SALS User Documentation

Introduction to the Submersible Audio Light Sensor or SALS

The Submersible Audio Light Sensor (SALS) application and handheld probe is a tool to be used in chemistry and other science laboratory classes when a qualitative indication of a change in light level is needed. This is done with an iOS® or Android™ device (iPhone®, iPad®, or Android, including the MATT Connect™) with the downloaded SALS app that is connected to the SALS probe via Bluetooth®. The probe comprises a glass wand covered entirely with black PVC except at the tip, where the light detector (photoresistor) is located. A conversion box is located at the other end of the wand, and this is where light levels are converted to Bluetooth network data. The probe tip is submersible in commonly used laboratory solutions held in beakers, test tubes or other transparent vessels in which the slim probe can be immersed, and a reaction can take place. If the light level within the vessel decreases, the tone produced by the conversion box and emitted by the connected device decreases in pitch (becomes lower). This can be demonstrated by simply placing the SALS probe into a dark place (like a drawer) after achieving tone output in ambient room lighting. If the light level within the vessel increases, the reverse will happen: the tone emitted by the device increases in pitch (becomes higher). This can be demonstrated by pointing the probe tip toward a light source such as a window or overhead room lighting. The sensor can be used to identify significant color differences in liquids or on the surfaces of solid objects in air (e.g., pH paper or different types of rocks). SALS is intended to be used by elementary, middle, and high school students as well as those attending college classes. Science teachers can also use the sensor to provide audio information in conjunction with visual science demonstrations that involve color or light level changes.

Note: The SALS app is fully functional using the iOS VoiceOver Screen Reader Utility and the Android TalkBack Screen Reader Utility.

How to download the SALS Application and use the Bluetooth Low Energy SALS Probe

The SALS probe is a low energy Bluetooth device which works with the SALS app downloaded to any iOS or Android device running **iOS version 14** or

later or **Android version 6** or later. To get the SALS app, open the Apple App Store® on the iOS device or Google Play® store on the Android device you will be using. Search for Submersible Audio Light Sensor and download it to your device.

To turn on the SALS probe, slide the switch on the conversion box away from the probe wand. Remember that the probe is still ON if the switch remains in the ON position and the probe DOES NOT automatically turn off. This feature of the SALS probe requires the user to remember to turn the switch to the OFF position (toward the probe wand) after the experiment or activity is complete in order to preserve battery charge.

To connect the probe to the SALS app, tap the Connect button in the lower left corner of the Home screen. When the probe is connected, the connect button changes to the Disconnect button. Tapping the Connect button brings you to a screen that lists all SALS probes that are within Bluetooth range (if there is more than one SALS device in the room that is switched ON). If the device you are using was connected to a probe previously, that probe will be first in the list. Remember that the probe must be turned ON for it to be recognized by the SALS app. If no probe is within range, a message stating No probes found will appear.

To disconnect the SALS probe, tap the Disconnect button in the lower left corner of the Home screen. A pop up will allow you to choose between Disconnect or Cancel. You can also disconnect by sliding the probe switch to the OFF position (toward the probe wand). The Home screen will state Probe not connected at the top.

Description of the SALS Home Screen

Tap the Submersible Audio Light Sensor icon to launch the app; this brings you to the SALS Home screen. Starting from the top left corner and moving clockwise you will find the Demo, Settings, and Connect buttons. If the device is connected to a probe, a Mute button is located at the top right corner of the screen.

Demo button

Tapping the Demo button at the top left corner shows a new screen called Demo Mode. At the top of the screen there is a bar with a movable sliding dot. Two buttons, Done and On, are located at the top left and top right corners, respectively. Tapping On allows you to hear the tone range from the lowest tone when the dot is all the way left and the highest tone when the dot is all the way right. Use a finger to slide the dot. When Demo is on, the top right button becomes the Off button. Tap the Off button to silence the tone. Tap the Done button to return to the Home screen.

Saving demo tones

Demo tones can be saved. This provides the user with practice saving and comparing tones without needing to use the probe. While a Demo tone is playing, tap the Save button and a window appears to enter a name for the Demo sample. Tapping on the saved Demo sample brings up a window with three buttons: Play Saved Sample, Rename, and Delete. If a current Demo tone is playing and there are saved Demo samples, tapping on a saved Demo sample brings up a window with four buttons: Play Saved Sample, Play Current Sample, Auto Compare, and Replace Sample.

Mute button

Tapping the Mute button silences a tone during a reading with the probe and changes to the Unmute button. Tap Unmute to resume hearing the tone. Remember that this function will appear only when a device is connected to a probe.

Settings button

Tapping the Settings button brings you to a new screen called OPTIONS. There are buttons that allow you to change the Display to Hertz or Percentage and change the Playback to Tone or Speak (hear stated number of Hertz). This screen also allows you to Purge All Samples (including saved demo and sample tones) under the MAINTENANCE heading. The SUPPORT heading allows you to communicate with the software developer at APH by tapping the Feedback button. A new email screen addressed to technology@aph.org with a subject line stating SALS Feedback will appear. Complete the email with any concerns you have regarding SALS. Tap the Back button to return to the Home screen.

Connect button

Tapping the Connect button brings you to a screen that lists all SALS probes that are within Bluetooth range. If the device you are using was connected to a probe previously, that probe will be first in the list. Remember that the probe must be turned ON for it to be recognized by the SALS app. If no probe is within range, a message stating No probes found will appear.

Volume

Use the volume control of your iOS or Android device to control the volume of the tone or speech.

Starting SALS

When the SALS app is launched, the Home screen appears. To connect to a probe, tap the Connect button and the probe identification number in a bar

at the top of a new screen will appear. Tap this bar and the probe will connect to your device. Remember, the app can only connect to a probe that is turned ON.

Saving Sample Tones

If you wish to save a tone during a reading, tap the Save button on the SALS Home screen. A window and keyboard will appear, and you will be asked to name that sample. Saved tones appear in a SAMPLES list on the Home screen.

Managing Saved Sample Tones

To edit a saved sample tone with no tone currently playing, tapping on a saved sample will take you to a new screen that has three buttons: Play Saved Sample, Rename, and Delete. If a tone is currently playing, tapping on a saved sample will take you to a new screen that has four buttons: Play Saved Sample, Play Current Sample, Auto Compare, and Replace Sample. Tap Done to return to the Home screen.

Deleting All Tones (Demo and Samples)

To delete all tones, including saved Demo and Sample tones, tap the Settings button and then Purge All Samples under the MAINTENANCE heading. There will be two prompts asking you to confirm the request to delete the existing saved tones.

Playing and Comparing Saved Sample Tones

To play a saved sample tone, tap the sample entry on the Home screen. A new screen appears that states the name of the sample and its value in Hertz along with three buttons: Play Saved Sample (green), Rename (orange), and Delete (red).

- Tap the Play Saved Sample button to play the saved sample tone. This button now states Stop Playing Saved; tap this button to stop the tone.
- Tap the Rename button to rename the sample.
- Tap the Delete button to delete the sample.

Tap Done to stop the tone and return to the Home screen.

To compare a current tone with a saved tone, tap a saved tone entry on the Home screen while the current tone is playing. A new screen appears that states the name of the sample tone and its value in Hertz at the top, along

with four buttons: Play Saved Sample (green), Play Current Sample (red), Auto Compare (yellow), and Replace Sample (blue).

- Tapping the Play Saved Sample button will play the saved sample tone.
- Tapping the Play Current Sample button will play the current tone.
- Tapping the Auto Compare button will alternate playback of the saved and current tones in 5 second intervals.
- Tapping the Replace Sample button allows you to replace the saved sample tone with the current tone.

Tap Done to return to the Home screen.

Other Application Interactions

iOS devices

Phone calls may interfere with the tone when a probe is connected. When using this application on an iPhone, we recommend first putting your phone in Do Not Disturb mode.

Android devices

If you make or receive a phone call or the application loses focus for any reason while SALS is working, the program mutes the tone or Hertz announcements until the phone call is complete.

Changing the battery

Items needed to replace the battery in the SALS Probe include:

One CR2032 Lithium battery
Small Phillips head screwdriver
Small piece of tape

Before you start, feel where the probe wand meets the plastic box attached to it. When you put it back together, that is what it should feel like. If there is a large space between the probe wand and the box, the wand might fall out.

Steps to replace:

1. Place the probe flat on the table with the wand tip to the right, and the box to the left. The switch should be on the side near you.
2. Near the probe wand two small nuts are recessed into the box. Place a small piece of tape over the nuts, making sure the tape does not extend to the sides of the probe box.

3. Flip the probe so the wand tip is still to the right, the box is still to the left, but now the switch is away from you.
4. Unscrew the two screws on the box. The two screws are on both sides of the plastic case where it meets the probe. You do not have to take them all the way out. You only need to take them out until they release the back half of the plastic box. This way you can more easily keep track of the screws.
5. Separate the two halves of the plastic box. The probe wand will also slide out.
6. On the left side of the open plastic box, you will feel a battery holder. Using the screwdriver or your fingernail, press the battery in the holder from the right to the left until you can take it out.
7. Slide the new battery in from the left to the right making sure the flat side of the battery is up.
8. Place the top part of the plastic box back on the bottom.
9. Slide the probe wand back in the plastic box. Make sure the wire slides all the way back into the probe towards the tip.
10. Lightly tighten the screws until they are snug.
11. Remove the tape.

Warnings

Sensor Probe Operating Parameters

Solvent Precautions

Use the SALS probe in aqueous or WATER-BASED solutions only! Organic solvents (such as acetone or alcohol) could dissolve the black PVC sleeve that encloses the glass tube holding the light detector (photoresistor).

Temperature Precautions

The SALS probe has been tested and will operate in solutions ranging in temperature from 0 to 100 degrees Celsius. However, it is not recommended to keep the probe in an extremely hot or boiling solution for extended periods of time. Immerse the probe in solutions of extreme temperatures for only as long as necessary to get a reading (tone or Hertz).

Frequently Asked Questions (FAQs)

What are the minimum smart device specifications needed to download and use the app?

A smart device with Bluetooth Low Energy running Android 6 or above and any device running iOS 14 or above.

Can the wand/glass rod part of the probe break?

Yes, the wand part of the probe is a PVC-covered glass tube, which is breakable with enough force. There is no way to replace a broken wand of a particular device; users are advised to purchase a new unit in the event of breakage.

How is the SALS probe powered?
The SALS probe comes with a preinstalled CR2032 Lithium 3v battery. This battery is not rechargeable, but it is replaceable. See battery replacement instructions in the section above.

How far away from a smart device or Matt Connect can the probe be used and still work as expected?
Try to use the SALS probe near (within 10 meters) the smart device to which it is connected. To avoid damage to the smart device, we recommend placing the phone, iPad, tablet, or MATT Connect on an elevated surface near the SALS probe to which it will connect.

The probe will not connect to my smart device.
Android smart devices require that the SALS app have location permission; these devices cannot connect if permission is not granted.
Make sure the probe switch is in the "ON" position.
Make sure Bluetooth is turned on in the Settings of your smart device.
Try using a fresh battery.

The probe will connect ok but disconnects often.
Try placing the probe closer to the smart device.
Try using a fresh battery.
If using the probe with the MATT Connect, the probe might disconnect often when the battery gets low. The MATT Connect seems to be especially sensitive to the battery level.

I cannot hear the tone/speech when the probe is connected to my smart device.
Make sure the smart device is not in "silent" mode.
Make sure the smart device volume is high enough to hear the tone/speech above the noise levels normally in the room or classroom in which it is being used.

If using the SALS probe in liquid, what kind of vessel should contain the liquid?
The vessel should be *clear* plastic or glass and large enough so the probe fits comfortably without causing the liquid to spill out. The vessel should also be sturdy or supported enough to hold the SALS probe without tipping the vessel over. Test tubes should be supported in a test tube

rack or other supportive apparatus such as a beaker or a clamp and ring stand. The vessel should be clear because changes in light level may not be apparent if measurements are made in an opaque container.

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