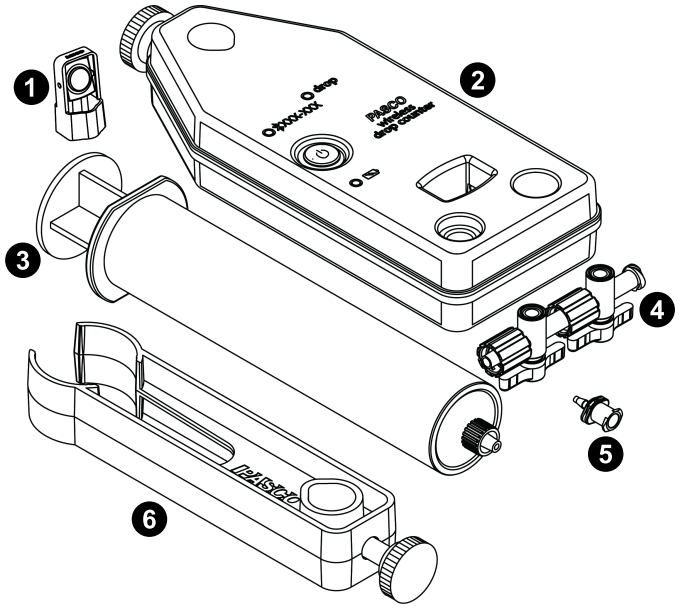
Wireless Drop Counter (PS-3214)

Equipment Included



1. Micro Stir Bar
2. Wireless Drop Counter
3. Syringe (60 mL)
4. Stopcock Valves (2)
5. Drop Tip
6. Syringe Holder
7. Micro USB Cable (1 meter; not shown)

Required Item

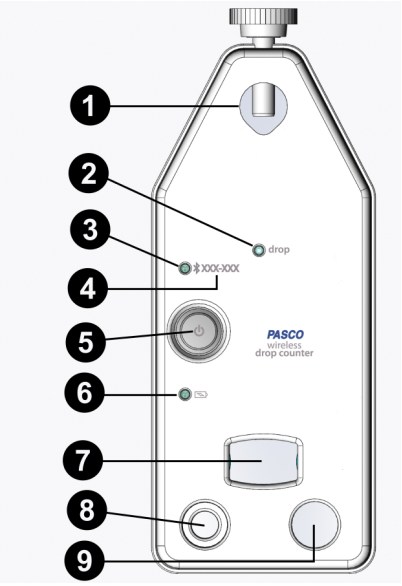
- PASCO Capstone or SPARKvue

Recommended Items

- Wireless pH Sensor (PS-3204)
- Wireless Temperature Sensor (PS-3201)
- Support Rod and Table Clamp
- Magnetic Stir Plate (SE-7700)
- Beaker (150 mL)
- Graduated Cylinder (10 mL)

Recommended Consumables

- 0.1 M NaOH
- 0.005 M HCl



1. Hole for Support Rod
2. Drop Indicator LED
3. Bluetooth LED
4. Device ID
5. ON/OFF Button
6. Battery LED
7. Drop Window
8. Hole for Temperature Sensor
9. Hole for pH Sensor

Introduction

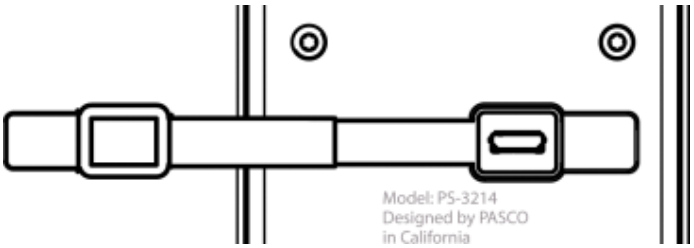
The PASCO Wireless Drop Counter is a versatile measuring device that can connect to a computer or mobile device, either wirelessly through Bluetooth or physically through a USB port. It includes a rechargeable battery and a Micro USB Cable. It measures the number of drops of fluid that fall through the rectangular opening (drop window) of the sensor and converts the drops into a volume. It is typically used in conjunction with a pH sensor and other equipment to perform a titration. Data from the Wireless Drop Counter and other sensors are recorded and displayed using software such as SPARKvue or PASCO Capstone. SPARKvue allows the sensor to work with a computer or a mobile device such as a tablet or smartphone when the sensor is connected. PASCO Capstone will work on a PC or Mac.

The Wireless Drop Counter can be mounted on a support rod. The counter is equipped with two integrated probe holders. The included Micro Stir Bar fits onto the end of a pH probe or other probe of the same diameter.

The included syringe, syringe holder, stopcock valves, and drop tip can be assembled into a drop dispenser that can be mounted on a support rod.

Initial Step: Charge the Battery

On the back of the Wireless Drop Counter, pry open the rubber seal that covers the Micro USB port. Charge the battery by connecting the Micro USB port to any standard USB **port** or USB **charger**, using the included Micro USB Cable. The charger circuit inside the sensor turns itself off when the unit is fully charged. The battery status light is solid yellow while charging. When fully charged, the light changes to solid green. Initial charging time may be three hours or longer, depending on the power source and the condition of the battery.



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

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 lights turn on.
2. Open SPARKvue.
3. Select **Sensor Data** on the Welcome Screen.

4. Select the sensor that matches its device ID. A notification will appear if a firmware update is available. Click **Yes** to update the firmware.
5. Close SPARKvue

PASCO Capstone

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

4. Select the sensor that matches its device ID. A notification will appear if a firmware update is available. Click **Yes** to update the firmware.
5. Close Capstone.

ON/OFF and Sleep Information

Before turning the sensor on, make sure that nothing is blocking the drop window. To turn the sensor on, press and **hold** the ON button. When the battery status LED shines red for a moment, release the ON button. The Bluetooth status LED will then start to blink. This indicates that the sensor is ready to be "paired" with a device using the data collection software.

NOTE: The sensor calibrates itself each time that it is turned on. Therefore, it is important that the drop window is unblocked when the sensor is turned on.

To turn the sensor off, press and **hold** the ON button for a moment until the battery status LED shines red. Release the ON button; the Bluetooth status LED will stop blinking. The sensor also puts itself to sleep after one hour of inactivity if connected, and after several minutes if not connected.

LED Information

The "drop" LED blinks when a drop is detected passing through the drop window.

If the lens in the drop window becomes obscured or dirty, the "drop" LED shines continuously. Clean the lens with water or a glass cleaner and a piece of lens paper or a lint-free cloth. Dry with a cotton swab.

The Bluetooth and the Battery Status LEDs operate as follows:

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected

NOTE: The Bluetooth LED will not light up if the sensor is connected via a USB port.

Battery LED	Status
Red blink	Low power
Yellow ON	Charging
Green ON	Fully Charged

Assemble the Drop Dispenser

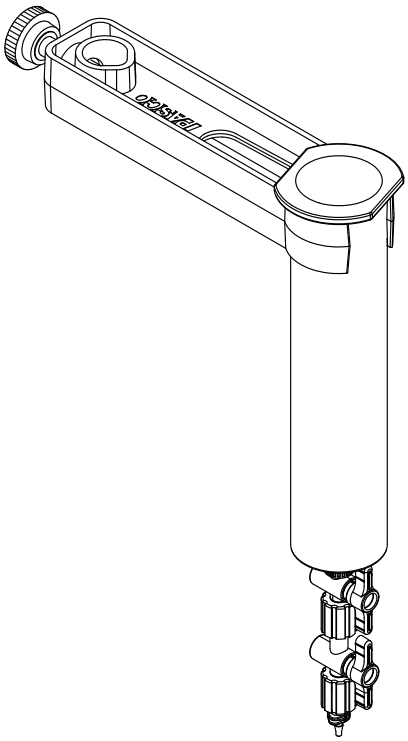


Figure 1. The complete Drop Dispenser, consisting of the syringe, two stopcocks, and the drop tip, connected to the syringe holder.

1. Remove the plunger from the syringe. Remove the protective white plastic caps from the stopcock valves.
2. Connect the two stopcocks together. Connect the stopcocks to the end of the syringe.
3. Connect the drop tip to the bottom of the stopcocks.
4. Attach the Drop Dispenser (syringe, two stopcocks, and drop tip) to the support rod using the syringe rod, as shown in Figure 1.

Calibrating the Drop Counter

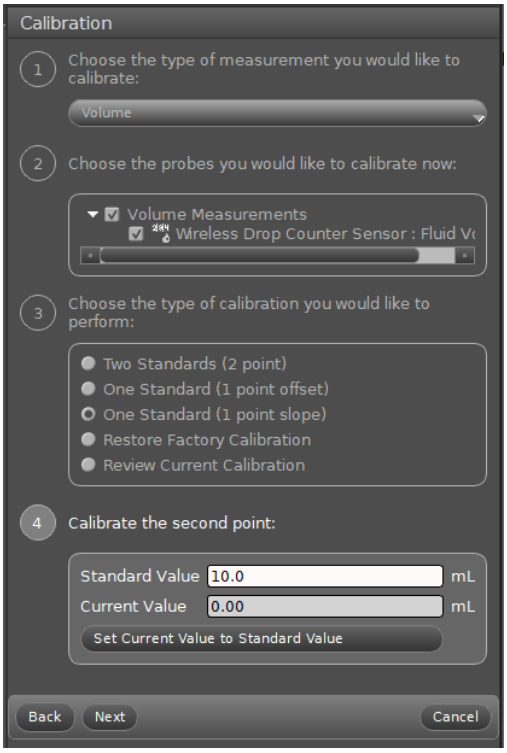
The Drop Dispenser has two stopcocks. The bottom stopcock is used to regulate flow rate, and the top stopcock is used to turn the flow on and off. The top stopcock should always be in either the completely open (handle vertical) position or the completely closed (handle vertical) position.

NOTE: If you are using PASCO standard equipment, calibration of the sensor is rarely required. However, if you are using third-party equipment, it is recommended that you take the following calibration steps.

The following two methods illustrate the calibration procedure:

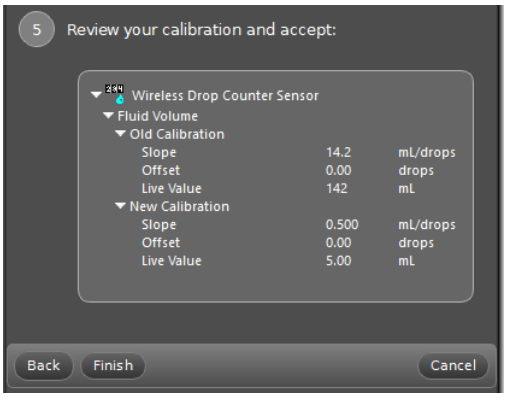
Calibration using PASCO Capstone

1. Attach the Drop Dispenser to a support rod if you have not already done so.
2. Fill the syringe with titrant. Place a beaker under the Drop Dispenser to catch the titrant.
3. Open both stopcock valves and adjust the valve on the bottom stopcock so that the drops fall at a rate of about 1 drop per second. Close the top valve after the rate is achieved. Discard the titrant in the beaker as directed by the instructor.
4. Mount the Wireless Drop Counter to the same support rod as the Drop Dispenser, between the Dispenser and the base.
5. Align the drop tip with the rectangular window in the Wireless Drop Counter. Place a graduated 10 mL cylinder under the Drop Counter window so it can catch drops from the drop tip and give you a measure of the volume.
6. Start Capstone. Connect the Wireless Drop Counter wirelessly to the computer with the following steps:
   a. In Capstone, open the "Hardware Setup" window.
   b. Turn on the Wireless Drop Counter.
   c. Click the Drop Counter with the Device ID that matches the Device ID number (XXX-XXX) printed on your sensor.
7. In Capstone, click the "Calibration" icon in the **Tools** panel to open the **Calibration** window. In Step 1, select the Volume measurement and click "Next". In Step 2, the "Wireless Drop Counter Sensor" is picked by default. In Step 3, the default choice for type of calibration is "One Standard (1 point slope)". Click "Next" to open Step 4.



8. Open the top stopcock valve to let the titrant begin dripping into the cylinder. Note that Capstone will automatically begin recording the number of drops (you do not need to click "Record").
9. After about 5 mL of titrant is collected in the graduated cylinder, close the top stopcock. Carefully measure the exact volume of titrant in the graduated cylinder.

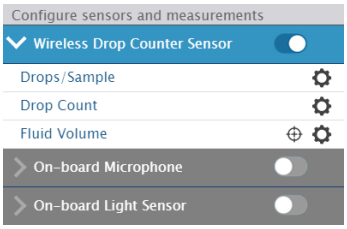
10. In Capstone, highlight the number in the "Standard Value" text box in Step 4. Enter the exact volume of titrant that you collected in the graduated cylinder (5 mL in this example), then click the button "Set Current Value to Standard Value".
11. Step 5 automatically opens, showing "New Calibration" in the lower half. In this example, Capstone counted 10 drops and the volume was 5.0 mL, so the "New Calibration" shows "Slope" equal to "0.500 mL/drops".



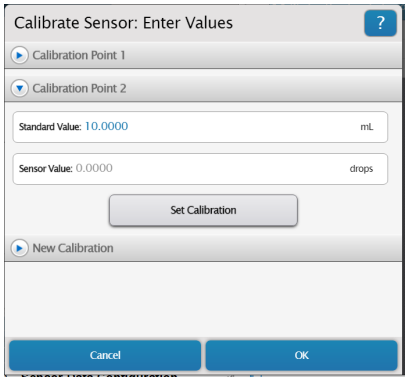
12. Click "Finish" to return to Step 1, then click the "Calibration" icon in the **Tools** panel again to close the **Calibration** window.

Calibration using SPARKvue

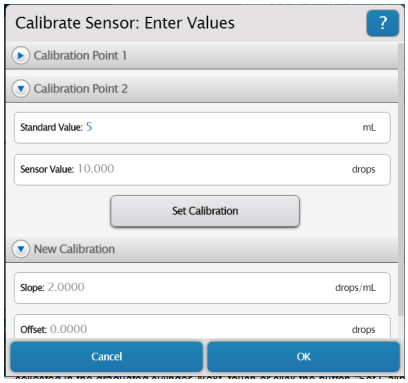
1. Attach the Drop Dispenser to a support rod if you have not already done so.
2. Fill the syringe with titrant. Put a beaker under the Drop Dispenser to catch the titrant.
3. Open both stopcock valves and adjust the valve on the bottom stopcock so that the drops fall at a rate of about 1 drop per second. Close the top valve after the rate is achieved. Discard the titrant in the beaker as directed by your instructor.
4. Mount the Wireless Drop Counter to the same support rod as the Drop Dispenser, between the Dispenser and the base.
5. Align the drop tip with the rectangular window of the Wireless Drop Counter. Place a graduated 10 mL cylinder under the Drop Counter window so it can catch drops from the drop tip and give you a measure of the volume.
6. Start SPARKvue. The "choose a path" window opens.
7. Connect the Wireless Drop Counter to SPARKvue using the following steps:
   a. In SPARKvue, click or touch "Sensor Data".
   b. Turn on the Wireless Drop Counter.
   c. From the list of available Bluetooth devices, select the device matching the Device ID number (XXX-XXX) printed on your sensor.
8. Select a Template from the options on the right to enter the Experiment window.
9. Select the **Hardware Setup** icon in the bottom right corner. This window shows the name of all connected sensors and selected measurement choices. Note that each measurement has a gear-shaped "Edit Data Properties" icon; in this case, the Fluid Volume measurement also has a "Calibrate measurement" icon.



10. Select the "Calibrate Measurement" icon next to "Fluid Volume" to open the **Calibrate Sensor** window.
11. In the **Calibrate Sensor** window, click "Continue" once you have ensured the Drop Dispenser and Wireless Drop Counter are properly in position. A screen containing a text area for "Standard Value" and a display area for "Sensor Value" will open.
12. Open the top stopcock valve on the Drop Dispenser to allow titrant to begin dripping into the cylinder. Note that SPARKvue will automatically begin recording the number of drops (you do not need to click "Record").



13. After about 5 mL of titrant has been collected in the graduated cylinder, close the bottom stopcock. Carefully measure the exact volume of titrant in the graduated cylinder.
14. Highlight the number in the "Standard Value" text box and enter the exact volume of titrant that you collected in the graduated cylinder (5.0 mL in this example), then click "Set Calibration".
15. *Optional:* Click "New Calibration" to see the Slope and Offset values. In this example, the Slope is "2.0000 drops/mL" because 10 drops were counted and the volume of the titrant entered is 5 mL.



16. Click "OK" to close the **Calibrate Sensor** window, then click anywhere in the Graph display to close the "Configure sensors and measurements" menu.

About the Calibration

Calibration information is stored in the Wireless Drop Counter and can be used by both PASCO Capstone and SPARKvue. The information can be changed as needed. Note that if you use a different liquid as the titrant, or if you change the drop rate or drop size by adjusting the stopcock valves on the Drop Dispenser, you will need to recalibrate.

Titration Setup

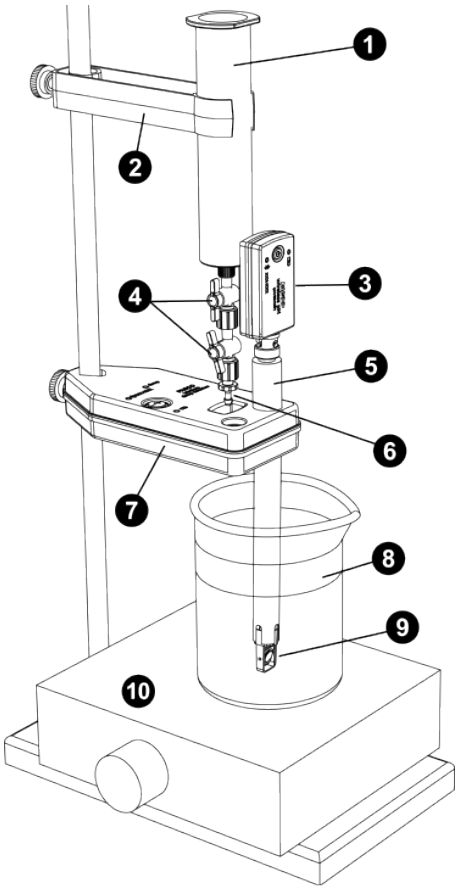


Figure 2. The titration setup, with the Wireless Drop Counter and syringe holder mounted to a support rod.

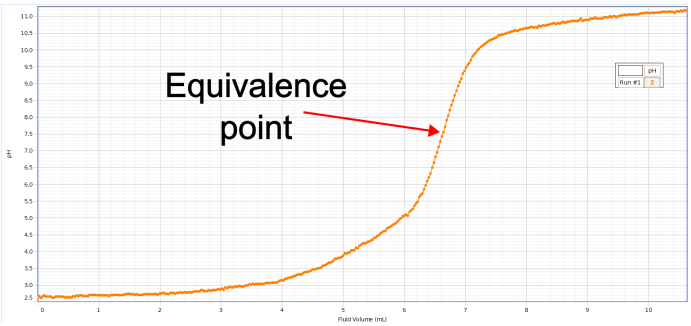
1. Syringe with 50 mL of 0.1 M NaOH
2. Syringe Holder
3. Wireless pH Sensor
4. Stopcocks
5. Direct Connect pH Probe
6. Drop Tip
7. Wireless Drop Counter
8. 150 mL Beaker with 100 mL of 0.005 M HCl
9. Micro Stir Bar
10. Magnetic Stirrer

Assemble the Titration Setup

1. Mount the Wireless Drop Counter on a support rod.
2. Attach a pH Probe to a Wireless pH Sensor (PS-3204). Place the pH probe into the larger of the two sensor ports on the Wireless Drop Counter.
3. Mount the Micro Stir Bar to the end of the pH Probe.
4. Arrange the magnetic stirrer and a 150 mL beaker with 100 mL of 0.005 M HCl, such that the end of the pH Probe and the Micro Stir Bar are submerged in the liquid in the beaker.
5. Mount the Drop Dispenser above the Wireless Drop Counter and position it so that the drop tip is placed over the rectangular window of the Drop Counter. Fill the syringe with 50 mL of 0.1 M NaOH.

Acid-Base Titration

1. Set up the equipment as shown in Figure 2, including consumables.
2. Start PASCO Capstone or SPARKvue. Connect the Wireless Drop Counter and a Wireless pH Sensor to the software.
3. Use the software to create a graph display of pH (vertical axis) vs. Fluid Volume (horizontal axis).
4. Start the magnetic stirrer. Check that the micro stir bar is able to rotate.
5. In the software, click "Start" (SPARKvue) or "Record" (Capstone) to begin recording data.
6. Adjust the stopcock valves on the Drop Dispenser so that the titrant drops fall at about 1 drop per second.
7. Observe the data on the pH versus Fluid Volume graph. After the equivalence point is reached, continue collecting data until the pH curve flattens.
8. Close the stopcock valve and stop data recording.



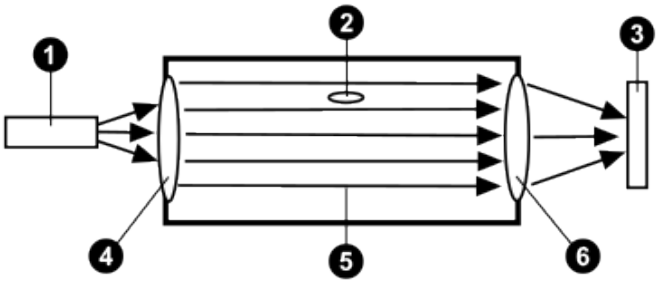
Other Titrations

Titrations with different solutions can be performed using the same equipment and procedure. Other probes, such as conductivity or ORP, can be used in place of the pH probe.

Theory of Operation

The Wireless Drop Counter uses an infrared light source and a photodetector. Lenses spread the light into a "sheet" and refocus it onto the photodetector. When a drop of fluid passes through the Wireless Drop Counter, it partially blocks this sheet of light, and the photodetector registers a momentary decrease in light intensity.

The Wireless Drop Counter uses infrared light and ignores visible light. On power up, it automatically adjusts the light level for the best sensitivity. Use the Wireless Drop Counter away from direct sunlight or other sources of infrared that may interfere with its operation.



1. Infrared light source
2. Drop
3. Detector
4. Collimating lens
5. Sheet of light
6. Focusing lens

Troubleshooting the Sensor

- If the indicator light flashes twice for a single drop and the Wireless Drop Counter registers more drops than actually dispensed, fluid is most likely splashing back into the drop window. Adjust the position of the beaker, Wireless Drop Counter, or Drop Dispenser to eliminate splash back.
- If the indicator LED remains on constantly and the Wireless Drop Counter does not register drops, the lenses in the drop window are likely dirty or wet. Clean the lenses in the drop window with water or a glass cleaner; dry with a cotton swab or tissue.
- If the sensor loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly **hold** the ON button on the sensor for 10 seconds and then release. 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 on the sensor for 10 seconds and then release. Start the sensor in the usual way.
    - If this does not fix the problem, turn Bluetooth off and then back on on the computing device. Retry.
- If the Wireless Drop Counter will not turn on, use the micro USB cable to connect it to a USB port or charger.

Probe Care and Maintenance

The Wireless Drop Counter Sensor is splash-resistant but not waterproof. Do not immerse the sensor in liquid. If the inside surfaces of the drop window need to be cleaned, use a piece of lens paper or a lint-free cloth and water or a glass cleaner.

Tips

- Except for opening and closing the stopcocks, do not touch the syringe of the Drop Dispenser during the titration; otherwise the drop size may change significantly.
- The drop rate must remain approximately constant (for example, about 2 drops per second) in order for the drop size to remain constant.
- Drop size depends on the exact position of the stopcock valves. Therefore, the average drop size will be different for every titration. For each different titration, re-calibrate the sensor, since the new titrant may have differently sized drops if it has a different density.

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	pasco.com/help/sparkvue

PASCO Capstone

Software	Help > PASCO Capstone Help
Online	pasco.com/help/capstone

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

Regulatory Information

Limited Warranty

For a description of the product warranty, see the Warranty and Returns page at www.pasco.com/legal.

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.