WirelessCharge Sensor

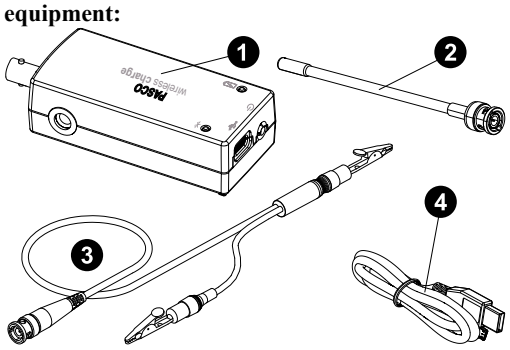
PS-3240

Introduction

The Wireless Charge Sensor is designed to allow students to measure the electrostatic charge on an object. With the aid of PASCO data collection software, the sensor can measure either charge or voltage and plot them on a variety of displays. The sensor ships with a BNC-to-alligator clip cable, which can be used to connect the sensor's BNC port to electrostatic equipment such as the Faraday Ice Pail (ES-9042A), and an E-Field Detector, which plugs into the BNC port and can be used to compare the relative charges of objects.

Components

Included equipment:



1. Wireless Charge Sensor
2. E-Field Detector
3. BNC-to-alligator clip cable
4. USB-C cable

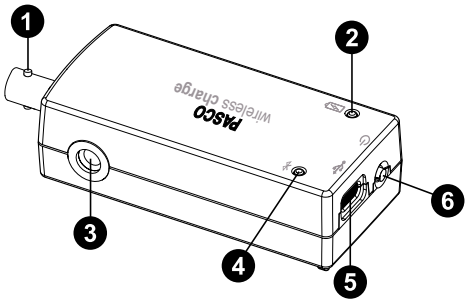
Required equipment:

- PASCO Capstone or SPARKvue data collection software

Recommended equipment:

- Faraday Ice Pail (ES-9042A)
- Charge Producers and Proof Plane (ES-9057C)
- Conductive Spheres (ES-9059C)
- Electrostatics Voltage Source (ES-9077)

Features:



1. **BNC port**

   Use to connect the sensor to the E-Field Detector, or to electrostatic equipment via the BNC-to-alligator clip cable.

2. **Battery Status LED**

   Indicates the charging status of the sensor's battery.

LED	Status
Red blink	Low battery
Yellow ON	Charging
Green ON	Fully charged

3. **Threaded hole**

   Use to mount the sensor to a ¼-20 threaded rod, such as the Mounting Rod (ME-9483).

4. **Bluetooth Status LED**

   Indicates the status of the sensor's Bluetooth connection.

LED	Status
Red blink	Ready to pair
Green blink	Paired
Yellow blink	Remotely logging data

   See the PASCO Capstone or SPARKvue help site for information on remote data logging.

   NOTE: The Bluetooth Status LED is disabled while the sensor is connected to a computer via USB.

5. **USB-C port**

   Use to connect the sensor to a USB charger via the included USB-C cable. You can also use the port and cable to connect the sensor to a computing device without Bluetooth. (Note that iOS does not support this connection method.)

6. **Power button**

   Press and briefly hold to turn the sensor on or off. To preserve battery life, the sensor is designed to automatically turn off after several minutes of inactivity if not connected.

Initialstep: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.

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 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: Main Menu > Check for Updates

PASCO Capstone: Help > Check for Updates

Check for a firmware update

SPARKvue

1. Press the power button until the LEDs turn on.
2. Open SPARKvue, then select **Sensor Data** on the Welcome Screen.
3. From the list of available devices, select the sensor that matches your sensor's device ID.
4. A notification will appear if a firmware update is available. Click **Yes** to update the firmware.
5. Close SPARKvue once the update is complete.

PASCO Capstone

1. Press the power button until the LEDs turn on.
2. Open PASCO Capstone and click **Hardware Setup** from the Tools palette.
3. From the list of available wireless devices, select the sensor that matches your sensor's device ID.
4. A notification will appear 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 Charge 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 sensor.

Connecting the sensor to a computer via micro USB cable:

1. Open SPARKvue, then click **Sensor Data**.
2. Connect the provided USB-C cable from the USB-C port on the Wireless Charge 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 measurement you intend to record from the **Select measurements for templates** column by clicking the check box next to the relevant measurement's name.
2. Click **Graph** in the **Templates** column to open the Experiment Screen. The graph's axes will auto-populate with the selected measurement versus time.
3. Click **Start** to begin collecting data.

PASCO Capstone

Connecting the sensor to a computer via Bluetooth:

1. Turn on the Wireless Charge Sensor. Check to make sure the Bluetooth Status LED is blinking red.
2. Open PASCO 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 sensor.

Connecting the sensor to a computer via micro USB cable:

1. Open PASCO Capstone. If desired, click **Hardware Setup** to check the connection status of the sensor.
2. Connect the provided USB-C cable from the USB-C port on the Wireless Charge 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. In the graph display, click the **<Select Measurement>** box on the y-axis and select an appropriate measurement from the list. The x-axis will automatically adjust to measure time.
3. Click **Record** to begin collecting data.

Measurements

Charge

Measurements with the BNC-to-alligator clip cable

The best method for measuring charge using the Wireless Charge Sensor makes use of the Faraday Ice Pail (ES-9042A). Connect the red alligator clip of the sensor's cable to the inner cylinder and the black alligator clip to the outer cylinder, as shown below. When a charged object is inserted into the pail's inner cylinder without touching the cylinder's surface, a proportional charge is induced on a capacitor inside the sensor. The sensor then measures the voltage across the capacitor and uses this value to calculate the approximate charge on the object.

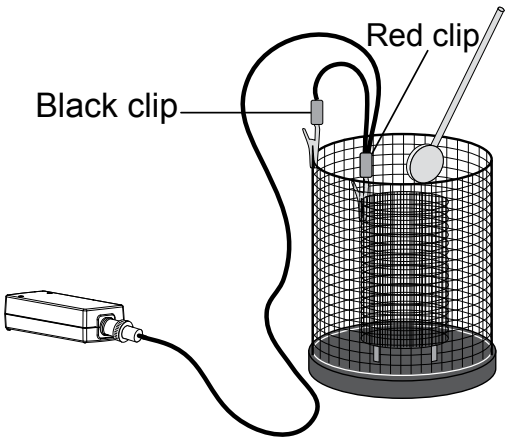


Figure 1. The Wireless Charge Sensor connected to a Faraday Ice Pail (ES-9042A), with a proof plane about to be inserted for charge measurement.

Measurements with the E-Field Detector

When the E-Field Detector is plugged into the sensor's BNC port and a charged object is brought near its tip, a voltage will be induced across the sensor's internal capacitor. Unlike with the previous method, the charge measurements found using the E-Field Detector do not represent approximate values of the actual charge on the objects. However, the measurements are proportional to the strength of the charge detected and thus are useful for making qualitative comparisons between the charges of different objects.

Voltage

The Wireless Charge Sensor can also be used as a high-impedance voltmeter. To use the sensor as a voltmeter, connect the signal input leads across the voltage source you wish to measure. However, like the charge measurement, the voltage measurement is not a direct measurement of the potential difference between the terminals, but rather is derived from a calculation based on the internal capacitor's voltage. As a result, the voltage reading will not immediately drop to zero when the sensor is disconnected from the voltage source.

Advice for data collection

The following list details various common sources of error encountered in electrostatics measurements, as well as tips on how to minimize the impact of these sources on your data.

- Zero the sensor between measurements to discharge all excess charge from the sensor. To zero the sensor, connect the sensor to the Faraday Ice Pail via the cable or to the E-Field Detector, then press **Zero All Sensors** (SPARKvue) or **Zero Sensor Now** (PASCO Capstone) on the bottom toolbar. Before zeroing, make sure there are no charged objects in or near the pail or near the E-Field Detector.
- When using the sensor with the Faraday Ice Pail (ES-9042A), remember to ground the Ice Pail in between sections of the experiment. To do so, place your finger on the inner pail and outer shield at the same time, remove your finger from the inner pail, and release the outer shield. (Do not remove your hand from the shield before releasing the inner pail, as this will not effectively ground the pail.)
- The Wireless Charge Sensor is extremely sensitive and may report small changes in charge when objects in its vicinity are moved. As such, move objects as little as possible when conducting an experiment with the sensor.

Battery replacement

The battery compartment is located on the back of the sensor, as shown in Figure 2. If the battery needs to be replaced, you can do so using the 3.7V 300mAh Replacement Lithium Battery (PS-3296). To install the new battery:

1. Use a Phillips screwdriver to remove the screw from the battery door, then remove the door.
2. Unplug the old battery from the battery connector and remove the battery from the compartment.
3. Plug the replacement battery into the connector. Make sure the battery is properly positioned inside the compartment.
4. Place the battery door back in place and secure it with the screw.

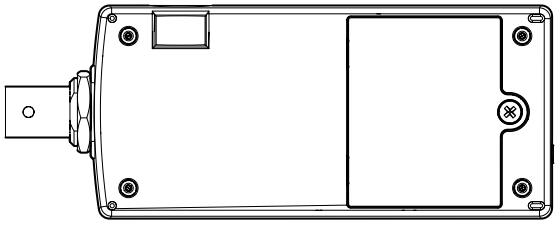


Figure 2: Location of battery compartment.

After replacing the battery, make sure to dispose of the old battery properly per your local laws and regulations.

Software help

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

SPARKvue

Software: Main Menu > Help

Online: help.pasco.com/sparkvue

PASCO Capstone

Software: Help > PASCO Capstone Help

Online: help.pasco.com/capstone

Specifications and accessories

Visit the product page at pasco.com/product/PS-3240 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-3240.

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
Phone	1-800-772-8700 x1004 (USA) +1 916 462 8384 (outside USA)
Email	support@pasco.com

Have questions?

Ask from PASCO's Global Science Education Partner in Estonia DIFI.NET OÜ

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Limited warranty

For a description of the product warranty, see the Warranty and Returns page at 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.

Have questions?

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