

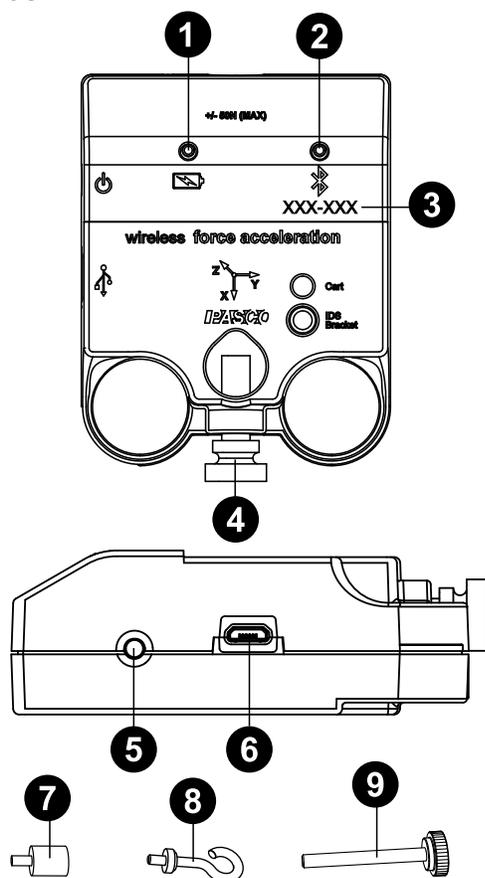
# Wireless Force-Acceleration Sensor (PS-3202)

## Introduction

The Wireless Force-Acceleration 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 using the included USB cable. The sensor measures force up to  $\pm 50$  newtons (N), acceleration up to  $\pm 16$  g (where 1 g is equal to  $9.8 \text{ m/s}^2$ ), and angular rotation rate up to  $\pm 2000$  degrees per second (dps). The sensor measures force as a push or pull along its x-axis and measures acceleration in three dimensions (x, y, and z). PASCO Capstone or SPARKvue can show the resultant acceleration. The sensor uses a micro-electromechanical system (MEMS) device.

The sensor is designed to optimize the battery usage time. Since each sensor has a unique device ID number, more than one can be connected to a computer or tablet at the same time.

## Features



### 1 Battery Status LED

Indicates the charging status of the battery.

| Battery LED | Status        |
|-------------|---------------|
| Red blink   | Low power     |
| Yellow ON   | Charging      |
| Green ON    | Fully charged |

### 2 Bluetooth Status LED

Indicates the status of the sensor's Bluetooth connection.

| Bluetooth LED | Status                |
|---------------|-----------------------|
| Red blink     | Ready to pair         |
| Green blink   | Connected             |
| Yellow blink  | Remotely logging data |

For information on remote data logging, see the PASCO Capstone or SPARKvue online help.



**NOTE:** The Bluetooth Status LED is disabled when connecting the sensor to a computer using a USB cable.

### 3 Device ID

Use this to identify the sensor when connecting via Bluetooth.

### 4 Rod clamp thumbscrew

Use this to mount the sensor to a rod or rod stand.

### 5 ON/OFF button

Press to turn the sensor on. Press and briefly hold to turn the sensor off. Note that the sensor automatically turns itself on when connected to a computer via USB. To preserve battery, the sensor puts itself to sleep after several minutes of inactivity if not connected.

### 6 Micro USB port

Use with the included micro USB cable to connect the sensor to a USB charger. The port and cable can also be used to directly connect the sensor to a computer without the use of Bluetooth. This connection method is not supported by iOS.

### 7 Bumper attachment

Attach this to the threaded hole on the front of the sensor when recording measurements from collisions or impacts.

### 8 Hook attachment

Attach this to the threaded hole on the front of the sensor when recording measurements from forces pulling on the sensor.

### 9 Cart thumbscrew

Use this to mount the sensor to a PASCO cart.

### 10 Micro USB cable (not pictured)

## Initial step: Charge the battery

Charge the battery by connecting the micro USB port to any standard USB charger. The Battery Status LED is solid yellow while charging. When fully charged, the LED changes to solid green.

## Get the software

You can use the sensor with SPARKvue or PASCO Capstone software. If you're not sure which to use, visit [pasco.com/products/guides/software-comparison](https://www.pasco.com/products/guides/software-comparison).

SPARKvue is available as a free app for Chromebook, iOS, and Android devices. We offer a free trial of SPARKvue and Capstone for Windows and Mac. To get the software, go to [pasco.com/downloads](https://www.pasco.com/downloads) or search for **SPARKvue** in your device's app store.

If you have installed the software previously, check that you have the latest update:

### SPARKvue

Go to Main Menu  > **Check for Updates**

### PASCO Capstone

Go to **Help** > **Check for Updates**.

## Check for a firmware update

### SPARKvue

1. Press the power button until the LEDs turn on.
2. Open SPARKvue.
3. Select **Sensor Data** on the Welcome Screen.



4. From the list of available devices, select the sensor that matches your sensor's device ID. A notification appears if a firmware update is available. Click **Yes** to update the firmware.
5. Close SPARKvue once the update is complete.

### PASCO Capstone

1. Press and hold the power button until the LEDs turn on.
2. Open PASCO Capstone.
3. Click **Hardware Setup**.



4. From the list of available devices, select the sensor that matches your sensor's device ID. A notification appears if a firmware update is available. Click **Yes** to update the firmware.
5. Close Capstone once the update is complete.

## Set up the software

### SPARKvue

#### Connecting the sensor to a tablet or computer via Bluetooth:

1. Turn on the Wireless Force-Acceleration Sensor. Check to make sure the Bluetooth Status LED is blinking red.
2. Open SPARKvue, then click **Sensor Data**.
3. From the list of available wireless devices on the left, select the device which matches the device ID printed on your Wireless Force-Acceleration Sensor.

#### Connecting the sensor to a computer via micro USB cable:

1. Open SPARKvue, then click **Sensor Data**.
2. Connect the provided micro USB cable from the micro USB port on the sensor to a USB port or powered USB hub connected to the computer. The sensor should automatically connect to SPARKvue.

#### Collecting data using SPARKvue:

1. Select the measurements you intend to record from the **Select Measurements for Templates** menu by clicking the check box next to the relevant measurements' names.
2. Click **Graph** in the **Templates** section to open the Experiment Screen. The graph's axes will auto-populate with the selected measurements.
3. Click **Start**  to begin recording data.

### PASCO Capstone

#### Connecting the sensor to a computer via Bluetooth:

1. Turn on the Wireless Force-Acceleration Sensor. Check to make sure the Bluetooth Status LED is blinking red.
2. Open Capstone, then click **Hardware Setup**  in the **Tools** palette.
3. From the list of **Available Wireless Devices**, click the device which matches the device ID printed on your Wireless Force-Acceleration Sensor.

#### Connecting the sensor to a computer via micro USB cable:

1. Open Capstone. If desired, open **Hardware Setup**  to check the connection status of the sensor.
2. Connect the provided micro USB cable from the micro USB port on the sensor to a USB port or powered USB hub connected to the computer. The sensor should automatically connect to Capstone.

#### Collecting data using Capstone:

1. Double-click the **Graph**  icon in the **Displays** palette to create a new blank graph display.
2. To assign measurements to the graph's axes, click each **<Select Measurement>** box and select an appropriate measurement from the list.
3. Click **Record**  to begin collecting data.

## Zero (tare) the sensor

At the beginning of an experiment, the measurement from the sensor may not be zero when the force or acceleration is actually zero. This is a normal behavior that is corrected when you zero (or tare) the sensor using PASCO Capstone or SPARKvue. For information on zeroing the sensor, check the PASCO Capstone or SPARKvue online help and search for "Zero sensor".



**IMPORTANT:** Zeroing of the acceleration sensor should *only* be done if you are only measuring the acceleration on a single axis, as zeroing the acceleration sensor will cause the other two acceleration measurements to no longer be accurate.

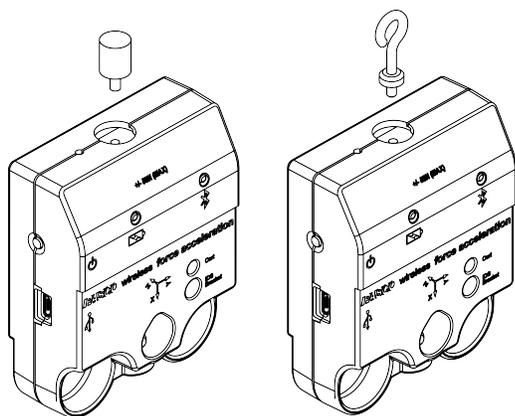
## Calibration

The Wireless Force-Acceleration Sensor is calibrated at the factory. Further calibration is not usually necessary, especially if you are measuring a change in force, acceleration, or rotational motion, rather than absolute values of any of these quantities. However, it is possible to calibrate the sensor using PASCO Capstone or SPARKvue. For information on this procedure, see the Capstone or SPARKvue online help.

## Set up the hardware

### Connecting bumper and hook attachments

Screw the bumper or hook attachment into the threaded hole on the front end of the sensor, as shown below. This will connect the attachment to the force sensor, allowing force values to be properly recorded.



**IMPORTANT:** If using the Wireless Force-Acceleration Sensor for collisions, do NOT use the rubber bumper, as the force of impact on the bumper may damage the internal force sensor. Instead, use any of the following components can be used as a bumper for collision experiments:

- Light Spring Bumper (ME-9275)
- Bumper Accessory Set (ME-9884)
- Magnetic Bumper Set (ME-9885A)

## Direction of acceleration sensitivity

The acceleration sensing units inside the sensor are oriented so that the lines of greatest sensitivity follow the x, y, and z arrows indicating the direction of acceleration.

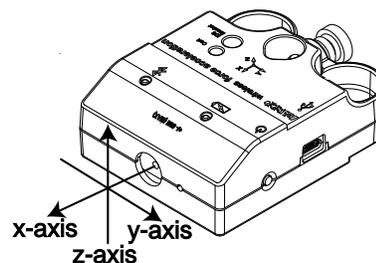


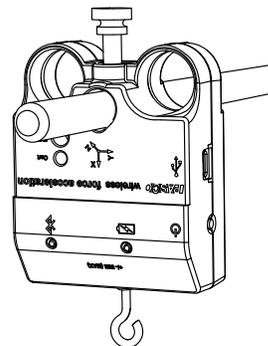
Figure 1. The axes of greatest acceleration sensitivity.

In the orientation shown in Figure 1, the x-axis direction is 'along' the axis of the sensor. The y-axis direction is perpendicular to the axis of the sensor and parallel to the label on top of the sensor. The z-axis direction is perpendicular to the label on top of the sensor.

## Mounting the sensor

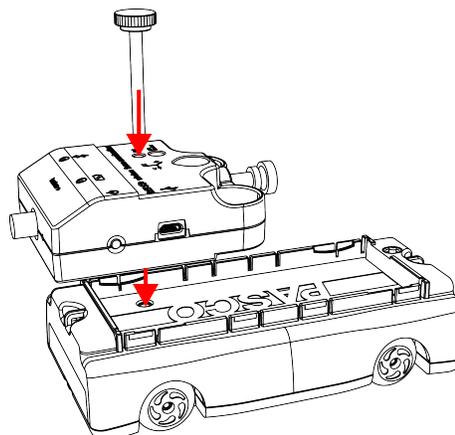
### To mount the sensor on a rod:

Slide the sensor onto a rod and secure it in place with the rod clamp thumbscrew, as shown below.



### To mounting the sensor on a PASCO cart:

1. Insert the included cart thumbscrew through the hole in the sensor labeled **Cart**.
2. Place the sensor onto the top surface of the PASCO cart. Screw the thumbscrew into the threaded hole on the top of the cart, securing the sensor in place.



## About the battery

The Wireless Force-Acceleration 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 USB charger.

## Maximizing battery life

Two factors that affect battery life are the storage temperature and the number of charge cycles. Therefore, to maximize battery life, avoid storing the sensor in very cold or very hot environments, and disconnect the sensor from its charger once it has been fully charged.

## Troubleshooting

- If the Wireless Force-Acceleration Sensor loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly **hold** the button until the LEDs blink in sequence, 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 persists, press and **hold** the ON button for 10 seconds, then release the button and start the sensor in the usual way.
- If the previous steps do not fix a connection problem, turn Bluetooth off and then back on for your computer or tablet, then retry.

## Software help

The SPARKvue and PASCO Capstone Help provide additional information on how to use this product with the software. You can access the help within the software or online.

### SPARKvue

**Software:** Main Menu  > Help

**Online:** [help.pasco.com/sparkvue](http://help.pasco.com/sparkvue)

### PASCO Capstone

**Software:** Help > PASCO Capstone Help

**Online:** [help.pasco.com/capstone](http://help.pasco.com/capstone)

## Specifications and accessories

Visit the product page at [pasco.com/product/PS-3202](http://pasco.com/product/PS-3202) to view the specifications and explore accessories. You can also download experiment files and support documents from the product page.

## Experiment files

Download one of several student-ready activities from the PASCO Experiment Library. Experiments include editable student handouts and teacher notes. Visit [pasco.com/freelabs/PS-3202](http://pasco.com/freelabs/PS-3202).

## Technical support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to answer your questions or walk you through any issues.

-  Chat [pasco.com](http://pasco.com)
-  Phone 1-800-772-8700 x1004 (USA)  
+1 916 462 8384 (outside USA)
-  Email [support@pasco.com](mailto:support@pasco.com)

## Regulatory information

### Limited warranty

For a description of the product warranty, see the Warranty and Returns page at [www.pasco.com/legal](http://www.pasco.com/legal).

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### Product end-of-life disposal



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 or disposal service, or the place where you purchased the product. The European Union WEEE (Waste Electronic and Electrical Equipment) symbol on the product or its packaging indicates that this product must not be disposed of in a standard waste container.

### CE statement

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

### FCC statement

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.

### Battery disposal



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 battery used in this product is marked with the European Union symbol for waste batteries to indicate the need for the separate collection and recycling of batteries.