AudCal System

Audiometric Calibration

LD Atlas™

LARSON DAVIS
A PCB DIVISION

Larson Davis

AudCal Systems
Reference Manual

Copyright

Disclaimer

Safety

If the equipment is used in a manner not specified by Larson Davis, the protection provided by the equipment may be impaired.

Record of Serial Number and Purchase Date

SoundAdvisor Model 831C   Serial Number: _____
Preamplifier Model: _____   Serial Number: _____
Microphone Model: _____   Serial Number: _____
Coupler Model: _____   Serial Number: _____

Recycling

PCB Piezotronics, Inc. is an environmentally friendly organization and encourages our customers to be environmentally conscious. When this product reaches its end of life, please recycle the product through a local recycling center or return the product to:

PCB Piezotronics, Inc.
Attn: Recycling Coordinator
1681 West 820 North
Provo, Utah, USA 84601-1341
where it will be accepted for disposal

Warranty

For warranty information, refer to our *Terms and Conditions of Sale* on our website,
www.larsondavis.com/TermsConditions.aspx.

i.1 Contact Larson Davis

Website

www.larsondavis.com

Worldwide Corporate Headquarters

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E-mail: sales@larsondavis.com

Module 1   Introduction

1.1 Overview

AudCal is software for testing the calibration of audiometers and sound booths by using the SoundAdvisor Model 831C Sound Level Meter (831C). Equipment for testing audiometric calibration includes 831C, necessary microphones, preamplifiers, couplers, and AudCal software. If purchased altogether as a system, the software will come preloaded with the equipment and ready to use in the case.

SoundAdvisor Model 831C Sound Level Meter

The 831C comes standard with real time fractional octave filters necessary for audiometer tests, plus additional features such as FM and pulse, and a powerful 6400-line FFT for narrow-band analysis and total harmonic distortion. Real time analysis for HL, frequency & THD Hearing level measurements are simple using the real time 1/3 octaves of the 831C. The 6400-line FFT mode displays frequency bands to locate and measure harmonics for THD measurements.

G4 LD Utility with AudCal Software

G4 LD Utility software connects with various Larson Davis products, like the HVM200 human vibration meter and the 831C. With AudCal, connecting your 831C opens to AudCal View where you setup customers and their equipment, run a suite of tests, and generate reports.

LD Atlas App

Connect your tablet (mobile device) to the 831C WiFi, use the LD Atlas app to control the test environment. See live data, add/edit customers, and progress through the entire test suite. Through the app you can generate reports/certificates, sign them with the touch-screen, and save the PDF to your phone or email.

Data Storage

The 831C maintains a database of your calibrators, microphones, couplers, mastoid, and 831C with model, serial number and calibration date information. If purchased as a system, all the equipment with serial numbers, sensitivity data, and calibration due dates will already be added making it out-of-the-box ready to use. It is recommended to backup this data with a file on a PC through G4 LD Utility.

1.2 AudCal Systems

There are four AudCal systems. All four systems contain the following common items, additional items are listed below:

- SoundAdvisor Model 831C Sound Level Meter with AudCal firmware
- PRM831 Preamplifier
- CAL250 Precision Acoustic Calibrator
- ADP019 adapter for CAL250
- EXC006 6 ft microphone extension cable
- DVX014 WiFi dongle
- ADP010 Earphone test adaptor
- 377A15 1" prepolarized pressure microphone
- ADP008A 1" to 1/2" mic thread adaptor
- CCS007-N hard case with foam
- Mass handle weight and earphone retaining ring
- USB to mini cable and power supply USB cable
- ADP010 and CBL093 for direct input signal testing
- 3 1/2" windscreen
- Four (4) NiMH AA batteries

SYS014

- AEC100 Artificial Ear Coupler

SYS015

- AEC100 Artificial Ear Coupler
- AMC493B Artificial Mastoid Coupler
- Weight bag

SYS016

- AEC201 Artificial Ear Coupler
- 377C13 1/2" Prepolarized Pressure Microphone
- IEC Type 1 adapter

SYS017

- AEC201.F Artificial Ear Coupler
- 377C13 1/2" Prepolarized Pressure Microphone
- AMC493B Artificial Mastoid Coupler
- Weight bag
- IEC Type 1 adapter

FIGURE 1-1 Systems of Equipment

SYS014

SYS015

SYS016

SYS017

1.3 System Requirements

Table 1.1 PC System Requirements for G4 LD Utility

	Minimum	Recommended
Operating System	Windows® 7/Windows 10	Windows 7 Pro 64-bit
Computer Processor	1.5 GHz	2 GHz
Computer Memory	4 GB	8 GB
Available Hard Disk Space	2 GB	2 GB
Screen Resolution	1024 X 768	1280 X 1024
CD Drive	No	Yes
USB Connection	Yes	Yes
PDF Viewer	Standard or Open Source PDF Viewer	Adobe Acrobat Viewer
Internet	Required for remote internet connections.	

Table 1.2 Tablet/Mobile Device Requirements for App

	Apple	Android
Space	2.5MB	2.8M
OS Version	10 or later	Android Oreo; 8 and up
Screen Size	≥8"	≥8"
PDF Viewer	✓	✓
WiFi	✓	✓

Module 2 Getting Started

2.1 Download LD Atlas App

Use your mobile device to find and download the LD Atlas app from Google Play™ or the Apple App Store®. To find the app, search for "LD Atlas" and look for this icon from Larson Davis:

FIGURE 2-1 LD Atlas App

2.2 Download G4 LD Utility

G4 LD Utility (G4) software enhances the features, flexibility, and ease-of-use of SoundAdvisor Model 831C sound level meter by providing setup utilities, instrument calibration, computer-based control of the instrument, report and certificate generations and download, database syncing and integration.

You can download G4 at http://www.larsondavis.com/G4 or find the software on the supplied USB drive. Run LDsetup.exe to begin the install process. The install program prompts for any additional required information. A PCB Piezotronics folder will be created under the Program menu and a shortcut will be placed on the desktop.

2.3 Connect to 831C SLM

Your 831C is where the AudCal system is. You can access and control it through the LD Atlas app, or through a PC using the software G4 LD Utility. G4 also allows you to backup your data.

2.3.1 Connecting to a Mobile Device via Access Point

With the LD Atlas app, you can make a direct WiFi connection to the 831C from your mobile device:

TAKE NOTE If there is no 831C WiFi available, make sure the 831C is turned on, the WiFi dongle is inserted, and it is in Access Point mode. Navigate **Tools → Setup WiFi → Menu** and select **Set Access Point**.

Step 1 Open the WiFi settings on your mobile device.

Step 2 Connect to the 831C WiFi network displaying the serial number of your meter. The password to connect to the 831C WiFi is: wifi831c

Step 3 Launch the LD Atlas app to begin controlling the meter on your mobile device.

2.3.2 Connecting 831C to G4 LD Utility on a PC

Using a USB cable, you can directly connect your PC to meter and operate it using G4 LD Utility.

LEARN MORE For more information on working with G4 LD Utility, refer to the G4 LD Utility Software Manual.

Step 1 Connect the 831C to a PC with the provided USB cable.

Step 2 Launch G4 and click **Connect**.

Step 3 Choose radio buttons for **831** and **USB**.

Step 4 Select your meter from the list, and then click the **Connect** button.

FIGURE 2-2 G4 connection
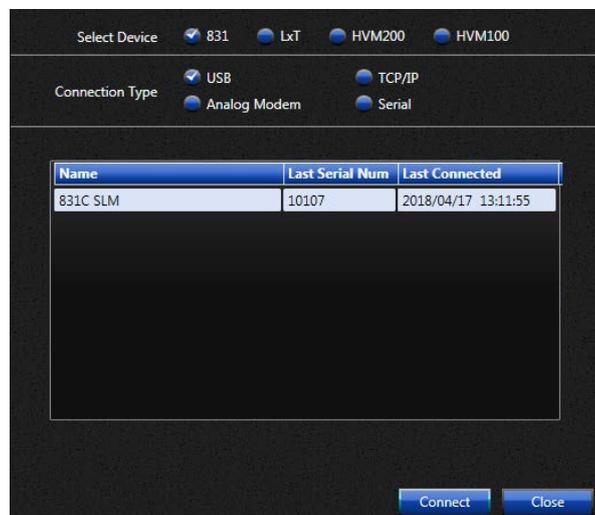
2.4 Case Layout for Testing

The case can be used for transportation of the system and for testing. The 831C SLM, and coupler can remain in the case. Connect to the 831C through a mobile device and WiFi (or connect a laptop to the 831C to run AudCal). Calibrate your microphone while it remains in the case. Place the transducers over the coupler inside the case during testing.

FIGURE 2-3 Case Layout for testing
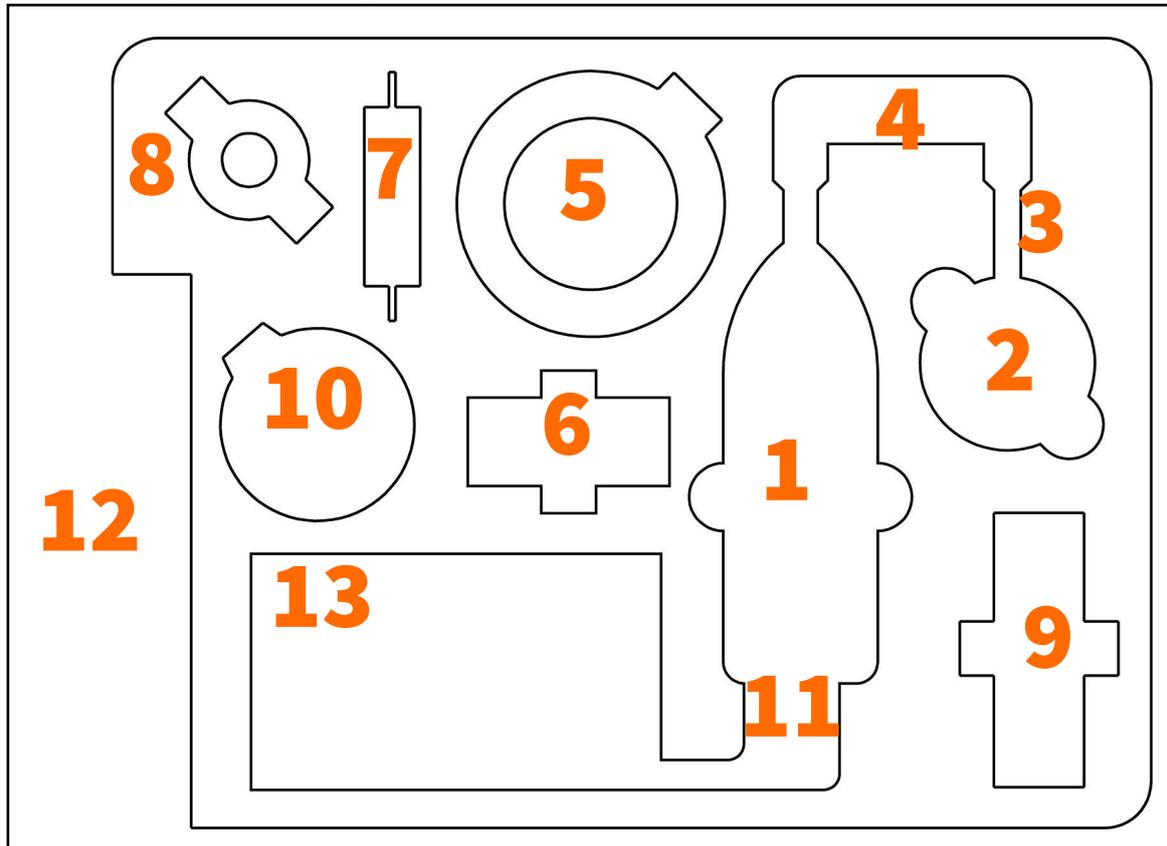
1. SoundAdvisor Model 831C Sound Level Meter

2. Coupler; AEC201 or AEC100

    • 377A15 1" prepolarized microphone (AEC100 and booth testing)

    • 377C13 1/2" prepolarized microphone (AEC201)

3. PRM831 Preamplifier

4. EXC006 cable
    Connects the preamp to the coupler, and the 831C.

5. Earphone retaining ring and the weight bag
    Can be placed directly on the coupler in the case during testing.

6. AMC493B Artificial Mastoid

7. IEC Type 1 adapter MAEC101.06
    Can be used directly on the coupler in the case, and stored in this cavity for transportation.

8. Mass handle weight
    Stored in an "upside down" position to not damage the foam or device. It can be used directly on the coupler in the case and stored here for transportation.

9. CAL250 precision acoustic calibrator

10. Windscreen (booth testing)

11. USB cable and WiFi dongle
    Can be inserted and left in this cavity during testing and transportation.

12. Pillow support board
    Optional way to test, instead of testing directly in the case.

13. Large cavity for adapters, cables, cases for microphones and the preamplifier

Module 3   Software

3.1 Overview

The AudCal software uses the 831C to test audiometers and sound booths. Access the software through G4 LD Utility on a PC or the LD Atlas app on a mobile device. Through G4 your data can be saved in a local file that is synced with the data on your meter.

AudCal mode for 831C SLM

The 831C sound level meter will need to be set in AudCal mode for any AudCal functionality. If the meter is in another mode, like SLM mode, navigate to **Tools** menu on the meter and select **Audiometer Cal Mode**. You will know you are in this mode because it will gray out in the Tools menu.

FIGURE 3-1 831C AudCal Mode
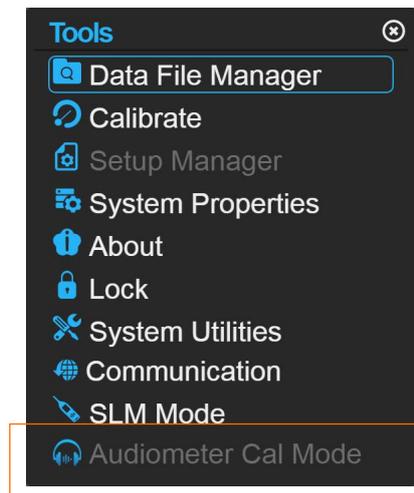
You can also change modes in G4 through the Meter Manager.

FIGURE 3-2 831C AudCal Mode in G4

FIGURE 3-3 Main Display

Multiple meters will appear here as new tabs

The meter manager can be accessed here, including calibration, settings, and mode changes

This section is called the "tree" it contains all your equipment, customers, and tests.

Status of actions

Select an item in the tree and the main view will have the options for that item

To see the "Live View" of the meter, click here.

Save entries

After entering all fields on an entry, select the **Save** button. Pressing **Cancel** will revert to the previous screen and the entry will not be added.

Delete/remove entries

An item, whether it be an SLM, customer, transducer, or test suite, when **Removed** will remove completely from AudCal, including any information below it on the tree. For example, if you remove a customer, then all locations, audiometers, transducers, and tests associated with that customer will be removed/deleted. Do not remove an entry unless this is the desired result.

Any entry that is removed will be removed from any synced file as well. If you sync AudCal with G4, that entry will be deleted from there as well. If there are multiple 831C SLMs that sync with that same source, that entry will also be deleted from those 831C SLMs. Do not remove/delete an entry unless this is the desired result. To learn more about the synced file, see "AudCal Options in G4" on page 6-1.

Pin/Dock Equipment Tree

You can click the pin in the upper right corner of the tree to unpin the pane. A tab will appear on the left side, and selecting that tab will collapse the pane altogether. Selecting the tab **Setup** again will open it, and you can re-pin the pane to the view.

FIGURE 3-4 Pin

3.2 My Equipment

Your equipment, if purchased as the AudCal system, will already be loaded to AudCal software and ready to calibrate and test. If you purchased items separately, and intend to manually add equipment, see 6.3 "Manually Add My Equipment" on page 6-3.

My equipment refers to the sound level meter, microphone/couplers, calibrator, and any other equipment used to test the audiometer.

FIGURE 3-5 My Equipment tree

Your equipment name is the model number followed by the serial number
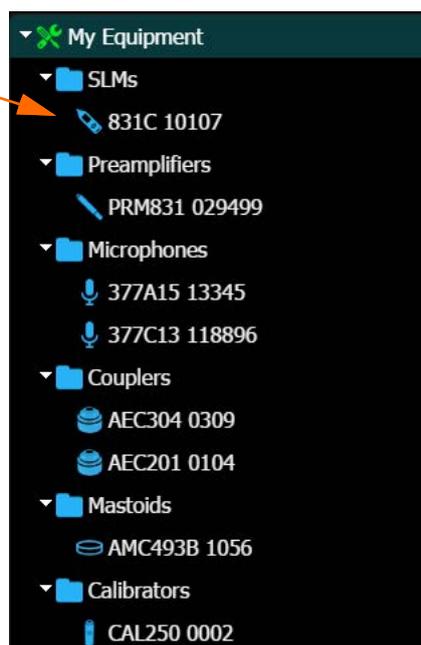
3.3 Customers

The second part of the tree is where your customers' information is stored. This is also where you will run your tests. Each customer can have multiple locations and at each location multiple audiometers and booths.

Every customer has their own entry with a unique name. Additionally, each location has a unique name, to easily identify and distinguish it from the other locations. A location contains every audiometer or booth that will be tested at that location.

TAKE NOTE Enter each new customer as a separate entry. There is no need to overwrite an existing customer entry with a new customer.

The tree organizes the customers, locations, and audiometers in this way:

- Customer 1

    - Location 1

        - Audiometers/Booths

    - Location 2

        - Audiometers/Booths

- Customer 2

    - Location 1

        - Audiometers/Booths

    - Location 2

        - Audiometers/Booths

3.3.1 Add Customer

Adding a customer is as simple as naming a customer. To add a customer, follow these steps:

Step 1   In the tree, select **Customers**.

Step 2   In the main view, select the button **Add Customer**.

Step 3   Enter a **Name** for the customer.

FIGURE 3-6 Add Customer Fields

Step 4   **Save**.

3.3.2 Add Location

A customer entry requires the location information entered before the audiometers and booths can be created. Enter the location the audiometer is at, not necessarily where the test is performed. If a customer only has one location, enter one location.

To add a location for a customer, follow these steps:

Step 1   In the tree, navigate **Customers** → Your Customer.

Step 2   In the main view, select the button **Add Location**.

Step 3   Enter **Name** for the location (i.e. Provo Location, Cincinnati Branch, South Annex).

TAKE NOTE The location information will appear on the report and will need to be accurate. There is no need to change it unless the audiometers and booths change locations.

Step 4   Enter **Street Address**, **City**, **State/Province**, and **Postal Code**.

Step 5   Enter **Contact Name**, **Phone**, and **Email** for your contact at that location or for the company.

FIGURE 3-7 Location fields

Step 6   **Save**.

3.3.3 Add Audiometer

Every audiometer that is tested will need to be added to AudCal. The audiometer can only be added in the location of a customer. Multiple audiometers can be created under one location.

To add an audiometer, follow these steps:

Step 1   In the tree, navigate **Customers** → Your Customer → Location audiometer is located.

Step 2   In the main view, select the button **Add Audiometer**.

TAKE NOTE The dropdown selection for **Manufacturer** and **Model** will show "Larson Davis" and "GSI 1716" only. To manually add a different model number or manufacturer, select the green add-item button.

Step 3   Enter **Serial Number** and **Inventory Number** (not required).

Step 4   Enter **Calibration Due** date.

Step 5   Select the **Audiometer Type** and **Number of Channels** from the drop down menus.

Step 6   Enter **Carrier FM Rate** and **FM Tone Deviation** (warble). These values can be found on the specification sheet for the audiometer. Please note, if the number is listed as a ± range, enter a whole number. For example, if the tone

deviation is listed as ±5, then enter 10. Only change this information if the audiometer supports this feature.

FIGURE 3-8 Audiometer fields

Step 7   Select **Edit/View** button for the Frequency Selection. You can select high, low, set to default, or manually select and deselect values. These are frequencies that will be tested. When finished, **Continue** and it will return you to the Audiometer screen.

Step 8   **Save** when finished.

3.3.4 Add Transducers

AudCal can test with the following transducers:

TAKE NOTE For ambient noise or sound booth testing see "Run Booth Test/Ambient Noise" on page 4-16.

- Supra-aural headset
- Insert earphones
- Circumaural headset
- Bone Vibrator
- Speakers

Add the transducers that will be used prior to creating a test. The transducers will be saved and used for future testing at that location and with that audiometer.

To add a transducer, follow these steps:

Step 1   In the tree, navigate **Customers** → Your Customer → Location → **Transducers**.

Step 2   In the main view, select the button **Add Transducer**.

Step 3   Select or enter **Model**.

Step 4   Enter **Left Serial Number** and **Right Serial Number**. If you selected **Bone Vibrator** as the transducer type, then only enter the one serial number.

Step 5   Select the **Coupler** that is paired with that transducer. For a bone vibrator, you will select the mastoid, and for speakers you will select a microphone.

Step 6   Select **Non-Certified Coupler Pairing** if the transducer and coupler are a non standard pairing. If this is the case, you will need to enter the RETSPL values for your coupler pairing manually. For more information, refer to Table A.1, "Standard coupler and headphone pairings," on page A-1.

FIGURE 3-9 Transducer setup

Step 7   **Save**.

3.3.5 Add Booth

Every booth that is tested will need to be added to AudCal. The booth can only be added in the location of a customer. Just like in real life, a booth is *at* a customer location.

To add a booth, follow these steps:

Step 1   In the tree, navigate **Customers** → Your Customer → Location booth is located.

Step 2   In the main view, select the button **Add Booth**.
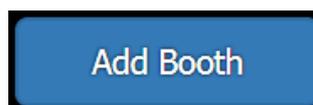
Step 3   Enter unique **name**. This is a descriptive name that makes for easy identification, for example "Main Office Booth", "South Annex Booth", "Dr. Jones's Booth".

Step 4   Enter **Test Due** date.

Step 5   **Save**.

Module 4 Performing Tests

4.1 Overview

Performing a test on an audiometer is the central function of AudCal. All your equipment, your customer, and your customer's equipment is added to AudCal first, before a test is performed. Once added, the test can be run, and rerun quickly.

The following is an overview of the steps to performing a test:

Step 1   Add your equipment, your customer, customer location, and customer's equipment

Step 2   Add test suite and setup

Step 3   Calibrate microphone

Step 4   Select tests you want to perform

Step 5   Setup test assembly

Step 6   Run left side for all tests, then run right side

Step 7   Generate report

Left and right

After all tests run on one side, then AudCal will switch to the other side and prompt you to start running. Once the left and right sides have ran, for the selected transducer, then the next test will go to the next transducer on the left side, then the right.

Rerun test

Rerun a specific failed step by double clicking or a long tap. After AudCal runs that step it will advance to the next one, you can select **Stop** to stop the automatic advance. The last test ran will be the one to determine a pass or fail. You can press **Stop** before the test stabilizes and records a measurement, and the results will reflect the last measurement taken.

Delete Test Suite

To delete a test suite, navigate to the **Setup** icon within a test, and select the **Remove** button. You will be asked if this action is desired. A test suite, once deleted, can not be recovered. Additionally, when you sync to your PC file through G4, the test will delete from there as well.

Hearing Level

On many tests, an HL value will be prompted from AudCal. Some audiometers may not be able to reach that level, if this is the case, use the max level the audiometer can output.

4.2 Create Test

TAKE NOTE The test name is always the date/time it was created. For this reason it is good practice to not create the test until you are ready to run a test.

Step 1 Navigate to your customer → location → audiometer → **Tests**. Select **Add Test Suite** button in the main view.
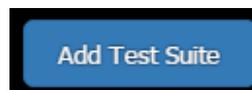
Step 2 Enter **Technician** name.

Step 3 Choose **Standard** from dropdown:

TAKE NOTE AudCal will use the test limits specified in the selected standard.

- ANSI S3.6 (1996)
- ANSI S3.6 (2004)
- ANSI S3.6 (2010) - most common/default
- IEC 60645

Step 4 If you have the AMC49B artificial mastoid, enter values for current **Temperature**, **Humidity**, **Pressure**, and

Elevation. Record the temperature and humidity currently displayed on the hygrometer (temperature and humidity sensor) in the AMC493B artificial mastoid case. The pressure entry must be the current barometric pressure reported in weather reports, which is typically normalized to sea level. AudCal will use the elevation entry to calculate the local air pressure.

Step 5 Select the equipment you will be using for the test: **Sound Level Meter**, **Calibrator**, and **Preamplifier**.

TAKE NOTE The RETSPL/FL values cannot be edited or changed after a test begins running. If you need to make changes, you will need to create a new test.

Step 6 Click on a transducer in the list with a "!", then select **RETSPL** button on the bottom (you may need to scroll the page down). There will be a "!" in the **RETSPL** column next to each transducer that will need to be set. You can manually set each one or load values from previously saved values. You can save any RETSPL data for future use.

FIGURE 4-1 Test Setup

Select standard to test to

Enter name

If the equipment you will be using does not appear in the dropdown list, select the add button

Select your equipment you will be using for this test

Select transducer then set the **RETSPL** values, if needed

After you enter the setup information, and before starting a test, make sure you **calibrate**

4.3 Calibrate Your Equipment

Before running a test, perform a calibration on your equipment. After a test has begun you cannot go back to do this. For more information on

calibration, refer to the SoundAdvisor Model 831C Sound Level Meter Manual.

To calibrate, follow these steps:

Step 1 If you have not added a **Test Suite** already, navigate to your customer → location → audiometer → **Tests**. Select **Add Test Suite** button in the main view.

Step 2 Select **Calibrate** icon in the **Setup** page of the test. The icon is in the top right side.

Step 3 Select CAL250 from the calibrator dropdown menu (you can use a different calibrator).

Step 4 Expose the microphone on the coupler. The grid cap needs to be on the microphone during calibration. When you remove the top of the coupler, if the grid cap comes off as well, pop out of the top piece, and screw back onto the microphone carefully. Do not attempt to calibrate over the exposed diaphragm. For the AEC100, the grid cap may be found in the microphone case. Carefully screw the grid cap on for calibration, and remove to perform tests.

FIGURE 4-2 Remove Coupler Top

Step 5   Carefully mount the calibrator over the microphone, using an adapter for a 1/2" mic (ADP019).

Step 6   Turn calibrator ON by pressing the button. The calibrator will turn off after one minute, so use within that time, or press the button again.

FIGURE 4-3 Calibration in case

Step 7   Select **Do Calibration** button in AudCal.

Step 8   Select **Yes** when complete.

The calibration is now complete.

If there is an error message, then the calibration is suspected to have been performed incorrectly. If an error message is received, check all settings and perform the calibration again, ensuring the calibrator is turned ON.

4.4 Test Assembly

Transducers are to be assembled on the coupler according to the Standard you are testing. The following figures show the typical setup for common transducers:

FIGURE 4-4 Supra-aural earphone

Weight assembly

Retaining ring (if needed)

AEC201 coupler (shown) or AEC100 coupler

FIGURE 4-5 Circum-aural earphone

Weight bag

IEC Type 1 adapter

AEC201 coupler

FIGURE 4-6 Bone vibrator

Additional weight (metal ring)

Weight assembly

Retaining ring

Bone vibrator

Mastoid

AEC201 (shown) or AEC100
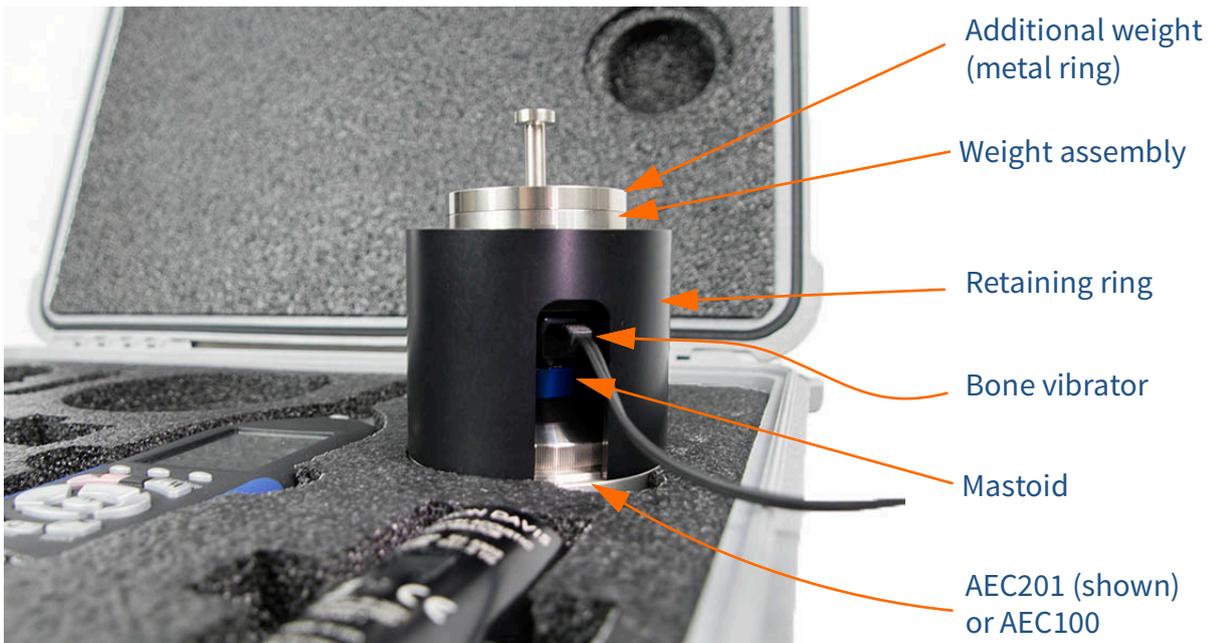
FIGURE 4-7 Insert earphones

EXC006 cable

Pillow to reduce vibrations

PRM831 preamplifier

AEC304 occluded ear simulator (sold separately)

Roll foam tip until very small, place in AEC304, and the foam will expand to fill space.

FIGURE 4-8 Direct Input

CBL093

barrel connector

ADP010

To audiometer

Directly into 831C

To headphone
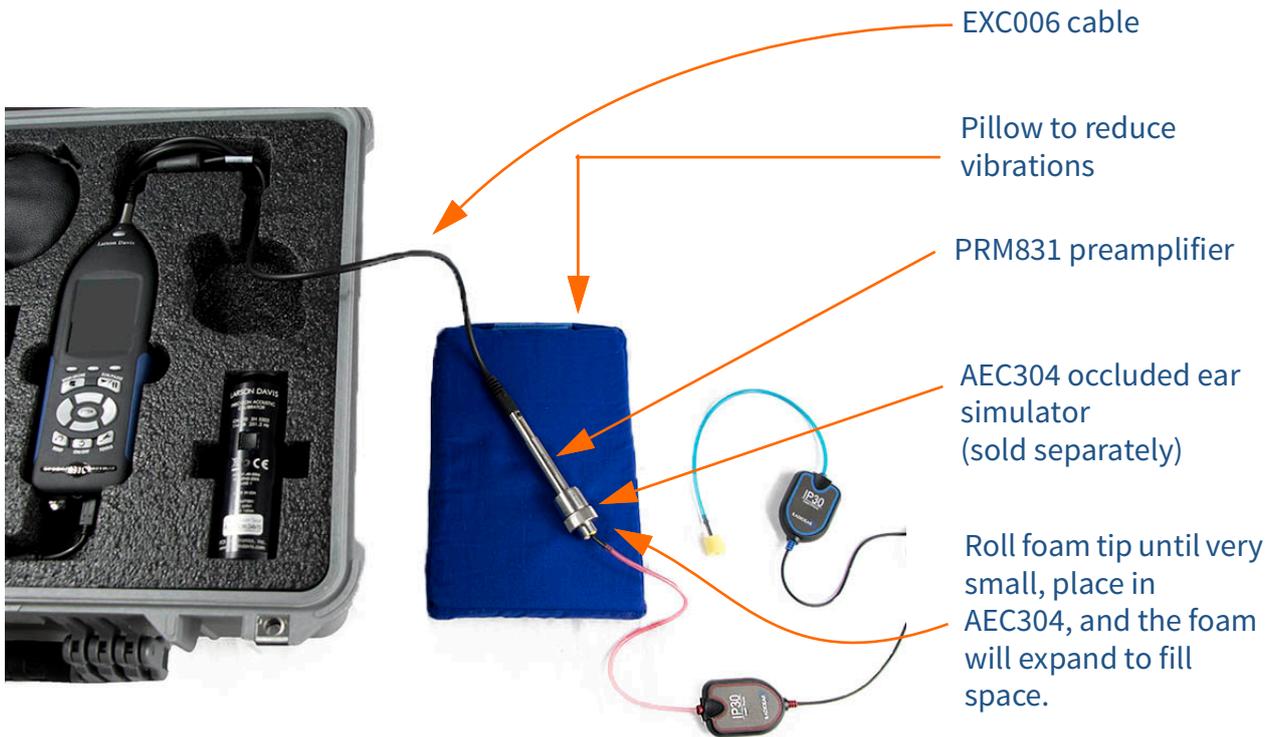
Direct Input Signal

To measure the noise floor or low level signals in the linearity test, you may want to do a direct input into the audiometer. Use the ADP010 and CBL093 to connect the audiometer and 831C. Additionally, connect a headphone to hear the signal.

Ground Loop
You may end up creating an unwanted ground loop while testing with the direct input. This can occur if at least two components connected are using an external power source, like a wall outlet. If the 831C is connected to a laptop that is connected to an outlet, and the 831C is also connected to an audiometer powered by a wall outlet, then a ground loop is created. Disconnect the laptop from the wall outlet to run on batteries, or use the WiFi dongle to connect to the meter wirelessly to break the ground loop.

4.5 Run Audiometer Tests

Navigate to tests from setup

After you setup a test and calibrate, select the transducer to test first in the top bar.

FIGURE 4-9 Transducers

Select a transducer to get started on a test

4.5.1 Test Displays

FIGURE 4-10 Frequency Test Example

Testing the supra on the left side

Hover over or tap to see more data

Run, stop, or advance to next test in the suite

Add note to current test that will appear in report

Check this box to see the table view

Double-click or long tap on failed step to rerun

Run
Select run to start the current test. The test will begin on the first step on the left and proceed through to the end. Once a test has finished, you can select **Run** again, this will reset and restart the test.

Stop
Select stop at anytime. The last stable and measured step will appear after the stop. Press stop if mistakingly began a test, or if currently re-running a test you do not wish to continue rerunning the current step.

Next
Select next to advance to the next "checked" test in the test suite. That test will automatically begin.

FIGURE 4-11 Test results display

A green dot is a passed test

A red dot is a failed test

A black dot is a test that was not selected to be performed

A gray dot is a test that was not performed

Left side   Right side
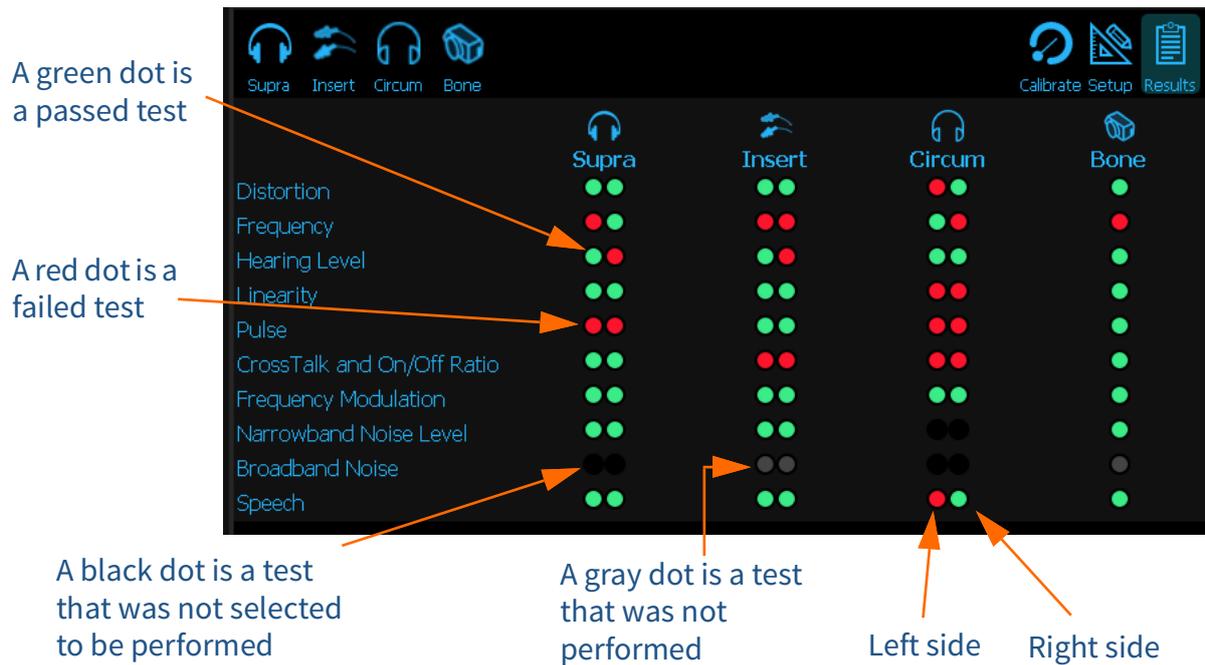
Clicking (or tapping) on a dot will jump you to that portion of the test suite. This is so you can rerun any failures, run tests that were missed, or quickly view results.

4.5.2 Run Distortion/Frequency Test

Harmonic Distortion test will ask you to set the audiometer to values from lowest frequency to highest, adjusting the hearing level as well. Once the signal is detected AudCal will automatically progress to the next frequency.

To pass Frequency, the measured sound pressure level needs to be within the limit.

Step 1   Select **Run** icon.

Step 2   Follow instructions in the top gray bar. It will indicate the frequency and hearing level you need to set on the audiometer. Once that signal is detected then AudCal will record that value and automatically advance to the next frequency.

Step 3   Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that step in the graph or table. (Or long-tap if on a mobile device).

4.5.3 Run Hearing Level Test

The Hearing Level test will ask you to set the audiometer to values from lowest frequency to highest, adjusting the hearing level as well. Once the signal is detected AudCal will automatically progress to the next frequency. To pass, the measured hearing level (dB HL) will need to be in range.

Step 1   Select **Levels** icon and select testing levels. When finished, press **Set**.

Step 2   Select **Run** icon.

Step 3   Follow instructions in the top gray bar. It will indicate the frequency and hearing level you need to set on the audiometer. Once that signal is detected then AudCal will record that value and automatically advance to the next step.

Step 4   Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that step in the graph or table.

4.5.4 Run Linearity Test

Linearity tests the step variation between hearing levels. Set the frequency at which the linearity test will run, and indicate the maximum and minimum levels you want to test, along with the dial step. The dial step is the dB increment between hearing levels.

Step 1   Select **Frequency** at which you want to test in the drop down menu. Select the **HL Step** in the dropdown that you want to test: 2, 5, or 10. Enter the appropriate **Maximum** and **Minimum** output level of the audiometer at that frequency.

FIGURE 4-12 Linearity Setup

| Freq 1000 ▼ | Max 100 | Min 10 | HL Step 5 ▼ |

Step 2 Select **Run** icon.

Step 3 Follow instructions in the top gray bar. It will indicate the hearing level you need to set on the audiometer. Once that signal is detected then AudCal will record that value and automatically advance to the next hearing level.

Step 4 Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that step in the graph or table.

4.5.5 Run Pulse Test

The pulse test is for audiometers equipped with pulsed tones.

Step 1 Set audiometer to pulse mode or **Pulsed**.

LEARN MORE The frequency and hearing level for pulse can be set at a different value than requested from AudCal. This is the optimal range to test.

Step 2 Set the **Frequency** to 1000 Hz and the **Hearing Level** to 110 dB HL or max hearing level.

Step 3 Select **Run** icon.

Step 4 Select **Next** icon to go to next selected test.

FIGURE 4-13 Example Pulse Test
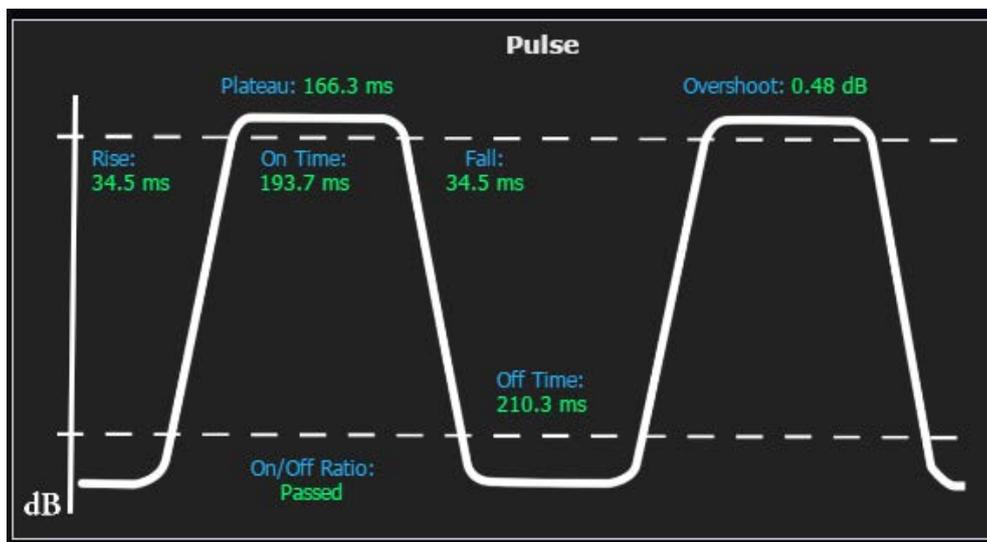
4.5.6 Run Crosstalk and On/Off Ratio Test

One side will be done at a time. When you switch sides, then the test will finish. This is done so you don't have to change equipment in the middle of a test suite.

Step 1 In the dropdown menu, select **Frequency** at which you want to test.
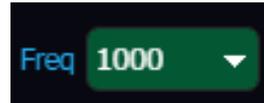
Step 2 Select **Run** icon.

Step 3 Follow instructions in the top gray bar. Turn the side being tested ON with the hearing level set to the indicated level, the other side OFF, and place at a distance from the tested headphone side. This will repeat, but with the current side being tested off and the other side on. Select **OK** in the popup once the conditions are met.

Step 4 Next, turn OFF both headphones and set to indicated level and select **OK**.

Step 5 Lastly, set both sides hearing level to indicated level and select **OK**.

Step 6 Select **Next** icon to go to next selected test.

4.5.7 Run FM Test

The Frequency Modulation tests frequencies at their maximum hearing level, and will pass if the deviation is as expected. The FM rate and tone deviation are based on the audiometer's specification sheet, and the entered value on the **Audiometer** page.

Step 1 Set audiometer to FM (warble).

Step 2 Select **Run** icon.

Step 3 Follow instructions in the top gray bar. It will indicate the frequency and hearing level you need to set on the audiometer. Once that signal is detected then AudCal will

record that value and automatically advance to the next frequency.

Step 4 Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that step in the graph or table.

FIGURE 4-14 FM Test Example

The yellow block shows at what percentage off of the expected modulation rate was measured

Deviation is green or red if it has passed or failed

A failed step will be outside the cerulean background
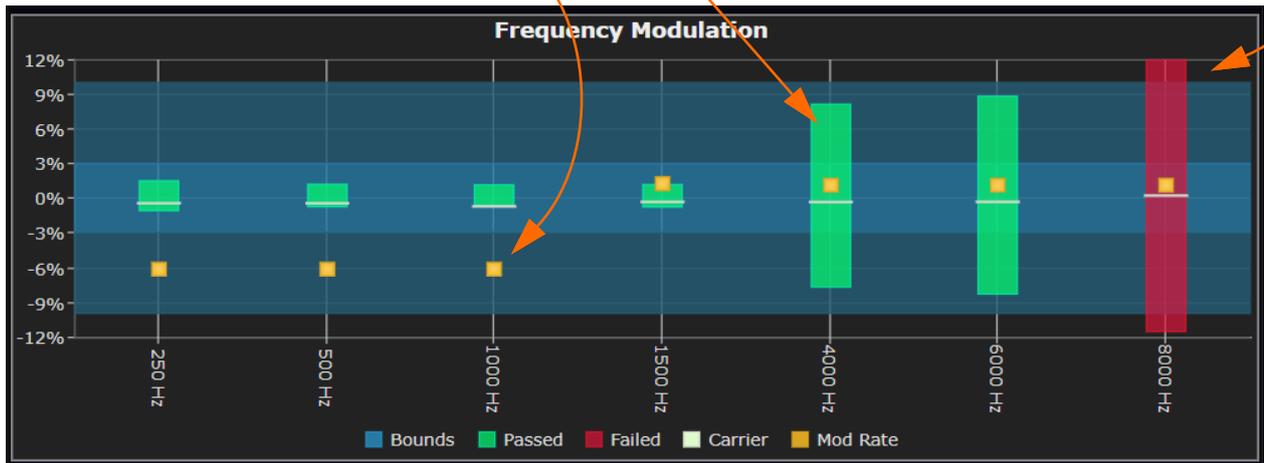
4.5.8 Run Narrowband Noise Level Test

Step 1 Set audiometer to NB Noise.

Step 2 Select **Levels** icon and set test levels. When finished, press **Set**.

Step 3 Select **Run** icon.

Step 4 Follow instructions in the top gray bar. It will indicate the frequency and hearing level you need to set on the audiometer. Once that signal is detected then AudCal will

record that value and automatically advance to the next frequency.

Step 5   Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that part in the graph or table.

4.5.9 Run Broadband Noise Test

There are three options for the broadband test: white noise, external A, and external B. You can select one, two, or all of these.

The following steps assume that all three options are selected.

Step 1   Set audiometer to White Noise.

Step 2   Select **Run** icon.

Step 3   Follow instructions in the top gray bar. It will indicate the frequency and hearing level you need to set on the audiometer. Once that signal is detected then AudCal will record that value and automatically advance.

Step 4   With the external A output connected to a signal source, set the audiometer External A source to ON and the hearing level to 70 dB HL.

Step 5   With the external B output connected to a signal source, set the audiometer External B source to ON and the hearing level to 70 dB HL.

Step 6   Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that part in the graph or table.

4.5.10 Run Speech Test

Step 1   Set the hearing level that you want to test. The default is set to 70. Select or deselect stimulus: microphone, ext A, ext B, and/or noise. The test will go through each one that is selected.

Step 2   Set audiometer to Speech Noise.

Step 3   Select **Run** icon.

Step 4   Follow instructions in the top gray bar.

Step 5   Select **Next** icon to go to next selected test or if you want to redo any portion of the test, double-click on that step in the graph or table.

4.6 Run Booth Test/Ambient Noise

If you are placing the meter in the booth, you may want to be connected via WiFi through the LD Atlas app or through TCP/IP through G4 LD Utility on a PC in order to run the test from outside the booth.

FIGURE 4-15 Booth test (ambient noise)

Windscreen

377A15 1" prepolarized microphone

ADP009 adapter

PRM831 preamplifier

All mounted directly onto the 831C SLM

SLM stand (not included)

Add booth test

Step 1   To add a booth test, navigate to the **Location** the booth is at under the **Customer**, and select **Add Booth** button.

Step 2 Name the booth. This is to distinguish multiple booths that may be at a location.

Step 3 Select that booth in the left side tree view, then select **Tests**. Finally, select **Add Booth Test** button.

Step 4 Enter **Technician** name.

Step 5 Select equipment that will be used for the test.

FIGURE 4-16 Booth test setup

Enter name

Select the Standard you want to test

If the equipment you will be using does not appear in the dropdown list, select the add button

Select equipment you will be using

After you enter the setup information, and before starting a test, make sure you **calibrate**
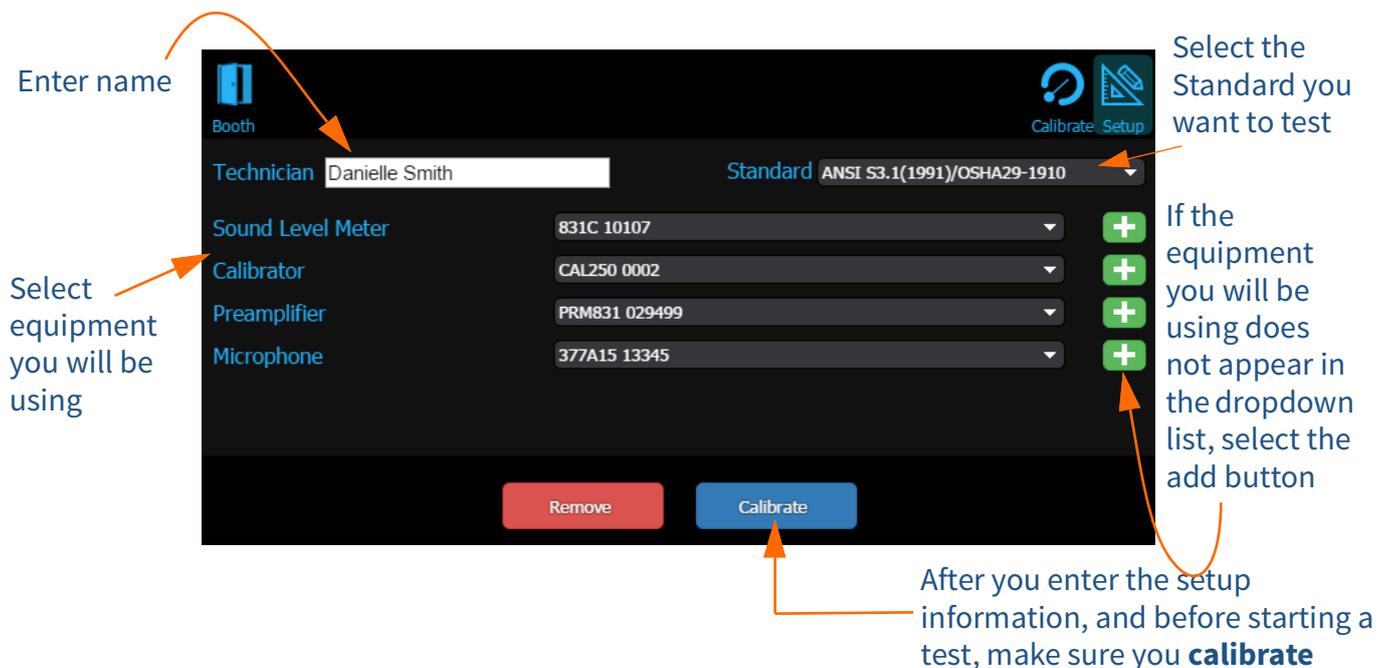
Calibrate microphone

To calibrate, follow the steps in "Navigate to tests from setup" on page 4-9.

Navigate to booth test from setup

After you setup a test select the booth icon in the top bar.

Run booth test

To run a booth test, many technicians place the 1" mic with the ADP008A adapter over the PRM831 or use the EXC006 extension cable and place the microphone in the booth. See Figure 4-8 Direct Input for an example setup.

Step 1 In the test, select **Booth** icon.

Step 2   Choose the radio button for **MPANLs** that fits your criteria along with the **Frequency Range**.

Step 3   When ready, select **Run** icon. The data will be gathered and the test will either pass or fail the criteria.

Generate certificate

After the booth test has been performed you can generate a certificate by selecting the **Certificate** icon below the results.

You will be prompted to use a signature, create a new one, or upload one. See "Create signature" on page 5-2.

Module 5 Reports & Certificates

5.1 Overview

For every test created a certificate and report can be generated. Notes, logos, and signatures can be electronically placed on the digital document, which can be emailed, printed, or saved on your device, PC, or a cloud based system. Under the **Results** page, you can review all the tests, generate a certificate, report, add notes, or add a logo.

FIGURE 5-1 Results Page Buttons

Add logo

A logo can be uploaded and AudCal will scale it to 400x50. You can see if any clipping or skewing has occurred to your graphic after you have uploaded it. You can remove it so that area is blank on the certificate, or upload a new one.

The following file formats are supported:

- PNG
- JPG
- BMP
- SVG

5.2 Generate Certificate

The **Generate Certificate** button will initiate a form for a signature. Once a signature is created or selected, then the certificate will generate using a logo uploaded to AudCal. You will then be asked to save the certificate. It is a PDF document, and can be saved in any directory or document viewing app you have available.

Create signature

Once you select **Generate Certificate**, a signature for the technician appears. If you are on a tablet, use the touch screen to draw your signature. If you are on a PC, you can use your cursor. The following options are available:

- Import - upload an image of a signature to use for this use and future use
- Undo - clears the last stroke that was made
- Clear - clears all strokes on the screen so you can try again
- Use - use the signature you just created for this one time
- Save - save the signature you created for this use and future use and generated certificate
- Cancel -action canceled, no certificate will be produced

Certificate information

The certificate generated will have the following information:

- Calibration date and valid through date
- Technician name
- Equipment calibrated:
  - Audiometer - Manufacturer, model number, serial number, type, number of channels, and inventory number
  - Transducers - Type, manufacturer, model numbers, serial numbers
- Equipment used to calibrate
  - Instrument, manufacturer, model number, and serial number
- Statement of Calibration - ex. Danielle Smith certifies that this audiometer meets or exceeds the minimum specifications described in the American National Standards Institute Specification for Audiometers (ANSI S3.6 2010)
- Signature
- Date Issued (generated)
- Logo

5.3 Generate Report

By selecting the **Generate Report** button, a report of the test will be produced as a PDF. On a PC a "Save As" dialogue box will appear asking where you want to save the report. You can rename it and save anywhere, including a cloud drive. On a tablet, it is recommended to save in a document app like iBooks® or directly in a linked Cloud drive.

Report information

The report generated will have the following information:

- Calibration date

- Technician name

- Logo

- Equipment calibrated

    - Audiometer - Manufacturer, model number, serial number, type, number of channels, and inventory number

    - Transducers - Type, manufacturer, model numbers, serial numbers

- Equipment used to calibrate

    - Instrument, manufacturer, model number, and serial number

- Calibration records, test summaries of graphs and tables showing what passed or failed

Module 6 Additional Features

6.1 AudCal Options in G4

G4 LD Utility is a multi-function software used to connect many Larson Davis instruments and meters. AudCal with the 831C is one part that G4 is capable of controlling. The options for AudCal functionality can be adjusted by navigating to **Tools →Options**.

FIGURE 6-1 Tools to Options in G4
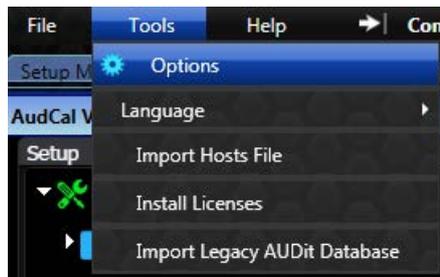
Then navigate to the **AudCal Options** tab.

FIGURE 6-2 AudCal Options
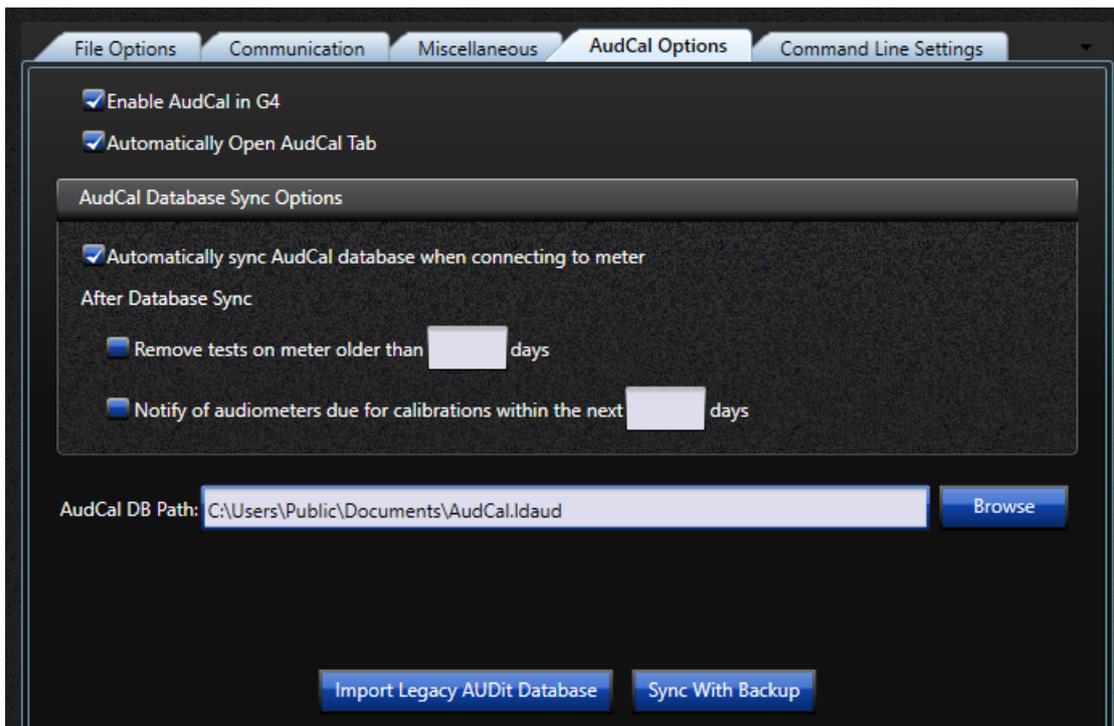
In this screen you can do the following:

Enable AudCal in G4

If G4 LD Utility does not show actions for AudCal, you can select this option. You can open AudCal through **File → Open AudCal**. From here you can create customers, add equipment, and other AudCal actions, then when you connect to a meter, a sync will augment the information with the information on the meter. For example, you can add customer information, with audiometers and transducers, then when you arrive at the location, connect to your meter, perform a sync, and create a test.

Automatically Open AudCal Tab

When you open G4, AudCal view will automatically appear as the default view, opposed to the default **Setup Manager** view.

AudCal Database Sync Options

Automatically sync the 831C with the data stored on the PC, which is the file indicated in the "Database Path (AudCal DB Path)".

You can remove old tests from the meter, for storage saving reasons, by indicating an "older than" date for removal.

Notification for Calibration

A popup will appear when you sync or connect to your 831C if any equipment is due for calibration.

Database Path (AudCal DB Path)

All the AudCal information is stored on a .ldaud file that can be stored anywhere your PC can access. This file can be on a network, cloud based drive, or in the default path in My Documents.

To indicate a file the 831C and G4 will sync to, select **Browse**. Name the file, then click **Save**.

6.2 Upgrade Instrument Firmware

To upgrade firmware navigate **File → Upgrade Firmware**. Complete the **Connection** box options and then follow the Upgrade Wizard instructions to complete the upgrade.

TAKE NOTE Begin the firmware upgrade process with the 831C "disconnected" from G4.

Current instrument firmware is distributed as part of G4 LD Utility installation and can be found by browsing to the following folder:

C:\Program Files (x86)\PCB Piezotronics\G4\Firmware

6.3 Manually Add My Equipment

Add an SLM

To add a new SLM, follow these steps:

Step 1 In the tree, select the folder **SLMs**.

Step 2 In the main view, select the button **Add SLM**.

Step 3 Enter the **Serial Number** for your 831C and the **Calibration Due** date.

Step 4 **Save**.

Add a preamplifier

To add a new preamplifier, follow these steps:

Step 1 In the tree, select the folder **Preamplifiers**.

Step 2 In the main view, select the button **Add Preamplifier**.

Step 3 Select **Manufacturer** and **Model**. If needed, click the green button to add a new manufacturer or model.

Step 4 Enter the **Serial Number** for your PRM831 and the **Calibration Due** date.

Step 5 **Save**.

Add a microphone

To add a new microphone, follow these steps:

TAKE NOTE If you are adding a microphone not supported natively by the 831C, you will need to set the nominal sensitivity in the Calibration Settings page on the meter. To learn more, refer to the SoundAdvisor Model 831C SLM Reference Manual.

Step 1 In the tree, select the folder **Microphones**.

Step 2 In the main view, select the button **Add Microphone**.

Step 3 Select **Manufacturer** and **Model**. If needed, click the green button to add a new manufacturer or model.

Step 4 Enter the **Serial Number** for your microphone.

Step 5 The **Frequency Response** will need to be manually entered or imported. Select the **Edit/View** button. If you can import the values, select the **Import** button, navigate

to the text file and **Open**. **Continue** to return to the microphone data screen.

Step 6   Enter the **Calibration Due** date.

Step 7   **Save**.

Add a coupler

To add a new coupler, follow these steps:

Step 1   In the tree, select the folder **Couplers**.

Step 2   In the main view, select the button **Add Coupler**.

Step 3   Select **Manufacturer** and **Model**. If needed, click the green button to add a new manufacturer or model.

Step 4   Enter the **Serial Number**

Step 5   Select the coupler **Type**.

Step 6   Select the **Microphone** that is inside this coupler. You must have already entered in the microphone for it appear in this list. To add a microphone see "Add a microphone" on page 6-3.

Step 7   Enter the **Calibration Due** date.

Step 8   **Save**.

Add a mastoid

To add a new mastoid, follow these steps:

Step 1   In the tree, select the folder **Mastoids**.

Step 2   In the main view, select the button **Add Mastoid**.

Step 3   Select **Manufacturer** and **Model**. If needed, click the green button to add a new manufacturer or model.

Step 4   Enter the **Serial Number**.

Step 5   Select the **Coupler** that is used with this mastoid. You must have already entered in the coupler for it appear in this list. To add a coupler see "Add a coupler" on page 6-4.

Step 6   Enter the **Calibration Due** date.

Step 7   The **Response Correction** will need to be manually entered or imported. Select the **Edit/View** button. If you can import the values, select the **Import** button, navigate

to file and **Open**. **Continue** to return to the mastoid data screen.

Step 8 **Save**.

Add a calibrator

To add a new calibrator, follow these steps:

Step 1 In the tree, select the folder **Calibrators**.

Step 2 In the main view, select the button **Add Calibrator**.

Step 3 Select **Manufacturer** and **Model**. If needed, click the green button to add a new manufacturer or model.

Step 4 Enter the **Serial Number**.

Step 5 Enter the **Output Frequency** and **Output Level** which are listed on the calibrator.

Step 6 Enter the **Calibration Due** date.

Step 7 **Save**.

6.4 Import AUDit Legacy into AudCal

AUDit software saved customers, equipment and tests in a .mdb file. If you have this file and want to add it to AudCal to be used with the 831C, save that file on a PC with G4 LD Utility and upload.

TAKE NOTE Depending on your age of data, some information may not be available after importing. Review your data after import.

To import and sync legacy Audit into AudCal, follow these steps:

Step 1   Save .mdb file to PC.

Step 2   Launch G4 LD Utility.

Step 3   Navigate **Tools → Import Legacy Audit Database**. Choose file, then select **OK**.

FIGURE 6-3 Import Legacy Database
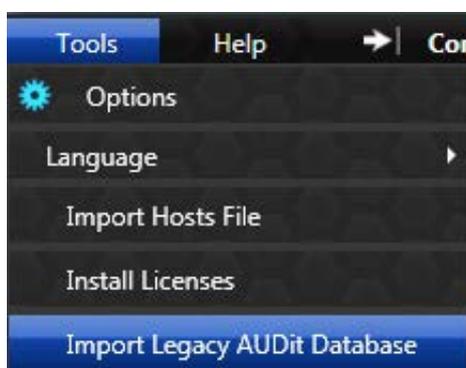
Step 4   You will see a success message if the legacy file can be imported.

Step 5   Connect to 831C.

Step 6   Sync to database by navigating **File → Sync AudCal Data**. You can remove .mdb file from PC.

A.1 Coupler/Headphone Pairings

AudCal automatically loads RETSPL data to these standard coupler/ headphone pairings. If you are using a nonstandard pairing, you will need to enter the RETSPL manually.

Table A.1 Standard coupler and headphone pairings

Head phone	AEC100	AEC201-A	AEC202	AEC203	AEC304	RETSPL	Notes
Ear Tone			✔	✔	✔ (occluded)	ISO 389-2	
ER-3A/5A			✔	✔		ANSI S3.6	
Koss HV/1A		✔				ISO 389-5	Use weight bag
		✔				ANSI S3.6	
Telephonics TDH-39	✔	✔				ISO 389-1	Use mass handle weight
	✔	✔				ANSI S3.6	
Telephonics TDH-49		✔				ISO 389-1	Use mass handle weight
	✔	✔				ANSI S3.6	
Telephonics TDH-50		✔				ISO 389-1	Use mass handle weight
	✔	✔				ANSI S3.6	
Sennheiser HDA200		✔				ISO 389-5	Use weight bag and type 1 adapter plate
		✔				ISO 389-8	
		✔				ANSI S3.6	
Sennheiser HDA280		✔				ISO 389-1	Use mass handle weight
		✔				ANSI S3.6	
	✔					Sennheiser	
Sennheiser HDA300	✔	✔				Sennheiser	Use mass handle weight
Beyer DT-48	✔	✔				ISO 389-1	Use mass handle weight
		✔				ANSI S3.6	
Interacoustics DD45	✔	✔				Interacoustics	Use mass handle weight
Radio Ear B-71	✔	✔				ISO 389-3	Use mass handle weight and optional AMC493B weighting mass
	✔	✔				ANSI S3.6	

A.2 Data Collection

The way the AudCal on the 831C SLM collects data for the tests is as follows:

Distortion, Frequency, Speech

Collected using FFT and 100 Hz high-pass filter.

FFT specifications:
- Number of lines: 6400
- Frequency span: 20 kHz
- Window type: Hanning window
- Frequency weighting: Z Weighted

Hearing Level, Linearity, Crosstalk and On/Off Ratio, Broadband Noise

Collected using FFT and 100 Hz high-pass filter.

FFT specifications:
- Number of lines: 6400
- Frequency span: 20 kHz
- Window type: Flat top window
- Frequency weighting: Z Weighted

Narrowband Noise

Collected using FFT and 100 Hz high-pass filter. The FFT is averaged over an 8 second period in order to provide more stable measurements and this average is what is used to calculate the noise level.

For Center Frequencies ≤ 1kHz
- Number of lines: 6400
- Frequency span: 2kHz
- Window type: Rectangular
- Frequency weighting: Z Weighted

For Center Frequencies >1kHz
- Number of lines: 6400
- Frequency span: 20kHz
- Window type: Rectangular
- Frequency weighting: Z Weighted

Pulse

Collected using a 100 Hz high-pass filter and a Hilbert filter to create an analytic signal which is used to find the envelope of the signal. All data points (e.g. rise time, fall time etc.) are found using this envelope. Two full pulses are required before all data points are valid and each point is measured as defined by the ANSI/ASA S3.6-2010 standard

Frequency Modulation

Collected using a 100 Hz high-pass filter and a Hilbert filter to create an analytic signal which is used by a demodulation algorithm. Data is updated every 2 seconds and requires a minimum ±2% frequency deviation before the mod rate will be calculated.

A.3 Measurement Detection

AudCal automatically progresses through each step of a test after a signal is detected as stable and a measurement taken. Once the values are within the expected limits, the values are set as the measurement. If the values are outside standard limits, AudCal waits up to 20-30 seconds before noting this step as failed then progresses to the next step.

However, there are some tests that do not follow this standard, to learn what conditions result in a stability and a measurement, refer to the following:

Distortion
Once the measured frequency is ±8% of the expected frequency, and the measured HL is ±25 dB of the expected HL.

Frequency
Once the measured frequency is ±8% of the expected frequency.

Hearing Level
Once the measured frequency is ±8% of the expected frequency, and the measured HL is ±10 dB of the Standards requirement for Air or Bone and audiometer type.

Linearity
Once the measured frequency is ±4% of the expected frequency, and the measured HL is within ±half of the HL step.

Pulse
Once the pulse signal is detected. This test will not time out.

Crosstalk and On/Off Ratio
Once you have selected **OK** on the dialogue box, a measurement will be taken.

Frequency Modulation (FM)
Once the measured frequency is ±10% of the expected frequency, and the Modulation Rate is stable.

Narrowband Noise
Once the measured frequency is within half the range between step frequencies.

Broadband Noise
The measurement is taken over several seconds and averaged over the required octave bands.

Speech
Once the measured HL is with in ±8% of the specified HL.

A.4 Measurement Accuracy

FFT Amplitude Accuracy	
Input Amplitude	**Accuracy**
≤ 110 dB	< ±0.2 dB
> 110 dB	< ±0.1 dB

FFT Frequency Accuracy	
Input Frequency	**Accuracy**
100 Hz to 20 kHz	< ±0.02% Hz

Self Distortion	
Frequency Range	**Accuracy**
100 Hz to 20 kHz	< ±0.04%

Frequency Modulation			
Metric	**Accuracy Carrier ≤ 500 Hz**	**Accuracy Carrier > 500 Hz**	**Unit**
Carrier	< ±0.2%	< ±0.1%	Hz
Modulation Rate	< ±0.2%	< ±0.2%	Hz
Max Frequency	< ±0.7%	< ±0.1%	Hz
Min Frequency	< ±0.6%	< ±0.1%	Hz

Pulse			
Metric	**Accuracy Carrier ≤ 500 Hz**	**Accuracy Carrier > 500 Hz**	**Unit**
Rise	< ±0.7	< ±0.4	ms
Fall	< ±0.7	< ±0.3	ms
On	< ±0.4	< ±0.3	ms
Off	< ±0.3	< ±0.3	ms
Plateau	< ±1.5	< ±1.1	ms
On/Off	< ±0.7	< ±0.5	dB
Overshoot	< ±0.2	< ±0.2	dB