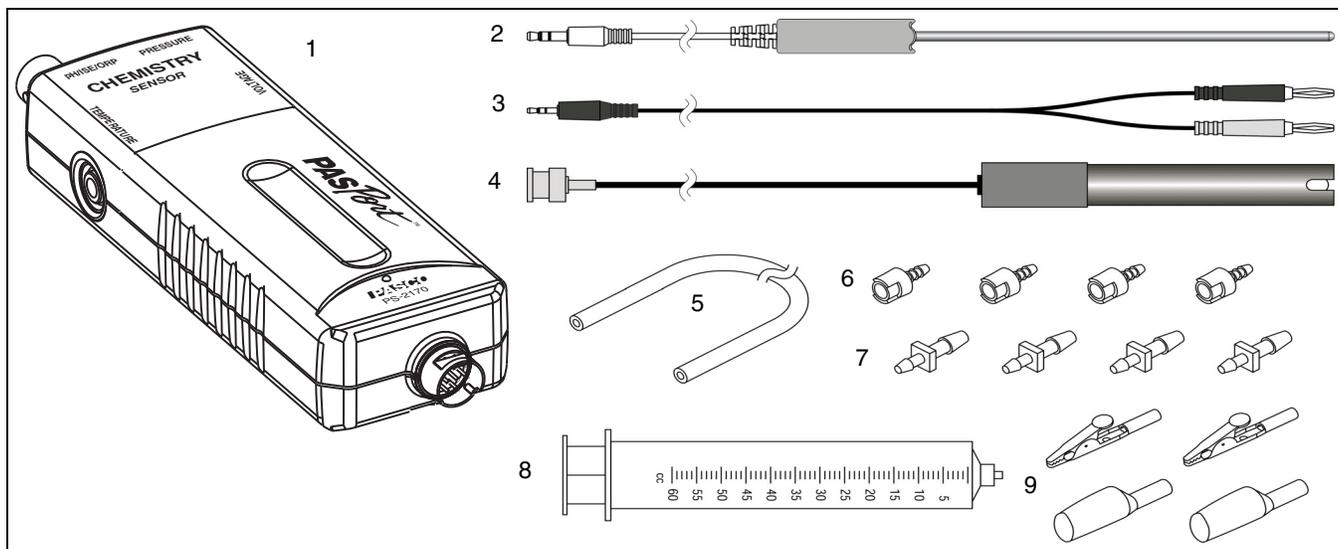


Chemistry MultiMeasure Sensor

PS-2170



Included Equipment

- 1. Chemistry MultiMeasure Sensor
 - 2. Stainless Steel Temperature Probe
 - 3. Voltage Probe
 - 4. pH Electrode
 - 5. Polyurethane Tubing (60 cm, 0.125 inch ID)
 - 6. Quick-release Connectors (qty. 4)
 - 7. Tubing Connectors (qty. 4)
 - 8. Syringe (60 cc)
 - 9. Alligator Clip with Insulator (qty. 2 each)
- Polyurethane Tubing, (blue, 15 cm, 0.25 inch OD) *not shown*

Model Number

- PS-2170
 - PS-2153
 - PS-2165
 - PS-2573
- Hose and Coupling Kit

Required Equipment

PASPORT Interface and
Data Acquisition Software

Note

See PASCO catalog or
www.pasco.com

Optional Equipment	Note
Fast-response Temperature Probe	PS-2135 (3-pack)
Skin/surface Temperature Probe	PS-2131
Various Ion-selective Electrodes (ISE)	See PASCO catalog or www.pasco.com
Oxidation Reduction Potential (ORP) Electrode	CI-6716

Introduction

The PS-2170 Chemistry MultiMeasure Sensor combines four sensors in a single unit:

- Temperature
- Absolute gas pressure (built-in)
- pH, ORP, and ion-selective electrode voltage
- Voltage

The sensor includes a temperature probe, a voltage probe, and a pH electrode. The pressure sensing element does not use an external probe. The sensor comes with alligator clips and insulators, a syringe, blue polyurethane tubing, and a Hose and Coupling Kit.

When connected to a PASPORT interface, the multi-sensor collects data at up to 100 samples per second from each component sensor. You can use just one component sensor at a time or any combination simultaneously. If you have a PASPORT interface that supports multiple sensors, or if you have more than one interface connected to your computer, you can use the Chemistry MultiMeasure Sensor in combination with other PASPORT sensors.

Sensor, Interface, and Software Setup

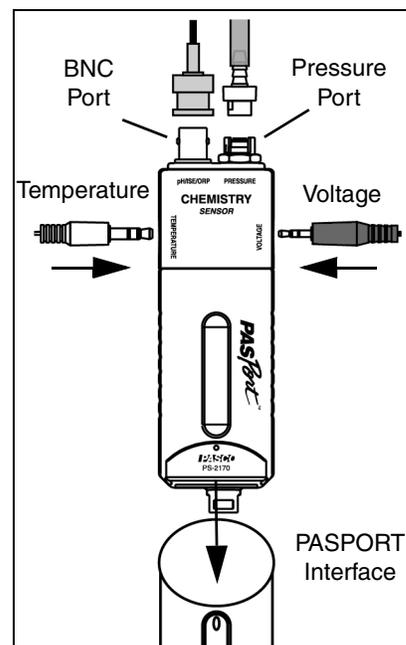
Connect the multi-sensor to your PASPORT interface as pictured (right). Connect any or all of the included probes to the multi-sensor. (You can leave any of the probes disconnected if you do not plan to use it.) If you will be using a pH Electrode (included) or an ion-selective electrode or oxygen reduction potential electrode, connect it to the pH/ISE/ORP port (BNC port). Align the grooves of the BNC connector on the probe with the pins on the BNC port. Push the connector onto the port and turn the connector clockwise until it locks in place. If you plan to measure pressure in an apparatus or the included syringe, connect it to the sensor's pressure port using the included clear tubing and a quick-release connector.

For detailed information about each of the multi-sensor sensor's component sensors see pages 4–6.

Follow the instructions in the Computer Setup section to set up the sensor with a PASPORT-compatible interface connected to a computer using PASCO Capstone or SPARKvue HD software.

Follow the instructions in the Wireless Setup section to set up the sensor with a mobile device such as a tablet or smart phone using a wireless interface such as the AirLink2 or SPARKlink and the SPARKvue HD software

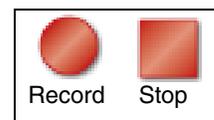
Follow the instructions in the Hand-Held Setup section to set up the sensor with a SPARK Science Learning System (SPARK SLS) or the Xplorer GLX hand-held data-logger.



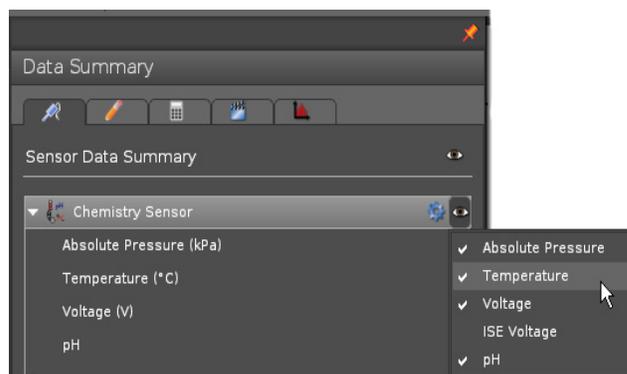
Computer Setup

Using PASCO Capstone

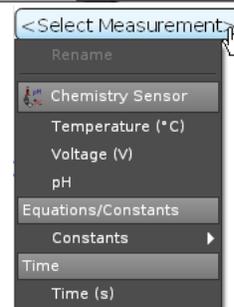
- Connect a PASPORT-compatible interface to the computer and start the PASCO Capstone software. (Refer to the documentation that came with your PASPORT interface for instructions on connecting it to your computer.) In Capstone, click the Record button to begin data collection; click the Stop button to stop data collection.



- Note that the sensor may collect data for probes that are not connected. To hide measurements that you do not need, click the Data Summary icon (📊) in the Tools palette to open the Sensor Data Summary panel. Click the Visibility icon (👁) to view the menu of parameters. Check or un-check the measurements as needed. Click the Data Summary icon again to close the panel.

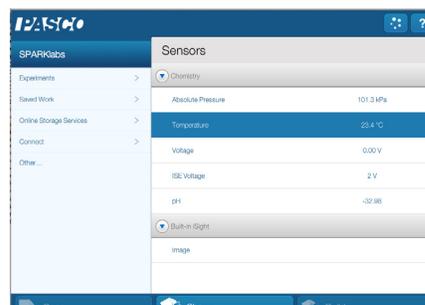


- In the Workbook page, click one of the configured display combinations, or drag icons from the Displays palette into the Workbook page. In a display, click the “<Select Measurement>” menu to view the sensor parameter choices. Click a parameter in the menu to set the measurement for that display.



Using SPARKvue HD

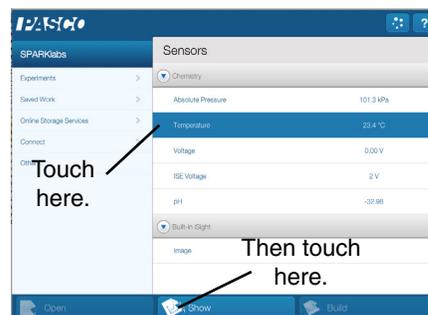
- Connect a PASPORT-compatible interface to the computer and start the SPARKvue HD software. (Refer to the documentation that came with your PASPORT interface for instructions on connecting it to your computer.) In SPARKvue HD, the opening screen shows the list of measurements for the sensor. For example, click “Temperature” and then click “Show” to open a Graph display screen.
- In the Graph display screen, click the green Record button (▶) to begin recording data. Click the red Stop button (⏹) to stop recording data.



Wireless Setup

Using SPARKvue HD

- Use the SPARKvue HD software to pair a mobile device such as a tablet or smart phone to a PASCO wireless interface such as the AirLink2 or SPARKlink Air. (Refer to the documentation that came with your PASCO wireless interface for instructions on connecting it to your mobile device.)
- Connect the sensor to the wireless interface. In SPARKvue HD, the opening screen shows the list of measurements for the sensor. For example, touch “Temperature” and then touch “Show” to open a Graph display screen.
- In the Graph display screen, touch the green Record button (▶) to begin recording data. Touch the red Stop button (⏹) to stop recording data.



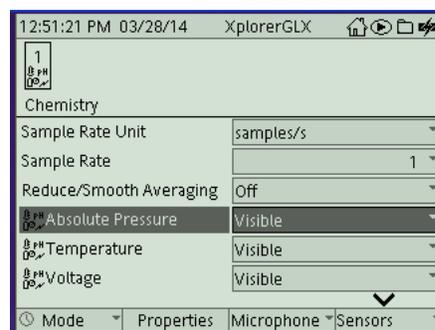
Hand-held Setup

Using the SPARK SLS

- Connect the sensor to a port on the SPARK SLS and turn on the interface. The sensor parameter screen opens and shows the list of measurements for the sensor.
- In the sensor parameter screen, touch or click the measurement, and then touch ‘Show’ to open a graph display of the measurement.
- Touch “Start” (▶) to begin recording data. Touch “Stop” (◻) to stop recording data.

Using the Xplorer GLX

- Turn on the interface and connect the sensor to a port on the top. A Digits display of Absolute Pressure (kPa) and Voltage (V) opens automatically and shows the data being monitored.
- Press the **Start/Stop** key (▶) to begin recording data. Press the same key again to stop recording.
- Note that the sensor may collect data for probes that are not connected. Hide or ignore these measurements. To hide measurements that you do not need, open the Sensors screen (from the Home screen, press (F4)). In the Sensors screen, use the up or down cursor keys to highlight a measurement. Press “Check” (⊙) to change the visibility of that measurement. (You can also change the sampling rate and open the calibration dialog box from the Sensors screen.)



Calibration Information

See the Appendices for detailed information about calibrating the sensor.

Temperature

Use this component of the multi-sensor to measure the temperature of a fluid or object. The measurement can be displayed in units of °C, °F, or K. You can use the included stainless steel probe or a different probe, such as the Fast-response Temperature Probe (PS-2135) or Skin/Surface Temperature Probe (PS-2131). PASCO apparatus containing an embedded 10 kΩ thermistor can also be connected to the multi-sensor. The multi-sensor automatically detects the presence of a temperature probe, and it will only collect temperature data if a probe is connected.

Measuring Temperature

To measure temperature, connect the probe and start data collection. Immerse the tip of the probe in a fluid or place it in contact with an object. The stainless steel probe can be used in both dry conditions and in liquids, such as water and other mild chemicals and solutions*. The included blue polyurethane tubing allows the stainless steel probe to fit inside a standard 0.25” diameter stopper hole.

Tip: For better chemical resistance, use a Teflon® cover (CI-6549).

Temperature Calibration

The temperature measurement can be calibrated; however, for most applications calibration is not necessary. Use a two-point calibration with two standards of known temperature. For instructions on calibrating the sensor, see the Appendices.

pH/ISE/ORP

The pH/ISE/ORP input of the multi-sensor is a specialized voltage sensor. Its BNC connector accepts the included pH electrode, as well as ion selective electrodes (ISE) and oxygen reduction potential (ORP) electrodes. The sensor measures the voltage produced by any of these electrodes. When used with a pH electrode, the sensor also computes the pH based on the measured voltage.

Connect the pH electrode (or other electrode) to the pH/ISE/ORP port and start data collection. On your computer or interface, display the **ISE Voltage** measurement (this measurement is valid for pH and ORP electrodes as well as ISE) or the **pH** measurement for the calculated pH (assuming that the pH electrode is connected).

Measuring pH

The pH electrode produces a voltage proportional to the pH of the solution that it is immersed in. This voltage is measured by the multi-sensor, which computes pH.

Unscrew and remove the storage bottle from the electrode (be careful not to spill the storage solution). Push the O-ring and bottle cap up the electrode handle. Rinse the electrode tip with distilled water. If you see bubbles in the electrode bulb, gently shake the electrode downward (similar to shaking down a thermometer). Start data collection. Place the tip of the electrode in the solution to be measured and wait for the reading on your computer or interface to stabilize. Rinse the electrode with distilled water before measuring another solution.

pH Calibration

The pH measurement can be calibrated; however, for most applications calibration is not necessary. Perform a two-point calibration with two buffer solutions of known pH. For instructions on calibrating in the sensor for pH, see the Appendices.

pH Electrode Maintenance and Storage

Cleaning

If the pH electrode becomes contaminated, use one of these methods to clean and restore it. After any of these procedures, rinse the electrode with deionized water and soak the electrode in the electrode storage solution for 1 hour.

- **General Cleaning:** Soak the electrode in 0.1 molar hydrochloric acid (HCl) or 0.1 molar nitric acid (HNO₃) for 30 minutes.
- **Bacterial Growth:** Soak the electrode in a 1:10 dilution of household laundry bleach for 15 minutes.
- **Protein Deposits:** Soak the electrode in a solution of 1% pepsin in 0.1 molar HCl for 15 minutes.
- **Inorganic Deposits:** Soak the electrode in 0.1 molar tetra sodium EDTA (ethylenediaminetetra-acetic acid) solution for 15 minutes.
- **Oil and Grease Film:** Wash the electrode carefully in a mild detergent or a solvent known to be effective for the particular film.
- **Unknown Contamination:** Soak the electrode alternately in 1 molar sodium hydroxide (NaOH) and 1 molar HCl. Leave it in each solution for one minute. Rinse completely between soakings. End with HCl. (The NaOH etches the glass and the HCl reestablishes hydrogen ions on the surface.)

If these steps fail to improve the response of the electrode, replace it with a PS-2573 pH Electrode (or equivalent).

Storage

Store the pH electrode in the included electrode storage bottle with one of the following solutions. (Never store the electrode in distilled water.)

- **Short-term** (up to one week): pH 4 buffer solution or tap water.
- **Long-term** (over one week): pH 4 buffer solution with 1 g per 100 mL of potassium chloride (KCl) added.

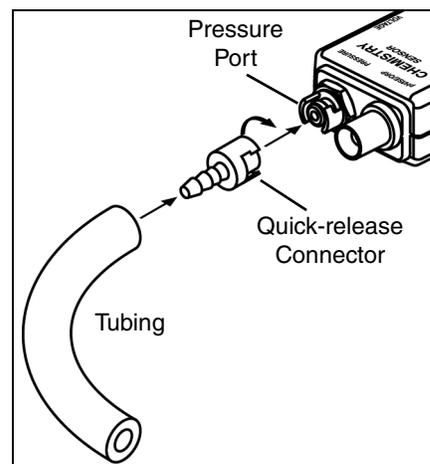
Pressure

This component of the multi-sensor measures absolute gas pressure from 0 kPa to 700 kPa. The measurement can be displayed in units of kPa, N/m^2 , pounds per square inch (p.s.i.), atmospheres (atm), or torr.

With nothing connected to the pressure port, the sensor measures atmospheric pressure (about 101 kPa).

To measure the pressure in an apparatus or the included syringe, connect it to the sensor using the included tubing and connectors. Insert the barbed end of a quick-release connector into a piece of tubing. Push the quick-release connector onto the sensor's pressure port and twist it clockwise to secure it. If your apparatus has a barbed or tapered connector (such as the included syringe), plug it directly into the other end of the tubing. If the apparatus has a quick-release pressure port, use another quick-release connector on the other end of the tubing. Use one of the included tubing connectors to connect the tubing to larger-diameter tubing or to a rubber stopper with a hole.

Note: Do not allow liquid to enter the pressure port.



Voltage

Use the voltage component of the multi-sensor to measure electric potential difference between the terminals of a battery or power supply, or two points on a circuit. The voltage probe has two connectors: red and black, and two alligator clips with insulators. The sensor measures the voltage of the red connector in reference to the black connector. Its range is ± 10 V.

Specifications

General	
Component Sensors	Temperature, pH/ISE/ORP probe voltage, Absolute Pressure, Voltage
Max. Sampling Rate	100 samples per second (for each component sensor)
Default Sampling Rate	10 samples per second
Temperature	
Range	$-35\text{ }^{\circ}\text{C}$ to $+135\text{ }^{\circ}\text{C}$
Accuracy	$\pm 0.5\text{ }^{\circ}\text{C}$
Resolution	0.01 $^{\circ}\text{C}$ or better
Sensing Element	10 k Ω thermistor located in probe tip
pH/ISE/ORP probe voltage	
Electrode Connector	standard BNC
Voltage Range	-2000 mV to $+2000\text{ mV}$
Voltage Resolution	0.1 mV
pH Range	0 to 14
pH Resolution	0.001
Absolute Pressure	
Range	0 kPa to 700 kPa
Accuracy	2 kPa
Resolution	0.1 kPa
Repeatability	1 kPa

Voltage	
Range	-10 V to + 10 V
Accuracy	± 0.1 V
Resolution	± 0.04 mV
Voltage Protection	up to 240 V
Input Resistance	2 M Ω

Appendix A: PASCO Capstone Calibration

In PASCO Capstone, click the Hardware Setup icon in the tools palette to open the Hardware Setup panel. Confirm that the icon of the sensor appears with the icon of the interface being used. Click the Hardware Setup icon again to close the panel. Click the Calibration icon (🌐) in the Tools palette to open the Calibration panel. For a two-point calibration, you will need two “known standards,” such as two buffer solutions of known pH or two liquids of known temperature, such as ice water and hot water. For temperature calibration, a standard thermometer will also be needed.

1. The first step in the Calibration panel is to choose the type of measurement you would like to calibrate. The default for the Chemistry sensor is “Temperature”. The other choice on the menu is “pH”. Click “Next”.
2. In the second step, the temperature probe is automatically selected (if the default measurement is kept). Move to the third step.
3. The third step in the panel is to choose the type of calibration. “Two Standards (2 point)” is the default. Click “Next”.
4. The fourth step in the panel is to calibrate the first point. The “Standard Value” shows 0.00 °C. (This Standard Value can be changed if necessary. Highlight the “Standard Value” and enter a new value if needed). For this example, put the temperature probe into a “known standard” of ice water. Click “Set Current Value to Standard Value” and then click “Next”.
5. The fifth step in the panel is to calibrate the second point. The “Standard Value” shows 100 °C. For this example, put the temperature probe into a “known standard” of hot water along with the thermometer. Highlight the “Standard Value” and enter the temperature from the thermometer. Click “Set Current Value to Standard Value” and then click “Next”.
6. The sixth step in the panel is to review and accept the calibration information. Click “Back” to return to a previous step. Otherwise, click “Finish”. The first step in the panel appears again. Follow the same procedure to calibrate for another type of measurement.
7. Click the Calibration icon in the Tools palette to close the Calibration panel.

Calibration

- 1 Choose the type of measurement you would like to calibrate:
 Temperature
- 2 Choose the probes you would like to calibrate now:
 Temperature Measurements
 Chemistry Sensor, Ch P1 : Temperat
- 3 Choose the type of calibration you would like to perform:
 Two Standards (2 point)
 One Standard (1 point offset)
 One Standard (1 point slope)
 Restore Factory Calibration
 Review Current Calibration
- 4 Calibrate the first point:
 Standard Value 0.00 °C
 Current Value 0.152 °C
 Set Current Value to Standard Value
- 5 Calibrate the second point:
 Standard Value 100 °C
 Current Value 99.9 °C
 Set Current Value to Standard Value
- 6 Review your calibration and accept:

Chemistry Sensor, Ch P1		
Temperature		
Old Calibration		
Slope	1.00	°C/Units
Offset	0.00	Units
Live Value	76.6	°C
New Calibration		
Slope	1.30	°C/Units
Offset	-1.23	Units
Live Value	98.1	°C

Back Finish Cancel

Appendix B: SPARKvue HD Calibration

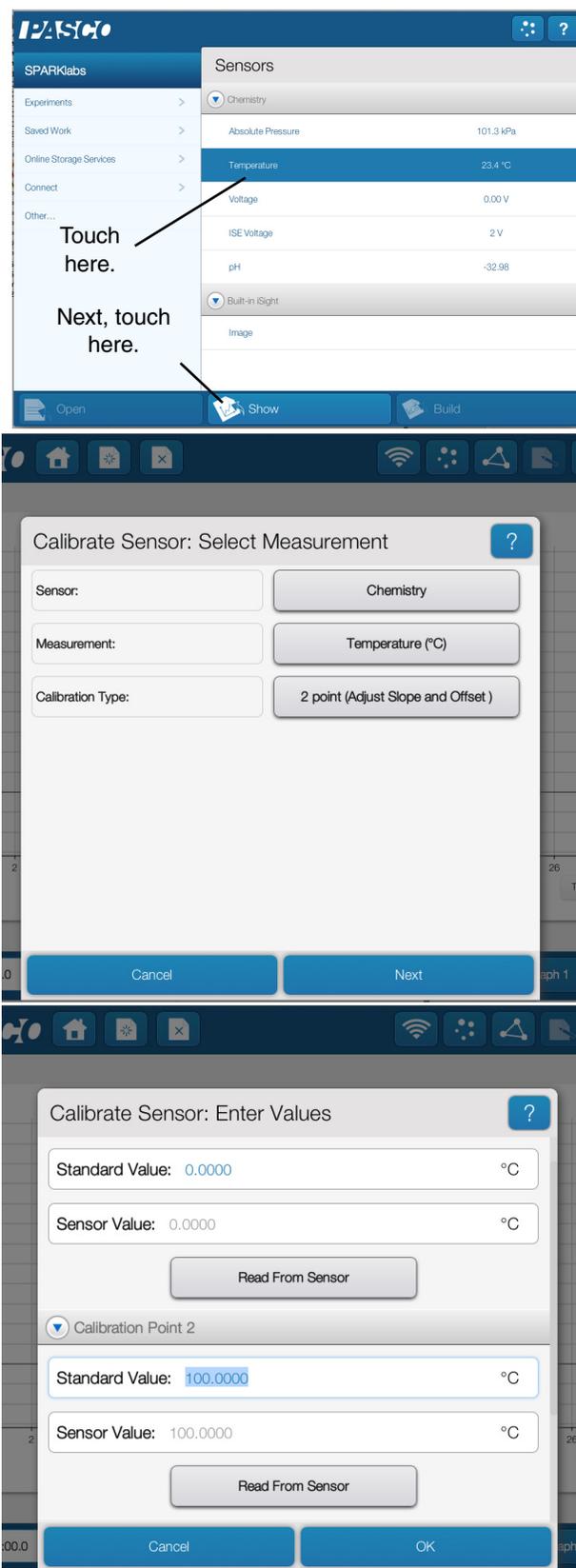
You can use the SPARKvue HD software if you are using the Chemistry MultiMeasure Sensor with a PASPORT-compatible interface connected to a computer, or with a mobile device paired with a PASCO wireless interface, such as the AirLink2 or SPARKlink Air.

If the sensor is connected to a PASPORT-compatible interface, start the SPARKvue software on the computer. If the sensor is connected to a SPARK SLS interface, start the interface.

For a two-point calibration of the Temperature probe, you will need two “known standards,” such as two liquids of known temperature, such as ice water and hot water. A standard thermometer will also be needed.

After startup, the screen will show the list of measurements for the Chemistry Sensor.

1. Touch “Temperature” and then touch “Show”.
 - The screen will show a Graph display of temperature and time.
2. Touch the “Experiment Tools” icon () in the Graph display screen to open the Experiment Tools menu. In the Experiment Tools menu, touch “Calibrate Sensor”.
 - The screen will show “Calibrate Sensor: Select Measurement”. The Sensor (Chemistry), Measurement (Temperature (°C)), and Calibration Type (2 point) are already selected.
3. Click “Next” to open the “Calibrate Sensor: Enter Values” screen.
4. The Calibration Point 1 “Standard Value” shows 0.0000 °C. (This Standard Value can be changed if necessary. Highlight the “Standard Value” and enter a new value if needed). For this example, put the temperature probe into a “known standard” of ice water. Wait a few moments. Click “Read From Sensor”.
 - The screen of the Graph display returns.
5. The Calibration Point 2 “Standard Value” shows 100.0000 °C. For this example, put the temperature probe into a “known standard” of hot water along with the thermometer. Wait a few moments and read the temperature on the thermometer. Highlight the “Standard Value” and enter the temperature from the thermometer. Next, click “Read From Sensor” and then click “OK”.
 - Follow the same procedure to calibrate pH. Use two buffer solutions of known pH value, such as pH 4 and pH 7.

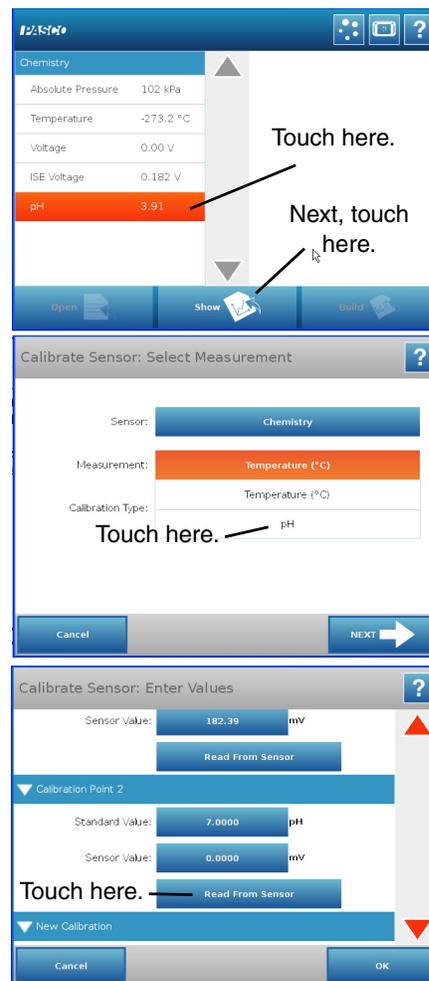


Appendix C: SPARK SLS Calibration

For a two-point calibration of the pH Probe, you will need two “known standards,” such as two buffer solutions of pH 4 and pH 7. If the sensor is connected to a SPARK SLS interface used as a standalone data-logger, start the interface.

After startup, the SPARK SLS screen will show the list of measurements for the Chemistry Sensor.

- For this example, touch “pH” and then touch “Show”.
 - The screen will show a Graph display of ‘pH’ and Time.
- Touch “Experiment Tools” () to open the Experiment Tools screen.
- In the Experiment Tools screen, touch “Calibrate Sensor” to open the Calibrate Sensor screen. The screen shows the Sensor (Chemistry), the Measurement (the default is “Temperature”), and the Calibration Type (2 point (Adjust Slope and Offset)). Touch “Temperature” and then touch “pH” from the menu to change the Measurement. Touch “Next” to open the “Calibrate Sensor: Enter Values” screen.
- For Calibration Point 1, place the sensor’s probe into the first “known standard”, such as the pH 4 buffer solution. Wait a few moments and then touch “Read From Sensor”. Carefully rinse the probe in distilled water.
- For Calibration Point 2, touch the down arrow () to scroll down to the bottom of the screen. Place the probe’s sensor into the second “known standard”, such as the pH 7 buffer solution. Wait a few moments and then touch “Read From Sensor”. Rinse the probe in distilled water.
- Click “OK” until the screen of the Graph display returns.

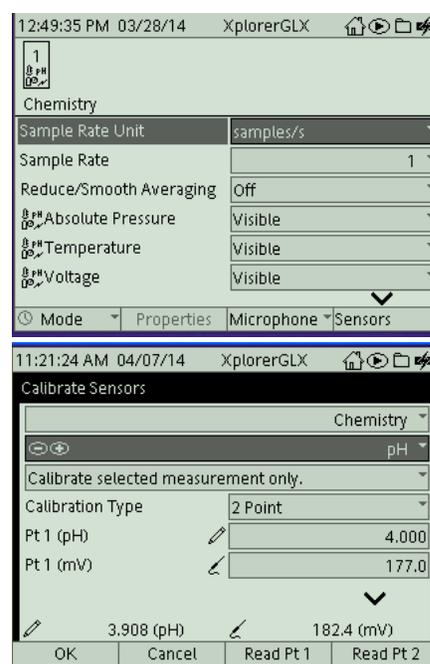


Appendix D: Xplorer GLX Calibration

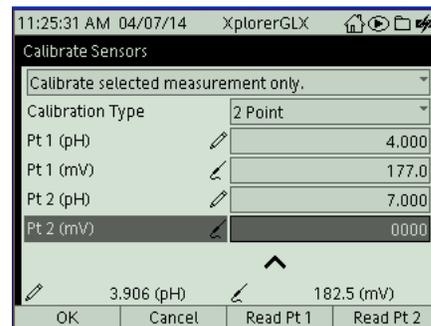
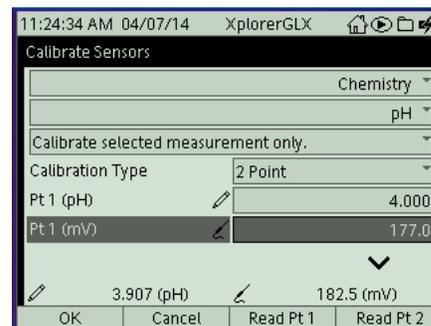
For a two-point calibration of the pH Probe, you will need two “known standards,” such as two buffer solutions of pH 4 and pH 7.

If you are using the Chemistry Sensor with the Xplorer GLX in standalone mode, connect the sensor to one of the ports on the top of the Xplorer GLX and turn the interface on.

- Optional: Go to the Home Screen (), Press F4 () to go to the Sensors screen. Use the down arrow () and the “Check” button () to change the visibility of the measurements as needed.
- Press F4 () again to open the Sensors menu. Use the down arrow () to select “Calibrate” and press “Check” ().
 - The Calibrate Sensors screen shows the sensor (Chemistry) and the default Measurement (Temperature (°C)). Use the down arrow () to select “Temperature”. Press “Check” () to change the measurement to “pH”. The Calibration Type should be “2 Point”. (If not, use the down arrow to highlight “Calibration Type” and press “Check” () to select “2 Point” from the menu.)



3. Use the down arrow (∇) to highlight “Pt 1 (mV)”. (NOTE: If you need to change the Standard Value, highlight Pt 1 (pH), press “Check”, and use the keypad to enter the correct Standard Value.)
4. Put the Chemistry Sensor’s pH Probe into the first “known standard” (pH 4 buffer solution). Wait a few moments and then press F3 ($F3$) to “Read Pt 1”.
5. Use the down arrow to scroll down to the second calibration point, Highlight “Pt 2 (mV)”. Put the Chemistry Sensor’s pH Probe into the second “known standard” (pH 7 buffer solution). Wait a few moments and then press F4 ($F4$) to “Read Pt 2”.
6. Press F1 ($F1$). “OK”, to return to the Sensors screen.
7. In the Sensors screen, press \leftarrow to return to the Home Screen.



Technical Support

For assistance with any PASCO product, contact PASCO at:

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

Phone: 916-462-8384 (worldwide)
877-373-0300 (U.S.)

Web: www.pasco.com

Email: support@pasco.com

Limited Warranty

For a description of the product warranty, see the PASCO catalog.

Copyright

The PASCO scientific 012-09523B *Chemistry MultiMeasure Sensor Instruction Manual* is copyrighted with all rights reserved. Permission is granted to non-profit educational institutions for reproduction of any part of this manual, providing the reproductions are used only in their laboratories and classrooms, and are not sold for profit. Reproduction under any other circumstances, without the written consent of PASCO scientific, is prohibited.

Trademarks

PASCO, PASCO scientific, PASCO Capstone, MultiMeasure Sensors, PASPORT, SPARK Science Learning System, SPARKvue, and Xplorer GLX are trademarks or registered trademarks of PASCO scientific, in the United States and/or in other countries. All other brands, products, or service names are or may be trademarks or service marks of, and are used to identify, products or services of, their respective owners. For more information visit www.pasco.com/legal. Teflon is a registered trademark of DuPont.

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.

