# PASCO

Wireless Spirometer

PS-3234

> 🗅 **Note:** This is not a medical device. It is designed for educational use only and should not be used in any medical process such as life support or patient diagnosis. It is also not intended for use in graduate research or industry including industrial control or any type of industrial testing.

> 🗅 **Note:** Read the instructions before using this product. Students should be supervised by their instructors. When using this product, follow the instructions in this manual and all local safety guidelines that apply to you.

> 🗅 **Note:** Do not share mouthpieces or filters. The mouthpieces and filters are intended for a single-use 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 PASCO Spirometer. Discontinue use if the subject encounters breathing difficulty or discomfort.

What's included
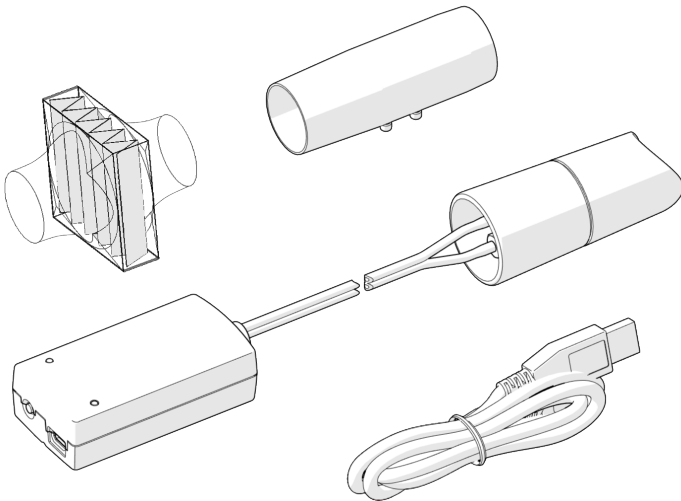
- Wireless Spirometer
- 3× Mouthpiece
- 3× Mouthpiece Filter
- USB Cable

Features
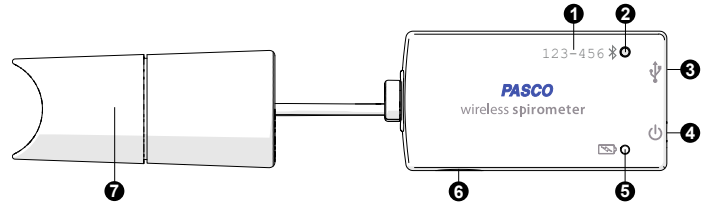
1. **Device ID**
    Use to identify the sensor when connecting using Bluetooth.

2. **Bluetooth Status Light** ✳
    Indicates the status of the Bluetooth connection.

LIGHT	STATUS
Red, blink	Ready to pair
Green, blink	Paired
Yellow, blink	Remotely logging data

3. **USB Port** ⟐
    Use with the USB cable to connect to a USB wall charger to charge the battery. Also use to send measurement data to software when connected to a USB port of a computer or mobile device (iOS devices not supported).

4. **Power Button** ⏻
    Press and hold for one second to turn the sensor on or off.

5. **Battery Status Light** 🔋
    Indicates the battery level and charging status.

LIGHT	STATUS
Red, blink	Low battery level
Green, solid	Fully charged
Yellow, solid	Charging

6. **Threaded Hole**
    Use for mounting the sensor, such as to a mounting rod. Accepts 1/4-in–20 screws.

7. **Handle**
    Attach the mouthpiece to the handle. Hold the handle upright and steady while collecting data.

Getting started

Charge the battery

Connect the Wireless Spirometer USB port ⟵⟶ to a USB charger using the included USB cable. The battery light 🔋 displays yellow while charging and changes to green when fully charged.

Get the software

You can use the Wireless Spirometer with SPARKvue or PASCO Capstone software. If you're not sure which app to use, visit **pasco.com/products/guides/software-comparison** for help. 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.

WINDOWS AND MAC	CHROMEBOOK, IOS, AND ANDROID
Go to **pasco.com/downloads**.	Search for **SPARKvue** in your device's app store.

If you already have the software, check that you have the latest update installed:

⬚ SPARKvue

Go to the **Main Menu** ☰ then select **Check for Updates**.

☁ PASCO Capstone

In the menu bar, click **Help** then select **Check for updates**.

Connect to the software

⬚ SPARKvue

1. Press and hold the power button ⏻ until the lights turn on.
2. Open SPARKvue.
3. Select **Sensor Data** on the Welcome Screen.

4. Select the Wireless Spirometer that matches its device ID.

> 092-746 Spirometer

> ⓘ **Important:** You may be prompted to update the firmware if a new version is available. If so, click **Yes** to update the firmware.

5. Select the measurements you want to display. **Lung Volume** is selected by default.
6. Select a template to display the data.

☁ PASCO Capstone

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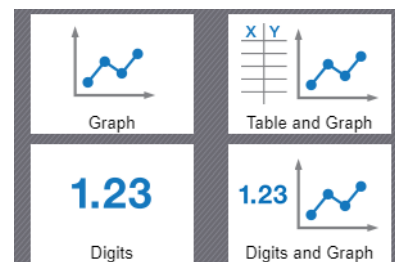3. Click **Hardware Setup**.

4. Select the Wireless Spirometer that matches its device ID.

> 092-746 Spirometer

> ⓘ **Important:** You may be prompted to update the firmware if a new version is available. If so, click **Yes** to update the firmware.

5. Click **Hardware Setup** again to close the panel.
6. Click **Sensor Data** to display a graph of Lung Volume versus Time.

Set up and collect data

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, making sure to align the pin on the mouthpiece with the notch on the handle. Connect the filter to the mouthpiece so that it creates a snug fit.

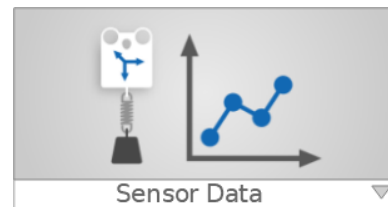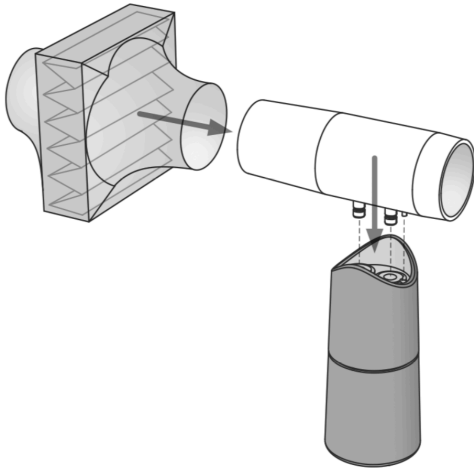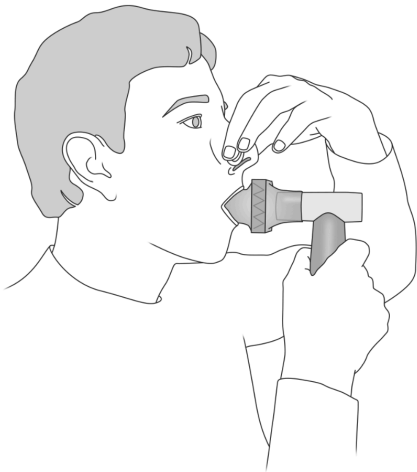2. Tell the subject to hold their breath, place teeth and lips on the filter, pinch their nose closed, stand still, and relax.

3. Start data collection. The sensor performs a calibration procedure which is indicated by the Bluetooth light flashing red. Proceed to the next step when the light flashes green.
4. Talk the test subject through each of the following data collection steps. Do not allow the test subject to see the data as it's 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 run the test a few times to get satisfactory data.

Interpretation of the data
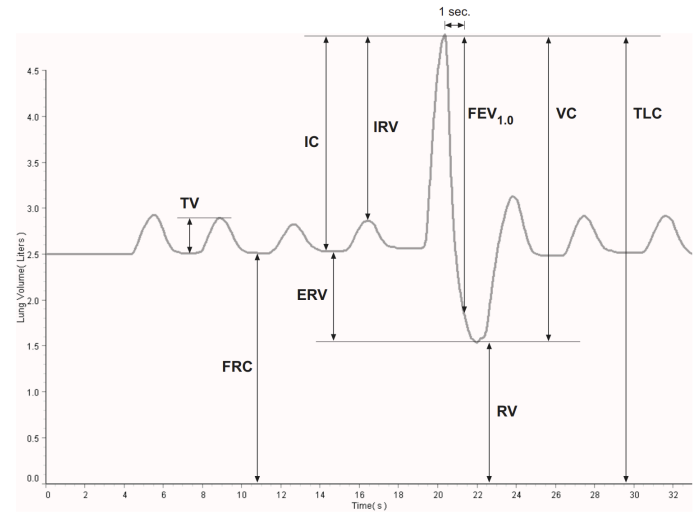
Tidal Volume (TV)
This is the volume of one breath or the amount of air moved into and out of the lungs during normal breathing.

Functional Residual Capacity (FRC)
This is the amount of air left in the lungs after a normal expiration (FRC = RV + ERV). A typical FRC is around 2.5 liters.

Inspiratory Capacity (IC)
This is the maximum amount of air that can be inspired after a normal expiration (IC = TV + IRV).

Expiratory Reserve Volume (ERV)
This is the amount of air moved out of the lungs during a forced expiration, beyond the level of tidal expiration.

Inspiratory Reserve Volume (IRV)
This is 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$_{1.0}$)
This is the volume of air moved out of the lungs in the first second of a forceful expiration following a maximal inspiration.

Residual Volume (RV)
This is the amount of air remaining in the lungs at the end of a forced expiration. A typical RV is around 1.2 L.

Vital Capacity (VC)
This is 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 forced inhalation.

Troubleshooting

In your graphs of Total Flow and Lung Volume, you may notice a slow drift or slight fluctuation in the baseline. These can be eliminated, in most cases, as described below. Note that slow baseline changes usually do not significantly affect the measurements of volumes and capacities that you take from the graphs.

- Air pressure changes in the environment during the measurement period can influence the sensor readings. Sources of such pressure changes include doors opening or closing, ventilation systems starting or stopping, and air movement within the testing room. In most cases, environmental pressure variation is tolerably low over the typical 30-second test period.
- The sensor calculates Total Flow by integrating the measured Flow Rate over time. Because of this time integration, a very small offset in the Flow Rate measurement may result in a noticeable upward or downward trend in the baseline of the Total Flow (or Lung Volume) data. This trend usually does not have a significant effect on the volume and capacity measurements taken from the graph, since each measurement is made between two data points recorded within a few seconds. In the data collection software you can eliminate the trend with this calculation: Total Flow = integral((1 - inrange(0, .03, abs(smooth(10, R)))) * R)
- Define R as the Flow Rate. Use the calculated data in place of the data directly from the sensor. If the trend is still apparent, increase the ".03" parameter so that it is slightly larger than the Flow Rate offset.

Download an experiment

Download one of several student-ready activities from the PASCO Experiment Library. Experiments include editable student handouts and teacher notes. Go to pasco.com/freelabs/ps-3232.

If you want to explore on your own, check out the SPARKvue and PASCO Capstone help guides to search for specific topics.

SPARKvue

Software: Go to the **Main Menu** ☰ then select **Help.**

Online: pasco.com/help/sparkvue

PASCO Capstone

Software: In the menu bar, click **Help** then select **PASCO Capstone Help.**

Online: pasco.com/help/capstone

Specifications and accessories

Visit the product page at pasco.com/product/PS-3234 to view the specifications and explore accessories. Experiment files and support documents can also be found on the product page.

Technical Support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to provide assistance with this or any other PASCO product.

Phone (USA)	1-800-772-8700 (Option 4)
Phone (International)	+1 916 462 8384
Online	pasco.com/support

Regulatory information

Warranty, Copyright, and Trademarks

Limited Warranty

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

Copyright

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Product end of life disposal instructions

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.

Battery disposal instructions

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.

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.

CE statement

This device has been tested and found to comply with the essential requirements and other relevant provisions of the applicable EU Directives.