

Wireless Spirometer

PS-3234

Introduction

The Wireless Spirometer is designed for use with PASCO Capstone or SPARKvue data collection software. The sensor allows you to perform respiratory measurements, such as flow rate, lung volume, and pressure.

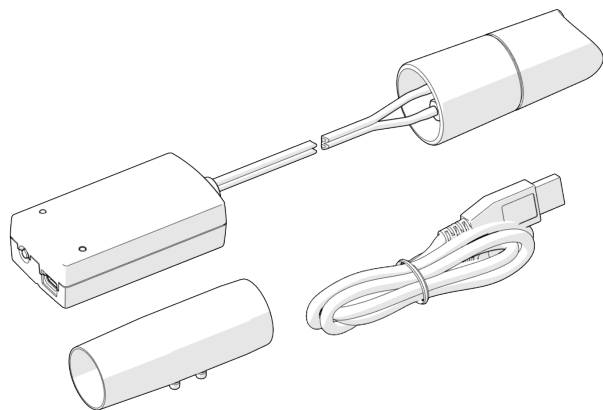
NOTE:

- This is NOT a medical device. It is designed for educational use only and should *not* be used in life support, patient diagnosis, or any other medical process. It is also not intended for graduate research or industry, including industrial control or any type of industrial testing.
- Read all instructions before using the product. Students should be supervised by their instructors. When using this product, follow the instructions in this manual and all applicable local safety guidelines.
- Do not share mouthpieces. The mouthpieces are intended for a single occasion, which may include several tests with the same individual.

CAUTION: In medical settings, pulmonary function tests are performed under the supervision of a medical professional. When using a spirometer without medical supervision, use extra caution. A person with a medical condition that may be affected by a pulmonary function test should NOT use the Wireless Spirometer. Immediately end use if the subject experiences breathing difficulty or discomfort.

Equipment

Included equipment:

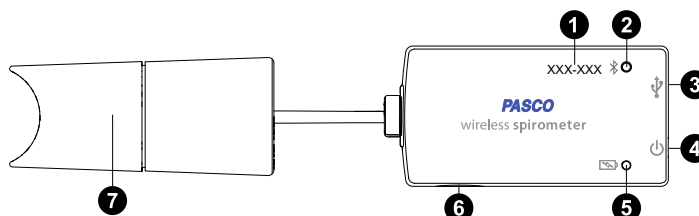


- Wireless Spirometer
- 3× mouthpieces
- USB cable

Required software:

- PASCO Capstone or SPARKvue data collection software

Features



1 Device ID

Use to identify the sensor when connecting via Bluetooth.

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	Logging data

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

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

3 Micro USB port

Use to connect the sensor to a USB wall charger via the included charging cable. The port and cable can also be used to connect the sensor to the software via the USB port of a computer or mobile device. (Note that this connection method is not supported by iOS.)

4 Power button

Press and briefly hold to turn the sensor on or off.

5 Battery Status LED

Indicates the battery level and charging status of the sensor.

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

6 Threaded hole

Accepts ¼-20 screws. Use to mount the sensor to a mounting rod or other similar apparatus.

7 Handle

Attach the mouthpiece here. Hold the handle upright and steady while collecting data.

Getting started

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:** 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 Spirometer. 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 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 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 Spirometer. 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 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.

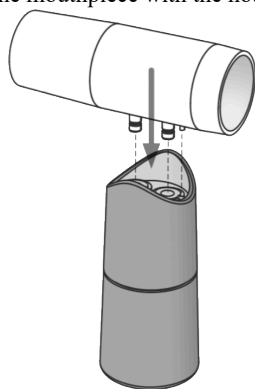
Collecting data using Capstone:

1. Double-click the **Graph**  icon in the **Displays** palette to create a new blank graph display.
2. 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.

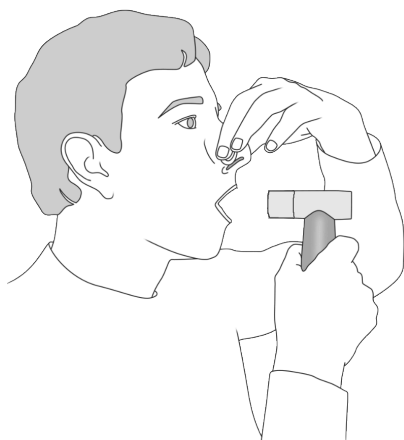
Data collection

Using the sensor requires two people: one to serve as the test subject, and one to perform data collection.

1. Connect the mouthpiece to the handle as shown below. Make sure to align the pin on the mouthpiece with the notch on the handle.



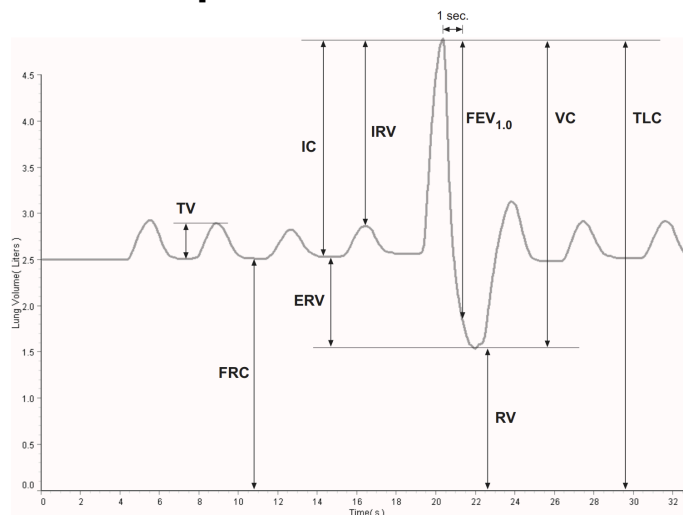
2. Tell the subject to hold their breath, pinch their nose closed (see below), place their teeth and lips on the filter, stand still, and relax. The subject should continue holding their breath until the start of Step 4.



3. Begin data collection. The sensor will perform a calibration procedure, as indicated by the Bluetooth Status LED flashing red. During calibration, no air movement should occur in the spirometer. Wait until the light returns to flashing green, then move to the next step.
4. Guide the test subject through each of the following steps. For most accurate results, avoid showing the data to the test subject as it is collected.
 - a. Take four normal breaths.
 - b. Inhale as deeply as possible, then exhale deeply with maximum effort.
 - c. Take two normal breaths.
5. Stop data collection.

NOTE: You may need to perform the test a few times to ensure data is satisfactory. If the data drifts, or if the calibration light does not turn green, see **Troubleshooting**.

Data interpretation



When performed correctly, a plot of lung volume versus time for the experiment described in **Data collection** will yield data similar to what is shown above. The following values can be obtained from such a plot:

- **Tidal Volume (TV)**

The volume of one breath, or the amount of air moved into and out of the lungs during normal breathing.

- **Functional Residual Capacity (FRC)**

The amount of air that is left in the lungs after a normal expiration ($FRC = RV + ERV$). This value is typically about 2.5 L.

- **Inspiratory Capacity (IC)**

The maximum amount of air that can be inspired after a normal expiration ($IC = TV + IRV$).

- **Expiratory Reserve Volume (ERV)**

The amount of air moved out of the lungs during a forced expiration, beyond the level of tidal expiration.

- **Inspiratory Reserve Volume (IRV)**

The amount of air moved into the lungs during a forced inspiration, beyond the level of tidal inspiration.

- **Forced Expiratory Volume in One Second ($FEV_{1.0}$)**

The volume of air moved out of the lungs in the first second of a forceful expiration after a maximal inspiration.

- **Residual Volume (RV)**

The amount of air remaining in the lungs at the end of a forced expiration. This value is typically about 1.2 L.

- **Vital Capacity (VC)**

The maximum movable amount of air that is contained by the lungs ($VC = TV + IRV + ERV$).

- **Total Lung Capacity (TLC)**

Maximum volume of air the lungs hold at peak inspiration.

Troubleshooting

You may notice a slow drift or slight fluctuation in the baseline in your graphs of Total Flow and Lung Volume. In most cases, these can be eliminated by following the steps below. Note that slow baseline changes usually do not significantly affect the measurements of volumes and capacities that can be found from the graphs.

- Air pressure changes in the environment during measurement can influence the sensor readings. These pressure changes can be caused by doors opening or closing, ventilation systems starting or stopping, and air movement within the testing room, among other potential sources. Try to reduce the presence of such changes while collecting data. In most cases, natural environmental pressure variation is tolerably low over the typical 30 second data collection period.
- If you observe significant drift across multiple runs, try switching Steps 3 and 4 in the **Data collection** procedure, allowing the sensor to calibrate while resting motionless on a flat surface *before* being held to the subject's mouth.

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-3234 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-3234.

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

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.