Larson Davis

SOUND LXT TRACK®

Operation Manual

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I770.01 Rev E

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Record of Serial Number and Purchase Date

LxT Model: LxT1 ☐ LxT2 ☐ **Serial Number:** ___________

Preamplifier Model: _________ **Serial Number:** ___________

Microphone Model: _________ **Serial Number:** ___________

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CHAPTER

1

Introduction

Welcome to the Larson Davis SoundTrack LxT®. This versatile instrument, with graphic display, performs the functions of several instruments. It puts the combined features of a precision sound level meter and a real-time frequency analyzer in the palm of your hand.

About This Manual

This manual has 18 chapters and 5 appendices covering the following topics:

Chapters

- **Chapter 1 - Introduction:** Orients the user to the contents of this user manual and the LxT features, functions and measurement capabilities.
- **Chapter 2 - First Use:** Describes the process of unpacking the LxT and preparing for first use.
- **Chapter 3 - Overview:** A brief discussion of the displayed views, the keypad and navigation through the various functions of the LxT.
- **Chapter 4 - Basic Measurement Setup:** A detailed description of setting up the LxT for the measurement of basic sound level parameters
- **Chapter 5 - Basic Data Display:** A detailed look at the various metrics and information presented on these screens during and following a basic sound level measurement.

- **Chapter 6 - Run Control:** The LxT provides a number of run modes to control the time duration of a measurement. These include Manual Stop, Timed Stop, Stop when Stable, Continuous, Single Block Time and Daily Timer modes.

- **Chapter 7 - Making a Measurement:** Describes the important steps in making an accurate sound level measurement.

- **Chapter 8 - Voice Recording:** The user is instructed in the process of recording, reviewing and saving voice messages.

- **Chapter 9 - Time History:** Describes the use of the optional firmware LxT-LOG for measuring time history data.

- **Chapter 10 - Data Explorer:** Learn to use the Data Explorer to view stored data files, load settings from a saved data file and other operations.

- **Chapter 11 - System Properties:** A discussion of instrument related functions.

- **Chapter 12 - Lock and Unlock The LxT:** A discussion of the various scenarios to lock or unlock the LxT and the interaction with running a measurement.

- **Chapter 13 - Calibration:** Describes the process of calibrating an LxT.

- **Chapter 14 - About:** A look at basic LxT system related information.

- **Chapter 15 - System Utilities:** A description of the utilities available within the LxT.

- **Chapter 16 - Hardware:** A description of the major hardware related features of the LxT.

- **Chapter 17 - Parameters Measured:** An overview of the many parameters measured and recorded by the LxT

- **Chapter 18 - Memory Utilization:** Presents formulas to determine the memory used when saving parameters to internal memory

Appendices

- **Appendix A - Technical Specifications:** Provides a listing of acoustic, electronic, environmental and physical characteristics of the LxT.
- **Appendix B - Measuring to IEC61672-1:** Provides specifications and information specifically required to appear in the manual by this standard.
- **Appendix C - Integrated Level Calculations:** provides information on TWA, Leq, SEL, Dose and Projected Dose calculations.
- **Appendix D - Glossary:** Contains technical definitions of key acoustic and vibration terms.
- **Appendix E - Warranty/Customer Satisfaction:** A presentation of warranty and customer satisfaction policies.

Special Features of the Electronic Version

There are a variety of special techniques for navigating through pdf documents which can greatly simplify finding specific items in this manual. Three of these, bookmarks, links and cross references are discussed below.

Bookmarks

Opening Bookmarks

Bookmarks are clickable navigation tools in pdf files. To open a bookmark, left click the upper tab on the left of the screen labeled **Bookmarks.** These will appear as shown FIGURE 1-1.

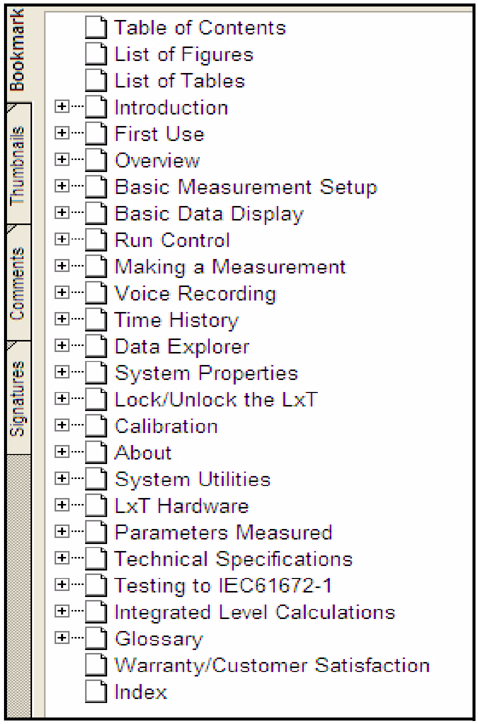


FIGURE 1-1 Bookmarks

In the unexpanded view, bookmarks lists the names and page numbers of chapters and appendixes in order of appearance, as well as the Table of Contents and the Index.

Closing Bookmarks

To close bookmarks, simply left click the tab once more.

Expanding Bookmarks

For any entry, if there is a + within the rectangle to the left, there are sub-entries which can be displayed upon expanding the tree by clicking the rectangle. For example, clicking the + to the left of any chapter will expand it into major headings and by clicking all the + symbols, the complete tree for that chapter will be shown. In the following figure we can see the entry Measurement Setup completely expanded.

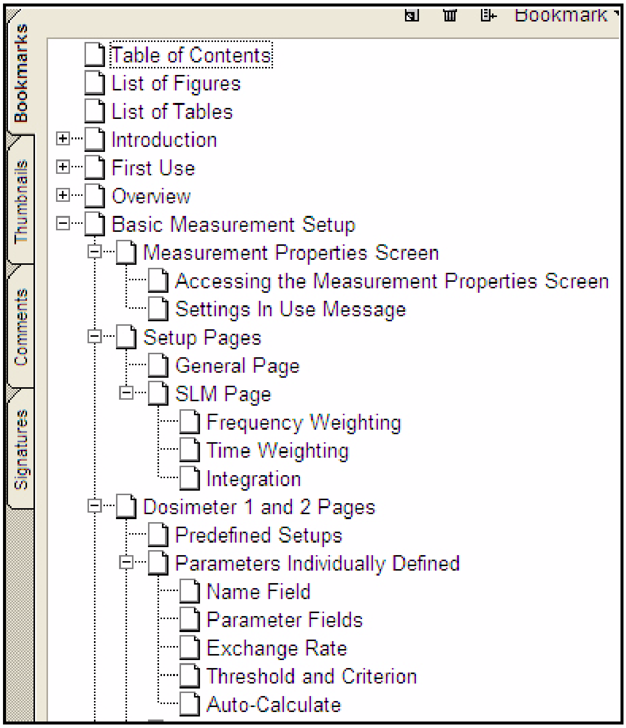


FIGURE 1-2 Bookmarks Expanded

Click to Display a Page

Left click on any text field (Chapter name, Appendix name, Table of Contents, Index, or any sub heading) and the page displayed on the right will jump to the page associated with that text field.

Return to Previous View

There are several methods to return to a previous view. These methods differ in the various version of Adobe Reader. Refer to Help in your version of Adobe Reader.

To return to the page which was displayed previous to clicking on a bookmark text line, click the “View Menu” in the menu bar. Click the “Goto” and then “Previous View” on the pop up menus.

Links

Click a Link to Display a Page

The Table of Contents and the Index have a page number associated with each item. For the Table of Contents, left click on the text line and that page will be displayed. For the Index, left click on the page number itself to display the page associated with that entry.

Return to Previous View

To return to the page which was displayed previous to clicking on an item in the Table of Contents or a page number in the Index, click the "View Menu" in the menu bar. Click the "Go to" and then "Previous View" on the pop up menus.

Cross References

Click Cross Reference

Throughout this manual there are cross reference links to other chapters and figures. The cross reference may appear similar to: FIGURE 3-5 "Measurement Properties Screen" page 3-3. Left click on these text areas to display the page associated with that cross reference.

Return To Previous View

To return to the previously displayed page, click the "View Menu" in the menu bar. Click "Goto" and then "Previous View" on the pop up menus.

Features

Hardware Features

The Larson Davis SoundTrack LxT has the following features:

- **Precision integrating sound level meter**
- **64 MB unformatted standard data memory (120 MB optional)**
- **160 X 240 graphic LCD display with backlight and icon-driven user interface**
- **Silent Touch elastomeric keypad**
- **Large dynamic range providing single SLM display page**
- **RMS Detectors: Slow, Fast & Impulse**
- **RMS Frequency Weighting: A, C & Z**
- **Peak Frequency Weighting: A, C & Z**
- **L_N statistics: 6 user-selected values over the range ($L_{0.01}$ through $L_{99.99}$) and Histogram tables**
- **Jack for AC/DC output or headset microphone and speaker**
- **Compatible with 61 m (200 ft.) microphone extension cable (full scale to 20 kHz)**
- **4-AA batteries provide 16 hour operating time**
- **USB 2.0 full speed peripheral connector and AC/DC output**
- **Field-upgradeable firmware**
- **WS001 windscreen**

Basic Measurements

- **SPL, Leq, Lmax, Lmin, SEL, Lpeak, Lpeak(max)**
- **2 Sets of hygiene metrics: Lavg, TWA(x), Dose, ProjDose, Lep,d**
- **E, E8, E40**
- **SEA peak exposure**
- **2 RMS event counters and 3 Peak event counters**
- **L_N table, displays 6 user-selected L_N metrics**

Basic Operation

- **Auto-Store with Auto-Reset**
- **Run Timer and Stop-When-Stable Control**
- **Real-time clock**
- **Start time, elapsed time and paused time**
- **Time stamping for Lmax, Lmin, Lpeak(max) metrics**
- **Session Log**
- **Lock functions**
- **Calibration with calibration history and list of calibrators**
- **Power management**
- **Status bar and About display**
- **Multiple languages**
- **Data files and Data Explorer**
- **Automatic data backup to prevent data loss on power failure**
- **Overall measurement**

Available Options

- **Real-time 1/1 Octave Frequency Analysis (LXT-OB1)**
- **Real-time 1/3 & 1/1 Octave Frequency Analysis (LXT-OB3)**
- **Automatic Data Logging with intervals from 1 second to 24 hours (LXT-LOG)**
- **Digital Voice Annotation (LXT-DVA) (includes SLM LxT Headset LXT-IH)**
- **120 MB Memory (LXT-MEM120)**

Standard Accessories

The LxT is delivered with the standard accessories described below.

Microphone and Preamplifier

The LxT is delivered with one of the following combinations of microphone and microphone preamplifer.

Instrument	Microphone Preamplifier	Microphone	Microphone Sensitivity	Measurement Range
LxT1	PRMLxT1	377B02	50 mV/Pa	38 dB to 140 dB
LxT2	PRMLxT2	7052	22.6 mV/Pa	37 dB to 139 dB

Table 1-1 Microphone and Preamplifier

Other

- **Windscreen, 3 1/2 in. diameter (WS001)**
- **Alkaline Batteries: 4-AA**
- **Lanyard**
- **Qty 4 SS button socket head screws, 4-40 x 3/16, to secure access to battery door when using in an explosive atmosphere (Larson Davis part number 5290.0185)**
- **Hex Driver, 1/16" miniature, for use with battery door access screw**
- **LxT User Manual I770.01**
- **SLM Utility-G3 software, providing setup utilities, calibration routines, remote instrument control from PC, data downloading and export of data to 3rd party software such as MS Excel**
- **SLMScreengrabber software to capture and save screen displays as bitmap files.**

Optional Accessories

The LxT will conform to all referenced standards using any of these optional accessories.

Microphones

- **377B02 1/2 in. Type 1 Free Field, 50 mV/Pa**
- **7052 1/2 in. Type 2 Free Field, 20 mV/Pa (order MIC006)**
- **377A01 1/4 in. Type 1 Free Field, 4 mV/Pa (ADP043 1/4" microphone to 1/2" preamplifier adaptor required)**

Microphone Preamplifiers

- **PRMLxT1 Type 1 with 14 dB capacitive attenuation**
- **PRMLxT2 Type 2 with 6 dB capacitive attenuation**
- **PRMLxT1L Low-Level Type 1 with no attenuation**
- **PRMLxT2L Low-Level Type 2 with no attenuation**

Microphone and Preamplifier Configurations

- **PRMLxT1 or PRMLxT1L with 377B02**
- **PRMLxT2 or PRMLxT2L with 7052**
- **PRMLxT1 or PRMLxT1L with 377A01 (including ADP043 adapter)**

Equivalent Electrical Impedance Adaptor

An equivalent electrical impedance adapter can be used in place of the microphone when the instrument is being measured electrically. The adapter is simply a series capacitor with the same capacitance as the microphone it is replacing. The following adapters will be available for sale.

- **ADP002 6.8pF Adaptor for 1/4 in., 7pF microphone (377B01)**
- **ADP005 18pF for 1/2 in., 18pF microphone (7052)**

Cables

Direct Input Cable or Adaptor

- **Microphone Extension Cable: EXCXXX, where XXX is the length in feet (XXX = 010, 020, 050, 066, 100 and 200 available).**
- **USB Cable: CBL138**
- **AC/DC Output Cable: CBL139**
- **Universal AC Power Adaptor: PSA029**

Software

- **Blaze® software (SWW_BLAZE_LXT) for setup, control and high speed data download.**

- **DNA (Data, Navigation and Analysis) software for instrument control, high speed data download, data streaming with real-time data display on PC, advanced data graphic presentations and powerful report generation features.**

Other

- **Headset with microphone for voice recording/ playback (LXT-HS). Note: this is included with the optional accessory LXT-DVA**

- **Storage Case: LXT-CCS**

Tripods

- **TRP001: Instrument/Camera Tripod with ADP032 1/2 in. microphone clip**

- **TRP002: Microphone Stand with adjustable height and boom angle.**

Calibrators

- **CAL150**

- **CAL200**

LxT Components

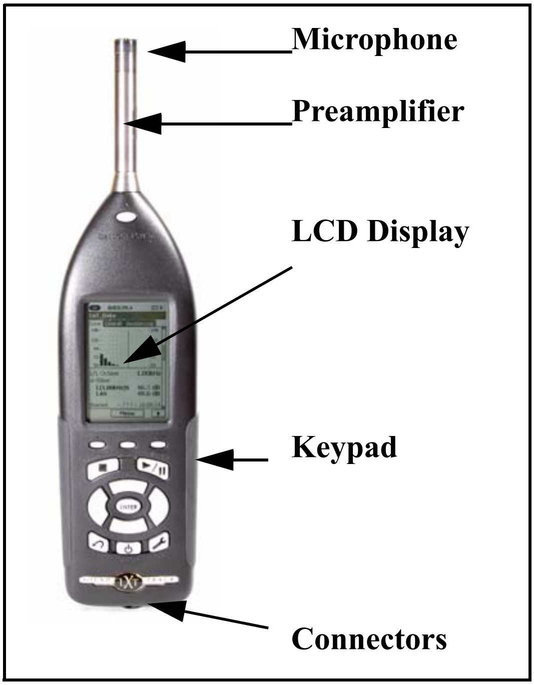


FIGURE 1-3 The LxT

The SoundTrack LxT is a convenient hand-held sound level meter / real-time analyzer with a simple user interface.

The standard LxT shown in FIGURE 1-3 includes the following:

- **1/2 in. diameter condenser microphone**
- **Backlit graphic 160 x 240 pixel LCD display**
- **13-key soft rubber backlit keypad**
- **AC/DC output, control, USB, and external power connectors (shown in FIGURE 1-4)**
- **True "hand held" instrument with "sure grip" pads**

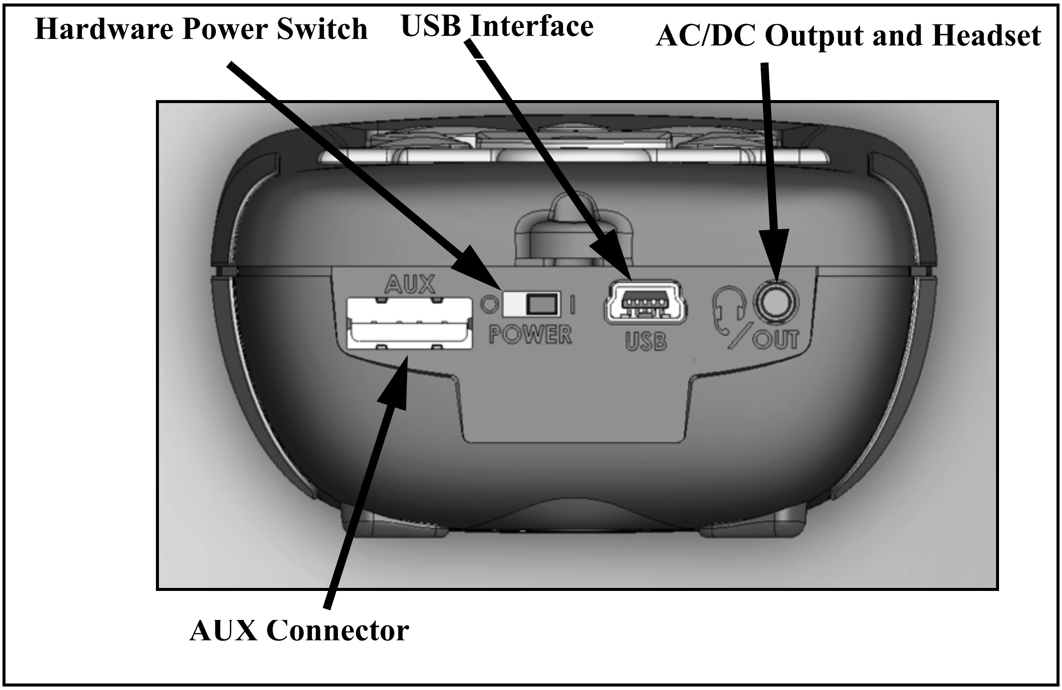


FIGURE 1-4 LxT Bottom View

CHAPTER

2 First Use

This chapter outlines the steps to unpack the LxT and prepare it for first use. The following topics are covered:

- **Unpacking and Inspection**
- **Connecting the microphone and preamplifier**
- **Installing 4 AA batteries**
- **Using USB power**

You will then be ready to use the LxT for actual measurements.

Unpacking and Inspection

Your LxT has been shipped in protective packaging. Please verify that the package contains the items listed below. Retain the packaging for safe shipment for calibration service. Report any damage or shortage immediately to Larson Davis, Inc. at 888 258-3222 (U.S. toll free) or (716) 926-8243.

- LxT
- PRMLxT Microphone Preamplifier
- Microphone
- Lanyard
- 4 - AA Alkaline Batteries

- Hex Driver and 4 replacement screws, used to secure the battery door to prevent battery exchange in explosive atmospheres

- User Manual I770.01

Record Serial Numbers of LxT and Components

If you have not already done so, please record the purchase date, the model and serial numbers for your instrument, preamplifier and microphone in the spaces provided on the copyright page "LxT Model: LxT1 LxT2 Serial Number: ___________" on page i-iii. You will find the instrument's Model and Serial numbers printed on the label on the instrument's back panel. The microphone's model and serial numbers are engraved on the outside of the microphone as shown in FIGURE 2-1 "Microphone" . The preamplifier's model and serial numbers are engraved on the outside surface of the preamplifier. You may be asked to provide this information during any future communications with Larson Davis, Inc.

FIGURE 2-1 Microphone

Connecting the Microphone and Preamplifier

The bottom end of the microphone attaches to the top end of the preamplifier. The top end of the preamplifier has a single gold pin and threads on the preamplifier body. The model and serial number of the microphone are engraved on the side.

FIGURE 2-2 Microphone-Preamplifier

Carefully place the bottom end of the microphone over the top end of the preamplifier and gently screw the assembly together. The microphone body will seat smoothly against the preamplifier body. DO NOT use excessive force.

When removing the microphone, turn while gripping the microphone body, not the grid cap, to prevent damage to the microphone diaphragm.

Connecting the Preamplifier to the LxT

Note: The connectors are keyed for correct alignment.

The bottom end of the preamplifier has a 5 pin connector that fits snugly into the top of the LxT. Insert the preamplifier into the mating connector on the LxT. Rotate the preamplifier until the keyways line up. Press the assemblies together until a small click is heard. The microphone / preamplifier assembly is now securely attached to the LxT.

Caution: Do not attempt to unscrew the collar/ring at the top of the LxT body.

If the LxT is ON when the preamplifier is connected to the LxT, the Preamp Connected message box will appear for several seconds.

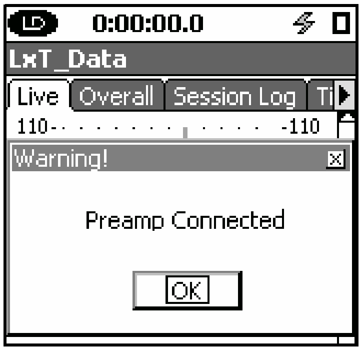


FIGURE 2-3 Preamplifier Connected

Press the ENTER key to clear the message box.

Disconnecting the Preamplifier from the LxT

When transporting the LxT, it is recommended that the preamplifier and microphone be detached and placed in a secure location in the carrying case.

On the front surface of the LxT, just below the preamplifier connector, is a small button. Press and hold this button while pulling the microphone / preamplifier assembly out of the LxT.

FIGURE 2-4 Push Button to Release Preamplifier

If the LxT is switched ON when the preamplifier is disconnected, the Preamp Disconnected message box will appear for several seconds.

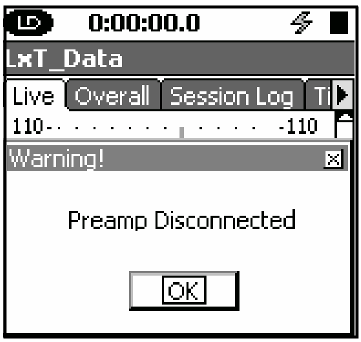


FIGURE 2-5 Disconnect The Preamplifier

Press the ENTER key to clear the message box.

Inserting Alkaline Batteries

Note: There are 2 tabs on the bottom of the battery door that engage the case of the LxT

The LxT is designed for use in areas requiring Intrinsic Safety approval as well as use in safe atmospheres. By the standards, it is required that access to the battery compartment be secured to deter opening in a hazardous atmosphere and batteries cannot be changed in a hazardous atmosphere. A hex screw is provided to secure the battery door in these uses. Extra screws were provided when the unit was shipped.

The battery compartment of the LxT is located on the back of the unit. There is a clip on the battery door and a hex screw holding the door in place.

To remove the battery door, first remove the screw (if installed). Then pull the clip towards the battery door while lifting. The battery door will pivot away from the unit.

FIGURE 2-6 Battery Door

Insert 4 fresh AA alkaline batteries as shown in FIGURE 2-7. Ensure correct alignment of the batteries + and - terminals.

FIGURE 2-7 Insert Batteries

After the batteries are installed, insert the two tabs on the bottom edge of the battery door into the mating slots in the case. Close the battery door, allowing the clip to snap in place on the case. Install the screw that was removed at the beginning of the procedure.

Hardware Power Switch

DO NOT use the hardware power switch to turn the LxT OFF. This may cause data to be lost. Press the ⏻ key, then the Off soft key to turn the LxT off.

The Hardware Power Switch on the bottom of the LxT, as shown in FIGURE 1-4 "The LxT Bottom View” on page 1-14 and FIGURE 15-3 "LxT Bottom Panel” on page 15-5, disconnects the batteries from the LxT hardware, including the real time clock. This prevents battery drain when the LxT is not in use for an extended period of time (≥ 2 weeks). If the Hardware Power Switch is in the "O" position, the batteries are disconnected.

After installing batteries be sure to move the switch to the "|" position. This applies power to all of the LxT hardware.

The Hardware Power Switch should not be used to turn the LxT ON and OFF. If the Hardware Power Switch is used to turn the LxT off, data may be lost.

See also "Switching On the LxT" on page 3-1

Using USB Power

The LxT cannot be operated under USB power if the internal batteries are discharged (flat) for reasons described in this section.

The LxT can be powered from batteries or, if available, from the USB host portion of your computer. It can also be powered externally using the PSA029 power supply, as described in the section "External Power Supply" on page 15-7.

When batteries are installed, USB power is negotiated with the host and cannot be utilized until permission is granted by the host. This means that the LxT must run on batteries until allowed to run on USB power by the host.

If there are no batteries installed in the LxT, USB power will be utilized without host permission.

Thus, make sure that the batteries can provide sufficient power for the LxT to turn On. Otherwise, remove the batteries and turn on the LxT using USB power.

CHAPTER

3 Overview

Display and Softkeys

When the LxT is first switched on, the Data Display Screen will appear. When a measurement is in progress, it will look similar to FIGURE 3-1 "Data Display Screen".

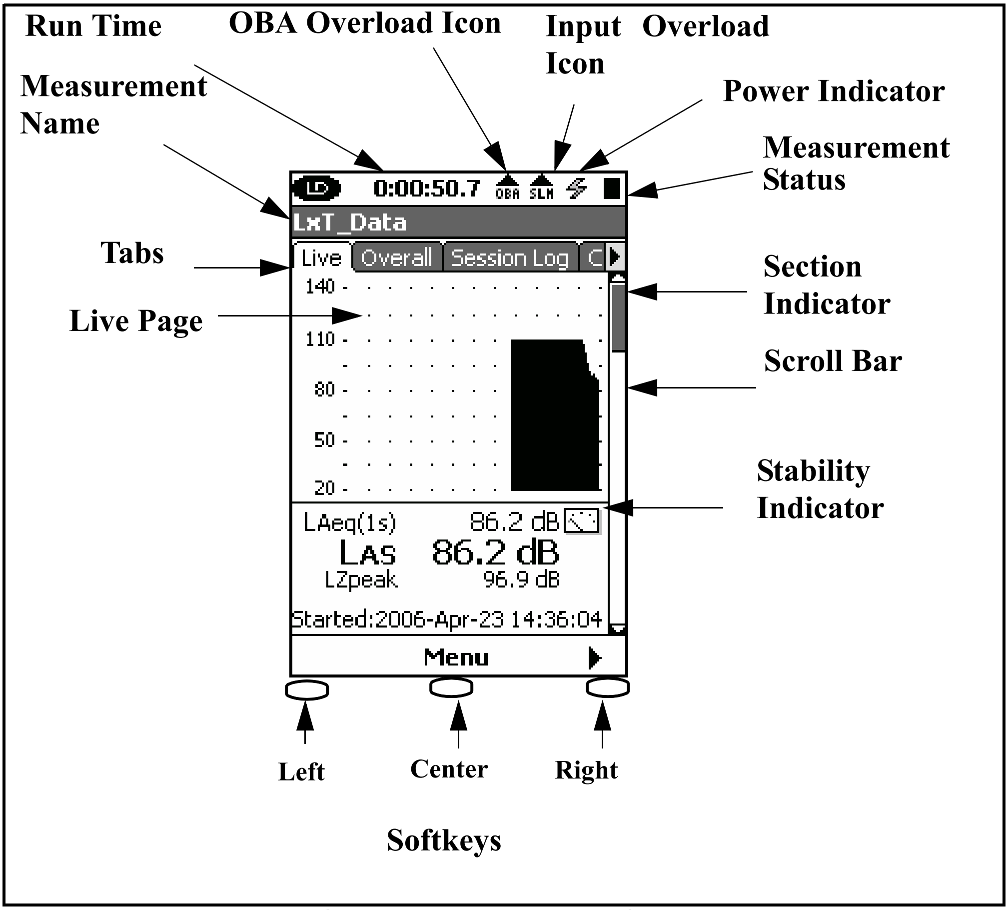


FIGURE 3-1 Data Display Screen

Display Sections and Icons

Screens

A Screen comprises everything which can be seen on the display at one time. There are four different screens available with the LxT, which are described in more detail in the section "Screens" on page 3-12.

Tabs

The tabs indicate the active page as well as any other possible pages available in this view.

Page

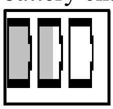
This is the main body of the screen. The page contains the data to be viewed. There may be more than 1 section for a page. This is indicated on the scroll bar.

Scroll Bar and Section Indicator

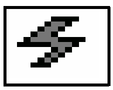
The scroll bar represents the complete page. The section indicator shows the location on the page you are viewing.

Power Indicator

One of the three possible images indicating the state of the battery charge.



or the external power connection icon



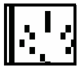
will be displayed. to indicate that the batteries or power supply are providing sufficient power to operate the meter within specifications.

Measurement Name

This is the file name to be used for the data file.

Stability Indicator

For certain measurement modes and for calibration, an indication of the stability of the measured signal is presented in the following icon.



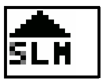
Run Time

This is the amount of time the measurement has been running.

Input Overload Icon

When a signal from the preamplifier exceeds the calibrated input range of the LxT, the Input Overload Icon will appear. While the overload is present, the icon will flash on and off. When the overload is removed, the icon will be removed from the display.

If a measurement is running and an overload occurs, the icon shown below will flash during the overload.



When the overload has been removed, the icon will still be present (not flashing) to indicate that an overload has occurred during the measurement. A reset will clear the icon from the display.

OBA Overload Icon

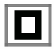
If the input to the Octave Band Analyzer (optional firmware LxT-OBA required) becomes overloaded, the icon shown will appear to indicate the overload.

This icon operates similar to the Input Overload Icon shown in the above section "Input Overload Icon".

When the OBA Range property is set to Low, the OBA Overload Icon will activate at a level 30 dB lower than it would had the OBA Range been set to Normal.

Measurement Status

Reset Icon



The Reset Icon indicates that a reset has occurred.

Run Next Icon

The Run Next icon appears when the (RUN/PAUSE) key is pressed and the LxT is waiting for filters and detector initialization to complete. The LxT will automatically start the run after the wait or warm-up state is completed.

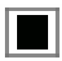
Run Icon

The Run Icon moves from left to right to indicate that a measurement is running.

Pause Icon

The Pause Icon indicates that the present run has been paused.

Stop Icon



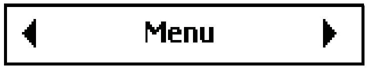
A Stop Icon is displayed when a measurement has been stopped.

Store Icon

When a data file has been stored, the Store Icon is displayed.

Softkeys

Beneath the display, on the body of the LxT, there are three Softkeys as shown at the bottom of FIGURE 3-1 "Data Display Screen". Above each Softkey is a label, which in this case will look as shown below.



The label indicates the action which will take place when the key is pressed. Softkeys are so named because the role of each key can change depending upon the screen being displayed, as indicated by the label.

Changing Views

In the Data Views, the labels of the Left and Right Softkeys are left and right arrow symbols, respectively. These indicate that the Left and Right Softkeys are used to scroll the selection of the tab page being displayed in the corresponding direction. One press of the Right Softkey will bring up the Overall Page, and a second press will bring up the Session Log View. Then, sequential presses of the Left Softkey will bring up the Overall Page, then the Live Page.

Keypad

The LxT has a 13 button keypad. The upper 3 keys are discussed in the section titled "Softkeys" on page 3-5.

ON/OFF Key

Turn On The LxT

The (ON/OFF) key is used to turn the LxT ON and OFF. If the instrument is OFF, pressing this key will turn ON the instrument. There will be a slight delay from pressing the button until a start up screen is displayed.

Turn Off The LxT

See Chapter 3 "Power Control View" on page 3-7

There are three methods to turn off the LxT.

- **Method 1**: Press the (ON/OFF) key to bring the Power Control Page into view. Press the Left Softkey, labeled **Off**, to turn off the LxT.

- **Method 2:** Press and hold the (ON/OFF) key

- **Method 3:** Press the (ON/OFF) key twice

Power Control Page

If the LxT is ON, pressing the (ON/OFF) key will bring up the Power Control screen.

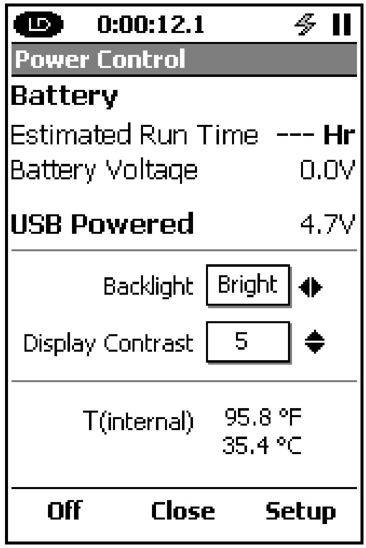


FIGURE 3-2 Power Control View

Located on the first section of this screen is the Estimated Battery Run Time (calculated using the voltage of the installed batteries), Battery Voltage and the USB Power voltage.

Note that the Backlight and Display Contrast can also be adjusted from the Power Page as described in the section "Power" on page 11-5

In the next section of this display, Backlight Mode and Display Contrast are adjusted using the , , and keys. There are 3 choices for Backlight Mode: Off, Dim and Bright which are adjusted using the and keys. The Display Contrast has a range of -9 to 9 which is adjusted using the . and keys

The last section displays the LxT temperature that is used to automatically adjust the contrast of the display to compensate for temperature changes.

Press the Left Softkey, labeled **Off**, to turn off the LxT.

Pressing the Right Softkey, labeled **Setup**, takes you to the System Properties Device Page. See Chapter 11 "System Properties" on page 11-1

The Center Softkey provides an exit, escape or cancel function as well as the function displayed above it on the display.

Pressing the Center Softkey, labeled **Close**, will close this screen and return to the Data View screens.

RESET Key

If desired, the LxT can be set to display a Reset Prompt menu prior to the completion of a reset operation, as described in "Reset Prompting" on page 11-13.

To reset a measurement in progress, press the (RESET) key. This will erase all data previously measured and reset the run time clock to zero. A reset will not reset stored data files.

A reset can be initiated when the LxT is running, paused or stopped. However, it must be stopped for the reset operation to be performed.

Resetting When Running or Paused

If it is running or paused when the (RESET) key is pressed, a Stop Required Menu will be displayed as shown in FIGURE 3-3.

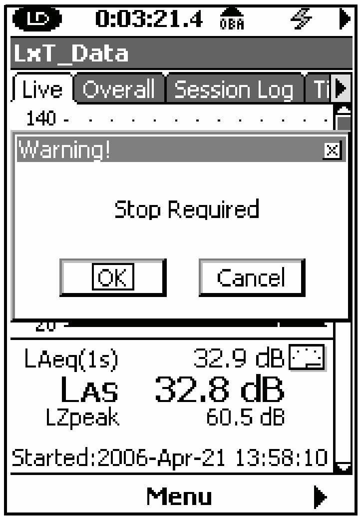


FIGURE 3-3 Stop Required Prompt

The **OK** response will already be highlighted, so simply press the (ENTER) key to continue.

Otherwise, press the key to highlight **Cancel** and then the (ENTER) key to cancel both the Stop and the Reset operations.

After selecting to Stop the measurement, the Save File Menu, shown in FIGURE 7-9 "Save File Menu” on page 7-14, will appear to provide a choice of saving the measured data prior to the reset or not as described in "Storing the Measurement" on page 7-14.

Resetting When Stopped

If the LxT is stopped when the (RESET) key is pressed, the Stop Required Menu will not appear, but the Save File Menu will appear to provide a choice of saving the measured data prior to the reset or not.

After the reset has been performed, the (STOP/STORE) key will produce a steady red light to indicate the measurement state as Stopped, Reset.

Starting a New Measurement

The key (RUN/PAUSE) key must be pressed to start a new measurement.

TOOLS Key

Note that there is one more icon, System Utilities, which does not appear in FIGURE 3-4. It is necessary to scroll down below the Lock and About icons in order to see it.

Pressing the (TOOLS) key will bring you to the Control Panel screen.

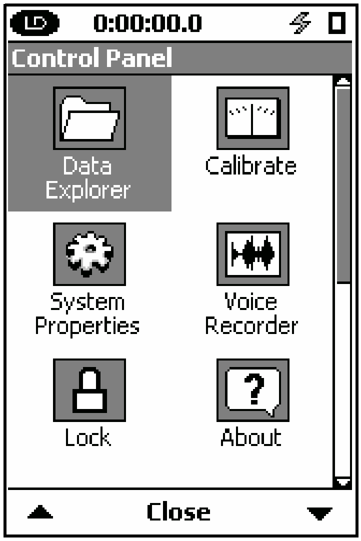


FIGURE 3-4 Control Panel

Table 3-1indicates the chapter in which each of these functions is described.

Function	Chapter Number
Voice Recorder	8
Data Explorer	10
System Properties	11
Lock	12
Calibrate	13
About	14
System Utilities	15

Table 3-1 Chapters Describing Functions From the Control Panel

The Left and Right Softkeys and the , , and keys allow selection of the desired function. To activate the desired function, press the ENTER key. Pressing the Center Softkey labeled **Close** will return to the Data View.

LEFT and RIGHT Keys

The and keys are used for moving horizontally on a screen. This includes moving the highlight from one property to the next.

UP and DOWN Keys

The and keys are used for moving vertically on a screen. This includes moving the highlight from one property to the next and to move to a previous or next data page section.

These keys are also used for character entry by scrolling through a list of characters in a text box.

ENTER Key

The ENTER key is typically used for completing an action or accepting a value.

RUN/PAUSE Key

The (RUN/PAUSE) key will initiate a run. If a measurement is running, this key will pause the run. It will not end the run; the (STOP/STORE) key is used for that. Pressing the (RUN/PAUSE) key, when the unit is PAUSED, will continue the run. This key is only active on a Data View screen.

STOP/STORE Key

Note: Pressing the (RUN/PAUSE) key when the unit is in STOP mode, will continue the previous run.

The (STOP/STORE) key will end a run. Pressing the key a second time will store the data in a file. This key is only active on a Data View screen.

Screens

There are four different screens available on the LxT:

- **Data Display Screen:** used to display measured data.
- **Measurement Properties Screen:** used to set the parameters for a measurement.
- **Tools Screen:** used to set non-measurement related parameters and to implement calibration.
- **Power Control Screen:** used to check battery power, control the contrast and backlight of the display and other features.

The diagram shown in FIGURE 3-5 "Main View Block Diagram" illustrates the manner in which the user can move between these four screens.

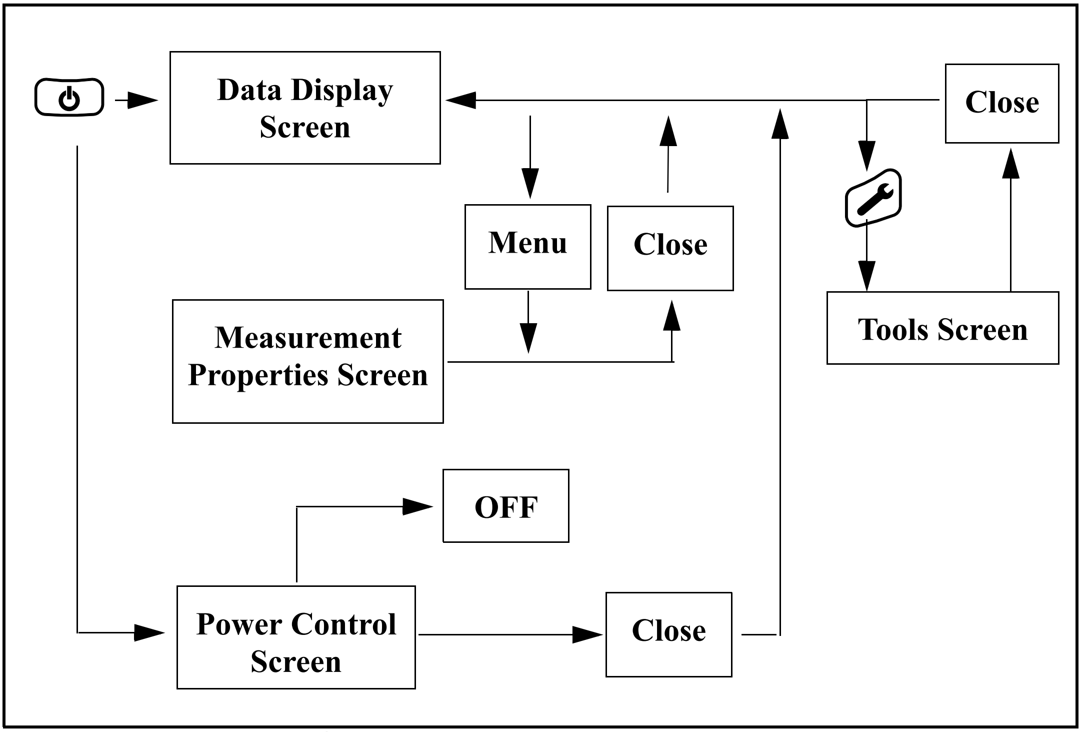


FIGURE 3-5 Main View Block Diagram

Data Display Screen

When the (ON/OFF) key is pressed to switch ON the LxT, the Data Display Screen appears.

Measurement Properties Screen

From the Data Display Screen, pressing the Center Softkey, labeled **Menu**, will bring up the Measurement Properties Screen.

When in the Measurement Properties Screen, pressing the Center Softkey, now labeled **Close**, will bring back the Data Display Screen.

Tools Screen

The Tools Screen is accessed by pressing the (TOOLS) key at the lower right of the LxT front panel. To exit from the Tools Screen and return to the Data Display Screen, press the Center Softkey, now labeled **Close.**

Power Control Screen

The Power Control Screen is opened by pressing the (ON / OFF) key while in a Data View screen. To exit from the Power Control screen, press the Center Softkey, labeled **Close**.

Data Display Screen

For a more detailed description of the Data Display Screen and its associated Views, see Chapter 5 "Basic Data Display" on page 5-1.

There are four Data Views in the Data Display Screen, identified by their titles on the tabs at the top of the screen as follows:

- **Live:** Data is continuously displayed in this view whether there is a measurement in progress or not.
- **Overall:** The data displayed in this view represents data measured and averaged beginning from the time the measurement was started by pressing the Run key until the elapsed time indicated above the display. If the Pause or Stop key is pressed, the elapsed time will be stopped. However, pressing the Run key again will continue this overall measurement as shown by the elapsed time restarting from the time when it had previously been paused or stopped.
- **Session Log:** The Session Log is a record of data accumulation actions. A time-stamped record is made for every Run, Pause, Stop or Voice Message action.
- **Time History (optional):** This view displays data measured using the time history measurement feature.

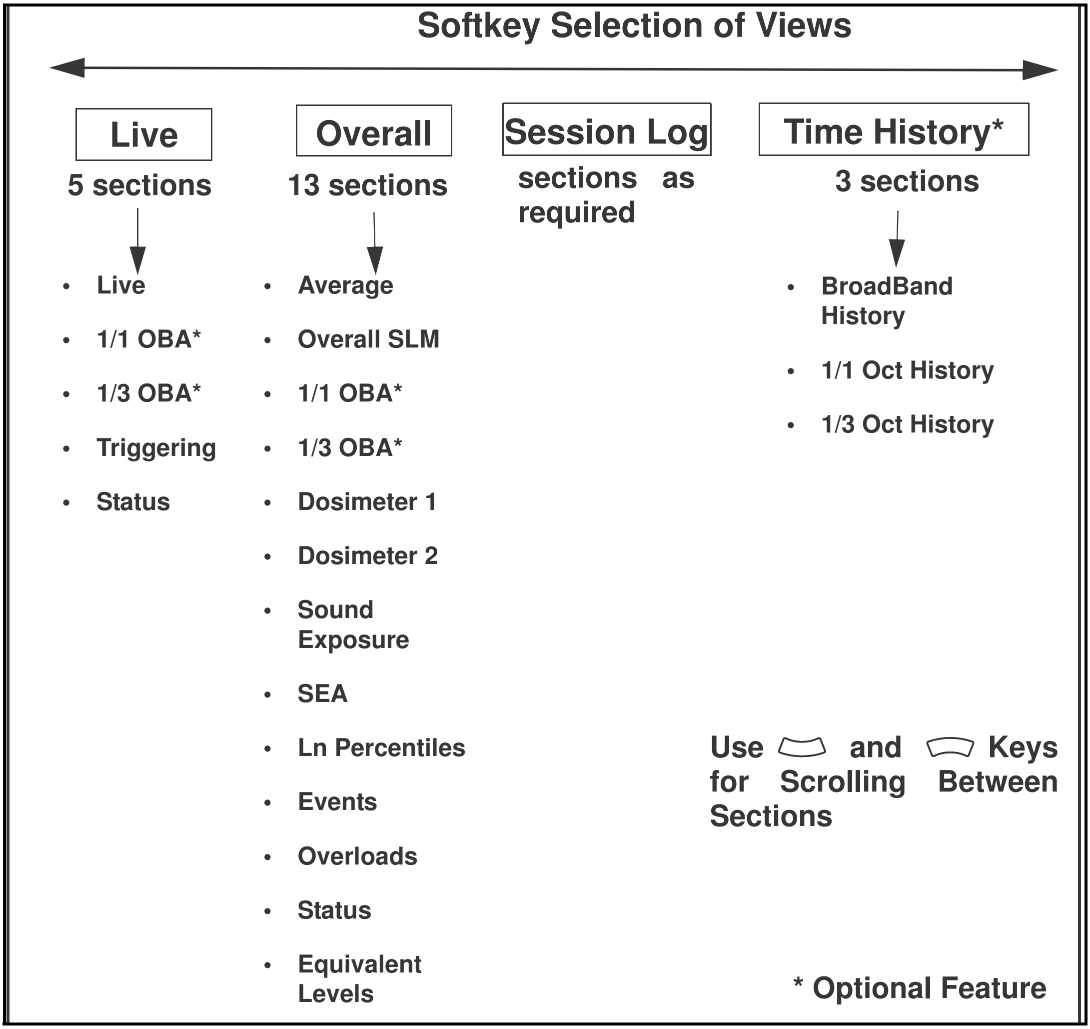


FIGURE 3-6 Data Display Screens

Changing Data Pages

To switch between tab pages, use the Left and Right Softkeys.

Scrolling Between Sections

To display different sections Data Views, use the and keys.

Measurement Properties Screen

Note that the screen is not wide enough to show the tabs for all thirteen setup pages at the same time. Use the Right and Left Softkeys to scroll the view to the right or left respectively.

For a more detailed description of the Measurement Properties Screen and its associated pages, see Chapter 4 "Basic Measurement Setup" on page 4-1.

There are ten Measurement Property Pages in the Measurement Properties Screen, identified by their titles on the tabs at the top of the page as follows:

- **General:** used to create a file name and a measurement description.
- **SLM:** used to setup the parameters for the measurement of sound levels.
- **Dosimeter 1:** used to setup the parameters for the measurement of sound exposure and noise dose.
- **Dosimeter 2:** used to setup the parameters for the measurement of sound exposure and noise dose.
- **Ln:** used to define the parameters for the measurement of Ln statistics.
- **OBA (optional):** used to setup the real-time octave band frequency analysis.
- **Control:** use to setup the mode of measurement timing.
- **Time History (optional):** Permits the automatic logging of up to xxx parameters as a function of time.
- **Triggers:** used to setup the triggers which define noise exceedance events.
- **Markers (optional):** Use in conjunction with time history measurements, this feature permits the user to annotate portions of a time history record to identify noise sources or make other notes.

.

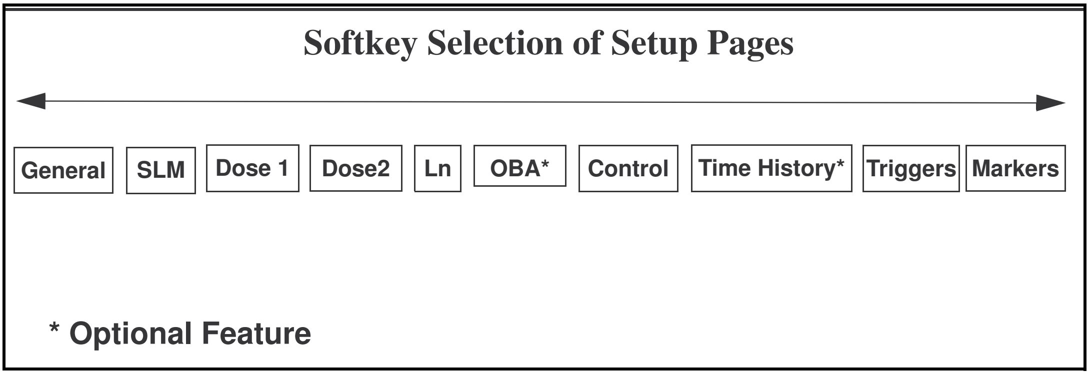


FIGURE 3-7 Measurement Properties Screen

Changing Setup Pages

As indicated in the diagram, to switch between setup pages, use the Left and Right Softkeys. Since each page has only one section, vertical scrolling is not required.

Tools Screen

For a detailed description of the Tools Screen, see "Control Panel - System Properties" on page 11-1.

The Tools Screen uses icons to represent the different functions available, as shown in FIGURE 3-8 "Tools Screen".

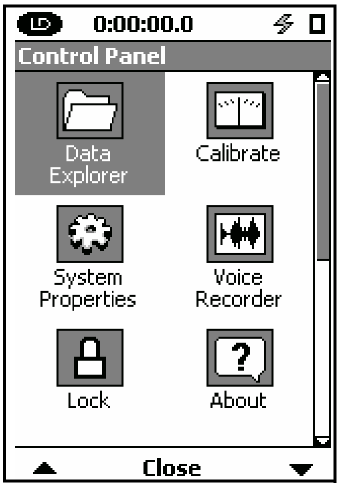


FIGURE 3-8 Tools Screen

Selection of an item is done by highlighting the icon representing the desired function, and pressing the ENTER key.

To highlight a particular icon, the Left and Right Softkeys and the , , and keys are used as indicated by the arrows in FIGURE 3-9 "Highlighting a Tools Icon".

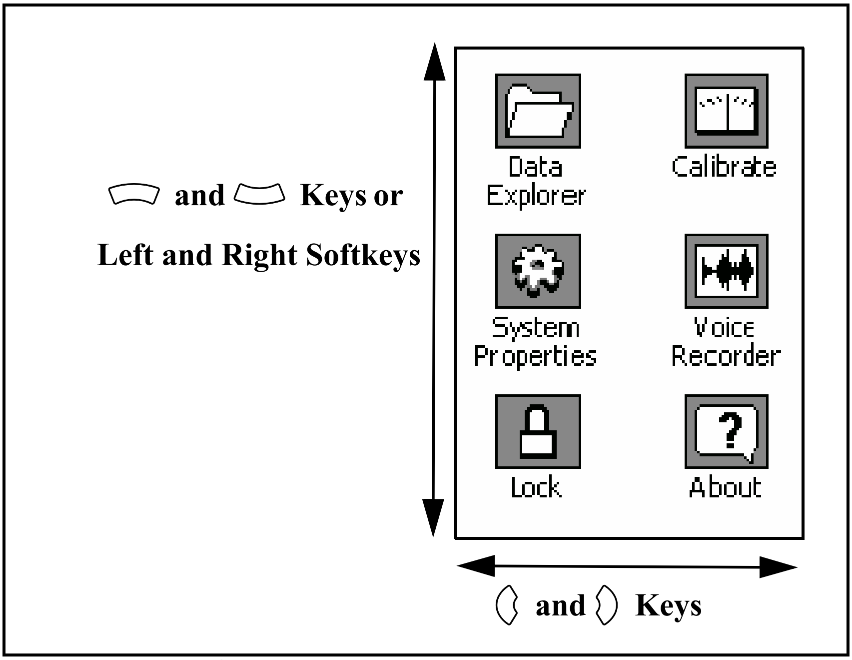


FIGURE 3-9 Highlighting a Tools Icon

Data Explorer

For a detailed description of the Data Explorer, see Chapter 10 "Data Explorer" on page 10-1.

The Data Explorer is used to examine data which had been stored following previous measurements. It is also used to manage stored measurements such as rename or delete files.

System Properties

For a detailed description of the System Properties Pages, see Chapter 11 "System Properties" on page 11-1.

System Property Pages are used for general instrument bookkeeping. Functions such as setting the instrument date and time, display contrast adjustment, date format, etc. are located here. These are single section pages.

There are four System Property Pages:

- **Device:** instrument identification is entered here.
- **Time:** the date and time are set on this page.
- **Power:** controls that affect power consumption are located here.
- **Preferences:** regional characteristics are configured here
- **Displays:** set displays to appear or be hidden

.

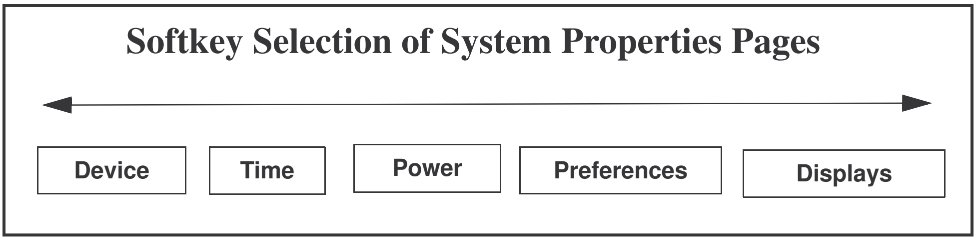


FIGURE 3-10 System Property Pages

The Right and Left Softkeys are used to scroll between System Property Pages.

Lock

For a detailed description of the Lock feature, see Chapter 12 "Lock/ Unlock the LxT" on page 12-1.

Lock permits the LxT to be configured such that certain keys are locked so their functionality cannot be utilized.

Calibrate

For a detailed description of the calibration procedure, see Chapter 13 "Calibration" on page 13-1.

Calibrate is used to verify and adjust the calibration of the LxT prior to a measurement.

Voice Recorder

For a detailed description of the voice recording feature, see Chapter 8 "Voice Recording" on page 8-1.

A method to allow voice annotation of the data is described in Chapter 8 "Voice Recording" on page 8-1.

About

For a detailed description of the About Pages, see Chapter 14 "About" on page 14-1.

The About Pages provide the user with information specific to this instrument such as serial number, options, etc. These are single section pages.

There are four About Pages:

- **About:** shows information such as serial number and firmware revision.
- **Standards:** lists the standards that the LxT meets
- **Options:** shows the options that are available in this instrument.
- **User:** user entered instrument identification.

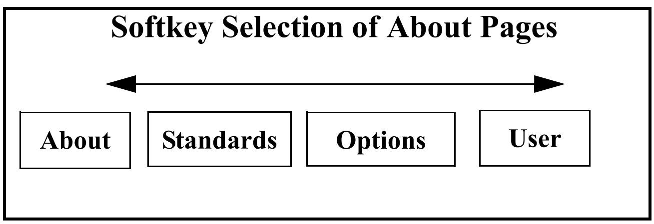


FIGURE 3-11 Softkey Selection of About Pages

The Right and Left Softkeys are used to scroll between the About Pages.

CHAPTER

4 Basic Measurement Setup

This chapter describes the setup of the LxT to perform basic sound level measurements. These measurements may include the following:

- **Leq, Lmax, Lmin corresponding to user-selected values of frequency weighting and detector**
- **Lpeak and Lpeak(max) corresponding to a user-selected value of frequency weighting.**
- **1/1 and/or 1/3 Octave real-time spectra (LxT-OB3 required)**
- **Six values of Ln based on six user-selected values of the parameter n.**
- **Count of the number of times the levels (RMS and Peak) exceeded user-selected threshold values.**
- **Sound exposure and sound exposure level data.**

The LxT can measure many additional sound parameters simultaneously with these basic sound measurements as described in subsequent chapters.

Measurement Properties Screen

Accessing the Measurement Properties Screen

The parameters defining a measurement are set from the Measurement Properties Screen.

This screen can only be accessed from the Data Views. Press the Center Softkey labeled **Menu,** press the key to highlight **Settings,** and press the key. The Measurement Properties Screen will now be displayed with the page selected that is most appropriate for the data display from which it was activated.

Settings In Use Message

If the LxT is not already connected to a computer running Blaze or LxT Utility software, ignore this section.

If the Blaze or LxT Utility software is already connected to the LxT when an attempt is made to access the Measurement Properties Screen, the display shown in FIGURE 4-1 "Settings In Use By LxT Utility Message" will appear.

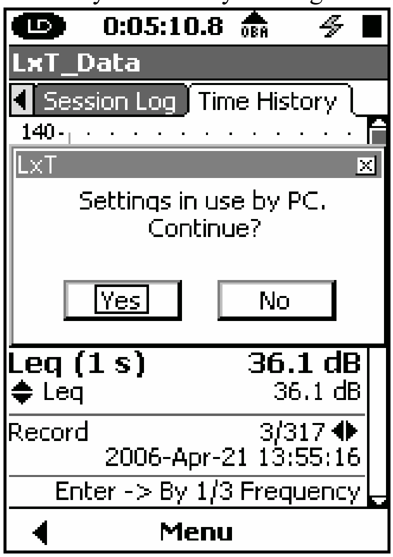


FIGURE 4-1 Settings In Use By LxT Utility Message

This warns the user that accessing the Measurement Properties Screen will cause setup changes which had been made using the LxT Utility during this session to be lost.

To continue and access the Measurement Properties Screen, highlight **Yes** and press the ENTER key. To cancel the attempt to access the Measurement Properties Screen, highlight **No** and press the ENTER key.

Setup Pages

Only a few of these horizontally arranged tab pages (three in Figure 4-2) can be seen at one time. To see those off-screen to the right use the Right Softkey beneath the display. To scroll back to the left, use the Left Softkey beneath the display.

Depending on the firmware options loaded in the LxT, there may be as many as ten different setup pages in the Measurement Properties Screen, each identified by a title on a tab at the top as shown in Figure 4-2.

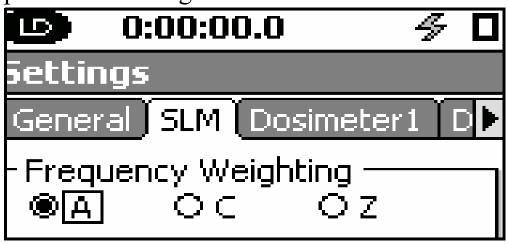


FIGURE 4-2 Tabbed Setup Pages

For basic measurements, we will only be concerned with the following pages:

- **General**
- **SLM**
- **Dosimeter 1**
- **Dosimeter 2**
- **Ln**
- **OBA**
- **Control**
- **Triggers**

The Right and Left Softkeys are used to scroll through the available pages, to the right and left, respectively, in the order they are listed above.

Each of these is described in detail in the sections which follow.

General Page

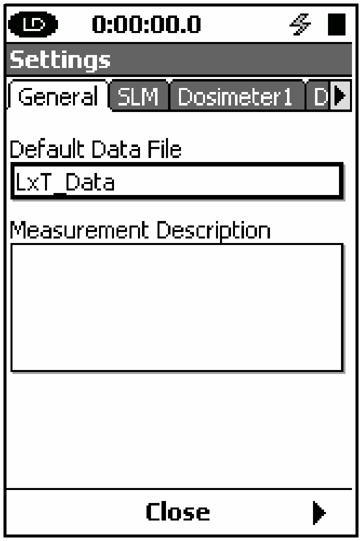


FIGURE 4-3 General Page

Note: The LxT Utility Software can be used to easily enter both the file name and the measurement description.

The General Page is used to enter a file name and a measurement description for the measurement being defined. Upon opening, the Default File Name “LxT_Data” may appear in the file name field.

To enter a new file name, highlight the Default File Name text box and press the ENTER key. Use the , . and keys to enter a new name. The ENTER key is pressed to complete the entry process.

SLM Page

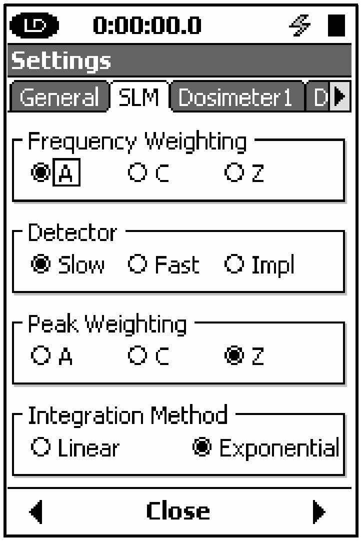


FIGURE 4-4 SLM Page

Selections of Frequency Weighting, Detector, Peak Weighting and Integration Method are made one-at-a-time, using the and keys to move the highlight to the desired section prior to making the selection.

Use the and keys to highlight the appropriate item for the selected parameters. Press the ENTER key to make the selection.

Frequency Weighting

A, C and Z frequency weightings are provided for the RMS and peak detectors. These are selected separately.

Time Weighting

Available time weightings for the RMS detector are: Slow, Fast and Impulse.

Integration

Note that the LxT can be set to run for a preset integration time as described in "Timed Stop Mode" on page 6-4

Two Integration methods are available: Linear and Exponential.

Exponential Integration

Exponential integration would typically be selected to provide compatibility with older analog instruments in which all measurements involve exponential time weighting of signals. Exponential detectors have a tendency to hide small events in the long decay of a loud impulsive event.

Linear Integration

Linear integration integrates only energy that occurs during a given time period and therefore does not exhibit the decay slope of a Fast, Slow or Impulse exponential detector.

The value of the integrated level is displayed immediately following the end of the integration time.

For long duration measurements both integration methods report the same value in that they both have equivalent “energy under the curve”, although short term metrics may vary.

Dosimeter 1 and 2 Pages

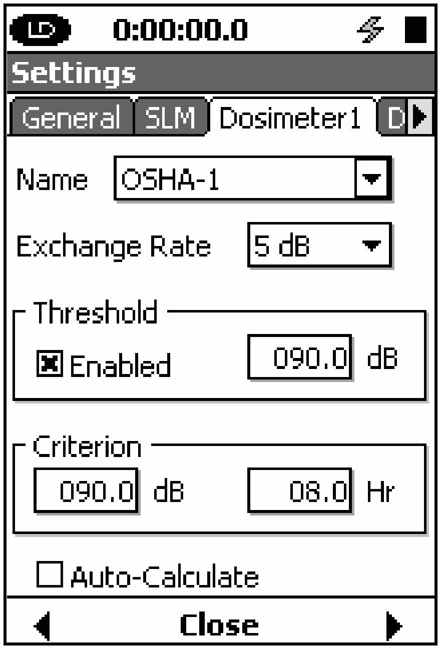


FIGURE 4-5 Dosimeter 1

The Dosimeter 1 and Dosimeter 2 Pages are provided to permit the evaluation of two independent noise dose data sets. Other than being on separate pages, they are identical.

Predefined Setups

In most cases, measurements of this type are setup to conform to a specific standard. The LxT permits the user to create such a setup in a single step by simply selecting the applicable standard. The standards addressed by the LxT and the corresponding parameters are as shown in Table 4-1 "Predefined Noise Dosimeter Setups".

Standard	Exchange Rate	Threshold	Criterion	
			Level	**Hours**
OSHA-1	5	90	90	8
OSHA-2	5	80	90	8
ACGIH	3	80	85	8
NIOSH	3	80	85	8
IEC	3	Not Enabled	85	8

Table 4-1 Predefined Noise Dosimeter Setups

The Name field will already be highlighted when the Dosimeter View is opened. If this has been changed, use the key to move the highlight back to the Name field.

The names of the predefined setups can be accessed from the Name field at the top of the display. Press the ENTER key to drop down a list of predefined setups by name as shown in FIGURE 4-6 "Predefined Dose Setups" .

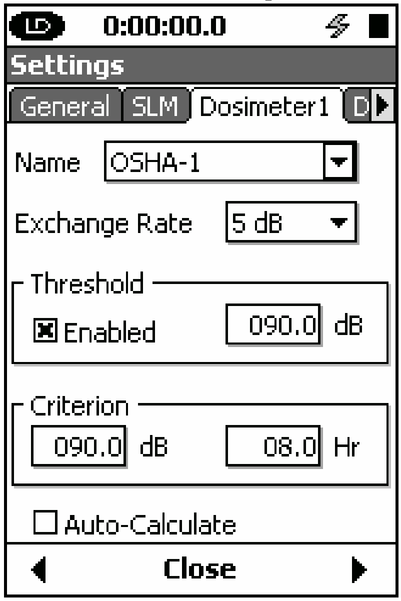


FIGURE 4-6 Predefined Dose Setups

Use the and keys to highlight the name of the desired setup and press the key to make the selection. The name of this setup will now appear in the Name field and all parameters will be set according to the setup selected, as shown in FIGURE 4-7 "IEC" .

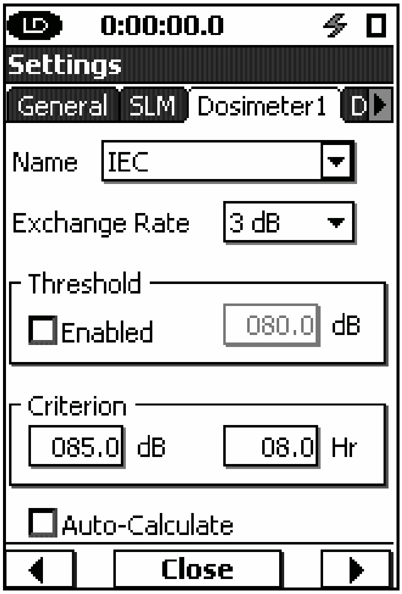


FIGURE 4-7 IEC

Parameters Individually Defined

In the Dosimeter Page there are two fields (Name and Exchange Rate) and two sections (Threshold and Criterion).

Name Field

If a predefined setup has been selected and any of the preset parameters are modified, the user should consider changing the name of the setup.

The Name field is optional, although many users will enter text associated with the measurement to be performed such as a specific company Dose standard ("My Dose") or the name of a standard not in the list. To enter a name, use the and keys to highlight the Name field. Use the key to highlight the name portion of the highlighted box. Then press the ENTER key. Use the , , and keys to enter the desired characters. Press the ENTER key to complete your entry.

Parameter Fields

The titles of the second field (Exchange Rate) and the two sections at the lower portion of the display (Threshold and Criterion) correspond to the three parameters we wish to set. Within each is a numeric field into which the user can enter the value desired. Use the and keys to highlight the desired section and proceed as described below.

Exchange Rate

To set the exchange rate, highlight the data field and press the ENTER key to open a drop down list of values, as shown in FIGURE 4-8 "Exchange Rate List" .

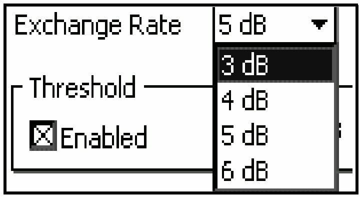


FIGURE 4-8 Exchange Rate List

Use the and keys to highlight the desired value and press the ENTER key to make the selection.

Threshold and Criterion

Note that when setting the Threshold value, the Enabled check box must be checked before data can be entered into the numeric field. Use the Left Softkey to highlight the box and press the ENTER key.

To set these parameters, after highlighting the appropriate section, press the ENTER key, use the , , and keys to enter the numeric value desired, then press the ENTER key.

Auto-Calculate

As described above, the Criterion Level and Time are set independently. However, in the standards there is a linear relationship between the Criterion Level and the Time. When Auto-Calculate is activated, by checking the check box to the left, then only one of these need be entered and the other will be automatically set to follow the standard.

Ln Page

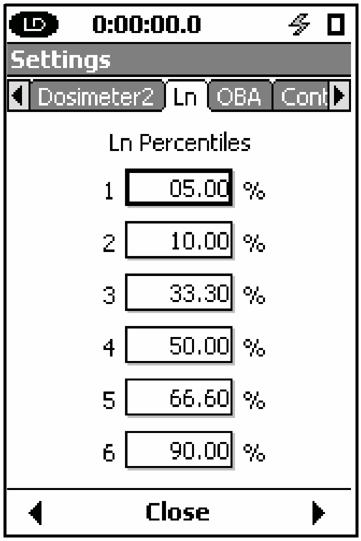


FIGURE 4-9 Ln Page

The Ln value is the measured sound level which was exceeded n% of the measurement time. For example, a value of L_{90} = 35 dB means that the measured sound level was above 35 dB for 90% of the measurement period. These statistical values are commonly used to describe the characteristics of non-steady sound such as environmental noise.

The LxT can calculate six different Ln values based on user-defined values of n, which can be in the range 00.01 to 99.99%.

Using the and keys, select the desired Ln percentage to change. Press the ENTER key. Use the , , and keys to adjust the value to the desired Ln percentile. Press the ENTER key to accept this new value. Use the same procedure to modify other values as needed.

Octave Band Analyzer Page (Optional)

This page will only appear when the LxT has the optional LxT-OB1 or LxT-OB3 firmware enabled.

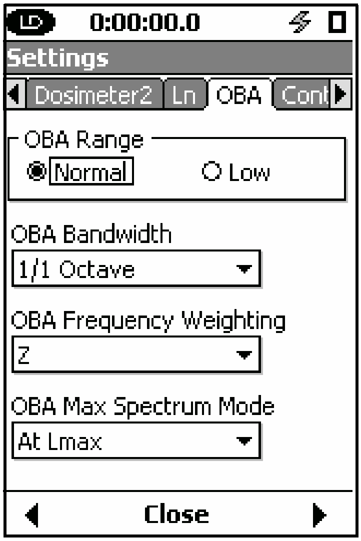


FIGURE 4-10 OBA Page

OBA Range Setting

Use the Left and Right Softkeys to select Normal or Low range and press the ENTER key to accept the selection. In the Low range, the gain is increased by 30 dB to provide a stronger electrical signal for the measurement of low level sounds.

OBA Bandwidth Setting

When the LxT-OB1 firmware is enabled, the only choice will be to set the 1/1 octave On or Off.

When the LxT-OB3 firmware is enabled, the user can select to perform 1/1 Octave analysis, 1/3 Octave analysis, both 1/1 and 1/3 Octave analysis simultaneously or None.

Use the arrow key to highlight the OBA Octave data field and press the key to open the OBA Bandwidth Menu.

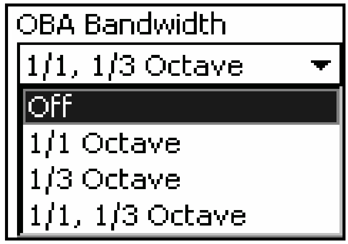


FIGURE 4-11 OBA Bandwidth Menu

Turning off the frequency analysis will reduce the battery drain.

Left click on the desired frequency bandwidth to make a selection. Select **Off** to have no real-time analysis module active.

OBA Frequency Weighting

The user can select to frequency weight the 1/1 and/or 1/3 Octave frequency analysis modules using A, C or Z weighting.

Use the arrow key to highlight the OBA Frequency Weighting data field and press the key to open the OBA Frequency Weighting Menu.

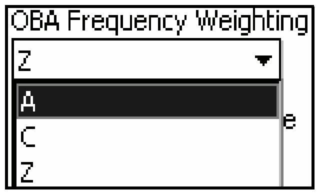


FIGURE 4-12 OBA Frequency Weighting Menu

Use the and keys to move the highlight to the desired section and press the key to make a selection

OBA Max Spectrum Mode

Note that the Max Spectrum data does not appear when making a basic sound level measurement. It is only included here for completeness. For more information on this feature, see "1/1 and 1/3 Octave Spectra" on page 9-2.

When using the Measurement History feature, the user can select one of the following forms of the Max Spectrum to be measured and stored.

At Lmax Mode

When the "At Lmax" mode has been selected, the Max spectrum which is stored is the spectrum which was measured at the instant that the overall sound pressure level reached its maximum

Bin Max Mode

When the "Bin Max" mode has been selected, each frequency band represents the largest value which occurred during the measurement interval. Since the maximum levels for the frequency bands may have occurred at different times during the measurement, this may not be a spectrum which actually existed.

Use the key to highlight the OBA Max Spectrum Mode data field and press the key to open the OBA Max Spectrum Mode Menu.

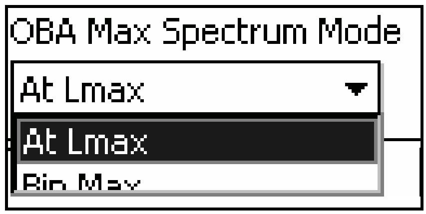


FIGURE 4-13 OBA Max Spectrum Mode Menu

Use the and keys to move the highlight to the desired section and press the key to make a selection

OBA Time Averaging

The time averaging used for the 1/1 and 1/3 octave frequency analysis depends upon the integration method selected for the sound level meter function, described in "Integration" on page 4-6.

Exponential SLM Integration

When using exponential integration for the sound level meter, all 1/1 and 1/3 octave spectrum values are based on the same exponential time weighting, Slow or Fast, selected for the sound level measurement.

Linear Integration

When using linear integration for the sound level meter, the Leq value is determined digitally; there is no exponential averaging. However, the Lmax and Lmin values are determined using the same exponential weighting, Slow or Fast, selected for the sound level measurement.

Control Page

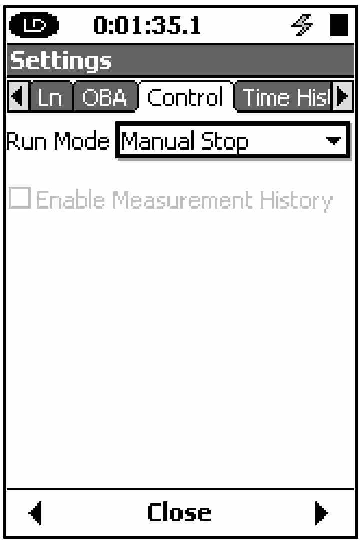


FIGURE 4-14 Control Page

A detailed description of the Run Mode is presented in Chapter 6 "Run Control" on page 6-1.

The Control Page is used to set the Run Mode for the measurement to be performed. There are six modes of measurement duration available. In this chapter we will address only the first three.

- **Manual Stop:** The measurement is initiated manually by pressing the (Run/Pause) key and it is paused upon pressing the (Run/Pause) key a second time.

- **Timed Stop:** The measurement is initiated manually by pressing the (Run/Pause key and will be stopped automatically after a user-defined time period.

- **Run Until Level Stable:** The measurement is initiated manually by pressing the (Run/Pause) key. The measurement will stop when the measured level has remained within a user-defined range and the measurement has run for a user-defined time period.

Left click the down arrow in the Run Mode data field to open the Run Mode Menu.

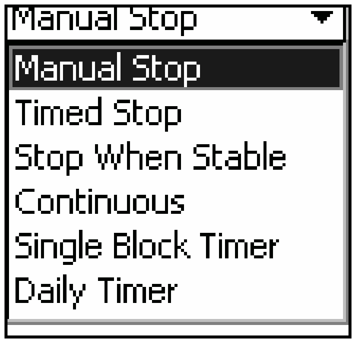


FIGURE 4-15 Run Mode Menu

To set the mode, use the and keys to highlight the mode desired and press the ENTER key to make the selection. The screen will then look as shown in Figure 4-16, Figure 4-17 or Figure 4-19, depending upon the mode selected. For the "Timed Stop" and "Stop When Stable" modes, further information must be entered.

Manual Stop Mode

.

FIGURE 4-16 Manual Run Mode

The run mode is indicated as “Manual Stop”; no further information is required.

Timed Stop Mode

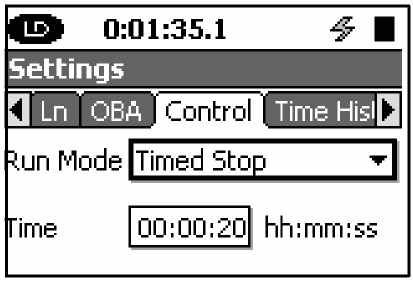


FIGURE 4-17 Timed Stop Run Mode

The run mode is indicated as “Timed Stop”. Timed Stop has only 1 parameter, time.

The measurement will run for the duration specified, after which it will be stopped. The range of time values which can be entered is 00:00:01 to 99:59:59 in the format hh:mm:ss.

Entering Run Time

To enter the Run Time, use the and keys to highlight the Time data field and press the ENTER key. This will produce a cursor which can be moved left and right to different digit positions in the data field using the and keys, as shown in Figure 4-18.

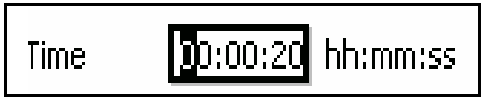


FIGURE 4-18 Entering Time in Timed Stop Run Mode

At any digit position, use the and keys to adjust the value over the range 0 to 9. When the desired value of time has been entered, press the ENTER key to conclude the process.

Stop When Stable Mode

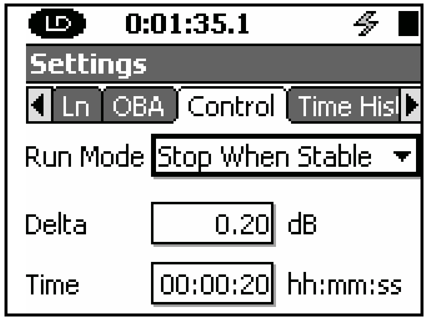


FIGURE 4-19 Stop When Stable Run Mode

The run mode is indicated as "Stop When Stable". Data fields are provided to define Delta and Time.

Entering Delta Level

The Delta level is the maximum one minute change in overall average level (i.e. L_{Aeq}) allowed for the measurement to be considered stable.

Entering Time

The Time is the duration that the measurement must run before the measurement can stop.

If the time were set to 0, the measurement would run until the stability condition was met.

If a duration is set, the measurement would run for the duration specified and then continue until the stability condition was met.

For each, use the and keys to highlight the desired data field and press the ENTER key. Use the and keys to position the cursor and the and keys to set the digit for that position. When the desired value has been entered, press the ENTER key.

Triggers Page

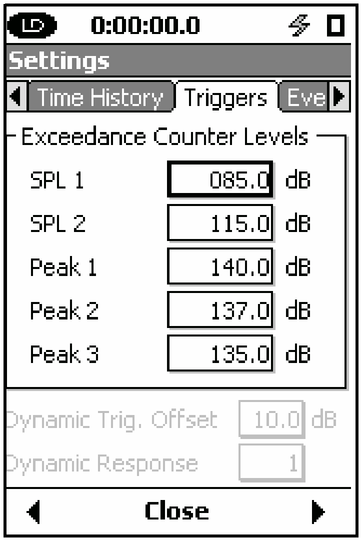


FIGURE 4-20 Triggers Page

The Triggers Page is used to define threshold levels associated with exceedance events; instances where the measured sound level exceeds the user-defined threshold as shown in FIGURE 4-21 "Exceedance Event Example" .

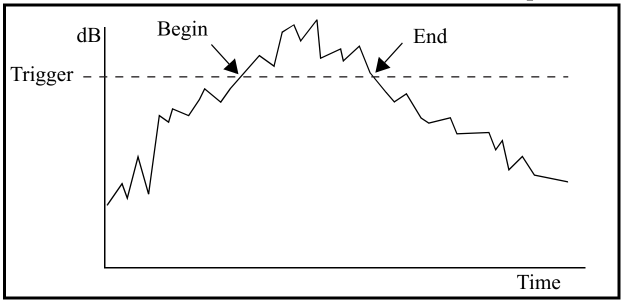


FIGURE 4-21 Exceedance Event Example

RMS Trigger Levels

There are two threshold levels, SPL Trigger Levels 1 and 2 which can be set to initiate an exceedance event when the measured RMS level (Slow, Fast or Impulse) exceeds either of these thresholds.

Exiting Measurement Property Screens

To exit the Measurement Properties Screen, press the Center Softkey labeled **Close**.

If any setup parameters have been changed, the “Apply Changes” message box will be displayed as shown in FIGURE 4-22 "Apply Changes" .

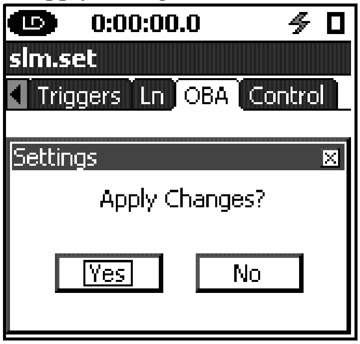


FIGURE 4-22 Apply Changes

At this point the parameter changes made from the Measurement Properties Screen have not yet been implemented in the instrument. Use the and keys to select either **Yes** or **No**, and press the ENTER key to implement the changes or cancel the changes, respectively. This will return the Data Display Screen to the display.

CHAPTER

5

Basic Data Display

In the previous chapter, the setup procedure for a basic sound level measurement was described. This chapter describes how this data would be displayed during or following a measurement sequence.

The LxT can measure many additional sound parameters simultaneously with these basic sound measurements as described in subsequent chapters.

Data Labels

The labels for sound metrics in the LxT are designated by international standards. For many displayed values, the frequency and time weighting are indicate in the name of the metric. Example: L_{AS} is the A-weighted sound pressure level measured using the Slow detector. Sound pressure level is often referred to as SPL.

Tabbed Page Structure

Only a few of these horizontally arranged tab pages (three in Figure 5-1) can be seen at one time. To see those off-screen to the right use the Right Softkey beneath the display. To scroll back to the left, use the Left Softkey beneath the display.

Measured data are displayed using a number of tabbed pages arranged horizontally across the screen, as shown in Figure 5-1. Depending on the firmware options loaded in the LxT, there may be as many as seven different data display pages in the Data Display Screen, each identified by a title on a tab at the top.

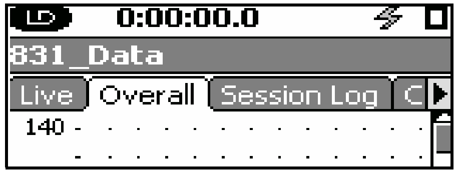


FIGURE 5-1 Tabbed Page Structure

Live Page

When the LxT is turned ON, the user is presented with the Live Page. The measurements displayed on the Live Page are always active, real-time measurements. The displayed values are not controlled by the (RUN/ PAUSE) key. This allows you to view the current SPL without disrupting any overall data. For example, suppose you are making a measurement and an unwanted event takes place, causing you to stop the measurement. With the measurement stopped, you can monitor the actual level on the Live Page to be certain that the residue effects of the unwanted event have died down before beginning a new measurement.

There are five sections to the Live Page. To scroll between sections use the or keys. The Right and Left Softkeys beneath the display scroll between pages.

Sound Level Profile

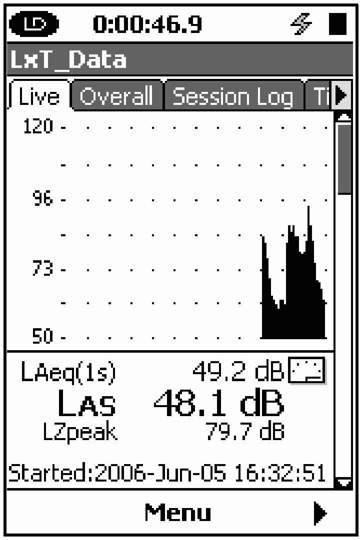


FIGURE 5-2 Live Page, Section 1

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

Section 1 presents a recent history of L_{Aeq} calculated for each second. The graph presents the last 120 seconds of the measurement.

The $L_{Aeq(1s)}$ is the numeric presentation of the most recently graphed 1 second value.

The L_{AS} is the instantaneous measured level from the RMS detector.

The L_{Zpeak} is the current measurement from the 1 s. peak detector.

The time at the bottom of the page is the date and time the measurement was started.

1/1 Octave Band Analyzer (Optional)

The 1/1 Octave Band Analyzer display appears only when the instrument is loaded with the optional LxT-OB3 firmware.

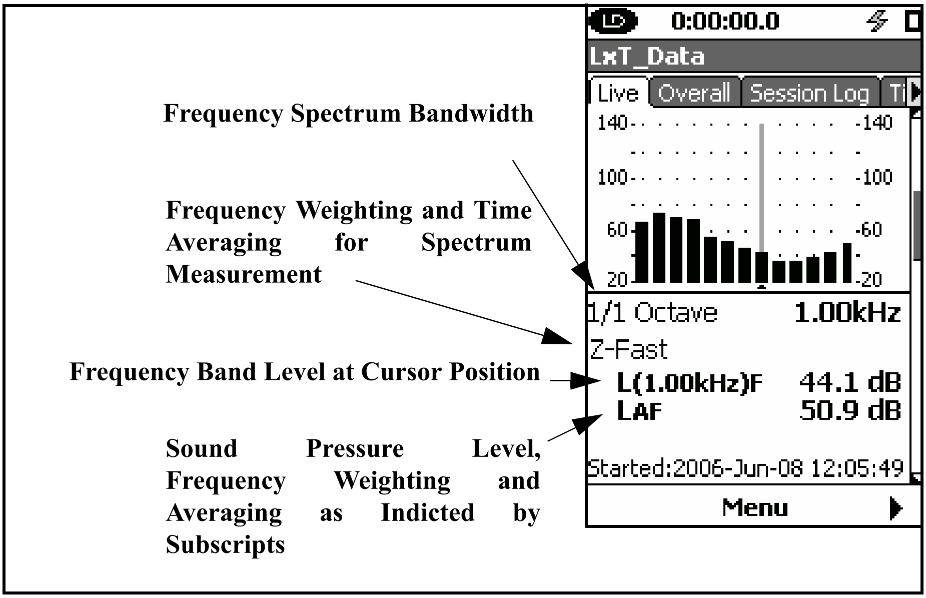


FIGURE 5-3 Live Page, Section 2

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

Note that the spectrum frequency weighting is selected independently from that of the sound level measurement, as described in "OBA Frequency Weighting" on page 4-14. The detector is the same as that of the sound level measurement.

Section 2 shows a bar graph of sound level in 1/1 octave frequency bands. The right most bar on the graph is the L_{AS}.

It is indicated beneath the graph that it is in 1/1 octave bands. On the graph, the vertical bar for the selected octave band is highlighted. The frequency of the octave band for which data is being displayed, the sound pressure level frequency weighting (A weight) and the detector response (Slow) are also shown.

$L_{(1.00kHz)S}$ indicates the sound level in the 1 kHz band with a Slow detector setting.

L_{AS} is the A weighted, Slow detector response sound level.

Cursor

Use the and keys to move the cursor left and right, respectively.

1/3 Octave Band Analyzer (Optional)

The 1/3 Octave Band Analyzer display appears only when the instrument is loaded with the optional LxT-OB3 firmware.

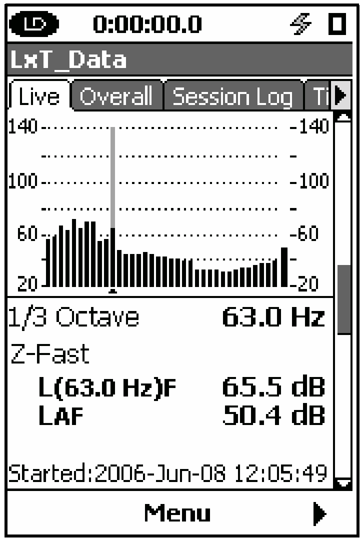


FIGURE 5-4 Live Page, Section 3

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

Section 3 is similar to FIGURE 5-3 "Live Page, Section 2" . The graph and data are presented for 1/3 octave bands.

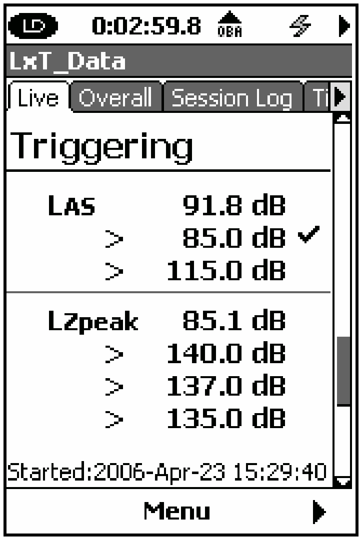


FIGURE 5-5 Live Page, Section 4

For a description of the setup of these trigger values, see "Triggers Page" on page 4-20.

Section 4 displays the sound level and peak level with their associated trigger points. Exceedances of these trigger points will be indicated by a check mark appearing to the right of each. The check mark will appear only as long as the measured level remains above the trigger point.

Time, Battery Voltage and Memory

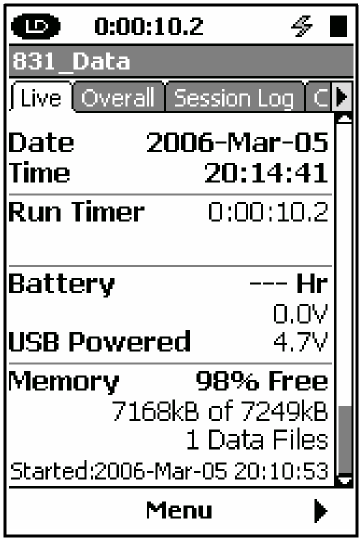


FIGURE 5-6 Live Page, Section 5

Note: If there is USB power, the estimated battery time will not be a true representation of the available battery life. Check this when operating on battery power only.

In Section 5, the status view indicates the current date and time, the run time for the measurement, battery voltage, calculated run time and memory usage.

The Memory section indicates the amount of memory available as a percentage and in number of kBytes. The number of stored data files is also indicated.

Overall Page

In this section we only address those sections of the Overall Page associated with basic sound level measurements. Other pages associated with data provided by optional firmware may also appear. Although the 1/1 and 1/3 octave spectra require optional firmware (LxT-OB3), we do include the display of this data in this chapter.

The Overall Page may have as many as thirteen sections. To scroll between sections use the or keys. Use the Right and Left Softkeys to scroll between pages.

Leq

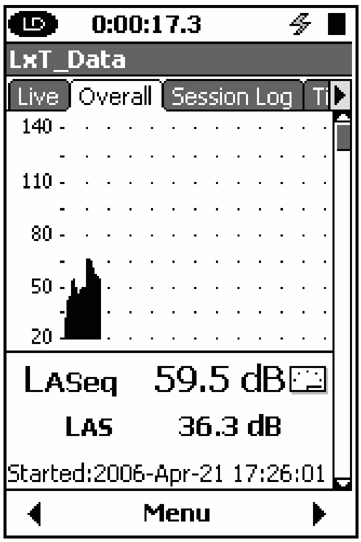


FIGURE 5-7 Overall Page, Section 1

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

The graph in Section 1 depicts the average sound level for the last 120 seconds of the measurement. The run time for the average calculation is shown at the top of the screen. The graph is updated once per second and the calculation of the average sound level is updated approximately four times a second.

The L_{ASeq}, frequency weighting (A) and detector response (Slow), is the equivalent sound level based on the run time of the measurement.

The L_{AS} is the instantaneous measured level from the RMS detector.

The time at the bottom of the page is the date and time the measurement was started.

Maximum, Minimum and Peak Sound Levels

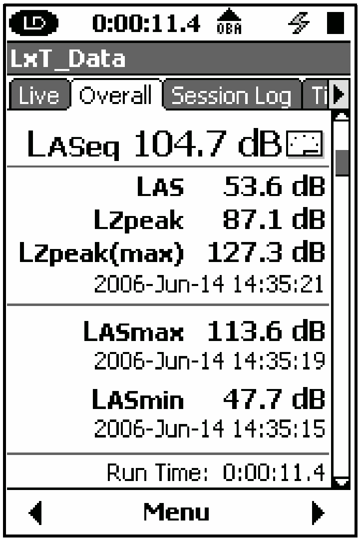


FIGURE 5-8 Overall Page, Section 2

L_{ASeq} and the L_{AS} are also shown in Section 2 of the Overall Page.

The L_{Zpeak} (Z frequency weighting) is the current measurement from the peak detector.

The $L_{Zpeak(max)}$ is the highest level the peak detector has measured during the run time of the measurement. A date and time of occurrence is recorded with this event.

See Chapter 3 "RESET Key" on page 3-8.

The $L_{Zpeak(max)}$ is also considered the peak hold. Whenever data is reset, this parameter is cleared. To reset data, press the (RESET) key.

The L_{ASmax} is the highest level the RMS detector has measured during the run time of the measurement. A date and time of occurrence is recorded with this event.

The L_{ASmax} is also considered the max hold. Whenever data is reset, this parameter is cleared. To reset data, press the (RESET) key.

The L_{ASmin} is the lowest level the RMS detector has measured during the run time of the measurement. A date and time of occurrence is recorded with this event.

1/1 Octave Band Analyzer (Optional)

The 1/1 Octave Band Analyzer display appears only when the optional firmware LxT-OB1 or LxT-OB3 has been enabled and this measurement mode has been selected in the setup.

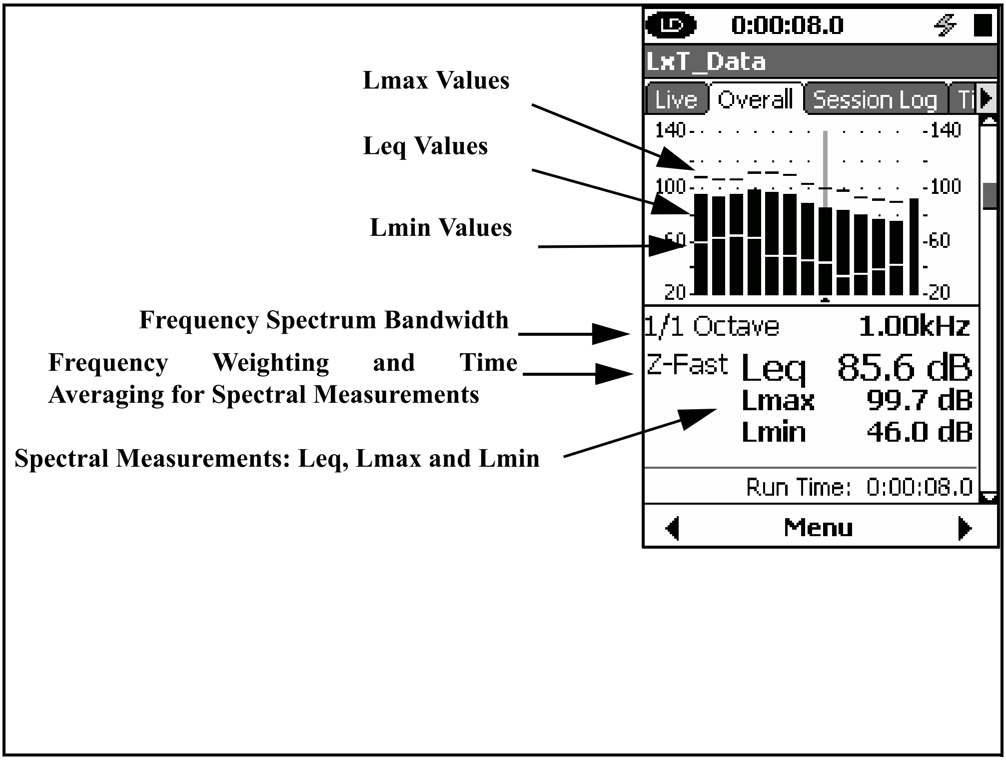


FIGURE 5-9 Overall Page, Section 3

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

The data displayed in in Section 3 shows Leq, Lmax and Lmin sound levels in 1/1 octave frequency bands calculated for the duration of the measurement. The right most bar on the graph is the sum of the Leq values for the total spectrum.

The bar for the displayed frequency band is highlighted. The highlight can be moved using the and keys.

Leq

L_{eq} is the energy average sound level of the frequency band for the duration of the measurement.

Lmin

L_{min} is the minimum sound level of the frequency band for the duration of the measurement.

Lmax

The value of L_{max} depends upong the choice of Max Spectrum Mode selected in the OBA setup, described in "OBA Max Spectrum Mode" on page 4-15.

Bin Max

When the Max Spectrum Mode is "Bin Max", then the value of Lmax for each frequency band is the maximum value which occurred in that band during the entire measurement period. 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.

At Max

When the Max Spectrum Mode is "At Lmax", the Lmax spectrum is the actual spectrum which was measured at the instant that the measured sound pressure level achieved its maximum value. As a result, this is an actual spectrum which occurred during the measurement period, and it represents the frequency content of the signal which produced the maximum instantaneous sound pressure level.

1/3 Octave Band Analyzer (Optional)

The 1/3 Octave Band Analyzer display appears only when the instrument is loaded with the optional LxT-OB3 firmware and this measurement mode has been selected in the setup.

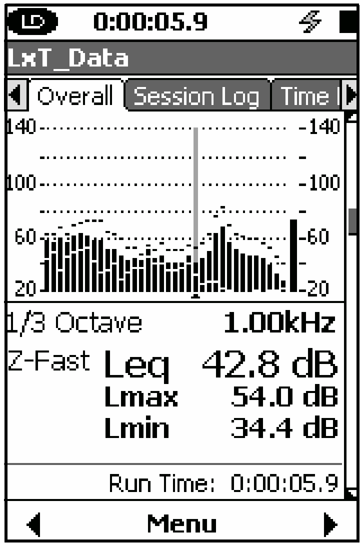


FIGURE 5-10 Overall Page, Section 4

Note that the graph scaling can be modified as described in section "Adjust Graph Scale" on page 5-23.

The data displayed in Section 4 is similar to that displayed for a 1/1 octave spectrum measurement, described in "1/1 Octave Band Analyzer (Optional)" on page 5-4, except that it represents 1/3 octave data.

.

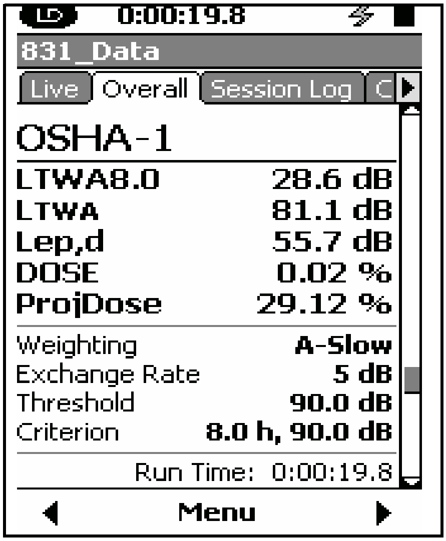


FIGURE 5-11 Dosimeter 1 & 2 Display, Sections 5 and 6

There are two separate, but similar, dosimeter data displays in sections 5 and 6. In this example, we can see that the measurement parameters correspond to the setup named “OSHA-1”.

The Lateral (Time Weighted Average for 8 hours) is calculated for the predetermined Criterion Time, in this case 8 hours.

The ProjDose (Projected Time Weighted Average) is calculated from data measured during the measurement run time.

The Daily Personal Noise Exposure, $L_{ep,d}$, is next on the display. This is calculated from data measured during the run time of the measurement.

Dose is calculated for the predetermined Criterion Time and Criterion Level (100% definition).

Projected Dose is calculated for the run time and the Criterion Level.

The remainder of the display shows the parameters used for the measurement: Frequency Weighting, Exchange Rate, Threshold and Criterion (time and level).

Sound Exposure

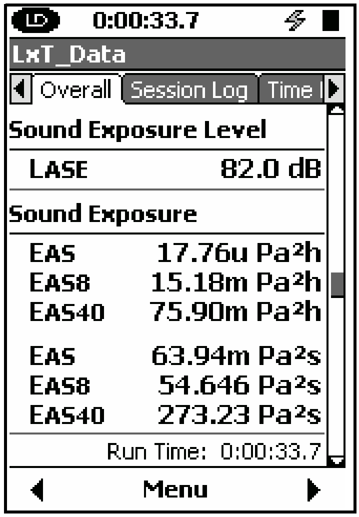


FIGURE 5-12 Overall Page, Section 7

Section 7 shows the Sound Exposure metrics (in this instance for A-weighted, Slow). L_{ASE} is the sound exposure level (previously known as SEL). The Sound Exposure metrics indicate the actual and extrapolated (8 and 40 hours) exposure accumulated in terms of hours and seconds. These are discussed in "Sound Exposure (SE)” on page D-17 and "Sound Exposure Level (SEL, LE)” on page D-17.

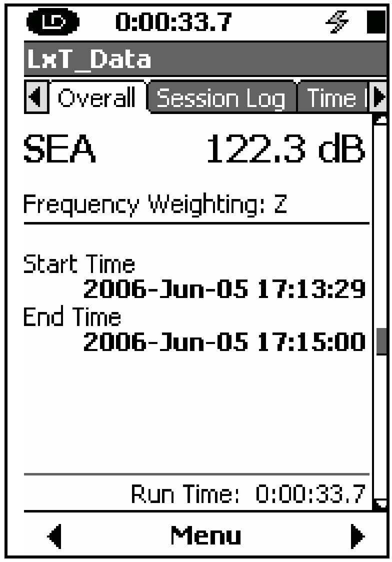


FIGURE 5-13 SEA Display, Section 8

SEA is an integration of 1 second peaks that exceeded 120 dB. Both the SEA value and the frequency weighting used for the measurement are displayed.

Ln Percentiles

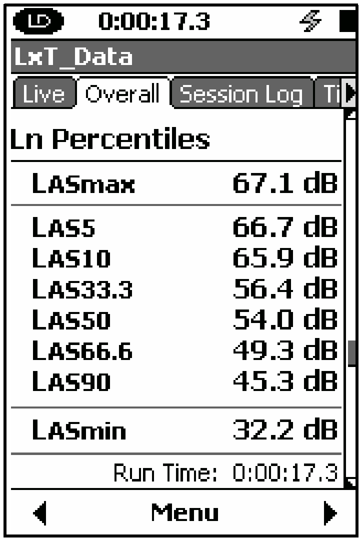


FIGURE 5-14 Overall Page, Section 9

Section 9 displays the Ln statistics for the measurement based on the run time. Also shown are the maximum and minimum sound levels measured. An Ln is the level that was exceeded “n” percent of the time.

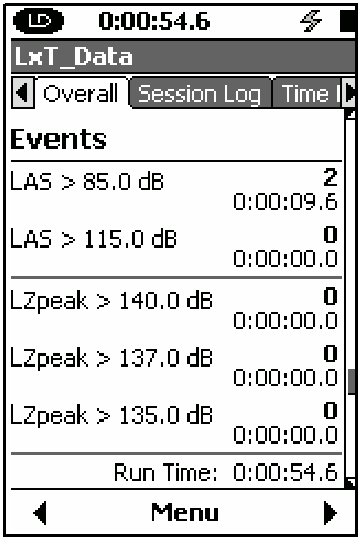


FIGURE 5-15 Overall Page, Section 10

Section 10 shows the number of exceedances that have occurred during the measurement and the total duration of exceedances. Exceedances are shown for two threshold levels of the RMS detector and three for the peak detector.

Overloads

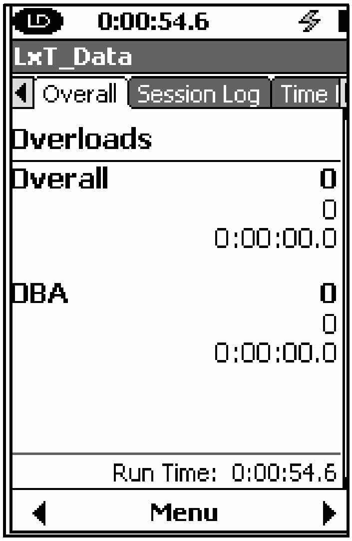


FIGURE 5-16 Overall Page, Section 11

Section 11 shows the overloads which have occurred during the measurement.

Number of Measurements

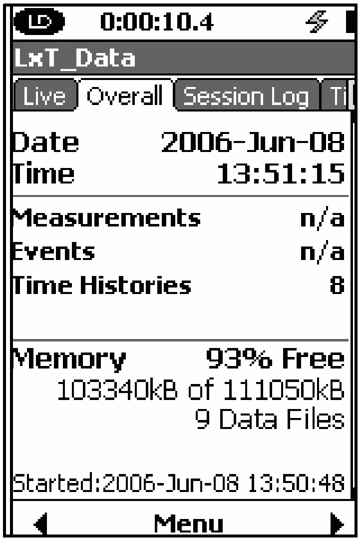


FIGURE 5-17 Overall Page, Number of Measurements by Type, Section 12

Section 12 presents the quantity of each type of measurement which has been made and also the memory status.

Equivalent Levels

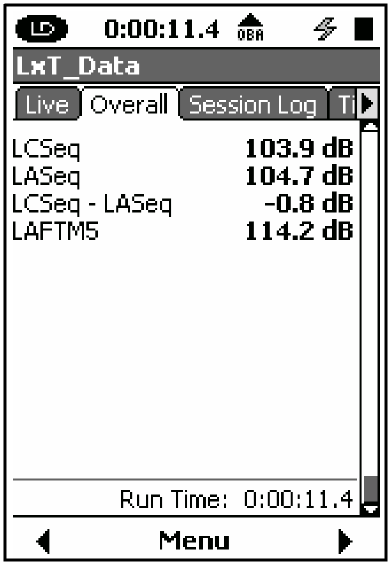


FIGURE 5-18 Equivalent Page, Section 13

The parameter LAFTMS will only appear when "Takt Maximal Data" has been selected on the Preferences Page as shown in "Takt Maximal Data" on page 11-13.

Section 13 displays three equivalent levels calculated for the total measurement time. L_{CSeq} and L_{ASeq} are equivalent levels measured using Slow RMS averaging and using frequency weightings of C and A, respectively. The difference between them, L_{CSeq} - $L_{ASeq,}$ is often used as an indicator of the amount of low frequency content in a sound. It is also used as a parameter for the selection of hearing protectors, since noise fields having a large amount of low frequency sound can require more effective hearing protectors than would otherwise be indicated by the measured L_{ASeq} level alone.

Session Log Page

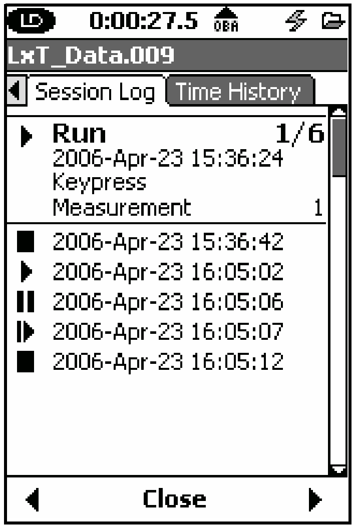


FIGURE 5-19 Session Log Page

The Session Log is a record of data accumulation actions .

A time-stamped record is made for every Run, Pause, Stop, Voice Message or Marker action. The source responsible for each action is also recorded which may be any of the following:

- **Key press**
- **USB command**
- **Run timer compete**
- **Low battery**
- **Out of memory**
- **Preamplifier disconnect.**

The icons in the left column of the display indicate the action: Run, Pause, Voice Recording, etc. The date and time of the action is displayed next to the icon.

Each measurement segment (from Run to Stop) is numbered, as is each voice message.

Using the and keys the user may scroll the list and expand each item. In the upper right corner of the expanded item the number indicates which item is being viewed out of how many total items are in the list.

Adjust Graph Scale

The graphic display of sound pressure level versus time and frequency spectra (1/1 and 1/3 octave) uses default settings of 50 dB for the baseline and a range of 70 dB, making the top of the graph 120 dB. To change any one of these graphs, press the Menu softkey to obtain the display shown in FIGURE 5-20.

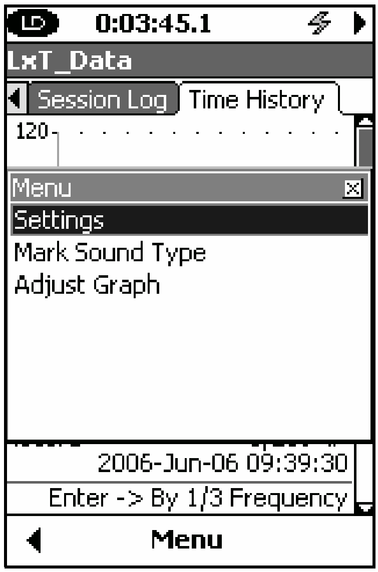


FIGURE 5-20 Graph Menu Display

Use the key to highlight **Adjust Graph** and press the ENTER key to obtain the Adjust Graph menu shown in FIGURE 5-21

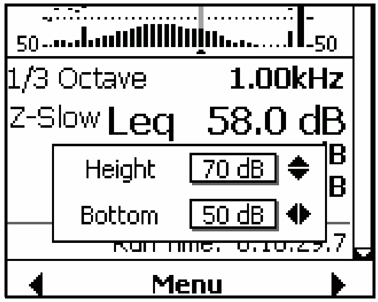


FIGURE 5-21 Adjust Graph Menu

Use the and keys to change the baseline level and the and keys to adjust the range between the baseline and the top of the display. Press the ENTER key to implement the change.

CHAPTER

6 Run Control

The LxT provides a number of run modes to control the time duration of a measurement. These are all described in detail in this chapter.

Run Control Setup

The Run Control is setup from the Control Page of the Measurement Setting Screen, as shown in Figure 6-1.

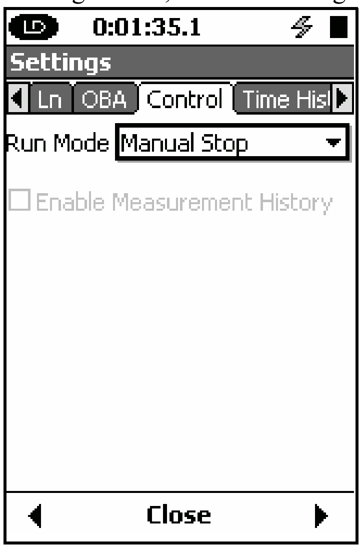


FIGURE 6-1 Control Page

The Control Page is used to set the Run Mode for the measurement to be performed. There are six modes of measurement duration available.

- **Manual Stop:** The measurement is initiated manually by pressing the (Run/Pause) key and it is stopped by pressing the (Stop) key.

- **Timed Stop:** The measurement is initiated manually by pressing the (Run/Pause key and will be stopped automatically after a user-defined time period.

- **Stop When Stable:** The measurement is initiated manually by pressing the (Run/Pause) key. The measurement will stop when the measured level has remained within a user-defined range and the measurement has run for a user-defined time period.

- **Continuous:** The measurement is initiated manually by pressing the (Run/Pause) key and it is stopped by pressing the (Stop) key. Measurements are made continuously from start to stop.

- **Single Block Timer:** The measurement is initiated manually by pressing the (Run/Pause) key and it is stopped by pressing the (Stop) key. Measurements are made only during the time interval defined by the single block timer.

- **Daily Timer:** The measurement is initiated manually by pressing the (Run/Pause) key and it is stopped by pressing the (Stop) key. Measurements are made only during the separate time blocks defined by the setup.

When the Control Page is opened, the Run Mode field will already be highlighted. Press the (Enter) key to open the Run Mode Menu.

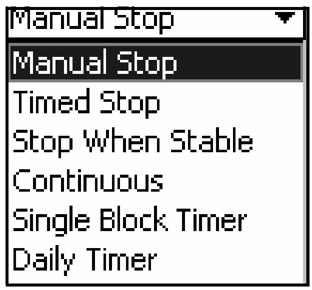


FIGURE 6-2 Run Mode Menu

To set the mode, use the and keys to highlight the mode desired and press the (Enter) key to make the selection. Each of the Run Modes is described in the following sections.

Run Modes

Manual, Timed Stop, Stop When Stable or Continuous

When the run mode used is Manual, Time Stop, Stop When Stable or Continuous, this single measurement will run continuously from start time to end time. However, when Daily Auto-Store has also been enabled with the Continuous run mode, there will also be one or more blocks of data corresponding to 24-hour periods (assuming that the measurement time encompassed at least one complete 24-hour period as programmed).

Single Block Time or Daily Time

When the run mode is Single Block Timer or Daily Timer, this single measurement will consist of data measured over different blocks of time between the start date and time and the end date and time.

Manual Stop Mode

FIGURE 6-3 Manual Stop Mode

The run mode is indicated as “Manual Stop”; no further information is required.

Timed Stop Mode

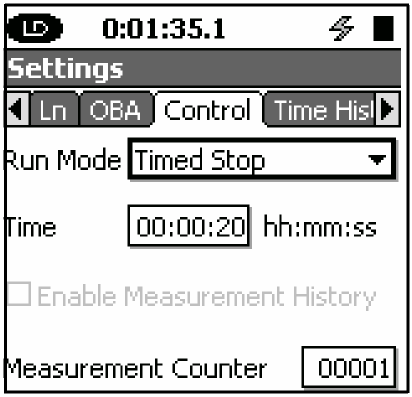


FIGURE 6-4 Timed Stop Mode

The run mode is indicated as “Timed Stop”. Timed Stop has only one parameter, time.

The measurement will run for the duration specified, after which it will be stopped. The range of time values which can be entered is 00:00:01 to 99:59:59 in the format hh:mm:ss.

Entering Run Time

To enter the Run Time, use the and keys to highlight the Time data field and press the key. This will produce a cursor which can be moved left and right to different digit positions in the data field using the and keys, as shown in Figure 6-5.

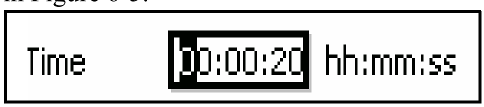


FIGURE 6-5 Entering Time in Timed Stop Mode

At any digit position, use the and keys to adjust the value over the range 0 to 9. When the desired value of time has been entered, press the key to conclude the process.

Stop When Stable Mode

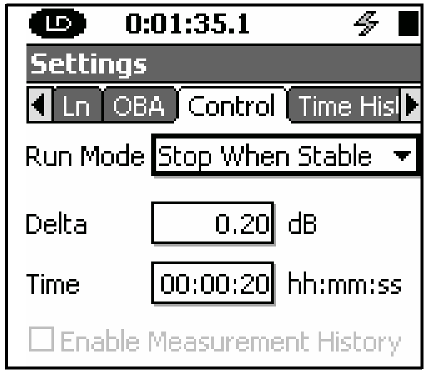


FIGURE 6-6 Stop When Stable Mode

The run mode is indicated as “Stop When Stable”. Data fields are provided to define Delta and Time.

Entering Delta Level

The Delta level is the maximum one minute change in overall average level (i.e. L_{Aeq}) allowed for the measurement to be considered stable.

Entering Time

The Time is the duration that the measurement must run before the measurement can stop.

If the time were set to 0, the measurement would run until the stability condition was met.

If a duration is set, the measurement would run for the duration specified and then continue until the stability condition was met.

For each, use the and keys to highlight the desired data field and press the key. Use the and keys to position the cursor and the and keys to set the digit for that position. When the desired value has been entered, press the key.

Continuous Run Mode

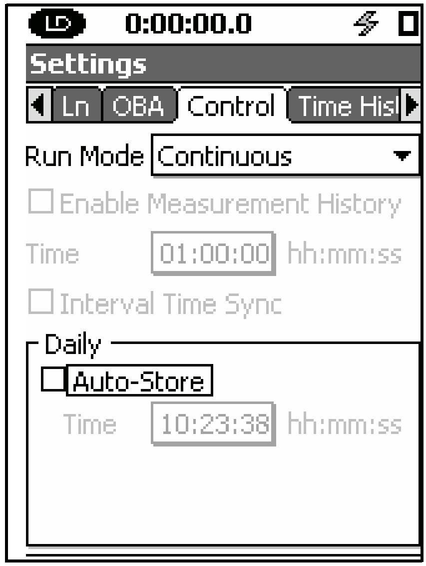


FIGURE 6-7 Continuous Run Mode

The run mode is indicated at the top as “Continuous”. The Continuous Run Mode is very similar to the Manual Mode, except for the Daily Auto-Store feature described below. The measurement will continue until the measurement is manually stopped.

Daily Auto-Store

When the Auto-Store check box in the Daily Section is checked, daily measurement reports for 24-hour time periods, beginning at a user-specified time, will be automatically stored (assuming that the measurement time period encompasses at least one 24-hour time period as programmed). Use the and keys to highlight the Auto-Store field and press the ENTER key. to insert a check mark (repeat the procedure to remove a check mark).

When the check mark is inserted, a data field will be opened as shown in FIGURE 6-8 to define the start time for the 24-hour time period to be used for the report.

FIGURE 6-8 Auto-Store Report Start Time

Use the key to highlight the data field below and press the ENTER key. Use the and keys to position the cursor and the and keys to set the digit for that position. When the desired value has been entered, press the ENTER key.

Use the key to highlight the data field below and press the ENTER key. Use the and keys to position the cursor and the and keys to set the digit for that position. When the desired value has been entered, press the ENTER key.

Single Block Timer Mode

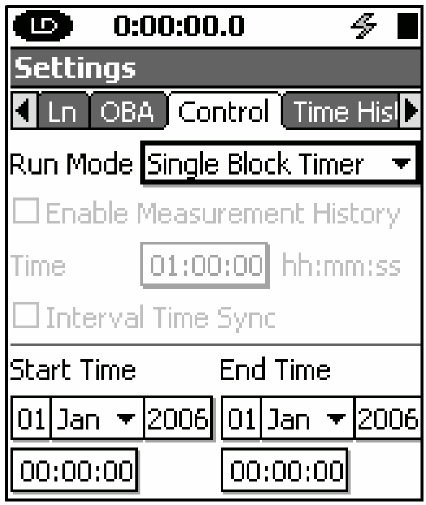


FIGURE 6-9 Single Block Timer

The run mode is indicated at the top as “Single Block Timer”. This mode is used when a single measurement is to be made starting at a user-defined date and time and ending at another user-defined date and time.

The Start and End dates and times are set using the data fields provided in the lower section of the menu. To set these parameters, use the , , , and keys to highlight each field and press the ENTER key. For the parameter fields requiring numeric entries, use the technique described in section "Entering Run Time" on page 6-4. For the months, pressing the ENTER key will open a the menu shown in FIGURE 6-10.

FIGURE 6-10 Selecting Months for Single Block Timer

Daily Timer Mode

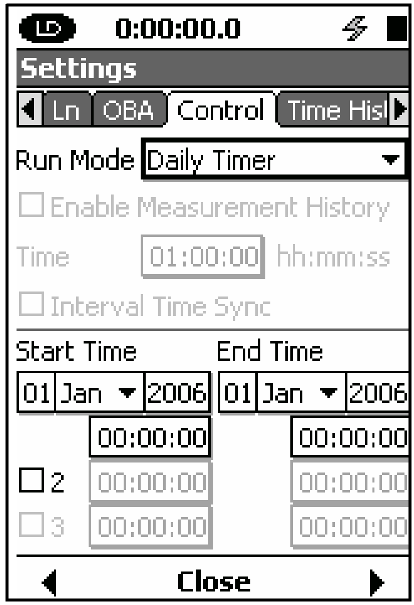


FIGURE 6-11 Daily Timer Mode

The run mode is indicated at the top as “Daily Timer Mode”. This mode is used when measurements are to be made daily over the same non-overlapping time intervals; up to three can be programmed.

As seen in Figure 6-11, the Start and End dates and the Start and End times for the first interval are set in the same manner as used for the Single Block Timer Mode, as described in ‘Single Block Timer Mode” on page 6-7. Placing check marks in the check boxes 2 and 3 will open data fields to define the Start and End times for the 2nd and 3rd time intervals, as shown in Figure 6-12.

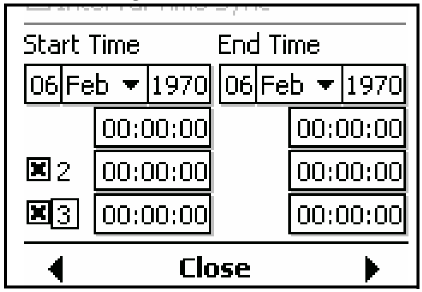


FIGURE 6-12 Daily Timer: Three Timed Stop Mode

CHAPTER

7

Making a Measurement

In this chapter we describe how to make and store an accurate sound level measurement. Before doing this, make sure that the LxT has been setup to meet the requirements for the measurement as described in Chapter 4 "Basic Measurement Setup" on page 4-1.

Configuration of the System

The System LxT should be configured as shown in Figure 1-3 on page -13 with the preamplifier connected to the front of the instrument and the microphone connected to the end of the preamplifier.

The use of the microphone extension cable EXCXXX, where XXX is the length in feet (XXX = 010, 020, 025, 035, 050, 060, 100 and 200 available) will not affect the ability of the LxT to comply with standards referenced in this manual.

If desired, a microphone extension cable may be connected between the preamplifier and the body of the LxT. For more details on the positioning of the LxT and the permitted length of the extension cable, see "Positioning the LxT" on page 7-5.

Switching On the LxT

DO NOT use the hardware power switch to turn the LxT OFF. This may cause data to be lost. See "Hardware Power Switch" on page 2-7 for additional information on the use of the hardware power switch.

With fresh batteries installed, press the (ON/OFF) key, shown in 'ON/OFF Key" on page 3-6, to switch on the LxT.

Start-up Period

The start-up period will be less than twenty seconds. As the instrument is starting up, the display will show the following screen.

FIGURE 7-1 Boot Graphic

Data View and Data Display screen refer to Live, Overall and Session Log Pages.

When the LxT is fully started, the Data Display Screen will appear as shown in FIGURE 7-2 "Data Display Screen, Live Page" .

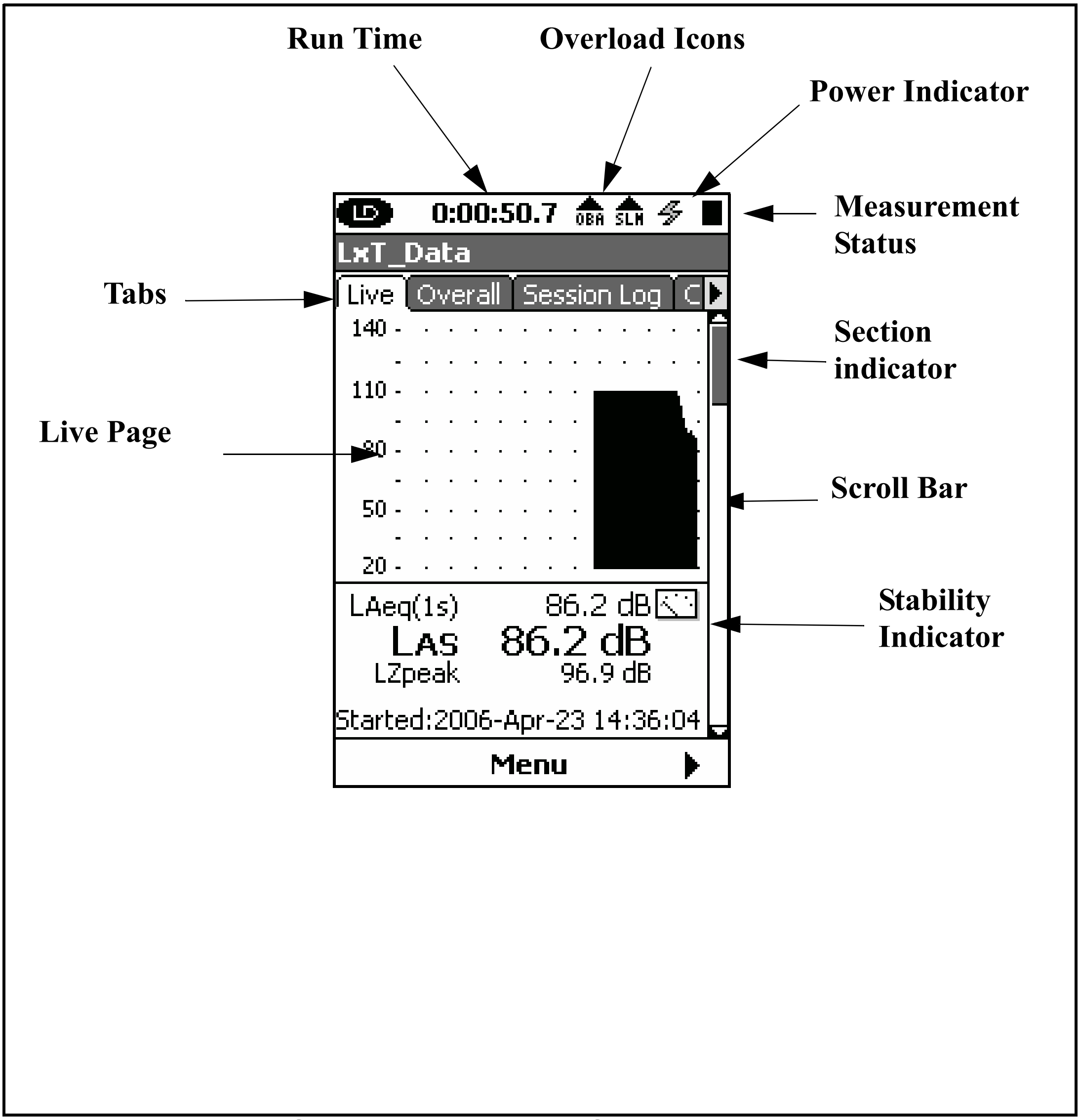


FIGURE 7-2 Data Display Screen, Live Page

The (STOP/STORE) key will produce a steady red light to indicate that the LxT is in the stopped state with no data yet measured.

Views

In this screen, there are three tabs labeled “Live”, “Overall” and “Session Log”, each of which is associated with a page. Because the Live Tab is selected, the Live Page is seen in FIGURE 7-2. The Left and Right Softkeys, defined below, are used to select these tab pages.

Softkeys

There are three buttons beneath the display, aligned with the **left arrow**, **Menu** and **right arrow** keys as shown in FIGURE 7-3 “Softkeys" .

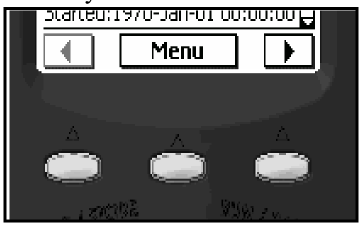


FIGURE 7-3 Softkeys

These buttons are called softkeys because pressing any one will invoke the action associated with the text or symbol directly above it on the screen. In this instance, pressing the Left or Right Softkey will display the tab page to the left or right, respectively, of the tab page presently displayed. The Center Softkey will open a menu associated with this screen. These are context-sensitive, meaning that the text or symbol above each Softkey, and the associated action, can change depending upon the page appearing at that time. See Chapter 3 "Softkeys” on page 3-5.

LxT Setup

Set the measurement parameters of the LxT as described in Chapter 4 "Basic Measurement Setup" on page 4-1.

Calibrating the LxT

The LxT must be calibrated using a sound level calibrator prior to performing a measurement. The procedure for calibration is described in Chapter 13 "Calibration" on page 13-1.

Positioning the LxT

Observer Position

The meter will be either mounted upon a tripod or held in the hand. In order to avoid the effect of sound reflections from the body of the operator interfering with the measurement, the meter should be located as far as possible from the body. Thus, when actually performing the measurement, the operator should place himself at a distance behind the tripod-mounted meter, or extend the hand-held meter as far from the body as is comfortable.

Microphone Extension Cable

If desired, a microphone extension cable may be placed between the meter and the preamplifier/microphone. No correction is required when using Larson Davis Model EXCXXX microphone extension cables in lengths up to 300 feet. XXX is the length in feet (XXX = 010, 020, 025, 035, 050, 060, 100, 200 and 300 available).

When doing so, take care that the preamplifier/microphone is held or mounted in such a way to minimize the effect of reflections on the sound field near the microphone.

Use of a 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, it is recommended that a windscreen be placed over the microphone. Larson Davis provides the WS001 windscreen, a 3 1/2" diameter ball made of open cell foam which can be placed over the microphone and preamplifier as shown below.

FIGURE 7-4 Position of Windscreen

To install the windscreen, hold the meter in one hand and the windscreen in the other. Insert the microphone/preamplifier assembly into the opening in the windscreen as shown below and slide the windscreen completely down over the preamplifier.

FIGURE 7-5 Placement of Windscreen

Prior to beginning the measurement, select the Live View. You can now see a live display of the instantaneously measured data.

The position of the vertical scroll bar on the right side of the display indicates the page being displayed relative to the available pages; first page at the top, last page at the bottom.

The data available for display from the Live View is distributed over three pages (four or five pages with the optional OBA feature). Use the and keys to change pages.

Take a minute or so to examine these different displays before continuing with this example.

Use the softkeys to select the Overall View. Note that the measurement and display of data has not yet begun and that the measurement run time displayed at the very top of the screen indicates 00:00:00:0.

Performing the Measurement

Starting the Measurement

The LxT uses a single range for sound level measurements, so there is no need to select a range. as part of making a measurement

The Live Display provides a running sound level measurement whether or not the LxT is actually performing a measurement while the Overall Display provides the measurement actually being made. Select the Overall Display in order to observe the measurement in progress.

Press the (RUN/PAUSE) key to start the measurement, which will start the run clock and initiate the measurement and display of overall data.

Data Display

See Chapter 5 "Overall Page" on page 5-7

The measured data are available for display from the Overall View. These data are distributed over thirteen sections (with the LxT-LOG and LxT-OBA options). Use the and keys to change sections. The first two sections from the top present basic sound level parameters as shown in FIGURE 7-6 and FIGURE 7-7

.

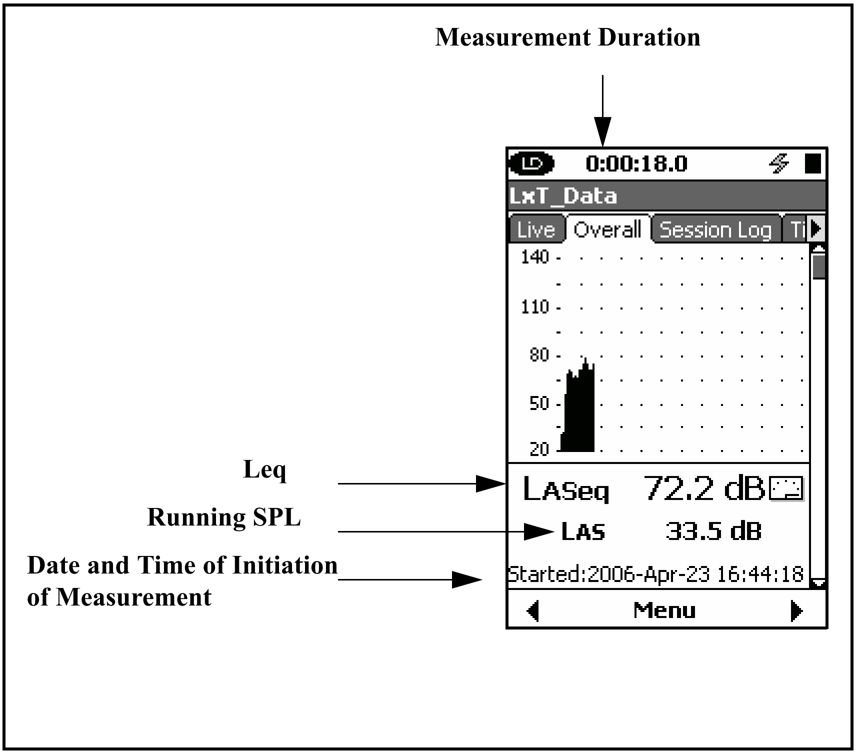


FIGURE 7-6 Leq and Running SPL

The two digital displays present the Leq value (72.2 dB) and the running SPL (33.5 dB). Both of these were measured using A-weighting and Slow detector as indicated by the **AS.** The duration of the measurement is indicated at the top of the display and the data and time that the measurement was initiated are indicated at the bottom of the display. The graph represents the value of Leq as a function of time during the measurement.

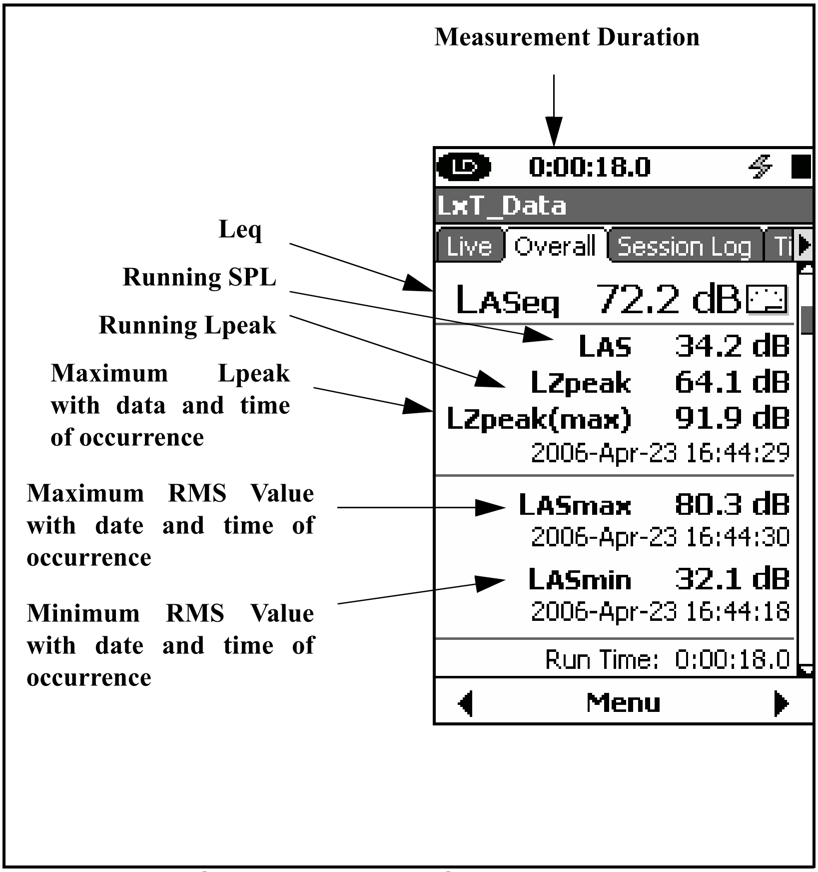


FIGURE 7-7 Multiple Sound Level Parameters

Measurement Range

The measurement ranges over which the LxT meets the standards, which depend upon the selected frequency weighting, are shown in Table A-11, “LxT Performance Specifications,” on page A-9. Measurements which include levels outside this range should not be considered accurate. An overload indication will appear when levels above the range appear. However, the user should take care not to rely on measurements whose levels are below the lower limit of the specified range.

Overload Indication

When a signal from the preamplifier exceeds the calibrated input range of the LxT, the Input Overload Icon will appear at the top of the display. .

While the overload is present, the icon will flash on and off. When the overload is removed, the icon will be removed from the display.

If a measurement is running and an overload occurs, the icon will flash during the overload. When the overload has been removed, the icon will still be present (not flashing) to indicate that an overload has occurred during the measurement. A reset will clear the icon from the display.

Pausing the Measurement

At any time the measurement of overall data can be temporarily suspended by pressing the (RUN/PAUSE) key. Note that the run clock will also pause. However, instantaneous data will continue to be displayed in the Live View.

Note that a measurement may be paused and then run again multiple times.

Pressing (RUN/PAUSE) key one more time will cause the measurement to begin again and overall data will continue to be accumulated. The run clock will also begin again from the time indicated when the pause had occurred. The overall data will not be affected by any acoustic events occurring during the time period that the LxT was paused.

Resetting the Measurement

A measurement is most often reset when a noise event which is not typical of the measurement desired takes place. For example, an aircraft passing overhead when attempting to measure the background noise in a normally quiet area.

To reset a measurement in progress, press the (RESET) key. This will erase all data previously measured and reset the run time clock to zero. A reset will not reset stored data files.

A reset can be initiated when the LxT is running, paused or stopped. However, it must be stopped for the reset operation to be performed.

Resetting When Running or Paused

If it is running or paused when the (RESET) key is pressed, a Stop Required Menu will be displayed as shown in FIGURE 7-8.

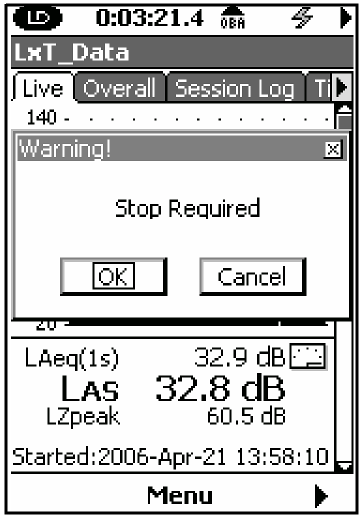


FIGURE 7-8 Stop Required Prompt

The **OK** response will already be highlighted, so simply press the (ENTER) key to continue.

Otherwise, press the key to highlight **Cancel** and then the (ENTER) key to cancel both the Stop and the Reset operations.

After selecting to Stop the measurement, the Save File Menu, shown in Figure 7-9 on page -14, will appear to provide a choice of saving the measured data prior to the reset or not as described in ‘Storing the Measurement” on page 7-14.

Resetting When Stopped

If the LxT is stopped when the (RESET) key is pressed, the Stop Required Menu will not appear, but the Save File Menu will appear to provide a choice of saving the measured data prior to the reset or not.

Starting a New Measurement

The key (RUN/PAUSE) key must be pressed to start a new measurement.

Stopping the Measurement

Note that the LxT can be stopped when either running or paused.

Press the (STOP/STORE) key to suspend the overall measurement.

Pressing the key (RUN/PAUSE) key afterwards will continue the overall measurement which had been stopped.

Storing the Measurement

Note: a measurement can only be stored when the measurement has been stopped.

To store the measurement, press the (STOP/STORE) key one more time. The Save File menu will then be displayed, as shown in FIGURE 7-9 "Save File Menu" .

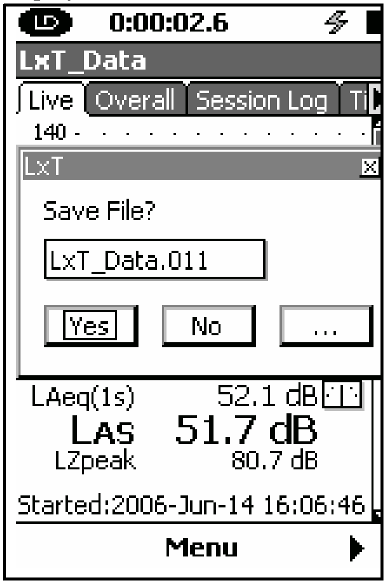


FIGURE 7-9 Save File Menu

The data will be stored under the file name defined in the section "General Page" on page 4-4 (TEST 3 in FIGURE 7-9) along with a file number. The file number automatically begins at 000 for the first measurement stored and will index so that whenever a measurement is stored the file number assigned will be the next in sequence following the measurement previously stored.

After a file has been successfully stored, the LxT will automatically reset when the **(**RUN/PAUSE) key is pressed to begin another measurement.

To continue with the save operation, use the right arrow key to highlight **Yes** and press the ENTER key.

To abort the save operation, use the right arrow key to highlight **No** and press the ENTER key.

Overwriting a Saved File

If you wish to use this data to replace a data file already saved in the LxT, instead of highlighting **Yes** or **No**, highlight the box with the title "**...**" and press the ENTER key. This will open a window listing all the data files already saved in the LxT, as shown in FIGURE 7-10.

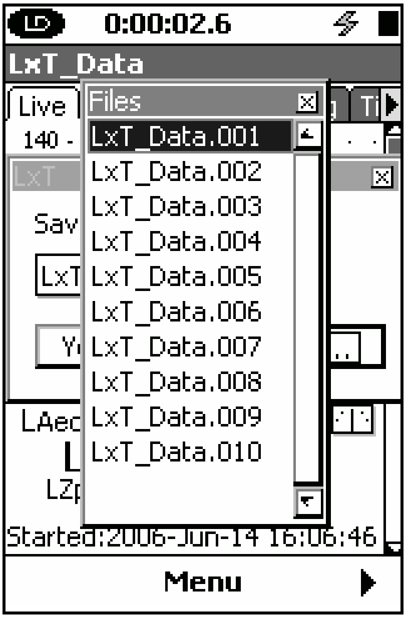


FIGURE 7-10 Saved Data Files

Use the and keys to select the file which is to be overwritten and press the ENTER key. This will replace the file name and number which previously appeared with this one, as shown in FIGURE 7-11.

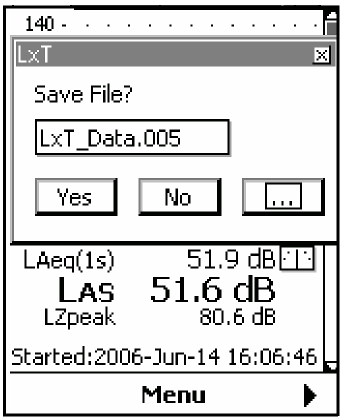


FIGURE 7-11 Overwriting a Saved File

To continue with the overwrite operation, use the key to highlight **Yes** and press the key. This will open the Overwrite Confirmation menu, shown in FIGURE 7-12

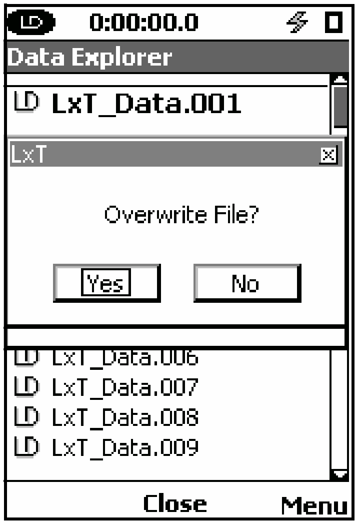


FIGURE 7-12 Overwrite Confirmation

Highlight **Yes** and press the key to implement the overwrite operation.

To abort the overwrite operation, use the key to highlight **No** and press the key.

To select a different previously saved file to overwrite, use the key to highlight the box with the title "**...**" and press the key to repeat the overwrite procedure.

Low Level Sound Fields

As long as the sound level being measured is within the measurement range shown in Table A-10, "Frequency Weightings; Larson Davis," on page A-7, inherent (self-generated) noise and linearity problems can be ignored.

It is possible to correct the measured RMS sound pressure levels for the typical inherent noise levels (see the noise floor specifications in Table A-11, "LxT Performance

Specifications," on page A-9) as long as the difference between the measured sound level and the inherent noise level is greater than 3 dB. This is done by subtracting the inherent sound level from the total sound level using the following formula.

$$Lcorr = 10\log\left(10^{(Lmeas)/10} - 10^{(Linh)/10}\right)$$

where

Lcorr = corrected sound level

Lmeas = measured sound level

Linh = inherent noise level.

CHAPTER

8 Voice Recording

Control Page - Voice Recording

To activate the Voice Recorder Page, press the (TOOLS) key. Use the , or keys to highlight the Voice Recorder icon as shown below.

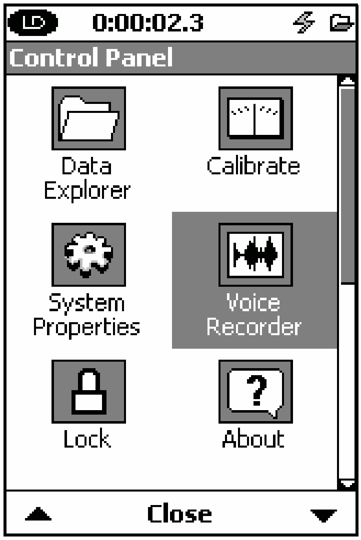


FIGURE 8-1 Control Panel

Press the ENTER key to open the Voice Recorder Page.

Press the **Close** Softkey to exit from this page.

By connecting a headset to the headset jack on the bottom of the LxT, voice annotation may be recorded using the headset microphone. Voice records may be played back through the headset speaker.

With no headset plugged in, a record may be made of the sound arriving at the measurement microphone.

Voice Recorder

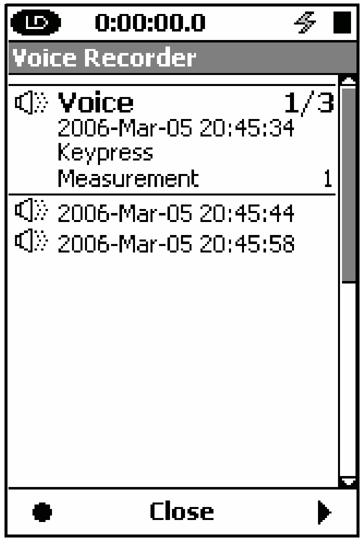


FIGURE 8-2 Voice Recorder

The Voice Recorder Page will present a list of existing voice records. The scroll bar and section indicator depict where you are in the list of files.

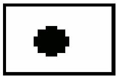
Using the and keys, scroll through the list of voice records. You may playback the highlighted voice record through a headset speaker by pressing the Right Softkey.

When measurement data is stored, all voice records that are shown on the list will be stored in the data file. The voice records list will then be empty.

Record

With a headset and microphone attached to the headset jack on the bottom of the LxT, a voice record can be made.

Record Button



Press the Left Softkey to begin recording. The Recording message box will appear. The meter indicates the relative signal level from the recording microphone and the progress bar shows the elapsed time of the measurement. The progress bar length represents 20 seconds, which is the maximum time for a voice recording.

FIGURE 8-3 Recording

Press the 

key to stop recording if 20 seconds has not elapsed. At the end of 20 seconds, recording will stop automatically.

Save Prompt

When the recording has been stopped, the Save Prompt shown in FIGURE 8-4 will appear.

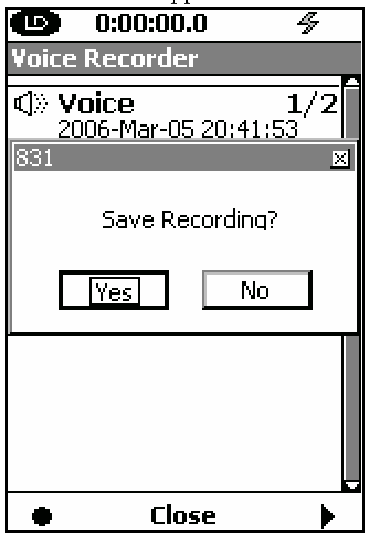
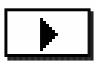


FIGURE 8-4 Save Recording Prompt

Select **Yes** to save the recording or **No** to close the recording session without saving the recording.

Playback

Playback Button



To playback a highlighted voice record, press the Right Softkey. With a headset attached to the headset jack on the bottom of the case, you will hear the voice recording in the headset speaker.

FIGURE 8-5 Playback

The meter indicates the relative amplitude of the recorded sound.

The progress bar indicates the elapsed time of the playback of the recording. The progress bar length represents the actual recording time.

Press the ENTER key to stop the playback.

At the end of the voice record, the playback will stop automatically.

CHAPTER

9 Time History

This chapter describes the measurement features associated with the optional data logging firmware LxT-LOG.

Parameters Logged

Using the Time History mode, the LxT can automatically log up to sixteen parameters, both acoustic and non-acoustic, at time intervals ranging from one second to twenty-four hours.

Acoustical Parameters

Sound Pressure Level Values

RMS Levels

The following RMS sound pressure level values, measured using the frequency weighting and averaging selected during the measurement setup as described in ‘SLM Page” on page 4-5, can be logged.

- Leq
- Lmax
- Lmin

Peak Level

Values of Lpeak, measured using the frequency weighting selected during the measurement setup as described in ‘SLM Page” on page 4-5, can be logged.

Specialized Acoustic Parameters

- L_{AFTM5}: Taktmaximal 5 (utilized in Germany) using A-weighting and Fast detector. This also requires selection from the Preferences page, ‘Takt Maximal Data” on page 11-13.

- L_{twa1} and L_{twa2}: time-weighted averages associated with Dose 1 and Dose 2 exchange rates and thresholds. See ‘Dosimeter 1 and 2” on page 5-14.

- LCSeq - LASeq

1/1 and 1/3 Octave Spectra

The optional firmware LxT-OB1 or LxT-OB3 is required for these parameters to be measured.

When the LxT-OB1 firmware is enabled, the following frequency spectra can be logged.

- OBA 1/1 Leq
- OBA 1/1 max
- OBA 1/1 min

When the LxT-OB3 firmware is enabled, the following frequency spectra can be logged.

- OBA 1/1 Leq
- OBA 1/1 max
- OBA 1/1 min
- OBA 1/3 Leq
- OBA 1/3 max
- OBA 1/3 min

Non-Acoustical Parameters

From LxT

Battery Level

Internal Temperature

Time History Setup

Time History is setup using the Time History tab page of the Measurement Setup View, as shown in Figure 9-1.

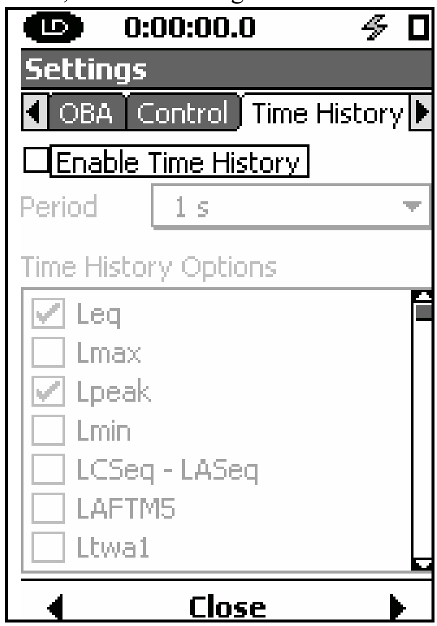


FIGURE 9-1 Time History Setup Menu

Press ENTER key to enable the Time History functionality and to place a check in the Enable Time History check box. This will add additional items to the Time History setup menu, as shown in FIGURE 9-2.

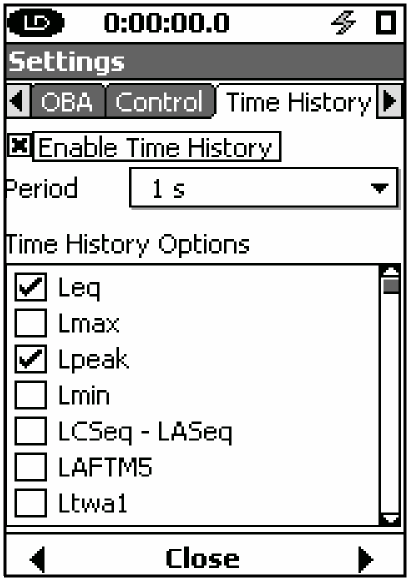


FIGURE 9-2 Time History Setup Menu: Enabled

Set Time History Period

To set the Time History Period, use the key to highlight the Period data field and press the ENTER key to list all the available values of time, as shown (partially) in Figure 9-3.

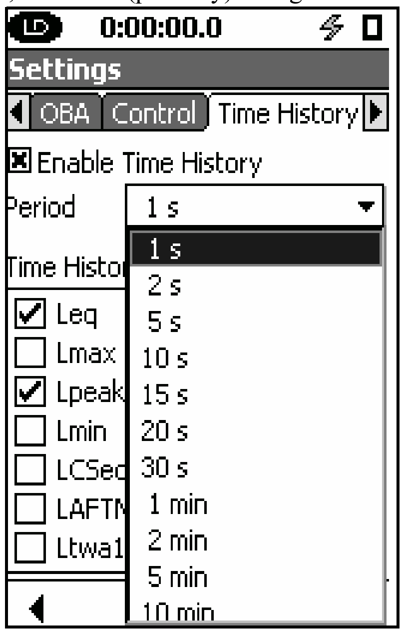


FIGURE 9-3 Time History Period Menu

As you scroll downwards, when the highlight reaches the bottom of the window, the list will scroll upwards to reveal additional values.

The following values are available for selection as time increment for the Time History:

Seconds

1, 2, 5, 10, 15, 20, 30

Minutes

1, 2, 5, 10, 15, 20, 30

Hours

1, 24

Use the and keys to highlight the desired increment of time and press the ENTER key to make the selection.

Select Time History Parameters

The parameters available for selection are described in ‘Parameters Logged” on page 9-1.

The Time History Options Menu is used to select, one-by-one, the parameters to be stored for each time increment. Use the key to highlight the Time History Options window and press the ENTER key. The first item in the options list will be highlighted, as shown in Figure 9-4.

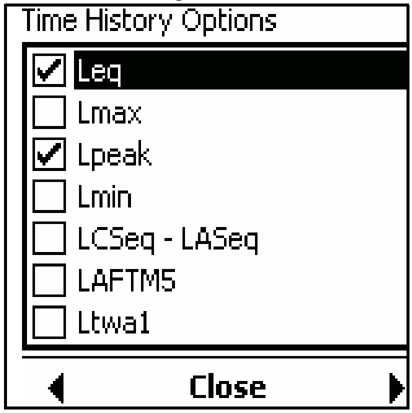


FIGURE 9-4 Time History Options Window

Use the and keys to move the highlight down or up, respectively, and use the or key to select an option and place a check in the check box. Use the same keys to deselect a box already checked.

Exiting Time History Options

When the options have been designated as desired, press the ENTER key to exit from the Time History Options Menu. You will then be able to display other pages of the Measurement Setup Menu or exit from the Measurement Setup Menu by pressing the center softkey labeled **Close**.

Time History Display

Single Value Parameters

When the LxT is not equipped with the optional firmware LxT-OB1 or LxT-OB3, or if it is equipped with this option but the measurement of 1/1 and 1/3 octave spectra has been set to Off in the measurement setup, all measured parameters will be single value parameters.

In this section we discuss the time history graph which appears for single value parameters such as sound levels, and non-acoustic parameters.

Time History data is displayed on the Time History tab page of the Data Display View as shown in Figure 9-5.

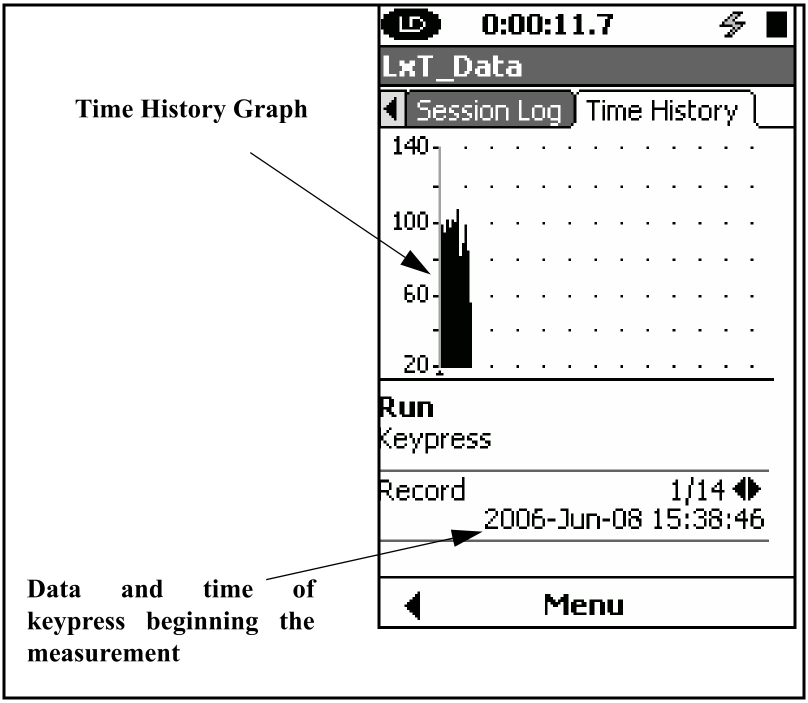


FIGURE 9-5 Time History Display: First Point; Keypress Beginning Measurement

Note that the graph scaling can be modified as described in section 'Adjust Graph Scale" on page 5-23.

The first display, labeled **Run**, represents the keypress initiating the measurement, with the corresponding data and time. There will be be no measured data associated with this sample point.

Data Display at Cursor Position

Press the key once to display data measured during the first time interval, as shown in FIGURE 9-6. Once data are displayed, use the and keys to move the cursor right or left, respectively, in increments equal to the time history period. .

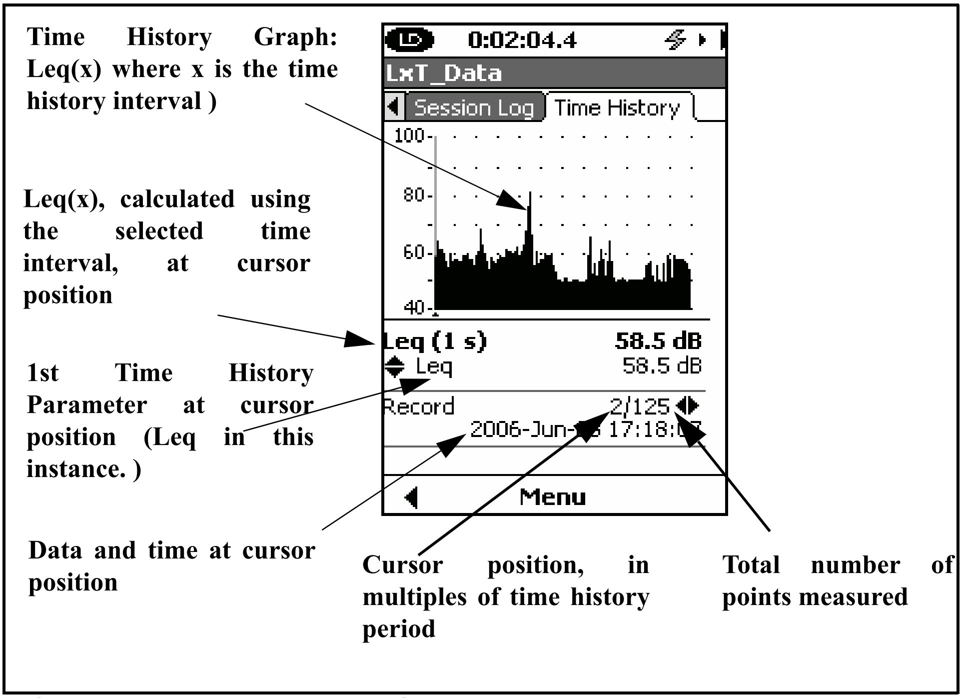


FIGURE 9-6 Measured Data at Cursor Position, First Time History Parameter

The time history graphs for Leq(x) and the selected time history parameter are overlaid on the display (not visible in FIGURE 9-6 because the selected parameter is the same as the Leq(x).

In the above figure, the value of the first of the time history parameters, in this case **Leq**, is displayed for the cursor position. To display the value of this parameter for other samples, use the and keys to select a different cursor position.

Displaying Other Time History Parameters

As explained in section ‘Parameters Logged” on page 9-1, the user can select to log up to sixteen different parameters as a function of time, setup as described in section ‘Select Time History Parameters” on page 9-6. The default value is the first parameter selected during the setup procedure.

When repeatedly pressing the key, the logged parameter values will be displayed in the same sequence as they appeared in the list when selected, as described in ‘Select Time History Parameters” on page 9-6.

By pressing the and keys, the value displayed can be shifted to represent a parameter one later or earlier, respectively, in sequence in the user-created list of parameters to log.

For example, in FIGURE 9-7 we have pressed the key to select Lpeak, the next parameter in the selection sequence, at the same cursor position used to graph and display Leq in FIGURE 9-6.

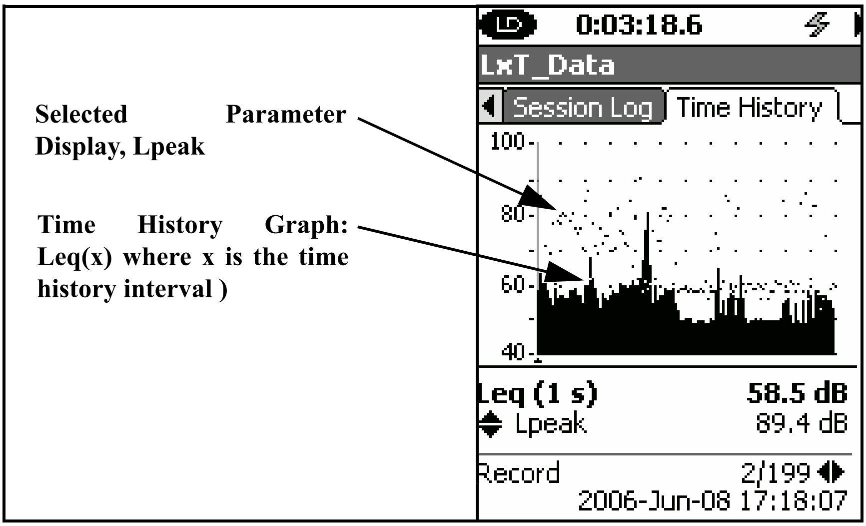


FIGURE 9-7 Time History Graph and Value of LApeak at Same Time as FIGURE 9-6.

Frequency Spectra Display

When either of the optional firmwares LxT-OB1 or LxT-OB3 have been enabled and either the 1/1 octave spectra or the 1/3 octave spectra, or both, have been selected to be logged in the time history, then frequency spectra will appear in the list of parameters which can be displayed.

In the list of parameters which can be logged with a time history measurement, frequency spectra will appear as a group beginning with the 9th item in the list. For example, if both 1/1 and 1/3 octave spectra have been activated for the measurement, the following frequency spectra will appear in the selection list as items 9 through 14

- OBA 1/1 Leq
- OBA 1/1 max
- OBA 1/1 min
- OBA 1/3 Leq
- OBA 1/3 max
- OBA 1/3 min

1/1 or 1/3 Octave Spectra

When only one type of frequency spectrum, 1/1 or 1/3 octave, has been selected to be logged, the basic time history graph might look at shown in FIGURE 9-8.

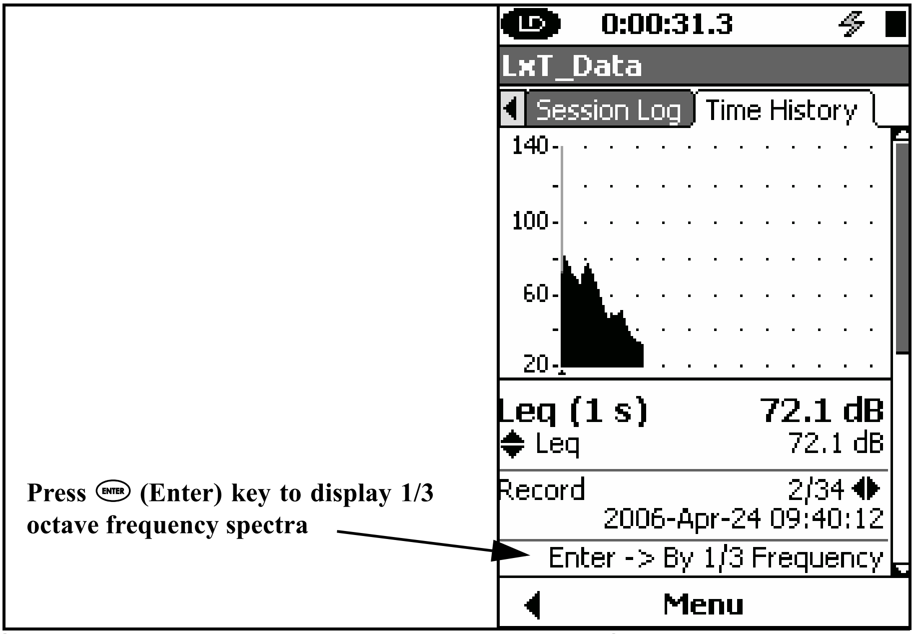


FIGURE 9-8 Time History Display with Frequency Spectrum Data Logged

The (Enter) key is now used to toggle the display between Time History and Frequency Spectrum**.**

In the above figure, we see a new a text message at the bottom of the screen with the message "Enter → By 1/3 Frequency", indicating that the key is to be pressed to display a 1/3 frequency spectrum. If the spectrum type being logged is 1/1 octave, the message would read Enter →By 1/1 Frequency"

If , without pressing the (Enter) key, we press the key until the displayed parameter becomes OBA 1/3 Leq, the display will look as shown in FIGURE 9-9.

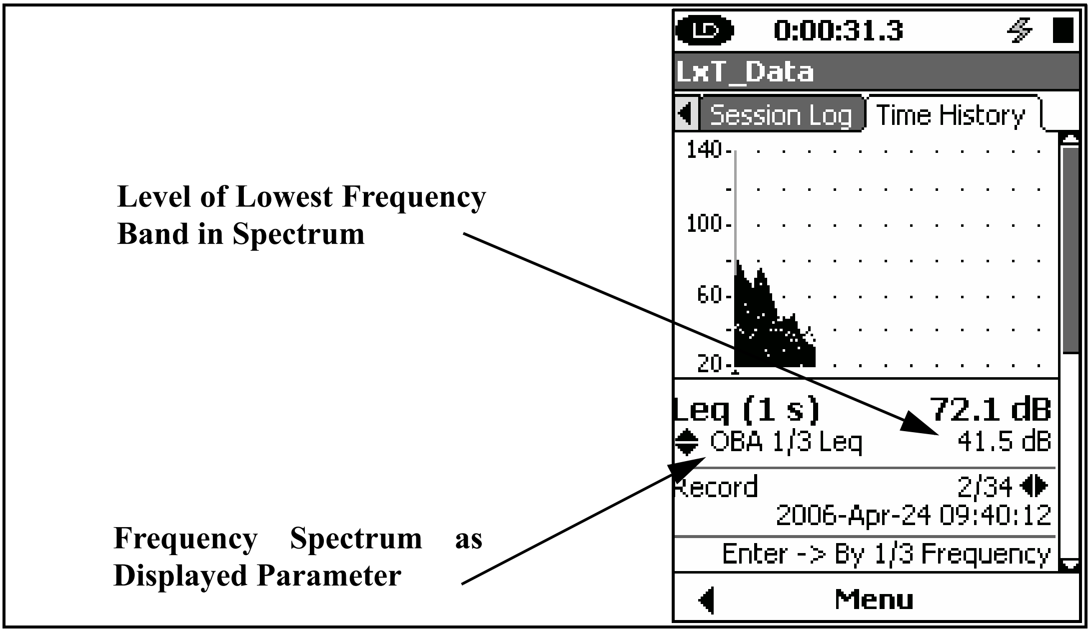


FIGURE 9-9 Time History Display with Frequency Spectrum as Displayed Parameter

Although the displayed parameter is a frequency spectrum, the graph remains that of the Leq time history. The level displayed is that of the lowest frequency band of the spectrum.

In order to display the spectrum itself, press the (Enter) key as called for by the text message “Enter → By 1/3 Frequency”. This will change the display to that of the frequency spectrum corresponding to the displayed parameter, as shown in FIGURE 9-10

.

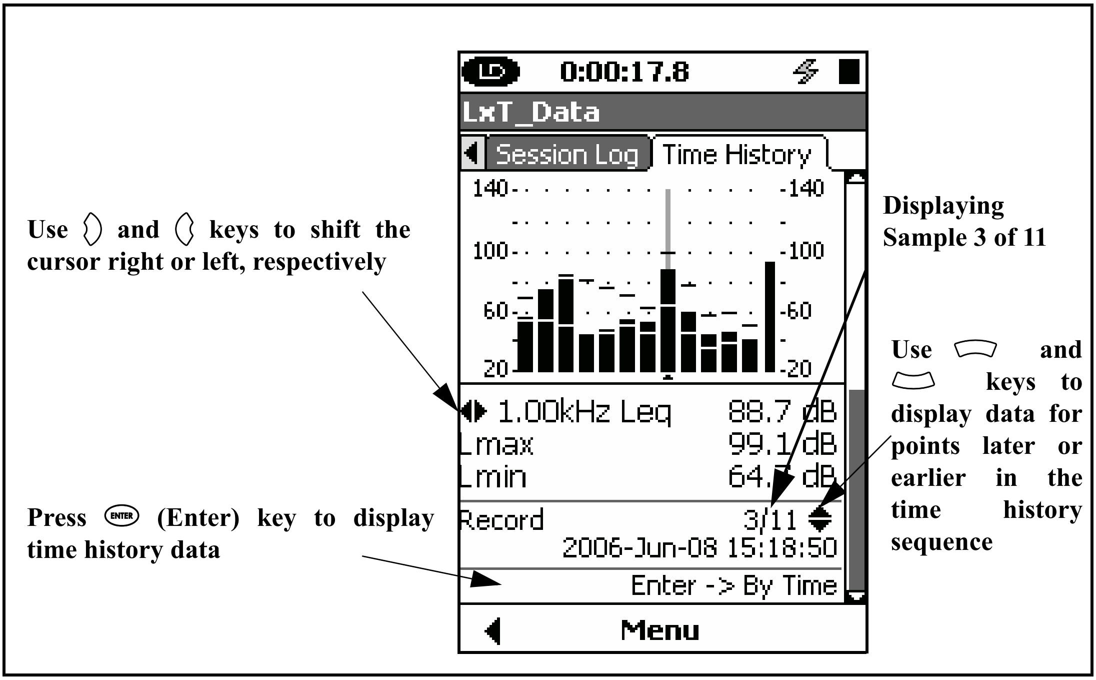


FIGURE 9-10 1/1 Octave Leq Spectrum, Time Sample 2

Note that the graph scaling can be modified as described in section ‘Adjust Graph Scale” on page 5-23.

The bar graph display is a 1/3 octave Leq spectrum with the cursor located at 1 kHz. The level in that frequency band is displayed numerically as 88.7 dB.

Because in our setup we also selected to log OBA 1/3 max and OBA min in addition to OBA Leq, there are curves for all three values in the display and numerical values are displayed for all three at the cursor frequency.

From the annotation we can see that this spectrum corresponds to the 3rd time interval and that data have been stored for 11 time intervals.

Moving the Frequency Cursor

Use the and keys to move the cursor to higher or lower frequencies, respectively, in order to read the parameter value at different frequencies.

Changing the Time Interval Value

Use the and keys to increase or decrease the time interval for the data displayed. For example, pressing the key three time will increase the time interval by three steps, producing the display shown in FIGURE 9-11.

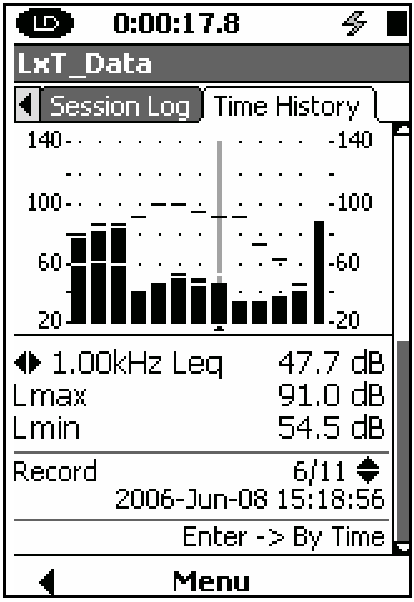


FIGURE 9-11 1/1 Octave Leq Spectrum, Time Sample 5

Returning to Time History Display

To return to the time history display, press the (Enter) key, as indicated in the test message near the bottom of the display shown in FIGURE 9-11.

1/1 and 1/3 Octave Spectra

When both 1/1 and 1/3 octave spectra are being logged, the time history display will begin by displaying the text message “Enter → By 1/1 Octave” as shown in FIGURE 9-12.

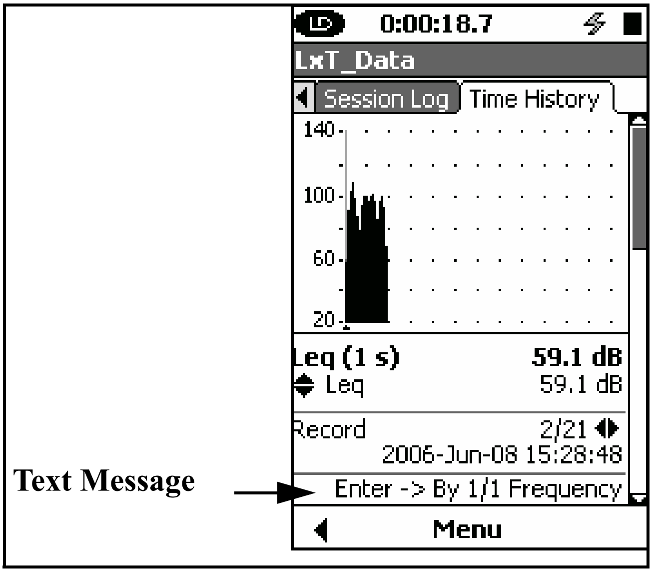


FIGURE 9-12 “Enter → By 1/1 Frequency” To Display 1/1 Octave Spectrum

From this display the single parameter time history data are shown, and the 〈 and 〉 keys can be used to scroll forwards or backwards in time, respectively.

By pressing the ENTER key, the display will change to a 1/1 octave display, and the text message will change to read "Enter → By 1/3 Octave", as shown in FIGURE 9-11..

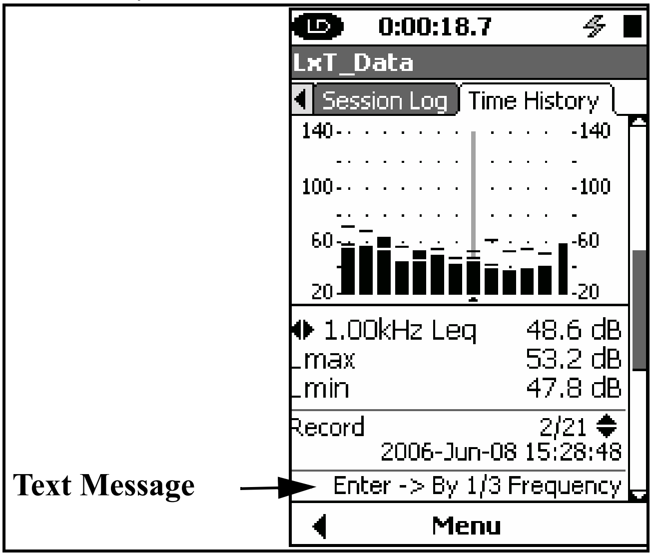


FIGURE 9-13 "Enter → By 1/3 Frequency" To Display 1/3 Octave Spectrum

From this display 1/1 octave data are displayed and the and keys can be used to scroll forwards or backwards in time, respectively.

By pressing the ENTER key one more time, the display will change to a 1/3 octave display, and the text message will change to read "Enter → By Time.

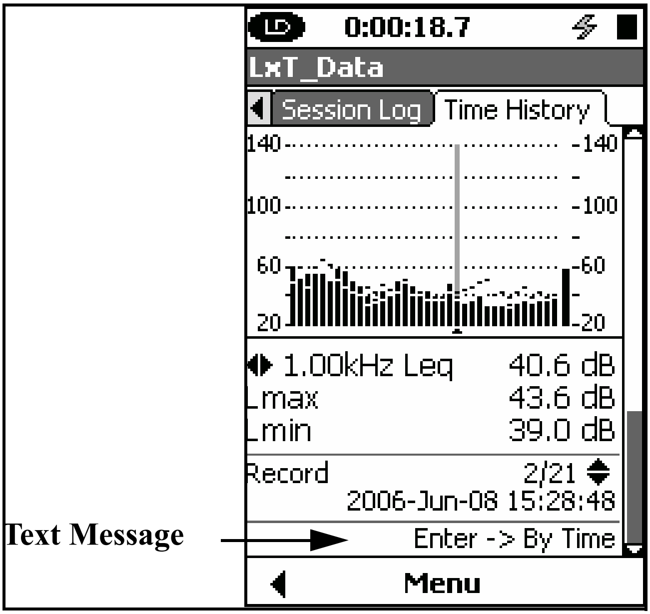


FIGURE 9-14 "Enter → By Time" To Display Time History

From this display 1/3 octave data are displayed and the and keys can be used to scroll forwards or backwards in time, respectively.

As indicated by the text message, press the (Enter) key again to return to a time history display as shown in FIGURE 9-12.

Markers

Markers are used to annotate portions of the time history, especially for the purpose of identifying sound sources as they become dominant in the measurement. The LxT offers ten separate user-definable markers

Markers Setup

Markers are setup using the Markers tab page of the Measurement Setup View, as shown in Figure 9-15.

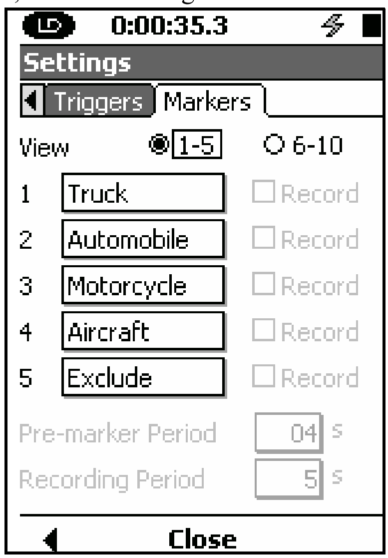


FIGURE 9-15 Markers Setup Window, Markers 1 - 5

There are five markers with names predefined for convenience shown in this figure. Any of these names can be changed by the user. To view markers 6 -10, use the key to highlight the 6 - 10 text line and radio button and press the key to obtain the display shown in Figure 9-16.

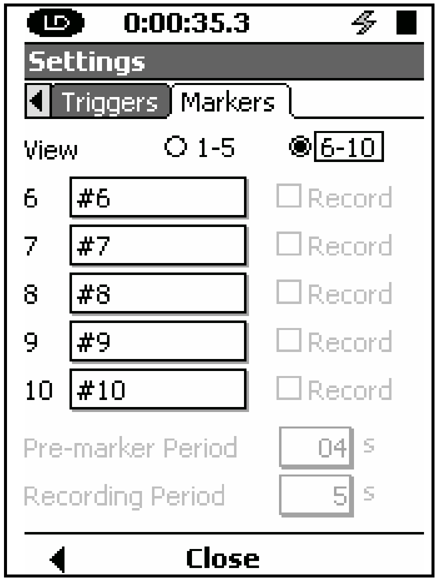


FIGURE 9-16 Markers Setup Window, Markers 6 - 10

Naming a Marker

The process of naming markers is simplified by using the LxT Utility software.

To name a marker, use the and keys to highlight the field of the marker to be named and press the key. This will produce a cursor which can be moved left and right to different digit positions in the data field using the and keys, as shown in Figure 9-17.

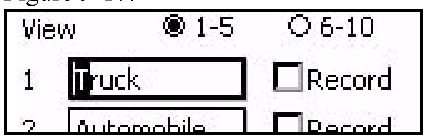


FIGURE 9-17 Marker Name Field

At any horizontal position, use the and keys to select a an alphanumeric character. When the desired name has been entered, press the key to conclude the process.

Using Markers

The Time History page of the Data Display View is used to display the data, as shown in FIGURE 9-5 “Time History Display: First Point; Keypress Beginning Measurement" .

Before or after the measurement is begun, press the **Menu** softkey to bring up the display shown in Figure 9-18.

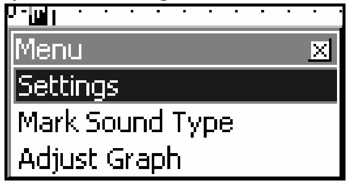


FIGURE 9-18 Menu Options

Use the key to highlight **Mark Sound Type** and press the key, which will modify the Time History display as shown in Figure 9-19.

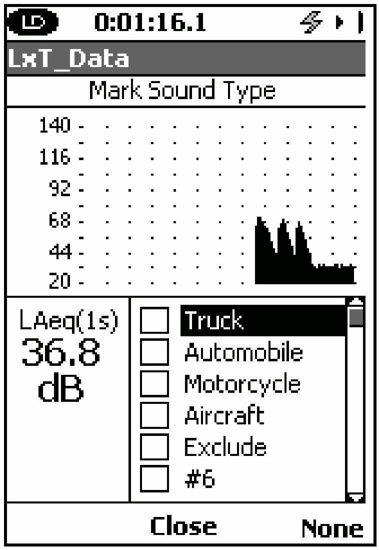


FIGURE 9-19 Time History Display with Markers

Setting Markers On/Off

At any time during a measurement, any of the markers can be set **On** or **Off.** Use the and keys to highlight the field of the desired marker. Pressing the key will set an **Off** marker to the **On** state and place a check mark in the check box. Similarly, pressing the ◊ key will set an **On** marker to the **Off** state and delete the check mark from the check box.

Setting All Markers Off

To set all markers to **Off**, press the right softkey labeled **None**.

Close Marker Control Window

Press the left softkey labeled **Close** to close the marker control window and return the display to the standard Time History display.

Markers Display

When any type of marker has been active during a time history measurement, this will be indicated by a solid horizontal line at the top of the screen as shown in "Time History Display with Frequency Spectrum Data Logged" on page 9-11.

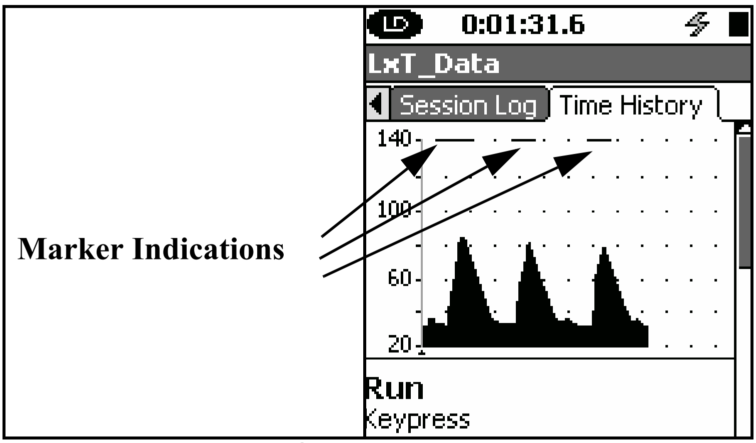


FIGURE 9-20 Marker Indication on Time History Display

Note that the graph scaling can be modified as described in section 'Adjust Graph Scale" on page 5-23.

The LxT Utility software provided with the LxT will show the names of the markers along with the time history data when the data is exported. See the LxT User Manual for details.

CHAPTER

10 Data Explorer

Control Panel - Data Explorer

To activate the Data Explorer Page, press the (TOOLS) key. Use the , or keys to highlight the Data Explorer icon as shown in FIGURE 10-1 "Control Panel".

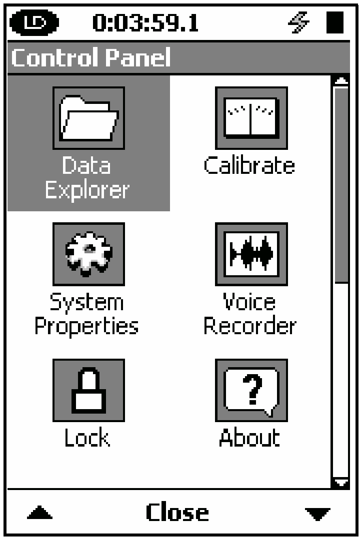


FIGURE 10-1 Control Panel

Press the ENTER key to open the Data Explorer Page.

Press the **Close** Softkey to exit from this page.

Data Explorer

There is one Data Explorer Page. It shows a directory of all the stored data files. There is a scroll bar to indicate the relative position in the list of data files. There may be more data files in the directory than are displayed on this page. All files may be viewed by scrolling through the list.

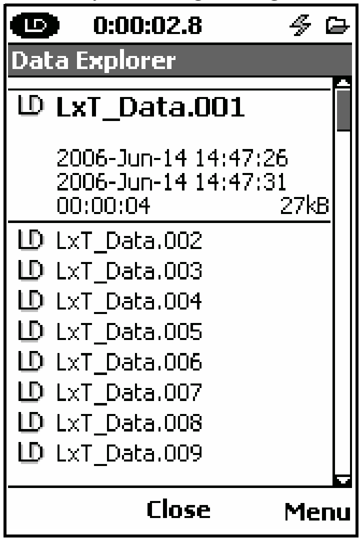


FIGURE 10-2 Data Explorer

Using the and keys you can scroll the list of data files. As each file is selected you get an expanded view of the directory entry showing:

- File name
- Description of measurement
- Start date and time of measurement
- End date and time of measurement
- Run time of measurement

Menu Softkey

Press the key to view the data file or press the Right Softkey labeled **Menu** for more options.

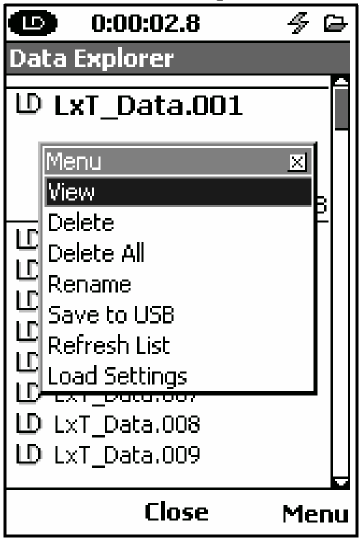


FIGURE 10-3 Data Explorer Menu

Using the and keys, select the desired function. Press the key to execute the function selected. To leave this menu without taking any action press the **Close** Softkey.

View

The View function opens a data view of the selected data file.

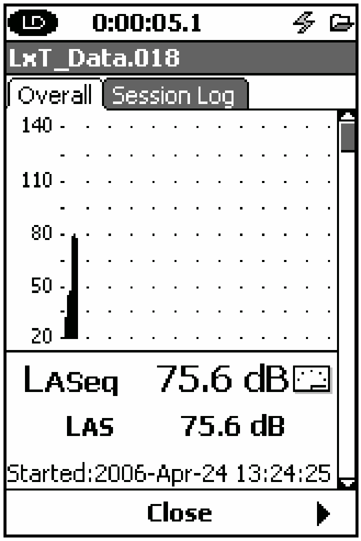


FIGURE 10-4 Data View Page

The Data View screen is similar to the Data Display screen. See ‘Overall Page” on page 5-8.

The file name of the data file being displayed is found in the title bar near the top of the screen.

For information on the Session Log Page see ‘Session Log Page” on page 5-22.

Pressing the Center Softkey labeled **Close** returns the screen to the Data Explorer view.

Delete

This deletes the selected stored data file. When the Delete menu item is highlighted and the ENTER (Enter) key is pressed, a message box appears asking you to confirm the request to delete the file.

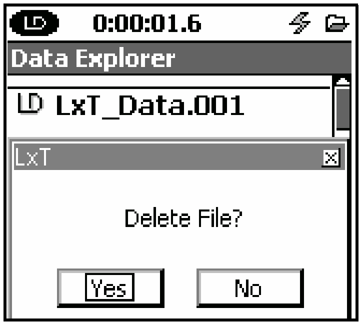


FIGURE 10-5 Delete File

Highlight the appropriate response using the or keys and the ENTER (Enter) key.

Delete All

This deletes all of the stored data files. When the Delete All menu item is highlighted and the ENTER (Enter) key is pressed, a message box appears asking you to confirm the request to delete all files.

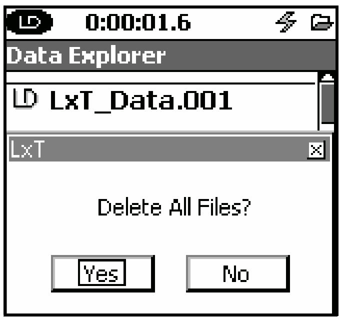


FIGURE 10-6 Delete All Files

Highlight the appropriate response using the or keys and the ENTER (Enter) key.

Rename

The Rename menu item enables you to change the name of the selected data file. Pressing the (Enter) key brings up a message box for editing the file name.

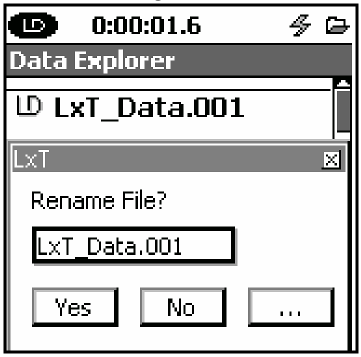


FIGURE 10-7 Rename File

Highlight the text box with the file name. Press the (Enter) key and the first character in the file name will be highlighted. Using the , , and keys, modified the file name. Press the (Enter) key to complete the changes.

Highlight the **Yes** button to accept the changes or the **No** button to discard the changes, the press the (Enter) key.

If your new file name is the same as a file already in the directory, an Overwrite message box will appear. See FIGURE 10-10 “Overwrite Confirmation" . If you select **Yes**, then the old file will be over written with the newly named file. A response of **No** will return the Rename message box. Use the or keys to make a selection and press the (Enter) key.

Overwrite an Existing File

Another method of renaming a file is to overwrite a stored file. Highlight the “**...**” button and press the ENTER (Enter) key to display a list of file names as shown in FIGURE 10-8.

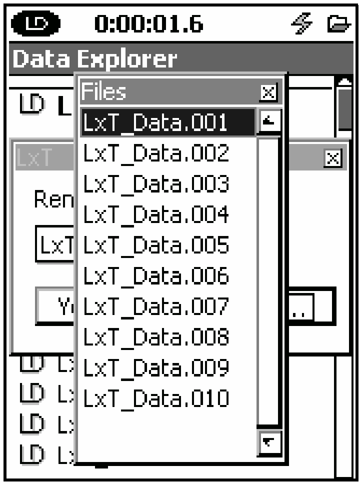


FIGURE 10-8 File Name List

Select a name from the list and press the ENTER (Enter) key The Rename File will now open again, with the name of the file which is to be overwritten in the file name field, as shown in FIGURE 10-9

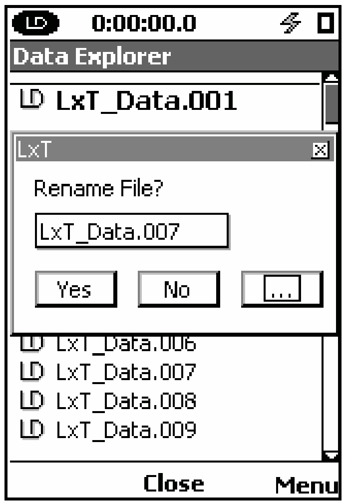


FIGURE 10-9 Selection of File to be Overwritten

Highlight **Yes** and press the (Enter) key to display the Overwrite Confirmation menu, shown in FIGURE 10-10..

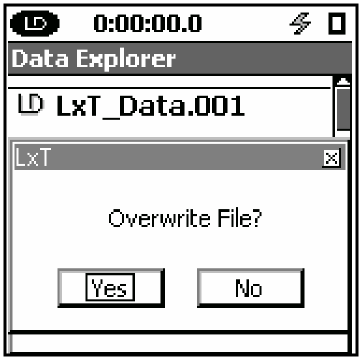


FIGURE 10-10 Overwrite Confirmation

Select the desired response and press the (Enter) key. If you select **Yes**, then the old file will be over written with the selected file. A response of **No** will return to the Rename message box.

Refresh List

The Refresh List menu item will refresh the file list on the Data Explorer Page.

Load Settings

Using the Load Settings Menu item, a new measurement may be run with the exact same parameters as the selected measurement. When the (Enter) key is pressed, the parameters from the selected measurement are loaded so a new measurement may be made. This is a convenient method to duplicate a previous measurement.

CHAPTER

11

System Properties

The System Property Pages are used to identify and / or control functions of the LxT that are not related to sound measurement or calculations.

Control Panel - System Properties

To activate the System Property Pages, press the (TOOLS) key. Use the , or keys to highlight the System Properties icon as shown in FIGURE 11-1 "Control Panel" .

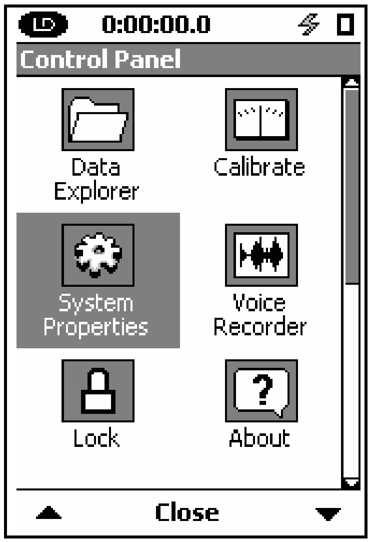


FIGURE 11-1 Control Panel

Press the ENTER key to open the System Property Pages.

There are four System Property Pages that may be selected using the Right and Left Softkeys. All System Property Pages have one section.

Device

It is easier to enter the text information for these three fields using the Blaze software or the SLM Utility-G3 software.

The Device Page has three fields in which the user may enter information about the instrument. This can identify the owners company name and address. Information may be easily placed in these fields using Blaze software.

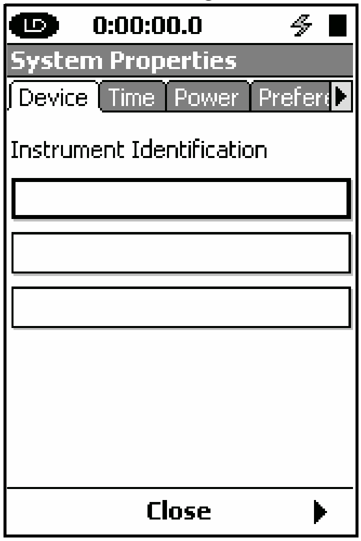


FIGURE 11-2 Device Page

Using the and keys select one of the three fields to edit. Press the ENTER key to highlight the 1st character position in the field. The , , and keys are used to scroll through a list of characters and change character positions in the field. When the information is complete, press the ENTER key to accept the information and move the highlight out of the field. At this point another field could be selected and the above process repeated.

Time

The time and date for the LxT may be adjusted on the time page.

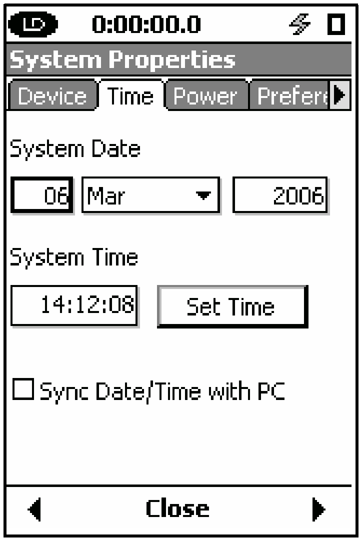


FIGURE 11-3 Time Page

Setting Day and Year

Using the , , and keys, highlight the data field of the numerical parameter to modify. Press the key to highlight the 1st character position in the date, year or time field. The , , and keys are used to modify the parameter. Press the key when modifications are complete.

Selecting the Month

When the Month box is highlighted, pressing the key will drop down a list of months. See FIGURE 11-4 "Month List" .

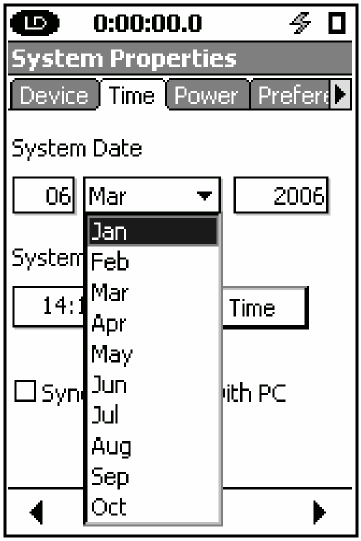


FIGURE 11-4 Month List

Use the and keys to highlight the desired month. Press the key to accept the selection and exit the field.

Sync Data/Time with PC

Selecting the "Sync Date/Time with PC" check box enables the LxT time to be set to the PC time when the unit is connected to the LxT Utility software. This function is enabled if there is an X in the check box. To modify the state of the check box, move the highlight to the check box and press key. The state of the check box will change.

Power

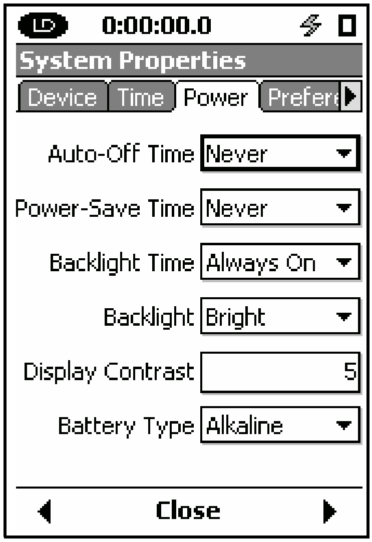


FIGURE 11-5 Power Page

There are five drop down list fields and one scrollable value field on the Power Page. These fields are selected and modified as discussed in the previous sections.

Auto-Off Time

Auto-Off time is the duration of time the instrument will stay on when no activity is occurring: button presses, running a measurement, USB communications, etc.

Pressing the (ON / OFF) key will return the instrument and the display to the state it was in when the Auto-Off time expired.

If the instrument is connected to external power, this feature is ignored.

Available durations are:

- “5 min”
- “10 min”
- “30 min”
- “60 min”
- “Never”

The default value is “Never”.

Power-Save Time

The duration selected in the Power-Save Time field sets the length of time the instrument will continue to measure sound level and update the display when the instrument is not in run mode and no other activity is taking place, such as key presses or USB communication. At the end of this time, the LxT enters a power save mode. In this mode, the sound pressure level is shown as “---”.

To exit this mode, press the  (RUN / PAUSE) key. There will be a few seconds delay before the instrument starts recording data.

If the LxT is connected to external power, this feature is ignored.

Available durations are: 5 minute, 10 minute, 30 minute, 60 minute and Never. The default is “Never”.

Backlight Time

This sets the duration of time the backlight remains on after the last key press. Available choices are:

- “5 sec”
- “10 sec”
- “30 sec”
- “60 sec”
- “Always On”

The default is “10 sec”.

Backlight Mode

Note that using the backlight on bright setting will significantly increase power consumption and decrease battery life

This field sets the intensity of the backlight. Options for backlight mode are: Off, Dim and Bright. The default is Off.

The Backlight mode can also be set by pressing the key as described in the section ‘ON/OFF Key” on page 3-6.

Display Contrast

Note that the Display Contrast can also be set from the display by pressing the key as described in the section "ON/OFF Key" on page 3-6. This is the preferred method of adjusting contrast because the changes are made immediately. With the method described here, the change is not applied until the System Properties display is closed.

This parameter is used to adjust the contrast of the display to accommodate varying viewing angles, temperature and lighting condition. Adjustment ranges from - 9 to +9. The default is 0.

Battery Type

To avoid damage to batteries, always set the correct battery type.

Select the type of battery installed in the LxT. This information is used for the calculation of battery life. Available battery types are: Alkaline and NiMH.The default is Alkaline.

Preferences

The Preferences Page is used to select general instrument formatting.

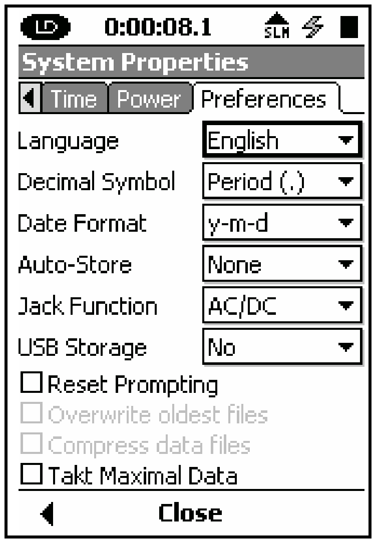


FIGURE 11-6 Preferences Page

Use the and keys to highlight the preference to be selected and left click the ENTER key to view a list of options.

Languages

The LxT supports the following languages:

- English
- French
- German
- Italian
- Portuguese
- Spanish

English is the default language.

Use the and keys to highlight the Language field and press the ENTER key to obtain a listing of the language choices as shown in FIGURE 11-7.

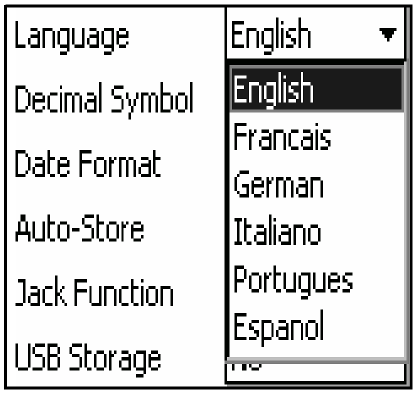


FIGURE 11-7 Language Preferences

Use the and keys to highlight the desired language and press the ENTER key to make a selection.

Decimal Symbol

The LxT supports two formats for the decimal symbol

- Period (.)
- Comma (,)

Use the and keys to highlight the Decimal Symbol field and press the key to obtain a listing of the choices as shown FIGURE 11-8.

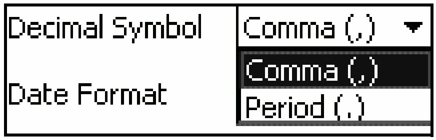


FIGURE 11-8 Decimal Symbol Preferences

Use the and keys to highlight the desired symbol and press the key to make the selection.

Date Format

The LxT supports two formats for expressing dates

- day-month-year
- year-month-day

Use the and keys to highlight the Date Format field and press the key to obtain a listing of the choices as shown in FIGURE 11-9.

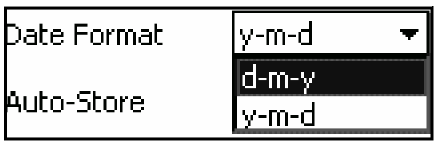


FIGURE 11-9 Date Format Preferences

Use the and keys to highlight the desired Date Format and press the key to make the selection.

Auto-Store

The LxT provides three Auto-Store options to enhance your data gathering activities:

- None
- Prompt
- Store

Use the and keys to highlight the Auto-Store field and press the key to obtain a listing of the choices as shown in FIGURE 11-10.

FIGURE 11-10 Auto-Store Preferences

Use the and keys to highlight the desired Auto-Store option and press the key to make the selection.

None

The user must press the (STOP/STORE) key to Stop the measurement. Press it again to store the data and also assign a filename. See 'Storing the Measurement" on page 7-14.

Prompt

When the (STOP/STORE) key is pressed to stop a measurement, the user will be prompted to save the data file. See 'Storing the Measurement" on page 7-14. If the user responds **Yes**, then a data file is saved. If **No** is selected, a data file is not saved. If data was stored when the (RUN/PAUSE) key is pressed, the instrument is automatically reset so a new measurement may begin.

Store

In this mode, when the (STOP/STORE) key is pressed, a data file is automatically saved. The default file name is assigned to the file. There is no user interaction in this process.

Pressing the (RUN/PAUSE) key, the instrument will automatically reset so a new measurement may begin.

Jack Function

The AC/DC Out/Headset Jack on the bottom of the instrument can be configured to provide one of the following:

- As an AC/DC output of the signal from the detector. Use with the optional AC/DC Output Cable (CLBL139); AC signal is output via the red BNC and DC signal via the white BNC. The AC output is typically directed to a frequency analyzer or oscilloscope and the DC output is typically directed to a strip chart recorder.

- As a microphone and speaker connection when used with the optional headset for voice recording/playback (ACC003)

It can also be set to **Off**.

The jack function setting becomes active as soon as it is selected.

Use the and keys to highlight the Jack Function field and press the ENTER key to obtain a listing of the choices as shown in FIGURE 11-11.

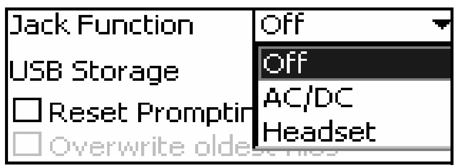


FIGURE 11-11 Jack Function Preferences

Use the and keys to highlight the desired Jack Function press the ENTER key to make the selection.

USB Storage

This can be used to cause data to be stored to a USB memory device instead of to internal memory. Use the and keys to highlight the USB Storage field and press the ENTER key to obtain a listing of the choices as shown in FIGURE 11-11.

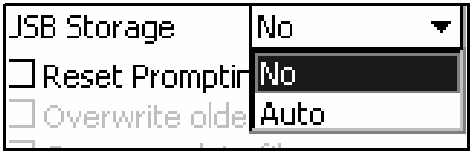


FIGURE 11-12 USB Storage Preferences

To have data stored to the USB memory device, use the and keys to highlight **Auto** and press the ENTER key to make the selection.

To have data stored to internal memory, use the and keys to highlight **No** and press the ENTER key to make the selection.

Reset Prompting

If the Reset Prompting check box is checked, the user will be prompted with an “Are You Sure” message box whenever the (RESET) key is pressed. If it is not checked, this prompt will not appear prior to the reset action taking place.

Use the and keys to highlight the Reset Prompting check box. Pressing the ENTER key toggles the state of the check box.

Takt Maximal Data

When this is checked, the parameter LAFTMS is also measured and displayed on the Community Noise Page of the Overall Screen and as a parameter of a Time History measurement.

Displays

The Displays page permits some customization of the displays.

Start

The user can select to have one of the following displays appear when the LxT is switched **On**.

With the Start field highlighted, press the ENTER key to obtain a list of options, as shown in

FIGURE 11-13 Display Start Options

Use the and keys to highlight the Display Start option and press the ENTER key to make the selection.

Selecting Displays to Appear

When there are measurement functions not being used or data displays which are not of interest for a measurement, the instrument operation can be streamlined by hiding selected displays. As a default, all available displays are set to appear.

Tab Page Selection

Use the key to highlight the Tabs field to to list the tab pages for which displays can be set to appear or be hidden, as shown in FIGURE 11-14.

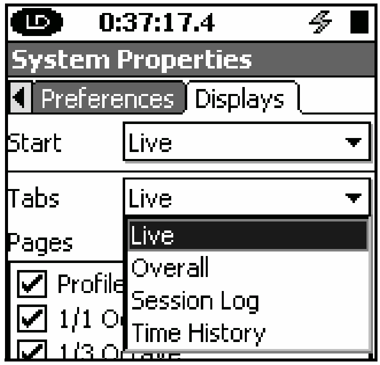


FIGURE 11-14 Display Tab Page Options

Use the and keys to highlight the desired Tab Page and press the ENTER key to make the selection.

Display Selection

The displays which can be set to appear or be hidden are shown below for each of the possible Tab Page selections.

Live Page Displays (5)

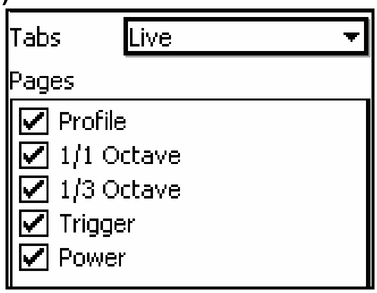


FIGURE 11-15 Live Page Displays

Overall Page Displays (13)

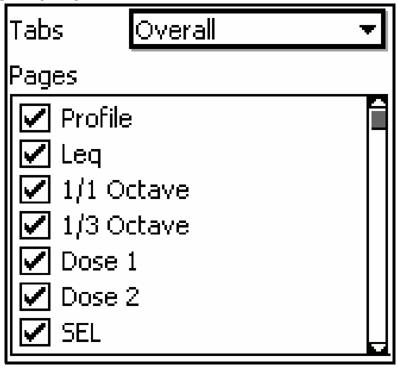


FIGURE 11-16 Overall Page Displays

Session Log Display

FIGURE 11-17 Session Log Displays

Time History Displays (3)

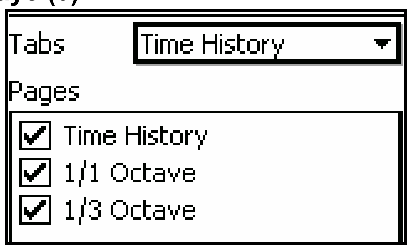


FIGURE 11-18 Time History Displays

All displays which have a check in their check box will appear on the LxT.

To modify any of the displays associated with one of the Tab Pages, use the or keys to highlight the field listing those displays and press the key. to obtain the display shown in FIGURE 11-19.

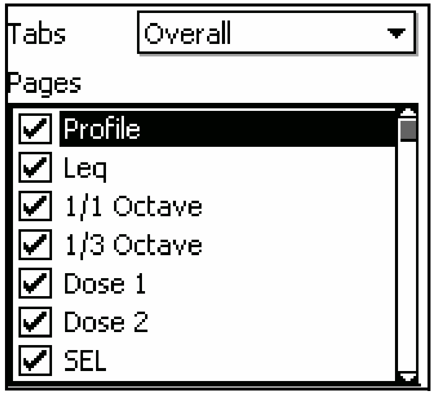


FIGURE 11-19 Display; Set to Appear or Hide

Pressing the key will toggle the state of the highlighted display between **Appear** (checked) and **Hide** (unchecked).

Use the and keys to highlight different displays and set them as desired. When finished setting the display types for this Tab Page, press the key.

When all desired modifications have been made to the displays for all Tab Pages, press the center softkey **Close** to return to the Control Panel.

CHAPTER 12

Lock/Unlock the LxT

To prevent unauthorized use or tampering with measurements and data, the LxT has a lock feature. When this is enabled, the LxT is tamper proof to a level selected by the user. There are 4 levels of security provided by this feature.

Control Panel - Lock

To activate the Lock Page, press the (TOOLS) key. Use the , , or keys to highlight the Lock icon as shown in FIGURE 12-1 "Control Panel"..

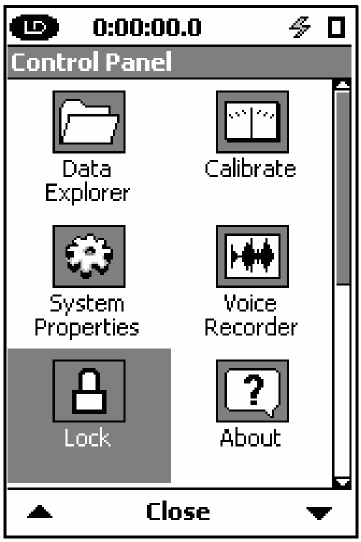


FIGURE 12-1 Control Panel

Press the ENTER key to open the Lock Page.

There is one Lock Page. There are three items on this page the user may configure.

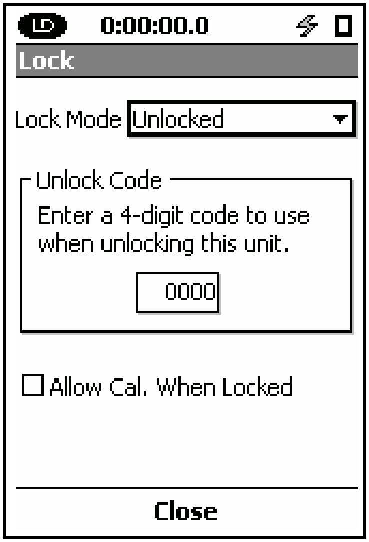


FIGURE 12-2 Lock Page

Using the and keys, highlight the Lock Mode list box. Press the ENTER key to drop down the list.

FIGURE 12-3 Lock Mode List

Use the or keys to highlight the desired lock mode. Press the ENTER key to accept the selection.

Lock Modes

Unlocked

The user has complete access to the features of the instrument.

Lock w/Auto-Store

The user cannot change the data view in this mode. Only the status line at the top of the screen is updated. A measurement may be running when this mode is enabled or pressing the (RUN / PAUSE) key will begin a measurement. A measurement cannot be paused. Pressing the (STOP / STORE) key stops the run and stores the data but does not reset the measurement. See Chapter 12 "Locked With Auto-Store" on page 12-9.

Lock w/Manual Store

In this mode, the Auto-Store preference is disabled, see Chapter 11 "Preferences" on page 11-8.

The user cannot change the data view in this mode. Only the status line at the top of the screen is updated. Measurements may be run, paused and stopped. See Chapter 12 "Locked With Manual-Store" on page 12-12.

Fully Locked

The user has no access to the instrument, except to start a run. Auto-Store preferences are enabled in this mode. See Chapter 12 "Fully Locked" on page 12-6.

A measurement cannot be reset when the Model LxT is locked in any mode.

Unlock Code

Move the highlight to the Unlock Code Field.

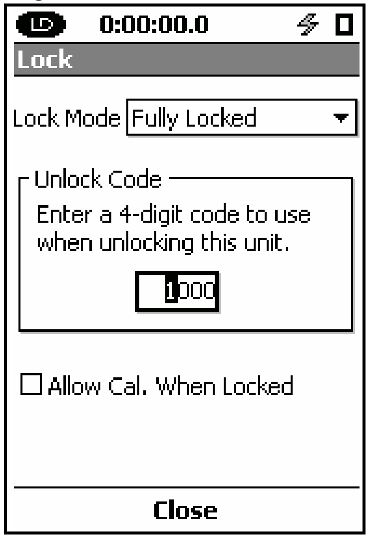


FIGURE 12-4 Unlock Code

Press the ENTER key. The 1st character in the field will be highlighted. Use the , , or keys to select the desired unlock code. To accept the new unlock code, press the ENTER key.

Press the **Close** soft key to exit the Lock Page.

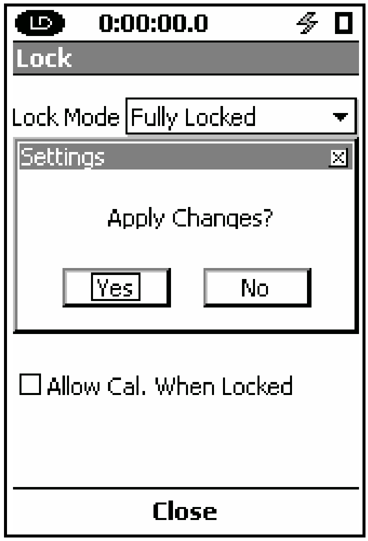


FIGURE 12-5 Apply Changes

Make the choice whether to accept the changes using the or keys and then press the ENTER key to complete the process.

Allow Cal When Locked

Move the highlight to **Allow Cal. When Locked**. Pressing the ENTER key will toggle the state of the check boxes shown in FIGURE 12-6 "Allow Cal Check Box". If the box is checked, calibration will be allowed while the unit is locked, but not running a measurement.

FIGURE 12-6 Allow Cal Check Box

Fully Locked

FIGURE 12-7 Fully Locked

If you have selected Fully Locked for the Lock Mode, upon accepting the changes, FIGURE 12-7 "Fully Locked" represents the view you will have. At this point, the instrument is not running a measurement. It is possible to select the Fully Locked mode while a measurement is in progress.

Pressing the (RUN/PAUSE) key will start a measurement by bring up the following message box.

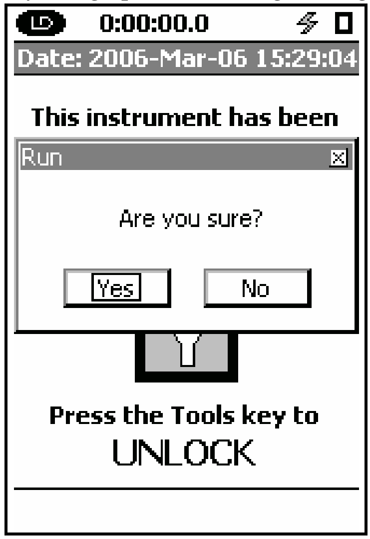


FIGURE 12-8 Are You Sure

Use the , and keys to select the desired response. Selecting **Yes** will begin the measurement. A measurement cannot be Paused, Stopped or Stored in the Fully Locked mode.

To unlock the LxT, press the (TOOLS) key..

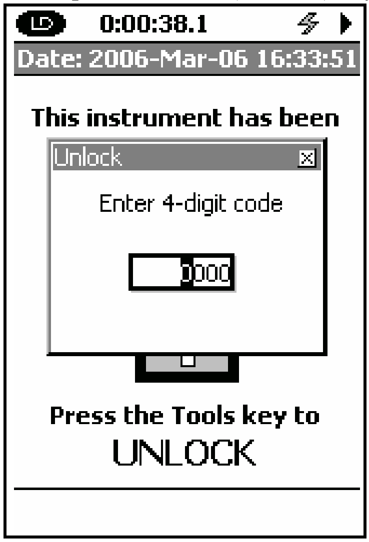


FIGURE 12-9 Unlock

The key or the Right or Left Softkey may also be used.

The , , and keys are used to enter your 4 digit code, then press the key.

The Model LxT is unlocked and all functions are available to the user.

Locked With Auto-Store

If the Locked w/Auto-Store mode has been selected, upon accepting the changes on the Lock Page, the view would look as shown in FIGURE 12-10 "Locked with Auto Store or Manual Store".

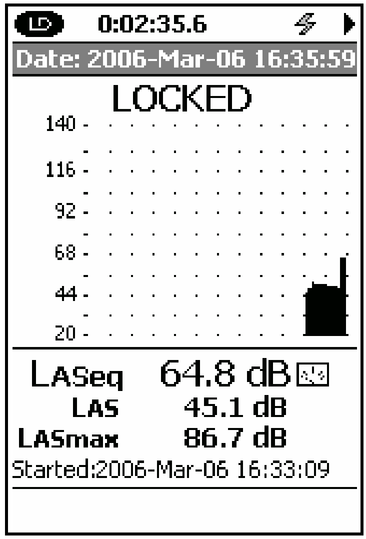


FIGURE 12-10 Locked with Auto Store or Manual Store

In this mode, measurements may be started by pressing the (RUN/PAUSE) key. A measurement may not be

Paused or Stopped. Pressing the (STOP/STORE) key will initiate storing the data file.

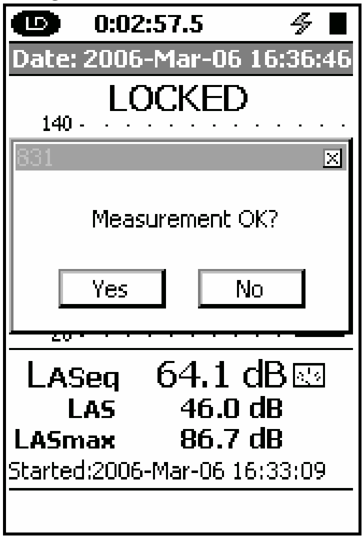


FIGURE 12-11 Auto-Store-Stop

Use the , and keys to select the desired response. If **Yes** is selected, the data file will be saved. The unit is still locked and a new measurement may be started by pressing the (RUN/PAUSE) key. If **No** is selected, the data is reset and a new measurement may be made

Unlock

To unlock the LxT, press the (TOOLS) key, the ENTER key or the Right or Left Softkey. Enter your 4 digit code, then press the ENTER key..

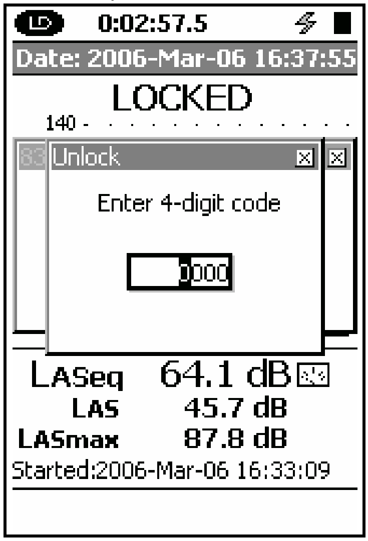


FIGURE 12-12 Auto-Store-Unlock

The LxT is unlocked and all functions are available to the user.

Locked With Manual-Store

If the Locked w/Manual-Store mode has been selected, upon accepting the changes on the Lock Page, the view would be as shown in FIGURE 12-10 "Locked with Auto Store or Manual Store".

In this mode, a measurement is started by pressing the (RUN / PAUSE) key. Pressing the (RUN / PAUSE) key a second time will pause the measurement and pressing it again will continue the measurement.

The (STOP / STORE) key will stop a measurement and a pressing it a second time will initiate the storage process by displaying the “Save File” prompt as shown in FIGURE 12-13.

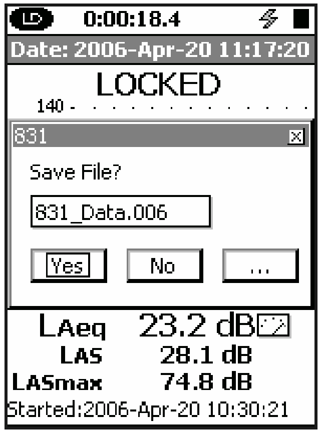


FIGURE 12-13 Manual Store When Locked

Left click **Yes** to store into the file number indicated, **No** to abort the storage operation or **...** to overwrite a file into which data has already been stored.

Unlock

To unlock the LxT, press the (TOOLS) key, the ENTER key or the Right or Left Softkey. Enter your 4 digit code, then press the ENTER key. See FIGURE 12-10 "Locked with Auto Store or Manual Store".

The LxT is unlocked and all functions are available to the user. The measurement may be stored.

Calibration When The LxT Is Locked

When the LxT is in any of the lock modes, and is stopped, the unit may be calibrated. This is only possible if the “Allow Cal. When Locked” check box, on the Lock Page, has been checked previous to entering Lock mode. See FIGURE 12-6 "Allow Cal Check Box".

If the Center Softkey indicating **CAL** is active, as shown in FIGURE 12-14, press this key. This will bring up the calibration screen. See Chapter 13 "Calibration" on page 13-1 for complete details on calibrating the LxT.

FIGURE 12-14 Locked with Calibration Permitted

CHAPTER 13

Calibration

Control Panel - Calibrate

To activate the Calibration function, press the (TOOLS) key. Use the , or keys to highlight the Calibrate icon as shown below.

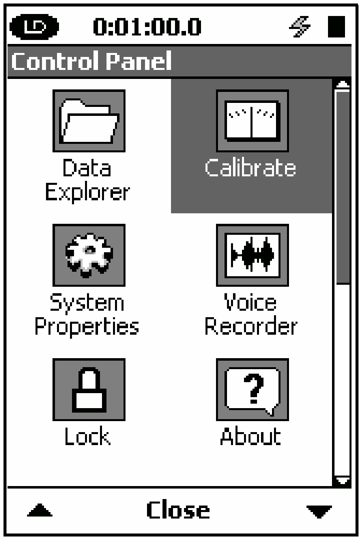


FIGURE 13-1 Control Panel

Press the ENTER key to open the Calibrate Pages.

There are 3 Calibration Pages:

- **Calibrate** - used to perform a calibration.
- **History** - a list of the 10 previous calibrations.
- **Certification** - Shows the last certification performed.

Exiting from the Calibration Function

Press the **Close** Softkey to exit from the calibration function.

Calibrate

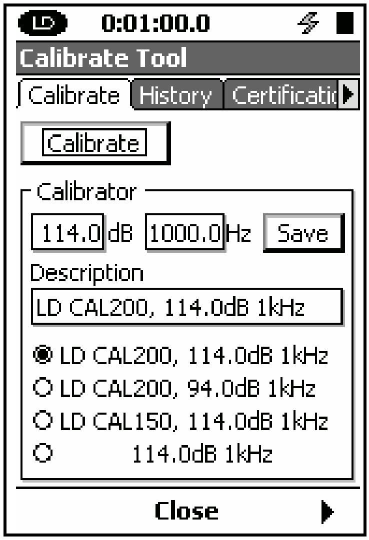


FIGURE 13-2 Calibrate Page

The LxT automatically switches to C weighting and Fast detector response for calibration. The Fast detector response reduces the stabilization time required before calibration.

After calibration, the LxT returns to the original frequency and time weighting set by the user.

On the Calibrator section of this page, there is an area to enter information about a calibrator and a list of calibrators. The user may select a calibrator from the list or enter new information about a calibrator.

Calibrator

Recommended Calibrator

Table 13-1 'Recommended Calibrators for Use with LxT1 and LxT2' lists the sound level calibrators which Larson Davis recommends for calibrating the Lxt1 and LxT2.

When using a 1/4” microphone, the adaptor ADP024, a 1/4” microphone adaptor for the 1/2” opening in the CAL150 and CAL200 calibrators, is also required.

Calibrator	Instrument	Calibrator Precision	Output	Frequency
CAL200	LxT1, LxT2	Class 1	94/114 dB	1 kHz
CAL150	LxT2	Class 2	94/114 dB	1 kHz

Table 13-1 Recommended Calibrators for Use with LxT1 and LxT2

Calibrating the LxT1 and 377B02 microphone

Many users find that using the nominal calibrator pressure level without corrections for temperature and static pressure provides sufficient accuracy for engineering purposes. However, for standard work, the proceedure described here is recommended.

The CAL200 provides a nominal pressure level of 94 dB or 114 dB. The exact levels are printed on the Larson Davis calibration sheet that came with the calibrator. When using a free-field microphone, the pressure level at the microphone diaphragm will be slightly different. Thus, a free field correction of -0.12 dB should be applied to either of these levels. If the calibrator and instrument are near room temperature (23° C) and near sea level (101.3 kPa) then no other corrections need to be made. If the calibration sheet for the CAL200 indicates 113.98 dB for it's level when set to 114 dB then set the Cal Level in the LxT to 113.86 dB and 1000 Hz.

When the microphone and instrument are at a temperature other than near room temperature or static pressures not near sea level, then corrections will need to be added for the ambient temperature and the prevailing static pressure. Check the calibration data shipped from Larson Davis with the CAL200 to get these corrections. The corrections can be added to the level obtained in the previous paragraph to get the actual level of the CAL200.

The 377B02 microphone's sensitivity varies with static pressure. If the instrument is calibrated in one environment and moved to another, then the sensitivity will change (after stabilization) depending on the change of temperature and pressure. The coefficient of static pressure is -0.01 dB/kPa. If the system is calibrated at 85 kPa for instance then it will be 0.16 dB less sensitive at sea level (101.3 kPa). The sensitivity of the 377B02 and LxT varies slightly with temperature also. The coefficient of temperature is -0.009 dB/°C. If the system is calibrated at 18°C then it will be 0.04 dB less sensitive at 23°C.

The Larson Davis 3" Wind Screen has less than 0.05dB effect on the system response at 1 kHz.

Set the CAL200 level switch to 94 or 114 dB.

Calibrating the LxT2 and 7052 microphone

Many users find that using the nominal calibrator pressure level without corrections for temperature and static pressure provides sufficient accuracy for engineering purposes. However, for standard work, the proceedure described here is recommended.

The CAL200 provides a nominal pressure level of 94 dB or 114 dB. The exact levels are printed on the Larson Davis calibration sheet that came with the calibrator. When using a free-field microphone, the pressure level at the microphone diaphragm will be slightly different. Thus, a free field correction of -0.12 dB should be applied to either of these levels. If the calibrator and instrument are near room temperature (23° C) and near sea level (101.3 kPa) then no other corrections need to be made. If the calibration sheet for the CAL200 indicates 113.98 dB for it's level when set to 114 dB then set the Cal Level in the LxT to 113.86 dB and 1000 Hz.

When the microphone and instrument are at a temperature other than near room temperature or static pressures not near sea level, then corrections will need to be added for the ambient temperature and the prevailing static pressure. Check the calibration data shipped from Larson Davis with the CAL200 to get these corrections. The corrections can be added to the level obtained in the previous paragraph to get the actual level of the CAL200.

The 7052 microphone's sensitivity varies with static pressure. If the instrument is calibrated in one environment and moved to another, then the sensitivity will change (after stabilization) depending on the change of temperature and pressure. The coefficient of static pressure is -0.036 dB/kPa. If the system is calibrated at 85 kPa for instance then it will be 0.57 dB less sensitive at sea level. The sensitivity of the 377A02 and LxT varies slightly with temperature also. The coefficient of temperature is -0.01 dB/°C. If the system is calibrated at 18°C then it will be 0.05 dB less sensitive at 23°C.

The Larson Davis 3" Wind Screen has less than 0.05dB effect on the system response at 1 kHz.

Set the CAL200 level switch to 94 or 114 dB.

Adding a Calibrator

When adding a calibrator to the list, the following information may be entered:

- Calibration Level
- Calibration Frequency
- Calibrator Description

The calibration level and frequency values are as specified in section ‘Calibrating the LxT1 and 377B02 microphone” on page 13-3.

Using the , and keys highlight each text box in the calibrate section of the page and enter the correct information about a calibrator.

Press the ENTER key to highlight the first character in the text box. The , and keys are used to edit the information in the text box. Press the ENTER key to complete entry.

When the calibration level, calibration frequency and calibrator description have been entered, highlight the **Save** button and press the ENTER key to save the information to the list of calibrators.

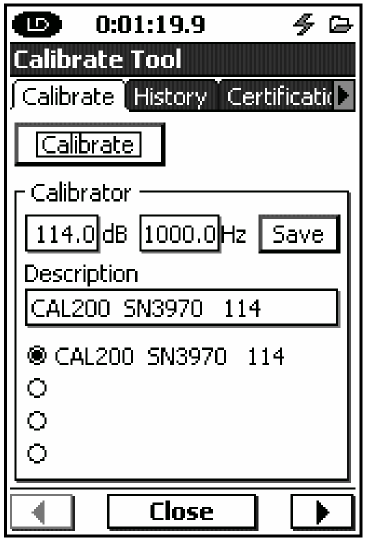


FIGURE 13-3 New Calibrator

If the desired calibrator is already in the list, highlight the calibrator and press the ENTER key. The radio button next to the selected calibrator will be filled in and the calibration information will appear above.

Calibrating The LxT

Refer to the calibrators operating instruction for more information.

After selecting a calibrator from the list above, the LxT is ready for calibration.

Carefully insert the microphone into the microphone opening in the top of the calibrator. Turn on the calibrator.

Highlight the **Calibrate** button on the LxT and press the ENTER key.

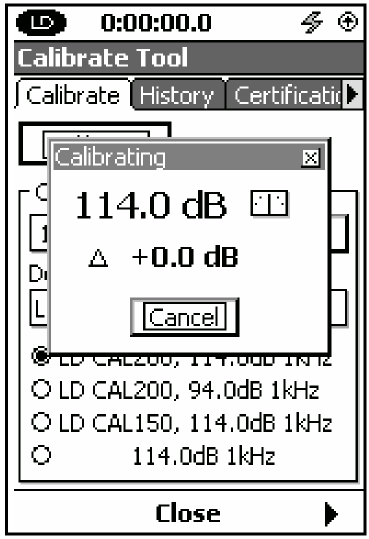


FIGURE 13-4 Calibrating

The Calibrating message box appears.

The present sound level (114.0 dB), the difference between the calibration level and the present sound level (Δ) and an indication of stability are displayed in this message box. When the pointer in the stability indicator is vertical, the sound level is stable.

The **Cancel** button is highlighted. Pressing the ENTER key will abort the calibration.

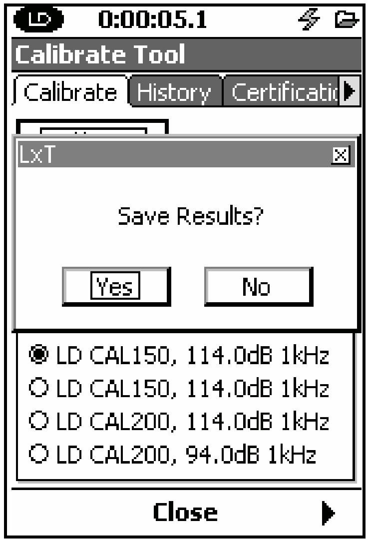


FIGURE 13-5 Save Calibration

*You can simply verify the calibration by selecting **No**. Also, if no significant changes are seen you may choose to answer **No** also.*

When the calibration is completed, a message box appears. Selecting **Yes** will save the results of the calibration and **No** will cancel the results of the calibration. Highlight the desired button and press the ENTER key.

History

Using the Right and Left Softkeys, scroll to the History Page.

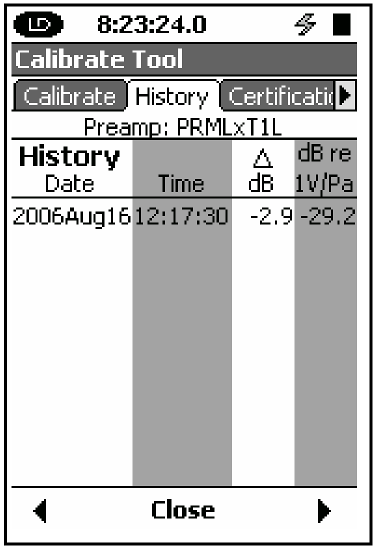


FIGURE 13-6 History Page

The History Page lists the last ten calibrations. For each entry the date, time, change in sensitivity and microphone sensitivity are displayed.

Certification

FIGURE 13-7 Certification Page

The Certification Page shows the date of the last certification and the due date for the next certification. Information about the calibration facility, typically Larson Davis, Inc. is displayed in the middle of the page.

A certification interval of one year is recommended but this can be lengthened or disabled depending on applicable requirements.

The user has the opportunity to set the calibration interval and a calibration reminder.

Use the and keys to highlight the desired drop down list box and press the ENTER key. A list of available times will appear. Using the and keys highlight the desired duration and press the ENTER key.

Available Certification Intervals are: 1 year, 2 years, 3 years and 4 years.

Available Certification Reminder times are: 15 days and 30 days.

CHAPTER

14 About

The About Pages give summary information concerning the instrument, available options and instrument identification.

Control Panel - About

To activate the About Pages, press the (TOOLS) key. Use the , , or keys to highlight the About icon as shown in FIGURE 14-1 "Control Panel".

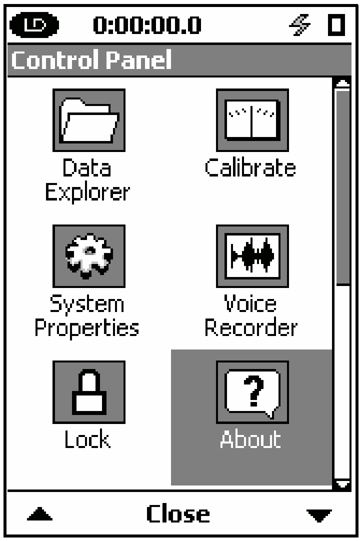


FIGURE 14-1 Control Panel

Press the ENTER key to open the About Pages.

There are three About Pages that may be selected using the Right and Left Softkeys. All About Pages have one section. There is no user input required on these pages.

About

This page gives you important information such as Serial Number and Firmware Revision. See FIGURE 14-2 "About Page".

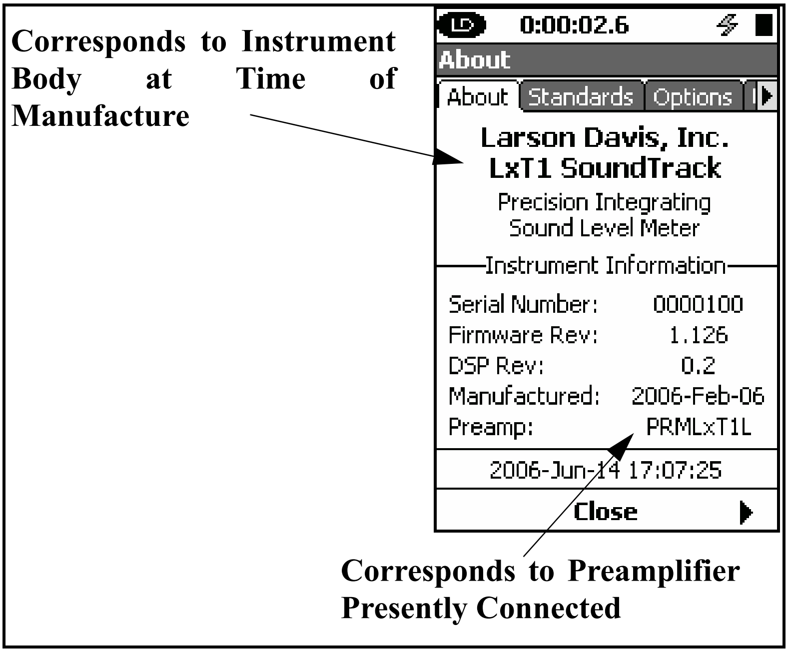


FIGURE 14-2 About Page

Standards

The Standards Page lists the standards that the LxT meets. See FIGURE 14-3 "Standards Page".

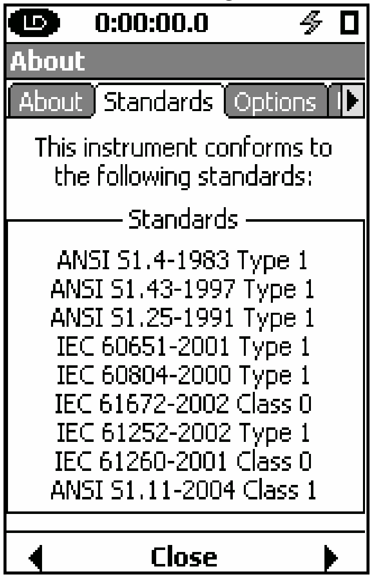


FIGURE 14-3 Standards Page

Options

Options may be added at any time "In the Field". Just call one of the telephone numbers listed on the inside front cover or contact your local representative, listed under "Sales" on the Larson Davis web site www.LarsonDavis.com.

The Options Page lists available options for the LxT. A check mark next to an option indicates that the option is enabled. See FIGURE 14-4 "Options Page".

FIGURE 14-4 Options Page

User

This page displays any identifying information the user may have entered on the System Properties / Device Page or using Blaze software. See FIGURE 14-5 "User Page".

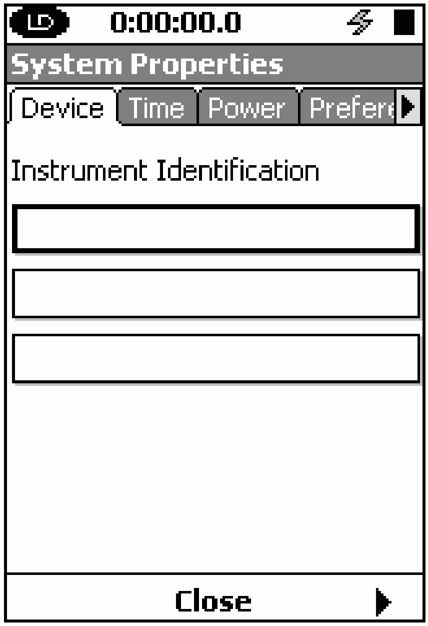


FIGURE 14-5 User Page

Credits

Just like a major motion picture, it takes a large staff of experienced professionals working long hours behind the scenes to produce a product like the LxT. We are pleased to present a rolling list of credits to acknowledge these individuals for their valuable contributions.

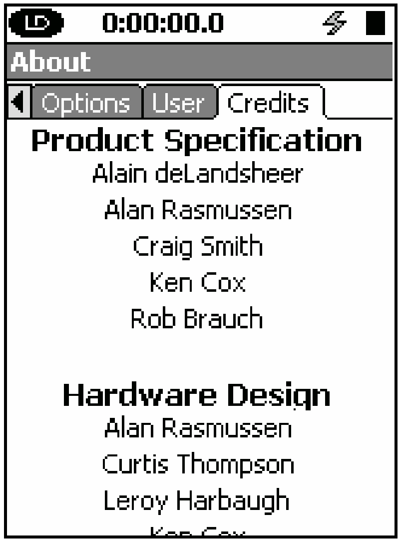


FIGURE 14-6 Credits

CHAPTER

15

System Utilities

Control Panel - System Utilities

Note: It is necessary to press the key one time in order to see the System Utilities icon on the Control Panel.

To activate the System Utilities Page, press the (TOOLS) key. Use the , , or keys to highlight the System Utilities icon as shown in FIGURE 15-1 "Control Panel"..

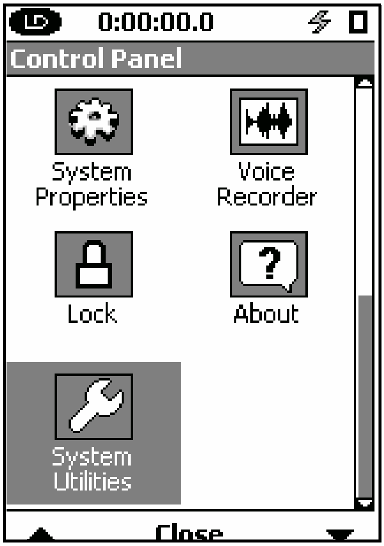


FIGURE 15-1 Control Panel

Press the key to open the System Utilities Page.

There is one System Utilities Page: File System.

File System

The File System page is used to repair or recover from file system problems. The functions available on this page are similar to function that would be used to manage a hard drive. See FIGURE 15-2 "File System".

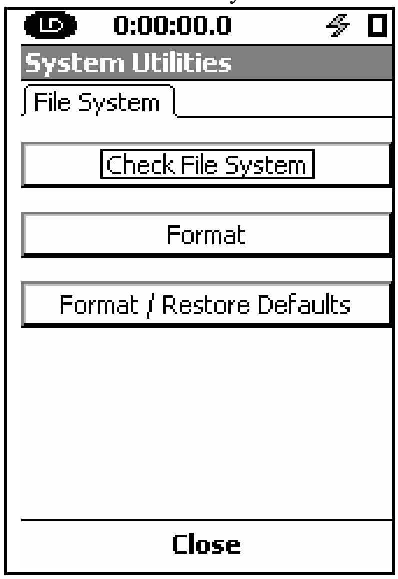


FIGURE 15-2 File System

The three functions on the File System page are

- Check File System
- Format
- Format & Restore Defaults

Use the and keys to select the desired function. Press the key to initiate this operation.

Warning: Using these functions may cause loss of data and restoration of the LxT to default conditions.

The user should only activate these functions if there appears to be a problem.

Check File System

These utilities will detect and repair file system problems.

When the Check File System button is selected, the LxT will check the file system in the LxT, similar to Check Disk on a PC. If a problem is detected, an attempt will be made to repair the problem.

Format

Selecting this function will format the internal data storage area in the memory of the LxT. This operates similar to the Format function on a PC. System and measurement properties are preserved.

Format & Restore Defaults

Selecting this function formats the internal data storage area in the memory of the LxT. The LxT is then restored to factory settings.

The Format and Format & Restore Defaults function will erase all internal data files, but it will not affect data stored in USB memory.

CHAPTER 16

LxT Hardware

Components

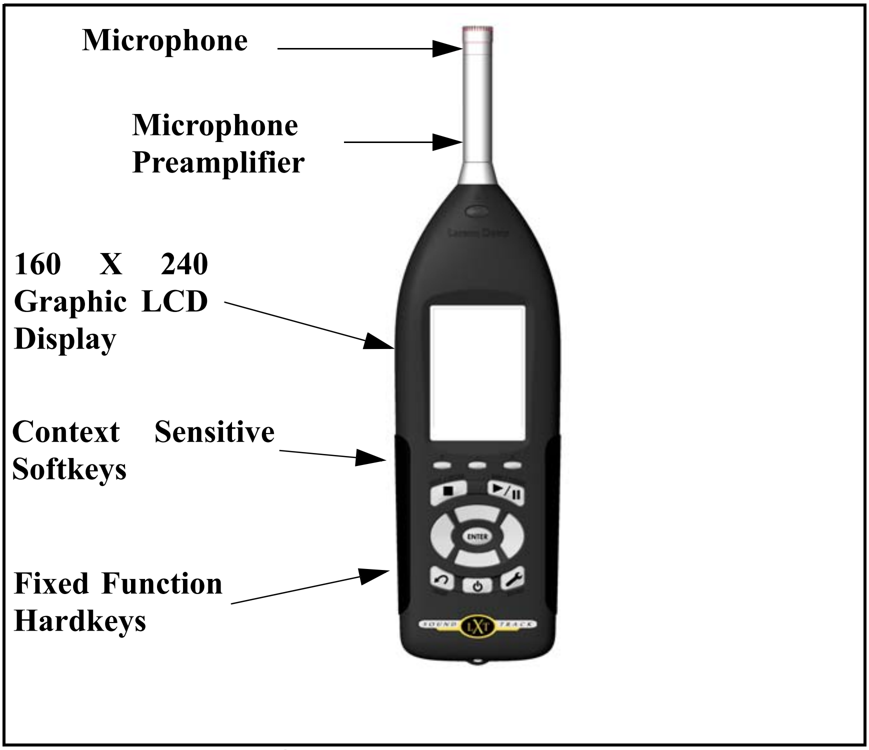


FIGURE 16-1 LxT Front View

Microphone and Microphone Preamplifier

There are three models of microphone and four preamplifiers available for use with the LxT. There are two equivalent electrical impedance adaptors available. These are discussed in Chapter 1 "Optional Accessories" on page 1-10.

Display

The LxT has a 160 x 240 graphic, liquid crystal display. The display is backlit to provide comfortable viewing in most ambient light situations. Controls are provided for contrast and backlight adjustments. These controls are discussed in Chapter 3 "Power Control Page" on page 3-7 and Chapter 11 "Power" on page 11-5.

Keypad

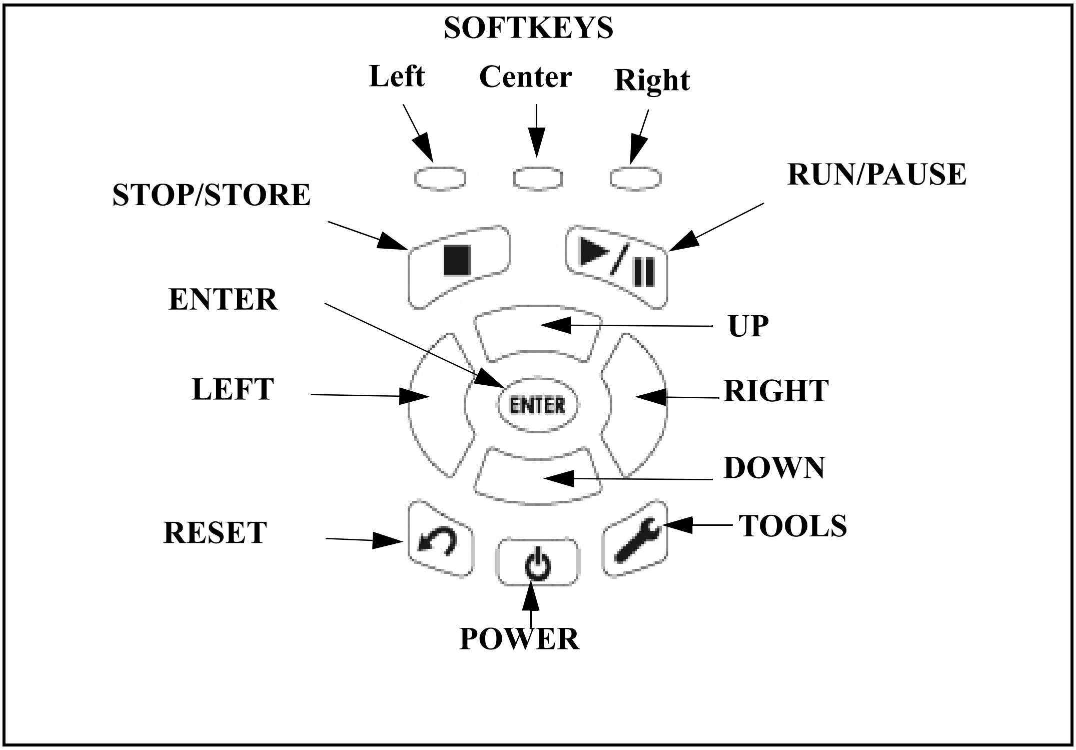


FIGURE 16-2 LxT Keys

Softkeys

The three push button keys just beneath the display, on the body of the LxT, are called Softkeys. Above each Softkey, on the bottom of the display, is an icon that may contain a label. The label indicates the action which will take place when the key is pressed. Softkeys are so named because the role of each key can change depending upon how it is programmed, as indicated by the label.

Hardkeys

The ten push button hardkeys have fixed functionalities as defined below.

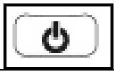
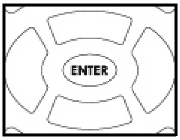
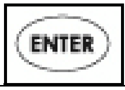
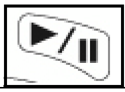
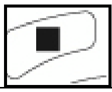
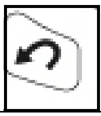
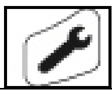
	The Power button is used to turn the LxT ON and OFF when the Hardware Power Switch, on the base of the unit is in the “|” position.
	The Navigation buttons; Up, Down, Left and Right are multipurpose keys used to highlight icons and defined areas on the display, make a selection from multiple options, scroll through sections of multi section Data Views, and to input alphanumeric characters into data fields.
	The Enter button is used to implement data entry associated with selections from multiple options or the input of alphanumeric characters into data fields.
	The Run/Pause Button is used to initiate and pause a measurement, and to continue a paused measurement.
	The Stop/Store Button is used to stop a measurement and to store a measurement when the measurement is stopped
	The Reset Button is used to reset a measurement.
	The Tools Button is used to set a number of parameters not associated with a specific measurement, such as setting date and time, managing power options and setting personal preferences (i.e. language, decimal and date formats, etc.).

Table 3-1 Keypad Hardkeys

Connectors and Interfaces

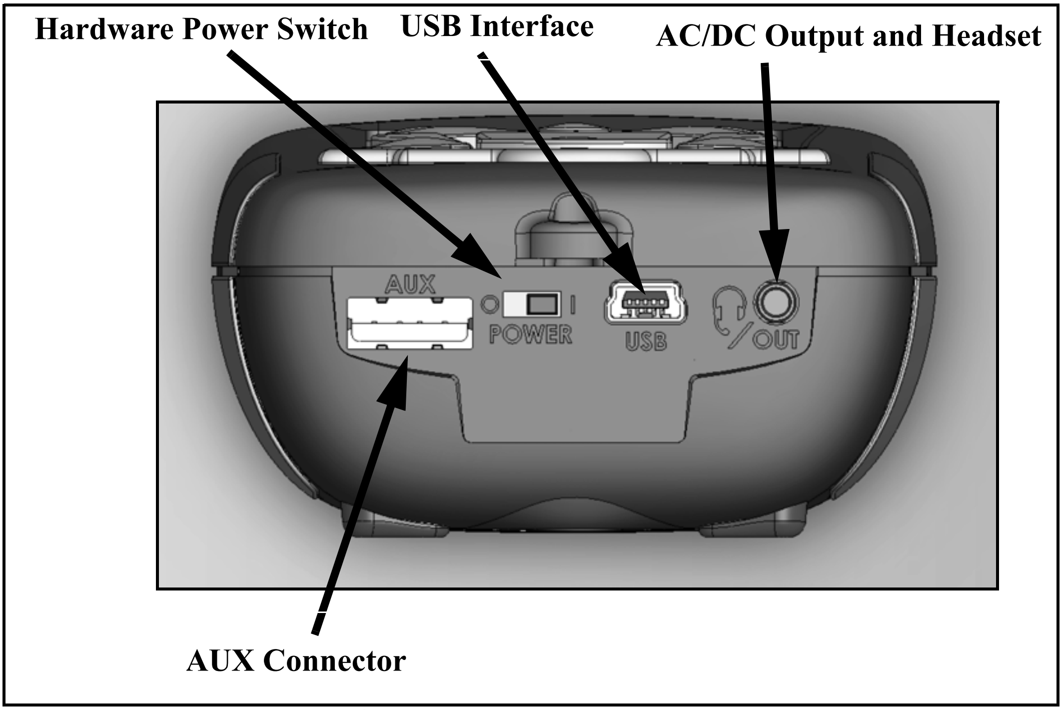


FIGURE 16-3 LxT Bottom Panel

DO NOT use the hardware power switch to turn the LxT ON or OFF. This will cause data to be lost. See "Hardware Power Switch" on page 2-7 for additional information on the use of the hardware power switch.

- **AUX Connector:** reserved for future developments.
- **Hardware Power Switch:** when set to “O”, completely powers down the LxT with the exception of permitting the real-time clock to continue. Set to “|” for instrument operation.
- **USB Interface:** used for communication with a PC, utilization of USB memory devices, control of the LxT from the PC and downloading of data from the LxT to the PC. The PSA029 external power supply may be connected here.
- **AC/DC Output and Headset Jack:** used to output analog AC and DC signals or to connect to a headset for the recording and playback of voice records. See “Jack Function” on page 11-12.

Batteries

The installation of batteries into the LxT is discussed in Chapter 2 "Inserting Alkaline Batteries" on page 2-6.

The LxT is compatible with AA alkaline and nickel metal hydride batteries. Energizer, Duracell and other nationally recognized brands are the preferred suppliers of alkaline batteries. These will provide the user with the best battery life estimation. Energizer and Ray-O-Vac, 2500 mAH, AA, NiMH batteries and their respective fast chargers are also recommended.

CAUTION:

- **NiMH batteries cannot be charged in the LxT. Do not mix alkaline and NiMH batteries in the LxT.**
- **Do not mix batteries from different manufacturers**
- **Replace all four batteries when installing fresh cells**
- **NiMH batteries may not be used in areas requiring Intrinsic Safety Approval.**

See Chapter 3 "Power Control Page" on page 3-7

Battery Voltage and Estimated Run Time are displayed on the Power Control screen and the last section of the Live Pages.

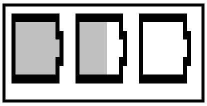


FIGURE 16-4 Battery Status Icons

A battery icon is always available in the status bar at the top of the screen. The icon shows the state of the battery charge as a full icon with fresh batteries, decaying to an empty battery near the end of the battery life. The battery voltage and the state of the battery icon directly reflect the remaining Estimated Run Time as displayed by the instrument.

As the battery nears end-of-life, the empty battery symbol will begin to flash. The unit will shut down in a short time because the battery voltage is too low.

When the battery is at the end-of-life, the LxT will stop running, save all data and instrument status, then turn off. When the unit is turned on again, with fresh batteries or an external power supply, the unit will return to the state it was in when it shut down.

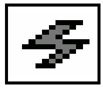


FIGURE 16-5 External Power Icon

If external power is supplied through the USB connector, the battery icon is replaced with the External Power icon.

When external power is connected to the LxT, the unit is not dependant on batteries. The Estimated Run Time calculation is valid only if there is no external power.

External Power Supply

The LxT cannot be operated under external power, USB or from an external power supply, if the internal batteries are discharged (flat) for reasons described in this section.

If there are no batteries installed in the LxT, external power via USB or an external power supply will be utilized without host permission. Thus, you can remove depleted batteries and run on USB power only or power from an external power supply. However,

The LxT can be powered from batteries or, if available, from the USB host portion of your computer. It can also be powered externally using the PSA029 power supply, as described in the section "External Power Supply" on page 16-7.

External power, whether provided via USB or an external power supply, is negotiated with the host and cannot be utilized until permission is granted by the host. This means that the LxT must run on batteries until allowed by the host to run on USB or external power . If the batteries cannot provide sufficient power (flat cells) the LxT will not power on. Ensure that the LxT has good batteries in order to turn on.

PSA029

The PSA029 is supplied with mains power adaptors for most areas of the world. Locate the plug adapter for your locality and install it by sliding it onto the supply case.

The PSA029 external power supply for the LxT has an input operating voltage range of 90 to 274 VAC and a power line frequency range of 47 to 63 Hz. The output voltage from the supply is 5 VDC. The external power supply connects to the USB connector on the bottom of the LxT.

With the power supply connected and operating at rated conditions, the LxT will operate properly with or without batteries installed. If the LxT is operated on external power only, no batteries installed, there is a possibility of instrument malfunction if there is an interruption of power to the LxT for any reason.

CHAPTER

17 Parameters Measured

This chapter describes the different acoustic parameters which can be measured, displayed and stored using the LxT.

Basic Sound Level Measurements

Frequency Weighting

See "SLM Page" on page 4-5

Each of the sound level parameters measured at one time will be frequency weighted as set by the user from the Measurement Properties Pages. The frequency weighting for RMS and Impulse averaged sound levels will be the same, selected independent from the frequency weighting for peak detection.

RMS and Impulse Weighting

The LxT measures RMS and Impulse averaged sound level values using one of the following user-selected frequency weightings:

- A-Weighting
- C-Weighting
- Z-Weighting

Peak Weighting

The LxT measures peak sound level values using one of the following user-selected frequency weightings:

- A-Weighting
- C-Weighting
- Z-Weighting

RMS Averaging

The exponential averaging time for RMS sound levels is set to one of the following:

- Slow
- Fast

An impulse detector is also available.

Sound Level Metrics Measured

In Table 17-1 "Sound Level Metrics Measured" the symbol X is used to represent the user-selected RMS and Impulse frequency weighting (A, C or Z) and the symbol Y is used to represent the user-selected peak frequency weighting (A, C or Z). The symbol V represents the time weighting Fast, Slow or Impulse.

	Selected RMS Averaging				
Metric	**Fast**	**Slow**	**Impulse**	**Peak**	**Integrated**
Instantaneous Sound Level	L_{XF}	L_{XS}	L_{XI}	L_{Ypeak}	
Maximum Sound Level	L_{XFmax}	L_{XSmax}	L_{XImax}	$L_{Ypeak(max)}$	
Minimum Sound Level	L_{XFmin}	L_{XSmin}	L_{XImin}		
Equivalent Level			L_{XIeq}		L_{XVeq}

Table 17-1 Sound Level Metrics Measured

1/1 and/or 1/3 Octave Frequency Spectra

The LxT can perform just 1/1 or 1/3 octave real-time frequency spectra measurements or they can both be measured simultaneously. These spectra will be made using a user-selected frequency weighting (A, C or Z). The averaging time is the same as that selected for the sound level measurements (Fast, Slow or Impulse).

Spectral data is displayed on both the Live and Overall Pages, but only the Overall Data can be stored.

Live Page

From the Live Page, the graphic shows the instantaneous SPL value for all frequencies and the bar to the far right shows the summation value for the entire frequency band. The value corresponding to the cursor position is displayed numerically beneath the graph.

Overall Page

From the Overall Page, the graphic shows the energy equivalent level calculated over the measurement time period at each frequency band and, at the far right, for the summation of all frequency bands. The values displayed digitally beneath the graph represent the following data for the frequency band at the cursor position.

- Leq
- Lmax
- Lmin

Sound Exposure Metrics Measured

See Chapter 9 "Industrial Hygiene" on page 9-1

The LxT measures two separate and independent sets of sound exposure metrics.

The following parameters are user-selectable:

- Exchange Rate: 3, 4, 5 or 6 dB
- Threshold Enable: Yes or No
- Threshold Level: Numeric entry
- Criterion, Level and Hours: Numeric entries

In Table 17-2: "Sound Exposure Metrics Measured" the symbol X is used to represent the user-selected RMS and Impulse frequency weighting (A, C or Z) and the symbol Y is used to represent the user-selected peak frequency weighting (A, C or Z).

The symbol V is used to represent the user selected time weighting (F, S or I)

Metric	Symbol
Sound Exposure Level, SEL	L_{XVE}
Average Sound Level, Lavg	L_{Xavg}
Time Weighted Average Level, TWA(x)	TWA(8)
Noise Dose	DOSE
Projected Noise Dose	ProjDose
Daily Personal Noise Exposure, Lep,d	LXep,8
Sound Exposure, E	E_{XV}
Projected 8 Hour Sound Exposure	E_{XV8}
Projected 40 Hour Sound Exposure	E_{XV40}
SEA	SEA

Table 17-2:Sound Exposure Metrics Measured

Statistical Metrics Measured

See "Ln Page" on page 4-12

Six Ln statistical parameters are measured using the frequency weighting (A, C or Z) and exponential averaging (Slow or Fast) selected when setting up the LxT for a sound level measurement. These six values are user-selected over the range $L_{0.01}$ to $L_{99.99}$.

Exceedance Counters

See "Triggers Page" on page 4-20

The LxT has three exceedance event counters: two RMS event counters and three peak event counters. For each exceedance there is a threshold level, event counter and duration.

The thresholds L_{XV} or L_{Ypeak} are the levels that the parameter must exceed to increment the counter and duration. X is RMS frequency weighting, Y is peak frequency weighting and V is time weighting.

The Count is the number of times each parameter has exceed the preset level.

The duration is the total accumulated duration of all exceedances for a specific parameter.

Miscellaneous Parameters

S.E.A.

SEA is a time integration of peak levels that exceed 120 dB.

CHAPTER

18 Memory Utilization

This chapter presents formulas to calculate the amount of memory used by the parameters which can be stored to internal memory.

Overall Data

Each overall data block stored when performing a "Save File" operation will utilize 27 kB of memory.

Session Log

The amount of memory utilized, in bytes, when storing a session log is calculated as follows:

40 + 12 *Number of records

where Number of records includes all Run, Pause, Stop, Voice Message and Marker events.

Time History

The amount of memory utilized, in bytes, when storing a time history block is calculated as follows:

40 + (16*Number of parameters enabled)*Number of records

where Number of Records = Number of Samples + Number of Run, Pause and Stop events

Voice Messages

The amount of memory utilized, in bytes, when storing each voice message is calculated as follows:

24+20480*Record Length

where Record Length is in seconds.

APPENDIX

A Technical Specifications

The specifications contained in this chapter are subject to change without notice. Please refer to calibration and measurement results for data on a specific unit.

Standards Met

The LxT meets the specifications of the following standards:

Instrument	LxT1	LxT2
Sound Level Meter Standards	IEC61672-1 (2002-05) Class 1, Group Z IEC60651 (1979) plus Amendment 1 (1993-02) and Amendment 2 (2000-10) Type 1, Group Z IEC60804 (2000-10) Type 1, Group Z ANSI S1.4-1983 (R 1997) plus Amendment S1.4A-1985, Type 1 ANSI S1,43-1997, Type 1	IEC61672-1 (2002) Class 2, Group Z IEC60651 (1979) plus Amendment 1 (1993-02) and Amendment 2 (2000-10) Type 2, Group Z IEC60804 (2000-10) Type 2, Group Z ANSI S1.4-1983(R 1997) plus Amendment S1.4A 1985, Type 2ANSI S1,43-1997, Type 2
Octave Filter Standards (Options OB1 or OB3 only)	IEC61260 (1995-07) plus Amendment 1 (2001-09), 1/1 and 1/3-octave Bands, Class 1, Group Z, all filters ANSI S1.11-2004 Class 1	IEC61260 (1995-07) plus Amendment 1 (2001-09), 1/1 and 1/3-octave Bands, Class 1, Group Z, all filters ANSI S1.11-2004 Class 1
Personal Noise Dosimeter Standards	IEC61252 Ed. 1.1 (2002) Type 1 ANSI S1.25-1991 Class 1	IEC61252 Ed. 1.1 (2002) Type 2 ANSI S1.25-1991 Class 2

Table A-1 Standards Met by LxT

Declaration of Conformity

Larson Davis Inc. declares that:

LxT Sound Level Meter

has been measured in representative configuration with: PRMLxT1 preamplifier, 377B02 microphone and the following cables: EXC010 microphone extension cable, CBL138 USB interface cable and CBL139 AC/DC output cable in accordance with the following directives:

- 89/336/EEC The Electromagnetic Compatibility Directive and its amending directives

has been designed and manufactured to the following specifications:

- EN 50081-1 (1992) - Electromagnetic compatibility - Generic emission standard Part 1. Residential, commercial, and light industry.
- EN 50082-2 (1995) - Electromagnetic compatibility - Generic immunity standard Part 2. Industrial environment.

LxT Specifications

LxT Main Characteristics:

Class 1 Precision Integrating Sound Level Meter with real-time 1/3 Octave Filters, classified as group X for the emission of, and susceptibility to, radio frequency fields.
64 MB standard data memory. 120 MB optional
High contrast 1/8th VGA LCD display with white LED backlight; sunlight readable
Icon-driven graphic user interface
Soft rubber backlit keys
Large dynamic range
Time weightings: Slow, Fast, Impulse, Integration and Peak
Frequency weightings: A, C, Z
1/1 and 1/3 octave frequency analysis available
Voice message annotation available, which includes headset
L_n statistics (L0.01 through L99.99 available)
Blaze software available for setup, control, high speed data download, analysis and reporting
Multi-tasking processor allows measuring while viewing data or transferring data
Data Secure Feature saves data to permanent memory every minute
AC/DC outputs to recorder
Long battery life; 16 hours continuous measurement
Field-upgradable firmware: keeps instrument current with the latest measurement features via ROM disk upgrades
Two-year limited warranty

Table A-2 LxT Main Characteristics

General Specifications

Reference level:	114.0 dB SPL
Reference level range	Single large Range for SLM Normal for OBA option
Reference frequency:	1000 Hz
Reference direction:	0° is perpendicular to the microphone diaphragm
Temperature:	≤ ± 0.5 dB error between -10° C and 50°C
Storage temperature:	-20°C to 70°C
Humidty:	≤ ± 0.5 dB error from 30% and 90% relative humidity at 40°C
Equivalent mic impedance:	16 pF for Larson Davis 1/2” microphone
Range level error (OBA option):	≤ ±0.1 dB relative to the reference range
Digital Display Update Rate	Four times per second (0.25 sec between updates). First display indication is available 0.25 seconds after initiation of a measurement.
Nominal Drift of Displayed Time	Within limits +1.7 to - 6.0 second/day
Effect of an extension cable (EXCXXX) on calibration:	none (up to 200 feet)
Electrostatic Discharges	The LxT is not affected by electrostatic discharges.

Table A-3 General Specifications

AC/DC Output

AC output voltage range:	±1.00 Volts peak (~ 70 dB dynamic range)
DC output voltage range:	0 to +3 Volts (0 to 300 dB) $V0 = SPL/100$ $SPL = 100 \times V0$ or Sensitivity = 0.01 V/dB with resolution of 0.001 V
AC output impedance:	Low impedance speaker driver (instrument readings are not affected by AC or DC output loading)
DC output impedance	3650 Ω
AC/DC output connector:	2.5 mm stereo jack Tip: DC out Ring: AC out Sleeve: Ground When using the CBL139 cable, the DC signal is on the White connector and the AC signal is on the Red connector.

Table A-4 AC/DC Output Specifications

Power Supply

Batteries:	4-AA (LR6) Alkaline or NiMH cells
External power	Powered through USB interface from computer or AC/DC converter PSA029; 5 volt ± 5% required.

Table A-5 Power Supply Specifications

Battery	Operating Life, Hours
4-AA (LR6) Alkaline cells	16

Table A-6 Internal Battery Operating Lifetime

Memory Retention without Batteries or External Power	
Data memory	Permanently stored in non-volatile flash memory every one minute. If power failure, maximum data loss will be less then one minute.
Real-time Clock	≥ 10 minutes

Table A-7 Memory Retention

Physical Characteristics

Length with microphone and preamplifier:	11.35 inches	29 cm
Length, instrument body only	8.80 inches	22.4 inches
Width:	2.80 inches	7.10 cm
Depth:	1.60 inches	4.10 cm
Weight with batteries; no preamplifer or microphone:	1.0 lb	471 g
Weight with batteries, preamplifer and microphone:	1.1 lb	513 g

Table A-8 Physical Characteristics

Resolution

Levels:	0.1dB
Dose:	0.01%
Elapsed time:	0.1 second
Real time clock	1 second
Calendar:	01 Jan 2005 - 31 Dec 2038

Table A-9 Resolution Specifications

Frequency Weightings

Nominal Frequency	Exact Frequency	Z-Weight (Ideal)	A Weight (Ideal)	C Weight (Ideal)	Electrical Limits: Class 1 or 2	Microphone Limits: Class 1	Microphone Limits: Class 2
10	10.00	-0.0	-70.4	-14.3	+ 1.4, - 0.7	±1.5	+ 3.3, - ∞
12.5	12.59	-0.0	-63.4	-11.2	+ 0.5, - 0.6	±1.3	+ 3.3, - ∞
16	15.85	-0.0	-56.7	-8.5	+ 0.4, -0.5	±1.0	+ 3.3, - ∞
20	19.95	-0.0	-50.5	-6.2	+ 0.3, -0.4	±0.5	±2.0
25	25.12	-0.0	-44.7	-4.4	±0.2	±0.5	±2.0
31.5	31.62	-0.0	-39.4	-3.0	±0.2	±0.5	±2.0
40	39.81	-0.0	-34.6	-2.0	±0.2	±0.5	±1.3
50	50.12	-0.0	-30.2	-1.3	±0.5	±0.5	±1.3
63	63.10	-0.0	-26.2	-0.8	±0.5	±0.5	±1.3
80	79.43	-0.0	-22.5	-0.5	±0.5	±0.5	±1.3
100	100.00	-0.0	-19.1	-0.3	±0.5	±0.5	±1.0
125	125.00	0.0	-16.1	-0.2	±0.5	±0.5	±1.0

Table A-10 Frequency Weightings; Larson Davis

Frequency Weightings							
160	158.50	0.0	-13.4	-0.1	±0.2	±0.5	±1.0
200	199.50	0.0	-10.9	0.0	±0.2	±0.5	±1.0
250	251.20	0.0	-8.6	0.0	±0.2	±0.5	±1.0
315	316.20	0.0	-6.6	0.0	±0.2	±0.5	±1.0
400	398.10	0.0	-4.8	0.0	±0.2	±0.5	±1.0
500	501.20	0.0	-3.2	0.0	±0.2	±0.5	±1.0
630	631.00	0.0	-1.9	0.0	±0.2	±0.5	±1.0
800	794.30	0.0	-0.8	0.0	±0.2	±0.5	±1.0
1000	1000.00	0.0	0.0	0.0	±0.2	±0.5	±1.0
1250	1259.00	0.0	0.6	0.0	±0.2	±0.5	±1.0
1600	1585.00	0.0	1.0	-0.1	±0.2	±0.5	±1.3
2000	1995.00	0.0	1.2	-0.2	±0.2	±0.5	±1.3
2500	2512.00	0.0	1.3	-0.3	±0.2	±0.5	±1.7
3150	3162.00	0.0	1.2	-0.5	±0.2	±0.5	±1.7
4000	3981.00	0.0	1.0	-0.8	±0.2	±0.5	±2.0
5000	5012.00	0.0	0.5	-1.3	±0.2	± 0.75	±2.3
6300	6310.00	0.0	-0.1	-2.0	±0.2	±1.0	±3.0
8000	7943.00	0.0	-1.1	-3.0	±0.2	±1.0	±3.3
10000	10000.00	0.0	-2.5	-4.4	±0.2	±1.0	+ 3.3, - ∞
12500	12590.00	0.0	-4.3	-6.2	±0.2	±1.5	+ 3.3, - ∞
16000	15850.00	0.0	-6.6	-8.5	±0.3	±2.0	+ 3.3, - ∞
20000	19950.00	0.0	-9.3	-11.2	±0.5	±2.0	+ 3.3, - ∞

Table A-10 Frequency Weightings; Larson Davis

		LxT1	LxT1L	LxT2	LxT2L	Direct In
Measurement Range[1]	A	39 to 140 dB	27 to 118 dB	37 to 139 dB	31 to 126 dB	13 to 117 dBμV
	C	39 to 140 dB	29 to 118 dB	37 to 139 dB	35 to 126 dB	10 to 117 dBμV
	Z	44 to 140 dB	34 to 118 dB	42 to 139 dB	42 to 126 dB	16 to 117 dBμV
Noise Floor[1]	A	29 dB	17 dB	27 dB	21dB	2.8 dBμV
	C	29 dB	19 dB	27 dB	25dB	1.3 dBμV
	Z	34 dB	24 dB	32 dB	32dB	5.6 dBμV
Linearity Range[2]	A	≥ 104 dB 36 to 140 dB	≥ 102 dB 16 to 118 dB	≥ 103 dB 36 to 139 dB	≥ 102 dB 24 to 126 dB	≥ 106 dBμV 11 to 117 dBμV
	C	≥ 105 dB 35 to 140 dB	≥ 100 dB 18 to 118 dB	≥ 104 dB 35 to 139 dB	≥ 100 dB 26 to 126 dB	≥ 107 dBμV 10 to 117 dBμV
	Z	≥ 103 dB 37 to 140 dB	≥ 93 dB 25 to 118 dB	≥ 100 dB 39 to 139 dB	≥ 93 dB 33 to 126 dB	≥ 103 dBμV 14 to 117 dBμV
SPL Max Level[1]		140 dB	118 dB	139 dB	126 dB	117 dBμV
Peak Max Level		143 dB	121 dB	142 dB	129 dB	120 dBμV
Peak Range[2]	A	71 dB	71 dB	71 dB	71 dB	71 dBμV
	C	71 dB	70 dB	71 dB	71 dB	70 dBμV
	Z	66 dB	66 dB	66 dB	66 dB	66 dBμV

[1] Microphone and electrical self-noise included
[2] Electrical Measurements

Table A-11 LxT Performance Specifications

Sound Level Meter Specifications

RMS Time weighting:	Slow, Fast or Impulse
Frequency Weightings	A, C or Z See Table A-10 ” on page A-7
Peak detector Frequency weighting	A, C or Z
Reference range:	Normal range
Exchange rates:	3, 4, 5, or 6 dB
Sample rate:	51,200 Hz
Peak rise time	28 µS

Table A-12 Sound Level Meter Specifications

1/1 and 1/3 Octave Filters

The 1/1 and 1/3 octave filters (OB1 and OB3 Options) comply with all requirements of IEC 61260:1995 including amendment 1 (2001) for Class 1. These digital filters are sampled at a rate of 51,200 samples per second, with base X10 center frequencies and having real-time performance for all filters. The 0 dB gain setting is the reference range and the reference input signal is 1 Volt rms at 1 kHz.

Frequency Range

1/1 Octave Filters: 8 Hz to 16 kHz

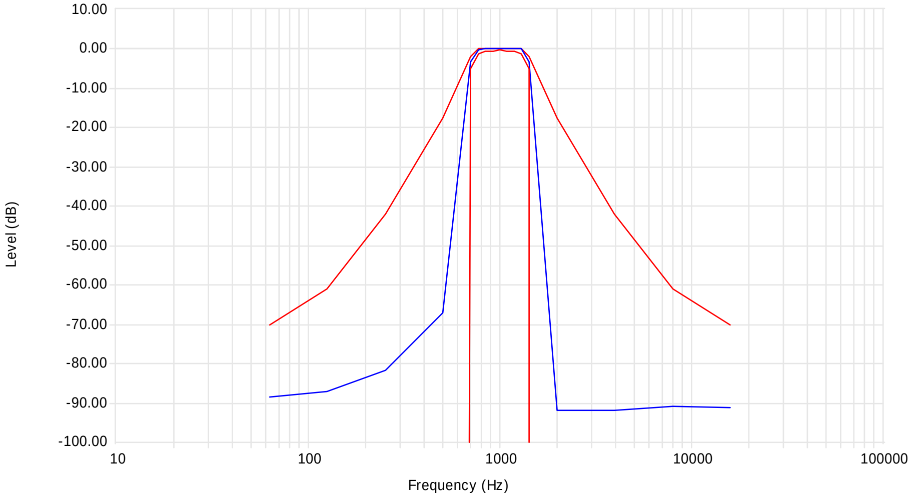
1/3 Octave Filters: 6.3 Hz to 20 kHz

Filter Shapes

The following figures present the filter shapes for the 1/1 and 1/3 octave bands centered at 1 kHz. Overlaid with these curves are the limit curves associated with IEC 61260:1995 Class 1.

	Sound Level Meter Model: LxT Serial Number: 0000033 Certificate of 1000.0 Hz Full Octave Filter Shape

This Class 1 Sound Level Meter (including attached PRMLXT1 preamplifier and ADP005 18pF input adapter) was calibrated with a reference 1kHz sine wave. The instrument's 1000.0 Hz filter response was then electrically tested using a 137.00 dBSPL sinewave at selected frequencies as specified in IEC 61260-am1 (2001-09).



Freq (Hz)	Measured (dB)	Uncert (dB)	Limits (dB)
63.10	-88.46	0.10	-70.00, -inf
125.89	-87.18	0.10	-61.00, -inf
251.19	-81.81	0.10	-42.00, -inf
501.19	-67.18	0.10	-17.50, -inf
707.95	-3.11	0.10	-2.00, -5.00
771.79	-0.21	0.10	+0.30, -1.30
841.40	-0.00	0.10	+0.30, -0.60
917.28	-0.00	0.10	+0.30, -0.40
1000.00	0.00	0.10	+0.30, -0.30

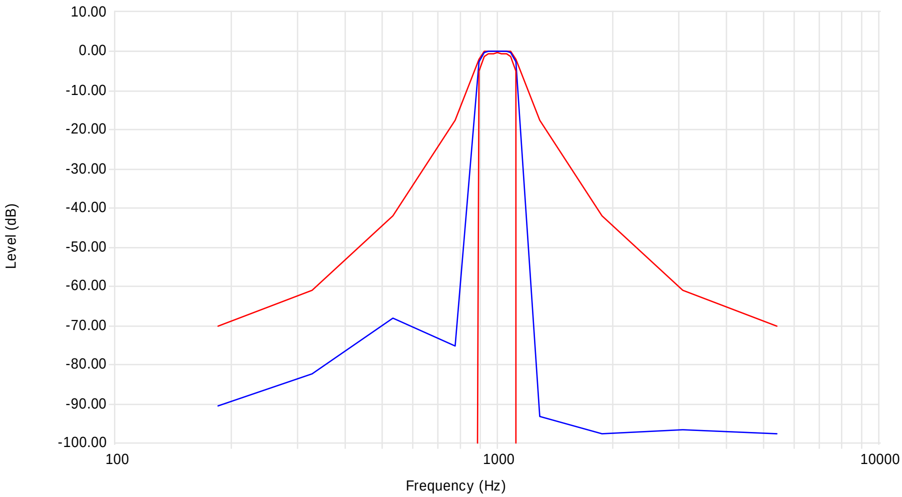
Freq (Hz)	Measured (dB)	Uncert (dB)	Limits (dB)
1090.18	0.00	0.10	+0.30, -0.40
1188.50	0.00	0.10	+0.30, -0.60
1295.69	0.01	0.10	+0.30, -1.30
1412.54	-3.15	0.10	-2.00, -5.00
1995.26	-91.94	0.10	-17.50, -inf
3981.07	-91.92	0.10	-42.00, -inf
7943.28	-90.84	0.10	-61.00, -inf
15848.93	-91.27	0.12	-70.00, -inf

Table A-13 Passband of 1kHz 1/1 Octave Filter

.

Sound Level Meter Model: LxT Serial Number: 0000033
Certificate of 1000.0 Hz Third Octave Filter Shape

This Class 1 Sound Level Meter (including attached PRMLXT1 preamplifier and ADP005 18pF input adapter) was calibrated with a reference 1kHz sine wave. The instrument's 1000.0 Hz filter response was then electrically tested using a 137.00 dBSPL sinewave at selected frequencies as specified in IEC 61260-am1 (2001-09).



Freq (Hz)	Measured (dB)	Uncert (dB)	Limits (dB)	Freq (Hz)	Measured (dB)	Uncert (dB)	Limits (dB)
185.46	-90.61	0.10	-70.00, -inf	1026.67	-0.00	0.10	+0.30, -0.40
327.48	-82.27	0.10	-61.00, -inf	1055.75	0.00	0.10	+0.30, -0.60
531.43	-68.01	0.10	-42.00, -inf	1087.46	-0.14	0.10	+0.30, -1.30
772.57	-75.25	0.10	-17.50, -inf	1122.02	-2.56	0.10	-2.00, -5.00
891.25	-2.50	0.10	-2.00, -5.00	1294.37	-93.15	0.10	-17.50, -inf
919.58	-0.29	0.10	+0.30, -1.30	1881.73	-97.63	0.10	-42.00, -inf
947.19	0.01	0.10	+0.30, -0.60	3053.65	-96.71	0.10	-61.00, -inf
974.02	-0.00	0.10	+0.30, -0.40	5391.95	-97.53	0.10	-70.00, -inf
1000.00	0.00	0.10	+0.30, -0.30				

Table A-14 Filter Skirts of 1kHz 1/3 Octave Filter

Position of Instrument and Operator

When making a measurement, it is recommended that the observer be positioned as far behind and to the right of the instrument as possible to minimize interference of the sound field at the microphone resulting from body reflections. When using the LxT, the meter is held in one hand with the arm extended away from the body. Better results can be obtained by using a tripod.

Effect of Windscreen

The Corrections which should be subtracted from the measured data when using the Larson-Davis Model WS001 3½ inch diameter windscreen with a ½ inch Larson-Davis microphone are as indicated in the following graphs.

Windscreen Response with Respect to No Windscreen

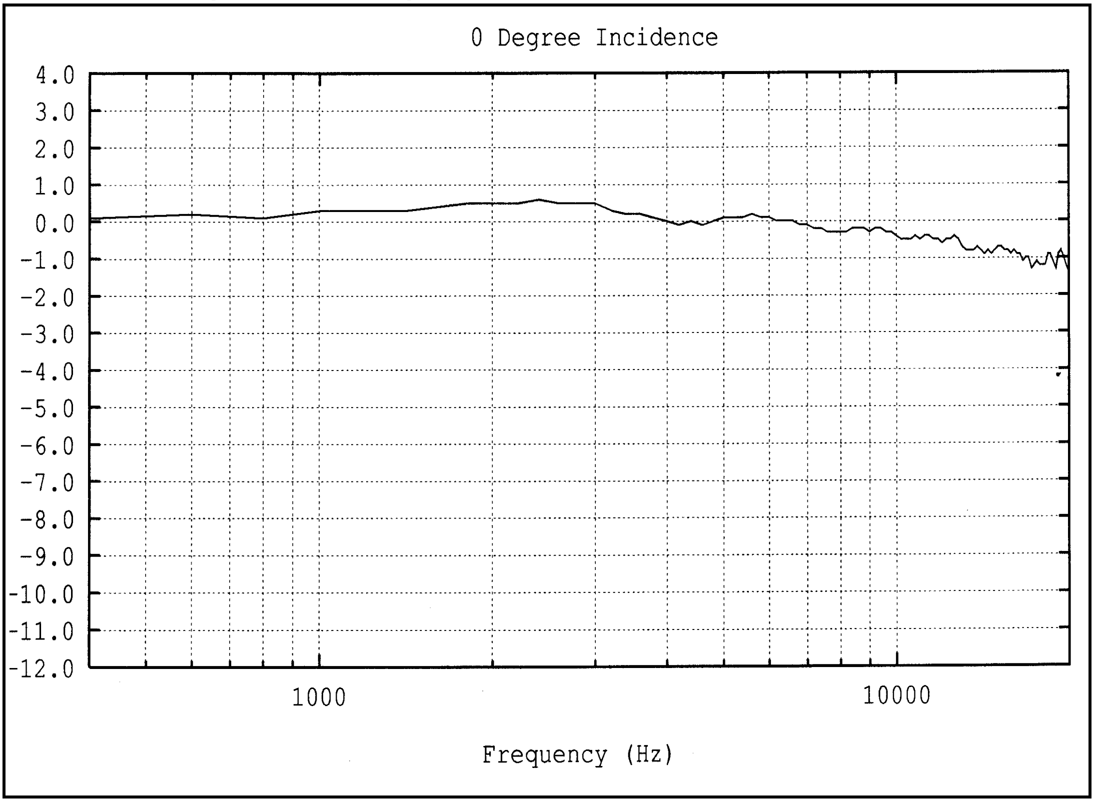


FIGURE A-1 Effect of Wind Screen; 0° Incidence

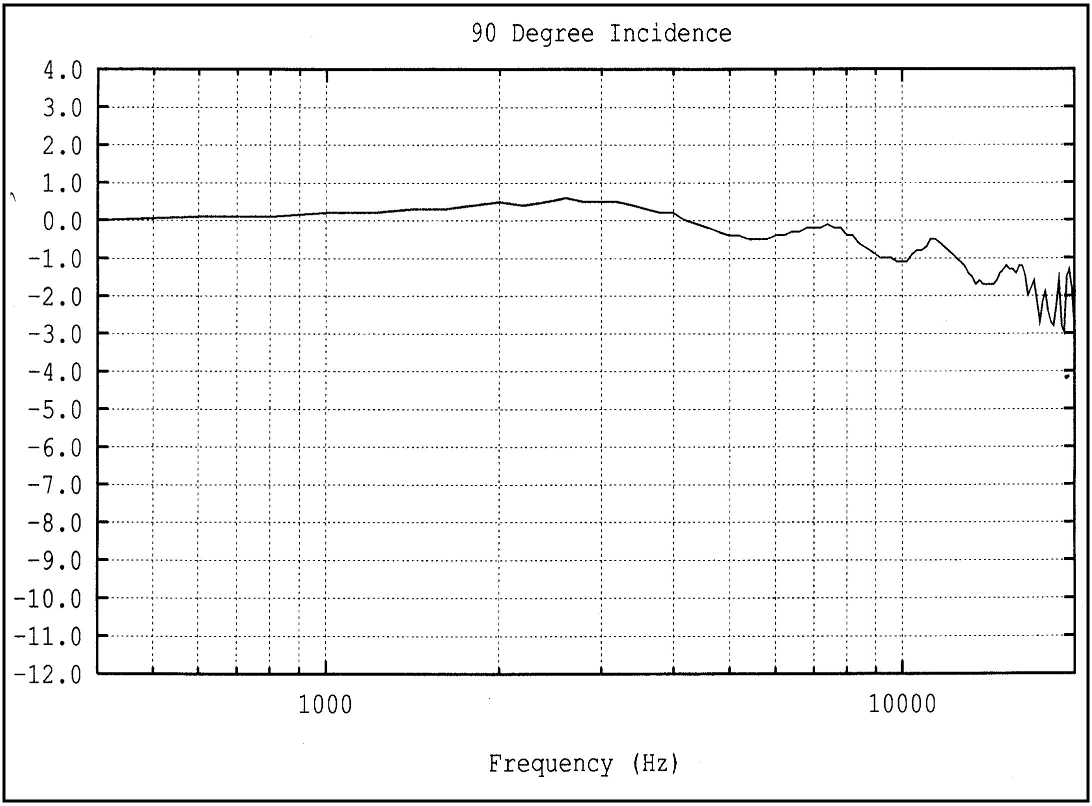


FIGURE A-2 Effect of Wind Screen; 90° Incidence

Frequency Response

LxT With 377B02 Free Field Microphone and PRMLxT1 Preamplifier.

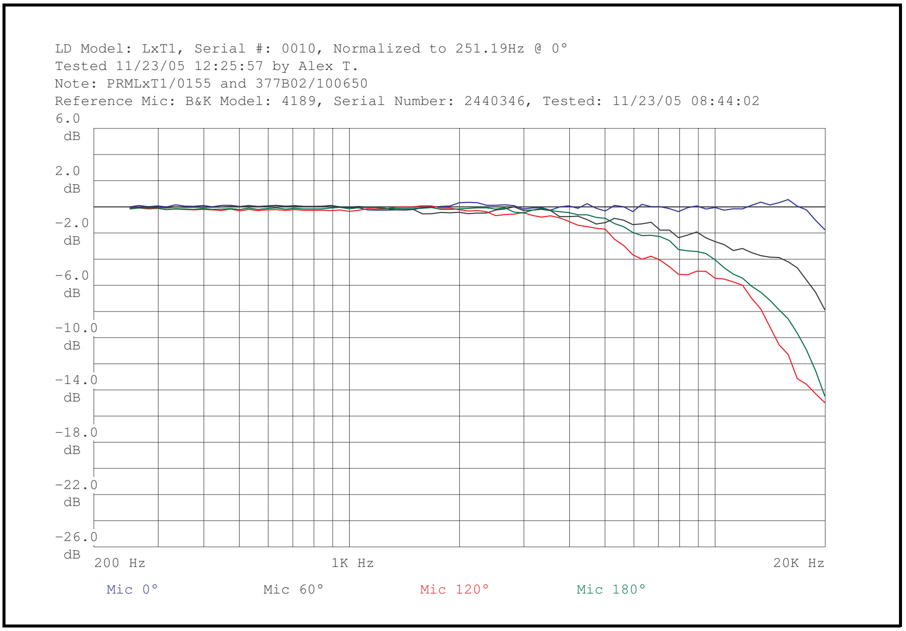


FIGURE A-3 LxT with 377B02 Microphone: 0, 60,120 and 180 degree

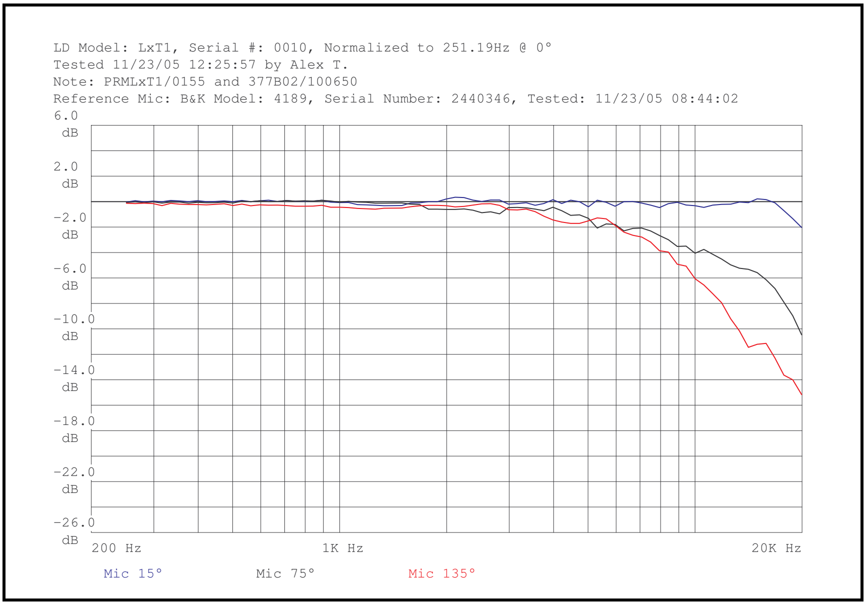


FIGURE A-4 **LxT with 377B02 Microphone: 15, 75 and 135 degrees**

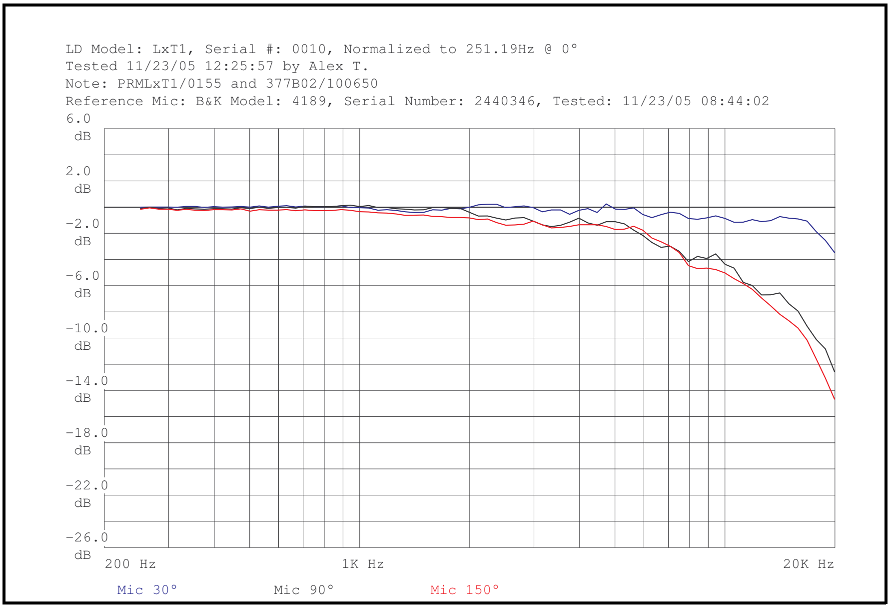


FIGURE A-5 **LxT with 377B02 Microphone: 30, 90 and 150 degrees**

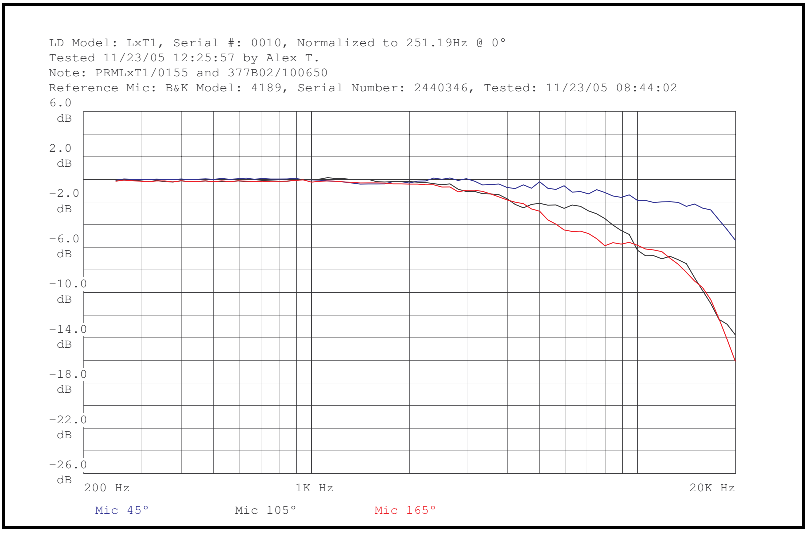


FIGURE A-6 **LxT with 377B02 Microphone: 45, 105 and 165 degrees**

Directional Characteristics

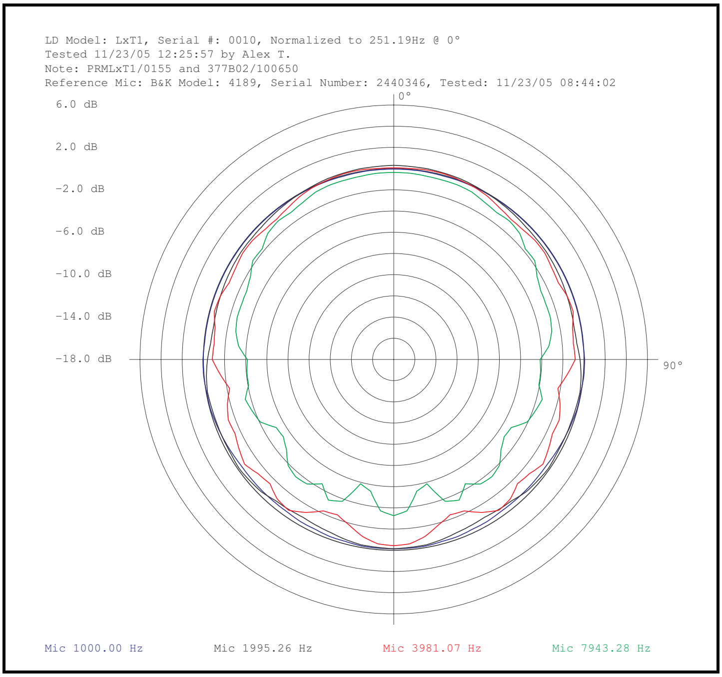


FIGURE A-7 LxT with 377B02: 1000.00 Hz, 1995.26 Hz, 3981.07 and 7943.28 Hz

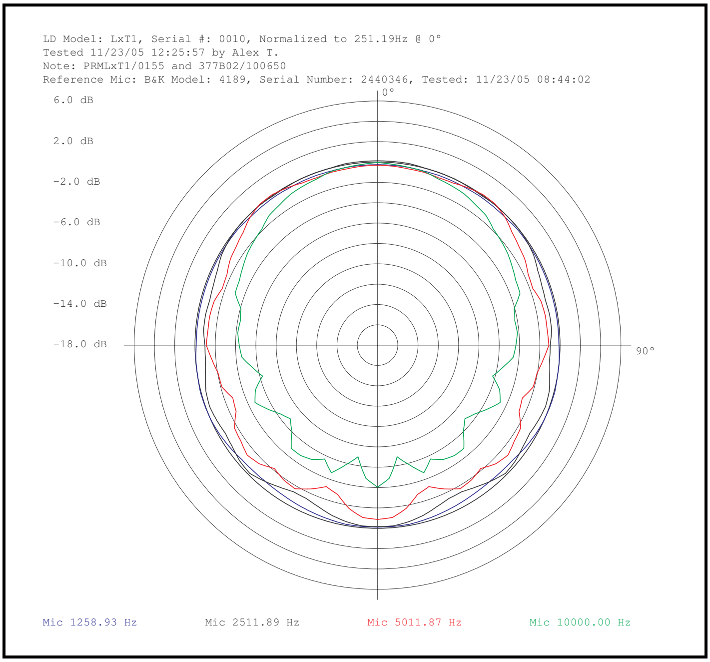


FIGURE A-8 **LxT with 377B02 Microphone: 1258.93 Hz, 2511.89 Hz, 5011.87 Hz and 10000.00 Hz**

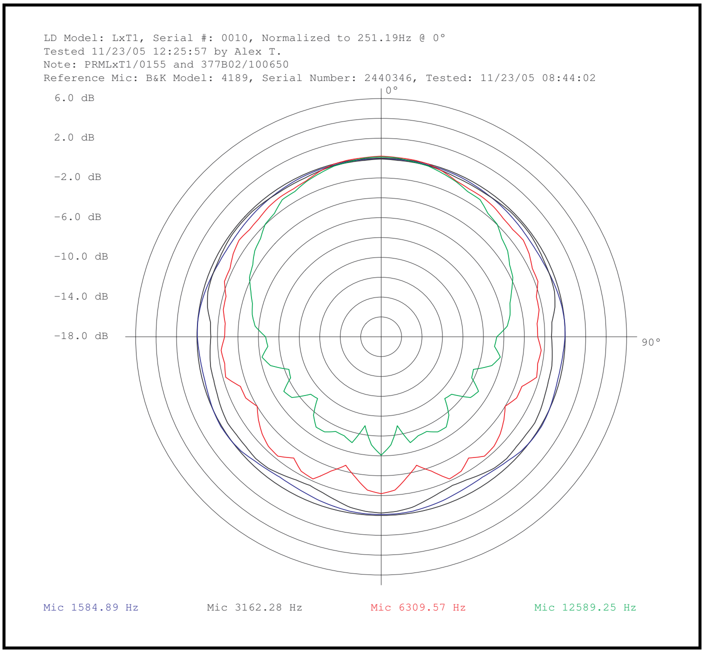


FIGURE A-9 LxT with 377B02 Microphone: 1584.89 Hz, 3162.28 Hz, 6309.57 Hz and 12589.25 Hz

LxT With 7052 Free Field Microphone and PRMLxT2 Preamplifier.

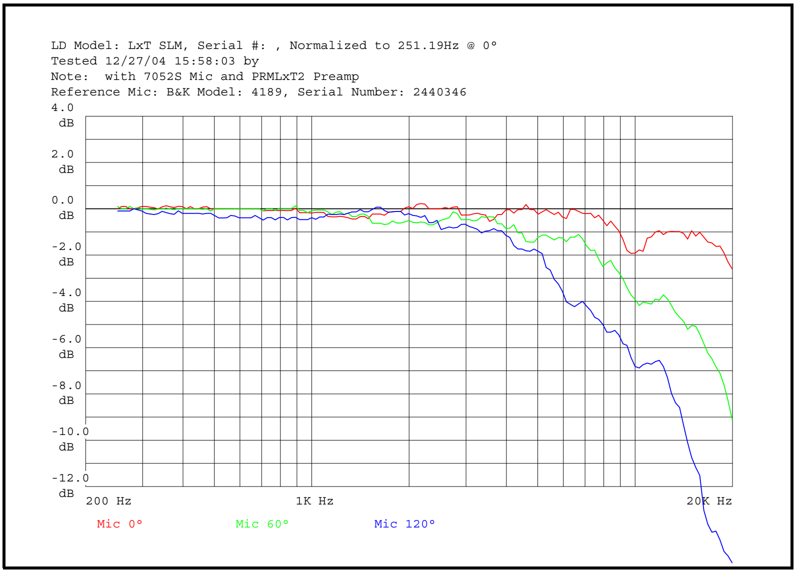


FIGURE A-10 LxT with 7052 Microphone: 0, 60 and 120 degree

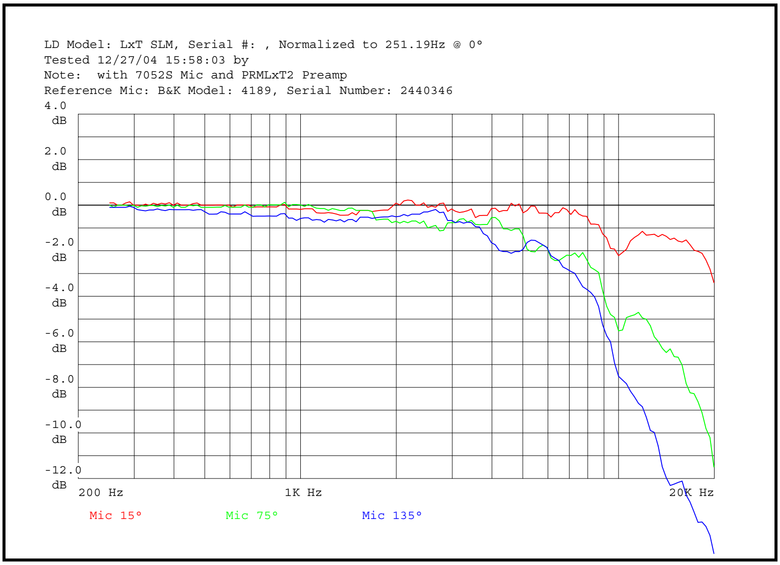


FIGURE A-11 **LxT with 7052 Microphone: 15, 75 and 135 degrees**

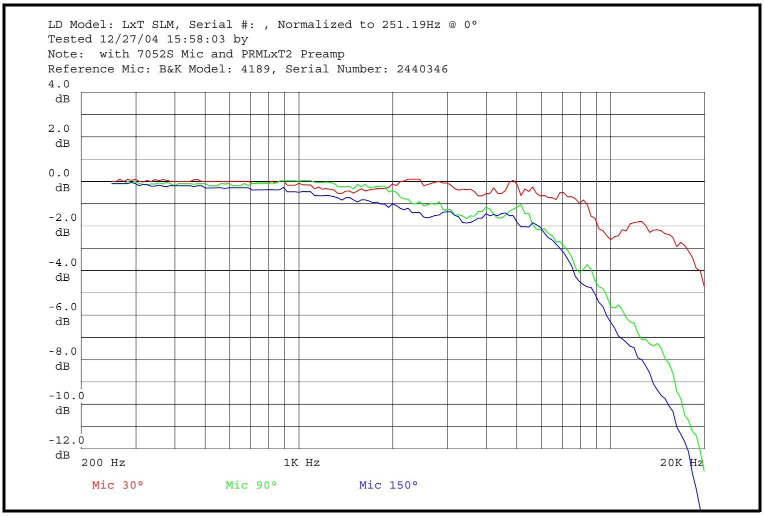


FIGURE A-12 **LxT with 7052 Microphone: 30, 90 and 150 degrees**

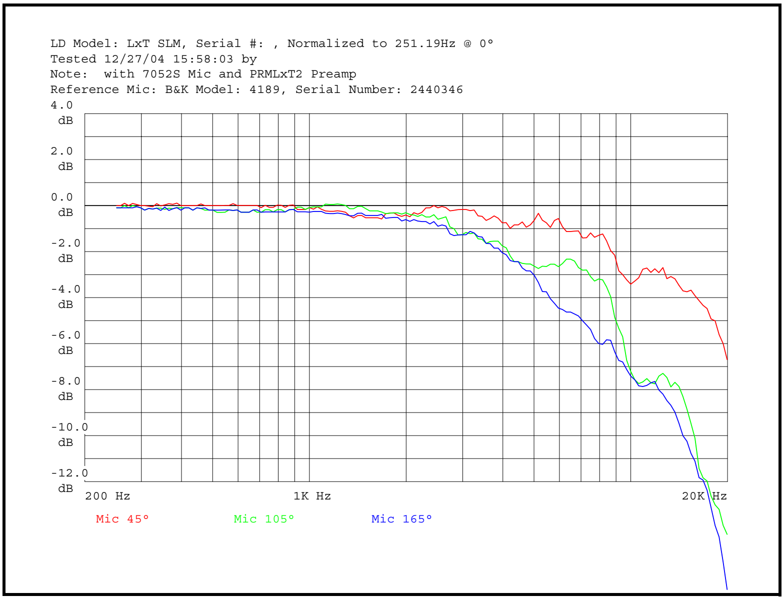


FIGURE A-13 **LxT with 7052 Microphone: 45, 105 and 165 degrees**

Directional Characteristics

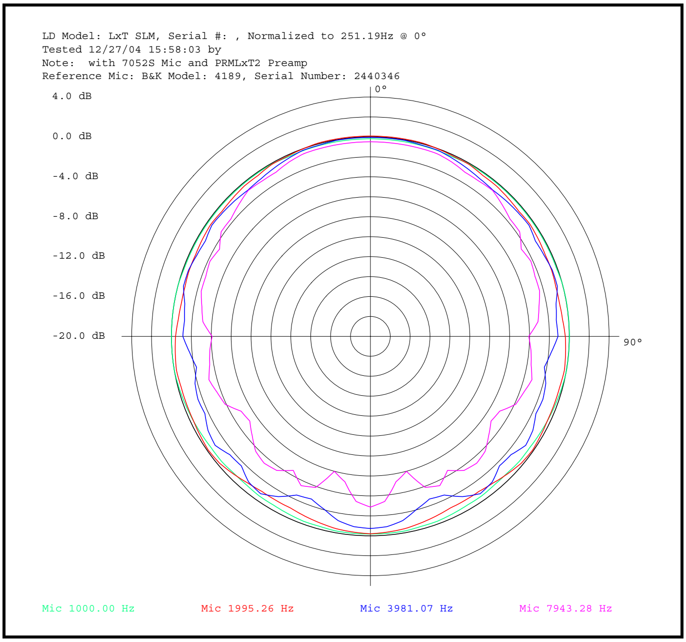


FIGURE A-14 LxT with 7052 Microphone: 1000.00 Hz, 1995.26 Hz, 3981.07 and 7943.28 Hz

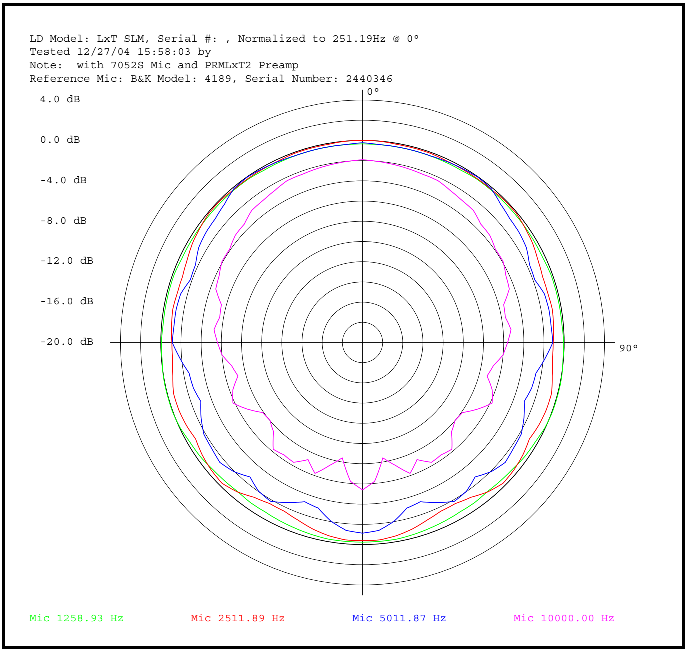


FIGURE A-15 LxT with 7052 Microphone: 1258.93 Hz, 2511.89 Hz, 5011.87 Hz and 10000.00 Hz

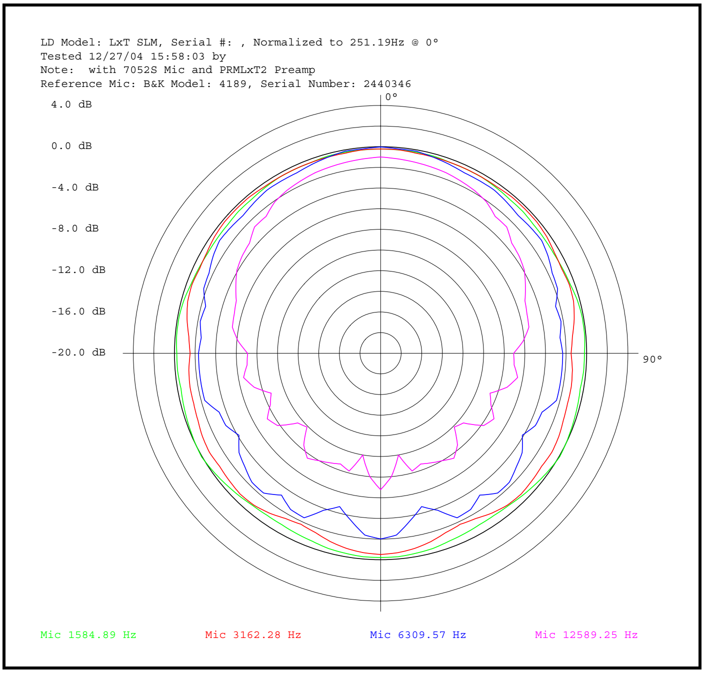


FIGURE A-16 **LxT with 7052 Microphone: 1584.89 Hz, 3162.28 Hz, 6309.57 Hz and 12589.25 Hz**

Noise Levels

The noise of the LxT includes contributions from the following components:

- Instrument and preamplifier
- Microphone

In the following sections, the noise levels for each component, and the total, are presented as a function of frequency.

LxT1, PRMLxT1 with 377B02

17-Nov-05

377B02, PRMLxT1 and LxT1 Noise

Frequency Hz	LxT1 & PRMLxT1 Noise dB SPL	377B02 Noise dB SPL	LxT1, PRMLxT1 and 377B02 Noise dB SPL
6.3	18.6	-21.2	18.6
7.9	18.0	-20.2	18.0
10.0	17.5	-19.2	17.5
12.6	17.0	-18.2	17.0
15.8	16.9	-17.2	16.9
20.0	16.4	-16.2	16.4
25.1	16.3	-15.2	16.3
31.6	15.5	-14.2	15.5
39.8	14.2	-13.2	14.2
50.1	12.8	-12.2	12.8
63.1	11.6	-11.2	11.6
79.4	10.6	-10.2	10.6
100.0	9.9	-9.2	10.0
125.9	9.7	-8.2	9.8
158.5	9.5	-7.2	9.6
199.5	9.2	-6.2	9.3
251.2	9.2	-5.2	9.4
316.2	9.2	-4.2	9.4
398.1	9.7	-3.2	9.9
501.2	10.0	-2.6	10.2
631.0	10.6	-1.8	10.8
794.3	11.3	-0.8	11.6
1000.0	12.1	-0.1	12.4
1258.9	12.9	0.8	13.2
1584.9	13.8	1.5	14.0
1995.3	14.8	2.5	15.0
2511.9	15.7	3.2	15.9
3162.3	16.6	3.9	16.8
3981.1	17.5	4.4	17.7
5011.9	18.5	4.9	18.7
6309.6	19.5	5.1	19.7
7943.3	20.5	5.1	20.6
10000.0	21.4	4.8	21.5
12589.3	22.5	4.3	22.6
15848.9	23.5	3.4	23.5
19952.6	24.4	2.1	24.4
Awt	29.1	16.7	29.3
Cwt	28.9	17.8	29.2
Zwt	33.6	22.9	34.0

Table A-15 Noise; LxT1, PRMLxT1 with 377B02

LxT1, PRMLxT1L with 377B02

17-Nov-05

377B02, PRMLxT1L and LxT1 Noise

Frequency Hz	LxT1 & PRMLxT1L Noise dB SPL	377B02 Noise dB SPL	LxT1, PRMLxT1L and 377B02 Noise dB SPL
6.3	10.3	-21.2	10.3
7.9	9.2	-20.2	9.2
10.0	8.2	-19.2	8.2
12.6	7.2	-18.2	7.2
15.8	6.1	-17.2	6.1
20.0	5.1	-16.2	5.1
25.1	4.4	-15.2	4.4
31.6	3.4	-14.2	3.5
39.8	2.6	-13.2	2.7
50.1	1.4	-12.2	1.6
63.1	0.1	-11.2	0.4
79.4	-1.0	-10.2	-0.5
100.0	-1.8	-9.2	-1.1
125.9	-2.7	-8.2	-1.6
158.5	-3.6	-7.2	-2.0
199.5	-4.1	-6.2	-2.0
251.2	-4.8	-5.2	-2.0
316.2	-5.4	-4.2	-1.8
398.1	-5.8	-3.2	-1.3
501.2	-6.1	-2.6	-1.0
631.0	-6.5	-1.8	-0.5
794.3	-6.5	-0.8	0.2
1000.0	-6.6	-0.1	0.8
1258.9	-6.6	0.8	1.5
1584.9	-6.2	1.5	2.2
1995.3	-5.8	2.5	3.1
2511.9	-5.3	3.2	3.8
3162.3	-4.6	3.9	4.5
3981.1	-3.9	4.4	5.0
5011.9	-3.2	4.9	5.5
6309.6	-2.3	5.1	5.8
7943.3	-1.4	5.1	6.0
10000.0	-0.5	4.8	5.9
12589.3	0.4	4.3	5.8
15848.9	1.4	3.4	5.5
19952.6	2.3	2.1	5.2
Awt	8.0	16.7	17.3
Cwt	11.7	17.8	18.8
Zwt	18.0	22.9	24.1

Table A-16 Noise; LxT1 with PRMLxT1L and 377B02

LxT2, PRMLxT2 with 7052

Frequency Hz	LxT2 & PRMLxT2 Noise dB SPL	7052S Noise dB SPL	LxT2, PRMLxT2 and 7052S Noise dB SPL
6.3	13.6	-17.2	13.6
7.9	12.9	-16.2	12.9
10.0	10.6	-15.2	10.6
12.6	11.7	-14.2	11.7
15.8	11.1	-13.2	11.1
20.0	10.4	-12.2	10.4
25.1	10.0	-11.2	10.0
31.6	10.6	-10.2	10.6
39.8	8.8	-9.2	8.9
50.1	7.6	-8.2	7.7
63.1	6.4	-7.2	6.6
79.4	6.0	-6.2	6.3
100.0	6.2	-5.2	6.5
125.9	5.1	-4.2	5.6
158.5	5.5	-3.2	6.0
199.5	5.1	-2.2	5.9
251.2	5.4	-1.2	6.3
316.2	5.9	-0.2	6.8
398.1	6.5	0.8	7.5
501.2	7.4	1.8	8.5
631.0	7.6	2.8	8.9
794.3	8.6	3.8	9.9
1000.0	9.4	4.8	10.7
1258.9	10.2	5.5	11.5
1584.9	11.3	6.4	12.5
1995.3	12.1	7.0	13.3
2511.9	13.1	7.5	14.1
3162.3	14.0	8.0	15.0
3981.1	15.0	8.4	15.9
5011.9	16.1	8.8	16.8
6309.6	17.0	9.2	17.7
7943.3	18.0	9.5	18.5
10000.0	19.0	9.6	19.4
12589.3	19.9	9.4	20.3
15848.9	20.9	8.8	21.2
19952.6	21.8	8.5	22.0
Awt	26.4	19.5	27.2
Cwt	25.6	21.3	27.0
Zwt	30.0	26.3	31.5

Table A-17 Noise; LxT2, PRMLxT2 with 7052

LxT2, PRMLxT2L with 7052

Frequency Hz	LxT2 & PRMLxT2L Noise dB SPL	7052S Noise dB SPL	LxT2, PRMLxT2L and 7052S Noise dB SPL
6.3	13.9	-17.2	13.9
7.9	11.9	-16.2	11.9
10.0	10.8	-15.2	10.8
12.6	10.7	-14.2	10.7
15.8	10.5	-13.2	10.5
20.0	9.7	-12.2	9.7
25.1	8.9	-11.2	8.9
31.6	7.9	-10.2	8.0
39.8	7.3	-9.2	7.4
50.1	6.0	-8.2	6.2
63.1	5.6	-7.2	5.8
79.4	4.2	-6.2	4.6
100.0	3.6	-5.2	4.1
125.9	2.8	-4.2	3.6
158.5	1.8	-3.2	3.0
199.5	1.2	-2.2	2.8
251.2	0.7	-1.2	2.8
316.2	0.3	-0.2	3.1
398.1	-0.1	0.8	3.4
501.2	-0.1	1.8	3.9
631.0	-0.4	2.8	4.5
794.3	-0.1	3.8	5.3
1000.0	0.1	4.8	6.1
1258.9	0.6	5.5	6.7
1584.9	1.0	6.4	7.5
1995.3	1.6	7.0	8.1
2511.9	2.1	7.5	8.6
3162.3	2.7	8.0	9.1
3981.1	3.4	8.4	9.6
5011.9	4.0	8.8	10.0
6309.6	4.7	9.2	10.5
7943.3	5.4	9.5	10.9
10000.0	6.2	9.6	11.2
12589.3	7.1	9.4	11.4
15848.9	7.8	8.8	11.3
19952.6	8.7	8.5	11.6
Awt	14.9	19.5	20.8
Cwt	17.5	21.3	22.8
Zwt	23.4	26.3	28.1

Table A-18 Noise; LxT2, PRMLxT2L with 7052

Microphone Preamplifier Specifications

The general specifications for the LxT microphone preamplifiers are shown in Table A-19 'LxT Preamplifiers'.

	Nominal Microphone Sensitivity	Nominal Preamplifier Attenuation	Nominal Sensitivity at LxT Input	Nominal Sensitivity	Sensitivity Limits	
Preamplifier Model	(mV/Pa)	(dB)	(mV/Pa)	dB re. 1V/Pa	Low (dB)	High (dB)
PRMLxT1	50	22.8	3.6	-48.9	-51.9	-45.9
PRMLxT1L	50	1.3	43.2	-27.3	-30.3	-24.3
PRMLxT2	22.6	14.6	4.2	-47.5	-50.5	-44.5
PRMLxT2L	22.6	1.3	19.5	-34.2	-37.2	-31.2

Table A-19 LxT Preamplifiers

The following sections present the specifications for the four different microphone preamplifiers which can be used with the LxT.

Model PRMLxT1

The Larson Davis PRMLxT1 is an electret microphone preamplifier for use with a Larson Davis LxT Sound Level Meter. It requires very little supply current and will drive 200 feet of cable. The preamplifier operates over wide temperature and humidity ranges. It has a built in attenuation of 23 dB for use with 50 mV/Pa sensitivity microphones up to 140 dBSPL.

Specifications

Frequency response

with respect to the response at 1 kHz with 13 Volts rms input and 18 pF equivalent microphone.

4 Hz to 10 Hz +0.1, -0.2 dB

12.6 Hz to 40 kHz +0.1, -0.1 dB

Lower -3 dB limit < 1 Hz

Attenuation

22.8 dB (typical)

Input Impedance

10 G Ohm // 5.3 pF

Output Impedance

50 Ohm

Maximum Output

2.8 Vpp

143 dB peak for microphones with 50 mV/Pa sensitivity

Maximum Output Current

10 mA peak

Distortion

Harmonics <-60 dBC with 0.7 Volt rms output at 1 kHz

Output Slew Rate

2 V/µS (typical)

Electronic Noise

with 18pF equivalent microphone

1.1 µV typical A-weighted (1.4 µV max)

1.6 µV typical Flat 20 Hz to 20 kHz (2.1 µV max)

Power Supply Voltage

6 to 10 Volts

DC Output Level

~1/2 power supply voltage

Power Supply Current

1.3 mA typical

Temperature Sensitivity

<±0.05 dB from -10° to +50°C (14° to +122°F) operating range to 60°C (140°F)

Humidity Sensitivity

<±0.05 dB from 0 to 90% RH, non-condensing at 40°C (104°F)

Dimensions

12.7 mm diameter x 73 mm length (0.50" dia x 2.88" length)

Microphone Thread

11.7 mm - 60 UNS (0.4606 - 60 UNS)

Cable Driving Capability

LxT SLM (1 V rms output signal)

To 20 kHz with 200'(61 m) cable

All values are at 23°C, 50% RH, 7.5 Volt supply, 3 m (10') cable and equivalent microphone of 18pF unless otherwise stated.

Output Connector

Switchcraft TA5M

5-Pin male

Pin	Signal
1	Signal Ground
2	Signal Output
3	Power Supply + 7 Volts

Table A-20 **Output Connector**

Pin	Signal
4	Preamp sense
5	No Connection
Shell	Connect to preamp housing

Table A-20 **Output Connector**

Compatibility

Use with Larson Davis 377B02 or any ½" electret microphone having about 50 mV/Pa sensitivity and meeting the mechanical requirements of IEC 61094-4. It can be used with either the Larson Davis ADP043 or ADP008 adapters for ¼" or 1" electret microphones.

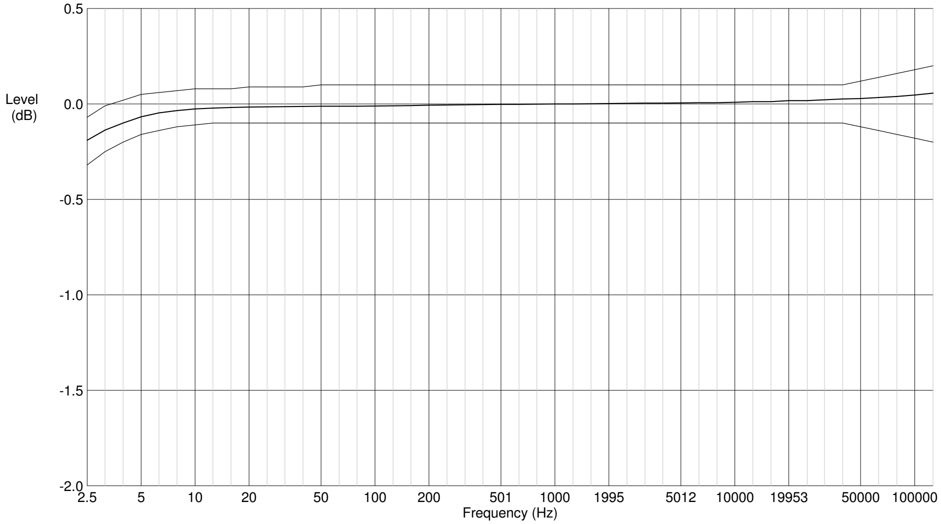
In the interest of constant product improvement, specifications are subject to change without notice.

Larson Davis provides a complete line of acoustic measurement tools including dosimeters, sound level meters, real time analyzers, preamps, calibrators and microphones.

Larson Davis

Preamplifier Model: PRMLxT1 Serial Number: 0163
Certificate of Electrical Conformance

Frequency response of this model PRMLxT1 preamplifier was tested at a level of 13.858 Vrms with 18pF microphone capacitance and driving a short cable. Output level at 1kHz is 0.9442 Vrms (-0.499 dBV), uncertainty 0.045 dB. Output is 3.511 V DC, uncertainty 0.001. Results are displayed relative to the level at 1kHz.



Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)	Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)
2.51	-0.19	0.075	-0.07, -0.32	630.96	-0.00	0.016	+0.10, -0.10
3.16	-0.14	0.058	-0.01, -0.25	794.33	-0.00	0.016	+0.10, -0.10
3.98	-0.10	0.058	+0.02, -0.20	1000.00	0.00	0.016	+0.10, -0.10
5.01	-0.07	0.036	+0.05, -0.16	1258.90	0.00	0.016	+0.10, -0.10
6.31	-0.05	0.036	+0.06, -0.14	1584.90	0.00	0.016	+0.10, -0.10
7.94	-0.03	0.036	+0.07, -0.12	1995.30	0.00	0.016	+0.10, -0.10
10.00	-0.03	0.016	+0.08, -0.11	2511.90	0.00	0.016	+0.10, -0.10
12.59	-0.02	0.016	+0.08, -0.10	3162.30	0.00	0.016	+0.10, -0.10
15.85	-0.02	0.016	+0.08, -0.10	3981.10	0.01	0.016	+0.10, -0.10
19.95	-0.02	0.016	+0.09, -0.10	5011.90	0.01	0.016	+0.10, -0.10
25.12	-0.02	0.016	+0.09, -0.10	6309.60	0.01	0.016	+0.10, -0.10
31.62	-0.01	0.016	+0.09, -0.10	7943.30	0.01	0.016	+0.10, -0.10
39.81	-0.01	0.016	+0.09, -0.10	10000.00	0.01	0.016	+0.10, -0.10
50.12	-0.01	0.016	+0.10, -0.10	12589.00	0.01	0.016	+0.10, -0.10
63.10	-0.01	0.016	+0.10, -0.10	15849.00	0.01	0.016	+0.10, -0.10
79.43	-0.01	0.016	+0.10, -0.10	19953.00	0.02	0.016	+0.10, -0.10
100.00	-0.01	0.016	+0.10, -0.10	25250.00	0.02	0.022	+0.10, -0.10
125.89	-0.01	0.016	+0.10, -0.10	31500.00	0.02	0.022	+0.10, -0.10
158.49	-0.01	0.016	+0.10, -0.10	39750.00	0.03	0.022	+0.10, -0.10
199.53	-0.01	0.016	+0.10, -0.10	50000.00	0.03	0.022	+0.12, -0.12
251.19	-0.01	0.016	+0.10, -0.10	63000.00	0.03	0.047	+0.14, -0.14
316.23	-0.01	0.016	+0.10, -0.10	79500.00	0.04	0.047	+0.16, -0.16
398.11	-0.00	0.016	+0.10, -0.10	100000.00	0.05	0.047	+0.18, -0.18
501.19	-0.00	0.016	+0.10, -0.10	126000.00	0.06	0.063	+0.20, -0.20

Noise floor data: 1kHz (1/3 Octave) = 0.16 uV, -15.7 dBuV, uncertainty = 0.47 dB
Flat (20Hz-20kHz) = 1.7 uV, 4.4 dBuV, uncertainty = 0.47 dB
Awt = 1.0 uV, 0.3 dBuV, uncertainty = 0.46 dB

Uncertainties are given as expanded uncertainty at ~95% confidence level (k = 2).

Technician: Ron Harris   Test Date: 30SEP2005

FIGURE A-17 Certificate of Conformance; PRMLxT1

Model PRMLxT1L

The Larson Davis PRMLxT1L is an electret microphone preamplifier for use with Larson Davis LxT Sound Level Meters. It requires very little supply current and will drive 200 feet of cable. The preamplifier operates over wide temperature and humidity ranges. It is for use with 50 mV/Pa sensitivity microphones up to 118 dBSPL.

Specifications

Frequency response

with respect to the response at 1 kHz with 1.1 Volts rms input and 18 pF equivalent microphone.
4 Hz to 10 Hz +0.1, -0.5 dB
10 Hz to 40 kHz +0.1, -0.18 dB
Lower –3 dB limit < 1.5 Hz

Attenuation

1.2 dB (typical)

Input Impedance

10 G Ohm // 3 pF

Output Impedance

50 Ohm

Maximum Output

2.8 Vpp
121 dB peak for microphones with 50 mV/Pa sensitivity

Maximum Output Current

10 mA peak

Distortion

Harmonics <-67 dBc with 0.7 Volt rms output at 1 kHz

Output Slew Rate

2 V/µS (typical)

Electronic Noise

with 18pF equivalent microphone

1.8 µV typical A-weighted (2.5 µV max)
3.2 µV typical Flat 20 Hz to 20 kHz (5 µV max)

Power Supply Voltage

6 to 15 Volts

DC Output Level

~1/2 power supply voltage

Power Supply Current

1.3 mA typical

Temperature Sensitivity

<±0.05 dB from -10° to +50°C (14° to +122°F) operating range to 60°C (140°F)

Humidity Sensitivity

<±0.05 dB from 0 to 90% RH, non-condensing at 40°C (104°F)

Dimensions

12.7 mm diameter x 73 mm length (0.50” dia x 2.88” length)

Microphone Thread

11.7 mm – 60 UNS (0.4606 – 60 UNS)

Cable Driving Capability

LxT SLM (1 V rms output signal)
To 20 kHz with 200’(61 m) cable

All values are at 23°C, 50% RH, 7.5 Volt supply, 3 m (10’) cable and equivalent microphone of 18pF unless otherwise stated.

Output Connector

Switchcraft TA5M

5-Pin male

Pin	Signal
1	Signal Ground
2	Signal Output
3	Power Supply + 7 Volts
4	Preamp sense
5	No Connection
Shell	Connected to preamp housing

Table A-21 Input Connector

Compatibility

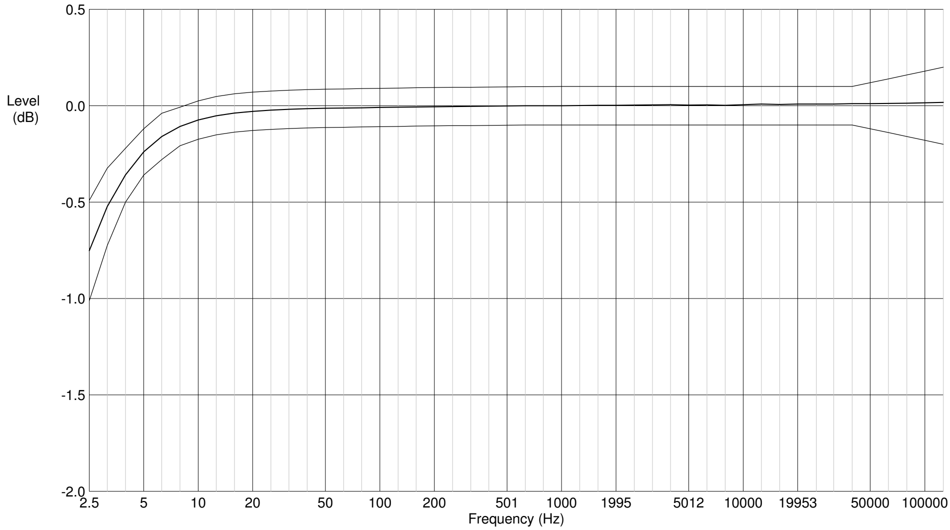
Use with Larson Davis 377B02 or any ½" electret microphone having about 50 mV/Pa sensitivity and meeting the mechanical requirements of IEC 61094-4. It can be used with either the Larson Davis ADP043 or ADP008 adapters for ¼" or 1" electret microphones.In the interest of constant product improvement, specifications are subject to change without notice.

Larson Davis provides a complete line of acoustic measurement tools including dosimeters, sound level meters, real time analyzers, preamps, calibrators and microphones.

Larson Davis

Preamplifier Model: PRMLxT1L Serial Number: 0102
Certificate of Electrical Conformance

Frequency response of this model PRMLxT1L preamplifier was tested at a level of 1.157 Vrms with 18pF microphone capacitance and driving a short cable. Output level at 1kHz is 1.0167 Vrms (0.144 dBV), uncertainty 0.035 dB. Output is 3.664 V DC, uncertainty 0.001. Results are displayed relative to the level at 1kHz.



Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)	Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)
2.51	-0.75	0.075	-0.49, -1.01	630.96	-0.00	0.016	+0.10, -0.10
3.16	-0.52	0.058	-0.32, -0.73	794.33	0.00	0.016	+0.10, -0.10
3.98	-0.36	0.058	-0.22, -0.50	1000.00	0.00	0.016	+0.10, -0.10
5.01	-0.24	0.036	-0.12, -0.36	1258.90	0.00	0.016	+0.10, -0.10
6.31	-0.16	0.036	-0.04, -0.28	1584.90	0.00	0.016	+0.10, -0.10
7.94	-0.11	0.036	-0.01, -0.21	1995.30	0.00	0.016	+0.10, -0.10
10.00	-0.07	0.016	+0.03, -0.17	2511.90	0.00	0.016	+0.10, -0.10
12.59	-0.05	0.016	+0.05, -0.15	3162.30	0.00	0.016	+0.10, -0.10
15.85	-0.04	0.016	+0.06, -0.14	3981.10	0.01	0.016	+0.10, -0.10
19.95	-0.03	0.016	+0.07, -0.13	5011.90	0.00	0.016	+0.10, -0.10
25.12	-0.02	0.016	+0.08, -0.12	6309.60	0.00	0.016	+0.10, -0.10
31.62	-0.02	0.016	+0.08, -0.12	7943.30	0.00	0.016	+0.10, -0.10
39.81	-0.02	0.016	+0.08, -0.12	10000.00	0.01	0.016	+0.10, -0.10
50.12	-0.01	0.016	+0.09, -0.11	12589.00	0.01	0.016	+0.10, -0.10
63.10	-0.01	0.016	+0.09, -0.11	15849.00	0.01	0.016	+0.10, -0.10
79.43	-0.01	0.016	+0.09, -0.11	19953.00	0.01	0.016	+0.10, -0.10
100.00	-0.01	0.016	+0.09, -0.11	25250.00	0.01	0.022	+0.10, -0.10
125.89	-0.01	0.016	+0.09, -0.11	31500.00	0.01	0.022	+0.10, -0.10
158.49	-0.01	0.016	+0.09, -0.11	39750.00	0.01	0.022	+0.10, -0.10
199.53	-0.01	0.016	+0.09, -0.10	50000.00	0.01	0.022	+0.12, -0.12
251.19	-0.00	0.016	+0.10, -0.10	63000.00	0.01	0.047	+0.14, -0.14
316.23	-0.00	0.016	+0.10, -0.10	79500.00	0.01	0.047	+0.16, -0.16
398.11	-0.00	0.016	+0.10, -0.10	100000.00	0.02	0.047	+0.18, -0.18
501.19	-0.00	0.016	+0.10, -0.10	126000.00	0.02	0.063	+0.20, -0.20

Noise floor data: 1kHz (1/3 Octave) = 0.45 uV, -7.0 dBuV, uncertainty = 0.47 dB
Flat (20Hz-20kHz) = 3.5 uV, 10.9 dBuV, uncertainty = 0.47 dB
Awt = 1.7 uV, 4.8 dBuV, uncertainty = 0.46 dB

Uncertainties are given as expanded uncertainty at ~95% confidence level (k = 2).

Technician: Jason Grace Test Date: 05OCT2005

FIGURE A-18 Certificate of Conformance; PRMLxT1L

Model PRMLxT2

The Larson Davis PRMLxT2 is an electret microphone preamplifier for use with Larson Davis LxT Sound Level Meters. It requires very little supply current and will drive 200 feet of cable. The preamplifier operates over wide temperature and humidity ranges. It has a built in attenuation of 15 dB for use with 20 mV/Pa sensitivity microphones up to 140 dBSPL.

Specifications

Frequency response

with respect to the response at 1 kHz with 5.3 Volts rms input and 18 pF equivalent microphone.

2.5 Hz to 10 Hz +0.1, -0.25 dB

10 Hz to 40 kHz +0.1, -0.1 dB

Lower -3 dB limit < 1 Hz

Attenuation

14.6 dB (typical)

Input Impedance

10 G Ohm // 40 pF

Output Impedance

50 Ohm

Maximum Output

2.8 Vpp

143 dB peak for microphones with 20 mV/Pa sensitivity

Maximum Output Current

10 mA peak

Distortion

Harmonics <-67 dBc with 0.7 Volt rms output at 1 kHz

Output Slew Rate

2 V/µS (typical)

Electronic Noise

with 18pF equivalent microphone

1.0 µV typical A-weighted (1.4 µV max)

1.4 µV typical Flat 20 Hz to 20 kHz (2.2 µV max)

Power Supply Voltage

6 to 15 Volts

DC Output Level

~1/2 power supply voltage

Power Supply Current

1.3 mA typical

Temperature Sensitivity

<±0.05 dB from -10° to +50°C (14° to +122°F) operating range to 60°C (140°F)

Humidity Sensitivity

±0.05 dB from 0 to 90% RH, non-condensing at 40°C (104°F)

Dimensions

12.7 mm diameter x 73 mm length (0.50" dia x 2.88" length)

Microphone Thread

11.7 mm - 60 UNS (0.4606 - 60 UNS)

Cable Driving Capability

LxT SLM (1 V rms output signal)

To 20 kHz with 200'(61 m) cable

All values are at 23°C, 50% RH, 7.5 Volt supply, 3 m (10') cable and equivalent microphone of 18pF unless otherwise stated.

Output Connector

Switchcraft TA5M, 5-Pin male

Pin	Signal
1	Signal Ground
2	Signal Output
3	Power Supply + 7 Volts
4	Preamp sense
5	No Connection
Shell	Connect to preamp housing

Table A-22 Input Connector

Compatibility

Use with ACO 7052 or any ½" electret microphone having about 20 mV/Pa sensitivity and meeting the mechanical requirements of IEC 61094-4. It can be used with either the Larson Davis ADP043 or ADP008 adapters for ¼" or 1" electret microphones.

Optional Accessories:

EXC010	Extension cable, 5-pin Switchcraft male to 5-Pin Switchcraft female, 10 feet long
EXC020	Extension cable, 5-pin Switchcraft male to 5-Pin Switchcraft female, 20 feet long
EXC050	Extension cable, 5-pin Switchcraft male to 5-Pin Switchcraft female, 50 feet long
EXC100	Extension cable, 5-pin Switchcraft male to 5-Pin Switchcraft female, 100 feet long
ADP005	18 pF equivalent ½" Microphone with BNC Connector input
ADP008	Adapter for 1" microphones
ADP040	Microphone Signal Tee
ADP043	Adapter for ¼" microphones
ADP068	Preamplifier holder for ½" preamplifiers on microphone stand

Table A-23 Optional Accessories

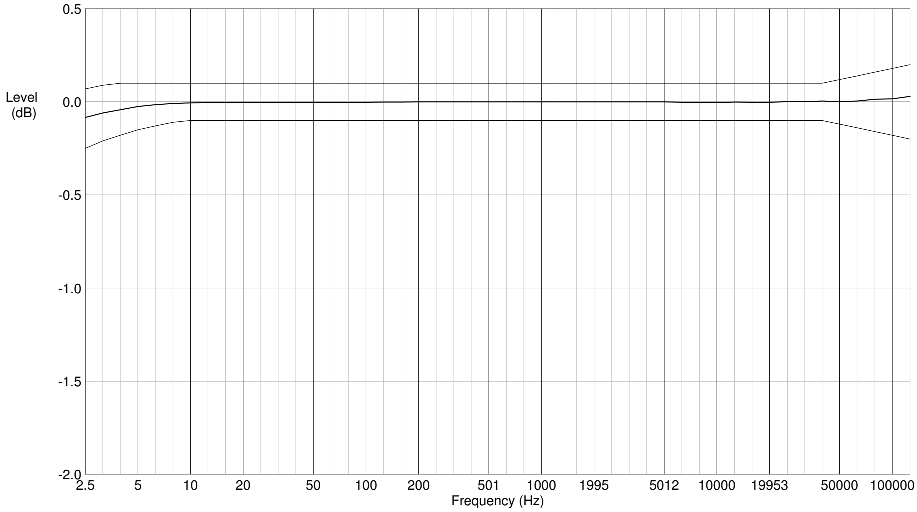
In the interest of constant product improvement, specifications are subject to change without notice.

Larson Davis provides a complete line of acoustic measurement tools including dosimeters, sound level meters, real time analyzers, preamps, calibrators and microphones.

Larson Davis

Preamplifier Model: PRMLxT2 Serial Number: 0182
Certificate of Electrical Conformance

Frequency response of this model PRMLxT2 preamplifier was tested at a level of 5.356 Vrms with 18pF microphone capacitance and driving a short cable. Output level at 1kHz is 1.0039 Vrms (0.034 dBV), uncertainty 0.035 dB. Output is 3.454 V DC, uncertainty 0.001. Results are displayed relative to the level at 1kHz.



Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)	Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)
2.51	-0.08	0.075	+0.07, -0.25	630.96	0.00	0.016	+0.10, -0.10
3.16	-0.06	0.058	+0.09, -0.21	794.33	0.00	0.016	+0.10, -0.10
3.98	-0.04	0.058	+0.10, -0.18	1000.00	0.00	0.016	+0.10, -0.10
5.01	-0.03	0.036	+0.10, -0.15	1258.90	0.00	0.016	+0.10, -0.10
6.31	-0.02	0.036	+0.10, -0.13	1584.90	0.00	0.016	+0.10, -0.10
7.94	-0.01	0.036	+0.10, -0.11	1995.30	0.00	0.016	+0.10, -0.10
10.00	-0.01	0.016	+0.10, -0.10	2511.90	0.00	0.016	+0.10, -0.10
12.59	-0.00	0.016	+0.10, -0.10	3162.30	0.00	0.016	+0.10, -0.10
15.85	-0.00	0.016	+0.10, -0.10	3981.10	0.00	0.016	+0.10, -0.10
19.95	-0.00	0.016	+0.10, -0.10	5011.90	0.00	0.016	+0.10, -0.10
25.12	-0.00	0.016	+0.10, -0.10	6309.60	-0.00	0.016	+0.10, -0.10
31.62	-0.00	0.016	+0.10, -0.10	7943.30	-0.00	0.016	+0.10, -0.10
39.81	-0.00	0.016	+0.10, -0.10	10000.00	-0.00	0.016	+0.10, -0.10
50.12	-0.00	0.016	+0.10, -0.10	12589.00	-0.00	0.016	+0.10, -0.10
63.10	-0.00	0.016	+0.10, -0.10	15849.00	-0.00	0.016	+0.10, -0.10
79.43	-0.00	0.016	+0.10, -0.10	19953.00	-0.00	0.016	+0.10, -0.10
100.00	-0.00	0.016	+0.10, -0.10	25250.00	0.00	0.022	+0.10, -0.10
125.89	-0.00	0.016	+0.10, -0.10	31500.00	0.00	0.022	+0.10, -0.10
158.49	-0.00	0.016	+0.10, -0.10	39750.00	0.00	0.022	+0.10, -0.10
199.53	-0.00	0.016	+0.10, -0.10	50000.00	0.00	0.022	+0.12, -0.12
251.19	0.00	0.016	+0.10, -0.10	63000.00	0.00	0.047	+0.14, -0.14
316.23	0.00	0.016	+0.10, -0.10	79500.00	0.01	0.047	+0.16, -0.16
398.11	0.00	0.016	+0.10, -0.10	100000.00	0.02	0.047	+0.18, -0.18
501.19	0.00	0.016	+0.10, -0.10	126000.00	0.03	0.063	+0.20, -0.20

Noise floor data: 1kHz (1/3 Octave) = 0.17 uV, -15.3 dBuV, uncertainty = 0.47 dB
Flat (20Hz-20kHz) = 1.6 uV, 3.9 dBuV, uncertainty = 0.47 dB
Awt = 1.0 uV, 0.2 dBuV, uncertainty = 0.46 dB

Uncertainties are given as expanded uncertainty at ~95% confidence level (k = 2).

Technician: Ron Harris Test Date: 20JAN2006

FIGURE A-19 Certificate of Conformance; PRMLxT2

Model PRMLxT2L

The Larson Davis PRMLxT2L is an electret microphone preamplifier. It requires very little supply current and will drive 100 feet of cable. The preamplifier operates over wide temperature and humidity ranges. It is for use with 20 mV/Pa sensitivity microphones up to 126 dBSPL.

Specifications

Frequency response

with respect to the response at 1 kHz with 1.1 Volts rms input and 18 pF equivalent microphone.

4 Hz to 10 Hz +0.1, -0.5 dB

10 Hz to 20 kHz +0.1, -0.18 dB

Lower -3 dB limit < 1.5 Hz

Attenuation

1.2 dB (typical)

Input Impedance

10 G Ohm // 3 pF

Output Impedance

50 Ohm

Maximum Output

With LxT SLM

2 Vpp

126 dB peak for microphones with 20 mV/Pa sensitivity

Maximum Output Current

10 mA peak

Distortion

Harmonics <-62 dBc with 1.1 Volts rms input at 1 kHz

Output Slew Rate

2 V/µS (typical)

Electronic Noise

with 18pF equivalent microphone

1.8 µV typical A-weighted (2.5 µV max)

3.2 µV typical Flat 20 Hz to 20 kHz (5 µV max)

Power Supply Voltage

6 to 15 Volts

DC Output Level

~1/2 power supply voltage

Power Supply Current

1.3 mA typical

Temperature Sensitivity

<±0.05 dB from -10° to +50°C (14° to +122°F) operating range to 60°C (140°F)

Humidity Sensitivity

<±0.05 dB from 0 to 90% RH, non-condensing at 40°C (104°F)

Dimensions

2.7 mm diameter x 125 mm length (0.50" dia x 4.92" length)

Microphone Thread

11.7 mm - 60 UNS (0.4606 - 60 UNS)

Cable Driving Capability

LxT SLM (1 V rms output signal)

To 20 kHz with 200' (60 m) cable

All values are at 23°C, 50% RH, 7.5 Volt supply, 3 m (10') cable and equivalent microphone of 18pF unless otherwise stated.

Output Connector

Switchcraft TA5M, 5-Pin male

Pin	Signal
1	Signal Ground
2	Signal Output
3	Power Supply + 7 Volts
4	Preamp sense
5	No Connection
Shell	Connect to preamp housing

Table A-24 Input Connector

Compatibility

Use with ACO 7052 or any ½" electret microphone having about 20 mV/Pa sensitivity and meeting the mechanical requirements of IEC 61094-4. It can be used with either the Larson Davis ADP043 or ADP008 adapters for ¼" or 1" electret microphones.

Optional Accessories:

EXCXXX	Extension Cable 5-Pin Switchcraft male to 5-Pin Switchcraft female (XXX feet long)
ADP005	18 pF equivalent ½" Microphone with BNC Connector input
ADP008	Adapter for 1" microphones
ADP040	Microphone Signal Tee
ADP043	Adapter for ¼" microphones
ADP068	Preamplifier holder for ½" preamplifiers on microphone stand

Table A-25 Optional Accessories

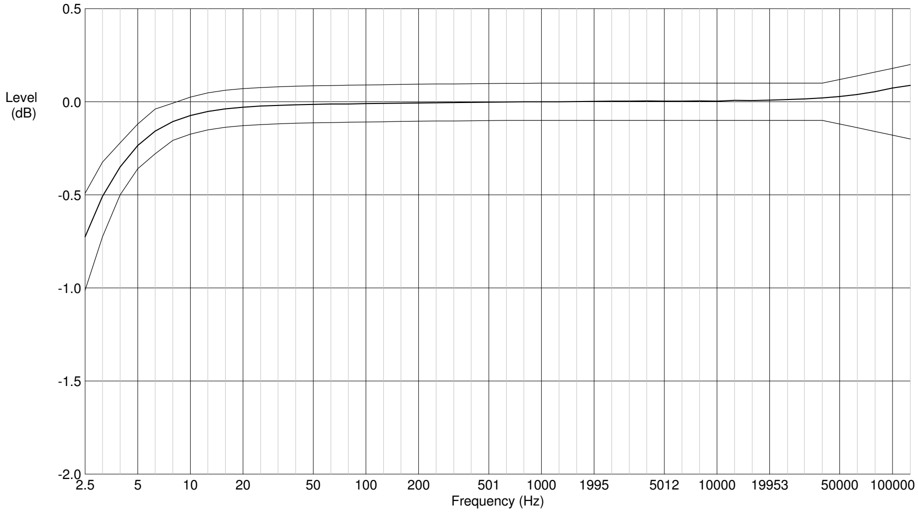
In the interest of constant product improvement, specifications are subject to change without notice.

Larson Davis provides a complete line of acoustic measurement tools including dosimeters, sound level meters, real time analyzers, preamps, calibrators and microphones

Larson Davis

Preamplifier Model: PRMLxT2L Serial Number: 0104
Certificate of Electrical Conformance

Frequency response of this model PRMLxT2L preamplifier was tested at a level of 1.157 Vrms with 18pF microphone capacitance and driving a short cable. Output level at 1kHz is 1.0018 Vrms (0.016 dBV), uncertainty 0.035 dB. Output is 3.586 V DC, uncertainty 0.001. Results are displayed relative to the level at 1kHz.



Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)	Freq (Hz)	Measured (dB)	Uncert (dB)	Tolerance (dB)
2.51	-0.73	0.075	-0.49, -1.01	630.96	-0.00	0.016	+0.10, -0.10
3.16	-0.51	0.058	-0.32, -0.73	794.33	0.00	0.016	+0.10, -0.10
3.98	-0.35	0.058	-0.22, -0.50	1000.00	0.00	0.016	+0.10, -0.10
5.01	-0.23	0.036	-0.12, -0.36	1258.90	0.00	0.016	+0.10, -0.10
6.31	-0.16	0.036	-0.04, -0.28	1584.90	0.00	0.016	+0.10, -0.10
7.94	-0.11	0.036	-0.01, -0.21	1995.30	0.00	0.016	+0.10, -0.10
10.00	-0.07	0.016	+0.03, -0.17	2511.90	0.00	0.016	+0.10, -0.10
12.59	-0.05	0.016	+0.05, -0.15	3162.30	0.00	0.016	+0.10, -0.10
15.85	-0.04	0.016	+0.06, -0.14	3981.10	0.01	0.016	+0.10, -0.10
19.95	-0.03	0.016	+0.07, -0.13	5011.90	0.00	0.016	+0.10, -0.10
25.12	-0.02	0.016	+0.08, -0.12	6309.60	0.00	0.016	+0.10, -0.10
31.62	-0.02	0.016	+0.08, -0.12	7943.30	0.00	0.016	+0.10, -0.10
39.81	-0.02	0.016	+0.08, -0.12	10000.00	0.00	0.016	+0.10, -0.10
50.12	-0.01	0.016	+0.09, -0.11	12589.00	0.01	0.016	+0.10, -0.10
63.10	-0.01	0.016	+0.09, -0.11	15849.00	0.01	0.016	+0.10, -0.10
79.43	-0.01	0.016	+0.09, -0.11	19953.00	0.01	0.016	+0.10, -0.10
100.00	-0.01	0.016	+0.09, -0.11	25250.00	0.01	0.022	+0.10, -0.10
125.89	-0.01	0.016	+0.09, -0.11	31500.00	0.02	0.022	+0.10, -0.10
158.49	-0.01	0.016	+0.09, -0.11	39750.00	0.02	0.022	+0.10, -0.10
199.53	-0.01	0.016	+0.09, -0.10	50000.00	0.03	0.022	+0.12, -0.12
251.19	-0.01	0.016	+0.10, -0.10	63000.00	0.04	0.047	+0.14, -0.14
316.23	-0.00	0.016	+0.10, -0.10	79500.00	0.06	0.047	+0.16, -0.16
398.11	-0.00	0.016	+0.10, -0.10	100000.00	0.07	0.047	+0.18, -0.18
501.19	-0.00	0.016	+0.10, -0.10	126000.00	0.09	0.063	+0.20, -0.20

Noise floor data: 1kHz (1/3 Octave) = 0.37 uV, -8.6 dBuV, uncertainty = 0.47 dB
Flat (20Hz-20kHz) = 3.7 uV, 11.3 dBuV, uncertainty = 0.47 dB
Awt = 2.3 uV, 7.4 dBuV, uncertainty = 0.46 dB

Uncertainties are given as expanded uncertainty at ~95% confidence level (k = 2).

Technician: Jason Grace   Test Date: 09MAR2005

FIGURE A-20 Certificate of Conformance; PRMLxT2L

B Testing to IEC61672-1

This appendix presents information for measuring the sound level meter functionality of the LxT according to IEC61672-1.

Sections 5, 6, 7 and 9 (except 9.3)

The following table references sections and tables in this manual where information called for in specific sections of IEC61672-1 can be found. In certain instances the requested information is not applicable, as noted in the Comments column.

Further information called for in section 9.3 for testing, as appropriate for a sound level meter, can be found in "Section 9.3" on page B-10.

Section	LxT Manual	Comments
5.1.4	"LxT Components" on page 1-13	
5.1.6	"Standard Accessories" on page 1-9 and "Optional Accessories" on page 1-10	
5.1.7	"Connecting the Microphone and Preamplifier" on page 2-3 and "Connecting the Preamplifier to the LxT" on page 2-4	
5.1.8		Computer software is not an integral part of the LxT
5.1.10	"LxT Main Characteristics" on page A-3	
5.1.12		The Model LxT measures sound level using a single range
5.1.13	"General Specifications" on page A-4	
5.1.14	"RESET Key" on page 3-8 and "Maximum, Minimum and Peak Sound Levels" on page 5-9	

Section	LxT Manual	Comments
5.1.15	"AC/DC Output Specifications" on page A-5 and "g) Electrical Insert Signals" on page B-11	
5.1.16	"i) Highest Sound Pressure Level" on page B-11	
5.1.17		The Model LxT is a single channel instrument
5.1.18	"Start-up Period" on page 7-2	
5.2.1	"Calibrator" on page 13-3	
5.2.3	"Calibrating The LxT" on page 13-7	
5.2.4	"9.2.4 d Frequency Responses and Corrections" on page B-8	
5.2.5	"9.2.4 d Frequency Responses and Corrections" on page B-8	
5.2.6	"9.2.4 d Frequency Responses and Corrections" on page B-8	
5.2.7	"d) Periodic Testing" on page B-9	
5.2.8	"d) Periodic Testing" on page B-9	
5.4.12		No optional frequency responses
5.5.9	"f) Linear Measurement Starting Level" on page B-10	
5.5.10	"f) Linear Measurement Starting Level" on page B-10	
5.5.11	"k) Display Device" on page B-11	
5.6.1	"h) Inherent Noise" on page B-11	
5.6.2	"h) Inherent Noise" on page B-11	
5.6.3	"LxT Performance Specifications" on page A-9	
5.6.4	"LxT Performance Specifications" on page A-9	
5.6.5	"Low Level Sound Fields" on page 7-16	

Section	LxT Manual	Comments
5.10.1	"Overload Indication" on page 7-11 and "Maximum, Minimum and Peak Sound Levels" on page 5-9	
5.11.1		See comment for section 5.11.2
5.11.2		LxT measures sound level using a single range. The lower limit for level linearity error is caused by the inherent noise from the microphone and electronic elements within the sound level meter.
5.12.1	"LxT Performance Specifications" on page A-9	
5.14	"Triggers Page" on page 4-20	
5.15.2	"Basic Data Display" on page 5-1	
5.15.3	"Display" on page 16-2	
5.15.4	"Basic Data Display" on page 5-1	
5.15.5	"General Specifications" on page A-4	
5.15.6	"Integration" on page 4-6	
5.15.7	"Software" on page 1-12	
5.15.8		The LxT uses no alternative display devices
5.16.1	"AC/DC Output Specifications" on page A-5 and "Jack Function" on page 11-12	
5.17.1	"Control Page" on page 4-16 and "Time" on page 11-3	
5.17.1 NOTE 2	"General Specifications" on page A-4	
5.17.2	"Timed Stop Mode" on page 6-4	
5.18.1	"Connectors and Interfaces" on page 16-5	
5.18.2	"o) AC Power and Radio Frequency Susceptibility" on page B-13	
5.19.1		The LxT is a single channel instrument

Section	LxT Manual	Comments
5.20.1	"Power Indicator" on page 3-2	
5.20.2	"Power Supply Specifications" on page A-5	
5.20.3	"Power Supply Specifications" on page A-5 and "Internal Battery Operating Lifetime" on page A-6	
5.20.4	Table A-4, “Power Supply Specifications,” on page 5	
5.20.5		The LxT is not intended to be powered by a public source of AC power
6.1.2	"l) Typical Stabilization Time" on page B-12	
6.2.2	"Calibrating The LxT" on page 13-7	
6.5.2	"General Specifications" on page A-4	
6.6.1	"o) AC Power and Radio Frequency Susceptibility" on page B-13	
6.6.3		No detectable increase in any direction with application of 74 dB A-weighted sound level.
6.6.9	"o) AC Power and Radio Frequency Susceptibility" on page B-13	
7.1	"Microphone Extension Cable" on page 7-6	
7.2	"Effect of Windscreen" on page A-14	
7.3	"Optional Accessories" on page 1-10	
7.4	"Octave Band Analyzer Page (Optional)" on page 4-13	
7.5		No manufacturer-provided auxiliary devices are provided
9.2.1 General		
a	"Standards Met" on page A-1	
b	"Configuration of the System" on page 7-1, "Microphone Extension Cable" on page 7-6 and "Use of a Windscreen" on page 7-6.	

Section	LxT Manual	Comments
c	"Standard Accessories" on page 1-9 and "Optional Accessories" on page 1-10	
d		No microphone extension or microphone extension cable is required to meet specified standards
e		The LxT is a single channel instrument
9.2.2 Design Features		
a	"Parameters Measured" on page 17-1	
b	"Frequency Response" on page A-16	
c	Table A-11, “Sound Level Meter Specifications,” on page 10	
d	Table A-11, “Sound Level Meter Specifications,” on page 10	
e	"LxT Performance Specifications" on page A-9	
f		The LxT measures sound level using a single range
g	"LxT Main Characteristics" on page A-3 and "LxT Performance Specifications" on page A-9	
h	Table A-10, “Model 831 Performance Specifications,” on page 10	
i	Table A-11, “Sound Level Meter Specifications,” on page 10	
j		Computer software is not an integral part of the LxT
k		None. No optional frequency weightings
9.2.3 Power Supply		
a	"Power Supply Specifications" on page A-5 and "Internal Battery Operating Lifetime" on page A-6	

Section	LxT Manual	Comments
b	"Power Indicator" on page 3-2	
c	"Power Supply Specifications" on page A-5	
d		The LxT is not intended to be powered by a public source of AC power
9.2.4 Adjustments to Indicated Levels		
a	"Recommended Calibrator" on page 13-3	
b	"Recommended Calibrator" on page 13-3	
c	"Calibrating The LxT" on page 13-7	
d	See "d) Frequency Response and Corrections" on page B-9	
9.2.5 Operating the Sound Level Meter		
a	"General Specifications" on page A-4	
b	"Positioning the LxT" on page 7-5	
c		The LxT measures sound level using a single range
d	"Low Level Sound Fields" on page 7-16	
e	"Start-up Period" on page 7-2	
f	"Integration" on page 4-6	
g	"Control Page" on page 4-16 and "Time" on page 11-3	
h	"Timed Stop Mode" on page 6-4	
i	"RESET Key" on page 3-8 and "Maximum, Minimum and Peak Sound Levels" on page 5-9	
j	"Overload Indication" on page 7-11 and "Maximum, Minimum and Peak Sound Levels" on page 5-9	
k	"Measurement Range" on page 7-11	
l	"Triggers Page" on page 4-20	

Section	LxT Manual	Comments
m	"Software" on page 1-12	
n	"Connectors and Interfaces" on page 16-5	
o	"h) Inherent Noise" on page B-12	
p	"AC/DC Output Specifications" on page A-5 and "Jack Function" on page 11-12	
9.2.6 Accessories		
a	"Effect of Windscreen" on page A-14	
b	"Microphone Extension Cable" on page 7-6	
c	"Octave Band Analyzer Page (Optional)" on page 4-13	
d		No manufacturer-provided auxiliary devices are provided
9.2.7 Influence of variations in environmental conditions		
a		No components of the LxT are intended to be operated only in an environmentally controlled enclosure
b	"Declaration of Conformity" on page A-2	
c	"c) Microphone Reference Point" on page B-10	

The following two sections are related to the LxT1 and the LxT2 configurations, respectively. In each, information is provided which corresponds to the specific item number in this standard.

Section 9.2.4

a) Calibrator

The calibrator to be used with the LxT1 is the Larson Davis Model CAL200.

b) Calibration Frequency

The calibration check frequency is 1000 Hz.

c) Calibration Procedure

For calibration refer to the chapter "Calibration" on page 10-1.

d) Frequency Response and Corrections

.

Table 1 Larson Davis LxT1 with PRMLxT1 and typical 377B02 Microphone average frequency responses and corrections
Required by IEC 61672-1 Sections 5.2.4, 5.2.5, 5.2.6 and 9.2.4 (d)

Frequency	0° Free Field Response	0° Free Field Corrections[1]	Effect of Wind Screen	Wind Screen on LxT1 0° Free Field	0° Free Field Corrections with Wind Screen on LxT1[1]	expanded uncertainty of Corrections @ 95%
Hz	dB	dB	dB	dB	dB	dB
251.19	0.0	0.0	0.0	0.0	0.0	0.4
316.23	0.0	0.0	0.1	0.0	0.0	0.4
398.11	0.0	0.0	0.0	0.0	0.0	0.4
501.19	0.1	-0.1	0.1	0.1	-0.1	0.4
630.96	0.1	-0.1	0.0	0.1	-0.1	0.4
794.33	0.0	0.0	0.1	0.1	-0.1	0.4
1000.00	-0.1	0.1	0.1	0.0	0.0	0.4
1059.25	-0.1	0.1	0.1	0.0	0.0	0.4
1122.02	-0.3	0.3	0.2	-0.1	0.1	0.4
1188.50	-0.3	0.3	0.2	-0.1	0.1	0.4
1258.93	-0.3	0.3	0.2	-0.1	0.1	0.4
1333.52	-0.3	0.3	0.3	0.0	0.0	0.4
1412.54	-0.3	0.3	0.2	-0.1	0.1	0.5
1496.24	-0.2	0.2	0.3	0.0	0.0	0.5
1584.89	-0.1	0.1	0.3	0.2	-0.2	0.6
1678.80	0.0	0.0	0.3	0.2	-0.2	0.6
1778.28	0.0	0.0	0.3	0.3	-0.3	0.6
1883.65	0.0	0.0	0.4	0.4	-0.4	0.6
1995.26	0.3	-0.3	0.4	0.7	-0.7	0.6
2113.49	0.4	-0.4	0.5	0.9	-0.9	0.6
2238.72	0.3	-0.3	0.5	0.8	-0.8	0.6
2371.37	0.1	-0.1	0.5	0.7	-0.7	0.6
2511.89	0.2	-0.2	0.5	0.7	-0.7	0.6
2660.73	0.1	-0.1	0.6	0.7	-0.7	0.6
2818.38	0.1	-0.1	0.5	0.6	-0.6	0.6
2985.38	-0.2	0.2	0.5	0.3	-0.3	0.6
3162.28	-0.2	0.2	0.4	0.2	-0.2	0.6
3349.65	-0.1	0.1	0.3	0.3	-0.3	0.6
3548.13	-0.4	0.4	0.3	-0.1	0.1	0.6
3758.37	0.1	-0.1	0.2	0.3	-0.3	0.6
3981.07	0.0	0.0	0.1	0.1	-0.1	0.6
4216.97	-0.1	0.1	0.0	-0.1	0.1	0.6
4466.84	0.3	-0.3	-0.1	0.2	-0.2	0.6
4731.51	-0.1	0.1	-0.3	-0.4	0.4	0.6

Continued on next page

5011.87	-0.4	0.4	-0.1	-0.5	0.5	0.6
5308.84	0.1	-0.1	-0.1	0.1	-0.1	0.6
5623.41	0.0	0.0	-0.1	-0.1	0.1	0.6
5956.62	-0.3	0.3	0.0	-0.3	0.3	0.6
6309.57	0.3	-0.3	0.1	0.4	-0.4	0.6
6683.44	0.0	0.0	0.1	0.1	-0.1	0.6
7079.46	0.0	0.0	0.0	-0.1	0.1	0.6
7498.94	-0.2	0.2	-0.1	-0.4	0.4	0.6
7943.28	-0.4	0.4	-0.3	-0.7	0.7	0.6
8413.95	-0.1	0.1	-0.4	-0.5	0.5	0.6
8912.51	0.1	-0.1	-0.5	-0.4	0.4	0.6
9440.61	-0.3	0.3	-0.3	-0.6	0.6	0.6
10000.00	-0.2	0.2	-0.2	-0.4	0.4	0.6
10592.54	-0.3	0.3	-0.1	-0.4	0.4	0.7
11220.18	-0.2	0.2	-0.4	-0.6	0.6	0.8
11885.02	-0.3	0.3	-0.7	-1.0	1.0	0.9
12589.25	0.1	-0.1	-0.7	-0.6	0.6	1.0
13335.21	0.4	-0.4	-0.8	-0.4	0.4	1.0
14125.38	0.1	-0.1	-0.5	-0.4	0.4	1.0
14962.36	0.3	-0.3	-0.8	-0.5	0.5	1.0
15848.93	0.5	-0.5	-1.0	-0.5	0.5	1.0
16788.04	0.1	-0.1	-1.0	-0.9	0.9	1.0
17782.79	-0.2	0.2	-1.0	-1.2	1.2	1.0
18836.49	-1.1	1.1	-0.9	-1.9	1.9	1.0
19952.62	-1.8	1.8	-1.3	-3.1	3.1	1.0

[1]add numbers in this column to levels read on the LxT1 to correct the level at a specific frequency

Section 9.3

a) Reference Sound Pressure Level

The reference sound pressure level is 114 dB re 20 μPa.

b) Reference Level Range

The reference level range is normal.

c) Microphone Reference Point

The microphone reference point is the center of the diaphragm of the 377B02 microphone.

d) Periodic Testing

Table 2 lists values of Larson Davis LxT1 with PRMLxT1 and 377B02 Microphone adjustment data of A-weighted levels used for periodic measurements.

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Table 2 - Larson Davis LxT1 with PRMLxT1 and 377B02 Microphone

adjustment data of A-weighted levels used for periodic testing

Frequency	0° Free Field Corrections from B&K 4226 Calibrator[1]	0° Free Field Corrections with WS from B&K 4226 Calibrator[1]	0° Free Field Corrections from B&K UA0033 EA[1]	0° Free Field Corrections with WS from B&K UA0033 EA[1]	expanded uncertainty of Corrections @ 95% confidence
Hz	dB	dB	dB	dB	dB
31.62	-0.2	-0.2	0.0	-0.1	0.25
63.10	-0.1	-0.2	0.0	-0.1	0.25
125.89	0.0	-0.1	0.0	-0.1	0.25
251.19	-0.1	-0.1	0.0	-0.1	0.25
501.19	0.0	0.0	0.1	0.1	0.25
1000.00	0.0	0.0	0.0	0.0	0.25
1995.26	0.6	0.9	0.6	0.9	0.30
3981.07	1.1	1.1	1.0	1.0	0.35
7943.28	2.3	1.9	2.9	2.6	0.40
12589.25	5.2	4.4	6.8	6.0	0.50
15848.93	5.4	4.3	8.1	7.0	0.60

[1]add numbers in this column to levels read on the LxT to correct to the 0° Free Field level at a specific frequency

EA - Electrostatic Actuator

WS - Wind Screen

e) Linear Operating Range

A-weighted sound levels for the LxT1 at the upper and lower limits of the linear operating ranges..

31.5 Hz	1 kHz	4 kHz	8 kHz	12.5 kHz
78 dB to 100.6 dB	36 dB to 140 dB	35 dB to 139 dB	37 dB to 138.9 dB	40 dB to 135.7 dB

f) Linear Measurement Starting Level

The starting point for measuring level linear errors on the reference range is 114 dB.

g) Electrical Insert Signals

The electrical design of the input device to insert electrical signals into the preamplifier is a series 18pF ± 5% capacitor. The Larson Davis ADP005 is used for this purpose. The ADP005 can be used for noise floor measurements by attaching the included short on the front of the ADP005.

h) Inherent Noise

Inherent Noise of the LxT1:

Weighting	Total Noise[1]	Electrical Noise[2]
A	28	28
C	28	27
Flt	32	31

[1]combination of the electronic noise and the thermal noise of the microphone at 20°C measured in a sealed cavity and vibration isolated

[2] electronic noise of the instrument with an ADP005 in place of the microphone

i) Highest Sound Pressure Level

The highest sound pressure level the Larson Davis LxT1 is designed to accommodate at the level of overload is 140 dB. The peak-to-peak voltage at this level is 28 Vpp input through the ADP005.

j) Battery Power Voltage Range

The battery power supply voltage range for which the LxT1 conform to this standard:

6.4 Volts maximum

The LxT will shut down if the battery is below 4.0 Volts when used with alkaline batteries. Therefore from 4.0 to 6.4 Volts is the usable range of battery voltage.

k) Display Device

The display device will display all levels over the entire linear operating range.

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 30 % (non-condensing) then 30 minutes are required.

m) Field Strength > 10 V/m

The Larson Davis model LxT1 was not measured for field strengths greater than 10 V/m.

n) Radio Frequency Emission

The mode of operation of the LxT1 that produces the greatest radio frequency emission levels was with the LxT1 set to run and with an LxT-EXC010 (10' microphone extension cable) used to connect the PRMLxT1 to the LxT1. Adding the USB cable did not emit more radio frequencies levels.

o) AC Power and Radio Frequency Susceptibility

The mode of operation of the LxT1 that produced the greatest measurement susceptibility to A.C. power frequency and radio frequency fields was with the LxT1 set to run, USB cable attached and with an LxT-EXC010 (10' microphone extension cable) between the PRMLxT1 and the LxT1.

LxT2

Section 9.2.4

a) Calibrator

The calibrator to be used with the LxT2 is the Larson Davis Model CAL150.

b) Calibrator Frequency

The calibration check frequency is 1000 Hz.

c) Calibration Procedure

For calibration refer to the chapter "Calibration" on page 10-1.

d) Frequency Response

Table 1 Larson Davis LxT2 with PRMLxT2 and typical 7052S Microphone average frequency responses and corrections Required by IEC 61672-1 Sections 5.2.4, 5.2.5, 5.2.6 and 9.2.4 (d)

Frequency	0° Free Field Response	0° Free Field Corrections¹	Effect of Wind Screen	Wind Screen on LxT2 0° Free Field	0° Free Field Corrections with Wind Screen on LxT2¹	expanded uncertainty of Corrections @ 95%
Hz	dB	dB	dB	dB	dB	dB
251.19	0.0	0.0	0.0	0.0	0.0	0.4
316.23	0.1	-0.1	0.0	0.1	-0.1	0.4
398.11	0.1	-0.1	-0.1	0.0	0.0	0.4
501.19	0.0	0.0	0.1	0.1	-0.1	0.4
630.96	0.0	0.0	0.1	0.1	-0.1	0.4
794.33	-0.1	0.1	0.0	-0.1	0.1	0.4
1000.00	-0.2	0.2	0.1	-0.1	0.1	0.4
1059.25	-0.2	0.2	0.1	-0.1	0.1	0.4
1122.02	-0.3	0.3	0.2	-0.1	0.1	0.4
1188.50	-0.4	0.4	0.2	-0.2	0.2	0.4
1258.93	-0.4	0.4	0.3	-0.1	0.1	0.4
1333.52	-0.4	0.4	0.3	-0.1	0.1	0.4
1412.54	-0.3	0.3	0.2	-0.1	0.1	0.5
1496.24	-0.4	0.4	0.3	-0.1	0.1	0.5
1584.89	-0.2	0.2	0.2	0.0	0.0	0.6
1678.80	-0.3	0.3	0.3	0.0	0.0	0.6
1778.28	-0.1	0.1	0.3	0.2	-0.2	0.6
1883.65	-0.1	0.1	0.3	0.2	-0.2	0.6
1995.26	0.1	-0.1	0.4	0.5	-0.5	0.6
2113.49	0.2	-0.2	0.4	0.6	-0.6	0.6
2238.72	0.2	-0.2	0.4	0.6	-0.6	0.6
2371.37	0.0	0.0	0.5	0.5	-0.5	0.6
2511.89	0.0	0.0	0.4	0.4	-0.4	0.6
2660.73	0.0	0.0	0.5	0.5	-0.5	0.6
2818.38	0.1	-0.1	0.4	0.5	-0.5	0.6
2985.38	-0.3	0.3	0.5	0.2	-0.2	0.6
3162.28	-0.2	0.2	0.3	0.1	-0.1	0.6
3349.65	-0.3	0.3	0.2	-0.1	0.1	0.6
3548.13	-0.6	0.6	0.2	-0.4	0.4	0.6
3758.37	-0.3	0.3	0.1	-0.2	0.2	0.6
3981.07	-0.1	0.1	-0.1	-0.2	0.2	0.6
4216.97	-0.2	0.2	-0.1	-0.3	0.3	0.6
4466.84	0.0	0.0	-0.1	-0.1	0.1	0.6
4731.51	0.0	0.0	-0.3	-0.3	0.3	0.6

Continued on next page

5011.87	-0.2	0.2	-0.4	-0.6	0.6	0.6
5308.84	0.0	0.0	-0.5	-0.5	0.5	0.6
5623.41	-0.3	0.3	-0.3	-0.6	0.6	0.6
5956.62	-0.4	0.4	0.2	-0.2	0.2	0.6
6309.57	0.0	0.0	0.3	0.3	-0.3	0.6
6683.44	-0.1	0.1	0.1	0.0	0.0	0.6
7079.46	-0.2	0.2	-0.1	-0.3	0.3	0.6
7498.94	-0.4	0.4	-0.2	-0.6	0.6	0.6
7943.28	-0.5	0.5	-0.2	-0.7	0.7	0.6
8413.95	-0.5	0.5	-0.3	-0.8	0.8	0.6
8912.51	-1.0	1.0	-0.7	-1.7	1.7	0.6
9440.61	-1.8	1.8	-0.6	-2.4	2.4	0.6
10000.00	-1.9	1.9	-0.6	-2.5	2.5	0.6
10592.54	-1.8	1.8	-0.4	-2.2	2.2	0.7
11220.18	-1.2	1.2	-0.4	-1.6	1.6	0.8
11885.02	-1.0	1.0	-0.6	-1.6	1.6	0.9
12589.25	-1.0	1.0	-0.4	-1.4	1.4	1.0
13335.21	-1.0	1.0	-0.4	-1.4	1.4	1.0
14125.38	-1.1	1.1	-0.3	-1.4	1.4	1.0
14962.36	-1.0	1.0	-0.2	-1.2	1.2	1.0
15848.93	-1.0	1.0	-0.6	-1.6	1.6	1.0
16788.04	-1.4	1.4	-0.9	-2.3	2.3	1.0
17782.79	-1.6	1.6	-0.5	-2.1	2.1	1.0
18836.49	-1.9	1.9	-0.8	-2.7	2.7	1.0
19952.62	-2.6	2.6	-0.8	-3.4	3.4	1.0

[1]add numbers in this column to levels read on the LxT2 to correct the level at a specific frequency

Section 9.3

a) Reference Sound Pressure Level

The reference sound pressure level is 114 dB re 20 µPa.

b) Reference Level Range

The reference level range is normal.

c) Microphone Reference Point

The microphone reference point is the center of the diaphragm of the 7052 microphone.

d) Periodic Testing

See table 2 for values of Larson Davis LxT2 with PRMLxT2 and 7052 Microphone adjustment data of A-weighted levels used for periodic measurements.

Table 2 Larson Davis LxT2 with PRMLxT2 and 7052S Microphone
adjustment data of A-weighted levels used for periodic testing

Frequency	0° Free Field Corrections from B&K 4226 Calibrator¹	0° Free Field Corrections with WS from B&K 4226 Calibrator¹	0° Free Field Corrections from B&K UA0033 EA¹	0° Free Field Corrections with WS from B&K UA0033 EA¹	expanded uncertainty of Corrections @ 95% confidence
Hz	dB	dB	dB	dB	dB
31.62	-0.1	-0.1	-0.1	-0.1	0.25
63.10	-0.1	-0.1	0.0	0.0	0.25
125.89	-0.1	-0.1	0.0	0.0	0.25
251.19	0.0	-0.1	0.1	0.0	0.25
501.19	0.1	-0.2	0.1	-0.1	0.25
1000.00	0.0	0.0	0.0	0.0	0.25
1995.26	0.4	-0.2	0.5	-0.1	0.30
3981.07	1.3	1.4	1.1	1.2	0.35
7943.28	2.8	3.4	3.1	3.7	0.40
12589.25	6.7	8.0	6.1	7.4	0.50
15848.93	8.0	9.5	8.4	9.9	0.60

¹add numbers in this column to levels read on the LxT to correct to the 0° Free Field level at a specific frequency

EA - Electrostatic Actuator

WS - Wind Screen

e) Linear Operating Range

A-weighted sound levels for the LxT2 at the upper and lower limits of the linear operating ranges.

31.5 Hz	1 kHz	4 kHz	8 kHz	12.5 kHz
77 dB to 99.6 dB	34 dB to 139 dB	33 dB to 138 dB	36 dB to 137.9 dB	38 dB to 134.7 dB

f) Linear Measurements Starting Level

The starting point for measuring the level linear errors on the reference range is 114 dB.

g) Electrical Insert Signals

The electrical design of the input device to insert electrical signals into the preamplifier is a series 18pF ± 5% capacitor. The Larson Davis ADP005 is used for this purpose. The ADP005 can be used for noise floor measurements by attaching the included short on the front of the ADP005.

h) Inherent Noise

Inherent Noise of the LxT2:

Weighting	Total Noise[1]	Electrical Noise[2]
A	27	26
C	27	25
Flt	32	30

[1]combination of the electronic noise and the thermal noise of the microphone at 20°C measured in a sealed cavity and vibration isolated

[2]electronic noise of the instrument with an ADP005 in place

i) Highest Sound Pressure Level

The highest sound pressure level the Larson Davis LxT2 is designed to accommodate at the level of overload is 139 dB. The peak-to-peak voltage at this level is 10.7 Vpp input through the ADP005.

j) Battery Power Voltage Range

The battery power supply voltage range for which the LxT2 conform to this standard:

6.4 Volts maximum

The LxT will shut down if the battery is below 4.0 Volts when used with alkaline batteries. Therefore from 4.0 to 6.4 Volts is the usable range of battery voltages.

k) Display Device

The display device will display all levels over the entire linear operating range.

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 30 % (non-condensing) then 30 minutes are required.

m) Field Strength > 10 V/m

The Larson Davis model LxT2 was not measured for field strengths greater than 10 V/m.

n) Radio Frequency Emission

The mode of operation of the LxT2 that produced the greatest measurement radio frequency emission levels was with the LxT2 set to run and with an LxT-EXC010 (10' microphone extension cable) used to connect the PRMLxT2 to the LxT2. Adding the USB cable did not emit more radio frequencies levels.

o) AC Power and Radio Frequency Susceptibility

The mode of operation of the LxT2 that produced the greatest measurement susceptibility to A.C. power frequency and radio frequency fields was with the LxT2 set to run, USB cable attached and with an LxT-EXC010 (10' microphone extension cable) between the PRMLxT2 and the LxT2.

APPENDIX

C Integrated Level Calculations

Basic Integrated Level Calculations

Equivalent Continuous Sound Level

The Larson Davis SoundTrack LxT calculates equivalent continuous sound levels based on equations from IEC standard 61672-1, Section 3.9 which defines L_{eq} as follows:

Note that the LxT displays the equivalent continuous A-weighted sound pressure level as L_{Aeq}.

Equivalent continuous A-weighted sound pressure level (also average A-weighted sound pressure level) is defined as follows:

$$L_{\mathrm{AT}} = L_{\mathrm{AeqT}} = 20\lg\left\{\left[\left(1/T\right)\int_{t-T}^{\tau} P_A^2(\xi)\,d\xi\right]^{1/2} / P_0\right\} dB$$

where:

$L_{Aeq\mathrm{T}}$ is the equivalent continuous A-weighted sound pressure level re 20 µPa, determined over a time interval T

ξ is a dummy variable of time integration over the averaging time interval ending at the time of observation t

T is the averaging time interval

$p_A(\xi)$ is the A-weighted sound pressure

p_0 is the reference sound pressure of 20 μPa

In the equation, the numerator of the argument of the logarithm is the root-mean-square, frequency-weighted sound pressure level over the averaging time interval T.

Note that the format used by the LxT to display equivalent continuous sound pressure level is L_{Xeq}, *where* X *is the frequency weighting (*X = A, C or Z*).*

When a frequency weighting other than A is used, the frequency weighting used shall be included explicitly in the title and the formula of the quantity, for example equivalent continuous C-weighted sound pressure level:

$$L_{CT} = L_{CeqT} = 20\lg\left\{\left[\left(\frac{1}{T}\right)\int_{t-T}^{\tau} P_C^2(\xi)\,d\xi\right]^{1/2} / P_0\right\} dB$$

If no frequency weighting is used, the quantity is simply called equivalent continuous sound pressure level.

Time-Weighted Averages

The Larson Davis LxT calculates many time-integrated levels or time-weighted averages (TWA) based on different parameters and time intervals. They are all designed and programmed to perform the equation specified in IEC 61672-1 with allowances for the following:

A, C and Flat frequency weighting characteristics

Various interval times, both fixed interval TWAs and variable interval event TWAs

Exchange-rates, or “doubling rates” can be entered that effect certain TWA measurements

Certain TWA measurements include a programmable threshold with only levels above this threshold contributing to the measurement

No attempt is made to meet the IEC 61672-1 requirement to title the TWA by frequency weighting and time interval within the analyzer's display or report system. The Frequency Weighting and Time Interval are both displayed in the same view to meet this requirement.

The following figure indicates how the requirements are met in the LxT.

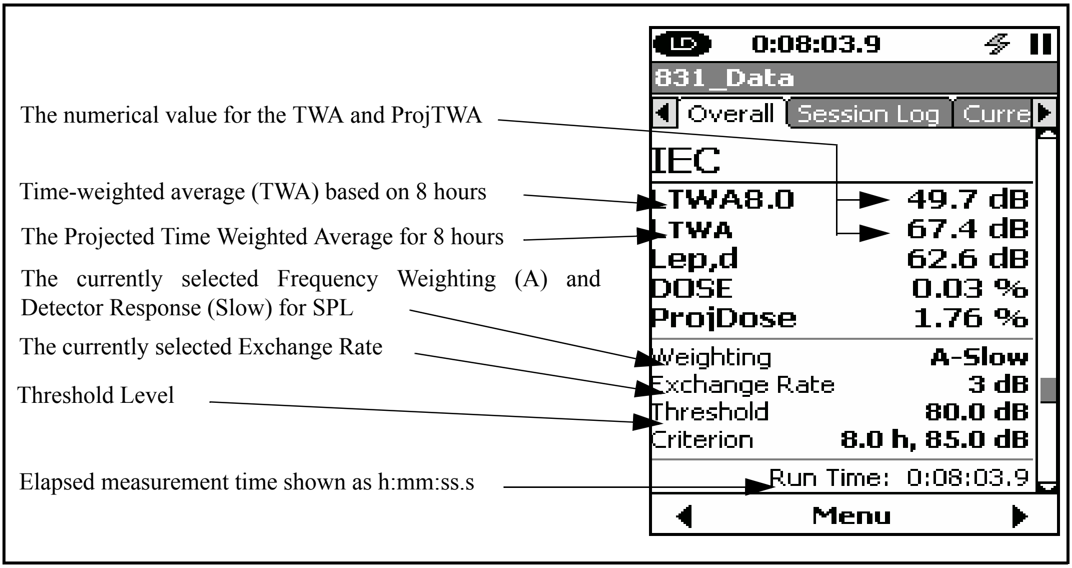

FIGURE C-1 TWA

Note that the LxT displays the time weighted average as TWA[Hr] *where Hr is the time in hours over which the average is performed.*

The actual equations used within the LxT are based on those for IEC 61672-1 and are implemented according to this equation:

$$L_{TWA} = L_{cal} + k \bullet \log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \log(n)$$

where:

$L_{(s)}$ is the current SPL at sample s (for measurements that include a threshold, $L_{(s)}$ is set to -× if $L_{(s)}$ is less than the Threshold Level L_t)

k is the exchange rate constant which is equal to:

10.00 for an exchange rate of 3 dB (L_{eq})

13.29 for an exchange rate of 4 dB (L_{DOD})

16.61 for an exchange rate of 5 dB (L_{OSHA})

20.00 for an exchange rate of 6 dB (L_{Avg})

n is the total number of samples taken in the measurement. The sample rate is 32 samples per second.

L_{cal} is the calibration offset that corrects for various sensitivities of microphones

SEL Calculations

Note that the LxT displays SEL as L_{XE}*, where* X *is the frequency weighting (*X = A, C or Z*).*

SEL is available for the overall measurement and is calculated using this formula:

$$SEL = L_{cal} + k \bullet \log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \log(32)$$

All of the SEL energy values in the analyzer utilize the Threshold and Exchange Rate settings. Care should be taken when modifying these settings since some standards or governments require SEL to be taken without a Threshold (set it to zero) and with an Exchange Rate of 3 dB.

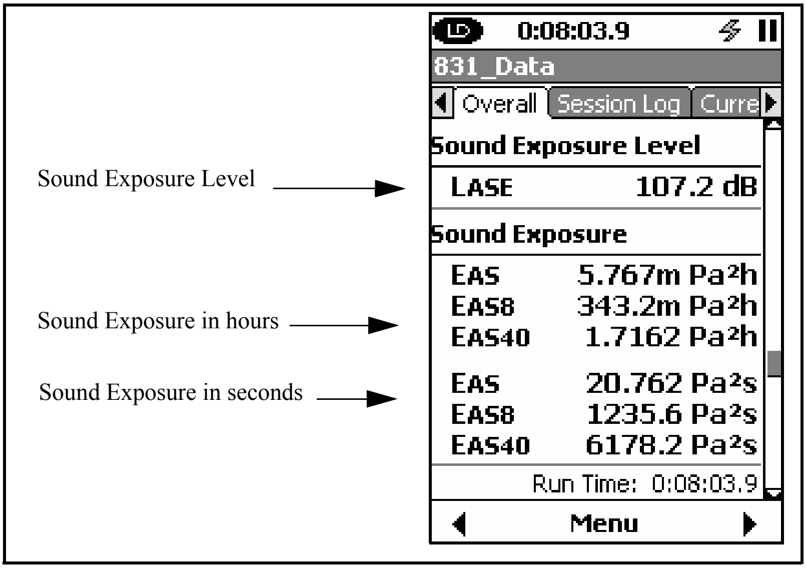

FIGURE C-2 Sound Exposure Level and Sound Exposure

Dose and Projected Dose Calculations

Dose is a measure of Sound Exposure and is defined in ANSI S1.25 Section 4.7 as:

$$D(Q) = \left(\frac{100}{T_c}\right) \cdot \int_0^T 10^{\left(\frac{L - L_c}{q}\right)} dt$$

See FIGURE C-3 "DOSE and Projected DOSE"

where:

D(Q) is the percentage criterion exposure for exchange rate *Q*

T_c is the criterion sound duration = 8 hours

T is the measurement duration in hours

t is the time in hours

L is the SLOW, (or FAST) A-weighted sound level, a function of time, when the sound level is greater than or equal to L, or equals -× when the A-weighted sound level is less than L_t

L_t is the threshold sound level specified by the manufacturer

L_C is the criterion sound level specified by the manufacturer

Q is the exchange rate in dB, and q = the parameter that determines the exchange rate, where:

q = 10 for a 3 dB exchange rate

q = 13.29 = 4/log(2) for a 4 dB exchange rate

q = 16.61 = 5/log(2) for a 5 dB exchange rate

q = 20 = 6/log(2) for a 6dB exchange rate

The factor of 100 in the equation produces a result that is a percentage.

Dose is obtained from the accumulations made for TWA and SEL using the formula:

where,

$L_{(s)}$ is the current SPL at sample s; for measurements that include a threshold $L_{(s)}$ is set to × if $L_{(s)}$ is less than the Threshold Level L_t

$$DOSE = 10^{\left[\log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \frac{L_c}{k} - \log(T_c 115200) + \log(100)\right]}\%$$

k is the exchange rate constant. See the explanation for “q” on the previous page.

n is the total number of samples taken in the measurement. The sample rate is 32 samples per second.

T_c is the criterion sound duration as set by the LxT’s “Criterion Time Hours” setting which by default is set to 8 hours L_c is the criterion sound level as set by the LxT’s “Overall Criterion” or “Current Criterion” settings.

Addition of the term “log(100)” was used to implement the 100 multiplier of the ANSI equation that creates the percentage. Subtracting the log of the Criterion Time was used to implement the division of Criterion Time of the ANSI equation.

Projected Dose in the analyzer is obtained with an equation similar to that of Dose except that the actual duration (time) of the measurement is used rather than a Criterion Time, as thus:

$$\text{PROJDOSE} = 10^{\left[\log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \frac{L_C}{k} - \log(n) + \log(100)\right]}\%$$

where the log(n) is the actual time factor, n being the total number of samples taken.

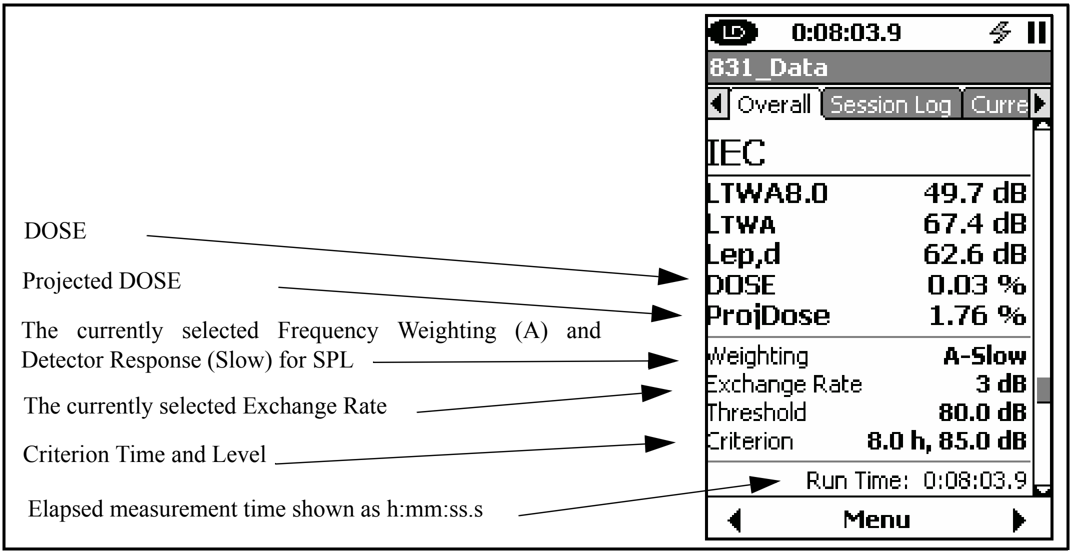

FIGURE C-3 DOSE and Projected DOSE

Sound Exposure Calculations

Sound exposure and sound exposure level are calculated as specified in IEC 61672-1.

Note that the LxT displays Sound Exposure as E_X*, where* X *is the frequency weighting (*X=A, C or Z*).*

Sound Exposure

See FIGURE C-2 "Sound Exposure Level and Sound Exposure"

The A-weighted sound exposure E_A of a specified event is represented by

$$E_A = \int_{t1}^{t2} p_A^2(t)dt$$

where $P_A{}^2(t)$ is the square of the A-weighted instantaneous sound pressure during an integration time starting at t_1 and ending at t_2.

The unit of A-weighted sound exposure is pascal-squared seconds if A-weighted sound pressure is in pascals and running time is in seconds. However it is sometimes expressed in pascal-squared hours for measurements of noise exposure in the workplace.

Note that the LxT displays Sound Exposure Level as L_{XE}*, where* X *is the frequency weighting (*X=A, C or Z*).*

Sound Exposure Level

The A-weighted sound exposure level L_{AE} is related to a corresponding measurement of time-average, A-weighted sound level, L_{AT} or L_{AEeqT}, by

$$L_{AE} = 10\lg\left\{\left[\int_{t1}^{t2} p_A^2(t)dt\right] / \left(p_0^2 T_0\right)\right\} dB = 10\lg\left(E_A / E_0\right) dB = L_{AT} + 10\lg\left(T / T_0\right) dB$$

where

E_A is the A-weighted sound exposure in pascal-squared seconds

E_0 is the reference sound exposure of:

$(20\ \mu Pa)^2 \times 1s = 400 \times 10^{-12}\ Pa^2s$

T0 = 1 s

$T = t_2 - t_1$, the time interval for measurement, in seconds, for sound exposure level and time-average sound level

Community Noise Descriptors

L_{DN}

The day-night level L_{DN} defined by the following formula:

$$L_{dn} = 10Log_{10}\left\{\frac{1}{24}\left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{2200} 10^{L_i/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10}\right]\right\}$$

L_{DEN}

The day-evening-night level L_{DEN} is defined by the following formula:

$$L_{DEN} = 10\lg\left(\frac{1}{24}\right)\left[12 * 10^{\frac{Lday}{10}} + 4 * 10^{\frac{Levening+5}{10}} + 8 * 10^{\frac{Lnight+10}{10}}\right]$$

In the default form, the day has eight hours, the evening has four hours and the night has eight hours, as can be seen in the equation. The default times for these periods are as follows

- **Day: 07.00 to 19.00**
- **Evening: 19.00 to 23.00**
- **Night: 23.00 to 07.00**

Lday, Levening and Lnight are A-weighted long-term average sound levels measured during the day, evening and night, respectively.

To account for the increased impact of environmental noise during the evening and night, penalties are added to the measured level; 5 dB for evening and 10 dB for night, as can be seen in the equation.

The Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002, relating to the assessment of environmental noise permits member states to shorten the evening period by one or two hours and lengthen the day and/or the night accordingly and also to choose the time for the start of the day.

To accommodate these and other possible modifications, the Day/Night page permits the user to modify the times for the beginning of the Day, Evening and Night periods and the penalties to be utilized when calculating 24-hour integrated values.

CNEL

In the state of California, a commonly used community noise descriptor is Community Noise Equivalent Level (CNEL), defined by the following formula:

$$CNEL = 10\log_{10}\left\{\frac{1}{24}\left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{1900} 10^{L_i/10} + \sum_{1900}^{2200} 10^{(L_i + 5)/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10}\right]\right\}$$

This is essentially the same as the L_{DEN} using default values, with the exception that the evening period begins at 22.00 instead of 23.00. Thus, by making this change in the L_{DEN} formula, the measured value will represent CNEL.

APPENDIX

D Glossary

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 for additional definitions. Specific use of the terms defined are in the main body of the text.

Allowed Exposure Time (T_i)

It is the allowed time of exposure to sound of a constant A-weighted sound level given a chosen Criterion Level, Criterion Duration, and Exchange Rate. The equation for it 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, K is the Exchange Rate Factor and L_{avg} is the Average Sound Level.

E*xample*: If $L_c = 90$, $T_c = 8$, $Q = 3$ and $L_i = 95$ then

$$= \frac{8}{10^{(95-90)/10}} = \frac{8}{2^{(95-90)/3}} = 5.656 = \text{5 hours and 39 minu}$$

This means that if a person is in this area for 5 hours and 39 minutes he will have accumulated a Noise Dose of 100%.
Standard: ANSI S12.19

Average Sound Level (L_{avg})

It is 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 $L_{avg}=L_{TWA(LC)}$

$$L_{avg} = qLog_{10}\left(\frac{1}{T}\int_{T_1}^{T_2} 10^{(L_p(t))/q}dt\right)$$

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

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 (T_c)

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.

$$CSE = T_c 10^{L_c/q}$$

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

$$L_{dn} = 10Log_{10}\left\{\frac{1}{24}\left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{2200} 10^{L_i/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10}\right]\right\}$$

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.

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, *Lp* 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 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 D-1 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 1		
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 D-1 below:

$$dB = 10Log_{10}\left[\frac{P^2}{P_0^{\ 2}}\right] = 20Log\left[\frac{P}{P_0}\right] \qquad ;p_0 = 20\mu Pa$$

Table 2 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 2) and compare with equation D-1. 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 2

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 (L_{DOD})

The Average Sound Level calculated in accordance with Department of Defense Exchange Rate and Threshold Level. See Average Sound Level

Dose

(See Noise Dose)

Detector

The part of a sound level meter that converts the actual fluctuating sound or vibration signal from the microphone to one that indicates its amplitude. It first squares the 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).

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. The equation for it is

$$L_{TWA(8)} = L_c + qLog_{10}\left(\frac{D}{100}\right)$$

NOTE: This definition applies only for a Criterion Duration of 8 hours.
Standard: ANSI S12.19

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.

$$L_{eq} = 10Log_{10}\left[\frac{\int_{T_1}^{T_2} p^2(t)dt}{p_o^2 T}\right]$$

where p is the sound pressure and the Measurement Duration (specific time period) $T=T_2-T_1$. See Sound Exposure Level.

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.
Standard: ANSI S12.19

Exchange Rate, Q	Exchange Rate Factor, q	Exposure Factor, k
3.01	10	1
4	13.333	.75
5	16.667	.60
6.02	20	.50

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). See the definition of Acoustic Near Field for the advantages of 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. See the definition of 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 that of the center frequency. Note table in Frequency Filter - Frequency Weighting.

Frequency Filter - Weighted

A special frequency filter that adjusts the amplitude of all parts of the frequency spectrum of the sound or vibration unlike band pass filters. It can be composed of one or more of the following types:

A-Weighting: A filter that adjusts the levels of a frequency spectrum in 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 levels of a frequency spectrum in the same way the human ear does when exposed to higher levels of sound. This weighting is seldom used. See table below.
C-Weighting: A filter that adjusts the levels of a frequency

spectrum in the same way the human ear does when exposed to high levels of sound. This weighting is most often used for evaluation of equipment sounds. See table below.

Flat-Weighting: A filter that does not adjust the levels of a frequency spectrum. It is usually an alternative selection for the frequency-weighting selection.

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

L_{eq}

See “Energy Equivalent Sound Level”, “Sound Level”, Energy Average”, and “Time Weighted Average”

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(C).

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:

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:

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 way, 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 excluding 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 (D)

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.

where

T is Measurement Duration

T_c is Criteria Time

$$D = \frac{100T}{T_c}10^{(L_i - L_c)/q}$$

L_i is TWA

L_c is Criteria Level

q is exchange rate factor; see page D-8 "Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)"

Standard: ANSI S12.19

Noise Exposure

(See Sound Exposure)

OSHA Level (L_{OSHA})

The Average Sound Level calculated in accordance with the Occupational Safety and Health Administration Exchange Rate and Threshold Level.

Preamplifier

A part of the 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

It is the Noise Dose expected if the current rate of noise exposure continues for the full Criterion Duration period.

Single Event Noise Exposure Level (SENEL, L_{AX})

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 an aircraft or automobile passby.

Sound

The rapid oscillatory compressional changes in a medium (solid, liquid or gas) that propagate to distant points. It is characterized by changes in density, pressure, motion, and temperature as well as other physical quantities. Not all rapid changes in the medium are sound (wind noise) since they do not propagate.
The auditory sensation evoked by the oscillatory changes.

Difference between sound and noise: Sound is the physical phenomenon associated with acoustic (small) pressure waves. Use of the word *sound* provides a neutral description of some acoustic event. Generally, noise is defined as unwanted sound. It can also be defined as sound that causes adverse effects on people such as hearing loss or annoyance. It can also be defined as the sound made by other people. In every case, noise involves the judgment of someone and puts noise in the realm of psychology not physics.
Rules:
1. Use word *sound* to describe measurements to remove the emotional overtones associated with the word *noise*. Some sound metrics use noise in their name and it is proper to use the name as it is.

Sound Exposure (SE)

It is the total sound energy of the actual sound during a specific time period. It is expressed in Pascals-squared seconds.

$$SE = \int_{T_1}^{T_2} p_A^2(t)dt$$

where p_A is the sound pressure and $T_2 - T_1$ is the Measurement Duration (specific time period).
When applied to hearing damage potential, the equation is changed to

$$SE = \int_{T_1}^{T_2} [p_A^2(t)]^k dt$$

where k is the Exposure Factor. See Exchange Rate.
Standard: ANSI S1.25

Sound Exposure Level (SEL, L_E)

The total sound energy in a specific time period. The equation for it is

$$SEL = 10Log_{10}\left[\frac{\int_{T_1}^{T_2} p^2(t)dt}{p_0^2 T}\right]$$

The sound pressure is squared and integrated over a specific period of time (T_2-T_1) this is called the sound exposure and has the units Pascal squared- seconds or Pascal squared-hours. P0 is the reference pressure of 20 µPa and T is the reference time of 1 second. It is then put into logarithmic form. It is important to note that it is not an average since the reference time is not the same as the integration time.

Sound Pressure

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). It is the amplitude of the oscillating sound pressure and is measured in Pascals (Pa), Newtons per square meter, which is a metric equivalent of pounds per square inch. To measure sound, the oscillating pressure must be separated from the steady (barometric) pressure with a detector. The detector takes out the steady pressure so only the oscillating pressure remains. It then squares the pressure, takes the time average, and then takes the square root (this is called rms for root-mean square). There are several ways this can be done.

Moving Average: The averaging process is continually accepting new data so it is similar to an exponential moving average. The equation for it is

$$p_{rms} = \sqrt{\frac{1}{T}\int_{t_s}^{t} p^2(\xi)e^{-(t-\xi)/T}d\xi}$$

The sound pressure is squared and multiplied by a exponential decay factor so that when the time of integration is near the current time (t) it is essentially undiminished. 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 is it the slower the decay factor reduces and the slower the response of the system to rapid changes. These are standardized into three 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, L_p)

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 MicroPascals (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 on 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

$$L_p = 20\log_{10}\left[\frac{p_{rms}}{p_0}\right] \qquad p_{rms} = p_0 10^{L_p/20}$$

where p_0 is the reference sound pressure of 20 µPa. The square of the sound pressure is a power-like quantity that can be expressed in the original form of the level definition

$$L_p = 10\log_{10}\left[\frac{p_{rms}^2}{p_0^2}\right] \qquad p_{rms}^2 = p_0^2 10^{L_p/10}$$

Sound Pressure Level can be converted to sound pressure as follows. If the sound pressure is 1 Pascal, then the sound pressure level is

$$L_p = 20\log_{10}\left[\frac{1}{20 \bullet 10^{-6}}\right] = 20\log_{10}[50000] = 20[4.699] = 94.0dB$$

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

$$Pa = 20 \bullet 10^{-6} \bullet 10^{76.3/20} = 20 \bullet 10^{3.815-6} = 20 \bullet 10^{-2.185} = 20[0.0065] = 0.13$$

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).

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

$$L_w = 10\log_{10}\left[\frac{W}{W_0}\right] \qquad W = W_0 10^{L_w/10}$$

Sound Speed, (c,)

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.

$$\mathrm{c} = 20.05\sqrt{\mathrm{degC} + 273} \qquad \mathrm{m/sec}$$

$$\mathrm{c} = 49.03\sqrt{\mathrm{degF} + 460} \qquad \mathrm{ft/sec}$$

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.

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, $L_{TWA(TC)}$)

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 L_{eq}.

$$L_{TWA(TC)} = K\log_{10}\left(\frac{1}{T}\int_{T_1}^{T_2} 10^{(L_p(t))/K}\,dt\right)$$

where $T_c = T_2 - T_1$ 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.

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

$$k = \frac{2\pi}{\lambda} = \frac{2\pi f}{c} = \frac{\omega}{c}$$

where λ is the wavelength, c is the sound speed, f is the frequency in Hz, and ω is the radian frequency. It has the dimensions of inverse length.

APPENDIX

E Warranty/Customer Satisfaction

A. Total Customer Satisfaction. Larson Davis, Inc. (“LD”) guarantees Total Customer Satisfaction. If, at any time you are not completely satisfied with any LD product, LD will repair, replace or exchange it at no charge, except as otherwise provided in this Limited Warranty. The employees of LD strive to provide superior, unmatched customer service. Should you find yourself dissatisfied with any LD product for any reason, consult a LD Application engineer or local representative/ distributor to discuss your situation.

B. Purchase Price Refund/Limited Warranty. LD warrants to the original purchaser (the "Buyer") that, unless otherwise expressly specified in writing by a LD officer, all LD products shall be free of defects in material and workmanship for a period of two (2) years from date of original purchase. In furtherance of LD's commitment to Total Customer Satisfaction, LD will, for a period of one (1) year from date of original purchase, refund 100% of the customer's purchase price for any LD product with which the buyer is not completely satisfied, subject to the exceptions contained in Paragraph J of this Limited Warranty. The option of a refund may be selected during this one (1) year period in lieu of repair, replacement or exchange of the product.

Extended Labor Warranty. In furtherance of LD's commitment to Total Customer Satisfaction, LD offers an extended labor warranty of one (1) year on all products calibrated or certified by a factory technician at any time or from time-to-time during the first seven years of the product life from date of manufacture. The customer's sole remedy pursuant to this extended warranty is to receive free labor for any repairs required during the period in which the extended warranty is effective. This extended labor warranty is subject to the limitations as outlined in Paragraph J.

Service & Repair Limited Warranty. In addition to the limited warranties set forth above, LD offers a 90-day parts and labor limited warranty for all repair work performed at the factory. This warranty is limited to parts repaired or replaced at the factory by LD. This warranty is also subject to the limitations as outlined in Paragraph J.

C. Shipping Charges. The buyer will return the product freight prepaid by the Buyer to an authorized service center. The product will be returned to the buyer freight prepaid by LD.

D. Products Manufactured by Others. This Limited Warranty does not cover any products manufactured by others. Such products are subject to the warranty, if any, of their respective manufacturers, and to be repaired only by a respective authorized service person for such products. LD shall have no obligation to undertake repairs of products manufactured by others.

E. <u>NO SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.</u> LD'S SOLE OBLIGATIONS UNDER THIS LIMITED WARRANTY ARE SET FORTH ABOVE IN PARAGRAPHS A, B, C AND D. IN NO EVENT SHALL LD (ITS CONTRACTORS OR SUPPLIERS) BE LIABLE TO THE BUYER FOR ANY LOST PROFITS, DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, IN TORT OR ANY OTHER LEGAL THEORY. SUCH DAMAGES FOR WHICH LD SHALL NOT BE RESPONSIBLE INCLUDE, BUT ARE NOT LIMITED TO, LOST TIME AND CONVENIENCE, LOSS OF USE OF THE PRODUCT, THE COST OF A PRODUCT RENTAL, COSTS OF GASOLINE, TELEPHONE, TRAVEL OR LODGING, THE LOSS OF PERSONAL OR COMMERCIAL PROPERTY, AND THE LOSS OF REVENUE.

Some states do not permit the limitation or disclaimer of incidental or consequential damages. Therefore, the above disclaimer of incidental or consequential damages may not apply to certain purchasers.

F. <u>NO LIABILITY IN EXCESS OF PURCHASE PRICE.</u> IN NO EVENT SHALL LD'S OBLIGATIONS UNDER THIS LIMITED WARRANTY EXCEED THE PURCHASE PRICE OF THE PRODUCT PLUS ANY SHIPPING CHARGES THAT LD MAY BE OBLIGATED TO PAY PURSUANT TO PARAGRAPH C ABOVE.

G. <u>NO EXTENSION OF STATUTE OF LIMITATIONS.</u> ANY REPAIRS PERFORMED UNDER THIS LIMITED WARRANTY SHALL NOT IN ANY WAY EXTEND THE STATUTES OF LIMITATIONS FOR CLAIMS UNDER THIS LIMITED WARRANTY.

H. <u>WAIVER OF OTHER WARRANTIES.</u> THE EXPRESS WARRANTIES SET FORTH IN THIS LIMITED WARRANTY ARE IN LIEU OF AND EXCLUDE ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Some states do not permit the disclaimer of implied warranties. Therefore, the above disclaimer of implied warranties may not apply to certain purchasers.

I. <u>Procedure for Warranty Performance.</u> If the product fails to perform to LD's specifications, the Buyer must provide LD with the applicable model and serial numbers, the date of purchase, and the nature of the problem.

J. <u>ADDITIONAL EXCLUSIONS FROM THIS LIMITED WARRANTY.</u> NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED IN THIS LIMITED WARRANTY, THIS LIMITED WARRANTY DOES NOT COVER ANY OF THE FOLLOWING:

1. **EQUIPMENT THAT HAS BEEN ABUSED, DAMAGED, USED BEYOND RATED CAPACITY, OR REPAIRED BY PERSONS OTHER THAN AUTHORIZED SERVICE PERSONNEL**.

2.DAMAGE CAUSED BY ACTS OF GOD THAT INCLUDE, BUT ARE NOT LIMITED TO, HAILSTORMS, WINDSTORMS, HURRICANES, TORNADOES, SANDSTORMS, LIGHTNING, FLOODS AND EARTHQUAKES.

3.DAMAGE UNDER CONDITIONS CAUSED BY FIRE OR ACCIDENT, BY ABUSE OR BY NEGLIGENCE OF THE USER OR ANY OTHER PERSON OTHER THAN LD, BY IMPROPER INSTALLATION, BY MISUSE, BY INCORRECT OPERATION, BY "NORMAL WEAR AND TEAR", BY IMPROPER ADJUSTMENT OR ALTERATION, BY ALTERATIONS NOT COMPLETED BY AUTHORIZED SERVICE PERSONNEL, OR BY FAILURE OF PRODUCTS PARTS FROM SUCH ALTERATIONS.

4.COSTS OF REPAIRING DAMAGE CAUSED BY POOR OR IMPROPER MAINTENANCE OR UNAUTHORIZED REPAIR.

5.COSTS OF MODIFYING THE PRODUCT IN ANY WAY ONCE DELIVERED TO THE BUYER, EVEN IF SUCH MODIFICATIONS WERE ADDED AS A PRODUCTION CHANGE ON OTHER PRODUCTS MADE AFTER THE BUYER'S PRODUCT WAS BUILT.

Authority to Alter This Limited Warranty. No agent, representative, distributor, or authorized dealer of LD has any authority to alter the terms of this Limited Warranty in any way. This Limited Warranty may be altered only in a writing signed by an authorized officer of LD.

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