range       | 4 m    |
| Transducer Rotation | 180°   |
| Resolution          | 1.0 mm |

## 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-3219, 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.

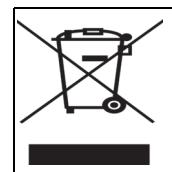
#### CE Statement

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.



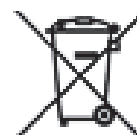
#### Battery Disposal Instructions:

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<br>iPhone 4S and later<br>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®?

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).