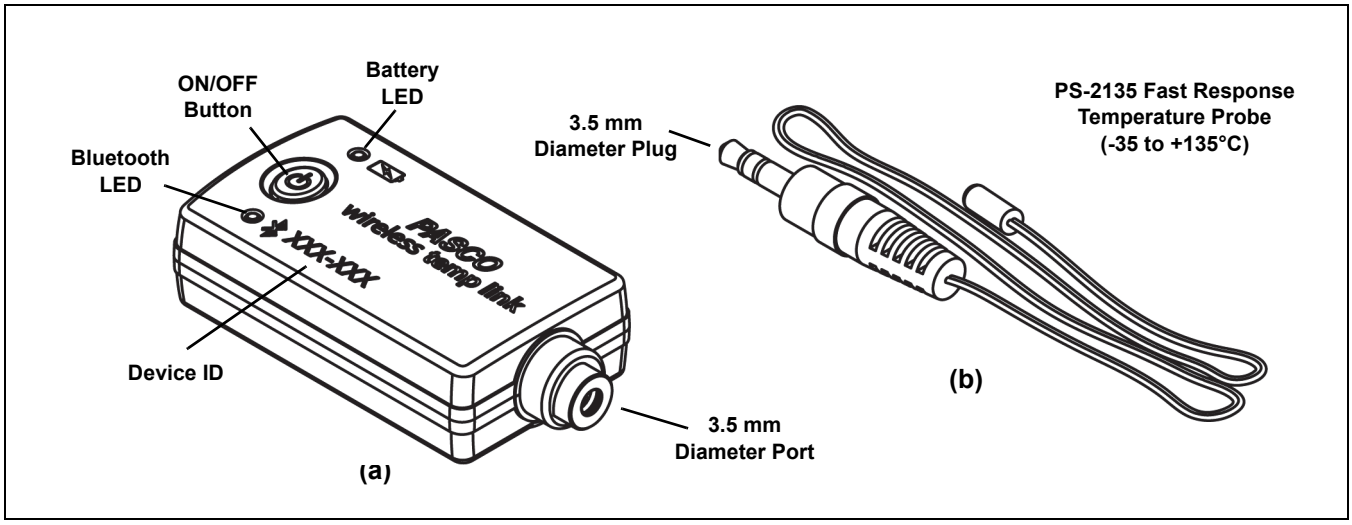
Wireless Temperature Link

PS-3222

Power: Replaceable Battery (CR2032)
Connection: Bluetooth SMART



Equipment Included	
(a) PS-3222 Wireless Temperature Link	**(b) PS-2135 Fast Response Temperature Probe**

Required Item*	Part Number*
PASCO Data Collection Software	see www.pasco.com

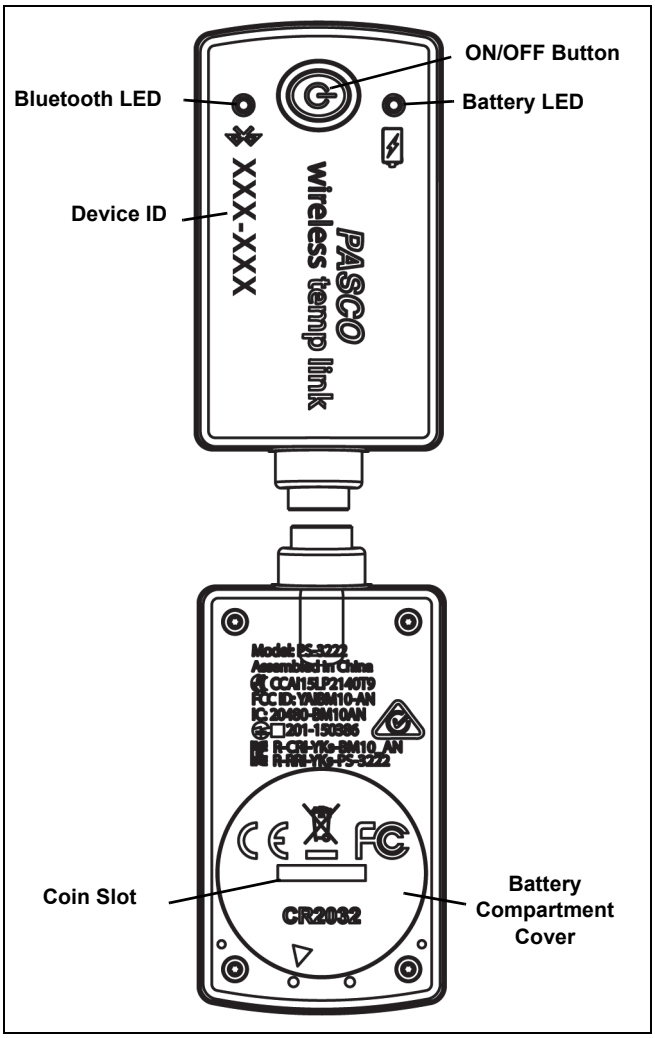
***See the PASCO catalog or the PASCO web site www.pasco.com for more information.**

Compatible Equipment*	Temperature Range
PS-2131 PASPORT Skin/Surface Temperature Probe	-35 to +135°C
PS-2133 Stainless Steel Temperature Probe	-35 to +135°C
TD-8595 Absolute Zero Sphere	-35 to +135°C
TD-8596A Ideal Gas Law Apparatus	-35 to +135°C

Consumable	Product Number*
Coin Cell Battery (CR2032)	PS-3204 Pack of 10

Introduction

The PASCO Wireless Temperature Link is a versatile measuring device that can connect to a computer or mobile device wirelessly through Bluetooth (BLE). It has a PS-2135 Fast Response Temperature Probe with a wide temperature range (-35 to +135°C). The temperature measurement is transmitted wirelessly through Bluetooth (BLE) and recorded and displayed by the PASCO software such as SPARKvue or PASCO Capstone. SPARKvue allows the sensor to work with a computer or with a mobile device such as a tablet or smart-phone when the sensor is connected. PASCO Capstone will work on a PC or Mac.



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.

Features

The Wireless Temperature Link is powered by a replaceable three volt coin cell battery (included) and is well-suited for continuous recording and discrete measurements. The sensor is designed to optimize the battery usage time.

Since each sensor has a unique Device ID number, more than one sensor can be connected to a computer or tablet at the same time.

The sensor housing is water resistant, but not waterproof. Immersing it in water may cause a loss of wireless connection. Put only the Temperature Probe into the substance being measured.

Connect the Temperature Probe or other Apparatus

Put the 3.5 mm diameter plug of the temperature probe (or other apparatus) into the 3.5 mm diameter port on the Wireless Temperature Link.

ON/OFF and Sleep Information

To turn the sensor on, press and **hold** the ON/OFF button. When the Battery LED shines red for a moment, release the ON button. Then, the Bluetooth LED will blink. This indicates that the sensor is ready to be “paired” with a device using the data collection software.

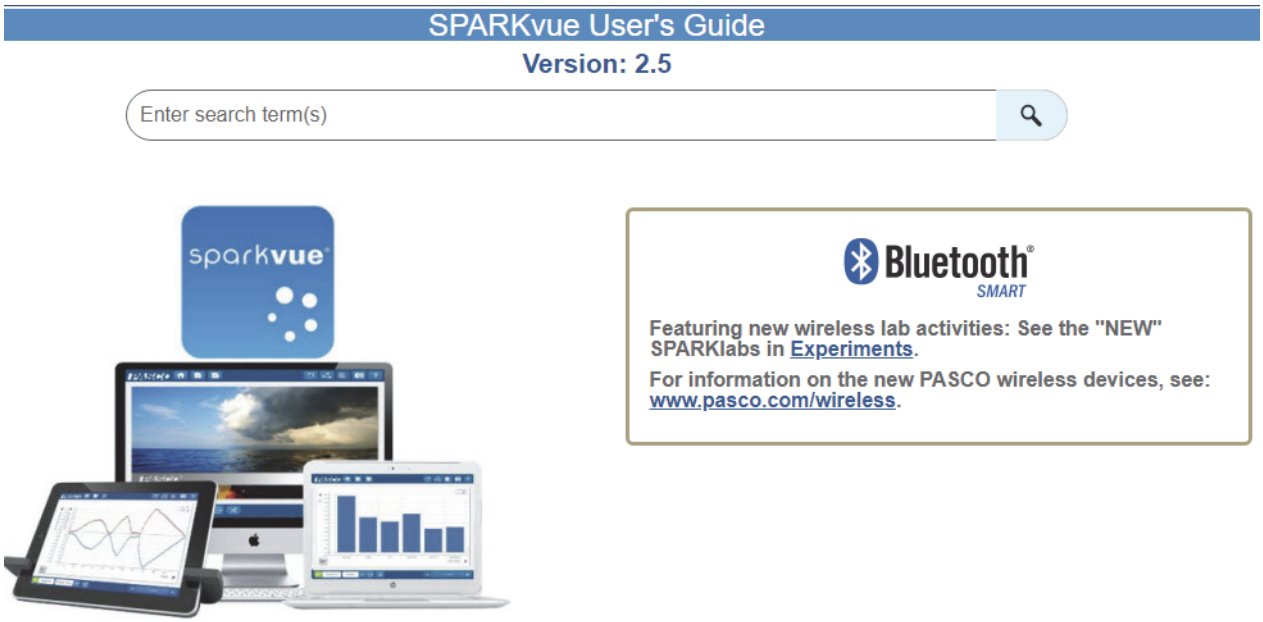
To turn the sensor off, press and **hold** the ON button for a moment until the battery LED shines red. Release the ON button and the Bluetooth LED stops blinking. The sensor puts itself to sleep after one hour of inactivity if connected, and after several minutes if not connected.

Set-up

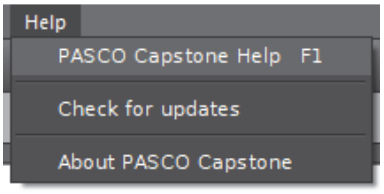
Software Help

- In Sparkvue, open the Main Menu and select “Help” for information about collecting, displaying, and analyzing data.
- In the window that opens is the address of the web page for **Help**. Copy and paste the address into a web browser program to open the Sparkvue User’s Guide web page (see below).

SPARKvue “Help” Window



- In PASCO Capstone, select **PASCO Capstone Help** from the **Help** menu, or press **F1**.



Connect the Sensor Wirelessly to a Device or a Computer via Bluetooth

Connect the Sensor in SPARKvue

1. Turn on the sensor and start SPARKvue.

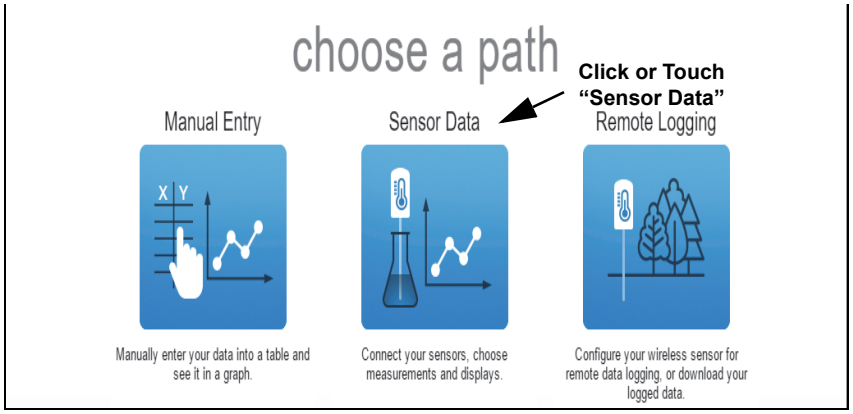
- The “choose a path” window opens.

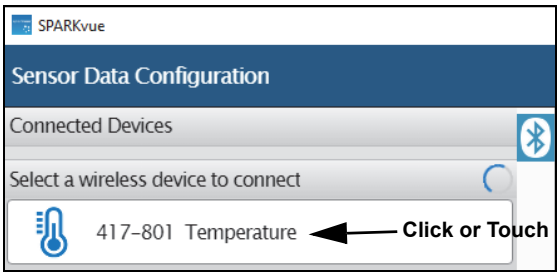
2. To “pair” the Wireless Drop Counter wirelessly to the computing device (e.g., computer or tablet), click or touch “Sensor Data” in the “choose a path” window.

- The “Sensor Data Configuration” screen opens.

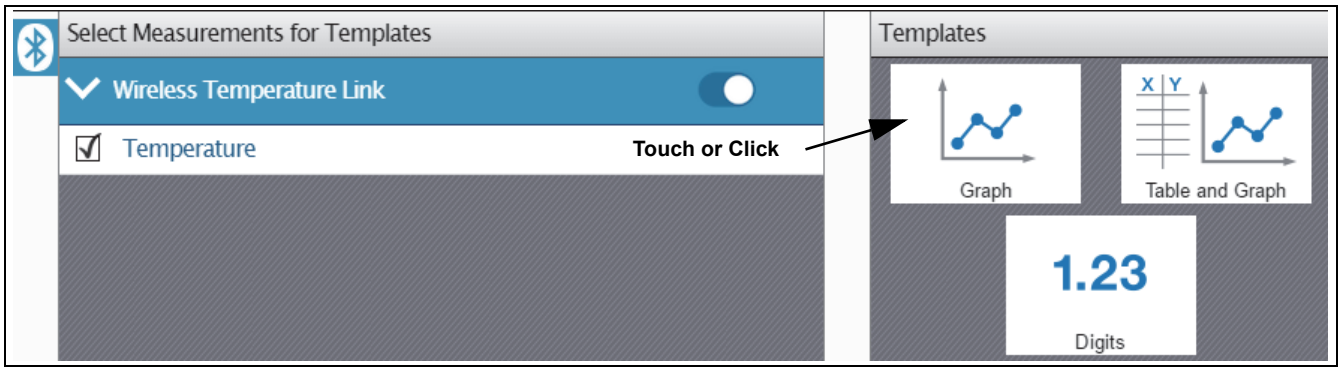
3. In the “Sensor Data Configuration screen”, look in the “Connected Devices” list. Touch or click to select the correct address that matches the Device ID XXX-XXX number found on the Wireless Temperature Link.

- A message confirms that the sensor is being connected.





- Next, in the “Sensor Data Configuration” screen, the “Select Measurement for Templates” panel now shows the sensor and its measurements. “Temperature” is the measurement selected as default. The “Templates” panel shows “Graph”, “Table and Graph”, and “Digits” as the choices.



4. In the “Templates” panel, touch or click the “Graph” template to open a “Graph” display.

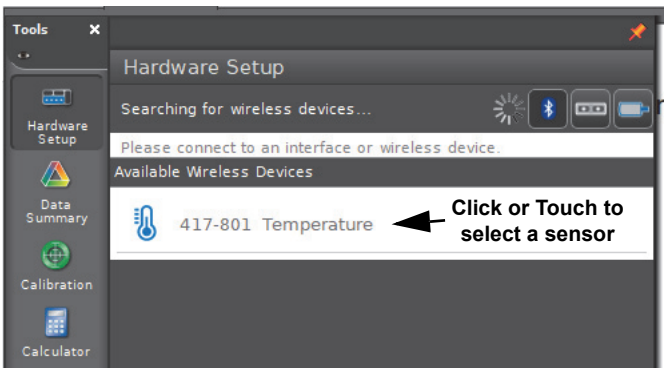
- The Graph display shows “Temperature (°C)” as the measurement on the vertical axis. The “Hardware Setup” icon is in the lower right-hand corner.

Collect Data

1. Click or touch the “Start” button to begin collecting data. Watch the Graph display to see the data as it is recorded.

Connect the Sensor in PASCO Capstone

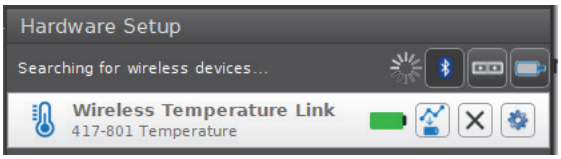
1. Turn on the sensor and start the software. In PASCO Capstone, click or touch the “Hardware Setup” icon in the Tools palette to open the Hardware Setup panel.



- The Hardware Setup panel confirms that the software is “Searching for wireless devices”. The panel shows the “Available Wireless Devices”.

2. Touch or click the desired sensor in the Hardware Setup panel that matches the XXX-XXX Device ID number on the sensor.

- The Hardware Setup panel changes to show that the Wireless Temperature Link is connected.



3. Click or touch the “Hardware Setup” icon in the Tools palette to close the Hardware Setup window.

Collect Data

1. In PASCO Capstone, select a display in the main window. In the display, use the <Select Measurement> menu(s) to set up the desired measurement in the display.

2. Select Record to begin collecting data.

Using the Sensor

LED Information

The Bluetooth LED (light-emitting diode) and the battery LED operate as follows:

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

Battery LED	Status
Red blink	Low power

*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: Latest versions of SPARKvue and PASCO Capstone support logging. Check the PASCO Web page at:www.pasco.com/software for the latest software version.

Calibrating the Wireless Temperature Link

- Calibration is not always necessary, especially if you are measuring a change in temperature rather than absolute temperature values. However, it is possible to calibrate the sensor. For detailed information, see Appendix B.

Battery Usage

- The Wireless Temperature Sensor includes a 3 V coin cell battery (CR2032). 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 short time of inactivity.

- We expect more than one year of battery life, but the actual amount depends on factors such as the data collection sampling rate.

Sensor Storage

- If the sensor will be stored for many months, we recommend that you remove the battery to avoid damaging the sensor in case of a battery leak.

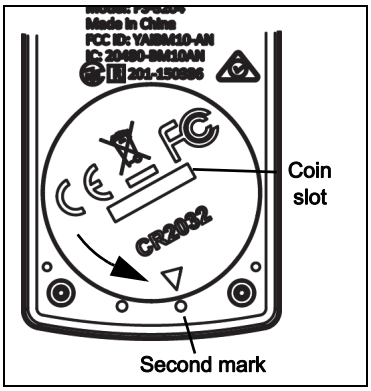
Battery Removal and Replacement

- If the sensor’s battery status LED blinks red, the battery may need to be replaced. Replacing the small, disk-shaped battery involves removing the Battery Compartment Cover on the bottom of the sensor, removing

the old battery, installing a new battery of the same type, and replacing the Battery Compartment Cover. The procedure needs a coin and a CR2032 three volt battery.

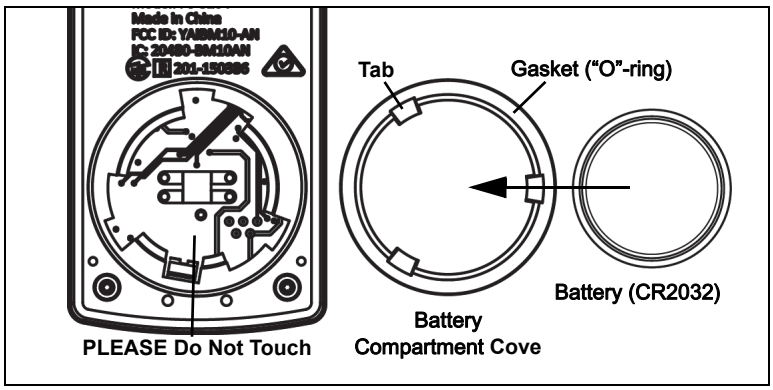
- (NOTE: This battery is available from PASCO and in electronic and commercial stores.)

Remove the Battery Compartment Cover



- Hold the sensor bottom-side up. Use a coin in the slot to turn the Battery Compartment Cover counterclockwise (left-to-right) until the indicator on the door is aligned with the second mark on the sensor.

- Turn the sensor bottom-side down so that the Battery Compartment Cover can drop into the palm of your hand. Make sure that the battery cover gasket stays on the cover. The gasket is an “O-ring” that is held in place by the tabs on the cover. Please do not touch the inside of the battery compartment



- Remove the used battery from the Battery Compartment Cover and replace it with a new identical type battery. Note that the battery is held in place by the small tabs on the cover. The side of the battery with the “+” on it should be against the cover.

Replace the Battery Compartment Cover

- Put the Battery Compartment Door with the new battery back onto the sensor. Align the indicator on the cover with the second mark, and use the coin in the slot to turn the cover clockwise (right-to-left) until the indicator is aligned with the first mark on the sensor.

(See “Battery Disposal Instructions” under Technical Support.)

Related Item

- Coin-cell Battery Replacement Pack (10 pack) - PS-3504

See the PASCO web site at www.pasco.com for more information.

Troubleshooting the Wireless Temperature Link

- If the sensor loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly hold the button until the status LEDs blink, and then release the button

- 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 ten seconds and then release the button. Turn on the sensor in the usual way.

- In the software, turn Bluetooth off and then turn it back on. Retry.

Temperature Probe Maintenance

- Rinse and dry the temperature probe before putting the sensor away for storage.

Suggested Experiments

Practically any experiment that uses a temperature measurement can be done with the PS-3222 Wireless Temperature Link and the Fast Response Temperature Probe. In addition, the Wireless Temperature Link is designed to work with other PASCO temperature probes and with the TD-8595 Absolute Zero Sphere and the TD-8596A Ideal Gas Law Apparatus.

See the PASCO Web site at www.pasco.com/products/lab-manuals for more information about experiments.

Sensor Specifications

Wireless Temperature Link	
Range	-35°C to +135°C
Accuracy	±0.5° C
Resolution	0.05°C
Sample Rate	Up to 20 Hz

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)
877-373-0300 (U.S.)

Web: www.pasco.com

Email support@pasco.com

Check the PASCO website for the latest version of the instruction manual.

www.pasco.com/manuals

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www.pasco.com/legal.

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 (shown 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: Bluetooth Compatibility

Check 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 LX / LXi	All models
Android	Android 4.4 and later
Chrome OS	Chromebooks with Bluetooth 4.0
Mac OS X	Models introduced July 2011 or later[1]
Windows	Windows 7 and later (requires PS-3500 Adapter*)
Windows 10 Creator	All models

*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 some Windows computers, some 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 *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.

Appendix B: Calibration

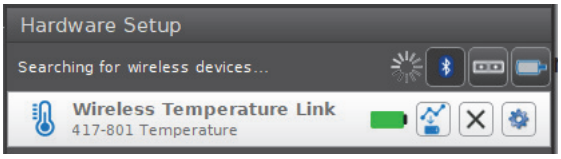
Calibration is not always necessary, especially if you are measuring a change in temperature rather than absolute temperature values. However, it is possible to calibrate the sensor.

Prepare for Calibration

Calibration will need an ice-water bath, a container of hot water, and a thermometer. The sensor will need to be "paired" with a tablet or computer, and the data collection software (for example, SPARKvue or Capstone) should be running.

Capstone Calibration

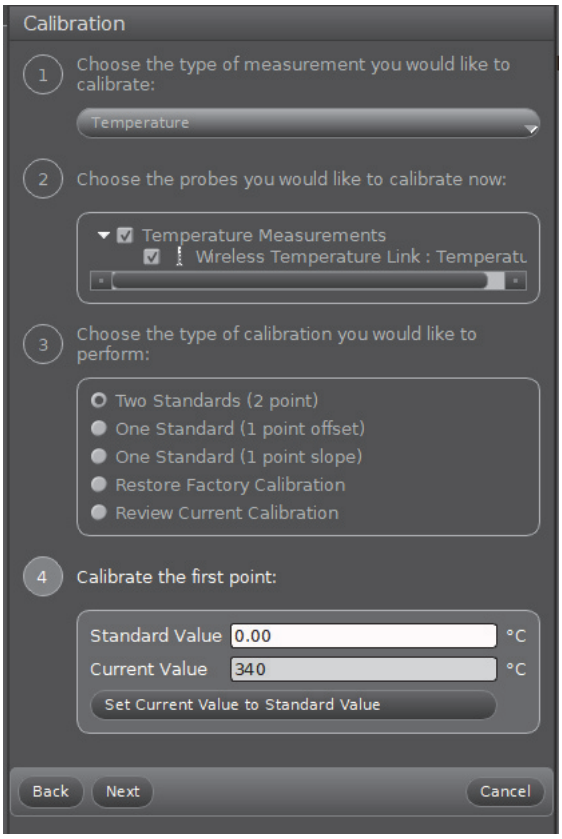
1. Turn on the sensor. Start Capstone. "Pair" the Wireless Temperature Link wirelessly to the computing device (e.g., computer) as explained earlier.



2. In Capstone, click the "Calibration" icon in the Tools palette to open the "Calibration" window. In Step 1, select the Temperature measurement and click "Next". In Step 2 the "Wireless Temperature Link" is picked by default. In Step 3, Two Standards (2 point) is the default choice. Click or touch "Next".

3. In Step 4, put the thermometer into the ice-water bath. Also put the end of the Fast Response Temperature Probe in the ice-water bath. When the "Current Value" stabilizes, enter the temperature reading in the "Standard Value" text box. Click "Set Current Value to Standard Value". Click "Next" to open Step 5.

4. In Step 5, move the thermometer and the Fast Response Temperature Probe to the container of hot water. When the "Current Value" stabilizes, enter the temperature reading in the "Standard Value" text box. Click "Set Current Value to Standard Value". Click "Next". Review the calibration and then click "Finish". Close the Calibration window.

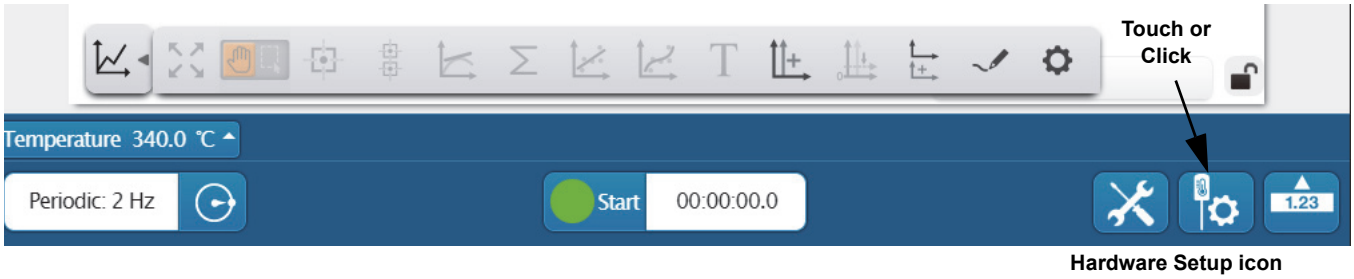


SPARKvue Calibration

1. Turn on the sensor and start SPARKvue.

2. In the "Welcome" screen, click or touch "Sensor Data" to open the "Sensor Data Configuration" screen. Connect (pair) the Wireless Temperature Link under "Connected Devices" as described earlier.

3. In the “Sensor Data Configuration” screen, touch or click the “Graph” in the Templates” part of the screen to open a graph display.

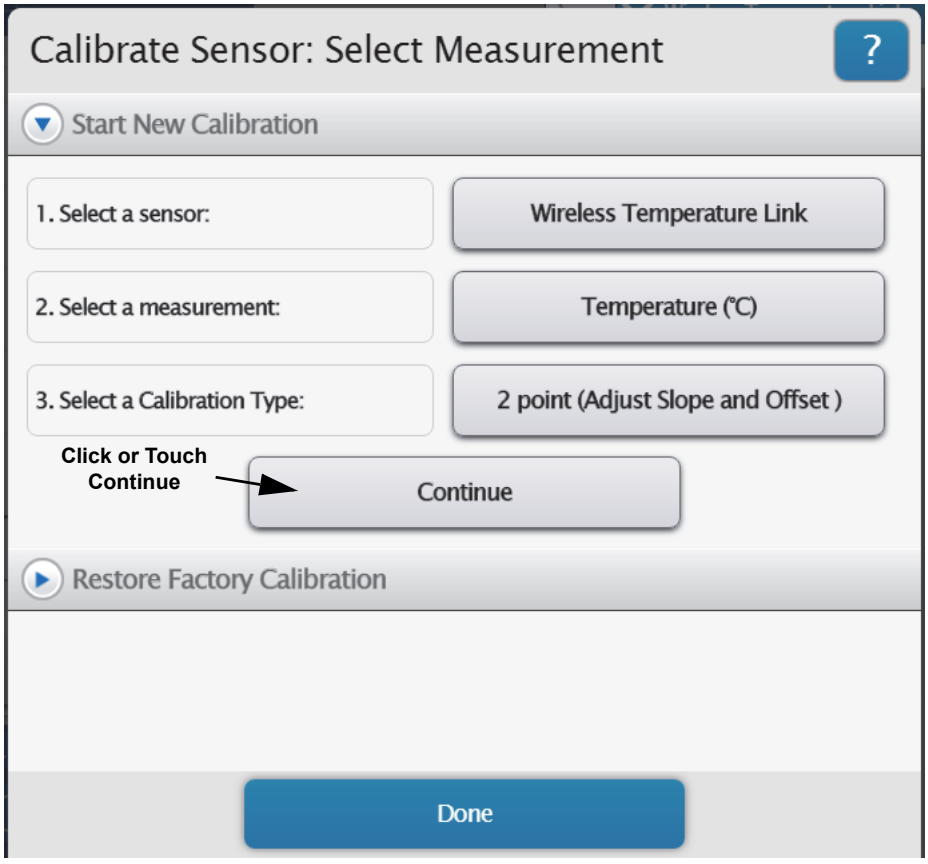


Hardware Setup icon

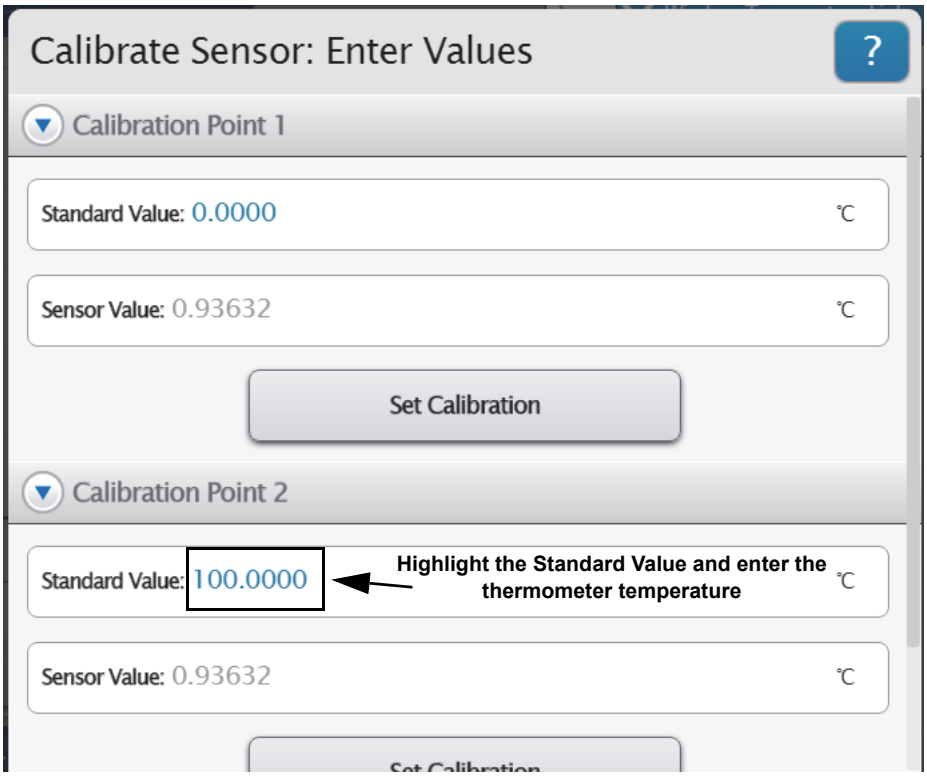
4. Below the Graph, touch or click the “Hardware Setup icon” to open the “Calibrate Sensor: Select Measurement” window.

- In this window, the sensor, measurement, and calibration type are already selected.

5. Click or touch “Continue” to open the “Calibrate Sensor: Enter Values” window.



6. Put the thermometer into the ice-water bath. Also put the end of the Fast Response Temperature Probe in the ice-water bath. When the “Sensor Value” stabilizes, click or touch the Set Calibration “button.



7. Move the thermometer and the Fast Response Temperature Probe to the container of hot water. When the "Sensor Value" stabilizes, highlight the Standard Value and enter the temperature from the thermometer in the text box. Click or touch "Set Calibration". Check the New Calibration and click or touch "OK" to return to the graph display.

Theory of Calibration

One of the functions of the PASCO Data Collection Software (SPARKvue or PASCO Capstone) is to take the stream of raw data from a sensor and transform it into the calibrated data that you see in the Graph, Table, and other displays. If you do not calibrate a sensor yourself, the software uses a default calibration that is loaded when the sensor is connected.

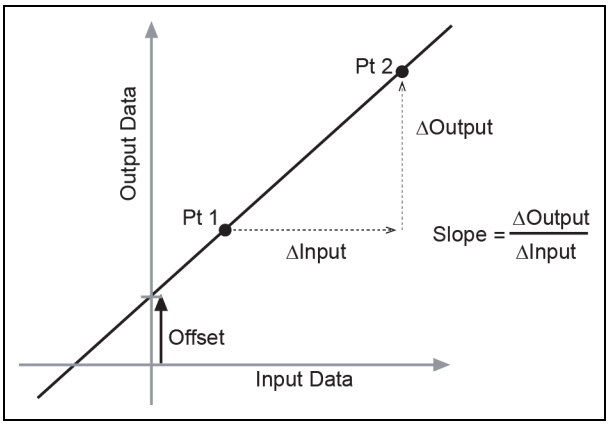
You can think of the software as taking in raw data and outputting calibrated data. When you perform a calibration, the software redefines the linear equation that transforms the raw input data into the calibrated output data. The linear function is of the form:

Calibrated Output = Slope x Raw Input + Offset

Or:

Raw Input = (Calibrated Output- Offset)/Slope

The function can be represented graphically as a line.



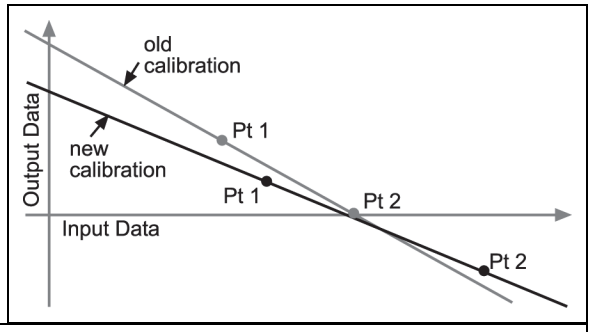
Two points, Pt 1 and Pt 2, define the line. In the two-point calibration procedure, each point is reset by associating a known standard value (for instance, the temperature of ice water) with a raw input measurement that the sensor sends out when it is in that standard. In a one-point calibration, only one of the points is reset by the user.

Types of Calibration

There are three types of calibration: two-point, one-point slope, and one-point offset. Any of these calibrations can be performed on a single sensor, or simultaneously on multiple similar sensors; however, for any given sensor, the software will automatically select the most typical calibration type as the default setting.

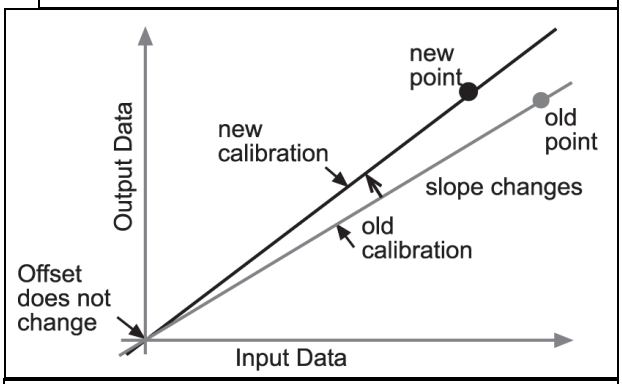
Two-Point

In a two-point calibration, you reset two points to define a new line. This type of calibration affects both the slope and the offset.

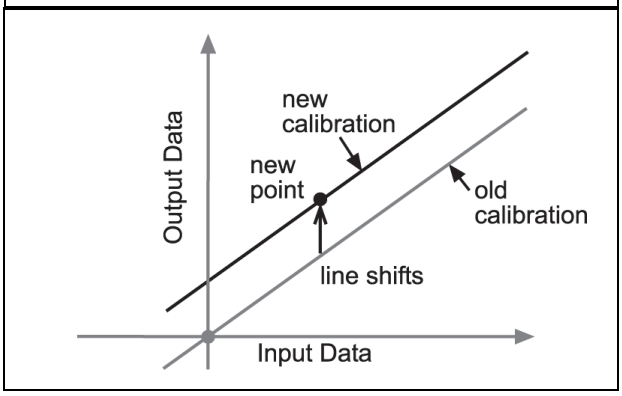


One-Point Slope

In a one-point slope calibration, you reset only one point. The slope of the line changes so that the line intersects the new point, while the offset (or Y-intercept) does not change.



One-Point Offset

In a one-point offset calibration, you reset only one point. The line shifts so that it intersects the new point, but its slope does not change.

Offset calibration is usually used to make one sensor agree with another sensor. Due to normal variation among probes, a second probe might read consistently higher than the first probe. Normally this difference would be insignificant; however, an offset calibration can be used to bring the sensors into closer alignment.