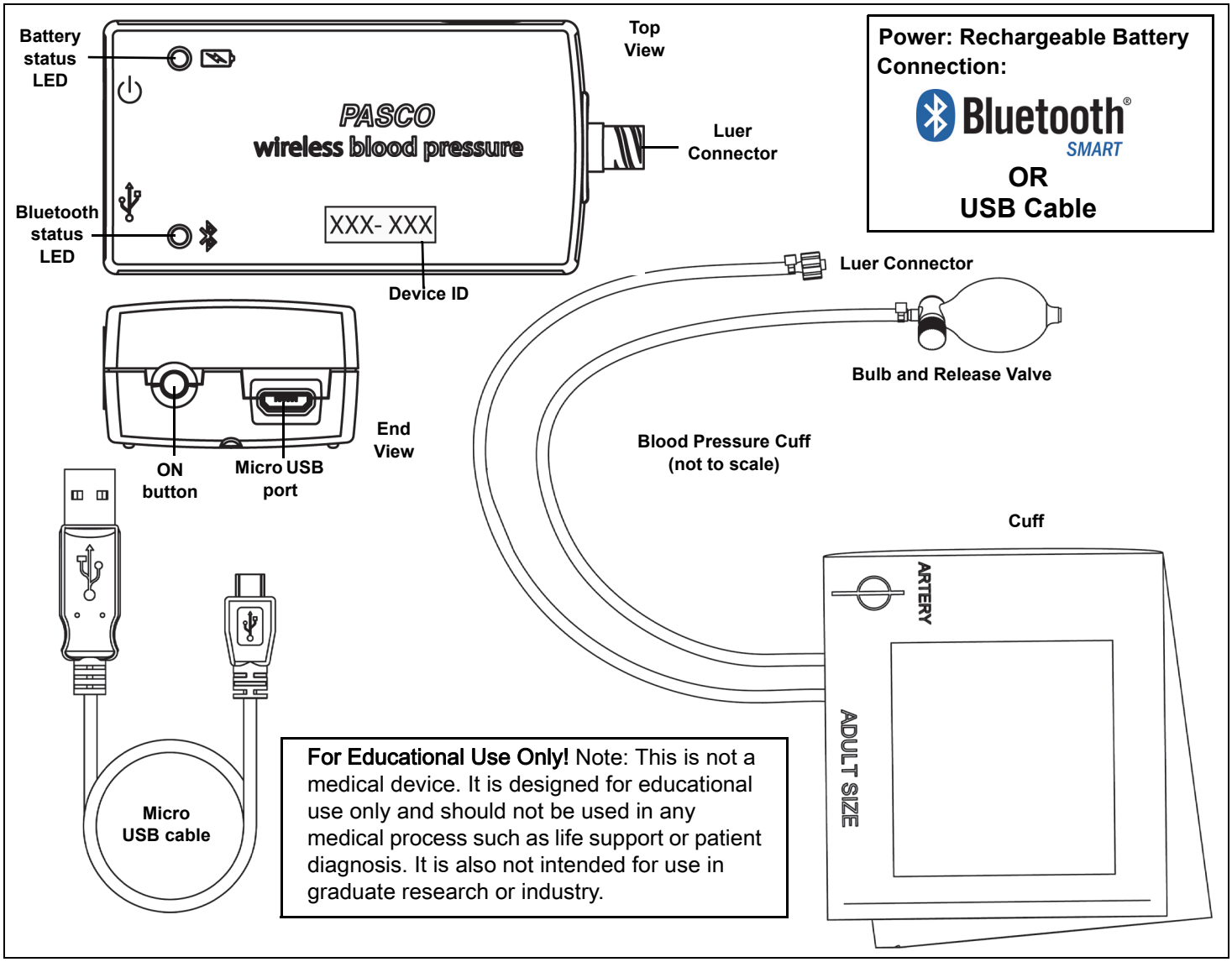
Wireless Blood Pressure Sensor

PS-3218



Hardware

Included Equipment	Quantity
Wireless Blood Pressure Sensor (PS-3218)	1
Micro USB Cable (1 meter)	1
Blood Pressure Cuff*, Standard (PS-3592)	1

Introduction

The Wireless Blood Pressure Sensor is a combination wireless *and* USB sensor that connects to a computer or tablet device through Bluetooth, and can also connect to a computer with a USB cable (included). The sensor measures pressure in the range between 0 and 260 millimeters of mercury (mmHg).

The Wireless Blood Pressure Sensor includes a standard size blood pressure cuff with a bulb and release valve.

Two other cuff sizes are available: PS-3591 Blood Pressure Cuff, Small, and PS-3593, Blood Pressure Cuff, Large. See **www.pasco.com** for more information.

Data Collection Software

PASCO Capstone

- Mac OS X
- Windows

SPARKvue

- Mac OS X
- Windows
- iOS
- Android
- Chromebook

See the PASCO web site at

www.pasco.com/software

for help in selecting the right PASCO software and to check for the latest versions.

Software Help

See the SPARKvue Help or PASCO Capstone Help for information about collecting, displaying, and analyzing data.

- In SPARKvue, select the HELP button (?) in any screen including the Home Screen.
- In PASCO Capstone, select **PASCO Capstone Help** from the **Help** menu, or press **F1**.

Bluetooth SMART Compatibility

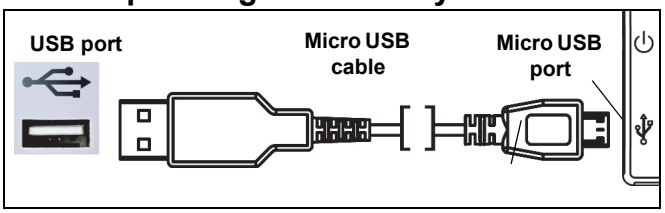
For more information about wireless compatibility, see the PASCO website at:

www.pasco.com/compatibility

Platform	Bluetooth SMART Compatibility
iOS	iPad 3 and later iPhone 4S and later iPod touch 5 and later
SPARK Element	All models
Android	Android 4.4 and later
Chromebook	Chrome OS (requires PS-3500 Adapter*)
Mac OS X	Models introduced July 2011 or later*
Windows	Windows 7 and later (requires PS-3500 Adapter*)

See Appendix B for more information about the PS-3500 Adapter and Mac OS X models.

Initial Step: Charge the Battery



- **Connect the Cable**: Use the Micro USB Cable to connect the micro USB port on the sensor to a USB **port** or USB **charger** such as the PASCO PS-3501 USB Charging Station. Charging begins automatically. The charger circuit inside the sensor turns itself off when the unit is fully charged. The battery status LED will shine yellow as the battery is charging, and will shine green when the battery is charged. The battery is partially charged at the factory. Initial charging time may be three hours or longer depending on the power source and the condition of the battery.

LED Information

The Bluetooth and the Battery Status LEDs operate as follows:

For a wireless Bluetooth connection:

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected
Yellow blink	Logging*

Battery LED	Status
Red blink	Low power

For a micro USB cable connection to a USB *port*:

Bluetooth LED	Status
OFF	--
OFF	--
Yellow blink	Logging*

Battery LED	Status
Yellow ON	Charging
Green ON	Charged

For a micro USB cable connection to a USB *charger*:

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected
Yellow blink	Logging*

Battery LED	Status
Yellow ON	Charging
Green ON	Charged

*__Logging__: PASCO wireless sensors can either stream live data to a compatible device or log data (save it to the sensor's memory). The data can then be uploaded to the device for display and analysis at a later time. Logging capability supports long-term or remote data collection while not connected to the device.

Note: The latest versions of SPARKvue and PASCO Capstone support logging. Check the PASCO Web page at:

www.pasco.com/software

for the latest software version.

ON/OFF Information

To turn the sensor on, press the ON button. The status LEDs will blink. To turn the sensor off, press and **hold** the ON button for a moment until the status LEDs stop blinking. The Wireless Blood Pressure Sensor puts itself to sleep after 1 hour of inactivity if connected, and after several minutes if not connected.

Set Up the Software

SPARKvue

Connecting the Sensor to a Tablet or a Computer via Bluetooth

- For SPARKvue, select the Bluetooth icon. In the **Wireless Devices** list. The sensors are ordered by proximity to the device. Select the correct address that matches the Device ID XXX-XXX number found on the sensor. Select Done.

Connecting the Sensor to a Computer with the Micro USB Cable

- Connect the micro end of the included Micro USB Cable into the micro USB port on the end of the sensor. Connect the other end of the Micro USB Cable to a USB port on the computer, or into a powered USB hub connected to the computer.

- In the SPARKvue Home Screen, select a measurement from the list under the sensor's name. A graph of the measurement versus time opens.

Collecting Data

- Select the Start button to begin collecting data.

PASCO Capstone

Connecting the Sensor to a Tablet or a Computer via Bluetooth

- For PASCO Capstone, select **Hardware Setup** in the Tools palette. In **Hardware Setup** the sensors are ordered by proximity to the device. Select the address that matches the Device ID XXX-XXX number on the sensor.

Select a display in the main window or from the **Display** palette. In the display, use the **<Select Measurement>** menu to pick a measurement to be shown.

Connecting the Sensor to a Computer with the Micro USB Cable

- Connect the micro end of the included Micro USB Cable into the micro USB port on the end of the sensor. Connect the other end of the Micro USB Cable to a USB port on the computer, or into a powered USB hub connected to the computer.

- In PASCO Capstone, select a display in the main window or from the **Displays** palette. In the display, use the **<Select Measurement>** menus to pick the measurement to be shown.

Collecting Data

- Select **Record** to begin recording data.

Troubleshooting the Wireless Blood Pressure SensorBlood

- If the Wireless Pressure Sensor loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly ***hold*** the button until the status LEDs blink in sequence, and then release the button. 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 for 10 seconds and then release. Start the sensor in the usual way.

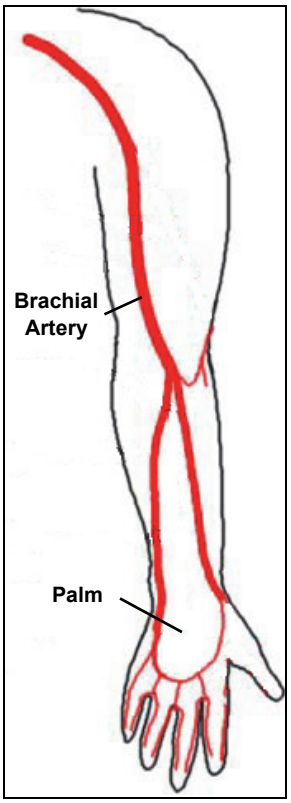
- Turn Bluetooth off and then back on. Retry.

About Blood Pressure

With the Wireless Blood Pressure Sensor, students can easily measure heart rate (beats per minute) and systolic and diastolic arterial blood pressure (millimeters of mercury). Students gain a greater understanding of the physiology of the circulatory system when they also learn about the physiology of blood pressure. The systolic and diastolic pressure provided in the digit display can be used by the student to verify their own determination of blood pressure from a graph of pressure versus time.

Blood pressure is the force that blood exerts on the walls of blood vessels. This pressure is caused by the contraction of the heart and by muscles that surround blood vessels. Blood pressure is always highest in the two main arteries that leave the heart. Because the pressure is usually a little higher in the left artery, blood pressure is usually measured in the brachial artery supplying the left arm.

Blood pressure consists of two measurements: systolic and diastolic pressure. It is represented as a ratio of systolic pressure to diastolic pressure, for example 130/80 (“one-thirty over eighty”).



In most parts of the world, blood pressure is reported in millimeters of mercury (mmHg).

Systolic pressure is the pressure of the blood on the artery walls when it leaves the ventricles at peak ventricular contraction, when the heart is emptying its chambers of blood. It is the “top number” of the blood pressure ratio. Normal systolic pressure for a male is approximately 120 mmHg and for a female is approximately 110 mmHg.

Diastolic pressure is the pressure of the blood on the artery walls when the ventricles relax and the heart's chambers fill with blood. It is the “bottom number” of the blood pressure ratio. Normal diastolic pressure for a male is approximately 80 mmHg and for females is approximately 70 mmHg.

Systolic and diastolic pressures are affected by various biological and environmental factors. For example, the salt in a person's diet can cause the kidneys to change the amount of fluid in our blood, resulting in changes in blood pressure. Diet, stress, exercise, body position, drugs, hormonal changes and genetic factors can affect a person's blood pressure.

About the Sensor

The Wireless Blood Pressure Sensor consists of a pressure sensor box and a blood pressure cuff with bulb and valve. The sensor is a digital sphygmomanometer that uses an electronic pressure sensor to measure the mean arterial pressure and then calculates systolic and diastolic blood pressure and heart rate (in beats per minute).

The blood pressure cuff consists of an inflatable bladder connected by one hose to a hand pump bulb with a push-button release valve, and by a second hose with a connector that attaches to the pressure sensor box.

The Wireless Blood Pressure Sensor uses the oscillometric technique to estimate blood pressure. When the oscillations of pressure in a blood pressure cuff are recorded during gradual deflation, the point of maximal oscillation corresponds to the mean intra-arterial pressure. The oscillations begin at approximately systolic pressure and continue below diastolic, so that systolic and diastolic pressure can only be estimated indirectly according to an empirically derived algorithm.

Usage

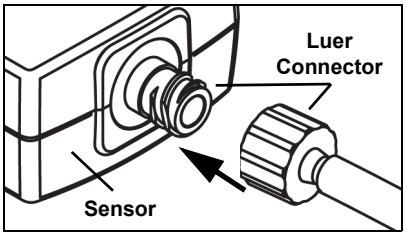
Experiment ideas:

- Determine the effects of exercise on blood pressure and heart rate.
- Explore the effects of body position on blood pressure and heart rate.
- Compare the blood pressure and heart rate of students in the class.

Set Up the Hardware

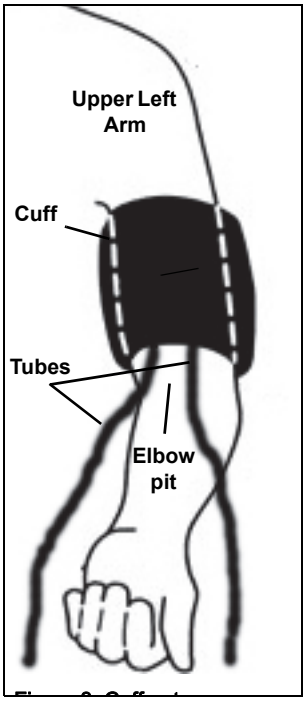
Connecting the Sensor to the Cuff

Screw the luer connector on the end of the blood pressure cuff tube onto the luer connector on the sensor.



Cuff and Arm Placement

First, find a partner. A student cannot measure his or her own blood pressure. Partner 1 should be the patient and partner 2 should conduct the measurement.



The patient should remove any constrictive clothing or jewelry that may interfere with the cuff placement.

Locate the approximate position of the main artery (brachial artery) on the inside of your upper left arm by pressing with your fingers near the inside edge of your biceps muscle about five or ten centimeters (cm) above the elbow pit.

Partner 2 should help the patient wrap the cuff snugly around the upper left arm

above the elbow with the two tubes hanging down (one on each side of the arm).

Use the hook-and-pile material to hold the cuff in place. Position the cuff's bottom edge at about 2.5 cm (one inch) above the elbow pit.

Rotate the cuff as needed to position the white index line (labeled ARTERY) on the cuff over the main artery (brachial artery) on the inside of your left arm.

Procedure

Partner 1 should sit without crossing your legs. Relax. Rest your left elbow and forearm on a solid surface with your palm facing upward. The cuff should be slightly lower than your heart.

Partner 2 should press and hold the push-button release valve to make sure that all of the air in the cuff has been released.

In the data collection software, set up Digits displays of pressure, diastolic pressure, and systolic pressure. You may also want to view pressure versus time on a Graph display.

The patient should stay as still as possible during the blood pressure measurement. Do not talk or move if possible.

Partner 2 should press “Start” or “Record” to begin data collection and then use the bulb to pump air into the cuff.

CAUTION: Do not pump above 200 mmHg.

If there is discomfort, push and hold the push-button on the release valve to deflate the cuff.

Monitor the pressure in the Digits displays. When the pressure reaches approximately 170 mmHg, partner 2 should stop pumping and let go of the bulb.

NOTE: The pressure in the cuff will decrease automatically (at about 3 mmHg per second) so the cuff will slowly deflate by itself in about a minute.

When the cuff is deflated, press “Stop” to end data collection. After the measurement is finished, release the remaining air in the cuff by pressing the push-button release valve on the bulb and holding it for several seconds. You should be able to hear air coming out of the cuff.

(See **Appendix A: Sample Data**.)

Mounting the Sensor

The Wireless Blood Pressure Sensor housing includes a threaded hole (1/4-20) on one side. Screw a PASCO Mounting Rod (ME-9483 10 pack) into the threaded hole, and use clamps and support rods to hold the sensor in place.

About the Battery

The Wireless Blood Pressure Sensor’s battery is partially charged at the factory. If the battery status LED blinks red, use the micro USB cable to connect the sensor to a USB port or a USB charger.

Battery Usage

Battery life is very important to making the sensor simple and always ready to use, so all of the PASCO wireless products are designed for long battery life. For example, the sensor turns itself off after a few minutes of inactivity.

The battery life between charges for the Blood Pressure Sensor varies depending on the sampling rate. The battery life ranges between 11 hours for high sample rates to more than 70 hours for low sample rates.

In typical classroom/lab use, this would translate to a battery life between charges ranging from one to four weeks or more, because full-day continuous sampling would be unusual. Even in the most extreme case with a high sample rate, the Blood Pressure Sensor battery would support a full day of use before needing to recharge.

Maximizing Battery Life

One factor that affects battery life is the storage temperature and the number of charge cycles. Therefore, avoid storing the sensor in very cold or very hot environments.

Related Products

Other physiology sensors include the following:

- Wireless Hand Grip Heart Rate Sensor PS-3206
- Wireless Exercise Heart Rate Sensor PS-3205
- PASPORT EKG Sensor PS-2111
- PASPORT Spirometer PS-2522

Suggested Experiments

See the PASCO Web site at

www.pasco.com/products/lab-manuals

for more information about experiments.

Specifications

Blood Pressure	Value
Unit	millimeters of mercury (mmHg)
Range	0 to 260 mmHg
Accuracy	±3 mmHg
Resolution	0.05 mmHg

Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific
10101 Foothills Blvd.
Roseville, CA 95747-7100

Phone: +1 916 462 8384 (worldwide)
8700-772-8700 (U.S.)

Web: www.pasco.com

Email: support@pasco.com

The Reference Guide will be updated periodically. For the latest revision of this Reference Guide, visit the PASCO Web site at

www.pasco.com/manuals

and enter the product number, PS-3218, in the text window.

Replacement Parts

For information about possible replacement parts, contact Technical Support:

Limited Warranty
For a description of the product warranty, see the PASCO catalog. For more information visit www.pasco.com/legal.

FCC Statement
This Class A digital 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.

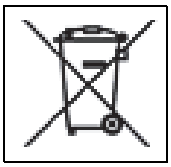
Product End of Life Disposal Instructions:
This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a 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/disposal service, or the place where you purchased the product.

The European Union WEEE (Waste Electronic and Electrical Equipment) symbol (to the right) and on the product or its packaging indicates that this product **must not** be disposed of in a standard waste container.

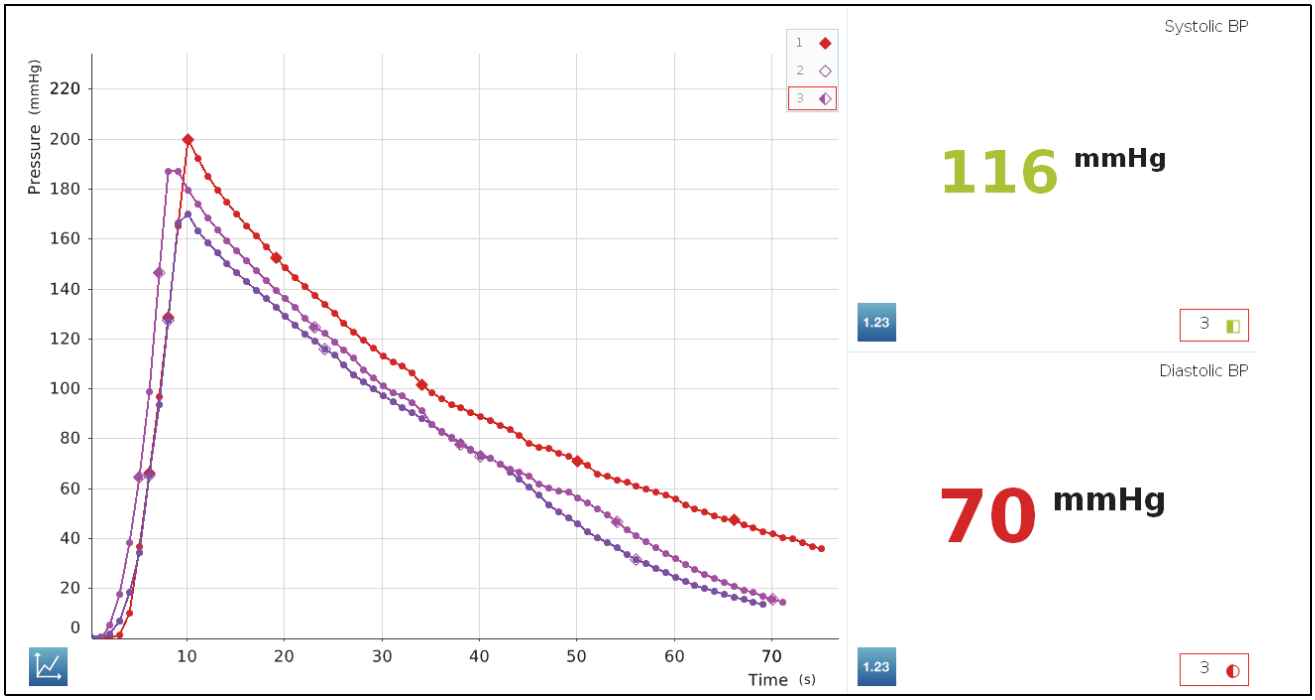
Battery Disposal Instructions:
Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where you can drop off your waste battery for recycling, please contact your local waste disposal service, or the product representative.

The Lithium Polymer (Li-Poly) rechargeable battery used in this product is marked with the International symbols to indicate the need for the separate collection and recycling of batteries.

Li-Poly

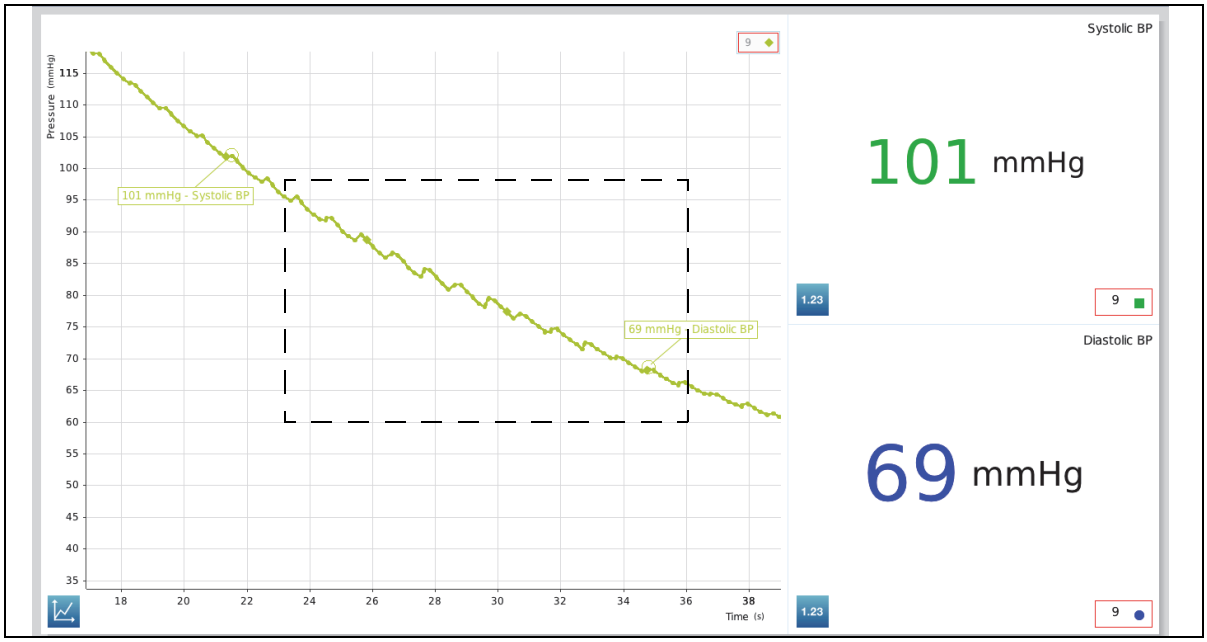


Appendix A: Sample Data



How To Find Systolic and Diastolic Blood Pressure Manually

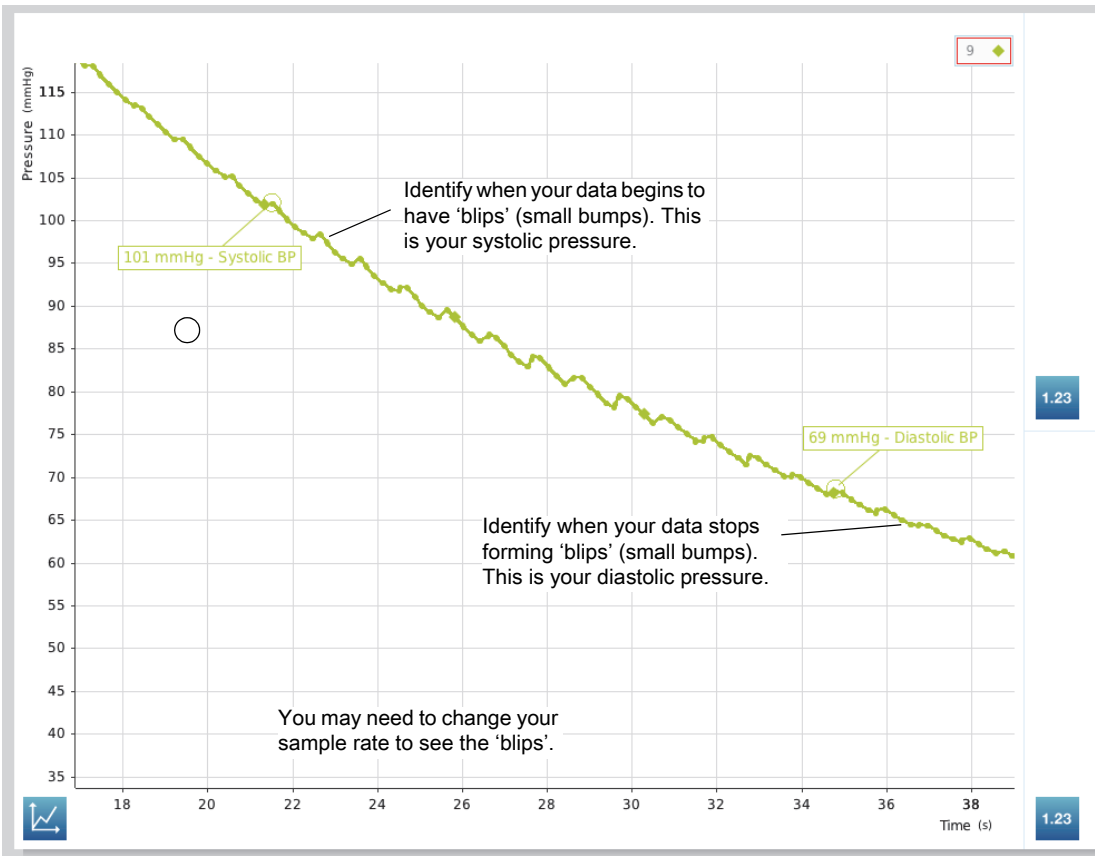
1. Select a single data run. Enlarge an area of the pressure measurement between 120 and 60 mmHg.



2. Identify when your data begins to form ‘blips’ (small bumps). This is your systolic pressure.

3. Next, identify when your data stops forming ‘blips’ (small bumps). This is your diastolic pressure.

4. You may need to change your sample rate in order to see the ‘blips.



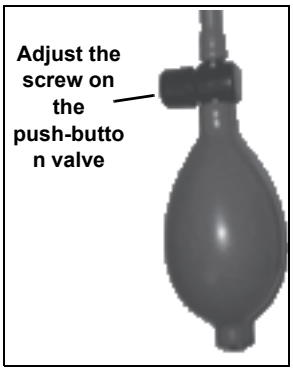
Troubleshooting

Why are the Systolic and/or Diastolic Pressure Not Appearing?

- Perhaps the size of the cuff is incorrect. You may have a cuff that is too small or too large.
- The pressure in the cuff may be falling too quickly, or not fast enough. The pressure release rate should be between 2 and 5 mmHg per second, and never less than 2 mmHg per second.

Adjusting the Pressure Release Rate for the Blood Pressure Cuff

The default pressure release rate is 3 mmHg per second. To adjust the rate up or down, use a small screwdriver to turn the adjustment screw in the center of the top of the push-button valve. Turn the screwdriver counter-clockwise to slow down the release rate and turn the screwdriver clockwise to speed up the release rate. The pressure release rate is normally slower if the person's arm is larger.



Storage

Disconnect the blood pressure cuff from the sensor for storage.

IMPORTANT: The PASCO Blood Pressure Sensor is designed for educational use only. It cannot be used for diagnosis.

Appendix B: Bluetooth SMART Compatibility

Check the PASCO Web page at

www.pasco.com/compatibility

for the latest information on Bluetooth SMART compatibility.

Platform	Bluetooth SMART Compatibility
iOS	iPad 3 and later iPhone 4S and later iPod touch 5 and later
SPARK Element	All models
Android	Android 4.3 and later
Chromebook	Chrome OS (requires PS-3500 Adapter*)
Mac OS X[1]	Models introduced July 2011 or later
Windows 7 and 8	Requires PS-3500 Adapter*
Windows 10	Bluetooth SMART compatible

*The PS-3500 USB Bluetooth 4.0 Adapter, when connected to a USB port, allows up to three Bluetooth SMART devices, such as this PASCO wireless device, to connect to Windows computers, Chromebooks, and older Macintosh computers.

PS-3500 USB Bluetooth 4.0 Adapter

Note: The PS-3500 USB Bluetooth 4,0 Adapter is the only adapter we can currently recommend. Many other Bluetooth 4.0 adapters are available but this adapter has a specific design that enables in-app pairing of Bluetooth SMART sensors.

[1]To check the Mac computer's Bluetooth compatibility, do the following:

- Click the (Apple) Menu.
- Select *About This Mac*
- Click the *More Info*... button.
- Click the *System Report*... button.
- Select *Bluetooth* from the sidebar on the left, underneath *Hardware*.
- Scan down the list of information until you find "LMP Version".
- If your Mac is equipped with Bluetooth SMART, the LMP Version will show **0x6**. (Anything lower than **0x6** means an older version of Bluetooth. Your device will need the PS-3500 USB Bluetooth 4.0 Adapter.)

[1]The Mac Mini and MacBook Air were updated with Bluetooth SMART support in 2011. The MacBook Pro was updated in 2012. The Mac Pro that debuted in December 2013 has Bluetooth SMART support.

Exception: Before you upgrade to El Capitan (Mac OS X 10.11.x), if you have a Macintosh with LMP version "0x4" that requires the PS-3500 USB Bluetooth 4.0 Adapter, please contact PASCO Technical Support for further instructions.

What is Bluetooth SMART®?

Bluetooth SMART (also known as Bluetooth Low Energy or Version 4.0 of the Bluetooth specification) is the latest protocol of the proprietary open wireless technology standard created by telecoms vendor Ericsson in 1994. It is the power- and application-friendly version of Bluetooth that was built for the Internet of Things (IoT).