

# 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 use in 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 the product, follow the instructions in this manual and all applicable local safety guidelines.
- Do not share mouthpieces or filters. The mouthpieces and filters are intended for a single occasion, which may include several tests with the same individual.

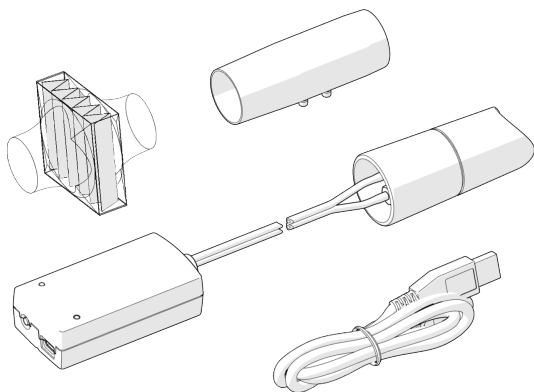


**CAUTION:** In medical settings, pulmonary function tests are performed under the supervision of a medical professional. When using a spirometer without medical supervision, use extra caution. A person with a medical condition that may be affected by a pulmonary function test should NOT use the Wireless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



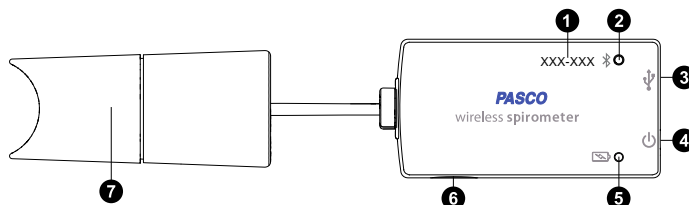
## Equipment

### Included equipment:



- Wireless Spirometer
- 3x mouthpieces
- 3x mouthpiece filters
- USB cable

### Features:



#### 1 Device ID

Use to identify the sensor when connecting via Bluetooth.

#### 2 Bluetooth Status LED

Indicates the status of the 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.



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

#### 3 USB port

Use with the USB cable to connect the sensor to a USB wall charger. The port 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 devices.

#### 4 Power button

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

#### 5 Battery Status LED

Indicates the battery level and current charging status.

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

#### 6 Threaded hole

Accepts 1/4-20 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

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 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 Wireless Spirometer.

#### 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. Select an option in the **Templates** section to open the Experiment Screen. The template 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 Spirometer. 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 Spirometer.

#### 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.

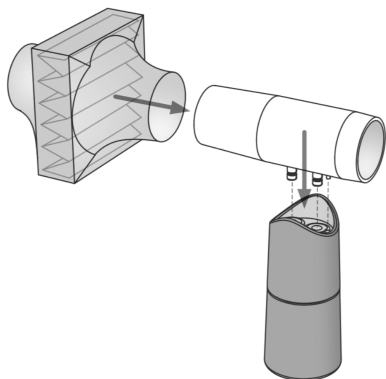
#### Collecting data using Capstone:

1. Double-click an appropriate icon in the **Displays** palette to create a new blank display of the corresponding type.
2. To assign measurements to the display, click each **<Select Measurement>** box and select an appropriate measurement from the list.
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. Connect the filter to the mouthpiece so that it creates a snug fit.



3. Tell the subject to hold their breath, place their teeth and lips on the filter, pinch their nose closed, stand still, and relax. (See below.)

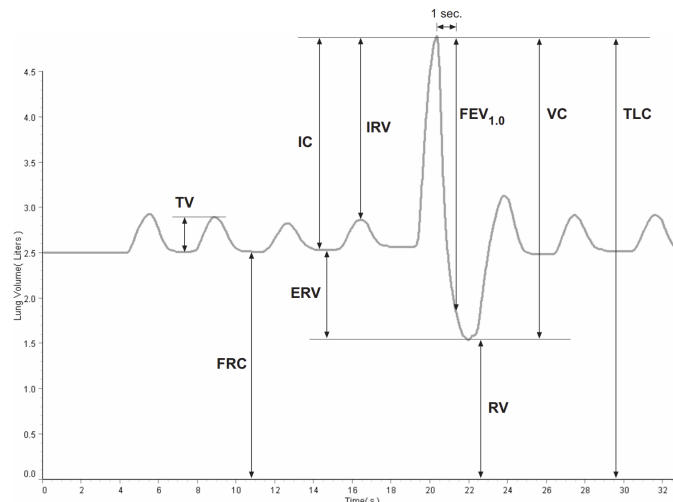


4. Begin data collection. The sensor will perform a calibration procedure, as indicated by the Bluetooth Status LED flashing red. Wait until the light flashes green, then move to the next step.
5. Guide the test subject through each of the following data collection steps. Do not show the data to the 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.
6. Stop data collection.



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

## Interpreting the data



When performed correctly, a plot of lung volume versus time for the experiment described in **Data collection** will yield data like what is shown above. The following quantities can be obtained from this 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 left in the lungs after a normal expiration ( $FRC = RV + ERV$ ). The typical FRC value is 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. The typical RV value is about 1.2 L.
- **Vital Capacity (VC)**  
The maximum movable amount of air 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 with 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 the measurement period 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 test 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 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-3234](http://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](http://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](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.