

## Standard Operating Procedure (SOP):

### pH Electrodes

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Figure 1 pH Electrode.



### Safety Warning:

- The electrode does not contain hazardous materials. Flush eyes or skin with plenty of water as a precaution should the electrode leak. Filling solution in the electrode is 30% KCL, 70% water.

**Note:** Handle the electrode with care. Dropping the electrode may result in damaging the electrode, contamination and/or inaccurate measurements.

**Always gently stir or use a stirrer when measuring.** Leaving the electrode still will displace ions in the solution, and cause incorrect readings.

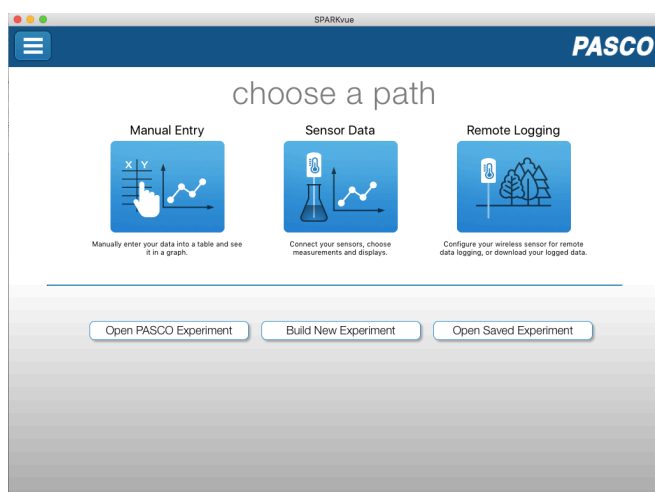
### Procedure:

*The pH Electrode consists of an electrode body containing a liquid internal filling solution in contact with a gelled organophilic membrane containing an ion exchanger. When the membrane is in contact with a solution containing free hydrogen ions, an electrode potential develops across the membrane. This electrode potential is measured against a constant reference potential, using an ISE Amplifier such as the PASCO PS-3204 Wireless pH amplifier.*

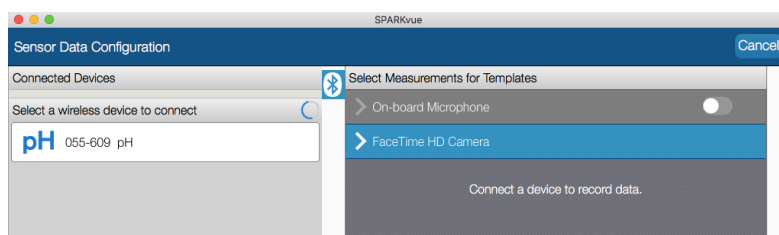
1. The electrode is permanently filled with filling solution. Check that liquid can be seen in the electrode. Very gently shake the electrode downward in the same manner as a clinical thermometer to remove any small air bubbles that may be trapped behind the membrane. A single large bubble is ok. Prior to first usage, or

after long term dry storage, immerse the pH electrode in a mix of pH 4 buffer that contains 1 g of potassium chloride (KCl) per 100 mL of solution for at least 24 hours. The electrode is now ready for use.

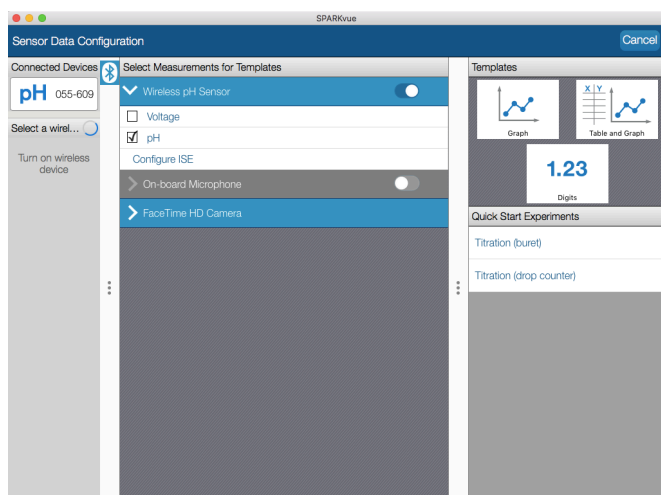
2. Attach the pH electrode to the BNC connector of the pH sensor, turn the pH amplifier or interface on and set aside to warm up for about 5 minutes.
3. Prepare two pH standards that cover the upper and lower levels of the intended measurements. For a more general calibration, standards of pH 4 and pH 10 are recommended. *Note: These standards may be pre-prepared.*
4. Pour a small amount of the most acidic standard (pH 4 for general calibration) into a 150 mL beaker to a depth of around 2 cm. Pour a similar amount of the other standard (pH 10 for general calibration) into a second 150 mL beaker to a depth of 2 cm
5. Start “Sparkvue” on your device. Click the central big button labeled “Sensor Data” to begin.



6. Connect your sensor or interface. If the sensor is connected by USB it will appear as an available sensor in the middle list. If connecting by Bluetooth, the sensor will appear in the list of available unconnected sensors. The closest to you should be at the top of the list and can be confirmed by the unique digit code embossed on the top of the sensor



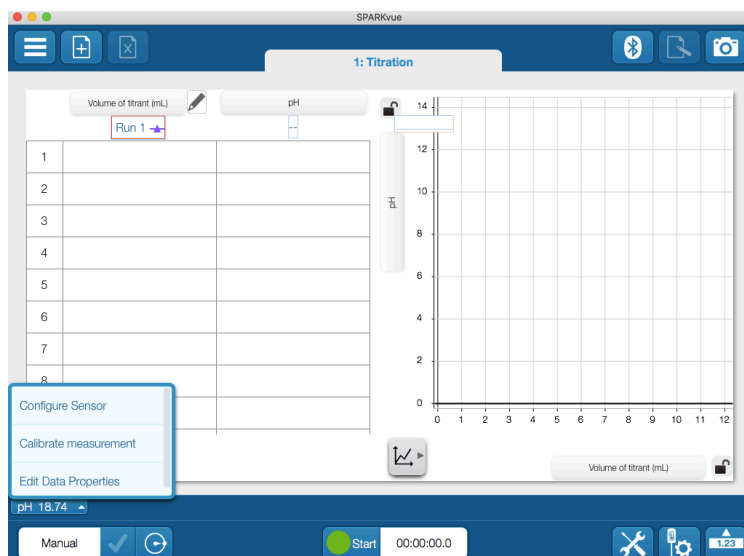
7. Tap on the corresponding device to connect. This may take a few seconds.



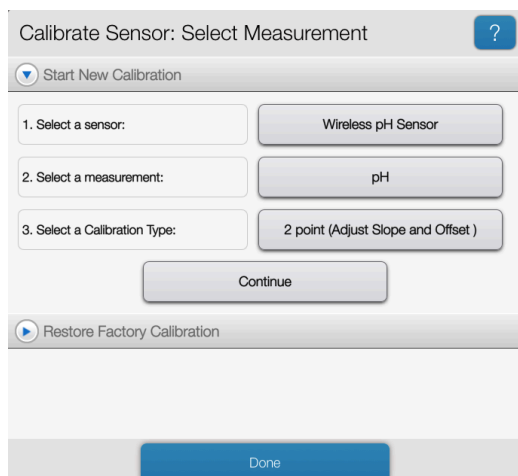
*Note: If the sensor doesn't appear in the list of available devices check that it is on and that the Bluetooth indicator on the device is flashing red. Flashing green indicates that it is already connected to another device. Turn it off and back on to disable other connections.*

*Note: Sparkvue may display a message indicating that the amplifier firmware needs updating. Tap "Cancel" to continue to connect.*

8. Once connected, the pH sensor will appear in the list of connected devices. Click on the relevant display icon or Quick Start Experiment to complete set up.
9. To calibrate the pH electrode, tap on the small digital read out of pH at the bottom of the screen. The "calibrate measurement" option will be listed in the pop up menu




From the sensor list, choose the pH sensor you have connected. For multi-sensors, choose the option for pH.



The screen will default to a 2-point calibration. Click “Continue” to proceed to the calibration screen.

10. In the calibration screen, type in the pH of the first standard. *A value of 4 has been pre-entered to assist. Change this, where necessary, to match the value of the standard you are using.*



11. Swirl the electrode gently in the solution for a few seconds then tap on “Set Calibration”.
12. Now do calibration Point 2. Tap on the arrow at left to display the entry screen. Enter the concentration of the second pH standard. *A value of 10 has been pre-entered to assist. Change this, where necessary, to match the value of the standard you are using.*

13. Pour the second standard solution into a 150ml beaker to a depth of approximately 2 cm. Rinse the electrode in distilled water, blot dry, and immerse the electrode tip in the standard. Stir gently for a few seconds or until the sensor value is reasonably stable (it won't sit on exactly the same value) then click on "Set Calibration". Click OK when done. The sensor is now calibrated and ready for use.
14. To save the calibration for later use:  
**Wireless pH:** The calibration for the calibration is stored on the sensor box. Make sure that the sensor and electrode are kept together. The calibration will be automatically restored next time the sensor/electrode pair are used. If the electrode is changed then the calibration process should be repeated.  
**PASPort blue pH sensors:** The calibration is stored in the currently open Sparkvue file. Save this file for later use with this electrode.
15. You are now ready to measure the samples supplied. Tap on the green "Start" button to start and stop recording for each sample in turn or use the options provided in the Sparklab to complete a titration or other measurement of pH change.

## Measuring Hints

1. All samples and standards should be at a similar temperature for precise measurement. Small differences (such as during an exothermic or endothermic reaction will not affect comparisons). For solutions at significantly higher, or lower, temperatures redo the calibration.

2. The sensing membrane may show some black precipitate which looks like mould. To test this, place the sensor in ~150 mL of warm water and let it sit in the warm water for 15-20 minutes. If the amount of suspected mould has decreased or disappeared altogether, then it was in fact undissolved salt that is part of the gel mixture in the sensor's shaft.
3. Constant, but not violent, stirring is necessary for accurate measurement. Gentle, hand stirring or the use of a magnetic stirrer is recommended.
4. Always rinse the electrode with distilled water and blot dry between measurements. Use a clean, dry tissue to prevent cross-contamination.