

Wireless Conductivity Sensor (PS-3210A)

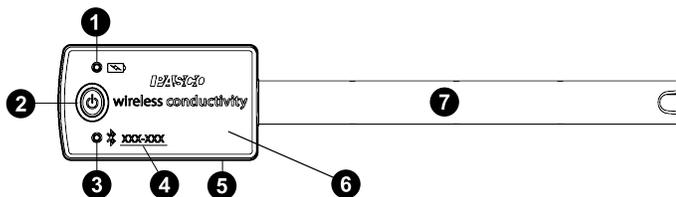
Introduction

The Wireless Conductivity Sensor measures conductivity over a range from 0 to 40,000 microsiemens/centimeter ($\mu\text{S}/\text{cm}$), double the range of older versions. The probe is able to work in a variety of solutions. Measurements are transmitted wirelessly via Bluetooth and recorded and displayed by PASCO software on a connected wireless device, such as a tablet or computer. The Wireless Conductivity Sensor is powered by a replaceable three volt coin cell battery (included) and is well-suited for continuous recording and discrete measurements. The sensor is designed to optimize the battery usage time.

Since each sensor has a unique device ID number, more than one Wireless Conductivity Sensor can be connected to a computer or tablet at the same time.

The sensor housing is water-resistant, but immersing it in liquid may cause a loss of wireless connection. Only the Conductivity Probe should be placed into the substance being measured.

Features



1 Battery Status LED

Indicates the battery level of the sensor by blinking red at low power.

2 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 off after several minutes of inactivity if not connected.

3 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	Logging data

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

4 Device ID number

Use this to identify the sensor when connecting via Bluetooth.

5 Water-resistant gasket

Protects the sensor's internal components from water damage in the event the sensor is exposed to water.

6 Sensor housing

Tolerates temperatures in the range of -15°C to $+50^{\circ}\text{C}$.

7 Probe

Tolerates temperatures in the range of 0°C to 80°C .

Background

Electrolytic conductivity is defined as the ability of a liquid to conduct electrical current. In conductive solvents, dissolved ions are the principle conductors of electricity. By selecting the appropriate electrode, one can easily measure the electrical conductivity of liquids ranging from ultra-pure water to extremely salty solutions.

How well a solution conducts electricity is dependent on the following parameters:

- Concentration of ions
- Mobility of ions
- Valence of ions
- Solution temperature

The Wireless Conductivity Sensor determines the electrical conductivity (EC) of a solution by measuring the alternating current (AC) flowing through a circuit when an AC signal is applied to a 2-cell electrode submerged in the solution.

The accuracy of conductive measurements depends on the following factors:

- Absence of contamination
- Resistance of the electrodes to polarization
- Consistent electrode geometry (cell constant) between calibration and measurement
- Consistent temperature between calibration and measurement

Other features

- Data from the Wireless Conductivity Sensor can be used to determine Total Dissolved Solids (TSD).
- The sensor measures temperature and automatically compensates for it.

Sensor theory

Conductance is the reciprocal of resistance. Conductivity is the *specific conductance* of a material, or the conductance measured between the opposite faces of a one centimeter cube of a material.

The electrode cell in the end of the Conductivity Probe is constructed of an insulating material embedded with stainless steel pins. These metal contacts serve as sensing elements and are placed at fixed distances apart.

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 when 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 when the update is complete.

Set up the software

SPARKvue

Connecting the sensor to a tablet or computer:

1. Turn on the Wireless Conductivity 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 Conductivity Sensor.

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:

1. Turn on the Wireless Conductivity 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 Conductivity Sensor.

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.

Setting the ion coefficient

Electrical conductivity (EC) measured in microsiemens per centimeter ($\mu\text{S}/\text{cm}$) can be converted to Total Dissolved Solids (TDS) in parts per million (ppm) using an *ion coefficient*. This coefficient is determined by the ions in the solution, the specific mixture of which is frequently unknown. The following ranges are recommended, with any value from 0.01 to 0.99 acceptable.

- 0.5 to 0.57 for potassium chloride (KCl), which is the most common calibration standard.
- 0.45 to 0.5 for sodium chloride (NaCl), commonly used for testing brackish water and seawater.
- 0.65 to 0.85 for the 442™ solution (40% sodium bicarbonate, 40% sodium sulfate, and 20% sodium chloride) that is used to simulate natural freshwater (rivers, lakes, wells, etc.). [Developed by the Myron L Company.]

The software's default coefficient is 0.65. The value of the coefficient is stored in the sensor.

To set the ion coefficient, connect the sensor to SPARKvue or Capstone as described above, then follow these steps:

SPARKvue

1. From the **Sensor Data** screen, enable the measurement of Total Dissolved Solids.
2. Select a Template to open the Experiment Screen.
3. From the bottom left of the Experiment Screen, click the **Live Data Bar** for Total Dissolved Solids, then click **Configure Sensor**.
4. Enter the appropriate value in the **Ion Coefficient** box.

PASCO Capstone

1. From the **Hardware Setup** tool, click the **Properties**  button next to the Wireless Conductivity Sensor to open the **Properties** window.
2. Enter the appropriate value in the **Ion Coefficient** box.

Sample conductivity values

The following table provides the typical conductivity of common aqueous solutions at a temperature of 25°C.

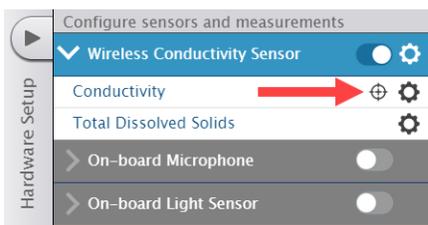
Solution	Conductivity ($\mu\text{S}/\text{cm}$)
Drinking water	50 to 1,000
Wastewater	900 to 9,000
KCl solution (0.01 M)	1,400
Potable water maximum	1,500
Brackish water	1,000 to 80,000
Industrial process water	3,000 to 140,000

Calibrating the sensor

The Wireless Conductivity Sensor is calibrated at the factory and does not require initial calibration. However, the sensor can be calibrated in SPARKvue or Capstone, using two standard solutions of known conductivity. To calibrate the sensor, connect it to SPARKvue or Capstone, then follow the steps below.

SPARKvue

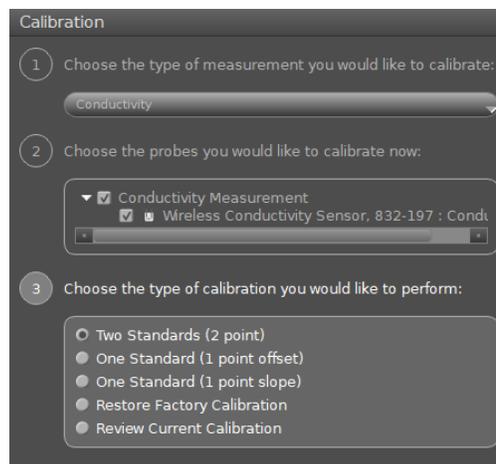
- From the Experiment Screen, click **Show Hardware Setup** , then select the **Calibrate**  icon under the Conductivity Sensor to open the **Calibrate Sensor** menu.



- For the new calibration settings, ensure that the sensor is **Wireless Conductivity Sensor**, the measurement is **Conductivity ($\mu\text{S}/\text{cm}$)**, and the calibration type is **2 point (Adjust Slope and Offset)**, then click **Continue**.
- Insert the Conductivity Probe into a beaker containing your first standard solution. Wait for the value of conductivity recorded in the **Sensor Value** box under **Calibration Point 1** to stabilize.
- Under **Calibration Point 1**, enter the known conductivity of the first standard solution into the **Standard Value** box, then click **Set Calibration**.
- Remove the Conductivity Probe from the first beaker, rinse with de-ionized water, then insert the probe into a beaker containing the second standard solution. Wait for the value of conductivity recorded in the **Sensor Value** box under **Calibration Point 2** to stabilize.
- Under **Calibration Point 2**, enter the known conductivity of the second standard solution into the **Standard Value** box, then click **Set Calibration**.
- Check **New Calibration** to ensure the resulting calibration is appropriate, then click **OK** to finish.

PASCO Capstone

- Select **Calibration**  from the **Tools** palette.
- Ensure that **Conductivity** is selected in the dropdown box, then click **Next**.
- Ensure that **Two Standards (2 point)** is selected from the list of calibration types, then click **Next**.



- Insert the Conductivity Probe into a beaker containing your first standard solution. Wait for the value of conductivity recorded in the **Current Value** box to stabilize.
- Enter the known conductivity of the first standard solution into the **Standard Value** box, then click **Set Current Value to Standard Value**.
- Remove the Conductivity Probe from the first beaker, rinse with de-ionized water, then insert the probe into a beaker containing the second standard solution. Wait for the value of conductivity recorded in the **Current Value** box to stabilize.
- Enter the known conductivity of the second standard solution into the **Standard Value** box, then click **Set Current Value to Standard Value**.
- Review your new calibration to ensure it is appropriate, then click **Finish**.

Battery usage

The Wireless Conductivity Sensor contains a three volt coin cell battery (CR2032). Battery life is very important to making the sensor simple and always ready to use. Therefore, like all PASCO wireless products, the Wireless Conductivity Sensor is designed for long battery life. For example, after several minutes of inactivity, the sensor turns itself off to preserve the battery.

The included battery should provide more than one year of battery life, but the actual amount depends on factors such as the data collection sampling rate.

Sensor storage

If the sensor will be stored for several months, we recommended that you remove the battery and store it separately to avoid damaging the sensor in case of a battery leak.

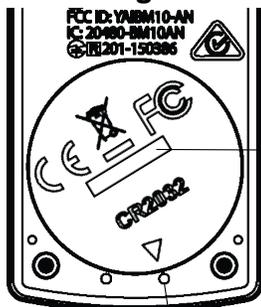
Battery removal and replacement

If the sensor's Battery Status LED blinks red, the battery may need to be replaced. Replacing the battery requires removing the Battery Compartment Door on the bottom of the sensor, removing the old battery, installing a new battery of the same type, and replacing the Battery Compartment Door. This procedure requires a coin and a CR2032 three volt battery, such as those included in the PS-3504 Coin Cell Battery Pack.



NOTE: This type of battery is also commonly available in electronic and commercial stores.

Removing the Battery Compartment Door

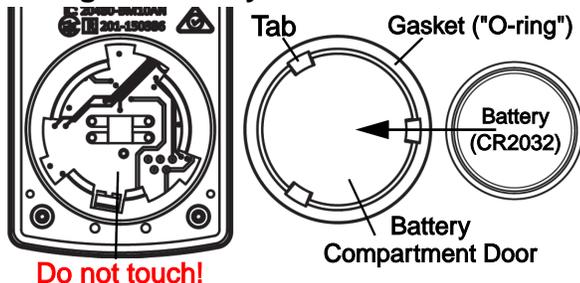


Hold the sensor with the bottom side up. Insert a coin into the slot and use it to turn the Battery Compartment Door counterclockwise until the indicator on the door is aligned with the second mark on the sensor.

Turn the sensor so the bottom side is down, allowing the Battery Compartment Door to drop into the palm of your hand. Make sure that the battery door

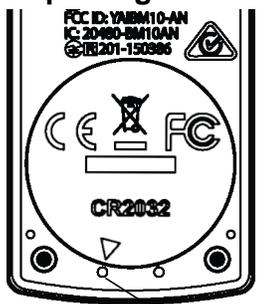
gasket stays on the door. The gasket is an "O-ring" that is held in place by the tabs on the door. *Do not touch* the inside of the battery compartment, as this may damage the sensor.

Replacing the battery



Remove the used battery from the Battery Compartment Door and replace it with a new battery of the same type. *Note that the battery is held in place by the small tabs on the door.* The side of the battery with the "+" on it should be against the door.

Replacing the Battery Compartment Door



Put the Battery Compartment Door, along with the new battery, back onto the sensor. Align the indicator on the door with the second mark, then use the coin in the slot to turn the door clockwise until the indicator is aligned with the first mark on the sensor.

When disposing of the battery, follow the battery disposal guidelines under **Regulatory information**.

Troubleshooting

- 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, then release the button.
- 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 ten seconds, then release the button. Turn on the sensor in the usual way.
- If the above instructions do not fix the problem, turn Bluetooth off and back on for your computer or tablet, then retry the connection process.

Conductivity Probe maintenance

If readings become variable or well outside the expected range, use the eraser of a No.2 pencil to clean the pins by pushing each pin into the eraser material and removing. Repeat until no film appears around the puncture holes. Rinse and dry the conductivity probe before putting the sensor away for storage. The probe fits in the Electrode Support (PS-3505).

Cleaning

When cleaning the probe, select an appropriate solvent for the contaminants to which the probe is exposed:

- For general deep cleaning, use 0.1 M nitric acid.
- For oils, hot water with dish detergent can be used for cleaning.
- For solutions containing lime or other hydroxides, clean with a 5-10% solution of hydrochloric acid. When a stronger cleaning solution is required, use concentrated hydrochloric acid mixed into 50% isopropanol.
- For solutions containing algae and bacteria, use chlorine bleach.

Clean by dipping or immersing the end of the probe in the cleaning solution, agitating for two or three minutes, and rinsing first with tap water and then several times with distilled or deionized water.

Before measurement, immerse the probe in distilled water, gently tap out any trapped air bubbles, soak for at least an hour in distilled water, and recalibrate.

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

PASCO Capstone

Software: Help > PASCO Capstone Help

Online: help.pasco.com/capstone

Specifications and accessories

Visit the product page at [pasco.com/product/PS-3210A](https://www.pasco.com/product/PS-3210A) 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-3210A](https://www.pasco.com/freelabs/PS-3210A).

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](https://www.pasco.com)
-  Phone 1-800-772-8700 x1004 (USA)
+1 916 462 8384 (outside USA)
- Email 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.

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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.