

SoundAdvisor **831C Sound Level Meter**

Reference Manual



Larson Davis

SoundAdvisor

Model 831C

Sound Level Meter

Reference Manual

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Module 1 Model 831C Features

The SoundAdvisor™ Model 831C SLM is a Class 1 acoustic monitoring instrument with a full-color touchscreen that measures noise frequency, sound pressure level, and community and environmental sound. The “C” in 831C refers to the full-color screen.

G4 LD Utility software (G4) connects your meter to your PC via USB, WiFi, or TCP/IP. With G4 you can calibrate the meter, create setup files, download measurements, and analyze the results.

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1.1 Applications and Basic Operations

The 831C monitors:

- City noise
- Construction noise
- Airport noise
- Nuisance noise
- Noise ordinance compliance
- Wind farm noise

The 831C performs the following operations:

TRY THIS Explore the interface, press buttons, change settings, and test the operations.

- Measure sound using run, stop, pause, and resume measurement
- Display broadband and spectral sound values on a full-color display screen
- View live and stored data while a measurement is in process
- Log simultaneously to time, statistical measurement, and event histories
- Use markers to annotate portions of time histories, including voice annotation
- Automatically back up data to prevent data loss on power failure
- Calibrate using a Precision Acoustic Calibrator, and store calibration history
- Time-stamping for L_{max} , L_{min} , $L_{peak-(max)}$ single event metrics.
- Sync clock with PC, attached GPS, or Network Time Protocol (NTP)
- Create multiple Setup configurations using the Setup Manager
- Stream and record audio continuously or for events using sample rates up to 51.2 ksp/s in compressed or uncompressed format

- Communicate via USB, Ethernet, WiFi, or cellular (with cellular gateway)
- Operate completely from the device itself, or remotely using G4 LD Utility software
- Easily expand memory using USB memory
- Select desired color theme on the full-color graphic LCD display with touchscreen user interface

1.2 Hardware Features

The 831C is a precision-integrating sound level meter with the following hardware features:

TAKE NOTE Up to 32GB USB memory can be purchased from Larson Davis as an option.

- 2 GB internal industrial grade data memory
- 240 x 320 full-color graphic LCD display with touchscreen user interface
- Quiet Touch elastomeric keypad
- Meter uses NiMH, photo-lithium, lithium-Ion, and alkaline cells; 4-AA batteries provide upwards of 8 hours operating time
- AC/DC output jack with full dynamic range option
- Compatible with 61 m (200 ft.) microphone extension cable (full scale to 20 kHz)
- Dust-resistant, durable plastic case with lanyard (tripod mount is also available)
- USB 2.0 high-speed host connector for mass storage, weather sensors, USB headset, and WiFi communication devices
- USB 2.0 high-speed peripheral connector for control and data download by a PC
- I/O connector for power, weather transducers, logic input/output, and preamplifier communications

1.3 Performance Features

- Large dynamic range, > 120 dBA
- RMS Detectors: Slow, Fast, Impulse
- RMS Frequency Weighting: A, C, Z
- Peak Frequency Weighting: A, C, Z
- Any Level™ Simultaneous measurement and display of Max and Min sound pressure levels (Slow, Fast, and Impulse detectors), plus L_{eq} and Peak levels, all with A, C and Z frequency weighting
- Weather Measurements (Wind Speed and Direction, Temperature, and Humidity with SEN03x)
- SLM and FFT modes
- Multiple language support: English, French, Italian, German, Spanish, and Chinese
- Field-upgradeable firmware

1.4 Standard 831C Package Contents

The 831C is shipped in protective packaging. First, verify the shipment contains all parts and accessories for the configuration you selected. Report any damage or shortage immediately to Larson Davis/PCB Piezotronics, Inc. See the back cover of this manual for contact information. We also recommend that you retain the packaging for safe shipment for calibration service.

The 831C is available as part of a specialized system or in a standard configuration. The following accessories are contents of the standard configuration:

FIGURE 1-1 Contents, SoundAdvisor 831C Standard Package



Item Descriptions	
1. SoundAdvisor 831C Acoustic Meter	
2. Microphone (377B02) ½-inch free-field prepolarized microphone, 50 mV/Pa, providing performance conforming to Class 1 sound level meter standards	<p>Note: You can use other microphones with the 831C. For more information, see 1.5.2 Hardware Options.</p>
3. Microphone (377C20) ½-inch random incidence prepolarized microphone, 50 mV/Pa, providing performance conforming to Class 1 sound level meter standards	
4. Microphone Preamplifier (PRM831)	<p>CAUTION: Sensitive to static electricity</p>
5. Microphone Preamplifier (PRM2103)	
6. Accessory Kit (831-ACC) includes these items: Hard Shell Case (831-CCS) Universal AC USB Power Adapter (PSA029) USB to mini-B cable, 1.8 m (CBL138) 3 ½-inch windscreen (WS001) Four (4) Rechargeable AA NiMH batteries	
7. USB Drive <i>Not formatted for data storage</i>	Includes: G4 LD Utility software, <i>SoundAdvisor 831C Reference Manual</i> , Digital Calibration Certificates
8. Lanyard	Attaches to USB drive for easy retrieval

1.4.1 About Serial Numbers

The 831C serial number is printed on the back panel label. The microphone model and serial numbers are engraved on the outside of the microphone. The preamplifier model and serial numbers are engraved on the outside surface of the preamplifier.

We recommend that you record the purchase date, model and serial numbers for your instrument, preamplifier, and microphone.

1.5 Available Options and Accessories

In this section:

- [1.5.1 Firmware Options](#)
- [1.5.2 Hardware Options](#)

1.5.1 Firmware Options

The following upgrades/options are available to purchase from Larson Davis.com or via your LD representative.

Optional Firmware Packages	
Octave Band Analysis (831C-OB3)	Simultaneous, real-time 1/1 & 1/3 Octave Frequency Analysis for the range of 6.3 Hz to 20 kHz. Compliant with IEC 61260:2014 Class 1 and ANSI S1.11-2014 Class 1 standards.
Time History (831C-LOG)	Creates a record of changes in sound pressure level over time as a Time History, with selectable logging periods from 2.5 ms to 24 hours.
Event History and Measurement History with Exceedance logging (831C-ELA)	Measurement History for the manual or timed storage of statistical data, acoustic Event History, and exceedance-based logging analysis.
Sound Recording (831C-SR)	Save event-based or manual sound recordings in the measurement data file. in compressed or uncompressed (WAV or OGG) format that can be shared via email or SMS
Measurement History, Sound Recording (831C-MSR)	Measurement History for the manual or timed storage of statistical data with all sound recording capabilities.
Meteorological Data Collection (831C-WTHR)	Provides a complete variety of metrics for measuring and describing wind, precipitation, relative humidity and other conditions provided by your compatible weather sensor. Compatible with analog and digital sensors; from simple to complex applications.
Sierra Wireless Cellular Communication (831C-SW)	Make direct USB communication with Sierra Wireless RV50X cellular gateway.

Optional Firmware Packages	
AudCal Software (831C-AUD)	Using the AudCal software from Larson Davis in conjunction with your SoundAdvisor 831C enables you to test the calibration of audiometers and sound booths.
Scheduling (831C-SCH)	Meter measurement scheduling feature for 831C and G4 LD Utility.
Agency Approval (831C-LNE/PTB/METTAS)	When installed and enabled, the Agency Approval firmware enables you to produce measurement data that is approved by the following agencies: LNE, PTB, METTAS. When in use, the “LNE” or “PTB” icon displays above the menu bar as shown in Fig. (LNE Displays w FW.png)
FFT Analysis and Tone Assessment (831C-FFT)	FFT and Tonality firmware option is used to determine the frequency content and tonality of the measured sound or vibration. Includes spectrogram and single or double integration for vibration analysis applications.
RT60 and Room Acoustics (831C-RA)	Use this option on the 831C to determine the reverberation time of a room and calculate sound absorption according to international RT60 specifications (ISO 3382 and ISO 354).
LEARN MORE For more information on installing and enabling these firmware options, see 9.7 "Enabling or Disabling Options" on page 92.	

1.5.2 Hardware Options

The SoundAdvisor 831C is the industry standard for a wide range of acoustic measurement applications when equipped with the applicable hardware, sensors, adapters, and protective accessories. The following table contains only a few examples of adaptive hardware options, such as microphones, preamplifiers, software, power supplies, tripods, calibrators, sensors, protective cases, adapters, and cables. For a complete listing of standard and system accessories, see the [SoundAdvisor Ordering page at Larson Davis.com](#).

Description	Available Options	
Microphone Options Note: These mics are available directly from Larson Davis. You can also use other microphones with the 831C.	Microphone (377A15) 1-inch, prepolarized pressure condenser microphone; 50 mV/Pa. Provides performance conforming to Class 1 sound level meter standards.	Microphone (377C01) ¼-inch free-field prepolarized microphone; 2 mV/Pa. Provides performance conforming to Class 1 sound level meter standards.
	Microphone (377C13) ½-inch, prepolarized, pressure condenser microphone; 12.6 mV/Pa. Provides performance conforming to Class 1 sound level meter standards.	Microphone (377C10) ¼-inch free-field prepolarized microphone; 1.0 mV/Pa. Provides performance conforming to Class 1 sound level meter standards.
Microphone Preamplifier Options	Preamplifier (426E01) ½-inch ICP Low Noise microphone preamplifier (requires adapter ADP074)	Preamplifier (PRM2103) Outdoor microphone preamplifier

Description	Available Options	
Environmental Protection Options	Environmental Shell (EPS2116) Protects microphone and preamplifier from rain and wind with mounting options for pipes, poles, and most tripods	
	Weather-proof Enclosure (EPS030-831) For remote noise monitoring; includes battery	
	Solar-powered noise monitoring system (NMS/EPS044) For outdoor, long-term, and unattended sound monitoring	
	Permanently-installed, solar-powered noise monitoring system (NMS/EPS045) For outdoor, long-term, and unattended sound monitoring	
Weather Data Acquisition Options	Digital weather transmitting station; wind speed and direction, temperature, humidity, pressure, and rainfall (SEN031), (CBL229 and DVX018 included for connection)	
	Ultrasonic Anemometer: wind speed and direction sensor (SEN032), (CBL229 and DVX018 included for connection)	
Communication Options	Ethernet Adapter (DVX012) Ethernet and USB Hub (DVX 013) WiFi Adapter (DVX014) Dual port USB Hub (DVX015) Serial to USB Adapter (DVX018)	831-INT-ET with integrated Ethernet capability
GPS Antenna	GPS Receiver, USB connector; magnetic mount (GPS002)	
Equivalent Electrical Impedance Adapter Options Choose one of the following adapters in place of the microphone when making very high impedance measurements. The adapter acts as a series capacitor with the same capacitance as the microphone it replaces. If you're making a square wave pulse measurement, include a 100 kHz, low pass, T-filter with the adapter.	6.8pF BNC Input Adapter for ¼-inch, 7 pF microphone equivalent (ADP002)	
	12 pF, BNC Input Adapter for ½-inch, 12 pF microphone equivalent (ADP090)	
	BNC In-Line, Low Pass Filter, 75kHz(ADP092)	
Cable Options		
Microphone Extension Cable: EXCXXX (shielded), where XXX is the length in feet (XXX = 010, 020, 050, 100, and 200 available)	USB Cable (CBL138)	
AC/DC Output Cable (CBL139)	I/O Interface Cable (CBL170)	

Module **2** Instrument Overview

This module describes the hardware and display components that contribute to the SoundAdvisor™ Model 831C.

In this module:

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2.1 Assembling Your 831C SLM

In this section:

- [2.1.1 Connecting the Microphone and Preamplifier](#)
- [2.1.2 Connecting the Preamplifier to Meter](#)
- [2.1.3 Disconnecting the Preamplifier](#)
- [2.1.4 Preparing the 831C for Long Term Storage](#)

2.1.1 Connecting the Microphone and Preamplifier

CAUTION DO NOT handle the microphone and preamplifier without observing the following items:

- Ground yourself so the pogo pin is not exposed to static shock.

- Never use excessive force.
- Gripping tightly or screwing tightly is unnecessary.
- Do not remove the microphone grid cap and expose the diaphragm.

FIGURE 2-1 Microphone and Preamplifier PRM831



The bottom of the microphone attaches to the top of the preamplifier. The preamplifier body houses a single gold pin with threads on the top edge, which are designed to fit the 1/2-inch microphone.

CAUTION Do not allow dust or debris to collect in an unassembled preamplifier.

- Step 1.** Carefully place the bottom of the microphone over the top of the preamplifier and gently screw the assembly together. The microphone body should seat smoothly against the preamplifier body.

To disconnect the microphone:

- Lightly grip the microphone body and gently turn.

2.1.2 Connecting the Preamplifier to Meter

CAUTION Do not attempt to screw the preamplifier onto the 831C

- Step 1.** Both the preamplifier and the preamplifier housing on the meter are marked for correct alignment. Look for an engraved line along the length of the preamplifier, which aligns with the arrow above the preamp release button on the 831C. For reference, see *Figure 2-2*.
- Step 2.** With the alignment marks on both pieces lined up vertically, insert the 5-pin connector of the preamplifier into the top of the 831C until you hear a small click.

2.1.3 Disconnecting the Preamplifier

- Step 1.** To disconnect the preamplifier, *press and hold* the **preamp release button** shown in *Figure 2-2*, while gently pulling the microphone/preamplifier assembly from the meter.

FIGURE 2-2 831C Preampifier Housing



2.1.4 Preparing the 831C for Long Term Storage

The Hardware Power Switch on the bottom of the 831C disconnects the batteries from the 831C hardware. (For reference, see *Figure 2-6*.) The real-time clock maintains its value while the switch is off. The power switch prevents battery drain when the meter is not in use for an extended period of time. If you plan to store the meter for more than 2 weeks, remove the batteries.

If the switch is in the “0” position, the batteries are disconnected. After installing batteries be sure to move the switch to the “|” position.


CAUTION DO NOT use the hardware power switch to turn the 831C OFF. Permanent damage and data loss may occur. Press the **Power** button once, then select **Off**.

2.2 Powering the 831C SLM

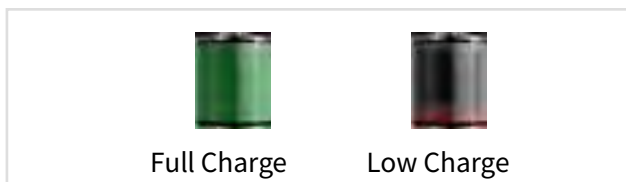
In this section:

- [2.2.1 Using Battery Power](#)
- [2.2.2 Using External Power](#)
- [2.2.3 Understanding 831C Power Events and Indications](#)

2.2.1 Using Battery Power

Current Battery Voltage is displayed on the Power Control page. To access the Power Control page, press the **Power button** .

In the Status Bar section of the meter display, the battery icon indicates the state of the battery charge by the color and fill.



CAUTION Do not mix different types of batteries. Only charge NiMH batteries.

CAUTION Do not mix batteries from different manufacturers, replace all 4 batteries at the same time.

CAUTION When changing batteries, select the correct **Battery Type** in **System Properties**. See [9.3.1 Changing Batteries and Editing the Battery Type](#).

CAUTION Resolve a Session Log entry “Charging Stopped” by checking the batteries, and ensuring the correct battery type is selected in **System Properties**. Additionally, the battery may be too old to charge. Battery may also be read as an incorrect battery type, which may happen to fully discharged NiMH batteries. Use an external battery charger to restore charge, then install in meter. Additionally, the batteries may be too hot or too cold.

CAUTION The 831C is compatible with Energizer, Duracell, and other commercially-recognized brands of these battery types:

- AA nickel metal hydride (NiMH)
- AA Alkaline
- AA 1.5 Volt Lithium

CAUTION Optimal battery temperature is 0° C–45° C.

Understanding the Low Battery Indication

As the battery nears the end of expected life, the empty battery symbol begins to flash. When the battery is no longer functioning, the 831C stops running, saves all data and instrument status, then turns off. When you power the 831C again with fresh batteries or an external power supply, the unit returns to the state it was in prior to shutting down.

Installing Batteries

FIGURE 2-3 Installing batteries into the 831C.



The battery compartment of the 831C is on the back of the instrument.

When installing batteries, always insert 4 fresh AA batteries, and observe polarity markings.

Charging Batteries in the 831C

You can charge batteries (NiMH only) in the meter in about 7 hours when the meter is powered off.

Before you begin:

- Install batteries as shown in ["Installing Batteries" on page 10](#).

Step 1. On the 831C, press **Tools**  → **System Properties**.

Step 2. Select **NiMH** as the **Battery Type**.

Step 3. The **Charge** drop-down menu is automatically set to **On**. If you do not want your power source to charge the batteries, select **Off**.

Step 4. Select **Save**, then click **Yes** to confirm your choice.

TAKE NOTE Batteries charge more efficiently when the meter is powered off. For details about 831C button LED indicators, see ["Understanding Charging Status LED Indications" on page 12](#).

Step 5. Power the meter off.

Step 6. Connect the meter (with the USB cable) to the included power cable (PSA029), and plug this in to a wall outlet or other external power source.

TAKE NOTE If you're using a power cable other than the one supplied with the meter, use a 28 AWG or larger wire for proper charging.

Understanding Charging Status LED Indications

The charge status indicated by the green LED behind the **Power** button is as follows:

- Solid green: Charging
- No green light: Not charging
- Green light wink: Maintaining charge
- Green light fast blink (two times per second): Charger fault
- Green light fastest blink (three times per second): Meter is powering on or shutting down

Resolving a “Charging Stopped” Session Log Entry

To resolve a “Charging Stopped” Session Log entry, check the battery placement, and make sure the correct **Battery Type** is selected (**Tools** → **System Properties**).

Resolving an “Incorrect Battery Type” Session Log Entry

Infrequently, when the battery becomes too old to charge, the meter may register the battery as the incorrect battery type. This can also occur when newer NiMH batteries are fully discharged. In this case, charge the batteries using an external battery charger, then install them in the meter.

You may also see this error when the batteries become too hot or too cold. Optimal battery temperature is 0° C–45° C.

2.2.2 Using External Power

The following available external power sources augment the 831C's internal battery:

- USB port from a computer
- USB port from PSA029 power supply
- I/O connector from an external +10.8 to +25 Volt DC mains power source.

Accessing External Power by Using the USB Port

- Step 1.** Connect the PSA029 power cable to an external power source on one end and to the included USB Type B power cable (CBL138) on the other end.
- Step 2.** Then insert the mini-USB (Type B) connector into the mini USB (Type B) port on the bottom of the meter.

CAUTION If you operate the 831C without batteries and power is interrupted, you may lose your data.

With the PSA029 power supply connected and operating at rated conditions, the 831C operates properly with or without batteries installed. Use the included cable (or another cable with the same gauge wire) to prevent excessive power loss.

2.2.3 Understanding 831C Power Events and Indications

The SoundAdvisor™ 831C has a multi-color back-lighted keypad, which provides the following colored indications for charging and measurement statuses.

Understanding Charging Status Indicators






The charging status is indicated by the green LED behind the **power button**  as shown in *Table 2.1*.

Table 2.1 Charging Status LED Indicator

Charging Status	 Green LED
Charging	solid green 
Not charging	off
Charging stopped (charger or battery fault)	short green blink 
Meter is powering up or shutting down	fast, quick green blink 

In addition to keypad indications, the appearance of one the following icons on the meter display indicate a significant power event.

Understanding a Low Voltage Shutdown Event

The 831C preserves the service life of an external battery by preventing it from being discharged excessively. When the battery voltage drops below the External Shutoff Voltage (default value +10.8 volts) and remains above +10.2 volts for one minute, the instrument stops, saves data, and turns off.

Understanding a Power On Attempt After Power Loss Event

Automatic Power On Attempt After Power Loss Event is an 831C feature that applies only when the meter is operating on “Continuous” Meter Control. This pertains most often to outdoor noise monitoring applications.

If the 831C is operating on “Continuous” Meter Control the following two circumstances qualify for the power on attempt:

- When the meter shuts down due to a low battery
- When the input voltage from an external power supply falls below the value set for the External Shut-off Voltage.

in which it automatically attempts to power up after a short reprieve. It remains on with an adequate power supply. However, if the battery is still discharged, the meter powers off and again attempts to power on after a short reprieve. This cycle of “power on” attempts continues until the meter successfully powers on.

and shuts down due to a low battery—or when the input voltage from an external power supply source falls below the indicated External Shutoff Voltage—

This feature is designed to allow the 831C to automatically restart and resume a continuous measurement when power is lost due to low solar power or after an extended power outage.


When the 831C is powered from an external supply and the input voltage falls below the indicated External Shutoff Voltage threshold, it powers off and attempts the power on cycle

LEARN MORE To learn more about reboot time after a power loss, see Table A-7 “831C Power-On Attempts After External Power Failure” on page A-8.

Understanding a Sudden Loss of External Voltage Event

When the external voltage is suddenly lost—if the external supply is disconnected or the main power fails and there is no external battery—the 831C continues to run on internal batteries if they are present and in good condition. If battery power is not present, the 831C immediately switches to an internal recovery battery and powers down safely.

Understanding the External Power Indicator

When connected to an external power source using the included USB cable, the **External Power icon**  replaces the Battery icon.

If your meter has fully-charged NiMH batteries and is plugged into a power source, this icon indicates that it’s using power from the external source, and is not charging or using any power from the batteries.

Understanding a Low Power at Start Up Indicator



At start up, the 831C performs a power check. If the supplied power is too low, the **low power icon** displays over top of the first display. For more information see **Table A-6, “Status for Low Power at Boot-up”**.


Understanding Low Input Power Indicator

When “**Low Input Power**” displays on the Power Control Page (see *Figure 2-4* on this page), the USB cable cannot supply sufficient power to charge the internal batteries. To

resolve this issue, contact Larson Davis (see back cover of this manual) and request the CBL138—which is a 3-foot, USB 2.0 A Male to Mini-B, 5-pin Male 28/24 AWG Cable with Ferrite Core.




2.2.4 Powering On or Off

Powering On

Press and hold the **ON/OFF** button  on the meter until the screen flashes and the green LED under the button lights up.

Powering Off

There are 3 ways to power off the 831C:

- Press the **ON/OFF** button  once to access the Power Control page, then press the **top-left softkey** to select **Off**.
- From any screen, press and hold the **ON/OFF button**  for 3 seconds to begin the shut down sequence.
- Press and hold the **ON/OFF button**  for 10 seconds to force an immediate shutdown. **CAUTION:** Using this method may result in lost data.

2.2.5 Using the Power Control Page



From the Live View, press the **up button**  to view your meter's current power settings (**Live 8/8**).

FIGURE 2-4 831C Power Control Page (Live View)

Battery settings display here. You can edit these settings from the Power Control page. For more information, **1.** see [9.3 Editing Power Settings](#).



Date	2019-07-02
Time	10:12:10
Run Timer	13:47:49.4
Battery	Charging
NiMH	5.4 V
USB Powered	4.7 V
T(internal)	90 °F
Memory	12% Free
	219.3 MB of 1.8 GB
	17 Data Files

2.3 Instrument Hardware Overview

FIGURE 2-5 831C Instrument Overview (front)



FIGURE 2-6 Instrument Hardware



CAUTION DO NOT use the hardware power switch to turn the 831C ON or OFF. The purpose of this switch is to disconnect the batteries for long-term storage (1 to 2 weeks). See **2.1.4 "Preparing the 831C for Long Term Storage" on page 9.**

CAUTION DO NOT use the AC/DC port as a headphone jack.

- 1. AUX** connector intended for use with USB mass storage, cellular modem, GPS, headphones, speakers, and future devices.
- 2.** Hardware **Power** Switch when set to “0” completely powers down the 831C for storage. Set to “|” for instrument operation.
- 3. USB** Interface 2.0 peripheral full-speed port used for communication, full control, and downloading of data to PC. The PSA029 external power supply may be connected here. The maximum USB cable length is 1m and the cable is part number CBL138.
- 4. AC/DC** 2.5 mm Output jack for analog AC/DC output signals.
- 5.** The **I/O Connector** for peripherals and external power is typically used for external devices.

2.3.1 Using the 831C Keypad

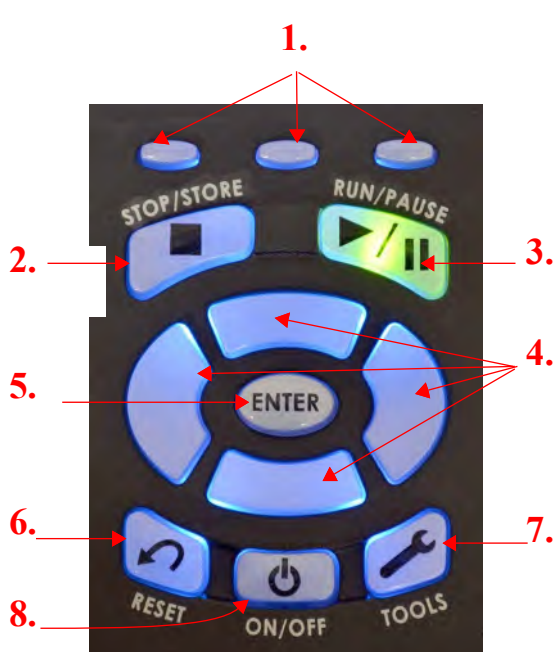








In this section:

- **831C Button Actions**
- **Entering Text**
- **LED Keypad Indicators**

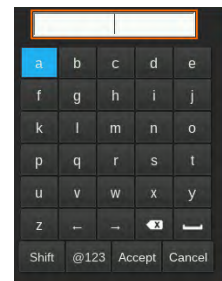
The 831C has 13 buttons that are used to start, stop, or pause a measurement; navigate within the display, and power the meter off. To navigate the display on the meter, you can press directly on the touchscreen using the tip of your finger, or use the navigation buttons as shown in *Table 2.2*.





831C Button Actions

Table 2.2 831C Button Actions

Action	Button(s)	Description
<p>FIGURE 2-7</p> 	<p>1.</p> 	In a menu, press a top soft key to navigate to left or right tabs
	<p>1.</p> 	When specific menu name displays above a top softkey, press that key to access the menu.
	<p>1.</p> 	When Close displays above the top-middle soft key, press to close or save. To exit without saving, press it, and then select No or Cancel .
	<p>2. 7</p>	When running, press Stop/Store to stop; press when the meter is stopped to store the measurement.
	<p>3. 9</p>	Press Run/Pause once to Run; press while running to Pause; press while Paused to resume the measurement.
	<p>4.</p> 	Move left or right within a display (e.g., move highlighted octave band)
	<p>5.</p> 	Press the Enter button to move up and down on certain pages.
	<p>5.</p> 	Press the Enter button to make a selection.
<p>6.</p> 	Press the Reset button to clear unsaved measurement data. Press again to reset filters (this may take a few seconds).	
<p>7. 3</p>	Press the Tools button to access all menus.	
<p>8.</p> 	Press power to begin shutting down.	

5.
FIGURE 2-8
Entering Text



The 831C allows for complete operation from the meter. When you press **Enter**  to select a field to enter text, a virtual keypad appears. Use the **up**, **down** , and **left**, **right**  navigation buttons to navigate it. Press the **Enter** button  to make a selection.

LED Keypad Indicators











The SoundAdvisor™ 831C has a multi-color, back-lighted keypad (see *Figure 2-7*), which provides the following SLM measurement statuses by using the LEDs behind the **Stop** button  and the **Play/Pause** button . *Table 2.3* shows the measurement states associated with the red and green LED back lights.

Table 2.3 Measurement Status LED Indicators

Measurement State	● Red LED 	● Green LED 
Stopped with Reset	long, quick red blink 	off
Stopped	long then short red blink 	off
Paused	short red blink 	short green blink 
Running	off	Long then short green blink 
Waiting for valid data to begin running	short delayed blink 	off

2.4 Display Elements Overview

In this section:

- [2.4.1 Changing Display Color Themes](#)
- [2.4.2 Using Tabs and Pages](#)
- [2.4.3 About Status Bar Icons and Indicators](#)
- [2.4.4 Main Menu Overview](#)
- [2.4.5 Tools Menu Overview](#)
- [2.4.6 Power Control Menu Overview](#)

2.4.1 Changing Display Color Themes

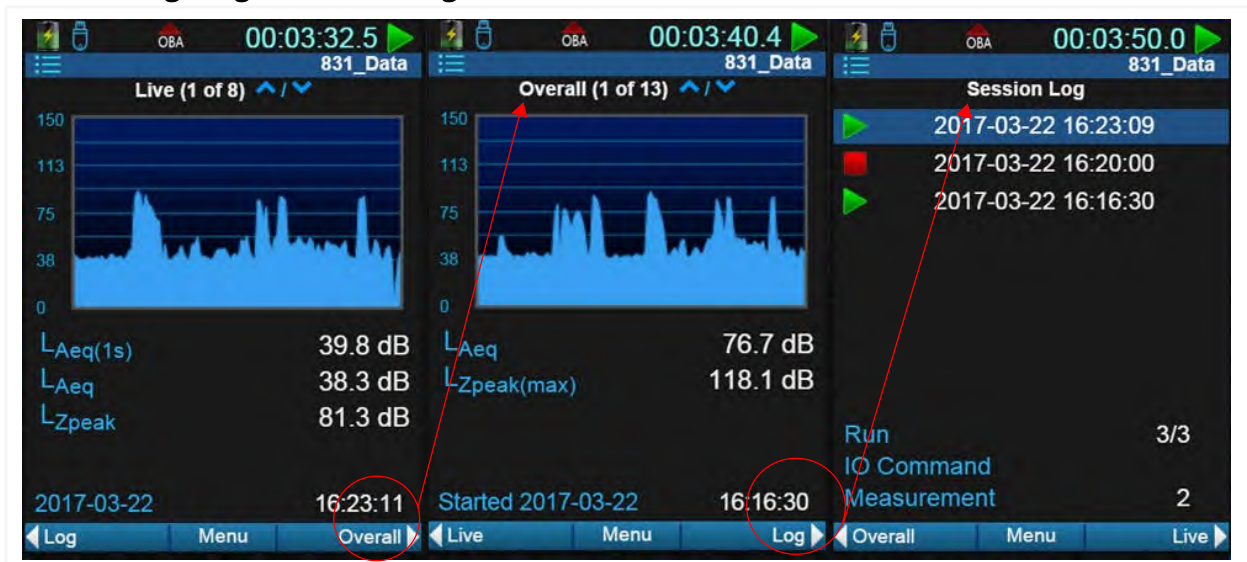
The 831C has a multi-color, back-lighted LCD touchscreen and allows you to select your preferred color theme. The Dark theme is featured in this manual. For more information, see [9.4.7 Customizing the Display Color Theme](#).

2.4.2 Using Tabs and Pages

The 831C interface is organized into tabs. The **Live** and **Overall** tabs are further organized into pages that can be accessed using the up or down navigation buttons (⏮ ⏭). If needed, additional pages of measurement data are available to purchase from Larson Davis.

When the 831C is first powered on, the Live tab (Page 1) is the first screen you see. Press the top-left or top-right softkeys (◀ ▶) to navigate between tabs. *Figure 2-9* shows the next two tabs to the right of the Live tab.

FIGURE 2-9 Navigating Tabs to the Right

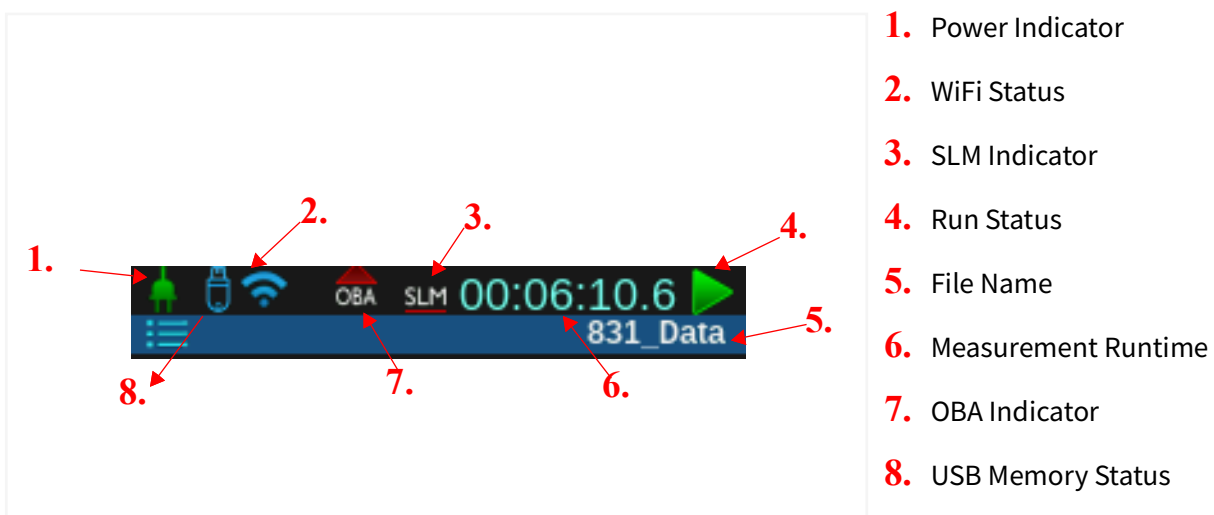


LEARN MORE For complete details on each tab and page, see [Module 4 Using the Data Display](#).

2.4.3 About Status Bar Icons and Indicators

The status bar at the top of the screen displays the meter, measurement, connection, alert status, and battery status as shown in *Figure 2-10*.

FIGURE 2-10 Status Bar



Power and Battery Power Indicators

The battery icon indicates the state of the battery charge by color and volume. When using battery power, the battery icon indicates the state of the battery from fully charged to depleted, left to right. The bolt symbol appears over the battery icon if the battery is currently charging.



External Power Icon



The external power connection icon appears when the 831C is powered from an external power supply or from the USB port.

WiFi Status Icon

See [13.3 Using WiFi On Your 831C](#).

USB Memory Status Icons



When you insert a USB drive into the 831Cs USB port, the **USB drive icon** appears in the Status bar of the meter's display as shown in *Figure 2-10*.



If the Data Storage setting is set to USB, but no USB drive is inserted, the **USB not available icon** appears. Files save to the meter until you insert a USB drive.



If the USB drive is removed during a measurement, the same icon appears, the measurement ends, and data with that measurement is not visible on the meter. When the USB drive is reinserted, the **USB caution icon** appears. The meter notifies you that there is unsaved data and prompts you to Save or Delete the measurement data. You cannot continue with the same measurement.

Input Overload Icon



When a signal from the preamplifier exceeds the calibrated input range of the 831C, the Input Overload icon appears. While the overload is present, the icon flashes.

When the overload condition resolves, the icon is still present (not flashing) to indicate that an overload has occurred during the measurement. Press the RESET button to clear the icon from the display.

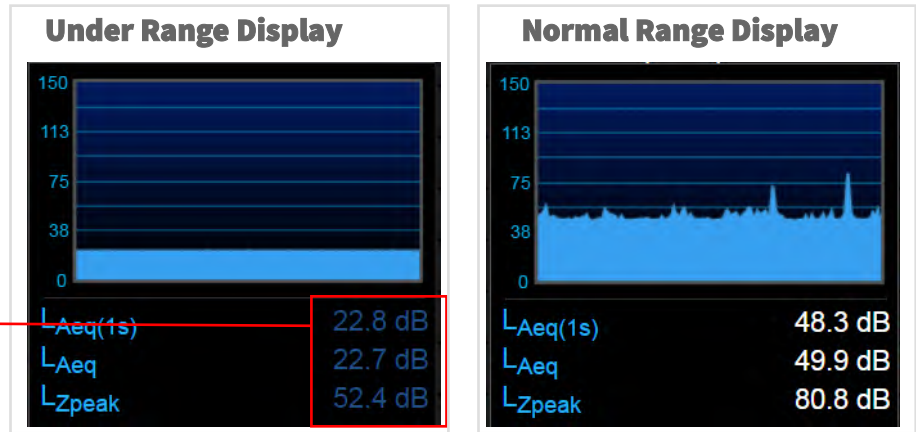
Under Range Icon



The Under Range icon displays in the status bar while an under range condition applies. For details about the under range level, see [5.1.2 Determining Noise Floor, Overload, and Under Range Levels](#).

FIGURE 2-11 Display for Under Range vs. Normal Range Live Data

Values in an “under range” condition appear in dark blue on the Live tab.



OBA Overload Icon



The OBA Overload icon displays while the input to the Octave Band Analyzer is overloaded.

TAKE NOTE When the OBA Range property is set to **Normal**, the OBA Overload Icon displays at a level 33 dB lower than if the OBA Range had been set to **High**.

OBA Under Range Icon

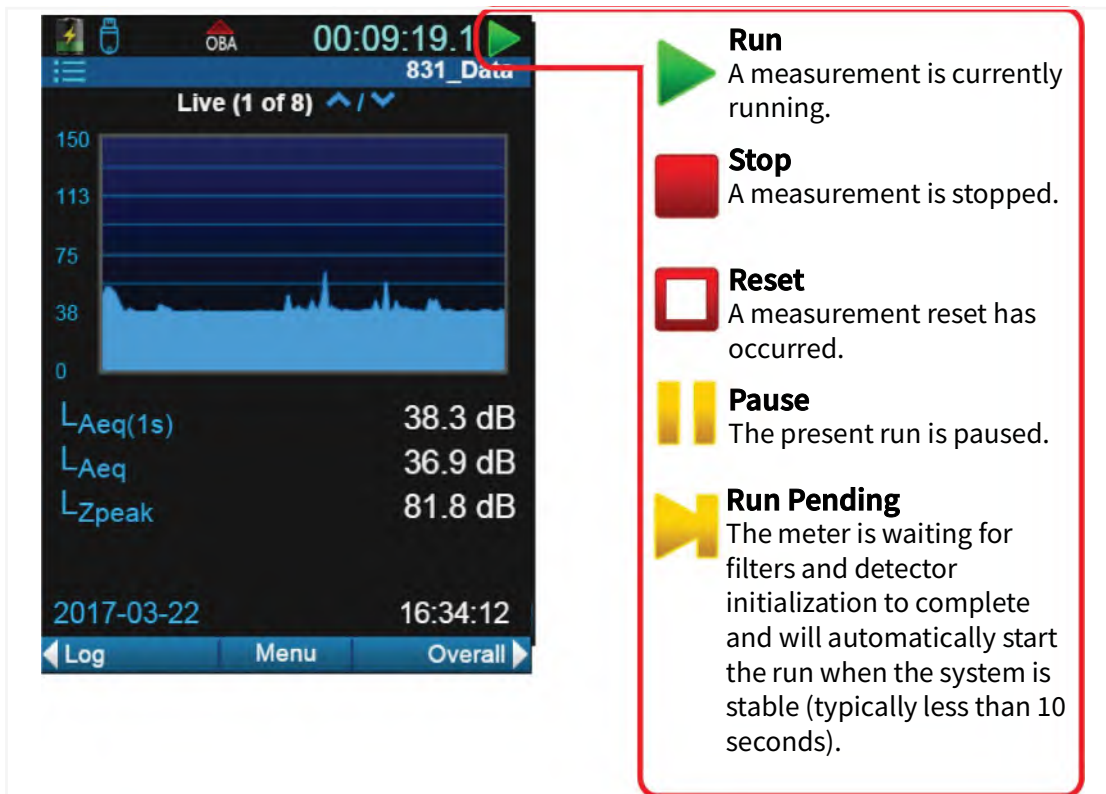
When the signal from the preamplifier drops so that the noise level of the instrument and the preamplifier influence the measurement, an Under Range condition exists.

When all filters of the OBA are “under range” the OBA Under Range Icon flashes.



Measurement Status Icons

FIGURE 2-12 Measurement Status Icons



If the touchscreen is enabled, or if you're operating the meter remotely, tapping the icon produces the following result:

Table 2.4 Using the Measurement Status Icon

Measurement State	Action	Resulting Measurement State
Run	Tap Once	Stop
Run	Double Tap	Pause
Pause	Tap Once	Run
Stop/Reset	Tap Once	Run
Stop/Reset	Double Tap	Store
Run Pending	N/A	N/A
Power Save	Tap Once	Run

Sleep Icon



When the 831C is not connected to a PC, it can be put in a battery power saving “sleep” mode that shuts down the analog circuitry, including the preamplifier. In this case, the Sleep icon displays in place of the measurement status icon.

To learn more about power saving options, see [9.3 Editing Power Settings](#).

File Operation Icon



The file operation icon appears in the status bar while a file is saved to the USB, moved from the USB to meter, or copied. All these operations are done in the Data File Manager.

For more information, see [8.2 Using the File Manager](#).

2.4.4 Main Menu Overview

The 831C main menu contains the following 5 features:

Setup Manager

The Setup Manager is a menu on the 831C —divided into tabs just like the 831C main display— that enables you to customize measurement settings in a setup file or “Setup.” To access the Setup Manager, press the **Menu** (○●○) soft key, and select **Setup Manager**.

TAKE NOTE You can also create a setup file using G4 LD Utility, then transfer the file to the meter. For more information, see the *G4 LD Utility Manual*.

Mark Sound Type

When you've purchased and installed firmware option 831C-SR or 831C-MSR, this feature allows you to assign a **Sound Type** marker to the current sound. When you examine the data file after the measurement, the marker indicates where that sound type occurred

during the measurement. See [20.2 Using Mark Sound Type to Make Manual Sound Recordings](#).

Adjust Graph Menu

Allows you to adjust the X and Y on the visual graph when needed.

Reset

This feature operates the same as the **Reset** button on the meter. Press once to clear any unsaved data for that measurement. Press a second time to reset filters. You may need to wait a few seconds while filters reset completely before making a new measurement.


Locate

Allows you to locate a record from a measurement and/or event history measurement. Explained in Modules 15–17.

Print Screens

Available when the 831C is connected to an external printer. For more information, see [21.4 "Utilizing an External Printer" on page 166](#).

2.4.5 Tools Menu Overview

Press **Tools**  to access the following menus and settings on the 831C:

File Manager

Access all data files on the meter or the inserted USB drive. For more information, see [Module 8 Managing Measurement Data Files](#).

Calibrate

Calibrate the microphone for accurate measurement. See [Module 5 Calibrating Your SoundAdvisor 831C](#).

Setup Manager

Setup measurement parameters and metrics. See [Module 6 Creating a Measurement Setup](#).

System Properties

Access properties for the meter, set time, language, and other preferences. See [Module 9 Setting System Properties](#).

About Tab: System Information

Access system information. See [Module 10 System Information](#).

Lock

Lock the meter's screen to prevent tampering. See [Module 11 Managing 831C Security](#).


System Utilities

Format or restore file system. See [Module 12 Using System Utilities](#).

Communication

Quick access to communication properties. See [Module 13 831C Network and Connections](#).

2.4.6 Power Control Menu Overview

To access the following actions on the Power Control menu, press **power**  once.

- Battery Information
- Display Brightness
- Power Off
- Reboot

Module **3** Getting Started

In this module:

3.1	Operating the 831C by Using the Meter Display	-----26
3.2	Operating the 831C Remotely	-----27
3.2.1	Operating the 831C from G4 LD Utility Software	
3.2.2	Operating the 831C from the LD Atlas App	
3.2.3	Operating the 831C from a Web Browser	
3.3	Setting File Storage Preferences	-----28
3.3.1	Selecting a File Storage Location	
3.3.2	Using the 831C File Storage Calculator	

3.1 Operating the 831C by Using the Meter Display

- Step 1.** Prepare your data file storage preferences as shown in [8.1 "Setting Data File Storage Preferences" on page 75](#).
- Step 2.** Create a measurement setup file as shown in [Module 6 Creating a Measurement Setup](#).
LEARN MORE Depending on your measurement type and installed firmware options, Modules 15-18 may be helpful while creating the measurement setup file.
- Step 3.** Calibrate your 831C as shown in [Module 5 Calibrating Your SoundAdvisor 831C](#).
- Step 4.** Make a measurement as shown in [Module 7 Making a Measurement](#).
LEARN MORE The G4 LD Utility manual contains several chapters with example measurements. Depending on your measurement type, Modules 4–Environmental Noise Study Example in the G4 LD Utility Manual may also be helpful.
- Step 5.** Use the 831C File Manager to view and work with data files on the meter. For more information, see the following sections:
- [8.2 "Using the File Manager" on page 77](#)
 - [8.3 "Saving, Moving, or Copying Data Files" on page 79](#)
- Step 6.** For more information about modeling your measurement data files in G4, see the *G4 LD Utility Manual*, Module 7 Working With Data Files in G4.

3.2 Operating the 831C Remotely

In this section:

- [3.2.1 Operating the 831C from G4 LD Utility Software](#)
- [3.2.2 Operating the 831C from the LD Atlas App](#)
- [3.2.3 Operating the 831C from a Web Browser](#)

3.2.1 Operating the 831C from G4 LD Utility Software

- Step 1.** Launch the G4 LD Utility software.
- Step 2.** Open the G4 Manual. To do this in G4, go to **Help** → **Manuals** → **G4 LD Utility**.
- Step 3.** Begin by completing the applicable processes in **Module 2 Getting Started in G4**.

The 831C can also operate on an automated weekly schedule when using G4 and the 831C Scheduling firmware option (831C-SCH), which is available from Larson Davis.

LEARN MORE For more information on this feature, see the *G4 LD Utility Manual* “Module 6 G4 Features for 831C.”

3.2.2 Operating the 831C from the LD Atlas App

- Step 1.** Install the LD Atlas app.

Installing LD Atlas for Mobile Devices



The LD Atlas app is available for Android from the Google Play Store¹, or for iOS from the Apple App Store².

- a. Open the app store on your mobile device.
 - b. Search for “LD Atlas” and follow the prompts to install it.
- Step 2.** Launch LD Atlas on your mobile device.
- Step 3.** Establish a WiFi connection from the meter to your mobile device. For more information, see [13.3 Using WiFi On Your 831C](#).

1. Android is a trademark of Google, LLC.

2. Apple and iPhone are trademarks of Apple, Inc., registered in the U.S. and other countries.

- Step 4.** In LD Atlas on your mobile device, and tap the name of your meter in the Meters Panel. If the meter is connected, the meter type icon displays in blue.

Figure 3-1 LD Atlas Meters Screen



- Step 5.** To operate the 831C in LD Atlas, you may adapt all processes described in the *G4 LD Utility Manual* beginning with “2.3 Connecting the Meter in G4.”

3.2.3 Operating the 831C from a Web Browser

We recommend using G4 LD Utility or LD Atlas, but if needed you can operate your meter remotely by using a web browser.

- Step 1.** Establish a network connection from the 831C to the Internet. For more information, see **Module 13 831C Network and Connections**.
- Step 2.** You may want to consider activating the 831C network and meter security features described in **Module 11 Managing 831C Security**.
- Step 3.** Open a web browser on a mobile device or PC. We recommend using Google Chrome.
- Step 4.** In the address field, type the IP address of your 831C Sound Advisor.
Ex: 192.168.103.25/SoundAdvisor
TRY THIS To find your meter’s IP address when using WiFi, go to **Tools** → **Setup WiFi**. “My IP” appears at the top of the screen. To find your meter’s IP address when using Ethernet, go to **Tools** → **Communication**.
- Step 5.** For step by step instructions to create a measurement, follow the process outlined in **3.1 "Operating the 831C by Using the Meter Display" on page 26**.

3.3 Setting File Storage Preferences

Before you begin making a measurement, use the meter preferences to indicate where your future data files will be stored.

In this section:

- [3.3.1 Selecting a File Storage Location](#)
- [3.3.2 Using the 831C File Storage Calculator](#)

3.3.1 Selecting a File Storage Location

In this section, choose how and where files are saved when a measurement stops.

Step 1. On your 831C, go to **Tools**  → **System Properties** → **Preferences**.

Step 2. From the **Auto-Store** drop-down menu, choose one of the following values:

- **None**

After a measurement, the system properties do not save or prompt you to save the measurement data. Choose this setting if you plan to use an auto store option in the setup file or the Scheduling firmware option (831C-SCH).

- **Prompt**


After a measurement ends, the meter system properties displays a dialog where you can choose to store the measurement or cancel.

- **Store**

After a measurement ends, the meter system properties automatically store the data file.


Step 3. Select one of the following options from the **Data Storage** drop-down menu:

- **Internal**

The 831C has 1.8 GB of internal memory. When the available internal memory reaches 10 MB, the 831C stops automatically. If the remaining unsaved data is less than 800 kB, press **Stop/Store**  to save it. Before you begin another measurement, download all internal data to an external drive or PC by using the Data File Manager or G4 LD Utility.

TAKE NOTE This option is not available as the Primary storage location for FFT measurements which utilize OGG file compression.

- **USB**

With this option, data files saved manually (and by the meter's auto-store preference) save to the inserted USB drive. If there's no USB drive available, the **USB not available icon**  displays in the top status bar, and data files save to the 831C internal memory.

TAKE NOTE We recommend that you choose this storage option as the primary storage location for FFT measurements that utilize OGG file compression.

Step 4. Click **OK** to confirm a meter reset, if needed, then click **Close** to save your changes.

LEARN MORE For information about copying files to USB, see [**8.3.2 "Moving or Copying Data Files to a USB Drive" on page 80**](#). For information about moving internal files to a PC via G4, see the *G4 LD Utility Manual*.

LEARN MORE For details about saving files to an SMTP or cloud storage account, see [**9.10 "Enabling or Disabling Remote \(Cloud\) Storage" on page 94**](#).

3.3.2 Using the 831C File Storage Calculator

The Memory page on the Live view provides a helpful file storage calculator that can help you estimate the amount of storage a measurement might require. For details, see **"About the Memory Page" on page 36.**

Module **4** Using the Data Display

The 831C takes a measurement, and simultaneously displays the resulting data a series of themed tabs, such as the Live tab, Overall tab, etc. At a minimum, tabs and pages display the following SLM metrics:

- Real time sound metrics
- Frequency of sound at each octave
- L_{eq} , L_S , L_{PEAK} of the overall or live sound
- Fast and Impulse detectors
- Temperature, GPS, and elevation of the measured sound
- The current sound, weighted for specific values

This module shows how to navigate and view SLM data, and how to adjust or customize the data display to fit your requirements.

In this module:

4.1	SoundAdvisor 831C Display for SLM Mode	31
4.2	Enabling or Disabling Display Tabs	48
4.3	831C Display for FFT Mode	49



4.1 SoundAdvisor 831C Display for SLM Mode

In this section:

- **4.1.1 Understanding the Live Tab**
- **4.1.2 Understanding the Overall Tab**
- **4.1.3 Viewing Weather-Related Data**
- **4.1.4 Understanding the Session Log Tab**
- **4.1.5 Adjusting the Graph Scale On Any Tab**

4.1.1 Understanding the Live Tab

When the 831C is powered on, the Live tab is the first display. Since the values on the Live tab show active, real-time values the meter is currently sensing, this page is not controlled by the Run/Pause button. The Live tab allows you to view the current SPL (sound pressure level) without disrupting your measured data.

Press the **up**  or **down**  buttons to scroll up or down on the pages of the Live tab.

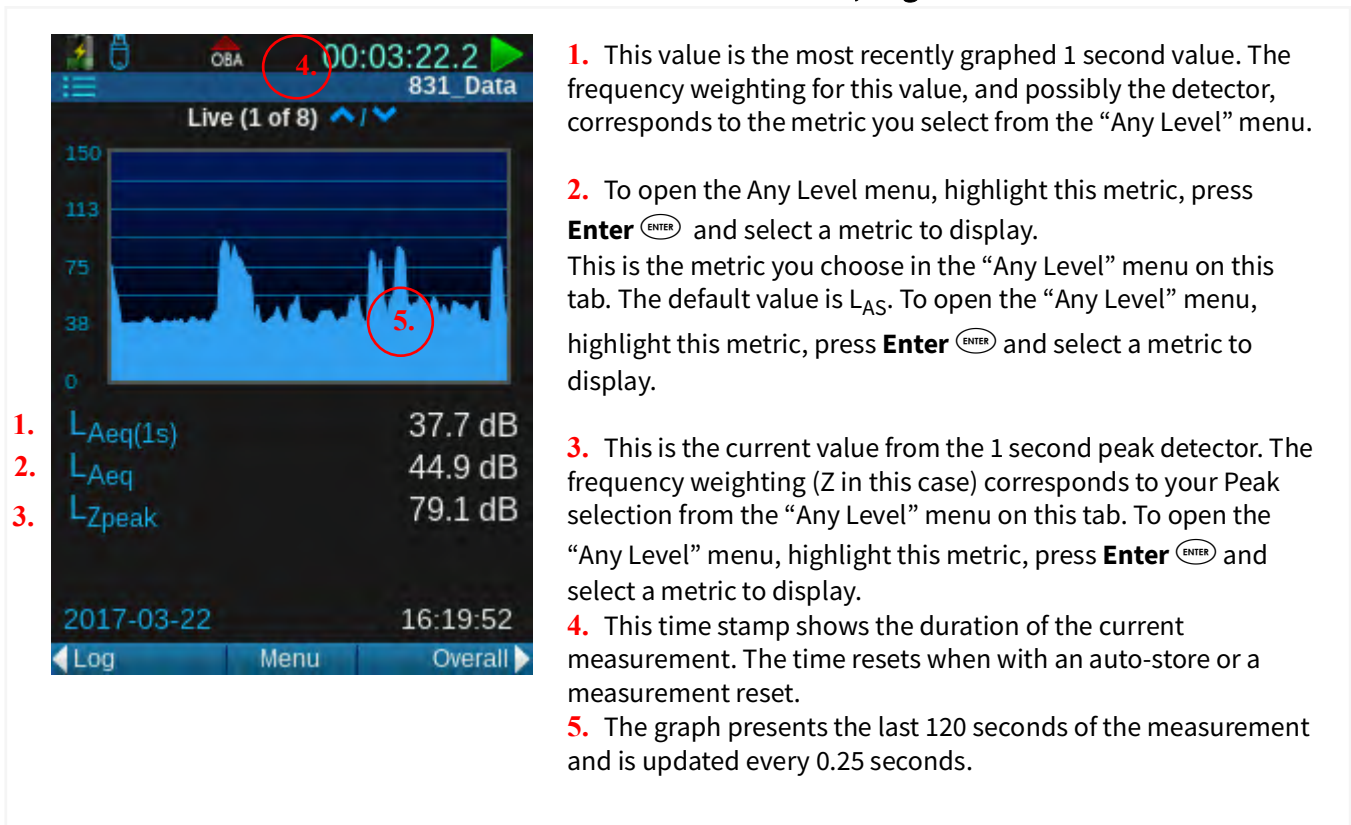
The labels for sound metrics on the 831C are designated by international standards. For many displayed values, the frequency and time weighting are indicated in the name of the metric. For example, L_{AS} is the A-weighted sound pressure level measured using the Slow detector.

LEARN MORE For more information about labels on display pages look for specific terms in the [Module C Glossary](#).

TAKE NOTE Depending on which features and options you've enabled, your 831C Live tabs may differ from those shown in this section.

The Live tab (page 1) presents current sound levels the meter is sampling. Metrics displayed on this page are all customizable as shown in *Figure 4-1*.

FIGURE 4-1 Details of the Live Tab, Page 1



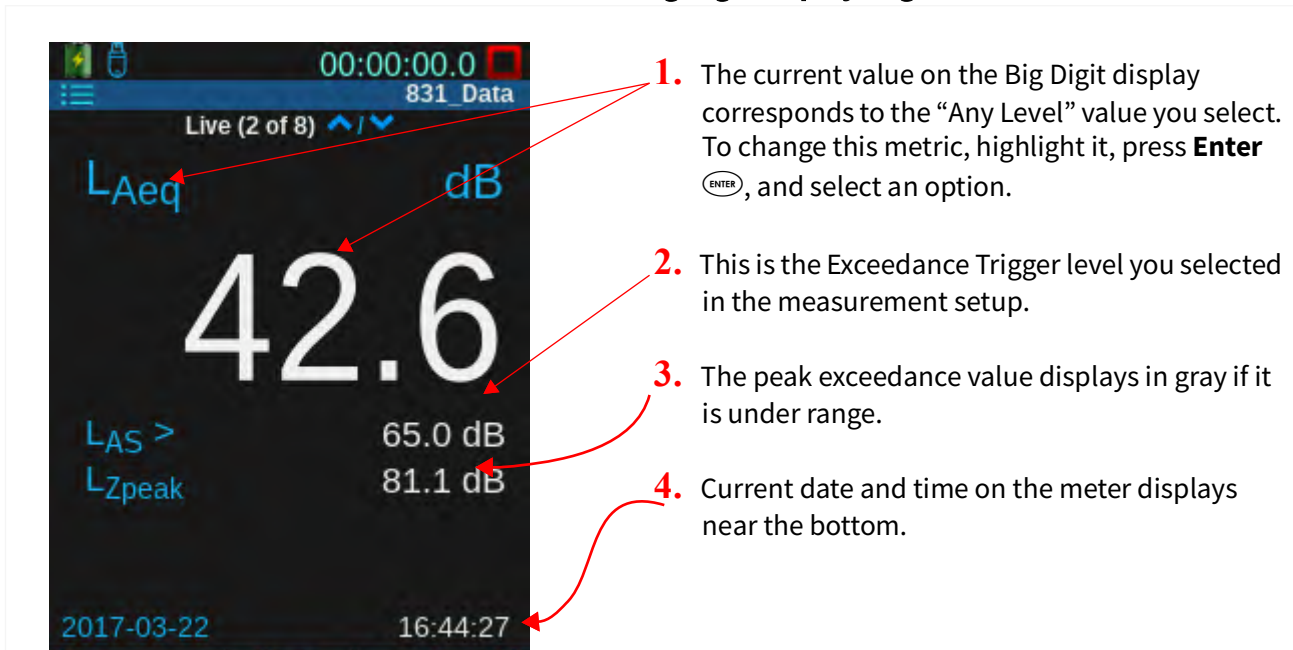
Adjusting the Graph Scale

You can adjust the Y-axis of the graph to show dB values between 340 and -20. For details, see [4.1.5 Adjusting the Graph Scale On Any Tab](#).

About the Big Digit Sound Page

The big digit display is best for observing the instantaneous sound level and monitoring when the measured sound exceeds a defined trigger level.

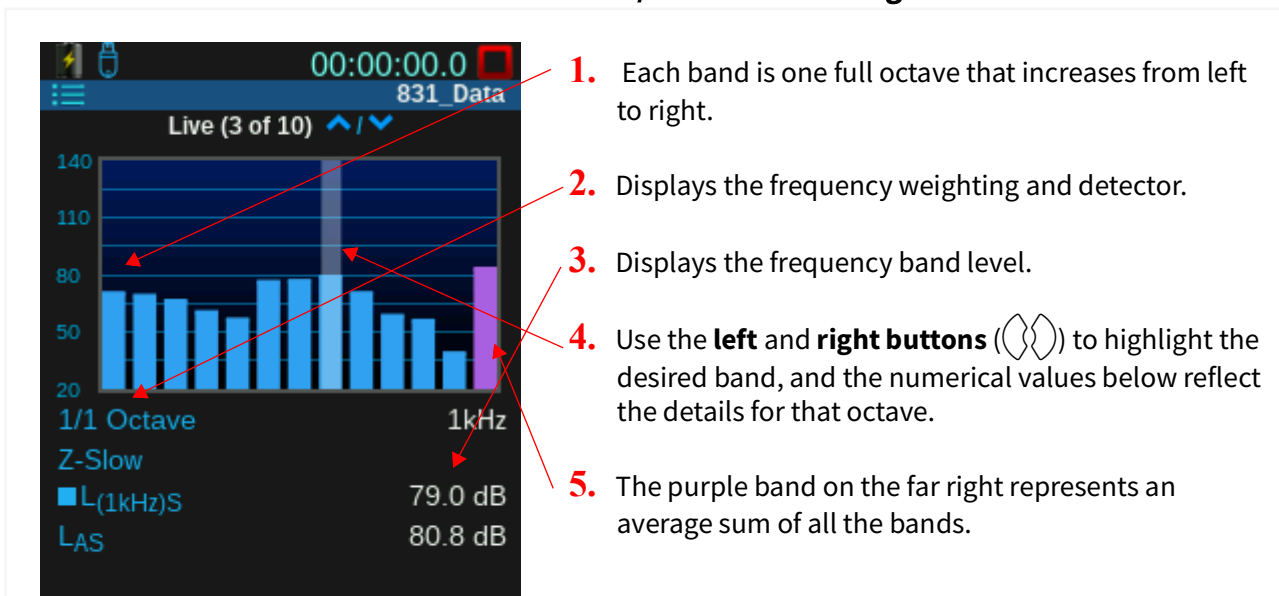
FIGURE 4-2 Live Tab: Big Digit Display Page



About the Octave Band Analyzer Page

TAKE NOTE This feature requires the 831C-OB3 firmware option. Four pages on the Live tab relate to which octave band setting you choose in the measurement setup. The height of each band in the graph is the amplitude of sound for that frequency.

FIGURE 4-3 Live Tab: 1/1 Octave Band Page



About the Normalized Octave Band Page

TAKE NOTE This page only displays when you enable the Spectral Ln feature in the measurement setup file.


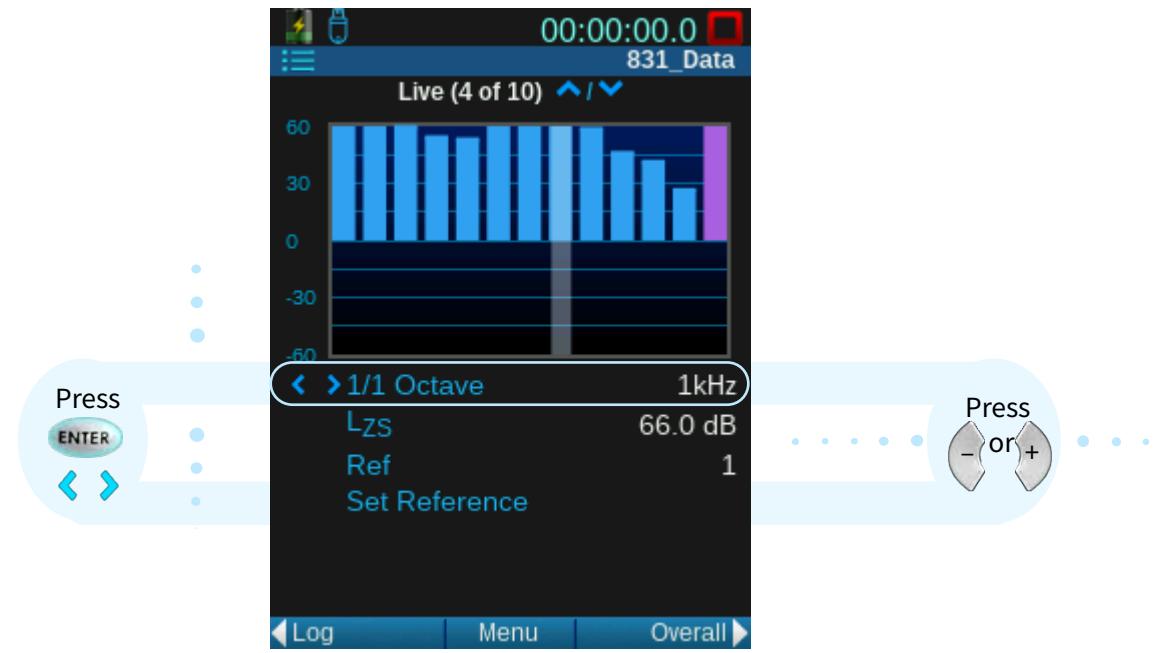
Similar to the regular octave band pages, the normalized band pages show octave bands (for 1/1 or 1/3) and the numerical values of the highlighted band. However, the data is normalized using the reference spectra you define at **Tools**  → **System Properties** → **Reference Spectra**.

FIGURE 4-4 Live Tab: Normalized Octave Band Page




1. View References 1, 2, 3, 4, A, -A, C, and -C.
2. To save the selected values to use as a reference: highlight **Set Reference** in blue arrows, then press **Enter**  to save the setting.

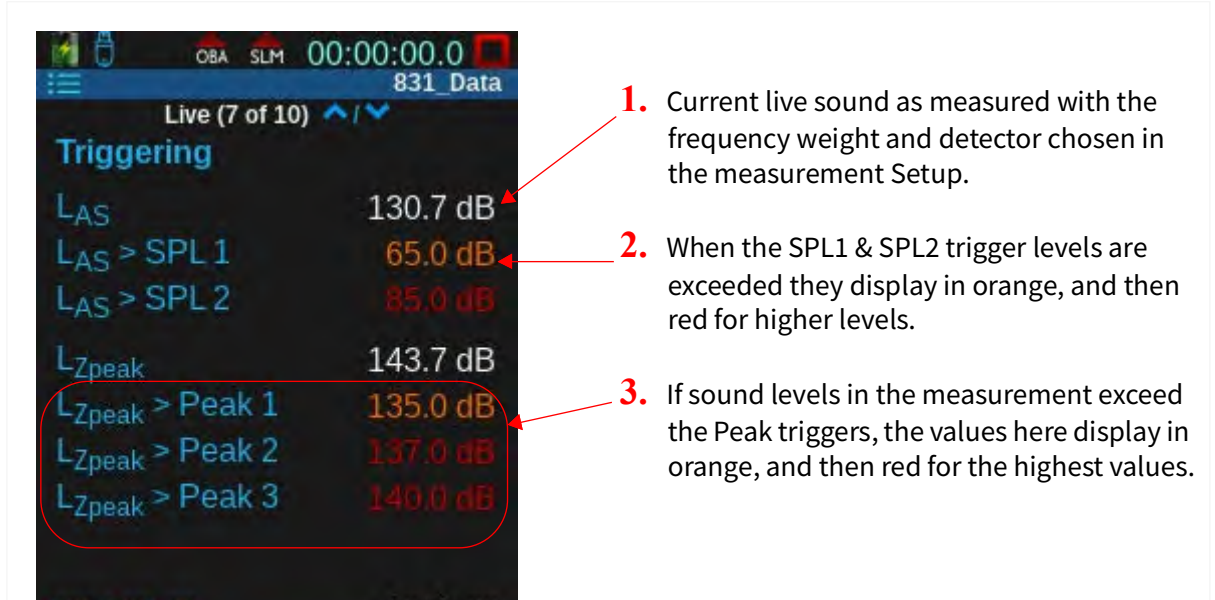
Table 4.1 User-Defined Reference Spectra Definitions

User Defined	1 2 3 4
Positive Frequency Weighting	A C
Negative Frequency Weighting	-A -C

About the Triggering Page

The Triggering page shows when any of the Trigger levels you define in the measurement setup have been exceeded.

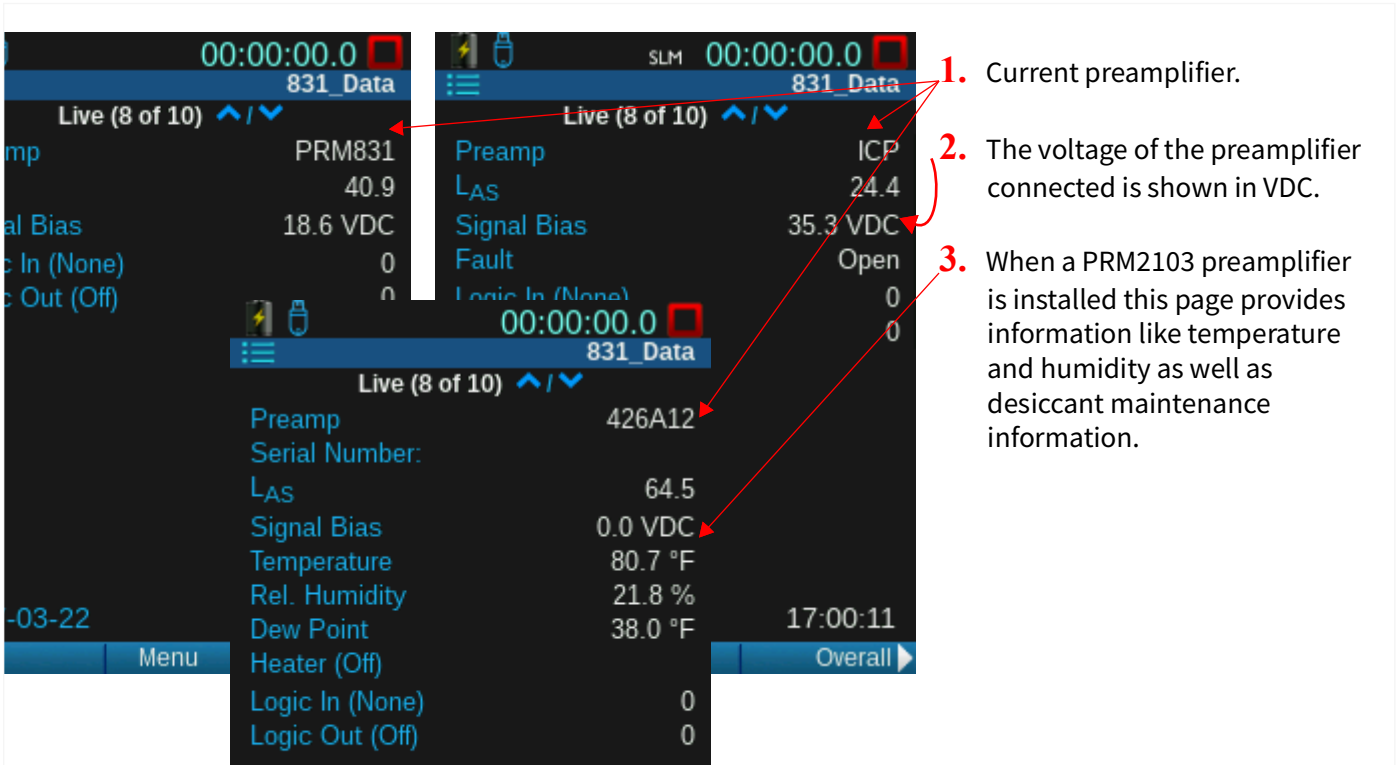
FIGURE 4-5 Live Tab: Triggering Page



About the Preamp Interface Page

Use the information on the preamplifier interface page to validate the proper operation of the meter. *Figure 4-6* shows how this page's display may differ, depending on the preamp installed.

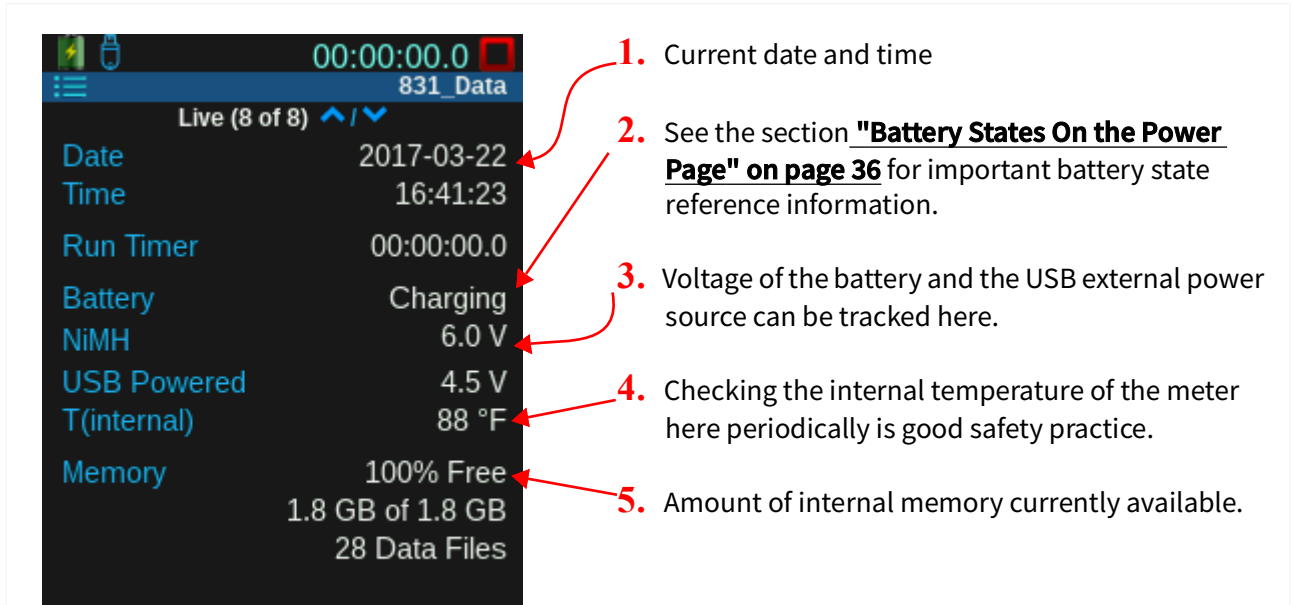
FIGURE 4-6 Live Tab: Preamp Interface Page



About the Power Page

The Power page shows the meter status items as shown in *Figure 4-7*.

FIGURE 4-7 Live Tab: Power Page



Battery States On the Power Page

Any of the following battery states can appear on the Power Page.

- Estimated battery runtime: If the meter is being powered by batteries, an estimated runtime is listed in hours.
- Charger Off: The batteries are not charging.
- Charging: Batteries are charging.
- Maintain Charge: Batteries are at capacity.
- Low Power Input: The USB cannot supply power sufficient to charge the internal batteries.
- Too Hot/Cold: Batteries are not charging because there is an invalid temperature range detected for safe charging.
- Over Voltage: Attempted to charge; non-rechargeable cells, or batteries are failing.

About the Memory Page

The Memory page displays a helpful data storage calculator that can help you estimate the amount of storage a measurement might require as shown in *Figure 4-8*.

FIGURE 4-8 Live Tab: Memory Page

The screenshot shows the 'Live (11 of 11)' tab with the following data:

Memory	53% Free
	993.3 MB of 1.8 GB
	125 Data Files
File Size Estimation	
Overall	46.1 KB
Measure (ea)	58.6 MB
Time Hist (h/d)	0 B/0 B
Events	Off
Total	58.6 MB

Annotations:

1. After you configure the measurement Setup, the File Size Estimation Total becomes valid for your proposed measurement.
2. **Time History (h/d)**: When 2 values display on this line, the first value is the amount of memory required to store each hour of time history data. The second value is the amount of memory required to store each day of time history data.
3. **Events**: When enabled, **Events (ea.)** is the amount of memory required for each event. **Event Num**: Enter a number, which is the number of events you anticipate during the measurement.

4.1.2 Understanding the Overall Tab

The Overall tab values include all records in the current measurement.

Overall is similar to the Live tab, with an SLM page and subsequent pages showing sound data. The overall data resets when the measurement is stopped and saved, or when you press the **Reset button** (↶).

TAKE NOTE Pages on the Overall tab become available depending on your installed firmware options and enabled features. As a result, your Overall tab pages may differ from those shown in this section.

About the Overall SLM Page (Overall Page)

FIGURE 4-9 Overall Tab: SLM Page

The screenshot shows the 'Overall (1 of 16)' tab with the following data:

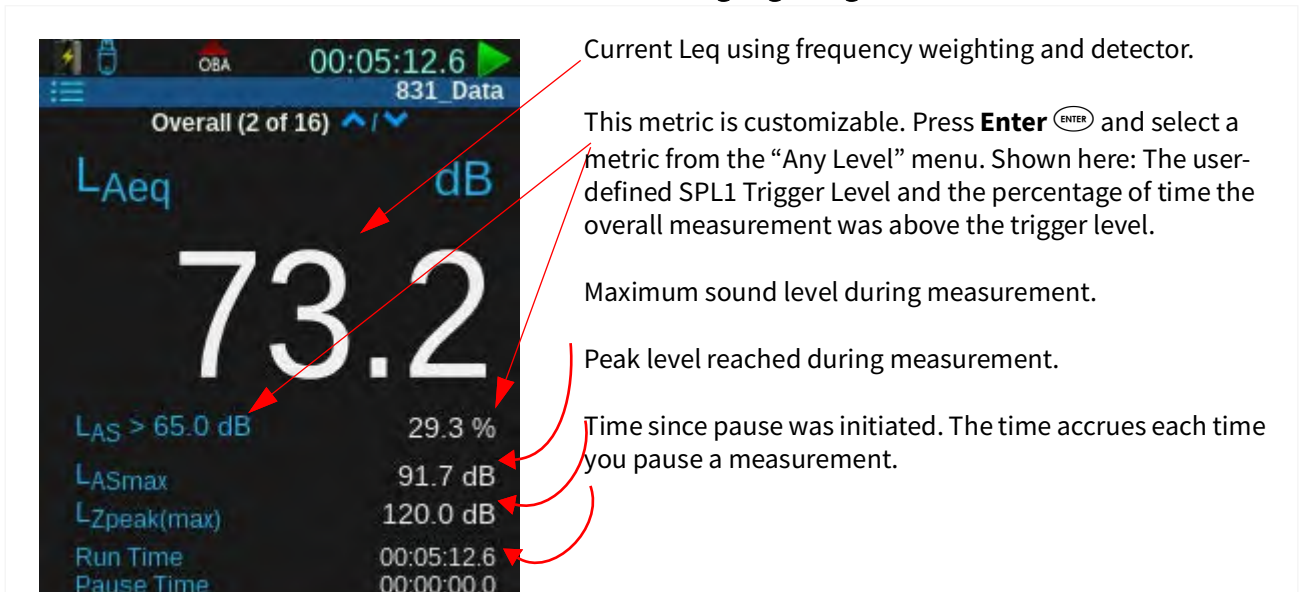
Run time	00:05:03.7
L_{Aeq}	73.3 dB
L_{Zpeak(max)}	120.0 dB

Annotations:

1. Run time of the current measurement. This time continues during a pause.
2. The data graph presents info from beginning (left) to end (right).
3. This L_{eq} value uses the frequency weighting and detector from the measurement setup file. It is the equivalent sound based on the run time of the measurement.
4. This SLM metric for the current measurement is customizable. Press **Enter** (ENTER) to select a new metric from the "Any Level" menu.

About the Overall Big Digit Page (Overall Page)

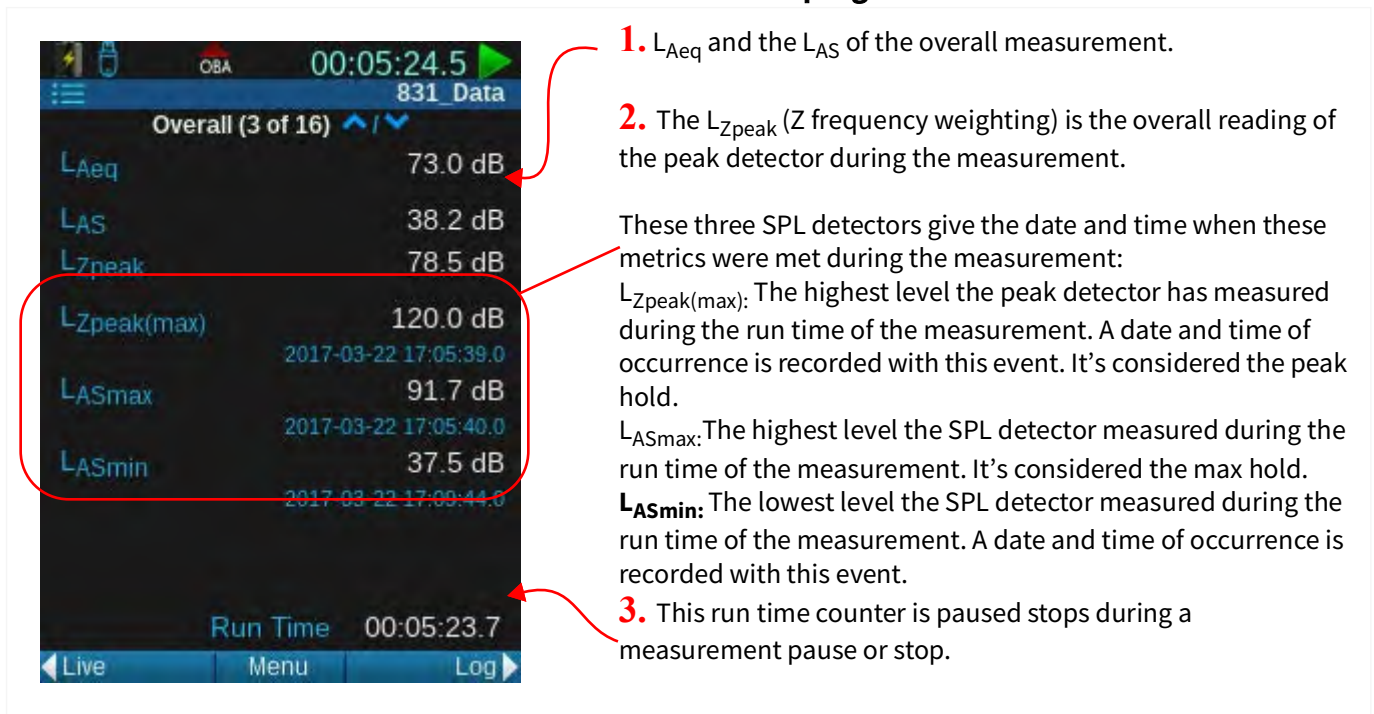
FIGURE 4-10 Overall Tab: Big Digit Page



About the Overall L_{eq} Page (Overall Page)

Metrics displayed on this page are ones you chose in the measurement setup.

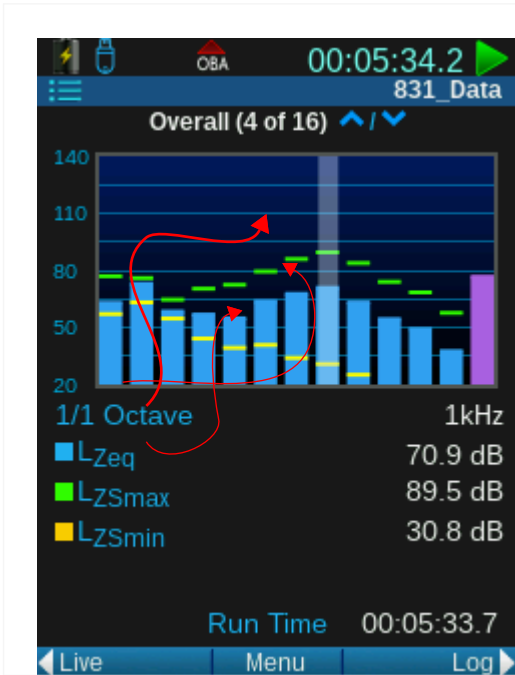
FIGURE 4-11 Overall Tab: Leq Page



About the Octave Band Analyzer Page (Overall Page)

TAKE NOTE This feature requires the 831C-OB3 firmware option, and OBA enabled in the measurement setup file.

FIGURE 4-12 Overall Tab: 1/1 Octave Band Page






The height of each band in the graph is the amplitude of sound for that frequency. If you enabled 1/3 Octave bands in the Setup, the 1/3 Octave Band page is similar, but each band represents a bandwidth of 1/3 octave.

LEARN MORE Just like the Live tab, you can customize the metrics on this octave band page as shown in [About the Octave Band Analyzer Page](#).

Data shown on the Overall pages clears when the measurement is stored, or when you press **Reset** on the meter. Notice that the numerical values on the Octave Band page are color coded to show a relationship to the graphed octave band. For example, the blue box next to L_{Aeq} data corresponds to the blue bands in the graph. See [Table 4.2](#) to view the reference colors.

Table 4.2 Overall Octave Band Legend

 L_{eq}	<p>“Leq” is the average sound level of the highlighted frequency band for the duration of the measurement.</p>
 L_{max}	<p>L_{max} is the maximum sound level of the highlighted frequency band. The maximum spectrum is determined by the Max Spec setting.</p> <p>Bin Max: When set to Bin Max, this value is the maximum value which occurred during the entire measurement for that frequency band. Since individual frequency bands may reach their maximum levels at different times, this spectrum might be one which never occurred at any instant during the measurement period.</p> <p>At Max: When set to At Lmax, this value is the instantaneous spectrum at the moment when the broadband maximum occurred (such as LSmax).</p>
 L_{min}	<p>L_{min} is the minimum sound level of the highlighted frequency band for the duration of the measurement. Since individual frequency bands may reach their minimum levels at different times, this spectrum might be one which never occurred at any instant during the measurement period.</p>

About the Normalized Octave Band Page (Overall Page)

TAKE NOTE This feature requires the 831C-OB3 firmware option, and OBA enabled in the measurement setup file.


The user-defined references are determined at this location: **Tools**  → **System Properties** → **Reference Spectra**.

FIGURE 4-13 Overall Tab: Normalized Octave Bands

The normalized octave band page displays the numerical values of the highlighted band. The data is then normalized using the Spectral Ln value you select in the measurement setup file.

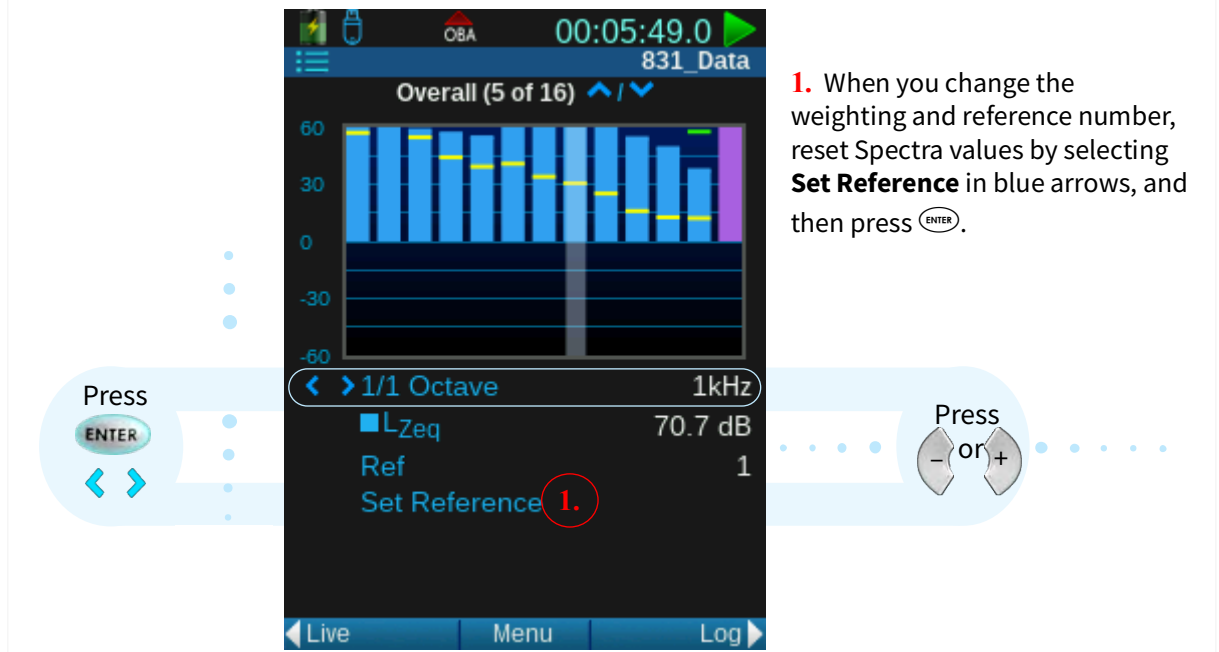


Table 4.3 User-Defined Reference Spectra Definitions

User Defined	1 2 3 4
Positive Frequency Weighting	A C
Negative Frequency Weighting	-A -C


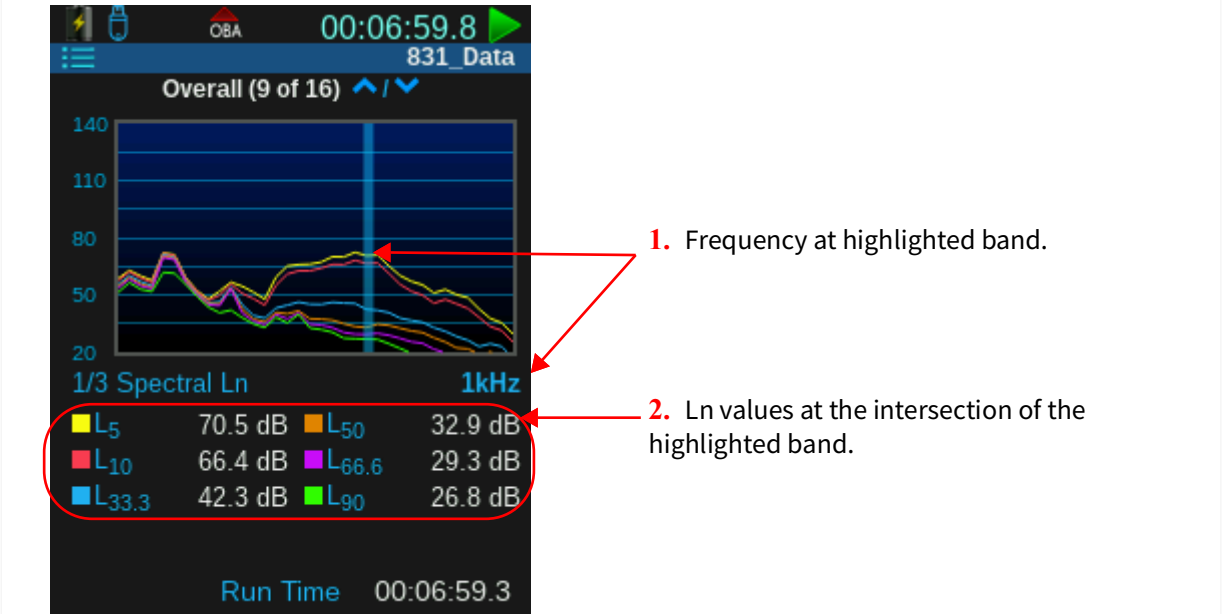
If the frequency components are too small or too large to view in the graph, press **Menu**  → **Adjust Graph**. The Buffer Overrun line item is an indication that rarely displays when using the 831C in FFT Mode while sampling sound at higher frequency resolutions. It indicates that some samples may have been lost.

FIGURE 4-14 Overall Tab: 1/3 Octave Spectral Ln

Overall Spectral Ln page displays Ln as a function of frequency for the six user-selected values of n .

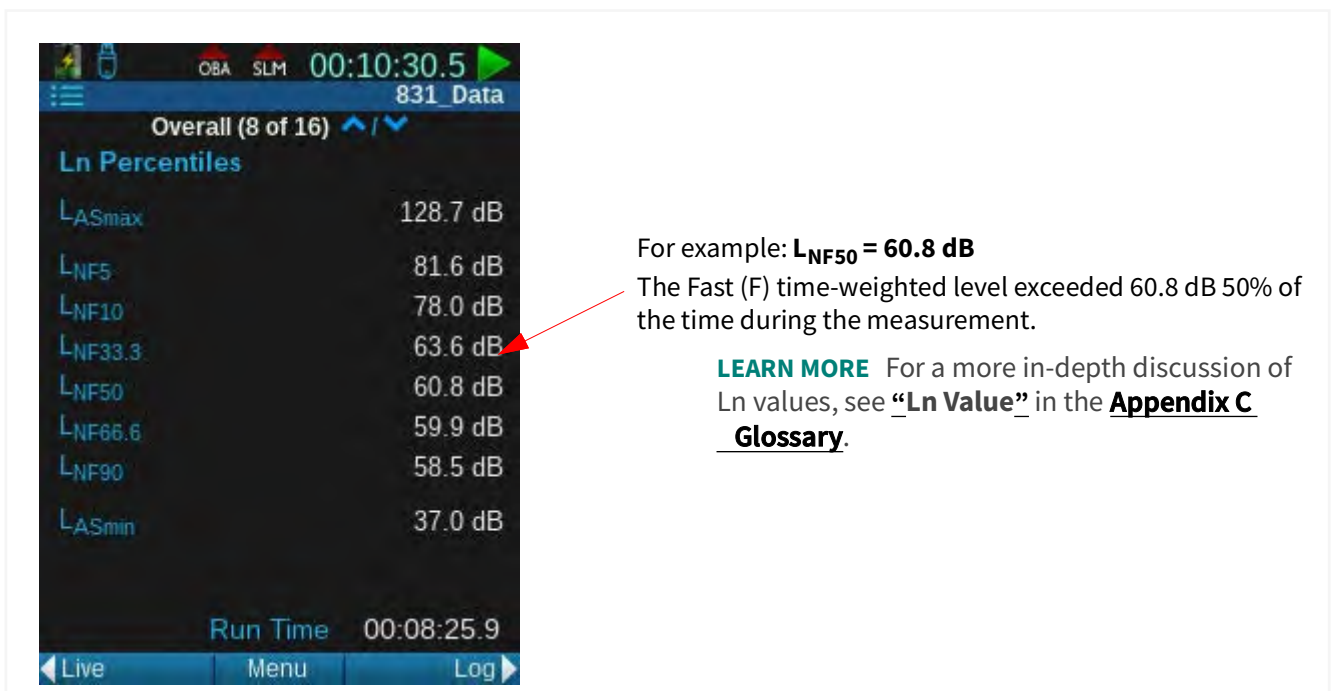


About the Ln Percentiles Page (Overall Page)

An Ln percentile is a statistical measurement of the level that exceeds the selected value “n” percent of the time. The statistics are based on the level defined by the current weighting and detector.

The Ln Percentiles page displays the six Ln statistics for the measurement based on the run time, and the maximum and minimum sound levels measured. You can customize the threshold level in the measurement setup prior to or during a measurement. For details on this, see **6.2.2 Customizing Setup Values On the Setup Manager Tabs**.

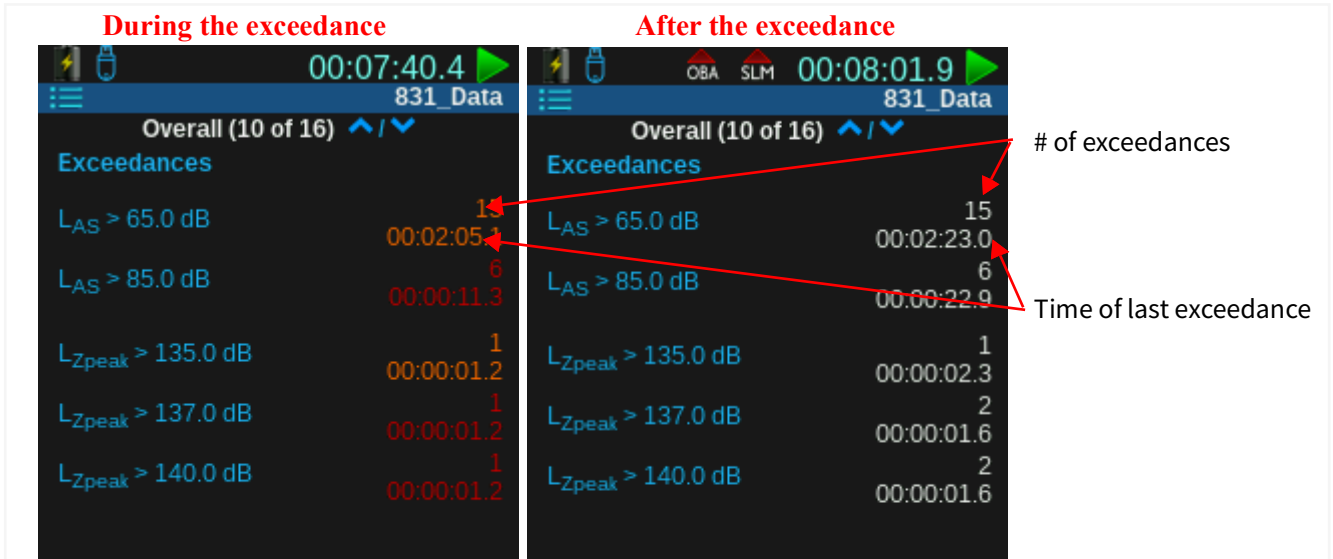
FIGURE 4-15



About the Exceedances Page (Overall Page)

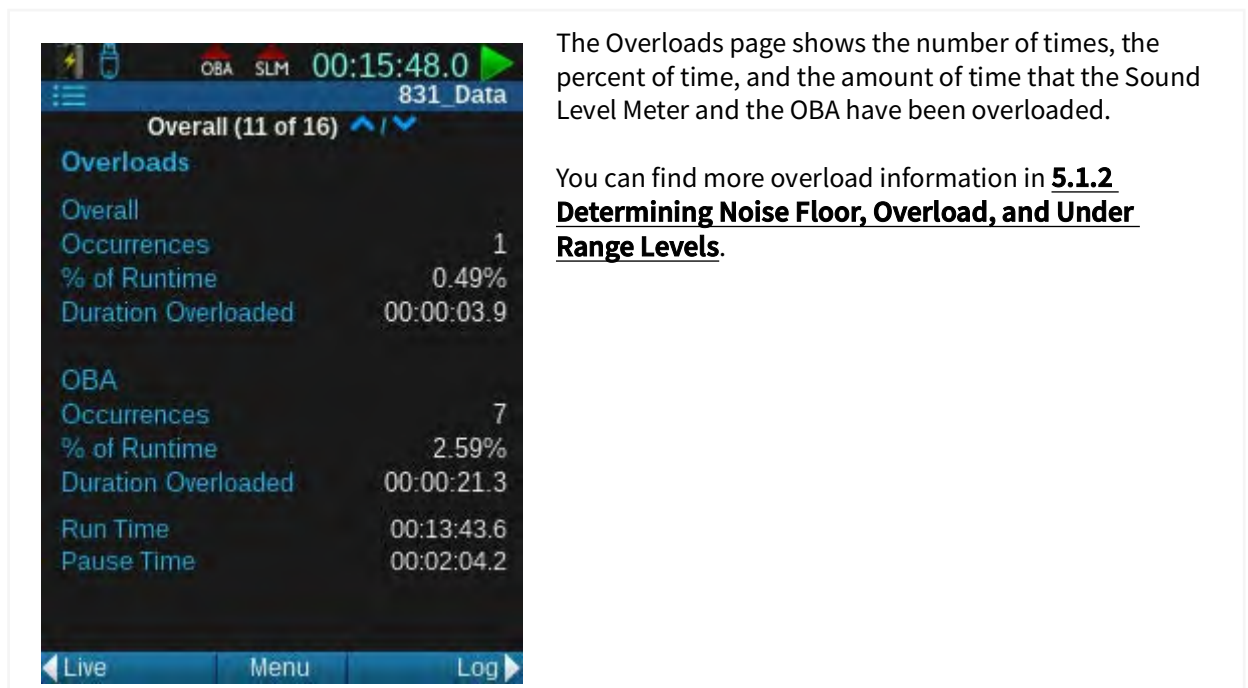
An exceedance occurs when the level defined by the current weighting and detector exceeds the Trigger Level you set in the measurement setup. The Exceedances page has 2 L_{AS} and 3 L_{Zpeak} exceedance values. *Figure 4-16* shows that each time a trigger level is exceeded during a run, the counter for that level advances from 14 to 15, and the value displays in orange or red.

FIGURE 4-16



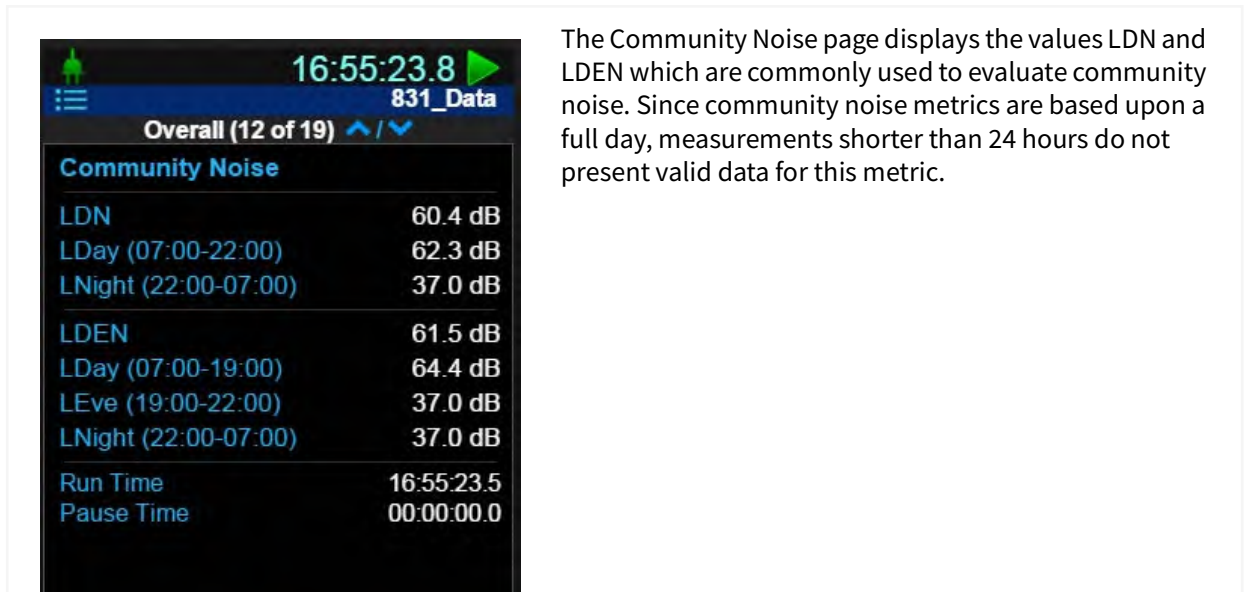
About the Overloads Page (Overall Page)

FIGURE 4-17



About the Community Noise Page (Overall Page)

FIGURE 4-18



The Community Noise page displays the values LDN and LDEN which are commonly used to evaluate community noise. Since community noise metrics are based upon a full day, measurements shorter than 24 hours do not present valid data for this metric.

TAKE NOTE The metric CNEL is equivalent to LDEN.

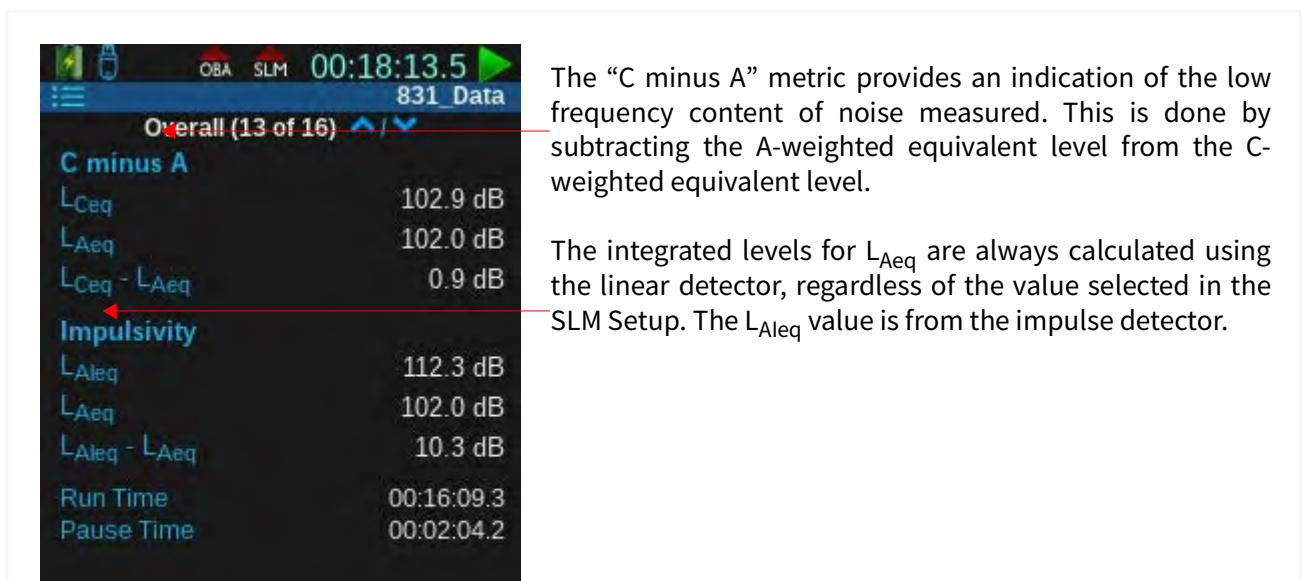
Metrics shown here are dependent on the number of Day, Evening, and Night hours, which you set in the measurement setup file.

Understanding LDEN

Although the standard ISO 1996-2:2007 specifies default values used in the calculation of LDEN, in practice the time values defining the day, evening and night periods may be changed, as permitted by Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. It is important to verify prior to the measurement that the values have been properly defined for your purposes.

About the C Minus A Impulsivity Page (Overall Page)

FIGURE 4-19



The “C minus A” metric provides an indication of the low frequency content of noise measured. This is done by subtracting the A-weighted equivalent level from the C-weighted equivalent level.

The integrated levels for L_{Aeq} are always calculated using the linear detector, regardless of the value selected in the SLM Setup. The L_{Aeq} value is from the impulse detector.

About the TA-Lärm Page (Overall Page)

This metric is primarily used in Germany. To turn off this display, or any other display that is not related to your measurement, see [4.2 Enabling or Disabling Display Tabs](#).

About the Sound Exposure Level Page (Overall Page)


This page is primarily used for the practice of industrial hygiene.

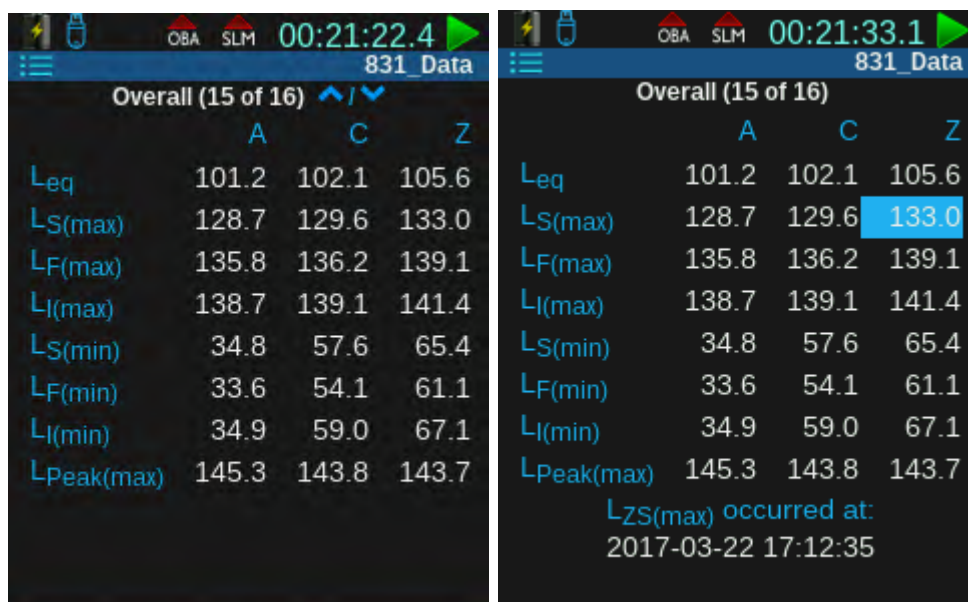
FIGURE 4-20 Sound Exposure Level Page



About the Metrics Matrix Page (Overall Page)


FIGURE 4-21

The metrics matrix page displays the data the meter is always measuring in one page. Press **Enter**  to move the cursor.



Viewing the Power Page (Overall Page)

FIGURE 4-22



The screenshot shows the 'Overall (16 of 16)' page for '831_Data'. The data displayed is as follows:

Item	Value
Date	2017-03-22
Time	17:33:52
Session Log	6
Measurements	2
Events	1
Time Histories	95
Sound Recordings	1
Memory	100% Free
	1.8 GB of 1.8 GB
	30 Data Files

The 'Time' entry includes a clock icon, which is highlighted by a red arrow. To the right of the screenshot, text explains that the clock icon indicates the time is currently synced with NTP servers.

4.1.3 Viewing Weather-Related Data

SoundAdvisor 831C is compatible with a variety of analog and digital weather sensors. In addition to the data file result, weather-related data displays during the measurement on the Live Tab and Overall Tab Weather pages, as shown in this section.

Figure 4-23 and Figure 4-24 show weather readings from a Vaisala Weather Transmitting Station (SEN031), connected to the 831C. Your display may differ, depending on the connected sensor and chosen settings.

LEARN MORE For complete information on the range of available weather sensors, see **Module 21 Utilizing Non-Acoustic Inputs.**

FIGURE 4-23 Live Tab, Weather Pages

This figure shows some of the available metrics from the SEN031/2 Weather Station available from Larson Davis, which reports once per second.

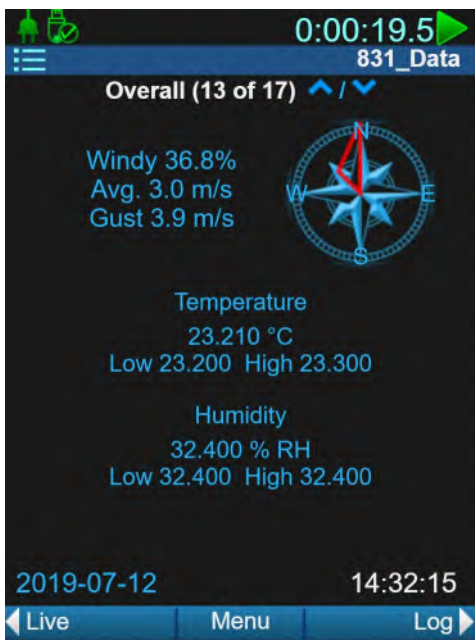
1. **Windy** is the percentage of time that the current wind speed exceeds the configured threshold value.

2. The Compass display is selectable in the setup. The red polygon on the compass graphically indicates the relative duration (see “Windy” above) as a percentage, where the compass center is zero and the outer edge is 100. Wind direction is indicated by the outer edge point of the polygon.



LEARN MORE For more information about enabling and configuring weather accessories, see **Module 21 Utilizing Non-Acoustic Inputs**. For more information on viewing weather-related data in the resulting measurement file, see the *G4 LD Utility Manual*, “7.4 Viewing Measurement Data.”

FIGURE 4-24 Overall Tab, Weather Pages



On the Overall tab, Weather metrics on this page are an average of reported metrics from the measurement start until the current period.

TAKE NOTE To view additional weather-related data, download and open the data file in G4. Locate the Event History data, and look for the following columns:

- Wind Speed @ L_{max} (mi/h, sampled at 4 times/second)
- Wind Dir @ L_{max} (compass direction or degrees)
- Gust Speed (samples the running average/1 min, then reports an average rate over 10 mins.)
- Gust Dir (Compass direction)
- Trig Src (Event Trigger Source)
- Trig Level (usually in dB)
- Rain Max Rate (in/hr), Rain Accumulation (in/s) (precipitation updated 1 time / 10 seconds)
- Hail Max Rate (in²/h), Hail Accumulation (in/s)

In G4, weather-related events and their triggers display in the following columns in the Event Time History data: **Gust Speed** (mi/h), **Gust Dir** (Compass Direction).

4.1.4 Understanding the Session Log Tab

On the Session Log tab, the 831C creates a time-stamped record for every meter action, including Calibrate, Run, Pause, Resume, Stop, Voice Message, and Sound Recording,


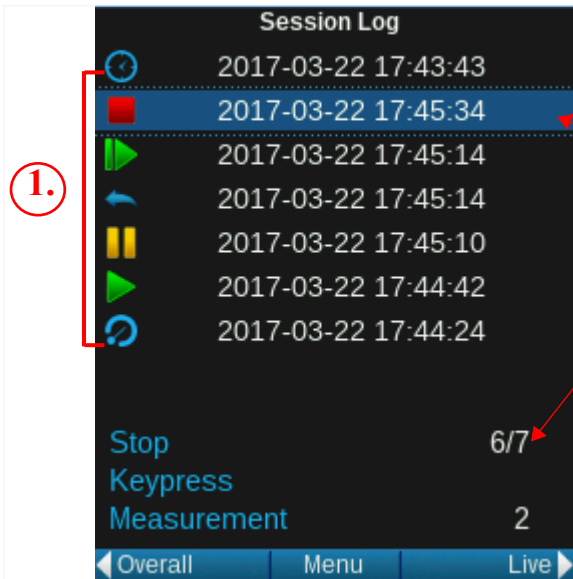
and others. When you store a data file or press the **Reset button** , the session log clears and begins a new log.

FIGURE 4-25 Session Log Tab



1. For this example, there was a time sync, a back-erase; a measurement pause then resume, and a calibration.

2. Highlight a log entry to see the source (i.e. “keypress”), and measurement number near the bottom of the screen. More detail is also available in the resulting file’s Data view.

Table 4.4 lists meter actions included in the Session Log.

Table 4.4 831C Meter Actions that Create Session Log Items

Action	Session Log Item
Key press	Measurement stop
Measurement run	Measurement pause
Resume from pause	Measurement reset
Calibration record and change	Run timer complete
Marker set	Low battery
GPS Time Sync	Out of memory
Charging stopped	Create new average
Preamplifier connect/disconnect	USB Connection detected
831 INT-ET (Comm Failure)	
NTP Time Sync	System time change
Back-erase	For details, see <u>“Pausing the Measurement and Using Back Erase” on page 71.</u>
Buffer Overrun (FFT Mode)	For details, see <u>About the Buffer Overrun Session Log Item</u>

About the Buffer Overrun Session Log Item

The Buffer Overrun line item is an indication that rarely displays when using the 831C in FFT Mode while sampling sound at higher frequency resolutions. It indicates that some samples may have been lost.

If this occurs, you may need to adjust some settings to ease the data collection load. For example, you could lower the number of lines, reduce the frequency span, or remove one or more time history metrics.

4.1.5 Adjusting the Graph Scale On Any Tab

The default amplitude (dB) setting for the graphic display of sound pressure level versus time and frequency spectra for this meter are shown in *Table 4.5*.

Table 4.5

Level vs. Time Graphs	20 dB to 140 dB
Frequency Spectra, Normal Range	20 dB to 140 dB
Frequency Spectra, Low Range	-10 dB to 110 dB

To adjust the graph scale, do the following:


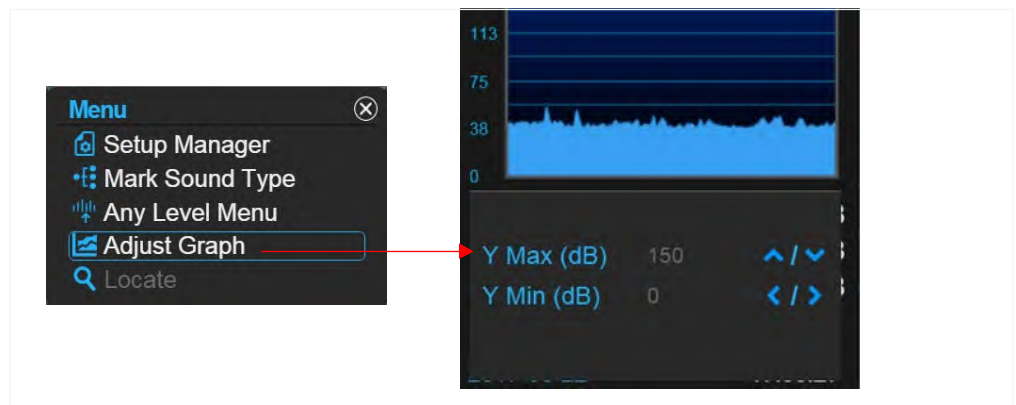
- a. Select the **Menu softkey** (○●○). This opens the Live Menu.
- b. Select  **Adjust Graph**. This opens the graph range.

FIGURE 4-26



- c. Highlight **Y Max** or **Y Min** and press the **up** or **down buttons** (⏶ ⏷) to adjust the scale. You can adjust the Y-axis of the graph to show dB values between 340 and -20.
- d. Press the **Close softkey** (○●○), then select **Yes** to save your changes.

4.2 Enabling or Disabling Display Tabs

Step 1. On the 831C, go to **Tools**  → **System Properties**.

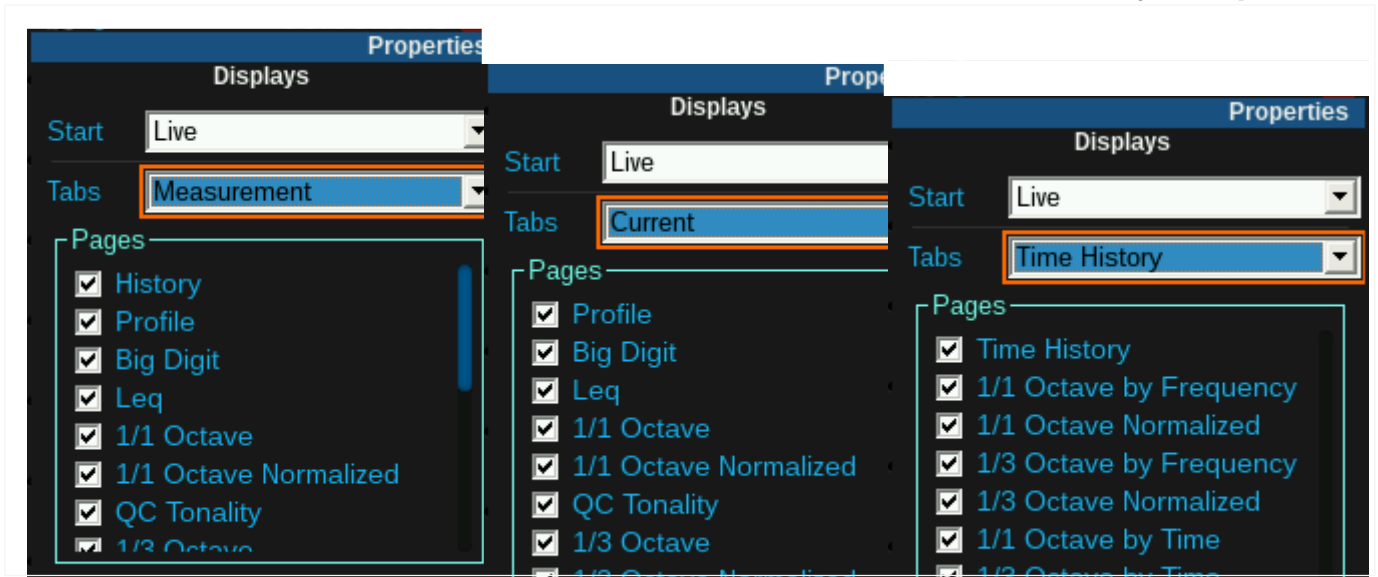
Step 2. Use the **top-right softkey** (○○●) to navigate to **Displays**.

Step 3. From the **Start** drop-down menu, choose the first page you want the meter data to display on.

Step 4. From the **Tabs** drop-down menu, select the tab your option is associated with.

Step 5. In the Pages section, select the checkbox in-line with the options you want visible on the meter.

FIGURE 4-27 Measurement, Current, and Time History Tab Options



Step 6. Press **Close** (⏻), then select **Yes** to save your changes. Or select **No** to exit without saving.

4.3 831C Display for FFT Mode

For complete display information for the 831C in FFT Mode, see [19.3.1 "Viewing Live Data On the Meter" on page 170](#).

Module **5** Calibrating Your SoundAdvisor 831C

This module covers acoustic calibration of your SoundAdvisor 831C. This is the most commonly used calibration method, and the one required by most national and international standards prior to making a measurement.

In acoustic calibration, a sound level calibrator provides an acoustic signal of a known amplitude and frequency to the microphone. From the voltage level measured by the meter, you can determine the sensitivity of the microphone.

In this technique, we assume that the calibrator is functioning correctly and that we're using the most appropriate calibrator for the instrument and intended use. Adapting or altering this procedure may result in improper calibration and incorrect sensitivity values.

In this module:

5.1	Understanding Calibration Values	-----49
5.1.1	Determining Microphone Sensitivity	
5.1.2	Determining Noise Floor, Overload, and Under Range Levels	
5.1.3	Understanding Calibration Stability	
5.2	Choosing a Calibrator	-----51
5.3	Reviewing the Calibration Settings	-----51
5.4	Calibrating Your SoundAdvisor 831C	-----54
5.4.1	Calibrating While Using Meter Security (Lock Mode)	
5.4.2	Performing a calibration check (when using PRM2103)	

5.1 Understanding Calibration Values

This section is intended to help you interpret values tied to the calibration results of the instrument. Accurate calibration values contribute to quality measurements.

In this section:

- **5.1.1 Determining Microphone Sensitivity**
- **5.1.2 Determining Noise Floor, Overload, and Under Range Levels**

5.1.1 Determining Microphone Sensitivity

The primary role of sound level meter calibration is to establish a numerical relationship between the sound level at the diaphragm of the microphone and the voltage measured by the meter. This enables the meter to display the accurate sound pressure level in dB. The result of a calibration is the determination of the sensitivity of the meter, including microphone and preamplifier, typically in dB re 1V/Pa or mV/Pa.

5.1.2 Determining Noise Floor, Overload, and Under Range Levels

A secondary role of calibration is to determine the sound level which would overload the instrument (Input Overload level) and the minimum sound level (Under Range level) that can be accurately measured without being influenced by the operational noise from the meter (Noise Floor).

Noise Floor Level

The noise floor is calculated as the energy sum of the noise generated by the microphone, preamplifier, and instrument circuitry. The appropriate noise floor, and nominal sensitivity compute automatically in the 831C with the following preamplifiers and their commonly paired microphones:

- PRM831
- PRM2103
- ICP with ADP074

Overload Level

When using a microphone having a sensitivity of 50 mV/Pa, the input overload may occur approximately as shown in Table 5.1.

Table 5.1 Input Overload Levels

Input Gain, dB	Overload Level, dB Peak
0	143
20	123

Under Range Level

The Under Range level is the higher of the following levels:

- Noise Floor + 9.14 dB (the under range value shown when self noise contributes ≥ 0.5 dB to the readings).
- Actual point where the log-linearity exceeds maximum permitted value.


Except for very low-noise-level microphones, the under range level is usually determined by the noise floor + 9.14 dB.

LEARN MORE For more information about measurement range, noise floor, linearity range, and max peak levels as they relate to different microphones and gain settings, see “SLM Performance (Nominal Values)” on page A-3.

5.1.3 Understanding Calibration Stability

The 831C maintains a stable value of sensitivity over long periods of time. Significant changes in sensitivity, or a pattern of small but regular sensitivity changes, are indicative of problems with the measurement system. To assist you in identifying these situations, the 831C provides 2 notifications:

- Calibration History Table

This table includes data and date/time for the 10 most recent calibrations. It's a good idea to periodically review the instrument's Calibration History, which is found on the meter under **Tools**  → **Calibration** → (○○●)...**Cal Hist.**

- Large Change Notifications

During calibration, the meter makes an automatic comparison between the sensitivity determined by the calibration and the previous value. A pop-up warning displays when the difference between these two values exceeds 3 dB.

5.2 Choosing a Calibrator

Acoustic Measurements

Larson Davis recommends the following calibrator for the 831C for acoustic measurements:

- Larson Davis Model CAL200: 94/114 dB @ 1 kHz.

TAKE NOTE If using a 1/4-inch microphone, the 1/4-inch adapter (ADP024, or ADP109) is required.

The following instances may require you to enter unique correction values in the Calibration Settings tab as shown in [5.3 Reviewing the Calibration Settings](#).


- Using a free-field microphone: For details, see the calibration data shipped with calibrator.
- The calibrator and instrument are at a temperature other than room temperature (23° C) or not near sea level. For details, see the calibration data shipped with calibrator.
- When you move the meter to another location (e.g. meter moved to or from 85 kPa static pressure elevation). Recalibrate first, then enter values if needed.

Outdoor Measurement

When using the 426A12 outdoor microphone and power supply or the Model 2100 outdoor preamplifier, we recommend completing a calibration check using an electrostatic actuator (E.A) as described in the equipment manual.

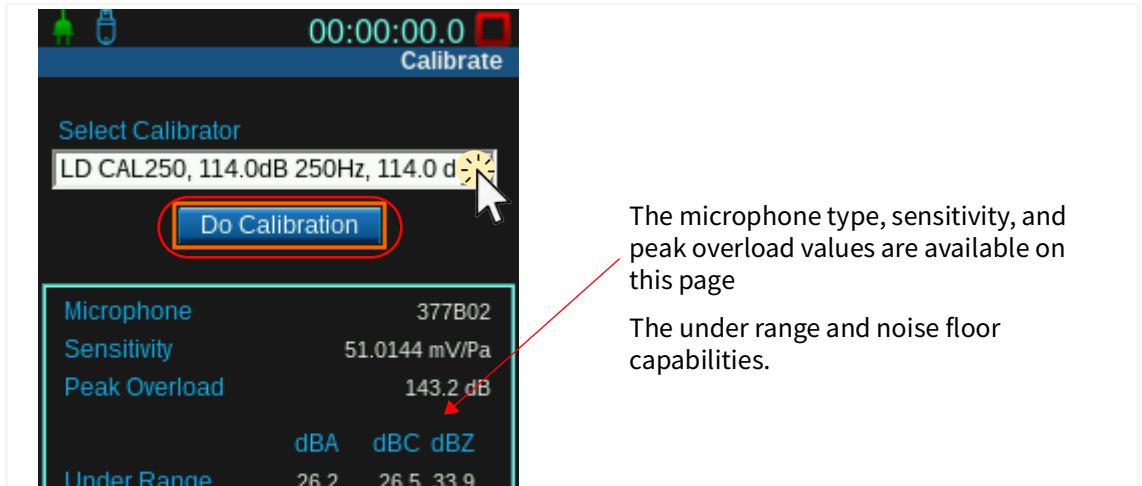
5.3 Reviewing the Calibration Settings

When you perform a calibration using any preamplifier prelisted for the 831C, the SoundAdvisor updates the saved calibration information for that preamplifier. If you install a different preamplifier, the SoundAdvisor applies the previously saved calibration information. As long as the same microphone is being used with that preamplifier, the calibration is accurate.

Step 1. On your 831C, select **Tools**  → **Calibrate**.

Step 2. Choose an option from the **Select Calibrator** drop-down menu as shown in Figure 5-1.

FIGURE 5-1 Calibrate tab



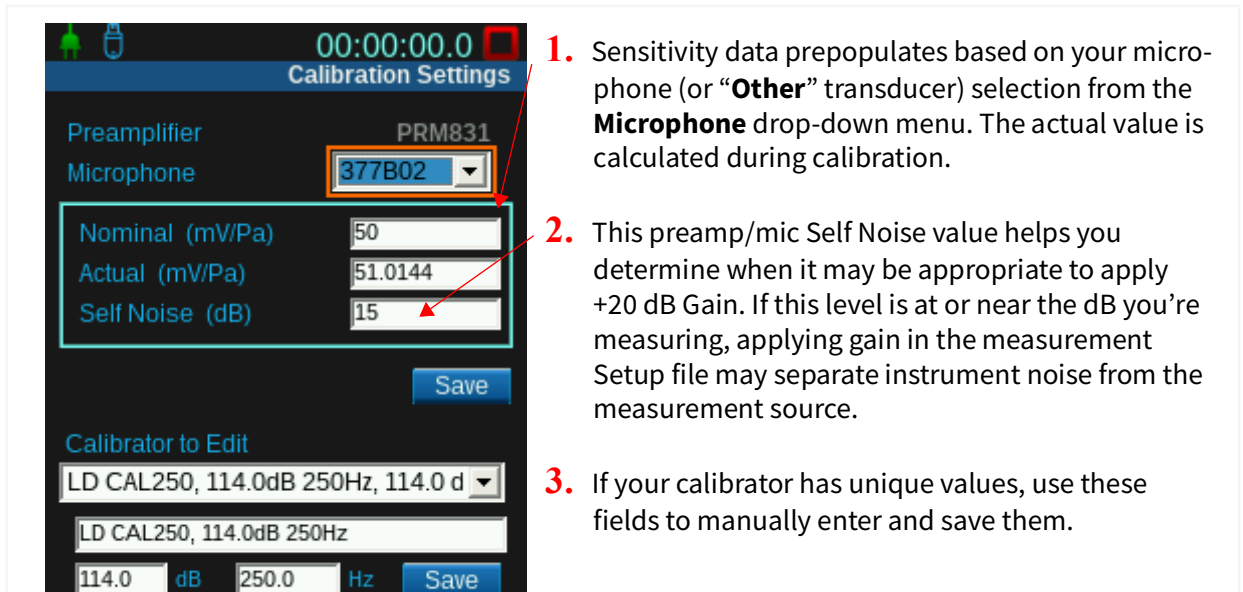
The microphone type, sensitivity, and peak overload values are available on this page

The under range and noise floor capabilities.

Step 3. Navigate to the Calibration Settings tab using the **top-right softkey** (☐○●). When you're using a known preamplifier, the 831C supplies the preamplifier serial number, or type (ICP or Direct), and the saved sensitivity on the Calibration Settings tab.

Step 4. If needed, select your microphone from the **Microphone** drop-down menu. If you're using a different transducer, select **Other**, and manually enter the sensitivity from the transducer documentation.

FIGURE 5-2 Calibration Settings tab



1. Sensitivity data prepopulates based on your microphone (or "Other" transducer) selection from the **Microphone** drop-down menu. The actual value is calculated during calibration.

2. This preamp/mic Self Noise value helps you determine when it may be appropriate to apply +20 dB Gain. If this level is at or near the dB you're measuring, applying gain in the measurement Setup file may separate instrument noise from the measurement source.

3. If your calibrator has unique values, use these fields to manually enter and save them.

Step 5. Navigate to the Calibration History tab by using the **top right softkey** (○○●)

FIGURE 5-3 Calibration History tab

Preamp: PRM831

Date	Time	Delta dB	dB re 1V/Pa
2017-Mar-22	17:44:24	0.1	-25.8
2017-Mar-16	14:39:14	-0.0	-25.9
2017-Mar-16	14:34:42	0.1	-25.9
2017-Mar-12	11:33:12	0.2	-26.0
2016-Oct-13	11:17:26	-0.1	-26.1
2007-Jan-01	01:27:32	0.0	-26.0
2006-Dec-31	23:03:07	0.0	-26.0
2006-Dec-31	23:10:06	1.9	-26.0
2007-Jan-02	20:49:11	-1.9	-27.9
2007-Jan-02	18:02:25	1.9	-26.0

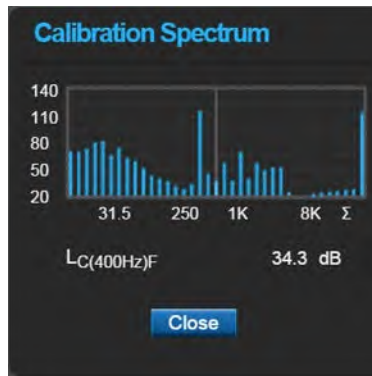
Every calibration is logged as an event in the Calibration History.

Values in the **Delta dB** column show the difference between the level measured during the current calibration and the level from the previous calibration.

The measured mic sensitivity is shown in decibels relative to 1 V/Pa or **dB re 1 V/Pa**.

Step 6. Select a log entry from the list, and Calibration Spectrum window appears as shown in .

FIGURE 5-4 Calibration Spectrum



Since space is limited on the meter display, you'll find a more detailed version of the Calibration History in G4. For more information, see section 1.4.3 Calibration Histories Tab in the *G4 LD Utility Reference Manual*.

Step 7. Navigate to the **Calibration Certification** tab (○○●), which shows when the meter was last certified by the factory and when it is due for recertification.

FIGURE 5-5 Calibration Certification Tab

Calibrate: Certification

Performed 2017-Mar-13
Due Never

Factory Certification
PCB Piezotronics, Inc.
1681 West 820 North
Provo, UT 84601
716.926.8243

Interval ▾
Reminder ▾

◀ Cal Hist Close Calibrate ▶

The date of the last certification and the due date for the next certification displays here.

The certification interval can be changed to reflect your own certification time line.

A reminder is displayed as a popup showing the number of days before your chosen interval has passed.

Step 8. Press **Close** (○●○) to save your settings.

5.4 Calibrating Your SoundAdvisor 831C

We recommend that you complete this process prior to each measurement.

When you schedule service and certified internal calibration for your meter at the factory, the resulting correction data is stored on the meter, and stated in the calibration documentation that returns with your meter. We recommend that you connect to G4 and calibrate your microphone just after factory calibration, so that the updated values then can be saved to the G4 Calibration History. See *Figure 5-3* for Calibration History details.



Step 1. On your SoundAdvisor, select **Tools**  **Calibrate**.

Step 2. Choose your calibrator from the **Select Calibrator** drop-down menu.

LEARN MORE Refer to the calibrator's user guide for more information.

TAKE NOTE For more information on the **Other** option, see [5.2 "Choosing a Calibrator" on page 51](#).

Step 3. Insert the 1/2" microphone into the 1/2" microphone opening at the bottom of the calibrator.

Step 4. Power the calibrator on. The calibrator turns off after 1 minute. Use it within that time, or press the power button again.

Step 5. Use the navigation keys to select **Do Calibration**. The 831C calibrates and asks if you want to save the results.

Step 6. Select **Yes** when complete.


TAKE NOTE If you see an error message (such as Calibration Out of Range), verify that the dB level for your calibrator and your meter are the same, then perform the calibration again. Be sure to power the calibrator on each time.

5.4.1 Calibrating While Using Meter Security (Lock Mode)

While the meter interface is locked, you can still calibrate the meter when the measurement is stopped.

Before you begin:

- Lock the meter interface as shown in [11.1.2 "Unlocking the Meter from the Meter Interface" on page 103](#).

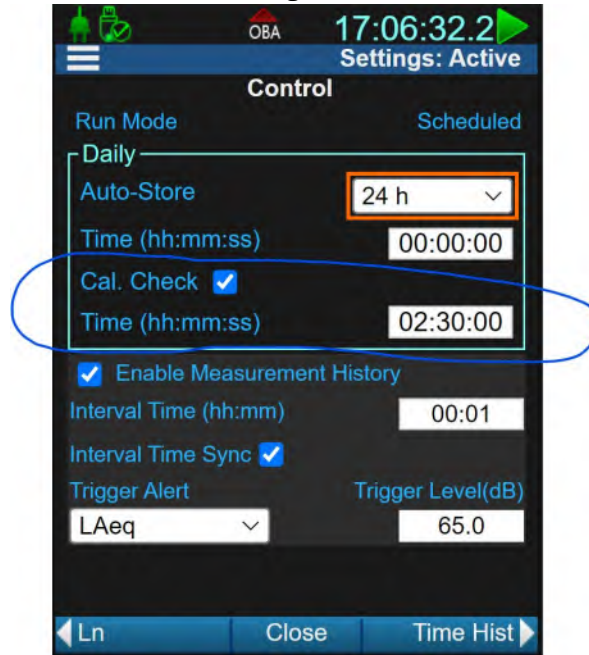
Step 1. Press the **Cal** () button to navigate directly to the Calibrate display.

Step 2. Complete the calibration process as shown in **5.4 "Calibrating Your SoundAdvisor 831C" on page 54.**

5.4.2 Performing a calibration check (when using PRM2103)

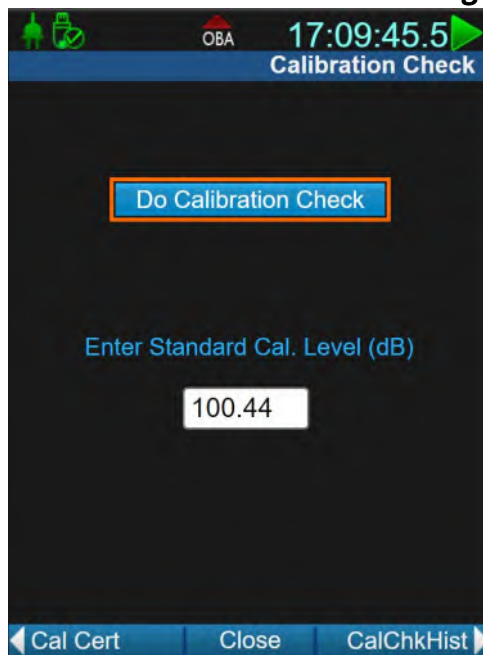
The LD Model PRM2013 outdoor preamplifier can be used to perform a remote calibration check. This calibration check can be scheduled within the Tools->Setup Manager->Control page when running a daily Timer, Continuous, or Scheduled run mode. Check the "Cal Check" option and set the time for the calibration check.

FIGURE 5-6 Control Page with Cal. Check Setting



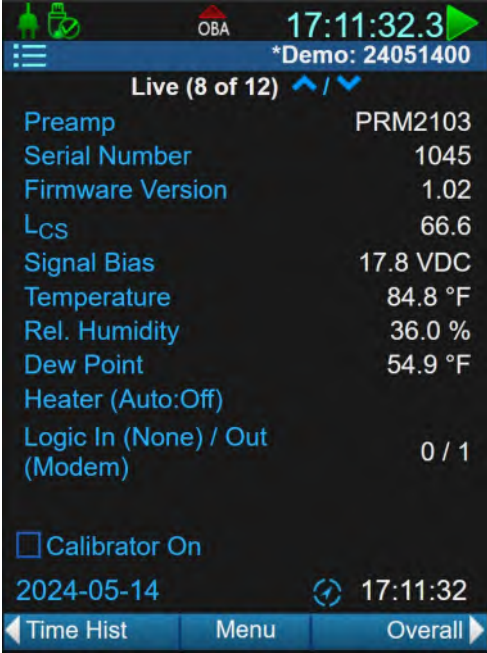
A manual calibration check can be run from the Tools->Calibrate->Calibration Check page.

FIGURE 5-7 Calibration Check Page



The PRM2103 Calibrator tone can be also manually turn on my checking the box next to “Calibrator On” on the Preamplifier information page of the live tab. This does not add a calibration check history entry, but turns on the calibration tones.

FIGURE 5-8 Preamplifier Information Page



Module 6 Creating a Measurement Setup

The 831C makes measurements based on the properties and metrics you save in the setup file (Setup). Setups are created, edited, and deleted using the meter’s Setup Manager. This module describes using the Setup Manager on the 831C and guides you through the process of saving a Setup.

You may also complete this process with your connected meter in G4 LD Utility.

In this module:

- 6.1 831C Setup Manager Overview -----56
- 6.2 Creating a Custom Setup File On the Meter -----57
 - 6.2.1 Creating a New Setup File On the Meter
 - 6.2.2 Customizing Setup Values On the Setup Manager Tabs
 - 6.2.3 Saving the Setup File
 - 6.2.4 Choosing a Meter Control Run Mode
- 6.3 Troubleshooting a Measurement Setup File -----65

6.1 831C Setup Manager Overview





To access the Setup Manager on the 831C, select **Tools**  → **Setup Manager**. The Setup Manager Files view is the first page in the Setup Manager and displays as shown in *Figure 6-1*.

FIGURE 6-1 Setup Manager Files View On 831C



To edit a Setup, use the meter buttons to highlight it, then press the **right** or **left softkeys** ( ) to view and edit properties of the selected setup file.

The blue menu bar near the top displays the name of the Setup you are currently editing, as shown in this figure.

The **Active** setup is the saved profile of settings that will be used for the upcoming measurement. Before beginning a measurement, you may set any setup file in the list to be the “Active” setup, as shown in this module.

The **Default** setup is always available in this view. When set as the “Active” setup, all meter settings are restored to factory default values. The Default setup can’t be edited or deleted, but can be opened and saved with a unique name to create a new setup file.


6.2 Creating a Custom Setup File On the Meter


While you can edit and save measurement settings directly in the **Active** setup, it's a good practice to save a setup file with a unique name for each kind of measurement. This section shows you how.

In this section:

- [6.2.1 Creating a New Setup File On the Meter](#)
- [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#)
- [6.2.3 Saving the Setup File](#)
- [6.2.4 Choosing a Meter Control Run Mode](#)

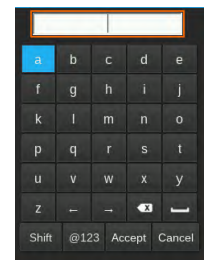
6.2.1 Creating a New Setup File On the Meter

Step 1. On the 831C, go to **Tools**  → **Setup Manager**.

Step 2. In the Files view of the Setup Manager, highlight the **Default** setup item and press **Enter** . This opens the Setup Manager pop-up menu.

Step 3. Select **Save As**. This opens the virtual keypad.

Step 4. Enter a name for your Setup using the navigation buttons and select **OK**. Your setup file appears in the Setup Manager Files view.







6.2.2 Customizing Setup Values On the Setup Manager Tabs

Some tabs (pages) in this section become available when you purchase and install optional firmware from Larson Davis. If a step indicates a feature that isn't available on your meter, move to the next step.

Before you begin:

- Complete [6.2.1 Creating a New Setup File On the Meter](#)

Step 1. On the 831C, navigate to the Files view of the Setup Manager (**Tools**  → **Setup Manager**).

Step 2. Highlight and select your setup file in the list ( or  + ). The name of your setup displays in the **Settings:** line (see *Figure 6-2*).


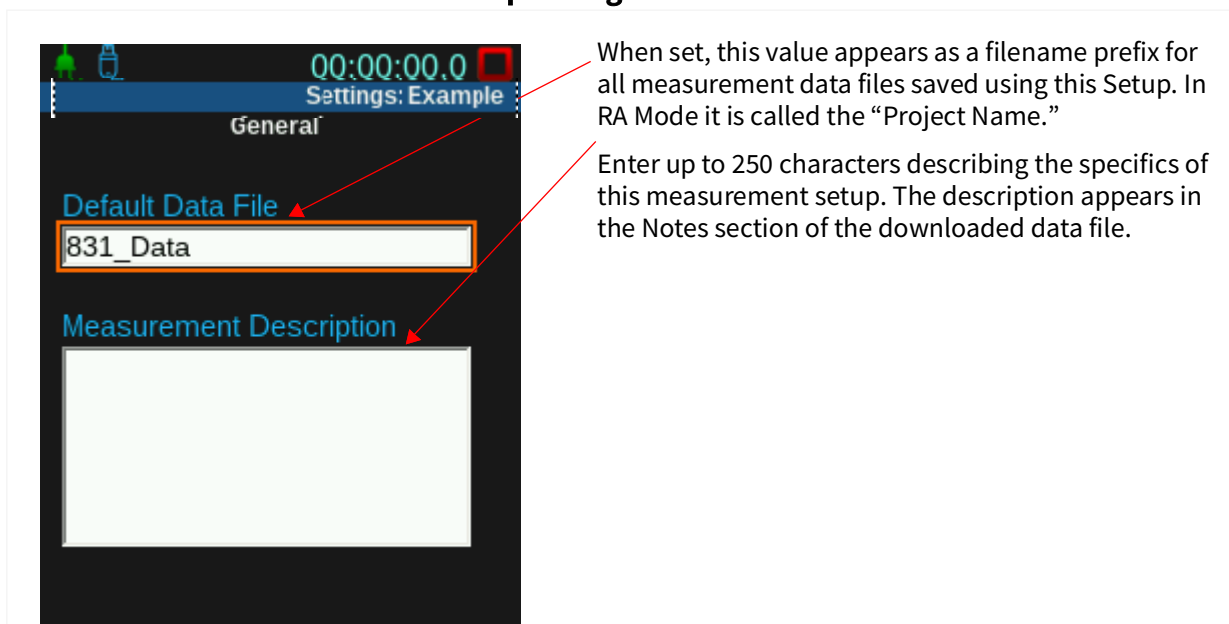
Step 3. Use the **right softkey** () to navigate to the **General** tab, and enter your preferred details. These fields are optional.

FIGURE 6-2 Setup Manager: General Tab




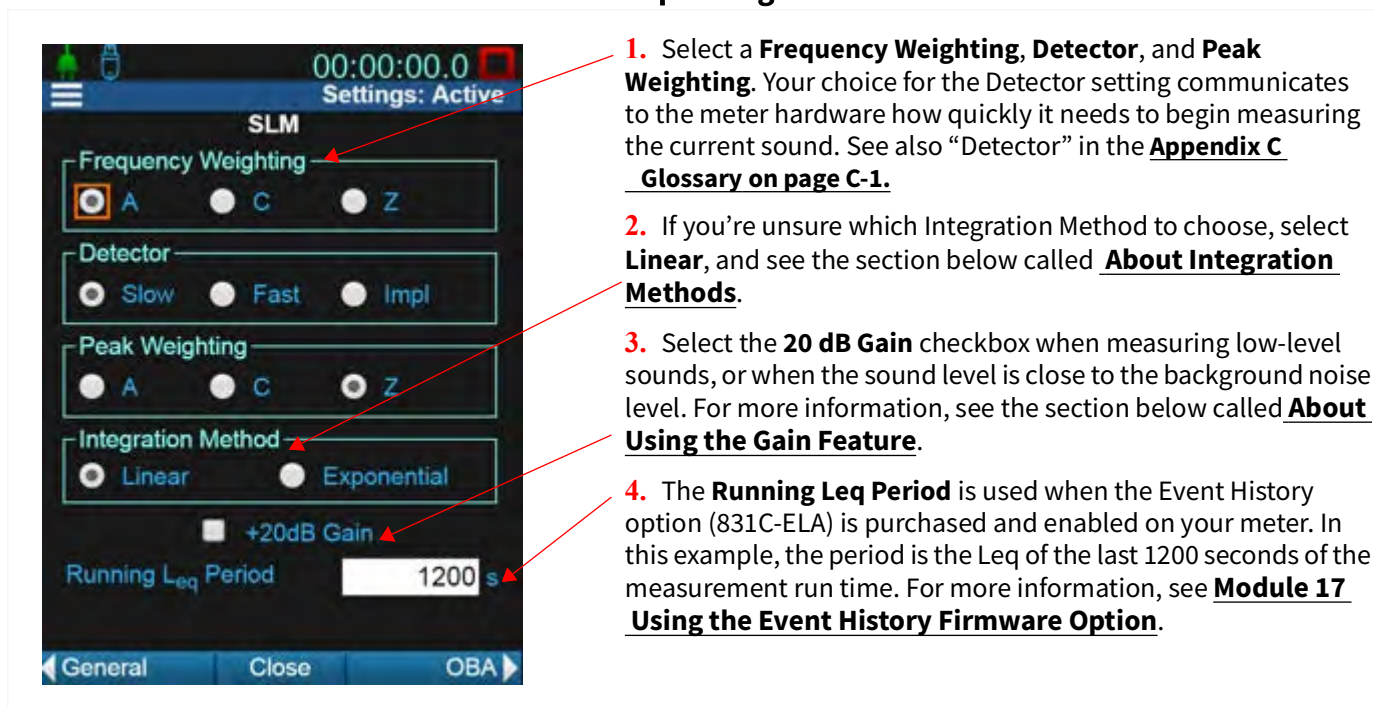
Step 4. Use the **right softkey** () to navigate to the **SLM** tab and select your preferred settings.

FIGURE 6-3 Setup Manager: SLM Tab



About Using the Gain Feature

When using a microphone with sensitivity of 50 mV/Pa, the input overload corresponds to the Gain setting as shown in *Table 6.1*.

Table 6.1 Correlation of Gain Setting to Range and Overload

Input Gain, dB	OBA Range	Overload Level, dB peak
0	High (48–141 dBA)	143
20	High (48–141 dBA)	123
0	Normal (25–110 dBA)	110
20	Normal (25–110 dBA)	90

About Integration Methods

Although the 831C measures levels at all 3 detector and frequency weighting settings according to your selection, some features require a single combination. The level defined by the detector and frequency weighting you select is used for the computation of Ln, Exceedances, Sound Exposure, and Sound Events. However, some features may not be available for Exponential Integration Method. See **Appendix C Glossary on page C-1**.

Step 5. If the OBA firmware option is enabled for your meter, use the **right softkey** (○●●) to navigate to the **OBA** tab and choose your preferred settings.

FIGURE 6-4 Setup Manager: OBA Tab

1. Normal or High: For measurement range specifications, see **Table A-18, “1/3 OBA Octave Linearity Range,” on page 18-A.**

2. Select **1/1 Octave** bandwidth, **1/3 Octave** bandwidth, or **both** simultaneously.

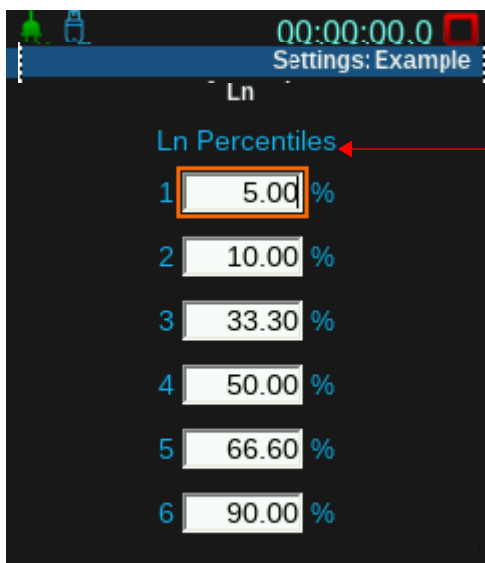
3. Choose a **Frequency Weight** for the 1/1 Octave and 1/3 Octave bandwidth frequency analysis.

4. For more information about **Max Spec** (Maximum Specification) values, see “Bin Max” and “At Lmax” in the **Appendix C Glossary on page C-1.**

5. Spectral Ln values can be measured using 1/1 or 1/3 octave bandwidths. If both **1/1 and 1/3** are selected in the **Bandwidth** setting, **Spectral Ln** only measures for 1/3 octaves.

Step 6. Use the **right softkey** (○○●) to navigate to the **Ln Percentiles** tab and select your preferred settings.

FIGURE 6-5 Setup Manager: Ln Percentiles Tab

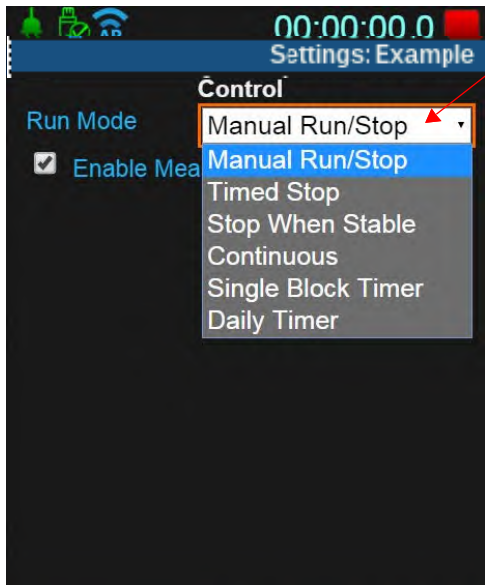


1. Enter any value from 00.01 to 99.99%. For more information, see “Ln Value” in the **Appendix C Glossary on page C-1**.

2. You may also edit Ln values and view the calculated value during a measurement.

Step 7. Use the **right softkey** (○○●) to navigate to the **Control** tab and choose your preferred settings.

FIGURE 6-6 Setup Manager: Control Tab

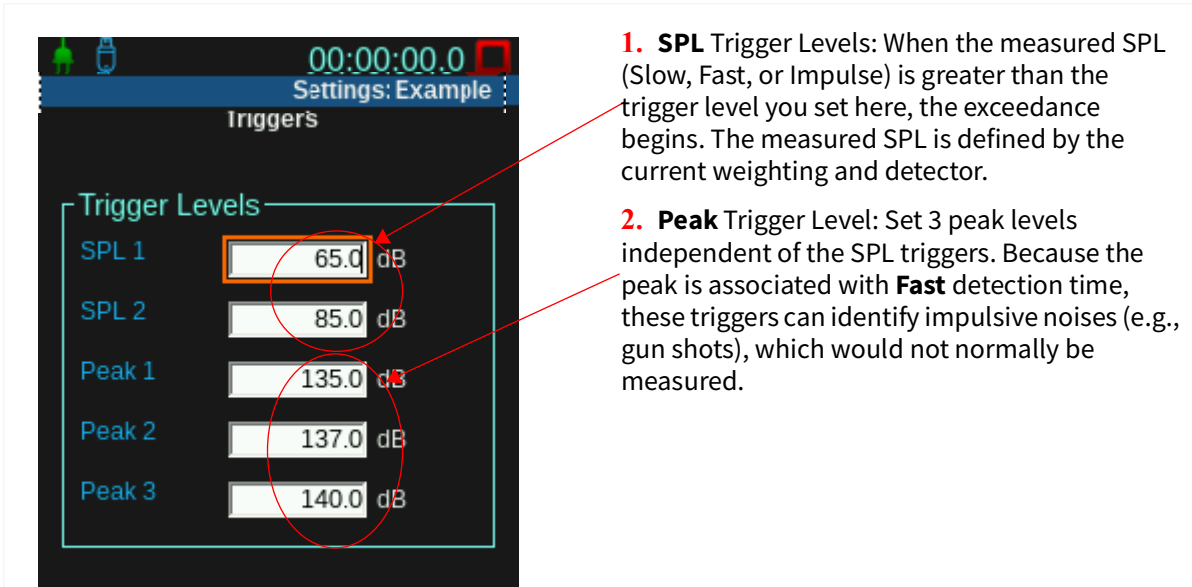


The Sound Advisor 831C has six Run Modes to control the meter during a measurement. For more information on each run mode, see **6.2.4 Choosing a Meter Control Run Mode**.

Step 8. If Time History is enabled on your meter, use the **right softkey** (○○●) to navigate to the **Time History** tab. For information on choosing these settings, see **Module 16 Using Time History**.

Step 9. Use the **right softkey** (○○●) to navigate to the **Exceedance Triggers** tab and select your preferred settings.

FIGURE 6-7 Setup Manager: Exceedance Triggers Tab



1. SPL Trigger Levels: When the measured SPL (Slow, Fast, or Impulse) is greater than the trigger level you set here, the exceedance begins. The measured SPL is defined by the current weighting and detector.

2. Peak Trigger Level: Set 3 peak levels independent of the SPL triggers. Because the peak is associated with **Fast** detection time, these triggers can identify impulsive noises (e.g., gun shots), which would not normally be measured.

Step 10. If Event History is enabled on your meter, use the **right softkey** (○○●) to navigate to the **Event History** tab. For information on choosing these settings, see **Module 17 Using the Event History Firmware Option**.

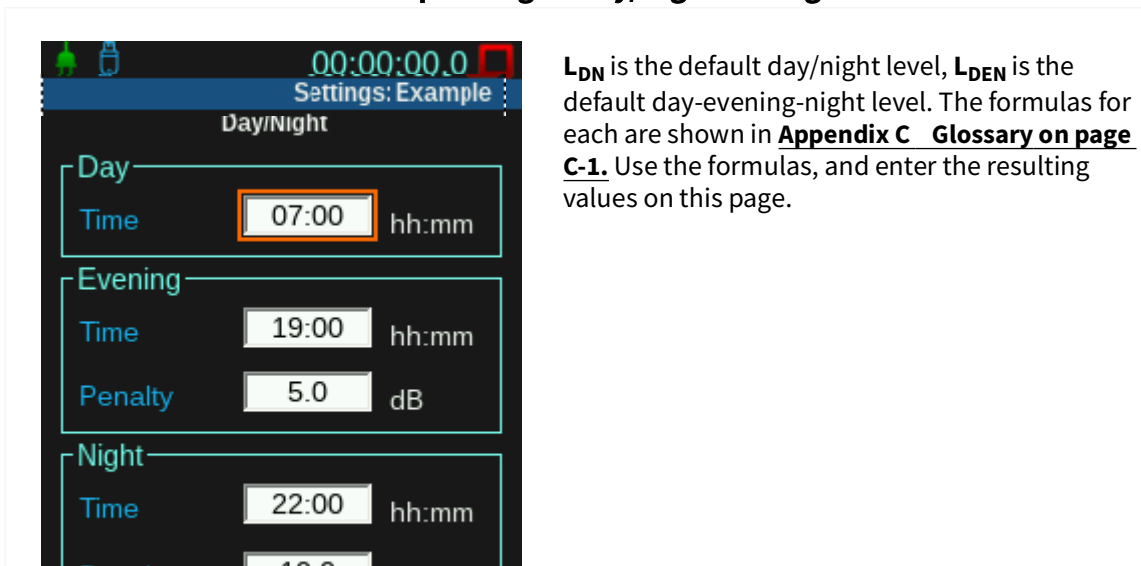
Step 11. If the optional Sound Recording firmware (831C-SR, or MSR) is enabled on your meter, use the **right softkey** (○○●) to navigate to the **Markers** tab. For information on choosing these settings, see **Module 20 Utilizing 831C Sound Recording**.

Step 12. Use the **right softkey** (○○●) to navigate to the **Day/Night Setting** tab, and select your preferred settings.

Although the ISO 1996-2:2007 standard specifies which default values should be used to calculate LDEN, in practice, the time values defining the day, evening, and night periods may be changed.

This is permitted by Directive 2002/49/EC of the European Parliament and of the Council of 25 June, 2002 relating to the assessment and management of environmental noise. Because of these recommendations and the versatility of the standard on this point, it's important to verify these values using the formulas for L_{DN} and L_{DEN} prior to making the measurement.

FIGURE 6-8 Setup Manager: Day/Night Setting Tab



L_{DN} is the default day/night level, L_{DEN} is the default day-evening-night level. The formulas for each are shown in **Appendix C Glossary on page C-1**. Use the formulas, and enter the resulting values on this page.

Step 13. (Optional) If you plan to collect weather data for your measurement, do the following:

- a. Connect your weather sensor as shown in [21.2 Installing a Weather Sensor](#).
- b. Press the **softkey** (●○○) until the Weather settings page displays in the Setup Manager. If the page is not available, verify that the Weather display is enabled on the meter. For reference, see [4.2 "Enabling or Disabling Display Tabs" on page 48](#).
- c. Select your preferred weather settings.

6.2.3 Saving the Setup File

Before you begin:

- Complete [6.2.1 Creating a New Setup File On the Meter](#)
- Complete [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#)

Step 1. To save your Setup and exit the Setup Manager, select **Close** (○○●○).

Step 2. In the Save dialog, choose **Yes** to save your settings.

Step 3. Highlight and press **Enter** (ENTER) on the name of the Setup you created.

Step 4. In the pop-up menu that appears, **Set to Active** is highlighted. Press **Enter** (ENTER) to select that option. The next measurement runs using the Setup you just created.

TAKE NOTE You can also complete the setup process in G4 LD Utility, which provides a simple, file transfer-style interface for configuring, saving, and transferring Setup files to your PC or to another meter. For more information, refer to the *G4 LD Utility Reference Manual*.

6.2.4 Choosing a Meter Control Run Mode

Before you begin:

- Complete steps 1–7 of section [6.2 Creating a Custom Setup File On the Meter](#).

On the Control tab, there are six automatic meter control run modes available. The mode determines which other settings and features are available. Click on a link below to learn about each meter control run mode.

In this section:

- [Using Manual Run/Stop Mode](#)
- [Using Timed Stop Mode](#)
- [Using Stop When Stable Mode](#)
- [Using Continuous Mode](#)
- [Using Single Block Timer Mode](#)
- [Using Daily Timer Mode](#)

When combined with the Measurement History feature, these three modes can be used to create multiple measurement intervals stored in a data file, with new data files created at regular time intervals. For more information, see [15.1 Configuring Measurement History \(MH\)](#).

Using Manual Run/Stop Mode

Recommended for:	When you want to manually control when the meter runs and stops.
Strength:	Custom, live measurement

Using this mode, you plan to start and stop the measurement manually. In this mode, the 831C meter preference for Auto-Store determines what happens when you stop the measurement.

- Step 1.** Select **Manual Run/Stop** from the Run Mode drop-down menu.
- Step 2.** If desired, enable any additional settings on the Control tab, and return to [Step 8. on page 60.](#)

Using Timed Stop Mode

Recommended for:	Site surveys
Strength:	All measurements have the same duration.

The measurement is initiated manually, and stops automatically after the period you indicate.

- Step 1.** Select **Timed Stop** from the Run Mode drop-down menu.
 - a.** Enter the measurement length in the **Time (hh:mm:ss)** field.
- Step 2.** If desired, enable any additional settings on the Control tab, and return to [Step 8. on page 60.](#)

Using Stop When Stable Mode

Recommended for:	On-site or off-site control of a measurement
Strength:	Measures sound (noise) until it stops changing.

- Step 1.** Select **Stop When Stable** from the Run Mode drop-down menu.
- Step 2.** Enter values for **Delta (dB)** and **Time** as stability parameters. If the parameter is detected, the measurement stops.
- Step 3.** If desired, enable any additional settings on the Control tab, and return to **Step 8. on page 60.**

Using Continuous Mode

Recommended for:	Continuous noise measurement
Strength:	Totally autonomous; automatic restart in case of power failure.

In this mode, when the meter is powered on, a measurement runs continuously and stores data files according to the Daily Auto-Store value you set. If you set **Daily Auto-Store** to **Never**, the meter defaults to your meter preferences for Auto-Store. If a measurement is paused, Continuous mode automatically resumes the measurement after 5 minutes.

- Step 1.** Select **Continuous** from the Run Mode drop-down menu.
- a.** Select an option from the **Daily Auto-Store** drop-down, and enter the time of day the data file should be stored in the **Time (hh:mm:ss)** field.
- TAKE NOTE** At the end of the Auto-Store period, the 831C saves measurement record to a new, incrementally-named, data file throughout the day based on the **Time (hh:mm:ss)**. Time indicates the time of day of the first auto store.
- TRY THIS** If you want to store a data file each hour of the day beginning at 10:05, choose the following settings:
- **Auto-Store:** 1 h
 - **Time (hh:mm:ss):** 00:10:05

If you press Run at 10:10, the measurement record will store at 11:05, 12:05, and so forth. In this case, the initial measurement record will contain only 50 minutes, while all others will contain the full hour.

- Step 2.** If desired, enable any additional settings on the Control tab, and return to **Step 8. on page 60.**

LEARN MORE If you're planning to use meter security (meter lock) during this measurement, refer to *Table 11.1 on page 102* to learn how these features work together.

Using Single Block Timer Mode

Recommended for:	Unmonitored measurements
Strength:	One measurement automatically starts and stops at the date and time you set.

Step 1. Select **Single Block Timer** from the Run Mode drop-down menu.

- a. Enter a **Start (y-m-d)** date and **Time**, and an **End (y-m-d)** date and **Time**, where **Time** is the time of day.

Step 2. If desired, enable any additional settings on the Control tab, and move to **Step 8. on page 60.**

LEARN MORE If you're planning to use meter security (meter lock) during this measurement, refer to *Table 11.1 on page 102* to learn how these features work together.

Using Daily Timer Mode

Recommended for:	Work area surveys, which follow a worker's daily schedule and account for breaks.
Strength:	Totally autonomous, daily intermittent measurement for long or short number of days.

Use Daily Timer mode to schedule one or more measurements, which start and stop according to the time you set, every day until the End date.

Step 1. Select **Daily Timer Mode** from the Run Mode drop-down menu.

- a. Enter a **Start (y-m-d)** date and **Time**, and an **End (y-m-d)** date and **Time**, where **Time** is the time of day.
- b. If desired, select the checkbox in-line with **2**, and **3** to enter additional measurement periods.


Step 2. If desired, enable any additional settings on the Control tab, and return to **Step 8. on page 60.**

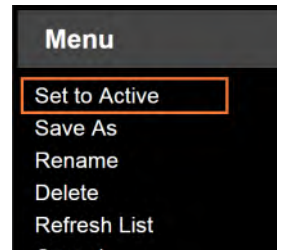
LEARN MORE If you're planning to use meter security (meter lock) during this measurement, refer to *Table 11.1 on page 102* to learn how these features work together.

6.3 Troubleshooting a Measurement Setup File

Setting the Default measurement setup as the Active setup can clear the meter when it's doing something unexpected and you don't know why.

Step 1. On the meter, select **Menu** () → **Setup Manager**.

- Step 2.** Select **Default** by highlighting it, then pressing **Enter** . This opens a pop-up menu.
- Step 3.** Highlight, select **Set to Active**, and confirm your choice if required.
- Step 4.** Press the **Close** softkey to save the meter settings.



Module 7 Making a Measurement



Making a measurement on the 831C can be as simple as viewing a live reading of the area using the Big Digit display, or as sophisticated as setting it up with environmental accessories, deploying it in the field, and logging measurements when the sound level is above 80 dB over the course of many months in all weather conditions. For both tasks, understanding the basics of measurement making is essential.

Quick Measurement Steps:

Step 1. Power On the 831C.

Step 2. Navigate to **Overall** display.

Step 3. Press **Run** .

Step 4. When finished, press **Stop** .

Step 5. Press **Store**  and save your data file.



In this module:

7.1	Before You Begin	-----67
7.1.1	Positioning the 831C	
7.1.2	Performing an Area Sound Field Check	
7.2	Performing the Measurement	-----70
7.2.1	Pausing the Measurement and Using Back Erase	
7.2.2	Resetting a Measurement	
7.2.3	Stopping the Measurement	
7.3	Storing the Measurement	-----73

7.1 Before You Begin

Before performing a measurement, follow these steps to ensure the measurement is performed properly:

LEARN MORE Each step has a link to the first 6 Modules in this manual, which relate to optimal performance of the 831C.

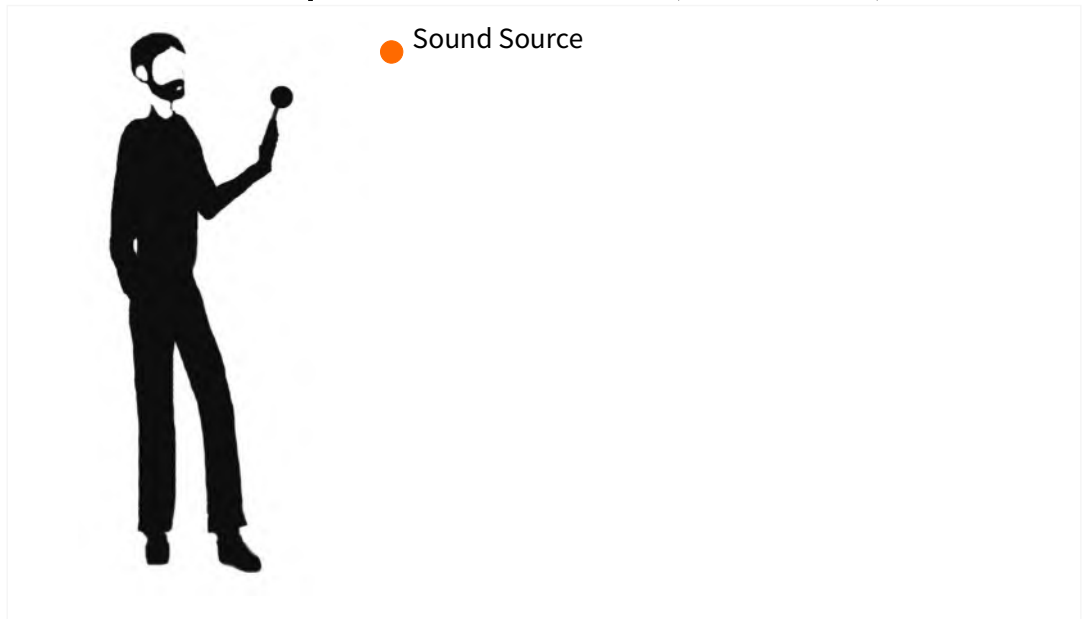
- Step 1.** Connect preamplifier and microphone to the 831C. For complete instructions, see [2.1.2 "Connecting the Preamplifier to Meter" on page 8](#).
- Step 2.** Power the meter **On** . For complete instructions, see [2.2.4 "Powering On or Off" on page 15](#).
- Step 3.** Navigate to **Tools**  → **Setup Manager** and indicate or check all values desired for your measurement. For complete instructions, see [6.2 Creating a Custom Setup File On the Meter](#).
- Step 4.** Calibrate the meter. For complete instructions, see [5.4 Calibrating Your SoundAdvisor 831C](#).

7.1.1 Positioning the 831C

The best position for sound recording is to mount the 831C on a tripod. If held in hand, position your body away from and on an angle to the meter to minimize interference of the sound field at the microphone resulting from body reflections. The microphone should be angled away from the body.

If using a free-field microphone like the 377B02, the meter should be “pointed” at the sound source being measured.

FIGURE 7-1 Optimal Hand Held Position (Free-Field Mic)



Utilizing a Microphone Extension Cable

TAKE NOTE Always position the preamplifier/microphone in a way to minimize the effect of reflections on the sound field near the microphone.

A shielded microphone extension cable may be placed between the meter and the preamplifier/microphone if needed for the measurement position. No correction is

necessary when using Larson Davis microphone extension cables in combined lengths up to 200 feet. XXX is the length in feet (XXX = 010, 020, 025, 035, 050, 060, 100 and 200) available.

This configuration has been applied with success in certain circumstances for RT60 Interrupted Method Reverberation Time measurements. Repositioning the mic/preamp on an extension cable within the room enables you to keep the 831C with you outside the room.

Windscreen

Wind blowing across the microphone generates pressure fluctuations on the microphone diaphragm which can produce errors in the measurement. As a result, when performing measurements in the presence of low level airflows, we recommended that you place a windscreen over the microphone and preamplifier. Larson Davis provides the WS001 windscreen, which is a 3 ½-inch diameter sphere made of open cell foam.

FIGURE 7-2 WS001 Windscreen

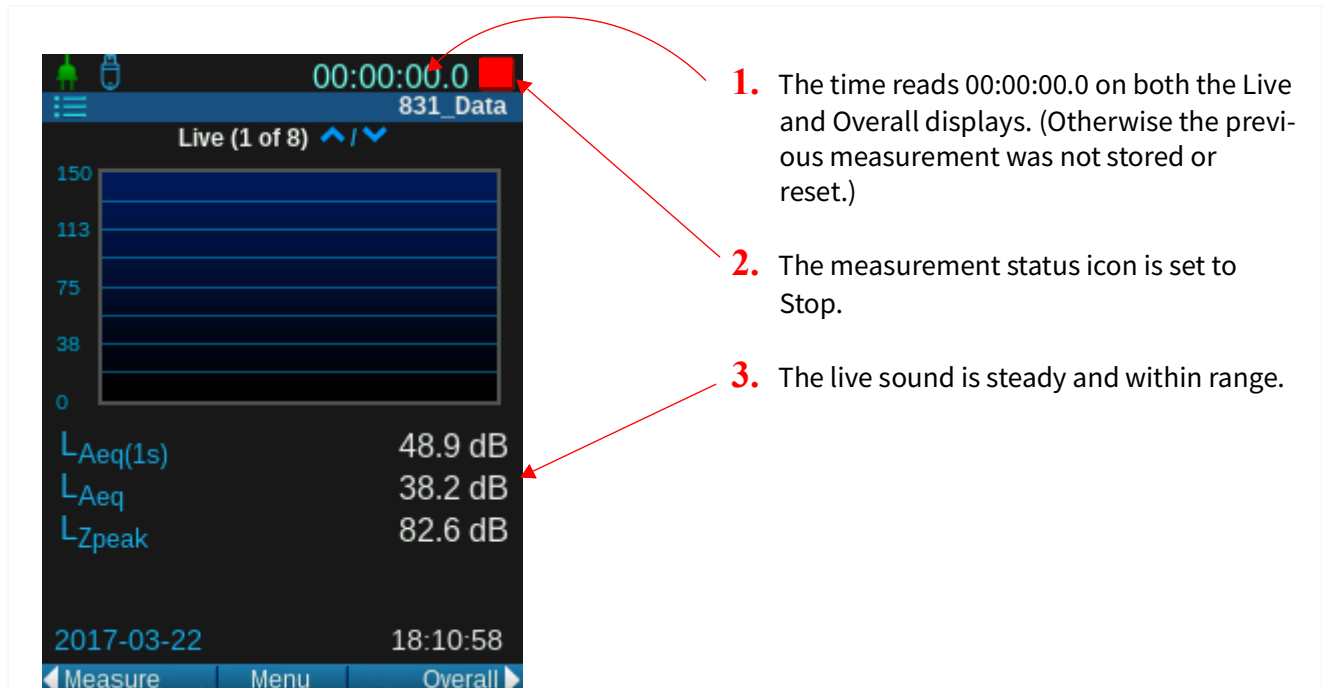


7.1.2 Performing an Area Sound Field Check

Starting a measurement during a dramatic sound change can affect your data in an unwanted way. Before starting any measurement, it's a good practice to briefly monitor the area sound.

Step 1. On the meter, observe the current sound readings on the Live tab as shown in *Figure 7-3*.

FIGURE 7-3 Standard Area Sound Before Measurement



LEARN MORE For more detail about the information displayed here, see [4.1.1 Understanding the Live Tab](#).

7.2 Performing the Measurement

Before you begin:

- Charge or provide uninterrupted power for your meter for the measurement duration. For details, see [2.2 "Powering the 831C SLM" on page 9](#).
- Create a measurement setup file for this measurement as shown in [Module 6 Creating a Measurement Setup](#).
- Complete an Area Sound Field Check as shown in [7.1.2 Performing an Area Sound Field Check](#).


Step 1. On the 831C, navigate to the **Live View** → **Overall** tab and press **Run** .

Step 2. During the measurement, the meter may display keypad LED indicators, or measurement range indicators as described here.

Keypad LED Indicators

When performing a measurement, the state of the 831C is indicated in several ways: measurement state icon, Overall display animation, and the red and green illumination of the STOP/STORE and RUN/PAUSE keys.

Table 7.1 Measurement State LED Indicators

Measurement State	Red LED 		Green LED 	
Stopped	Winking	**_*_*	Off	
Paused	Flashing	*_*-	Flashing	_**
Running	Off		Winking	**_*_*
Waiting for valid data to begin running	Delayed wink	----*	Off	

LEARN MORE To learn more about the displays and icons, see [2.4 Display Elements Overview](#).

The Measurement Range Indicators: Overload or Under Range

The measurement ranges over which the 831C meets the standards depend upon the selected frequency weighting. Measurements which include levels outside this range should not be considered accurate. An overload indication appears when levels are above the range. However, it isn't recommended to rely on measurements where the levels are below the lower limit of the specified range.

Overload



As part of the calibration procedure, the overload level (dB Peak) for A, C, and Z weighting is determined for the current instrument setup and microphone/preamplifier. When the sound pressure level is higher than the calibrated overload level, the input overload icon flashes while the condition exists.

Under Range



When the sound pressure level is lower than the meter's noise floor (the noise level of the instrument and the preamplifier), the Under Range icon flashes while the condition exists.

7.2.1 Pausing the Measurement and Using Back Erase

The measurement can be temporarily paused at any time, any number of times. During a pause, the run clock does not stop and instantaneous data continues on the Live tab.

After a pause, press the **Run/Pause button**  to resume the measurement. The Overall data is not impacted by any acoustic events occurring during the pause.

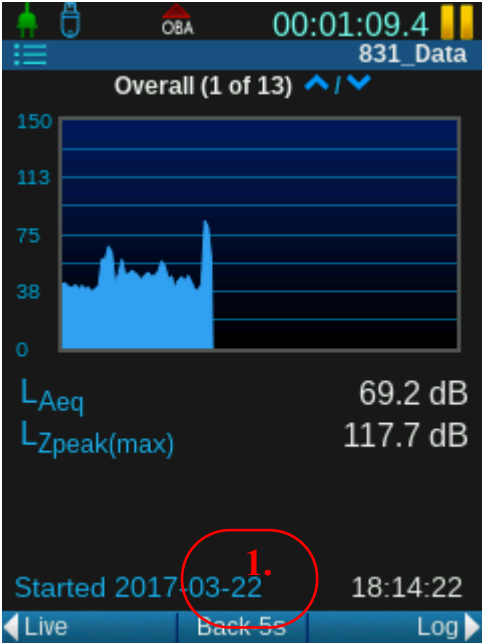
Using the Back-Erase Feature While Paused

The 831C has a back-erase feature that allows for a quick erase of the last 10 seconds (or 5 seconds) of measured data. This feature is used to erase sounds that are recorded, but not wanted in the overall measurement. The back erase is shown as an event in the Session Log and in the Time History record as shown in the following segments.

Back erase is not available when any of the following have been enabled in the active Setup:

- Measurement History
- Event History
- Spectral Ln
- Event Sound Recording

FIGURE 7-4 Using 831C Back Erase

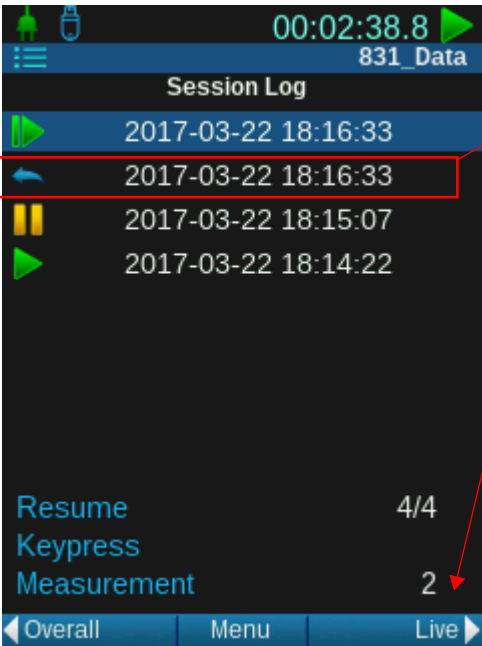


1. Use **Back-Erase** by pressing the **middle softkey** (○●○). This erases the last 10 seconds. To erase only 5 seconds, choose **Undo** (○●○), then select **Back-5s** when it appears.
2. To close Back Erase, press **Run** (▶||) to resume, or **Stop** (■) to end the measurement.

Back Erase on the Session Log

The session log displays a Back Erase line entry to indicate data has been erased as shown in *Figure 7-5*.

FIGURE 7-5 Back Erase



1. The back-erase icon appears in the Session Log when a segment of the measurement is erased during a pause.
2. The Time History record number to which back erase is applied is shown near the bottom of the screen.

Back Erase in the Time History Record


When you use the back-erase feature, time history resumes at the time the measurement resumes. In the resulting Time History data log, the back-erased period is marked as a record type as shown in *Figure 7-6*.

FIGURE 7-6 Back Erase In the Resulting Time History Data

Record #	Date	Time	Record Type	Cause	#	TH Record
1	2016-10-03	17:16:53	Run	Key	1	0
2	2016-10-03	17:17:17	Pause	Key	1	0
3	2016-10-03	17:17:28	Back Erase	Key	-10	0
4	2016-10-03	17:17:28	Resume	Key	2	0
5	2016-10-03	17:17:55	Stop	Key	2	0

7.2.2 Resetting a Measurement

A measurement often needs to be reset when a radical noise event takes place that is unnecessarily recorded in your data. For example, an aircraft passes overhead when attempting to measure the background noise in a normally quiet area.

To reset a measurement in progress, stop the measurement, then press the **Reset** . This erases all data previously measured and resets the run time clock to zero. A reset doesn't reset stored data files, only the current run. A reset can be initiated when the 831C is running, paused, or stopped.

CAUTION Current measurement data is not automatically saved. You must manually store the data or use an Auto-Store option. Once you store, your data is not lost during a reset. If you initiate a reset while a measurement is running or paused, the 831C automatically stops the measurement.



7.2.3 Stopping the Measurement

When you stop the 831C during a run or a pause, this stops the run clock. Resuming a run continues the overall measurement; the run clock also begins again from the time indicated when the stop occurred.

7.3 Storing the Measurement

Step 1. Press the **Stop button**  to stop the measurement.

TAKE NOTE You cannot save a file with the same name as a currently saved data file. If you want the new data file to replace the old data file, rename or delete the old file first. See **Module 8 Managing Measurement Data Files**.

- Step 2.** Press the **Store button** . The meter Auto-Stores or prompts you to store the measurement. (For more information about Auto-Store, see **8.1 "Setting Data File Storage Preferences" on page 75**).
- Step 3.** If you're prompted to store the file, you can change the name of the data file by highlighting the name and pressing **Enter** . This displays the virtual keypad. When finished entering the name, select **Yes** to save.

Module 8 Managing Measurement Data Files

Each time you manually or automatically store measurement results, a new data file is created or appended and saved to the location you specify. While the 831C has 1.8 GB of available internal memory, you may also choose USB or cloud storage as shown in this module.

In this module:

8.1	Setting Data File Storage Preferences	75
8.2	Using the File Manager	77
8.2.1	Viewing a Measurement Data File	
8.2.2	Using Load Settings	
8.2.3	Using Create Average	
8.3	Saving, Moving, or Copying Data Files	80
8.3.1	About File Naming Conventions	
8.3.2	Moving or Copying Data Files to a USB Drive	

8.1 Setting Data File Storage Preferences

On the Meter Preferences page, the Auto-Store and Data Storage settings allow you to indicate where, when, and how you want the meter to react when it's time to store a measurement.

When storing to a USB drive:

TAKE NOTE Using 30GB or more of the standard 32GB USB drive, or storing more than 600 files on a USB thumb drive may cause noticeable delays when powering on the meter and when viewing the Files tab in G4. We recommend using the file size estimation details on the meter (see the final screen of the Live page), to estimate how your current measurement may impact the total amount of stored data on your USB drive.

For optimal performance, we recommend PNY USB storage drives. Regardless of which drive you use, we recommend that you periodically save your USB files to a computer (or other permanent storage), and format the USB drive. For more information on this process, see [Module 12 Using System Utilities](#).

Step 1. On your 831C, select **Tools**  **System Properties**  **Preferences**.

Step 2. Choose an option from the **Auto-Store** drop-down menu:

Choosing an Auto-Store Meter Preference

The Auto-Store meter preference allows you to choose what happens when a measurement stops.

- **None:** All storage must be done manually, unless “Continuous Daily Auto-store” mode is indicated in the active setup.


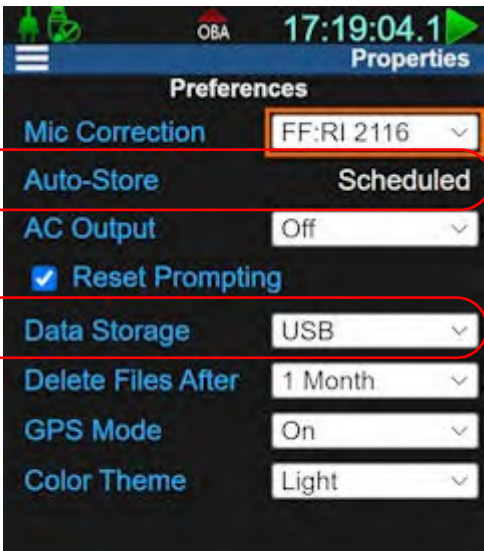
- **Prompt:** When you press the **Stop button** , or a stop occurs, you are prompted to save the measurement data file. We recommend this setting for manual measurements only.
- **Store:** A measurement is automatically stored when a measurement is stopped.

Table 8.1 shows the result of each option for manual or timed stop, and its effect on the run mode you choose.

Table 8.1 Run Modes and Auto-Store Preferences

Run Mode	Type of Stop	Prompt (Auto-Store)	Store (Auto-Store)
Timed Stop	Timer final stop	Prompts at timer's end	Stores automatically
	Manual stop	Prompts when stopped	Stores automatically
Stop When Stable	Timer stop	Prompts when stable	Stores automatically
	Manual stop	Prompts when stopped	Stores automatically
Single Block Timer	Timer stop	Prompts at timer's end	Stores automatically
	Manual stop	Prompts when stopped	Stores automatically
Daily Timer	Timer stop	Prompts at timer's end	Stores automatically
	Manual stop	Prompts when stopped	Stores automatically
Manual	—	Prompts when stopped	Stores when stopped
Continuous	Interval stop	Follows Daily Auto-Store settings	
	Manual	Prompts when stopped	Stores when stopped

FIGURE 8-1 Preferences Page



1. The Auto-Store meter preferences include: **Prompt, Store, None, and Scheduled.**
2. Your data file can store to the internal memory, to a USB drive, or to a remote (cloud) storage account. If your measurement includes sound recordings, refer to file storage details in **"Choosing a File Format for Recorded Sound Files" on page 178.**

LEARN MORE For more information about enabling SFTP or cloud storage, see **9.10 "Enabling or Disabling Remote (Cloud) Storage" on page 94.**


8.2 Using the File Manager

The File Manager is a directory of all saved data files. Only one user at a time can perform actions on data files. If a user is in the Data File Manager and another attempts to open it, the second is prompted to end the first user's session before they can begin their own.

TRY THIS G4 LD Utility provides a simplified way to access and examine resulting data files. For more information, see the *G4 LD Utility Manual* from LarsonDavis.com.

Step 1. On the 831C, select **Tools**  → **Data File Manager**.

FIGURE 8-2 File Manager Overview



1. When a USB drive is inserted, the USB icon displays.

2. Shows the available internal memory by default. If you insert a USB drive and set your File Storage Meter Preference to **Store** (**Setup Manager** → **System Properties** → **Preferences**), this information refers to the available USB memory instead of the 831C internal memory.

3. This data file is stored in 2 locations. The top file is saved on the "USB" drive. The bottom file is saved to the meter's internal memory.

4. The name includes the **Default Data File** prefix you defined on the General tab in the measurement setup. In RA Mode, this is called the "Project Name."

5. The current measurement can be running, paused, or stopped while viewing data files.

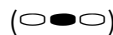
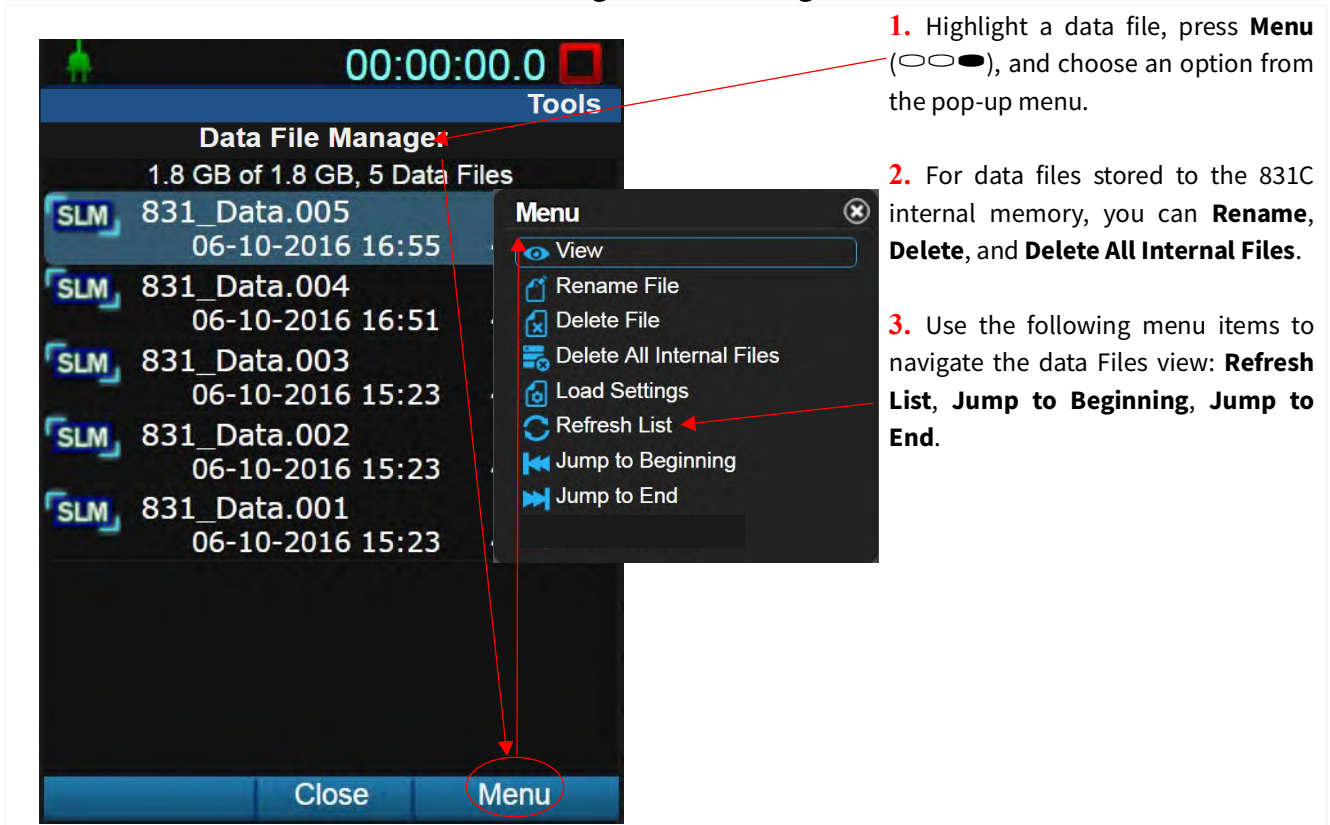
Step 2. Use the File Manager as demonstrated in *Figure 8-3*, and press **Close**  when finished.

FIGURE 8-3 Using the File Manager



1. Highlight a data file, press **Menu** (○●●), and choose an option from the pop-up menu.
2. For data files stored to the 831C internal memory, you can **Rename**, **Delete**, and **Delete All Internal Files**.
3. Use the following menu items to navigate the data Files view: **Refresh List**, **Jump to Beginning**, **Jump to End**.

8.2.1 Viewing a Measurement Data File






- Step 1.** On the 831C, select **Tools** (🔧) → **Data File Manager**.
- Step 2.** Highlight a data file, press **Menu** (○●●), then choose **View**. This opens a read-only display of the Overall and Session Log tabs for the measurement. The **data file icon** (📄) displays in-line with the file name to indicate that you are seeing a data file and not live data.

8.2.2 Using Load Settings

From a data file, you can load the measurement Setup properties used to create the data file into the Active setup.

Before you begin:

- Save your current Active settings to a new Setup file, if needed. Settings in the Active setup will be lost.
- Stop any measurement currently running or paused

- Step 1.** On the 831C, select **Tools**  → **Data File Manager**.
- Step 2.** Highlight the desired data file, press **Menu** () , and select **Load Settings** from the pop-up menu. (No confirmation appears)
- Step 3.** **Close** () the Data Manager, then select **Tools**  → **Setup Manager**, and choose **Active** from the Files view. Press the **right** or **left softkeys** () to examine the Setup properties.






8.2.3 Using Create Average

The Create Average feature takes a saved data file and adds its average as an instance to the unsaved Overall measurement.

CAUTION Any unsaved measurement is overwritten with the new average instance.

- You can add multiple files to the average. Each appears as a new instance in the Overall measurement pages. However, each file can only be added once.
- A measurement can run after the averages are loaded. But this isn't recommended for averaging purposes.
- After data files are averaged, you can save the new data as a single file

Follow these steps to create an average of your data file(s):

- Step 1.** On the 831C, select **Tools**  → **Data File Manager**.
- Step 2.** Highlight the desired data file, and select **Menu** () .
- Step 3.** Select **Create Average** from the pop-up menu.
- Step 4.** In the File manager, highlight a different data file, and select **Menu** () .
- Step 5.** Select **Add to Average** from the pop-up menu.
- Step 6.** Repeat steps 4–5 until all data files you want to average have been added.
- Step 7.** Press **Close** () to close the File manager, then navigate to the **Overall** display to view the average data.
- Step 8.** To save the averaged data file, press **Stop/Store** .

8.3 Saving, Moving, or Copying Data Files

In this section:

- [8.3.1 About File Naming Conventions](#)
- [8.3.2 Moving or Copying Data Files to a USB Drive](#)

8.3.1 About File Naming Conventions

In addition to manually naming a data file, there are 2 conventions the 831C uses to automatically generate unique file names. These are a product of the run mode indicated in a setup. *Table 8.2* contains details and examples.


Table 8.2 Data File Naming Conventions


Run Mode	File Naming Convention	Example	Additional Information
Manual Stop	“Default Data File”.NNN	831_Data.001	The “Default Data File” can be changed on the General setup page. NNN represents single digits that increment sequentially from 001–999, then reset to 001 to create a unique filename.
Continuous: Up to 48 daily auto-stores per day (choose a storage period: once per 24 hr to once per 30 mins)	YYMMDDXX.LD0	18031401.LD0	The filename is 12 characters and includes the year, month, and day followed by 2 digits. The values of XX increment from 00–99 to create a unique filename.
Continuous: Stores Every 15 mins or 10 mins	YYMMDDXX.LD0	1610110A.LD0	The filename includes the year, month, and day followed by a hexadecimal number that increments from 00–FF to create a unique filename.
Continuous: Stores every 5 mins, 3 mins, or 2 mins	YYMMDDXXX.LD0	181205AA6.LD0	Filename is 13 characters: the year, month, and day followed by 3 alphanumeric values that increment from 000–FFF to create a unique filename.

LEARN MORE For more information on continuous auto store, see section 6.2.3 [Using Continuous Mode](#).

8.3.2 Moving or Copying Data Files to a USB Drive

Complete this section to move or copy a data file from internal memory to a USB drive.

Step 1. Insert a USB drive in the 831C. Wait for the **USB icon**  to appear in the meter Status bar. (About 10 seconds.)

If the Data Storage setting is set to “USB,” but no USB drive is inserted, the **USB not available icon**  appears. Files save to the internal memory until you insert a USB drive.


Step 2. Select **Tools**  → **Data File Manager**.

Step 3. Highlight the desired data file, and press **Menu** (○ ○ ●).

Step 4. Select one of the following actions from the pop-up menu:

- **Copy File to USB**
The data file will be copied onto the USB drive. The original file will remain saved on the 831C.
- **Move File to USB**
The original data file moves from the internal memory to the USB drive.
- **Copy All Internal to USB**
Copies of all data files on the 831C are saved to the USB drive. The original data files remain saved in internal memory.
- **Move All Internal to USB**
All original data files move from the internal memory to the USB drive. The internal memory is blank.

Step 5. Examine the Data File Manager to confirm the desired action.

TAKE NOTE If the USB drive is removed during a measurement, the USB not available icon appears. When this occurs, the measurement ends, and data with that measurement is not visible on the meter. When the USB drive is reinserted, the **USB caution icon**  appears. The meter notifies you that there is unsaved data and prompts you to Save or Delete the measurement data. You cannot continue with the same measurement.

Module 9 Setting System Properties

This module is a reference for all SoundAdvisor™ 831C system properties.

In this module:

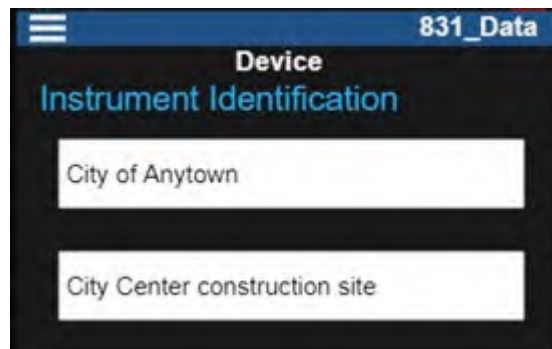
9.1	Setting Instrument Identification	-82
9.2	Updating Meter Time	-83
9.3	Editing Power Settings	-84
9.4	Setting Meter Preferences	-88
9.5	Setting Localization Options	-91
9.6	Setting Active/Hidden Pages On the Displays Tab	-92
9.7	Enabling or Disabling Options	-93
9.8	Setting Network Preferences	-93
9.9	Configuring an Email Server On the Meter	-94
9.10	Enabling or Disabling Remote (Cloud) Storage	-95
9.11	Utilizing the Logic In or Logic Out Feature	-96
9.12	Choosing Preamp Heater Options	-98
9.13	Setting Reference Spectra	-99
9.14	Generating an App Password	-99

9.1 Setting Instrument Identification

Step 1. On your 831C, select **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until the **Device** page displays.

Enter 30 characters per field of identifying information. The instrument identification displays on the **Tools**  → **About** page and in alert notifications.



9.2 Updating Meter Time

The 831C provides a variety of options for updating/syncing meter time, especially when connected in G4 LD Utility.



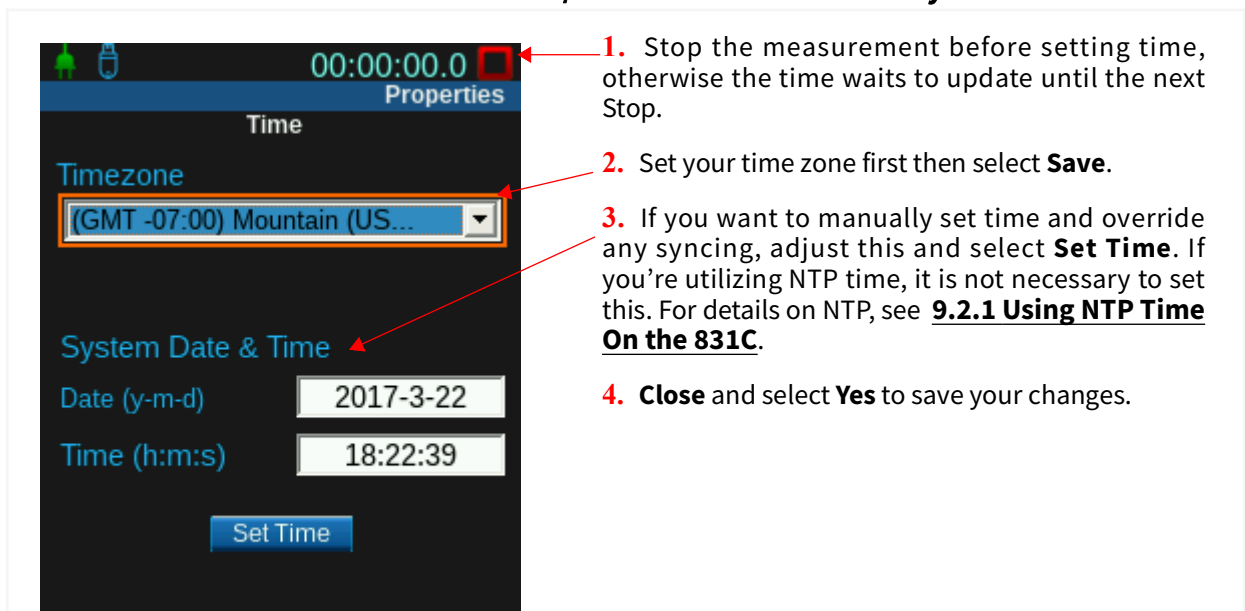
- Step 1.** On your 831C, select **Tools**  → **System Properties**.
- Step 2.** Press the **right softkey** () until the **Time** page displays.
- Step 3.** Select the **Time Zone** for the meter.
- Step 4.** Select one of the following time sync methods:
 - NTP Time Sync for 831C, as shown in [9.2.1 Using NTP Time On the 831C](#)
 - G4 Time Sync On Meter Connect, as shown in
 - G4 Scheduled Time Sync, as shown in

FIGURE 9-1 Set Date/Time & Timezone Manually

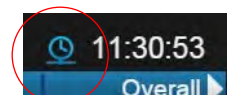


TAKE NOTE You can also sync the 831C with the time on your PC by utilizing G4 LD Utility. For more information on this process, open G4 and click **Help** → **Manuals** → **G4 LD Utility**.

9.2.1 Using NTP Time On the 831C

NTP (Network Time Protocol) is a clock synchronization Internet protocol intended to synchronize all participating computers to within a few milliseconds of Coordinated Universal Time (UTC).

When the 831C successfully syncs with NTP servers, the NTP icon appears in-line with the current time on the Live and Overall tabs. When the meter is synced with NTP time and the Internet connection is subsequently lost, the 831C attempts to reconnect to NTP servers for up to 2.5 hours. During this time the **NTP icon** persists. If NTP servers cannot be reached after that time, the 831C stops trying to reconnect and the NTP icon is removed.




TAKE NOTE This time sync method supersedes others. When the 831C is set to NTP time, no other time sync methods are available. G4 LD Utility will not time sync with the meter at the time of first connection and the meter will not sync with G4 at the scheduled time.

Before you begin:

- Set the correct Time Zone on your meter (**Menu** → **System Properties** → **Time**)
- Verify an active Internet connection via Ethernet, wireless modem, or WiFi, or connect a GPS antenna to the meter

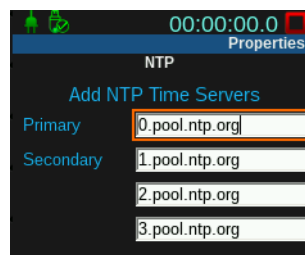
Step 1. On the meter, select **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until the **NTP tab** displays.

Step 3. Enter a **Primary** and **Secondary** NTP Time Server address as shown in *Figure 9-2*.

For details and server addresses, see the **NIST Physical Laboratory Time Frequency Services** website (<https://tf.nist.gov/tf-cgi/servers.cgi>).

FIGURE 9-2 Entering NTP Server Addresses



9.3 Editing Power Settings

In this section:

- **9.3.1 Changing Batteries and Editing the Battery Type**
- **9.3.2 Setting the Meter Auto-Off Period**
- **9.3.3 Using Analog Power-Save Mode**
- **9.3.4 Setting the Backlights On Period**
- **9.3.5 Enabling or Disabling the Keypad Backlight**
- **9.3.6 Setting the External Shutoff Voltage**

FIGURE 9-3 Power tab

Set your **Battery Type** and **Charge** preference each time you change batteries to prevent damage or fire.



9.3.1 Changing Batteries and Editing the Battery Type


The 831C can be powered by alkaline, 1.5V lithium, or nickel-metal hydride (NiMH) batteries.

CAUTION Do not mix alkaline and NiMH batteries.

CAUTION Do not mix batteries from different manufacturers.

CAUTION Do not replace only 1, 2, or 3 batteries. Replace all 4 batteries when installing fresh cells.

CAUTION Do not change the batteries without also setting the Battery Type (as shown in this section). To prevent serious damage, injury, or fire, edit the **Battery Type** setting each time you install a different type of battery. When the battery type is set to NiMH, the internal charger is enabled. This can result in fire or injury with alkaline or lithium batteries.

- Step 1.** On your 831C, select **Tools**  → **System Properties**.
- Step 2.** Press the **right softkey** (○ ○ ●) until the **Power** tab displays.
- Step 3.** Select the **Battery Type**. When changing batteries, the **Battery Type** must match the type of batteries you're installing.
- Step 4.** Install 4 new batteries. For details, see [2.2.1 "Using Battery Power" on page 9](#).
- Step 5.** If you've installed NiMH batteries and want to charge them in the meter, enable the Charging feature.


Enabling Charging for NiMH Batteries


- a. From the **Charge** drop-down, select **On**.
- b. Use the included USB cable to connect to a wall outlet. For best results, turn the meter off while charging.

LEARN MORE For more information, see [2.2.1 "Using Battery Power" on page 9](#).

9.3.2 Setting the Meter Auto-Off Period


The Auto-Off property determines the period after which the instrument powers off when not in use.


- Step 1.** On your 831C, select **Tools**  → **System Properties**.
- Step 2.** Press the **right softkey** (○ ○ ●) until the **Power** tab displays.
Any of the following actions keep the meter on and restart the Auto-Off period:
 - Button press
 - Running a measurement
 - USB communication
 - Remote communication

Pressing the **Power button**  returns the instrument and the display to the state it was in when the Auto-Off time expired.

9.3.3 Using Analog Power-Save Mode

Step 1. On your 831C, select **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until the **Power** tab displays.


Power-Save mode is indicated by the **sleep icon** . When the meter is not running, this mode can significantly conserve battery power, since it shuts down the meter's analog circuitry and signal processing activities.

Step 3. From the **Power-Save** drop-down menu, select the period the instrument should stay powered after a measurement has stopped.

The analog circuitry, including power to the preamplifier, shuts down when the instrument is stopped for the period you chose. Performing a calibration, a reset, or starting a measurement restores power. The meter can run the measurement after a short 10 second power-up.



9.3.4 Setting the Backlights On Period

Step 1. On your 831C, select **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until the **Power** tab displays.

Step 3. Select an option for **Backlights On**. This is the duration the 831C display is back lit after the last key press. Selecting **Always** slightly increases power consumption.

9.3.5 Enabling or Disabling the Keypad Backlight

Step 1. On your 831C, select **Tools**  → **System Properties**, then press the **top-right softkey** () until the **Power** tab displays.

Step 2. Select an option for the **Keypad Backlight**.


The blue LEDs under the keypad can be enabled or disabled according to your preference. The Red LED behind the STOP/STORE button, and the green LEDs under the RUN/PAUSE and ON/OFF buttons are always enabled.

TAKE NOTE Increasing the back light brightness significantly increases the meter's power consumption, which decreases battery life.

Step 3. If desired, select the LCD screen back light intensity as a percentage.

When battery life is below 10%, the 831C overrides this setting and downgrades the LCD Brightness to 50%. If the user-defined setting is below 50% brightness, it remains the same.

9.3.6 Setting the External Shutoff Voltage

Step 1. On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** (○ ○ ●) until the **Power** tab displays.

Step 2. If desired, customize the **External Shutoff Voltage**. When the voltage of an external battery drops below this value, the 831C shuts off to prevent damage to the external batteries.

LEARN MORE The default voltage is 10.8 volts. To customize this setting, enter a value between 10–25 volts if your battery usage is other than a standard 12V SLA battery. For more information, see [Table A-6 on page A-8](#).


9.4 Setting Meter Preferences

In this section:

- [9.4.1 Selecting a Microphone Correction](#)
- [9.4.2 Automatically Deleting Older Files](#)
- [9.4.3 Enabling or Disabling AC Output](#)
- [9.4.4 Enabling the Reset Prompt](#)
- [9.3.5 Enabling or Disabling the Keypad Backlight](#)
- [9.4.6 Enabling GPS Mode](#)
- [9.4.7 Customizing the Display Color Theme](#)

9.4.1 Selecting a Microphone Correction

The 831C can automatically apply corrections to a measurement to account for an environmental shroud or a specific microphone as shown in this section.

Step 1. On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** (○ ○ ●) until the **Preferences** tab displays.

Step 2. Select a option from the **Mic Correction** drop-down menu. Use Table 9.1 as a reference.

Table 9.1 Microphone Correction Options

Option	Current Microphone	Simulates
WS001 ^a (Default)	Any Microphone	Windscreen response without presence of physical windscreen
Off	No Correction	
RI:FF	Random Incidence	Free-Field
FF:RI	Free-Field	Random Incidence
FF:RI 2016/8	Free-Field with EPS2106	Random Incidence
FF:FF 2016/8	Free-Field with EPS2106	Free-Field
FF:90 2016/8	Free-Field with EPS2106	90-degree measurement
FF:RI 2116	Free-Field with EPS2116	Random Incidence
FF:FF 2116	Free-Field with EPS2116	Free-Field
FF:90 2116	Free-Field with EPS2116	90-degree measurement
P:RI 377A15	1" Pressure	1" Random Incidence

a. When the "WS001" microphone correction is active, the 831C meets Class 1 sound level meter requirements with or without a windscreen on the microphone.

9.4.2 Automatically Deleting Older Files




When selected, the 831C assesses the age of all files stored on the meter once every 24 hours and deletes files older than the value you specify in days. The maximum value is "730" days. Select "0" from the drop-down menu to disable this feature.

9.4.3 Enabling or Disabling AC Output


The **AC/DC Output** does not drive a headset or headphones. It is a full dynamic range AC/DC power output that can be turned **On** or **Off**. The AC continually receives samples from the ADC. It has output while the ADC is on and stops during power-save. The DC level is your configured L_{wT} level while running.




FIGURE 9-4 831C AC/DC Output



- Step 1.** On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Preferences** tab displays.
- Step 2.** Select an option from the **AC Output** drop-down menu, then press **Close** () to save your changes.




9.4.4 Enabling the Reset Prompt

Whenever you make a measurement that you don't want to keep, you can press the  **Reset** button to clear the unsaved data. When you enable **Reset Prompting**, the meter requires you to confirm your choice before clearing the data. We recommend enabling this feature.

- Step 1.** On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Preferences** tab displays.
- Step 2.** Choose the checkbox in-line with **Reset Prompting**, then press **Close** () to save your changes.

9.4.5 Setting the Data Storage Location



Use this feature to indicate where your data files are stored.

- Step 1.** On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Preferences** tab displays.
- Step 2.** Choose an option from the **Data Storage** drop-down menu, then press **Close** () to save your changes.



LEARN MORE See **8.3 "Saving, Moving, or Copying Data Files" on page 80.**

TRY THIS When using G4, you can also save data files to a remote (cloud) storage account. For more information, in G4 go to **Help** → **Manuals** → **G4 LD Utility Manual**.

9.4.6 Enabling GPS Mode

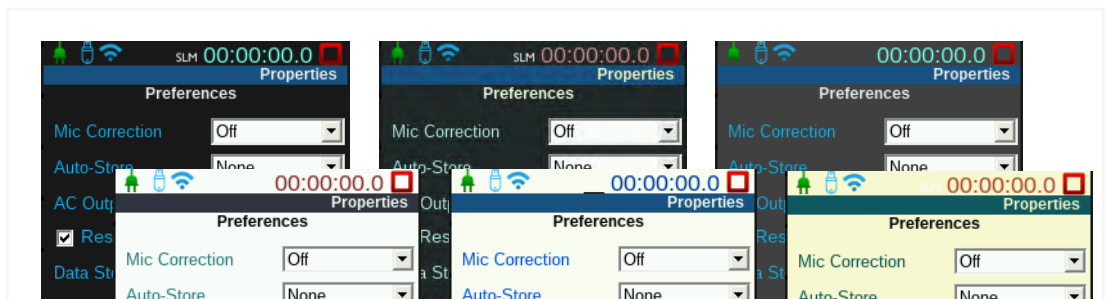
- Step 1.** On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Preferences** tab displays.
- Step 2.** If you want to attach a GPS device through the Aux port, select **On** from the **GPS Mode** drop-down menu.

9.4.7 Customizing the Display Color Theme



- Step 1.** On your 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Preferences** tab displays.
- Step 2.** Choose an option for the **Color Display**.

The 831C LCD screen has 6 color theme options: 3 light and 3 dark. We recommend the light screens when you're operating the meter in sunlight or outdoor settings. We recommend the dark themes for indoor or low-light use.

FIGURE 9-5 Available 831C Color Themes



9.5 Setting Localization Options

To access the following settings on the meter, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Locale** tab displays.

Selecting a Language

The 831C has a built in language translation feature, which allows you to view the meter display in the following languages: English, French, German, Italian, Portuguese (PT & BR), Norwegian, Spanish, Swedish, Czech, Turkish, Chinese, and Thai.

Selecting a Decimal Symbol

Depending on your preference, select a period or a comma for the decimal place, and save your change.

Selecting a Date Format

Select one of the 2 available date formats: **dd-mm-yyyy** and **yyyy-mm-dd**, then **Save** your change. For example: 2020-02-14.

Setting a Unit of Measurement

The default unit of measurement for the 831C is **SI** (International System of Units). However you can also select **English** units. Make your selection and **Save** the change.

9.6 Setting Active/Hidden Pages On the Displays Tab

To access these settings on the meter, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Displays** tab appears.

Customizing the Start Display

The **Start** option allows you to choose the display that you see when you boot up the 831C.

- Select your option from the **Start** drop-down. Your new start display appears on the next power up.

Customizing Tab & Page Display

Step 1. Select an option from the **Tabs** drop-down menu, then select the checkbox inline with the **Pages** list that you want to display on your meter (see *Figure 9-6*). Pages not selected are hidden, not deleted.


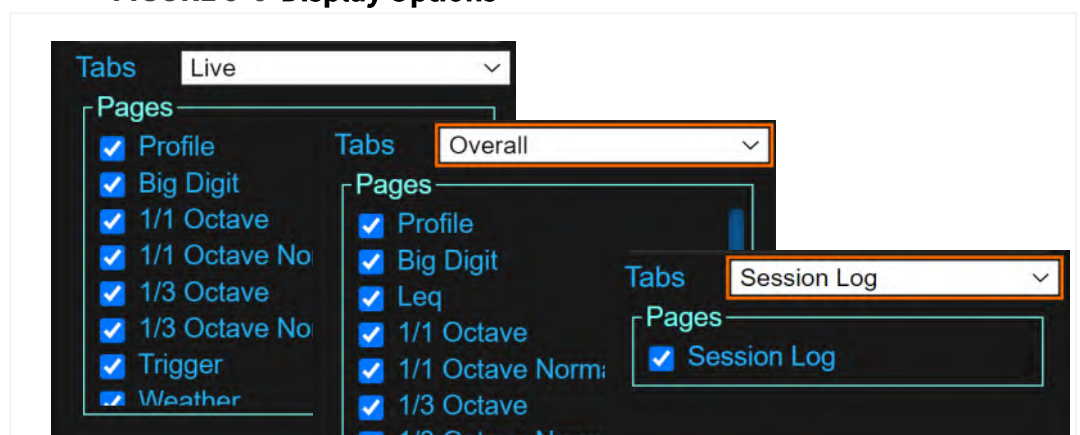
Step 2. Press **Close** () to save your changes.

FIGURE 9-6 Display Options




9.7 Enabling or Disabling Options

This section shows how to enable or disable any firmware option purchased from Larson Davis. Default options don't appear in the list since they cannot be disabled.

Table 9.2 Firmware options available on the System Properties Options tab:

1/1 Octave OBA	1/3 Octave OBA	Sound Recorder
Event History	Measurement History	Time History
Weather/ Meteorological Data	Fast Time History	Measurement History with Sound Recording
FFT	File Averaging	Sierra Wireless Cellular Communication
Fast Weather	QC Tonality	Agency Approval (LNE, PTB, METTAS, etc)
Scheduling	Room Acoustics-RT60	Audiometer Calibration-AudCal
NF30 Ln	Touch Screen	

Step 1. On your SoundAdvisor 831C, go to **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until you see the **Options** page.

Step 3. Select the checkbox in-line with the options you want available in the 831C interface.

TAKE NOTE Disabling an option in this section hides the installed option from the interface. You can select to enable it again at anytime.

Step 4. Reboot the meter to save the changes.



9.8 Setting Network Preferences

See **Module 13 831C Network and Connections**.


9.9 Configuring an Email Server On the Meter

Complete this section to designate an email server on the meter to access all user account features when using G4 LD Utility or LD Atlas. While this process can be completed from the meter interface as described in this section, it is most easily be accomplished in G4 LD Utility software.

Before you begin:

- We recommend that you use 2-Step Verification when using Google® G-mail™. If you use G-mail, complete section **9.14 Generating an App Password** before proceeding.
- If your meter is configured with a static IP address, you will need to enter the fixed network addresses you previously defined during this process. For help with this, see **13.2.1 Setting a Static IP Address**.
- If you're planning to use network security, create an email account on an email server that supports HTTPS and encryption protocol. For more information, see your email provider's documentation.

Step 1. On the 831C, select **Tools**  → **System Properties**.

Step 2. Press the **right softkey** () until the **Email** page displays.

Step 3. Enter a **Hostname** for your mail server, and a **Username** and **Password** for your mail account as shown in *Figure 9-7*.

Step 4. Select the **Security** level for the account. Check your email provider's documentation if you need help with this.

FIGURE 9-7 Email Account Properties

TLS Trusted CA (preferred)

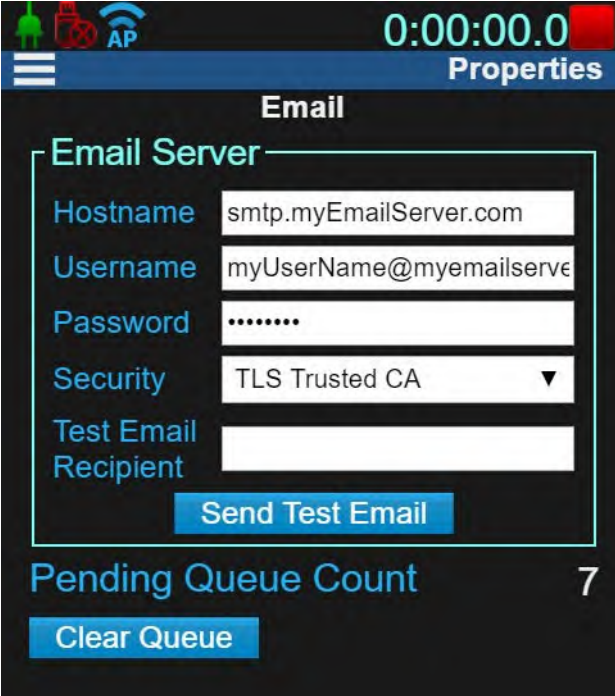
The 831C matches responding server with a provided certificate to verify that the responding server is known. If the responding server can't be verified, the email will not send. Most email providers (such as Gmail) use this type of security.

TLS On

Certain configurations use their own method for validating that an email server is the correct server—such as the US military. Use this setting when instructed by your IT department.

TLS Off

This is option uses only a login name and password to access an email server. This method is not secure, and we don't recommend it.



The screenshot shows the 'Email Properties' screen on the 831C meter. The top status bar displays '0:00:00.0' and 'Properties'. The main title is 'Email'. Below it, the 'Email Server' section contains the following fields: 'Hostname' with the value 'smtp.myEmailServer.com', 'Username' with 'myUserName@myemailserve', 'Password' with masked characters '.....', 'Security' set to 'TLS Trusted CA' with a dropdown arrow, and 'Test Email Recipient' which is empty. A blue 'Send Test Email' button is located below the 'Test Email Recipient' field. At the bottom of the screen, there is a 'Pending Queue Count' of '7' and a blue 'Clear Queue' button.

Step 5. Click **Send a Test Email**.

If you don't receive a notification within a few minutes of initiating a test, check to see if your meter is connected to the Internet. Also, make sure a proxy is not filtering your email.

For additional questions or troubleshooting, contact your local IT support.

Step 6. Click **Close** (○●○) to save your settings and exit the menu.

9.9.1 Enabling Alert Notifications

In 831C firmware version 4.5+, this workflow is only available by using G4 LD Utility software. Email and text alert notifications are now configured as part of the user account in G4.

Additionally, with the optional Scheduling firmware (831C-SCH), users can schedule periods when they want to receive alert notifications.

LEARN MORE For details on this process, in G4, go to **Help** → **Manuals** → *G4 LD Utility*, Module 6 G4 Features for 831C.

9.10 Enabling or Disabling Remote (Cloud) Storage

When a measurement data file is automatically or manually saved, you can save it on the meter, to a USB drive, or upload directly to a remote storage service such as Dropbox¹ or an SFTP account. You can also choose to receive an alert notification via email or text when a file is saved to cloud storage.

Saving to remote (cloud) storage requires you to first configure the remote storage details with your storage provider, complete the initial setup by using the G4 Setup Manager, then enable the storage method in G4. This section demonstrates the third and last step.



TAKE NOTE When cloud storage is enabled, data files continue to be stored remotely until you disable it, as shown in this section.

Before you begin:

- Prepare a remote storage account with your storage provider
- Complete the initial remote storage setup for your meter in G4, as shown in G4 LD Utility Manual, 6.2.1 Configuring Remote Storage.

LEARN MORE To complete this process, in G4 go to **Help** → **Manuals** → **G4 LD Utility Manual** → 6.2.1 Setting Up Cloud Storage.

1. Dropbox is a registered trademark of Dropbox, Inc. in the US and other countries.

Step 1. To enable or disable cloud storage on the 831C, select **Tools**  → **System Properties**, then press the **right softkey** () until the **Cloud Storage** page displays.


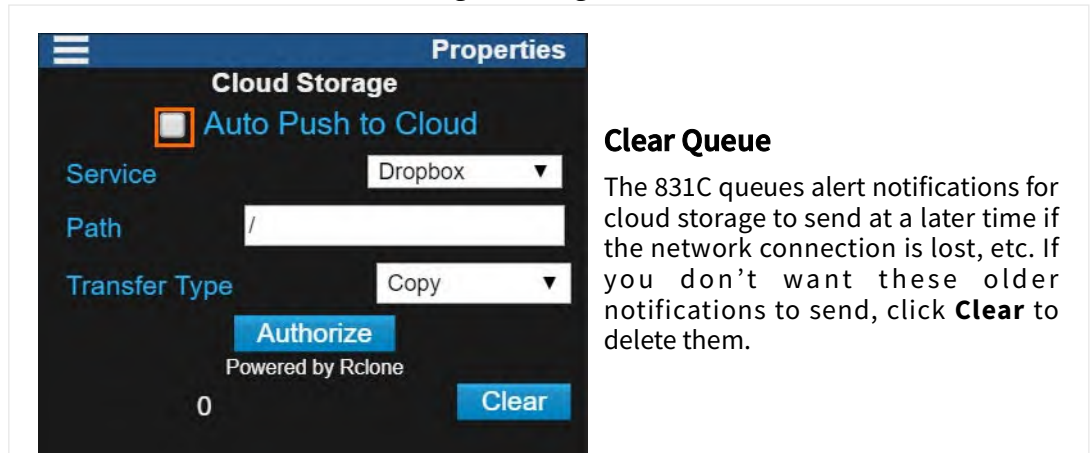
Step 2. Select the checkbox in-line with **Auto Push to Cloud** as shown in *Figure 9-8*, then press **Close** () to save your changes.

FIGURE 9-8 Cloud Storage Settings on 831C



9.11 Utilizing the Logic In or Logic Out Feature

The 831C can receive input from an external device using the Logic In or Logic Out feature, which may initiate a variety of actions.



In this section:

- [9.11.1 Utilizing the Logic In Feature](#)
- [9.11.2 Utilizing the Logic Out Feature](#)

9.11.1 Utilizing the Logic In Feature

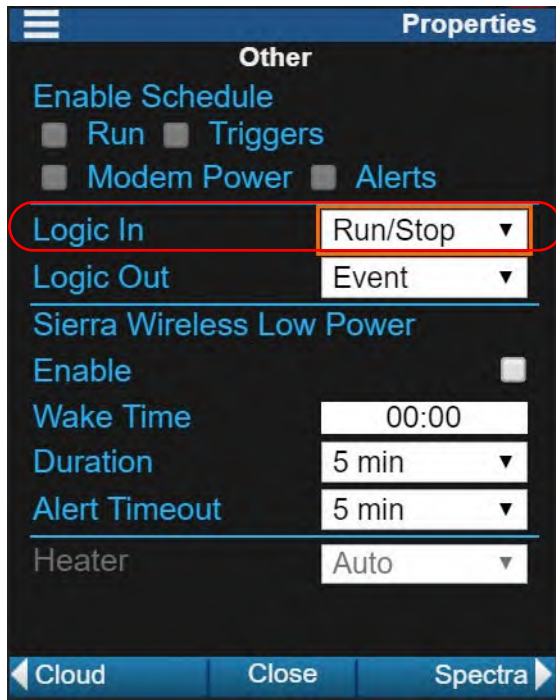
The Logic Input line receives a signal from an external device, which is usually connected using the included I/O Interface cable (CBL170).

LEARN MORE For pinout information, see [Table A-4 on page A-6](#).

Step 1. To select properties for this feature on the meter, select **Tools**  → **System Properties**, then press the **left softkey** () until the **Other** page displays.

Step 2. Select a signal trigger from the **Logic In** drop-down menu as shown in *Figure 9-9*.

FIGURE 9-9 System Properties: Other tab



A device connected to the 831C using the I/O Interface cable (via Logic In) can be activated by the following external triggers:

Run/Stop State

A measurement run or stop can be initiated when the Time History (831C-ELA) option is installed and enabled on your meter.

Marker

With the Time History (831C-LOG) option installed and enabled for that measurement, Marker #1 will be initiated for the Recording Time indicated in the Setup, even if there is no sound recording. If sound recording is enabled for Marker #1, a sound recording also occurs at this time.

Step 3. Press **Close** (○●○) to save your changes, then reboot the meter.

9.11.2 Utilizing the Logic Out Feature

The Logic Out line, when triggered, transmits a signal to an external device, which is usually connected to your 831C via the included I/O Interface cable (CBL170). Some common applications for this feature include, connecting a printer or a cellular modem to the 831C.

Step 1. To select properties for this feature on the meter, press **Tools** (🔧) → **System Properties**, then press the **top-left softkey** (●○) until the **Other** page displays.

Step 2. Select a signal trigger from the Logic Out drop-down menu. The Logic Out signal is triggered by the following items:

Run/Stop

When the Logic Out is set to **Run/Stop**, the output is driven high when the 831C is running and is driven low when it is stopped.

Event

When Logic Out is set to **Event**, the output is activated with an event trigger. To utilize this state, you must purchase, install, and enable the Time History firmware option (831C-ELA) on your meter.

LEARN MORE To learn more about the Time History option, see **Module 16 "Using Time History" on page 122.**

Marker

When Logic Out is set to **Marker**, a marker for sound recording is initiated, the output is activated for the Recording Time as indicated in the setup. To utilize this state you must purchase, install, and enable the Sound Recording firmware option (831C-SR) on your meter.

LEARN MORE To learn more about the Sound Recording option, see [Module 20 "Utilizing 831C Sound Recording" on page 177.](#)

Modem

When Logic Out is set to **Modem**, a connected modem (such as a Sierra Wireless™ RV50X cellular modem), becomes active. This connection is particularly used in conjunction with the Larson Davis NMS044/045 system. The Sierra Wireless Low Power section of this page is also connected to this setting. For more information, access the [NMS044 System Reference Manual](#) from LarsonDavis.com.

9.12 Choosing Preamp Heater Options

If a heater is detected as part of your chosen preamp, select your preference for the heater control.


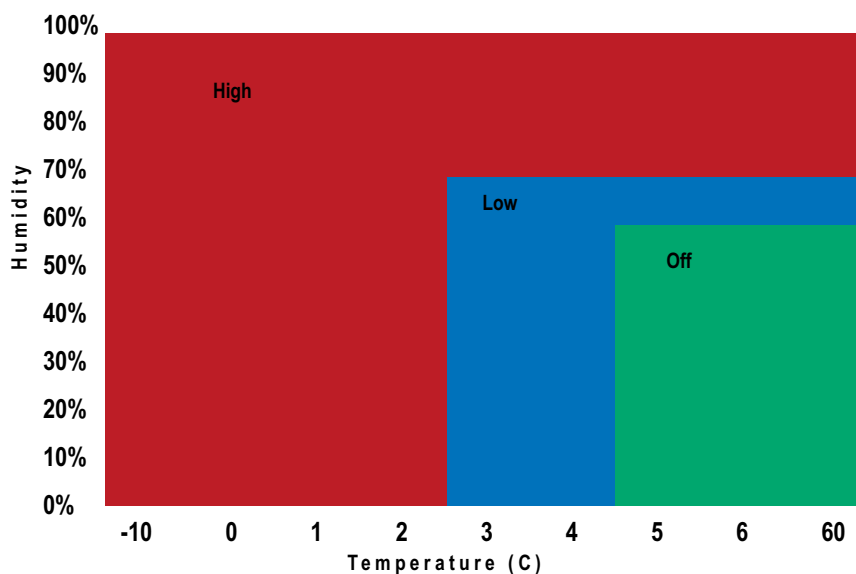
- Step 1.** On the meter, press **Tools**  → **System Properties**, then press the **left softkey** (●○○) until the **Other** page displays.
- Step 2.** Choose a setting from the **Heater** drop-down menu.
- **Enabled:** The heater automatically turns on or off according to the humidity and ambient temperature as shown in *Figure 9-10*. We recommend using this setting.

FIGURE 9-10 Recommended Heater Settings
Heater Control





- **Timer:** Turns the heater on and off automatically according to the **Start Time** (24-hr time) and **End Time** (24-hr time) you set here.
- **Off:** The heater remains off.

9.13 Setting Reference Spectra

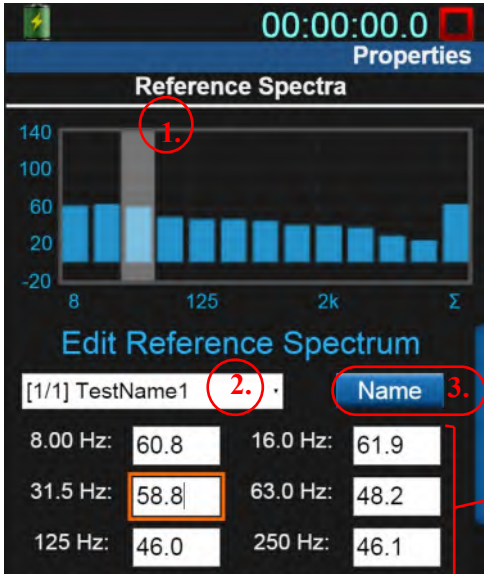
This feature applies to SoundAdvisor™ 831C meters with the Octave Band Analysis firmware option (831C-OB1) purchased, and installed.

When you apply octave band data, you have the option to choose a negative or positive A, or C weighting, or you can define up to 4 unique reference spectra as shown in the following process.

Step 1. On the meter, press **Tools**  → **System Properties**, then press the **left softkey** () until the **Reference Spectra** page displays.

Step 2. Use any of the methods in *Figure 9-11* to define reference spectra values.

FIGURE 9-11 Setting Reference Spectra Values




1. Use any of the meter navigation buttons to highlight a band. Press 5 to use the keyboard to define a spectrum value for that octave.

2. Use this drop-down to select which octave band spectra values you want to display in the space below.

3. Select **Name** to rename any of the user-defined reference spectra shown in the drop-down menu.

4. This space displays the 12 octaves that can be defined for 1/1 Octave, and 36 octaves that can be defined for 1/3 Octave. As you use the navigation buttons to move through the list, the page scrolls down.

Edit Reference Spectrum	
[1/1] TestName1	Name
8.00 Hz: 60.8	16.0 Hz: 61.9
31.5 Hz: 58.8	63.0 Hz: 48.2
125 Hz: 46.0	250 Hz: 46.1

Step 3. When finished editing, press **Close** () to save your changes.

TRY THIS If desired, you can view these reference values on the following meter displays:

- Live view. See [About the Normalized Octave Band Page](#)
- Overall view. See [About the Normalized Octave Band Page \(Overall Page\)](#)
- Overall OBA page. See [About the Octave Band Analyzer Page \(Overall Page\)](#).

9.14 Generating an App Password

Once you set up the App Password, you will not need to log in each time you want to connect to your mail account. An app password is a 16-digit pass code that gives a non-Google app or device permission to access your Google account.

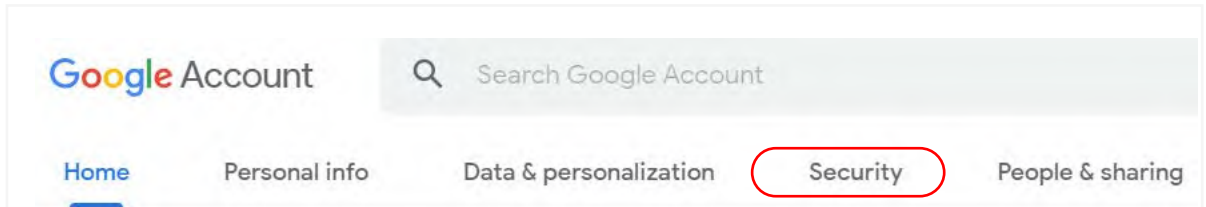
Before you begin:

- Set up 2-Step Verification on your account.

Step 1. Log in to your Google account. You can also access your Google Account by logging in to your Gmail account.

Step 2. On the top navigation panel, choose **Security**.

FIGURE 9-12



Step 3. On the “Signing in to Google” panel, choose **App Passwords**. If you don’t see this option:

- 2-Step Verification is not set up on your account
- 2-Step Verification is set up for security keys only
- Your account receives verification through work, school, or another organization and can’t use this feature
- You’ve turned on **Advanced Protection** for your account

Step 4. At the bottom, choose **Select app** and choose the app you’re using.

Step 5. Choose **Select device**, choose **Other** and give your device a name.

Step 6. Choose **Generate**.

Step 7. Enter the app **Password** on the **System Properties** → **Email** tab. The password is the 16-character code in the yellow bar on your device.

TAKE NOTE Most of the time you’ll only enter the app password once per app or device, so you don’t need to memorize it.

Step 8. If desired, select **Generate a Test Email**.

Module 10 System Information

System information is contained on the About Menu.


On the 831C, select **Tools**  → **About** to view the following details on 3 tabs:

FIGURE 10-1 About, Standards, Options Tabs



Module **11** Managing 831C Security

The SoundAdvisor 831C provides a meter lock and network security options to prevent the unauthorized use of an instrument or tampering with measurement data when operating remotely.

In this module:

11.1	Using the Meter Lock	101
11.1.1	Locking the Meter	
11.1.2	Unlocking the Meter from the Meter Interface	
11.1.3	Unlocking the 831C in G4 LD Utility	
11.2	Using Network Security	103

11.1 Using the Meter Lock

If you are concerned about preventing tampering or unauthorized use of the meter, complete the process in this section to lock the meter display and buttons.

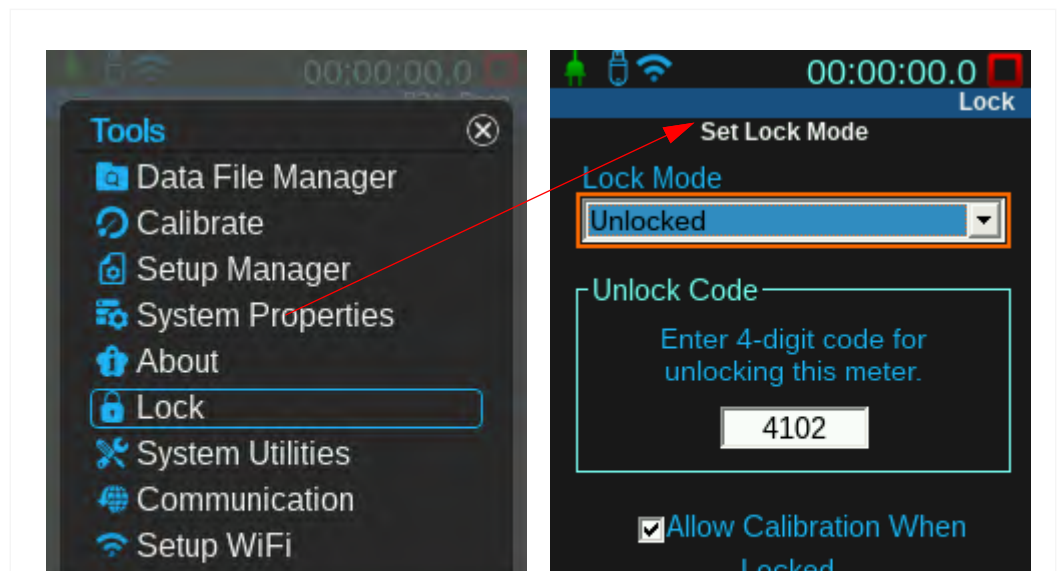
In this section:

- **11.1.1 Locking the Meter**
- **11.1.2 Unlocking the Meter from the Meter Interface**
- **11.1.3 Unlocking the 831C in G4 LD Utility**

11.1.1 Locking the Meter

Step 1. On the 831C, select **Tools**  → **Lock**. This opens the Set Lock Mode screen.

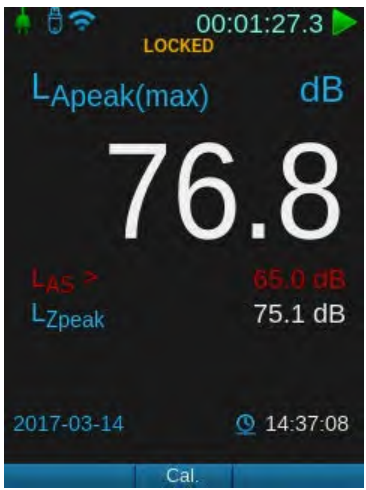
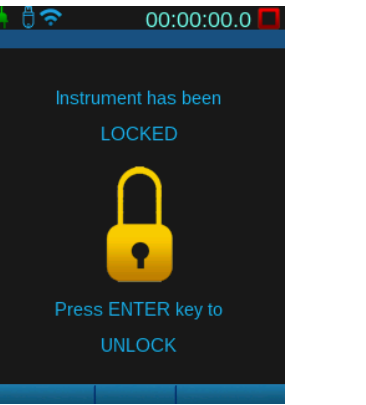
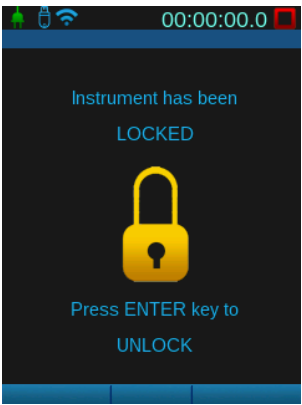
FIGURE 11-1 Tools Menu




Step 2. Choose an option from the **Lock Mode** drop-down menu.

In each lock mode option, the meter displays differently, and certain meter operations are restricted. Refer to *Table 11.1* to understand which lock mode fits your measurement study needs.

Table 11.1 Allowed Operations Per Lock Mode

Lock Mode	Available Operations	Meter Display	File Store Notes
<p>Lock with Auto Store: When the measurement is stopped, the “Measurement OK?” dialog box appears. Select Yes to save the measurement with an auto-generated file name. Select No to cause a reset without saving.</p>	<ul style="list-style-type: none"> ✓ Run ✗ Pause ✓ Stop ✓ Reset ✓ Calibration 	<p>Live View page 1 only (Big Digit Format)</p> 	<p>If your System Properties indicate an Auto-Store prompt, you are prompted to change the file name and save the file. If you select No, the measurement stops and data remains unsaved on the meter.</p>
<p>Lock with Manual Store</p>	<ul style="list-style-type: none"> ✓ Run ✗ Pause ✓ Stop ✓ Reset ✓ Calibration 		<p>If you use this mode, be sure to select an auto-store option in your current Setup. The measurement runs and stores as indicated in the Setup.</p>
<p>Fully Locked</p>	<ul style="list-style-type: none"> ✓ Run ✗ Pause ✗ Stop ✗ Reset ✓ Calibration 	<p>Lock screen only</p> 	<p>If you use this mode, be sure to select an auto-store option in your current Setup. The measurement runs and stores as indicated in the Setup.</p>

Step 3. Enter an **Unlock Code**. This code can be 1–4 digits. The first digit should not be a zero. If you set “0123” as your code, the meter will save it as “123”.

TAKE NOTE Please record your unlock code in a secure place. Your code can also be retrieved from G4 LD Utility. In G4, go to the  **Manager** page, select the **Maintenance** tab and choose **Lock/Unlock**.

Step 4. If desired, select the checkbox in-line with **Allow Calibration when Locked**.

When you select this option, you can calibrate the 831C any time a measurement is not running, even when locked.

LEARN MORE For more information on calibrating the meter while locked, see [5.4.1 Calibrating While Using Meter Security \(Lock Mode\)](#).

Step 5. Press **Close**, then choose **Yes** to save your changes.

11.1.2 Unlocking the Meter from the Meter Interface

To unlock the 831C from the meter interface, follow these steps:

Step 1. Press the **Tools**  or **Enter**  button.

Step 2. Press **Enter**  again to open the virtual keypad.


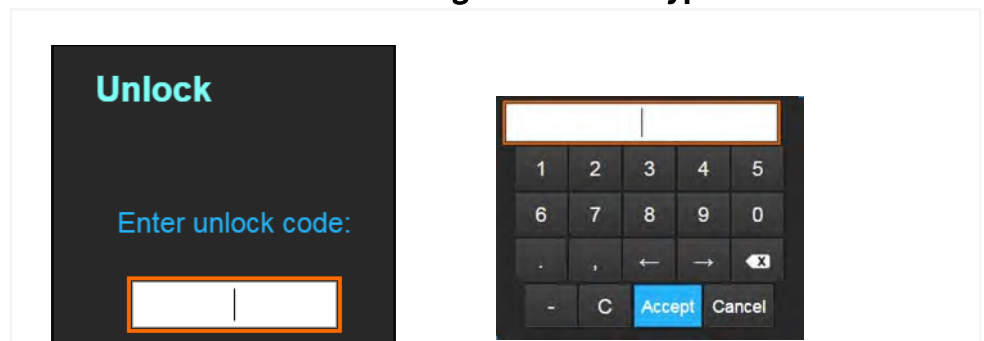
Step 3. Enter your unlock code, then press **Enter** .

FIGURE 11-2 Unlock Code Dialog and Virtual Keypad



11.1.3 Unlocking the 831C in G4 LD Utility

See the *G4 LD Utility Manual*, Module 6.1.1 Using the Meter Lock for 831C in G4.

11.2 Using Network Security

Features in this section are available only when using the 831C SLM (firmware version 4.5 +) with G4 LD Utility software (version 4.5 +).

The SoundAdvisor™ 831C network security feature is intended to protect a meter from unwanted interference or tampering when operating over a remote connection using G4, the LD Atlas app, or a browser (We recommend Google Chrome™¹).

1. Google Chrome is a trademark of Google, LLC.

Refer to the *G4 LD Utility Manual*, Module 6.2 Using Network Security for 831C for complete details. The following outline provides an overview of the process:

- Step 1.** Install or update G4 LD Utility to version 4.5 + on your PC.
- Step 2.** Connect the instrument to your PC and G4 as shown in **Section 2.1** of the *G4 LD Utility Manual*. (In G4, go to **Help** → **Manuals** → **G4 LD Utility**.)
- Step 3.** Update your meter firmware to version 4.5 + as shown in **14.2 "Upgrading 831C Firmware by Using G4 LD Utility" on page 112**.
- Step 4.** Set up an Administrator account as described in Section 2.2 of the *G4 LD Utility Manual*. Be sure to choose a security option.
- Step 5.** Reboot the meter to update to a secure (HTTPS) connection.

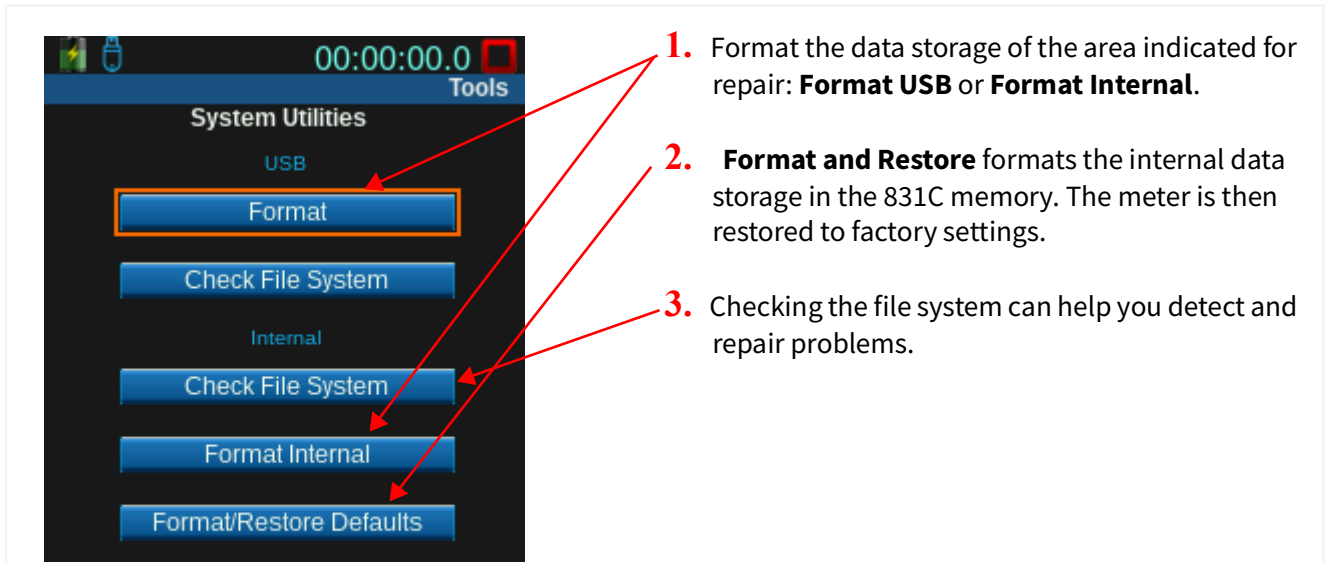
TAKE NOTE If a meter is connected to your PC using the included USB cable, you bypass the log on and authentication process and have direct access to the meter. To take advantage of 831C security, establish a network connection via WiFi, TCP, or Bluetooth.

Module 12 Using System Utilities

The System Utilities can repair or recover any file system problems. These functions are similar to what you might use to troubleshoot a hard drive.

To access these features on the 831C, select **Tools** → **System Utilities**.

FIGURE 12-1 System Utilities



CAUTION All data saved on the meter will be lost. Only the most recent calibration history record is preserved as the initial entry for the new calibration history. For AudCal users, using Format and Restore also clears the AudCal database.

TAKE NOTE If a measurement is running, stopped, or paused, a meter reset is required.

12.1 Troubleshooting a Bad Flash Block Error

The Flash memory device used by the 831C contains a controller that performs dynamic bad block mapping. In the event that a flash block fails after it's written, you may see a bad flash block error message.

If this occurs, download and save your data from the 831C to a USB drive or PC, and then select **Check File System** for either the internal or USB storage as shown in *Figure 12-1*. This feature forces the controller to re-map all bad blocks.

TAKE NOTE Data in a bad flash block is usually unrecoverable. Check these files for errors if you receive this error message.

Module **13** 831C Network and Connections

This section shows how to create physical and network connections for operating the 831C remotely, and other uses.

In this module:

13.1	Configuring 831C Network Connections	106
13.1.1	Connecting 831C to an Ethernet Port	
13.2	Setting the Meter's Network ID	107
13.2.1	Setting a Static IP Address	
13.2.2	Connecting the 831C to an Email Server	
13.3	Using WiFi On Your 831C	108
13.3.1	Connecting to a WiFi Network	
13.3.2	Using 831C as a WiFi Access Point	
13.4	Disconnecting a Cloud Storage Dropbox Account	110

13.1 Configuring 831C Network Connections

13.1.1 Connecting 831C to an Ethernet Port

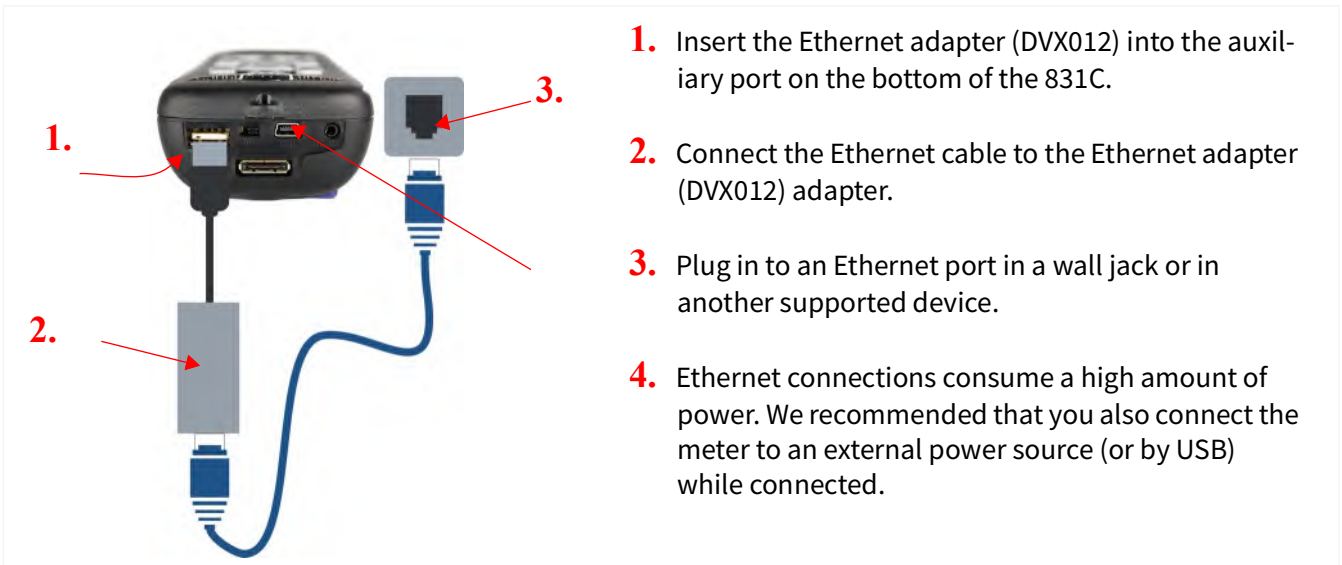
To connect the 831C to an Ethernet port, follow these steps:

Step 1. Verify that you have the following equipment:

- SoundAdvisor Model 831C SLM
- DVX012 USB to Ethernet adapter
- Ethernet cable
- A functional Ethernet network port

Step 2. Connect the assembly as shown in *Figure 13-1*.

FIGURE 13-1 831C Connected to Ethernet Port





13.2 Setting the Meter's Network ID

Access and configure your meter's networking properties—the network password, IP address, and MAC address as shown in the following sections.

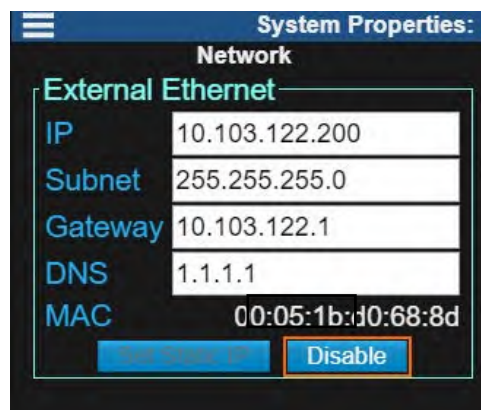
13.2.1 Setting a Static IP Address

Your meter communicates more efficiently with other devices when you set a static IP address instead of using a dynamically- assigned IP address.

Step 1. On your meter, select **Tools**  → **System Properties** →  to **Network** tab, as shown in *Figure 13-1*.

Step 2. Select **Set Static IP**.

FIGURE 13-2 System Properties→Network tab



- Step 3.** Enter your **IP**, **Subnet**, and **Gateway**, and **DNS** addresses. Coordinate with your IT professional if you need more information.
If you want the meter to return to using a unique (dynamically-assigned) IP address instead click the **Disable** button.
- Step 4.** Reboot the meter for these settings to take effect.

LEARN MORE You can also complete this process in G4. For more information, launch G4 and go to **Help**→**Manuals**→ *G4 LD Utility Manual*.

13.2.2 Connecting the 831C to an Email Server

If you entered a DNS address as directed in 13.2.1, this process is not necessary.



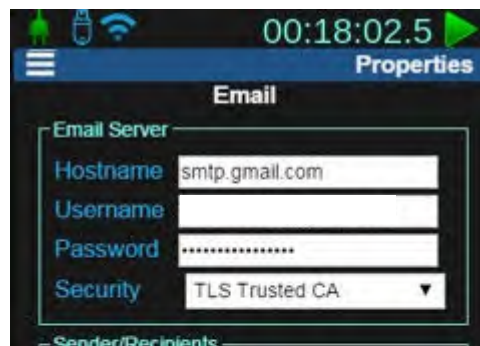
- Step 1.** Obtain the IP address of your mail server. Coordinate with your local IT professional for assistance, if needed.
- Step 2.** On your 831C, select **Tools**  → **System Properties** →  to the **Email** tab.
- Step 3.** Enter the IP address of your mail server as the **Hostname**.

FIGURE 13-3



- Step 4.** Complete all other fields on the Email tab, then click **Send Test Email**.

13.3 Using WiFi On Your 831C


In this section:

- [**13.3.1 Connecting to a WiFi Network**](#)
- [**13.3.2 Using 831C as a WiFi Access Point**](#)

13.3.1 Connecting to a WiFi Network

To connect the 831C to an existing WiFi network, complete the process in this section.

Before you begin:

- Connect the WiFi USB adapter (DVX0014) to the 831C. The WiFi status icon  appears in the top left.

Step 1. Navigate to **Tools**  → **Setup WiFi**.

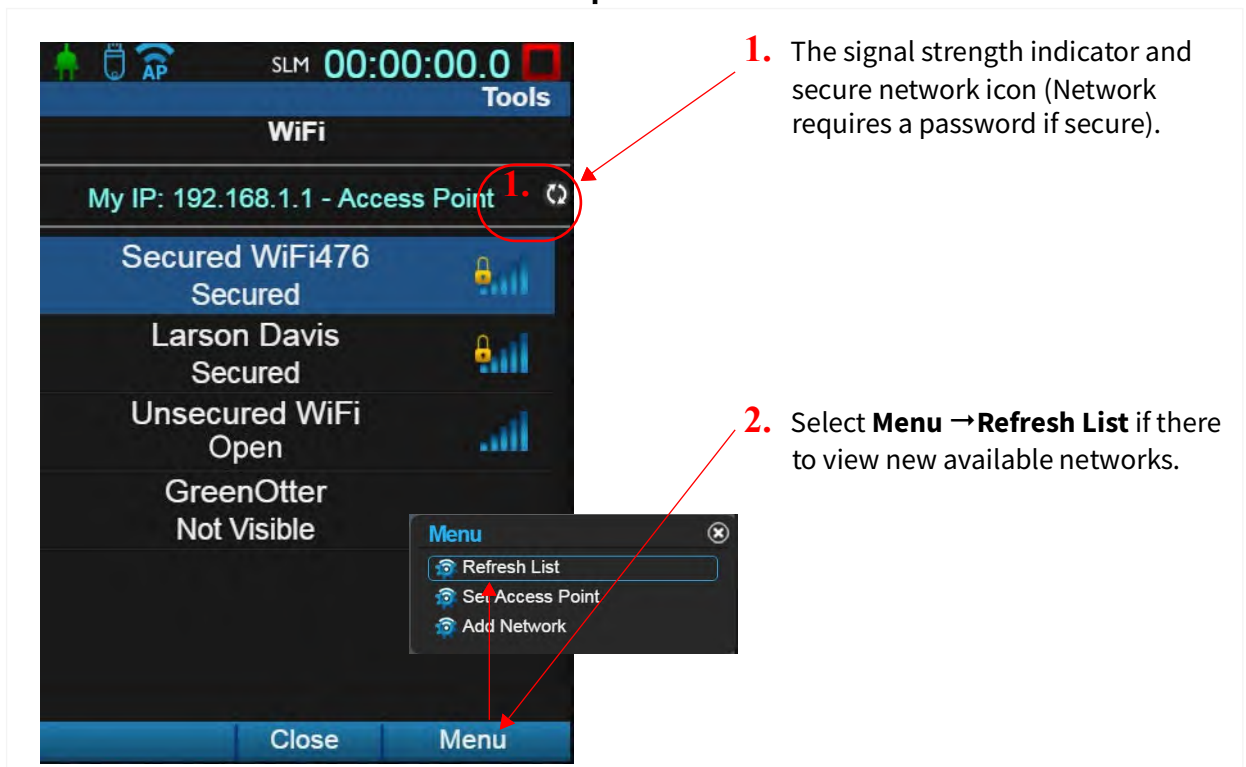
Step 2. Select an available network. If no network appears on the list, select **Menu** and select **Refresh List** as shown in *Figure 13-4*.

TRY THIS To connect to a hidden network, click **Menu** → **Add Network** and provide the network name.

Step 3. If required, enter the network password, and click **Add**.

Step 4. Verify your network connection details by clicking the newly added network in the list.


FIGURE 13-4 WiFi Setup





13.3.2 Using 831C as a WiFi Access Point

Setting the 831C as an Access Point enables the meter to broadcast a WiFi signal that other devices can connect to.

Before you begin:

- Download the LD Atlas app for mobile devices.
- Connect a WiFi USB adapter or USB hub (for multiple devices) to the 831C. The **WiFi status icon**  appears in the top left.
- Disable **Mobile Data** on the mobile device
- Enable **Bluetooth** on the mobile device, but do not select a device to connect to.

Step 1. On your 831C, select **Tools**  → **Setup WiFi**.

Step 2. Select **Menu**, then in the menu window that opens, select **Set Access Point**, and confirm your choice in the pop-up window. The **Access Point icon**  appears in the top left.

Step 3. On your mobile device, select the 831C meter as the WiFi network, and enter the password: “**wifi831c**”.

Step 4. On your mobile device, open the LD Atlas app, and select the name of your meter. This opens the 831C meter details.

LEARN MORE The LD Atlas app is available for iOS and Android devices. For more information, see [3.2.2 Operating the 831C from the LD Atlas App](#).

13.4 Disconnecting a Cloud Storage Dropbox Account

When you want to disconnect a previously configured cloud storage account, use this process to disconnect your Dropbox account permanently, or to connect G4 to a different cloud account.

Step 1. In your browser, log in to your account at Dropbox.com.

Step 2. Click on the account symbol in the top-right corner, and choose Settings.

Step 3. Select the **Connected Apps** section, as shown in *Figure 13-5*.

FIGURE 13-5 Dropbox Settings bar



Step 4. Scroll down to the G4 LD Utility line, and click to expand it.

Step 5. Scroll down again and click **Disconnect**.

Step 6. Choose **Disconnect** again to confirm your choice. Dropbox confirms the app is no longer connected to your account.

Module **14** Software, Firmware, and Options

In addition to meter operation, the G4 LD Utility (G4) is also used to install firmware and option upgrades as shown in the following processes. For a complete list of available firmware (versions) and firmware options (additional features or extended capability), see **1.5.1 "Firmware Options" on page 4.**

In this module:

14.1	Updating the G4 LD Utility Software -----	111
14.2	Upgrading 831C Firmware by Using G4 LD Utility -----	111
14.3	Upgrading Meter Firmware Options -----	112
14.4	Enabling or Disabling Firmware Options -----	113

14.1 Updating the G4 LD Utility Software

- Step 1.** Locate the G4 installer on the LD USB Drive included with your meter, or from www.LarsonDavis.com/G4.
- Step 2.** Double-click to download the G4 installer.
- Step 3.** Once the file is downloaded, unzip or extract the folder to your Desktop.
- Step 4.** Open the new folder and run **setup.exe**.
- Step 5.** Follow the on screen instructions to install the upgrade.
- Step 6.** To launch G4, use the shortcut the installer created on your Desktop, or select **G4** from the Start Menu.



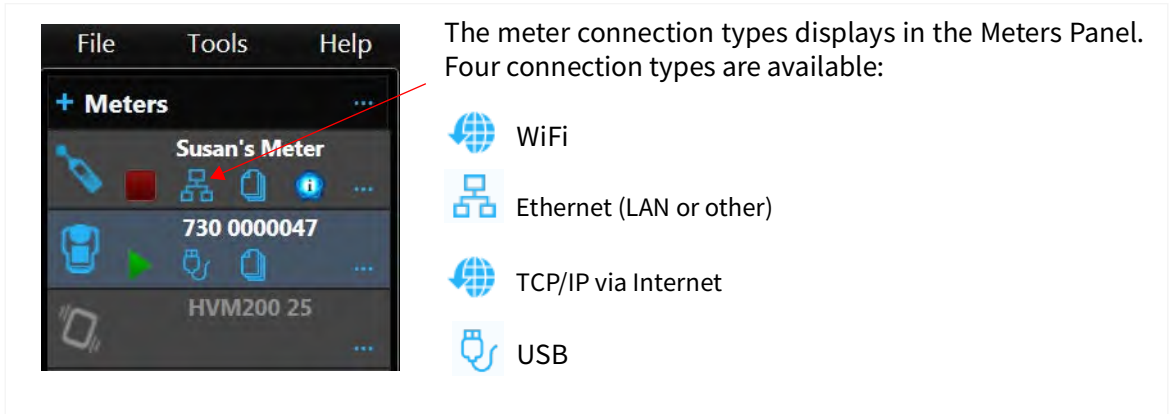
14.2 Upgrading 831C Firmware by Using G4 LD Utility

Before you begin:

- Power on your meter, and connect it to your PC via the USB cable (CBL138, part of the PSA029 power supply) or via TCP/IP. For more information about connecting your meter, see **Module 13 831C Network and Connections.**

- Step 1.** In the G4 Meters Panel, your connected meter displays in blue with one of the following connection types:

FIGURE 14-1





- Step 2.** Click the **Menu icon**  in-line with your meter, and select **Upgrade Firmware** from the pop-up menu. This opens the Upgrade Firmware or Options window.
- Step 3.** Click **Choose Firmware File**. This opens the File Explorer to the default firmware folder. G4 ships with the latest 831C firmware in this location.
- Step 4.** Select the **FW831C** file you want to install, and click **Open**.
- Step 5.** Confirm your choice by clicking **Upload Firmware**. A progress bar appears under the **Upload Firmware** button followed by progress screens until the firmware is upgraded.
- Step 6.** To confirm the installation, do the following:
- On 831C, select **Tools**  → **About** → **Options** to view your currently installed options, and to enable or disable installed options.
 - When 831C-LNE Agency Approval firmware is installed, the LNE or PTB icon appears near the top of the 831C display as shown in

FIGURE 14-2 Agency Approval Firmware Icon



LEARN MORE For information about customizing the way your firmware options display, see [14.4 Enabling or Disabling Firmware Options](#).

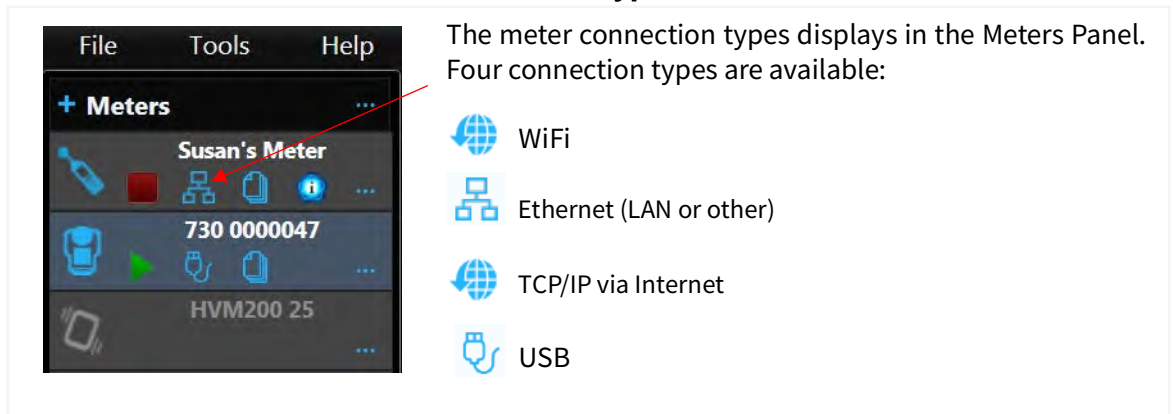
14.3 Upgrading Meter Firmware Options



Before you begin:

- When you purchase a meter upgrade or option, you receive the firmware option file as an email attachment from Larson Davis. Save this file to your PC on the Desktop.
- Power on your meter, and connect it to your PC via the USB cable (CBL138, part of the PSA029 power supply) or via TCP/IP. For more information about connecting your meter via TCP, see [Module 13 831C Network and Connections](#).

- Step 1.** In the G4 Meters Panel, connect your meter to your PC via the included USB cable or via TCP/IP. When connected, the meter icon displays in blue in-line with one of four connection types, as shown in

FIGURE 14-3 G4 Connection Types



- Step 2.** Click the **Menu icon**  in-line with the name of your meter, then select **Upload Options** from the pop-up menu. This opens the Upgrade Firmware or Options window.
- Step 3.** Click **Choose Options File**. This opens the File Explorer to the default firmware folder.
- Step 4.** Navigate to the Desktop (or to the location of the OP831C file you saved), select the file you want to install, and click **Open**.
- Step 5.** Confirm your choice by clicking **Upload Options**. A progress bar under the **Upload Options** button shows the status of your update and a series of progress screens.
- Step 6.** To confirm the installation, do the following: on your 831C, select **Tools**  → **About** → **Options** to view your currently installed options.

LEARN MORE For details on customizing your firmware options, see [14.4 Enabling or Disabling Firmware Options](#).

14.4 Enabling or Disabling Firmware Options

Once you download and install optional firmware, it's automatically enabled on your meter. To disable a firmware option, complete the steps in this section.




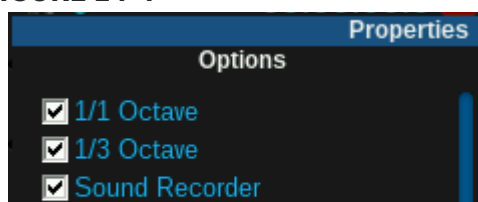

- Step 1.** On your 831C, select **Tools**  → **System Properties**.
- Step 2.** Press the **left** or **right softkey** ( ) until you see the **Options** screen.

FIGURE 14-4



Step 3. Select the checkbox in-line with the option you want to enable or disable on the meter.

TAKE NOTE If you have unsaved data or are currently running a measurement, the meter notifies you that a reset is needed to save the Options settings. Select **OK** and press the **Reset**  button to reset the measurement.

Step 4. Reboot your 831C.

TAKE NOTE If desired, you can temporarily hide the display tab (screen) of a disabled option. For more information, see [**4.2 Enabling or Disabling Display Tabs**](#).

Module **15** Using Measurement History

This module shows how to use the Measurement History (MH) feature of firmware option 831C-ELA, which allows you to segment the data gathered between Run and Stop into measurement intervals. Measurement intervals are saved as individual records within in a single data file.

Option 831C-ELA also provides exceedance-based logging analysis with manual or timed storage of statistical data.

In this module:

15.1 Configuring Measurement History (MH) -----115

15.2 Viewing Measurement History Data Files -----119

15.1 Configuring Measurement History (MH)

When the Measurement History-enabled (MH) measurement begins, the meter automatically creates a series of measurement intervals. You define the duration of each interval. When the measurement stops, all intervals are saved as individual records in one file.

While measurement parameters can be indicated directly in the Active setup, it's a good practice to create a named Setup file for each kind of measurement you perform, as shown in this section.

TAKE NOTE The G4 LD Utility also provides a simple, file transfer-style interface for completing this same process. For more information, refer to the *G4 LD Utility Manual*.

Before you begin:

- Verify that firmware option 831C-ELA is installed and enabled on your meter. For more information, see **14.4 Enabling or Disabling Firmware Options**.
- Create a measurement setup file (Setup) as shown in **6.2 Creating a Custom Setup File On the Meter**.

Step 1. On the 831C, select **Tools**  → **Setup Manager**.

Step 2. Press the **right softkey** () until the **Control** tab appears.

Step 3. Select a **Run Mode** and associated settings to complete the Setup. Click a link below for instruction on completing the Setup:




- **Selecting Manual or Stop When Stable Mode With Measurement History**
- **Selecting Timed Stop Mode With Measurement History**
- **Selecting Continuous Mode With Measurement History**
- **Selecting Single Block Timer Mode With Measurement History**
- **Selecting Daily Timer Mode With Measurement History**



LEARN MORE To view suggested applications for each run mode, see [6.2.4 Choosing a Meter Control Run Mode](#).

Selecting Manual or Stop When Stable Mode With Measurement History

- a. Select the **Enable Measurement History** checkbox.
- b. If you want to send a measurement interval exceedance alert, select your preferred method in-line with **Alerts**, then select a **Trigger Source** and **Trigger Level (dB)** for the alert. The Trigger Level cannot be less than 0.1 (dB).

TAKE NOTE **Trigger Sources** for this alert include the following statistics: **LAeq, LCeq, LZeq, Lmax, Lmin**, and all 6 values of **Ln**. If the current dB level is greater than the Trigger Level (dB) of the selected Trigger Source at any time during the current measurement interval, the 831C sends an alert notification via email or text when the interval ends.

- c. Select any additional settings on the Setup Manager tabs. For more information on this process, see [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#).
- d. Press **Close** () and save your Setup.
- e. Set it as the **Active** setup file.
- f. Go to **Tools** () → **System Properties** → **Preferences** and verify the **Auto-Store** setting. After you press the **Stop/Store button** () to end the measurement, the meter stores data according to the selected Auto-Store preference (None, Prompt, Store). For more information, see [8.1 Setting Data File Storage Preferences](#).
- g. Make a measurement.

TRY THIS With Measurement History +Auto-Store enabled, sequentially pressing the **Stop/Store button** () and the **Run/Pause button** () stores the measurement and initiates another measurement. This eliminates the need to perform a separate store.

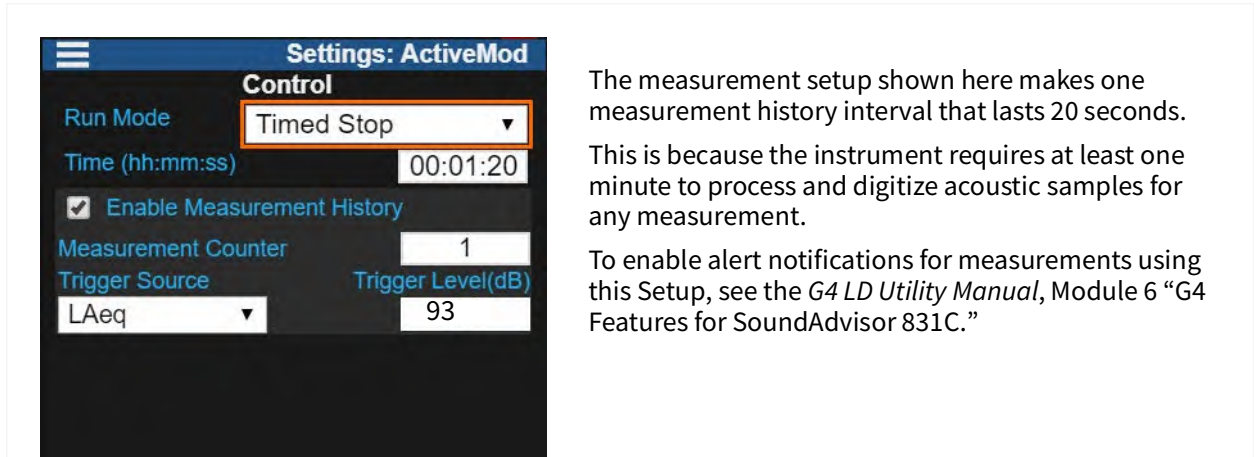
Selecting Timed Stop Mode With Measurement History

When Measurement History is enabled, Timed Stop allows you to automatically make and store the number of measurements you set as the Measurement Counter and then stop. Subsequent runs, each manually initiated, produce the same number of stored measurements.

- a. Select “Timed Stop” from the **Run Mode** drop-down menu.
- b. In the **Time (hh:mm:ss)** field, enter a length of time for the measurement.
- c. Select the **Enable Measurement History** checkbox, and enter the number of measurement records you want in the **Measurement Counter** field.

TAKE NOTE To use the **Measurement Counter**, the value of **Time** must be greater than 00:01:00 (1 min). This accounts for digital sampling and buffer time.

FIGURE 15-1 Timed Stop Mode



The measurement setup shown here makes one measurement history interval that lasts 20 seconds.

This is because the instrument requires at least one minute to process and digitize acoustic samples for any measurement.

To enable alert notifications for measurements using this Setup, see the *G4 LD Utility Manual*, Module 6 “G4 Features for SoundAdvisor 831C.”

- d. Select a **Trigger Source** and **Trigger Level (dB)** for the alert. The Trigger Level cannot be less than 0.1 (dB).

TAKE NOTE Trigger Sources for this alert include the following statistics: **LAeq, LCeq, LZeq, Lmax, Lmin**, and all 6 values of **Ln**. If the current dB level is greater than the Trigger Level (dB) of the selected Trigger Source at any time during the current measurement interval, the 831C sends an alert notification via email or text when the interval ends.

- e. Select any additional settings on the Setup Manager tabs. For more information, see **6.2.2 Customizing Setup Values On the Setup Manager Tabs**.
- f. Press **Close** (⏻) and save your Setup.
- g. Set it as the Active setup file.
- h. Go to **Tools** (🔧) → **System Properties** → **Preferences** and verify the **Auto-Store** setting. After the measurement stops, the meter stores data according to this preference (None, Prompt, Store). For more information, see **8.1 Setting Data File Storage Preferences**.
- i. Make a measurement.

Selecting Continuous Mode With Measurement History

- a. Select a **Daily Auto-Store** interval. At the end of the Auto-Store interval, the 831C saves the current measurement to a new, incrementally-named, data file throughout the day based on the **Time (hh:mm:ss)**. Time is the time of day you want to begin auto-storing measurement interval.

TRY THIS If you want to store a measurement interval each hour of the day beginning at 10:05, choose the following settings:


- **Auto-Store:** 1 hr
- **Time (hh:mm:ss):** 10:05:00

If you start the measurement at 10:10, the measurement interval stores at 11:05, 12:05, and so forth. In this case, the initial measurement history interval has only 50 minutes of data, while all others contain the full hour.

- b. If desired, select **Cal. Check**, and enter the **Time** of day it should occur.

- c. Select the **Enable Measurement History** checkbox, and enter a duration (hh:mm) for each measurement record in the **Interval Time** field. **Note:** Interval Time cannot be less than 00:01 (1 minute).
- d. If desired, select **Interval Time Sync**. This forces a new measurement record to begin every n minutes (or hours), where n is the value of **Interval Time**.
 - If you enter an **Interval Time** (hh:mm) value less than 0:01, the measurement interval syncs to the 1 min interval boundary.
 - If you enter any other **Interval Time** (hh:mm) value of 01:00 or more, the measurement syncs to the hour.
- e. If you want to send a measurement interval exceedance alert, select a checkbox in-line with **Alerts**.
- f. Select a **Trigger Source** and **Trigger Level (dB)** for the alert.

FIGURE 15-2 Continuous Run Mode



1. Trigger Level cannot be less than 0.1 (dB)

TAKE NOTE **Trigger Sources** for this alert include the following statistics: **LAeq, LCeq, LZeq, Lmax, Lmin**, and all 6 values of **Ln**. If the current dB level is greater than the Trigger Level (dB) of the selected Trigger Source at any time during the current measurement interval, the 831C sends an alert notification via email or text when the interval ends.

- g. Select any additional settings on the Setup Manager tabs. For more information, see [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#).
- h. Press **Close** (⊖) and save your Setup.
- i. Set it as the **Active** setup file.

Selecting Single Block Timer Mode With Measurement History

- a. Enter a **Start (y-m-d)** date and **Time**, and an **End (y-m-d)** date and **Time**, where **Time** is the time of day.
- b. Select the **Enable Measurement History** checkbox.
- c. If you want to send a measurement interval exceedance alert, select your preferred method in-line with Alerts, and select a Trigger Source and Trigger Level (dB) for the alert. The Trigger Level cannot be less than 0.1 (dB).

TAKE NOTE **Trigger Sources** for this alert include the following statistics: **LAeq, LCeq, LZeq, Lmax, Lmin**, and all 6 values of **Ln**. If the current dB level is greater than the Trigger Level (dB) of the selected Trigger Source at any time during the current measurement interval, the 831C sends an alert notification via email or text when the interval ends.

- d. Select any additional settings on the Setup Manager tabs. For more information, see [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#).
- e. Press **Close** (○●○) and save your Setup.
- f. Set it as the **Active** setup file.

Selecting Daily Timer Mode With Measurement History

- a. Enter a **Start (y-m-d)** date and **Time**, and an **End (y-m-d)** date and **Time**, where **Time** is the time of day.
- b. If desired, select the checkbox in-line with “2,” and “3” to enter additional measurement periods.
- c. Select the **Enable Measurement History** checkbox.
- d. If you want to send a measurement interval exceedance alert, select your preferred method in-line with **Alerts**, and select a **Trigger Source** and **Trigger Level (dB)** for the alert. The Trigger Level cannot be less than 0.1 (dB).

TAKE NOTE **Trigger Sources** for this alert include the following statistics: **LAeq, LCeq, LZeq, Lmax, Lmin**, and all 6 values of **Ln**. If the current dB level is greater than the Trigger Level (dB) of the selected Trigger Source at any time during the current measurement interval, the 831C sends an alert notification via email or text when the interval ends.

- e. Select any additional settings on the Setup Manager tabs. For more information, see [6.2.2 Customizing Setup Values On the Setup Manager Tabs](#).
- f. Press **Close** (○●○) and save your Setup.
- g. Set it as the **Active** setup file.

Recommended Next Steps:

- To enable alert notifications for this Setup, see the *G4 LD Utility Manual*, [Module 6 G4 Features for 831C](#).
- Make a measurement. For more information, see [Module Module 7 Making a Measurement](#).
- View and interpret the resulting data. For more information, see [15.2 Viewing Measurement History Data Files](#).

15.2 Viewing Measurement History Data Files

In this section:

- [15.2.1 Viewing Live Measurement Interval Data](#)
- [15.2.2 Viewing Measurement History Data](#)
- [15.2.3 Viewing Measurement History Data From a Stored File](#)

15.2.1 Viewing Live Measurement Interval Data

When the first measurement interval is underway, metrics and data display on the Current tab. When the measurement interval is complete, that data displays on the Measurement tab. The Current tab resets and begins displaying data for the next measurement interval in progress. At any time the Current tab displays the measurement interval currently in progress.



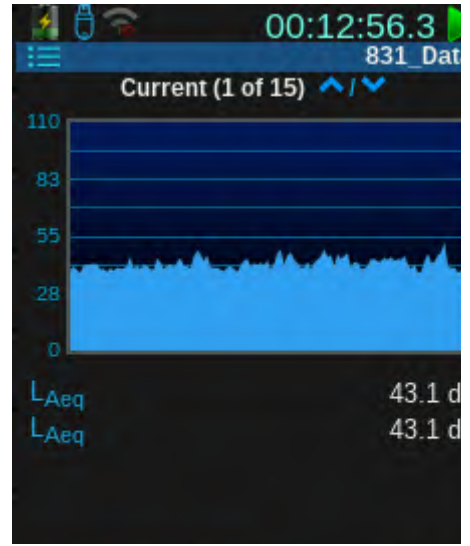
The Current tab displays data in pages just like Live or Overall, and depending on the firmware options Setup values enabled. Press the **Up** and **Down** buttons ( and ) to navigate through these pages. For more information, see **Module 4 Using the Data Display**.

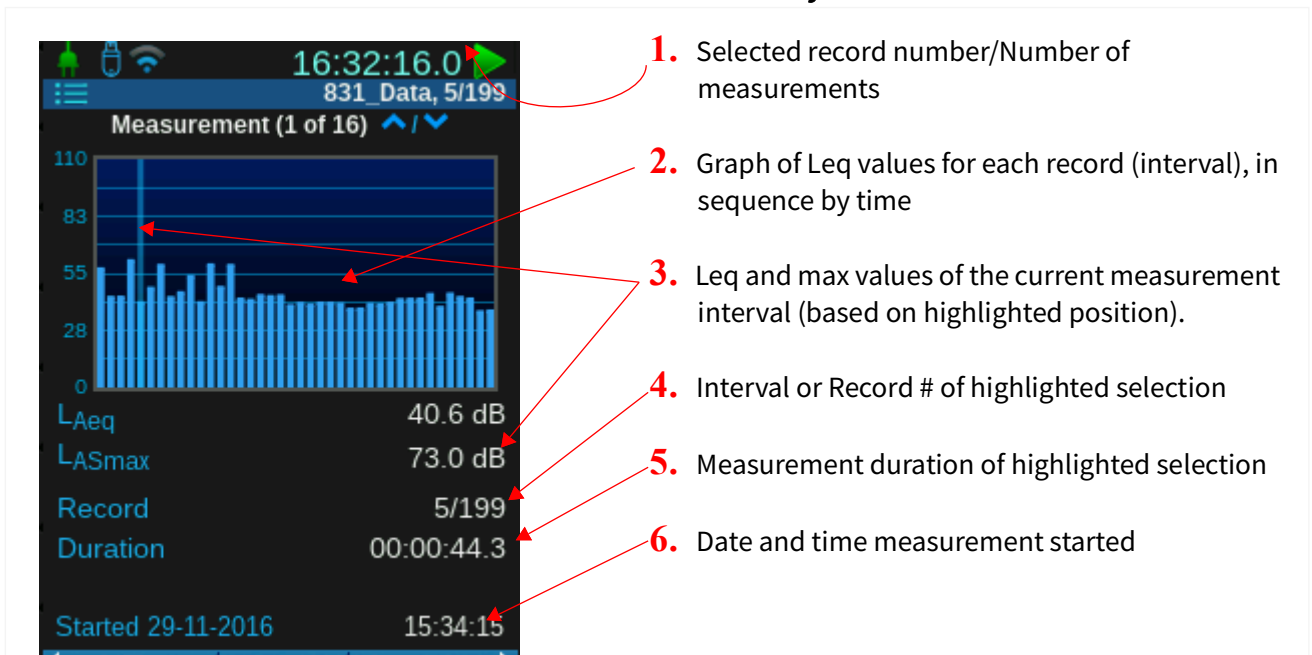
FIGURE 15-3



15.2.2 Viewing Measurement History Data

The Measurement tab can display data for any of the previously completed measurement intervals. Intervals (records) are numbered sequentially first to last and displayed left to right.



FIGURE 15-4 Measurement History





Changing the Displayed Record

The selected record number for which data is being displayed is indicated in the upper right next to the measurement name as you navigate up and down through the pages.

Frequency Spectra Displays

- When a frequency spectrum is displayed at the top, use the **Right** and **Left navigation buttons** ( ) to highlight a frequency band and display the associated levels.
- To change the displayed measurement record, shift to a non-spectrum page, then return to the frequency spectrum display.

Non-Spectra Displays

On screens that do not contain frequency spectrum displays, use the **Right** and **Left navigation buttons** ( ) to step right and left through the selected measurement record numbers.

15.2.3 Viewing Measurement History Data From a Stored File

The Data File Manager allows you to access and open files on the meter. For more information on using this see [8.2 "Using the File Manager" on page 77](#).

We recommend using the G4 LD Utility for viewing data files on your PC. For more information on this, see the module that corresponds to your measurement type in the *G4 LD Utility Manual*.

Module 16 Using Time History

The Time History feature provides a table of metrics recorded at regular intervals according to the settings you choose, and provides a method of graphing the measurement metrics over time. This feature is active on your instrument when you purchase and enable firmware option 831C-LOG or 831C-ELA.

Process Overview:


16.1	Setting Up a Measurement With Time History	122
16.2	Making a Time History Measurement With Sound Markers	124
16.3	Viewing Time History Data	125

16.1 Setting Up a Measurement With Time History


Time History describes the measured sound as a table of metrics recorded at regular intervals.

Before you begin:

- Verify that firmware option 831C-LOG is installed and enabled on your meter. For more information, see [14.4 Enabling or Disabling Firmware Options](#).
- Create a measurement setup file (Setup) as shown in [6.2 Creating a Custom Setup File On the Meter](#).

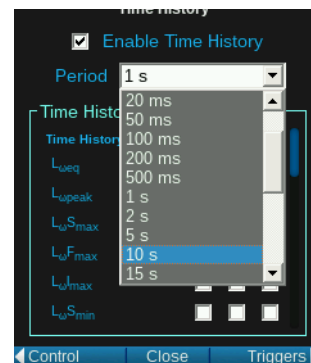
Step 1. On the 831C, select **Tools**  → **Setup Manager**.

TAKE NOTE The G4 LD Utility also provides a simple, file transfer-style interface for configuring, saving, and transferring Setup files to your PC or to another meter. For more information, refer to the *G4 LD Utility Manual*.

Step 2. Highlight the name of the Setup you want to configure with Time History, and press the **right softkey** () until the **Time History** tab displays.

Step 3. Check **Enable Time History** and select the desired time **Period** from the drop-down menu. See *Step 4. Enable the desired Time History Options. Not all options are available for every time period. Table 16.1 on page 123 shows data that is displayed for each Time History Metric, depending on the Time Interval Option you select.*

Step 4. Enable the desired Time History Options. Not all options are available for every time period. *Table 16.1 on page 123* shows data that is displayed for each Time History Metric, depending on the Time Interval Option you select.



Step 5. Select any additional settings on the Setup Manager tabs. For more information on this process, see **6.2.2 Customizing Setup Values On the Setup Manager Tabs**.

Step 6. Press **Close** (○●○) and save your Setup.

Step 7. Set it as the **Active** setup file.

Step 8. Make a measurement as shown in **16.2 Making a Time History Measurement With Sound Markers**.

Table 16.1 Time History Available Metrics

Time History Metrics	Time Interval Options				
	2.5, 5, 10 ms	20, 50 ms	100, 200 ms	500 ms, 1 s, 2 s	5 s -24 h
$L_{\omega eq}$		X	X	X	X
$L_{\omega peak}$		X	X	X	X
$L_{\omega SMAX}$			X	X	X
$L_{\omega Fmax}$			X	X	X
$L_{\omega I_{max}}$			X	X	X
$L_{\omega Smin}$			X	X	X
$L_{\omega Fmin}$			X	X	X
$L_{\omega I_{min}}$			X	X	X
$L_{\omega SSPL}$		X	X	X	X
$L_{\omega FSPL}$		X	X	X	X
$L_{\omega ISPL}$		X	X	X	X
$L_{Ceq} - L_{Aeq}$			X	X	X
$L_{Ieq} - L_{eq}$		X	X	X	X
OBA Bandwidth					
L_{eq}	1/1	X*	X	X	X
	1/3	X*	X	X	X
L_{max}	1/1		X	X	X
	1/3		X	X	X
L_{min}	1/1		X	X	X

* Only 1/1 Octave or 1/3 Octave can be chosen, not both.
 ** 1 second resolution and will not update between queries at faster than 1 second.

“ ω ” is the frequency weighting A, C, or Z

Table 16.1 Time History Available Metrics (Continued)

Time Interval Options						
	1/3			X	X	X
SPL	1/1		X	X	X	X
	1/3		X	X	X	X
LAFTM5						X
Miscellaneous						
Ln Statistics					X	X
Battery Voltage				X	X	X
Internal Temperature				X	X	X
External Power				X	X	X
Millisecond Time Resolution						
Tms	X	X	X	X	X	X
Weather**	X	X	X	X	X	X
* Only 1/1 Octave or 1/3 Octave can be chosen, not both.						
** 1 second resolution and will not update between queries at faster than 1 second.						
“ω” is the frequency weighting A, C, or Z						

16.2 Making a Time History Measurement With Sound Markers

The 831C Time History option also allows you to place sound type markers in the time history data as the sounds occur or during your post measurement analysis.

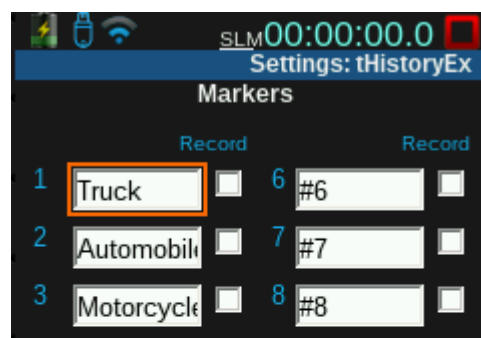
To make a measurement with sound markers, follow these steps:

Before you begin:

- Complete steps 1–4 of [16.1 Setting Up a Measurement With Time History](#).

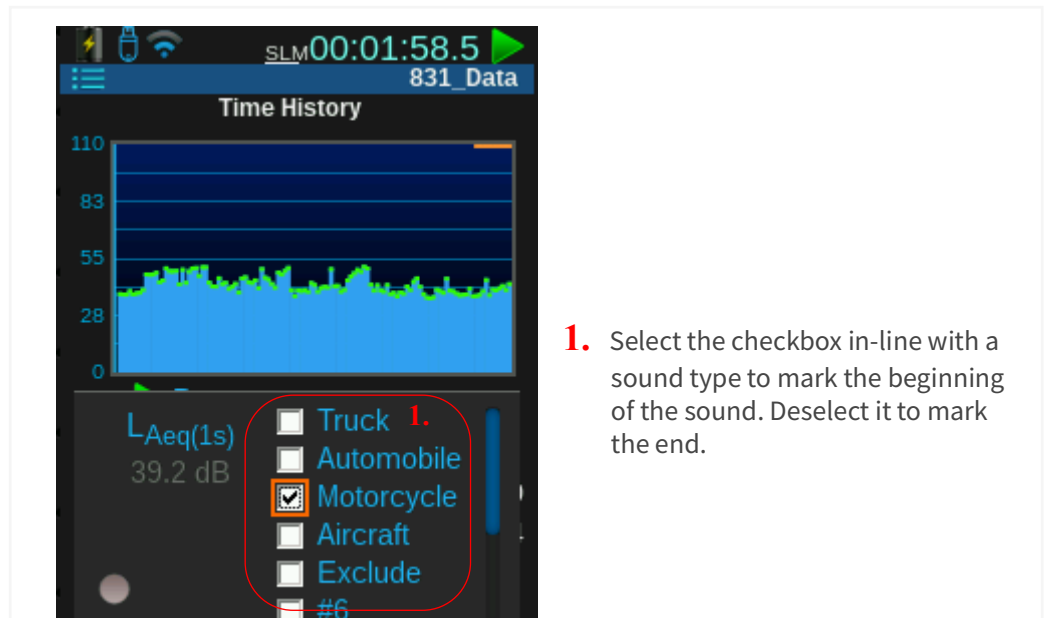
Step 1. With your Time History setup file highlighted in the Setup Manager, press the **right softkey** (☐☐●) until the **Markers** tab appears.

Figure 16-2 Setup Manager Markers Tab



- Step 2.** If desired, edit the marker names.
- Step 3.** Select the checkbox in-line with the sound types which should generate sound recordings this measurement.
- TAKE NOTE** If you're also planning to make sound recordings, section **20.2 Using Mark Sound Type to Make Manual Sound Recordings** is a good reference.
- Step 4.** Press **Close** (○●○) and save the Setup.
- Step 5.** Enter the Setup Manager, highlight the name of the Time History setup, and set it as the Active setup file.
- Step 6.** Run a measurement and navigate to the **Time History** or **Live** tab.
- Step 7.** Press the **Menu softkey**(○●○) and select **Mark Sound Type**.
- Step 8.** As shown in *Figure 16-3*, a partial menu appears over the bottom half of your Time History tab. As sound types occur, select any of the available markers to mark that sound type. Deselect the marker to end the mark.

Figure 16-3



16.3 Viewing Time History Data

Time History data displays on the Time History tab as shown in *Figure 16-4*.

Figure 16-4 Time History Tab (Page 1)

1. Highlight this line and use the **Enter** (ENTER) key to toggle from Record view to the metric view.
2. Depending on the enabled firmware options and the measurement setup used, the Time History screen can display data pages just like Live or Overall. Press the **up or down** () navigation buttons to navigate through these different pages.
3. Blue bands show the L_{Aeq} for the time interval. Green marks show the metric data (L_{Apeak} is shown here).
4. To jump to a different record number, press the **Menu** softkey and select **locate** from the pop-up menu.

Viewing Time History Octave Spectra Pages

If you indicated OBA metrics, the Time History tab contains multiple pages of Octave Spectra data as shown in *Figure 16-5*. From the Time History tab, press the **up or down buttons** () to view additional pages.

TRY THIS Highlight, then press **Enter** (ENTER) on each Time History page to see which values you can edit on each page.

Figure 16-5 Time History 1/1 Octave Page

1. Use the **Enter** (ENTER) button to switch from the frequency graph to the record number.
2. The highlighted band is the $L_{\omega eq}$ average sound level of for the duration of the measurement at that frequency.
3. To learn more about octave page displays, see **Module 4 "Using the Data Display"**.
4. Use the **left or right buttons** () to highlight the desired band; the numerical values below reflect the information at that octave.
5. Indicates the selected record number of the highlighted data.

Module 17 Using the Event History Firmware Option

This module shows how to perform a measurement using Event History, a feature of option 831C-ELA. This firmware upgrade provides event-based logging analysis and event history data with manual or timed storage of statistical data and measurement history.

Figure 17-1 Sound Event



1. An event starts when the measured sound pressure level exceeds at least one **Trigger Level** and persists longer than the **Minimum Duration** you define.
2. An event stops when the sound level drops 2 dB below the trigger level. This 2 dB hysteresis is to avoid the creation of multiple exceedances when the sound level is fluctuating at or near the trigger level.

Process Overview:

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17.2.1	Using (Continuous) Daily Auto-Store With Event History	
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17.4.1	Using Running Leq as an Event Trigger	
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17.1 Setting Up the Event History Measurement

This section shows how to add some or all of the following capabilities to a measurement setup file: Trigger Levels, Event History, Event Time History, and Alert Notifications.

Before you begin:

- Verify that firmware option 831C-ELA has been installed and enabled on your meter. For more information, see [14.4 Enabling or Disabling Firmware Options](#).

Step 1. Navigate to **Tools**  → **Setup Manager**.

TAKE NOTE The G4 LD Utility also provides a simple, file transfer-style interface for configuring, saving, and transferring Setup files to your PC or to another meter. For more information, refer to the *G4 LD Utility Manual*.

Step 2. Highlight the name of the Setup you want to configure with Event History.

TAKE NOTE If your Setup includes **Continuous** Run Mode on the Control tab, see [Table 17.3](#) below to predict how events will be logged when they persist from one Auto-Store **Period** into the next.

Step 3. Press the **left softkey** () until the **Event Triggers** tab displays.

Step 4. If needed, edit the **Trigger Source**, and **Trigger Level** values.

- For more information about setting advanced event triggers, such as using Running Leq, and 1/1 and 1/3 octave event triggers, see [17.4 "Setting Advanced Event Triggers" on page 132](#) before continuing.

Step 5. Press the **left softkey** () to navigate to the **Event History** tab.

Step 6. Select the checkbox in-line with **Event History**, and enter values for the **Min/Cont Duration**.

About the Minimum Duration: To prevent many small events of short duration, you can select a **Minimum Duration**. This is the length of time in seconds that levels must exceed the trigger levels to be labeled an event. This value can be 60 seconds or less.

TAKE NOTE If you are using this feature with Sound Recording, there are constraints on your Minimum Duration. See [20.1 "Understanding 831C Recording Settings and Sound Quality" on page 177](#).

About the Continuation Period: A noise event is initiated when the sound level exceeds the trigger level or levels you define. There may be situations where the sound level drops below the threshold level for a short period before exceeding them again. Statistically, if you want to consider this a continuation of the first event rather than a new event, you can set a **Continuation Period**. This is the length of time in seconds following an event where the measured sound level can dip below, then exceed the threshold level again, and still be statistically considered part of the initial event. This value must be 9 seconds or less.

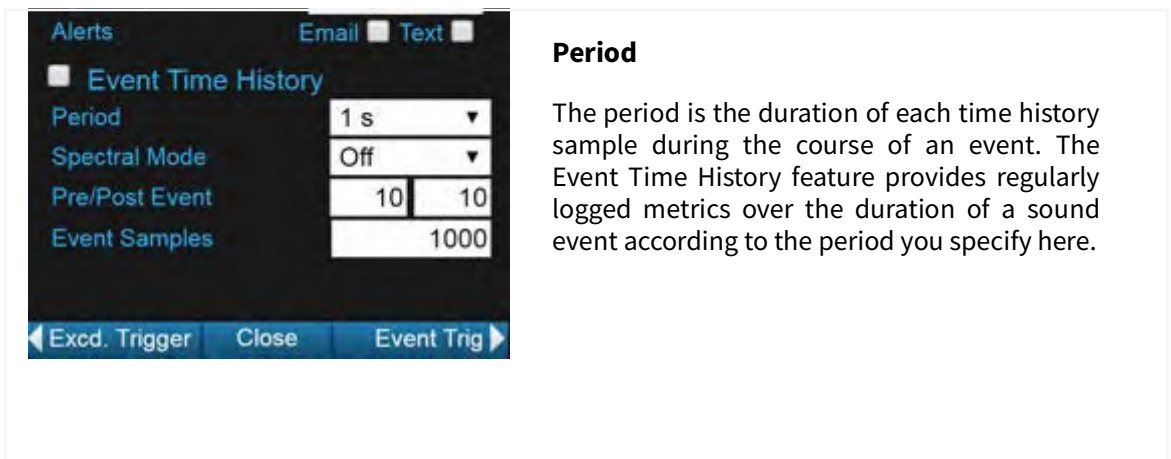
However, if the measured level drops below the threshold level and remains below it during the continuation period, the sound event is considered complete.

Step 7. Select **Level** or **Dynamic** from the **Trigger Method** drop-down menu.

LEARN MORE For more information, see [17.5 Understanding Level and Dynamic Triggering](#).

Step 8. If desired, enable **Event Time History**, and choose values for the following optional settings as shown in *Figure 17-2*:

Figure 17-2 Event Time History



Spectral Mode

Enabling Spectral Mode collects frequency bandwidth information for the duration of the sound event. If you enabled 1/1 Octave or 1/3 Octave band event triggers in Step 4, be sure you select **On** from the **Spectral Mode** drop-down menu here. To locate this information in the resulting data file, see [17.3.1 Viewing Octave Band and Spectral Events](#).

Pre/Post Event

Pre-Trigger and Post-trigger values indicate the number of samples you want to log prior to the event and after the event, respectively. A sample is equal to the Event Time History **Period**.

Event Samples


The Event Samples value indicates the maximum number of samples you want to record for each event. Choose any value 10–9999. Once the maximum is reached, no samples are logged, even if the event continues or post-trigger samples were set.

Example: If the sample **Period** is 1 second, the event lasts 15 seconds, and **Event Samples** is 10, only the first 10 periods (seconds) will be logged. Since this event extends beyond the maximum sample time, there will be no post-trigger sample logged, regardless of the set **Post Event** value.

Step 9. Press **Close** (○●○) and save the Setup.

Step 10. Enter the Setup Manager, highlight the name of the Event History setup, and set it as the Active setup file.


Step 11. If you want to send or receive alert notifications for sound events, do the following:

- a. Open G4 and log in to your meter account.
- b. Click the **edit icon**  in-line with your account.
- c. Scroll down to the Alert Notification section and select an email or text notification for **Events** and/or **Event Start**.
- d. Click **Save**, and confirm which meters this option applies to.

Step 12. Run an Event History measurement and store the data file, as shown in [17.2 Storing Event Data](#).

17.2 Storing Event Data

Event history data can be displayed during a measurement and after it has been stopped. The 831C provides 3 data storage methods:

- To manually store a data file after a measurement is stopped, press the **Stop/Store button** .
- To automatically store after a measurement, set your Auto-Store preferences as shown in [8.1 Setting Data File Storage Preferences](#).
- To schedule regular, daily storage, enable the Daily Auto-Store feature as shown in [17.2.1 Using \(Continuous\) Daily Auto-Store With Event History](#).

17.2.1 Using (Continuous) Daily Auto-Store With Event History

The 831C Daily Auto-Store feature provides a convenient way to store measurement data, especially when tracking acoustic events. The regular, daily storage periods create smaller files, and make it easy to access and navigate each event in the measurement.

Daily Auto-Store is available when you select Continuous Run Mode on the Control tab of the measurement Setup.

When using this feature, longer events may continue over from one auto-store period to another. The 831C handles this circumstance in the following ways:

Table 17.3 How Longer Events Can Affect the Auto Store Period

Daily Auto-Store Value	Mid-Event Auto-Store Result
5 min, 2 min, or 1 min	831C stores strictly according to the Period selected
10 mins and longer	831C waits for event to end (up to 1 min) before storing

When using 5-, 2-, or 1-minute Daily Auto-Store settings, the 831C strictly observes the Time and Auto-Store period you select to fulfill the event logging function.

For example, when a sound event persists across an Auto-Store boundary, the 831C stores and begins a new data file, which contains the remainder of the event data.

However, when a sound event persists across the Auto-Store boundary when using longer Daily Auto-Store periods (10 min+), the 831C continues measuring (up to 1 minute) to allow an in-progress event to end before storing the file.

17.3 Viewing Event History Data on the Events Tab

From the Live Tab, press the **right softkey** (○◻●) until the Events tab displays. After the first time interval has passed, data displays on the Event History tab in single values.

The Events tab can display multiple data pages just like the Live or Overall screens, depending on the firmware options enabled and the setup used. Use the **up and down buttons** (◀ ▶) to navigate through different pages on the Event History Tab. For more information, see [2.4.2 Using Tabs and Pages](#).

Figure 17-4 Event History Tab

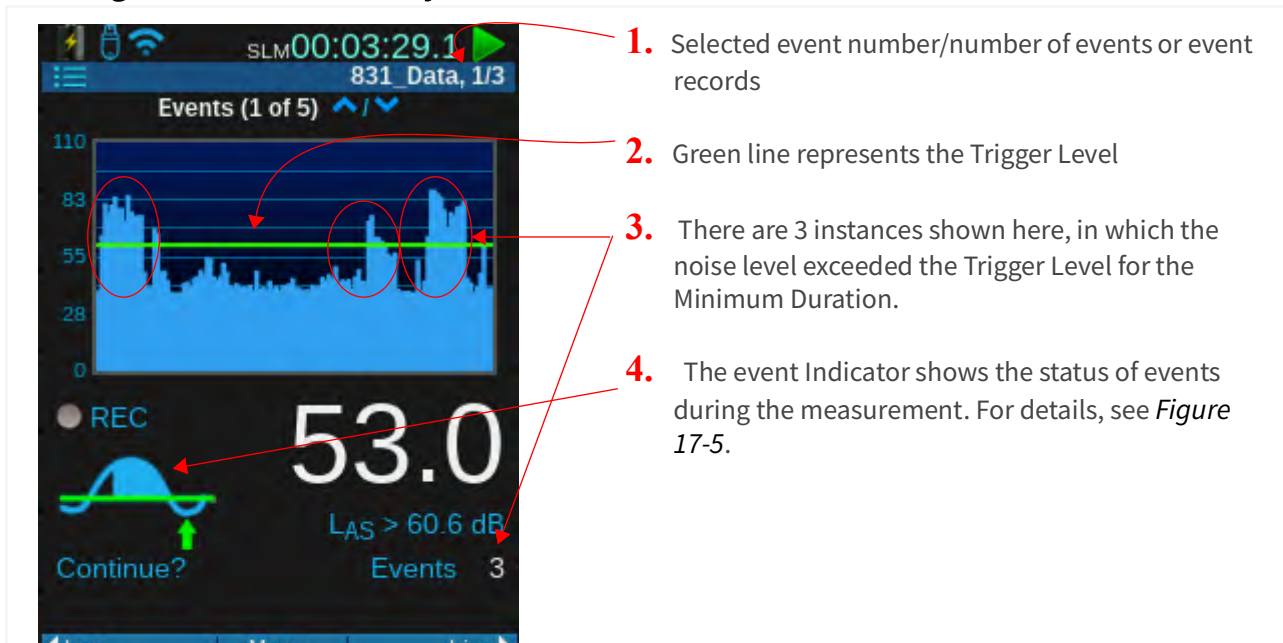
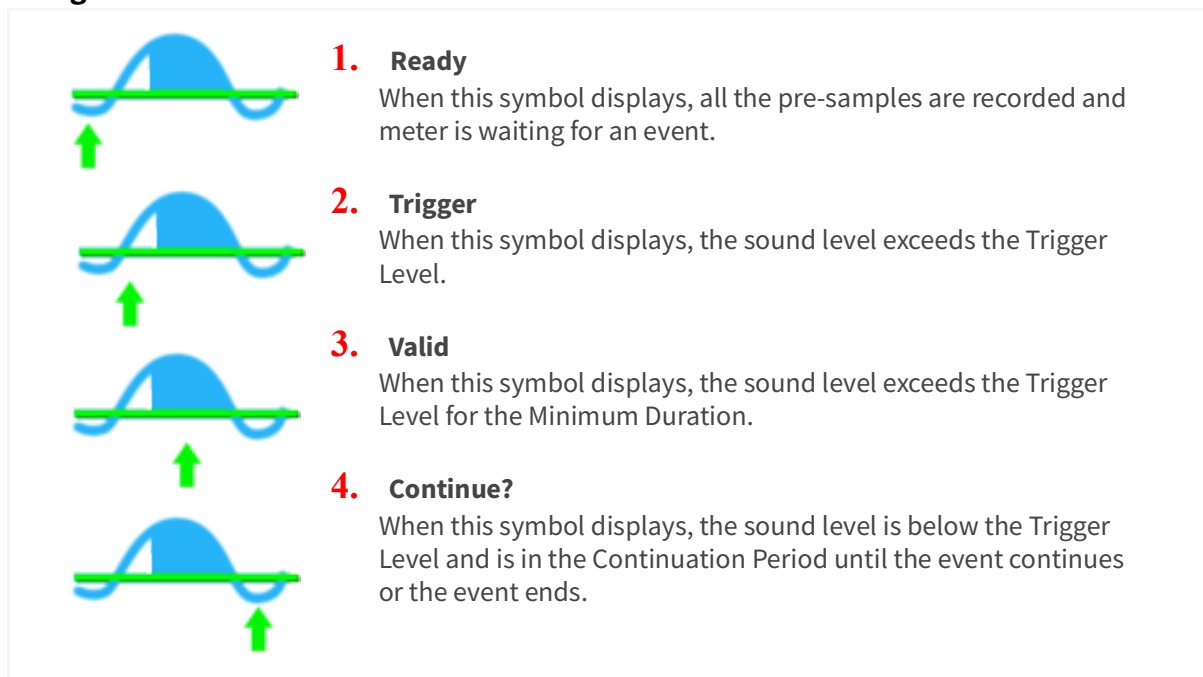


Figure 17-5 Event Indicator



17.3.1 Viewing Octave Band and Spectral Events

You can view the resulting events during a measurement in progress on the **Live View** → **Events** tab on pages 3–6, or after the measurement from the **Measurement** → **Events** tab on pages 3–4. If you enabled Spectral Mode in the measurement setup, the Events tab displays multiple pages of data.

Figure 17-6 Event History Tab- 1/3 Octave Page

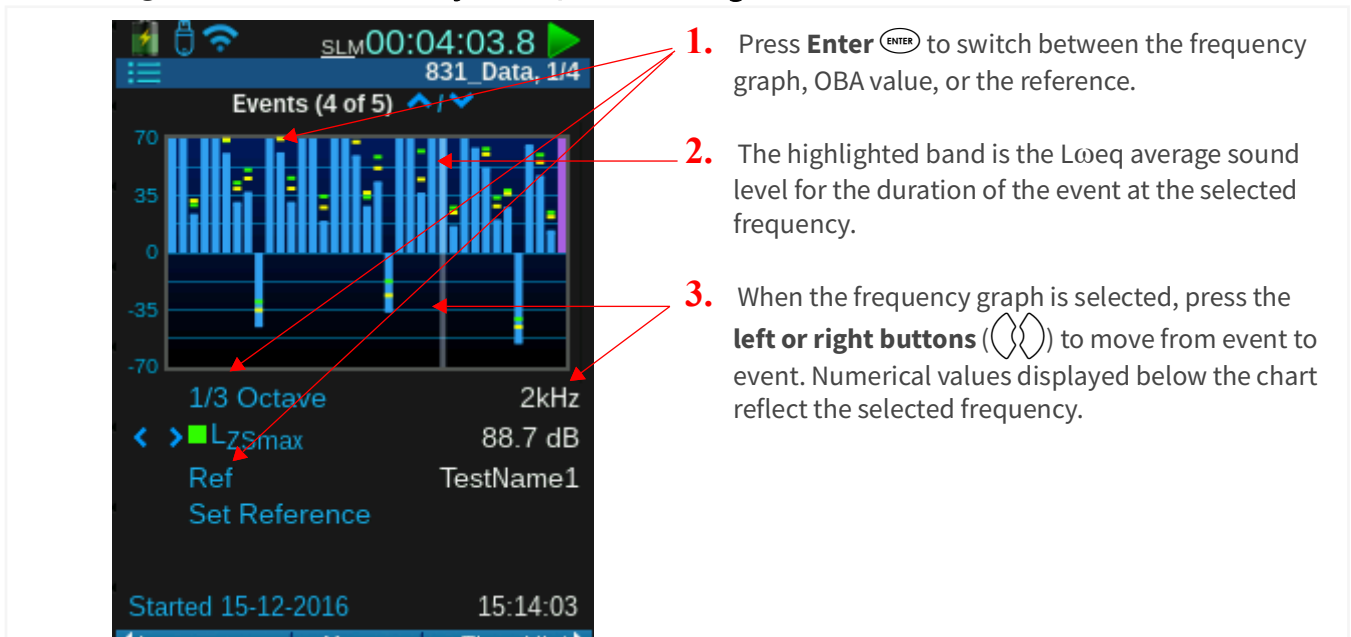
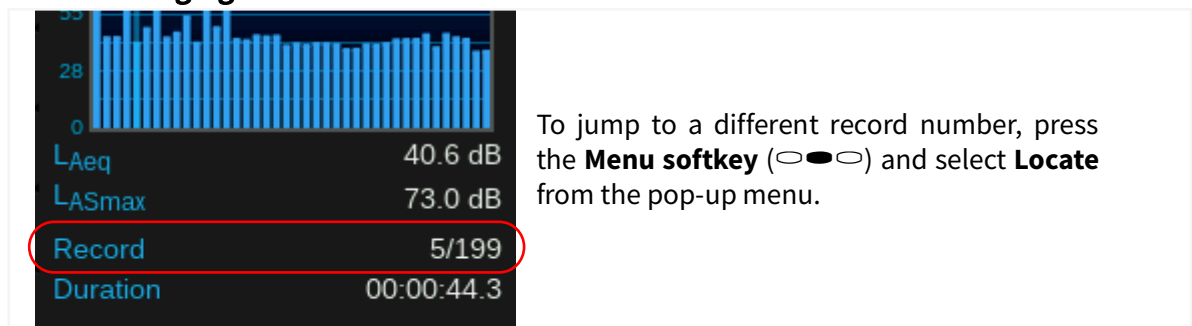


Figure 17-7 Changing Record Number



17.4 Setting Advanced Event Triggers

Select either of the following advanced trigger options to complete Step 4 for setting up Event triggers in a setup file.

In this section:

- [17.4.1 Using Running Leq as an Event Trigger](#)
- [17.4.2 Using 1/1 Octave and 1/3 Octave Event Triggers](#)

17.4.1 Using Running Leq as an Event Trigger

Using this feature, if the L_{eq} for the most recent period is greater than the set **Trigger Level**, the meter creates an event.

Before you begin:

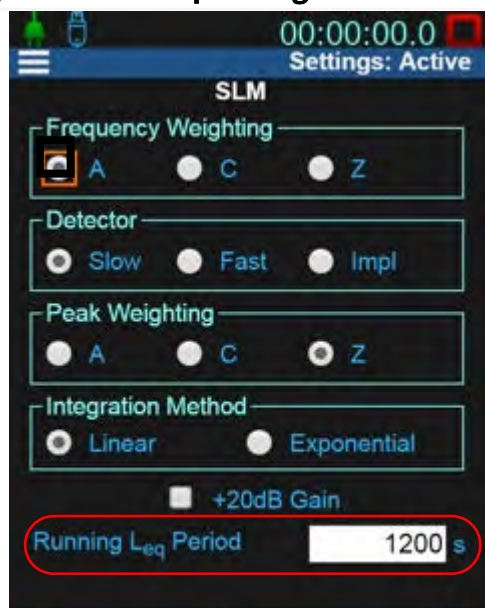
- This section explains an advanced application of step 4 in [17.1 "Setting Up the Event History Measurement" on page 127](#). Complete steps 1–3 in that section before proceeding.

Step 1. On the Event Triggers tab, select **Running Leq** from one of the **Trigger Source** drop-down menus, and enter a **Trigger Level** in dB.

Step 2. Use the **right or left softkeys** (◀▶) to navigate to the **SLM** Tab of the Setup Manager as shown in *Figure 17-8*.

Step 3. Enter a **Running Leq** period in seconds. Enter whole numbers only, such as 1–3600 (1 hour).

Figure 17-8 Setup Manager: SLM Tab



In this example, the period is set to be the Leq of the last 1200 seconds of the measurement run time.

Step 4. Return to Step 5 of [17.1 "Setting Up the Event History Measurement" on page 127](#).

17.4.2 Using 1/1 Octave and 1/3 Octave Event Triggers

Before you begin:

- This section explains an advanced application of step 4 in [17.1 "Setting Up the Event History Measurement" on page 127](#). Complete steps 1–3 of that section before proceeding.

- Purchase and install firmware option 831C-OB1, or 831C-OB3.

- Step 1.** On the 831C (or in G4), go to the **Setup Manager**→**System Properties**→**Reference Spectra** tab.
- Step 2.** Edit or verify the saved values as shown in [9.13 "Setting Reference Spectra" on page 99](#).
- Step 3.** On the 831C (or in G4), open the Setup Manager, and select your connected meter from the blue drop-down menu on the right.
- Step 4.** From the Setup Manager Files view, select the Setup you want to edit, and press the **left softkey** (●○○) until the **Event Triggers** tab displays.
- Step 5.** On the Event Triggers tab, choose a value for each of the following options:
- **Spectrum** from the **Full Octave** drop-down menu
 - **ALL**
When you select ALL, the meter triggers an event when all of the OBA values exceed the Reference Spectra selected for the Full Octave.
 - **ANY**
When you select ANY, the meter triggers an event when at least one of the OBA values exceeds the Reference Spectra selected for the Full Octave.
 - **Spectrum** from the **Third Octave** drop-down menu
 - ALL (as described above, but for the Third Octave Spectra)
 - ANY (as described above, but for the Third Octave Spectra)
- Step 6.** Return to Step 5 of [17.1 "Setting Up the Event History Measurement" on page 127](#) to complete the Setup.

17.5 Understanding Level and Dynamic Triggering

Your 831C SLM provides 2 ways to calculate an event trigger. The event trigger using Level Triggering is the static value you set. With dynamic triggering, the event trigger level adjusts according to the background noise (and any indicated offset) in each time history period.

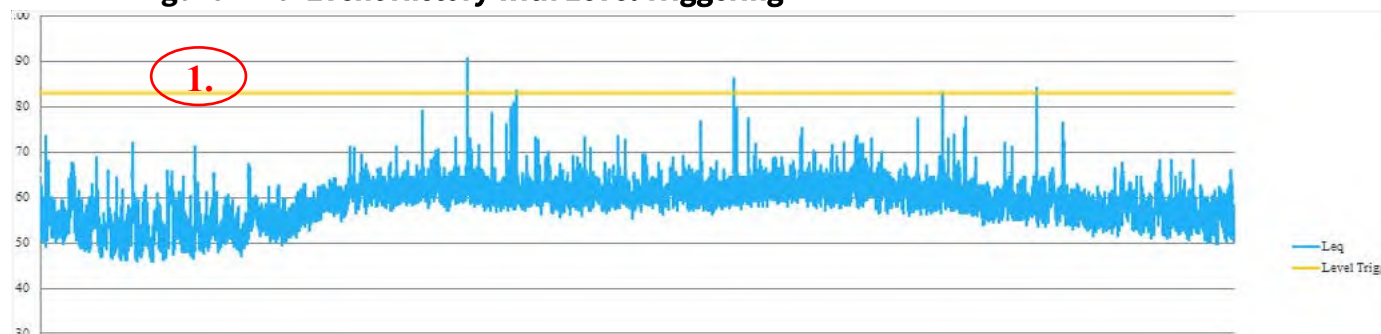
In this section:

- [17.5.1 Understanding Level Triggering](#)
- [17.5.2 Understanding Dynamic Triggering](#)

17.5.1 Understanding Level Triggering

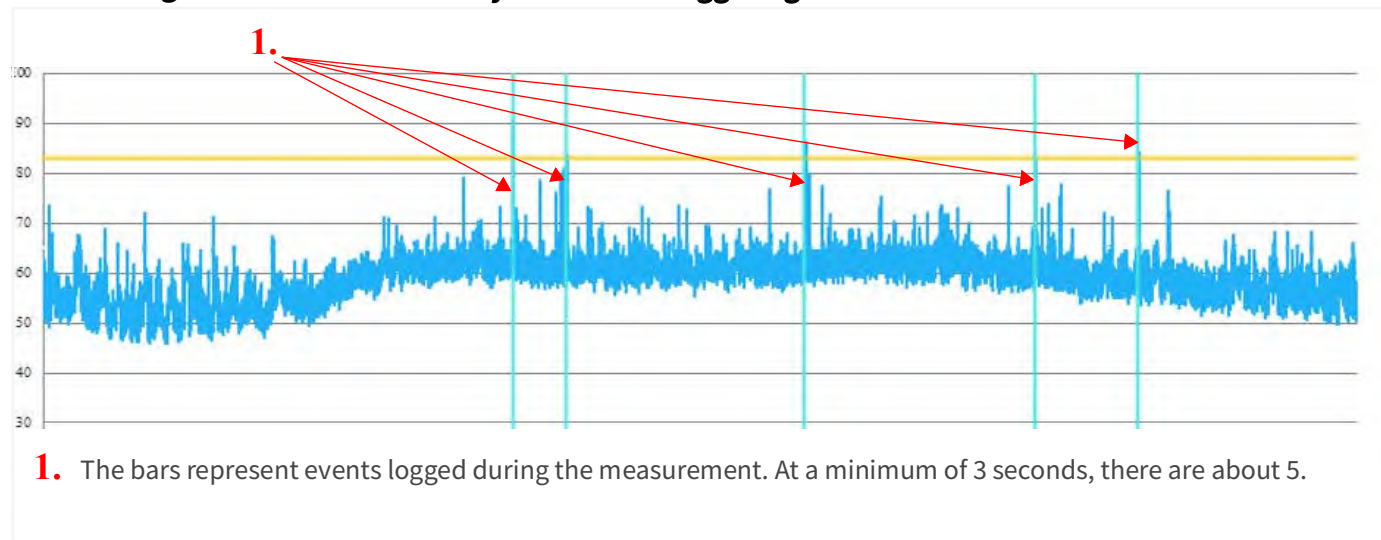
Using this method, all triggers are determined directly by their set threshold level, which is static throughout the entire measurement. The threshold level is calculated using all measured sound.

Figure 17-9 Event History with Level Triggering



1. The yellow line indicates the event trigger level, which was set at 84dB. The Leq in this example ran for a 24 hour period using a 1 second Time History Period.

Figure 17-10 Event History with Level Triggering and Events

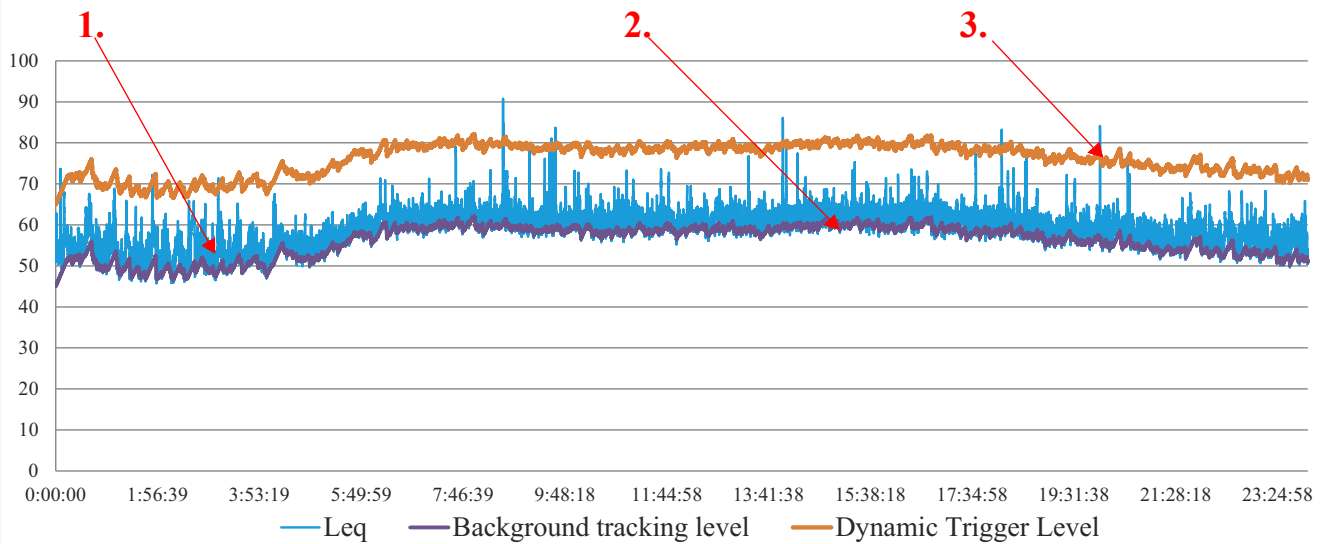


1. The bars represent events logged during the measurement. At a minimum of 3 seconds, there are about 5.

17.5.2 Understanding Dynamic Triggering

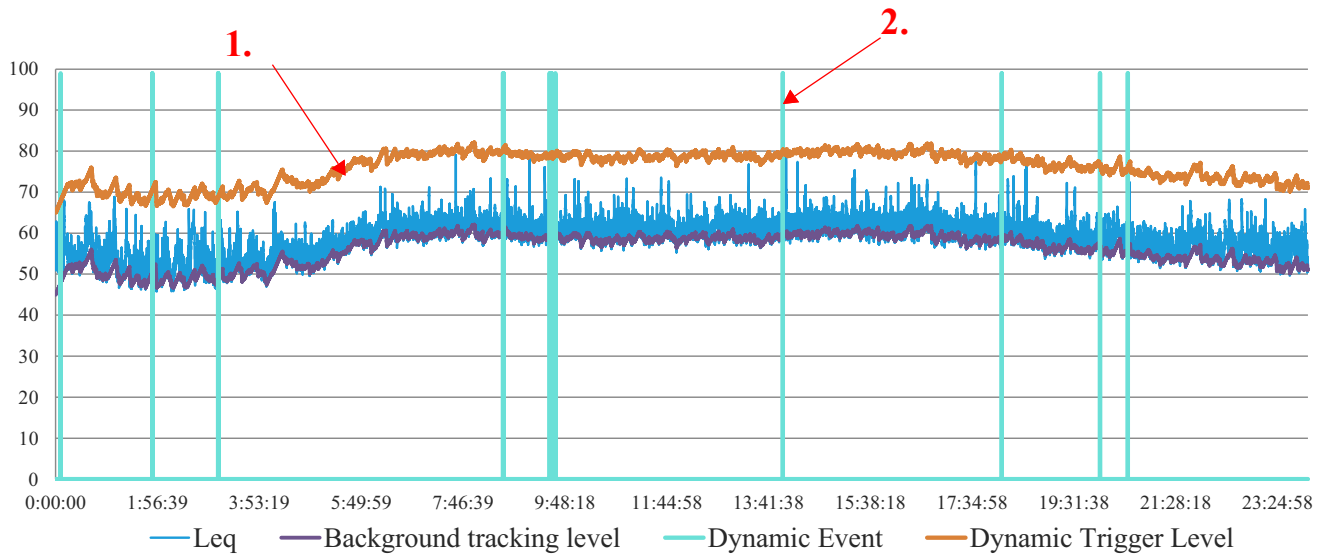
With dynamic triggering, the 831C tracks the background noise level, and adjusts the Trigger Level to equal the background noise plus any indicated offset. This effectively removes background noise from the trigger level calculation. To calculate events based on event noise only, Dynamic triggering is an appropriate method.

Figure 17-11 Event History with Dynamic Triggering



1. The Leq is set the same as in *Figure 17-9 Event History with Level Triggering*.
2. The background level is tracked throughout the measurement.
3. The trigger level is adjusted based on the background level and an indicated offset. Here the offset is 20 dB.

Figure 17-12 Event History with Dynamic Triggering and Events



1. With dynamic triggering, events only occur if the level exceeds the background level plus the offset. Here the offset is 20 dB.
2. The bars represent events logged during the measurement. There are about 11 with a Minimum Duration of 3 seconds.

About the Background Level

The background sound level used with dynamic triggering is the user-indicated **Ln** level (**Setup Manager** → **Ln Tab**). It's calculated using an algorithm that includes the rise rate in dB per minute. There are 5 Dynamic Trigger Parameters options available:

Table 17.13 Dynamic Response

Setting Number	Tracking Ln Percentile	Rise Rate, dB/minute	Description
1	95%	1/2	Lower tracking level
2	90%	1/3	Slow
3	90%	1/2	Default, normal operation
4	90%	1	Fast
5	80%	1	Fast and higher tracking level

When the measurement first begins, the background tracking level is set to the following:

Trigger Level SPL 1 – Offset = Initial Background Level

As the sound level increases above the background tracking level, the tracking level increases at the rise rate. As the sound decreases below the tracking level, the tracking level decreases at the rate determined by the dynamic response (Ln Percentile and its rate). Thus, the dynamic trigger level is set to the following:

Background level + Offset = Trigger Level

Module 18 RT60 Reverberation Time

When your SoundAdvisor™ 831C is equipped with the RT60 firmware option (831C-RA), use the 831C to determine the reverberation time of a room according to international RT60 specifications (ISO 3382 and ISO 354).

An RT60 measurement determines the length of time for sound to decay 60 dB in a space. These measurement parameters are available on the 831C:

- Impulse (Reverberation time in the room from start pistol, balloon burst, clapper, etc. is measured)
- Interrupted noise (Room fills with noise; noise is turned off abruptly to measure reverberation time)
- Computation of RT60 by using T20 and T30
- Quality indicators provide insight into the current sample quality and the overall measurement grade
- Data collection for full octave or third-octave band data

This module demonstrates procedures for operating the SoundAdvisor™ 831C to make a reverberation time measurement and view the resulting data on the meter. All features shown here require the SoundAdvisor 831C with firmware version 4.7 or newer, and the additional RT60 firmware option (831C-RA) installed. All options and accessories shown are available from Larson Davis.

Viewing 831C RT60 measurement files in G4 LD Utility enhances data visualization and offers analysis capability not available on the SoundAdvisor 831C screen.

For additional information on measuring and interpreting room acoustics, see the **Building Acoustics** section at LarsonDavis.com.

In this module:

18.1	Determining the Measurement Method and Grade -----	138
18.2	Preparing the RT60 Setup File -----	141
18.2.1	Utilizing a Quick Start Setup	
18.2.2	Creating an RT60 Setup for Interrupted Noise Method	
18.2.3	Creating an RT60 Setup for Impulse Response Method	
18.3	Preparing Noise Generation Equipment -----	147
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18.4.1	Excluding a Decay from the Ensemble	
18.5	RT60 Display Overview -----	153
18.5.1	831C Meter Display for RT60	
18.5.2	831C Data Display for RT60	

18.1 Determining the Measurement Method and Grade

Prior to making a measurement, determine the measurement method that satisfies the requirements of your measurement (Impulse Response or Interrupted Noise). *Table 18.1* explains the relationship between method and resulting measurement grade when using

the 831C to measure the reverberation time of an enclosed space. (Source: ISO 3382-2:2008)

Table 18.1 Response Method in Relation to Measurement Grade

Method (Bandwidth)	Resulting Grade		
	Survey	Engineering	Precision
Impulse (Octave)	✓	✗ ²	✗ ²
Impulse (Third octave)	✗ ¹	✗ ²	✗ ²
Interrupted (Octave)	✓	✓	✓
Interrupted (Third)	✗ ¹	✓	✓

Notes:

*1 Survey measurements are made in full octave bands only (ISO 3382-2:2008, Section 4.3.2)

*2 The impulse response method should only be used for survey purposes, (Section 6).

SoundAdvisor 831C Measurement Accuracy Grades

The SoundAdvisor 831C is compliant with the requirements of ISO 3382-2:2008 regarding measurement accuracy. Once you've established the appropriate method for your measurement, you can determine the level of accuracy, or tolerated uncertainty, that suits your application. The 831C RT60 firmware option comes with "quick start" measurement setup files prepared according to the requirements of each grade. Following the measurement, the meter indicates the current measurement grade and any adjustments that can be made to achieve the next accuracy grade.

Survey Grade

The survey grade measurement is appropriate for assessment of the amount of sound absorption for noise control purposes. It should be used for measurements prescribed by ISO 10052 by using the Impulse method. Survey measurements are made in octave bands only, and the nominal accuracy is assumed to be better than 10% for octave bands. (ISO 3382-2:2008)

On the 831C, you can quickly get started with a Survey grade measurement by selecting the "RT_Surv" setup file as the active setup for the measurement. In addition to utilizing this setup, you will need to measure reverberation time for at least two source/microphone locations. The Survey grade details are available for comparison to other accuracy grades in *Table 18.2*. Details on the "RT_Surv" setup file are shown in **18.2.1 "Utilizing a Quick Start Setup" on page 141**.

Engineering Grade

The Engineering grade measurement is appropriate for verification of building performance with specification of reverberation time or room absorption. It should be used for measurements prescribed by ISO 140 (all parts) with remarks to reverberation time measurements. The nominal accuracy is assumed to be better than 5% in octave bands and better than 10% in one- third octave bands. (ISO 3382-2:2008)

On the 831C, you can quickly get started with an Engineering grade measurement by selecting the "RT_Eng" setup file as the active setup for the measurement. In addition to utilizing this setup, you will need to measure reverberation time two or more times for

each source/microphone location, with at least six independent source/microphone locations. These details are available for comparison to other accuracy grades in *Table 18.2*. Details on the RT_Eng setup file are shown in **18.2.1 "Utilizing a Quick Start Setup" on page 141.**

Precision Grade

The precision grade measurement is appropriate where high measurement accuracy is required. The nominal accuracy is assumed to be better than 2.5% in octave bands and better than 5% in third-octave bands. (ISO 3382-2:2008)

On the 831C, you can quickly get started with a Precision grade measurement by selecting the "RT_Prec" setup file as the active setup for the measurement. In addition to utilizing this setup, you will need to measure reverberation time three or more times for each source/microphone location, with at least 12 independent source/microphone locations. These details are available for comparison to other accuracy grades in *Table 18.2*. Details on the "RT_Prec" setup file are shown in **18.2.1 "Utilizing a Quick Start Setup" on page 141.**

Table 18.2 Minimum Positions and Measurements per Accuracy Grade¹

	Survey	Engineering	Precision
Source/Microphone combinations	2	6	12
Source positions	≥ 1	≥ 2	≥ 2
Microphone positions	≥ 2	≥ 2	≥ 3
No. of decays in each position (Interrupted Noise Method)	1	2	3
Method	Impulse or Interrupted	Interrupted	Interrupted
Minimum Frequency Range	250 Hz to 2 kHz (Full octave)	125 Hz to 4 kHz (Full octave) 100 Hz to 5 kHz (Third octave)	
Standard	ISO 10052	ISO 140	

1. See ISO 3382-2(2008), 4.3.1 for additional details.

18.2 Preparing the RT60 Setup File

Before you begin:

- Verify that firmware option 831C-RA has been installed and enabled on your meter. For more information, see [14.4 Enabling or Disabling Firmware Options](#).

The SoundAdvisor 831C Room Acoustics option (831C-RA) comes with four quick start, prepared setup files. View and access these files from the 831C Setup Manager (**Tools** → **Setup Manager**). *Figure 18-1* describes each setup.

Figure 18-1 831C Reverberation Time Quick Start Setup Files

Settings: RT_Prec		
Setup Manager		
Active	RT	
RT_Eng	RT	RT_Eng applies the Interrupted Method and other settings to achieve an Engineering grade.
Default	RT	Select Default RT, press Enter (ENTER) and select "Save As" to create a new RT setup file.
ASTM2235	RT	ASTM2235 applies the Interrupted Noise method for testing sound insulating properties of building elements.
RT_Surv	RT	RT_Surv applies the Impulse Response method and associated settings to achieve a Survey grade.
RT_Prec	RT	RT_Prec applies the Interrupted Noise method and other settings to achieve a Precision grade.
DefaultMod	SLM	
NMS044	SLM	
Default	SLM	
Default	FFT	

If desired, you may prepare the measurement setup via the G4 LD Utility Setup Manager on a PC. For more information on this process, see "Module 8 RT60 Measurement Example" in the *G4 LD Utility Manual*.

In this section:

- **18.2.1 Utilizing a Quick Start Setup**
To compare and identify an RT60 quick start setup file for your project, choose this section.
- **18.2.2 Preparing an RT60 Setup for Interrupted Noise Method**
To customize a Setup for your Interrupted Noise project, complete this section.
- **18.2.3 Preparing an RT60 Setup for Impulse Response Method**
To customize a Setup for your impulse Response project, complete this section.

18.2.1 Utilizing a Quick Start Setup

- Step 1.** Identify a quick start reverberation time (RT) setup that meets the requirements of your project or international standard. *Table 18.3* and





Table 18.4 compare the measurement parameters of each quick start setup file on the 831C: RT_Eng, RT_Prec, ASTM2235, and RT_Surv.

Table 18.3 Interrupted Noise Method Prepared Setup Parameters

Setup Name	Filter		Exit Time	Band-width	Trigger Source/Level	Decays	Sample Period	Max Run	Build Time	OBA Range	Gain
	Low	High									
RT_Eng	100 Hz	5.0 kHz	10	1/3 octave	Mid-Band (80 dB)	3	5 ms	4 s	2 s	High	+20 dB
RT_Prec	100 Hz	5.0 kHz	10	1/3 octave	Mid-Band (80 dB)	4	5 ms	4 s	2 s	High	+20 dB
ASTM2235	100 Hz	5.0 kHz	10	1/3 octave	Mid-Band (80 dB)	5	5 ms	4 s	2 s	High	+20 dB

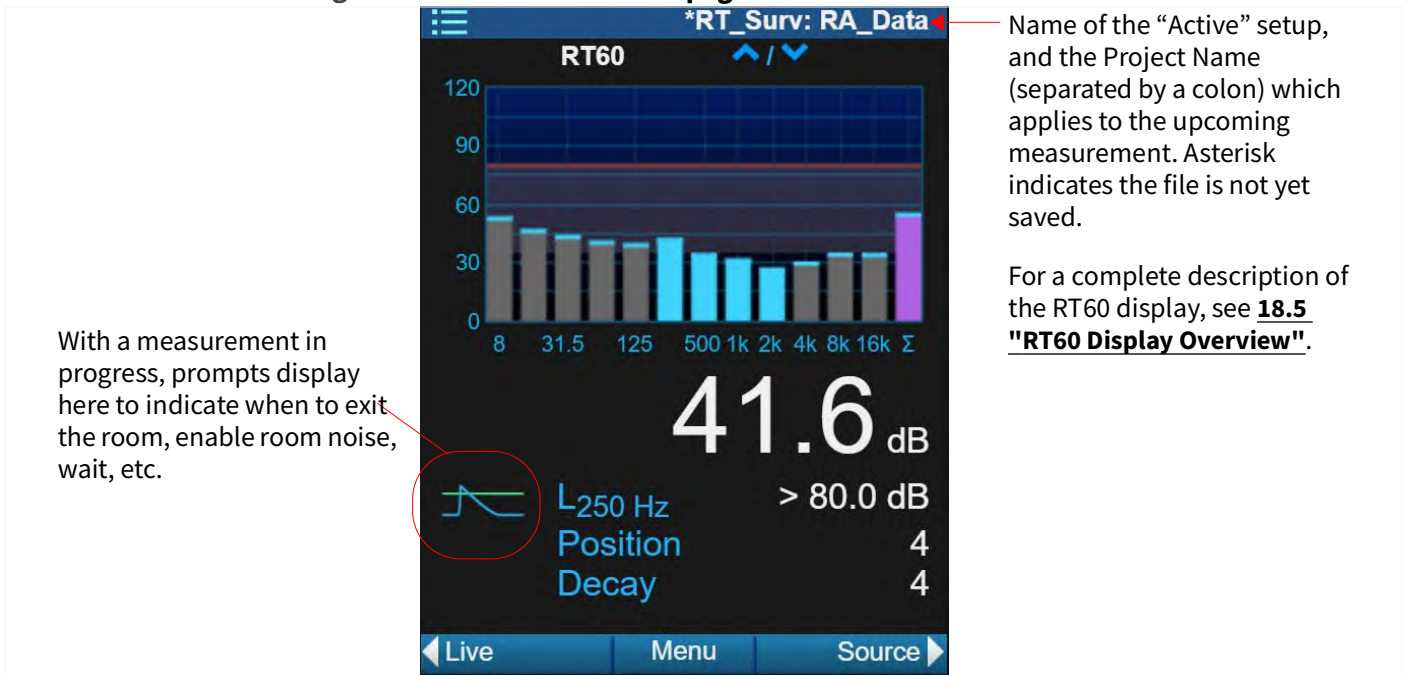
Table 18.4 Impulse Response Method Prepared Setup Parameters

Setup Name	Filter		Exit Time	Band-width	Trigger Source/Level	Decays	Sample Period	Max Run	OBA Range	Gain
	Low	High								
RT_Surv	250 Hz	2.0 kHz	10	1/1 octave	2.0 kHz (80 dB)	1	5 ms	4 s	High	0 dB

- Step 2.** Set your chosen Setup as “Active” on the 831C.
- a. On the 831C, choose **Tools**  → **Setup Manager**.
 - b. Highlight your chosen Setup in the Setup Manager list and press **Enter** .
 - c. In the Menu that opens, select **Set to Active**, and press **Enter** .
 - d. Press **Close** .

- Step 3.** From the 831C Live screen, press the right softkey (○◻●) to view the RT60 Status screen, which displays the name of the active setup in the top menu bar, as shown in *Figure 18-2*.

Figure 18-2 831C RT60 Status page



18.2.2 Creating an RT60 Setup for Interrupted Noise Method

In this section, follow the suggested steps to review or customize a prepared RT setup file utilizing the Interrupted Noise method. There are three quick start setups prepared for Interrupted Noise method measurements on the 831C in RA Mode. They're named for the measurement grade which they produce (See *Figure 18-1*). To edit or examine a prepared setup, complete this section. To use a prepared setup as is, skip to [18.4 Making the RT60 Measurement](#).

- Step 1.** On the 831C, go to **Tools** (🔧) → **Setup Manager**.
- Step 2.** Highlight **Default RT** in the Setup Manager list and press **Enter** (ENTER).
- Step 3.** In the pop-up menu that opens, select **Save As**, enter a unique name, and press **Enter** (ENTER).
- Step 4.** In the Setup Manager list, highlight the setup you just saved, and press the **right softkey** (○◻●) to set preferences on the **General** tab.
- Step 5.** Select values or enter parameters as needed for the following settings on the **General** tab:
- **Default Data File:** The name you enter here is a prefix for each data file generated when using this Setup

- **Measurement Description:** Enter measurement characteristics, such as occupancy and ambient temperature. This can also be easily managed in G4 after the measurement is downloaded.

Step 6. Press the **right softkey** (○○●) to view the RT60 tab, and select or enter values for the following settings:

- **Bandwidth**
Select “1/1”, or “1/3” octave
- **Method**
Select “Interrupted”
- **Trigger Source**
 - Select “Z”-weighting, “Mid Band” Frequencies, or a specific frequency

Mid Band Frequencies	
1/1 Octave	500 Hz, 1 kHz, 2 kHz
1/3 Octave	400 Hz, 500 Hz, 630 Hz, 800 Hz, 1 kHz, 1.25 kHz, 2.6 kHz

- **Trigger Level**
Enter the SPL in decibels that triggers the measurement start
- Number of **Decays** to record
When in question, refer to the standard, which specifies the number of required decays for each measurement grade.

Step 7. Press the **right softkey** (○○●) to view the RT60 Advanced tab.

Step 8. On the **RT60 Advanced** tab, select or enter values for the following settings:

- **Sample Period**
The length of each measured data point.
- **Max Run Time**
The length of time (in seconds) the meter collects data per decay after the trigger. The meter stores the data collected for that decay.
TAKE NOTE For measurements with many positions and mic/noise source combinations, we recommend a shorter Max Run Time.
- **Build Time**
The amount of time you allow for a noise generator to fill the room before beginning the measurement. Note: When utilizing the 831C internal noise generator, if the trigger level is not exceeded by the end of the Build Time, the noise generator stops.
- **OBA Range**
Choose the range (Normal/High) that best matches the levels produced by your noise generator and noise floor.
- **+20 dB Gain**
Select this option to amplify the signal entering the microphone.

Step 9. If you plan to use the 831C internal noise generator, press the **right softkey** (○○●) to view the Source tab. Otherwise, move to step 11.

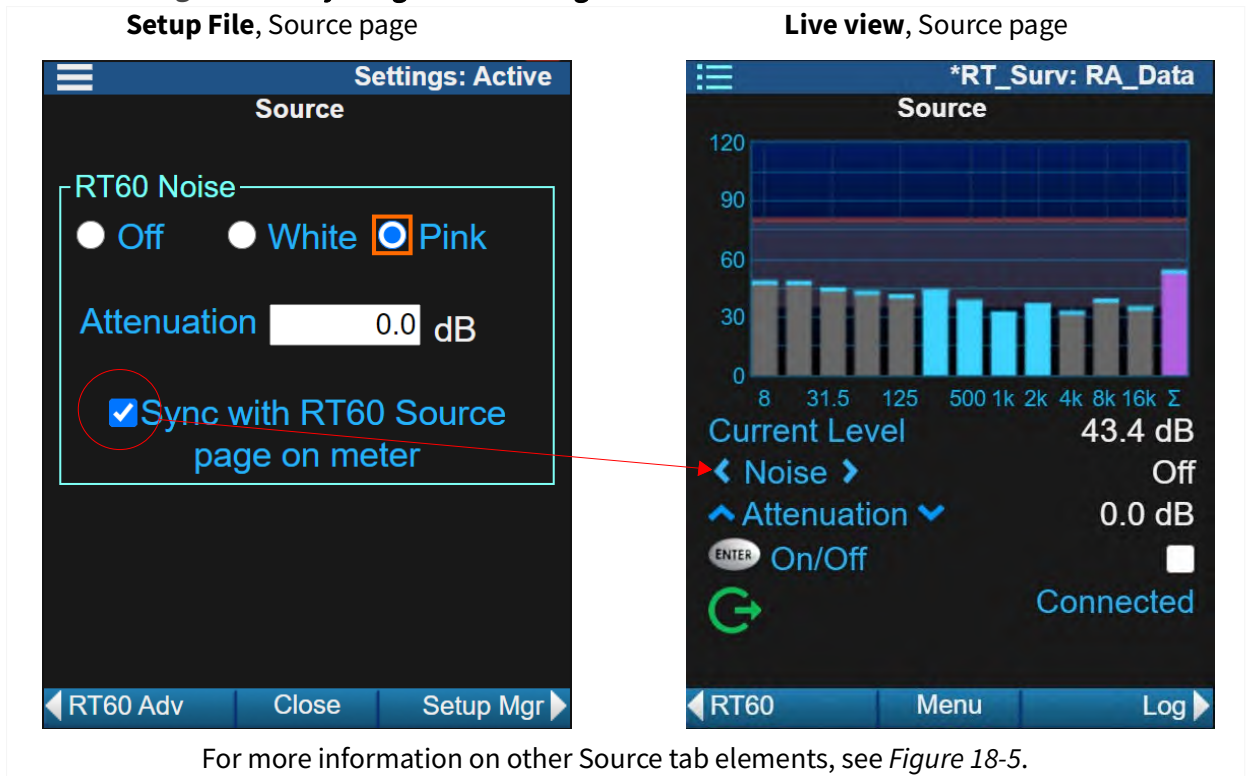
Step 10. Select values for the following settings on the **Source** tab:

- **RT60 Noise**
 - **Off:** Disables the 831C internal noise generator. Select this option when using an external noise generator.
 - **White:** Noise generated with equal energy per frequency by the 831C internal noise generator. When the 831C noise generator is enabled, the meter automatically coordinates the noise with the measurement.
 - **Pink:** Noise generated with equal energy per octave by the 831C internal noise generator. When the 831C noise generator is enabled, the meter automatically coordinates the noise with the measurement.
- **Attenuation**

If desired, enter a value in dB to adjust the 831C noise generator output.
- **Sync with RT60 Source page on meter**

When this option is enabled, you may edit the noise generator settings directly on the Live view→Source tab, as shown in *Figure 18-3*.

Figure 18-3 Syncing source settings with the Live Source tab




For more information on other Source tab elements, see *Figure 18-5*.

Step 11. Press the **middle softkey** (○●○) to **Close**, and then **Save** the Setup file.

Step 12. Move to **18.4 Making the RT60 Measurement**.

18.2.3 Creating an RT60 Setup for Impulse Response Method

Step 1. On the 831C, go to **Tools**  → **Setup Manager**.










Step 2. Highlight the RT setup **RT_Surv** in the Setup Manager list, then press **Enter** .

Figure 18-4 Setup Manager List, RT60 Impulse Setup File

	Default	RT
	ASTM2235	RT
	RT_Surv	RT
	RT_Prec	RT
	DefaultMod	SLM

“RT_Surv” is a quick start Setup file prepared for Impulse method measurements when using the 831C in RA Mode.

- Step 3.** In the pop-up menu that opens, select **Save As**, enter a unique name, and press **Enter** .
- Step 4.** In the Setup Manager list, highlight the setup you just saved, and press the **right softkey** () to set preferences on the **General** tab.
- Step 5.** Select values or enter parameters as needed for the following settings on the **General** tab:
- **Project Name**
Text entered here is a prefix for each data file generated when using this Setup.
 - **Lowest Filter**
From the drop-down menu, select the lowest frequency you want to include in the measurement.
 - **Highest Filter**
From the drop-down menu, select the highest frequency you want to include in the measurement.
 - **Measurement Description**
Enter measurement characteristics, such as occupancy and ambient temperature. This can also be easily managed in G4 after the measurement is downloaded.
- Step 6.** Press the **right softkey** () to view the **RT60** tab, and select or enter values for the following settings:
- **Bandwidth**
Select “1/1”
 - **Method**
Select “Impulse”
 - **Trigger Source**
From the drop-down menu, select the frequency value or category, which should begin the measurement.
 - **Trigger Level**
Enter the value in dB at which the measurement should be triggered.
 - **Decays**
Enter “1” for Impulse. Optionally, you may enter “2” and choose to Exclude a lesser quality decay.
- Step 7.** On the **RT60 Advanced** tab, select or enter values for the following settings:
- **Sample Period**
The length of time between each successive sample of full octave or one-third octave data.
 - **Max Run Time**
Set the max measurement time in seconds to collect data for each decay.

- **OBA Range**
Choose the range (Normal/High) which best matches the levels produced by your noise generator and noise floor.
- **+20 dB Gain**
Selecting this option amplifies the signal entering the microphone.

Step 8. Press the **middle softkey** (○●○) to **Close**, and then **Save** the Setup file.

Step 9. Move to **18.4 Making the RT60 Measurement.**

18.3 Preparing Noise Generation Equipment

The following noise generation equipment is available from Larson Davis.com:

External Noise Generator Equipment

- (Preferred solution) Omnidirectional sound source (BAS001) with power amplifier (BAS002) and optional tripod (TRP023)
- Directional sound source (BAS003) with power amplifier (BAS002)
- Accessory cables, for example: CBL180 (AC out to BNC), CBL181 (BNC to BNC), CBL182 (speaker cable)

831C Internal Noise Generator


- When enabled in the setup file, the 831C integrates the on-board internal noise generator with the meter measurement.

Impulse Noise Generator

- Impulsive sound source/clapper (BAS006)

Before you begin:

- Noise generation equipment from Larson Davis meets the requirements of ISO 3382 for RT measurements. See section 4.2.2 of ISO 3382-1 to verify compliance of noise generation equipment from other sources. For complete information, go to LarsonDavis.com and enter "Sound Sources" in the search bar.
- Gather cables, tripods and other accessories.

Step 1. Enable RA Mode on the 831C. To do this, select **Tools** , and choose **RA Mode** from the menu. When the switch is complete, "RA_Data" displays in the top right of the menu bar.

Step 2. Calibrate the microphone and preamplifier as shown in **5.3 Reviewing the Calibration Settings** and **5.4 Calibrating Your SoundAdvisor 831C.**

Step 3. Prepare your noise generator as directed in **"For Interrupted Noise Method:"** or **"For Impulse Response Method"**.

For Interrupted Noise Method:

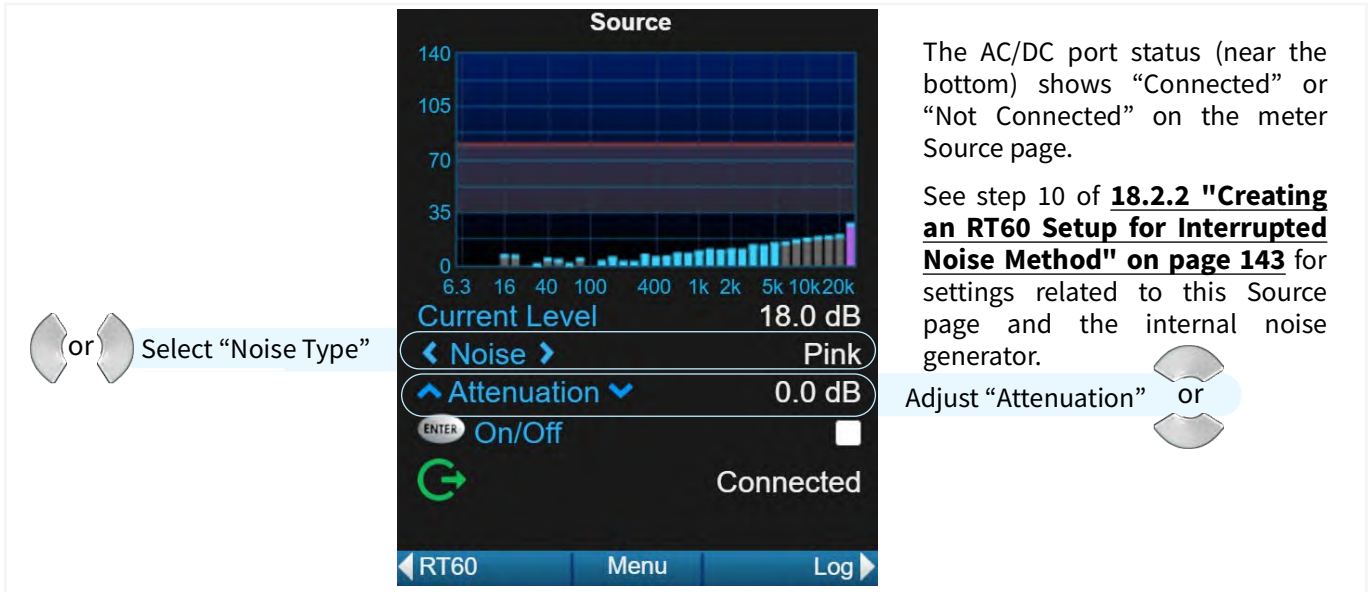
- a. Position, connect cables, and power on all external noise equipment.

To use the 831C Internal Noise Generator, do the following:

- Connect the 831C internal noise generator to a power amplifier, or speaker system in the room via the AC/DC port (bottom). To do this, use an AC out to BNC cable, such as CBL180 from Larson Davis.

- From the 831C Live page, press the right softkey (○●○) until the **Source** page displays. See *Figure 18-5* to verify the connection.

Figure 18-5 831C Source page



For Impulse Response Method

- Prepare impulse noise generation equipment according to manufacturer's direction.

18.4 Making the RT60 Measurement

Before you begin:

- Configure your meter storage preferences as shown in **8.1 Setting Data File Storage Preferences**
- (Optional) Connecting to the 831C via the LD Atlas on a mobile device enables you to see what's happening on the meter while you're out of the room. For more information, see **3.2.2 "Operating the 831C from the LD Atlas App" on page 27**.

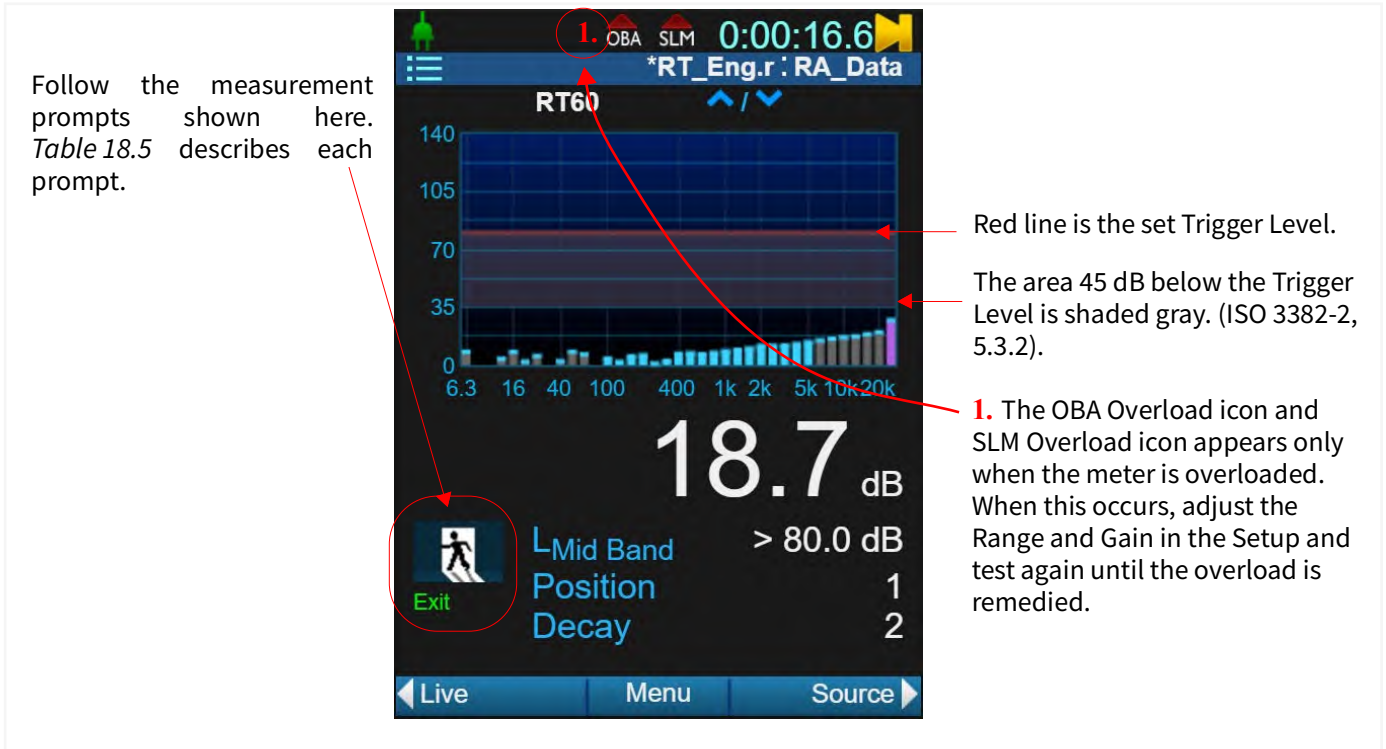
Step 1.

- Press **Menu** (○●○) → choose **Setup Manager**.
- Highlight the RT setup prepared for this measurement and press **Enter** (ENTER).
- In the pop-up menu, press **Enter** (ENTER) to select **Set to Active**.
- Press **Close** (○●○) to close the Setup Manager.

Step 2.

Position the 831C in the room, press (○●○) to view the RT60 page, and press **Run** (▶/||).

Figure 18-6 RT60 Status page and measurement prompt



Step 3. Measurement prompts in the lower left indicate when to exit the room, activate a noise generator, etc. during the run. Follow the measurement prompts in the lower left of the meter display, which indicate when to exit the room, activate a noise generator, etc. during the run. Table 18.5 explains each prompt.

Table 18.5 RT60 Measurement Prompts





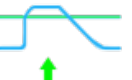


Measurement Prompt	Indication	Period Shown
Exit 	Exit the room and enable the noise generator if applicable.	Selectable by Exit Time saved in the setup file
Pre-trigger 	<ul style="list-style-type: none"> Pre-trigger prompt displays when 831C fills the pre-trigger buffer 	Until the pre-trigger buffer is full
Ready for Signal 	<ul style="list-style-type: none"> Ready prompt displays when the meter is ready for room noise  Flashing Stop/Store button cues you to activate the noise generator in the room. For Interrupted Noise: do not stop the noise source until this button stops flashing. When enabled in the Setup, 831C internal noise generator begins automatically 	For Interrupted Noise when utilizing the 831C internal noise generator: if the Trigger Level is not reached during the Build Time, the internal noise generator quiets after the Build Time + 10 seconds.
Valid (Interrupted method only) 	<ul style="list-style-type: none"> Valid prompt indicates the room has been successfully energized When enabled in the Setup, the 831C internal noise generator automatically stops 	After Build Time is successfully complete and while noise is being monitored for Trigger conditions

Table 18.5 RT60 Measurement Prompts (Continued)

Measurement Prompt	Indication	Period Shown
Triggered 	<ul style="list-style-type: none"> • (Interrupted) Trigger prompt displays when the source level has dropped 5 dB below the Trigger Level; the measurement is triggered • (Impulse) the source level is > the Trigger Level 	Selectable by Max Run Time in the setup file.
Complete 	<ul style="list-style-type: none"> • The decay is measured and the decay count increments; when all designated decays are complete, the position count increments. 	N/A

Step 4. Reposition the microphone or noise source and repeat steps 2–3 until the desired accuracy grade is achieved or until the RT60 tab displays the complete number of **Positions** and **Decays** for the project.

Step 5. Evaluate the measurement and apply **Best Practices for SoundAdvisor™ 831C RT60 Measurements.**

Best Practices for SoundAdvisor™ 831C RT60 Measurements

- Make sure the exit time is long enough to allow egress and any residual noise to subside
- Silence your cell phone and remove other possible sources of sound contamination
- Minimize the ambient noise in the room by turning off HVAC and other mechanical equipment
- Close doors, windows, and partitions to reduce reverberant energy from adjoining areas
- Use a noise generator/source with repeatable amplitude and spectral content
- Configure the instrument to take a few more decays than what is required. This allows you to choose the best samples for final inclusion. See **18.4.1 "Excluding a Decay from the Ensemble" on page 151** to learn more about excluding a decay with unexpected noise on the meter or in G4.
- For interrupted noise method measurements, (1) make a few trial runs to observe how loud the noise source should be. (2) Set the noise source output. For Interrupted Method only: the output level must be above the trigger level for a specific duration known as “Build Time” in the setup file. You may want to adjust this setting, the noise output, or both. (3) In the setup file, configure the 831C “Range” and “Gain” such that when the noise source is present the meter does not overload. (4) In the setup file, set the “Trigger Level” at or just below the maximum source level.
- Energize the room sufficiently. This may require multiple sound sources and measurements to characterize the decay times over the full desired spectrum.
- Take measurements with many microphone/noise source positions to improve the ensemble uncertainty (change quality indicators from Poor/Fair to Good). To review the minimum number of positions required to achieve a certain measurement grade, see *Table 18.2 on page 140*.
- Minimize obstructions in the subject room (see ISO 3382-2:2008(E) Section 4.1)

LEARN MORE For more information on this topic, see **9.4.1 "Selecting a Microphone Correction"**.

18.4.1 Excluding a Decay from the Ensemble

For an unsaved data file, when the 831C display is showing data for an individual decay, you may exclude the current decay from the overall ensemble average as shown in this section. All frequencies for the selected decay are then excluded from the ensemble calculation. This is helpful, for example, when a decay contains unwanted noise.

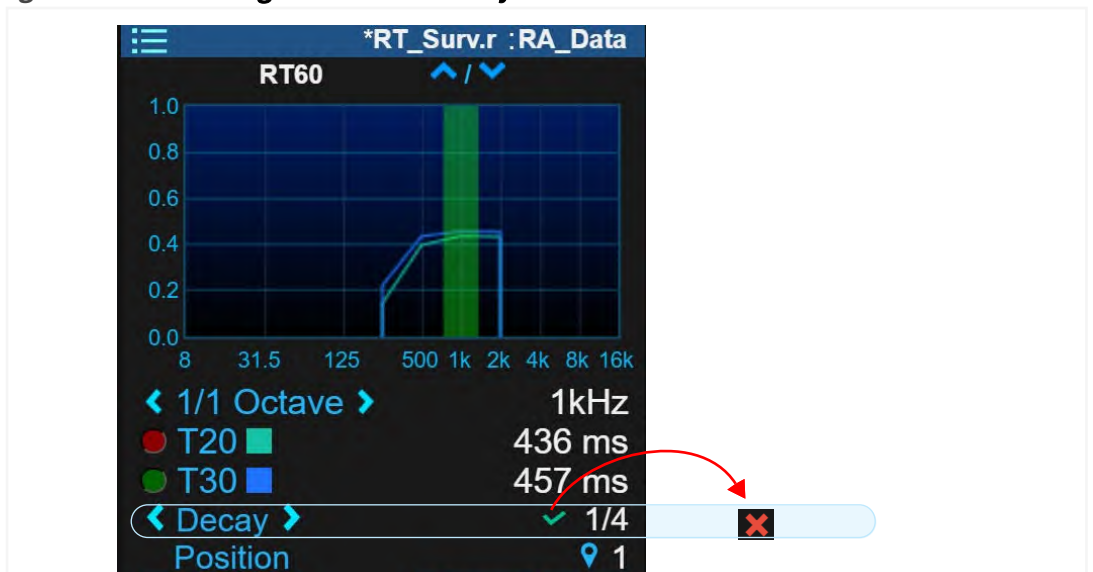
TAKE NOTE Once the file has been stored, it can't be edited on the 831C. So, to include or exclude decays from a saved file, open it in G4 LD Utility.

Step 1. Press **ENTER** to select the “Decay” line, and press **←** or **→** to select the decay number you want to exclude.

Step 2. Press **○●○** **Menu**→**Exclude**. The green check changes to a red X as shown in *Figure 18-7*.

Step 3. When applicable, tap the red X to include the excluded decay again.

Figure 18-7 Excluding the selected Decay



RT60 Quality Indicators and Reducing Measurement Uncertainty

The SoundAdvisor 831C quality indicators and ratings (Poor, Fair, Good) as described in *Table 18.6* are adapted from measurement procedures described in ISO 3382-1(2009), ISO 3382-2(2008) and application engineering recommendations for the 831C SLM. Suggestions in the table may help you determine the quality of your measurement or how to improve it.

Table 18.6 Quality Indicators and Reducing Measurement Uncertainty

Quality Indicator	Description
BT Bandwidth- Time Product	BT is the product of the filter bandwidth and the T20 or T30 decay time for that frequency. Good verifies that the measured decay is acoustic and not of the instrumentation. For very short reverberation times, Poor may indicate the reverberation time might have been influenced by the bandpass filter (ISO 3382-2:2008, 7.3, equation 4). See also <i>Table A-18, “OBA Filter Residual Decay Times”</i> .
Poor	≤ 16
Fair	N/A
Good	> 16

Table 18.6 (Continued) Quality Indicators and Reducing Measurement Uncertainty





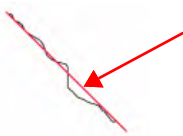








Quality Indicator	Description	
<p>BK Background Noise Level</p>	<p>BK is the difference between the signal used to energize the room and the background noise. (ISO 3382-2:2008, Sections 5.2.1 and 5.3.2). An indication of how sufficiently the room was energized above the background noise level.</p>	
	<p> Poor</p>	<p>Signal – Bkgd noise < 35 dB (T20) Signal – Bkgd noise < 45 dB (T30) Increase noise generator output, quiet mechanical room noise, exclude decays with circumstantial or situational noise, etc.</p>
	<p> Fair</p>	<p>N/A</p>
	<p> Good</p>	<p>Signal – Bkgd noise ≥ 35 dB (T20) Signal – Bkgd noise ≥ 45 dB (T30)</p>
<p>NL Non-Linearity</p>	<p>NL is the measurement of how well the decay follows a straight line. Non-linearity is reported as per mille ‰ (parts per thousand) deviation from zero or perfect linearity for T20 and T30 (ISO 3382-2:2008, Annex B.2).</p>	
	<p> Poor</p>	<p>> 10‰ deviation between the Decay Curve and the Regression Line Example:  Examine this position in the room further. Non-linear results are not always an indication of a poor measurement, but it may be the result of reverberations off of acoustic ceiling tiles, coupled spaces, etc. Follow best practices recommended in your chosen standard. Ensemble averages typically reduce non-linear responses from abnormal causes.</p>
	<p> Fair</p>	<p>> 5‰ but ≤ 10‰ deviation between the Decay Curve and the Regression Line</p>
	<p> Good</p>	<p>≤ 5‰ deviation</p>
<p>Cu Curvature</p>	<p>The ratio of T30 to T20 decay times expressed as a percentage (ISO 3382-2:2008, Annex B.2). When the T20 and T30 decays times are the same, the Curvature is 0%.</p>	
	<p> Poor</p>	<p>The ratio of T30 to T20 values as a percent is >10%. The graph of this type of decay may show the T20 or T30 lines intercepting the x-axis (time domain) at very different times. Rather than indicating a poor measurement, it may instead be the result of reverberations off acoustic ceiling tiles, coupled spaces, etc. Follow best practices recommended in your chosen standard.</p>
	<p> Fair</p>	<p>> 5% but ≤ 10% ratio for T30 to T20</p>
	<p> Good</p>	<p>≥ 0% but ≤ 5% ratio for T30 to T20. A negative value may indicate a measurement error.</p>
<p>SD Standard Deviation</p>	<p>SD is an estimate of uncertainty due to the number of averages used to calculate T60. The deviation decreases as the number of decays and positions increases. The 831C reports SD/RT as a percentage. See ISO 3382-2:2008, section 7.2 for calculation details.</p>	

Table 18.6 (Continued) Quality Indicators and Reducing Measurement Uncertainty

Quality Indicator		Description
 Poor		> 10%
 Fair		5% < SD ≤ 10%
 Good		≤ 5%

18.5 RT60 Display Overview

Two display areas are reviewed in this section: The 831C meter display provides feedback on the meter's state, the current levels, and RT60 metrics. This display is described in section [18.5.1](#). Immediately following a measurement or when opening a measurement file on the meter, the data display provides measurement metrics, decay curve graphs, and other details. This display is described in section [18.5.2](#).

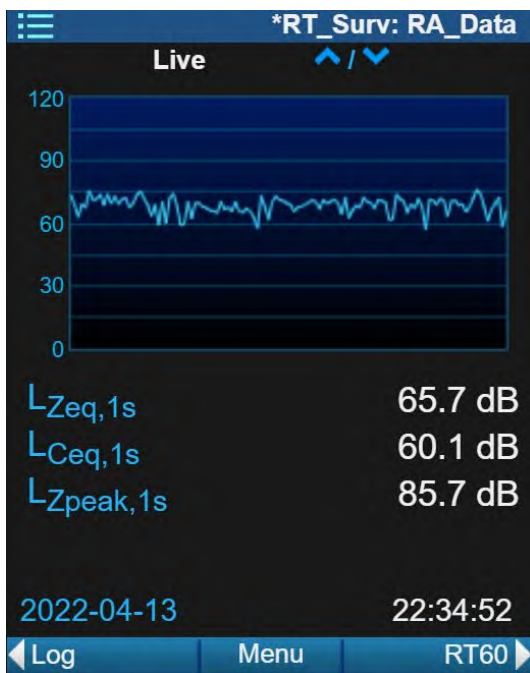
18.5.1 831C Meter Display for RT60

This section provides an overview of the Live, RT60, Source, and Session Log tabs for the 831C in RA mode.

Figure 18-8 Meter Live, and RT60 Tabs

The RT60 Live tab shows the metrics shown here.

Current RT60 measurement status including measurement prompts. For a detailed description of each page on this tab, see **18.5.2 831C Data Display for RT60**.



Press the right softkey (○○●) to view the RT60 tab.

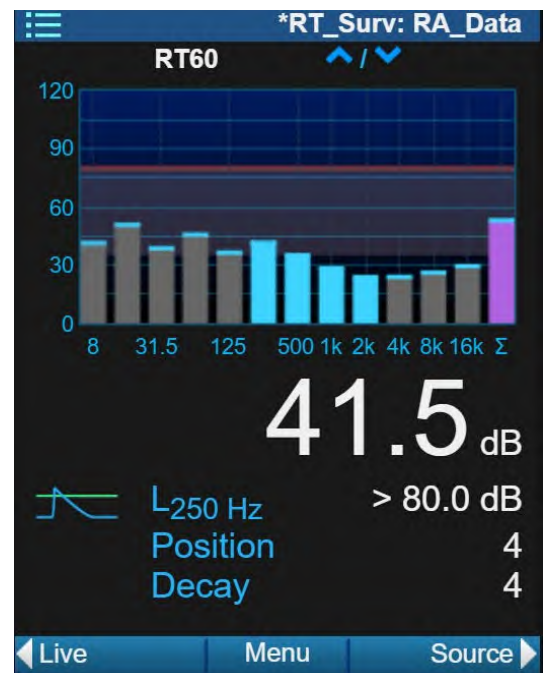
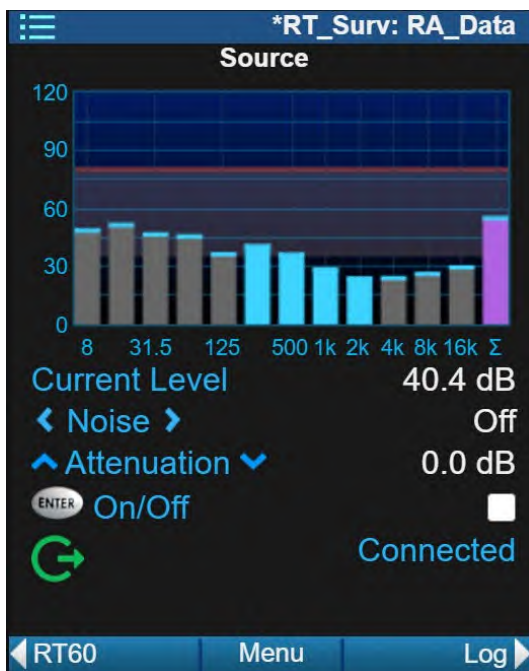


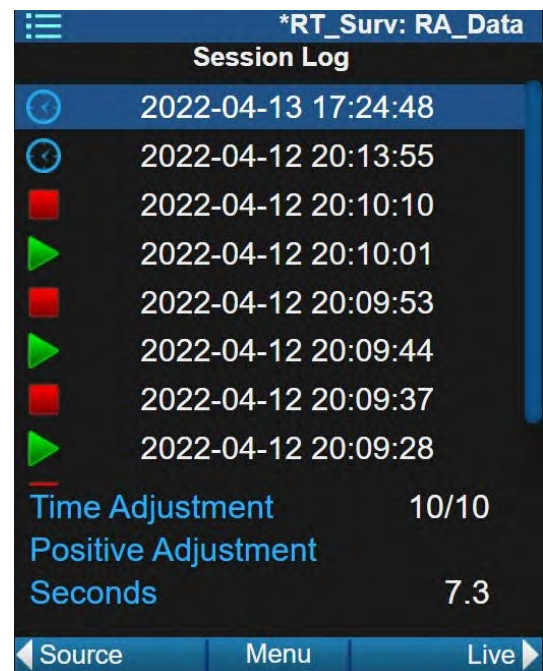
Figure 18-9 Meter RT60 Source, and Session Log Tabs

Current noise generator source status. This tab shows these display elements when the 831C internal noise generator is enabled.

Much like SLM mode, the RT60 Session Log tab shows the metrics shown here. For a complete list of session log items, see **4.1.4 Understanding the Session Log Tab**.



Press the right softkey (○○●) to view the Session Log tab.



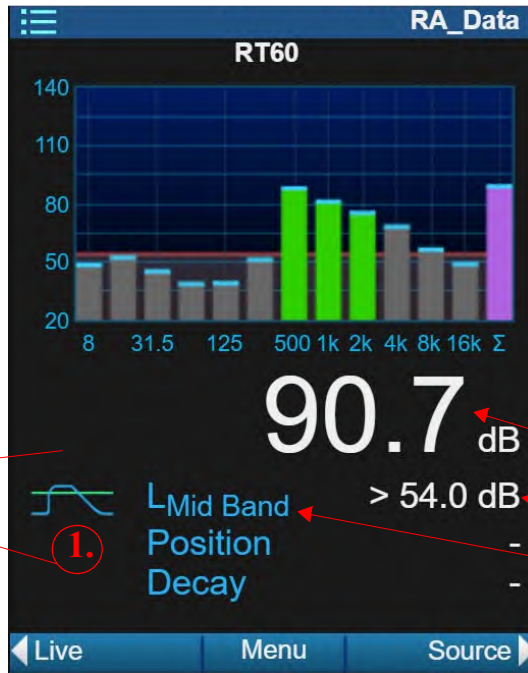
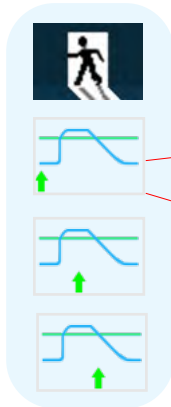
The Session Log is the final Meter tab on the 831C.

18.5.2 831C Data Display for RT60

Immediately following a measurement and prior to storing the file, the RT60 tab data pages on the SoundAdvisor™ 831C display as shown in this section.

Figure 18-10 RT60 Status Page

1. The RT60 Status page shows the status of the measurement. Prompts in the bottom left help you coordinate noise generation and quiet as the meter takes the measurement. See *Table 18.5 on page 149* for additional details.



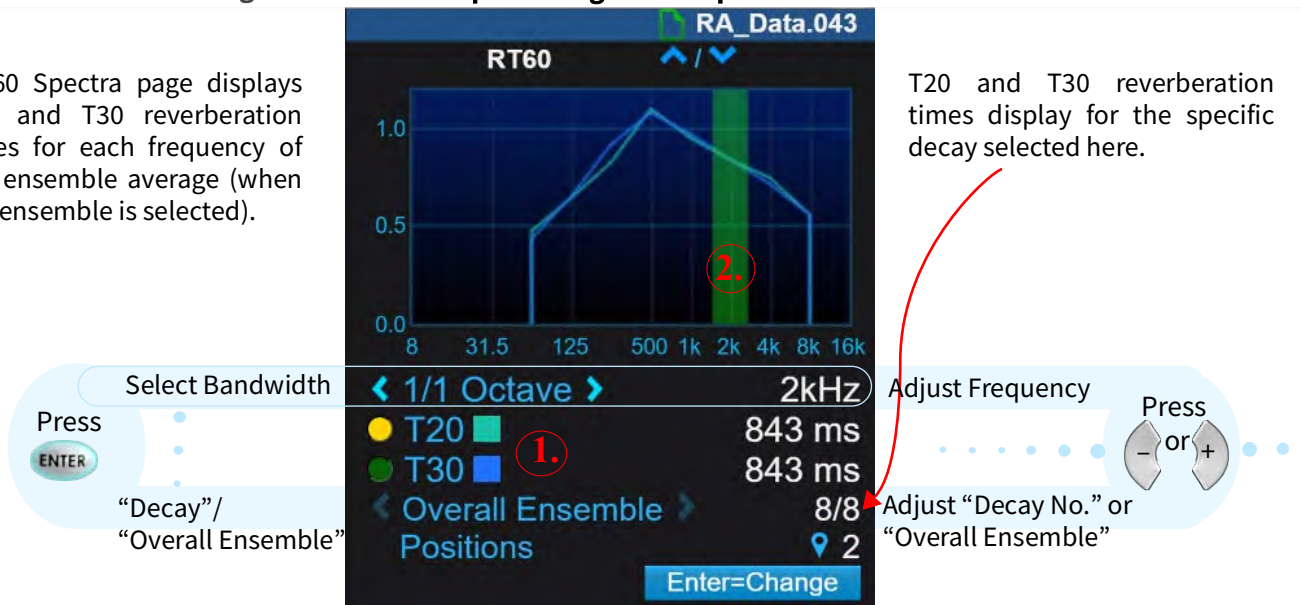
During the measurement, the display metrics are as follows:

- L_{eq} of the Trigger source
- Trigger Level
- Trigger Source

Press the down navigation button to the next page.

Figure 18-11 RT60 Spectra Page-Interrupted Method

RT-60 Spectra page displays T20 and T30 reverberation times for each frequency of the ensemble average (when the ensemble is selected).



T20 and T30 reverberation times display for the specific decay selected here.

1. Quality indicators display to the left of T20 and T30 values to show the degree of measurement uncertainty: Good (green circle), Fair (yellow circle), Poor (red circle).

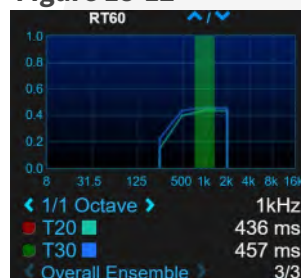
For more information see the section titled, **RT60 Quality Indicators and Reducing Measurement Uncertainty.**

Both T20 (green in the graph) and T30 (blue in the graph) display when data is able to be sampled. When data is inadequate for the selected frequency, the T value is “---”.

2. The graph selection bar shows the current octave frequency in the graph and is the color of the worst quality indicator for T30 (Good in this case). When T30 value isn’t available, T20 is shown when available.

Figure 18-12 is an example of the same Spectra page as above, but for an Impulse Method measurement.

Figure 18-12

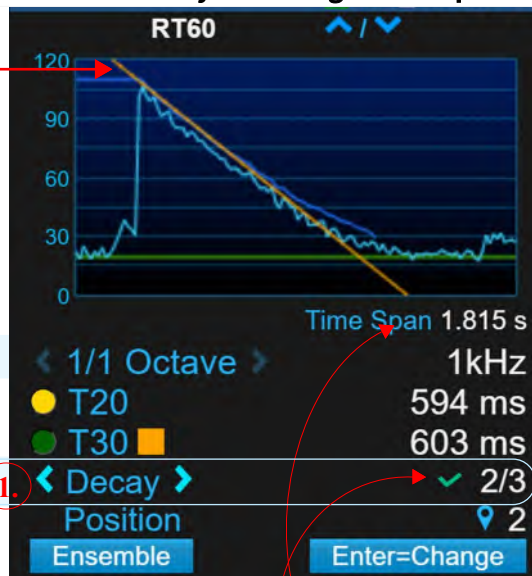


Navigate this display in the same way. The green bar highlights the selected frequency and is the color of the worst quality indicator.

Press the down navigation button to the next page.

Figure 18-13 RT60 Decay Curve Page-Interrupted Method

Regression Line (orange) for T30 decay curve.



The decay curve page allows you to examine or compare decays taken from each position. As shown below, this decay curve here is the second of three decays measured for Position 2.

Select "Octave"
Press ENTER

Select "Decay" 1.

Adjust Frequency

Press - or +

Adjust "Decay No." or "Overall Ensemble"

1. "Decay" is currently selected, and the graph shows the first of two decays taken for Position 1. Press \leftarrow to display the next decays and the Overall Ensemble decay for the current frequency.

To examine decays from another octave or frequency, press **Enter** to toggle blue selection arrows to "1/3 Octave," then press \leftarrow or \rightarrow to choose a frequency.

3. Time Span is the period of time shown in the graph window. The time span of each decay varies.

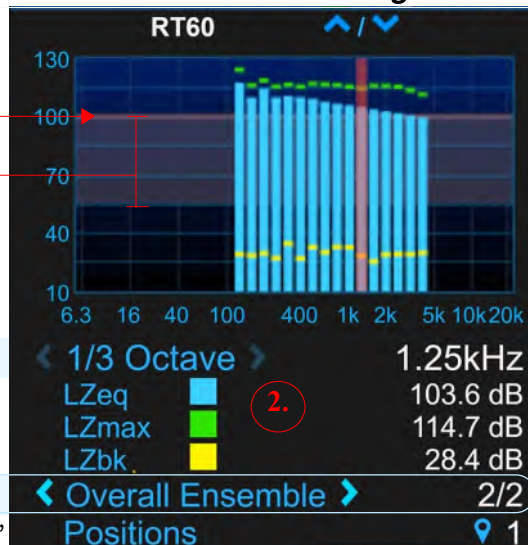
4. When "Decay" is selected, a green check mark shows it is included in the overall ensemble. To exclude a decay with unwanted noise, press $\left(\bullet\bullet\bullet\right)$ **Menu** \rightarrow **Exclude**. A red X would indicate that the selected decay is excluded from the overall ensemble calculation.

Press the down navigation button $\left(\cap\right)$ to the next page.

Figure 18-14 RT60 Excitation Levels Page

1. Trigger Level

Shaded area is Trigger Level- 45 dB



1. The Excitation Levels page is ideal for testing when the room is sufficiently energized to trigger the measurement and provide the appropriate signal-to-noise ratio for a T30 calculation.

Select "Octave"
Press ENTER

"Decay"/
"Overall Ensemble"

Adjust Frequency

Press - or +

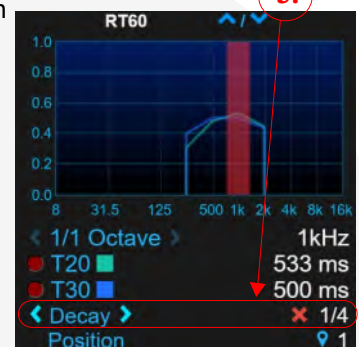
Adjust "Decay No." or "Overall Ensemble"

2. The excitation levels page shows the equivalent (■), maximum (■), and background noise (■) for all frequency bands of the ensemble when "Overall Ensemble" is selected in blue arrows, or for an individual decay when "Decay" is selected.

- L_{Zeq} is computed as the L_{eq} between the initial exceedance of the trigger level to when the signal falls below the trigger level minus 5 dB
- L_{Zmax} is the maximum value of the collected decay data
- L_{Zbk} is the background level measured for this frequency at this position

3. Figure 18-15 shows "Decay" is selected. A green check mark indicates the decay is included in the overall ensemble. To exclude a decay with unwanted noise, press $\left(\bullet\bullet\bullet\right)$ **Menu** \rightarrow **Exclude**. A red X indicates the selected Decay 1 of 4 has been excluded from the overall ensemble calculations. See [18.4.1 Excluding a Decay from the Ensemble](#).

Figure 18-15



Press the down navigation button $\left(\cap\right)$ to the next page.

Figure 18-16 Quality Summary

The Quality Summary page displays RT60 values and quality indicators for all frequencies between the highest and lowest filter chosen in the Setup. For 1/3 Octave measurements, these details span two pages.

Hz	RT60 (s)	BT	Bk	NL	Cu	SD
125	1.975	Green	Green	Red	Green	Red
160	0.137	Red	Green	Red	Red	Yellow
200	0.142	Red	Green	Red	Green	Green
250	0.109	Red	Green	Red	Green	Green
315	0.086	Red	Green	Red	Green	Green
400	0.030	Red	Green	Red	Green	Green
500	0.170	Green	Green	Red	Green	Green
630	0.246	Green	Green	Red	Green	Green
800	0.239	Green	Green	Red	Green	Green
1k	0.757	Green	Green	Red	Green	Yellow
1.25k	2.359	Green	Green	Red	Green	Yellow
1.6k	0.009	Red	Green	Red	Green	Green

RT60 Summary: < T20 T30 > (T20 selected)
 < Decay > (Decay selected, green checkmark)
 Position: 1/2 1 (Decay No. 1, Overall Ensemble 1)

1. Press **ENTER** to select T values

Select "Decay"/ "Overall Ensemble"

Choose T20/T30 Adjust "Decay No." or "Overall Ensemble"

Press - or +

1. Press **ENTER** to select the "T20, T30" line in blue arrows, then **ENTER** to toggle the quality summary for each. For more information on quality indicators, see **RT60 Quality Indicators and Reducing Measurement Uncertainty**.

2. When "Decay" is selected in blue arrows, a green check mark indicates this decay is included in the overall ensemble. To exclude a decay with unwanted noise, press **Menu** → **Exclude**. A red X indicates the decay has been excluded from the ensemble. See **18.4.1 Excluding a Decay from the Ensemble**.

Press the down navigation button to the next page.

Figure 18-17 Quality Detail Page

This display provides details on the quality indicators for the selected frequency. If a metric is classified as "Fair" or "Poor," the criteria for that metric is shown in the column on the right. For more information on these metrics, see **RT60 Quality Indicators and Reducing Measurement Uncertainty**.

RT60 Quality Detail Page: 1.25kHz

Adjust Frequency: 1.25kHz

1. Press **ENTER** to select "Octave" in blue arrows, then press **ENTER** or **ENTER** to change the frequency for which quality details are shown.

2. A green check indicates this decay is included in the overall ensemble. Alternatively, a red X indicates the decay has been excluded from the ensemble. For details on excluding a decay on the 831C, see **18.4.1 Excluding a Decay from the Ensemble**.

Adjust "Decay No." or "Overall Ensemble": 1/2 1

Press the down navigation button to the next page.

Figure 18-18 Accuracy Grade Page

The Accuracy Grade page compares the properties and settings you saved in the Setup with the properties and settings required to satisfy the Survey, Engineering, Precision grading criteria described in ISO 3382-2. This page may provide helpful feedback to verify appropriate setup of noise equipment and measurement properties prior to taking measurements in many positions.

RT60	
Estimated Grade	Setting conflict
Frequency Range	
Actual	125Hz - 4kHz
Required	100Hz - 5kHz
Positions	
Actual	1
Required	2
Decays/Position	
Actual	2
Required	1
Next Grade	Engineering
Frequency Range	100Hz - 5kHz
Positions	6
Decays/Position	2

The measurement shown here does not satisfy the Engineering grade criteria. In this situation, adjust the frequency range and make the measurement again with two or more positions.

The Accuracy Grade page is the final page in the 831C RT60 Data Display.

Module **19** FFT & Tonality Measurement

The SoundAdvisor™ 831C and the FFT and Tonality firmware option are used to determine the frequency content and tonality of the measured sound.

In FFT Mode, the 831C captures the waveforms of even complex sounds, computes the time and frequency domains, extracts peak frequencies and amplitudes, and applies chosen digital filters and data windowing preferences to produce the resulting data for view on the meter and in G4 LD Utility.

The 831C is also the instrument of choice for making an FFT measurement to assess the audibility of tones in the measured sound, according to international standards (ISO 1996-2, ISO PAS 20065).

This module provides an example procedure, which shows how to operate the SoundAdvisor™ 831C to make an FFT and Tonality measurement and analyze the resulting data on the meter. This process requires the SoundAdvisor 831C with firmware version 4.6 or newer, and the 831C FFT and Tonality option (831C-FFT) installed. All options and accessories shown here are available from Larson Davis.

Process Overview:

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19.1 Preparing the Equipment

Choose the section below that applies to your transducer to prepare and calibrate for a measurement. While you may use any transducer, this example shows how to select settings for a mic or an accelerometer. Selectable options for other transducers closely resemble one or the other of these.

You may also complete this process by using G4 LD Utility or the LD Atlas app for mobile.

In this section:

- [19.1.1 Preparing the Mic](#)
- [19.1.2 Preparing Other Transducers](#)

19.1.1 Preparing the Mic

When configured for an acoustic measurement, the SoundAdvisor® 831C¹ in FFT mode offers tonality computation according to ISO 1996 or ISO/PAS 20065, and data reporting in dB re 20 uPa, where the Integration feature is not available.

Supported Acoustic Hardware Configurations

Supported hardware configurations for acoustic measurements include:



- SoundAdvisor® Model 831C
- PRM831 preamplifier + microphone

OR




- SoundAdvisor® Model 831C
- Adapter ADP074: Switchcraft 5-pin to BNC adapter; max voltage is ± 8 Volts at the peak; available from www.pcb.com
- BNC cable
- 378 series ICP® preamplifier and microphone combination, such as 378B02 available from LarsonDavis.com

OR

- SoundAdvisor Model 831C
- Equivalent Switchcraft 5-pin to BNC adapter; max voltage of ± 8 Volts at the peak
- Equivalent CCP (IEPE) preamplifier and microphone combination

Step 1. Switch the meter from SLM Mode to FFT Mode. To do this, select **Tools** , and choose  **FFT Mode** from the drop-down menu.

Step 2. Select a **Transducer**:

- a. Select **Tools**  →  **Calibrate**.
- b. Press the **right softkey** () for **Settings**. This displays the Calibration Settings tab.
- c. For an acoustic measurement, select **Microphone** from the **Transducer** drop-down menu.

Step 3. Choose values for the model and sensitivity settings:

- a. Select the model from the **Microphone** drop-down menu.
- b. Enter the sensitivity for the **Nominal**, **Actual**, and **Self Noise**, then select **Save**.

TAKE NOTE This information can be found on the mic certification document that came with it.

1. SoundAdvisor and ICP are registered trademarks of PCB Piezotronics, Inc.

Step 4. Calibrate as shown in [5.3 Reviewing the Calibration Settings](#) and [5.4 Calibrating Your SoundAdvisor 831C](#).

Recommended Next Step:

- [19.2 Creating an FFT Setup File On the Meter](#)

19.1.2 Preparing Other Transducers

When configured for a vibration measurement by using any transducer other than a microphone, the 831C reports data in SI or Standard units for acceleration, velocity, or displacement, and the integration feature is available.

Supported Hardware Configurations

Recommended hardware configurations for vibration measurements include:

- SoundAdvisor^{®1} Model 831C
- Adapter ADP074
- PCB 003C10 series cable of appropriate length
- ICP^{®1} accelerometer, such as SEN024 (single axis, 10 mV/g) or SEN025 (single axis, 100 mV/g) Note: the maximum measurable frequency range for the 831C in FFT mode is 20 kHz.

Other supported hardware configurations for vibration measurements include:

- SoundAdvisor Model 831C
- Equivalent Switchcraft 5-pin to BNC electrical adapter
- Equivalent 10-32 to BNC coaxial cable of appropriate length
- Equivalent CCP (IEPE) electrical interface, single-axis accelerometer

For a complete selection of accelerometers and cables see www.pcb.com.

Before you begin:

- Obtain Adapter ADP074: a Switchcraft 5-pin to BNC adapter for use with the SoundAdvisor 831C and a compatible ICP (CCP) sensor. The maximum voltage for the adapter is ± 8 Volts at the peak. The adapter is available to order from www.pcb.com.
- Obtain the specified cable (see “Supported Hardware Configurations”).



Step 1. Insert the ADP074 5-pin connector into the top of the 831C.



1. SoundAdvisor and ICP are registered trademarks of PCB Piezotronics, Inc.

- Step 2.** Connect the cable end (BNC) to the ADP074 (BNC) and the cable end (10-32) to the accelerometer.




FIGURE 19-1 Example Connection: 831C, ADP074, Cable, and Accelerometer



- Step 3.** Switch the meter from SLM Mode to FFT Mode. To do this, select **Tools** , and choose  **FFT Mode** from the menu.

TAKE NOTE When you're ready to return to SLM mode, choose **Tools**  →  **SLM Mode**.

- Step 4.** Select the **Transducer** on the meter, as follows:

- a. Select **Tools**  →  **Calibrate**.
- b. Press the **right softkey** for **Settings** (). This displays the Calibration Settings tab.
- c. For a vibration measurement, select **Other** from the **Transducer** drop-down menu.
- d. Select **OK** to confirm that the frequency weighting should be changed to “Z.”

- Step 5.** On the Calibration Settings page, choose values for the Sensitivity settings, as follows:

- a. Enter the accelerometer **Sensitivity** and choose a **Sensitivity Unit** from the drop-down menu.

TAKE NOTE To set a custom unit of measure, choose **Custom** from the **Sensitivity Units** drop-down menu, and enter the unit in the **Custom** field. The **Display Units** field reflects the custom unit of measure you entered in the Custom field.

- b. The **Display Units** field reflects your selection for **Sensitivity Units**, unless you make another selection.
- c. From the **y-Axis Scale** drop-down menu, select **Linear** or **Logarithmic**, then choose **Save**.

TAKE NOTE Linear chart label intervals are set by using a consistent interval. Logarithmic chart labels are displayed in Base 10 format. Choose this scale to show large (exponential) fluctuations or very small values.

- d. Click **Save**.


19.2 Creating an FFT Setup File On the Meter

In this section, save the measurement properties, Auto-Store preference, and meter run preferences in a setup file, which can be used for your ISO-compliant FFT and Tonality measurements.

This section shows FFT-specific properties and settings and also refers you to portions of **Module 6 Creating a Measurement Setup** for non-FFT related settings. If you plan to measure tonality, this module also includes instructions for creating a measurement Setup file that's fully compliant with ISO 1996-2 or ISO/PAS 20065.

Before you begin:

- Configure your meter storage preferences as shown in **8.1 Setting Data File Storage Preferences**.
- Please note that any chosen **Mic Correction** settings (**Tools**→ **System Properties**→**Preferences**) are also applied in FFT Mode.

Step 1. On the 831C, go to **Tools**  → **Setup Manager**.


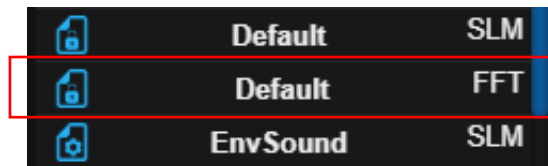


Step 2. Highlight the **Default** FFT Setup in the Setup Manager list, then press **Enter** .

FIGURE 19-2 Setup Manager List, Default FFT Setup File



Step 3. In the pop-up menu that opens, select **Save As**, enter a unique name, and press **Enter** .

Step 4. With the new FFT setup highlighted in the list, press the **right softkey** () to set preferences on the **General** tab.

Step 5. On the General tab, the **Default Data File** name you enter here is a prefix for each data file generated using this Setup.

Step 6. To create an ISO compliant measurement, use the **Measurement Description** field to enter a thorough description of the measurement site, transducer location, source location, etc., (See ISO 1996-2, section 12). This can also be easily managed in G4 after the measurement is downloaded.

Step 7. Press the **right softkey** () to set preferences on the FFT tab.

Step 8. On the FFT tab, choose a **Frequency Span**, which specifies the upper end of the frequency spectrum that should be sampled.

Step 9. From the **Lines** drop-down menu, choose the number of Lines of sampled data to be collected for each frequency.

Your selection for Frequency Span and Lines results in the Frequency Resolution. This is done by dividing your selection for frequency span by the number of Lines, sometimes called “bins.” The result is the bandwidth of each line (bin) in Hz/line or bin. Also, note that selecting a greater number of lines increases the FFT computation time.

TAKE NOTE For your selected frequency resolution, the SoundAdvisor 831C calculates the FFT measurement accurately to within 0.1 dB.

Sampled Data and the Windowing Function

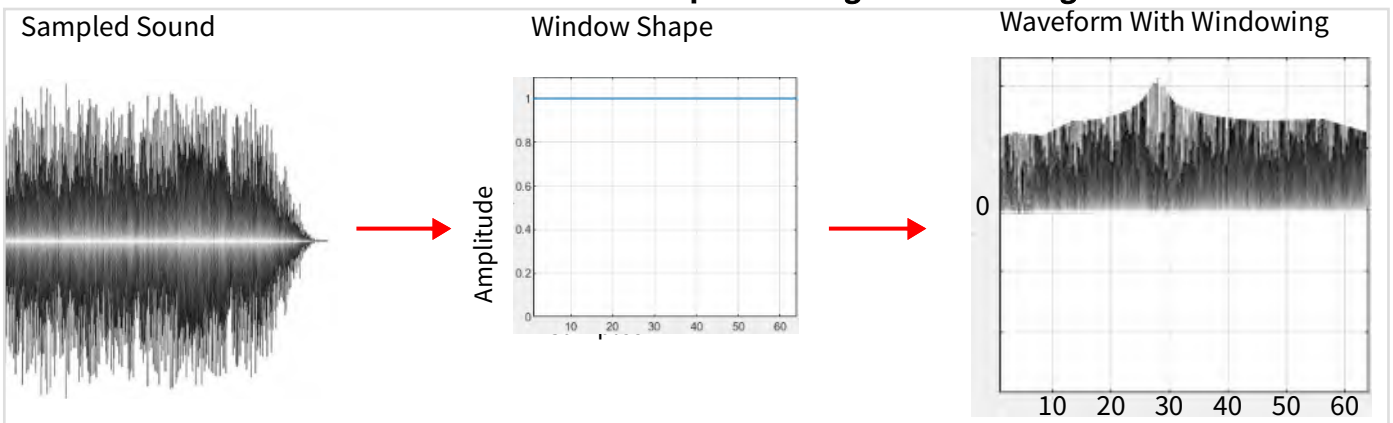
With fast Fourier transform mode, when the measured signal doesn't use up an even number of lines or when the number of lines is not a multiple of the sampling frequency, the resulting data "smears" into the adjacent lines. This results in additional high-frequency values that were not part of the original signal.

The Windowing function **helps** to account for this smeared data (Spectral Leakage) leading to a more accurate representation of the measured sound. It does this by zeroing the time domain function at the beginning and end of each record and by representing the wave form in an alternative sine wave format. See the following figures for more detail.

Step 10. Choose a **Window** method from the drop-down menu. The following options are available:

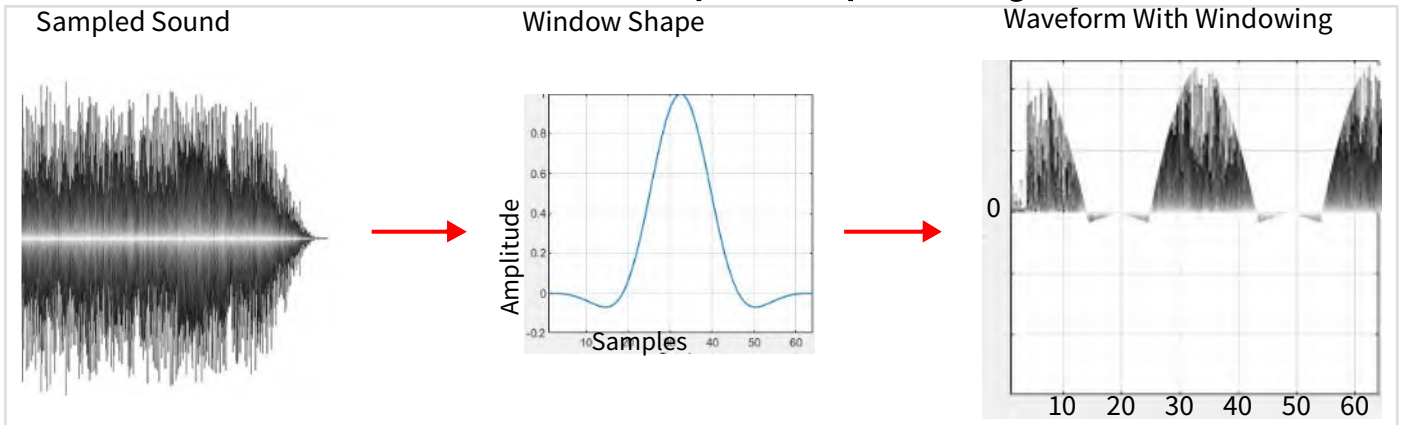
Rectangular: The windowing method distinguishes frequencies that are close together in the examined spectrum, but compromises on amplitude details. Use this method to view sounds within a particular spectrum.

FIGURE 19-3 Example- Rectangular Windowing



Flat Top: The Flat Top window shape descends below zero at the end of each time record and allows for wider-spaced peaks in the frequency domain. As a result, this method may more accurately show the true amplitude of peaks, but possibly with less detail in the signal overall.

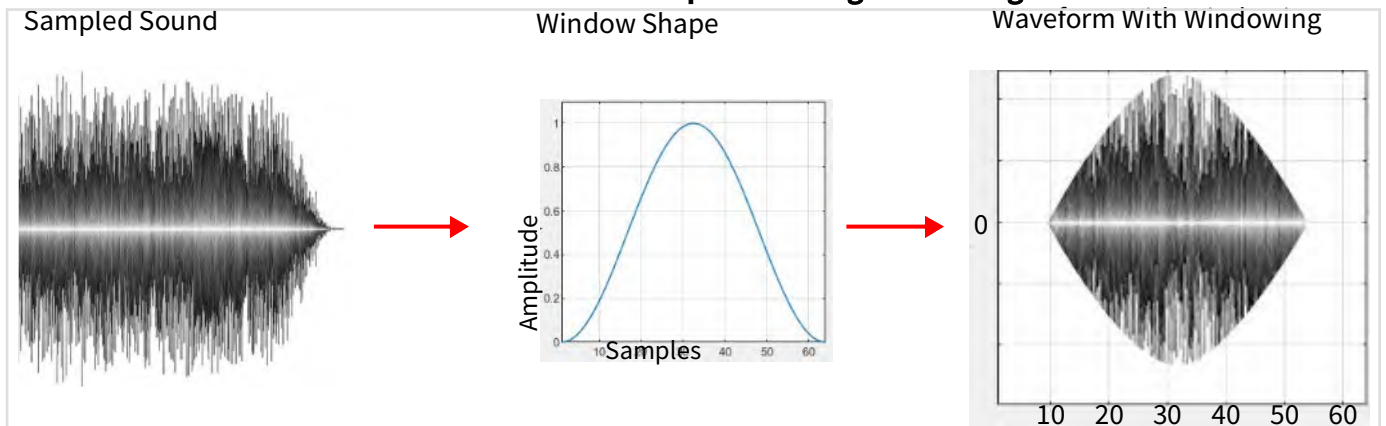
FIGURE 19-4 Example- Flat Top Windowing



Hanning: This windowing method forces the ends of the time record to zero and changes the wave form to a curve with side lobes to reduce any spectral leakage. The spectral leakage sometimes results when a sine wave signal is captured non-periodically.

The Hanning window is the G4 default and the most commonly used method, because it provides the most accurate levels with the least spectral leakage. It is also the windowing method required to meet the ISO Tonality standard. If you're not sure which window to apply; choose Hanning.

FIGURE 19-5 Example- Hanning Windowing



Step 11. Choose a **Frequency Weighting** for the 831C High-Pass filter. This weighting is used to provide a broadband Leq and peak level, and is also applied to the SLM data. When you choose “A”, or “C” weighting, the result can be used to provide an approximation of how the sound is perceived by the human ear. If you don't want to apply a pre-FFT filter frequency weighting to this measurement, choose “Z”.

LEARN MORE The High-Pass filter uses a custom Z-weight. For a description of the filter, see “High-Pass Filter” in section [A.7.1 FFT Analysis](#).

About the FFT Compute Times Table

G4 displays the minimum measurement time required to calculate the first FFT for your selected frequency resolution in the **FFT Compute Times (s)** table on the FFT tab.

The minimum measurement period has implications for the following meter control properties, which you can set on the Control page of the Setup Manager:

- When using a time-based meter control, the measurement duration (“Time”), must be longer than the minimum period in the table.
- The FFT History (measurement history for FFT) record Time (in hours, minutes, and seconds) must be longer than the minimum period in the table.

Measuring According to ISO 1996-2

Note that any combination of frequency span and FFT lines that produces a resolution of at least 3.3333 Hz/Line (with A-weighting and Hanning window) always meets the ISO 1996-2 tonality requirement. *Figure 19-6* illustrates the best choices for compliance.

FIGURE 19-6 Best Choices for 1996-2 Compliance

FFT Compute Times (s)					
Lines:	6400	3200	1600	800	400
20 kHz	0.32	0.16	0.08	0.04	0.02
10 kHz	0.64	0.32	0.16	0.08	0.04
5 kHz	1.28	0.64	0.32	0.16	0.08
2 kHz	3.2	1.6	0.8	0.4	0.2
1 kHz	6.4	3.2	1.6	0.8	0.4
500 Hz	12.8	6.4	3.2	1.6	0.8
200 Hz	32	16	8	4	2
100 Hz	64	32	16	8	4

Measuring According to ISO/PAS 20065

Note that any combination of frequency span and FFT lines that produces a resolution between 1.9–4Hz/Line (with A-weighting and Hanning window) always meets the ISO 20065 tonality requirement. The best choices for compliance are circled in *Figure 19-7*.



FIGURE 19-7 Best Choices for 20065 Compliance

FFT Compute Times (s)					
Lines:	6400	3200	1600	800	400
20 kHz	0.32	0.16	0.08	0.04	0.02
10 kHz	0.64	0.32	0.16	0.08	0.04
5 kHz	1.28	0.64	0.32	0.16	0.08
2 kHz	3.2	1.6	0.8	0.4	0.2
1 kHz	6.4	3.2	1.6	0.8	0.4
500 Hz	12.8	6.4	3.2	1.6	0.8
200 Hz	32	16	8	4	2
100 Hz	64	32	16	8	4

Step 12. Press the **right softkey** (○ ○ ●) to view the Control tab.



Step 13. Select a **Run Mode** from the drop-down menu. This controls how the meter ends a measurement and how history records are accumulated. The following segments describe FFT Run Modes in detail.

Using Manual Stop

A Manual Stop measurement begins when you press the **Run/Pause button**  and ends when you press the **Stop/Store button**  on the meter or in G4.



- a. Select **Manual Stop** as the **Run Mode**.
- b. If you select the checkbox in-line with **Enable FFT History**, a record is created with each stop. You may make as many records (runs) as you like. The Overall data includes data from all records.

Using Count Stop

A Count Stop measurement begins when you press the **Run/Pause button**  and ends when the number of FFT averages calculated equals the value you set for **FFTs in Average** (or you press the **Stop/Store button** .

- a. Select **Count Stop** from the **Run Mode** drop-down menu.
- b. Enter a value for **FFTs in Average**.
Refer to the standard you're using for specifics on the number of averages required for the measurement. The default value for FFTs in Average is 1, and the max value is 99,999.
- c. If you select the checkbox in-line with **Enable FFT History**, enter a value for **Record Count**, which is the number of records that should be created. The default value is 1.

Using Timed Stop

Timed Stop measurement begins when you press the **Run/Pause button**  and ends when the elapsed time for the measurement equals the value you set for **Run Time**. You can also stop the measurement at any time by pressing the **Stop/Store button** .



- a. Select **Timed Stop** as the **Run Mode**.
- b. Enter a **Run Time** in hours, minutes, and seconds.

The **Minimum Timing (s)** table on the FFT tab shows the time it takes to compute the first FFT (based on your selected frequency resolution). The **Run Time** for a Timed Stop measurement should be at least as long as the period shown in the table.

TAKE NOTE When using a timer-based Run Mode, FFT measurements may not end on timed boundaries. This means that it's possible for the actual run time to be slightly shorter than the period you enter for Run Time. A typical result is 19.4 seconds of measurement when entering 20 seconds Run Time.

- c. If you select the checkbox in-line with **Enable FFT History**, one FFT History record is created for each run time.

Using Continuous Run Mode

The meter runs when you press the **Run/Pause button**  and ends when you press the **Stop/Store button**  or when the meter loses battery power.

- a. Select **Continuous** as the **Run Mode**.
- b. Select the **Auto-Store** period, and enter the **Time** of day to store in hours, minutes, and seconds.
- c. If your preamplifier is equipped for a calibration check, select the checkbox in-line with **Cal. Check**, and enter a time of day in the **Time** field in hh:mm:ss format.
- d. If you select the checkbox in-line with **Enable FFT History**, **FFTs in Average** is the number of averages the meter calculates. Refer to the standard you're using for specifics on the number of averages required for your measurement. The default value is 1 and the max value is 99,999.
- e. The value you set for **Time** (in hours, minutes, and seconds) is the length of each FFT history record.

Using Single-Block Timer Mode

The measurement begins at the **Start** date and time and ends at the **End** date and time you set.

- a. Select **Single Block Timer** as the **Run Mode**.
- b. For the measurement, enter a **Start** date and time and an **End** date and time.
- c. Enter values for the next 3 settings if you plan to use FFT History (time history). Select the mark in-line with either **FFTs in Average** or **Time** as the method of determining the length of each record, then enter a value.
- d. If desired, select the checkbox in-line with **Enable FFT History**.
 - If you selected FFTs in Average, the Estimate box, outlined in green, shows the estimated measurement time needed to create that number of averages.
 - If you selected Time, The **FFTs in Avg** box, outlined in green, shows the number of averages that will be created during the measurement **Time** you entered.

Step 14. (Optional) The **Run on Trigger** feature enables the 831C to begin a measurement when the area sound level exceeds one or more of the selected levels. If you want the meter to begin a measurement based on a trigger level, do the following:

- a. Return to the **Control** tab (●○○) and choose **Timed Stop** or **Count Stop** from the **Run Mode** drop-down menu.
- b. Return to the **FFT Misc** tab (○○●).

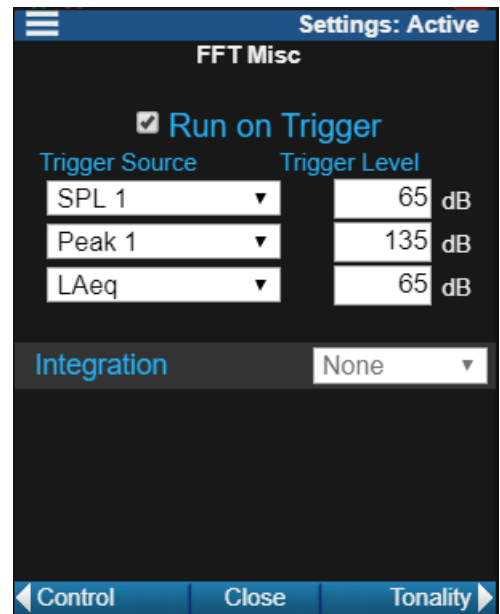
TAKE NOTE If your connected transducer is anything other than a microphone, only LZrms and LZpeak are available as a Trigger Source, and Tonality is not available.

- c. Select the checkbox in-line with **Run on Trigger**, as shown in *Figure 19-8*.

FIGURE 19-8 FFT Misc tab

- d. Select up to 3 **Trigger Sources** from the drop-down menus, and enter up to 3 **Trigger Levels**.
- e. If your Transducer is a microphone, integration is disabled. If you selected Other as the transducer, select an option from the **Integration** drop-down menu.

LEARN MORE For more information on each integration option, look for the terms in “ **Glossary**” on page C-1.



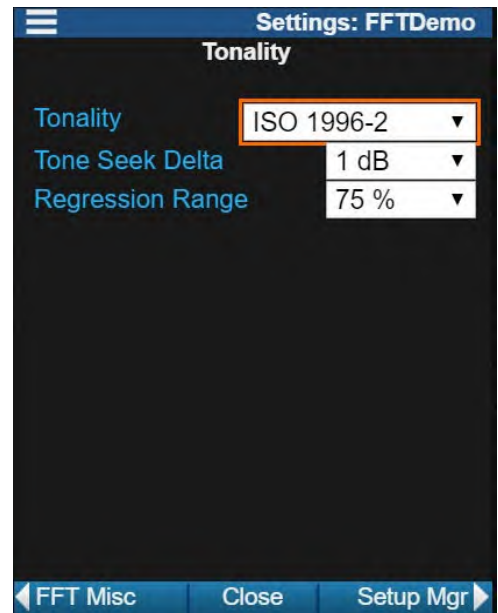
- Step 15.** If you’re using a microphone, press the **right softkey** (○●●) to set values on the **Tonality** tab. If you’re using another transducer, skip this step.
- a. If desired, select a Tonality standard from the **Tonality** drop-down menu.

FIGURE 19-9

For ISO 1996-2 tonality: the measurement must be A-weighted, averaged for at least 1 minute, with the Hanning window applied. If your settings differ from the selected standard, the 831C displays a prompt from which you can automatically choose standard-compliant settings.

For ISO/PAS 20065 tonality: the Line Bandwidth must be 1.9–4.0 Hz, etc. If your settings differ from the selected standard, the 831C displays a prompt from which you can automatically choose standard-compliant settings. Refer to the standard for other specifics.


- b. Select other available values according to the Tonality standard you selected. For additional information, look for these properties in “ **Glossary**” on page C-1, or in the selected standard.




- Step 16.** Press the **middle softkey** (○●○) to **Close** and save the Setup and return to the Setup Manager tab.

19.3 Making the FFT Measurement

- Step 1.** Make the FFT measurement setup the Active Setup on the meter. To do this, do the following:

- a. Enter the Setup Manager (**Tools**  → **Setup Manager**).
- b. Highlight the name of the FFT setup you created for this measurement.
- c. Press **Enter** , and select **Set To Active**.

Step 2. (Optional) If you want to enable and define alert notifications, open  G4 LD Utility and select the **Accounts/Schedule** view.

LEARN MORE For more information on setting alert notifications, launch G4 and navigate to **Help** → **Manuals** → **G4LD Utility** → 6.1 Getting Started With 831C Accounts in G4.


Step 3. Position the 831C for the measurement.

Step 4. Run the measurement.

TAKE NOTE For details on meter icons and indicators you might see during a measurement, see [4.1.4 "Understanding the Session Log Tab" on page 46](#).

Step 5. (Optional) If desired, after the FFT measurement is complete, switch the 831C to SLM Mode, connect a weather sensor (such as the SEN031 or SEN032 from Larson Davis) and measure site conditions.

19.3.1 Viewing Live Data On the Meter

In this section, take a tour of the live data on the meter display during a measurement, and learn how to customize display elements. Use the **right softkey** () to view the various tabs shown in this section.

Live Tab: SLM Data

The Live tab continues to show SLM data even in FFT mode. For additional details on this tab and associated pages, see [4.1.1 "Understanding the Live Tab" on page 31](#).

FFT Live Tab

The FFT Live tab displays the current and recently measured sound. While the 831C measures FFT spectra for up to 6400 lines of resolution, the display resolution is much lower than this. As a result, each line in the FFT graph may contain more than 1 measured value. In this case, the amplitude and frequency displayed for a cursor position is determined by the maximum value of the multiple, overlapping FFT levels. *Figure 19-10* describes display elements and available adjustments.

FIGURE 19-10 FFT Live Display Elements

The screenshot shows the 'FFT Live' interface with the following data:

LA	90.7 dB		
@ max	1000.0 Hz		
2nd	50.8 dB	3rd	29.6 dB
4th	16.8 dB	5th	22.4 dB

Buttons: Full Screen, Hold, Live, Menu, THD

Callouts:

1. When zoomed in on a 1:1 ratio, the level indicator (“@ max”) changes to show that the displayed level is no longer the max value of multiple overlapping levels, but the max value of a single level at the cursor.
2. Press the **left or right button** (◀▶) to advance the Manual cursor. To enable Max-Tracking or Harmonic cursors, press **Menu** (☰), and choose **Cursor Type**. For additional detail, see **"Editing the Cursor" on page 172**.
3. Press the **up button** (⏶) to **Zoom** in on a frequency range. The 831C allows zooming from the configured number of lines up to a 1:1 correspondence between displayed lines and FFT lines.
4. When you highlight **Hold** and press **Enter** (ENTER), the graph pauses for your examination, while the measurement continues. Select **Resume** to un-pause the graph.

◻◻● Live Data On the THD Tab

Use the **right softkey** (◻◻●) to select the THD tab.

FIGURE 19-11

The screenshot shows the 'THD' interface with the following data:

Fundamental	
Frequency	250.0 Hz
Amplitude	103.9 dB
THD+N	2.09 %
THD	2.00 %
Harmonics	
2nd	-48.0 dB 0.40 %
3rd	-34.4 dB 1.91 %
4th	-65.3 dB 0.05 %
5th	-48.6 dB 0.37 %

Buttons: FFT, Menu, Overall

Text:

The Total Harmonic Distortion tab displays fundamental, and harmonic amplitude, and the percent distortion for each. The percentages for THD+N (Total Harmonic Distortion + Noise) and THD are methods of examining the energy dispersion of the measured signal.

The percent distortion shows how much of the signal energy is based in the fundamental frequencies, and may be an indication of how inefficient a signal may be.

Editing the Cursor

When viewing Live data you can select the cursor type. Choose **Menu** (☰) → **Cursor Type** on the 831C, then select **Manual**, or **Max-Tracking**. Each can be displayed with or without harmonics. Editing the cursor is also shown in *Figure 19-10*. Use the **left** and **right buttons** (◀ ▶) to advance the Manual cursor and investigate tone details in the graph.

Using the Max-Tracking Cursor

From the Cursor Type menu, you can enable the Max-Tracking cursor, which automatically adjusts to show the frequency band with the maximum amplitude. If the maximum is not within the meter display window when zoomed in, the window re-centers to display the max as shown in *Figure 19-12*. **Please Note:** When the Max-Tracking cursor is enabled, you can't navigate from tone to tone in the graph.

Using Harmonic Cursors

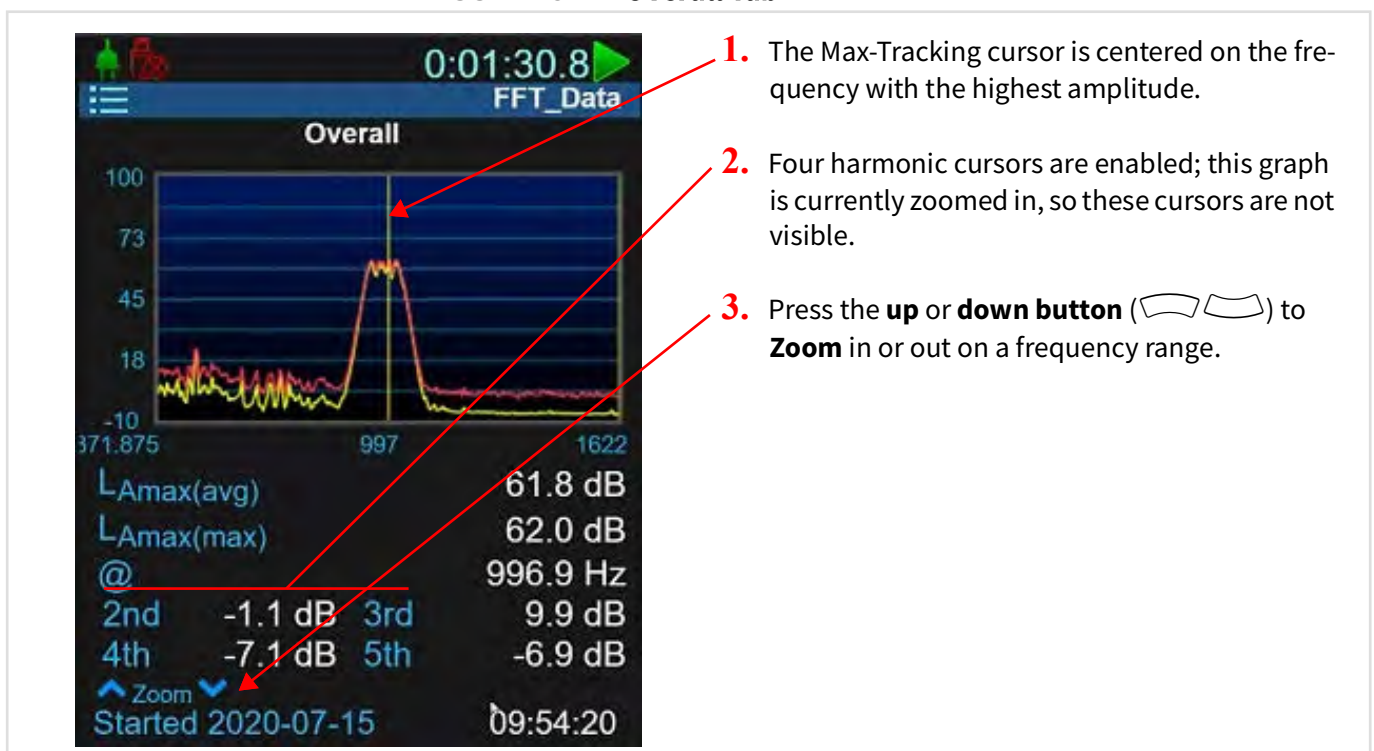
In the Cursor Type menu, you can set the number of harmonic cursors from 0 to 24 in increments of 4 by using the **up** or **down buttons** (⏶ ⏷). Please note that depending on the frequency of the primary cursor, all of the harmonic cursors may not display. For example, with a frequency span of 20 kHz and a fundamental frequency of 5 kHz, only 3 harmonic cursors will display within the frequency range. See *Figure 19-12* and *Figure 19-11* for examples of harmonic cursor displays.

☰ ● Live Data On the Overall Tab

Use the **right softkey** (▶) to select the Overall tab.

Just like in SLM Mode, the Overall tab displays levels as an average from the beginning of the measurement up to the present, as shown in *Figure 19-12*.

FIGURE 19-12 Overall Tab

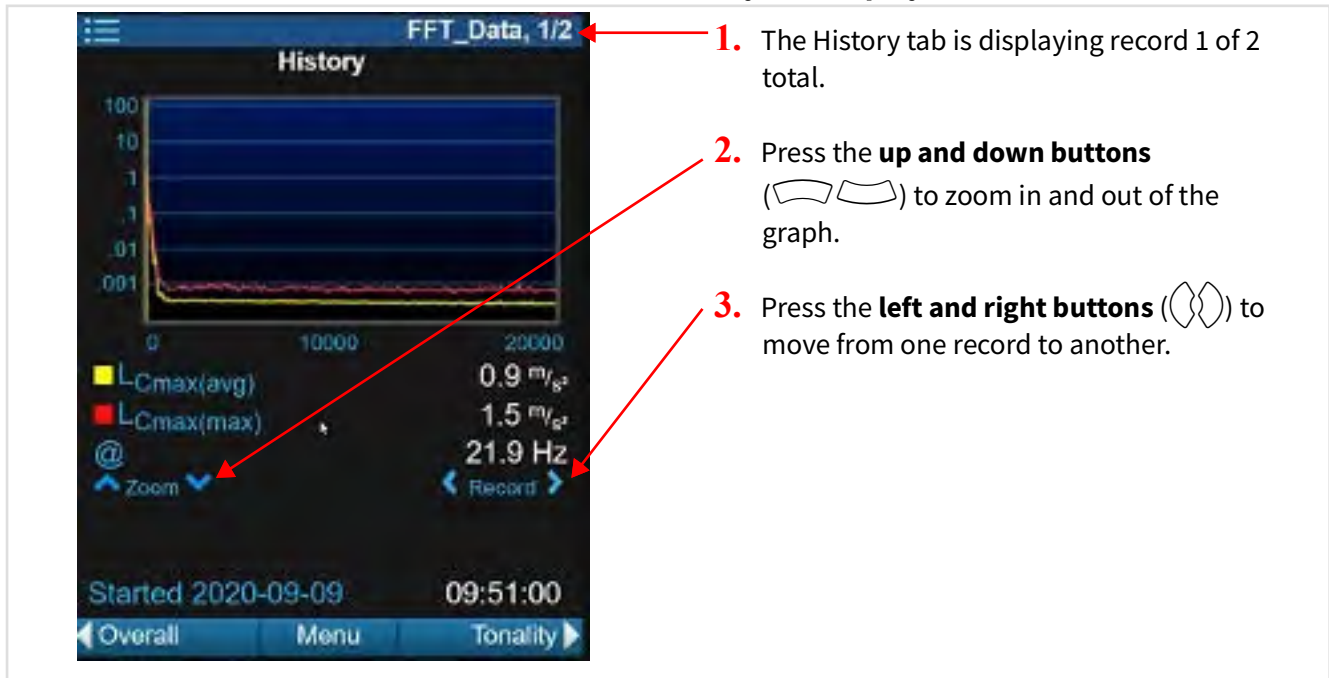



Live Data On the History Tab



Live historical data takes time to accumulate, so data on the History tab may not be immediately available during a measurement. In the following example of a vibration measurement, *Figure 19-13* shows historical vibration records.

FIGURE 19-13 FFT History Tab Displays a Vibration Record



To edit the y-axis graph scale, press **Menu** () and choose **Adjust Graph**. Units displayed for the y-axis depends on the transducer; the default is “decibel” for a mic, or “g” when you selected a transducer other than a mic. You may customize the units during the measurement setup, as shown in **19.1 Preparing the Equipment**.

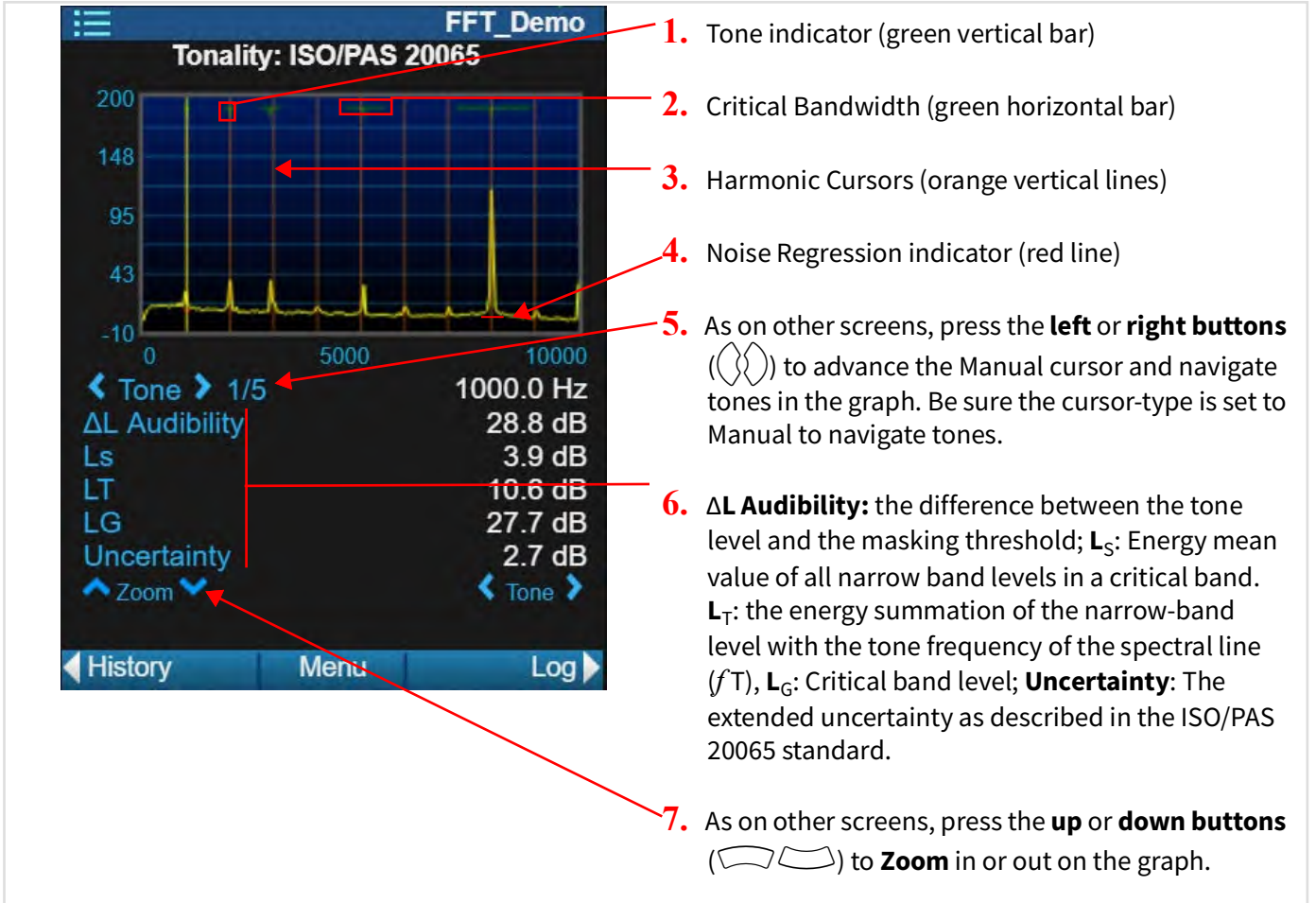


Viewing Data on the Live Tonality Tab (ISO/PAS 20065)

This section shows the 831C display when ISO/PAS 20065 is the measurement standard chosen in the setup. With the cursor over a tone in the graph, the following properties display for each tone: ΔL Audibility, Ls, LT, LG, Tone Count. For more detail on these properties, refer to the standard.

Additionally, ISO/PAS 20065 tonality data is only calculated based on the overall measurement data. For this reason, no live tonality data is available while the measurement is in progress. After the measurement is stopped, select the Live Tonality page to view the overall tonality.

FIGURE 19-14 Display Elements on the Live Tonality Tab (ISO/PAS 20065)

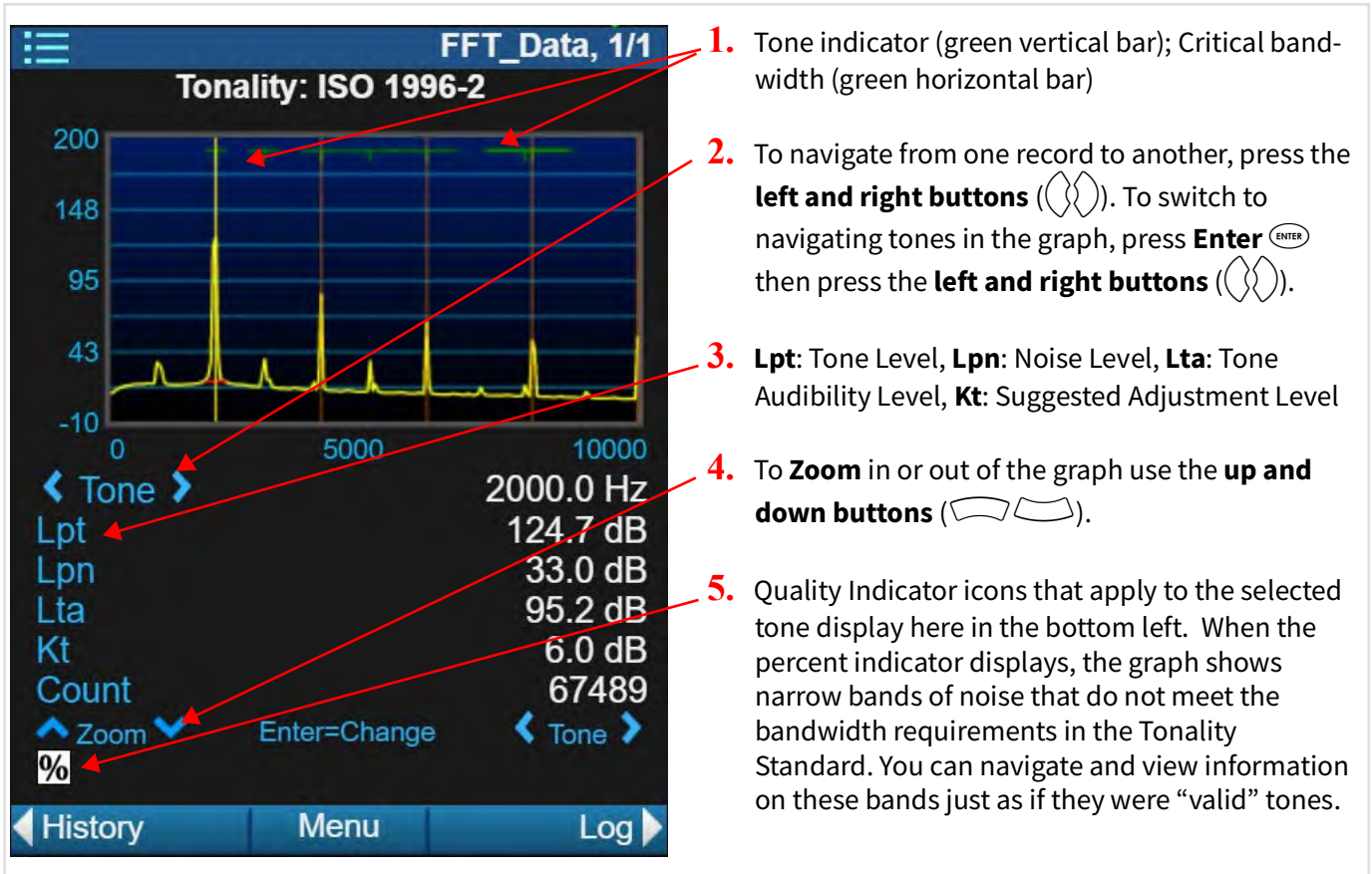


Live Data On the Tonality Tab (ISO 1996-2 Tonality)

In the following example, the ISO 1996-2 standard was chosen in the measurement setup.

For this standard, the 831C Tonality tab displays critical bandwidths, tone indicators, and regression noise. After the measurement is complete, you can navigate the Tonality tab just like the other tabs. The cursor begins on the first valid tone (or the tone at the lowest frequency). With the cursor over the area, the following details display for each valid tone: Lpt, Lpn, Lta, Kt, Count. For details on each term, refer to the applicable ISO standard.

FIGURE 19-15 Display Elements On the Live Tonality Tab- ISO1996-2



See Table 19.1 for details on each indicator including a suggested remedy.

Table 19.1 ISO 1996-2: Quality Indicators for Tonality Deficiencies








Icon	Deficiency	Remedy
	The measurement has not been averaged for at least 1 minute. See ISO 1996-2, section C.2.2	Run the measurement for at least 1 minute.
	The weighting is set to C. See ISO 1996-2, section C.2.2	Change to A-weighting to perform a standard measurement.
	The weighting is set to Z. See ISO 1996-2, section C.2.2	Change to A-weighting to perform a standard measurement.
	The Window is not Hanning. See ISO 1996-2, Note 1	Change the Windowing setting to “Hanning” in the measurement Setup.

Table 19.1 ISO 1996-2: Quality Indicators for Tonality Deficiencies (Continued)

Icon	Deficiency	Remedy
	The tone bandwidth is not less than 10 percent of the critical bandwidth.	Increase the resolution of the measurement by increasing the number of Lines, or by decreasing the Frequency Span in the Setup (FFT tab). If this icon displays even when the Hanning window is selected in the Setup, the bands of noise do not qualify as “tones” in the ISO 1996-2 standard.
	The effective bandwidth is not less than 5 percent of the critical bandwidth.	Change the Windowing method in the measurement Setup.
	The sound measurement does not contain sufficient regression data to display a standard regression line.	Increase the Regression Range in the measurement Setup (Tonality tab).

Viewing FFT Data On the Live Session Log Tab

The Session Log tab is the same in FFT mode and SLM mode. For details, see [4.1.4 "Understanding the Session Log Tab" on page 46](#).

19.4 Viewing FFT Data Files On the Meter

You can open and view saved FFT and Tonality data files on the 831C just as you would any other type of file. Please note that for ISO/PAS 20065 measurements, no tonality data is stored in the saved file. Instead, open the file in G4 and tonality information is calculated for display when the file is open.

For specifics on viewing data files on the 831C display, see [8.2 "Using the File Manager" on page 77](#).

LEARN MORE For information about viewing FFT files in G4, see **Module 9** of the *G4 LD Utility Manual*.

Module **20** Utilizing 831C Sound Recording

Sound recordings on the 831C are often created to identify the source of loud noises during a measurement.

The Sound Recording feature is available when you purchase and install firmware option 831C-SR. The upgrade allows you to trigger a recording and add a sound type label to the resulting measurement data using 3 methods: by creating a manual sound recording, by setting automated event-triggered recording, and by using measurement history event recording. This section shows how to use each method and the related settings and options.

While each of these procedures can be completed on the 831C, we recommend connecting the 831C in G4.

In this module:

20.1	Understanding 831C Recording Settings and Sound Quality	177
20.2	Using Mark Sound Type to Make Manual Sound Recordings	179
20.2.1	Configuring Markers for Sound Recording	
20.2.2	Making a Manual Sound Recording by Using Mark Sound Type	
20.3	Making an Automated Event Sound Recording	181
20.4	Enabling Measurement History Sound Recording	183
20.5	Listening to Sound Recordings	185

20.1 Understanding 831C Recording Settings and Sound Quality

This section provides essential background information for creating sound recording files for your measurement application.

In this section:

- **Choosing Resolution, Peak Overload, and Range Settings**
- **Choosing a File Format for Recorded Sound Files**

Choosing Resolution, Peak Overload, and Range Settings

About Resolution Values

Sound recordings are saved with 16-bit resolution, which provides a measurement range of about 90 dB. This means that the 831C is capable of recording sound signals with amplitudes no more than 90 dB below the level at which the selected range will overload. With this in mind, you may want to adjust the peak overload, gain, or range to obtain the best recording.

Adjusting Peak Overload, Gain, and Range

During calibration, the 831C automatically calculates the peak overload based on the current microphone type. To ensure the calibration will be accurate, you may adjust the peak overload value as shown here:


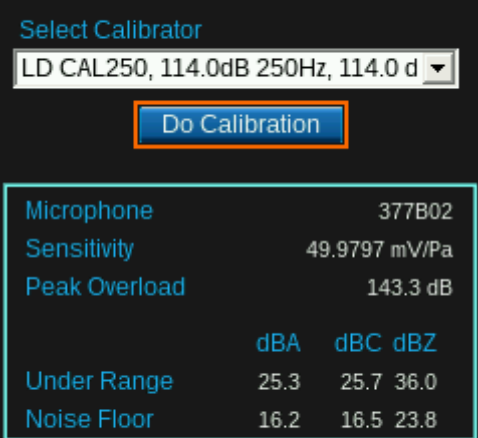

- a. In G4, open the meter tab and select the  **Calibrate** view. During calibration, the 831C automatically calculates the sound recording range based on the **Peak Overload** value as shown in *Figure 20-1*.

Figure 20-1



	dBA	dBC	dBZ
Under Range	25.3	25.7	36.0
Noise Floor	16.2	16.5	23.8

For additional detail, reference section **5.4 Calibrating Your SoundAdvisor 831C**.

- b. In G4, navigate to the Setup Manager SLM page. To do this, select **Setup Manager** → [select your Setup file from the list] →  **Menu** → **SLM** page.
- c. Verify or edit the **Gain** setting at either “0 dB” or “20 dB.”
- d. In the Setup, navigate to the **Sound** page.
- e. Verify or edit the **Range** selection for “Normal” or “High.” This selection adjusts the upper and lower range limit for any given microphone. We recommend using “Normal” range for sound recordings, unless you anticipate that recorded sounds will exceed 110 dBA. In that case, choose “High” range.

Choosing a File Format for Recorded Sound Files

In addition to the WAV format (Compression: Off), the 831C in G4 (version 4.6.5+) offers three OGG compression formats to reduce large file sizes: Low, Normal, and High. This section describes each of these options in detail.

Applying Compression or No Compression

Compressed files are more portable; easily shared over email and text, or as an alert notification. Compression (Normal) is often useful when handling large, environmental noise measurement files. However, compressed files naturally produce a result with less frequency detail than the original.

The WAV file format (Compression: “Off”) is the 831C default sound recording format. While this format requires more space, it preserves frequency and amplitude detail. Some If you plan to examine octave bands or require frequency and amplitude accuracy in the sound recording, we recommend selecting “Off” from the **Compression** drop-down menu.

Table 20.2 describes the approximate file size for a 60-second sound recording in each format. The WAV file sizes are accurate to the nearest 50 kB. The OGG (Compression: “Normal”) file sizes are approximations, since every compressed file is unique.

Table 20.2 Approximate Sound Recording File Sizes Per 60 Seconds

Sample Rate (kilosamples/second)	WAV (Compression: Off)	OGG (Compression: Normal)
8 ksps	0.96 MB	200 kB
16 ksps	1.98 MB	350 kB
24 ksps	2.88 MB	450 kB
48 ksps	5.67 MB	NA
51.2 ksps	6.14 MB	NA

The 831C compression settings—High, Normal, and Low—are comparable as shown in Table 20.3. Use this table to determine which setting is best for your measurement application.

TAKE NOTE The “Normal” compression setting in G4 version 4.6.5+ matches the OGG compression setting from preceding versions.

Table 20.3 831C OGG Compression Settings, File Size, and Sound Quality Rates

OGG Compression Settings	File Size	Preservation of Sound Quality
“High”	Varies with content. Estimate 2X smaller than “Normal”	Decreased sound quality compared to “Normal”
“Normal”	Normal (See Table 20.2)	Medium
“Low”	Varies with content. Estimate 2 X larger than “Normal”	Increased sound quality compared to “Normal”

Recommendations for Total File Size

Utilizing multiple features while recording, and longer measurements can result in very large files with longer download times. To keep file sizes manageable, we recommend saving sound files at least hourly and opening a new file every 24 hours.

20.2 Using Mark Sound Type to Make Manual Sound Recordings

During a measurement, you can manually record and mark or identify sounds the meter is measuring. The marked sounds are recorded for playback and are labeled as comments in the resulting data file.

Before you begin:

Verify that 831C-SR firmware is installed and enabled on your meter. For more information, see [14.4 Enabling or Disabling Firmware Options](#).

20.2.1 Configuring Markers for Sound Recording

Markers help you label and initiate a recording of the sound being measured. You can also use markers to simply mark the sound occurrence with a label that's saved in the measurement's Time History.




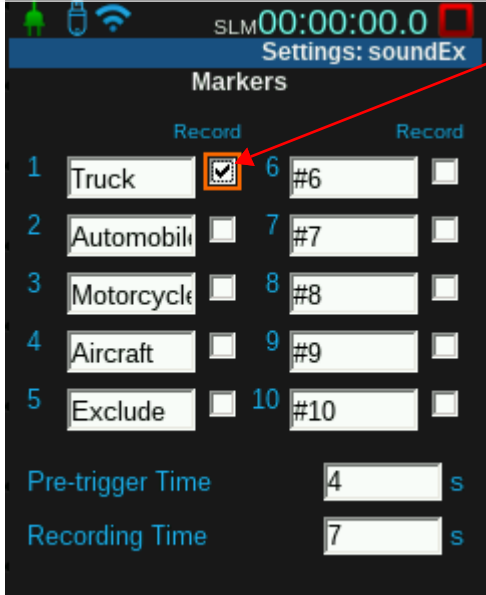


- Step 1.** On the meter, go to **Tools**  → **Setup Manager**.
- Step 2.** Highlight and select the setup file you want to enable for Sound Recording, then press the **left softkey** () until you see the **Markers** page.
- Step 3.** To enter or edit a sound type name, select the name field and press **Enter** ()
- Step 4.** Enter and select settings on the Markers page, as shown in 4a.–4c. in *Figure 20-4*.

Figure 20-4 Setup Manager Markers Page



The screenshot shows the 'Markers' page in the Setup Manager. At the top, it displays 'SLM 00:00:00.0' and 'Settings: soundEx'. The page is titled 'Markers' and has two 'Record' buttons. Below the title is a list of sound types with checkboxes and corresponding numbers (1-10). The 'Truck' entry (1) has its checkbox checked. Below the list are two input fields: 'Pre-trigger Time' with a value of 4 and 'Recording Time' with a value of 7. A red arrow points to the checked checkbox for 'Truck'.

- a.** Select the checkbox in-line with one or more sound types you want to label in the data file.
- b.** If desired, enter a **Pre-trigger Time**. This is the amount of time in seconds that is recorded prior to when you mark the sound.
- c.** Enter a **Recording Time**. This is the time in seconds that is recorded from the time you mark the sound. *Note:* You may also set this to “0” and manually stop the recording.

- Step 5.** When your sound settings are complete, press the **Close** softkey () and save the Setup.
- Step 6.** Next, set your setup file as the **Active Setup**.
- Step 7.** Press the **Close** softkey () and save your Setup. If you select **Cancel**, you will return to the Setup Manager without saving.
- Step 8.** Run a measurement and manually mark the sound types as shown in [20.2.2 Making a Manual Sound Recording by Using Mark Sound Type](#).

20.2.2 Making a Manual Sound Recording by Using Mark Sound Type

Mark, label, and record sounds by using the mark sound type feature, as shown in this section.

Before you begin:


- Complete the process shown in [20.2.1 Configuring Markers for Sound Recording](#).

Step 1. With a measurement currently running on the 831C, use the **left or right softkeys** (●○●) to navigate to the **Live** tab.

Step 2. Press **Menu** (○●○) and select **Mark Sound Type**. As shown in *Figure 20-4*, the bottom half of the screen displays a list of all enabled markers (sound types).

Step 3. Select the checkbox in-line with a marker to start the recording. When finished, a labeled sound record displays in the data file.

Figure 20-5 Mark Sound Type Sound Recording



You may also press the **left softkey** (●○●) to initiate a sound recording. To stop recording using this method, select **Stop**, **Close**, or stop the measurement.

IMPORTANT: If you don't manually stop the sound recording, it stops when the memory is full. Very large data files are time consuming to download and playback.

1. Select the checkbox in-line with a sound type label. This initiates the Pre-trigger period (if applicable) followed by the sound recording.
2. The Recording icon is red when the 831C is recording.


20.3 Making an Automated Event Sound Recording

This section shows how to set up the 831C in G4 to automatically record sound events with or without 831C Event History.

Before you begin:

- If you plan to utilize Event History for the measurement, create a setup file with Event History enabled as shown in [17.1 "Setting Up the Event History](#)

Measurement" on page 127. Note: You may still record event sounds without Event History, as shown in this section.

- Step 1.** In G4, navigate to the Setup Manager Event Triggers page on your connected meter. To do this, do the following:
- Select **Setup Manager** from the top menu bar.
 - (Right side) [select your measurement history-enabled Setup file from the list]
 - Select  **Menu** → **Event Triggers** page.

Step 2. Verify or edit Trigger Source or Trigger Level for available sources, and (when applicable) indicate the octave band triggers.

Step 3. Select  **Menu** → **Sound** page.

Step 4. If you're utilizing Event History for this measurement, be aware the 831C has sound recording constraints because of buffering demands. The following settings may be affected:

- **Sample Rate**, and **Pre-trigger Time** (Sound Setup page)
- **Minimum/Continuous Duration** (Event History Setup page)

If your selected Sample Rate and Pre-trigger time (and Min/Cont Duration, if applicable) require more buffer than is available, an error message appears and the 831C automatically adjusts these values to accommodate the recording. This error is also noted as an Audio Buffer Overrun entry in the 831C Session Log. *Table 20.6* shows recommended maximums for these settings when using automated Event Sound Recording.

TAKE NOTE If Event History is not enabled, but Event Sound is, the 831C still makes a sound recording for an event. In this case, the **Minimum Duration** is ignored and the recording begins immediately.

Table 20.6 Maximum Recommended Settings for 831C Sound Events

Sample Rate (kilosamples/second) (Sound Setup Page)	Minimum Duration + Pre-Trigger (Event History Setup Page/ Sound Setup Page)
8 ksps	≤ 60 s
16 ksps	≤ 30 s
24 ksps	≤ 20 s
48 ksps	≤ 10 s
51.2 ksps	≤ 9.375 s

Step 5. Select a **Sample Rate** from the drop-down menu. If you intend to conduct any kind of frequency analysis, we recommend a higher sample rate.

TAKE NOTE The 51.2 ksps sample rate serves a unique function. When used with Event Time History, the sound recording and the Time History record are synced. At any other sample rate, filter delays prevent this time synchronization.

Step 6. Select the checkbox in-line with **Save Event Sound**, and enter any other applicable values.

Figure 20-7 Sound Event Settings

The screenshot shows the 'Settings: EnvSound' interface. At the top, there is a timer showing '0:00:00.0'. Below it, the 'Sound' section includes a 'Sample Rate' dropdown set to '48 ksp', a 'Range' section with 'Normal' (25 - 109 dBA) selected and 'High' (47 - 140 dBA) unselected, and 'Audio Compression' set to 'Off'. The 'Save Event Sound' checkbox is checked. Below this, 'Snapshot Time (s)' is set to 7, and 'Pre-trigger Time (s)' is set to 4. The 'Save Measurement Sound' checkbox is unchecked, with its 'Snapshot Time (s)' set to 5. At the bottom, there are navigation buttons for 'Day/Night', 'Close', and 'Weather'.

1. For more information on selecting a range, see ["Choosing Resolution, Peak Overload, and Range Settings" on page 177.](#)
2. Select an **Audio Compression** setting. For more information, see ["Choosing a File Format for Recorded Sound Files" on page 178.](#)
3. **Snapshot Time** (< 9,999 s) is the length of the recording in seconds from the start of the triggering event.
4. **Pre-trigger Time** is the period in seconds prior to the event trigger that you want to include in the recording.

Step 7. **Save** the Setup, set it as the **Active** setup file, and **Close** (○●○) the Setup Manager.

Step 8. Run a measurement and examine the resulting sound recordings. Based on the settings shown in *Figure 20-8*, when the measured sound is above 65 dB (**SPL 1 Trigger Level**) for at least 4 seconds (**Trigger Time**) the event recording would include 11 seconds of sound (Pre-trigger + Snapshot Time).

Figure 20-8 Sound Event Live Example

The screenshot shows a live measurement screen. At the top, the timer is at '00:00:18.3' and the data is '831_Data, 1/1'. Below this, it says 'Events (1 of 4)'. A graph shows a sound level that has risen above a green horizontal line representing the trigger level. A red 'REC' icon is circled in red. Below the graph, the current reading is '74.9' and the trigger level is 'LAS > 65.0 dB'. At the bottom, it says 'Valid' and 'Events 1'.

If you monitor the measurement, notice that the record icon changes from gray to red during the designated Snapshot Time.

TAKE NOTE If a second event (such as a measurement history or manually triggered sound recording) begins during an ongoing sound recording, the sound recording extends. This continues until there are no more events. When you examine the recording after the measurement, you will find that the sound recording is associated to the first event even though it contains sound recordings for the subsequent events.

20.4 Enabling Measurement History Sound Recording

With both 831C-ELA and 831C-SR, or 831C-MSR, firmware options installed, you can set up the 831C to automatically initiate a sound recording snapshot at the beginning of each measurement history (MH) period.

Before you begin:

- Create a saved Setup file with Measurement History enabled. For reference, see [15.1 Configuring Measurement History \(MH\)](#).
- Review [20.5 Listening to Sound Recordings](#)
- Connect your meter in G4

Step 1. In G4, navigate to the Setup Manager Sound page on your connected meter. To do this, select **Setup Manager** → (Right side) [select your measurement history-enabled Setup file from the list].

Step 2. Select the checkbox in-line with Enable Measurement History and select from available settings. Note that MH settings (Time Periods, Triggers, or Interval Counts) differ based on your selected Run Mode.

Step 3. Choose  Menu → **Sound** page.

Step 4. On the Sound page, select or enter values for the following settings shown in *Figure 20-9*:

- **Sample Rate**
 - **Range**
 - **Audio Compression**
 - **Save Event Sound**
- } For more information on adapting these three settings to your measurement, see [20.1 Understanding 831C Recording Settings and Sound Quality](#).

When you select this setting with Event History enabled, the shorter one of these options is saved with the data file: either a recording of the Snapshot Time, or a recording of the full event including the Snapshot Time and Pre-trigger Time.

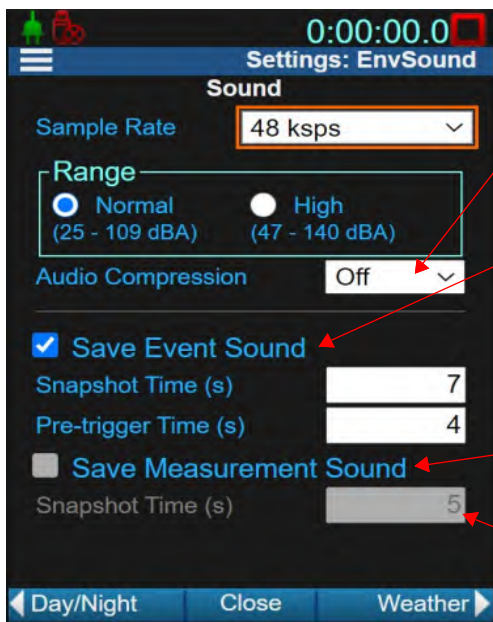
- **Snapshot Time (s)**
- **Pre-trigger Time (s)**
- **Save Measurement Sound**

When you select **Save Measurement Sound**, a sound recording at the beginning of each measurement history interval is included in the resulting data file.

- **Snapshot Time (s)**

The length of the sound recording from the start of the measurement interval. If this value is equal to the Measurement History interval, the entire interval is recorded.

Figure 20-9 Measurement Setup Sound Page



1. If you enable **Audio Compression**, sound recordings are saved in a compressed file format. For details, see ["Choosing a File Format for Recorded Sound Files"](#) on page [178](#)
2. (Optional: Applies only when Event History is also enabled in the Setup) When you select **Save Event Sound**, the shorter one of the associated options is included in the resulting data file: either a recording of the snapshot time, or the full event including the Snapshot Time and Pre-trigger Time.
3. Select the checkbox in-line with **Save Measurement Sound** to create a sound recording of the measured sound at the beginning of each measurement interval.
4. **Snapshot Time** (< 9,999 s) is the time in seconds that records from the start of each measurement interval.

Step 5. Select **Close** (○●○), save the Setup, then select it again and **Set to Active**.

Step 6. **Close** the Setup and run a measurement. Based on the settings shown in *Figure 20-9*, the first five seconds of each measurement interval are recorded.

20.5 Listening to Sound Recordings

In this section:

- [Playback on the 831C](#)
- [Playback After Saving in G4](#)

Playback on the 831C

Before you begin:

- Connect a USB-compatible headset or speaker to the 831C.

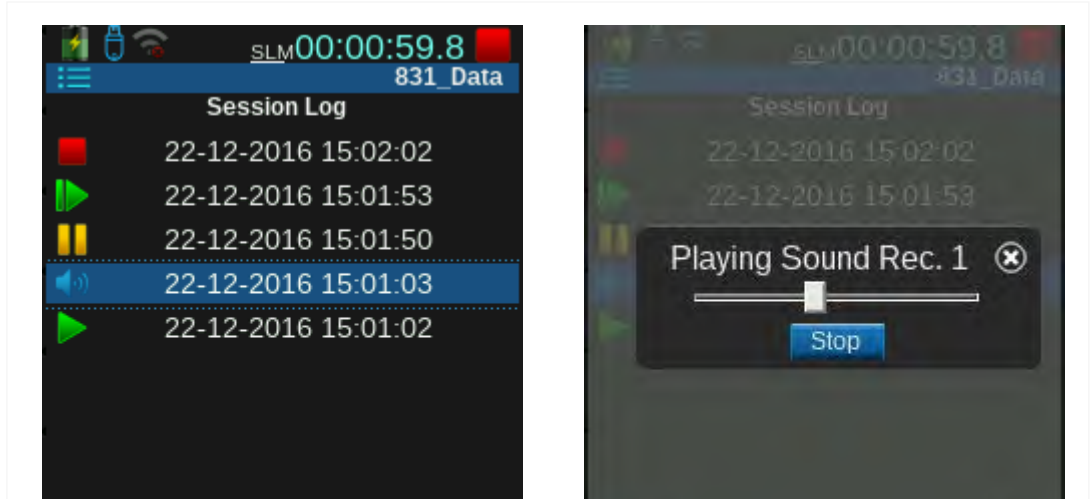
Step 1. On the 831C, press **Tools** (🔧) → **Data File Manager**.

Step 2. Highlight the file you want to open and press **Enter** (ENTER).

Step 3. Use the **left softkey** (●○) to display the Session Log tab.

Step 4. Select a sound event from the list. This opens the sound player.

Figure 20-10 Session Log Playback



Playback After Saving in G4

After the sound recording is stored, you can access it most easily from the G4 LD Utility.

LEARN MORE For more information, see section “4.8 Accessing Audio Files in G4” in the *G4 LD Utility Reference Manual*.

Module **21** Utilizing Non-Acoustic Inputs

This module discusses connecting transducers and other equipment to the SoundAdvisor 831C to provide additional, non-acoustical data; including the following devices:

- Weather sensors (Wind, Temperature, and Humidity)
- GPS devices
- External printers

In this module:

21.1	Overview of 831C-Compatible Weather Sensors	160
21.2	Installing a Weather Sensor	162
21.2.1	Installing SEN031 or SEN032 Weather Station	
21.2.2	Installing an Anemometer	
21.3	Configuring the 831C GPS Receiver Antenna	165
21.4	Utilizing an External Printer	166

21.1 Overview of 831C-Compatible Weather Sensors

This section reviews 831C-compatible devices for weather data collection.

SEN031 Vaisala Weather Transmitter Station

Figure 21-1 SEN031 General specifications



The SEN031 is a complete, digital weather station, and provides the weather and atmospheric metrics shown in *Table 21.1*.

Table 21.1 Available Weather Metrics, SEN031 Weather Station

Live	Overall	Current	Time History
Wind Speed	Avg Wind Speed	Avg Wind Speed	Avg Wind Speed
Wind Direction	Wind Direction	Wind Direction	Wind Direction
Temperature	Windy Percent (%)	Windy Percent	Gust Speed
Relative Humidity	Gust Speed	Gust Speed	Gust Direction
Avg Barometric Pressure	8x Wind Direction Percent	8x Wind Direction Percent	Avg Temp
Rain Accumulation	Avg Temp	Avg Temp	Min Temp
Rain Rate	Min Temp	Min Temp	Max Temp
Rain Duration	Max Temp	Max Temp	Avg Rel Humidity
Hail Accumulation	Avg Rel Humidity	Avg Rel Humidity	Max Rel Humidity
Hail Rate	Min Rel Humidity	Min Rel Humidity	Min Humidity
Hail Duration	Max Rel Humidity	Max Rel Humidity	Avg Barometric Pressure
	Avg Barometric Pressure	Avg Barometric Pressure	Min Barometric Pressure
	Min Barometric Pressure	Min Barometric Pressure	Max Barometric Pressure
	Max Barometric Pressure	Max Barometric Pressure	Max Rain Rate
	Max Rain Rate	Max Rain Rate	Rain Accumulation
	Rain Accumulation	Rain Accumulation	Rain Duration
	Rain Duration	Rain Duration	Max Hail Rate
	Max Hail Rate	Max Hail Rate	Hail Accumulation
	Hail Accumulation	Hail Accumulation	Hail Duration
	Hail Duration	Hail Duration	

The 831C displays these metrics on the Live view, Weather page and in the resulting measurement file. See **4.1.3 "Viewing Weather-Related Data" on page 45** to view this display and selectable units for the 831C Live view. To see how weather data appears in the resulting measurement file, see *G4 LD Utility Manual*, "7.4 Viewing Measurement Data."

Follow the manufacturer's complete instructions for installation and maintenance. Installation and setup on SoundAdvisor 831C is shown in **21.2.1 "Installing SEN031 or SEN032 Weather Station" on page 163**.

Refer to the weather station documentation at Vaisala.com for specifics on how the sensor measures and calculates available metrics.

SEN032 Ultrasonic Wind Sensor

Figure 21-2 SEN032 General specifications



The SEN032 is a complete, digital weather station, and provides the weather and atmospheric readings shown in *Table 21.2*

Table 21.2 SEN032 Wind Sensor Data Collection Metrics

Live	Overall	Current	Time History
Wind Speed	Avg Wind Speed	Avg Wind Speed	Avg Wind Speed
Wind Direction	Gust Speed	Gust Speed	Gust Speed
	Gust Direction	Gust Direction	Gust Direction
	Windy Percent	Windy Percent	
	8x Wind Direction Percent	8x Wind Direction Percent	

The 831C displays these metrics on the Live view, Weather page and in the resulting measurement file. See **4.1.3 "Viewing Weather-Related Data" on page 45** to view this display and selectable units for the 831C Live view. To see how weather data appears in the resulting measurement file, see *G4 LD Utility Manual*, "7.4 Viewing Measurement Data."

Follow the manufacturer's complete instructions for installation and maintenance. Installation and setup on SoundAdvisor 831C is shown in **21.2.1 "Installing SEN031 or SEN032 Weather Station" on page 163**.

Reference weather station documentation from Vaisala.com for specifics on how these metrics are calculated.

21.2 Installing a Weather Sensor

In this section:

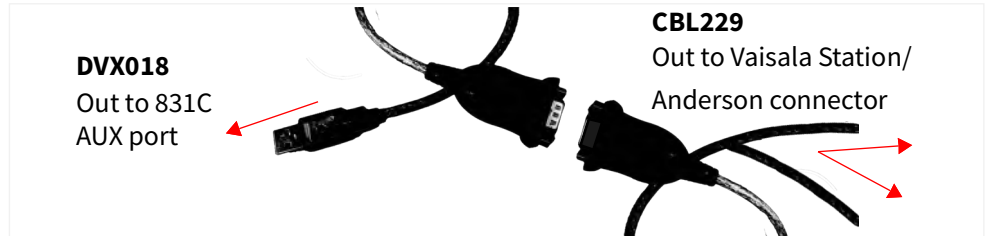
- **21.2.1 Installing SEN031 or SEN032 Weather Station**
- **21.2.2 Installing an Anemometer**

21.2.1 Installing SEN031 or SEN032 Weather Station

Connect the SEN031/032 weather station to the SoundAdvisor 831C via the included cables, as shown in *Figure 21-3*:

- DVX018: Serial to USB connector cable
- CBL229: Serial to split cable (Vaisala connector/Anderson connector)

Figure 21-3



21.2.2 Installing an Anemometer

The SoundAdvisor 831C is compatible with reed switch weather-sensing devices ranging from simple to complex, analog or digital. Complete this section to install this type of device.

Before you begin:

- For analog weather sensors: obtain the I/O Interface Cable (CBL170). Order the cable on LarsonDavis.com, or contact your local sales representative.

Step 1. Install and secure the sensor hardware as indicated in the sensor documentation.

Step 2. Review pinout instructions and diagrams provided in the sensor documentation and the CBL170 User Guide included with the cable.

Step 3. Create a connection to the 831C that matches your specific sensor. For suggested pinouts, see *Table 21.3* for wind sensors, and *Table 21.4* for wind sensors with wind direction.

Table 21.3 Pinouts for Reed Switch Wind Sensor

831C to CBL 170, DB-9 connector		Reed Switch Wind Sensor
PIN	Description	Description
1	Ground	Ground
2	Logic Out 3.3 V logic through 1 k Ω	
3	3.3 V Power Out through 220 Ω	27 k Ω resistor to pin 5; Wind speed pull up

831C to CBL 170, DB-9 connector		Reed Switch Wind Sensor
PIN	Description	Description
4	3.3 V logic in, +5 V max, -0.5 V min	
5	2.5 V full-scale, 100 k Ω load	Wind Speed Input
6	2.5 V full-scale, 100 k Ω load	
7	ADC1 Sensor Input 2.5 V full-scale, 100 k Ω load	
8	ADC2 Sensor Input 2.5 V full-scale, 100 k Ω load	
9	External Power +10 to +25 V DC	

Table 21.4 Pinouts for Reed Switch Wind Sensor with Wind Direction

831C to CBL 170, DB-9 connector		Reed Switch Wind Sensor
PIN	Description	Description
1	Ground	Ground
2	Logic Out; 3.3 V logic through 1 k Ω	
3	3.3 V Power Out through 220 Ω	Wind speed Output pull-up: 27 k Ω resistor to pin 5 Wind Direction Excitation: In-line 4.99 k Ω resistor
4	3.3 V logic in, +5 V max, -0.5 V min	
5	2.5 V full-scale; 100 k Ω load	Wind Speed Output
6	2.5 V full-scale; 100 k Ω load	Wind Direction Output
7	ADC1 Sensor Input; 2.5 V full-scale, 100 k Ω load	
8	ADC2 Sensor Input; 2.5 V full-scale, 100 k Ω load	
9	External Power; +10 to +25 V DC	

21.3 Configuring the 831C GPS Receiver Antenna

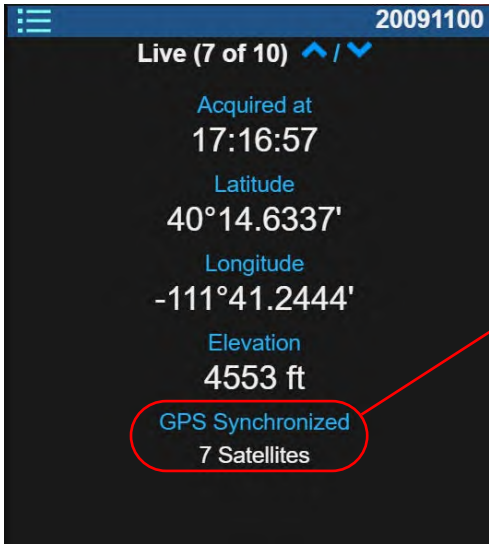
To provide global positioning information to the Model 831C, Larson Davis offers the USB GPS Receiver (GPS002). The receiver features a magnetic mount.

Figure 21-4 USB GPS Receiver (GPS002)



- Step 1.** To install the GPS receiver antenna, plug it into the 831C USB port.
- Step 2.** When you deploy and power on the 831C, you can use LD Atlas or the G4 Live View to verify the GPS location. On the meter interface or Live View, scroll down to the GPS page, as shown in *Figure 21-5*.

Figure 21-5 Live View, GPS Page



When configured correctly and when the meter is positioned in the path of at least three satellite signals, the unit's GPS location displays.

Four or more acquired satellite signals activate the local time.

TAKE NOTE The 831C also has a GPS setting, which can be disabled, if needed. Locate this setting in [9.4.6 Enabling GPS Mode](#).

21.4 Utilizing an External Printer

The 831C supports the external printer shown in *Figure 21-6*, which is available to order as an SLM accessory from LarsonDavis.com or your sales representative.

Figure 21-6 Thermal Printer (PRN003)



To print from the 831C, do the following:

- Step 1.** Power on and connect the printer to the 831C via USB
- Step 2.** On the 831C, press **Menu** (○●○).
- Step 3.** From the 831C menu that displays, choose one of the following print options:
 - **Print Summary**
 - **Print Screen** (Martel printer only)
 - **Print Enforcement**
 - **Print Calibration**

Appendix **A** Technical Specifications

In this module:

A.1	Instrument Platform Specifications	A-2
A.2	Model PRM831	A-10
A.3	Base Software	A-11
A.4	Octave Band Analysis Software – Option 831C-OB3	A-17
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Unless otherwise noted, these specifications apply to the SoundAdvisor Model 831C SLM used with a 377B02 microphone, PRM831 microphone preamplifier, and the EXC020 20 foot (6 m) preamplifier extension cable.

A.1 Instrument Platform Specifications

A.1.1 Standards Met

Safety:

IEC 61010-1:2010: Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

EMC Emission:

CISPR 11:2015 with Amend 1 (EN 55011)

EMC Immunity:

EN 61672-1:2013, EN 61000-6-2:2005




Electrostatic discharge (ESD) Immunity:

IEC61000-4-2:2008, ± 4 kV contact discharges and ± 8 kV air discharges.

Other Standards:

Test results and certificates compliant with ISO 17025

Table A-1 Safety Marks

	CE-mark indicates compliance with the EMC, Low Voltage, and RoHS Directives
cUL/UL and SAA	
	WEEE mark indicates compliance with the EU WEEE Directive
	UKCA mark indicates conformity with the applicable requirements for products sold within Great Britain

A.1.2 Supplied Microphone Specifications

Model 377B02, 1/2-inch free-field, prepolarized condenser microphone

Typical Sensitivity: 50 mV/Pa (+/-1.5 dB) corresponding to -26 dB re. 1 V/Pa

Frequency Response: 3.15 Hz to 20 kHz (+/-2 dB)

Capacitance: 12 pF

A.1.3 Microphone Preamplifier Specifications

Model PRM831, 1/2-inch diameter x 2.88"

Typical Preamplifier Attenuation: 0.08 dB

Connector: 5-Pin Male, Switchcraft TA5MLAUX

Mating Connector: 5-Pin Female, Switchcraft TA5FLAUX

Extension Cables: You can use a preamplifier extension cable between the meter and the preamplifier/microphone with no degradation for lengths up to 200 feet (61 m).

Microphone polarization voltage: 0 V (no polarization is provided, so use pre-polarized microphones)

A.1.4 SLM Performance Specifications

Table A-2 SLM Performance (Nominal Values)

Gain		Direct Input (dB μ V)		PRM831 with 377B02 (dB SPL)		PRM831 with 377C20 (dB SPL)		PRM831 with 377A15 (dB SPL)		378A04 (dB SPL)	
		0 dB	+20 dB	0 dB	+20 dB	0 dB	+20 dB	0 dB	+20 dB	0 dB	+20 dB
Measurement Range ¹	A	n/a	n/a	24-140	20-120	24-140	20-120	21-140	16-120	6-100	6-80
	C	n/a	n/a	26-140	25-120	26-140	25-120	21-140	16-120	10-100	8-80
	Z	n/a	n/a	36-140	33-120	36-140	33-120	27-140	25-120	19-100	18-80
Typical Noise Floor ¹	A	8.3	-0.1	16.3	15.6	16.3	15.6	12.5	12.0	5.4	5.5
	C	6.9	-1.4	16.8	16.3	16.8	16.3	12.5	12.0	10	8.0
	Z	12.3	3.0	23.4	23.2	23.4	23.2	16.5	15.5	18.4	17.5
Linearity Range ²	A	≥ 120	≥ 108	≥ 116	≥ 100	≥ 116	≥ 100	≥ 120	≥ 106	n/a	n/a
		20-140	12-120	24-140	20-120	24-140	20-120	20-140	14-120		
	C	≥ 121	≥ 110	≥ 114	≥ 96	≥ 114	≥ 96	≥ 120	≥ 106	n/a	n/a
		19-140	10-120	25-140	23-120	25-140	23-120	20-140	14-120		
	Z	≥ 117	≥ 104	≥ 104	≥ 87	≥ 104	≥ 87	≥ 114	≥ 96	n/a	n/a
		23-140	15-120	32-140	32-120	32-140	32-120	26-140	24-120		
Peak Range ²	A	65-143	46-123	65-143	44-123	65-143	44-123	64-143	45-123	46-103	26-83
	C	63-143	46-123	66-143	45-123	66-143	45-123	65-143	46-123	47-103	27-83
	Z	64-143	46-123	68-143	59-123	68-143	59-123	66-143	48-123	49-103	41-83
SPL Max Level ²		≥ 140	≥ 120	≥ 140	≥ 120	≥ 140	≥ 120	≥ 140	≥ 120	≥ 100	≥ 80
Peak Max Level ²		≥ 143	≥ 123	≥ 143	≥ 123	≥ 143	≥ 123	≥ 143	≥ 123	≥ 103	≥ 83

1. Microphone and electrical self-noise included

2. Electrical measurement, frequency 1kHz

A.1.5 User Interface Specifications

Keyboard: 13 keys, quiet elastomer touch with blue back-lighting for measurement control and data navigation.

Status Indicators:

- Red LED under the STOP/STORE key indicates measurement stopped
- Green LED under the RUN/PAUSE key indicates measurement running
- Green LED under the power key indicates battery charge and power on/off in progress

Display:

- TFT full color LCD, 240 by 320 dot matrix
- White backlight with adjustable brightness and on-time

- Touch screen to assist in data navigation and measurement control
- Multiple color themes for various lighting conditions

Display update rate: ≤ 1 s

Lock: User interface may be locked and unlocked

Languages: Czech, English, French, German, Italian, Norwegian, Portuguese, Russian, Spanish, Swedish, Turkish

A.1.6 Input Specifications

Connector: Latching 5-pin circular connector, mates to PRM831 or EXCxxx cables

Preamplifier Supply: 36 volt at 5mA available to power preamplifier

Input Impedance: $\geq 100\text{k}\Omega \parallel 300$ pF

Direct Input: Absolute maximum of ± 35 V, DC bias readout 0 to +35 V

Gain Control: Selectable 0 or +20 dB gain

Full Scale Input 0 dB Gain: ± 14.14 V_{peak} AC

Full Scale Input +20 dB Gain: ± 1.414 V_{peak} AC

ICP Input (use ADP074): Constant current of 4 mA, maximum voltage of 28 V

Sample Rate: 51,200 sps

A.1.7 USB Client Interface Specifications

Type: USB 2.0 High-Speed Mini-B connector

Power Draw: ≤ 500 mA from PC, USB Hub, or PSA029

Supported Hosts:

- Computer with SLM Utility-G4
- Ethernet Dock 831INT-ET
- NoiseTutor
- Computer with custom software using SWW-G4-SDK or SWW-G4-WIN

A.1.8 USB Host Interface Specifications

Type: USB 2.0 High-Speed, standard A connector

Supported Devices:

- USB Flash Memory Drive, up to 32GB FAT-32 Format, PN 831-MEM32G
- Ethernet Adapter, 1G/100M/10M, PN DVX012
- Ethernet Adapter & USB Hub, 1G/100M/10M, PN DVX013
- WiFi Wireless Adapter, Edimax EW-7811Un, or D-Link DWA-121, PN DVX014 (WPA/WPA2 encryption)
- GPS Receiver TopGNSS GNSS100L, PN GPS002
- USB to RS232 Serial Adapter, PN DVX018

- Multi-Metric Weather Sensor, Vaisala WXT520, PN SEN031
- Ultrasonic Wind Sensor, Vaisala WMT52, PN SEN032
- Wireless LTE Gateway, Sierra Wireless AirLink RV-50, PN COM-RV50-DC-E or COM-RV50-DC-U

A.1.9 AC/DC Output Specifications

Connector: 2.5mm (3/16”) Sub-Miniature Phone Jack, AC Output on RING, DC Output on TIP

AC Output Selections: (1) Off, (2) 0 dB, (3) +20 dB, (4) +40 dB, and (5) Preamp 10V

Gains of 0, +20 and +40 are relative to measurement full scale.

AC Output Voltage: For 0 dB through +40 dB selection: $\pm 2.12 V_{peak}$ Maximum (-16.5dB re. to input), suitable for LINE inputs

For Preamp selection: $\pm 14.14 V_{peak}$ Maximum

AC Output Impedance: $1k\Omega \parallel 1000pF$

AC Output Frequency Weighting: No frequency weighting is applied. Includes input's 0.1Hz high-pass filter only

DC Output Voltage: 10 mV/dB, +2.2 V maximum, 0V \approx 0dB & 2V \approx 200dB

DC Output Impedance: $1k\Omega \parallel 1000pF$
Note: DC Output only while meter is running

A.1.10 AC Performance Specifications

Table A-3 AC Output Maximum Values

AC Output Setting	Output re input (dB)	0 dB Gain Maximum* (dB re 20 μ Pa)	20 dB Gain Maximum* (dB re 20 μ Pa)
Off	Off	Off	Off
Out + 0 dB	-16.5	140	120
Out +20 dB	-36.5	120	100
Out +40 dB	-56.5	100	80
Preamp 10V	0.0	140	120
* Results for typical 377B02 microphone, actually sensitivity effects results			

A.1.11 I/O Connector Specifications

Provides External Power, Analog and Digital I/O, and enhanced capabilities for 831-INT

Mating connector: Hirose ST40X-18S or ST60X-18S

Logic Output: Output driven 0 to +3.3 V through 1 k Ω , setting selects function

Logic Input: Input accepts 0 to +3.3 V, $\approx 50 k\Omega$ load, setting selects function

External Power: +10 to +25 V, 500 mA, self resetting fuse

Digital Sensor Port: Synchronous serial port for PRM2103 and 426A12 metrics

Preamplifier Control: Digital control lines for preamplifier calibration check and overload detection

Windspeed Pulse Input: Input accepts 0 to +3.3 V pulses from anemometer (+5 V tolerant), 100 k Ω load. Edit Weather settings in the measurement setup to customize scale and units.

Analog Inputs: 3 channels, 0 to +2.5 V, 100 k Ω load. Edit Weather settings in the measurement setup to customize Scale and Units.

The pinouts for the I/O Connector are shown in *Table A-4*.

Table A-4 I/O Connector Pinouts

Pin #	Description	Signal Type
1	Ground, Digital and Power Supply	Ground
2	Logic Out 1, Logic Control Output	Output, 0 to +3.3 V
3	831C Activity	Output, 0 to +3.3 V
4	Logic In, Logic Control Input	Input, 0 to +3.3 V, 5 V tolerant
5	Ground, Digital and Power Supply	Ground
6, 7	Vext, External Power Input	Input, +10.8 V to +25 V, 0.5 A auto-resetting PTC fuse
8	SensorClk_L, LD 426A12 digital sensor clock	Output, open drain, +20 V max. open and 50 mA max. closed
9	SensorDIO, LD 426A12 digital sensor data	Bi-directional, +3.3 to +5 V logic, Open drain
10	CalOn_H, LD 426A12 calibration signal on	Output, 0 to +3.3 V
11	Ovld, LD 426A12 overload detection signal	Input, 0 to +5 V
12	Mains Power Status; OK when +3.3 V	Input, 0 to +3.3 V
13	+3.3 V to supply logic switches	Output, +3.3 V through 220 Ω
14	Wind Speed In, Pulse input for wind speed sensors	Input, 0 to +3.3 V, 5 V tolerant
15	Vwthr1, Analog to Digital Converter Input, Wind Direction	Input, 0 to +2.5 V, 100 k Ω load; Scale with 5 k Ω series resistor when using 3.3 V output of pin 13
16	Vwthr2, Analog to Digital Converter Input, Temperature	
17	Vwthr3, Analog to Digital Converter Input, Humidity	
18	Analog Ground, Signal ground for pins 15 through 17	Ground

1. To enable the “Logic In, Logic Control Input” feature, when making your own cable, pin 12 (Mains Power Status) must be driven by a resistance lower than about 20 k Ω . This may be done by connecting a 10 k Ω resistor from pin 12 to either pin 13 (+3.3 V, to simulate running on Mains power) or to pin 1 or 5 (Ground, to indicate run-

ning on external battery power). Pin 4 needs to be driven high to assert the Logic In and pulled low to de-assert the input. It should not be left floating. This can be done with a momentary push-button switch from pin 4 to pin 13 with a 10 k Ω pull down resistor to ground (10 k Ω from pin 4 to pin 1 or 5).

A.1.12 Battery Specifications

Size: 4 x AA size cells (LR6)

Types: 1.5 V Alkaline, 1.2 V NiMH rechargeable, 1.5 V Photo-Lithium

NiMH Charge Time: USB to power outlet (not PC), meter powered OFF during charging < 16 hours

Typical Operating Time: > 8 hours continuous measurement

A.1.13 External Power Specifications

Via USB Client Connector: Powered by computer or PSA029 Power Adapter, 5.0 \pm 0.5 V typical, 16 V absolute maximum

A.1.14 External DC Power Supply Specifications

DC power supply to 831C provides power to operate the instrument and PRM831 preamplifier, supply the USB Host port with 500mA, and charge the batteries when charging is enabled.

Recommended Supplies: Use cable CBL140 with PSA027

Voltage: +10 to +25 V

Supply Current Requirement: 1.0 A minimum

Power Consumption: As shown in *Table A-5*.





Table A-5 831C Elements of Power Consumption

Watts	Conditions/Settings
1.3	Display “Off,” running continuously, no USB Host devices, charging “Off,” power saving functions “On”
2	Display and backlight “On,” no USB Host devices, charging “Off”
< 5.4	With 2.5 W USB Host power, charging “On”
	Accessory Power Consumption
+0.3	USB Memory, 32GB (831-MEM32G)
+0.7	Ethernet Adapter (DVX012)
+0.75	Ethernet and USB hub (DVX013)
+0.4	WiFi Adapter (DVX014)
+0.3	Dual port USB hub (DVX015)
+1.85	RV50X Cellular Gateway
+0.5	GPS Antenna (GPS002)
+0.05	USB to RS232 Serial Adapter (DVX018)
+0.04	Vaisala Weather Station (SEN03x) Heater “Off”

831C at Low Power and Power Failure

Table A-6 and *Table A-7* describe the various indicators, states, and processes executed by the 831C during low power and power failure.

Table A-6 Status for Low Power at Boot-up

Power Level	Power Source	Parameters	Display
Low (Attempts to boot)	External	< External Shutoff Voltage ¹ + 0.8 V	Warning Only 
	Internal	< 4.2 V	Warning Only 
Very Low	External	< External Shutoff Voltage ¹ + 0.5 V	(Halts boot process) ² 
	Internal	< 4.1 V	(Halts boot process and shuts down) ² 
Dead (shut down)	External	< External Shutoff Voltage ¹ - 0.2 V	
	Internal	< 3.8 V	

1. The External Shutoff Voltage is a user-defined setting. See **Setting the External Shutoff Voltage on page 88**.
2. Boot process halts for one minute. If power level remains “very low” or less after one minute, the meter powers down for a period before attempting to power on. The period before powering on is determined by the number of failed boots. See *Table A-7*.

Table A-7 831C Power-On Attempts After External Power Failure

Power On Attempts	Period Since Last Power Fail
1	20 minutes
2	1 hour
3	2 hours
4	4 hours
5	6 hours
6	12 hours
7-16	24 hours

Power-On Time: < 2 minutes

Real-Time Clock: Documented Drift is < 0.3 seconds drift per 24-hour period over full operating temperature range with battery back-up power

Backup Time: One-year rechargeable battery backup

TAKE NOTE The 831C automatic “Power-on Attempts” shown in this table occur only when the meter is utilizing “Continuous” Meter Control in SLM mode.

A.1.15 Data Storage Specifications

Internal: Two GB, non-volatile flash memory dedicated to data and user setups

External: Up to 32 Gigabyte USB Flash Memory Drive from Larson Davis (831-MEM32G)

A.1.16 Electrostatic Discharge Specifications

The instrument is not adversely affected by electrostatic discharges.

A.1.17 Environmental Conditions Specs

Operating Temperature: -30 to +50°C (-22 to 122°F)

Storage Environment: -30 to +60° C (-22 to +158°F), less than 90% RH

Temperature Sensitivity: ≤ 0.5 dB sensitivity, -10 to +50°C (14 to 122°F) at 1 kHz

Humidity Sensitivity: ≤ ±0.5 dB sensitivity, 10% to 99% relative humidity (non-condensing)

A.1.18 Physical Characteristics

Dimensions:

- 290 x 71 x 41 mm (11.35") including microphone and preamplifier
- 224 x 71 x 41 mm (8.80") instrument body only

Weight:

- 531.6 g (18.8 oz) including batteries, preamplifier and microphone
- 489.2 g (17.3 oz) including batteries

A.2 Model PRM831

The Larson Davis PRM831 is an electret microphone preamplifier for use with a Larson Davis Model 831 Sound Level Meter. It requires little supply current and is capable of driving 300 feet of cable. The preamplifier

operates over wide ranges of temperature and humidity. It has very little attenuation for use with 50 mV/Pa sensitivity microphones up to 140 dBSPL.

A.2.1 Model PRM831 Specifications

Table A-8

Frequency Response	Response at 1 kHz with 1 Volt rms input and 12 pF equivalent microphone: 8 Hz to 16 Hz +0.1, -0.2 dB 16 Hz to 100 kHz +0.1, -0.1 dB Lower -3 dB limit < 1.5 Hz
Attenuation	0.1 dB (typical)
Input Impedance	10 G Ohm // 0.16 pF
Output Impedance	50 Ohm
Maximum Output	28 Vpp 143 dB peak for microphones with 50 mV/Pa sensitivity
Maximum Output Current	12 mA peak
DistortionHarmonics	< -70 dBC with 8 Volt rms output at 1 kHz
Output Slew Rate	2 V/μS (typical)
Electronic Noise (with 12 pF equivalent microphone)	1.8 μV typical A-weighted (2.4 μV max) 4.3 μV typical Flat 20 Hz to 20 kHz (5.0 μV max)
Power Supply Voltage	15 to 36 Volts
DC Output Level	~1/2 power supply voltage
Power Supply Current	1.9 mA typical
Temperature Sensitivity	< ±0.05 dB from -40° to +80° C (14° to +176 °F)
Humidity Sensitivity	< ±0.05 dB from 0 to 90% RH, non-condensing at 50° C (122 °F)
Dimensions	12.7 mm diameter x 73 mm length (0.50" diameter x 2.88" length)
Microphone Thread	11.7 mm - 60 UNS (0.4606 - 60 UNS)
Cable Driving Capability (<0.1 dB error)	Model 831 SLM: 10 V rms output signal, full scale <ul style="list-style-type: none"> To 50 kHz with 10' (3 m) cable To 25 kHz with 200' (61 m) cable To 20 kHz with 328' (100 m) cable To 18 kHz with 400' (122 m) cable To 15 kHz with 500' (152 m) cable To 6.3 kHz with 1000' (305 m) cable Model 831: 3 V rms signal, 10.5 dB below full scale <ul style="list-style-type: none"> To 80 kHz with 200' (61 m) cable To 63 kHz with 328' (100 m) cable To 50 kHz with 500' (152 m) cable To 10 kHz with 1000' (305 m) cable
Test Conditions	All values are at 23° C, 50% RH, 35 Volt supply, 3 m (10') cable and equivalent microphone of 12 pF unless otherwise stated.
Output Connector	Switchcraft TA5M 5-Pin male

Table A-9 Output Connector Key

Pin	Signal
1	Signal Ground
2	Signal Output
3	Power Supply + 35 Volts
4	Preamp sensor
5	No Connection
Shell	Connect to preamp housing

A.3 Base Software

A.3.1 Standards Met

Sound Level Meter Standards:

- IEC 61672-1:2013 Class 1, Group X
- IEC 60651 Ed 1.2 (2001) plus Amendment 1 (1993-02) and Amendment 2 (2000-10) Type 1, Group X
- IEC 60804 (2000-10) Type 1, Group X
- ANSI S1.4-2014 Class 1
- ANSI S1.4-1983 (R2006) plus Amendment ANSI S1.4A-1985 (R2006) Type 1
- ANSI S1.43-1997 (R2007) Type 1
- DIN 45657 Sound level meters - Additional requirements for special measuring tasks

A.3.2 Filter Response Values

- Frequency response values are available for sound field/microphone type and for environmental protection accessories.
- Note: “RI” indicates “Random Incidence” and “FF” indicates “Free-Field”
- For microphone 377C20: RI to FF filter
- For microphone 377B02: FF to RI filter
- For microphone 377B02 with EPS2106/8: FF to RI, FF to FF, FF:90° filters
- For microphone 377B02 with EPS2116: FF to RI, FF to FF, FF:90° filters
- For microphone 377B02 or 377C20 with WS001 windscreen: WS001 filter

For the following tables, view applicable instructions in the table footnotes.

Table A-10 Corrections for SLM with PRM831 and 377B02 Microphone

Frequency	0° Free Field Corrections ^{1,2}	0° Free Field Corrections with WS ^{1,2}	0° Free Field Corrections ^{1,3}	0° Free Field Corrections with WS ^{1,3}	Expanded uncertainty of Corrections ^{1,4}
Hz	dB re 1 kHz	dB re 1 kHz	dB re 1 kHz	dB re 1 kHz	dB
31	0.23	0.12	0.21	0.10	0.25
63	0.18	0.07	0.15	0.04	0.25
125	0.09	-0.02	0.10	-0.01	0.25

Frequency	0° Free Field Corrections ^{1,2}	0° Free Field Corrections with WS ^{1,2}	0° Free Field Corrections ^{1,3}	0° Free Field Corrections with WS ^{1,3}	Expanded uncertainty of Corrections ^{1,4}
250	0.10	-0.01	0.07	-0.03	0.25
500	0.25	0.17	0.26	0.18	0.25
1000	0.00	0.00	0.00	0.00	0.25
2000	0.43	0.69	0.42	0.69	0.25
4000	0.97	0.94	0.97	0.95	0.25
8000	2.60	2.25	3.02	2.67	0.35
12500	5.65	5.33	6.51	6.19	0.50
16000	7.69	6.92	8.46	7.68	0.50
<p>1. Add numbers in this column to levels read on the SLM to correct to the 0° Free Field level at frequency. 2. From B&K 4226 Calibrator 3. From B&K UA033 EA 4. Corrections at 95% confidence EA: Electrostatic Actuator WS: windscreen Note: Data was taken at reference conditions 23° C, 50% RH, 101.3 kPa</p>					

Table A-11 Corrections for SLM with PRM831 and 377C20

Frequency	0° Free Field Corrections ^{1,2}	0° Free Field Corrections with WS ^{1,2}	0° Free Field Corrections ^{1,3}	0° Free Field Corrections with WS ^{1,3}	Expanded uncertainty of Corrections ^{1,4}
Hz	dB re 1 kHz	dB re 1 kHz	dB re 1 kHz	dB re 1 kHz	dB
31	0.02	-0.22	0.07	-0.17	0.25
63	0.02	-0.22	0.07	-0.17	0.25
125	0.07	-0.17	0.07	-0.17	0.25
251	0.09	-0.16	0.078	-0.18	0.25
501	0.09	0.02	0.06	-0.01	0.25
1000	0.00	0.00	0.00	0.00	0.25
1995	0.46	0.78	0.48	0.80	0.25
3981	1.14	1.06	1.19	1.11	0.25
7943	3.23	2.95	3.64	3.36	0.35
12589	6.33	5.71	8.19	7.57	0.50
15848	8.05	5.49	9.58	7.02	0.50
<p>1. Add numbers in this column to levels read on the SLM to correct to the 0° Free Field level at frequency. 2. From B&K 4226 Calibrator 3. From B&K UA033 EA 4. Corrections at 95% confidence EA: Electrostatic Actuator WS: windscreen Note: Data was taken at reference conditions 23° C, 50% RH, 101.3 kPa</p>					

A.3.3 Measurement System Specifications

Integration Method:

- Equivalent level integration method can be Linear or Exponential.
- Exponential integrates the output of the selected time weighting (Slow, Fast, or Impulse)

Integration Time: Minimum: 0.1 s, Maximum: < 0.5 dB error: > 23 days

Frequency Weightings: A, C, Z parallel and simultaneous for each Time Weighting, selected frequency weighting (A, C, or Z) indicated by ω .

Peak Frequency Weightings: A, C, Z parallel, selected peak frequency weighting (A, C, or Z) indicated by ρ

Time Weightings/Detectors: Slow, Fast, Impulse, Linear and Peak simultaneously, selected time weighting (S, F, or I) indicated by τ .

Peak Rise Time: 30 μ s

A.3.4 Measurements Specifications

Instantaneous “Live” Metrics

For display and profile graph. Not stored with measurement.

A primary frequency and time weighting is selected by setting for RMS and Peak level to display, all levels are available in an “Any Level” matrix.

Time Weighting	A	C	Z	Units
Linear	L_{Aeq}	L_{Ceq}	L_{Zeq}	dB
Slow	L_{AS}	L_{CS}	L_{ZS}	dB
Fast	L_{AF}	L_{CF}	L_{ZF}	dB
Impulse	L_{AI}	L_{CI}	L_{ZI}	dB
Peak	L_{Apeak}	L_{Cpeak}	L_{Zpeak}	dB

A.3.5 Overall Metrics Specifications

A primary frequency and time-weighting is selected by setting for RMS and Peak level to display. All levels can be displayed by using the “Any Level” menu.

Table A-12

Time Weighting	A	C	Z	Units
Linear ¹	L_{Aeq}	L_{Ceq}	L_{Zeq}	dB
Linear ²	L_{ATeq}	L_{CTeq}	L_{ZTeq}	dB
Slow Maximum	L_{ASmin}	L_{CSmin}	L_{ZSmin}	dB
Slow Minimum	L_{ASmax}	L_{CSmax}	L_{ZSmax}	dB
1. Linear integration method selected by user 2. Exponential Integration method selected by user				

Table A-12 (Continued)

Fast Minimum	L_{AFmin}	L_{CFmin}	L_{ZFmin}	dB
Fast Maximum	L_{AFmax}	L_{CFmax}	L_{ZFmax}	dB
Impulse Minimum	L_{Almin}	L_{Clmin}	L_{Zlmin}	dB
Impulse Maximum	L_{Almax}	L_{Clmax}	L_{Zlmax}	dB
Peak	$L_{Apeak(max)}$	$L_{Cpeak(max)}$	$L_{Zpeak(max)}$	dB
1. Linear integration method selected by user 2. Exponential Integration method selected by user				

Table A-13 Occurrence Time for Minimum and Maximum Levels

Time Weighting	A	C	Z	Units
Slow Maximum	T_{ASmin}	T_{CSmin}	T_{ZSmin}	y/m/d h:m:s
Slow Minimum	T_{ASmax}	T_{CSmax}	T_{ZSmax}	y/m/d h:m:s
Fast Minimum	T_{AFmin}	T_{CFmin}	T_{ZFmin}	y/m/d h:m:s
Fast Maximum	T_{AFmax}	T_{CFmax}	T_{ZFmax}	y/m/d h:m:s
Impulse Minimum	T_{Almin}	T_{Clmin}	T_{Zlmin}	y/m/d h:m:s
Impulse Maximum	T_{Almax}	T_{Clmax}	T_{Zlmax}	y/m/d h:m:s
Peak	$T_{Apeak(max)}$	$T_{Cpeak(max)}$	$T_{Zpeak(max)}$	y/m/d h:m:s

Percentile Levels

Percentages “n1” through “n6” selectable, 0.01 to 99.99%. Statistics are sampled every 10ms from the selected frequency and time-weighted detector.

Table A-14

		Units
1	$L_{\omega Tn1}$	dB
2	$L_{\omega Tn2}$	dB
3	$L_{\omega Tn3}$	dB
4	$L_{\omega Tn4}$	dB
5	$L_{\omega Tn5}$	dB
6	$L_{\omega Tn6}$	dB

To calculate Ln values, the 831C crates an amplitude distribution table over the range of 0 to 199.7 d, in amplitude increments of 0.1 d. This data permits the calculation of Ln values for any value of n in the range 00.01 to 99.99%.

Exceedance Metrics

Exceedance levels (L1, L2, P1, P2 and P3) selectable in dB from 0.0 to 200.0, counts each time the level rises above the threshold and measure the duration while above the level minus 2 dB.

Table A-15

	Label	Count	Duration
SPL 1	$L_{\omega T} > L1$	0 to 99999	h:m:s.s
SPL 2	$L_{\omega T} > L2$	0 to 99999	h:m:s.s
Peak 1	$L_{\omega T} > P1$	0 to 99999	h:m:s.s
Peak 2	$L_{\omega T} > P2$	0 to 99999	h:m:s.s
Peak 3	$L_{\omega T} > P3$	0 to 99999	h:m:s.s

Overload Count and Duration Metrics

- Occurrences, count from 0 to 99999: nnnnn
- Overload Percentage: nnn.nn %
- Duration Overloaded: h:m:s.s
- Elapsed Run-Time: h:m:s.s
- Elapsed Pause-Time: h:m:s.s

Community Noise

- Day Night Level, midnight to midnight: LDN
- Daytime portion of Day Night Level: $L_{day} (T_{day} - T_{night})$
- Nighttime portion of Day Night Level: $L_{night} (T_{night} - T_{day})$
- Day Evening Night Level, midnight to midnight: LDEN
- Daytime portion of Day Night Level: $L_{Day} (T_{day} - T_{eve})$
- Evening-time portion of Day Night Level: $L_{Eve} (T_{eve} - T_{night})$
- Nighttime portion of Day Night Level: $L_{Night} (T_{night} - T_{day})$

C minus A

Mathematical subtraction of C and A-weighted equivalent levels

Linear	Exponential	Units
$L_{Ceq} - L_{Aeq}$	$L_{CTeq} - L_{ATEq}$	dB

Impulsivity

Mathematical subtraction of impulse and linear equivalent levels

Linear	Exponential	Units
$L_{Aeq} - L_{Aeq}$		dB

Location

GPS (external GPS, records last fix of measurement):

- Latitude: dg m.m

- Longitude: dg m.m
- Elevation: m or feet
- Time Acquired: h:m:s

A.3.6 Measurement Control Specifications

The following control modes provide for a variety of manual and automated measurements:

Manual: Manually control measurements-- RUN, PAUSE, RESUME, STOP, STORE

Timed Stop: Start manually and runs for set run time (1 second to 99 hours)



Stop When Stable: Start manually and runs until levels are stable

Continuous: Start manually or at power on and runs without interruption, Daily Auto-Store available, special restart after low battery features enabled

Single Block Timer: Runs from a set date and time to another date and time

Daily Timer: Runs for up to three time blocks per day qualified by a start date and an end date

A.3.7 Measurement Status

Measurement status is indicated on the display and with lights below the **Stop/Store button**  and **Play/Pause button** . Statuses include: Stopped Reset, Stopped, Run, Paused, Stored, and Standby.

Icons on display indicate overload, under range, battery state, and memory status.

A.3.8 Back-Erase

Erases the previous 5 or 10 seconds from a measurement. See **Pausing the Measurement and Using Back Erase on page 71.**

A.4 Octave Band Analysis Software – Option 831C-OB3

Complies with the following Octave Filter Standards:

- IEC 61260-1:2014/Part 1, 1/1 and 1/3-octave Bands, Class 1, Group X, all filters
- ANSI/ASA S1.11-2014/Part 1, 1/1 and 1/3-octave Bands, Class 1, Group X, all filters

OBA Specifications

Bandwidth: 1/1 Octave, 1/3 Octave, or simultaneous 1/1 and 1/3 Octave

Filter Type and Sample Rate:

Digital filters are sampled at a rate of 51,200 samples per second, with base 10 center frequencies and have real-time performance for all filters. The 0 dB gain setting and “high” OBA range is the reference range and the reference input signal is .5 Volt rms at 1 kHz.

1/1 Octave Center Frequencies: 8 Hz to 16 kHz

1/3 Octave Center Frequencies: 6.3 Hz to 20 kHz

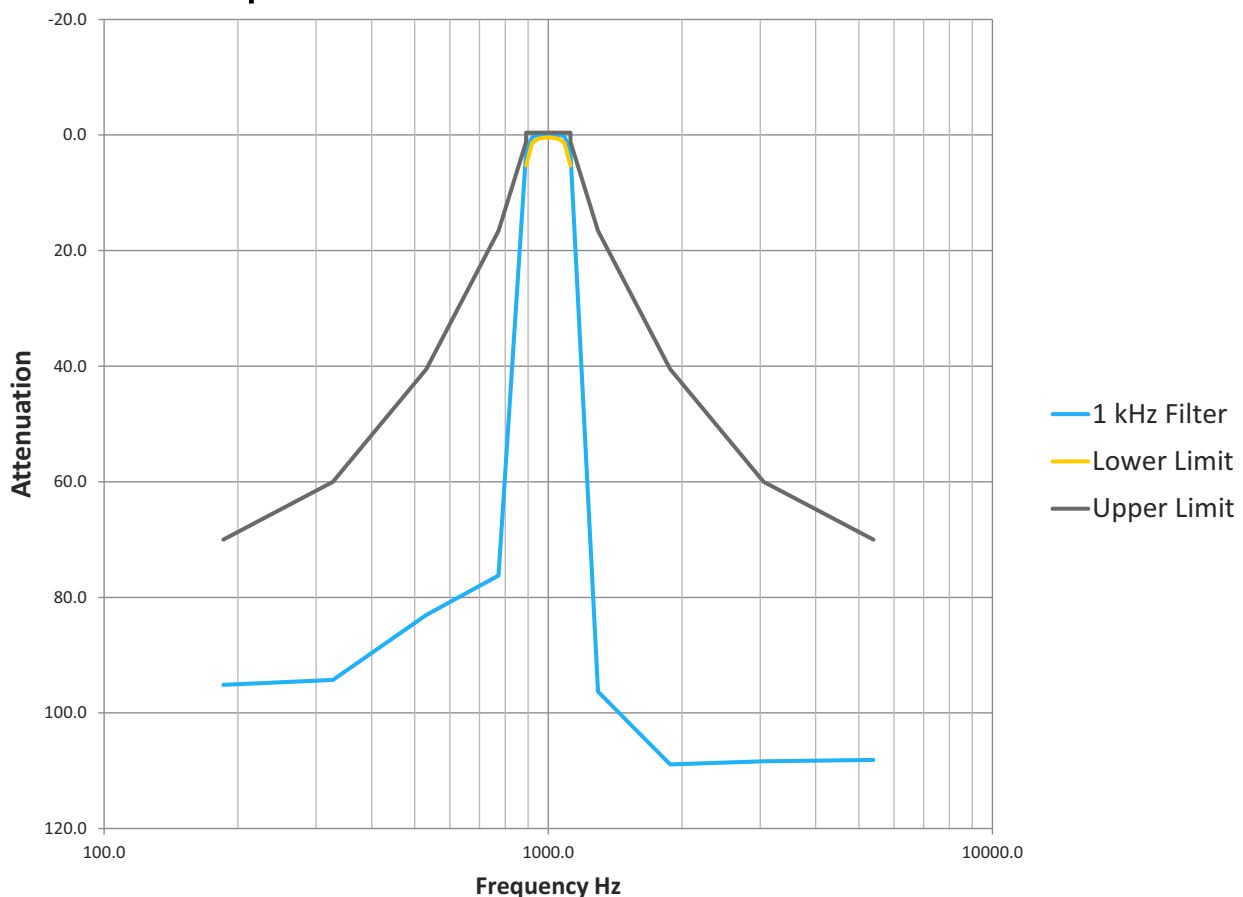
Measurement Range Specifications

Normal (107 dB full scale) and **High** (140 dB full scale). Note: These ranges assume a 50 mV/Pa microphone is being used.

Filter Shape

1/3 octave band centered at 1 kHz. Overlaid with the Class 1 limit curves as shown in *Figure A-1*.

FIGURE A-1 Filter Shape



A.4.1 1/1 and 1/3 OBA Filter Linearity Ranges (Normal and High)

Full Octave ranges are shown in *Table A-16*. Third Octave ranges are shown in *Table A-17*.

Table A-16 1/1 OBA Octave Linearity Range

Nominal Frequency (Hz)	High Range		Normal Range		Nominal Frequency (Hz)	High Range		Normal Range			
	0 dB Gain (dB)	+20 dB Gain (dB)	0 dB Gain (μdB)	+20 dB Gain (dB)		0 dB Gain (dB)	+20 dB Gain (μdB)	0 dB Gain (μdB)	+20 dB Gain (μdB)		
PRM831	8.0	≥ 108 32 to 140	≥ 89 31 to 120	≥ 80 30 to 110	≥ 61 30 to 90	Direct Input	8.0	≥ 102 110 to 39	≥ 98 23 to 120	≥ 101 9 to 110	≥ 89 1 to 90
	16.0	≥ 110 30 to 140	≥ 92 28 to 120	≥ 83 27 to 110	≥ 64 27 to 90		16.0	≥ 108 110 to 32	≥ 106 14 to 120	≥ 108 2 to 110	≥ 92 -2 to 90
	31.5	≥ 112 29 to 140	≥ 95 26 to 120	≥ 86 25 to 110	≥ 66 24 to 90		31.5	≥ 120 110 to 20	≥ 118 3 to 120	≥ 111 -1 to 110	≥ 96 -6 to 90
	63.0	≥ 113 27 to 140	≥ 97 23 to 120	≥ 88 22 to 110	≥ 69 21 to 90		63.0	≥ 119 110 to 22	≥ 117 3 to 120	≥ 110 0 to 110	≥ 95 -5 to 90
	125	≥ 113 27 to 140	≥ 100 20 to 120	≥ 91 19 to 110	≥ 73 18 to 90		125	≥ 117 110 to 24	≥ 115 5 to 120	≥ 108 2 to 110	≥ 94 -4 to 90
	250	≥ 113 27 to 140	≥ 103 17 to 120	≥ 94 16 to 110	≥ 76 15 to 90		250	≥ 115 110 to 26	≥ 113 7 to 120	≥ 106 4 to 110	≥ 93 -3 to 90
	500	≥ 111 29 to 140	≥ 105 15 to 120	≥ 96 14 to 110	≥ 78 13 to 90		500	≥ 112 110 to 28	≥ 111 9 to 120	≥ 104 6 to 110	≥ 91 -1 to 90
	1000	≥ 109 31 to 140	≥ 105 15 to 120	≥ 97 14 to 110	≥ 79 12 to 90		1000	≥ 109 110 to 31	≥ 109 12 to 120	≥ 101 9 to 110	≥ 88 2 to 90
	2000	≥ 106 34 to 140	≥ 104 16 to 120	≥ 96 15 to 110	≥ 79 11 to 90		2000	≥ 106 110 to 34	≥ 106 15 to 120	≥ 98 12 to 110	≥ 86 5 to 90
	4000	≥ 103 37 to 140	≥ 102 18 to 120	≥ 93 17 to 110	≥ 78 12 to 90		4000	≥ 103 110 to 37	≥ 103 18 to 120	≥ 95 15 to 110	≥ 83 8 to 90
	8000	≥ 100 40 to 140	≥ 99 21 to 120	≥ 91 20 to 110	≥ 76 14 to 90		8000	≥ 100 110 to 40	≥ 100 21 to 120	≥ 92 19 to 110	≥ 80 11 to 90
	16000	≥ 97 43 to 140	≥ 96 24 to 120	≥ 88 23 to 110	≥ 74 17 to 90		16000	≥ 97 110 to 43	≥ 96 24 to 120	≥ 88 22 to 110	≥ 77 14 to 90

Table A-17 1/3 OBA Octave Linearity Range

Nominal Frequency (Hz)	High Range		Normal Range		Nominal Frequency (Hz)	High Range		Normal Range	
	0 dB Gain (dB)	+20 dB Gain (dB)	0 dB Gain (μdB)	+20 dB Gain (dB)		0 dB Gain (dB)	+20 dB Gain (μdB)	0 dB Gain (μdB)	+20 dB Gain (μdB)

PRM831	6.3	≥ 107 34 to 140	≥ 90 31 to 120	≥ 81 29 to 110	≥ 62 28 to 90
	8.0	≥ 108 32 to 140	≥ 91 29 to 120	≥ 82 28 to 110	≥ 63 27 to 90
	10.0	≥ 110 30 to 140	≥ 92 28 to 120	≥ 83 27 to 110	≥ 64 26 to 90
	12.5	≥ 111 29 to 140	≥ 93 27 to 120	≥ 85 25 to 110	≥ 65 25 to 90
	16.0	≥ 112 28 to 140	≥ 94 26 to 120	≥ 86 24 to 110	≥ 66 24 to 90
	20.0	≥ 114 27 to 140	≥ 95 25 to 120	≥ 87 24 to 110	≥ 67 23 to 90
	25.0	≥ 115 25 to 140	≥ 96 24 to 120	≥ 88 23 to 110	≥ 68 22 to 90
	31.5	≥ 116 24 to 140	≥ 97 23 to 120	≥ 89 22 to 110	≥ 69 21 to 90
	40.0	≥ 117 23 to 140	≥ 99 22 to 120	≥ 90 21 to 110	≥ 70 20 to 90
	50.0	≥ 118 22 to 140	≥ 100 21 to 120	≥ 91 20 to 110	≥ 71 19 to 90
	63.0	≥ 119 22 to 140	≥ 101 20 to 120	≥ 91 19 to 110	≥ 72 18 to 90
	80.0	≥ 120 21 to 140	≥ 102 19 to 120	≥ 92 18 to 110	≥ 73 17 to 90
	100	≥ 120 20 to 140	≥ 103 18 to 120	≥ 94 17 to 110	≥ 74 16 to 90
	125	≥ 121 20 to 140	≥ 104 17 to 120	≥ 95 16 to 110	≥ 75 15 to 90
	160	≥ 121 20 to 140	≥ 105 16 to 120	≥ 96 15 to 110	≥ 76 14 to 90
	200	≥ 120 20 to 140	≥ 106 15 to 120	≥ 97 14 to 110	≥ 77 13 to 90
	250	≥ 119 21 to 140	≥ 107 14 to 120	≥ 98 12 to 110	≥ 79 11 to 90
	315	≥ 119 22 to 140	≥ 108 13 to 120	≥ 99 11 to 110	≥ 80 10 to 90
	400	≥ 118 23 to 140	≥ 109 12 to 120	≥ 100 10 to 110	≥ 81 9 to 90
	500	≥ 117 23 to 140	≥ 110 11 to 120	≥ 101 9 to 110	≥ 82 8 to 90
630	≥ 116 24 to 140	≥ 110 10 to 120	≥ 101 9 to 110	≥ 83 7 to 90	
800	≥ 115 25 to 140	≥ 110 10 to 120	≥ 102 9 to 110	≥ 84 7 to 90	
1000	≥ 114 27 to 140	≥ 110 10 to 120	≥ 102 9 to 110	≥ 84 6 to 90	
1250	≥ 113 27 to 140	≥ 110 10 to 120	≥ 102 9 to 110	≥ 85 6 to 90	
1600	≥ 112 29 to 140	≥ 109 11 to 120	≥ 101 9 to 110	≥ 85 5 to 90	
2000	≥ 111 29 to 140	≥ 109 12 to 120	≥ 100 10 to 110	≥ 85 6 to 90	

Direct Input	6.3	≥ 99 41 to 140	≥ 97 24 to 120	≥ 104 6 to 110	≥ 86 4 to 90
	8.0	≥ 102 39 to 140	≥ 100 21 to 120	≥ 106 4 to 110	≥ 90 0 to 90
	10.0	≥ 104 36 to 140	≥ 101 19 to 120	≥ 109 1 to 110	≥ 92 -2 to 90
	12.5	≥ 106 34 to 140	≥ 102 18 to 120	≥ 110 0 to 110	≥ 93 -3 to 90
	16.0	≥ 108 33 to 140	≥ 105 15 to 120	≥ 111 -1 to 110	≥ 94 -4 to 90
	20.0	≥ 123 18 to 140	≥ 115 5 to 120	≥ 112 -2 to 110	≥ 95 -5 to 90
	25.0	≥ 125 16 to 140	≥ 121 -1 to 120	≥ 113 -3 to 110	≥ 95 -5 to 90
	31.5	≥ 124 16 to 140	≥ 122 -2 to 120	≥ 114 -4 to 110	≥ 96 -6 to 90
	40.0	≥ 123 17 to 140	≥ 122 -2 to 120	≥ 114 -4 to 110	≥ 97 -7 to 90
	50.0	≥ 123 18 to 140	≥ 121 -1 to 120	≥ 113 -3 to 110	≥ 97 -7 to 90
	63.0	≥ 122 18 to 140	≥ 121 -1 to 120	≥ 112 -2 to 110	≥ 97 -7 to 90
	80.0	≥ 122 19 to 140	≥ 120 0 to 120	≥ 112 -2 to 110	≥ 98 -8 to 90
	100	≥ 121 19 to 140	≥ 119 1 to 120	≥ 111 -1 to 110	≥ 98 -8 to 90
	125	≥ 120 20 to 140	≥ 119 2 to 120	≥ 111 -1 to 110	≥ 99 -9 to 90
	160	≥ 119 21 to 140	≥ 118 2 to 120	≥ 110 0 to 110	≥ 99 -9 to 90
	200	≥ 119 22 to 140	≥ 118 2 to 120	≥ 110 1 to 110	≥ 99 -9 to 90
	250	≥ 118 22 to 140	≥ 117 3 to 120	≥ 109 1 to 110	≥ 98 -8 to 90
	315	≥ 117 23 to 140	≥ 117 4 to 120	≥ 109 1 to 110	≥ 97 -7 to 90
	400	≥ 117 24 to 140	≥ 116 4 to 120	≥ 108 2 to 110	≥ 96 -6 to 90
	500	≥ 116 24 to 140	≥ 116 4 to 120	≥ 108 3 to 110	≥ 95 -5 to 90
630	≥ 115 25 to 140	≥ 115 5 to 120	≥ 107 3 to 110	≥ 94 -4 to 90	
800	≥ 115 26 to 140	≥ 114 6 to 120	≥ 106 4 to 110	≥ 94 -4 to 90	
1000	≥ 114 27 to 140	≥ 113 7 to 120	≥ 105 5 to 110	≥ 93 -3 to 90	
1250	≥ 113 27 to 140	≥ 112 8 to 120	≥ 104 6 to 110	≥ 92 -2 to 90	
1600	≥ 111 29 to 140	≥ 111 9 to 120	≥ 103 7 to 110	≥ 91 -1 to 90	
2000	≥ 111 30 to 140	≥ 110 10 to 120	≥ 102 8 to 110	≥ 90 0 to 90	

Table A.17 1/3 Octave OBA Linearity Range (Cont...)

Nominal		High OBA Range		Normal OBA Range		Nominal		High OBA Range		Normal OBA Range	
Frequency (Hz)	0 dB Gain (dB)	+20 dB Gain (dB)	0 dB Gain (μdB)	+20 dB Gain (dB)	Frequency (Hz)	0 dB Gain (dB)	+20 dB Gain (μdB)	0 dB Gain (μdB)	+20 dB Gain (μdB)		
PRM831	2500	≥ 110 30 to 140	≥ 108 12 to 120	≥ 100 10 to 110	≥ 84 6 to 90	Direct Input	2500	≥ 110 31 to 140	≥ 109 11 to 120	≥ 101 9 to 110	≥ 89 1 to 90
	3150	≥ 109 31 to 140	≥ 107 13 to 120	≥ 99 11 to 110	≥ 84 6 to 90		3150	≥ 109 32 to 140	≥ 108 12 to 120	≥ 100 10 to	≥ 89 2 to 90
	4000	≥ 108 32 to 140	≥ 106 14 to 120	≥ 98 12 to 110	≥ 83 7 to 90		4000	≥ 108 33 to 140	≥ 107 13 to 120	≥ 99 11 to	≥ 88 3 to 90
	5000	≥ 107 34 to 140	≥ 105 15 to 120	≥ 97 13 to 110	≥ 82 8 to 90		5000	≥ 107 34 to 140	≥ 106 14 to 120	≥ 98 12 to	≥ 87 4 to 90
	6300	≥ 106 35 to 140	≥ 104 16 to 120	≥ 96 14 to 110	≥ 82 9 to 90		6300	≥ 106 35 to 140	≥ 105 15 to 120	≥ 97 13 to	≥ 86 5 to 90
	8000	≥ 105 36 to 140	≥ 103 17 to 120	≥ 95 15 to 110	≥ 81 9 to 90		8000	≥ 105 36 to 140	≥ 104 16 to 120	≥ 96 14 to	≥ 85 5 to 90
	10000	≥ 104 37 to 140	≥ 102 18 to 120	≥ 94 16 to 110	≥ 80 10 to 90		10000	≥ 104 36 to 140	≥ 103 17 to 120	≥ 95 15 to	≥ 84 6 to 90
	12500	≥ 103 38 to 140	≥ 101 19 to 120	≥ 93 17 to 110	≥ 79 11 to 90		12500	≥ 103 37 to 140	≥ 102 87 to 120	≥ 94 16 to	≥ 83 7 to 90
	16000	≥ 101 39 to 140	≥ 100 20 to 120	≥ 92 18 to 110	≥ 78 12 to 90		16000	≥ 101 39 to 140	≥ 101 19 to 120	≥ 93 17 to	≥ 82 9 to 90
	20000	≥ 100 40 to 140	≥ 99 21 to 120	≥ 91 19 to 110	≥ 77 13 to 90		20000	≥ 100 40 to 140	≥ 100 20 to 120	≥ 92 18 to	≥ 81 10 to 90

A.4.2 OBA Measurement System Details

Integration Method: Follows setting for SLM.

Frequency Weightings: Independent of setting for SLM, selected frequency weighting (A, C, or Z), indicated by ω .

Time Weightings/Detectors: Follows setting for SLM, time weighting (S, F, or I), indicated by τ .

Instantaneous “Live” Metrics: For display and profile graph only. Not stored with measurement.

	Linear	Exponential	Units
OBA Live Equivalent Level Spectrum, 1s	$L_{\omega eq(f)}$	$L_{\omega \tau eq(f)}$	dB

Overall Metrics:

	Linear	Exponential	Units
OBA Overall Equivalent Level Spectrum	$L_{\omega eq(f)}$	$L_{\omega \tau eq(f)}$	dB
OBA Overall Maximum Level Spectrum	$L_{\omega \tau max(f)}$	$L_{\omega \tau max(f)}$	dB
OBA Overall Minimum Level Spectrum	$L_{\omega \tau min(f)}$	$L_{\omega \tau min(f)}$	dB

Percentile Spectrum Levels, uses same percentages n1 through n6 selected in SLM, 0.01 to 99.99%. Statistics are sampled every 100ms from the selected OBA frequency weighting and time weighting into 0.1 dB wide amplitude classes, as shown in *Table A.17*.

		Units
1	$L_{\omega\tau n1}(f)$	dB
2	$L_{\omega\tau n2}(f)$	dB
3	$L_{\omega\tau n3}(f)$	dB
4	$L_{\omega\tau n4}(f)$	dB
5	$L_{\omega\tau n5}(f)$	dB
6	$L_{\omega\tau n6}(f)$	dB

Instrument Noise Levels With OBA, by Preamp

The following charts show the 831C instrument noise levels for the OBA filter With PRM831 and Direct Input.

FIGURE A-2 Self-Generated Noise Levels for 1/1 Octave Filter With PRM831

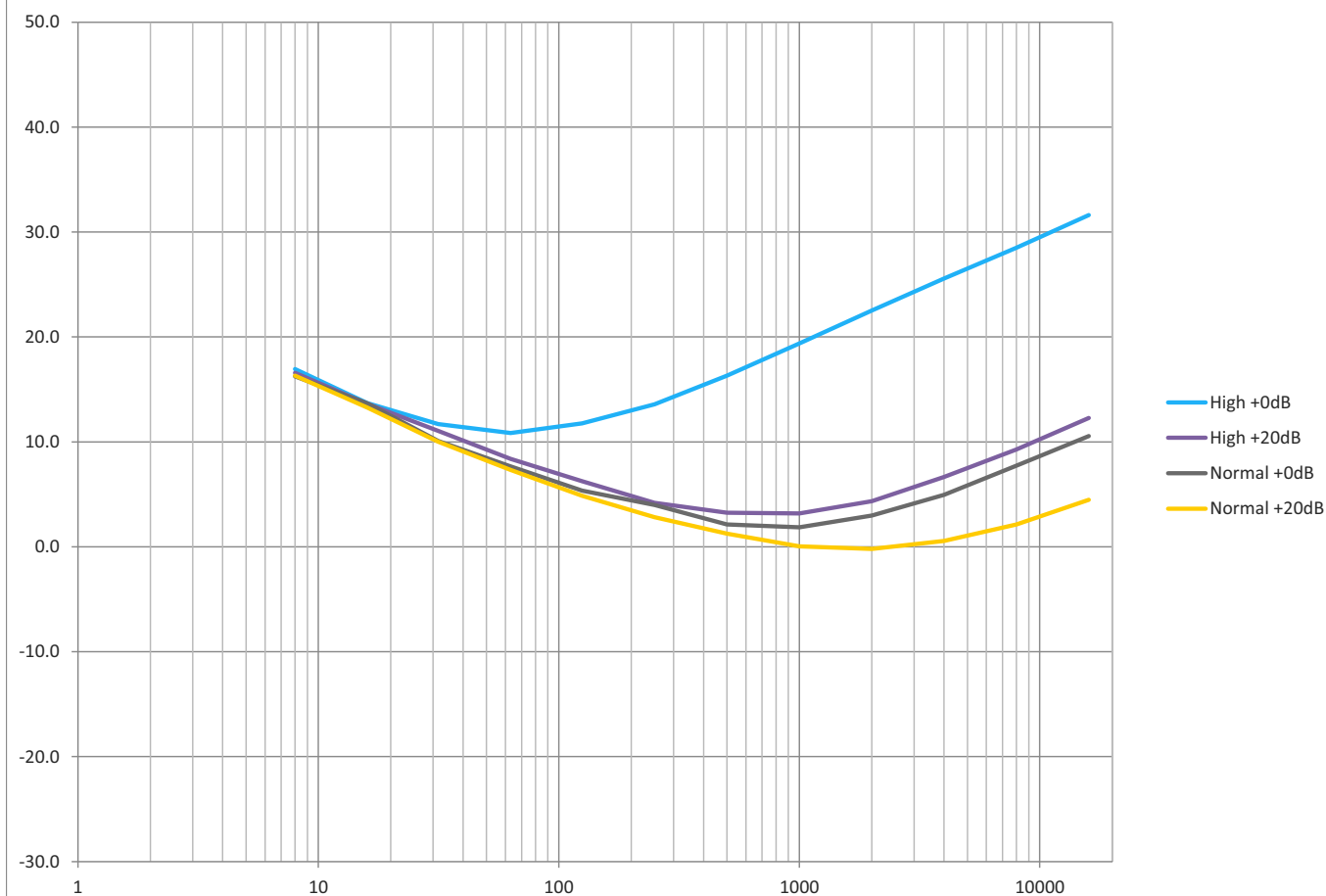


FIGURE A-3 Self-Generated Noise Levels for 1/1 Octave Filter With Direct Input

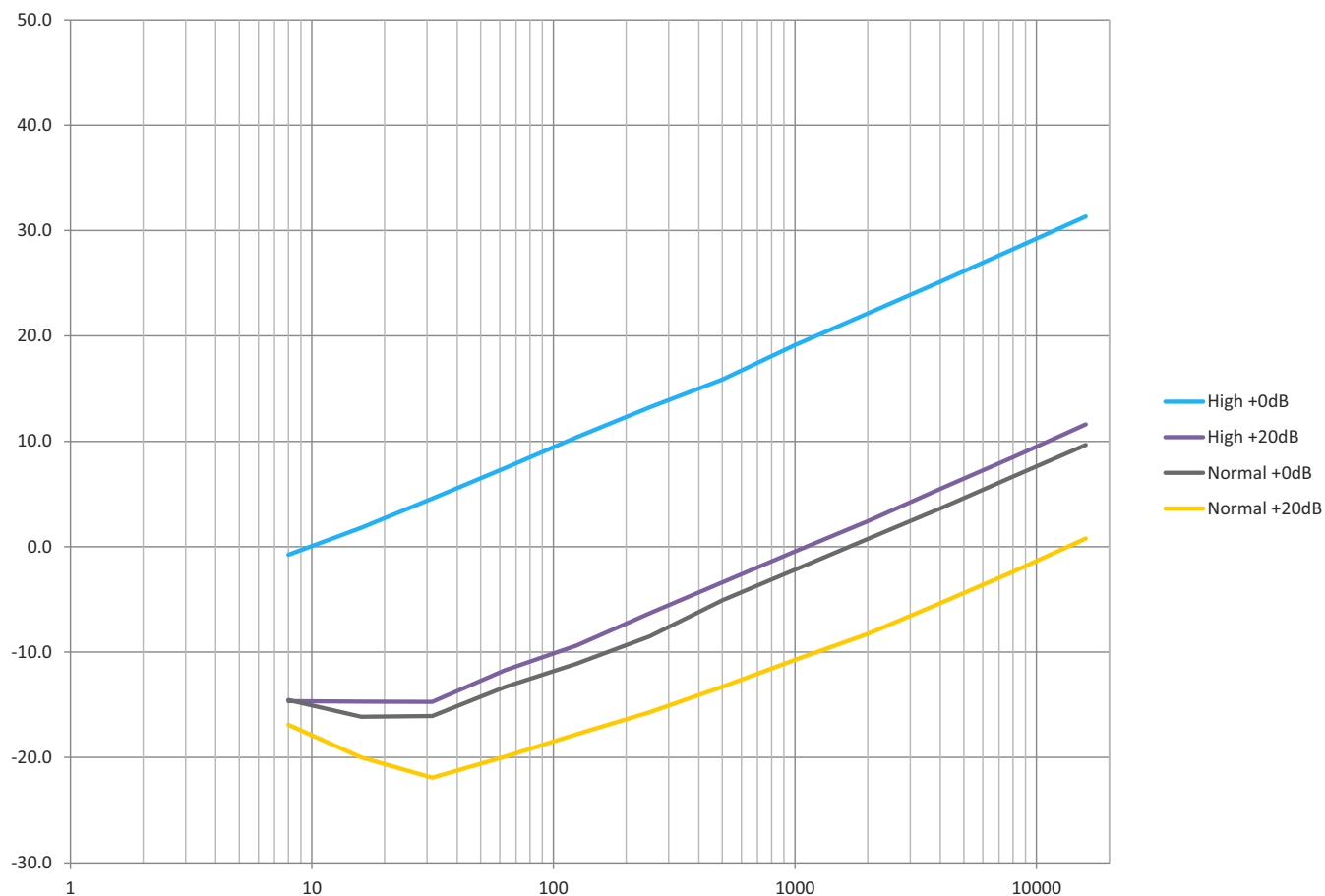


FIGURE A-4 Self-Generated Noise Levels for 1/3 Octave Filter With PRM831

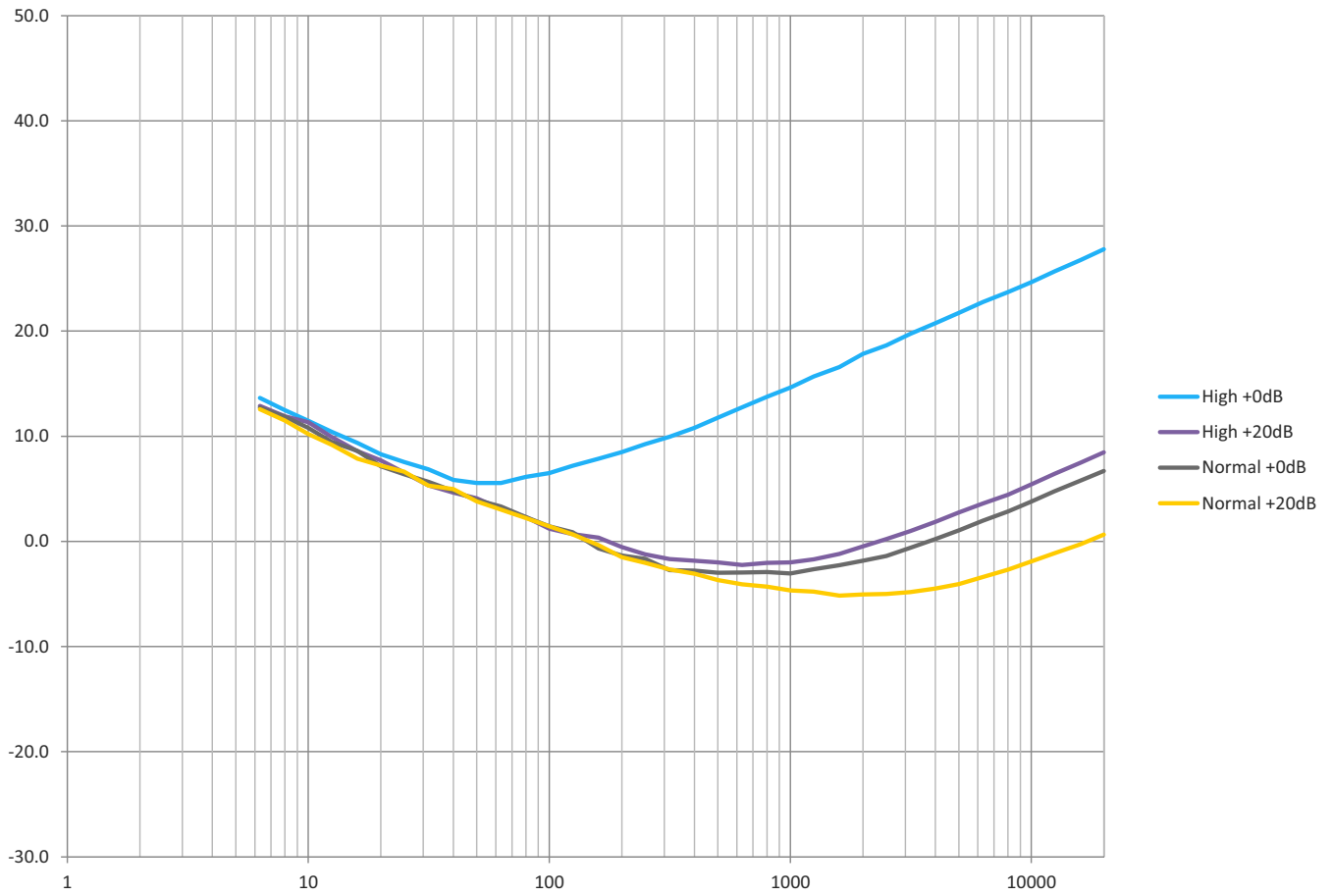
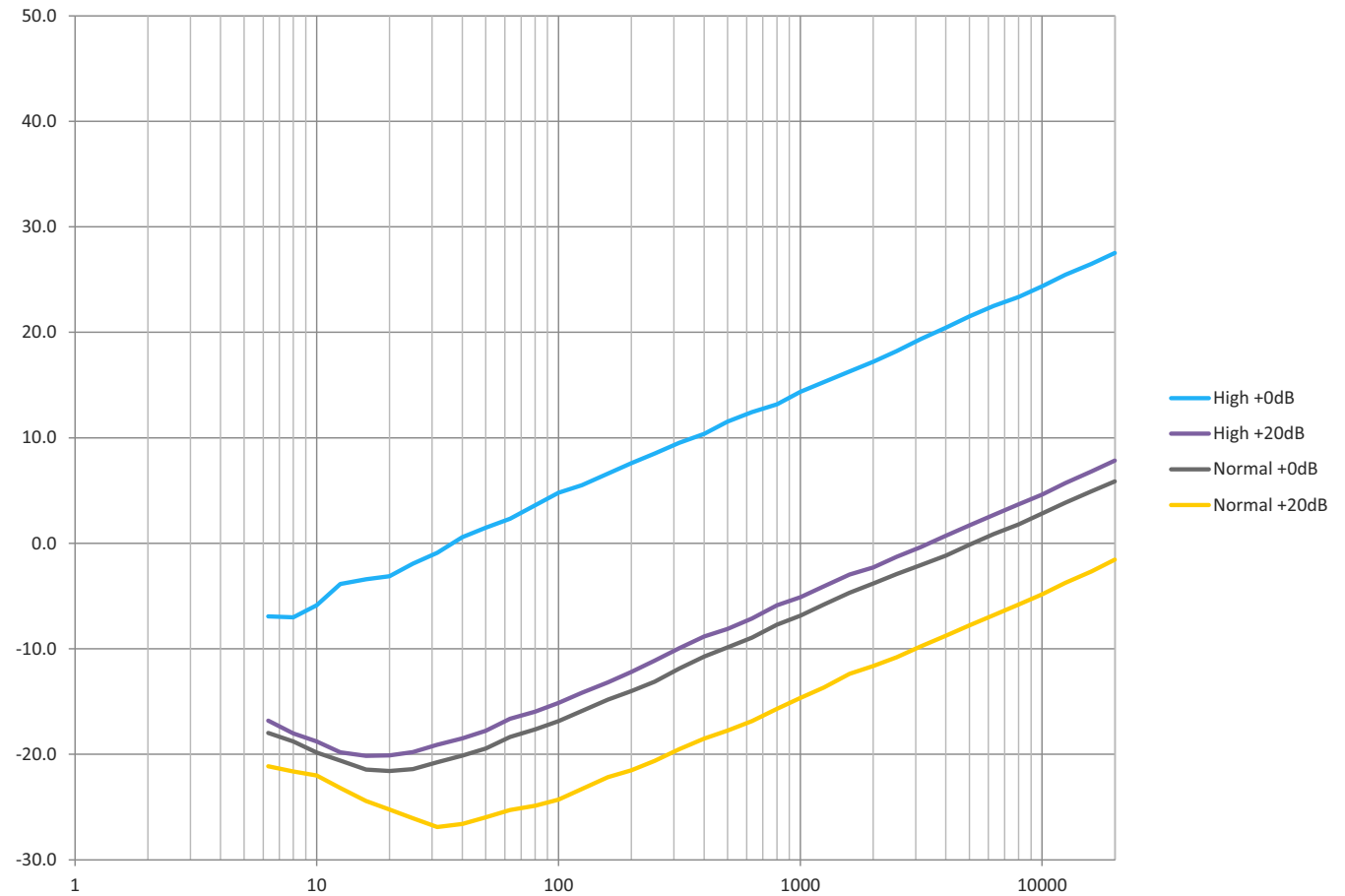


FIGURE A-5 Self-Generated Noise Levels for 1/3 Octave Filter With Direct Input



Instrument Noise Levels With OBA, by Microphone

The following charts (Figure A-6 through Figure A-13) show the typical instrument noise level for each microphone type in Normal and High range for 1/1 and 1/3 octave bands. Zoom in to view graph details.

FIGURE A-6 377A15/831C Instrument Noise, 1/1 Octave

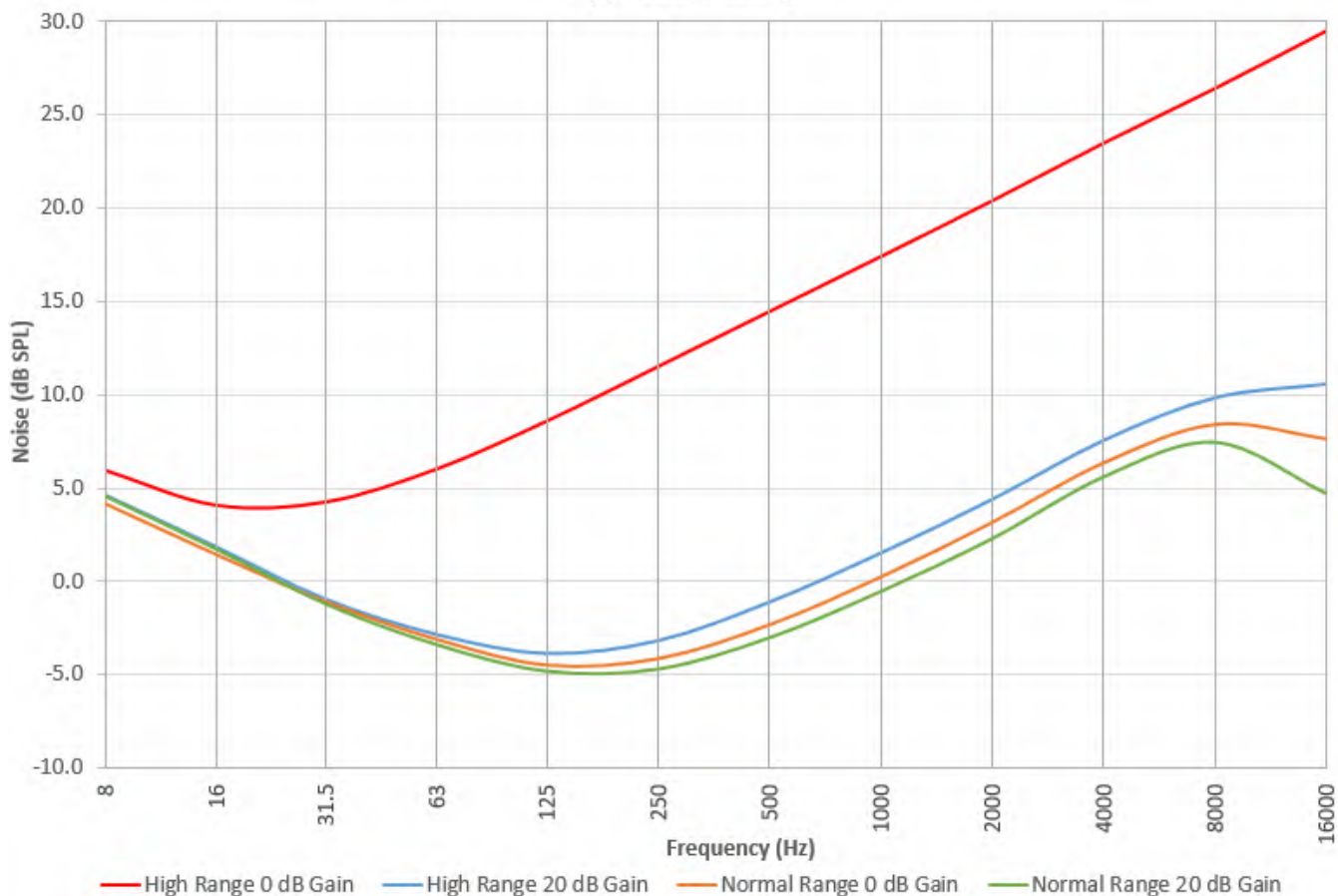


FIGURE A-7 377A15/831C Instrument Noise, 1/3 Octave

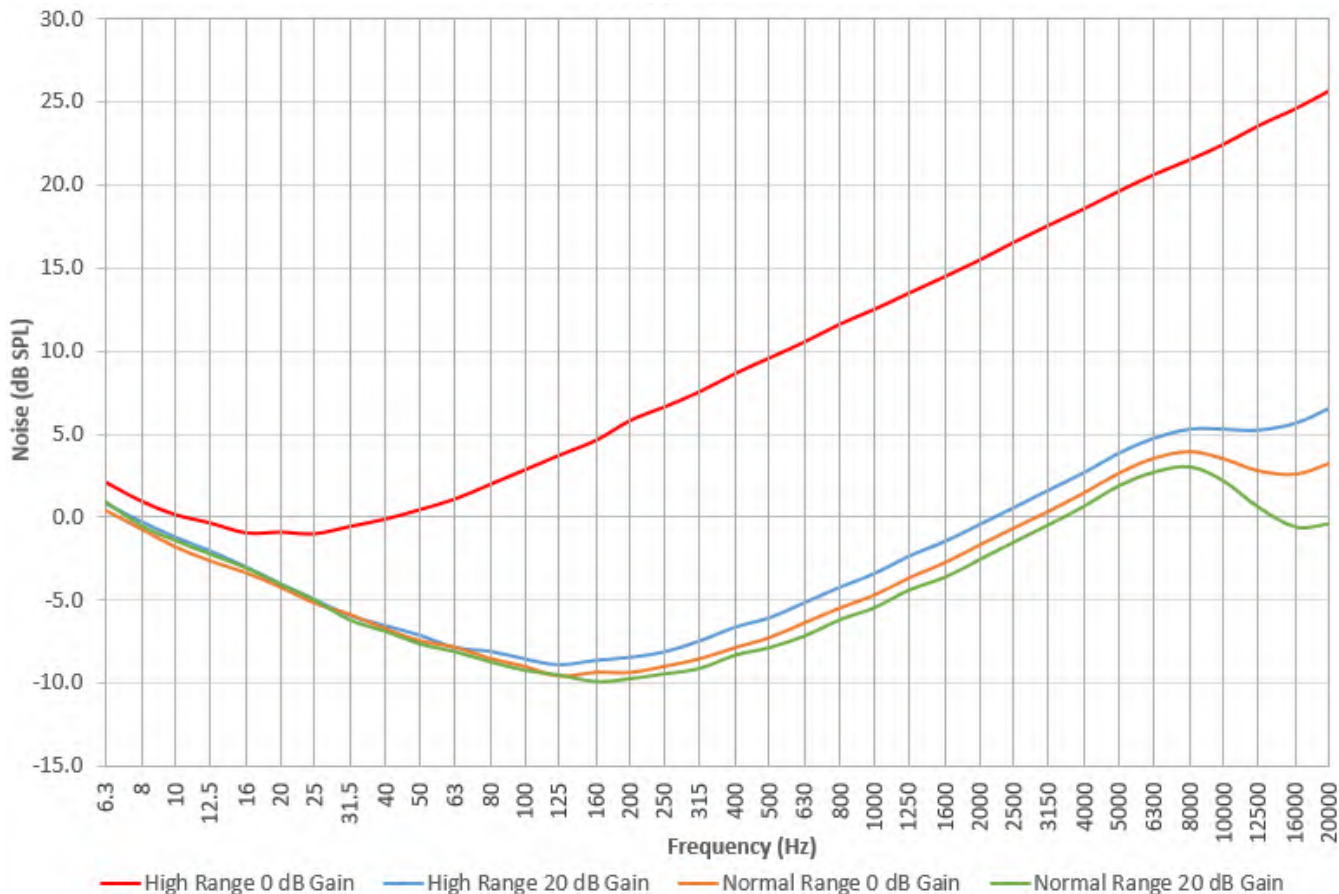


FIGURE A-8 377B02/831C Instrument Noise, 1/1 Octave

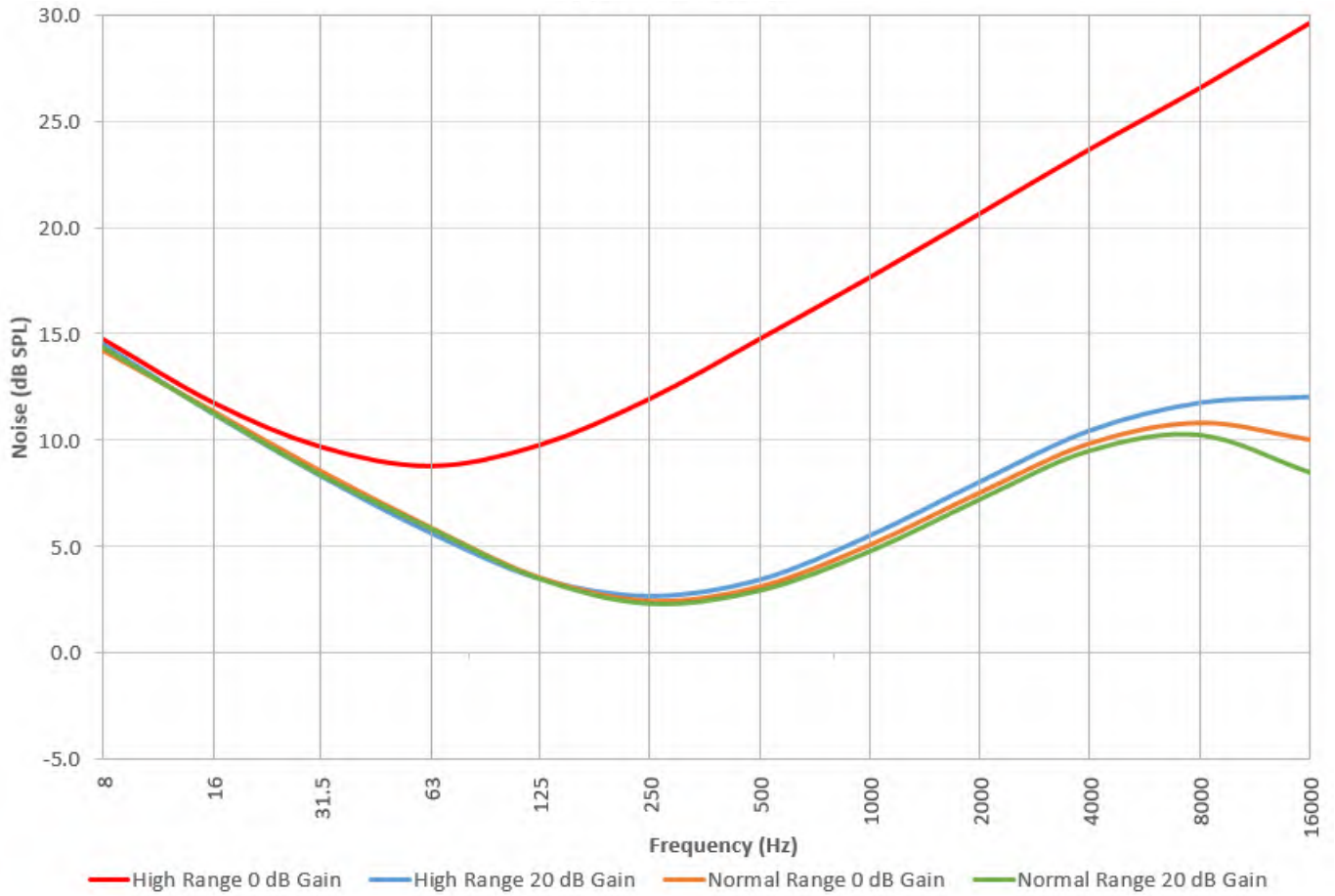


FIGURE A-9 377B02/831C Instrument Noise, 1/3 Octave

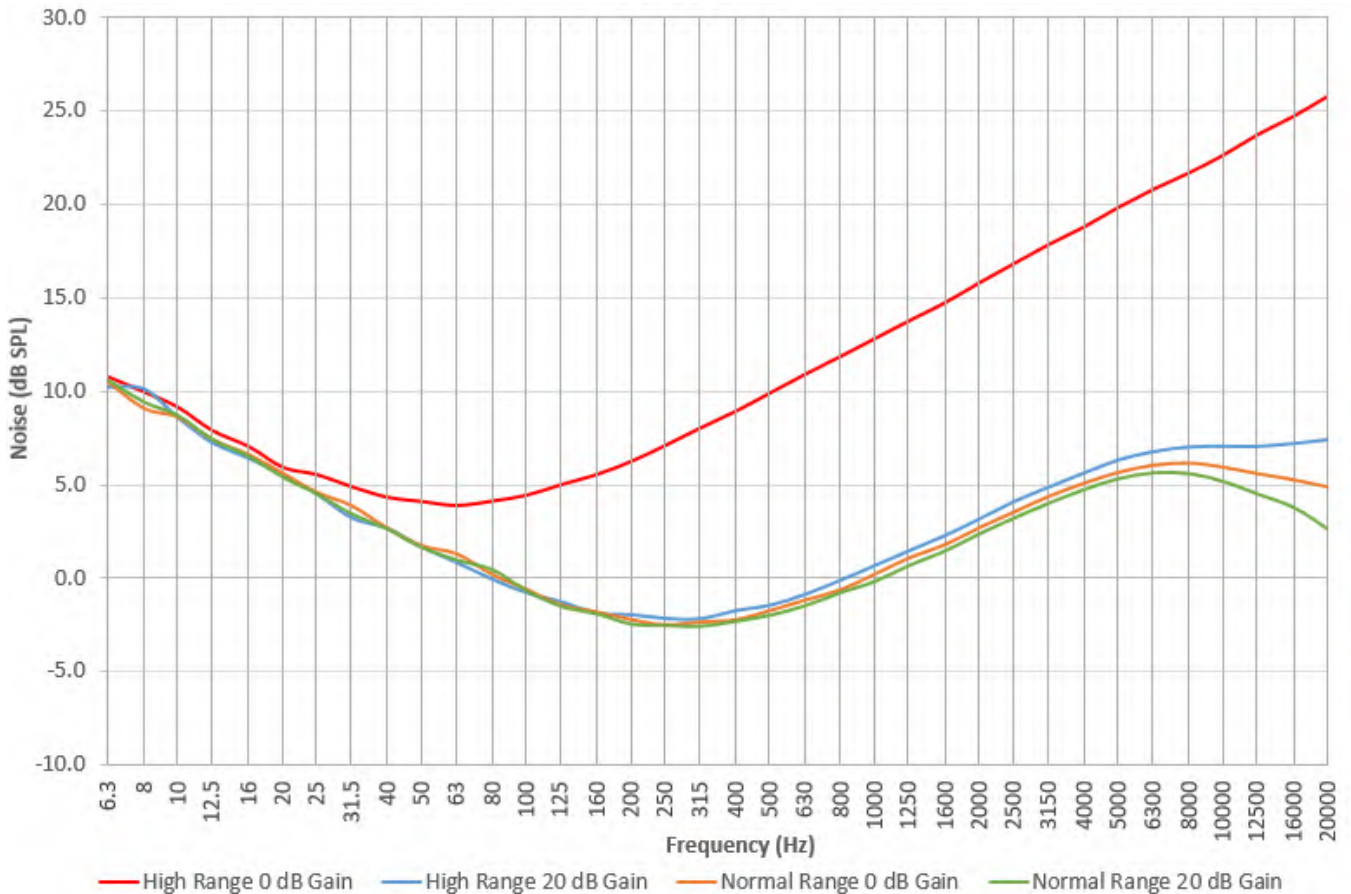


FIGURE A-10 377C20/831C Instrument Noise, 1/1 Octave
(1/1 Octave Bands)

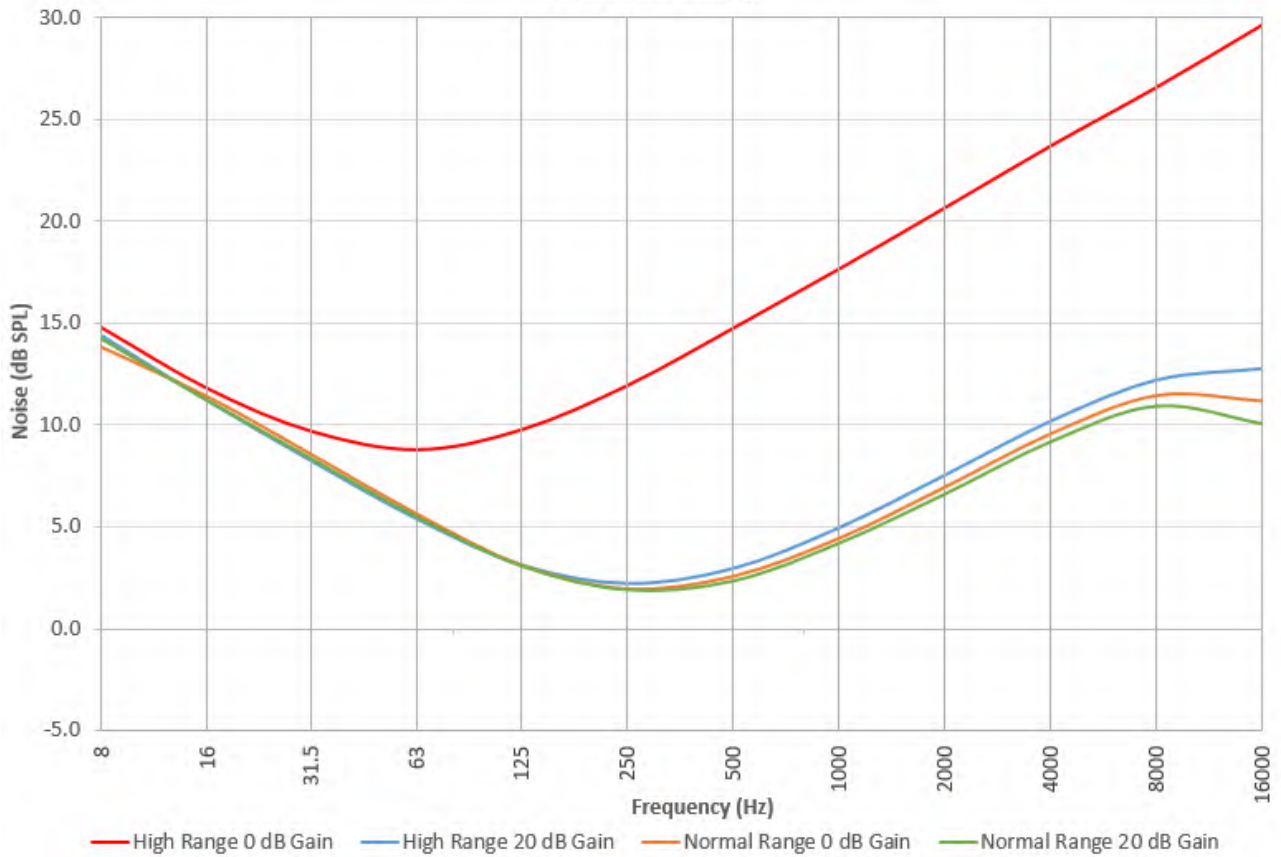


FIGURE A-11 377C20/831C Instrument Noise, 1/3 Octave

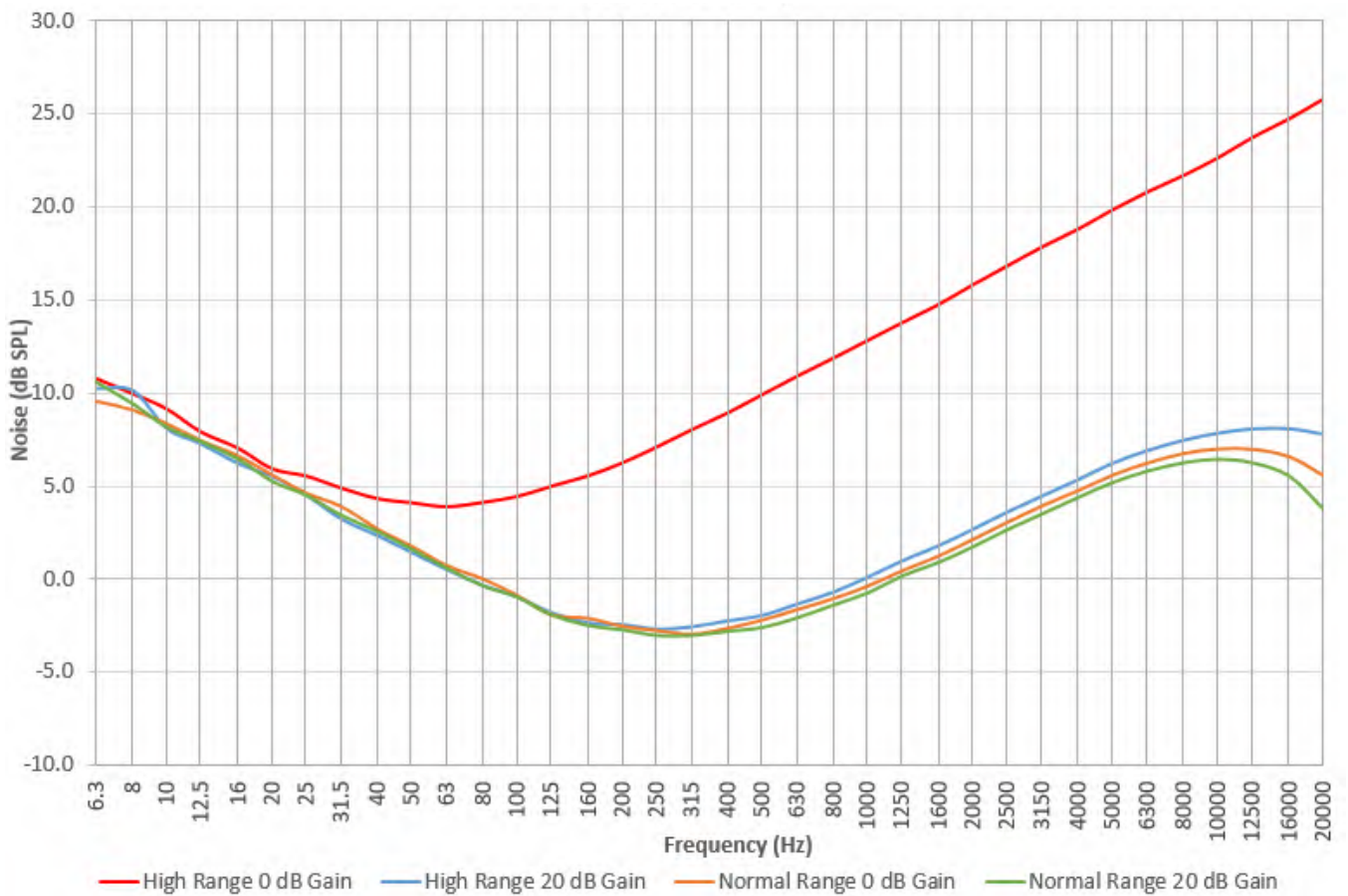


FIGURE A-12 378A04/831C Instrument Noise, 1/1 Octave

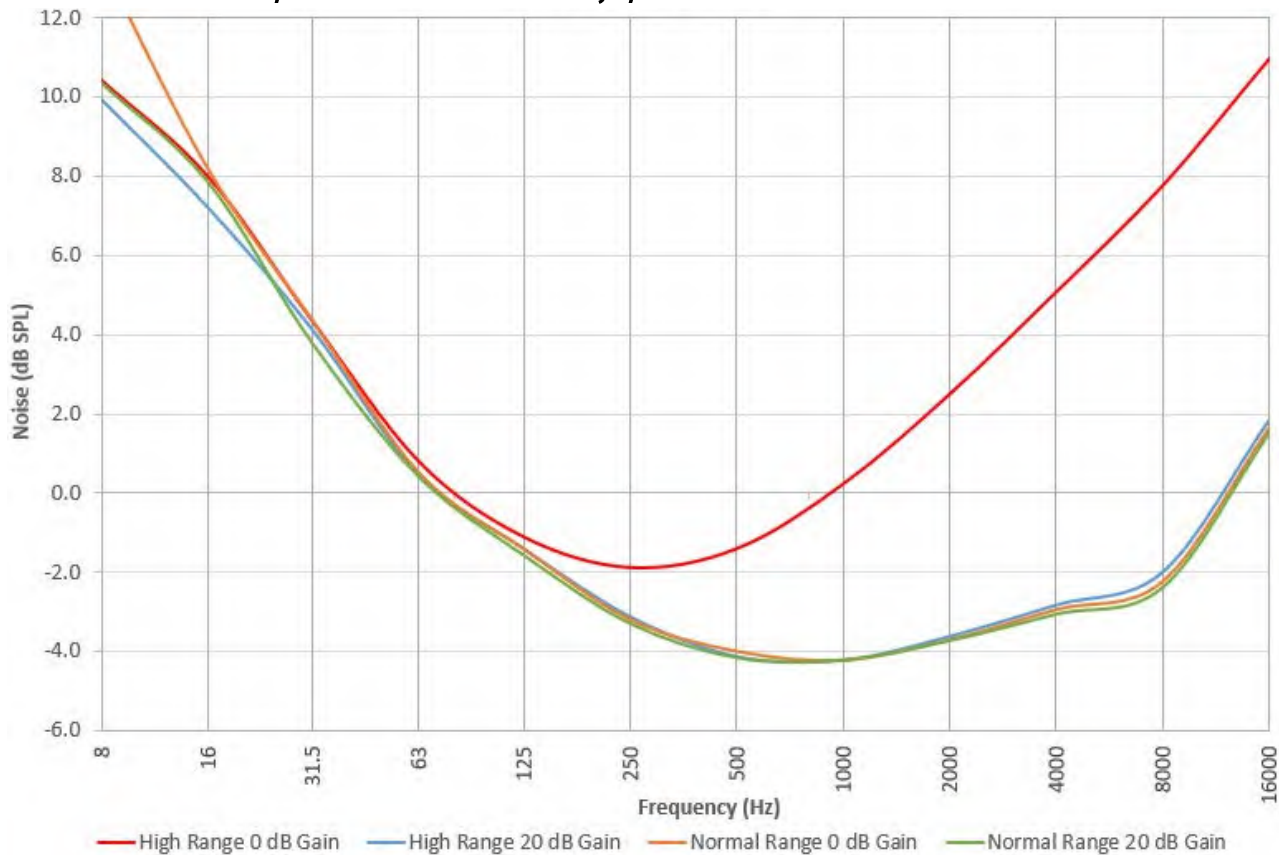
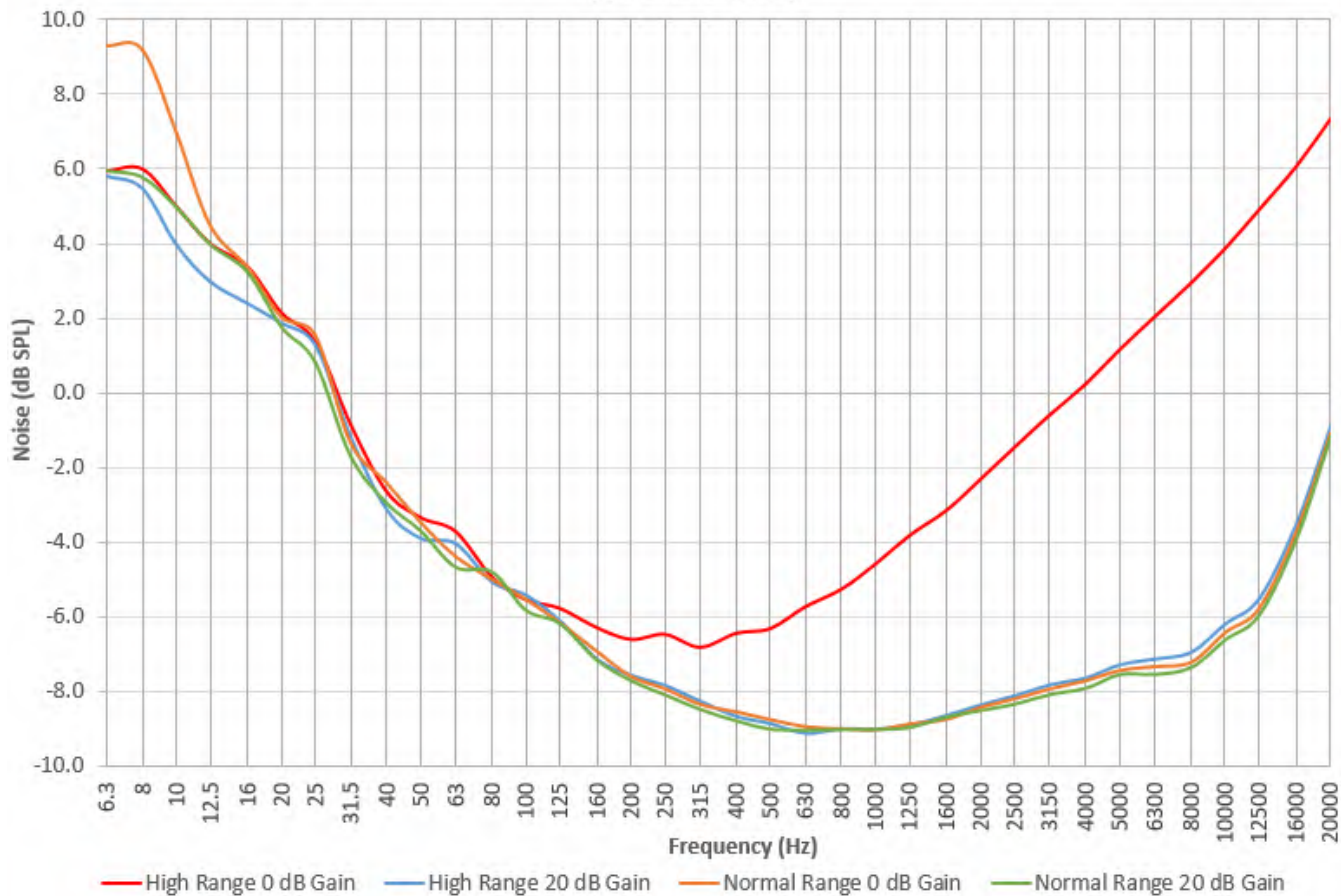


FIGURE A-13 378A04/831C Instrument Noise, 1/3 Octave



A.4.3 Typical Residual OBA Filter Decay Time for RT60 (Firmware Opt 831C-RT)

Table A-18 shows the typical residual decay time (TR) and the bandwidth-time product (BT) for each of the OBA filters on the Model 831C when in RA Mode. The source is a sine wave from a signal generator. The residual decay time for each frequency is the T30 of the ensemble average of 50 decays.

Table A-18 OBA Filter Residual Decay Times

Frequency	1/3 Octave		1/1 Octave	
	TR (ms)	BT	TR (ms)	BT
50.0 Hz	323.39	3.74		
63.0 Hz	306.84	4.47	133.03	5.91
80.0 Hz	244.40	4.48		
100 Hz	185.85	4.29		
125 Hz	141.88	4.12	57.71	5.12
160 Hz	116.37	4.26		
200 Hz	87.73	4.04		
250 Hz	71.07	4.12	29.64	5.25
315 Hz	53.56	3.91		
400 Hz	43.03	3.95		
500 Hz	33.52	3.88	16.40	5.79
630 Hz	26.33	3.83		
800 Hz	19.92	3.65		
1000 Hz	15.95	3.68	8.94	6.30
1250 Hz	12.60	3.66		
1600 Hz	11.59	4.24		
2000 Hz	8.22	3.78	5.84	8.22
2500 Hz	7.68	4.45		
3150 Hz	6.61	4.82		
4000 Hz	4.79	4.40	3.26	9.15
5000 Hz	3.54	4.09		
6300 Hz	3.33	4.86		
8000 Hz	3.21	5.88	3.41	19.09
10000 Hz	3.00	7.48		

A.5 Event Logging Software (Option 831C-ELA)

Measurement History Selectable Properties

Time Period: Selectable from 1 minute to 99 hours 59 minutes

Synchronization: Selectable to sync to time-of-day clock, for periods of 1, 2, 5, 10, 15, 20, 30 minutes, and 1, 24 hours

Measurements: Same measurements as Overall measurement

Event History Selectable Properties

Detection Methods: Level or Dynamic

Level Triggering: Events are initiated and stored when the measured sound level exceeds the trigger levels SPL1 and Peak 1 for the specified minimum duration and ends when not triggered for the continuation time

Dynamic Triggering: Trigger level is offset above a background tracking level

Trigger Levels: Selectable from 0 to 200 dB for the SPL ($L_{\omega\tau}$) or Peak ($L_{p_{peak}}$)

Dynamic Trigger Offset: Selectable from 3 to 99.9 dB for SPL ($L_{\omega T}$) above background tracking level

Dynamic Trigger Response: Selectable from five combinations of background tracking rate and tracking percentile.

Minimum Duration: Selectable from 0 to 9.9 s

Continuation Period: Selectable from 0 to 9 s

Event Time History: Selectable On or Off

Period: Selectable for periods 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, and 5 s

Pre-event Samples: Selectable from 0 to 99

Post-event Samples: Selectable from 0 to 100

Maximum Samples: Selectable up to 9999

Spectral Mode: Selectable On or Off, enables

Spectral Event Time History (requires 831C-OB3)

Event Measurements:

Date and Time of initial occurrence:
yyyy-mmm-dd hh:mm:ss

Date and Time of maximum occurrence:
yyyy-mmm-dd hh:mm:ss

Duration of event:
hh:mm:ss.s

	Linear	Exponential	Units
Equivalent Level	$L_{\omega eq}$	$L_{\omega \tau eq}$	dB
Sound Exposure Level	$L_{\omega E}$	$L_{\omega \tau E}$	dB
Sound Exposure	$E_{\omega E}$	$E_{\omega TE}$	Pa ² s
OBA Live Equivalent Level Spectrum (requires 831C-OB3)	$L_{\omega eq(f)}$	$L_{\omega \tau eq(f)}$	dB
OBA Live Maximum Level Spectrum (requires 831C-OB3)	$L_{\omega max(f)}$	$L_{\omega \tau max(f)}$	dB

	Linear	Exponential	Units
Event Time History Equivalent Level	$L_{\omega eq}$	$L_{\omega \tau eq}$	dB
Event Time History Equivalent Level 1/1 or 1/3 Spectra (requires 831C-OB3)	$L_{\omega eq(f)}$	$L_{\omega \tau eq(f)}$	dB

A.6 Time History Software (Option 831C-LOG)

Time History Measurement System

Time History can log an abundant selection of acoustic and non-acoustic metrics at equal time intervals.

Time Period: Selectable for periods 2.5 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 15 s, 20 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, and 24 h

Synchronization: Selectable to sync to time-of-day clock, for periods of 1, 2, 5, 10, 15, 20, 30 seconds; 1, 2, 5, 10, 15, 20, 30 minutes; and 1, 24 hours

Acoustic Measurements

Metrics are individually selectable

Period < 20 ms:

- OBA 1/1 Leq*
- OBA 1/3 Leq*
- Period \geq 20ms
- L_{Aeq} , L_{Ceq} , L_{Zeq} , L_{Apeak} , L_{Cpeak} , L_{Zpeak}

Period \geq 100 ms:

- L_{Aeq} , L_{Ceq} , L_{Zeq} , L_{Apeak} , L_{Cpeak} , L_{Zpeak}
- L_{AS} , L_{AF} , L_{AI} , L_{CS} , L_{CF} , L_{CI} , L_{ZS} , L_{ZF} , L_{ZI}
- L_{ASmax} , L_{AFmax} , L_{AImax} , L_{CSmax} , L_{CFmax} , L_{CImax} , L_{ZSmax} , L_{ZFmax} , L_{ZImax}
- L_{ASmin} , L_{AFmin} , L_{AImin} , L_{CSmin} , L_{CFmin} , L_{CImin} , L_{ZSmin} , L_{ZFmin} , L_{ZImin}
- $L_{Ceq}-L_{Aeq}$, $L_{Aeq}-L_{aeq}$, L_{AFTm5}

*OBA processing must be installed (Firmware Option 831C-OB3), and the OBA Bandwidth setting must be enabled on the meter.

Non-Acoustic Measurements

Metrics are individually selectable.

Millisecond Resolution, Period < 1 s: Tms

Period \geq 100 ms: Battery Voltage, External Power, Internal Temperature

426A12 or PRM2103 Metrics: Internal Temperature, Internal Humidity

SEN031 Metrics: Windspeed; Wind Gust Speed; Wind Direction; Temperature: Avg, Min & Max; Humidity: Avg, Min & Max; Barometric Pressure

SEN032 Metrics: Windspeed; Wind Gust Speed; Wind Direction

A.7 FFT Analysis Software Specifications (Option 831C-FFT)

Specifications for FFT analysis are given for the SoundAdvisor 831C with firmware option 831C-FFT installed.

A.7.1 FFT Analysis

Sampling Frequency: Down sampling from 51.2 kHz

Frequency Span: 100 Hz, 200 Hz, 500 Hz, 1 kHz, 5 kHz, 10 kHz, 20 kHz

Lines of Resolution: 400, 800, 1600, 3200, 6400

Weighting: A, C, and Z

FFT Windowing Options: Hanning, Flat Top, Rectangular.

Overlap: All windowing options have 33% overlap.

Tonality: Selectable according to ISO 1996-2 (2007, 2017), and ISO/PAS 20065.

High-Pass Filter: the low-frequency cutoff is 1 Hz (-3 dB)

A.7.2 FFT Measurement Control

Manual: Start and stop measurements manually by using G4 software, LD Atlas (for mobile iOS/Android), key press on the 831C, or via an external signal.

Exceedance: Measurements can also be started by an exceedance on one of three configurable, time-based, broadband trigger sources.

Logic Input: Measurements can also be started by configuring the Logic-In port to Run/Stop by using the included I/O interface cable (CBL170).

A.7.3 FFT History

This setting enables measurement history records for any of the following available run modes:

Manual Run/Stop: Measurements run and stop manual from any of the input methods.

Count Stop: Measurements run for a given number of spectra up to 99,999 averages per FFT History. Repeatable up to 99,999 times.

Timed Stop: Measurements run for a certain amount of time per FFT History. Repeatable up to 99,999 times.

Continuous: Measurements run continuously until a manual stop or until the battery cannot power the meter. Data automatically stores in the selected interval. Numerous intervals range from 1 minute to 24 hours.

Single-Block Timer: Measurement is set to automatically start and end at the selected time (Max: up to 10 years in the future).

Daily Timer: Daily measurements automatically start and stop and selected times, including up to 3 daily selected blocks.

A.7.4 Display Spectra

Latest (Live), Linear Average, and Maximum Spectra

X-axis display: Full frequency range, with the ability to zoom to 1:1 line to pixel ratio (with 215 lines possible) in Hz or CPM.

Y-axis display: Linear, or Logarithmic with a user-selectable scale feature (selectable from -60 dB to 340 dB).

G4 software: Full spectra display, with the ability to zoom beyond 1:1 line to pixel ratio for characterizing data.

A.7.5 Supported Hardware Configurations for FFT Measurements

The 831C in FFT mode is capable of computing both acoustic and vibration signals. See **Preparing the Mic on page 160** for acoustic hardware notes.

For a vibration measurement when configured with the adapter ADP074 and an accelerometer, take note that the maximum measurable frequency range for the 831C in FFT mode is 20 kHz. And the maximum voltage for the ADP074 is ± 8 Volts at the peak.

See **Preparing Other Transducers on page 161** for additional vibration hardware notes.

A.7.6 Cursors

Main Cursor: Level at the frequency selected: maximum tracking available.

Tone Cursor: Tonality information at the tone selected. Maximum tracking on Live data for ISO 1996-2 and ISO 20065.

Harmonic Cursors: Identifies harmonics of the frequency selected by the main cursor; up to 24 cursors.

A.8 PTB Approved Firmware

In order to be compliant with PTB requirements, the PTB firmware option and approved firmware must be installed on the Model 831C SLM. When the option and approved firmware are installed, an indicator will be displayed on the status bar indicating the PTB seal is intact. If any deviation from the PTB approved state is detected, the indicator will change to show that the PTB seal has been broken.

Parameters checked:

- 831C-PTB option must not be masked
- NF30-101 option must not be enabled
- PTB approved firmware must be installed
- Must be using a PRM831 or PRM2103 preamp
- Must be using a 377B02 microphone
- Calibration must be within 1.5 dB of the certified sensitivity
- Microphone corrections must be one of the following:
 - Off
 - FF:RI
 - FF:RI 2116
 - FF:FF 2116
 - FF:90 2116

The state of these parameters as well as the PTB seal state are stored in each data file and are viewable on the summary page of exported data.

TAKE NOTE PTB approved firmware can only be installed by an authorized representative.

A.9 Frequency Response Charts

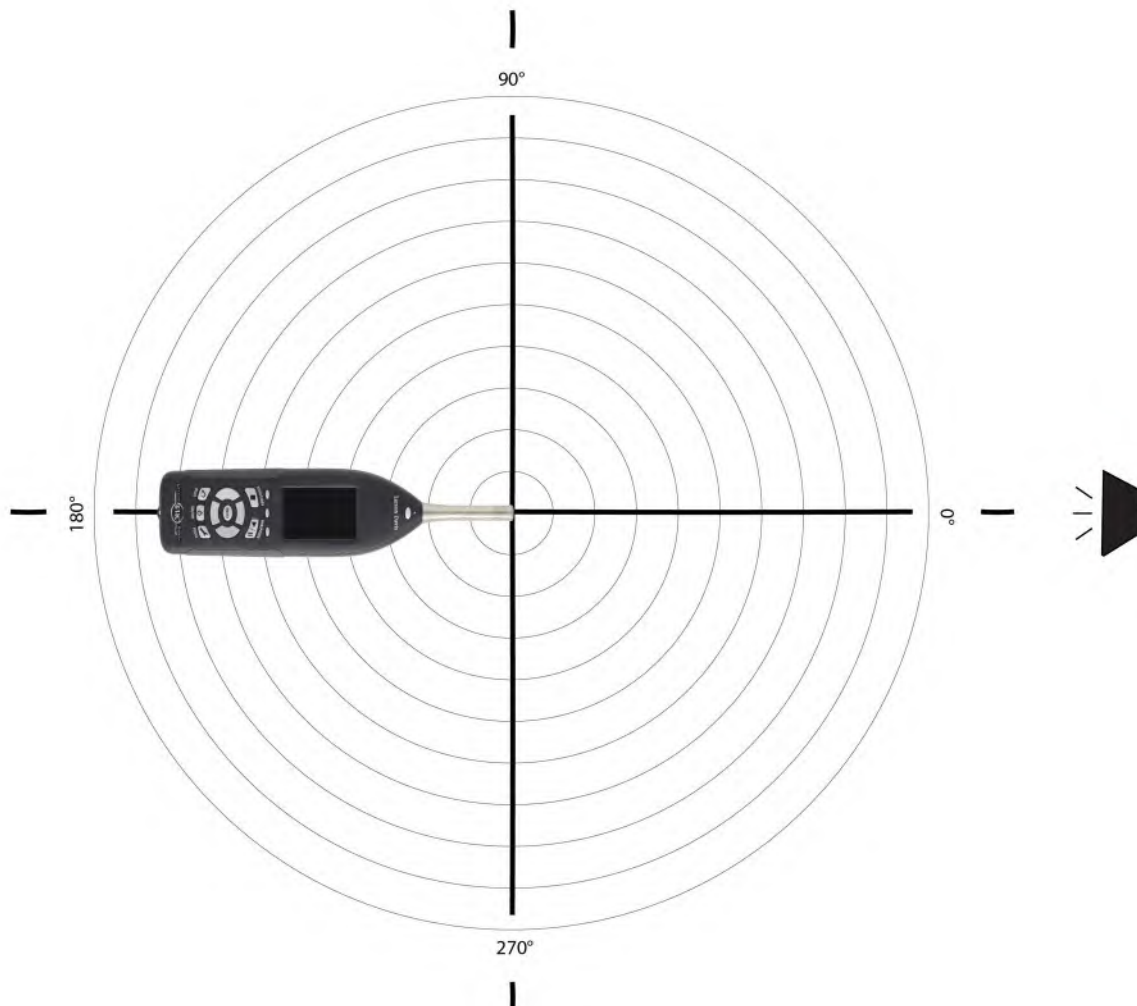
The following data was taken using the SoundAdvisor 831C sound level meter with a PRM831 preamplifier at degrees increasing by 10, starting with 0° and rotating to 350°. The frequency was measured in Hertz and ranged from ~200 Hz to 20 kHz.

In this section:

- [XY Plane Frequency Response](#)
- [XZ Plane Frequency Response](#)
- [Random Incidence Response](#)
- [Typical Z-Weight Frequency Response](#)
- [831C Low Noise Microphone Set \(831C-LOWN\) Frequency Response](#)

A.9.1 XY Plane Frequency Response

FIGURE A-14 Sound Source Plane Parallel To Display Screen (XY Plane)



377B02, XY Plane Frequency Response

FIGURE A-15 Model 831C with 377B02 Microphone / XY Plane

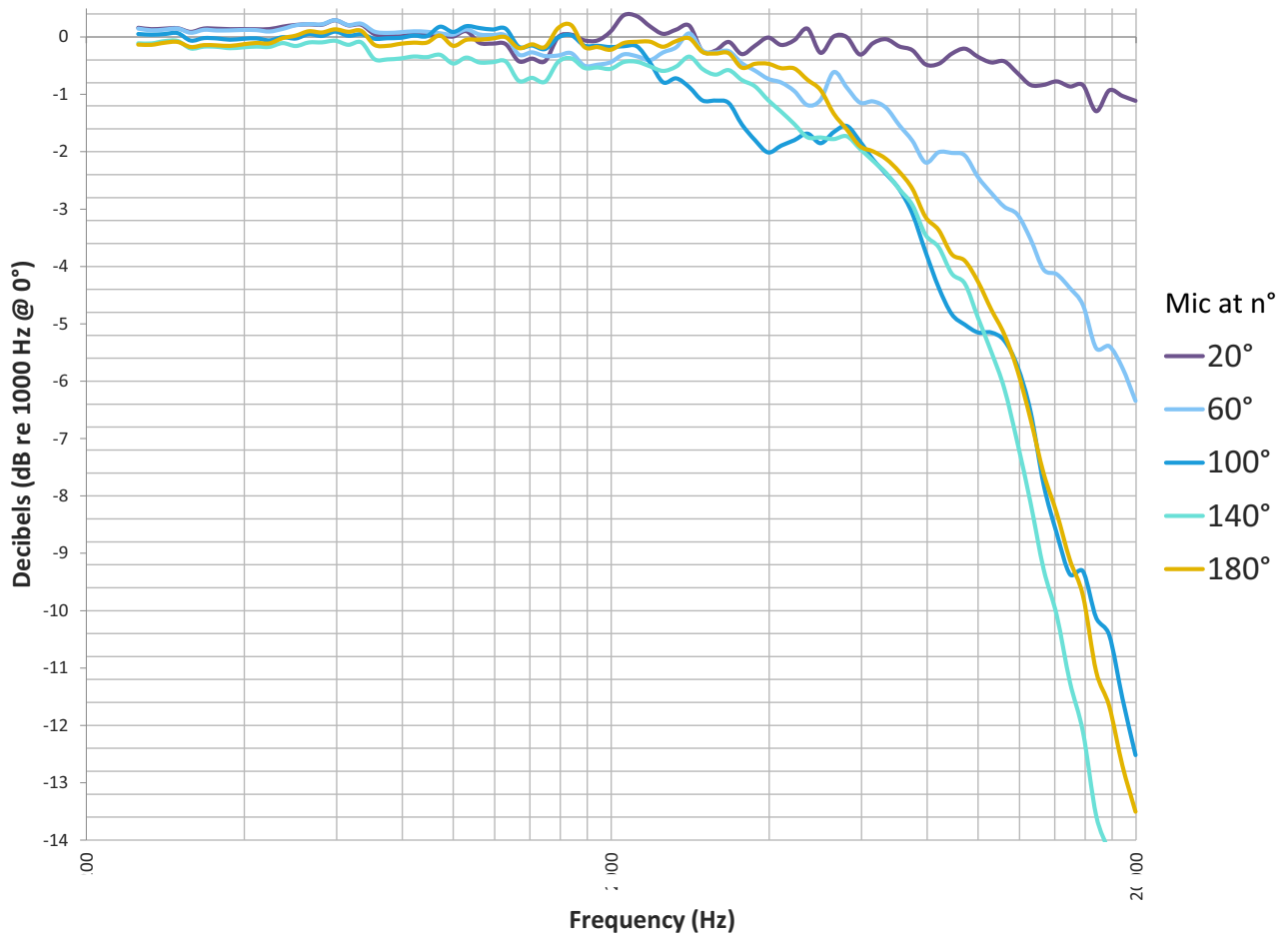


FIGURE A-16 Model 831C with 377B02 Microphone / XY Plane

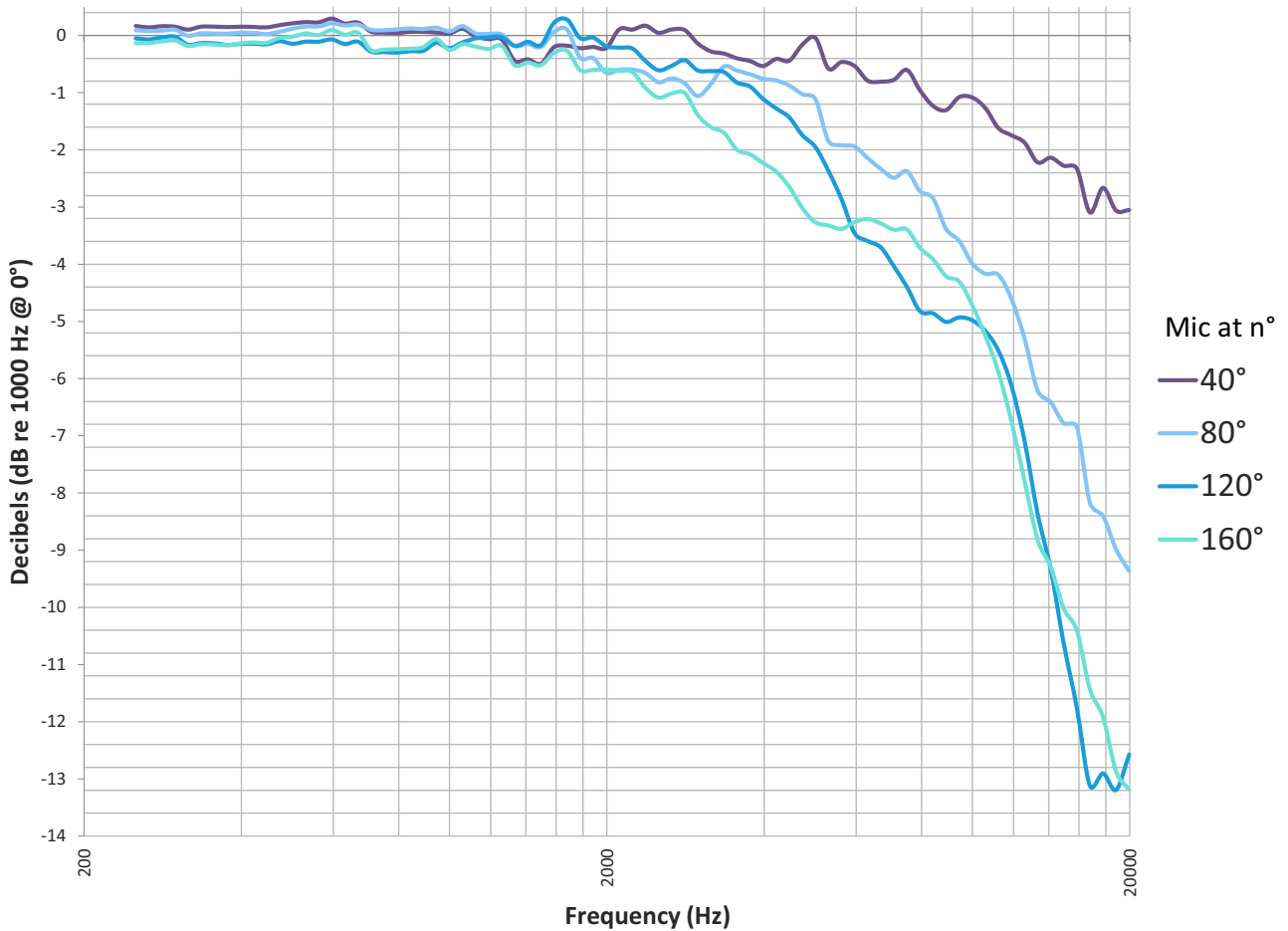


FIGURE A-17 Model 831C with 377B02 Microphone / XY Plane

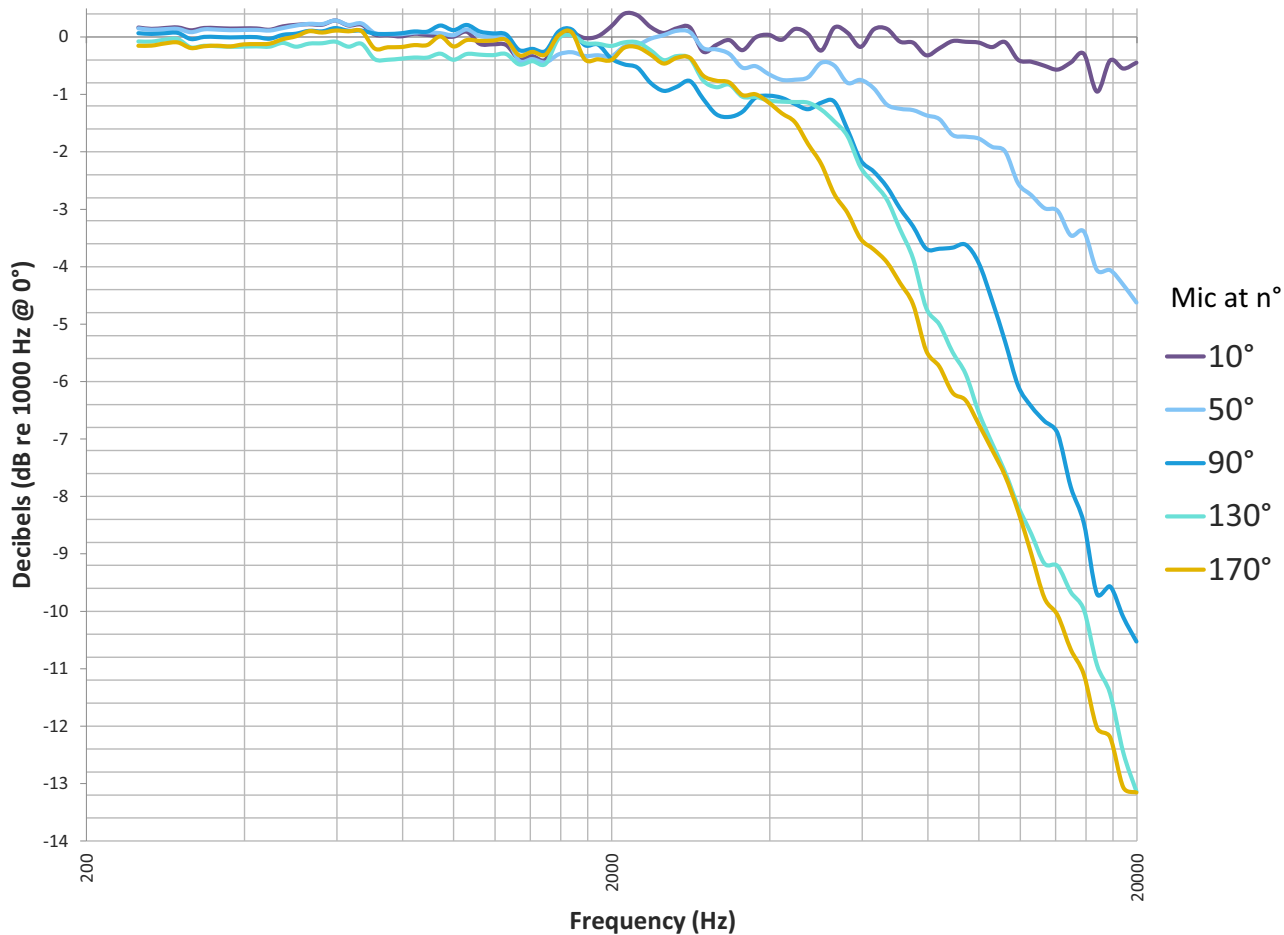


FIGURE A-18 Model 831C with 377B02 Microphone/ XY Plane

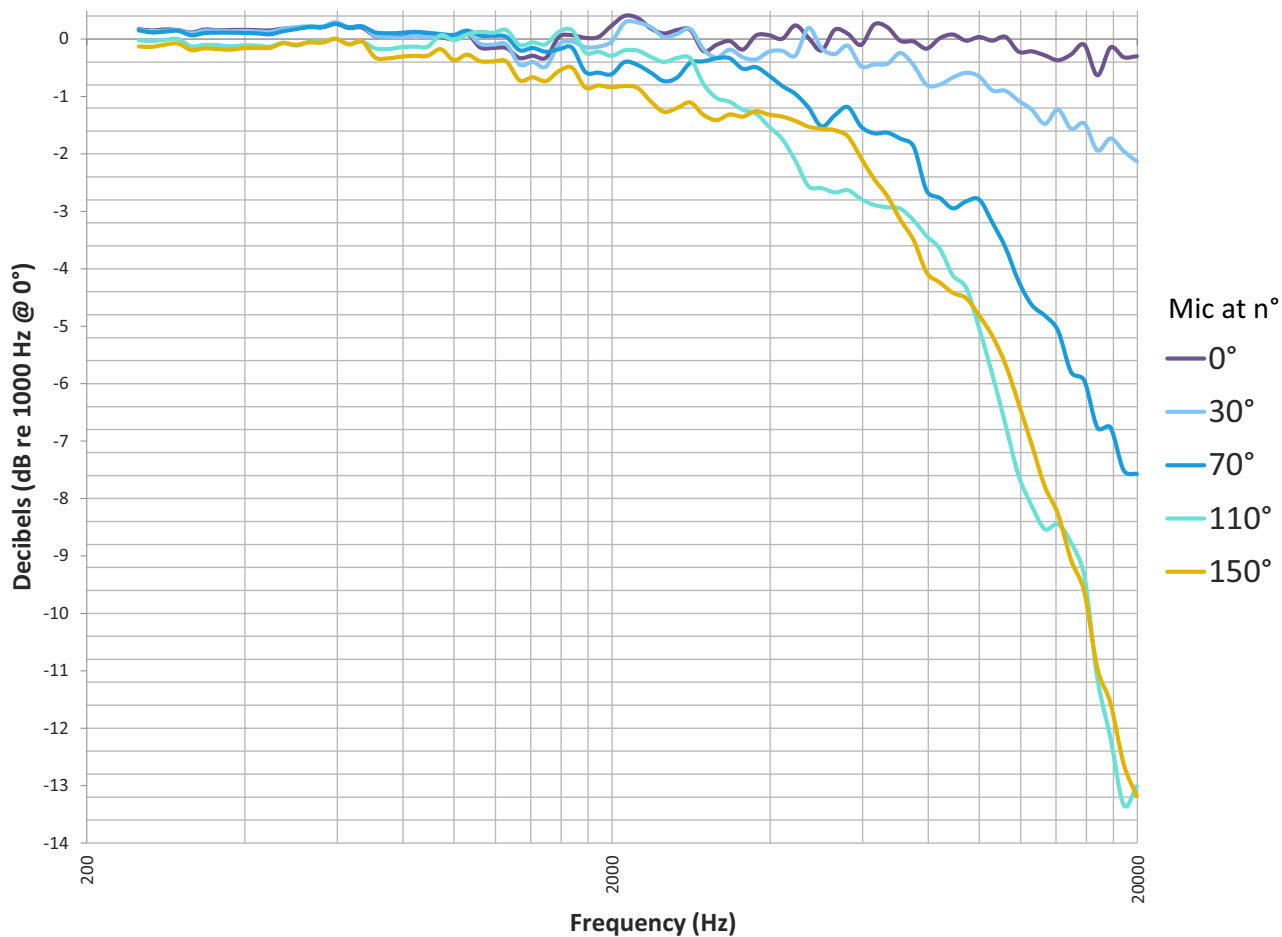
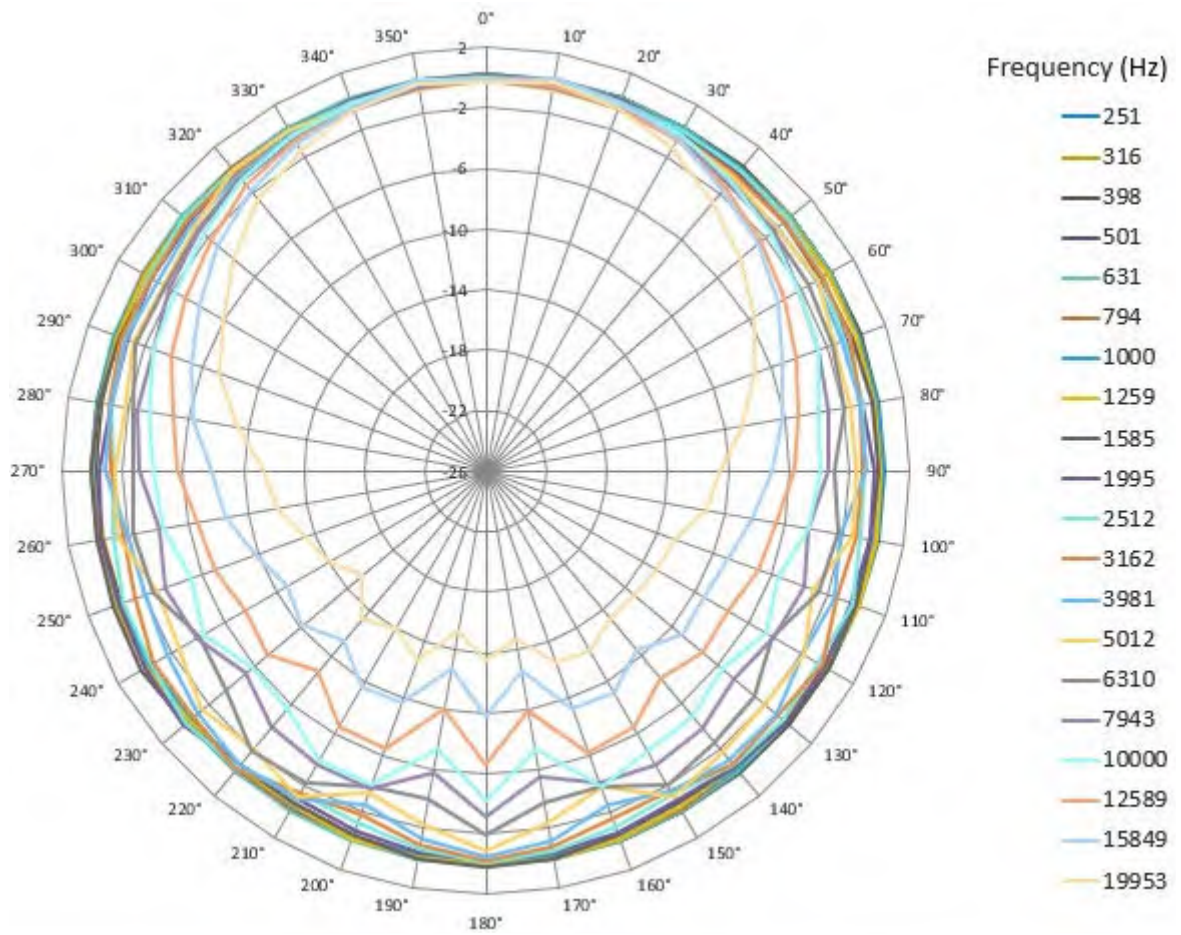


FIGURE A-19 Model 831C with 377B02 Microphone/ XY Plane, Referenced to Level at 0°



End of 377B02 XY Plane Frequency Response Graphs

377C20, XY Plane Frequency Response

FIGURE A-20 Model 831C with 377C20 RI Microphone/ XY Plane, Relative to 1000 Hz at 0°

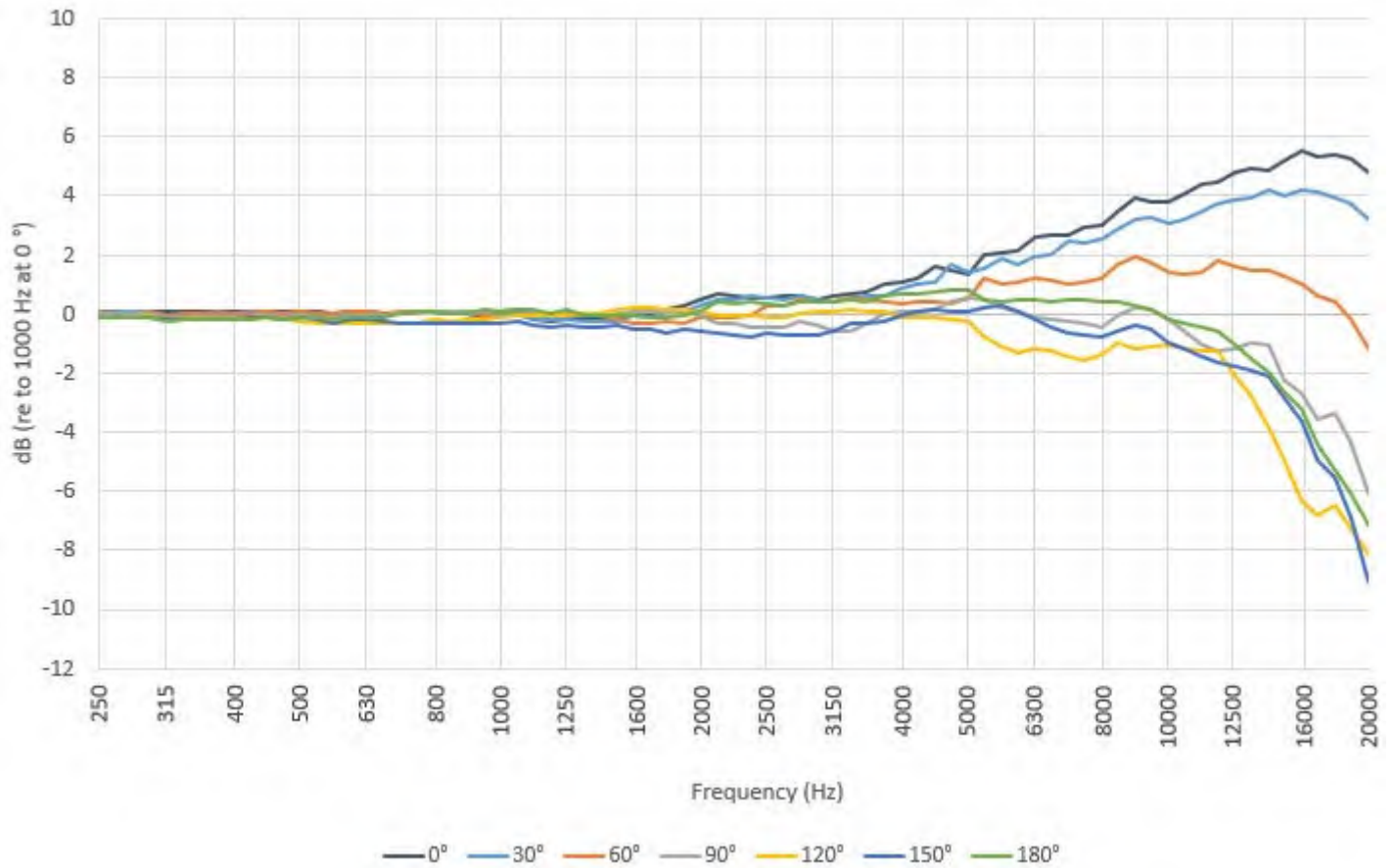


FIGURE A-21 Model 831C with 377C20 RI Microphone/ XY Plane, Relative to 1000 Hz at 0°

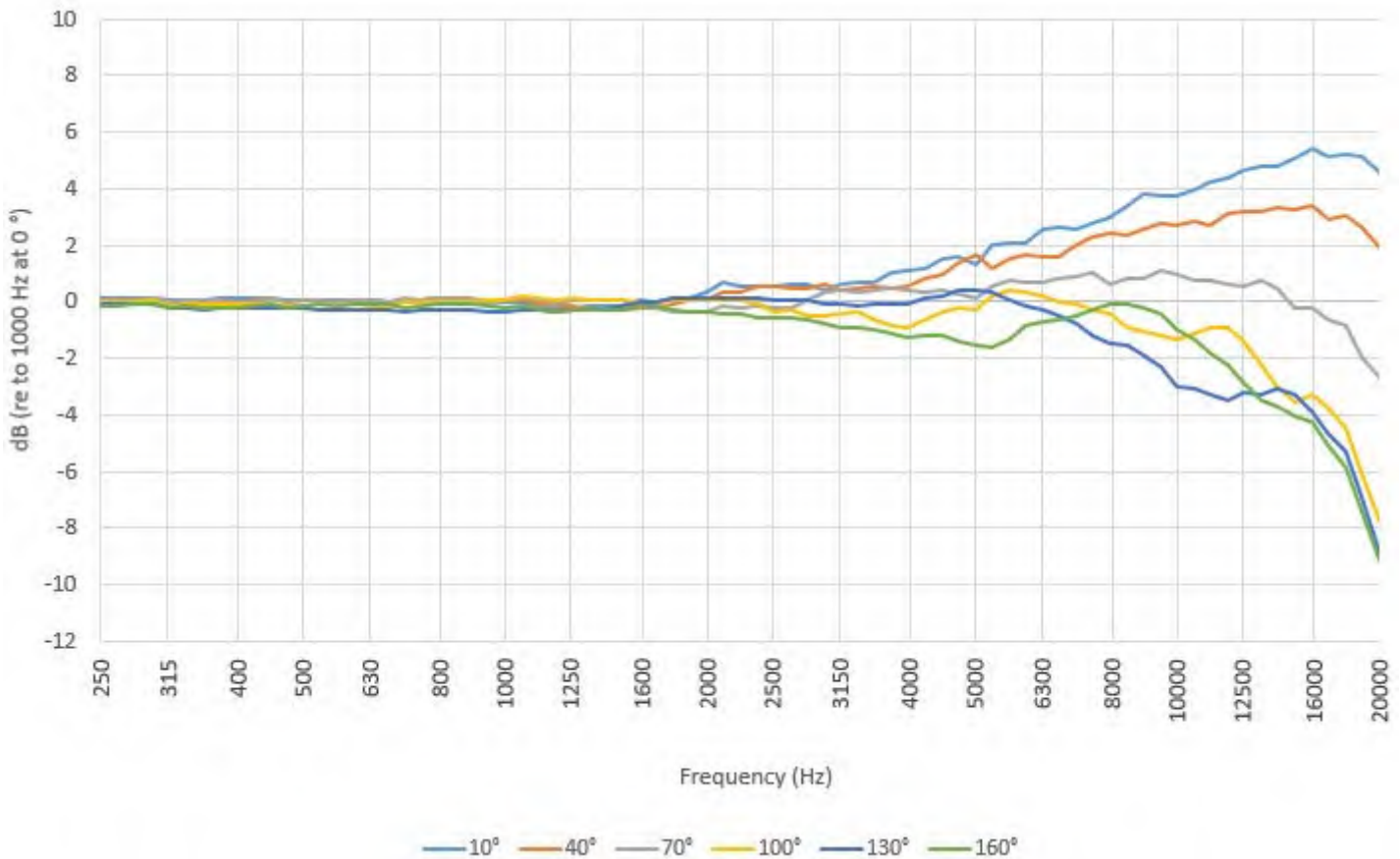


FIGURE A-22 Model 831C with 377C20 Microphone/ XY Plane, Relative to 1000 Hz at 0°

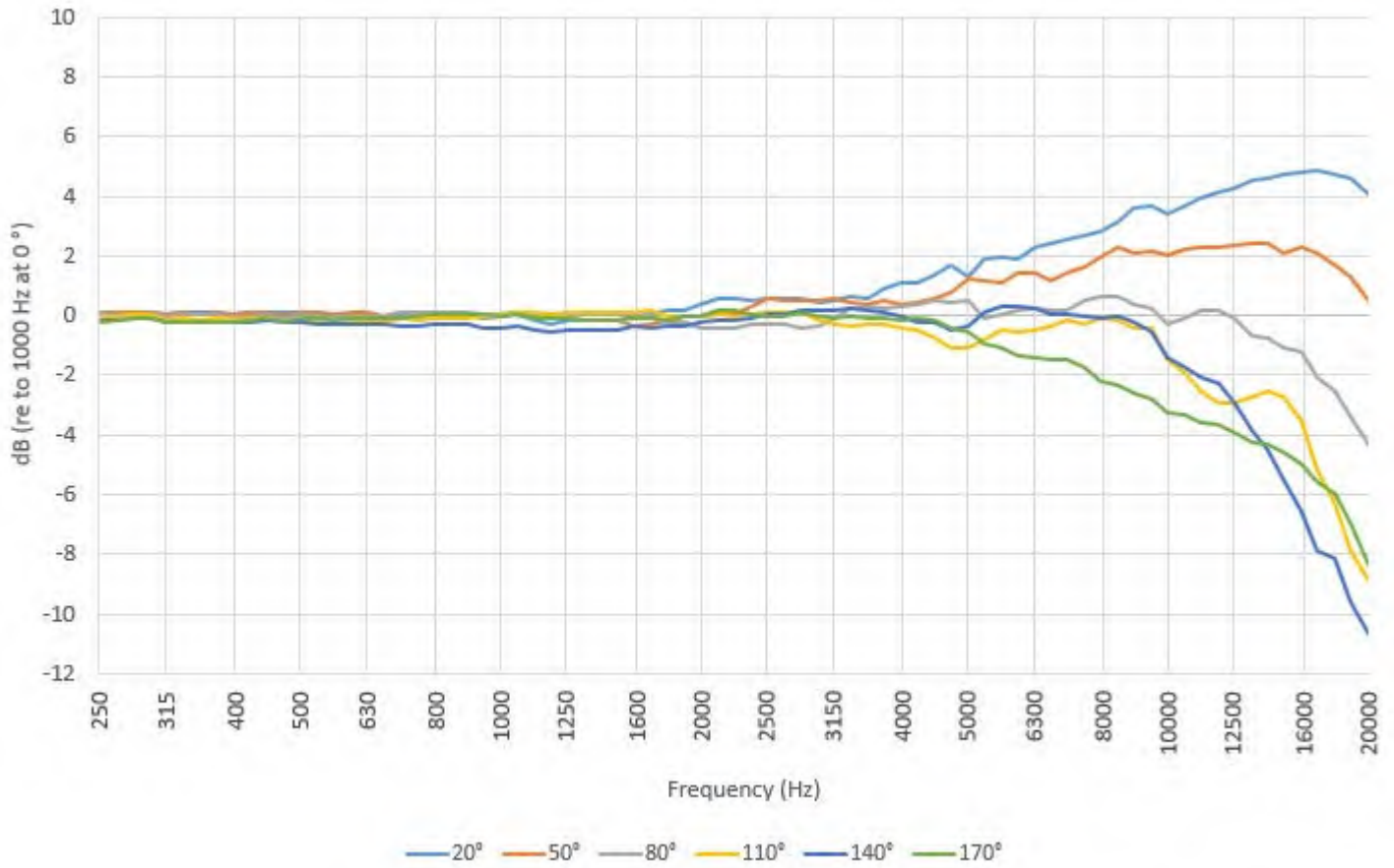
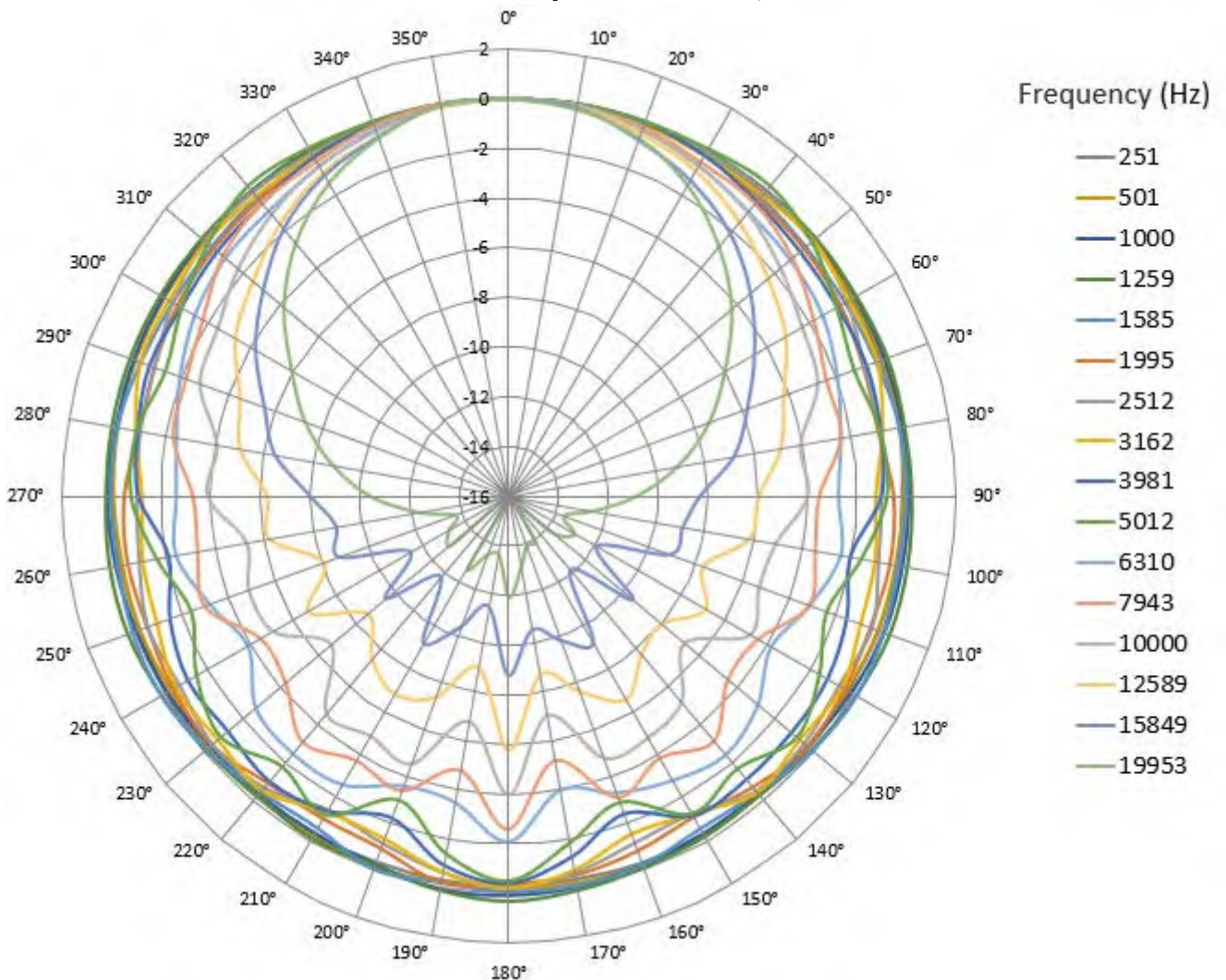


FIGURE A-23 Model 831C with 377C20 RI Microphone/ XY Plane, Referenced to Level at 0°



377A15, XY Plane Frequency Response

FIGURE A-24 Model 831C with 377A15 Pressure Mic with ADP008A/ XY Plane, Relative to 1000 Hz at 0°

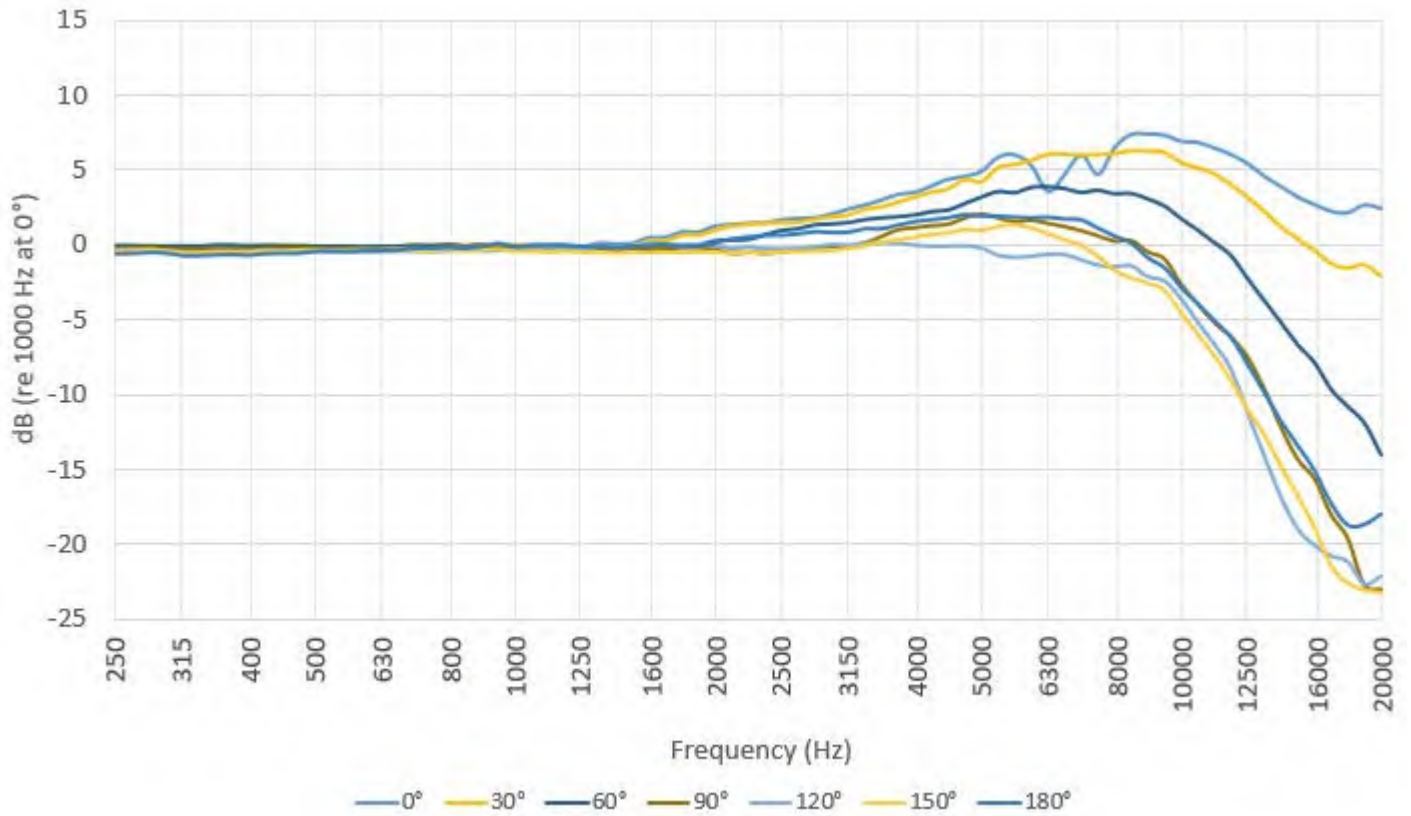


FIGURE A-25 Model 831C with 377A15 Pressure Microphone with ADP008A XY Plane Directional Response, Relative to 1000 Hz at 0°

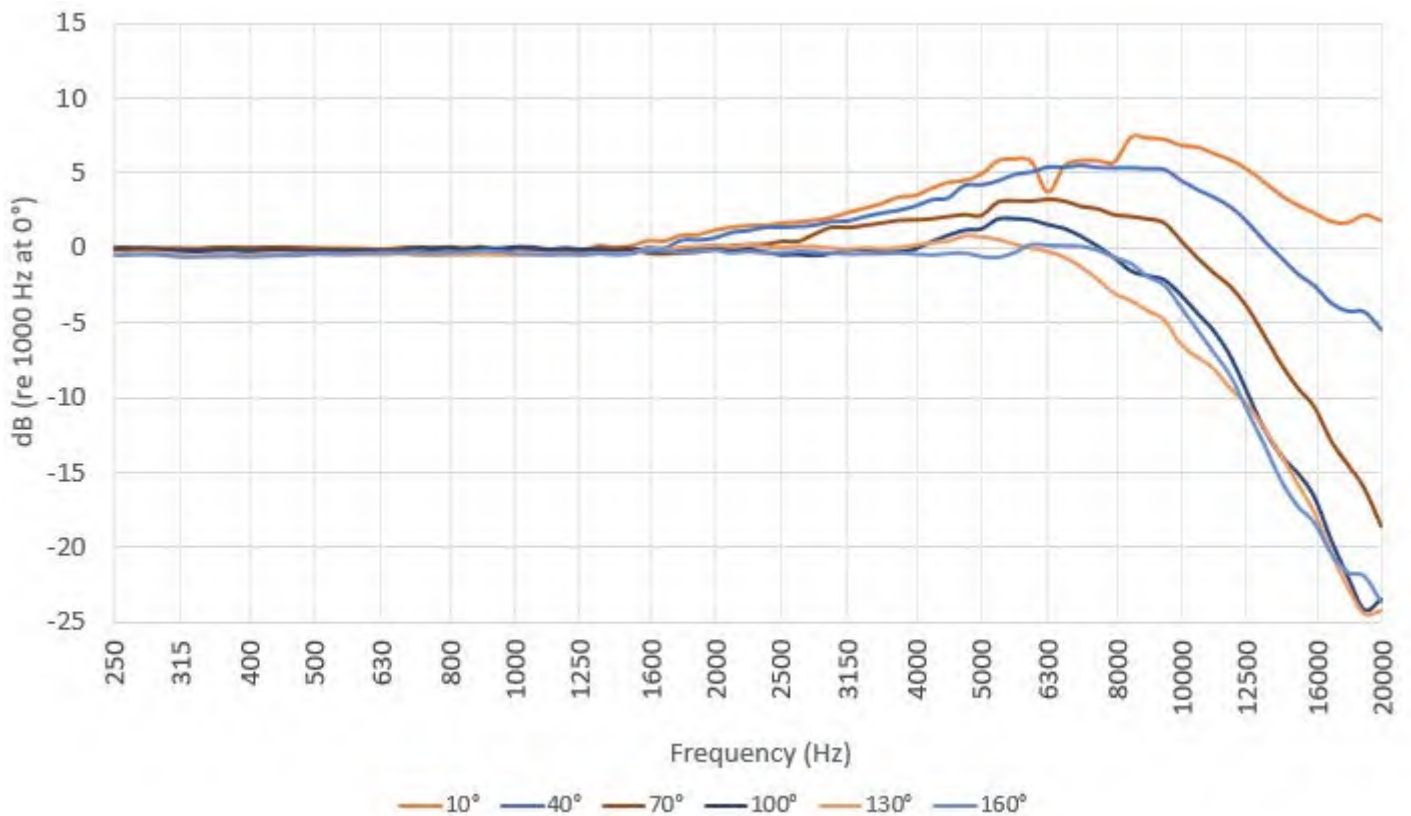


FIGURE A-26 Model 831C with 377A15 Pressure Mic with ADP008A/ XY Plane, Relative to 1000 Hz at 0°

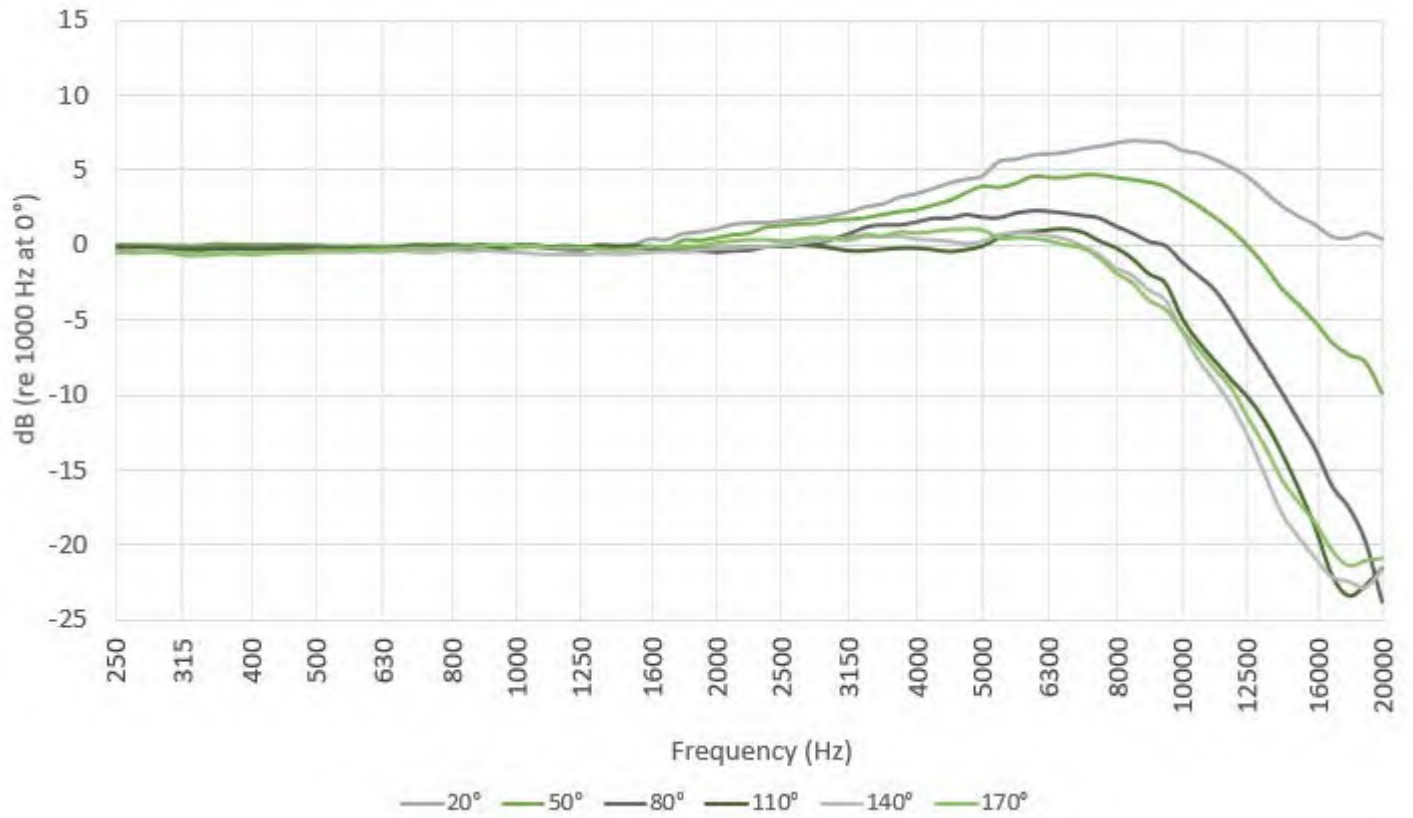


FIGURE A-27 Model 831C with 377A15 Pressure Mic with ADP008A/ XY Plane, Ref to Level at 0°

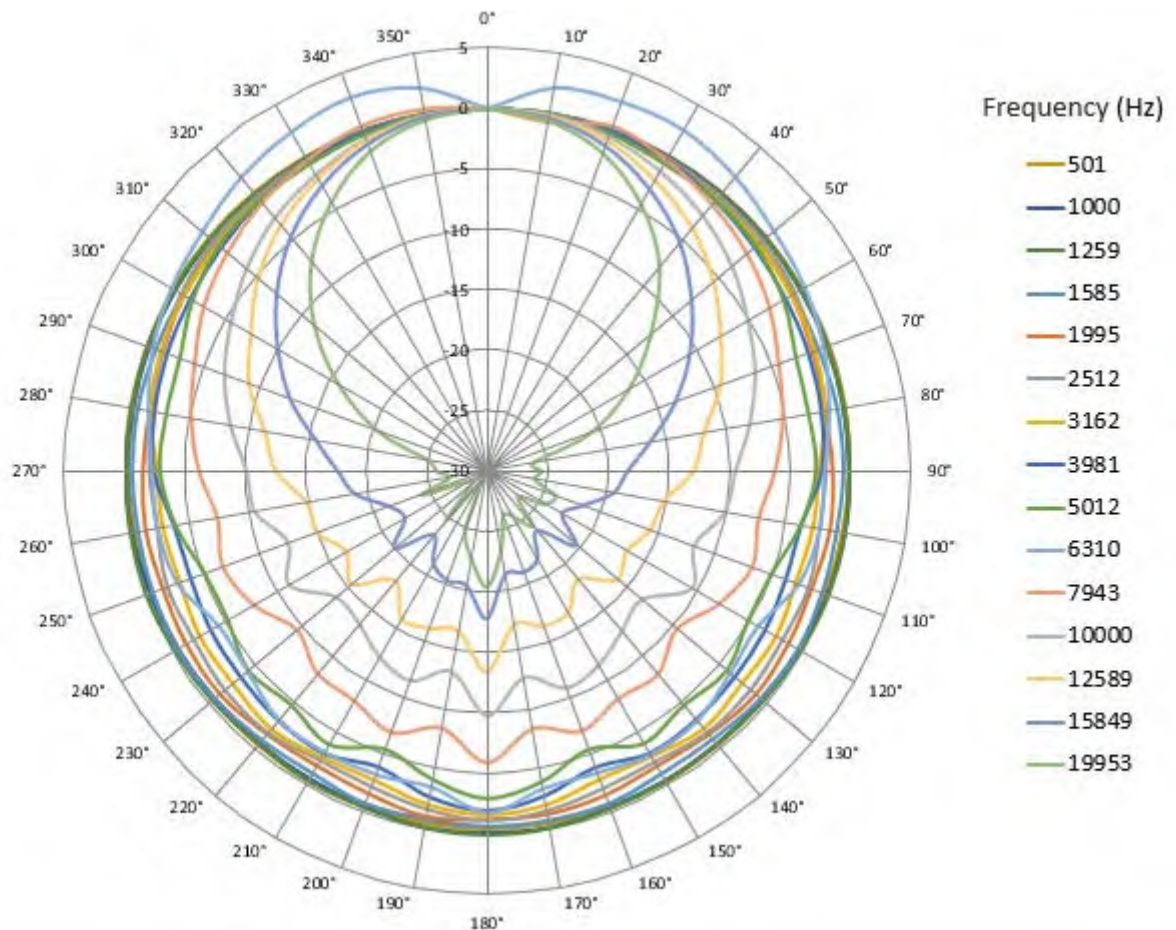
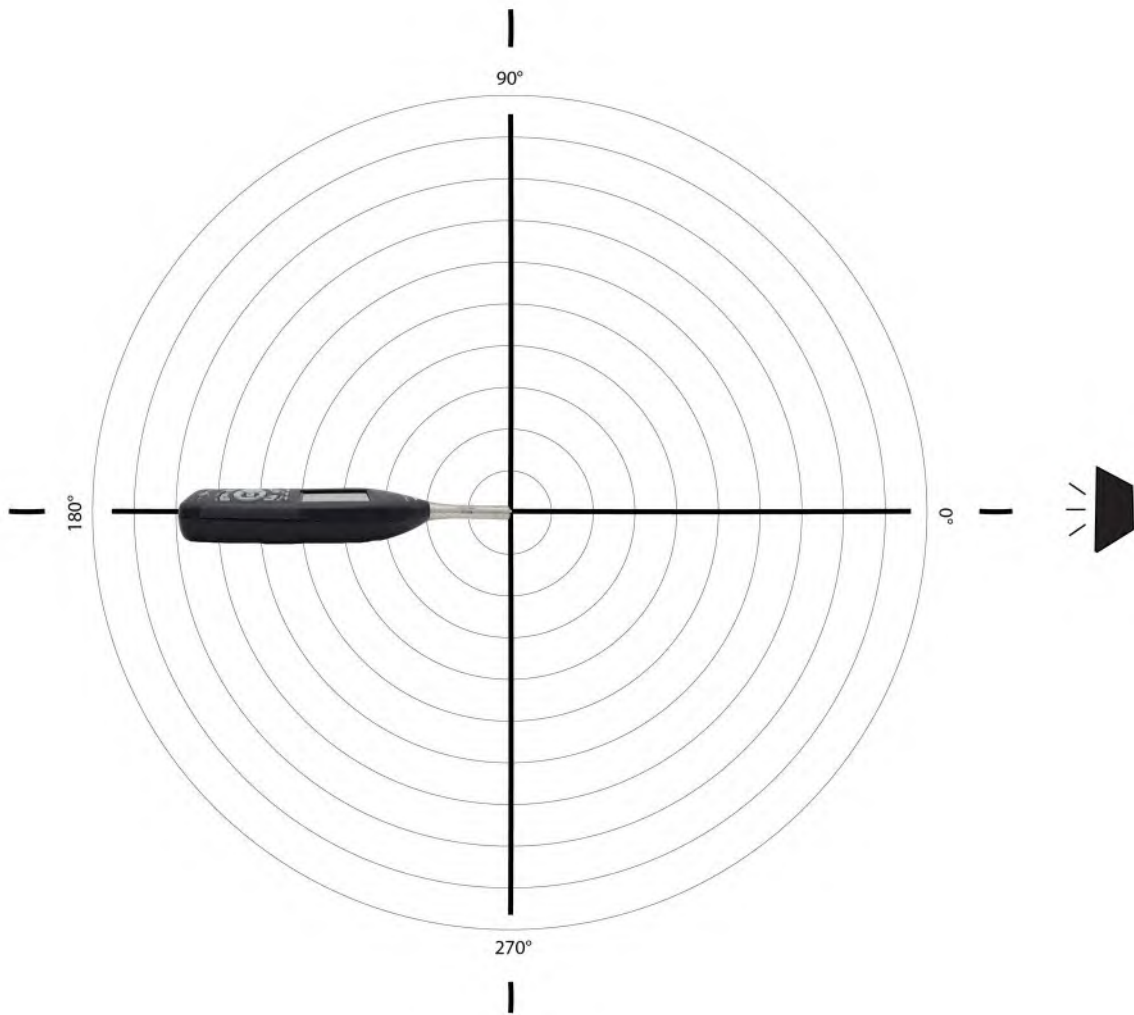


FIGURE A-28 Sound Source Perpendicular to Plane of Display Screen (XZ Plane)



377B02, XZ Plane Frequency Response

FIGURE A-29 Model 831C with 377B02 Microphone (XZ Plane)

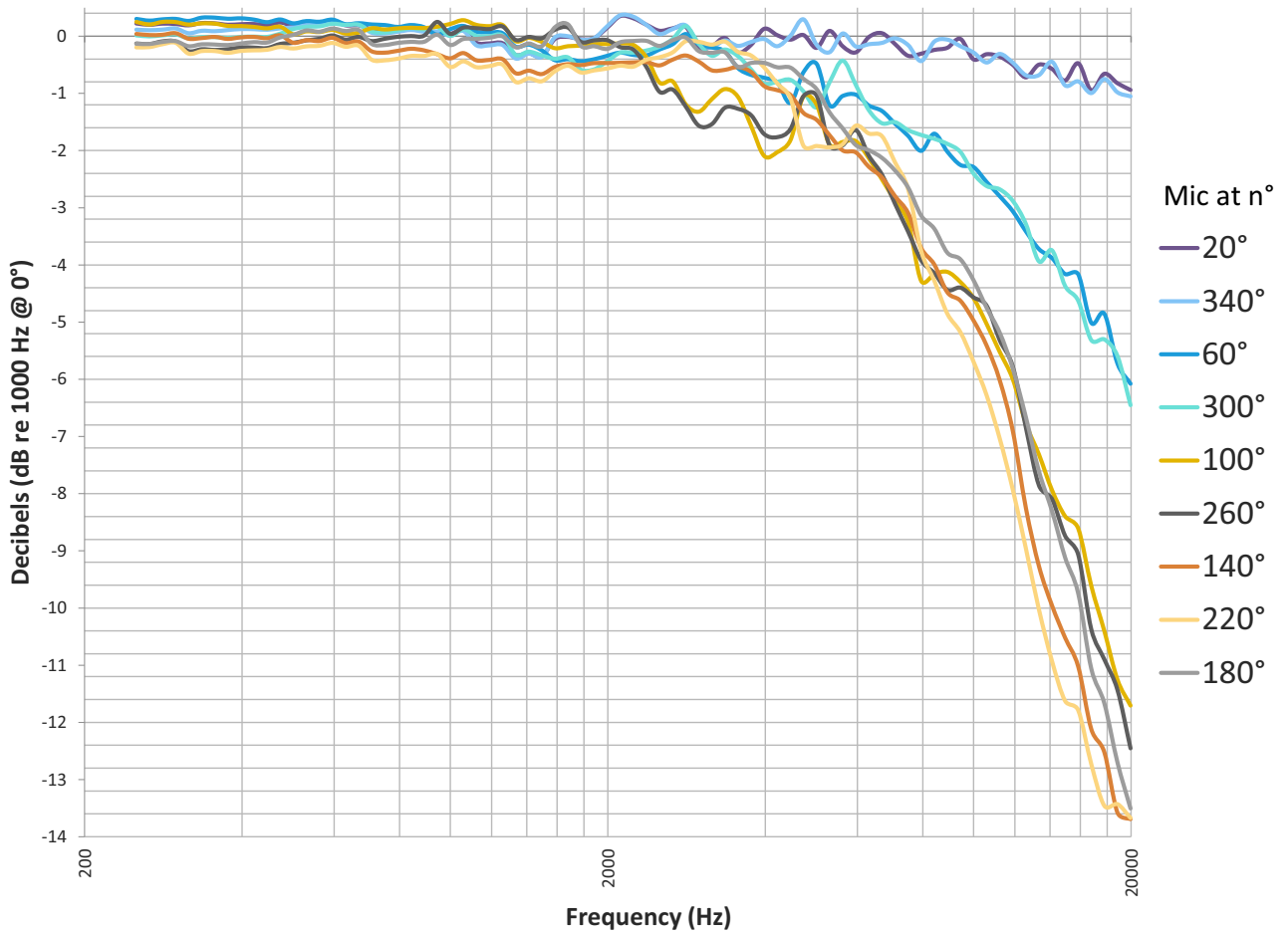


FIGURE A-30 Model 831C with 377B02 Microphone (XZ Plane)

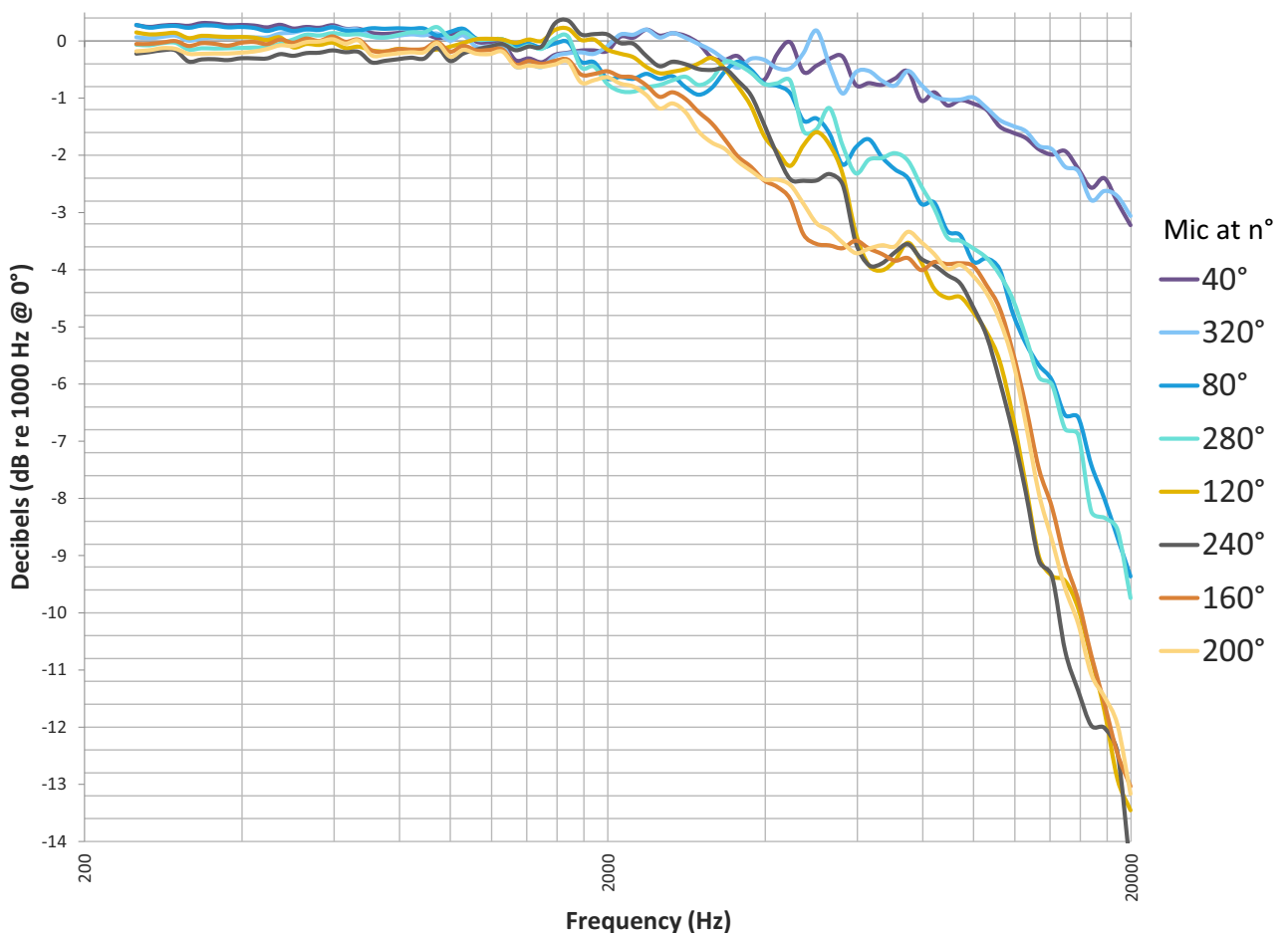


FIGURE A-31 Model 831C with 377B02 Microphone (XZ Plane)

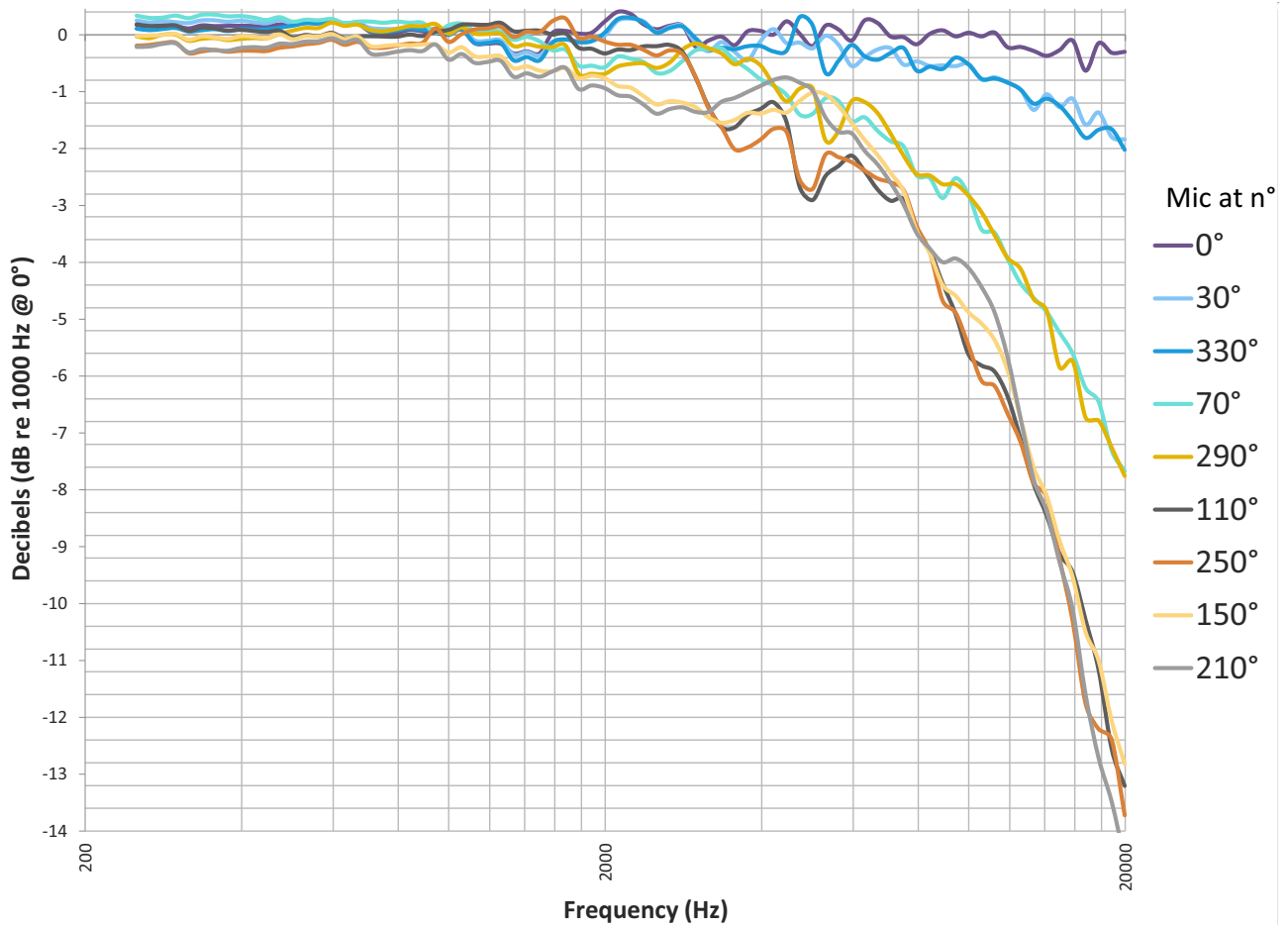


FIGURE A-32 Model 831C with 377B02 Microphone (XZ Plane)

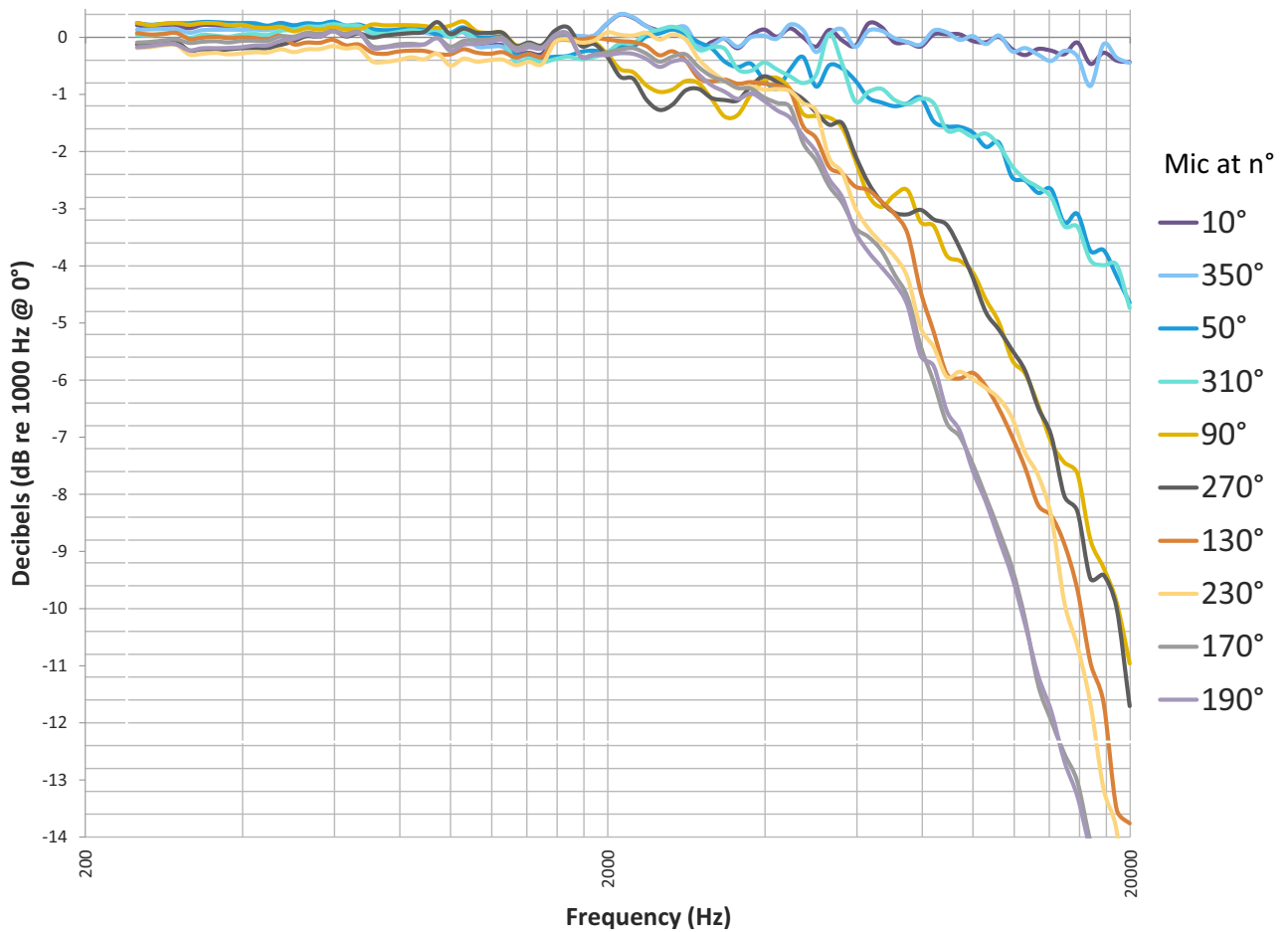
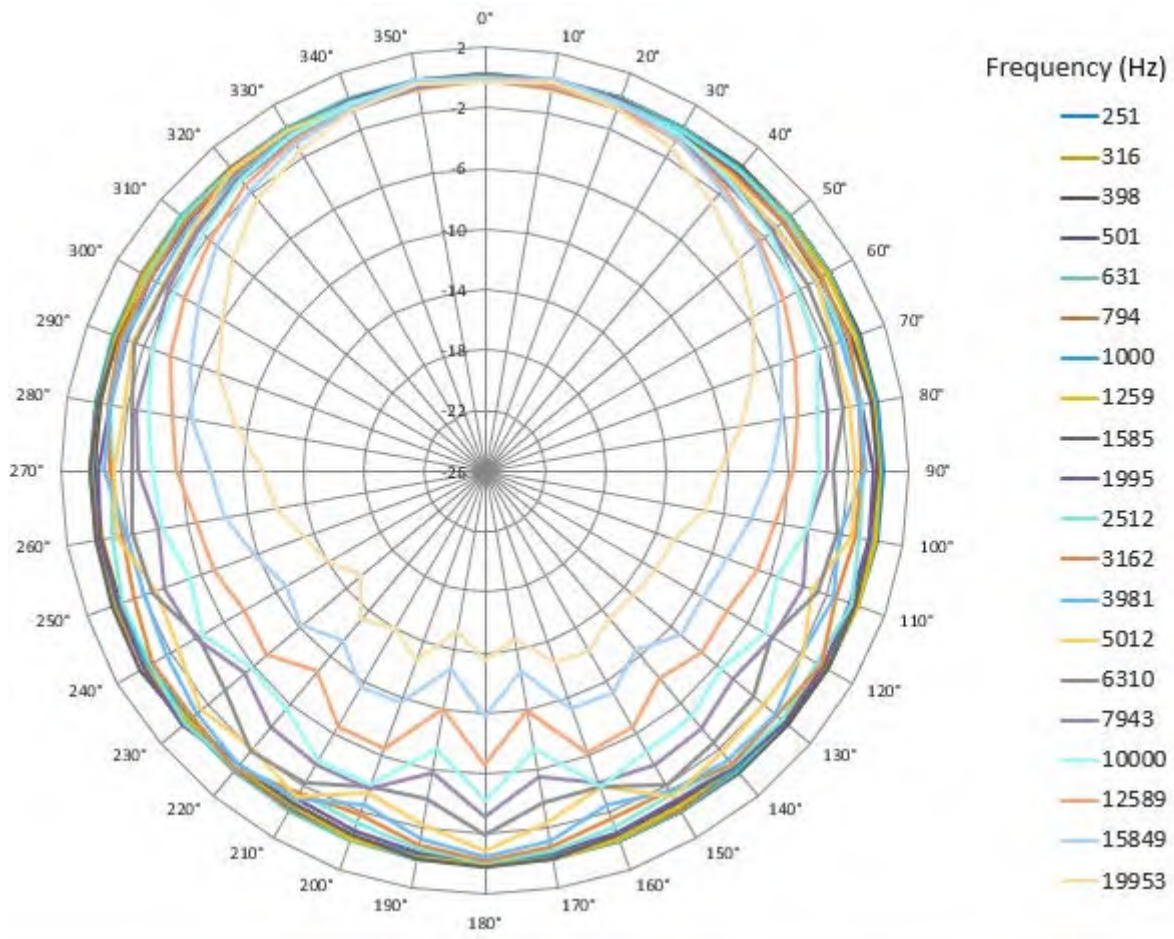


FIGURE A-33 Model 831C with 377B02 Microphone/ XZ Plane, Referenced to Level at 0°



377C20, XZ Plane

FIGURE A-34 Model 831C with 377C20 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

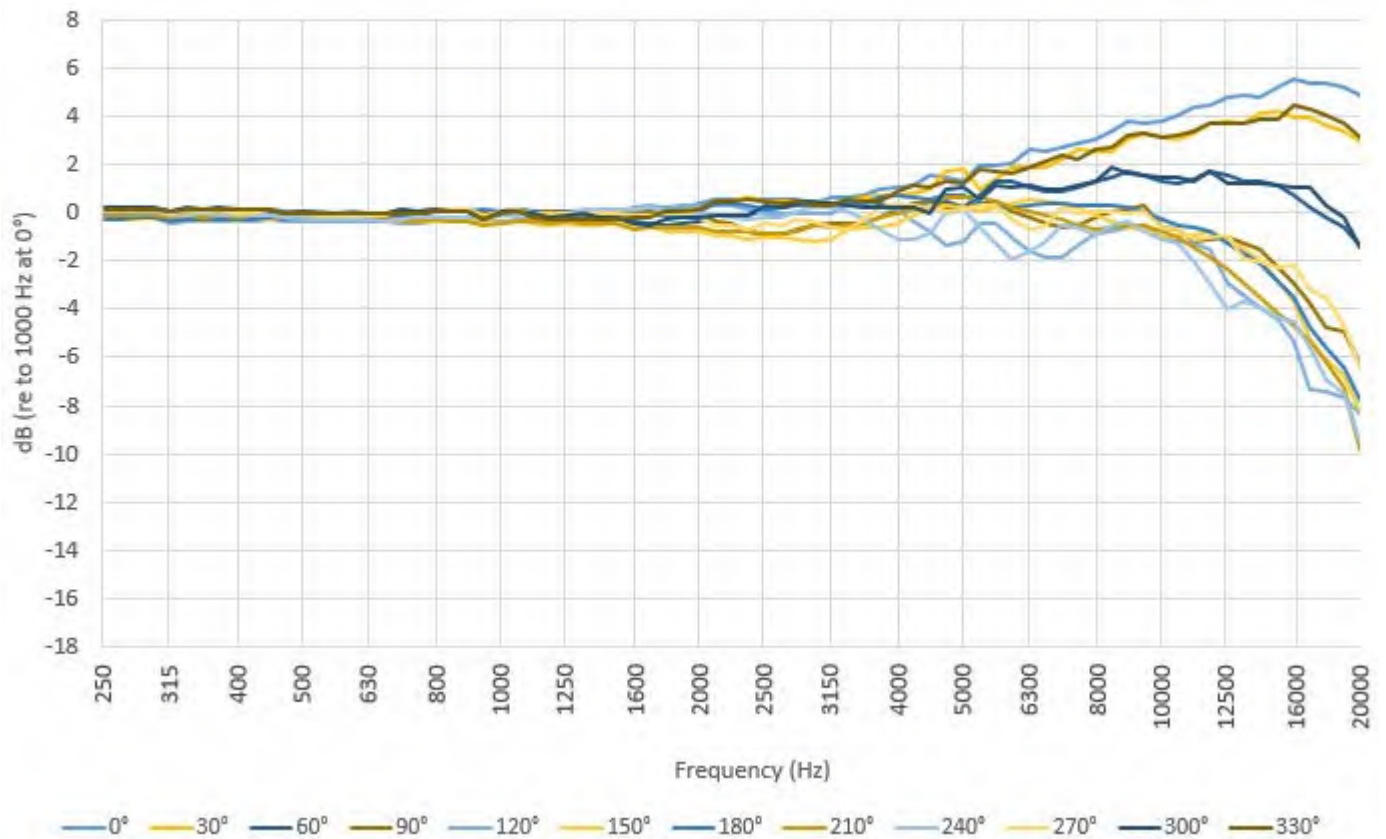


FIGURE A-35 Model 831C with 377C20 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

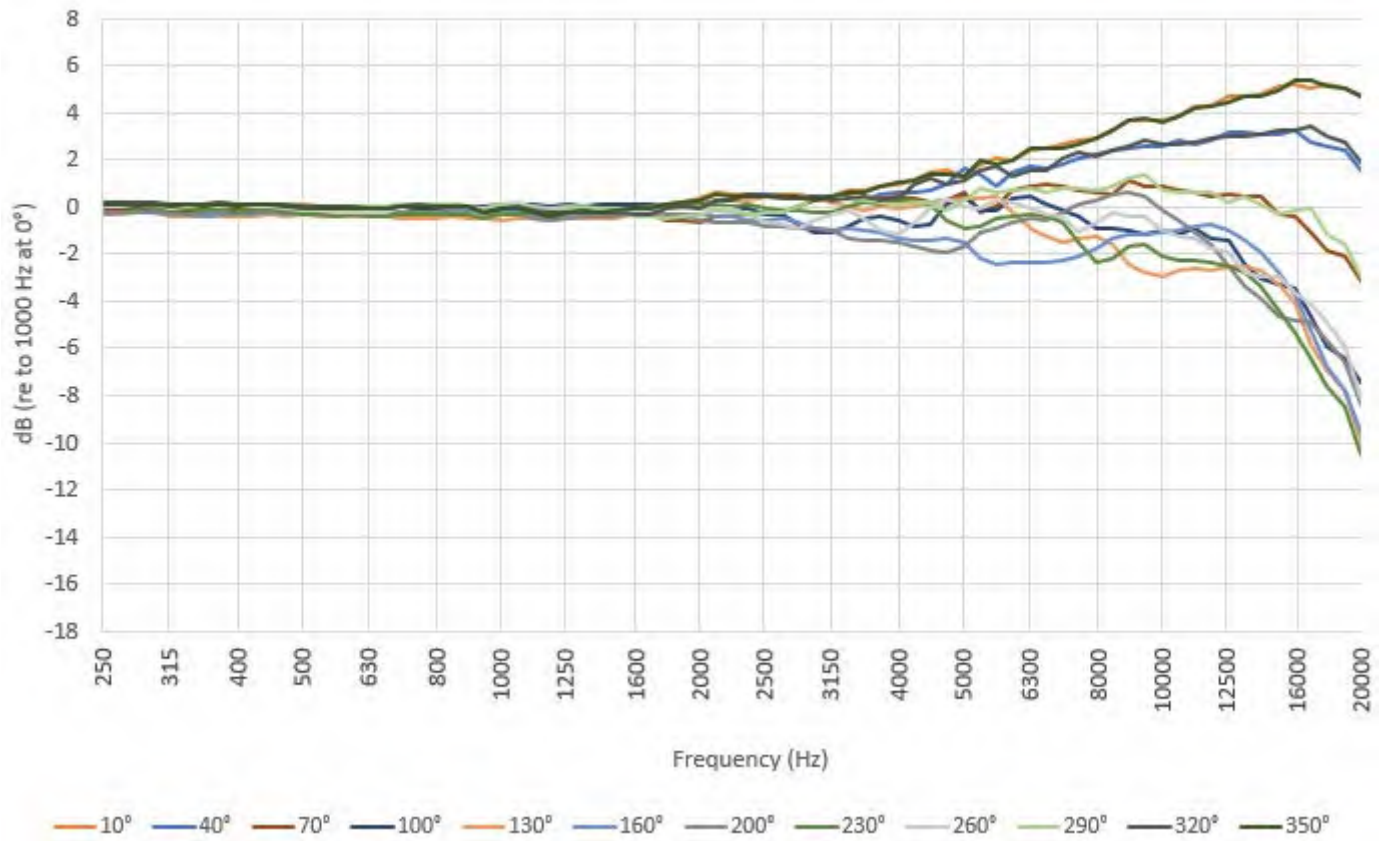


FIGURE A-36 Model 831C with 377C20 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

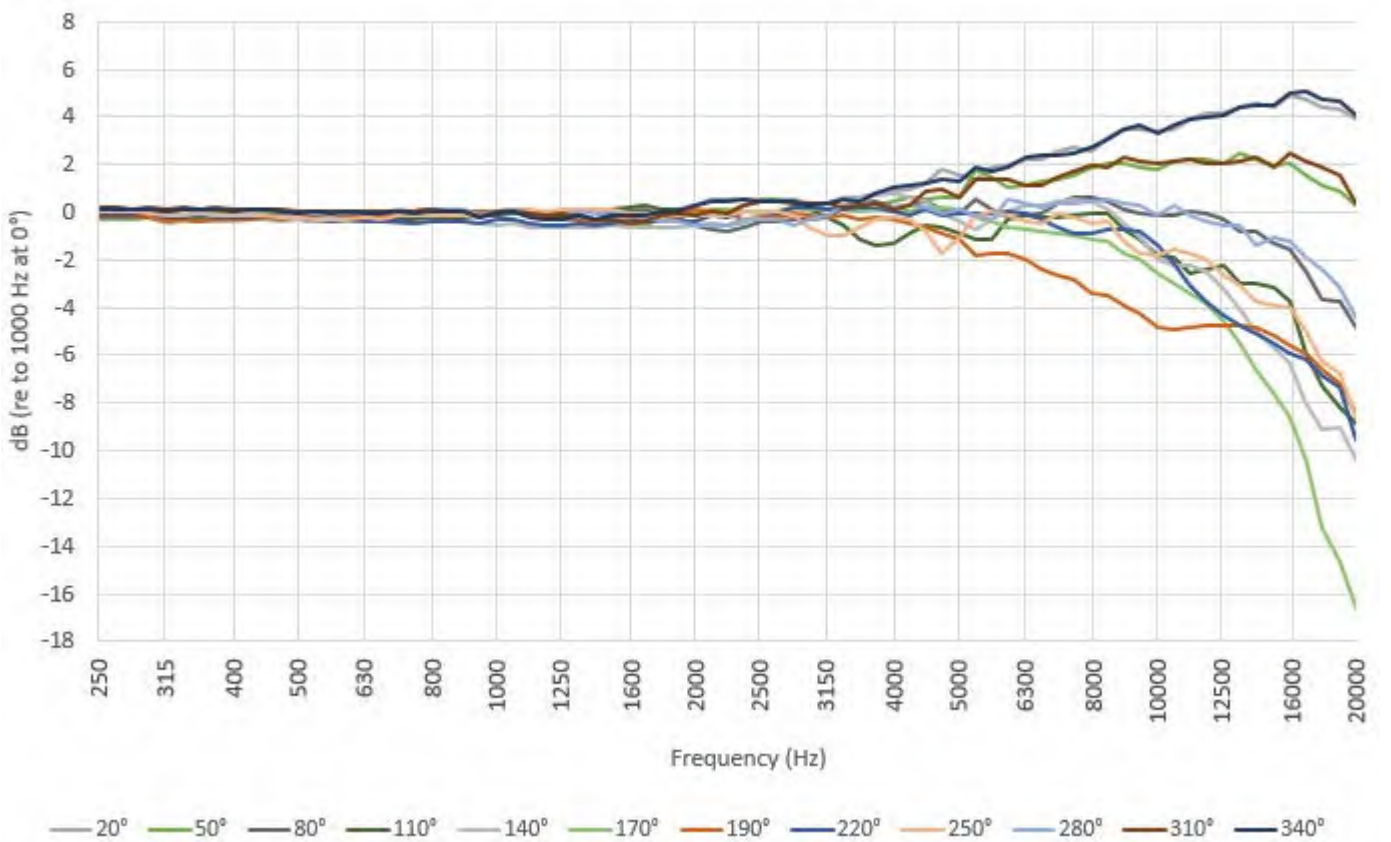
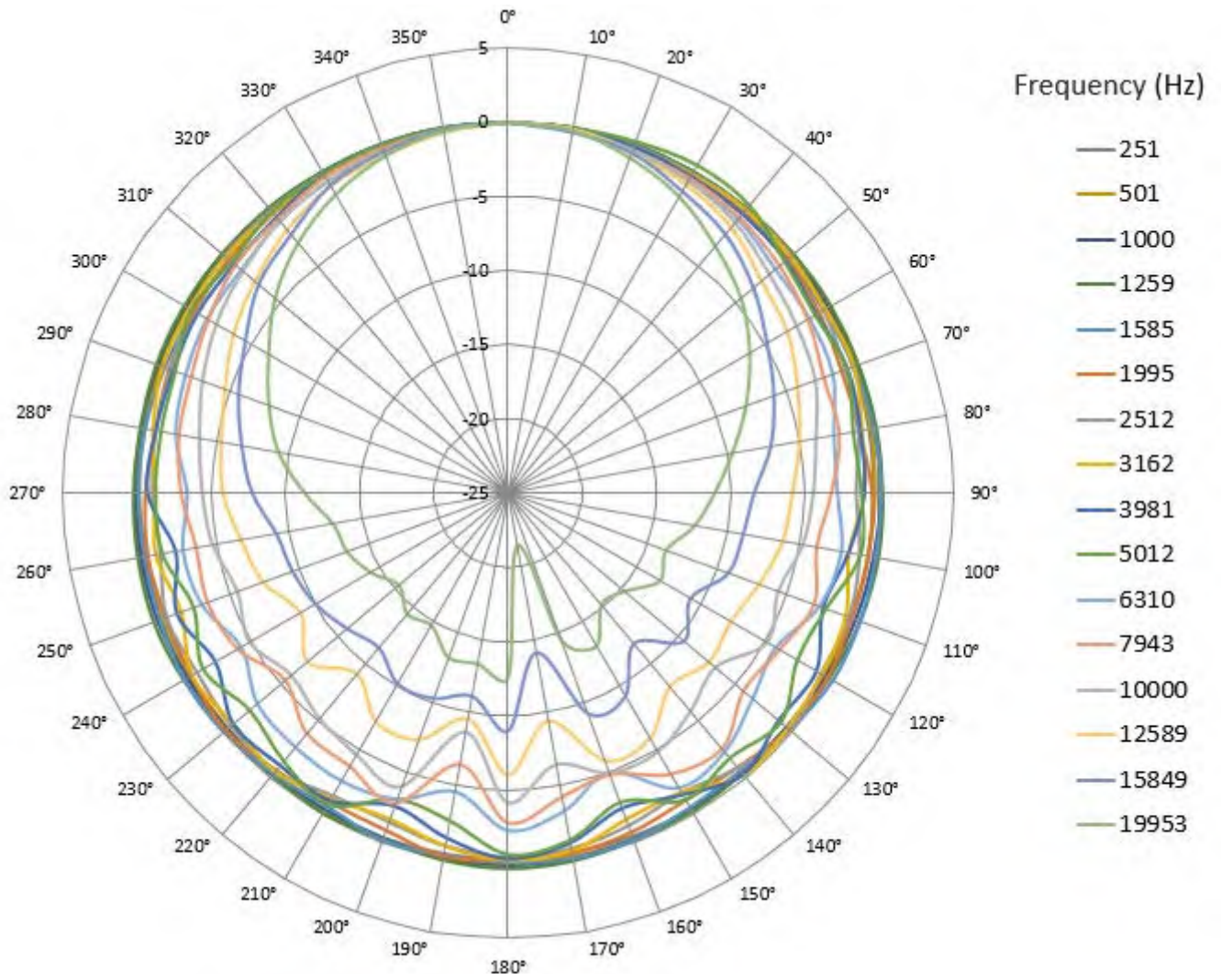


FIGURE A-37 Model 831C with 377C20 Microphone/ XZ Plane, Referenced to Level at 0°



End of 377C20 XZ Plane Frequency Response Graphs

377A15, XZ Plane

FIGURE A-38 Model 831C with 377A15 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

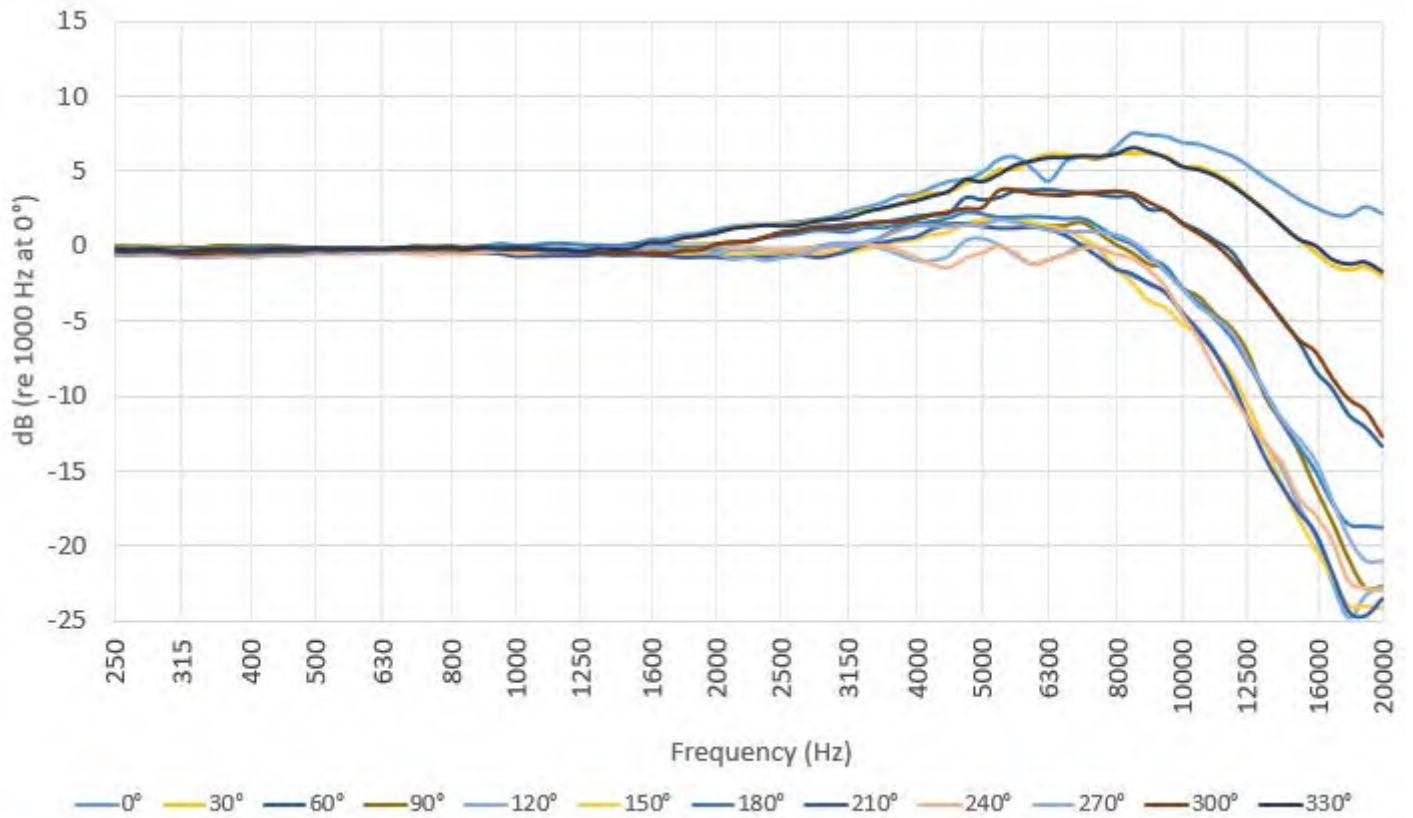


FIGURE A-39 Model 831C with 377A15 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

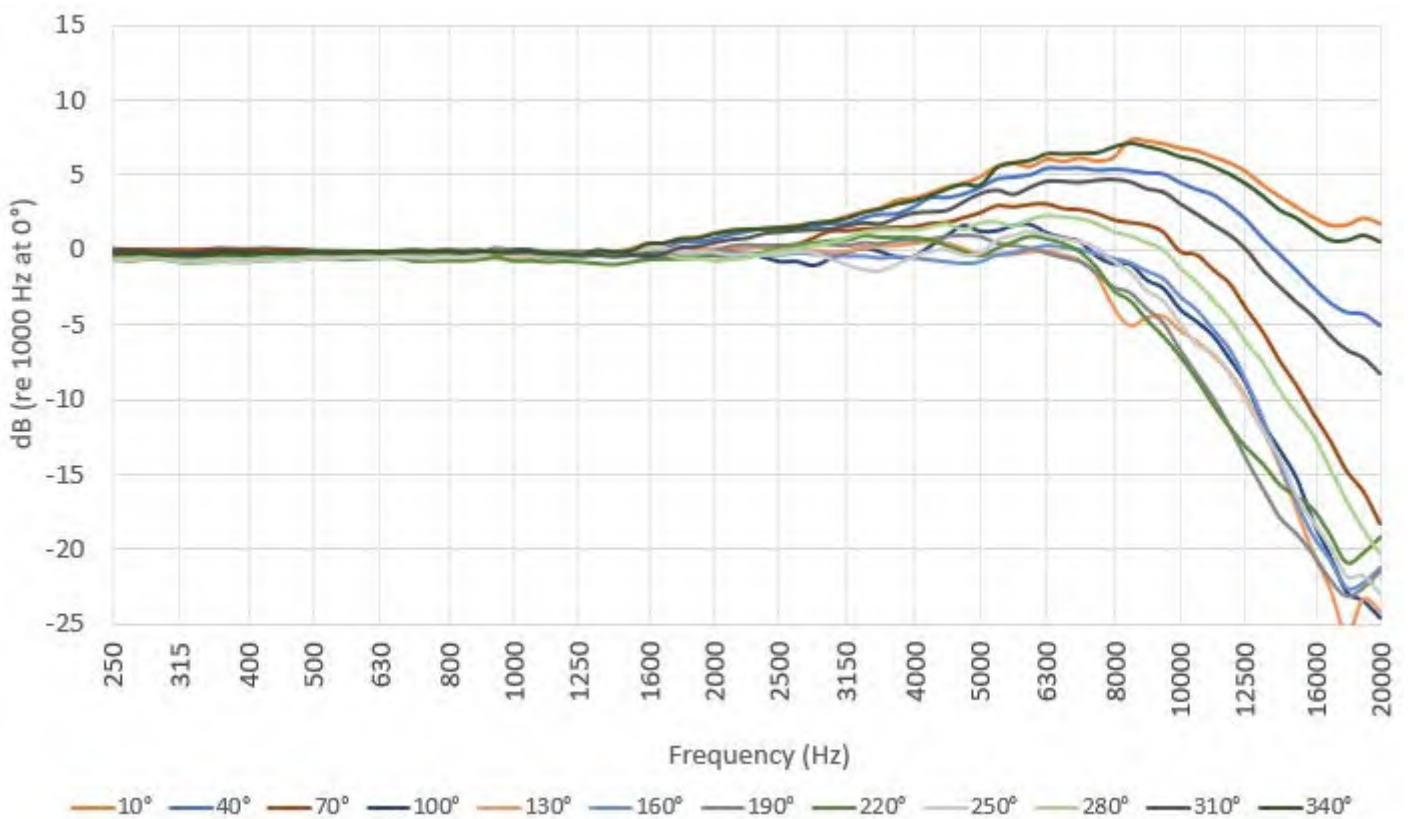


FIGURE A-40 Model 831C with 377A15 Microphone/ XZ Plane, Relative to 1000 Hz at 0°

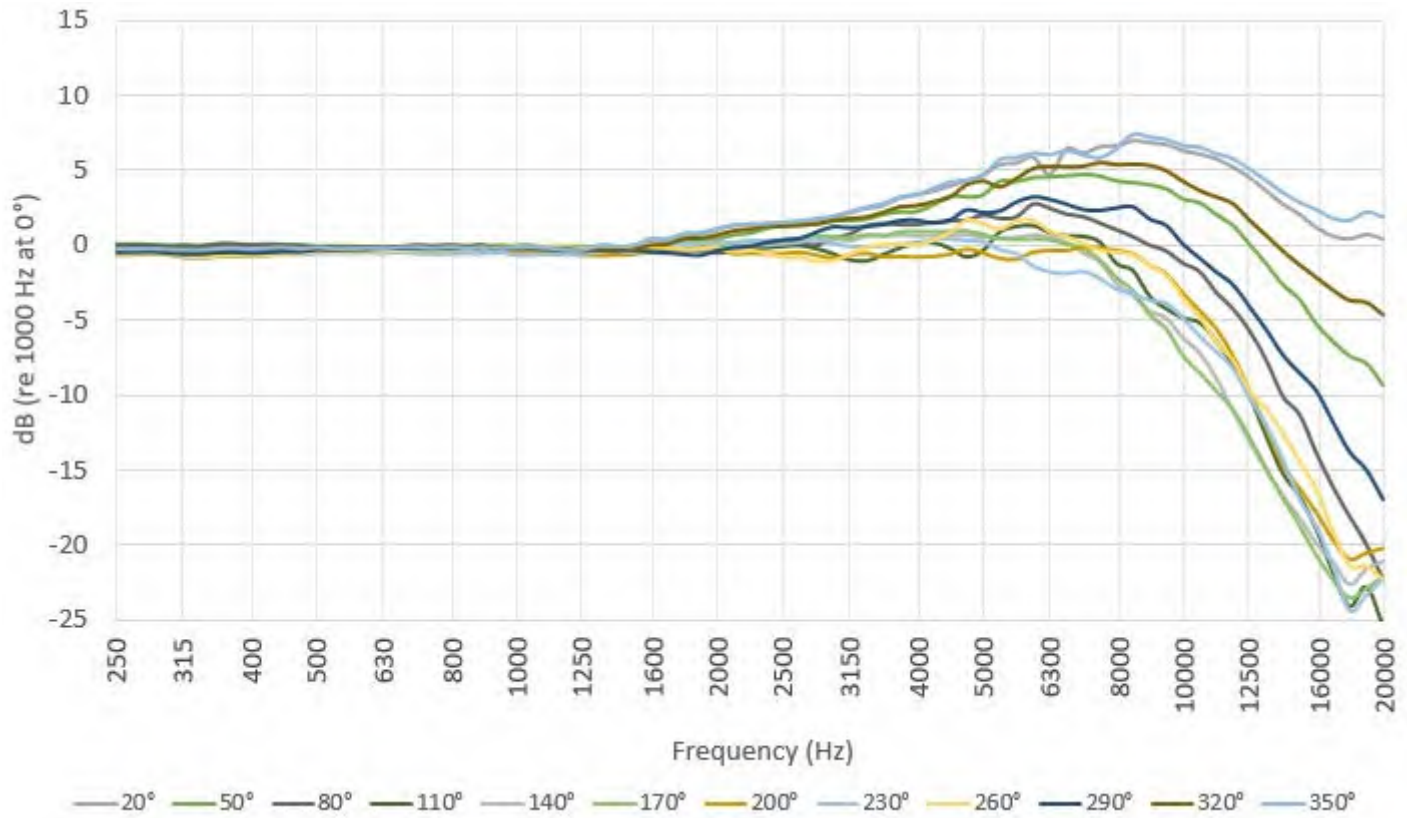
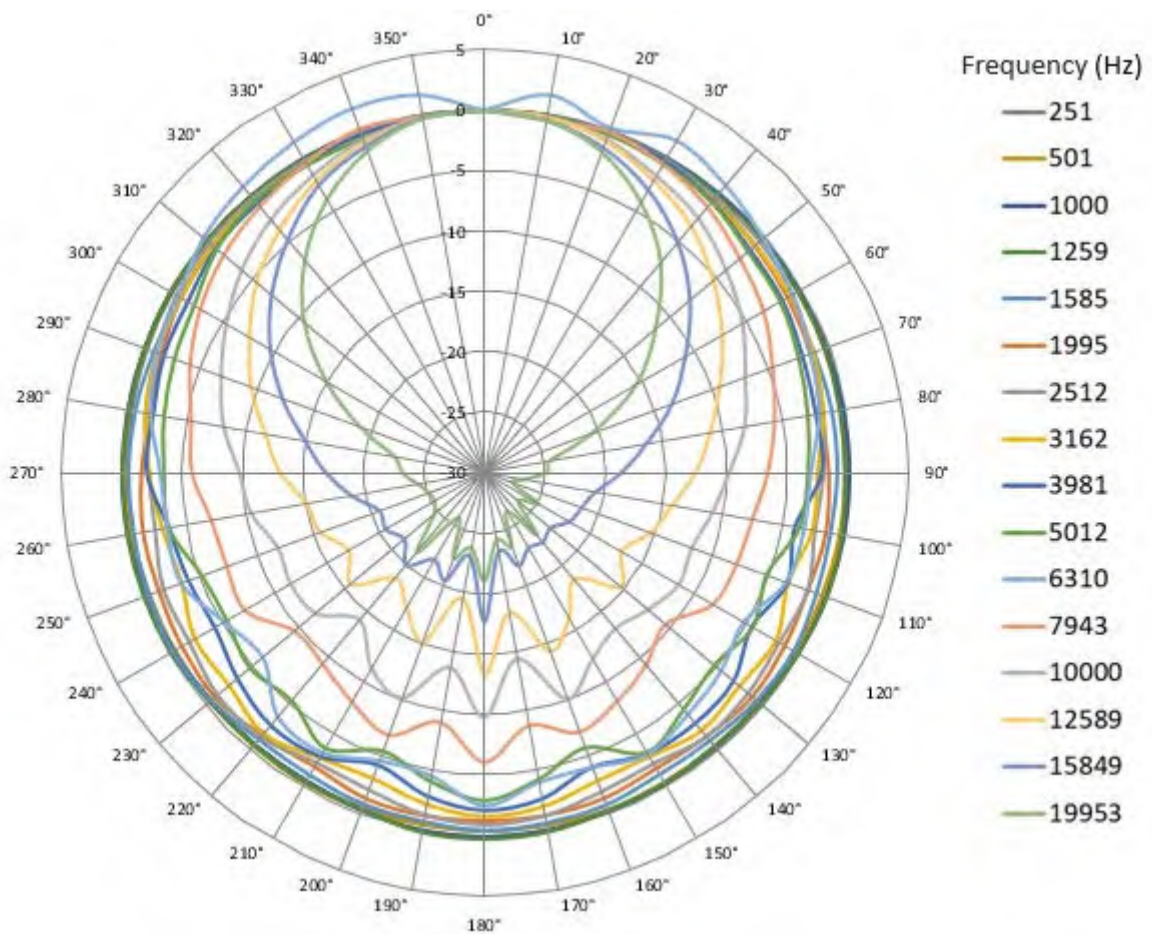
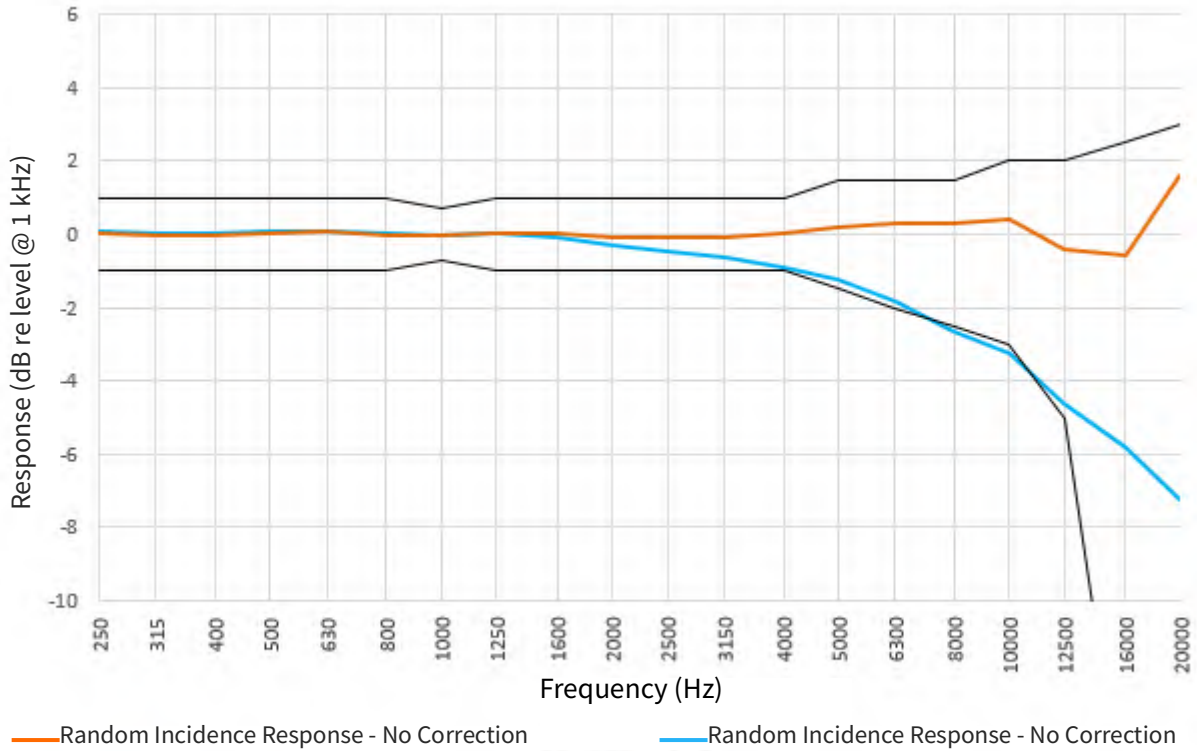


FIGURE A-41 Model 831C with 377A15 Microphone/ XZ Plane, Referenced to Level at 0°



A.9.3 Random Incidence Response

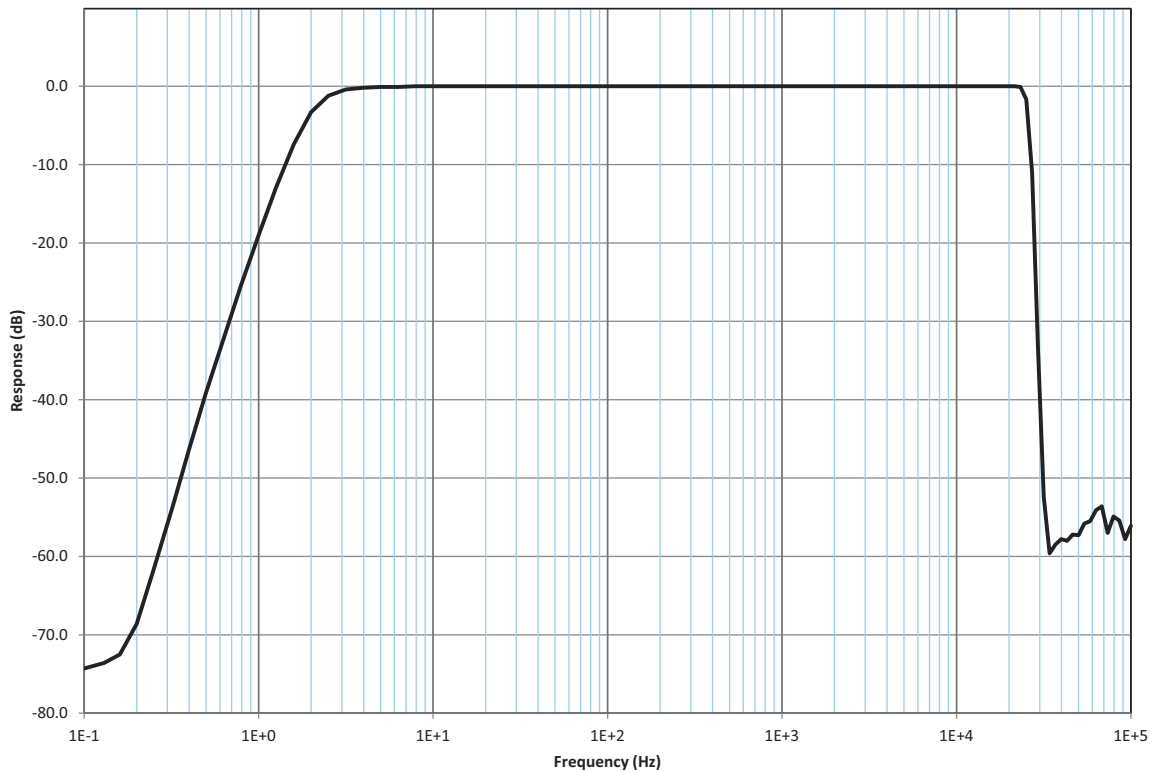
FIGURE A-42 831C With 377B02 Free-Field, Random Incidence Mic/ Normalized to 1 kHz at 0°



A.9.4 Typical Z-Weight Frequency Response

For frequency responses of the Model 831C with the PRM2103 preamplifier, see the Larson Davis PRM2103 *Outdoor Microphone Preamplifier Manual*. This Z-weighted frequency filter is inactive when the 831C is in FFT Mode.

FIGURE A-43 Frequency Weighting Z, Direct Input



A.9.5 831C Low Noise Microphone Set (831C-LOWN) Frequency Response

The 831C-LOWN microphone set uses an extension cable to connect to the 378A04 Low Noise Microphone and Preamplifier combination. Because of this, the directional response characteristics don't include the case reflections often shown with other microphone setups.

FIGURE A-44 831C With LOWN Mic Set Directional Response, Referenced to Free-Field Response

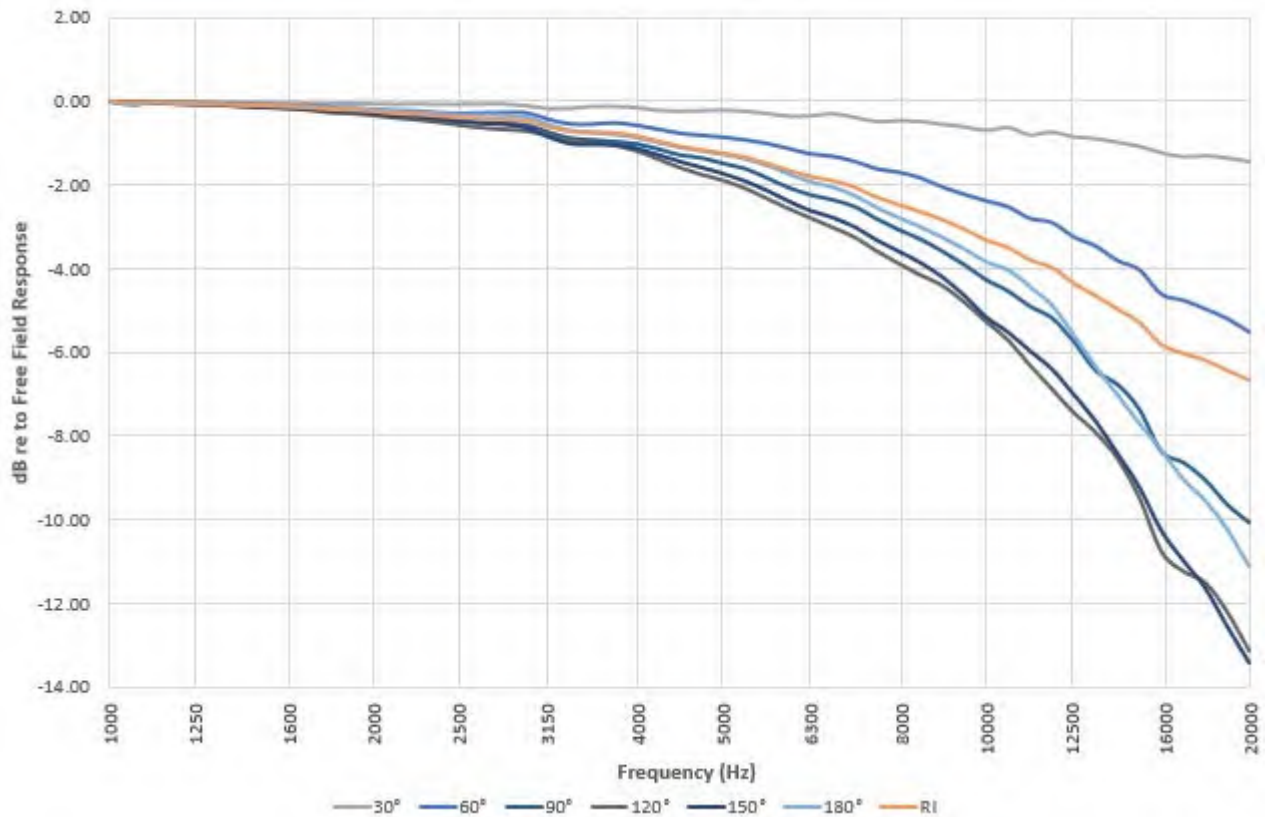


FIGURE A-45 831C With LOWN Mic Set/ Directional Response, Referenced to Free-Field Response

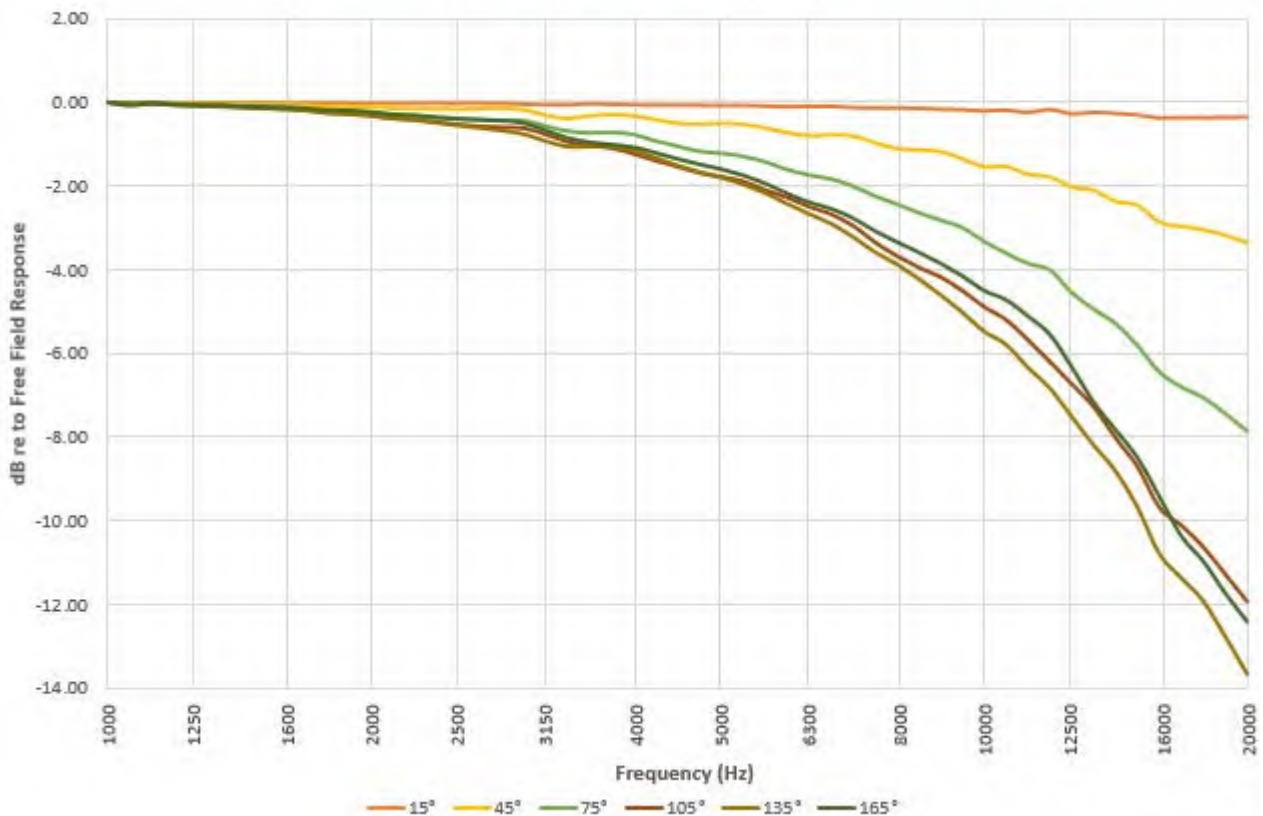
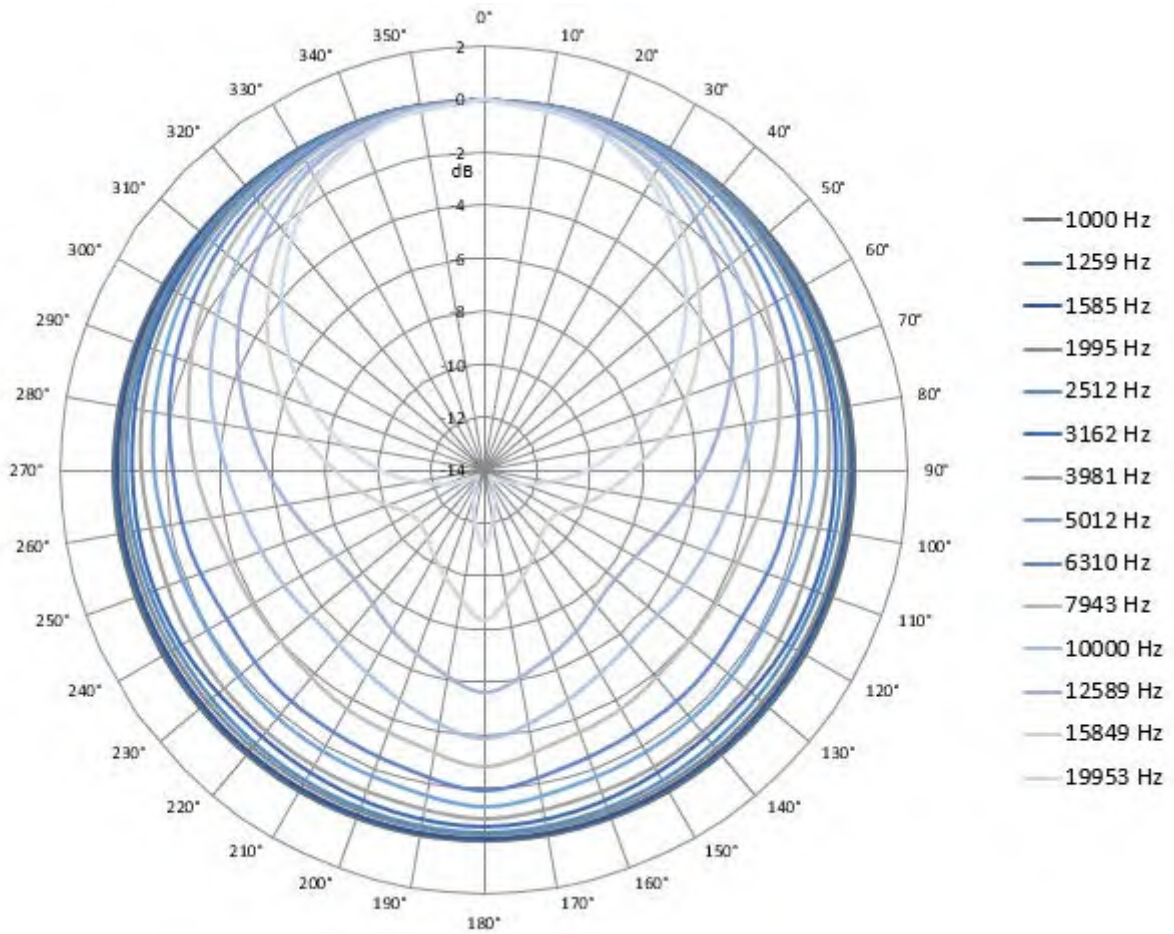


FIGURE A-46 831C with LOWN Mic Set/ Directional Response, Referenced to Level at 0°



End of Appendix A Technical Specifications

Appendix **B** Measuring Sound Using IEC 61672-1

B.1 Overview

This appendix presents information for assessing the sound level meter functionality of the Larson Davis SoundAdvisor Model 831C according to IEC 61672-1 Edition 2.0 2013-09.

Microphone correction filters should be set to “Off” except when testing to IEC 61672-2 Section 9.4.2 - Windscreen Corrections. The appropriate corrections and filter selections are described in this appendix within “section e”. For all IEC61672-3 testing, microphone correction filters should be set to “Off”.

B.2 IEC 61672-1 Section 9.3

a) Reference Sound Pressure Level

The reference sound pressure level is 114 dB re 20 μ Pa.

b) Reference Level Range

The reference level range is 0 dB gain (SLM) and High Range (OBA).

c) Microphone Reference Point

The microphone reference point is the center of the diaphragm of the 377B02 microphone.

d) Periodic Testing

Table A-10, “Corrections for SLM with PRM831 and 377B02 Microphone,” on page A-11 lists values of 831C with PRM831 and 377B02 Microphone adjustment data of A-weighted levels used for periodic measurements.

e) Required Frequency Response and Corrections

See *Table B.1 on page B-2*.

Table B.1 831C with PRM831/377B02 Microphone average frequency responses and corrections, required by IEC 61672-1

Exact Frequency	0° Free Field Response	0° Free Field Corrections¹	Effect of Wind Screen	0° Free Field, 831C with Wind Screen	0° Free Field Corrections, 831C with Wind Screen¹	Expanded uncertainty of Corrections @ 95%
Hz	dB	dB	dB	dB	dB	dB
251.19	-0.03	0.03	0.03	0.00	0.00	0.25
316.23	-0.11	0.11	0.15	0.04	-0.04	0.25
398.11	0.12	-0.12	-0.03	0.09	-0.09	0.25
501.19	0.14	-0.14	0.00	0.14	-0.14	0.25
630.96	0.18	-0.18	-0.09	0.09	-0.09	0.25
794.33	0.15	-0.15	-0.07	0.08	-0.08	0.25
1000.00	0.00	0.00	0.00	0.00	0.00	0.25
1059.25	0.00	-0.00	0.11	0.11	-0.11	0.25
1122.02	-0.12	0.12	0.03	-0.09	0.09	0.25
1188.50	-0.21	0.21	0.13	-0.08	0.08	0.25
1258.93	-0.39	0.39	0.31	-0.08	0.08	0.25
1333.52	-0.29	0.29	0.21	-0.08	0.08	0.25
1412.54	-0.27	0.27	0.20	-0.07	0.07	0.25
1496.24	-0.13	0.13	0.07	-0.06	0.06	0.25
1584.89	-0.02	0.02	0.23	0.21	-0.21	0.25
1678.80	0.01	-0.01	0.24	0.25	-0.25	0.25
1778.28	-0.01	0.01	0.26	0.25	-0.25	0.25
1883.65	-0.08	0.08	0.40	0.32	-0.32	0.25
1995.26	0.20	-0.20	0.43	0.63	-0.63	0.25
2113.49	0.36	-0.36	0.40	0.76	-0.76	0.35
2238.72	0.24	-0.24	0.53	0.77	-0.77	0.35
2371.37	0.01	-0.01	0.59	0.60	-0.60	0.35
2511.89	-0.03	0.03	0.60	0.57	-0.57	0.35
2660.73	0.19	-0.19	0.42	0.61	-0.61	0.35
2818.38	0.00	-0.00	0.55	0.55	-0.55	0.35
2985.38	-0.27	0.27	0.35	0.08	-0.08	0.35
3162.28	-0.04	0.04	0.30	0.26	-0.26	0.35
3349.65	0.01	-0.01	0.11	0.12	-0.12	0.35

Table B.1 831C with PRM831/377B02 Microphone average frequency responses and corrections, required by IEC 61672-1 (Continued)

3548.13	-0.13	0.13	-0.01	-0.14	0.14	0.35
3758.37	0.10	-0.10	-0.00	0.10	-0.10	0.35
3981.07	0.10	-0.10	0.00	0.10	-0.10	0.35
4216.97	-0.03	0.03	-0.20	-0.23	0.23	0.45
4466.84	0.35	-0.35	-0.22	0.13	-0.13	0.45
4731.51	0.06	-0.06	-0.39	-0.33	0.33	0.45
5011.87	-0.08	0.08	-0.39	-0.47	0.47	0.45
5308.84	-0.04	0.04	0.04	0.00	0.00	0.45
5623.41	-0.02	0.02	-0.09	-0.11	0.11	0.45
5956.62	0.04	-0.04	-0.16	-0.12	0.12	0.45
6309.57	0.21	-0.21	0.14	0.35	-0.35	0.45
6683.44	0.02	-0.02	0.25	0.27	-0.27	0.45
7079.46	0.04	-0.04	0.12	0.16	-0.16	0.45
7498.94	0.01	-0.01	-0.14	-0.13	0.13	0.45
7943.28	-0.03	0.03	-0.29	-0.32	0.32	0.45
8413.95	0.27	-0.27	-0.39	-0.12	0.12	0.55
8912.51	0.06	-0.06	0.13	0.19	-0.19	0.55
9440.61	0.01	-0.01	-0.03	-0.02	0.02	0.55
10000.00	0.01	-0.01	0.21	0.22	-0.22	0.55
10592.54	0.07	-0.07	0.09	0.16	-0.16	0.55
11220.18	0.05	-0.05	-0.05	0.00	0.00	0.55
11885.02	-0.01	0.01	-0.20	-0.21	0.21	0.55
12589.25	0.23	-0.23	-0.26	-0.03	0.03	0.55
13335.21	0.24	-0.24	-0.26	-0.02	0.02	1.00
14125.38	0.08	-0.08	-0.15	-0.07	0.07	1.00
14962.36	0.05	-0.05	-0.01	0.04	-0.04	1.00
15848.93	-0.23	0.23	0.41	0.18	-0.18	1.00
16788.04	-0.20	0.20	0.14	-0.06	0.06	1.00
17782.79	-0.15	0.15	-0.08	-0.23	0.23	1.00
18836.49	-0.18	0.18	-0.41	-0.59	0.59	1.00
19952.62	-0.13	0.13	-1.33	-1.46	1.46	1.00

1. Add numbers in this column to levels read on the 831C to correct the level at a specific frequency

Table B.2 831C with PRM831/377C20 Microphone average frequency responses and corrections, required by IEC 61672-1

Exact Frequency	Random Incidence Response	Random Incidence Response Corrections	Effect of Windscreen	Windscreen on 831C in RI Field	Random Incidence Corrections on 831C with Windscreen	Expanded Uncertainty of Corrections
Hz	dB	dB	dB	dB	dB	dB
251.19	0.04	-0.04	-0.18	-0.14	0.14	0.25
266.07	0.04	-0.04	-0.18	-0.15	0.15	0.25
281.84	0.05	-0.05	-0.18	-0.14	0.14	0.25
298.54	0.07	-0.07	-0.19	-0.12	0.12	0.25
316.23	-0.06	0.06	-0.14	-0.20	0.20	0.25
334.97	0.00	0.00	-0.14	-0.14	0.14	0.25
354.81	-0.02	0.02	-0.13	-0.15	0.15	0.25
375.84	0.01	-0.01	-0.12	-0.12	0.12	0.25
398.11	-0.05	0.05	-0.13	-0.17	0.17	0.25
421.7	-0.01	0.01	-0.12	-0.13	0.13	0.25
446.68	0.02	-0.02	-0.11	-0.09	0.09	0.25
473.15	-0.06	0.06	-0.10	-0.16	0.16	0.25
501.19	-0.02	0.02	-0.02	-0.05	0.05	0.25
530.88	-0.07	0.07	-0.02	-0.09	0.09	0.25
562.34	-0.10	0.10	-0.03	-0.13	0.13	0.25
595.66	-0.06	0.06	-0.03	-0.09	0.09	0.25
630.96	-0.07	0.07	-0.02	-0.08	0.08	0.25
668.34	-0.08	0.08	-0.02	-0.11	0.11	0.25
707.95	-0.03	0.03	-0.08	-0.11	0.11	0.25
749.89	-0.02	0.02	-0.07	-0.08	0.08	0.25
794.33	0.03	-0.03	-0.06	-0.04	0.04	0.25
841.4	0.00	0.00	-0.06	-0.05	0.05	0.25
891.25	0.00	0.00	-0.06	-0.06	0.06	0.25
944.06	-0.08	0.08	0.04	-0.04	0.04	0.25
1000	0.00	0.00	0.00	0.00	0.00	0.25
1059.25	0.05	-0.05	0.03	0.08	-0.08	0.25
1122.02	-0.04	0.04	0.12	0.08	-0.08	0.25
1188.5	-0.11	0.11	0.15	0.04	-0.04	0.25

Table B.2 831C with PRM831/377C20 Microphone average frequency responses and corrections, required by IEC 61672-1 (Continued)

1258.93	-0.06	0.06	0.13	0.07	-0.07	0.25
1333.52	-0.07	0.07	0.14	0.08	-0.08	0.25
1412.54	-0.07	0.07	0.13	0.06	-0.06	0.25
1496.24	-0.06	0.06	0.13	0.08	-0.08	0.25
1584.89	-0.08	0.08	0.19	0.11	-0.11	0.25
1678.8	-0.08	0.08	0.20	0.12	-0.12	0.25
1778.28	-0.08	0.08	0.25	0.18	-0.18	0.25
1883.65	-0.05	0.05	0.25	0.20	-0.20	0.25
1995.26	-0.07	0.07	0.34	0.27	-0.27	0.25
2113.49	-0.02	0.02	0.41	0.39	-0.39	0.35
2238.72	-0.05	0.05	0.41	0.36	-0.36	0.35
2371.37	-0.01	0.01	0.49	0.48	-0.48	0.35
2511.89	0.02	-0.02	0.52	0.54	-0.54	0.35
2660.73	0.00	0.00	0.52	0.52	-0.52	0.35
2818.38	0.05	-0.05	0.55	0.60	-0.60	0.35
2985.38	0.05	-0.05	0.51	0.56	-0.56	0.35
3162.28	0.03	-0.03	0.42	0.46	-0.46	0.35
3349.65	0.11	-0.11	0.31	0.42	-0.42	0.35
3548.13	0.10	-0.10	0.19	0.29	-0.29	0.35
3758.37	0.13	-0.13	0.07	0.20	-0.20	0.35
3981.07	0.13	-0.13	-0.03	0.09	-0.09	0.35
4216.97	0.18	-0.18	-0.19	-0.01	0.01	0.45
4466.84	0.24	-0.24	-0.35	-0.11	0.11	0.45
4731.51	0.30	-0.30	-0.55	-0.24	0.24	0.45
5011.87	0.34	-0.34	-0.64	-0.30	0.30	0.45
5308.84	0.42	-0.42	-0.85	-0.43	0.43	0.45
5623.41	0.46	-0.46	-0.83	-0.37	0.37	0.45
5956.62	0.49	-0.49	-0.44	0.05	-0.05	0.45
6309.57	0.50	-0.50	-0.19	0.31	-0.31	0.45
6683.44	0.44	-0.44	-0.16	0.28	-0.28	0.45
7079.46	0.53	-0.53	-0.21	0.32	-0.32	0.45
7498.94	0.56	-0.56	-0.21	0.35	-0.35	0.45

Table B.2 831C with PRM831/377C20 Microphone average frequency responses and corrections, required by IEC 61672-1 (Continued)

7943.28	0.61	-0.61	-0.35	0.25	-0.25	0.45
8413.95	0.74	-0.74	-0.73	0.01	-0.01	0.55
8912.51	0.77	-0.77	-1.22	-0.45	0.45	0.55
9440.61	0.73	-0.73	-1.29	-0.56	0.56	0.55
10000	0.44	-0.44	-0.85	-0.42	0.42	0.55
10592.54	0.43	-0.43	-0.60	-0.16	0.16	0.55
11220.18	0.40	-0.40	-0.56	-0.16	0.16	0.55
11885.02	0.42	-0.42	-0.78	-0.36	0.36	0.55
12589.25	0.29	-0.29	-0.95	-0.66	0.66	0.55
13335.21	0.16	-0.16	-1.00	-0.83	0.83	1
14125.38	0.07	-0.07	-0.85	-0.78	0.78	1
14962.36	-0.16	0.16	-1.22	-1.38	1.38	1
15848.93	-0.15	0.15	-1.55	-1.69	1.69	1
16788.04	-0.61	0.61	-1.65	-2.26	2.26	1
17782.79	-1.10	1.10	-1.52	-2.62	2.62	1
18836.49	-1.45	1.45	-1.88	-3.33	3.33	1
19952.62	-2.26	2.26	-1.89	-4.15	4.15	1

Table B.3 Directional Response of 3 ½-inch Windscreen

Frequency (Hz)	Angle from Reference Direction (Degrees) ¹												
	0	15	30	45	60	75	90	105	120	135	150	165	180
251.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
266.07	0.00	0.00	0.03	-0.03	0.00	0.00	0.00	-0.03	0.03	0.00	-0.03	-0.03	0.00
281.84	0.00	0.10	0.07	-0.03	-0.07	0.00	0.03	0.00	0.07	0.00	-0.03	0.03	0.00
298.54	0.07	0.07	0.00	0.00	-0.03	0.00	0.03	-0.03	-0.03	0.03	-0.10	0.03	0.00
316.23	0.00	0.03	0.07	0.00	-0.07	-0.03	0.00	-0.03	0.03	-0.03	-0.10	0.07	0.00
334.97	0.00	0.00	0.03	0.00	-0.07	-0.03	0.07	-0.13	0.00	0.00	-0.07	0.07	0.00
354.81	0.03	0.07	0.10	-0.03	-0.07	0.00	0.00	-0.03	0.03	0.03	-0.03	0.03	0.00
375.84	0.03	0.07	0.03	0.00	-0.03	-0.03	0.00	-0.03	0.03	0.00	-0.10	0.00	0.00
398.11	0.00	0.00	0.10	-0.03	-0.03	0.00	0.00	-0.03	0.07	-0.03	-0.07	0.07	0.07
421.70	0.00	0.00	0.07	0.03	-0.07	-0.03	0.00	-0.03	0.03	0.00	-0.07	0.00	0.00
446.68	0.00	0.03	0.03	-0.03	0.00	-0.03	0.10	0.03	0.03	0.00	0.00	0.00	0.00
473.15	0.03	0.03	0.03	0.00	0.03	-0.03	0.07	0.00	0.03	0.00	-0.07	0.03	0.00
501.19	0.10	0.10	0.13	0.07	-0.03	0.07	0.00	0.00	0.13	0.10	-0.07	0.03	0.00
530.88	0.03	0.10	0.13	0.07	-0.07	0.07	0.03	0.03	0.07	0.00	-0.03	0.03	0.00
562.34	0.10	0.10	0.13	0.07	0.03	0.07	0.00	-0.03	0.13	0.10	-0.03	0.00	0.07

Table B.3 Directional Response of 3 ½-inch Windscreen (Continued)

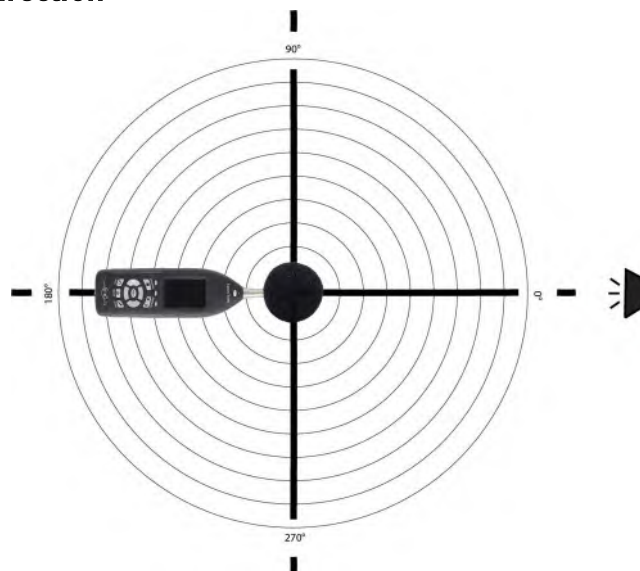
595.66	0.07	0.10	0.13	0.07	-0.03	0.03	0.00	0.00	0.10	0.07	-0.03	0.07	0.00
630.96	0.03	0.00	0.07	-0.03	0.00	0.07	0.10	0.07	0.13	0.10	0.03	0.10	0.10
668.34	0.10	0.10	0.13	0.07	0.03	0.00	0.03	0.03	0.07	0.00	0.03	0.10	0.00
707.95	0.10	0.10	0.13	0.07	0.03	0.07	0.10	0.07	0.03	0.10	0.03	0.10	0.00
749.89	0.10	0.10	0.13	0.07	0.00	-0.03	0.10	0.07	0.13	0.10	0.03	0.10	0.10
794.33	0.10	0.10	0.13	0.07	0.03	0.13	0.10	0.07	0.13	0.10	0.03	0.10	0.10
841.40	0.03	0.07	0.10	0.07	0.03	0.07	0.10	0.10	0.03	0.10	0.03	0.10	0.10
891.25	0.10	0.07	0.10	0.00	0.03	0.07	0.03	0.07	0.13	0.07	0.03	0.10	0.10
944.06	0.13	0.17	0.20	0.07	0.07	0.07	0.13	0.17	0.20	0.17	0.03	0.17	0.13
1000.00	0.20	0.10	0.13	0.07	0.03	0.17	0.10	0.17	0.23	0.10	0.03	0.10	0.10
1059.25	0.10	0.10	0.23	0.17	0.13	0.07	0.10	0.07	0.13	0.10	0.03	0.10	0.10
1122.02	0.20	0.23	0.23	0.13	0.13	0.17	0.10	0.17	0.23	0.20	0.13	0.13	0.10
1188.50	0.20	0.10	0.23	0.07	0.13	0.17	0.10	0.17	0.13	0.20	0.13	0.17	0.10
1258.93	0.13	0.17	0.23	0.17	0.13	0.17	0.23	0.13	0.23	0.17	0.13	0.10	0.20
1333.52	0.20	0.20	0.33	0.27	0.13	0.17	0.20	0.23	0.23	0.20	0.13	0.20	0.10
1412.54	0.20	0.20	0.23	0.17	0.23	0.17	0.20	0.27	0.23	0.20	0.13	0.17	0.20
1496.24	0.23	0.20	0.23	0.17	0.23	0.17	0.20	0.27	0.23	0.27	0.13	0.10	0.20
1584.89	0.33	0.30	0.37	0.30	0.27	0.27	0.33	0.27	0.30	0.27	0.20	0.27	0.30
1678.80	0.30	0.30	0.40	0.37	0.33	0.27	0.30	0.27	0.33	0.20	0.17	0.20	0.27
1778.28	0.40	0.40	0.43	0.37	0.33	0.33	0.40	0.37	0.33	0.40	0.13	0.30	0.30
1883.65	0.40	0.40	0.43	0.37	0.33	0.37	0.40	0.37	0.33	0.30	0.23	0.30	0.30
1995.26	0.40	0.50	0.43	0.47	0.43	0.47	0.40	0.37	0.37	0.40	0.23	0.33	0.30
2113.49	0.50	0.50	0.53	0.47	0.43	0.47	0.40	0.47	0.43	0.37	0.33	0.33	0.40
2238.72	0.50	0.50	0.53	0.47	0.43	0.47	0.50	0.47	0.47	0.40	0.30	0.40	0.40
2371.37	0.50	0.50	0.53	0.47	0.43	0.47	0.50	0.47	0.53	0.50	0.33	0.50	0.40
2511.89	0.50	0.57	0.53	0.57	0.50	0.57	0.53	0.53	0.53	0.50	0.37	0.47	0.47
2660.73	0.53	0.53	0.57	0.57	0.50	0.50	0.60	0.50	0.53	0.50	0.43	0.50	0.43
2818.38	0.57	0.53	0.57	0.60	0.50	0.50	0.53	0.53	0.57	0.57	0.43	0.57	0.50
2985.38	0.40	0.50	0.43	0.57	0.43	0.50	0.57	0.53	0.57	0.57	0.37	0.50	0.50
3162.28	0.40	0.40	0.53	0.50	0.33	0.57	0.50	0.47	0.53	0.50	0.43	0.50	0.50
3349.65	0.30	0.40	0.37	0.37	0.37	0.43	0.40	0.40	0.43	0.43	0.40	0.50	0.50
3548.13	0.23	0.27	0.33	0.30	0.23	0.37	0.33	0.33	0.37	0.40	0.33	0.40	0.40
3758.37	0.20	0.23	0.13	0.17	0.23	0.27	0.20	0.23	0.33	0.37	0.27	0.40	0.30
3981.07	0.10	0.10	0.13	0.13	0.00	0.13	0.10	0.10	0.23	0.20	0.13	0.27	0.23
4216.97	0.03	0.00	0.10	0.03	-0.10	0.07	0.00	-0.03	0.07	0.03	0.03	0.10	0.13
4466.84	0.00	-0.07	-0.07	-0.07	-0.17	-0.07	-0.10	-0.10	-0.07	0.00	-0.07	0.00	0.00
4731.51	-0.30	-0.20	-0.17	-0.23	-0.27	-0.30	-0.30	-0.43	-0.27	-0.20	-0.37	-0.20	-0.20
5011.87	-0.17	-0.20	-0.17	-0.30	-0.27	-0.23	-0.40	-0.33	-0.37	-0.40	-0.37	-0.30	-0.30
5308.84	0.00	-0.10	-0.07	-0.23	-0.30	-0.33	-0.40	-0.43	-0.47	-0.50	-0.60	-0.43	-0.43

Table B.3 Directional Response of 3 1/2-inch Windscreen (Continued)

5623.41	0.00	-0.07	-0.03	-0.17	-0.20	-0.33	-0.37	-0.43	-0.47	-0.50	-0.53	-0.43	-0.43
5956.62	0.17	0.07	0.10	-0.13	-0.17	-0.23	-0.33	-0.37	-0.43	-0.50	-0.57	-0.50	-0.40
6309.57	0.10	0.20	0.23	-0.03	-0.07	-0.03	-0.10	-0.33	-0.37	-0.40	-0.47	-0.40	-0.30
6683.44	0.13	0.10	0.20	0.07	-0.03	-0.03	-0.13	-0.17	-0.27	-0.33	-0.40	-0.40	-0.20
7079.46	0.03	0.07	0.07	0.07	0.03	0.00	-0.10	-0.13	-0.17	-0.27	-0.27	-0.23	-0.13
7498.94	-0.10	-0.10	-0.07	-0.03	-0.07	-0.03	-0.20	-0.23	-0.27	-0.20	-0.27	-0.10	-0.10
7943.28	-0.30	-0.37	-0.30	-0.23	-0.33	-0.23	-0.33	-0.40	-0.37	-0.33	-0.33	-0.20	-0.17
8413.95	-0.40	-0.37	-0.37	-0.43	-0.53	-0.43	-0.57	-0.57	-0.57	-0.50	-0.43	-0.23	-0.37
8912.51	-0.40	-0.50	-0.37	-0.53	-0.67	-0.63	-0.70	-0.73	-0.73	-0.80	-0.73	-0.50	-0.50
9440.61	-0.37	-0.40	-0.37	-0.50	-0.67	-0.70	-0.70	-0.83	-0.77	-0.90	-0.93	-0.77	-0.60
10000.00	-0.13	-0.20	-0.27	-0.43	-0.57	-0.57	-0.77	-0.83	-0.77	-0.90	-0.97	-0.90	-0.70
10592.54	-0.20	-0.20	-0.17	-0.40	-0.47	-0.47	-0.70	-0.83	-0.83	-0.83	-0.97	-0.87	-0.70
11220.18	-0.47	-0.43	-0.37	-0.43	-0.53	-0.47	-0.70	-0.90	-0.77	-0.80	-0.77	-0.90	-0.67
11885.02	-0.67	-0.73	-0.63	-0.60	-0.73	-0.57	-0.83	-0.90	-0.83	-0.87	-0.73	-0.70	-0.70
12589.25	-0.57	-0.73	-0.83	-0.87	-0.97	-0.97	-1.00	-1.00	-1.00	-1.17	-1.07	-0.90	-0.90
13335.21	-0.70	-0.67	-0.63	-0.83	-1.00	-1.17	-1.10	-1.07	-1.07	-1.37	-1.53	-1.20	-1.13
14125.38	-0.40	-0.50	-0.57	-0.60	-0.90	-1.00	-1.00	-1.20	-1.17	-1.37	-1.63	-1.47	-1.20
14962.36	-0.70	-0.73	-0.53	-0.73	-0.97	-0.90	-1.10	-1.33	-1.23	-1.50	-1.53	-1.43	-1.13
15848.93	-0.90	-0.90	-0.97	-1.03	-1.27	-1.13	-1.30	-1.60	-1.37	-1.57	-1.37	-1.40	-1.17
16788.04	-0.90	-1.07	-1.00	-1.30	-1.33	-1.47	-1.50	-1.53	-1.40	-1.70	-1.77	-1.43	-1.43
17782.79	-0.87	-0.93	-0.93	-1.10	-1.33	-1.53	-1.70	-1.57	-1.67	-1.73	-2.30	-2.00	-1.70
18836.49	-0.90	-1.10	-0.90	-1.10	-1.43	-1.43	-1.70	-1.83	-1.80	-1.83	-2.13	-2.27	-1.77
19952.62	-1.27	-1.30	-1.13	-1.47	-1.73	-1.67	-2.07	-2.30	-1.97	-2.23	-2.13	-1.97	-1.67

1. The corrections which should be subtracted from the measured data when using the Larson-Davis Model WS001 3 1/2-inch diameter windscreen with a 1/2-inch Larson-Davis microphone are as indicated in the following table

FIGURE B-1 Windscreen Direction



WS001 3 1/2" Windscreen Corrections

The following table and graph display correction factors for effects of the WS001 on the response of the sound level meter. These corrections are intended for laboratory use when testing to IEC 61672-2 Section 9.4.2 to account for effects of the WS001 windscreen. The WS001 filter selection in the 831C is appropriate when using the WS001 with a 377B02 microphone for free-field applications or in a diffuse field application when using a 377C20 microphone.

FIGURE B-2

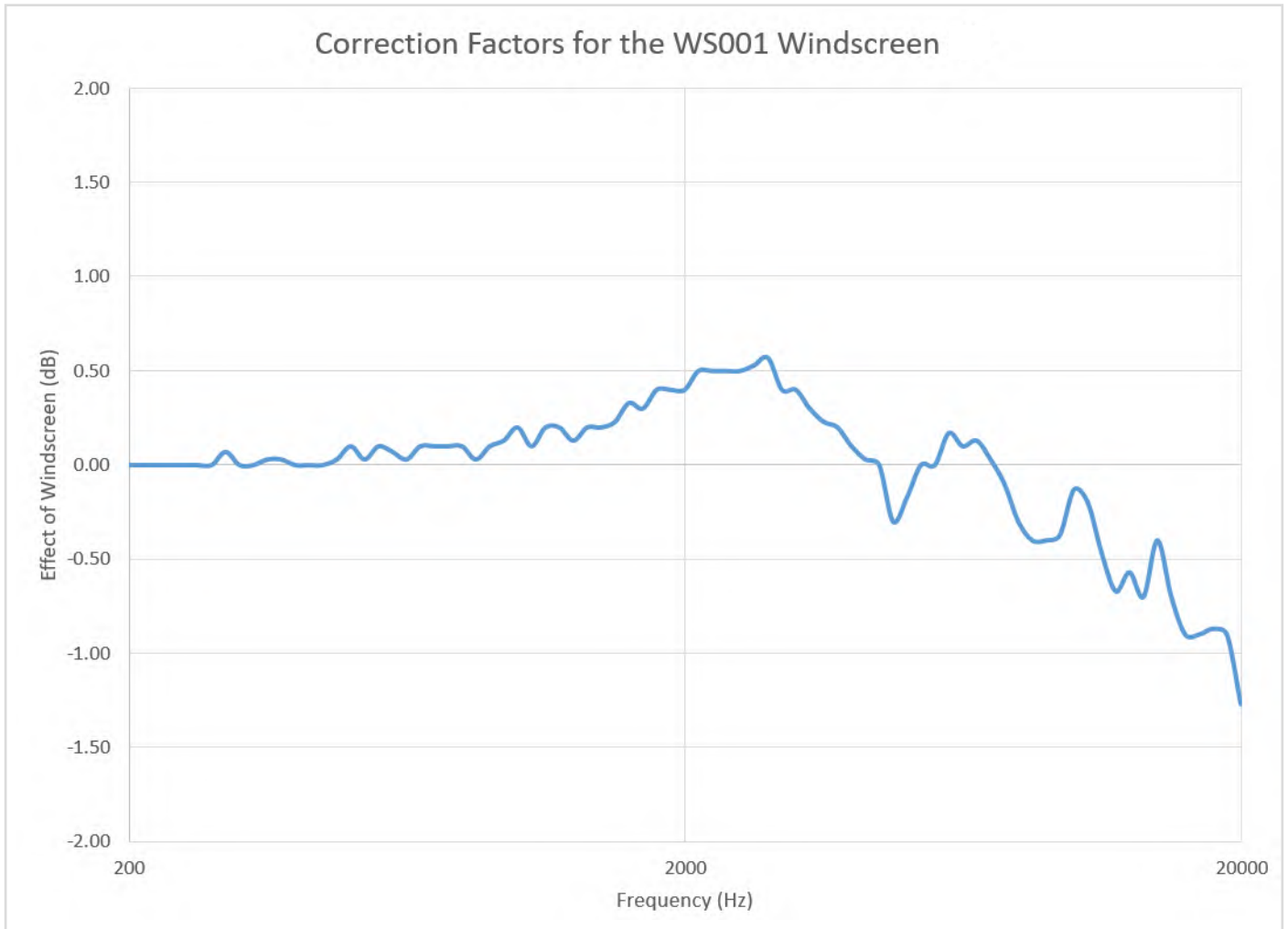


Table B.4 Correction Factors for WS001

Frequency	WS001 Windscreen Correction Factor	Expanded Uncertainty of Corrections @ 95%
Hz	dB	dB
63.10	0.00	0.20
79.43	0.00	0.20
100.00	0.00	0.20
125.89	0.00	0.20
158.49	0.00	0.20
199.53	0.00	0.20
251.19	0.00	0.20
266.07	0.00	0.20
281.84	0.00	0.20
298.54	0.07	0.20
316.23	0.00	0.20
334.97	0.00	0.20
354.81	0.03	0.20
375.84	0.03	0.20
398.11	0.00	0.20
421.70	0.00	0.20
446.68	0.00	0.20
473.15	0.03	0.20
501.19	0.10	0.20
530.88	0.03	0.20
562.34	0.10	0.20
595.66	0.07	0.20
630.96	0.03	0.20
668.34	0.10	0.20
707.95	0.10	0.20
749.89	0.10	0.20
794.33	0.10	0.20
841.40	0.03	0.20

891.25	0.10	0.20
944.06	0.13	0.20
1000.00	0.20	0.20
1059.25	0.10	0.20
1122.02	0.20	0.20
1188.50	0.20	0.20
1258.93	0.13	0.20
1333.52	0.20	0.20
1412.54	0.20	0.20
1496.24	0.23	0.20
1584.89	0.33	0.20
1678.80	0.30	0.20
1778.28	0.40	0.20
1883.65	0.40	0.20
1995.26	0.40	0.20
2113.49	0.50	0.20
2238.72	0.50	0.20
2371.37	0.50	0.20
2511.89	0.50	0.20
2660.73	0.53	0.20
2818.38	0.57	0.20
2985.38	0.40	0.20
3162.28	0.40	0.20
3349.65	0.30	0.20
3548.13	0.23	0.20
3758.37	0.20	0.20
3981.07	0.10	0.20
4216.97	0.03	0.30
4466.84	0.00	0.30
4731.51	-0.30	0.30
5011.87	-0.17	0.30
5308.84	0.00	0.30

5623.41	0.00	0.30
5956.62	0.17	0.30
6309.57	0.10	0.30
6683.44	0.13	0.30
7079.46	0.03	0.30
7498.94	-0.10	0.30
7943.28	-0.30	0.30
8413.95	-0.40	0.30
8912.51	-0.40	0.30
9440.61	-0.37	0.30
10000.00	-0.13	0.30
10592.54	-0.20	0.30
11220.18	-0.47	0.30
11885.02	-0.67	0.30
12589.25	-0.57	0.30
13335.21	-0.70	0.30
14125.38	-0.40	0.30
14962.36	-0.70	0.30
15848.93	-0.90	0.30
16788.04	-0.90	0.30
17782.79	-0.87	0.30
18836.49	-0.90	0.30
19952.62	-1.27	0.30

EPS2116 Corrections

The following table and graph display correction factors for effects of the EPS2116 on the response of the sound level meter with either the PRM831 or PRM2103 preamplifier and the 377B02 microphone. These corrections are intended for laboratory use when testing to IEC 61672-2 to account for effects of the EPS2116. The corrections are added to the electrical signals to replicate the acoustical response when the EPS2116 windscreen is in place. See Table B.5 for the appropriate filter selection in the sound level meter for a given test as well as the associated correction factor to be applied. Note that the correction factors are tabulated in Table B.7.

Table B.5 Test, Filter, and Correction Description

Table B.6

Test	Sound Level Meter Filter	EPS 2116 Correction (See Table A.2)
Free Field Response	FF:FF 2116	Free Field to Free Field EPS2116 Correction Factor
90 Degree Response	FF:90 2116	Free Field to 90 Degree EPS2116 Correction Factor
Random Incidence Response	FF:RI 2116	Free Field to Random Incidence EPS 2116

FIGURE B-3 Effect of EPS2116 Environmental Shroud

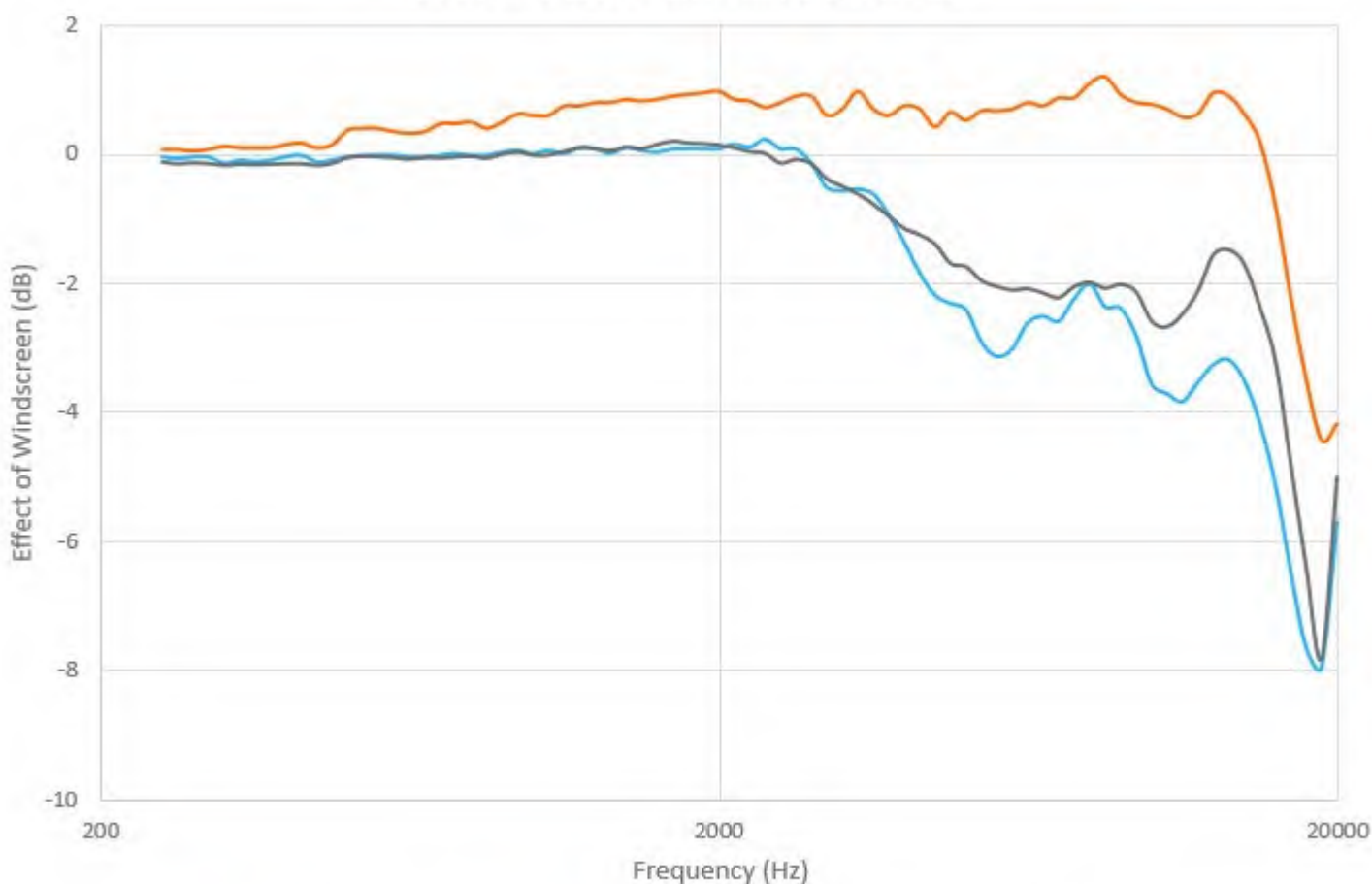


Table B.7 Effects of EPS2116 Environmental Shroud by Frequency

Frequency (Hz)	EPS2116 at 0 Degrees (dB)	EPS2116 at 90 Degrees (dB)	EPS2116 at Random Incidence (dB)	Expanded Uncertainty (dB)
63	0.05	-0.03	-0.10	0.20
79	0.05	-0.03	-0.10	0.20
100	0.05	-0.03	-0.10	0.20
126	0.06	-0.03	-0.10	0.20
158	0.06	-0.03	-0.10	0.20
200	0.07	-0.03	-0.10	0.20
251	0.85	0.05	0.12	0.20
316	0.13	-0.13	-0.16	0.20
398	0.15	-0.02	-0.13	0.20
501	0.37	-0.03	-0.03	0.20
631	0.32	-0.02	-0.06	0.20
794	0.50	0.00	-0.01	0.20
1000	0.60	0.03	0.00	0.20
1059	0.60	0.08	0.00	0.20
1122	0.75	0.12	0.11	0.20
1189	0.75	0.12	0.11	0.20
1259	0.80	0.10	0.11	0.20
1334	0.80	0.03	0.07	0.20
1413	0.85	0.12	0.13	0.20
1496	0.82	0.08	0.10	0.20
1585	0.85	0.05	0.17	0.20
1679	0.90	0.10	0.22	0.20
1778	0.93	0.10	0.19	0.20
1884	0.95	0.10	0.18	0.20
1995	0.98	0.10	0.16	0.20
2113	0.85	0.17	0.12	0.20
2239	0.82	0.12	0.06	0.20
2371	0.73	0.25	0.03	0.20
2512	0.80	0.10	-0.12	0.20
2661	0.90	0.10	-0.06	0.20
2818	0.90	-0.13	-0.13	0.20

2985	0.60	-0.50	-0.37	0.20
3162	0.70	-0.55	-0.48	0.20
3350	0.97	-0.53	-0.60	0.20
3548	0.70	-0.60	-0.76	0.20
3758	0.60	-0.92	-0.94	0.20
3981	0.75	-1.35	-1.13	0.20
4217	0.70	-1.82	-1.23	0.30
4467	0.43	-2.17	-1.38	0.30
4732	0.65	-2.30	-1.68	0.30
5012	0.53	-2.40	-1.73	0.30
5309	0.67	-2.90	-1.94	0.30
5623	0.67	-3.13	-2.04	0.30
5957	0.70	-3.00	-2.09	0.30
6310	0.80	-2.60	-2.07	0.30
6683	0.75	-2.50	-2.14	0.30
7079	0.88	-2.57	-2.21	0.30
7499	0.88	-2.22	-2.04	0.30
7943	1.10	-2.00	-1.97	0.30
8414	1.20	-2.35	-2.06	0.30
8913	0.93	-2.37	-2.00	0.30
9441	0.80	-2.80	-2.12	0.30
10000	0.77	-3.55	-2.57	0.30
10593	0.70	-3.70	-2.66	0.30
11220	0.58	-3.82	-2.46	0.30
11885	0.62	-3.52	-2.11	0.30
12589	0.95	-3.25	-1.54	0.30
13335	0.90	-3.17	-1.47	0.30
14125	0.63	-3.50	-1.69	0.30
14962	0.20	-4.15	-2.35	0.30
15849	-0.77	-5.10	-3.17	0.30
16788	-2.20	-6.45	-4.77	0.30
17783	-3.47	-7.65	-6.38	0.30
18836	-4.42	-7.95	-7.80	0.30
19953	-4.17	-5.70	-5.00	0.30

Sections f) through o) are applicable for both the PRM831 and PRM2103 preamplifiers.

f) Linear Operating Range

Table B.8 Linearity Range (Nominal Values)

Weighting	Gain	31.5 Hz		1 kHz		4 kHz		8 kHz		12.5 kHz	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
A	0 dB	24	101	24	140	24	141	26	139	26	136
	20 dB	21	81	20	120	20	121	20	119	20	116
C	0 dB	25	137	25	140	25	139	25	137	25	134
	20 dB	26	118	23	120	23	119	24	117	25	114
Z	0 dB	32	140	32	140	32	140	32	140	32	140
	20 dB	34	120	32	120	34	120	35	120	35	120

g) Linear Measurement Starting Point

Table B.9 Linear Measurement Starting Point

Gain	31.5 Hz	1 kHz	4 kHz	8 kHz	12.5 kHz
0 dB	74.5 dB	114 dB	115 dB	112.9 dB	109.7 dB
20 dB	54.5 dB	94dB	95 dB	92.9 dB	89.7 dB

h) Electrical Insert Signals

The electrical design of the input device to insert electrical signals into the preamplifier is a series 12pF ± 5% capacitor. The Larson Davis ADP090 is used for this purpose. The ADP090 is also use for noise floor measurements by attaching the included BNC short on the front of the ADP090.

i) Self Generating Noise in Low Level Sound Field

Table B.10 SLM Noise Levels

Self Generated Electrical Noise Weighting	0 dB Gain		20 dB Gain		Notes
	Typical (dB)	Max (dB)	Typical (dB)	Max (dB)	
A	10	12	6	9	Electronic noise of the instrument with an ADP090 (12 pF) in place of the microphone highest anticipated self-generated noise.
C	13	16	12	15	
Z	22	25	22	25	
A	16	19	16	17	Combination of the electronic noise and the thermal noise of the 377B02 microphone at 68 °F (20 °C) measured in a sealed and vibration isolated cavity with an averaging time of 60 seconds.
C	17	20	16	19	
Z	23	26	23	26	

j) Highest Sound Pressure Level

The highest sound pressure level the Larson Davis 831C is designed to accommodate at the level of overload is 140 dB. The maximum peak-to-peak voltage is 28 Vpp input through the ADP090.

k) Battery Power Voltage Range

The battery power supply voltage range for which the 831C conforms to this standard: 16.8 Volts maximum. The 831C shuts down if the battery is below 4.0 Volts when used with alkaline batteries. Therefore, from 4.0 to 16.8 Volts is the usable range of battery voltage. The instrument will shut off to ensure that no data is taken that would not meet the requirements of IEC 61672.

l) Typical Stabilization Time

The typical time interval needed to stabilize after changes in environmental conditions:

- For a temperature change of 5 °C, then 30 minutes are required.
- For a static pressure change of 5 kPa, then 15 seconds are required.
- For a humidity change of 25% (non-condensing), then 30 minutes are required.

m) Field Strength > 10 V/m

The 831C was not measured for field strengths greater than 10 V/m.

n) Radio Frequency Emission

The mode of operation of the 831C that produces the greatest radio frequency emission levels is with the 831C set to run with the LCD backlight on, an external charger (PSAA20R-120 charger), Ethernet dongle, and USB cable attached and with an EXC020 (20' microphone extension cable) between the PRM831 and meter.

o) AC Power and Radio Frequency Susceptibility

The mode of operation of the 831C that produced the least immunity to the effects of exposure to AC power-frequency and radio frequency field is with the 831C set to run with the LCD backlight on, an external charger (PSAA20R-120 charger), Ethernet dongle, and USB cable attached and with an EXC020 (20' microphone extension cable) between the PRM831 and meter.

FIGURE B-4 EM Field Orientation

1. EM Field Principal Direction



This appendix contains technical definitions of key acoustical and vibration terms commonly used with Larson Davis instruments. The reader is referred to American National Standards Institute document S1.1-1994 (R2004) for additional definitions. Specific use of the terms defined are in the main body of this manual.

Allowed Exposure Time (T_i)

The allowed time of exposure to sound that a constant A-weighted sound level in a chosen Criterion Level, Criterion Duration, and Exchange Rate.

The equation for T_i is

$$T_i = \frac{T_c}{2^{(L_{avg} - L_c)/Q}} = \frac{T_c}{10^{(L_{avg} - L_c)/q}}$$

where L_c is the Criterion Level, T_c is the Criterion Duration, Q is the Exchange Rate, q is the Exchange Rate Factor and L_{avg} is the Average Sound Level.

Example: If $L_c = 90$, $T_c = 8$, $Q = 3$ and $L_{avg} = 95$ then

$$T_i = \frac{8}{2^{(95 - 90)/3}} = \frac{8}{10^{(95 - 90)/10}} = 2.52 = 2 \text{ hours and } 31 \text{ minutes}$$

This means that if a person is in this area for 2 hours and 31 minutes he will have accumulated a Noise Dose of 100%.

Standard: ANSI S12.19.

See **"Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)"**

At L_{max}

At L_{max} is one of 2 choices for the Max Spec setting on the OBA Page of the Setup Manager. See also **"Bin Max"**

At L_{max} , is the instantaneous spectrum at the moment when the broadband maximum occurred, such as L_{ASmax} .

Average Sound Level (L_{avg})

The logarithmic average of the sound during a Measurement Duration (specific time period), using the chosen Exchange Rate Factor. Exposure to this sound level over the period would result in the same noise dose and the actual (unsteady) sound levels. If the Measurement Duration is the same as the Criterion Duration, then $L_{avg} = LTWA(L_c)$ where the Measurement Duration (specified time period) is $T = T_2 - T_1$ and q is the Exchange Rate Factor. Only sound levels above the Threshold Level are included in the integral. Standard: ANSI S12.19

$$L_{avg} = q \text{Log}_{10} \left(\frac{1}{T} \int_{T_1}^{T_2} 10^{(L_p(t))/q} dt \right)$$

Bin Max

Bin Max is one of 2 choices for the Max Spec setting on the OBA Page of the Setup Manager. See also **"At Lmax"**

Bin Max is the maximum value that occurred during the entire measurement for that frequency band. Since individual frequency bands may reach their maximum levels at different times, this spectrum might be one which never occurred at any instant during the measurement period.

Community Noise Equivalent Level (CNEL, L_{den})

A rating of community noise exposure to all sources of sound that differentiates between daytime, evening and nighttime noise exposure. The equation for it is

$$L_{den} = 10 \log_{10} \left\{ \frac{1}{24} \left[\sum_{0000}^{0700} 10^{(L_i+10)/10} + \sum_{0700}^{1900} 10^{L_i/10} + \sum_{1900}^{2200} 10^{(L_i+5)/10} + \sum_{2200}^{2400} 10^{(L_i+10)/10} \right] \right\}$$

The continuous equivalent sound level is generally calculated on an hourly basis and is shown in the equation as L. The levels for the hourly periods from midnight to 7 a.m. have 10 added to them to represent less tolerance for noise during sleeping hours. The same occurs from 10 p.m. to midnight. The levels for the hourly periods between 7 p.m. and 10 p.m. have 5 added to them to represent a lessened tolerance for noise during evening activities. They are energy summed and converted to an average noise exposure rating.

Criterion Duration (Tc)

It is the time required for a constant sound level equal to the Criterion Level to produce a Noise Dose of 100%. Criterion Duration is typically 8 hours.

Example: If the Criterion Level = 90 dB and the Criterion Duration is 8 hours, then a sound level of 90 dB for 8 hours, will produce a 100% Noise Dose. See Noise Dose. Standard: ANSI S12.19

Criterion Sound Exposure (CSE)

The product of the Criterion Duration and the mean square sound pressure associated with the Criterion Sound Level when adjusted for the Exchange Rate. It is expressed in Pascals-squared seconds when the exchange rate is 3 dB, where q is the Exchange Rate Factor. See **"Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)"**.

$$CSE = T_c 10^{L_c/q}$$

Standard: ANSI S1.25

Criterion Sound Level (L_c)

It is the sound level which if continually applied for the Criterion Duration will produce a Noise Dose of 100%. The current OSHA Criterion Level is 90 dB.

Standard: ANSI S12.19

Daily Personal Noise Exposure ($L_{EP,d}$)

It is the level of a constant sound over the Criterion Duration that contains the same sound energy as the actual, unsteady sound over a specific period. The period is generally shorter, so the sound energy is spread out over the Criterion Duration period.

Example: If the Criterion Duration = 8 hours and the specific period is 4 hours and the average level during the 4 hours is 86 dB, then the $L_{EP,d} = 83$ dB.

Day-Night Average Sound Level (DNL, L_{dn})

A rating of community noise exposure to all sources of sound that differentiates between daytime and nighttime noise exposure. The equation for it is

$$L_{dn} = 10 \log_{10} \left\{ \frac{1}{24} \left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{2200} 10^{L_i/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10} \right] \right\}$$

The continuous equivalent sound level (See definition) is generally calculated on an hourly basis and is shown in the equation as L.

The values for the hourly periods from midnight to 7 a.m. have 10 added to them to represent less tolerance for noise during sleeping hours. The same occurs from 10 p.m. to midnight. They are energy summed and converted to an average noise exposure rating.

Decay Curve

Graphical representation of the decay of the sound pressure level in a room as a function of the time after the sound source has stopped.

Decibel (dB)

A logarithmic form of any measured physical quantity and commonly used in the measurement of sound and vibration. Whenever the word level is used, this logarithmic form is implied. The decibel provides us with the possibility of representing a large span of signal levels in a simple manner as opposed to using the basic unit Pascal for acoustic measurements.

It is not possible to directly add or subtract physical quantities when expressed in decibel form since the addition of logarithmic values correspond to multiplication of the original quantity.

The word level is normally attached to a physical quantity when expressed in decibels; for example, L_p represents the sound pressure level.

The difference between the sound pressure for silence versus loud sounds is a factor of 1,000,000:1 or more, and it is very unpractical to use these large numbers. Therefore, a measure that would relate to “the number of zeros” would help, for example, 100,000 would be equal to 50 and 1000 would be equal to 30 and so on. This is the basic principal of the dB measure.

All dB values are unit free and therefore, the dB value is not the value of the quantity itself, but the ratio of that quantity to an actual reference quantity used. Thus, for every level in decibels there must be a well defined reference quantity. Sound versus vibration uses different references, but the dB principal is the same. When the quantity equals the reference quantity the level is zero. To keep dB values above zero, the reference is generally set to be the lowest value of the quantity that we can imagine or normally wish to use. Before explaining the calculation of dB values, it is useful to remember the following rules of thumb when dB values are used for sound levels:

- Doubling of the Sound Pressure = 6 dB
- Doubling of the Sound Power = 3 dB
- Doubling of the Perceived Sound Level = (approx) 10 dB

Note: The latter is frequency and level dependent, but the value “10 dB” is a good rule of thumb, especially around 1 kHz.

Table C.1 shows the actual value of a specific item, such as sound power, for which the sound level is calculated. First, the sound power value is divided with the reference used and then the ten-based logarithm is applied. This value is then multiplied by 10 to create the decibel value (see equation below).

For every 10 decibels, a unit called Bel is created. The decibel stands for: deci for “one tenth” and bel for “Bel” (compare decimeter). The relationship between Bel and decibel is thus: 1 Bel = 10 decibels. It is not possible to directly add or subtract decibel values, since addition of logarithmic values correspond to multiplication of the original quantity.

Table C.1 Sound Level

Power form, squared units		Level form
Ration of Value to Reference	Exponential Form of Ratio	10•Exponent
1	10^0	0
10	10^1	10
100	10^2	20
200	$10^{2.3}$	23
1,000	10^3	30
10,000	10^4	40
100,000	10^5	50
1000,000	10^6	60

Each time the sound pressure level increases by 6 dB, the corresponding sound pressure value is doubled and thus multiplied by 2. Each time the sound power level increases by 3 dB, the sound power value is multiplied by 2. Thus, it is important to notice that a

doubling of the sound power is equal to 3 dB, and a doubling of the sound pressure is equal to 6 dB, since a doubling of the sound pressure will result in a quadruple increase of the sound power. The advantage with using dB is simply that they remain the same even if we use sound pressure or sound power. Compare this to the use of voltage and power units in electrical engineering, units being related by $P \sim V^2$. In table 2 an illustration is made of values calculated on sound pressure, non-squared units.

The original definition of decibel was intended for power-like quantities, such as sound power. If we consider sound pressure levels instead (usually denoted P in acoustics), the equation will be the same, since the “two” in the squared units will move from within the bracket and become a 20 log instead of a 10 log and thus compensate for using linear or quadratic units. Please note that it is not allowed to use 20 log for squared units, since that expression assumes that we use linear units, like sound pressure in acoustics or voltage in electrical engineering. This is illustrated in equation below:

$$dB = 10 \text{Log}_{10} \left[\frac{P^2}{P_0^2} \right] = 20 \text{Log} \left[\frac{P}{P_0} \right] \quad ; p_0 = 20 \mu Pa$$

Table C.1 illustrates how a a tenfold increase of the sound pressure will result in an increase in 20 dB steps, while sound power increases in 10 dB steps. See the linear form (Table C.1) and compare with equation above. In conclusion, dB values are always the same, independent of using sound power or sound pressure as the base unit. A 6 dB increase implies four times the sound power or two times the sound pressure.

Table C.2 Sound Power Increase

Linear form, non-squared units		Level form
Ration of Value to Reference	Exponential Form of Ratio	20•Exponent
1	10^0	0
10	10^1	20
100	10^2	40
200	$10^{2.3}$	46
1,000	10^3	60
10,000	10^4	80
100,000	10^5	100
1000,000	10^6	120

Department of Defense Level (LDOD)

The Average Sound Level calculated in accordance with Department of Defense Exchange Rate and Threshold Level. See **"Average Sound Level (Lavg)"**.

Dose

See **"Noise Dose (Dose)"**.

Detector

The detector converts the actual fluctuating sound from the microphone into a signal that indicates its amplitude. Your choice for the Detector setting (Slow, Fast, or Impulse) determines the amplitude change rate. The detector first squares the sound signal, then

averages it in accordance with the time-weighting characteristic, and then takes the square root. This results in an amplitude described as rms (root-mean-square).

The Slow and Fast detector responses were originally developed to slow down the movement of the needle on an electro-mechanical meter, so that the amplitude could be determined. Slow and Fast detector settings are still useful in modern sound measurement instruments. Slow has a time constant of 1 second. Fast has a time constant of 1/8th second. The Impulse setting is a non-linear detector with the rise controlled by a 35 ms time constant followed by a peak hold that has a decay rate of 2.9 dB/second.

Eight Hour Time-Weighted Average Sound Level (L TWA(8))

It is the constant sound level that would expose a person to the same Noise Dose as the actual (unsteady) sound levels. According to the ANSI S12.19 standard, the equation for it is

$$L_{TWA(8)} = L_c + q \text{Log}_{10} \left(\frac{D}{100} \right)$$

NOTE: This definition applies only for a Criterion Duration of 8 hours.

Energy Equivalent Sound Level (L_{eq})

The level of a constant sound over a specific time period that has the same sound energy as the actual (unsteady) sound over the same period.

$$L_{eq} = 10 \text{Log}_{10} \left(\frac{1}{T_M} \int_Q^{T_M} \left(\frac{P(t)}{P_0} \right)^2 dt \right)$$

L_{eq}: the equivalent, continuous, linear-weighted sound pressure level re 20μPa, which is determined over a measured time interval, T_M - Q (sec).

P(t): the instantaneous sound pressure of the sound signal

P₀: the reference sound pressure of 20μPa

See **“Sound Pressure Level (SPL, L_p)” on page C-16.**

Ensemble Average

When utilized in RA Mode for measuring room acoustics, the 831C calculates an ensemble average, instead of the mathematical average, to best represent the reverberation time for the measured room. The individual decay beginnings are synchronized and the discrete sound pressure samples at each time interval are energy averaged. On the 831C Data File display, look for the “Overall Ensemble” label.

For more information, see **Module 18 "RT60 Reverberation Time"**.

Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)

It is defined in ANSI S1.25 as “the change in sound level corresponding to a doubling or halving of the duration of a sound level while a constant percentage of criterion exposure is maintained.” The rate and the factors are given in the table below.

Table C.3 Exchange Rate

Exchange Rate, Q	Exchange Rate Factor, q	Exposure Factor, k
3.01	10	1
4	13.29	.75
5	16.61	.60
6.02	20	.50

Standard: ANSI S12.19

Exponential Integration

The alternative to **"Linear Integration"** for the 831C SLM. Exponential integration shows a long decay of energy after an impulse. However, it may hide small events or loud impulsive events. For this reason, this method is not as commonly used as **"Linear Integration"**. Please note that when performing time history measurements of 10 seconds or less, you must use Linear integration.

Far Field

There are two types of far fields: the acoustic far field and the geometric far field.

Acoustic Far Field: The distance from a source of sound is greater than an acoustic wavelength. In the far field, the effect of the type of sound source is negligible. Since the wavelength varies with frequency (See the definition of Wavelength), the distance will vary with frequency. To be in the far field for all frequencies measured, the lowest frequency should be chosen for determining the distance. For example, if the lowest frequency is 20 Hz, the wavelength at normal temperatures is near 56 ft. (17 m); at 1000 Hz, the wavelength is near 1.1 ft. (1/3 m). **"Acoustic Near Field:"** for the advantages of being in the acoustic far field.

Geometric Far Field: The distance from a source of sound is greater than the largest dimension of the sound source. In the far field, the effect of source geometry is negligible. Sound sources often have a variety of specific sources within them, such as exhaust and intake noise. When in the far field, the sources have all merged into one, so that measurements made even further away will be no different. **"Geometric Near Field:"** for the advantages of being in the geometric far field.

Free Field

A sound field that is free of reflections. This does not mean that the sound is all coming from one direction as is often assumed, since the source of sound may be spatially extensive. See the definitions of near and far fields for more detail. This definition is often used in conjunction with reverberant field.

Frequency (Hz, rad/sec)

The rate at which an oscillating signal completes a complete cycle by returning to the original value. It can be expressed in cycles per second and the value has the unit symbol Hz (Hertz) added and the letter f is used for a universal descriptor. It can also be expressed in radians per second, which has no symbol, and the Greek letter ω is used for a universal descriptor. The two expressions are related through the expression $\omega=2\pi f$.

Frequency Band Pass Filter

The part of certain sound level meters that divides the frequency spectrum on the sound or vibration into a part that is unchanged and a part that is filtered out. It can be composed of one or more of the following types:

Low Pass: A frequency filter that permits signals to pass through that have frequencies below a certain fixed frequency, called a cutoff frequency. It is used to discriminate against higher frequencies.

High Pass: A frequency filter that permits signals to pass through that have frequencies above a certain fixed frequency, called a cutoff frequency. It is used to discriminate against lower frequencies.

Bandpass: A frequency filter that permits signals to pass through that have frequencies above a certain fixed frequency, called a lower cutoff frequency, and below a certain fixed frequency, called an upper cutoff frequency. The difference between the two cutoff frequencies is called the bandwidth. It is used to discriminate against both lower and higher frequencies so it passes only a band of frequencies.

Octave band: A bandpass frequency filter that permits signals to pass through that have a bandwidth based on octaves. An octave is a doubling of frequency so the upper cutoff frequency is twice the lower cutoff frequency. This filter is often further subdivided in 1/3 and 1/12 octaves (3 and 12 bands per octave) for finer frequency resolution. Instruments with these filters have a sufficient number of them to cover the usual range of frequencies encountered in sound and vibration measurements. The frequency chosen to describe the band is the center frequency. For more detail, see **Table C.4** in Frequency Weighting Filter.

Frequency Weighting Filter

The frequency filter used to adjust the amplitude of the frequency spectrum of the sound or vibration to account for the relative loudness perceived by the human ear.

A-Weighting: A filter that adjusts the amplitude of a frequency spectrum (20 Hz to 20 kHz) to be perceived the same way the human ear does when exposed to low levels of sound. This weighting is most often used for evaluation of environmental sounds. See table below.

B-Weighting: A filter that adjusts the amplitude of a frequency spectrum (20 Hz to 20 kHz) to be perceived the same way the human ear does when exposed to higher levels of sound in the lower frequencies (below 1 kHz). This weighting is sometimes used for musical listening purposes. See table below.

C-Weighting: A filter that adjusts the amplitude of a frequency spectrum (20 Hz to 20 kHz) to be perceived the same way the human ear does when exposed to high levels of sound. This weighting is most often used for evaluation of machinery and mechanical sounds. See table below.

Flat-Weighting: A filter that does not adjust the amplitude of a frequency spectrum. It is sometimes an alternative selection to A, B, and C-weightings.

Z-Weighting: Similar to a flat-weighting curve, this is a bandpass filter that does not adjust amplitude in the range of 10 Hz to 20 kHz.

Table C.4 Frequency Filter Response

Center Frequencies, Hz		Weighting Network Frequency Response		
1/3 Octave	1 Octave	A	B	C
20		-50.4	-24.2	-6.2
25		-44.7	-20.4	-4.4
31.5	31.5	-39.4	-17.1	-3.0
40		-34.6	-14.2	-2.0
50		-30.2	-11.6	-1.3
63	63	-26.2	-9.3	-0.8
80		-22.5	-7.4	-0.5
100		-19.1	-5.6	-0.3
125	125	-16.1	-4.2	-0.2
160		-13.4	-3.0	-0.1
200		-10.9	-2.0	0
250	250	-8.6	-1.3	0
315		-6.6	-0.8	0
400		-4.8	-0.5	0
500	500	-3.2	-0.3	0
630		-1.9	-0.1	0
800		-0.8	0	0
1000	1000	0	0	0
1250		0.6	0	0
1600		1.0	0	-0.1
2000	2000	1.2	-0.1	-0.2
2500		1.3	-0.2	-0.3
3150		1.2	-0.4	-0.5
4000	4000	1.0	-0.7	-0.8
5000		0.5	-1.2	-1.3
6300		-0.1	-1.9	-2.0
8000	8000	-1.1	-2.9	-3.0
10000		-2.5	-4.3	-4.4
12500		-4.3	-6.1	-6.2
16000	16000	-6.6	-8.4	-8.5
20000		-9.3	-11.1	-11.2

Integration Method

See "Linear Integration", or "Exponential Integration".

L_{eq}

See "Energy Equivalent Sound Level (L_{eq})", "Sound", and "Time Weighting"

Level (dB)

A descriptor of a measured physical quantity, typically used in sound and vibration measurements. It is attached to the name of the physical quantity to denote that it is a logarithmic measure of the quantity and not the quantity itself. The word decibel is

often added after the number to express the same thing. When frequency weighting is used the annotation is often expressed as dB(A) or dB(B).

Linear Integration

The alternative to **"Exponential Integration"** for the 831C SLM. This is the default and most commonly used integration method for measuring sound. Linear integrates only the energy during a given period. It does not show a decay slope of a Fast, Slow, or Impulse exponential detector. For additional information, see **"Exponential Integration"**.

Ln Value

The **Ln** value is the sound level that has exceeded n% over the total measurement time. For example, if n=90%, a displayed value of 35dB for L90 means that for 90% of the measurement period the dB level was at or above 35dB. These statistical values are commonly used to describe the characteristics of non-steady sound such as environmental noise.

Locate Ln settings on the Spartan or SoundExpert by choosing **Settings → Ln Settings**.

Measurement Duration (T)

The time period of measurement. It applies to hearing damage risk and is generally expressed in hours.

Standard: ANSI S12.19

Microphone Guidelines

Microphone - Types: A device for detecting the presence of sound. Most often it converts the changing pressure associated with sound into an electrical voltage that duplicates the changes. It can be composed of one of the following types:

Capacitor (Condenser): A microphone that uses the motion of a thin diaphragm caused by the sound to change the capacitance of an electrical circuit and thereby to create a signal. For high sensitivity, this device has a voltage applied across the diaphragm from an internal source.

Electret: A microphone that uses the motion of a thin diaphragm caused by the sound to change the capacitance of an electrical circuit and thereby to create a signal. The voltage across the diaphragm is caused by the charge embedded in the electret material so no internal source is needed.

Microphone - Uses: The frequency response of microphones can be adjusted to be used in specific applications. Among those used are:

Frontal incidence (Free Field): The microphone has been adjusted to have an essentially flat frequency response when in a space relatively free of reflections and when pointed at the source of the sound.

Random incidence: The microphone has been adjusted to have an essentially flat frequency response for sound waves impinging on the microphone from all directions.

Pressure: The microphone has not been adjusted to have an essentially flat frequency response for sound waves impinging on the microphone from all directions.

What a microphone measures: A microphone detects more than just sound. The motion of a microphone diaphragm is in response to a force acting on it. The force can be caused by a number of sources only one of which are we interested: sound. Non-sound forces are: (1) direct physical contact such as that with a finger or a raindrop; (2) those caused by the movement of air over the diaphragm such as environmental wind or blowing; (3) those caused by vibration of the microphone housing; and (4) those caused by strong electrostatic fields.

Rules to prevent interference:

1. Do not permit any solid or liquid to touch the microphone diaphragm. Keep a protective grid over the diaphragm.
2. Do not blow on a microphone and use a wind screen over the microphone to reduce the effect of wind noise.
3. Mount microphones so their body is not subject to vibration, particularly in direction at right angles to the plane of the diaphragm.
4. Keep microphones away from strong electrical fields.

A microphone measures forces not pressures. We would like the microphone to measure sound pressure (force per unit area) instead of sound force. If the pressure is applied uniformly over the microphone diaphragm a simple constant (the diaphragm area) relates the two, but if the pressure varies across the diaphragm the relationship is more complex. For example, if a negative pressure is applied on one-half the diaphragm and an equal positive pressure is applied to the other half, the net force is zero and essentially no motion of the diaphragm occurs. This occurs at high frequencies and for specific orientations of the microphone.

Rules to obtain the most accurate measurement:

1. Do not use a microphone at frequencies higher than specified by the manufacturer; to increase the frequency response choose smaller microphones.
2. Choose a microphone for free field or random incidence to minimize the influence of orientation.

A microphone influences the sound being measured. The microphone measures very small forces, low level sound can run about one-billionth of a PSI! Every measurement instrument changes the thing being measured, and for very small forces that effect can be significant. When sound impinges directly on a microphone the incident wave must be reflected since it cannot pass through the microphone. This results in the extra force required to reflect the sound and a microphone output that is higher than would exist if the microphone were not there. This is more important at high frequencies and when the microphone is facing the sound source.

Rules:

1. Do not use a microphone at frequencies higher than specified by the manufacturer; to increase the frequency response choose smaller microphones.
2. Choose a microphone for free field or random incidence to minimize the influence of orientation.

A microphone measures what is there from any direction: Most measurements are intended to measure the sound level of a specific source, but most microphones are not directional so they measure whatever is there, regardless of source.

Rules:

1. When making hand-held measurements, keep your body at right angles to the direction of the sound you are interested in and hold the meter as far from your body as possible. Use a tripod whenever possible.
2. Measure the influence of other sources by measuring the background sound level without the source of interest. You may have to correct for the background.

Near Field

There are two types of near fields: the acoustic near field and the geometric near field.

Acoustic Near Field:

The distance from a source of sound is less than an acoustic wavelength. In the near field, the effect of the type of sound source is significant. Since the wavelength varies with frequency (See the definition of Wavelength), the distance will vary with frequency. The most common example of a near field is driving an automobile with an open window. As you move your ear to the plane of the window, the sound pressure level builds up rapidly (wind noise) since most of the pressure changes are to move the air and very little of it compresses the air to create sound. Persons not far away, can hardly hear what you hear. The acoustic near field is characterized by pressures that do not create sound that can be measured in the far field. Therefore measurements made here are not useful in predicting the sound levels far way or the sound power of the source.

Geometric Near Field:

The distance from a source of sound is less than the largest dimension of the sound source. In the near field, effect of source geometry is significant. Sound sources often have a variety of specific sources within them, such as exhaust and intake noise. When in the near field, the sound of a weaker, but close, source can be louder than that of a more distant, but stronger, source. Therefore measurements made here can be used to separate the various sources of sound, but are not useful in predicting the sound levels and sound spectrum far from the source.

Noise

Typically it is unwanted sound. This word adds the response of humans to the physical phenomenon of sound. The descriptor should be used only when negative effects on people are known to occur. Unfortunately, this word is used also to describe sounds with no tonal content (random):

Ambient: The all encompassing sound at a given location caused by all sources of sound. It is generally random, but need not be.

Background: The all encompassing sound at a given location caused by all sources of sound, but the source to be measured. It is essentially the sound that interferes with a measurement.

Pink: It is a random sound that maintains constant energy per octave. Pink light is similar to pink noise in that it has a higher level at the lower frequencies (red end of the spectrum).

White: It is a random sound that contains equal energy at each frequency. In this respect, it is similar to white light.

Noise Dose (Dose)

It is the percentage of time a person is exposed to noise that is potentially damaging to hearing. Zero represents no exposure and 100 or more represents complete exposure. It is calculated by dividing the actual time of exposure by the allowed time of exposure. The allowed time of exposure is determined by the Criterion Duration and by the sound level (the higher the level, the shorter the allowed time). The sound levels must be measured with A-frequency weighting and slow exponential time weighting. See **“Projected Noise Dose” on page C-13.**

$$D = \frac{100T}{T_c} 10^{(L_i - L_c)/q}$$

T = Measurement Duration, T_c = Criteria Time, L_i = TWA, L_c = Criteria Level, q = exchange rate factor; **“Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)”**

Standard: ANSI S12.19

Noise Exposure

See **“Noise” on page C-12.**

OSHA Level (LOSHA)

The Average Sound Level calculated in accordance with the Occupational Safety and Health Administration Exchange Rate and Threshold Level.

Preamplifier

A preamplifier is a part of a sound level meter that matches a particular model of microphone to the meter. It must be chosen in conjunction with a microphone and a cable that connects them.

Projected Noise Dose

Projected Noise Dose is the **Noise Dose** expected if the current rate of noise exposure continues for the full **Criterion Duration** period.

Quality Indicators

A portion of Tonality standard (ISO 1996-2, or ISO/PAS 20065), which rates the audibility of tones in a measured spectrum according to the following values:

Lpt: the sound pressure level of tones in the critical band.

Lpn: Sound pressure level of the masking noise in the critical band.

DeltaLta: Tonal Audibility, or the difference between the SPL of the tones and the SPL of the masking noise. ($L_{pt} - L_{pn}$)

Kt: Possible adjustment to the measured sound pressure level that may be suggested to account for the impact of more prominent tones on the human ear.

Regression Range

When applying the 1996-2 Tonality standard, the Regression Range value enables you to set what percentage of the critical band should be represented to the left and right of

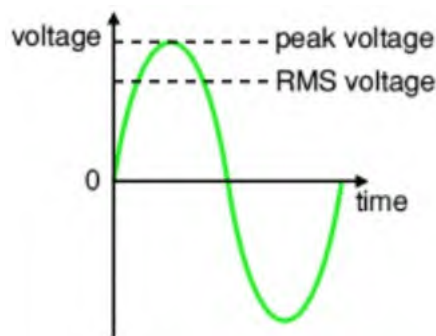
the center frequency. For example, selecting **75%** results in a range that is 75% to the left and 75% the right of the center frequency. A higher percentage displays more regression noise data. The Regression Range setting is located on the **Setup Manager → Tonality tab**. For details, see **18.3 "Making the FFT Measurement" on page 169**.

For details on defining a regression range, see ISO 1966-2 C.4.4.

RMS Value (Root-Mean-Square Value)

One method of describing the energy in a sampled waveform. A waveform is often described by the wave's peak value. However, the peak value occurs only once positively and once negatively within a cycle. Since the RMS value (root-mean-square) occurs twice positively and twice negatively, as identified in Figure C-1, the sum of these, and associated values, provides a closer approximation of the total energy of the measured sound, or the effective value of a varying current or voltage. For this reason, it is often applied in the process of calculating noise exposure. Mathematically, the RMS value is defined as the square root of the mean value of the squared values of the quantity taken over an interval.

FIGURE C-1



The RMS value of any function $y = f(t)$ over the range $t = a$ to $t = b$ can be defined by the following equation:

$$RMS\ value = \frac{1}{b-a} \int_a^b y^2 dt$$

Single Event Noise Exposure Level (SENEL, LAX)

The Single Event Noise Exposure Level is the total sound energy over a specific period. It is a special form of the **Sound Exposure Level** where the time period is defined as the start and end times of a noise event such as the passing of an aircraft or automobile.

Meter Location ID

A method used to identify a measurement file with a meter location. Each meter location is assigned a 2-digit location id from 01–39. This id is added to the **Default Data File** field in the measurement setup.

When extracting sound records from LDBIN files, the file name code “\$L,” for meter location, is added to the Default File Name (**Tools → Options → Command Line Settings**). Each resulting sound record also bears the meter location id.

Sound

Sound is comprised of rapid oscillatory compression changes in a solid, liquid, or gas medium that propagate to distant points. It is characterized by changes in density,

pressure, motion, and temperature. Not all rapid changes in the medium are sound since they do not propagate. Wind noise is an example of this. Sound can also be characterized as the auditory sensation evoked by the oscillatory changes.

Sound is the physical phenomenon associated with acoustic (small) pressure waves. Noise is unwanted sound that causes adverse effects in those exposed to it, such as hearing loss or annoyance. It can also be defined as the sound made by other people. In every case, choosing the word *noise* involves a judgment of whether the sound is welcome or not.

Sound Exposure (E)

Sound Exposure is the total sound energy of the actual sound during a specific time period. It is expressed in Pascals-squared seconds, or Pascals-squared hours. The following formula describes exposure in terms of E, where p_A is the sound pressure and $T_2 - T_1$ is the Measurement Duration (specific time period).

$$E = \int_{t_1}^{t_2} p_A^2(t) dt$$

Sound Exposure Level (SEL, LE)

The total sound energy in a specific time period usually expressed in decibels. The following equation shows that the sound pressure is squared and integrated over a specific period of time (t_2-t_1).

$$SEL = 10 \log_{10} \left[\frac{\int_{t_1}^{t_2} p^2(t) dt}{P_0^2 t} \right]$$

The Sound Exposure Level is usually expressed in Pascals squared-seconds or Pascals squared-hours. P_0 is the reference pressure of 20 μ Pa, and “t” is the reference time of 1 second. It is then put into logarithmic form. It’s important to note that this is not an average since the reference time is not the same as the integration time.

Sound Pressure

Sound Pressure is the physical characteristic of sound that can be detected by microphones. Not all pressure signals detected by a microphone are sound (e.g., wind noise).

Sound Pressure is the amplitude of the oscillating sound pressure and is measured in Pascals (Pa), or Newtons per square meter, which is a metric equivalent of pounds per square inch. To measure sound, a sound level meter uses a detector to separate the oscillating pressure from the steady (barometric) pressure. The sound level meter then squares the pressure, takes the time average, and takes the square root (this is called rms for root-mean square). This method is one of several ways to mathematically measure sound.

Moving Average: The averaging process is continually accepting new data so it is similar to an exponential moving average. In the equation, the sound pressure is squared and

multiplied by an exponential decay factor, so that when the time of integration is near the current time (t) it is essentially undiminished.

$$p_{rms} = \sqrt{\frac{1}{T} \int_{t_s}^t p^2(\xi) e^{-(t-\xi)/T} d\xi}$$

For times older (less) than the current time, the value is diminished and so becomes less important. The rate at which older data are made less influential is expressed by the constant T. The larger it is, the slower the decay factor reduces and the slower the response of the system to rapid changes. These are standardized into 3 values called Time Weighting. See the values below.

Fixed Average: The averaging process is over a fixed time period. The equation for it is

$$p_{rms} = \sqrt{\frac{1}{(T_2 - T_1)} \int_{T_1}^{T_2} p^2(t) dt}$$

The sound pressure is squared and averaged over a fixed time period. Unlike the moving average, the sound pressures in all time intervals are equally weighted.

Sound Pressure Level (SPL, Lp)

The logarithmic form of sound pressure. It is also expressed by attachment of the word decibel to the number. The logarithm is taken of the ratio of the actual sound pressure to a reference sound pressure which is 20 Micro-pascals (μ Pa). There are various descriptors attached to this level depending on how the actual sound pressure is processed in the meter:

Instantaneous: The time varying reading on a meter face or in a meter output due to changes in the sound pressure. The reading will depend on the time-weighting applied.

The fundamental relationship between the two is logarithmic

$$L_p = 20 \log_{10} \left[\frac{p_{rms}}{p_0} \right] \quad p_{rms} = p_0 10^{L_p/20}$$

where p_0 is the reference sound pressure of 20 μ Pa. The square of the sound pressure is a power-like quantity that can be expressed in the original form of the level definition

$$L_p = 10 \log_{10} \left[\frac{p_{rms}^2}{p_0^2} \right] \quad p_{rms}^2 = p_0^2 10^{L_p/10}$$

Sound Pressure Level can be converted to sound pressure as follows. If the sound pressure is 1 Pascal, then the sound pressure level is

$$L_p = 20 \log_{10} \left[\frac{1}{20 \bullet 10^{-6}} \right] = 20 \log_{10} [50000] = 20 [4.699] = 94.0 \text{ dB}$$

Calibrators often use a level of 94 dB so they generate a sound pressure of 1 Pascal.

If the sound pressure level = 76.3 dB, then the sound pressure is

$$Pa = 20 \cdot 10^{-6} \cdot 10^{76.3/20} = 20 \cdot 10^{3.815-6} = 20 \cdot 10^{-2.185} = 20[0.0065] = 0.13$$

Energy Average (L_{eq}): The value of a steady sound measured over a fixed time period that has the same sound energy as the actual time varying sound over the same period. This descriptor is widely used. It is a fixed average. See **“Sound Pressure” on page C-15.**

Impulse: The value of an impulsive sound. The reading will depend on the time-weighting applied.

Unweighted Peak: The peak value of a sound with a meter that has flat frequency weighting and a peak detector.

Weighted Peak: The peak value of a sound with a meter that has a frequency weighting other than flat and a peak detector.

Sound Power (W)

The sound power emitted by a sound source. It is measured in Watts.

Sound Power Level (PWL, L_w)

The logarithmic form of sound power. It is also expressed by attachment of the word decibel to the number. The logarithm is taken of the ratio of the actual sound power to a reference sound power, which is 1 pico-watt. Sound power level cannot be measured directly, but can only be deduced through measurements of sound intensity or sound pressure around the source. The equation for it is

$$L_w = 10 \log_{10} \left[\frac{W}{W_0} \right] \quad W = W_0 10^{L_w/10}$$

Sound Speed

The speed at which sound waves propagate. It is measured in meters per second. It should not be confused with sound or particle velocity which relates to the physical motion of the medium itself.

$$c = 20.05 \sqrt{\text{degC} + 273} \quad \text{m/sec}$$

$$c = 49.03 \sqrt{\text{degF} + 460} \quad \text{ft/sec}$$

Spectrum (Frequency Spectrum)

The amplitude of sound or vibration at various frequencies. It is given by a set of numbers that describe the amplitude at each frequency or band of frequencies. It is often prefixed with a descriptor that identifies it such as sound pressure spectrum. It is generally expressed as a spectrum level.

Taktmaximal-5

An integration of the five second maximum, A-frequency-weighted, fast time-weighted sound pressure levels.

$$L_{AFM5} = 10 \cdot \log \left[\frac{\sum \left(10^{\frac{L_{AF \max 5s(n)}}{10}} \right)}{n} \right]$$

Where $L_{A \max 5s(n)}$ is the maximum, A-weighted, fast exponential time-weighted sound pressure level for each “n” 5-second time period. “n” is the number of 5 second periods accumulated during the measurement.

Threshold Sound Level (Lt)

The A-weighted sound level below which the sound produces little or no Noise Dose accumulation and may be disregarded. It is used for hearing damage risk assessment.

Standard: ANSI S1.25

Time Weighted Average Sound Level (TWA, LTWA(TC))

It is the level of a constant sound over the Criterion Duration, that would expose a person to the same Noise Dose as the actual (unsteady) sound over the same period. If the Exchange Rate is 3 dB then the TWA is equal to the Leq.

$$L_{TWA(TC)} = K \log_{10} \left(\frac{1}{T} \int_{T_1}^{T_2} 10^{(L_p(t))/K} dt \right)$$

Where $TC=T_2-T_1$ and K is the Exchange Rate Factor. It is used for hearing damage risk assessment.

Standard: ANSI S12.19

Time Weighting

The response speed of the detector in a sound level meter. There are several speeds used.

Slow: The time constant is 1 second (1000 ms). This is the slowest and is commonly used in environmental noise measurements.

Fast: The time constant is 1/8 second (125 ms). This is a less commonly used weighting but will detect changes in sound level more rapidly.

Impulse: The time constant is 35ms for the rise and 1.5 seconds (1500 ms) for the decay. The reason for the double constant is to allow the very short signal to be captured and displayed.

Tone Seek Delta

This FFT and Tonality setting—associated with the 1996-2 Tonality standard—is used to distinguish noise pauses from masking noise in the measurement. The default value is 1 dB. Refer to ISO 1996-2 C.4.2 to determine which value to use for your measurement.

Vibration

The oscillatory movement of a mechanical system (generally taken to be solid). It is used as a broad descriptor of oscillations.

Wavelength (l)

The distance between peaks of a propagating wave with a well defined frequency. It is related to the frequency through the following equation

$$\lambda = \frac{c}{f}$$

where c is the sound speed and f is the frequency in Hz. It has the dimensions of length.

Wavenumber (k)

A number that is related to the wavelength of sound and is used to compare the size of objects relative to the wavelength or the time delay in sound propagation. It is related to wavelength through the following equation

where l is the wavelength, c is the sound speed, f is the frequency in Hz, and w is the radian frequency. It has the dimensions of inverse length.

$$k = \frac{2\pi}{\lambda} = \frac{2\pi f}{c} = \frac{\omega}{c}$$



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Firmware version 5.1.0
SoundAdvisor 831C Reference Manual
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