

Model 824

Precision Sound Level Meter & Real Time Analyzer

Reference Manual



Larson Davis

Model 824

Technical Reference Manual

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Appendix G Miscellaneous Information

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Introduction

Welcome to the Larson Davis 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 12 chapters and 5 appendices covering the following topics:

Chapters

- **Chapter 1 - Introduction:** Orients the user to the contents of this user manual and the System 824's features, functions and measurement capabilities. It also includes instructions on unpacking the System 824.
- **Chapter 2 - Overview:** Provides an overview of the instrument's capabilities and a description of each key along with its function and displays. It also includes instructions on working with menus.
- **Chapter 3 - Front Panel Keys; their Functions and Associated Menus:** Explains the functions associated with each key on the 824.
- **Chapter 4 - Quick Start:** Guides users in the immediate use of the System 824 including how to take measurements, understanding the readings, and storing data in the System 824.

- **Chapter 5 - System 824 Instrument Modes:** Provides descriptions of the System 824's standard instrument ID's.
- **Chapter 6 - System 824 Views:** Gives you a detailed description of the different display views available and how to access them.
- **Chapter 7- Using ID Setting Files:** Describes how to recall, customize and save IDs.
- **Chapter 8 - Printing a Report:** Describes how to print a report of the data collected with the System 824.
- **Chapter 9 - Performing a Sound Level Measurement:** Walks the user through the steps necessary to obtain a sound level measurement whose accuracy will be optimal for the measurement conditions.
- **Chapter 10 - Using the 824 Utility Software:** Describes how to connect the 824 to a computer, in order to download, translate and export data.
- **Chapter 11 - RTA (Optional):** Explains how the RTA high speed data gathering option enables you to perform architectural acoustics, impulse event analysis, and passby event analysis.
- **Chapter 12 - FFT (Optional):** Describes the features and functions of the fast fourier analysis option.
- **Chapter 13 - AUD (Optional):** Explains how the AUD option can be used to manually test an audiometer by measuring level, frequency, linearity, THD, pulse, crosstalk, frequency modulation, narrow band, broad band, and speech noise.

Appendices

- **Appendix A - Integrated Level Calculations:** Provides information on TWA Leq, SEL, dose and projected dose calculations.

- **Appendix B - Serial Port Remote Control Interface:** Explains how to use the Serial Port Interface for Remote Control of the System 824.
- **Appendix C - Technical Specifications:** Gives a listing of acoustic, electronic, environmental, and physical characteristics of the System 824
- **Appendix D - Glossary:** Contains Technical Definitions of key acoustical and vibration terms.
- **Appendix E - Memory Usage:** Provides details on the allocation of memory when data are stored. This information is particularly important for applications such as noise monitoring where measurements are performed and stored automatically over a period of days or weeks.
- **Appendix F - SLM Testing to IEC61672-1:** Presents information for testing the sound level meter function of the System 824 according to IEC61672-1.
- **Appendix G - Miscellaneous Information:** Contains additional information about the 824 in the form of questions and answers

Special Features of the Electronic Version

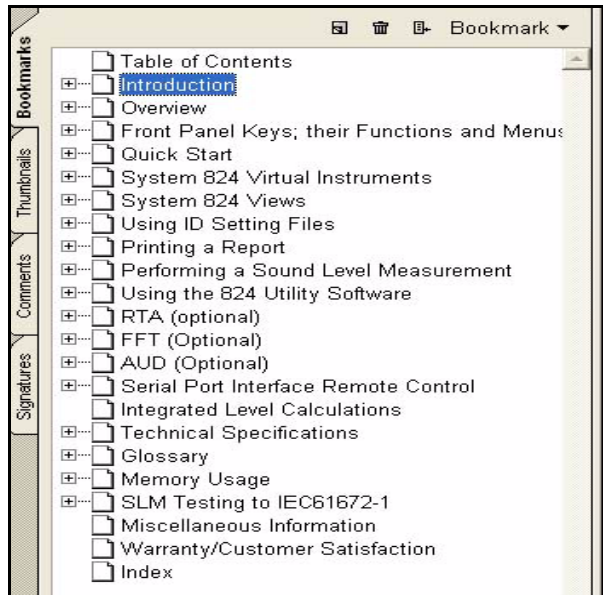
There are a variety of special techniques for navigating through pdf documents which can greatly simplify finding specific items in this manual. Two of these, bookmarks and links, are discussed below.

Bookmarks

Opening Bookmarks

Bookmarks are clickable navigation tools in pdf files. To open bookmark, left click the upper Tab on the left of the

screen labeled **Bookmarks**. These will appear as shown below.



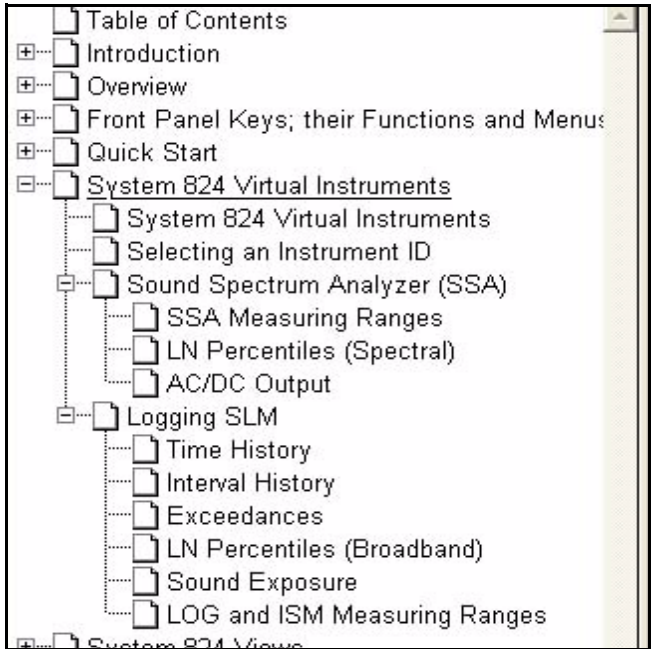
In the unexpanded view, bookmarks lists the names and page numbers of chapters and appendixes in order of appearance, as well as the Table of Contents and the Index.

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 System 824 Virtual Instruments completely expanded.



Click to Display 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

To return to the page which was displayed previous to clicking on a bookmark text line, right click on the display page, then left click on "Go to Previous View".

Links

Click to Display 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. To return to the previous display, follow the procedure described in "Return to

About This Chapter

This introductory chapter covers the following topics:


- *Formatting Conventions*: Provides an explanation of the fonts and other formatting conventions used in this manual.
- *Features*: Gives an overview of the System 824 keypad, functions and measurement capabilities.
- *Getting Started*: Provides instructions for unpacking, inspecting and initially assembling the System 824.

Formatting

This manual uses the following format conventions:

In step-by-step directions, the *process* (what you do) is shown in the right column, and the *rationale* (why you do it) with other cautions and comments are shown in the left column.

Keys to press on the LxT are shown with the icon representing the appropriate key. For example:

Press the  key

Items that appear in various on-screen menus (such as settings) are shown in bold and italicized style. For example:

Detector ***[Slow]***

Features

Hardware Features:

The Larson Davis System 824 has the following features:

- Large backlit bitmapped graphic display
- Soft rubber backlit keys
- Pop-up menus with scroll bars
- Pick and choose setup...just click and run!
- File management system (stores multiple measurements)
- Multiple Instruments

SSA: Sound Spectrum Analyzer combining a sound level meter and real-time spectrum analyzer (optional)

LOG: Logging SLM (optional)

ISM: Integrating SLM (standard)

RTA: Adds high speed spectral data gathering (optional)

FFT: Adds Fast Fourier Analysis to the 824 (optional)

AUD: Gives the 824 the ability to certify audiometers; used in conjunction with the AUDit software (optional)

TAL: Measures tonality according to DIN 45681 and appraisal of low frequencies according to DIN 45680 (optional)

- Type 1 precision integrating sound level meter: satisfies IEC61672-1 (tested with 377B41 microphone only), IEC 60651-1993, IEC 60804-1993, and ANSI S1.4 1985)

- Simultaneous measurement of sound pressure level using Fast, Slow, Impulse, Peak, and Leq detectors with A, C, and Flat weighting (SSA, ISM, LOG, and TAL instruments)
- Exceptionally large dynamic range (> 93 dB for SSA and > 115 dB for ISM and LOG)
- Digital filters with real-time rate to 20 kHz satisfying IEC 1260-1995 Class 1 and ANSI S1.11-1986 Type 1-D meeting linearity specifications over a range of 85dB:
 - 1/1 octave, 16 Hz to 16 kHz (11 filters)
 - 1/3 octave, 12.5 Hz to 20 kHz (33 filters)
- Automatic logging of sound level parameters including Interval data, L_n statistics, noise event detection using exceedance history and exceedance time history (LOG only)

The windspeed (tacho) and wind direction (throttle position) feature requires the firmware option 824-WND, not included with standard System 824 configurations.

- Measurement of windspeed (tacho) and wind direction (throttle position) using external weather transducers with inclusion of data in Views and Data Displays for SSA and LOG instruments.
- Real-time 1/3 octave spectrum analysis with rapid spectrum vs. time autostorage and triggering for sound decay measurement (RTA)
- Simultaneous operation of sound level meter with independent frequency and 1/3 octave analyzer function weighting (SSA)
- Advanced time history feature allows you to store up to 38 different parameters including spectral data with each time history sample
- Narrow band real-time frequency analysis with 400-line FFT and Hanning, Flat-Top or Rectangular window (FFT Mode)
- Standard memory (2 MB) sufficient to store one of the following:
 - 30,000 point 1/3 octave SSA Leq time history
 - 20,000 intervals with 1/3 octave Leq spectrum

- 12,300 SSA intervals with Leq & Max 1/3 octave spectra
- 60,000 LOG intervals without Ln
- 35,000 LOG intervals with Ln
- 1,000,000 point time history
- 70,000 RTA 1/1 octave spectra
- 28,000 RTA 1/3 octave spectra
- 2400 FFT 400 line snapshots
- AC/DC output, unweighted, with gain to 50 dB and attenuation to -20 dB
- Flash memory for in-field firmware upgrades
- Multi-tasking processor: provides simultaneous measuring, viewing, transferring and printing of data
- RS-422 (RS-232 compatible) interface:
Serial bit rate to 115 kbps
- Direct report printouts
- Windows™-based software included for setup, control, and high speed data downloading and translation to ASCII format

System 824 Components



Figure 1-1 *The System 824 is a convenient hand-held sound level meter with a simple user interface.*

The standard System 824 shown in Figure 1-1 includes the following:

- 1/2" diameter condenser microphone
- Backlit graphic 64 x 128 pixel LCD display
- 14-key soft rubber backlit keypad
- AC/DC output, control, serial, and external power connectors (shown in figure Figure 1-2)
- True "hand held" instrument with "sure grip" pads

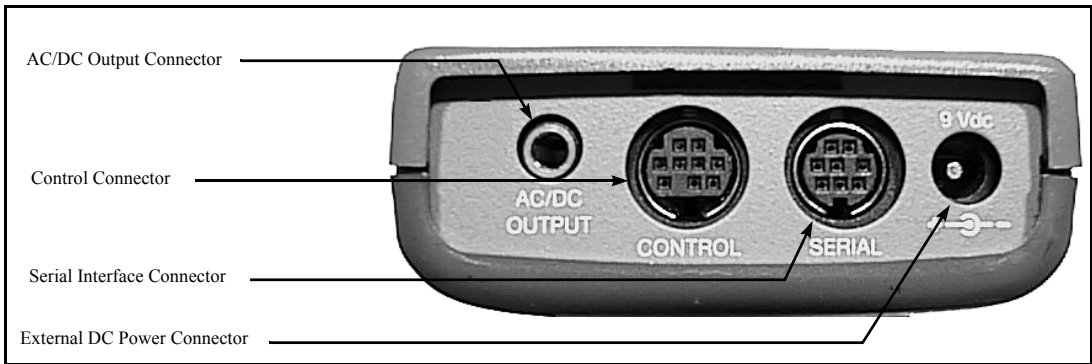


Figure 1-2 *The System 824 has a series of connectors located at the bottom of the device consisting of an AC and DC output connector, control connector, serial interface connector, and external DC power connector.*

The following is a layout of the control connector, which is used to control external devices and receive external wind and control information:

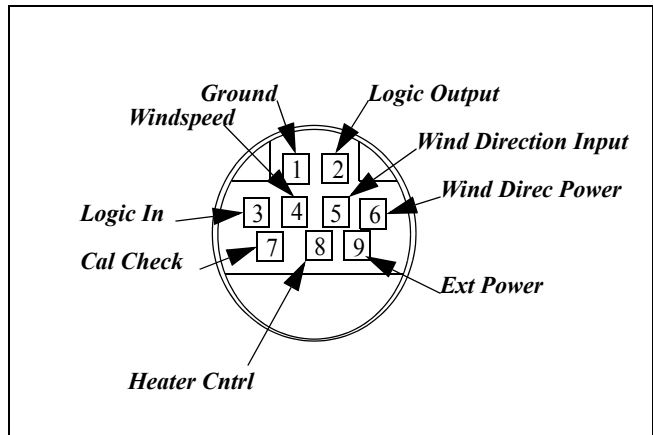


Figure 1-3 *9 pin mini DIN control connector; solder view*

- 1 - Ground
- 2 - Logic output (0 to + 5 volts, active high, through 1 k Ω)
- 3 - Logic input (0 to + 5 volts, active high, 100 k Ω load)
- 4 - Wind speed input (.05 to 10 Vdc peak to peak, 10 k Ω load)
- 5 - Wind direction A:D input (0 to 2.5 Vdc, 100 k Ω load))
- 6 - Wind direction power (+5 Vdc through 250 Ω)

- 7 - Calibration control output (0 to +5 volts, active high, 10 k Ω)
- 8 - Heater control output (open drain, +40 Vdc Max, 100 mA Max)
- 9 - External power input/output (+8 to +15 Vdc)

The serial connector is used for computer, printer and modem communications:

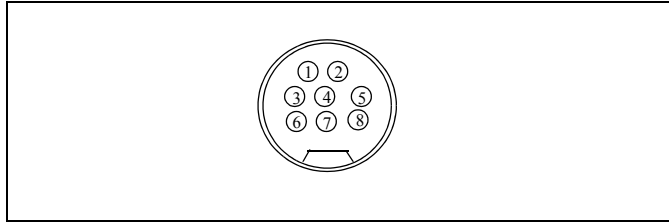


Figure 1-4 *The serial connector is an 8 pin mini DIN connector (AppleTalk™ compatible pinout).*

- 1 - Flow control output (RS-232C levels)
- 2 - Flow control input (RS-232C levels)
- 3 - Transmit data negative output (RS-232C levels)
- 4 - Ground
- 5 - Receive data negative input (RS-422)
- 6 - Transmit data positive output (RS-422)
- 7 - Control input (RS-232C levels)
- 8 - Receive data positive input (RS-422)

Both outputs have a 600 ohm series resistance.

The AC/DC output connector is used to output the signal from the System 824 microphone to external devices such as DAT recorders, real-time analyzers, other sound/vibration measurement equipment, voltmeters, chart recorders, etc.

NOTE: See the section "AC/DC Output" on page 6-5 for more details concerning the AC/DC outputs.

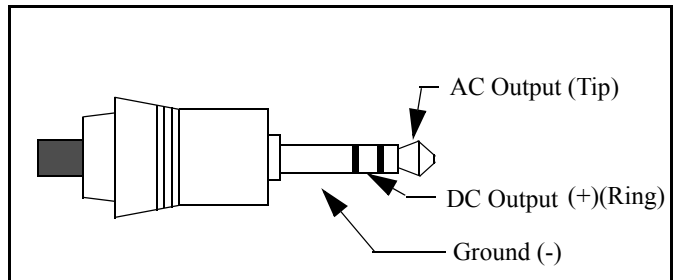
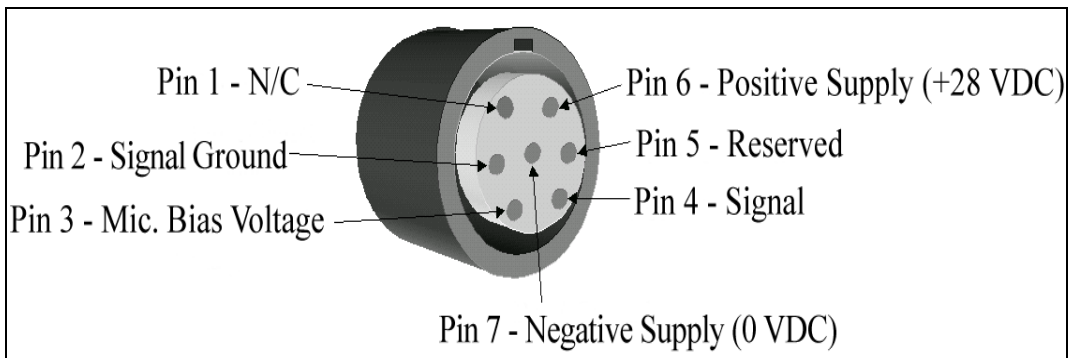


Figure 1-5 *AC/DC output connector*

Preamplifier Input Connector



The preamplifier input connector accepts the PRM902 preamp.

System Diagram

Figure 1-6, illustrates the acoustic-to-digital signal path in the System 824. As you can see, incoming sound is first converted to an electrical signal by the microphone. This electrical signal is amplified, filtered and then sampled by an analog-to-digital converter (ADC). The processor then

calculates all of the desired data based on the sampled data (sample rate of 48-51.2 kHz).

Getting Started

This section outlines the steps to unpack the System 824. The following topics are covered:

- Unpacking and Inspection
- Accessories and Optional Equipment
- Connecting Internal or External Power
- Environmental Considerations

You will then be ready to use the System 824 for actual measurements.

Unpacking and Inspection

Your System 824 has been shipped in protective packaging. Please verify 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 (801) 375-0177.

If you have not already done so, please record the purchase date, the model and serial numbers for your instrument, pre-amplifier and microphone in the spaces provided on the copyright page near the beginning of this manual. You will find the instrument's Model/Serial numbers printed on the label on the instrument's back panel. The microphone's Model/Serial numbers are located on the inside ring of the microphone. The pre-amplifier's Model/Serial numbers are engraved the outside surface. You may be asked to provide this information during any future communications with Larson Davis, Inc.

824 System diagram

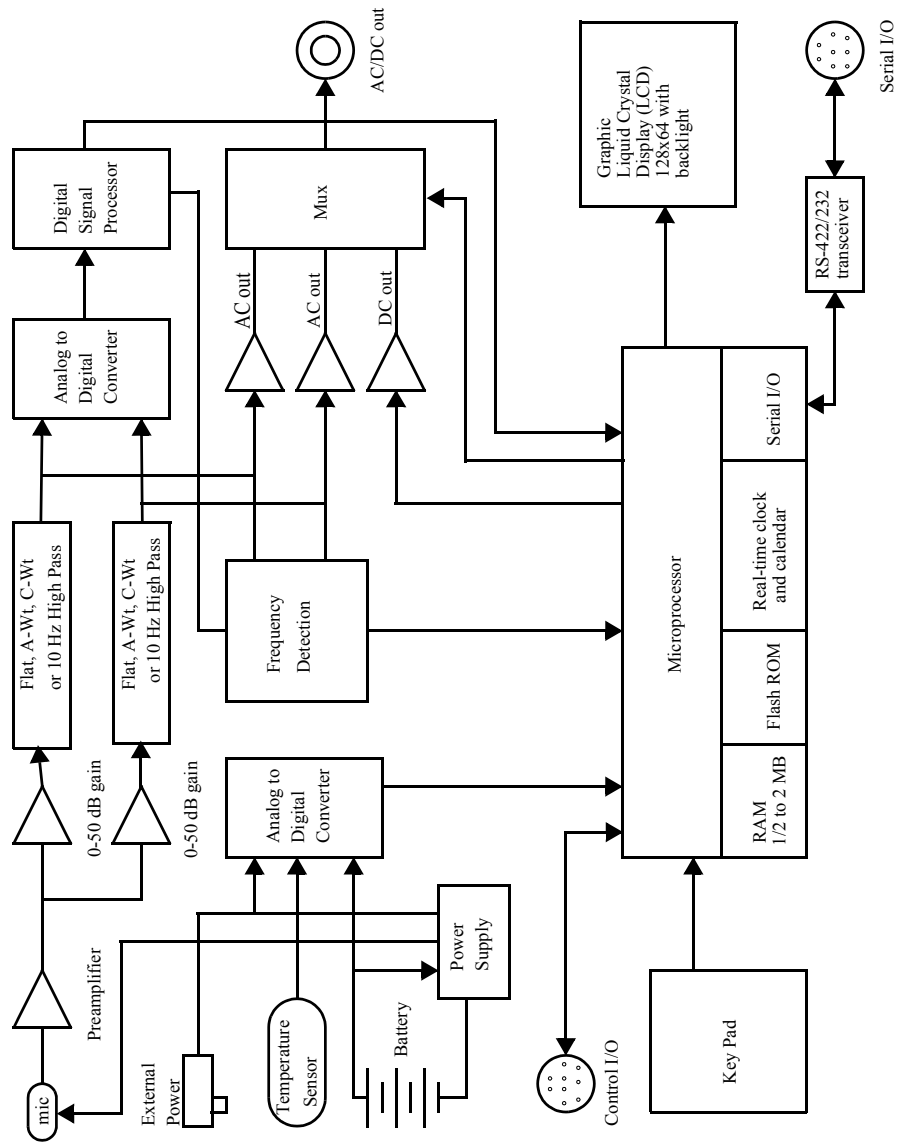


Figure 1-6 System Diagram

Comments concerning the Digital Signal Processor

Although the System 824 does have analog Flat, A-weight, C-weight and 10 Hz high pass filters ahead of the Analog to Digital Converter, most of the measurements use digital weighting filters created by the Digital Signal Processor. The Digital Signal Processor implements the following in order to provide measured data for a wide range of weightings, filters and detectors.

- A, C and Flat broadband filters
- Real-time FFT and 1/1 and 1/3 octave band filters
- Slow, Fast and Leq true RMS detectors
- Impulse and Peak detectors

If the System 824 is not being used for long periods of time (1 month or more), it is recommended that the batteries be removed to avoid damage to the instrument.

Accessories and Optional Equipment

The System 824, 824S, 824L and 824A can be purchased with or without a microphone; they all include the Model PRM902 microphone preamplifier.

The System 824, 824L and 824A are delivered with the following *standard* accessories (824-ACC Pack):

- Battery pack, NiMH, 3.6 V, 1.2 AH (BAT010)
- Reference Manual (I824.01)
- Serial cable, DB9S to DIN08 (CBL006)
- AC/DC output cable, 1/8" mini phone plug to dual phono or BNC (CBL042)
- Universal AC power adapter. (90 to 264 Vac, 50 to 60 Hz, 12 volt output) (PSA027)
- Alkaline battery terminal assembly (AM814.06) *Connects individual alkaline batteries when NiMH battery pack is not used.*

NOTE: Two Terminal assemblies are provided though only one is used. The second one is a spare. To avoid losing them, keep them in the accessory kit in the carrying case provided.

- Hard case 15"x19"x7" (CCS001) with foam insert (0860.0077)
- Windows™ utility software (SWW_824_UTIL)
- 10 foot microphone extension cable (EXA010)
- 3 1/2" diameter windscreen (WS001)

The 824S is delivered with the following *standard* accessories (824S Pack):

- 3 x 1.5 V "AA" alkaline batteries
- Alkaline battery terminal assembly (AM814.06) *Connects individual alkaline batteries when NiMH battery pack is not used.*
- 3 1/2" diameter windscreen (WS001)

The following *optional* equipment is also available:


- CAL200 Sound Level Calibrator, 1000 Hz @ 94 or 114 dB (IEC 942-1988 Class 1)
- CAL250 Sound Level Calibrator, 250 Hz @ 114 dB (IEC 942-1988 Class 1)
- Microphone extension cables are available in 1.5, 6, 10, 20, 25, 35, 50, 66, 100, and 200 foot lengths or custom lengths up to 328 feet.
- Direct BNC microphone input adapter (ADP005)
- External Battery Charger (PSA024) (Used to quick charge the BAT010)
- Accelerometer preamplifier for ICP accelerometers (PRA951-4 provides 4 mA DC current)

Connecting Internal or External Power

The 824 is shipped with a NiMH battery pack installed.

The System 824 can be powered using a 3.6 V NiMH battery pack, individual alkaline or NiMH cells, or an AC power supply adapter. For specifications on operating time under battery power, see “Battery Operating Time (full capacity, continuous operation, reference environmental conditions, individual cells may vary in performance)” on page -C-6. Below we will discuss how to install and use each.

Using the NiMH Battery Pack

For additional battery information, refer to the section  Power key on page 3-3. For detailed information on charging NiMH batteries, refer to the section "Power Settings" on page 3-6

If power is supplied with the AC Power adapter, the NiMH or alkaline batteries do not require removal and will power the unit if the AC power adapter fails. Without AC power or batteries installed, memory loss will occur.

To use a NiMH battery pack (BAT010) with the System 824, unscrew the battery cover at the back of the System 824 by hand or using a flat blade screwdriver. If individual cell batteries were previously used, remove the Terminal Assembly (Figure 1-8). Insert the battery pack so that the positive terminal is oriented down and to the right, as shown in Figure 1-7.



Figure 1-7 Battery compartment and cover with NiMH battery pack installed. (Note location of positive terminal.)

Using Alkaline Batteries or Individual NiMH rechargeable cells.









Use Duracell MN 1500 (1.5 volt, 2,850 mAH) alkaline battery or equivalent. You may also use the Duracell Ultra™ or Energizer Titanium™ next generation batteries which may provide up to 40% more run time.

Note: It is important to set the battery type to NiMH if individual NiMH cells are being used to power the instrument; otherwise there will not be sufficient battery reserve to preserve the memory once the batteries are drained. Also, the proper setting is important in terms of the ability of the instrument to accurately estimate the remaining battery life

Note: The System 824's "smart" charging system is designed to detect alkaline batteries and prevents accidental charging.

To use alkaline batteries or individual NiMH cells, remove the battery cover, and if installed, remove depleted batteries (or NiMH battery pack). If not already installed, insert a battery Terminal Assembly (AM814.06) so that it is positioned as shown in Figure 1-8. Insert three AA batteries so that polarities match those indicated in the battery compartment and secure the battery cover.

Indicate the battery type being used as follows;

- Step 1** Press the  key.
- Step 2** Press the  key
- Step 3** Use the  key to highlight "Type"
- Step 4** Press  key to activate the "Battery Type" menu.
- Step 5** Press  or  keys to select the appropriate battery type; alkaline or NiMH.
- Step 6** Press the  key to enter the selection, followed by the  key to close the Power menu.

If the rechargeable LD BAT010 battery pack is used, the setting is overridden and assumed to be NiMH. The 824 will automatically detect the presence of the pack, so the setting can be left to what would most likely be used if individual cells were to be used instead of the battery pack.

If alkaline cells are installed but erroneously declared as NiMH, the charger will start for several seconds, then will detect that they are not NiMH. Charging will be terminated and the battery type changed to alkaline. This safety measure will prevent primary cells from being charged and damaging the instrument due to leakage or explosion. Nevertheless, it is inadvisable to ever attempt to charge primary or non-rechargeable batteries.

Rechargeable individual NiMH cells can also be charged in an external rapid charger.



Figure 1-8 *Battery Terminal Assembly orientation.*



Figure 1-9 *Battery cover and compartment with alkaline batteries and Terminal Assembly installed. (Note location of Terminal Assembly.)*

Using the AC Power Adapter

You may use an external power source via the external power connector using the provided power adapter. The System 824 accepts 6 to 15 VDC and is internally fused at 0.5 A.

Overview

This Chapter presents a general overview of the structure of the Model 824, an example of selecting a Setup or Instrument Definition (ID), performing a measurement and storing the data. Subsequent chapters will deal specifically with these steps in a more structured manner.

System 824 Setups or Instrument Definitions

The power and flexibility of the System 824 gives you a variety of measurement possibilities. The System 824 has a number of distinct setups or Instrument Definitions (ID) from which you can select the one best suited for a particular application. You can, of course, modify any instrument definition for another application and add it to the existing list of instrument definitions.

The System 824 was designed to be upgraded with new instrument capabilities as they are made available. Please contact Larson•Davis for information on the latest available upgrades.

An ID name consists of an eight character name followed by a three character extension called the Instrument Type. Some IDs presently available are: SLM&RTA.SSA, SLM.ISM and Logging.LOG.

The complete ID consists of its name and an instrument setup based on one of the available Instrument Types. There are a number of factory supplied setups available for use by the user. In order to create a new setup, modify an existing ID and store it under a different name as a new setup. The Instrument Type will remain the same as that of the ID used to create it. Thus, a new setup created for the measurement of environmental noise by modifying the Logging.LOG ID might become ENV.LOG.

Instrument Definition (ID) Types

	Instrument Definition (ID)		
	SLM&RTA (SSA)	Logging (LOG)	SLM (ISM)
SLM Range (dBA)	80	105	105
Real-time Spectrum Analysis	1/1 and 1/3 octave bandwidths	No	No
Manual Data Storage	Yes	Yes	Yes
Back Erase	Yes	No	Yes
Automatic Data Logging	Time History Intervals (sound level and spectral data)	Time History Exceedance Events Intervals (sound level)	No
Major Applications	Noise Reduction Sound Power	Noise Monitoring Noise Workplace	Point & Shoot Law Enforcement Workplace Noise

Write Protect, Delete, Write Enable IDs

After an ID has been created, it can be protected (or locked), or deleted if necessary. This is described in detail in the section "Write Protect, Delete, Write Enable IDs" on page 3-17.

SLM&RTA (SSA)

The SSA ID performs simultaneous sound level measurements and real-time spectrum analysis using 1/1 or 1/3 octave bandwidths. The Instrument Type designation "SSA" represents Sound Spectrum Analyzer. Sound levels during the measurement period are displayed and can be stored for later recall. In addition to a live spectrum display, the System 824 can display an equivalent level (L_{eq}) spectrum, a minimum bin by bin level (L_{min}) spectrum and a maximum level (L_{max}) spectrum, which is the spectrum time

coincident with the maximum value of the sound pressure level during the measurement period.

A back erase function allows the removal of up to the last 30 seconds (in one second steps) of data when a disruptive noise occurs.

The 824 also provides an automatic measurement and logging feature which provides the sound level parameters L_{eq} , SEL, L_{max} , L_{min} , L_{Peak} and the L_{eq} and Max or Min spectra data at regular user-defined time intervals. Due to the complex digital processing necessary to perform simultaneous sound level measurements and spectrum analysis, the measurement range in this mode is reduced to 80 dBA.

The design of the System 824 permits the simultaneous measurement of the following sound level parameters, a feature we call “Any Data”:

	Leq	Peak	Live SPL			Lmax			Lmin		
			Detectors			Detectors			Detectors		
			Slow	Fast	Impl	Slow	Fast	Impl	Slow	Fast	Impl
A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: The detector used to create Leq is a pure integrating true RMS detector which integrates the energy over a specific period of time. It may be as short as 1/32 second, in a time history which may be as long as 24 hours. As a result, it does not include decay artifacts of older instruments that integrate the output of the SLOW or FAST detectors.

Peak Sound Pressure Level (L_{peak}) with A, C and Flat weighting.

Equivalent Continuous Sound Pressure Level (L_{eq}) with A, C and Flat weighting. A time history record can be enabled to capture samples at periods as short as 1/8th of a second.

Spectral Analysis with Time History Record allows you to record spectral data along with the 33 sound level parameters mentioned above.

An interval history which includes 6 L_n values (6 values with 0.1 dB resolution, based on user-selected percentages with 0.01% resolution).

For Takt users, as a no-cost option, the following additional parameters are provided:

Taktmaximal with the following combinations of frequency weighting and time weighting:

	Taktmaximal 3		Taktmaximal 5	
	Slow	Fast	Slow	Fast
A	✓	✓	✓	✓
C	✓	✓	✓	✓
Flat	✓	✓	✓	✓

SLM (ISM)

The SLM (ISM) is the simplest to operate, providing the functions of a “point-and-shoot” sound level meter with manual data storage. The SLM (ISM) Instrument ID measures the same thirty-three sound level parameters as the SLM&RTA (SSA) ID, but it does not provide frequency spectrum measurement capability. However, since less digital processing is required, the measurement linearity range is 105 dBA, permitting the use of a single range for all measurements.

Logging (LOG)

This ID is designed particularly for noise monitoring applications and provides extensive automatic data storage features. The Instrument Type designation, LOG, represents a Logging sound level meter. Like the SLM (ISM) ID, the measurement range is 105 dBA and does not provide frequency spectrum measurement capability. Up to thirty-six measured sound level parameters can be stored as a Time History record at rates as rapid as 32 samples per second.

The following parameters can be logged at user-selectable time intervals between 1 second and 99 hours (hh:mm:ss)

- L_{\max} , L_{\min} , SEL, and L_{eq} ($q=3$) or Time Weighted Average ($q=4, 5, \text{ or } 6$) levels for a selected detector (Slow, Fast, or Impulse) and a selected frequency weighting (A, C, or Flat)
- L_{peak} level corresponding to the frequency weighting selected for L_{eq} (see charts above) and a second L_{peak} level corresponding to one of the two alternative choices of frequency weighting.
- L_n (6 values with 0.1 dB resolution, based on user-selected percentages with 0.01% resolution)
- Date, time and duration of interval
- Six user-selected values of L_n can be measured and stored as part of the automatic interval data storage function.
- A special feature is the automatic measurement and logging of data associated with noise exceedance events that are triggered by the sound level exceeding a user-defined threshold. L_{eq} , SEL and L_{peak} for each event are logged along with a Time History of the sound level during each event.
- Daily history and community noise metrics.


Selecting a Measurement Setup

The simplest way to setup the instrument is to select the ID which most closely meets the requirements of the measurement to be made and then modify it to meet your specific needs. The instrument is delivered with a number of permanent setups. The standard ID delivered with the instrument is ISM. The optional IDs available are: SSA, LOG, RTA, FFT, AUD, and TAL. If the options for the SSA, LOG, RTA, FFT, AUD, or TAL have not been purchased, they can be evaluated in a **demo mode**.

Restrictions of demo IDs:


- Cannot print reports
- Cannot store data
- Cannot perform any I/O commands
- Only 20 demos are permitted
- Memory must be purged prior to activating these IDs

The following is an overview of how to select a measurement setup.

Step 1 To display the available instrument setups, press the  Setup key.

Note that each of the permanent setups has a letter “p” to the left of the setup name, indicating that it cannot be modified or deleted. It can be saved under another name and then modified.



At any time, one of the available setups will be the active setup. The name of this setup will be at the top of the list below the Edit Setting message. Pressing the  key while the “Edit Settings” menu item is highlighted initiates the modification procedure.

After selecting a measurement setup, press the **▶** key to initiate the measurement.

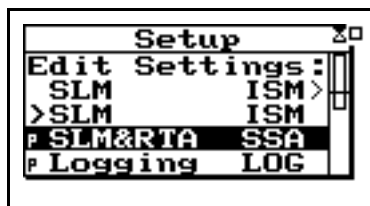
Step 2 To select the desired setup, scroll through the setup list with the **▲** and **▼** keys until the item is highlighted, then press **▼**.

It will be shown later how the Setup Menu can be utilized to modify one of the permanent setups to meet your requirements. The 824 Utility software is also very useful for selecting and modifying setups.

Performing a Measurement; SLM&RTA (SSA)

Without getting into the fine details of operating the System 824, let's just press some keys and see what it can measure and display.

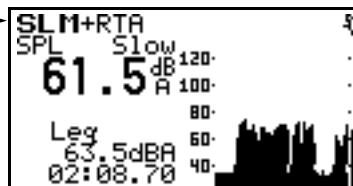
Step 1 Let's look at the SLM&RTA (SSA) ID Access the Setup Menu by pressing **Ⓜ** and use the **▼** and **▲** keys to highlight the SLM&RTA ID, as shown below:



Step 1 With SLM&RTA highlighted, press **▼** to select it as the current ID.

Step 2 Press the RUN/STOP key **▶** to begin a measurement and obtain a display resembling the following:

You can see from the top line that the meter is in the SLM+RTA mode, and the bold SLM indicates that it is the SLM display or VIEW as we refer to it when using the Model 824.





The large numerals represent the SPL measurement taken with the Slow detector and the A-weighting. In the lower left is an indication of the Leq value and the elapsed time of the measurement for which the Leq value is calculated. The graph being traced across the display is a time history of the SPL value.





Stop, Pause and Back Erase Functions

While taking a measurement you can stop, pause, and back erase.




Stopping and Starting Measurements

To stop the measurement, press the  key. Restart by pressing .

Pausing Measurements

To pause the measurement press the  PAUSE key. To continue the measurement press the  key a second time. While paused, the  and  keys can be used to move a cursor across the time history and display the SPL and secondary parameters as measured at any particular time during the measurement period.

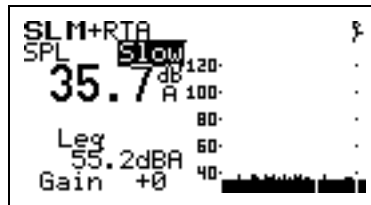
Back Erasing

Should an unwanted sound occur during the measurement, such as a door slam, you can pause the instrument, cursor to the left with the  key to a time prior to the unwanted event, and press the  key once more to recommence the measurement from that point, erasing the data to the right of the cursor. This is the *Back Erase* feature as indicated on the display when the  key had been initially pressed.

Changing the detector of the displayed SPL value

You can change the parameters being displayed in the View window while a measurement is in progress without going to the Setup menu.

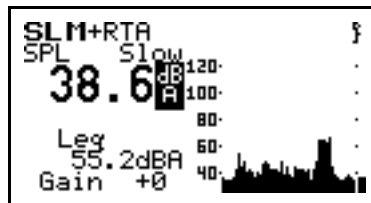
- Step 1** To change to the detector type, use the \blacktriangle or \blacktriangledown keys to highlight the Slow detector, as shown below:



- Step 2** To scroll through the optional detectors, press the \blacktriangleright or \blacktriangleleft arrow keys. This will display the SPL corresponding to the Fast and Impulse detectors. Go back to the Slow detector and press the check \checkmark key or wait several seconds until the highlight disappears.

Changing the frequency weighting of the displayed SPL value

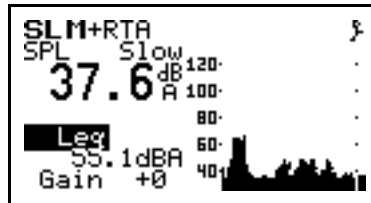
- Step 1** To select the frequency weighting parameter, press the \blacktriangle or \blacktriangledown keys to highlight the A-weighting as shown:



- Step 2** Use the \blacktriangleright or \blacktriangleleft arrow keys to display the C-weighted or Flat-weighted SPL corresponding to the Slow detector.

Changing the displayed secondary parameter

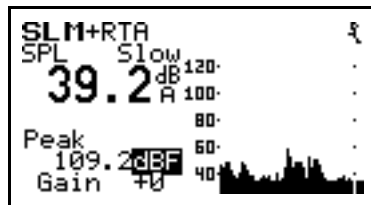
- Step 1** To select the secondary parameter to be displayed (Leq in this example), use the \blacktriangle or \blacktriangledown keys to highlight the Leq label.



- Step 2** Press the \blacktriangleright or \blacktriangleleft arrow keys to display the values of A-weighted SEL, Lmin, Lmax, Lpeak values. Select “Peak” and press the check \checkmark key.

Changing the frequency weighting of the displayed Lpeak value

- Step 1** With the Peak label selected, press the \blacktriangle or \blacktriangledown keys to highlight the Peak weighting.



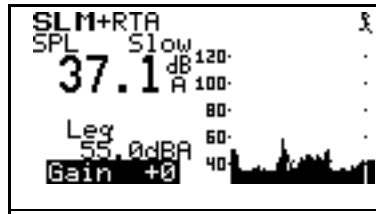
Use the \blacktriangleright or \blacktriangleleft arrow keys to display the A, C or Flat weighted Lpeak values.

Changing the amplitude range, or input Gain

When using the SSA ID, as in this example, the measurement range is 80 dB, unlike the ISM and LOG IDs for which it is 105 dB. In order to optimize a particular measurement, provisions have been made to select a value of input gain directly from the graphic display. The gain can

also be changed from the Setup Menu, as described later in this manual or it can be changed here.

Step 1 To change the gain, Use the ▲ or ▼ keys to highlight the Gain, as shown below



The gain shifts the dynamic range up or down. See page 5-3.

Step 2 Use the ► or ◀ arrow keys to change the input gain.

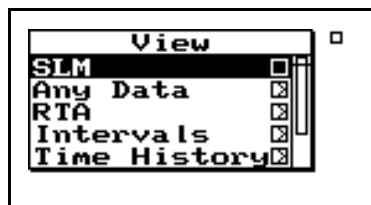
Views

For each instrument type (e.g. ISM, LOG or SSA), a unique set of data displays or VIEWS are available.

Selecting a VIEW





There are eight different VIEW choices available in the SSA instrument.



Step 1 To display the set of available data presentations, or VIEWS, press the View key (use the ▼ and ▲ keys to scroll through the entire range of choices).



The VIEW choices for the SSA instrument type are as follows:

SLM	Sound Level Meter parameters, graphic and digital display
Any Data	Tabular presentation of sound level meter parameters
RTA Live	Live display of real-time frequency spectrum
RTA Leq	Display of Leq spectrum over elapsed measurement period
RTA Max	Display of the live spectrum corresponding to the maximum value of sound pressure level occurring during the measurement period.
RTA Min	The minimum level recorded for each frequency during the measurement.
Intervals	Sound Level parameters measured and automatically stored at regular user-defined time intervals.
Leq Spectrum	Leq spectra measured and automatically stored at the interval rate.
Max/Min Spectra	Instantaneous spectrum corresponding to the maximum sound pressure level occurring during each of the user-defined time intervals or the minimum level for each frequency as selected by the “Intv Spectrum” setting.
Time History	Sound Level parameters and spectral data measured and automatically stored at user defined time periods.
Run Log	Displays the start and stop times/dates of the active measurement.
Ln Centiles	L1 - L99 displayed for the measurement period.

Use the up  and down  arrows to select a menu item, right  arrow to enter a submenu and left  arrow to exit a menu.

As part of this exercise, select each of these various VIEWS and use the  and  keys to see how a variety of different parameters are displayed within each function.


We have sought only to explain the general concept of the VIEW function at this time. More detailed explanations are provided later in Chapters 3 and 6.

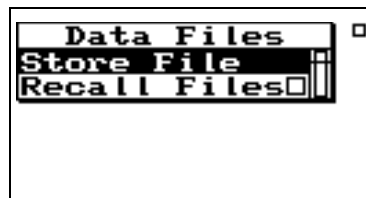
Data Storage and Recall


When a measurement has been performed and the instrument stopped, the measured data can be stored to non-volatile memory before the instrument is reset or the setup changed; otherwise the data will be lost. Attempting to change the setup while there is measured data available will cause the system to prompt you to store the data before continuing.

Storing Data


The “Recall Files” line only appears if data has previously been stored.

Step 1 To store measurement data, press the  DATA key. The following menu appears:







Step 2 With the message “Store File” highlighted, press the  Check key to store the data.

Recalling Data

Step 1 To recall stored data, highlight “Recall Files” and press the  Check key. The following screen appears.




- Step 2** Press the up  and down  arrow keys until the desired file is indicated. Press the check  key, select “Recall” from the menu and press the check  key again.


Calibration

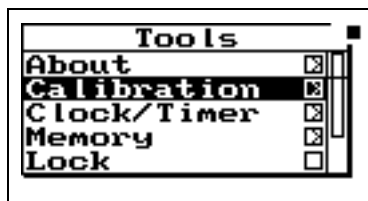
Power off the instrument prior to connecting a microphone or preamplifier; the high voltage spike created when connecting while the instrument is on can damage sensitive electronic components.

Calibration is one of the functions available from the Tools Menu.

- Step 1** Press the  TOOLS key.



- Step 2** Press the  key to highlight “Calibration”.



- Step 3** To setup the calibration process, press the **▶** key to move into the Calibration Menu.



- Step 4** To set the calibration level, press the **▼** and **▲** keys to highlight "Cal Level",



NOTE: The output level specified by the calibrator manufacturer will be at standard temperature and pressure. In practice the level is a function of temperature and static (barometric) pressure, so a corrected level should be used. Similarly, the sensitivity of the microphone itself is a function of temperature and static pressure. For directions on compensating for temperature and static pressure during calibration, see "Correction of Calibrator Output Level" on page 2-17.

- Step 5** To set the value of the sound level provided by the calibrator, press the **▶** key. This displays the **Cal Level** window.



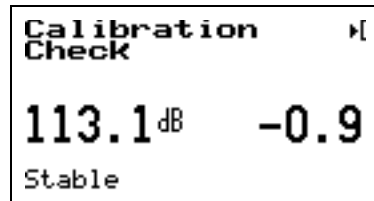
- Step 6** Then use the **◀** and **▶** keys (to move the cursor position) and the **▲** and **▼** keys (to change digits) to enter the proper level.

- Step 7** To select the new calibration level press the **✓** Check key.

Step 8 To verify that the instrument is properly calibrated, use the \blacktriangle key to highlight “Check”.

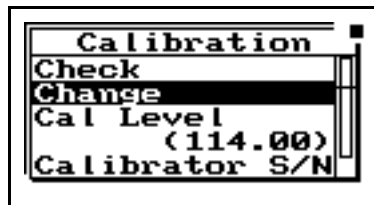


Step 9 Place the calibrator over the microphone, switch the calibrator ON, and press \checkmark to activate the calibration **Check** process.



The display will show the measured level and the difference from the calibrator level entered and the measured level as shown.

Step 10 If the calibration is not reasonably close to the level of the calibrator, the calibration can be changed by choosing **Change**. Press \checkmark , use the \blacktriangledown key to highlight “Change”.



Step 11 Switch the calibrator ON, and press \checkmark .

Correction of Calibrator Output Level

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 is delivered with the calibrator. The free field level is -0.12 dB from either of these levels. If the calibrator and instrument are near room temperature and near sea level then no other corrections need to be made. If the calibration sheet for the CAL200 indicates 113.98 dB for its level when set to 114 dB then set the Cal Level in the 824 to 113.86 dB.

When the microphone and instrument are at a temperature other than near room temperature or static pressures not near sea level, then corrections 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 377B41 microphone's sensitivity varies with static 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. The 377B41 and 824 vary with temperature. The coefficient of temperature is +0.012 dB/°C. If the system is calibrated at 25°C then it will be 0.024 dB less sensitive at 23°C.

Front Panel Keys; Functions and Menus


This chapter contains an overview of the functions which are accessed through the System 824 keypad (see Figure 3-1 below):






Figure 3-1 *System 824 Keypad.*

The 14 keys on the System 824 keypad are organized into these four sections: Power, Measurement, Navigation, and Control. These keys are covered in the following order in this chapter:

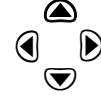


Power Key

 POWER	Turns on / off the System 824; accesses battery power monitoring and LCD utilities, and is used to close menus.
--	---



Measurement Keys




 RUN/STOP	Begins and ends measurements.
 PAUSE	Pauses readings while running, Previews current SPL when stopped. Activates Back Erase function.
 RESET	Displays Reset options menu. (Current, Overall, Options)

Navigation Keys

 ARROW	Used to move through System 824 menus, change settings, and scroll through data displays. The  key exits menu's.
 SELECT	Selects highlighted menu items (like a button on a mouse), concludes data entry (like the Enter key on a PC keyboard) and activates context specific menus (called <i>Check</i> menus).

Control Keys





 VIEW	Displays View menu choices where you can select which data to view.
 DATA	Displays the Data Files menu. This menu is used to store and recall Data Files.

 SETUP	Displays the Setup menu. Allows you to view and edit the settings for the active instrument or recall a stored Instrument Definition (ID).
 TOOLS	Displays the Tools menu. Allows you to change Calibration, Clock/Timer, Memory, Lock, Power Monitor, and Communication settings.
 PRINT	Displays the Print menu. Allows you to change print settings, and to print data reports and Snapshots.

NOTE: The reference information in this chapter is organized according to functions, rather than by tasks (which can use several functions).

The functions and displays associated with the above keys are described next. In addition, relevant reference material is included for settings and options which may be available for keys on the System 824 keypad.

Power Key


The purpose of the POWER key  on the System 824 is to turn the power on or off, close menus, and display the remaining battery life. Once the System 824 is turned on, pressing the  key again will activate a **PWR** display where you can change screen contrast, turn the backlight on or off, and adjust power options. To turn the instrument off, press and hold down the  key until prompted to **Please release key**. Release the  key and the instrument turns off.

This section discusses the following:


- Power-up the Instrument / Viewing **PWR** Display
- Power Settings
- Extra Notes on Power Conservation



Power-up the Instrument / Viewing PWR Display




To turn on the power:

- Step 1** Press the  key.
- Step 2** Allow the instrument to stabilize as indicated by the hourglass symbol in the screen's upper right hand corner.
- Step 3** As soon as the hour glass icon disappears, the System 824 is ready to acquire data.

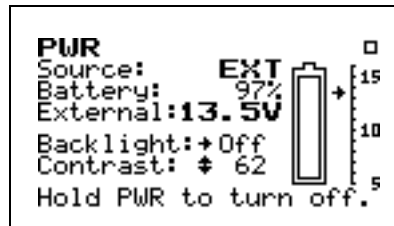
As soon as the System 824 is turned on, you can view the battery life and display settings through the **PWR** display. To do this:

- Step 1** Press the  key so that the following **PWR** display appears:


Pressing the  or  key again will return you to the previous display.

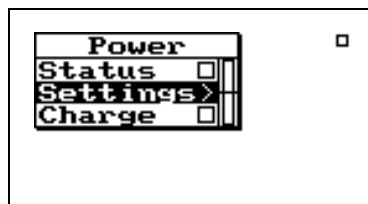
From this display, you can adjust the contrast and turn the backlight on or off. Pressing the  or  key adjusts the contrast. Pressing the  key turns the backlight on or off.

Note: If after powering up the 824 the display is not visible, turn the unit off by holding down the power key. Turn on the power again by pressing the power key and holding it down until you hear three beeps in quick succession.



This simple display indicates that the System 824 is plugged into an external source which is 13.5 volts; the battery is 97% full; the backlight is off; and contrast is at 62%.

- Step 2** From the **PWR** display, you can adjust the **Power** settings. To do this, press the  key. The following **Power** menu appears:



Check menus allow you easy access to system or instrument settings.

The ▲ or ▼ arrow keys, allow you to select the desired menu item and by pressing the ► key you can make changes to the setting.

The settings menu allows you to adjust the contrast (or viewing angle), turn the backlight on or off, and adjust settings that control the power-conservation features. These power-conservation features allow you to set the instrument to do the following:

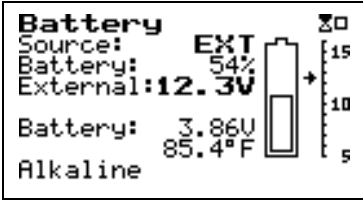
- Turn the backlight off after a set amount of time
- Automatically go into a standby mode after a set amount of time (display blanks and serial port turns off)
- Automatically shut off the instrument after a set amount of time
- Conserve internal battery for memory retention

If no keyboard activity is detected for the period of time set by the **Backlight Time** setting, the instrument will turn off the backlight. This conserves battery life since the backlight is a major consumer of battery power. If **Backlight Time** is set to zero (0), then the timer is disabled and the backlight will stay on until turned off manually. If the battery capacity is less than 30%, the backlight will automatically shut off in 3 seconds to conserve power. If the battery capacity is less than 15%, the backlight will not turn on at all.

Power Settings

Use the ▲ and ▼ keys to move from one setting to the next. Then use the ► key to change the selected setting. The ◀ key is used to return to previous menus.

The Power menu provides the following menu items:

Menu Items	Description
Status	Display's the Power Monitor display that shows the current battery type and charger status. 
Settings	Described later in greater detail.
Charge	Activates the smart battery charger.
Type	Select Alkaline or NiMH for individual cells. See "Connecting Internal or External Power" on page 1-18



Once the smart charger has been activated the 824 will not allow you to shut it off when the power key is held down. The 824 will beep and give the warning "Charging Battery, Please Wait". Simply press the power key again to force the 824 to shut off.

The charge mode will be activated automatically when external power is applied and the battery is at 75% capacity or less.

Whenever external power is applied, the 824 will trickle charge to keep the battery pack at full charge


WARNING! **The 824 must have external power applied and be left "ON" in order for the battery pack to charge!**


The power *Settings* menu item provides the following eight settings:

Menu Items	Available Setting Options	Description
Power Off Mode	Blank LCD Auto Off Manual Off	<p>Blank LCD - The instrument LCD display and serial communication port, will turn off after the keyboard and serial port have been inactive for the period of time set by the Standby Time setting.</p> <p>Auto Off - If the instrument is stopped with no reports printing, and the instrument remains inactive (i.e with no serial interface commands or key presses), for the period of time, set by the Auto-Off Time setting, the instrument will turn off.</p> <p>Manual Off - No automatic power reduction features are enabled.</p>
Auto Off Time	0 - 99 minutes	When <i>Auto Off</i> is activated, the System 824 powers down in the specified number of minutes of inactivity.
Standby Time	0 - 99 minutes	<i>Time (in minutes) when Standby Time power save is activated. When activated, the System 824 screen blanks and the serial port turns off. If any key is pressed or if incoming serial activity is detected, the instrument will exit Standby Time and become active again.</i>
Backlight Time	0 - 99 seconds	Time (in seconds) when the backlight is turned off. The backlight is reactivated when any key is pressed.
Backlight	On/Off	Turns backlight on/off.
LCD Contrast	0 - 99% (The default contrast setting is 66%)	Adjusts the contrast or viewing angle of the LCD display. This is done by pressing either the up or down arrow key. The  key increases the contrast percentage, darkens the display and makes it visible from a higher angle (when viewing from the bottom of the instrument). The  key decreases the contrast percentage, lightens the display and makes it more visible from a lower angle.

External Power	AC Pwr Battery	<p>AC Pwr - Indicates that the external power source is not a battery. If the external voltage is less than the internal battery voltage, then the internal batteries will supply power for the instrument.</p> <p>Battery - Indicates that the external power source is a battery (which should not be allowed to deep-discharge).</p>
Min Battery	0 to 15.9 (10.8 volts is the default setting)	Sets the external cutoff voltage when a battery is used for external power. 10.8 volts DC is the recommended setting for a 12 volt battery.

Extra Notes on Power Conservation

NOTE: To exit the Power display, press the left  arrow key or use the view key to the select desired view.

If you are using an external power supply, the  key will display the constant voltage coming from the power supply. If the external battery supply ever drops below 10.8 Volts, set by the *Min Battery* setting, the 824 will automatically turn off. Discharging some types of batteries (such as lead acid) deeply will greatly shorten their service life.


For detailed information on the use of external power, see "Power/Current Draw of 824 Using External Power" on page C-49

WARNING! Battery life is reduced by approximately 25% with the back-light on.

WARNING! Loss of power may cause loss of memory


WARNING! Turn off power to change the microphone or preamplifier. Sensitive electronics can be damaged by voltage spikes.

Run/Stop Key


Use the  RUN/STOP key to toggle the data gathering mode of the instrument from stop to run, or from run to stop. The mode of the instrument is indicated on the display in the upper right hand corner by a running man symbol if the


instrument is running, or a box symbol if the instrument is stopped.

NOTE: The Indicator Box in the upper right hand corner of the display will be solid if data is present, or open if no data has been taken.


Repeatedly pressing the  RUN/STOP key after beginning a measurement will stop, then restart the measurement without resetting the data buffer. As a result, the time will continue to increase for the overall measurement.


Reset Key


The  RESET key allows you to clear the data of the current measurement.

If you are using the simple sound level meter (SLM) instrument and wish to reset the data, simply press the  RESET key. This will reset all the data including the accumulated measurement values such as L_{eq} .

The SSA, ISM, and LOG instruments within the System 824, contain two independent data buffers that can separately accumulate data. In essence, the instrument becomes two sound level meters in one. The data in the primary buffer is referred to as the “overall” measurement, while data in the secondary buffer is referred to as the “current” measurement.

For the other instrument types, the System 824 gives additional flexibility when resetting the data. If you press the  RESET key *while the instrument is running*, the instrument will reset its data buffer for the current measurement and set the elapsed time for the current measurement to zero without affecting the data in the overall measurement.

If you press the  RESET key *while the instrument is stopped*, a menu will appear that will give you the choice of resetting the current data or the overall data together with the appropriate elapsed time counters.

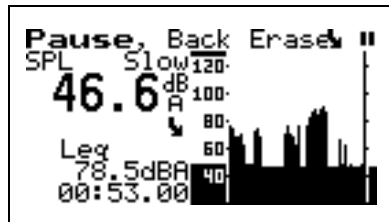
When editing system or instrument settings containing a string of numbers or characters, the  RESET key can also be used to clear the characters from the current position of the cursor to the end of the string.

⏸ Pause Key

The ⏸ PAUSE key has 3 basic functions in the ISM and SSA instruments: To Pause a measurement to avoid unwanted noise from entering into the measurement data. To erase unwanted data from the measurement and to preview the data coming into the instrument without registering the data.

Pause

The first function of the Pause key will cause the instrument to not accept any incoming data. Unlike pressing the stop key, pressing the pause key will not start a new measurement, but rather will simply pause the existing measurement for a moment. After the desired pause period, press the pause key ⏸ again to resume the measurement. The following screen will appear.






Pause, Back Erase

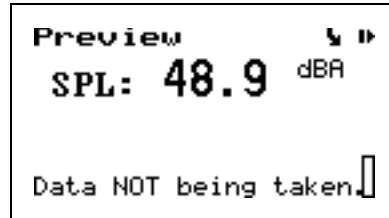
The second function of the pause key is to remove unwanted data from the measurement. The cursor is used for this function. The ⏪ and ⏩ arrow keys move the cursor across the graph.

NOTE: Moving the cursor bar left is like moving back in time.





Once it is at the desired point, press the ⏹ key to delete the data to the right of the vertical bar. After the instrument has deleted the unwanted data, the measurement will resume automatically.

Preview







Pressing the  PAUSE key when an instrument is “stopped” brings up a *Preview* display which allows you to view the SPL without affecting measured data. Pressing the  PAUSE key again will exit this screen or simply press the  RUN/STOP key to exit this screen and start taking a measurement.



Arrow Keys

The  and  (Up and Down) arrow keys navigate from one item to another in a menu, or from one record to another when displaying history data. Pressing and holding an arrow key will repeat the actuation of the key. These keys are also used to modify settings. Use the  key to step to the next higher number or character value, and use the  key to step to the next lower number or character value.

Pressing and holding an arrow key will repeat the actuation of the key. The repeat rate increases as the key is pressed for a longer period of time. Key pressure also has an effect on the repeat rate as does the amount of data available to view.

The  and  (Left and Right) arrow keys move between data displays, to move between characters of a setting being modified and to move through menus. Use the  arrow key to move from the current menu into a sub-menu or to modify a setting. Use the  arrow key to move out of a setting, to move from a sub-menu back to its parent menu, or to move back to a previous menu or display. The  and  (Left and Right) arrow keys will also move the vertical cursor bar within certain measurement displays.

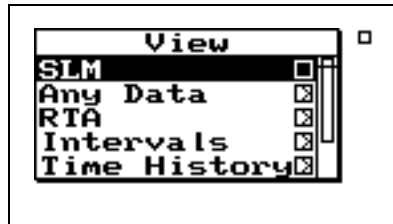
✓ Check Key

The ✓ key allows you to choose an item from a menu or to confirm the entry of a setting.

Pressing ✓ in many displays will bring up a menu from which you can make changes to settings appropriate to that display.

👁 View Key


The display of data on screen of the System 824 is controlled by the 👁 VIEW key. Each instrument type (e.g. SSA, ISM, or LOG) has its own set of available data displays which are selected using this key. When you press the 👁 key, a menu containing the available data displays will appear. The following example is a *View* menu for the SSA instrument:




The ▲ or ▼ keys and ✓ key allow you to select the desired display. While viewing data, often more than one display screen is available. You can use the ◀ and ▶ arrow keys to move from one screen to another.

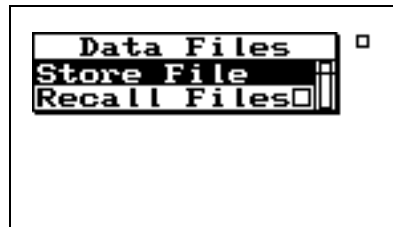
The data displays available under the 👁 key depend on the instrument type used to measure the data. These will be described in more detail in later chapters dedicated specifically to each instrument type.

Data Key

The  DATA key controls the storing and recalling of measurements, or data files from memory. Each file may contain cumulative data, time history, interval history, calibration data and histogram tables that can be stored as distinct measurements from other measurements with their data and histories. A list of all stored measurement data is shown and individually recalled by selecting it using the arrow keys and check key.




To access the **Data Files** menu press the  DATA key. A screen similar to the following appears:



If no data files have been saved, the Recall option will not be available for recall.




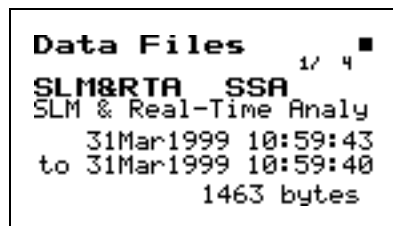
From this menu you can store data or view and recall stored data.

If the instrument is running when you try to store a Data File, you will be prompted to stop the measurement before storing the file.

To store measurement information into a *Data File*, highlight **Store File** using the  or  keys. Press the  key to select. The instrument will beep once to signify that the measurement has been stored.

To view a data file, use the  or  keys to select the desired data file. Each data file is marked with a number and the instrument used (e.g.: SLM&RTA SSA).

Press the  Data key again and select **Recall Files** to view a summary of the stored data files. The following screen appears:



To move from one record to another, use the ▲ or ▼ keys.

To exit the Data Files view, press the ⏪ to return to the previous display or select a new view using the ⏩ VIEW key.

Pressing the ⏩ key from the Data Files display, brings up a menu that allows you to recall data, jump to beginning or end of all records, find a specific data file, or purge all data files.

The **Data Files** screen shows the currently selected record number (1/4), start & stop dates and times, and the total bytes used by the record.

Pressing the ⏩ key and selecting **Recall File** from the *Data Files* menu, allows you to recall that measurement. An active data display will be shown.

When recalling a data file, the System 824 will switch to the instrument definitions (ID) that the data file was stored as (i.e. SLM&RTA to Logging, if the user was currently using the SLM&RTA instrument and recalled a Logging data file). If the run key ▶ is pressed while a recalled data file is active, the data is reset and the new data is taken using all of the settings that were stored with that data file.

The data file also contains calibration information that may be different than the current calibration. When Run is pressed, the recalled calibration is replaced by the latest /current calibration.

⚙ Setup Key

To the left of each ID is a symbol giving information about that ID: The '>' symbol indicates that the ID is currently active or that the ID is currently in memory. The lock symbol indicates that the ID is locked which protects the ID from being easily deleted. Press TOOLS to write protect or un-protect an ID. The 'p' symbol indicates that the ID is permanent and pre-defined. The '*' symbol indicates that the ID has changed and has not yet been saved.

Use the ⚙ SETUP key to access the **Setup** menu where you can select, create, and manipulate groups of instrument settings known as “instrument definitions” (ID). The **Setup** menu presents a list of pre-defined IDs (marked with a “p”) and user-defined IDs (if previously configured) that are available for use. To access the **Setup** menu, press the ⚙ key. A screen similar to this appears:



An ID defines the data that is to be measured for a particular project or type of application. The defined project IDs are listed in the **Setup** menu. You can create, edit, copy, and delete these project settings within this menu. You can also

define a project ID on a computer using the 824 Utility software and then install it into the instrument where it may be selected for use. For example, one project may require the “simple SLM” where no data logging is performed and the weighting and detector controls are available in the data display (rather than in a menu). Another example may be an hourly statistical measurement set to run for 8 hours using a LOG ID.

If data from a previous ID was not saved, you will be prompted to do so at this time. If settings to the current ID have been made, you will be prompted to save the ID at this time. The ISM and AUD instruments do not issue these prompts.

To select an instrument definition (ID), use the ▲ or ▼ keys to highlight the desired ID. Press the Ⓢ key to select and activate the it. The **Setup** menu then closes and the main display appears.

The modification of a selected ID to meet the requirements of a particular measurement application is an entire topic in itself which will be addressed in general in the next chapter and in detail in later chapters individually describing the setup and operation of each of the instrument types available for the System 824. However, once these modifications have been made, the new ID is named and stored as described in the following section.

Use the **Setup Tools** menu to create new IDs. To do this, press the Ⓢ SETUP Key and highlight the **Edit Settings** menu option. Press the Ⓣ TOOLS key to display the following screen:






With the **Setup Tools** menu you can create and/or modify instrument definition (ID) settings. The **Setup Tools** menu provides the following three options, which are later described in greater detail.

:

Menu Items	Description
Save ID	Saves/Creates an ID
Title	Description of ID
ID Name	Name of ID

Save ID

The **Save ID** menu item saves or creates an ID. Use the  or  keys to highlight **Save ID**, then press . You will then be prompted to verify the name for the ID. (See ID Name below)

Title

You can attach a description to your ID with the **Title** menu item. This description can be used on printed reports and other items. The **Title** field is capable of holding up to 30 characters.

ID Name

You use the **ID Name** menu item to give an ID a unique name that represents the ID in the **Setup** menu. The **ID Name** field is capable of holding up to 8 characters.

Name format: “ccccccc.ccc” The first 8 characters form the name and the last three are the extension that indicate the instrument type (e.g. “SSA”). The name does not have to be a full 8 characters long. Leading spaces and symbols will be removed from a name. Case is preserved but ignored when finding names. Embedded spaces will be converted to underscore. The name should start with a letter or number. The characters generally used in a name are A to Z, 0 to 9, and _ - (underscore, and dash) but may also be “ ‘ () [] ! @ # % \$ ^ & .

The allowed characters in names for IDs are compatible with PC filenames. The following characters are NOT allowed:

* + , . / : ; < = > ? [\] |

Write Protect, Delete, Write Enable IDs

NOTE: Within a given active instrument definition (ID), write protect or delete operations cannot be performed on files that were stored using that same ID. In order to protect or delete these files, the active ID must be changed. For example, stored FFT files can be protected or deleted by switching from the FFT ID to an ISM, LOG, or RTA ID.

The ID that is active, with a “>” by it, cannot be deleted.

Permanent IDs (marked with a ‘p’ in the Setup menu) cannot be write protected, modified, or deleted.

Write protected IDs (marked with a locked symbol on the Setup menu) cannot be deleted. The icon will not be displayed if the currently active ID is being used. Also, the currently active ID cannot be deleted.

After an ID has been created, it can be protected (or locked), or deleted if necessary. To do this, use the ▲ or ▼ keys from the **Setup** menu to highlight the desired ID.

Press the Ⓣ TOOLS key, and the following screen appears:






To write protect (or lock) an ID, use the ▲ or ▼ keys to highlight **Write Protect**, and then press the ✓ key. A locked symbol appears next to locked IDs in the Setup menu (except for the current running ID) and symbolizes that this ID is “Write Protected”. Once the ID is write protected, it cannot be changed or deleted until it is “Write Enabled”.





To delete an ID that has not been write protected, use the ▲ or ▼ keys to highlight **Delete ID**, then press the ✓ key. The ID is removed from memory and the ID name is removed from the **Setup** menu.

To write enable (or unlock) an ID, use the ▲ or ▼ keys from the **Setup** menu to highlight the desired write protected ID (marked with a locked symbol). Press the Ⓣ TOOLS key. Press the ✓ key on the highlighted **Write Enable** menu option. The locked symbol disappears next to the ID shown in the **Setup** menu, symbolizing that this ID is write enabled.



Tools Key

*NOTE: In certain situations you also use the  TOOLS key to delete, write enable, or write protect instrument definitions (ID) from the **Setup** menu (as previously described).*

NOTE: From any of the following displays, the  and  arrow keys will step to the next or previous display in the list.




The  TOOLS key allows you to access controls and operations such as calibration, battery usage, memory usage, setting date and time, timer, or computer port settings. You press the  TOOLS key to access the **Tools** menu. To modify settings press the  key on a menu item from the **Tools** menu. Pressing the  key on a menu item from the **Tools** menu allows you to view system settings and other displays.

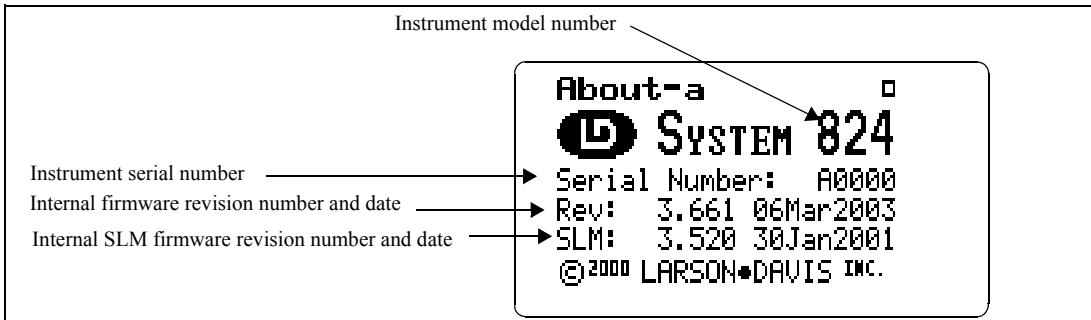
The **Tools** menu provides the following seven options, which are afterwards described in greater detail:

Menu Item	Available Settings Options ( key from <i>Tools</i> menu)	Setting Screens ( key from <i>Tools</i> menu)
About	Name (company name) Name (address line 1) Name (address line 2) Title (30 characters) Date Format (Normal or ISO-8601) Takt (enables Takt functionality) Yes or No	a - System revision information b - User information c - Installed instrument options
Calibration	Check Change Cal Level Calibrator S/N Noise Floor (not all versions)	Calibration - dates, times, and measurement when checked or changed

Clock/Timer	Current Time Current Date Day of Week Timer Mode Run Date Stop Date Run Time 1 Stop Time 1 Run Time 2 Stop Time 2	a - Current time, date, and time of next action b - Timer mode status and settings
Memory	Delete Last Purge All Data Files Allocated IDs Create EEPROM Backup	a - Memory status & current instrument record information b - Overall record status
Power Monitor	Display Power Status Power Settings > -Power Off Mode -Auto-Off Time -Standby Time -Backlight Time -Backlight -LCD Contrast -External Power -Min Battery Activate Battery Charger Type	Battery and external power status, battery type, and internal temperature
Communication	Baud Rate (300 - 115 K) Serial Address Flow Control Modem> -Modem Mode -Dial Out Mode -Phone # -Monitor Number -Modem Init	Lists command characters received and data characters sent by the instrument. Also shows the current standby timer status. The serial port and display are turned off when the timer reaches 0.


About

To access information about the System 824 use the  or  key to select **About** from the **Tools** menu, then press the  key. The following screen appears:







The **About-a** display shows the instrument’s model number and serial number as well as the firmware revision number and date.

The revision number indicated by “REV:” is changed when any firmware code change is made. The revision number indicated by “SLM:” is changed only when a firmware code modification is made that affects the accuracy of any SLM measurement data, and is used as an indicator to those who use third party verification (NIST or PTB, etc.) of instrument performance that testing should be performed.

Pressing the  key moves to the **About-b** screen. The following appears:

The **About-b** display shows the instrument’s custom name and title fields printed on System 824 reports. The fields are generally set to the owner’s name and address. The name is displayed at “power on” and printed on reports to customize them to your business.

About Settings edit mode can also be edited by pressing the  key from the **About** display screens (previously described).

To modify the **About** settings, use the  or  key to select **About** from the **Tools** menu, then press the  key. The **About** setting offers three **Name** fields and one **Title** field for use on System 824 reports.

Company Name, Address Line 1, Address Line 2- There are three lines available for user specific data. Each field




provides 30 alpha/numeric characters, and is used to describe the instrument or the organization to whom it belongs.


Title - Like the *Company Name* field, the *Title* field is capable of holding 30 alpha/numeric characters. It allows you to title the ID (Instrument Definition) you have created, and to describe your measurement.

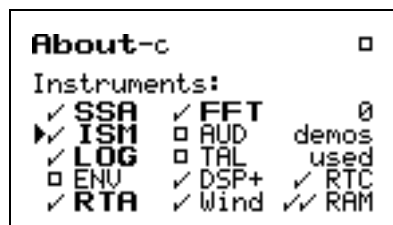
Date Format - Displays the date in Normal or ISO-8601 format. Normal has the form of **ddmmmyyyy** and ISO-8601 has the form **yyymmdd** where dd is the two digit date of the month 1 to 31, mmm is the month (i.e. JAN) and yyyy is the year (i.e. 2000).

See the section "Any Impulse Format" on page 5-8 for optional Takt views.

Takt - Enables Takt functionality to give you taktmaxmal values.

Press  twice to exit the menu.

Pressing the  key again moves to the *About-c* screen. The following screen appears:

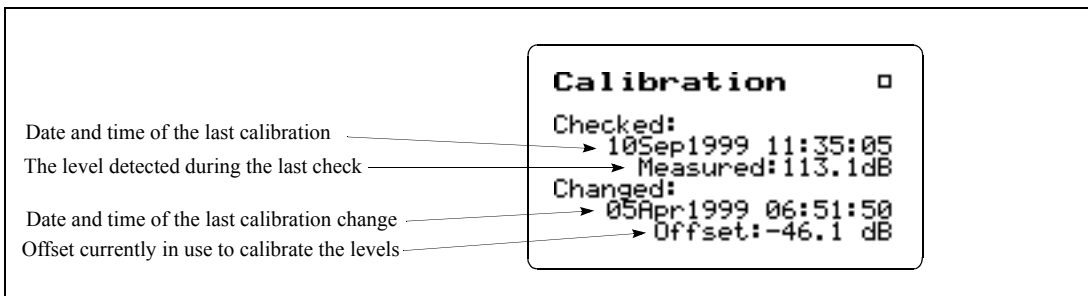


The *About-c* display shows the system's currently available instruments. Additional instruments can be added to the System 824 through firmware upgrades as they become available.

Checked instruments are installed and available for use. The number of demos used is indicated. Only 20 demos are allowed. When "demos used" equals 20, options not purchased are no longer available for use. If you have found them useful, they can be installed permanently without restrictions. Call Larson Davis for details.

Calibration

To calibrate the System 824, or to view previous calibration information, use the ▲ or ▼ key to select *Calibration* from the *Tools* menu, then press the ✓ key. The following screen appears:



The *Calibration* display shows the date and time of the last calibration change and the offset being used to calibrate the levels. It also shows the date and time of the last calibration check and the level detected during that check.

To utilize the calibration tool or modify the *Calibration* settings, use the ▲ or ▼ key to select *Calibration* from the *Tools* menu, then press the ▶ key. The *Calibration* menu provides the following settings:

Check - Activates the calibration check (level verification) process.

Change - Activates the calibration change (adjust) process.

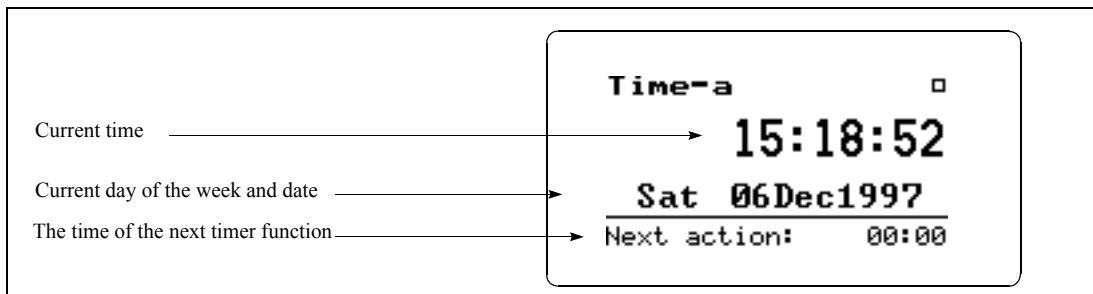
Cal Level - Enables the user to enter the sound pressure level generated by the calibrator.

Calibrator S/N - Enables the user to record the serial number of the calibrator (for reference).

Noise Floor - Enables the user to enter a noise floor value. Optimum values will depend on the type of measurement being performed. For a more detailed description, See “Entering the Noise Floor Values” on page 9-4.

Clock/Timer

To display the time and date, or to view the timer settings, use the ▲ or ▼ key to select **Clock/Timer** from the **Tools** menu, then press the Ⓢ key. The following appears:



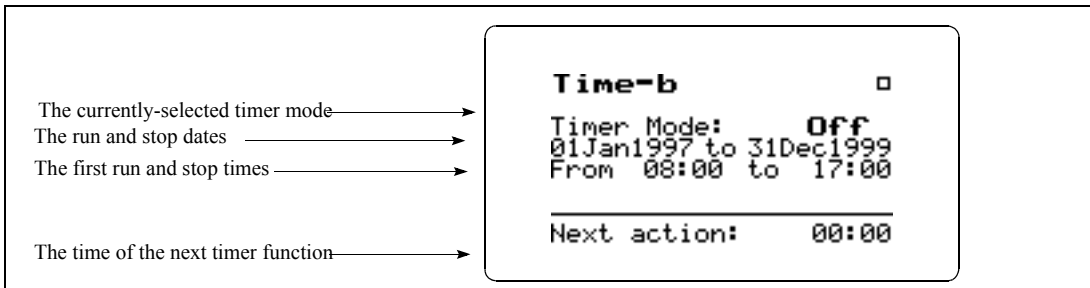
The **Time-a** or clock display shows the current time, day of the week, date and the time of the next timer action.

Pressing the ▶ key again moves to the **Time-b** screen. The following appears:

The **Time-b** or timer display shows the current timer programming including the mode and the appropriate run and stop times and dates.

Clock/Timer Settings can be changed by pressing the Ⓢ key from the Clock/Timer display screen.

To modify the **Clock / Timer** settings, use the ▲ or ▼ key to select **Clock / Timer** from the **Tools** menu, then press



the **▶** key. A screen similar to the following will appear:

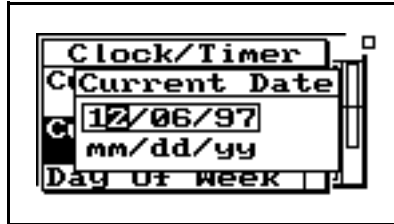
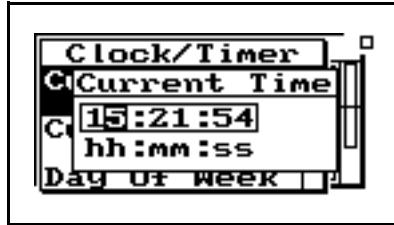


The clock in the 824 uses a 24 hour format with hours 0 through 11 being a.m. and hours 12 through 23 being p.m. For example, 5 p.m. will be displayed as 17:00:00.

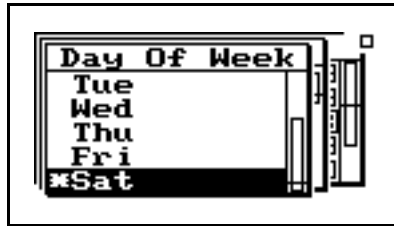
With the **Clock / Timer** menu you set the instrument's clock/calendar and timer. The first three menu items allow you to set the current time, date, and day respectively, while the remaining items (Run/Stop Date, Run/Stop Time 1, Run/Stop Time 2) allow you to control the timer function.

IF the date has not been set (month shows as???) then the message "Time not set!" will be shown when the Run key is pressed.

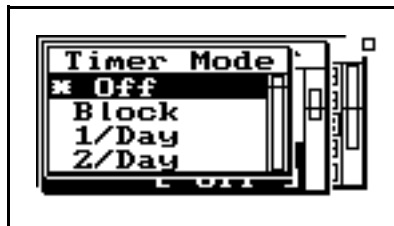
Current Time / Date - To set the current time and/or date, highlight the desired item (i.e. **Time** or **Date**) and then press the **▶** key. Modify the setting using the **◀** or **▶** key to select the digit desired to modify, then use the **▲** or **▼** key to modify.



Day Of Week - Allows you to change the current day of the week. Use the ▲ or ▼ key to highlight the desired day, then press the Ⓞ key to select.



Timer Mode - The timer is used when you want to have the 824 automatically turn on, gather data, and stop at pre-determined date(s) and time(s). The System 824 has four timer modes automating the start and end of measurements:



Off - The timer is disabled.

Block - The timer will automatically turn the instrument on and initiate a single measurement beginning at a certain time on one day and ending at a certain time on the same or another day.

NOTE: If the run time is later than the stop time, then a measurement will start on the stop date and end at the stop time on the date AFTER the stop date.

1/Day - The timer will automatically turn the instrument on and initiate one run/stop cycle per day from the run date until the stop date.

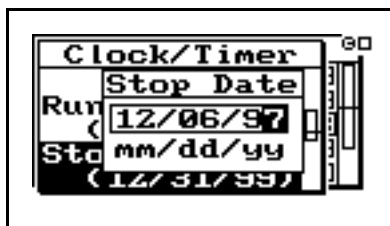
2/Day - The timer will automatically turn the instrument on and initiate two run/stop cycles per day.

The three “enabled” modes (i.e. 1/Day, 2/Day, and Block) use the dates set by the **Run Date** and **Stop Date** menu items to determine the range of “valid” days on which to make measurements.

Run Date - Specifies the starting date to take measurements.

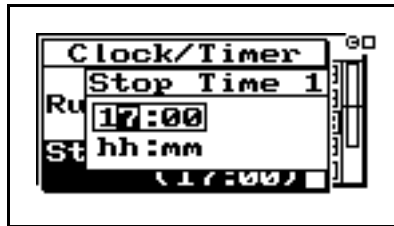
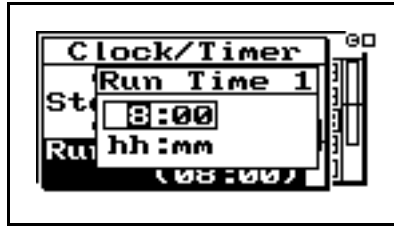


Stop Date - Specifies the date to end the measurement and disable the timer mode.






Run Time 1 / Stop Time 1 - These settings allow you to specify the beginning and ending times of a measurement.

NOTE: If you have selected the **Block, 1/Day** or **2/Day** mode, the timer will automatically turn the instrument on one minute prior to the run time.



Run Time 2 / Stop Time 2 - These settings are used to specify a second measurement's beginning and ending time in the 2/day timer mode.

Memory

To access the **Memory** display, use the  or  key to select **Memory** from the **Tools** menu, then press the  key. The following appears:

Available memory (as a percentage of total data memory) _____

Available memory (in bytes) _____

Number of various types of history records for a given ID (SSA in this example) _____

```

Memory-a
Free 94.47%
448909 of 475149 bytes
SSA
Log:

```

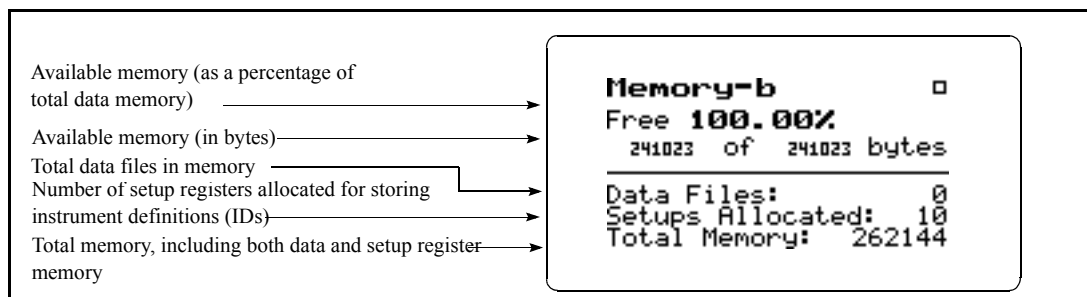
For detailed information on the usage of memory (e.g. bytes for each type of record stored), see "Memory Usage" on page E-1

Only those records enabled for the active instrument type are displayed.

The **Memory-a** display shows the amount of memory available for storing data. This information is given both in bytes and as a percentage of the total memory that can be used for storing data. (This "total memory" does not include the memory allocated for ID registers.)

In addition, the **Memory-a** display shows the number of previously-stored records (of various types) for the active ID.

Pressing the **▶** key again moves to the **Memory-b** screen. The following appears:



The top portion of the **Memory-b** display shows the same "available memory" information as in the **Memory-a** display. In addition, the **Memory-b** display shows the number of data files in memory; number of setup registers allocated; and the total amount of memory, including that memory allocated for setup registers.

Memory Settings can also be accessed by pressing the **⏴** key from the **Memory** display screen.

To modify the **Memory** settings use the **▲** or **▼** key to select **Memory** from the **Tools** menu, then press the **▶** key.

See next page for detailed information on the "Delete Last" feature.

Delete Last - The Delete Last feature will allow the user to delete the very last record stored in memory from any instrument type. To delete the last stored record, highlight **Delete Last** and press the Check C key.

"Purge All Data Files" is also available from the reset menu under the **RESET** **⏴** key.

Purge All Data Files - Pressing the **▶** or **⏴** key when the **Purge All Data Files** menu item is highlighted, allows you to purge all data files in memory. This clears the memory.

The default value of this setting is 10 allocated setup registers (which uses 5120 bytes of memory). The System 824 has ten permanent ID registers. These pre-defined ID registers cannot be changed or deleted and do not reduce the amount of data memory available. They are to be used primarily as templates for new, user-defined IDs.

Important: In order to not lose your customized settings in the event of memory loss or firmware upgrade, follow these steps.

Allocated ID's - Determines the number of setup registers that are allocated in memory for storing IDs. In essence, this setting determines how much memory is allocated for storing instrument definitions. Setting this to a higher value allows more IDs to be created, but reduces the amount of memory available for data storage by 512 bytes per allocated ID.

Create EEPROM Backup - Stores the most recently used SSA, ISM, and LOG IDs so that they may be recreated in the event of a memory loss.

1. Alter the permanent IDs as desired and save your customized setting using a name of your choice.
2. Enter the unit Name and other system settings in the TOOLS>About menu
3. Bring your favorite ISM, LOG and SSA ID to the top of the SETUP ID menu by selecting them one at a time. Alter a permanent ID and save your customized setting using a name of your choice.
4. Store these settings permanently using the TOOL>Memory>Create EEPROM Backup menu item.

Your settings will not become permanent.

Repeated whenever you update any of the system settings or IDs that you want to be permanent.

Deleting Stored Data

Delete Last Function

The **Delete Last** feature will allow the user to delete the very last record stored in memory from any instrument type. It also allows you to recall a file, delete individual records within that file, run the instrument again and append new data to memory. Essentially the record is **unstored** from memory.

824 Memory Structure

The memory structure of the 824 is a forward and reverse linked list. This means that for each type of data there is a pointer to the first record and a pointer to the last record and


that each record points to the next record and the previous record. This structure makes the memory very efficient (compared to fixed sector, file allocation table based memory structures) and sequential forward and reverse data retrieval is very fast.

This memory structure does not allow us to delete data in the middle of used memory in a way that would allow it to be reused. However, there is no problem deleting data from the last to the first.


Deleting the Last Stored Record

If “View Back” is selected you will be returned to the last view screen displayed.


If nothing is selected after a 30 second time period, this screen will disappear and return to the previous display.

Step 1 To delete the last stored record, press the TOOLS  key to access the TOOLS menu. The following menu appears:



Step 2 Highlight “Memory” and press the right  arrow key.



Step 3 Highlight “Delete Last” and press the Check  key.



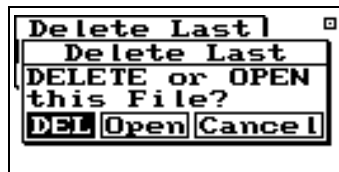
This display shows the last record that was stored along with the date and time of the data, the instrument type it is

recorded for, the bytes used by that record and how much memory is available.

Step 4 Press the Check (✓) key to delete this file. The following menu will appear:



Step 5 Highlight “Delete” and press the Check (✓) key. The record is deleted. If the last record was a data file then the following choices will appear:



DEL - Choosing “DEL” will erase the file and all of its contents.

Open - Choosing “Open” recalls the file into memory, the File record is deleted, and the data in memory marked as if it had never been stored. This allows you to run the instrument again and store the old data and the new data just acquired into a new file.

Cancel - Choosing “Cancel” cancels you out of the Delete File function and returns you to the previous display.

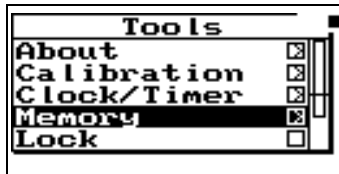
Choosing “Open” also allows you to delete individual records from the file after it has been opened. See the next page for instructions on deleting individual records. In essence this will UNDO the storing of a data file.


Deleting Individual Records

After selecting “Open” in Step 5 above, the file record is deleted and now you are allowed to look at each individual record and decide whether to delete or store it with new data appended to it. Follow these steps to delete individual records:


Step 1 The last display that was viewed will appear after selecting “Open”.

Step 2 Press the TOOLS  key and the following appears:




Step 3 Highlight “Memory” and press the right  arrow key to access the “Delete Last” function.



Step 4 Highlight “Delete Last” and press the Check  key.

The records will appear one at a time. Below are examples of some of the records.

<p>Delete Last ■</p> <p>Excd [LOG]</p> <p>07Sep1999 10:02:31</p> <p>00:03.93 57 bytes</p> <hr/> <p>Free Memory</p> <p>97.25% 462082/ 475149</p>	<p>Delete Last ■</p> <p>Interval [LOG]</p> <p>02Sep1999 08:51:35</p> <p>00:03.96 58 bytes</p> <hr/> <p>Free Memory</p> <p>97.99% 465632/ 475149</p>	<p>Delete Last ■</p> <p>RunLog+TH [LOG]</p> <p>02Sep1999 08:51:39</p> <p>20 bytes</p> <hr/> <p>Free Memory</p> <p>97.99% 465610/ 475149</p>
---	---	---

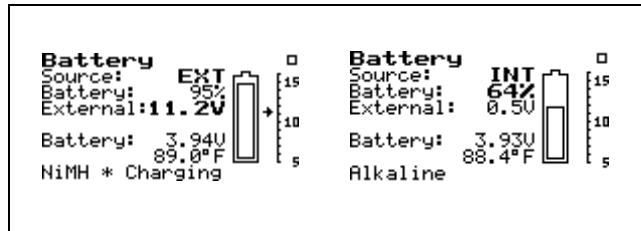
To delete them press the Check  key. The following will appear:



With “Delete” highlighted, press the Check (✓) key again to delete the record. The next record will appear. Continue this process until you have deleted all of records that you don’t want.

Power Monitor

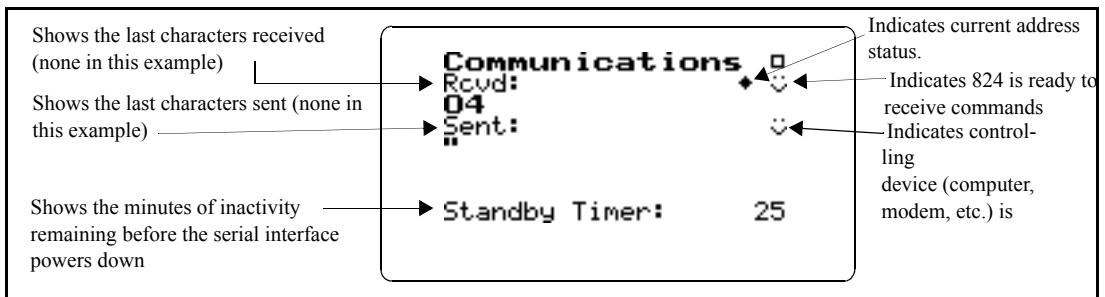
This menu option allows adjustment of the auto-power off, the contrast (or viewing angle), turns the backlight on or off and adjusts settings that control the power-conservation features. Refer to the section “(⏻) POWER key” on page page 3-3 for a full description of the **Power Monitor** settings. In the following example of the Power Monitor display, the battery indicates 3.49 V while charging. When the instrument is running, this will typically be 3.6V or less.



Communication

The **Communication** display shows the status of the serial port (i.e. how many minutes until the standby mode is automatically enabled) and the last characters received and transmitted and is used when troubleshooting communication problems and as an aid when writing programs to control the instrument.

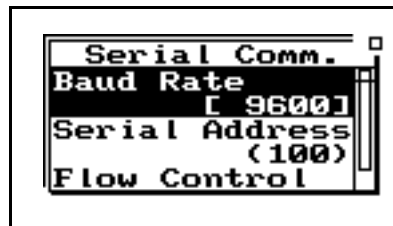
To access the **Communication** display, use the \blacktriangle or \blacktriangledown key to select **Communication** from the **Tools** menu, then press the \checkmark key. The following appears:



This menu can also be accessed by pressing the \checkmark key on the communications display.

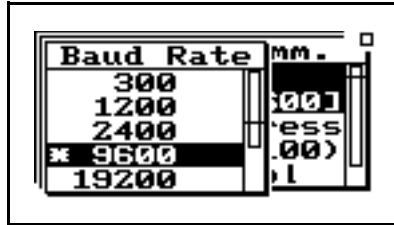
To access the **Communication** settings, use the \blacktriangle or \blacktriangledown key to select **Communication** from the **Tools** menu, then press the \blacktriangleright key. A menu similar to the following appears:

Use the right and left arrow keys to toggle between the Communication display and a list of Errors or Warning Messages. These messages are useful when troubleshooting I/O command problems.



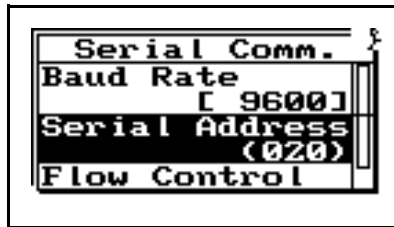
The printer has its own baud rate for printing reports and is not affected by this setting.

Baud Rate - Speed at which the System 824 communicates with controlling devices (computer, modem, etc.) through the serial port. The baud rate has a range from 300 to 115200 baud.

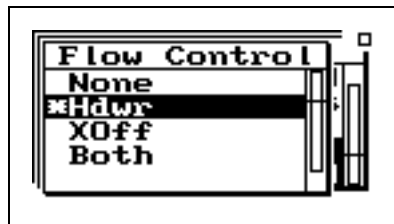


Default is set to the value of the last 2 digits of the serial number and can be set within the range of 1 to 100.

Serial Address - Address of instrument. This setting identifies the instrument within a network of instruments by assigning it a network or serial address.

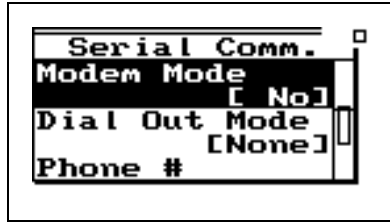


Flow Control - Flow control of the serial connection. Flow control can be changed to None, Hardware, Xoff, or Both. Flow control prevents the loss of data when either the instrument or controller's input buffer becomes full. Hardware flow control is recommended.

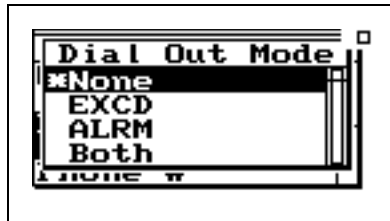
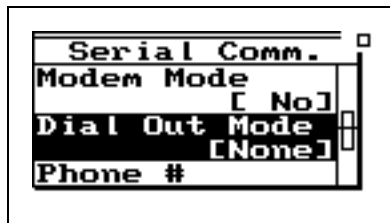


See the section "Modem Control Mode (All Instruments)" on page A-74 for more detailed information on modem communication.

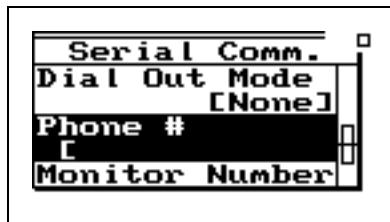
Modem Mode - Turns the modem mode on or off to allow communication to a telephone modem.



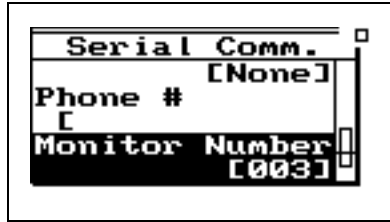
Dial Out Mode - The 824 will dial out on an Exceedance or an Alarm or both.



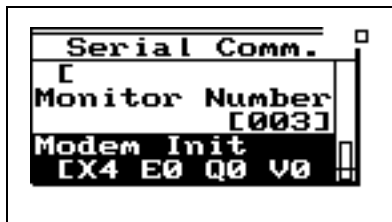
Phone Number - The 824 will dial the phone number entered here on the events selected in the dial out mode.



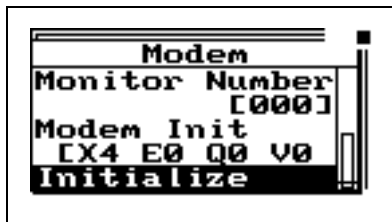
Monitor Number - The monitor number is used to identify which 824 is being queried and is sent with the 824's initial announcement.



Modem Init - The modem initialization string is entered here.




Initialize - The modem initialization string is sent out the RS232 port.




Print Key

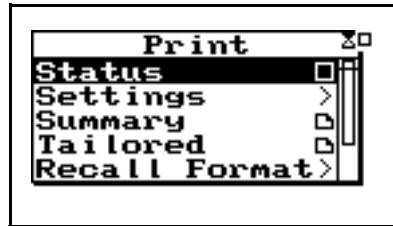
Refer to the section "Printing Reports" on page 8-2 for more information on printing.


The  PRINT key displays the printing options menu. These options enable printing of graphical and tabular data reports directly from the instrument to a serial printer. You can create high-resolution presentation-quality reports when printing to a laser printer because of the instrument's PDL-3 (Page Description Language) capabilities. Draft-quality tab-

ular data reports can also be printed on virtually any serial printer.


The **Print** menu provides the ability to output reports containing all the data gathered for the measurement to an attached printer. The main **Print** menu is activated by pressing the  PRINT key.

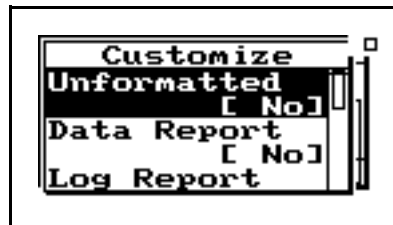
The Print menu changes depending upon the specific instrument being used.



With an appropriate printer connection, you can print a number of reports. The “Recall Format” sub-menu option is used to enable various reports. Do this by highlighting the corresponding menu item and pressing the  key.


Use “Tailored Report” to print the custom reports that are defined as part of an instrument definition (SSA and LOG IDs only).

Use the **Customize** sub-menu to further customize the report settings. In this sub-menu you can select the specific elements to include in the report and also the various data ranges for histograms, time histories, etc. To access this sub-menu, highlight **Customize** and press the  key.



Quick Start

The System 824 instrument provides simultaneous measurements of sound pressure level using Fast, Slow, Impulse, Peak and Leq detectors with A, C, and Flat weighting covering a large dynamic range of greater than 105 dB in the LOG and ISM instrument and 80 dB in SSA instrument.

With the System 824 calibrated, the desired instrument definition selected, and its associated settings properly configured, you can easily take a measurement and examine the readings from the data collected. Taking an actual measurement with the System 824 is as easy as pressing the  (RUN/STOP) key.


This chapter helps users begin using the System 824 immediately. This chapter will present the following:

- Turning on and Calibrating the System 824
- Taking Measurements and Storing Data
- Recalling Stored Data
- Deleting Stored Data
- Selecting and Modifying Instrument Definitions (IDs)

Turning On and Calibrating the System 824


This section guides you through the process of turning on and calibrating the System 824.

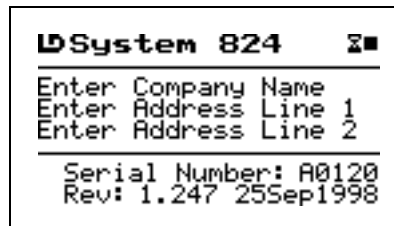
This screen displays three lines of user information which may be defined as name and address settings. You can use the 824 Utility Software to input this information. This display also shows the serial number of the instrument and the firmware version and date. The System 824 then loads the last instrument definition (ID) selected.


Pressing the  POWER key for 1 second turns the power OFF.

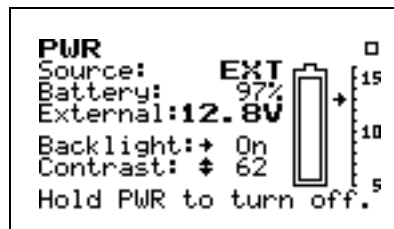
Power off prior to changing microphone or preamplifier to avoid possible damage of sensitive electronics due to high voltage spikes.


This screen shows you the current power source, battery level, and external power voltage.

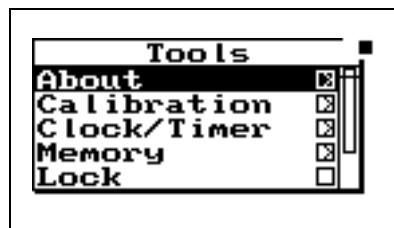
- Step 1** Turn on the System 824. To do this, press the  key (located on the left side of the key pad). By pressing this key, the Larson Davis logo appears while a number of tests are performed. The following screen then appears for a few seconds:



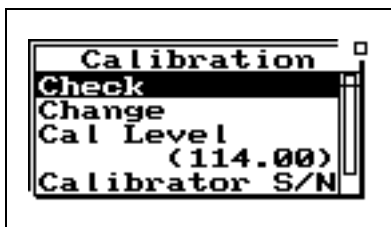
- Step 2** Check the battery level. After the System 824 is turned on, you can check the battery level. To do this, press the  POWER key momentarily. The following screen appears:



- Step 3** Calibrate the instrument. To do this, press the  TOOLS key. The following menu appears:



- Step 4** Using the \blacktriangledown key, highlight the **Calibration** menu item, then press the \odot key. The following screen appears:

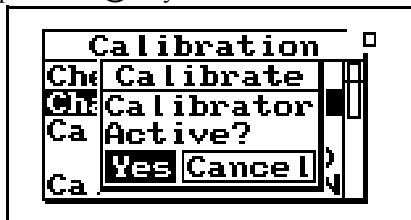


NOTE: The output level specified by the calibrator manufacturer will be at standard temperature and pressure. In practice the level is a function of temperature and static (barometric) pressure, so a corrected level should be used. Similarly, the sensitivity of the microphone itself is a function of temperature and static pressure. For directions on compensating for temperature and static pressure during calibration, see "Correction of Calibrator Output Level" on page 2-17.

- Step 5** The value of **Cal Level** (3rd item on the screen) must be set equal to the output level of the calibrator to be used for the calibration (typically 94 or 114 dB). If the value indicated is not equal to this value, use the \blacktriangledown key to highlight the **Cal Level** menu. Press the \odot key, use the horizontal and vertical arrow keys to input the correct value and press the \odot key to make the change.

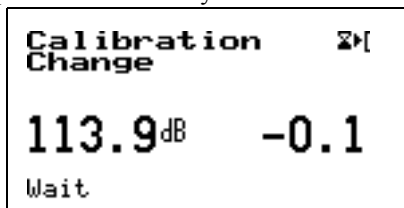
- Step 6** Place the calibrator over the microphone. Using the \blacktriangledown key again, highlight the **Change** menu item. Press the \odot key to start the **Calibration** process.

- Step 7** When prompted by the message shown below, press the \odot key to continue the **Calibration** process. If you wish to abort the calibration procedure, \blacktriangleright arrow key to select **Cancel** and press the \odot key.

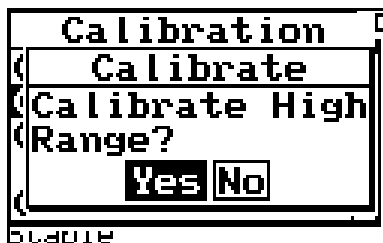


- Step 8** While the system is stabilizing, the measured level is indicated on the left of the screen and the difference between the measured level and the Cal Level Setting are show on the left and right sides

of the display, as shown below, along with the message *Wait* indicating that the calibration process is underway and should not be interrupted.



Step 9 When the calibration is complete, the message will change to Stable, after which the following display will appear to prompt the user to decide whether or not to calibrate the High Range as well. If you decide to calibrate the High range as well as the Normal range, there will be a forty second delay while the instrument stabilizes at the High range setting.



High Range Calibration

*Note: When using a prepolarized microphone, during setup **Electret** should have been selected as the **Transducer**. The High Range is not available when using a prepolarized microphone, so the prompt concerning calibration of the High Range will not appear.*

When the High Range is calibrated, the microphone bias voltage is reduced from 200 to 20 volts. This reduces the sensitivity of the microphone by 20 dB. As a result, the measured level indicated on the left of the display during the stabilization process should be 20 dB less than the Cal Level value.

Taking Measurements and Storing Data


This section provides examples of how to select an instrument ID, take a measurement, and store the resulting data.

SLM&RTA Measurements

NOTE: A solid black box indicates that the 824 is stopped with data, and a hollow box indicates that the 824 is stopped with no data present.

If the 824 is already using the SSA ID, there will be a '>' to the left of its name on the second menu line.

Whether using the SSA, ISM, or LOG instrument, the SLM is one of the most common functions used in the System 824. The following example explains how to record and store a measurement in the SLM mode of the SSA instrument.

Step 1 To activate the SLM&RTA SSA instrument, press the  SETUP key. A menu similar to the following appears:






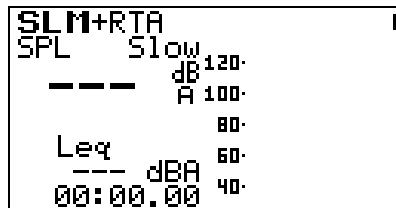
When changing from one ID to another you will be prompted to save your data if you have not already saved it. If you do not save your data at this point, any measurement readings you have taken will be lost.





If this is your first time using the System 824 and you have not set up any ID's, or have not taken any readings that need to be saved, select "No".


The bolded **SLM** text on the SLM view screen indicates that this is the SLM view of the SSA instrument. Any of the SSA displays can be active while taking a reading.

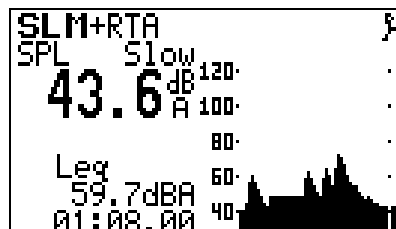
The instrument display shows a running symbol (upper right hand corner) when the instrument is actively taking measurements.

Step 2 Press the  or  arrow keys to highlight the **SLM&RTA SSA** item and press the  key to select it. The last used SLM+RTA display appears:



Step 3 At this point, if you want to view a display other than the one shown, press the  VIEW key. Use the  or  keys to highlight the desired display. For this example, highlight SLM and press the  key to select it. The SLM display of the SLM+RTA instrument shown in step 2 will appear. The Sound Level Meter with Real-Time Spectrum Analyzer is now ready to use.

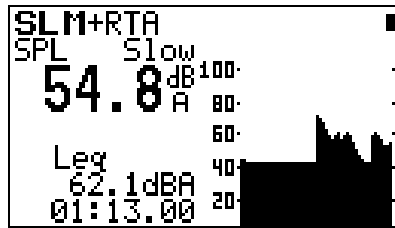
Step 4 To take a sample reading, press the  RUN/STOP key. A screen similar to the following appears:





Let the instrument continue to take measurements for about one minute. Make some noise and watch the results on the graph.

Step 5 Press the RUN/STOP key to stop the measurement.


The screen shows a black box symbol in the upper right hand corner indicating that the instrument is stopped and not taking a measurement.



If you attempt to store data while a measurement is still running a warning will be displayed, indicating that the measurement must first be stopped.

Step 6 To store the current measurement readings, press the  Data key. Select **Store File** and press the  key. This will store the measurement's data.



Step 7 To turn off the instrument, press and hold the  key until you are prompted to release it. The instrument then turns off.

NOTE: You may want to repeat the process of running a measurement, stopping, and storing its data a few times so that you will have several samples of stored data to choose from when trying this exercise.


Viewing RTA Displays during a Measurement



While taking measurements you can view the instrument's different displays. This section provides examples of viewing the SSA instrument's four RTA displays which include:

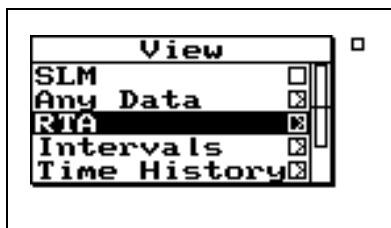
- RTA Live
- RTA L_{eq}
- RTA Max
- RTA Min




Do the following to view the RTA displays:

Step 1 Select the SLM&RTA (SSA) instrument from the *Setup* menu and press RUN/STOP S to begin taking a measurement as explained in the "SLM&RTA Measurements" section found on page 4-3.

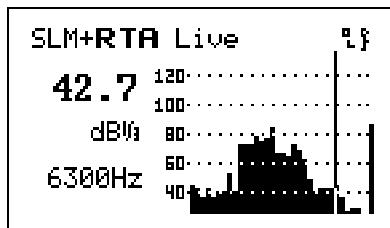
Step 2 While the measurement is running, press the  View key. The following screen appears:

If you select the RTA Live item with the  arrow key instead of the  Check key, you will be given the option to view the display in graphical or Tabular mode.



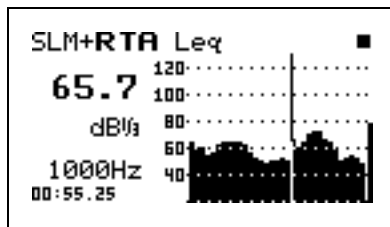
Step 3 Use the  and  arrow keys to highlight the RTA item and press the Check  key to select the RTA displays. A screen similar to the following appears:

The **RTA Live** screen shows a graphical display of the sound readings over a range of frequencies. The SPL for the selected frequency is displayed in the upper left corner. The frequency, as selected by the vertical cursor, is displayed in the lower left corner.



As the frequency is changed the cursor (vertical bar) will move accordingly across the graphical display, highlighting the corresponding graphical sound reading. Additionally, the digital frequency display will also change as will the digital readout of the sound measurement for the newly selected frequency.

The **RTA Leq** view shows a graphical display of average sound exposure for the measurement time. The **LEQ** for the selected frequency is displayed in the upper left corner. The selected frequency is displayed in the lower left corner. When the cursor is moved to the far right side, the broadband **Leq** is shown numerically and the cursor is no longer displayed (as shown here).



This is the minimum level obtained for each frequency since the last current reset.

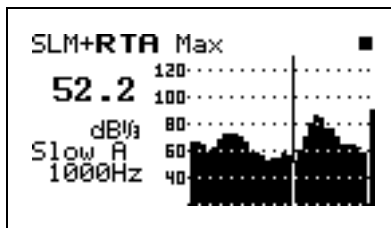
Step 4 Use the **▶** and **◀** arrow keys to change the selected frequency. As the selected frequency is changed, the SPL for that frequency will be displayed in the upper left corner. Additionally, the cursor bar will move along the graph to the position that corresponds to the SPL graphical display for that particular frequency.

Step 5 Press the **▼** arrow key to change to the **RTA Leq** view. A screen similar to the following appears:

Step 6 Use the **▶** and **◀** arrow keys to change the selected frequency. As the frequency is changed, the L_{eq} for that frequency will be displayed in the upper left corner. Additionally, the cursor bar will move along the graph to the position that corresponds to the L_{eq} graphical display for that particular frequency.

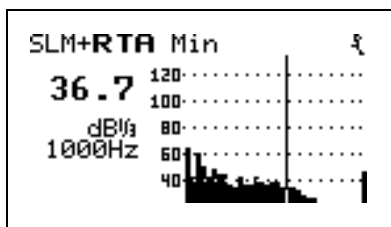
Step 7 Press the **▼** arrow key to change to the **RTA Max** view. A screen similar to the following appears:

The RTA Max view shows a graphical display of the Live spectrum of the maximum broadband level since the last current reset.



Step 8 Use the and arrow keys to change the frequency level being displayed.

Step 9 Press the arrow key to change to the *RTA Min* view. A screen similar to the following appears



Step 10 Use the and arrow keys if you want to move back and forth between the different RTA screens.


Step 11 Press the RUN/STOP key to stop the current reading.

Step 12 Press the Data key. Select *Store Data* and press the key to store the measurement's data.

If you attempt to store data while a measurement is still running, a warning will be displayed, indicating that the measurement must first be stopped.




Recalling Stored Data

Measurement data that has been stored can be recalled for review at any time. To recall a data file, do the following:

Step 1 Press the  Data key and a screen similar to the following appears:






When recalling a data file, the System 824 will automatically switch to the instrument that the data file was stored as (i.e. from Logging to SLM&RTA).

Step 2 Use the  up and  down arrow keys to highlight "Recall Files" and press the  check key. The following appears:



*The **Data Files** screen shows the currently selected record number, the ID used to take the measurement, the start/stop dates and times, and the total bytes used by the record.*

A summary of each data file can be viewed to determine if it is the desired measurement. To view each data file summary use the  up and  down arrow keys.


Step 3 You can recall the selected Data File by pressing the  Check key. The following screen appears:




The Data Files check menu includes the following:

Menu Items	Description
Recall Data	Recall the stored data file's measurement.
Beginning	Displays the Data File Summary of the first stored data file.
Ending	Displays the Data File Summary of the last stored data file.
Find	Allows you to find and display a Data File Summary by entering its associated Data File Number.
Purge All Data Files	Gives you the option to completely remove from memory all stored data files.

Selecting and Modifying Instrument Definitions (IDs)



As explained in the section "System 824 Setups or Instrument Definitions" on page 2-1, the way to prepare the System 824 for a measurement is to select an existing Setup or Instrument Definition (ID) from the list which appears on the display after pressing the Setup Key  and either use it as-is or modify it to suit the requirements of the measurement to be performed. In this section, we will explain in general how an ID is modified and stored using the Setup Menu of the System 824. More detailed descriptions for specific Instrument Types (e.g. ISM, LOG, or SSA) will be provided in later chapters. When a PC is available, the 824 Utility software is a very powerful tool for creating and storing new IDs and uploading them to the System 824 for use.

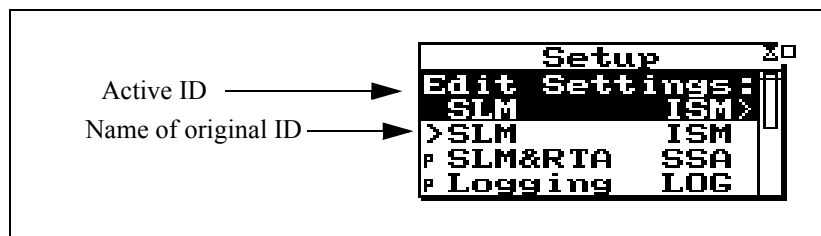
The Setup Menu

Pressing the  Setup key will produce a display similar to the following:

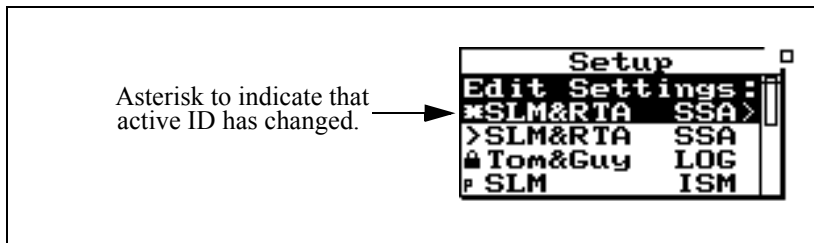


The Active ID

The first item in the list is the Active ID, which will be highlighted. If the user exits from the Setup Menu by pressing either  (a second time) or , the instrument is ready to perform a measurement as defined by that Active ID.



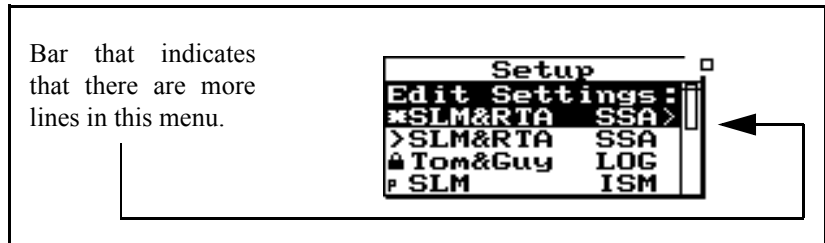
Following the Active ID is a list of the available IDs. In most cases, the first ID in the list will have the symbol ">" to the left, indicating that the Active ID was originally defined by selecting that ID. Thus, the name of the Active ID and this ID will be the same. If there is an asterisk "*" to the left of the Active ID, it indicates that modifications have been made to the Active ID since the selection of the ID below it, so they may no longer be the same. If there is no asterisk, then the Active ID and the one below remain identical.



There is one other possibility which should be mentioned. When a stored data file is recalled, then the ID stored with that file becomes the Active ID. Since the ID which was used to perform the measurement at that time may have since been modified or even deleted, a tilde “~” will appear to the left of the Active ID to indicate that it is approximately the same as another ID in the list.

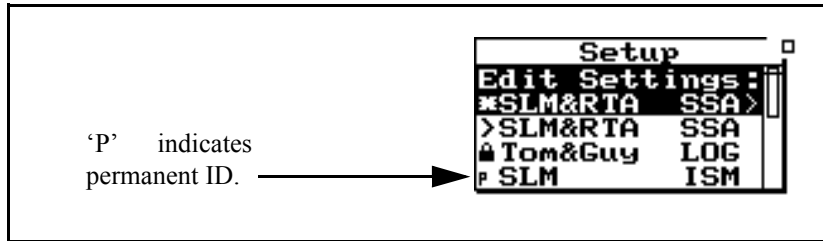
Menu Scrolling

There may be more items in a menu than can be shown in a single display. To the right of any menu window, there will be a vertical window within which there will be vertical bar. If this vertical bar extends from the top to the bottom of the vertical window, then all items in the list are shown in the display. If the vertical bar does not cover the length of the vertical window, this means that there are more items than can be displayed and that those presently being displayed fall within the portion of the vertical window covered by the vertical bar. In the example of the Setup Menu, it can be seen that there are more items than can be shown in one display and that those presently being displayed are at the top of the list. Use the up ▲ and ▼ arrows to scroll through the list and note how the vertical bar moves to indicate which portion of the list of menu items is presently being displayed.



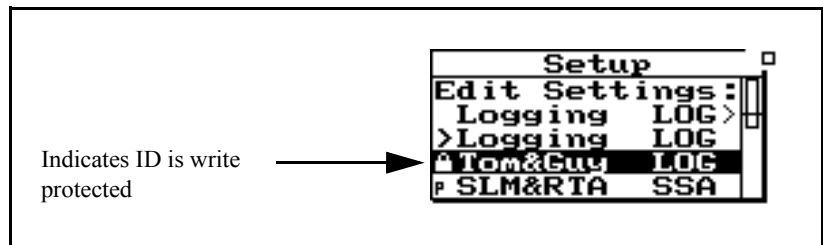
Permanent IDs

In the list of available IDs, those with a “P” to the left of the name are permanent IDs provided upon delivery. These can be selected, modified and used for a measurement, but the name must be changed when the modified ID is stored so that it does not conflict with the names of any permanent IDs.



Write-protected IDs

Those with a symbol of a padlock to the left are user-defined IDs which have been write-protected. Like the permanent IDs, these can be selected, modified and used for a measurement, but the name must be changed when stored.





Preparing for a Measurement

If data has been taken, the prompt



will be shown. Press the check key to reset data and edit the setting.




If the Active ID will provide the desired measurement, press either the Setup  key or  to exit from the Setup menu. The System 824 is now ready to perform a measurement according to the Setup represented by the Active ID.

If the Active ID is not satisfactory for the measurement, the following options are available:

- 1. Modify the Active ID as required
- 2. Select and use a different ID (make it the Active ID)


- 3. Select a different ID, make it the Active ID, and modify it as required.


Selecting a Different ID


Use the  and  keys to highlight the desired ID and make it the Active ID by pressing the  Check key. This will activate that ID, exit the Setup menu, and display the main data view. The instrument is ready to perform a measurement by pressing S Run/Stop.

Accessing the Settings Menu

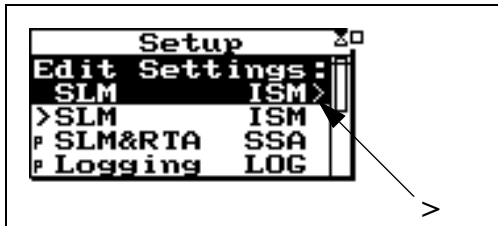
It is within the Settings menu and its associated Sub-menus, that the settings associated with the measurement are defined. Sound level measurements are made in the ISM LOG, and SSA Instrument Types, so all of these will include selections of RMS and peak detectors and broad band frequency weighting. IDs based on the LOG Instrument type will include parameters associated with automatic data storage such as Interval and Time History periods and threshold levels for triggering Exceedance Event data. Report settings are also included in the Settings menu when appropriate.

The following example will be used to illustrate the general structure and utilization of the Settings menu and sub-menus. Please follow this on your instrument. Since all versions of the System 824 include the SSA Instrument Type, we want to select the permanent ID SLM&RTA (SSA) as the Active ID. Press  to open the Setup menu.

Step 1 If the Active ID in your instrument is an unmodified version of SLM&RTA (SSA), press .

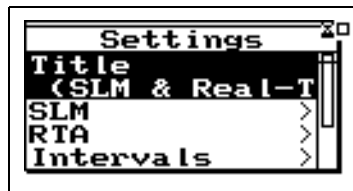
Step 2 If the Active ID in your instrument is anything other than SLM& RTA (SSA), then highlight SLM&RTA (SSA) and press  to make it the Active ID.

- Step 3** If the Active ID in your instrument is a modified version of the SLM&RTA (SSA), indicated by an asterisk to the left of the name, highlight “>SLM&RTA (SSA), press \odot , and in response to the message “Active ID has changed. Save?”, use \blacktriangleright to highlight “No” and press \odot to make it the Active ID.
- Step 4** Press \odot to display the Setup menu with SLM&RTA (SSA), unmodified, as the Active ID.



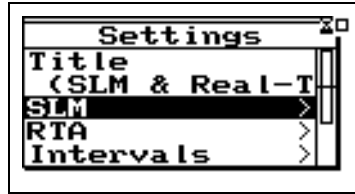
Accessing the Settings Menu to Initiate Editing or Modification


As mentioned above, the first item on the list, highlighted, is the Active ID. The message “**Edit Settings**”, along with the symbol “>” to the right, indicates that one should press \blacktriangleright in order to view or edit the Active ID. In many cases, the \odot Check key will accomplish the same result. This will produce the **Settings** menu list as shown below.




Note that all of the items in this list, with the exception of the first, Title, have the symbol “>” to the right indicating a sub-menu. In order to illustrate the Settings menu structure, please perform the following steps to set the SLM Weighting function.

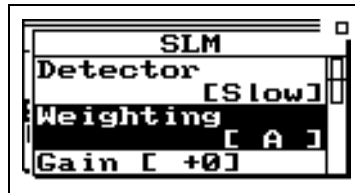
Step 1 Use  to highlight SLM




Step 2 Press  to produce the SLM sub-menu



Step 3 Use  to highlight Weighting (note that the present selection is "A")

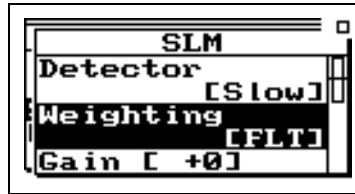


Step 4 Press  to open SLM Weighting Selections menu






Step 5 Use  to highlight "FLT"

Step 6 Press  to select FLT as the new SLM Weighting









For the purpose of continuing with this example later in this chapter, please do not press any keys.


Although we will not do this in the present example, we could highlight Detector noting that it is presently “SLOW”, press  to open a window listing the SLM Detector selections, highlight “FAST” and press  to select it as the new SLM Detector.

Regardless of the Instrument Type, one can modify any of the available parameters by selecting the proper Setup menu item, then the proper sub-menu item, then making a selection and pressing .

Once one or more modifications have been made, the user can follow one of three procedures:

- Setup  will close the menu, remembering its location the next time it is opened.
- Use the right  arrow key to step out one menu at a time.
- Press  power to close the menu and reset the menu position.

In either case, the instrument will be ready to perform a measurement. The major difference is that the second method, backing out by a sequence of  keys, possibly interspersed with  and  keys, leaves a memory of the path used to withdraw.

To better understand what happens when we back out of the Setting menu structure using repeated presses of , consider the following diagram illustrating the actions which

have been taken so far in the example above.






In this particular instance, when the **▶** key was used to move from the Settings menu to the SLM sub-menu and from the SLM sub-menu to the Selections menu, the item highlighted was not the first in the list. Observe that when **Ⓢ** was pressed to accept the selection of “FLT for the frequency weighting, upon returning to the Weighting sub-menu, the 2nd item was highlighted, just as it had been previous to entering the Selection menu using **▶** .


Continuing the example, press **◀** to exit from the SLM sub-menu to the Settings menu and note that the 2nd item is highlighted just as it had been earlier when **▶** was used to move from the Settings menu to the SLM menu.

Essentially, when the **◀** or **▶** key is used to move from a Menu, Sub-menu, or Selection menu, a pointer in the menu is set to the item which is highlighted at that time. If in the process of continuing with the editing process a Menu is accessed once again using the **◀** or **▶** keys, the item highlighted is determined by that pointer.



Continuing the example, use **◀** to exit completely from the Setup menu. Enter the Setup menu again by pressing **Ⓢ** and use three consecutive presses of **▶** to display the Settings menu, SLM sub-menu and Selection menu. In each case, the highlighted item is as it had been when previously exiting from that Menu. To the experienced user, this can be a valuable feature. Suppose, for example, one wished to use the Setup menu to quickly switch between choices of frequency weightings. Using the **◀** and **▶** keys alone one could access the desired Selection menu without the need to use **Ⓢ** to move the highlight down from the first item.

If one chooses to use the **◀** and **▶** keys to move between Menus and prefers to enter each Menu with the first item






highlighted, simply use the  key to highlight the first item in a Menu before exiting using the  or  key to exit.

If you have been using the arrow keys to move between Menus and menu items and you feel you have gotten lost, it is possible that you have entered a Menu where you do not recognize the displayed items because the highlighted item is rather far down the list. Try using the  key to move the highlight up to the first item and you may recognize where you are. In general, the items further down the list are for more advanced features and are less important for simple measurements.

Setting Control in the SLM View

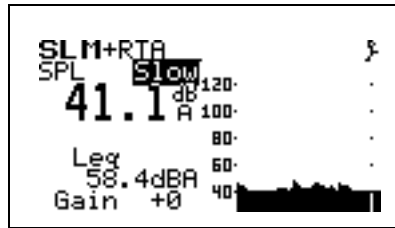
SLM settings can be adjusted from the *SLM* View screen. To activate the *SLM* view screen, turn on the System 824, press the  View key, highlight *SLM*, then press the  Check key.

While viewing simple sound level meter data, settings can be adjusted “on the fly” (without leaving the current display). The following table describes the keys that are used to change settings:

Key is used in	Action
 the ISM instrument instead of Gain.	Moves to the next setting
	Moves to the previous setting
 or 	Adjusts the current setting
	Enters the setting

The following is an example of how to select the RMS Detector within the SLM view:

Step 1 Press the ▲ or ▼ keys to highlight the current RMS detector (*Slow, Fast, Impl*).



Step 2 Press the ◀ or ▶ key to change the selection.

The table below shows how to use the arrow keys to navigate through the settings on the SLM display.

▲ ▼	Detector	Slow ▶ Fast ▶ Impulse ▶
▲ ▼	Weight	A ▶ C ▶ Flat ▶
▲ ▼	Second Value	Leq ▶ SEL ▶ Min ▶ Max ▶ Peak ▶
▲ ▼	Second Value Weight	A ▶ C ▶ Flat ▶
▲ ▼	Gain or *Range	0 ▶ +10 ▶ +20 ▶ +30 ▶ +40 ▶ +50 ▶ OR Low ▶ Normal ▶

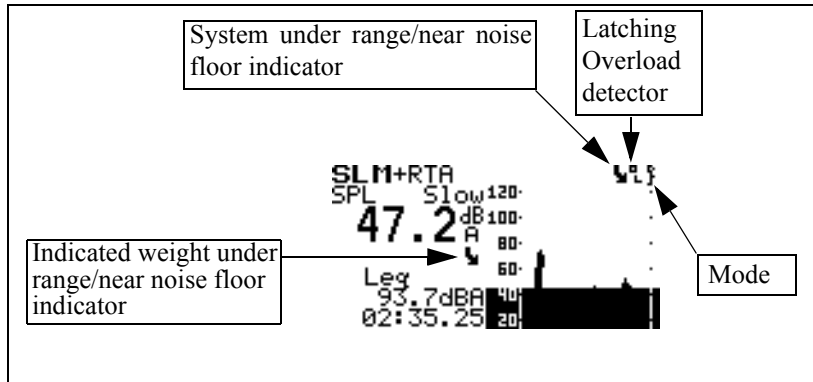
System 824 Views

This chapter introduces you to the various ways of viewing measured data for a particular setup or ID of the System 824. Specifically, this chapter covers the following topics:






- Status icons
- General views
- SLM+RTA specific views
- Logging SLM specific views


Status Icons and Indicators









When using the System 824 you will encounter a number of different display views. Each display contains an instrument status icon in the upper right hand corner of the display. This icon changes according to the current state of the instrument.






The following table describes the icons that may appear:

Icon	Description
	Animated Running Figure - The instrument is running and acquiring data.
	Solid Box - The instrument is stopped, data available.
	Open Box - The instrument is stopped, and reset.
	Open Box with small solid box - Viewing a recalled file.
	Solid Box with open box in middle - OverAll or Current data are available but not both.

NOTE: To set the noise floor level, go to the “Tools” menu and highlight “Calibration”. Scroll down to “Noise Floor” and press the  key. Enter the noise floor using the value provided by the microphone manufacturer’s specifications.


	<p>Double Bar - The instrument is paused.</p>
	<p>Play Symbol - The instrument is ready to run (as soon as stabilization completes).</p>
	<p>Arrow-Under-Range/Near Noise Floor Indicator -The instrument is under range when the arrow is longer. The instrument is near its noise floor when the arrow is shorter. The system indicator, in the upper right corner of the display, will indicate when any A, C, or Flat instantaneous Leq inputs are under range or near the noise floor. The indicated weight indicator, shown just below the db/weight icon, will show whether that particular weight is under range or near the noise floor.</p>
	<p>Block with Dark background and Light numerals-Defines upper and lower limits of linearity range.</p>
	<p>Bar and Play Symbol - The instrument is in preview. Current SPL and peak levels are displayed, but no data is being acquired.</p>
	<p>Animated Hourglass - The instrument is stabilizing to ensure accurate measurement.</p>
	<p>Animated Draining Battery - The battery is low, and the instrument will shut off soon.</p>
	<p>O.L. - The instrument has been overloaded; measurement may not be accurate due to an overload condition having occurred some time during the measurement.</p>

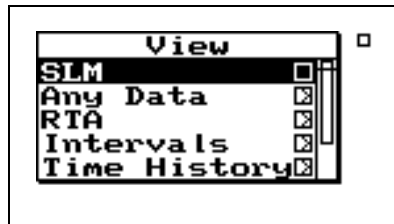
	Animated shrinking letter M - Indicates that less than 10% of memory is available when shown intermittently or out of memory when shown continuously.
	Animated Clock - Indicates that the automatic <i>run/stop timer</i> is active.
	Currently overloaded



General Views

The System 824 presents measurement data in both graphical and numerical/text formats for easy comprehension. This section provides an overview of the basic components of these display views. See the Chapter "Using ID Setting Files" on page 7-1 for detailed descriptions of the available settings contained within any of the System 824 views.

After you have selected the SLM&RTA operating mode or instrument ID, do the following to select the desired view.

Step 1 Press the  button and a screen similar to the following will appear.



Step 2 Use the  and  arrow keys to highlight the desired view.

Step 3 Press the Check (✓) key and the desired view will appear.

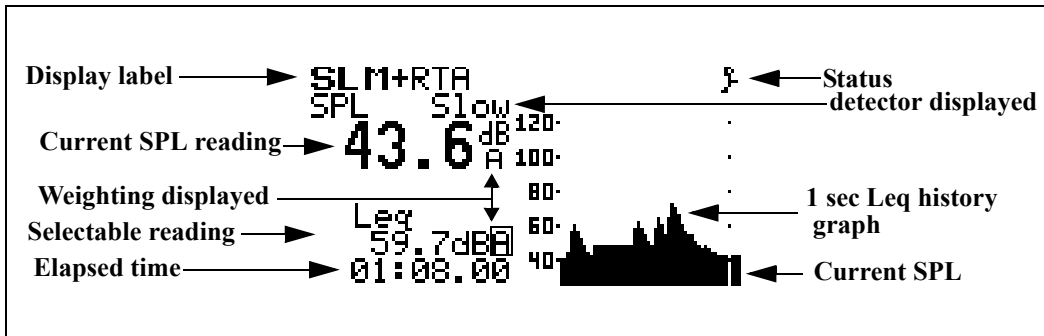
SLM Views

The SLM view is available to the ISM, SSA, and LOG instruments.

The SLM view shows the SLM data with a graphic display of Time History. In this graphical format, a running time history based upon 1 second L_{eq} values is scrolled across the screen showing the levels of the last fifty samples. New data points correspond to the detector and weighting selected by their respective settings. The larger digital display indicates the SPL for the selected values of detector and weighting. The smaller digital display indicates the level corresponding to one of the secondary parameters which are being measured concurrently.

The **SLM** view display consists of eight major components:

- Display label
- Selected detector
- Current SPL reading
- Selectable L_{eq} reading
- Weighting
- Elapsed time
- Status
- SPL history graph



The following is a brief description of each of these components:

Display label - The Display label identifies the display. The example above shows the SLM view for the SLM+RTA Instrument ID.




Selected detector - The selection determines which detector's data (e.g. Fast, Slow, Impl) is to be displayed.

Current SPL reading - Displays the current SPL reading (as does the level of the moving bar on the far right of the SPL history graph). The frequency weighting for SPL can be selected: *A*, *C*, or *FLAT*. The detector can be selected from: *Slow*, *Fast* and *Impl*.

All combinations of detector and weighting are measured simultaneously. The detector and weighting selected in the "Settings" menu are for measurements such as Ln and Interval broadband levels.

Selectable reading - This is used to view a second level which can be *Leq*, *SEL*, *Min*, *Max*, or *Peak*.

Weighting - This selection determines which weighting is being displayed for the SPL and selectable reading. When the selectable reading is showing *Peak*, the weighting for the *Peak* can be set to: *A*, *C* or *Flat* (independent of the current SPL frequency weighting).

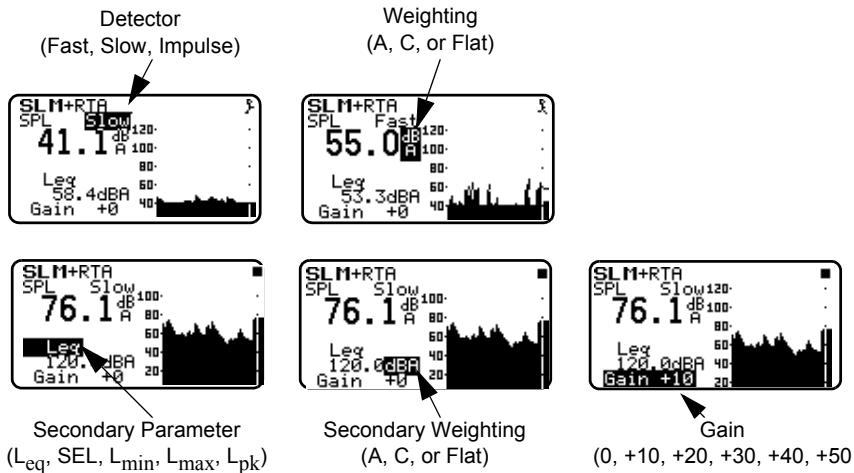
Elapsed time - Displays the current run time for the measurement. It resets to zero when the  RESET key is pressed, pauses when the  PAUSE key is pressed, and continues when the  PAUSE key is pressed again. The timer is displayed as mm:ss.ss, hh:mm:ss or hhhh:mm.

Status - Status represents the state of the instrument (as described at the beginning of this section).

SPL history graph - This shows one second Leq readings. The far right bar displays the current SPL readings. As readings are taken, they are placed onto the scrolling graph from right to left every second. The time axis, in the SPL history graph, shows time increasing from left to right.

You can use the arrow keys to select the detector, weighting, secondary parameter to be displayed and gain or range as shown below.





Key	Action
▼	Moves to the next setting
▲	Moves to the previous setting
◀ or ▶	Adjusts the current setting



Any Data View

The Any Data View presents a tabular display of SLM data in three different formats.

- Any Level Format
- Any Impl (Impulse) Format
- Any Time Format

The  and  arrow keys allow you to change the Any Data format you are viewing. The  and  arrow keys move you through each of the Any Data formats' available displays.

Any Level Format

In this view, five different tables present SPL (Fast and Slow), L_{\max} (Fast and Slow), L_{\min} (Fast and Slow), L_{eq} , SEL, and L_{peak} measured with A, C and Flat weighting as follows:

Any Level-a	
SPL Fast	SPL Slow
60.4dBF	76.8dBF
58.3dBC	74.8dBC
37.0dBA	72.0dBA

Any Level-b	
L_{eq}	SEL
78.3dBF	82.3dBF
76.3dBC	80.3dBC
73.7dBA	77.7dBA

Any Level-c	
L_{\max} Fast	L_{\max} Slow
99.0dBF	90.8dBF
97.4dBC	89.0dBC
95.4dBA	86.5dBA

Any Level-d	
L_{\min} Fast	L_{\min} Slow
45.2dBF	48.3dBF
42.8dBC	45.4dBC
32.6dBA	34.5dBA

Any Level-e	
SPL Fast	Peak
60.4dBF	124.0dBF
58.3dBC	123.7dBC
37.0dBA	124.6dBF

Any Impulse Format

In this view, three different tables present Impulse weighted parameters alongside similar Fast weighted parameters measured with A, C and Flat weighting as follows:

Any Impl-a	
SPL Fast	SPL Impl
66.8dBFB	85.4dBFB
63.0dBBC	85.3dBBC
57.4dBA	86.4dBA

Any Impl-b	
Lmax Fast	Lmax Impl
92.1dBFB	93.3dBFB
91.9dBBC	93.2dBBC
93.1dBA	94.4dBA

Any Impl-c	
Lmax Slow	Lmax Impl
86.1dBFB	93.3dBFB
86.1dBBC	93.2dBBC
87.1dBA	94.4dBA

Any Impl-d	
Takt3 Fast	Takt3 Slow
89.5dBFB	83.4dBFB
89.4dBBC	83.4dBBC
90.5dBA	84.4dBA

Any Impl-e	
Takt5 Fast	Takt5 Slow
90.1dBFB	83.4dBFB
90.0dBBC	83.6dBBC
91.1dBA	84.4dBA

Additional views if TAKT functionality is enabled.
See page 3-18.

Any Time Format

In this view seven different displays present the level, date and time of Lmax (Fast, Slow, and Impulse), Lmin

(Fast, Slow, and Impulse) and Lpeak measured with A, C and Flat weighting as follows:

Any/Time-a	
90.8dBFB	Lmax Slow
24Apr1997 14:33:59	
89.0dBBC	
24Apr1997 14:33:59	
86.5dBA	
24Apr1997 14:33:59	

Any/Time-b	
99.0dBFB	Lmax Fast
24Apr1997 14:33:59	
97.4dBBC	
24Apr1997 14:33:59	
95.4dBA	
24Apr1997 14:33:59	

Any/Time-c	
103.0dBFB	Lmax Impl
24Apr1997 14:33:59	
102.4dBBC	
24Apr1997 14:33:59	
100.4dBA	
24Apr1997 14:33:59	

Any/Time-d	
48.3dBFB	Lmin Slow
24Apr1997 14:33:46	
45.4dBBC	
24Apr1997 14:33:46	
34.5dBA	
24Apr1997 14:33:44	

Any/Time-e	
45.2dBFB	Lmin Fast
24Apr1997 14:33:44	
42.8dBBC	
24Apr1997 14:33:44	
32.6dBA	
24Apr1997 14:33:59	

Any/Time-f	
48.3dBFB	Lmin Impl
24Apr1997 14:33:44	
45.3dBBC	
24Apr1997 14:33:44	
34.0dBA	
24Apr1997 14:33:44	


Any/Time-g	
124.0dBFB	Peak
24Apr1997 14:33:59	
123.7dBBC	
24Apr1997 14:33:59	
124.6dBA	
24Apr1997 14:33:59	

SSA Specific Views

The System 824 has various displays for the SSA instrument. Understanding these displays lets you take full advantage of this instrument.

In addition to the *SLM* and *Any Data* views described earlier in this chapter, there are four spectral displays

available in the SSA instrument; the *RTA Live* (instantaneous) spectrum, the *RTA Leq* or time weighted averaged (since last reset) spectrum, *RTA Max* spectrum, which is the spectrum time coincident with the maximum value of the SPL during the measurement interval and *RTA Min*, which shows the minimum level obtained by each filter during the measurement interval. There are also displays for the Interval History, the Time History, the Run Log and for Ln Centiles.

Like all of the System 824 displays, these views are accessed via the  View key as described earlier in the “General Views” section of this chapter.


The following briefly describes the main views available to the SSA instrument.





Menu Items	Purpose
SLM	SLM data with graphic display of Time History.
Any Data	Tabular display of SLM data
RTA Live	Real-time frequency analysis display
RTA Leq	Leq frequency analysis display since the last reset
RTA Max	Frequency spectrum associated with the highest SPL RMS level since the last reset
RTA Min	The minimum level recorded for each frequency during the measurement.
Intervals	Shows an Leq spectrum, Max or Min spectral data, a broadband Leq, Lmax, Lmin, SEL, Lpeak and Spectral Lns for each interval period.

To store interval spectral Ln levels, set “Spectral Ln” to “Interval”, **enable Ln and Interval histories** and set “Intv Save Ln” to “Yes”.

SLM Time History	Shows the Leq for each time history period in graphical form plus the selected advanced T.H. items.
RTA Time History Live/Leq	Shows the spectral data for each time history period.
Run Log	Displays the start and stop times/dates of the active measurement
Ln Centiles	Ln percentile levels exceeded 'n' percent of the measurement time for broadband and spectral data.

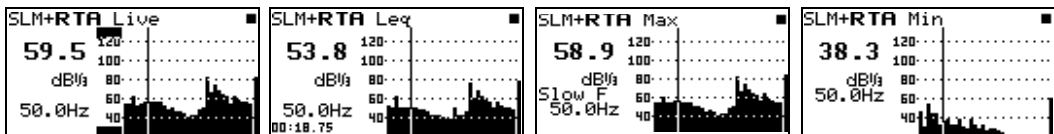
SSA Displays



All of the following views can be accessed through the  View key when using the SSA instrument.

Additionally, the *RTA Live*, *RTA L_{eq}*, *RTA Max* and *RTA Min* can be easily switched between each other by using the  or  to move to any of the other views. The  or  arrow keys can be used to move the cursor.

SSA Displays Including 1/1 or 1/3 Octave Spectral Data


The following are examples of the graphical displays for the *RTA Live*, *RTA Leq*, *RTA Max*, and *RTA Min*.




In the above views the cursor position (the vertical bar in the graph) corresponds to the level and frequency values shown on the left side of the display. The cursor or (frequency bar position) can be changed by pressing the  or  arrow keys. As the arrow keys are pressed, the vertical bar moves

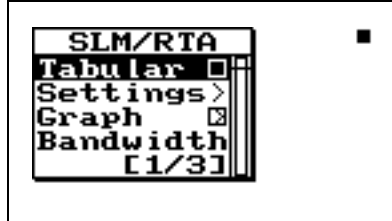
to the appropriate position and the frequency readout changes accordingly.



Tabular SSA Views




The Tabular display can also be accessed from the main View menu by highlighting the desired RTA view, pressing the  arrow key, and then selecting Tabular from the submenu that appears.

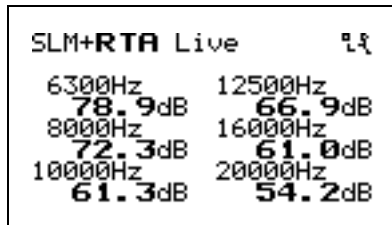
In addition to a graphical view, a tabular display is also available for the **RTA Live**, **RTA Leq**, or **RTA Max** modes which shows a tabular listing of the dB readings at specified frequency levels in each of these spectra. To access the tabular displays do the following:

- Step 1** Press the  Check key while in the **RTA Live**, **RTA Leq**, or **RTA Max** graphical views. The following menu appears:





While in the main tabular view, the  and  arrows keys cycle you through the different spectra's (i.e. RTA Live, RTA Max, and RTA Leq) tabular displays.


- Step 2** Highlight **Tabular** using the  or  arrow keys then press the  check key. A tabular display like the following screen appears:

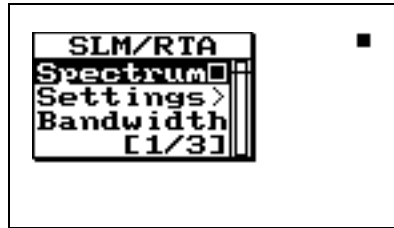


A screenshot of a tabular display titled "SLM+RTA Live". It shows a 2x2 grid of frequency and dB readings:

6300Hz	12500Hz
78.9dB	66.9dB
8000Hz	16000Hz
72.3dB	61.0dB
10000Hz	20000Hz
61.3dB	54.2dB

The  and  arrow keys move you through a series of tabular displays showing the current spectra's dB readings at each center frequency.

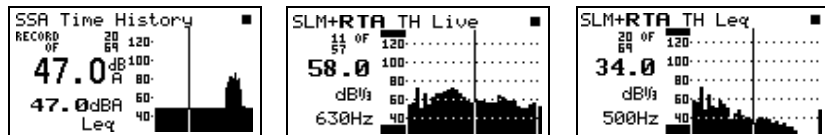
- Step 3** To return to the graphical view, press the  check key and the following menu appears:



Select “Spectrum” to view the graph again.

Time History Displays

The following are examples of the graphical displays for the *SLM Time History* and *RTA Time History* Views:



The up and down arrow keys change the record you are viewing. The or arrow keys change the position of the cursor.

SSA Intervals

NOTE: SSA Intervals are only available when the LOG option is installed.

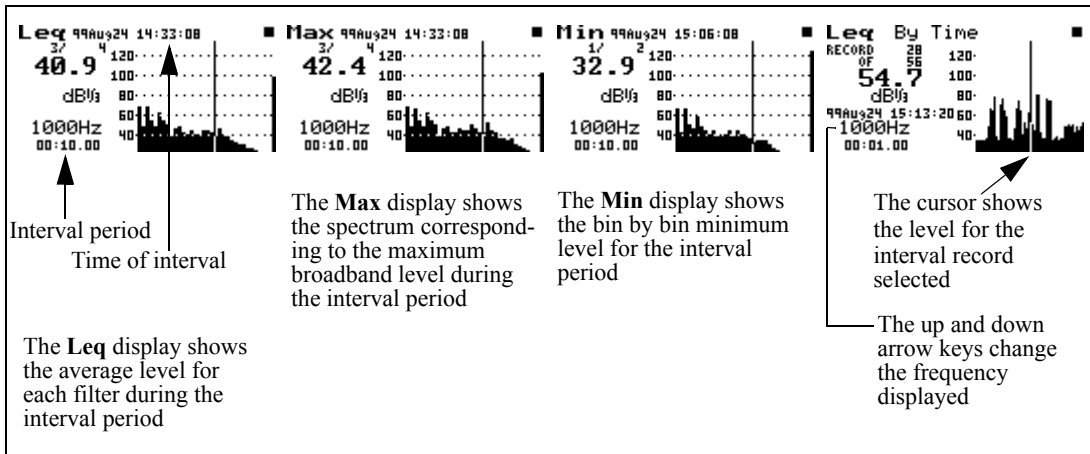
See the section "Intervals" on page 5-44 for a description of the Interval-a through Interval-d displays.

Only Min or Max can be displayed.

The Interval History shows a record of various sound pressure data and spectral data (including spectral LNs) gathered in time segments over the run time of the 824. An example would be a measurement where data is gathered in one hour time intervals over a 24 hour period.

The SSA instrument has 4 unique interval displays which show the *Max* spectra (at the time the broadband level was at maximum), *Min* spectra, which is a bin by bin minimum, the *Leq* or average of each frequency over the interval period and *Leq By Time* which shows the level for each frequency from each interval record over time.

The following are examples of the interval displays:



Do the following to ensure you have Spectral Lns for the interval period:

Go to the “Edit Settings” menu for the SSA instrument.



In the “Ln” menu set the following settings to [Yes] and [Interval].

Enable Ln [Yes]

Spectral LN [Interval]

In the “Interval” menu set the following settings to [Yes].

Intv Enable [Yes]

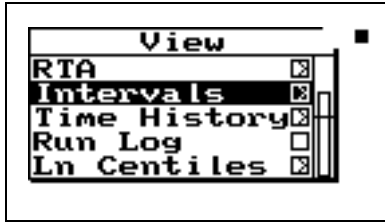
Intv Save Ln’s [Yes]


In the **Leq**, **Max**, and **Min** interval displays the cursor position (the vertical bar in the graph) corresponds to the SPL level and frequency values on the left side of the display. The up ▲ and down ▼ arrow keys change the record you are viewing.

In the **Leq By Time** display the up ▲ and down ▼ arrow keys change the frequency displayed. For each frequency the level is shown over time for each interval period. The right ► and left ◀ arrow keys move you to the next and previous interval record.

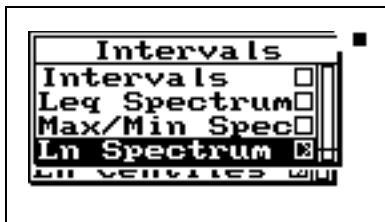
Interval **Spectral LNs** can also be selected for each interval period. Six Ln values are shown for each frequency. Also there are six graphical displays showing spectra for each of the six Ln values. In order to turn on the Spectral Lns for the interval period, go to the SSA settings menu and select “Interval” for the Spectra Ln setting under the “Ln” menu.


To view the Interval Spectral LN displays, press the View ⦿ key and highlight “Intervals”.

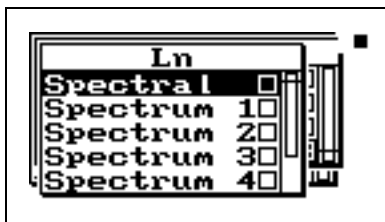



Press the right  arrow key to access the "Interval" display menu and highlight "Ln Spectrum".

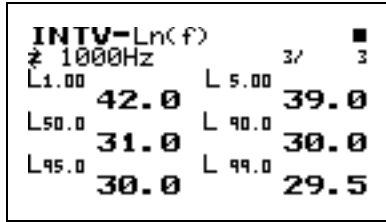
*Interval spectral LNs are only available when the LOG option is installed.



Press the right  arrow key to access the "Interval" Spectral LN displays. The following menu will appear:



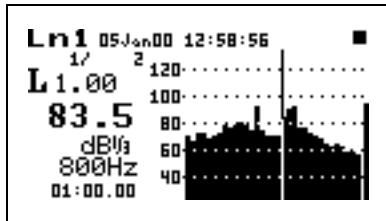
Highlight "Spectral" and press the check  key to view the INTV-Ln(f) display.



Use the right and left arrow keys to move to each one-third octave frequency.

To view the Spectral 1 through Spectral 6 displays (the 6 Ln values) use the up and down arrow keys. Below is an example of one of these displays:

See the section "Spectral LNs" on page 5-21 for a detailed description of this display.

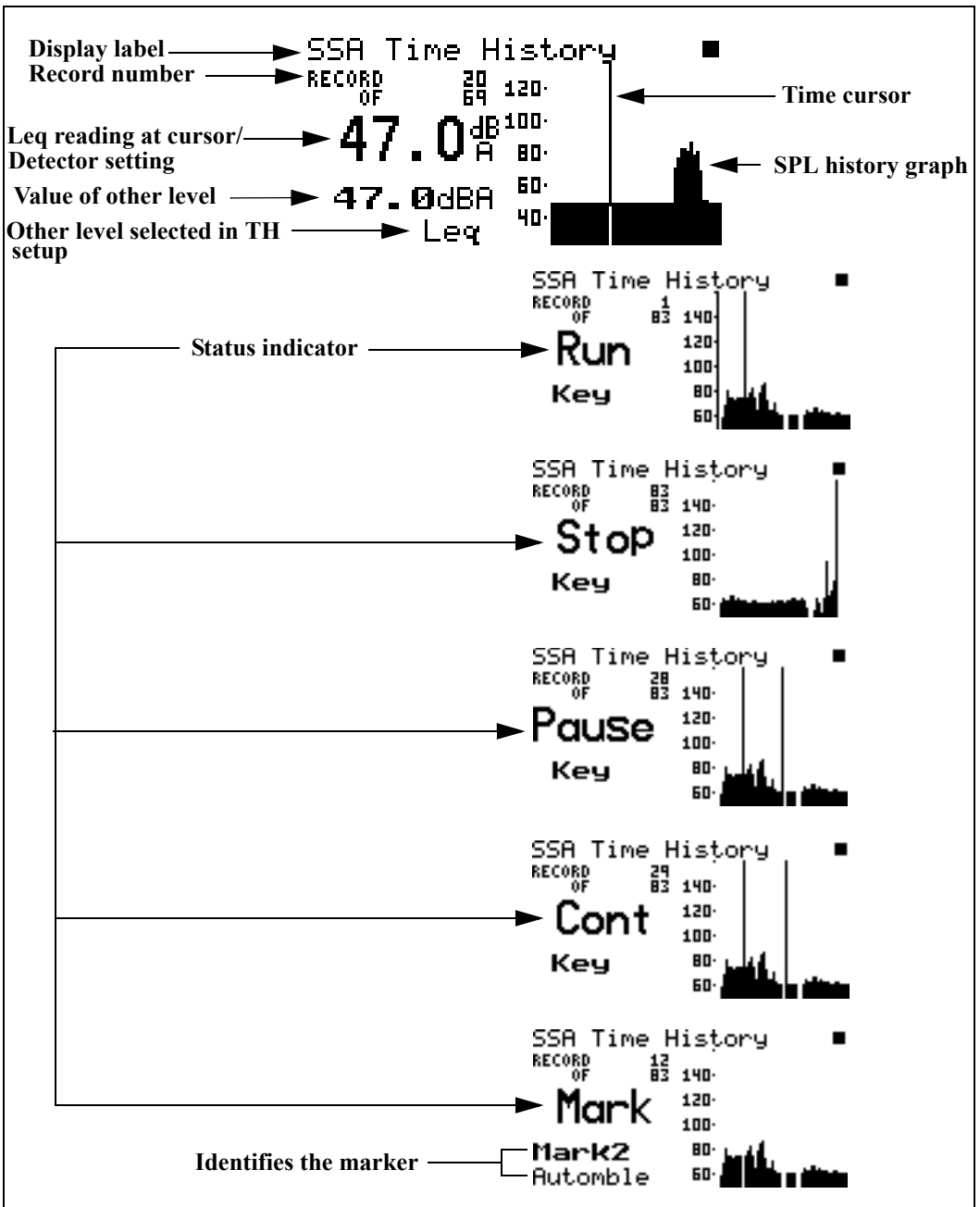


SSA Time History

The *SSA Time History* display consists of six major components:

- Display label
- Record number
- SPL reading at cursor
- Other level
- Status
- SPL history graph

The *SLM Time History* display is shown below:



The following discusses each of these display components:

Display label - This shows the current display (in this example, “*SSA Time History*”).



Leq reading at cursor - Displays the current Leq of the time history period. This level is also shown graphically.

Time cursor/Record number - The Time cursor (the vertical bar) allows you to scroll graphically through the history of the displayed measurement readings using the arrow keys. Notice that as you move back and forth in time that the record number changes. The total number of records is also shown.

Time history graph - Shows the history of Leq readings. Time increases towards the right of the display.

*TH represents **time history** which is the TH setup in the settings menu.*

Value of other level - This shows the value of the other levels selected in the TH setup.

Use the up  and down  arrow keys to view each level selected in the TH setup.

Other level - This shows all of the levels selected in the TH setup in the settings menu.

Status indicator -The status indicator will show one of the six possible events that occurred at the point of time referenced by the time cursor:

Run - Indicates that a measurement started at this time.

Stop - Indicates that measurement stopped at this time.

Pause - Indicates that the measurement paused at this time.

Cont - Indicates that the measurement continued at this time.



Reset - Indicates that the measurement was reset at this time.

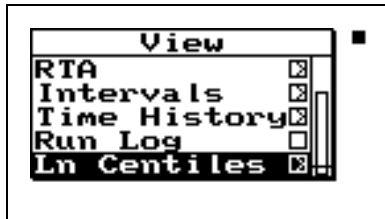
Mark - Indicates that a marker was set at this point in time.


Run Log

See page 6-41 for a description of the Run Log display.

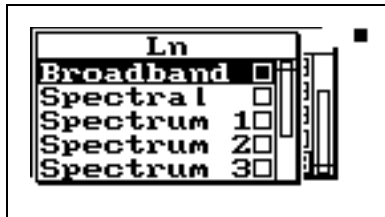
Ln Centiles


To access the Ln displays, press the View  key, use the  key to cursor down and highlight “Ln Centiles”.



Press the right  arrow key to view the Ln displays. The following menu will appear:

Spectral Lns are enabled by the “Spectral Ln” setting. These data and displays are only available when set to “Overall”. See the section “LOG and SSA Ln Settings” on page 7-20.



Highlight “Broadband” and press the check  key to view the SSA-Ln-a display.

Display label	SSA-Ln-a		
		L1.67	90.6
		L33.3	74.2
		L66.7	65.0
		L8.33	83.7
		L50.0	69.3
		L90.0	46.5


Percentile values & levels

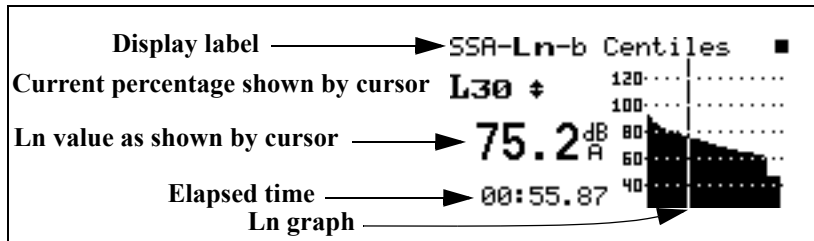
The following is a brief description of each of the components of this display:

- **Display label** - The Display label identifies the display which is the SSA-Ln-a display showing six Ln percentages for an overall measurement.
- **Percentile values & levels** - The Ln (percentile levels) level is that level which is exceeded 'n' percent of the measurement time. By modifying the six settings, you can select any six percentile values to be displayed at a time.



Lns are reset with an Overall Reset



NOTE: If Lns are enabled in the SSA instrument, then the Back-Erase feature is no longer available. (See the section "Pause, Back Erase" on page 3-10 for information on the Back-Erase feature)

Use the right  arrow key to view the SSA-Ln-b display.





The following is a brief description of each of the components of this display:

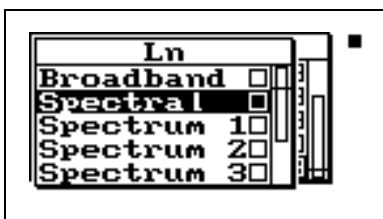
- **Display label** - The Display label identifies the display which is the SSA-Ln-b display showing Ln percentages 1 through 99 graphically for an overall measurement.
- **Current percentage** - Selects % of Ln to display (1 to 99), using the up  and down  arrow keys to move from one percentile to another.
- **Ln** - This shows the current Ln value.
- **Elapsed time** - Shows the elapsed run time accumulated since the last overall reset.

Use the up  and down  arrow keys to move from one percentile to another.

- **Ln graph** - Graph of Ln's from 1 to 99 (1 being on the left, 99 on the right). There are two levels represented by each bar. The highest of the two are graphed.

Spectral LNs

To return to the Ln display menu, press the View  key. To view the **Spectral Lns** highlight "Spectral" and press the check  key to view a tabular spectral display.



NOTE: Spectral Lns are measured for SSA instrument only. If a display bandwidth of one octave is selected with the "bandwidth" setting these displays will indicate "No Data Available for 1/1 octave".



This is a tabular display for each 1/3 octave frequency showing six Ln values for the selected frequency. Below is an example of one of the displays shown for each frequency.

Display label	SSA-Ln (f)			
Selected frequency	1250Hz			dB
Percentile values & levels	L1.67	L8.33		
	96.5	L50.0		95.0
	L33.3			83.5
	88.5	L90.0		33.0
	L66.7			78.0

The following is a brief description of each of the components of this display:

The '(f)' indicates "Ln of frequency f".

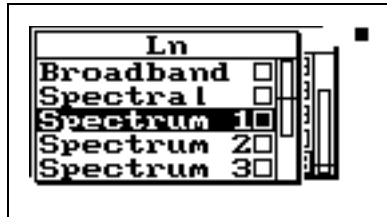
- **Display label** - The Display label identifies the display which is the SSA-Ln (f) display showing six Ln percent values for the frequency displayed.

Use the right  and left  arrow keys to move to each 1/3 octave frequency.

- **Selected frequency** - Shows the values for the frequency shown on the display

- **Percentile values & levels** - The Ln (percentile levels) level is that level which is exceeded ‘n’ percent of the measurement time for the frequency band. By modifying the six settings, you can select any six percentile values to be displayed. The settings may be changed at any time; spectral Ln data are only calculated while running.

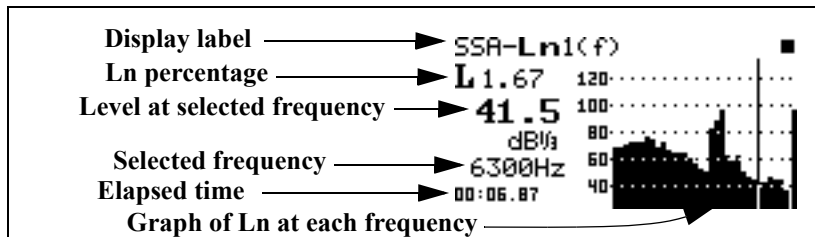
To view the spectral Lns in graphical form highlight “Spectrum 1” and press the check (✓) key.



Use the up (▲) and down (▼) arrow keys to move from one spectrum Ln display to another.

There are six displays showing all of the frequencies for each of the six Ln values.

Below is an example of one of the “Spectrum” displays.



The following is a brief description of each of the components of this display:

- **Display label** - The Display label identifies the display which is the SSA-Ln 1(f) display showing L 1.67 for all of the frequencies in graphical form.
- **Ln percentage** - Shows Ln percentage being displayed.
- **Level at selected frequency** - This shows the Ln level at the frequency selected.




Use the right  and left  arrow keys to change the frequency band.

Use an "Overall reset" to reset overall data.


- **Selected frequency** - Level shown at this frequency.
- **Elapsed time** - Shows the elapsed run time accumulated since the last overall reset.
- **Ln graph** - Graph of Ln for each frequency at the percentage level displayed.

Logging SLM Specific Views

The System 824 provides a number of different displays for the Logging SLM (LOG) instrument. Understanding these displays allows you to take full advantage of this instrument.

All of these views can be accessed by pressing the  View key when using the Logging SLM (LOG) instrument. Additionally, the  or  arrow keys can be used to cycle through an associated group of views. There are three sets of these grouped views:

- ***Any Data including Any Level, Any Impl, and Any Time.***
- ***Current SLM, Overall SLM, Exposure, Ln Centiles, and Stats.***
- ***Metrics, PassBy, and Wind / Tach.***

The Logging SLM (LOG) views are available when the Logging SLM is the active setup. These views can be accessed by pressing the  view key.


The following briefly describes the main views available in the Logging SLM (LOG) instrument.



Menu Items	Purpose
SLM	SLM data with graphic display of Time History.
Any Data	Tabular display of SLM data.
Current SLM	Maintains an accumulation of data that may be reset immediately.

Overall SLM	An accumulation of data over the entire measurement period and is reset when the entire measurement is reset.
Exposure	The Exposure displays show dose and projected dose, the sound exposure (E) and C-A.
Ln Centiles	Display shows six selected L_n values, a graph of L_1 to L_{99} and a graph of the percent greater than level.
Stats	The number of overloads and the number of events detected.
Run Log	A listing of each run, stop, pause, continue, and mark action with its cause, and date/time of occurrence.
Time History	Show the time history of L_{eq} and optionally many other levels such as L_{max} , L_{pk} or Advanced TH setup items over short duration periods. Can also show wind or tachometer data using external transducers.
Intervals	Shows a full statistical history over a longer time period by providing TWA, SEL, L_{min} , L_{max} , L_{pk-I} , L_{pk-II} , and six L_n values for each interval period. Can also show wind or tachometer data using external transducers.
Excd History	A special history which is saved when the level goes over a predetermined threshold. L_{eq} , SEL, L_{max} , L_{pk-I} , L_{pk-II} , duration and time history (if desired) are saved for each exceedance record. Can also show wind or tachometer data using external transducers.



Daily History	Ldn, CNEL, Leq 24, LPK-I, LPK-II, Ln's (if desired), Lmax and Lmin are calculated daily; and for each hour of the day the hourly Leq, EXCD Leq and background Leq. Can also show wind or tachometer data using external transducers.
Metrics	Measurement readings adjusted for night and day noise impact differences. Adjustments are based on standard nighttime sound penalties criteria (i.e. LDN, CNEL, etc.) The total exceedance and background Leq metrics are also displayed.
PassBy	Shows the largest single 10 dB passby event detected with its Leq, SEL, Lmax, duration, and occurrence date and time.
Wind / Tach	Shows wind or tachometer data.

Current SLM and Overall SLM Views

Current SLM clears and starts over when the  Reset button is pressed while running. Overall SLM does not clear during a reset, but continues accumulating data.

The  and  arrow keys can be used to cycle between the Current SLM, Overall SLM, Exposure, Ln Centiles, and Stats views.




The System 824 contains two independent data buffers that can accumulate data separately. In essence, the instrument becomes two sound level meters in one. The data in the primary buffer is referred to as the “overall” measurement, while data in the secondary buffer is referred to as the “current” measurement.

The **Current SLM** and **Overall SLM** Views have five common displays which can be cycled through using the  and  arrow keys. Since these displays are identical they will be discussed together. These displays are categorized as follows:


- a) SPL
- b) Times
- c) Min/Max

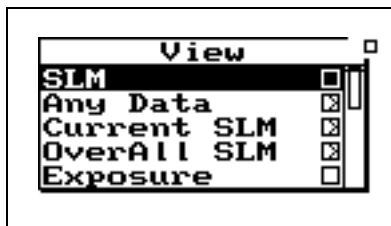
d) Peaks


e) TWA

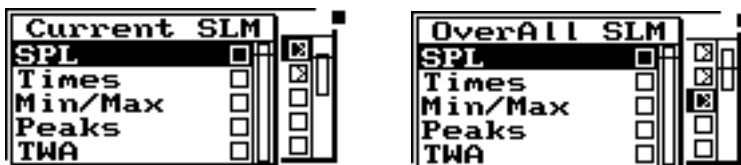
The different views can also be accessed by simply selecting either *Current* or *Overall SLM* with the  Check key from within the main View menu then cycling through the views with the  and  arrow keys.



These displays can be accessed directly from the View menu screen by doing the following:



Step 1 Press the  View key to enter the View menu.





Step 2 Highlight either *Current SLM* or *OverAll SLM*. Press the  arrow key and one of the following screen appears:



Step 3 Use the  and  arrow keys to highlight the desired view.

The  and  arrow keys allow you to move through the view's available displays.

Step 4 Press the  Check key or the  arrow key to enter the selected view.

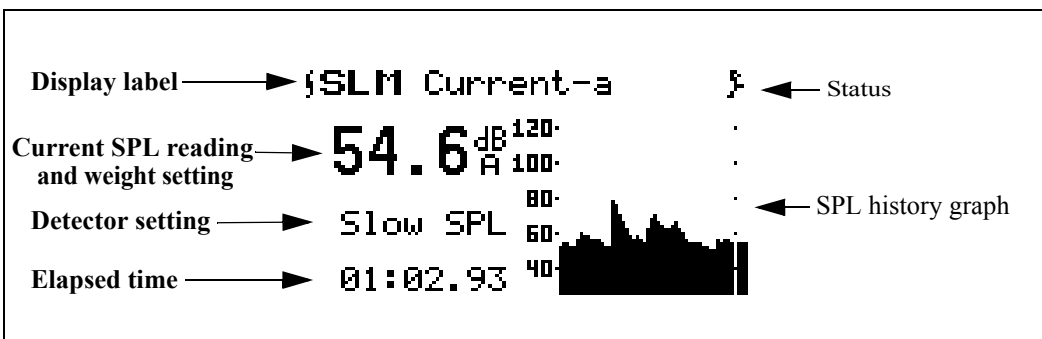
Current SLM/Overall SLM Display-a (SPL)

The *Current/Overall-a SLM* (or *SPL*) display consists of six major components:

- Display label
- Current SPL reading and weight setting
- Selected detector
- Elapsed time

- Status
- SPL history graph

The *Current SLM-a* or *SPL* display is shown below:



The following discusses each of these display components:

Display label - This shows the current display (in this example, "*SLM Current-a*"). The display represents both Current-a and Overall-a display.

Current reading and weight setting - Displays the current SPL reading. This level is also shown graphically by the bar on the far right of the SPL history graph. The frequency weighting for SPL can be either *A*, *C*, or *FLAT*.

Detector setting - The current detector is indicated (for example, *Slow SPL*) and can be Slow, Fast, or Impl.

Elapsed time - This displays the length of time the current measurement has been running. It will reset to zero when the ⊖ Reset key is pressed (Current SLM only). It will also pause when the ⏸ Pause key is pressed and then continue when it is pressed again. The timer is displayed as mm:ss.ss, hh:mm:ss or hhhh:mm.

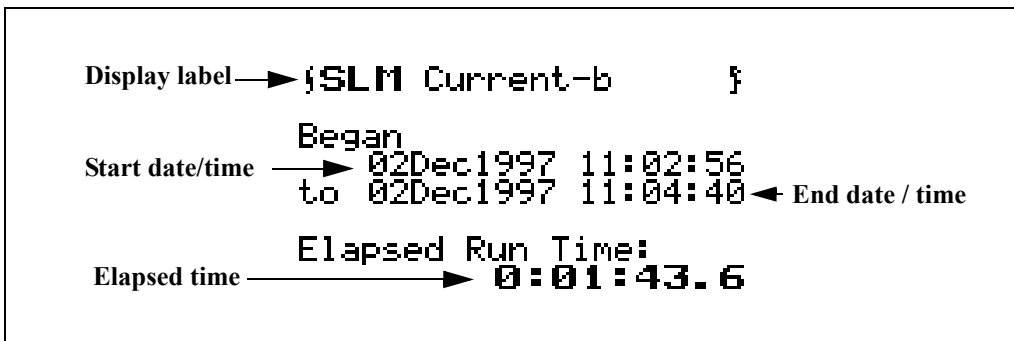
SPL history graph - Shows a recent history of one second Leq readings. The far right bar displays the current SPL reading. As readings are taken, they are placed onto the scrolling graph from right to left once per second.

Current/Overall SLM Display-b (Times)

The *Current / Overall-b SLM* or *Times* display consists of four major components:

- Display label
- Start date / time
- Elapsed time
- End date / time



The *SLM Current-b or Times* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*SLM Current-b*"). The display represents both Current-b and Overall-b display.

Start date/time - Date and time the current/overall measurement began.

Elapsed time - The Elapsed Time displays the length of time the current or overall measurements have been running. It will restart at zero when the  Reset key is pressed (Current SLM only). It will also pause when the  Pause key is pressed and then continue when it is pressed again. The timer is displayed as hhhh:mm:ss.s

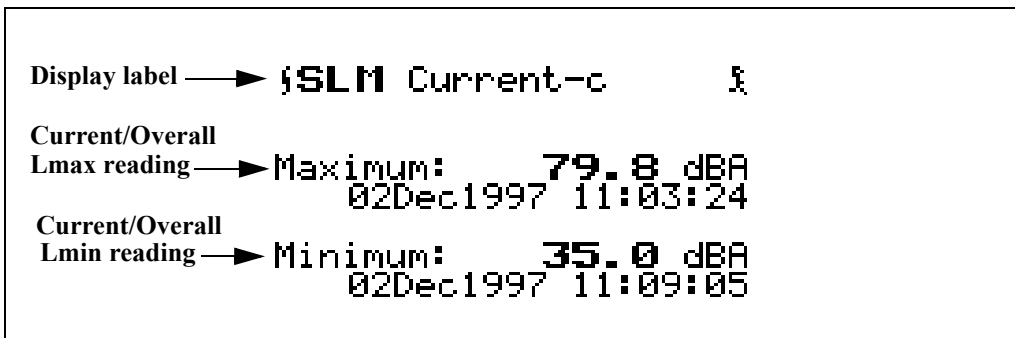
End date/time - Date and time the current/overall measurement ended (or current time if still running).

Current/Overall SLM Display-c (Min/Max)

The *Current/Overall-c SLM* or *Min/Max* display consists of three major components:

- Display label
- Current/Overall Lmax reading
- Current/Overall Lmin reading

The *SLM Current-c* or *Min/Max* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*SLM Current-c*"). The display represents both Current and Overall-c display.

Current / Overall Lmax reading - Displays Lmax or maximum level that occurred, and the date and time when it occurred.

Current / Overall Lmin reading - Displays Lmin or minimum level that occurred, and the date and time when it occurred.

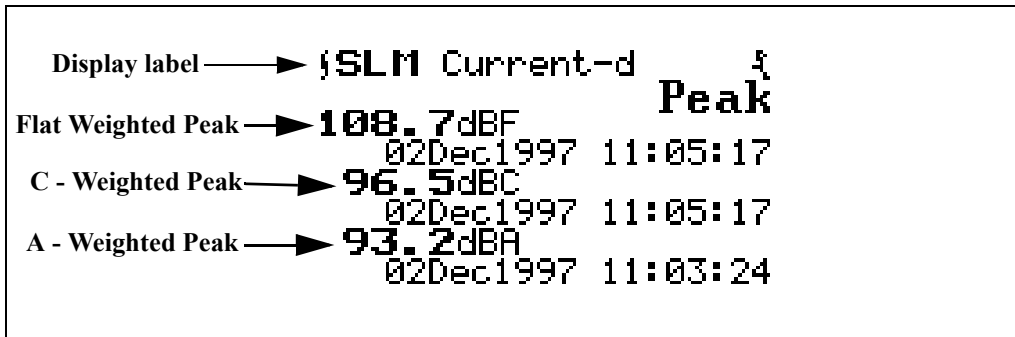
Current/Overall SLM Display-d (Peaks)

The *Current / Overall-d SLM* or *Peaks* Display consists of three major components:

- Display label

- Current / Overall Flat Weighted Peak
- Current / Overall C - Weighted Peak
- Current / Overall A - Weighted Peak

The *SLM Current -d* or *Peaks* display is shown below:



The following information explains each of the display's components:

Display label - Shows the display currently being used (for example, "*SLM Current-d*"). The display represents both Current-d and Overall-d display.

Current/Overall Flat Weighted Peak reading - Shows the flat weighted value from the System 824's peak detector along with the date and time that the peak event occurred.

Current/Overall C - Weighted Peak reading - Shows the C weighted value from the System 824's peak detector along with the date and time that the peak event occurred.

Current/Overall A - Weighted Peak reading - Shows the A weighted value from the System 824's peak detector along with the date and time that the peak event occurred.

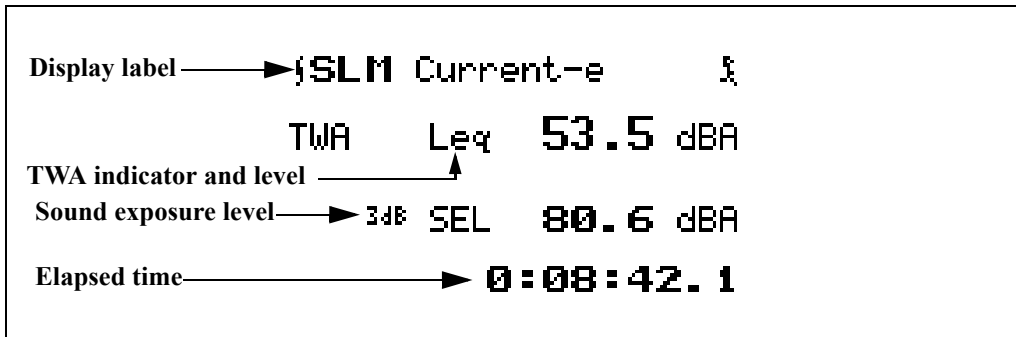
Current/Overall SLM Display-e (TWA)

The *Current/Overall-e SLM* display consists of four major components:

- Display label
- TWA indicator and level

- Sound exposure level
- Elapsed time

The *SLM Current -e* or *TWA* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*SLM Current -e*"). The display represents both Current and Overall -e display.

TWA indicator and level - The indicator is based on the exchange rate (Leq for 3dB exchange rate and threshold = 0. TWA for all others) and the Time Weighted Average level.

Sound exposure level - The Sound Exposure Level (SEL) is measured in dB. This is the TWA normalized to one second.

Elapsed time - This shows the elapsed run time accumulated since the last current/overall reset. This is the time over which the current TWA is averaged.

Exposure Views

The and arrow keys can be used to cycle between the Current SLM, Overall SLM, Exposure, Ln Centiles, and Stats views.

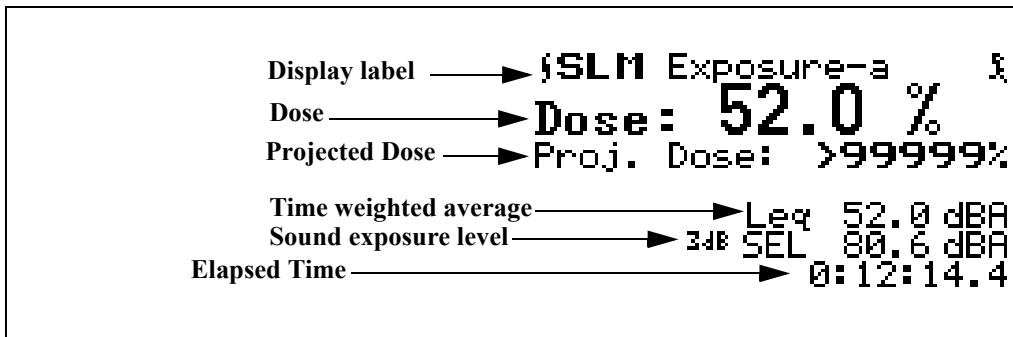
The *Exposure View* has three displays which can be accessed by simply selecting *Exposure* with the Check key from within the main View menu then cycling through the views with the and arrow keys until the desired display appears.

Exposure Display-a

The *Exposure-a* display consists of seven major components:

- Display label
- Dose
- Projected dose
- Time Weighted Average
- Sound Exposure Level
- Elapsed Time

The *Exposure-a* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*SLM Exposure-a*").

Dose - By definition, a person receives 100% dose when exposed to a noise having a TWA equal to the selected criterion level for a time equal to the criterion time (usually eight hours). This corresponds to the maximum safe noise exposure. Exposures at higher levels will result in a 100% dose in less time; or if exposure continues, the exposure will exceed 100% dose.

Projected dose - Projected dose is the dose that will occur if current noise levels continue for the entire criterion time.

Time weighted average - This display shows the Time Weighted Average (TWA) measured in dB.

Sound exposure level - This display shows the Sound Exposure Level (SEL) measured in dB.

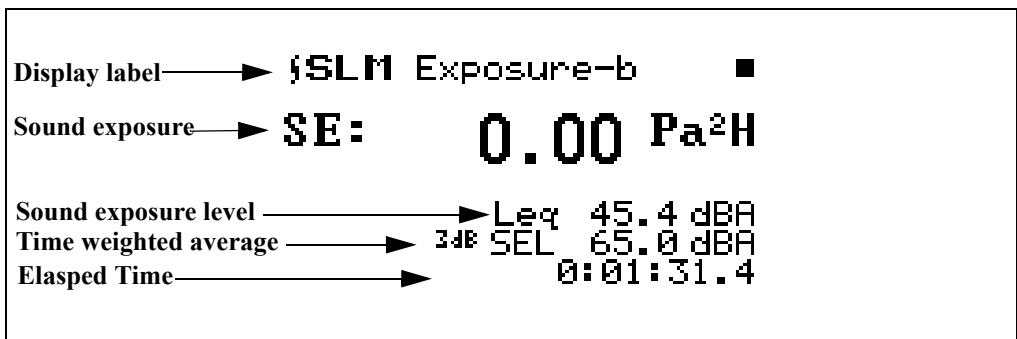
Elapsed time - The timer display shows the elapsed run time accumulated since the last overall reset. This is the time over which the overall TWA is averaged.

Exposure-b Display

The *Exposure-b* display consists of five major components:

- Display label
- Sound exposure
- Sound exposure level
- Time weighted average
- Elapsed Time

The *Exposure -b* display is shown below:



The following explains each of the display's components:

Display label - Shows the current display (for example, "*SLM Exposure-b*").

Takt3 and Takt5 are available options if Takt functionality has been enabled. (See the Menu Item "About" on page 3-18).

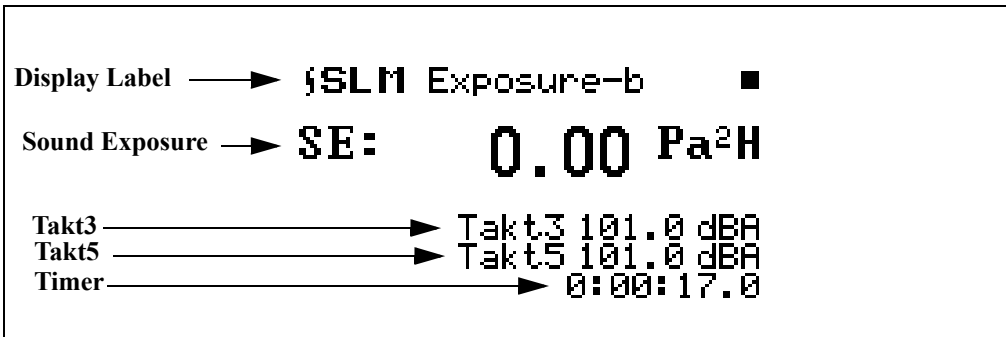
Sound exposure - Sound Exposure (E) in Pascal squared hours (Pa²H). The Sound Exposure (E) is a function of the L_{eq} and the elapsed time of the overall measurement.

Time weight average - This display shows the Time Weighted Average (TWA) measured in dB.

Sound exposure level - Shows the Sound Exposure Level (SEL) measured in dB.

Elapsed time - Shows the elapsed run time accumulated since the last overall reset. This is the time over which the overall TWA is averaged.

If Takt functionality has been enabled, the Exposure-b display will look as shown below:

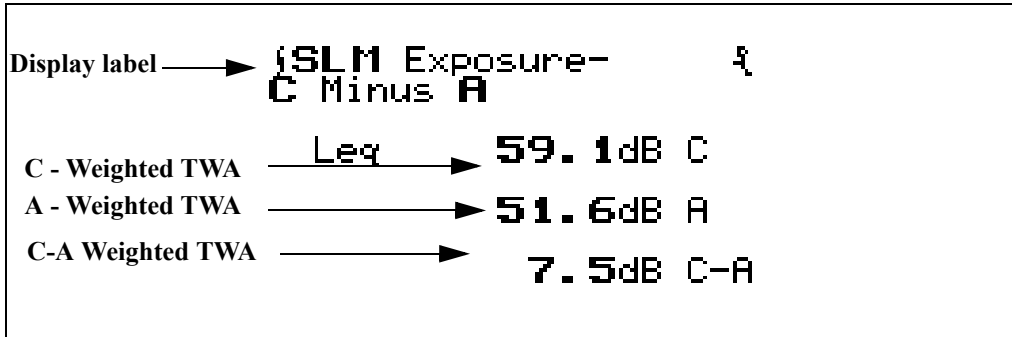


Exposure-c Display

The *Exposure-c* display consists of four major components:

- Display label
- C - Weighted TWA
- A - Weighted TWA
- C minus A TWA

The *Exposure-c* display is shown below:



The following explains each of the displays:

Display label - Shows the current display (for example, “*SLM Exposure-c*”).

C-Weighted TWA - This display shows the C weighted TWA (L_{eq}) over the duration of the measurement.

A-Weighted TWA -This display shows the A weighted TWA (L_{eq}) over the duration of the measurement.

This measurement is commonly used for assessing the effectiveness of hearing protection.

C minus A Weighted TWA - This display shows the C weighted TWA (L_{eq}) minus the A weighted TWA (L_{eq}) over the duration of the measurement.

Ln Centiles Views

The and arrow keys can be used to cycle between the Current SLM, Overall SLM, Exposure, Ln Centiles, and Stats views from the **Ln-a** display.

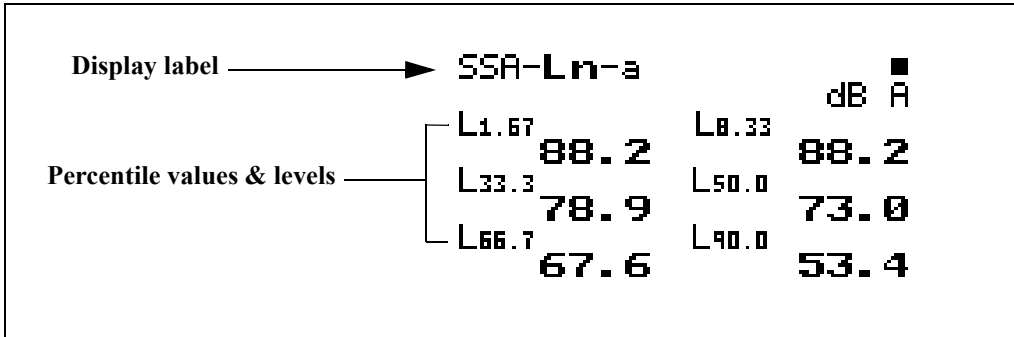
The **Ln Centiles** View has two displays which can be accessed by simply selecting **Ln Centiles** with the Check key from within the main View menu then cycling through the views with the and arrow keys until the desired display appears.

Ln-a Display

The **Ln-a** display consists of two major components:

- Display label
- Percentile values & levels

The **Ln Centiles-a** display is shown below for the LOG instrument:



The following explains each of the display's components:

Display label - Shows the current display (for example, "*Ln-a*").

Percentage settings are entered with a 1/100th dB resolution, but are displayed to the nearest 1/10th dB when 10 dB or greater.

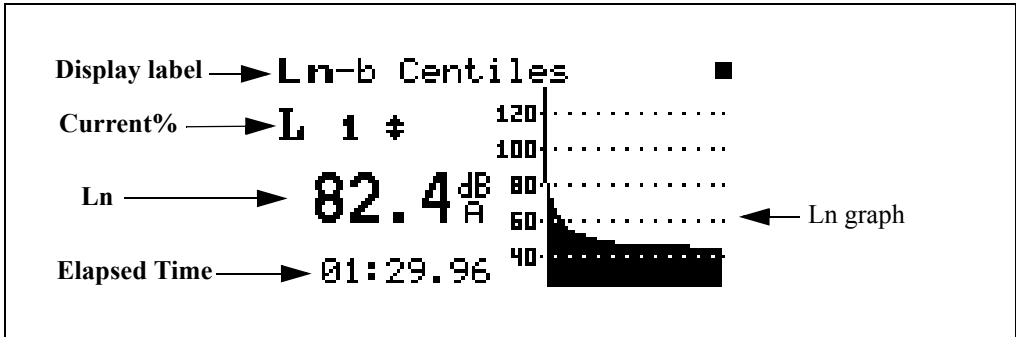
Percentile values & levels - The L_n (percentile levels) level is that level which is exceeded 'n' percent of the measurement time. By modifying the six settings you can select any six percentile values to be displayed at a time. For example, if you set one of these settings to 10.5, then $L_{10.5}$ would be one of the six percentiles that is displayed. The value of $L_{10.5}$ is the level that has been exceeded 10.5% of the time during the overall measurement.

Ln-b Display

The *Ln-b* display consists of five major components:

- Display label
- Current % record
- L_n
- Elapsed Time
- L_n graph

The *Ln Centiles-b* display is shown below for the LOG instrument:



The following explains each of the display's components:

Display label - Shows the current display (for example, "Ln-b Centiles").

Current% - Selects percentage of Ln to display (1 to 99), using the \blacktriangle and \blacktriangledown arrow keys to move from one percentile to another.

Ln - This display shows the current Ln value.

Elapsed time - Shows the elapsed run time accumulated since the last current reset.

Ln graph- Graph of Ln's from 1 to 99 (1 being on the left, 99 on the right).

NOTE: There are two Lns per bar in the graph. The higher of the two is graphed.

Stats Views

The **Stats** View has three displays which can be accessed by simply selecting **Stats** with the \checkmark Check key from within the main View menu then cycling through the views with the \blacktriangleright and \blacktriangleleft arrow keys until the desired display appears.

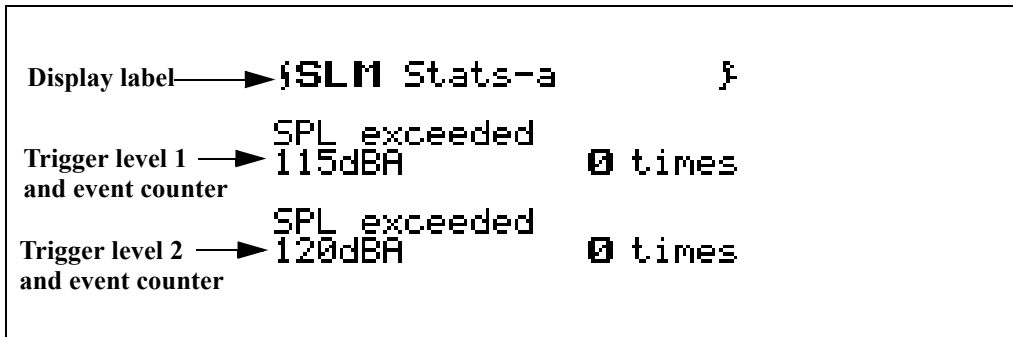
Stats-a Display

The ▲ and ▼ arrow keys cycle between the Current SLM, Overall SLM, Exposure, Ln Centiles, and Stats views.

The **Stats-a** display consists of three major components:

- Display label
- Trigger level 1 and event counter
- Trigger level 2 and event counter

The **Stats-a** display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "**SLM Stats-a**").

Trigger level 1 and event counter - This presents a summary of the number of times during the overall measurement that the SPL exceeded the pre-programmed trigger level 1. In this example, trigger level 1 is set to 115 dBA and the SPL exceeded this threshold 0 times. These may be considered as individual events.

Trigger level 2 and event counter - Summary of the number of times during the overall measurement that the SPL exceeded the pre-programmed trigger level 2. In this example, trigger level 1 is set to 120 dBA and the SPL exceeded this threshold 0 times. These may be considered as individual events.

Stats-b Display

The **Stats-b** display consists of three major components:

- Display label
- Peak-I trigger
- Peak-II trigger

The *Stats-b* display is shown below:

```

Display label  → SLM Stats-b      &
Peak-I trigger → Peak-I exceeded
                140dBf          0 times
Peak-II Trigger → Peak-II exceeded
                140dBA          0 times
  
```

The following explains each of the display’s components:

Display label - This shows the current display (for example, “*SLM Stats-b*”).

Peak-I trigger - This presents a summary of the number of times during the overall measurement that the Peak-I level exceeded its pre-programmed trigger level. In this example, Peak-I’s trigger level is set to 140dBf and the Peak-I level exceeded this threshold 0 times. These may be considered as individual events.

Peak-II trigger - This presents a summary of the number of times during the overall measurement that the Peak-II level exceeded its pre-programmed trigger level. In this example, Peak-II’s trigger level is set to 140dBA and the Peak-II level exceeded this threshold 0 times. These may be considered as individual events.

Stats-c Display

The *Stats-c* display consists of two major components:

- Display label
- Overload message

The *Stats-c* display is shown below:






The following explains the display's components:

Display label - This shows the current display (for example, "*SLM Stats-c*").

Overload message - The "Stats-c" display indicates the occurrence of instrument overloads during the measurement. If one or more overloads have occurred, the display shows the total number of overloads. If no overloads have occurred, the display shows a "No Overloads have occurred" message instead.

Run Log (LOG & SSA)

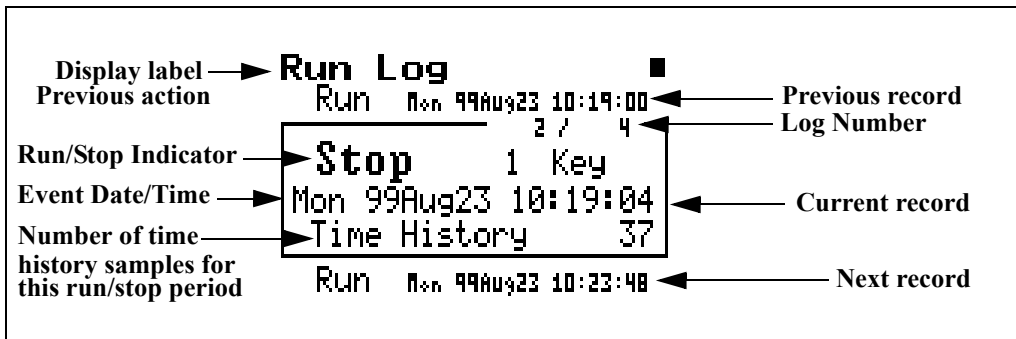
The Run Log displays the start and stop times/dates of the active measurement in the System 824's memory. You use the  and  arrow keys to scroll through the log records. The "Run Log" display can be accessed by simply selecting **Run Log** with the  Check key from within the main View menu.

The **Run Log** display consists of four major components:

- Display label
- Log number
- Event Date / Time

- Run / Stop indicator

The *Run Log* display is shown below for the LOG and SSA instruments:



The following explains this display's components:

Display label - Shows the display currently being used (for example, "*Run Log*").

Log Number- The "Run Log" display shows the start and stop times/dates of measurements in active memory. Each measurement is logged in memory in the order that it occurred. The Log Number indicates the order of the displayed log entry in relation to the other log entries currently in active memory.

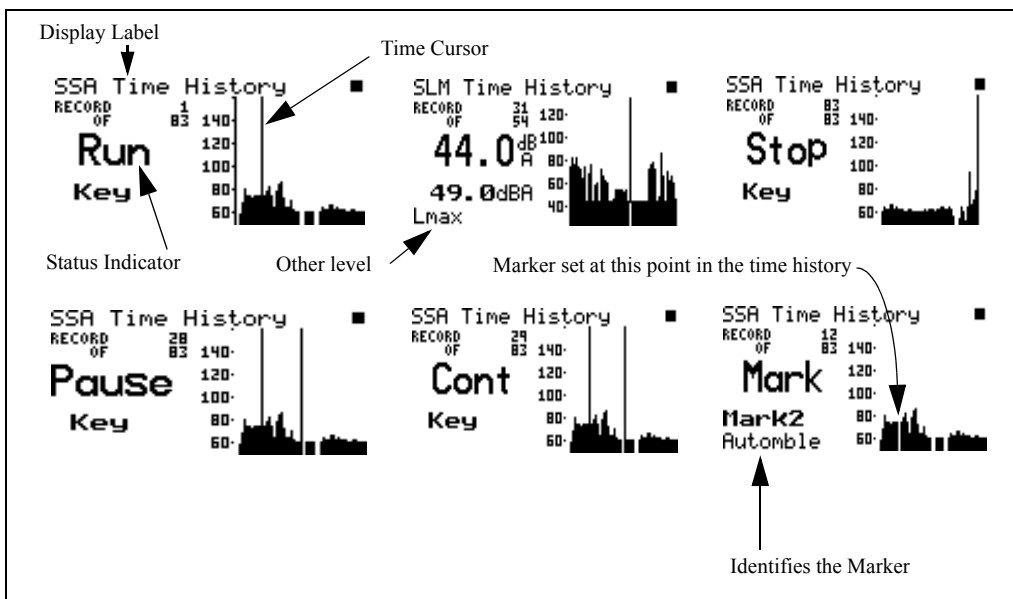
Event Date/Time - The Event Date/Time shows the time and date that this Log entry either started to run or was stopped.

Run/Stop Indicator- Each measurement reading log has two entries; one corresponding to when the measurement started to run and the other entry corresponding to when the measurement was stopped. The Run/Stop indicator shows whether the log entry indicates the time and date of a Run log entry or a Stop log entry.

Time History

With the Time History View you can graphically scroll through and view the SPL readings at different points of time in the measurement readings currently active in memory. You can access the *Time History* display by selecting *Time History* with the \odot Check key from within the main View menu.

Example *Time History* displays are shown below:



The following explains the display's components:

Display label - This shows the current display (for example, "*SLM Time History*").

Status Indicator- The Status Indicator will show one of the three possible events that occurred in the point of time referenced by the Time Cursor:

Run - Indicates a measurement started at this time.

Stop - Indicates a measurement stopped at this time.

Pause - Indicates the measurement paused at this time.

Cont - Indicates the measurement continued at this time.

Mark - Indicates a marker was set at this point in time.

Time Cursor- The Time Cursor (the vertical bar) allows you to scroll graphically through the history of the displayed measurement readings using the ◀ and ▶ arrow keys. The Time History display's Status Indicator will show what event took place at the point in time associated with the Time Cursor's current position.

See the section "Other Level - (LOG only)" on page 7-33 for additional details.

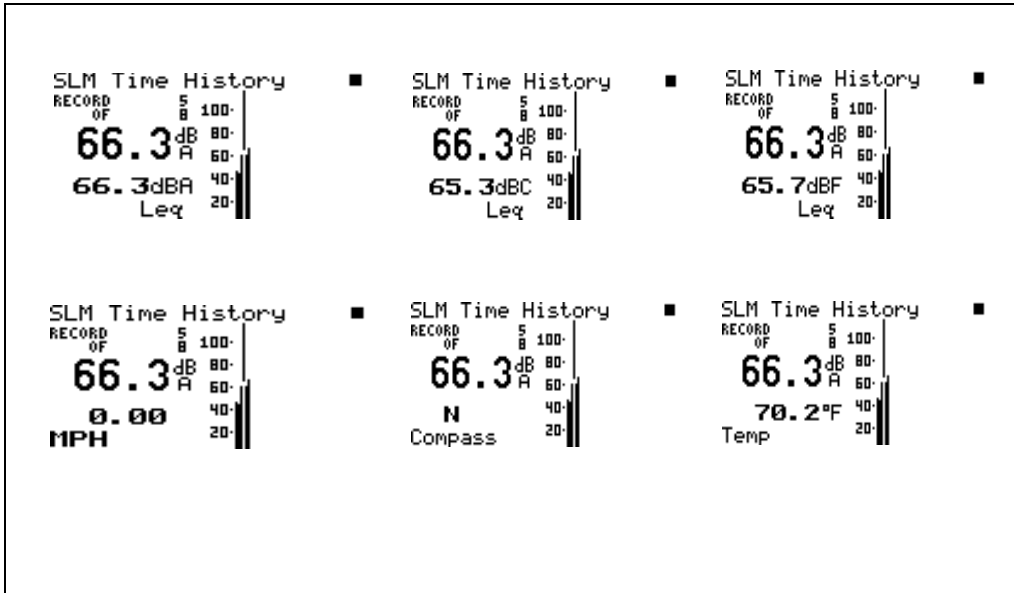
Other level - A wide range of different parameters can be displayed in this window depending upon the setup procedure utilized.

Single Other Level

The simplest situation is when the user selects to display a single alternative sound level parameter, Pk-II, Pk-I or Lmax, which is setup directly using the **Other Level** menu in the **Time History** menu. In this case, the value of this particular parameter will always appear in the same position as shown by the **Lmax** display in the figure above.

Multiple Other Levels

Alternatively, the user could select from as many as forty different parameters, which could include sound pressure levels with different weightings (A, C, or F) and different averaging times (S, F, I), RTA Spectra and even some non-acoustic parameters such as Wind/Tach data, Temperature (824 interior), External Voltage and Battery Voltage. Setting up for multiple other levels requires the use of the **Advnc TH** menu in the **Time History** menu. The selected parameters will be displayed in the same position as **Lmax** in the figure above. Use the ▲ and ▼ arrow keys to scroll through the **other** selected parameters. The following shows how six different values of "other parameter" can be displayed on one particular Time History View by using these arrow keys. The graphics on the second row indicate Windspeed, Wind Direction and Temperature (measured using a temperature transducer inside the System 824).



Intervals

The and arrow keys show different intervals in history. The and arrow keys cycle you through the different Interval screens.

The Intervals view shows a record of various sound pressure data gathered in time segments over a set period of time. An example would be a measurement where data is gathered in one hour time intervals over a 24 hour period. You can access the **Intervals** view display by selecting **Intervals** with the Check key from within the main View menu.

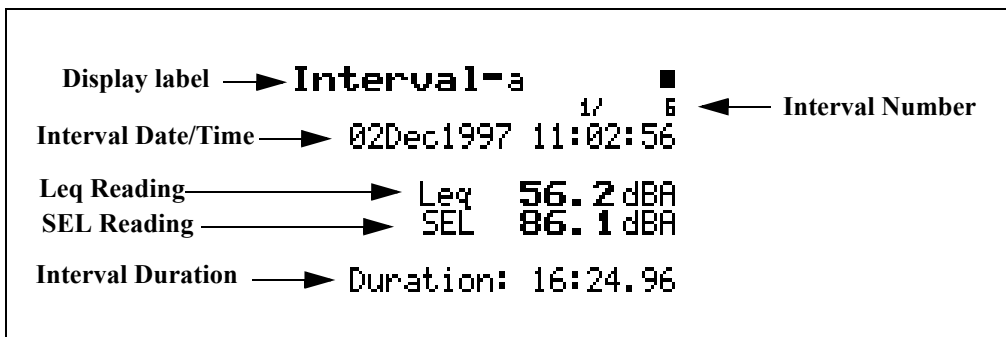
Intervals-a Display

The **Interval-a** display consists of six major components:

- Display label
- Interval Number
- Interval Date / Time

- Leq Reading
- SEL Reading
- Interval Duration

The *Interval-a* display is shown below for the LOG and SSA instruments:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Interval-a*").

Interval Number- The Interval display shows each measurement interval in the order that it occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

Interval Date / Time - The Event Date/Time shows the time and date that this interval began.

L_{eq} Reading - The L_{eq} Reading shows the Leq for the currently displayed interval.

SEL Reading - The SEL Reading shows the SEL for the currently displayed interval.

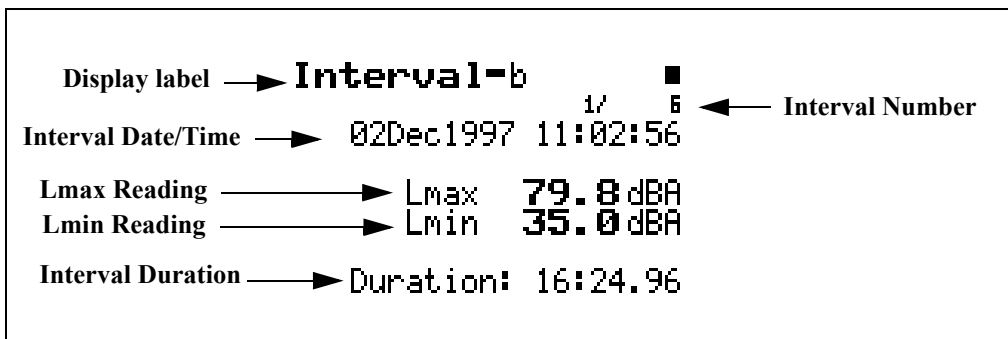
Interval Duration - The Interval Duration shows the length of time of the currently displayed interval.

Intervals-b Display

The *Interval-b* display consists of six major components:

- Display label
- Interval Number
- Interval Date / Time
- Lmax Reading
- Lmin Reading
- Interval Duration

The *Interval-b* display is shown below for the LOG and SSA instruments:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Interval-b*").

Interval Number- The "Interval" displays each measurement interval in the order that they occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

Interval Date/Time - The Event Date/Time shows the time and date that this interval began.

Lmin Reading - The Lmin Reading shows the Lmin for the currently displayed interval.

Lmax Reading - The Lmax Reading shows the Lmax for the currently displayed interval.

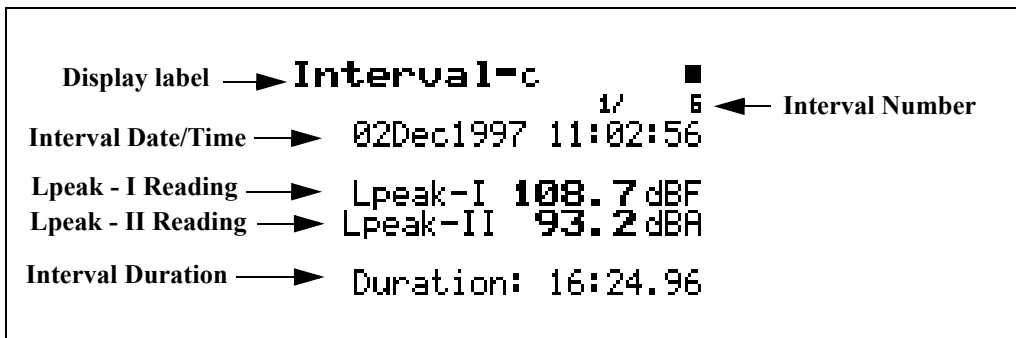
Interval Duration - The Interval Duration shows the length of time of the currently displayed interval.

Intervals-c Display

The *Interval-c* display consists of six major components:

- Display label
- Interval Number
- Interval Date / Time
- Lpeak - I Reading
- Lpeak - II Reading
- Interval Duration

The *Interval-c* display is shown below for the LOG and SSA instruments:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Interval -c*").

Interval Number- The Interval Number display shows each measurement interval in the order that it occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

Interval Date/Time - The Event Date/Time shows the time and date that this interval began.

Lpeak - I Reading - The Lpeak - I Reading shows the Lpeak - I reading for the currently displayed interval.

Lpeak- II Reading - The Lpeak - II Reading shows the LPeak - II reading for the currently displayed interval.

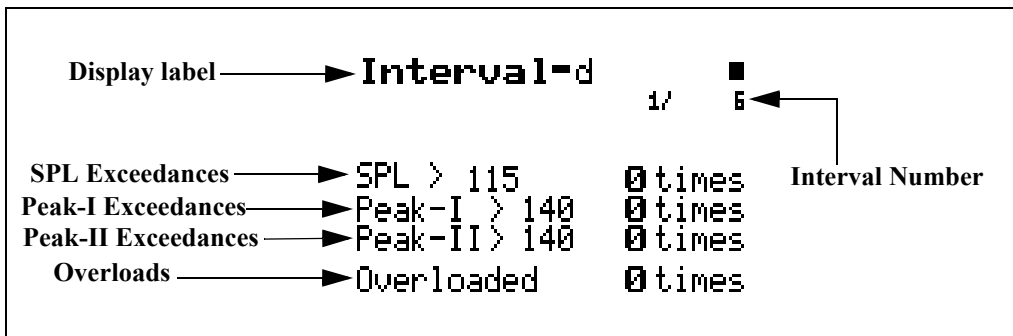
Interval Duration - The Interval Duration shows the length of time of the currently displayed interval.

Intervals-d Display

The *Interval-d display* consists of six major components:

- Display label
- Interval Number
- SPL Exceedances
- Peak - I Exceedances
- Peak - II Exceedances
- Overloads

The *Interval-d* display is shown below for the LOG and SSA instruments:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Interval-d*").

Interval Number- The Interval Number display shows each measurement interval in the order that it occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

SPL Exceedances - SPL Exceedances shows how many times during this interval that the instrument's SPL Exceedance Level was surpassed.

Peak-I Exceedances - Peak-I Exceedances shows how many times during this interval that the instrument's Peak - I Exceedance Level was surpassed.

Peak-II Exceedances - Peak-II Exceedances shows how many times during this interval that the instrument's Peak-II Exceedance Level was surpassed.

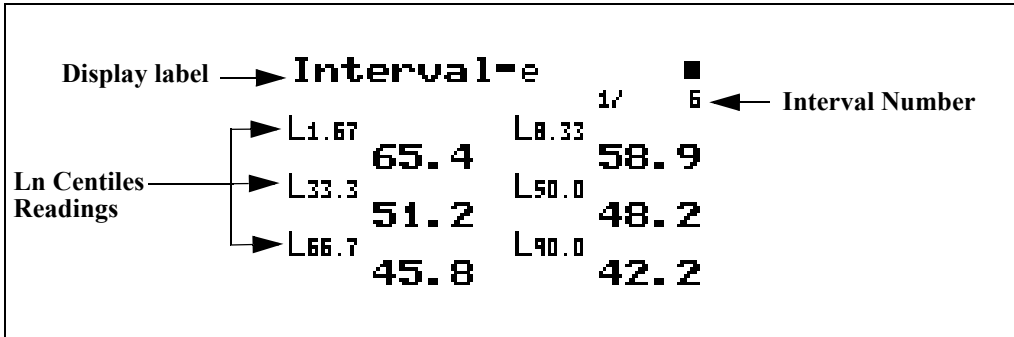
Overloads - This shows how many overloads occurred during this interval.

Intervals-e Display

The *Interval-e* display consists of three major components:

- Display label
- Interval Number
- Ln Centiles Readings

The *Interval-e* display is shown below (LOG instrument only):



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Interval-e*").

Interval Number - The "Interval Number" display shows each measurement interval in the order that it occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

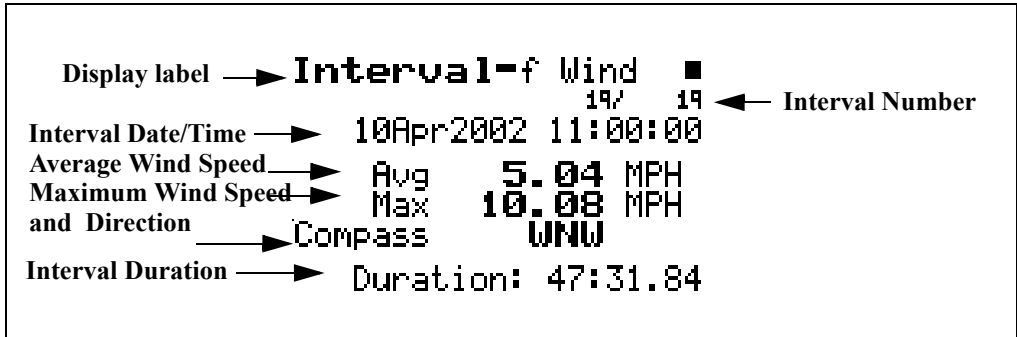
Ln Centiles Readings - Shows the six Ln Centiles readings for this interval.

Intervals-f Display

The *Interval-f* display consists of seven major components:

- Display label
- Interval Number
- Interval Date/Time
- Average Windspeed
- Maximum Windspeed
- Direction of Maximum Windspeed
- Interval Duration

The *Interval-f* display is shown below (LOG instrument only)



The following explains each of the display's components:

Display label - This shows the current display (for example, "Interval-f Wind").

Interval Number - The "Interval Number" display shows each measurement interval in the order that it occurred. The Interval Number indicates the order of the displayed interval in relation to the other interval records.

Interval Date/Time - The Interval Date/Time shows the date and time that this interval began.

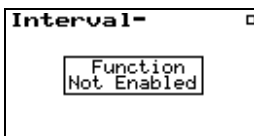
Average Windspeed - The Average Windspeed is the numerical average of the windspeed over the duration of this interval.

Maximum Windspeed - The Maximum Windspeed is the maximum instantaneous value of windspeed logged during this interval.

Direction of Maximum Windspeed - The Direction of Maximum Windspeed is the direction of the maximum instantaneous value of windspeed logged during this interval.

Interval Duration - The Interval Duration shows the length of time of the currently displayed interval.

This display will show



if the interval setting "Intv Save Ln's" is set to "No".


Exceedance History

Event recording begins when any one of the three following conditions is satisfied:

- The instantaneous sound pressure level, Lp, exceeds the value of SPL Exceedance Level 1 set by the user.
- The instantaneous peak level Pk-1, exceeds the value of Pk-1 Exceedance Level set by the user.
- The instantaneous peak level Pk-2, exceeds the value of Pk-2 Exceedance Level set by the user.

Event recording ends when all three of these levels, Lp, Pk-1 and Pk-2, are below their respective exceedance levels minus the Hysteresis level setting. The exceedance will only be saved if its duration is longer than the minimum duration setting.

For further information, see sections "LOG and SSA Triggering Settings" on page 7-23 and "Logging SLM Exceedance History Settings" on page 7-40. The System 824 Training Manual, available from Larson Davis, is also an excellent reference.

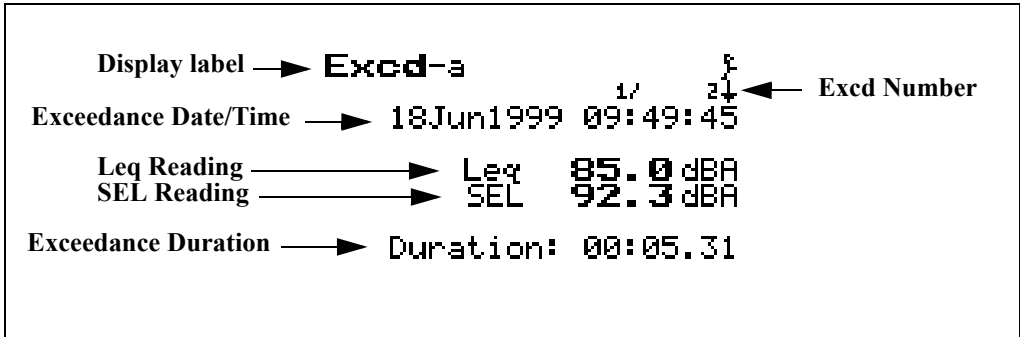
The Exceedance view shows a record of each exceedance recorded when the sound pressure level went over a predetermined threshold. You can access the **Excd History** view display by selecting **Excd History** with the  Check key from within the main View menu.

Excd-a Display

The **Excd-a** display consists of six major components:

- Display Label
- Exceedance Number
- Exceedance Date / Time
- Leq Reading
- SEL Reading
- Exceedance Duration

The **Excd-a** display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "Excd-a")

Exceedance Number - The "Exceedance" display shows each exceedance record in the order that it occurred. The exceedance number indicates the order of the displayed exceedance in relation to the other exceedance records.

Exceedance Date/Time - The Event Date/Time shows the time and date that this exceedance occurred.

Leq Reading - The Leq Reading shows the Leq for the currently displayed exceedance.

SEL Reading - The SEL Reading shows the SEL for the currently displayed exceedance.

Exceedance Duration - The Exceedance Duration shows the length of time this exceedance lasted.

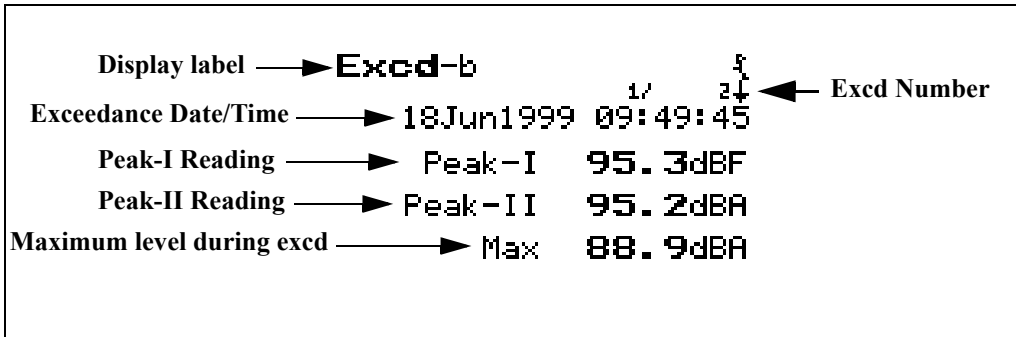
Excd-b Display

The *Excd-b* display consists of six major components:

- Display label
- Exceedance Number
- Exceedance Date / Time
- Peak - I Reading
- Peak - II Reading

- Max Reading

The *Excd-b* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Excd-b*")

Exceedance Number - The "Exceedance" display shows each exceedance record in the order that it occurred. The exceedance number indicates the order of the displayed exceedance in relation to the other exceedance records.

Exceedance Date/Time - The Event Date/Time shows the time and date that this exceedance occurred.

Peak-I Reading - The Peak-I Reading shows the Peak-I level recorded during this exceedance.

Peak-II Reading - The Peak-II Reading shows the Peak-II level recorded during this exceedance.

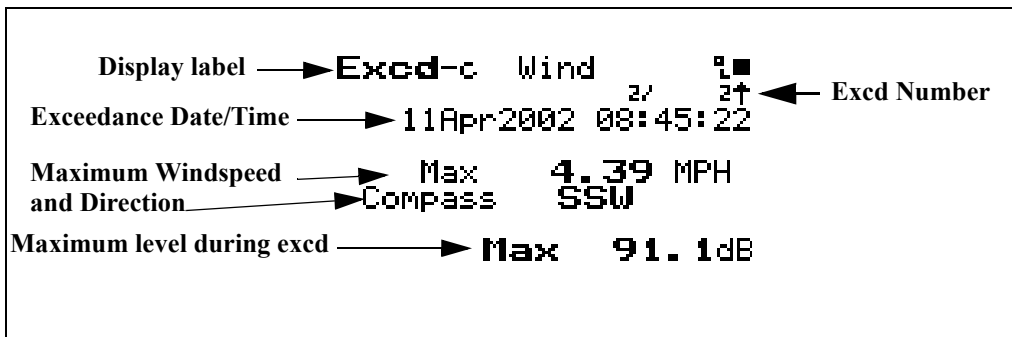
Maximum Reading - The Max Reading shows the maximum level recorded during this exceedance.

Excd-c Display

The *Excd-c* display consists of six major components:

- Display label
- Exceedance Number
- Exceedance Date / Time

- Maximum Windspeed
- Direction of Maximum Windspeed
- Maximum Reading



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Excd-c Wind*")

Exceedance Number - The "Exceedance" display shows each exceedance record in the order that it occurred. The exceedance number indicates the order of the displayed exceedance in relation to the other exceedance records.

Exceedance Date/Time - The Event Date/Time shows the time and date that this exceedance occurred.


Maximum Windspeed - The Maximum Windspeed is the highest instantaneous windspeed logged during this exceedance event.

Direction of Maximum Windspeed - The Direction of Maximum Windspeed is the direction of the maximum instantaneous value of windspeed logged during this exceedance event.

Maximum Reading - The Max Reading shows the maximum level recorded during this exceedance.



Excd Time History Display

You have the option of recording a time history for each exceedance by setting "Excd Time-Hist" to "Yes" under the

“Excd History” settings via the SETUP  key. An exceedance time history will be recorded for every exceedance record.

An exceedance time history will only be recorded when all of the criteria have been met such as:

- SPL Exceedance Level I
- Minimum Duration

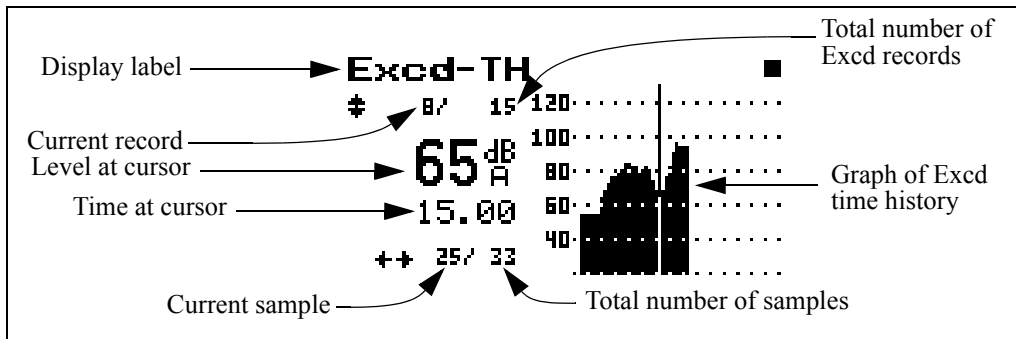
While displaying any of the Exceedance Displays (a, b or c), the corresponding Exceedance Time History can be displayed by pressing the  key twice. A subsequent double click of the  key will return the display to the corresponding Exceedance Display.

NOTE: For a detailed description of Exceedance Time History settings, see the section "Logging SLM Exceedance History Settings" on page 7-40.

The **Excd Time History** display consists of seven major components:





- Display Label
- Current Record
- Level at cursor
- Time at cursor
- Current sample
- Total number of samples
- Total number of Excd records
- Graph of Exceedance Time History



The **Excd Time History** display is shown below:



The following explains each of the display's components:

Display Label - This shows the current display (for example, "Excd-TH")

Current Record - The "Excd-TH" display shows each exceedance record in the order that it occurred. This number shows that you are viewing the time history corresponding to this particular exceedance record. Use the  and  keys to move forward or backwards, respectively, through the sequence of Exceedance History records. Alternately, you can press the  key, highlight Locate, and press the  key again. This will open a window permitting you to jump to the first or last Exceedance or to a selected exceedance record.

Level at Cursor - Shows the level in dB at the point in time indicated by the cursor. Use the  and  keys to position the cursor along the time axis.

Time at Cursor - Shows the time in seconds of the sample indicated by the cursor.

Current Sample - This is the current sample number as indicated by the cursor.





Total Number of Samples - Shows the total number of samples taken for this exceedance.

Total Number of Excd Records - Shows the total number of exceedances recorded.

The exceedance time history includes 10 samples preceding the event and 10 samples after the event. The maximum number of samples that can be stored are 128. In this case only the first 128 samples are stored including the 10 pre-event samples.

Graph of Exceedance Time History - Shows graphically all of the samples taken for the time history. These values follow the instantaneous sound envelope determined by short period Leq samples. As a result, it does not exhibit the relatively slow decay characteristics associated with Slow or Fast detectors.

Daily Views

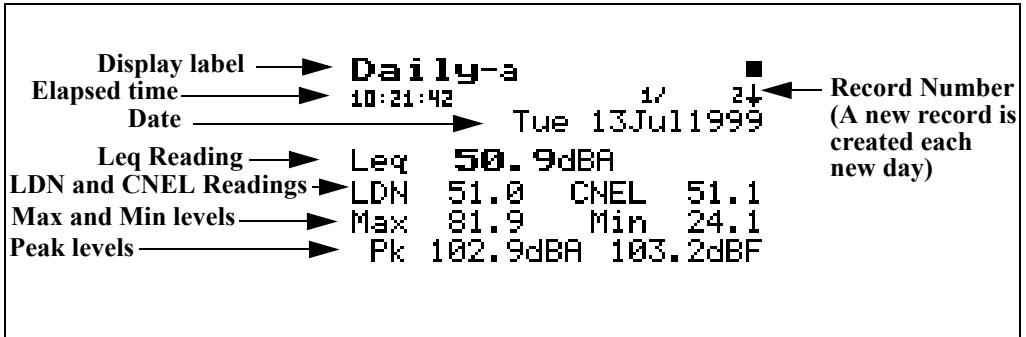
The Daily history logs daily sound statistics including Leq 24, LDN, CNEL, Ln's, Max, Min, and Peak data. The measurement period is from 12:00 midnight to 12:00 midnight each day. For each hour it logs Leq, Background Leq and the hourly Excd Leq. You can access the **Daily** display by selecting **Daily** with the  Check key from within the main View menu, then cycling through the views with the  and  arrow keys until the desired display appears. The hourly data is accessed by pressing the  Check key while in the **Daily-a** or **Daily-b** displays.

Daily-a Display

The **Daily-a** display consists of 11 major components:

- Display label
- Record Number
- Elapsed Time
- Date
- Leq Reading
- LDN and CNEL Readings
- Maximum and Minimum levels
- Peak level

The **Daily-a** display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "Daily-a").

If the 824 is started at 1900 hours, the first Daily record will run from 1900 hours to 0000 hours and then a new day (Daily record) will begin.

Record Number - Each "Daily" record is shown in the order that it occurred. The record number indicates the order of the displayed Daily record in relation to the other records. A new daily record is created each new day. A day is defined as 12:00 midnight to 12:00 midnight.

Elapsed Time - This shows the elapsed time of this day's measurement.

Date - This shows the day, date, month and year for this record.

Leq Reading - This shows the Leq for the day.

LDN Reading - The DNL (Day-Night Average Sound Level) display shows the equivalent sound level for a 24-hour period with a +10dB weighting applied to all sounds occurring between the times 22:00 and 07:00.

CNEL Reading - The CNEL (Community Noise Equivalent Level) display shows the equivalent sound level for a 24-hour period with a +5dB weighting applied to all sounds occurring between the times 19:00 and 22:00 and a +10dB weighting applied to all sounds occurring between the times 22:00 and 07:00.

Maximum and Minimum levels - This shows the maximum and minimum levels during this day's measurements.

Peak level - This shows the peak level during the day with different weighting applied.

Daily-b Display

The *Daily-b* display consists of 4 major components:

- Display label
- Record Number
- Date
- Ln Percentiles

The *Daily-b* display is shown below:

Display label	→	Daily-b							
Date	→	Tue	13	Jul	1999	17	24	←	Record Number
Ln Percentiles	—	L1.67	46.4	L8.33	41.6				
		L33.3	39.5	L50.0	38.3				
		L66.7	34.3	L90.0	24.8				

The following explains each of the display's components:

Display label - This shows the current display (for example, "*Daily-b*").

Record Number - Each "Daily" record is shown in the order that it occurred. The record number indicates the order of the displayed Daily record in relation to the other records. A new daily record is created each new day. A day is defined as 12:00 midnight to 12:00 midnight.

Date - Day, Date, month and year of the record

Ln Percentiles - The L_n (percentile levels) level is that level which is exceeded 'n' percent of the measurement time. You can select any six percentile values to be calculated and stored with the daily record.

Daily-c Wind Display

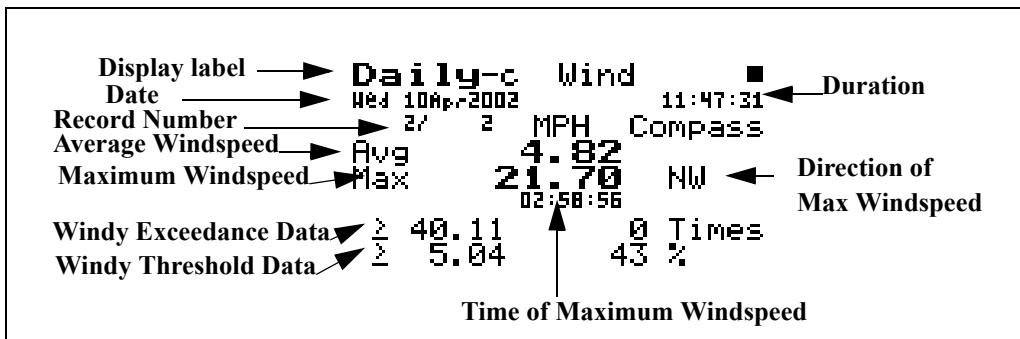
If the optional firmware 824-WND is not installed, the following message will appear

```
Wind/Tach      ■
Not Available
```

```
This option may be
purchased. Please
contact Larson Davis
```

The *Daily-c Wind* display consists of 10 major components:

- Display label
- Record Number
- Date
- Duration
- Average Windspeed
- Maximum Windspeed
- Direction of Maximum Windspeed
- Time of Maximum Windspeed
- Wind Exceedance Data
- Windy Threshold Data



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Daily-c Wind*").

Record Number - Each "Daily" record is shown in the order that it occurred. The record number indicates the order

of the displayed Daily record in relation to the other records. A new daily record is created each new day. A day is defined as 12:00 midnight to 12:00 midnight.

Duration - The Duration shows the length of time represented by this Daily View (measurement may have been stopped before the complete 24 hour period).

Average Windspeed - The Average Windspeed is the numerical average of the windspeed over the duration of this record.

Maximum Windspeed - The Maximum Windspeed is the highest instantaneous windspeed logged during this record.

Direction of Maximum Windspeed - The Direction of Maximum Windspeed is the direction of the maximum instantaneous value of windspeed logged during this record.

Time of Maximum Windspeed - The Time of Maximum Windspeed is the time (hh:mm:ss) when the maximum windspeed occurred.

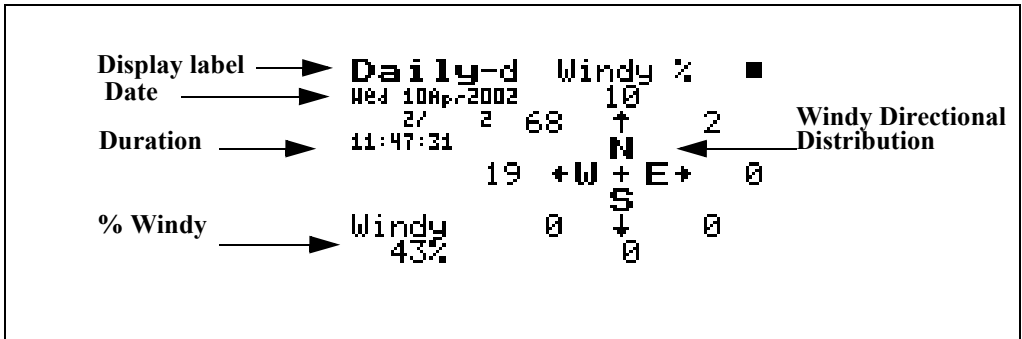
Wind Exceedance Data - The Wind Exceedance Data includes the value of the Wind Exceedance Level (in this instance 40.11) and the number of times the windspeed exceeded this level.

Windy Threshold Data - The Windy Threshold Data includes the value of the Windy Threshold Level (in this instance 5.04) and the percent of the time that the windspeed was above this level.

Daily-d Windy Percent Display

The *Daily-d Windy Percent* display consists of 4 major components:

- Display label
- Record Number
- Date
- Percent Windy Condition
- Windy Directional Distribution



The following explains each of the display's components:

Display label - This shows the current display (for example, "Daily-d Wind").

Record Number - Each "Daily" record is shown in the order that it occurred. The record number indicates the order of the displayed Daily record in relation to the other records. A new daily record is created each new day. A day is defined as 12:00 midnight to 12:00 midnight.

Percent Windy Condition - The Percent Windy Condition is the percent of the time the windspeed was above the Windy Threshold Level.

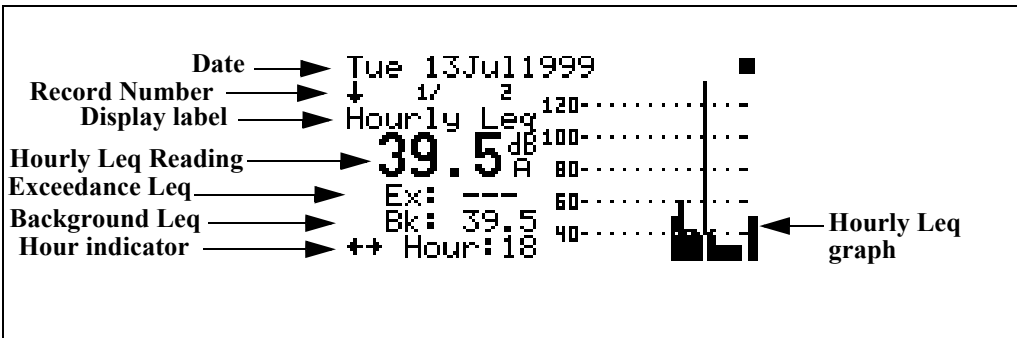
Windy Directional Distribution - The Windy Directional Distribution is shown on a compass rose with indications of the percent of the time that windspeeds above the Windy Threshold Level were in the directions covered by each of the eight directional coordinates. For example, in this instance winds having levels above the Windy Threshold Level of 5.04 (shown on the Daily-c View) were from the North West 68% of the time.

Hourly Leq Display

The *Hourly Leq* display consists of 7 major components:

- Display label
- Date
- Record Number
- Hourly Leq reading
- Exceedance Leq
- Background Leq
- Partial hour indicator
- Hourly Leq graph

The *Hourly Leq* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Hourly Leq*").

Date - Date of the record



Record Number - The record number indicates the order of the displayed Daily record in relation to the other records.

Hourly Leq Reading - This is the hourly Leq as shown by the cursor.



Exceedance Leq - This shows the average level of all of the exceedance events.




Background Leq - The background Leq is the hourly Leq minus the exceedance Leq.

Hour indicator - The hour indicator shows which hour of the day is being displayed. A “p” following the Hour indicator means that the measurement was not for a full hour.

Hourly Leq graph - This graph shows the Leq value for each hour. Use the  and  arrow keys to move the cursor to view the Leq, background Leq and exceedance Leq for each hour.

Metrics

The  and  arrow keys can be used to cycle between the *Metrics*, *PassBy*, and *Wind / Tach* views.

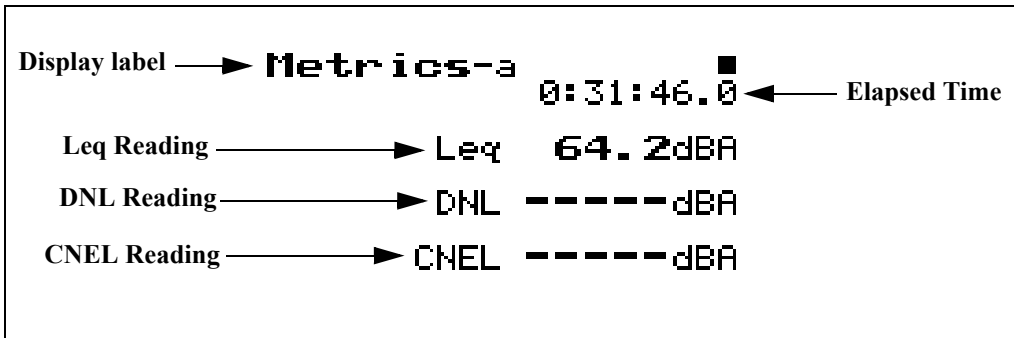
The **Metrics** View has two displays which can be accessed by simply selecting **Metrics** with the  Check key from within the main **View** menu then cycling through the views with the  and  arrow keys until the desired display appears.

Metrics-a Display

The **Metrics-a** display consists of five major components:

- Display label
- L_{eq} Reading
- DNL Reading
- CNEL Reading
- Elapsed Time

The **Metrics-a** display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "**Metrics-a**").

Leq Reading- This display shows the average level over the elapsed time.

DNL Reading - The DNL (Day-Night Average Sound Level) display shows the equivalent sound level for the entire measurement period with a +10dB weighting applied to all sounds occurring between the times 22:00 and 07:00.

CNEL Reading - The CNEL (Community Noise Equivalent Level) display shows the equivalent sound level for the entire period with a +5dB weighting applied to all sounds occurring between the times 19:00 and 22:00 and a +10dB weighting applied to all sounds occurring between the times 22:00 and 07:00.

Elapsed Time- This shows the elapsed time of the overall measurement.

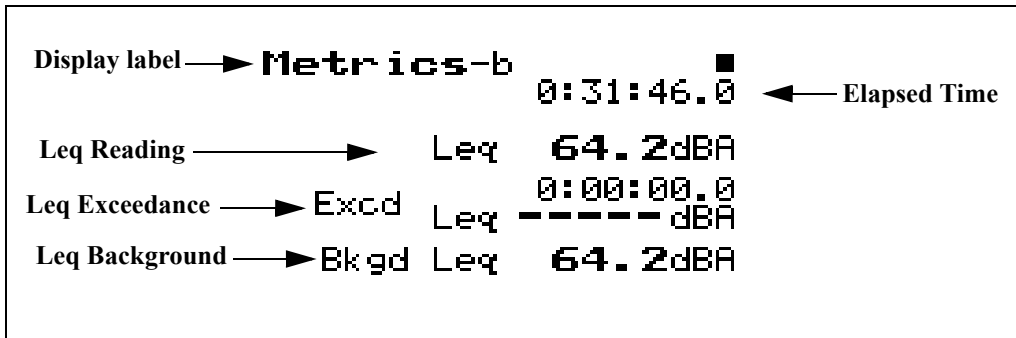
Metrics-b Display

The **Metrics-b** display consists of six major components:

- Display label
- L_{eq} Reading
- L_{eq} Exceedance
- L_{eq} Background

- Elapsed Time

The *Metric -b* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Metric-b*").

L_{eq} Reading - This shows the level of a constant sound over a specific time period that has the same sound energy as the (unsteady) sound over the same period.



Exceedance L_{eq} - This displays the average L_{eq} of all the exceedance events.


Exceedance Duration - Total time of all exceedances.

Background L_{eq} - This display shows the average L_{eq} for the total measurement period minus the combined event L_{eq}.

Elapsed Time - This shows the elapsed time of the overall measurement.

PassBy

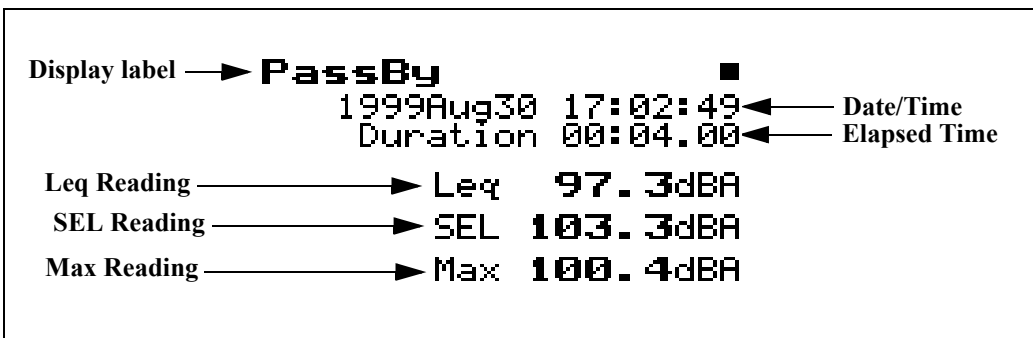
The  and  arrow keys can be used to cycle between the *Metrics*, *PassBy*, and *Wind / Tach* views.

The *PassBy* View has a single display that shows the largest single 10dB passby event detected. The display can be accessed by simply selecting *PassBy* with the  Check key from within the main View menu.

The *PassBy* display consists of six major components:

- Display label
- L_{eq} Reading
- SEL Reading
- Max Reading
- Date/Time
- Elapsed Time

The *PassBy* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*PassBy*").

L_{eq} Reading- This is the L_{eq} for the Passby event including all energy between the 10dB down points centered around the maximum.

SEL Reading - This display shows the total sound energy of a measurement compressed into one second.



Max Reading - This display shows the maximum sound pressure level that occurred during the passby.




Date/Time -This displays the date and time of the passby.

Elapsed Time - This shows the elapsed time between the 10dB down points prior to and following the maximum level measured.

NOTE: The Passby triggering system can be used to create an exceedance record of each passby; set "Excd Trigger" to [Passby].

Wind/Tach

The  and  arrow keys can be used to cycle between the Metrics, PassBy, and Wind / Tach views.

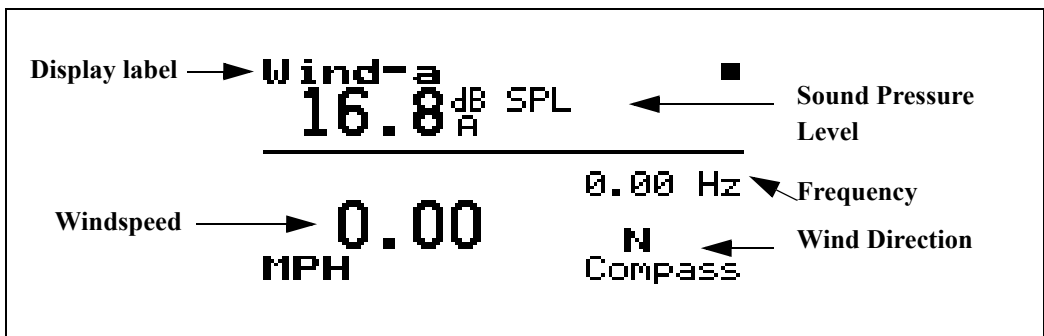
The *Wind/Tach* View has three displays which can be accessed by simply selecting *Wind/Tach* with the  Check key from within the main View menu then cycling through the views with the  and  arrow keys until the desired display appears.

Wind-a Display

The *Wind-a* display consists of five major components:

- Display label
- Sound Pressure Level
- Windspeed
- Wind Direction
- Frequency of Windspeed Signal

The *Wind-a* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Wind-a*").

Sound Pressure Level - This displays the instantaneous sound pressure level

Windspeed - This displays the instantaneous windspeed.

Wind Direction - This displays the instantaneous wind direction using compass coordinate points or in degrees.

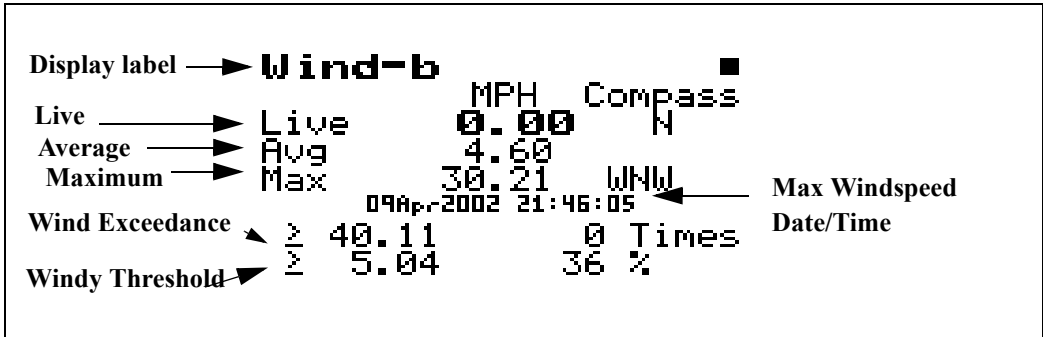
Frequency - This displays the instantaneous frequency of the signal from the windspeed transducer. This parameter is used primarily for troubleshooting.

Wind-b Display

The *Wind-b* display consists of seven major components:

- Display label
- Live Wind Speed and Direction
- Average Windspeed
- Maximum Windspeed and Direction
- Date/Time of Maximum Windspeed
- Wind Exceedance Data
- Windy Threshold Data

The *Wind-a* display is shown below:



The following explains each of the display's components:

Display label - This shows the current display (for example, "*Wind-b*").

Live Windspeed and Direction- This displays the instantaneous value of windspeed and direction.

Average Windspeed - This displays the average value of windspeed calculated since the initiation of the measurement or since the last data reset.

Maximum Windspeed and Direction- This displays the maximum value of windspeed and its direction since the initiation of the measurement or the last data reset.

Date/Time of Maximum Windspeed - This displays the data and time of the maximum windspeed.

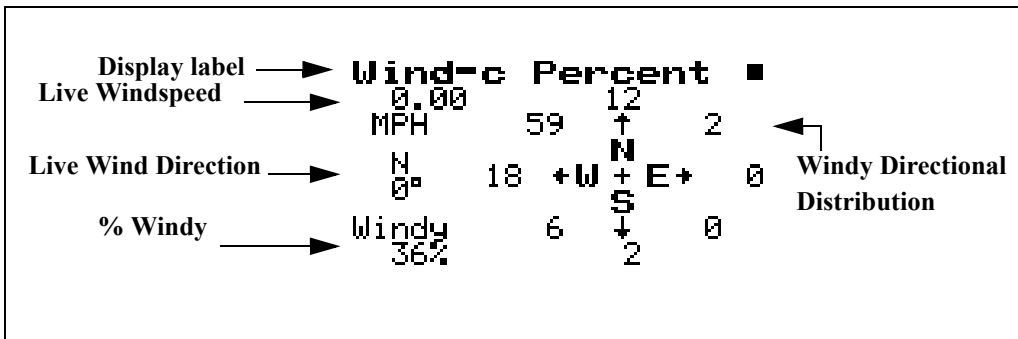
Windy Exceedance Data - The Windy Exceedance Data includes the value of the Windy Exceedance Level (in this instance 40.11) and the number of times the windspeed exceeded this level.

Windy Threshold Data - The Windy Threshold Data includes the value of the Windy Threshold Level (in this instance 5.04) and the percent of the time that the windspeed was above this level.

Wind-c Percent Display

The *Wind-c Percent* display consists of three major components:

- Display label
- Live Windspeed
- Live Wind Direction
- Percent Windy Condition
- Windy Directional Distribution



The following explains each of the display’s components:

Display label -This shows the current display (in this case, “*Wind -c Percent*”).

Live Windspeed - The Live Windspeed is the instantaneous value of windspeed.

Live Wind Direction - The Live Wind Direction is the instantaneous wind direction, indicated in both compass coordinates and degrees.

Percent Windy Condition - The Percent Windy Condition is the percent of the time the windspeed was above the Windy Threshold Level.

Windy Directional Distribution - The Windy Directional Distribution is shown on a compass rose with indications of the percent of the time that windspeeds above the Windy Threshold Level were in the directions represented by each of the eight directional coordinates. In this instance we can

see that winds having levels above the Windy Threshold Level of 5.04 (shown on the Windy-b View) were from the North West 59% of the time.

System 824 Virtual Instruments

System 824 Virtual Instruments

The System 824 presents a number of distinct “virtual instruments” enabling you to select the mode best suited to a particular application. You can, of course, create new setups for particular applications and add your own IDs to the System 824.

The SLM&RTA (SSA), Logging (LOG) and Integrating SLM (ISM) instruments are available in various 824 configurations. The table on the next page explains each of these instruments and shows the configuration in which it is available.

The following configurations of the System 824 are available:

- 824S, 824A, 824L, 824

The following options are also available:

- 824-RTA
- 824-FFT
- 824-AUD
- 824-TAL

The table below describes the basic functions of each configuration.

Instrument	824S	824L	824A	824	824-RTA	824-FFT	824-AUD	824-TAL
ISM - Integrating SLM measures LEQ, SEL, Min, Max, Peak, with all weights (A, C, Flat) and with all detectors (slow, fast, and impulse) simultaneously. Includes a high and low measuring range.	√	√	√	√				
SSA - Sound spectrum analyzer measures LEQ, SEL, Min, Max, Peak, with all weights (A, C, Flat) and with all detectors (slow, fast, impulse, peak and Leq) simultaneously plus 1/1 and 1/3 octave data stored in time and interval histories at storage rates as fast as 8 times per second. Included are Ln data showing 6 Ln values, a graph of L1 through L99 (broadband) and spectral Lns. Wind and Tach data with external transducers.			√	√				
LOG - Logging SLM measures LEQ, SEL, TWA, Min, Max, Peak, with all weights (A, C, Flat) and with all detectors (slow, fast, and impulse) simultaneously. Includes time history, interval history, exceedance history, daily history, Ln percentiles, statistical data, exposure, and dual SLM (current and overall). Wind and Tach data with external transducers.		√		√				
RTA - High speed spectral data gathering of up to 400 spectra per second using Autostore function. Spatial averaging of any number of spectra. Flexible triggering for data acquisition. Performs RT60, RC NCB, HTL. Exponential and linear detectors.					√			
FFT - 400 line FFT with Hanning, Flat-Top or Rectangular window, snapshot data storage, display zoom with a factor of 2, 4, or 8. Count averaging (1 to 16384), measures THD. Linear units can be user defined.						√		
AUD - Audiometer testing for level, frequency, linearity, THD, pulse, crosstalk, frequency modulation, narrow band, broadband, and speech noise.							√	
TAL - Performs complex tonality calculations required by DIN 45681. Measures the frequency of a dominant tone (F_T), the level of the tone (L_T), the bandwidth of the tonal group (F), the level of the group (L_G), and difference of the two levels ($L_T - L_G$). SLM measures L_A , L_C , L_{Aeq} , L_{Amax} , L_{Cmax} , L_{AF1M5} , L_{95} , and L_{Ceq} - L_{Aeq} . A snapshot history is provided to store and display data from the various modes.								√

This chapter will discuss how to select an ID in addition to providing an explanation of the features of the currently available IDs.




Selecting an Instrument ID

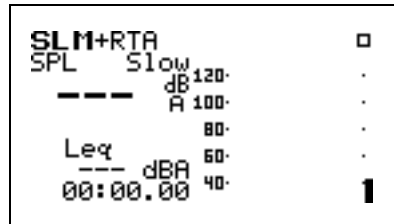
To select one of the System 824 instrument setups or IDs, do the following:

There will be a '>' to the left of the currently enabled instrument ID. The current ID will generally also remain at the top of the list. If the user changes the ID that is in use, the current ID will then have an asterisk to the left of the title.

Step 1 Press the  SETUP key. A menu similar to the following appears:



Step 2 Select the desired ID from the menu by using the  or  keys to highlight it, then press the  key to select it. That instrument's main display will appear:



Sound Spectrum Analyzer (SSA)

There are applications which call for the simultaneous measurement of both the sound pressure level and the real-time frequency spectrum. Very often you will wish to measure the weighted (A, C or Flat) sound pressure level while simultaneously measuring the unweighted frequency spectrum.

For these applications, the System 824 provides the *SSA* instrument.

With this instrument the SLM and RTA functions are operating simultaneously. The primary indicator range of the SLM function is 80 dBA, sufficient for most applications.

In operation, the instrument measures four sets of frequency spectra; the running instantaneous spectrum, the L_{eq} spectrum, the spectrum associated with the maximum SPL level that occurred during the measurement and the minimum bin by bin spectrum. It also gives you a time history record and Ln centiles. The time history record stores up to 38 parameters of your choice, including RTA Leq, RTA Max, or RTA Min, which is determined by the Time History setup under the settings menu.

SSA Measuring Ranges

By using a 24-bit DSP processor, the digital filters of the System 824 meets the specifications of IEC 61260 - Class 1 and ANSI S1.11-1986 Type 1-D over a linearity range exceeding 80 dB. The dynamic range of the analysis function, from noise floor to overload, is 85 dB (typical). Eight ranges are available, providing gain to +50 dB and attenuation to -20 dB in 10 dB steps.

The following presents the Measuring Ranges available for SPL, Peak and 1/3 Octave Filter measurements for the SSA instrument:

Measurement Range (SSA mode only)

	0dB Gain				10dB Gain				20db Gain				30dB Gain				40dB Gain				50dB Gain			
	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range
AW	33	48	128	80	24	38	118	80	15	28	108	80	8	23	98	75	7	20	88	68	6	20	78	58
CW	32	48	128	80	23	38	118	80	16	28	108	80	9	23	98	75	8	20	88	68	8	20	78	58
FLT	32	48	128	80	25	38	118	80	21	33	108	75	21	33	98	65	26	33	88	50	23	40	78	38
16.0	2	45	128	83	2	35	118	83	1	25	108	83	2	25	98	73	-1	28	88	60	1	23	78	55
31.5	3	43	128	85	1	35	118	83	1	23	108	85	2	25	98	73	-4	22	88	66	-4	23	78	55
63.0	4	40	128	88	0	33	118	85	1	23	108	85	0	22	98	76	-7	15	88	73	-7	18	78	60
125	2	40	128	88	-2	27	118	91	-3	28	108	80	-2	18	98	80	-9	11	88	77	-8	8	78	70
250	3	37	128	91	-3	25	118	93	-3	15	108	93	-4	15	98	83	-10	8	88	80	-9	8	78	70
500	12	33	128	95	4	25	118	93	-3	15	108	93	-4	13	98	85	-10	6	88	82	-10	8	78	70
1000	10	32	128	96	2	20	118	98	-4	15	108	93	-5	13	98	85	-10	6	88	82	-10	8	78	70
2000	15	32	128	96	6	20	118	98	-2	15	108	93	-5	13	98	85	-8	8	88	80	-8	8	78	70
4000	14	32	128	96	7	20	118	98	0	15	108	93	-2	13	98	85	-6	8	88	78	-6	8	78	70
8000	14	32	128	96	7	20	118	98	1	15	108	93	-1	13	98	85	-2	12	88	76	-3	13	78	65

*NF is noise floor

Start = start of linearity range

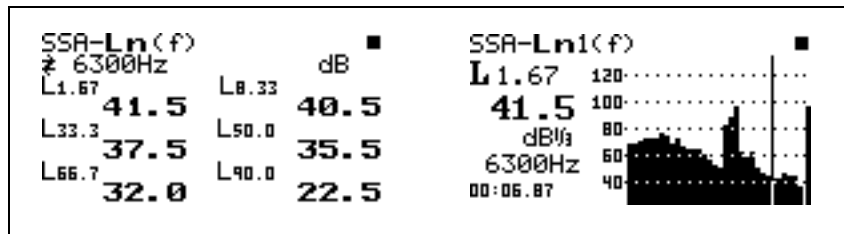
A-weighting, C-weighting, and Flat are measured to ANSI S1.4 and IEC 60651 standards for SLM linearity. 1/3 octave filters listed are measured to the IEC 61260 standard for Class 0 linearity which is ± 0.3 dB. The numbers in the table represent SPL levels with a typical

377B41 microphone which has 44.1 mV/Pa sensitivity.

L_N Percentiles (Spectral)

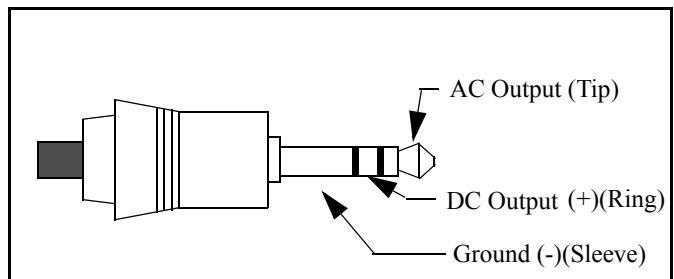
The System 824 L_N Centiles feature provides a display showing the six L_N values of one selected 1/3 octave filter.

It also displays spectra for the six L_N percentiles.



AC/DC Output

The AC/DC output on the 824 is through the 3.5mm stereo connector at the bottom of the instrument. This is a 2-channel output. A mono plug should NOT be used, it will short the “ring” signal to ground.



The two possible output signals are on the tip and the ring of the 3.5mm jack. The sleeve is ground. The selection in the 824 controls settings lists the signal output on the tip first, followed by the signal output on the ring. The AC output signal is always amplified or attenuated by the gain or attenuation selected for the instrument. For example, if one were using an SSA instrument with 20dB of gain, the AC output would also have 20 dB of gain from the input*.

**Also take into account a gain of approximately -0.25 dB in the PRM902 preamplifier.*

The DC output voltage is proportional to the SPL specified by the weighting setting according to this formula

$$SPL = ((V_{out})/0.0275) + StartLevel$$

StartLevel is a setting on the Ln settings menu. DC out has a range of 120 dB.

The output signals will vary based on which instrument type is used. For LOG and ISM instruments, the following table defines the output signals.

LOG and ISM Instrument AC and DC Output Settings		
824 Menu	3.5mm Connector Tip (Black)	3.5mm Connector Ring (red)
AC-1 AC-2	FLAT AC out	FLAT AC out with 30dB gain
AC-1 DC	FLAT AC out	Weighted DC out
AC-2 DC	FLAT AC out with 30 dB gain	Weighted DC out
AC-2 AC-1	FLAT AC out with 30 dB gain	FLAT AC out

For SSA instruments, the following table defines the output signals (output amplitude based on input **Gain** setting).

SSA Instrument AC and DC Output Settings		
824 Menu	3.5mm Connector Tip (Black)	3.5mm Connector Ring (red)
AC-1 AC-2	FLAT AC out	CWT AC out
AC-1 DC	FLAT AC out	Weighted DC out
AC-2 DC	CWT AC out	Weighted DC out
AC-2 AC-1	CWT AC out	FLAT AC out

The DC output is generated digitally from the SPL but is slower than the SLOW or FAST detector response with an exponential time constant of approximately 2.25 seconds.

For the AUD instrument, AC-1 is on the tip and the DC output is not used.

For the RTA instrument, the AC signal will be identical on the tip and ring.

Logging SLM

The **Logging SLM (LOG)** instrument is ideal for applications requiring the automatic measurement and storage of multiple parameters over an extended period as required for environmental noise monitoring. The Logging SLM provides automatic logging of sound level parameters including Interval data, L_n statistics, noise event detection and event time history records. Additionally, this mode provides a dynamic range of 115 dB.

Like other instrument modes, the Logging SLM mode is selected via the **Setup** menu. This section covers some of the data acquisition features of the **LOG** instrument.

Time History

The System 824 Time History logs L_{eq} readings and up to 37 additional parameters. The Time History graphical display allows you to scroll through the time history and Run/Stop events.

Interval History

The following Interval History parameters can be logged at user-selectable time intervals between 1 second and 99 hours (hh:mm:ss)

- L_{max} , L_{min} , SEL, and L_{eq} (q=3) or Time Weighted Average (q=4, 5, or 6) levels for a selected detector (Slow, Fast, or Impulse) and a selected frequency weighting (A, C, or Flat)

- L_{peak} level corresponding to the frequency weighting selected for L_{eq} (see above) and a second L_{peak} level corresponding to one of the two alternative choices of frequency weighting.
- L_n (6 values with 0.1 dB resolution, based on user-selected percentages with 0.1% resolution)
- Date, Time and Duration of Interval
- Average and maximum wind conditions (using external windspeed/direction transducers)

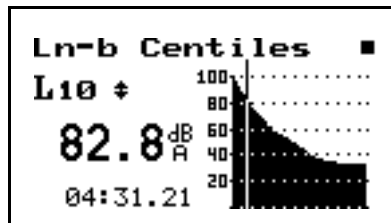
Exceedances

The 824 can log exceedance events based on sound levels that go over a predefined threshold. It can also be triggered by an event which raises the level by 10 dB. This is called a “Passby” event.

L_N Percentiles (Broadband)

The System 824 L_N Centiles feature provides a set of six percentile values to be measured and shown in the “ L_N Centiles” display. Using these six settings, you can select any six percentile values. For example, setting one of the six settings to 10.5 would show the SPL that has been exceeded 10.5% of the time during the time of overall measurement. These settings can each take on any value within the following range:

.01 to 99.99



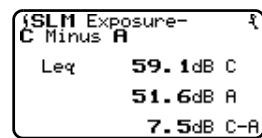
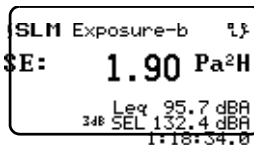
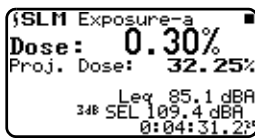
Sound Exposure

The System 824 lets you set the criteria level and criterion time for Dosimetry measurements. A 100% dose occurs if a person is exposed to a constant sound field with a SPL equal to the criterion level, for the criterion time or full dose hours. The criterion level setting can take on any integer value within the following range:

0 to 255 dB

Exposures at higher sound exposure levels than the overall criterion level will result in a 100% dose in less time; or, if exposure continues, the overall dose will exceed 100%.

The following are examples of the System 824 Sound Exposure displays:



LOG and ISM Measuring Ranges

The following table presents the typical RMS detectors measuring ranges for the LOG and ISM instruments:

Range	Frequency Weighting		
	A	C	Flat
Low Range	20–108 dB	25–108 dB	25–108 dB
Normal Range	23–128 dB	28–128 dB	30–128 dB
High Range	43–148 dB	48–148 dB	50–148 dB

NOTE: Ranges are in dB SPL using a typical 377B41 microphone with 44.1 mV/Pa sensitivity. See "RMS Measurement Range (LOG and ISM modes only)" on page C-11 for more 824 specifications.

The LOG and ISM instruments have a dynamic range of 105 dB.


Using ID Setting Files

The System 824 makes it easy to make the measurements you need through stored instrument definitions (ID). You can select one of the permanent ID's or you can create your own library using the 824's keypad or the 824 Utility software. This chapter will describe how to recall (or activate) an ID, customize it to suit your specific needs and then save it for later use. The details on each setting is described for the SSA, ISM and LOG instrument types.

This chapter covers the following:




- Recalling ID Setting Files
- Customizing Settings
- Menu Layout of SLM&RTA (SSA) Settings
- Menu Layout of High Dynamic Range Integrating SLM (ISM) settings
- Menu Layout of Logging (LOG) SLM Settings
- “Check Menus”

Recalling ID Setting Files

The procedural steps for recalling an ID setting file is identical for all the instrument types (i.e. SSA, LOG, ISM). The  SETUP key activates a menu that lists the active ID and all stored ID's. They are sorted in the order of most recently used first. If an ID is permanent, i.e. created by Larson-Davis and not detectable or changeable, it will have a “p” just to the left of its' name in the SETUP menu. These

permanent ID's are a good starting point for creating your own custom ID.

*If you have taken data that has not been stored or if the instrument is not reset, you will be prompted with "Data not Saved. Save?". Answer **Yes** to save the data, **No** to have the data reset or **cancel** to cancel the ID recall.*

To activate an ID, press the down  or up  arrow keys to highlight it and press the CHECK  key. The ID is then recalled, the menu closes and one of the previously viewed displays is shown. Data using these settings may now be taken or the settings may be further customized for your application.

NOTE: If any changes have been made to the current settings you will be prompted with "Active ID has Changed. Save?"

Customizing Settings

This section gives an example of using the standard settings in the SSA instrument. The procedures in this example can be applied to the other Model 824 modes and instruments by simply substituting the other instruments' specific settings for those of the SSA instrument.

Settings Example - SLM&RTA (SSA)

There are four general steps to setting up the SSA instrument: 1) Press the SETUP key. 2) Select the **SLM&RTA SSA** setting. 3) Press the SETUP key again. 4) Enter the **EDIT Settings** menu.




The following steps you through the example procedure of setting the SLM&RTA (SSA) instrument's **Detector** setting to **Fast**.

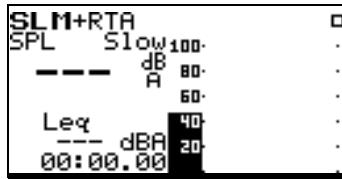
If the 824 is already in SSA mode, there will be a '>' to the left of "SLM&RTA SSA". In which case, skip to Step 3 below.

Step 1 Press the  SETUP key. A menu similar to the following appears:




If you have not already saved your data, you will be prompted to save it at this step.


Step 2 Select *SLM&RTA SSA* from the menu by using the  or  keys and then pressing the  Check key. The SLM+RTA screen appears:



The System 824 is now set to the *SLM&RTA (SSA)* instrument.

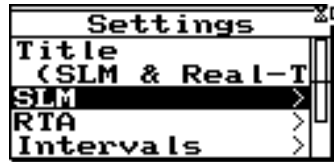
Step 3 To access the *Settings* menu, press the  Setup key. The *Edit Settings: SLM&RTA SSA* is highlighted as the *Setup* menu appears:



Step 4 Press the  key and the *Settings* menu for the *SLM&RTA (SSA)* instrument appears:



- Step 5** Using the ▲ or ▼ keys, highlight the SLM option and press the ✓ Check key.



- Step 6** Use the ▲ or ▼ keys to highlight the *Detector* setting, then press the ▶ key or the ✓ Check key. The *Detector Settings* menu appears:



- Step 7** In the pop-up windows use the ▲ or ▼ keys to highlight the *Fast* setting, then press the ✓ Check key to accept the setting change. The *SLM&RTA (SSA)* instrument's *Detector* setting is now set to *Fast*. Press the ⚙ Setup key to close the menu and return to the SLM+RTA view.

Settings Descriptions

Within the *Edit Settings* menu, use the ▲ and ▼ keys to move from one setting to the next. Use the ▶ key or ✓ Check key to select the setting to be modified. The ◀ key is used to return to previous menus.

Descriptions of the System 824 instrument's various settings are provided in this section. The following will be covered:

- “Common SLM Settings”
- “Common Control Settings”
- “Logging SLM TWA Settings”
- “Logging SLM Triggering Settings”
- “LOG and SSA Ln Settings”

- “LOG and SSA Time History Settings”
- “Logging SLM Interval Settings”
- “Logging SLM Exceedance History Settings”
- “Logging SLM Daily History Settings”
- “Logging SLM Define Report Settings”






In the following sections, headings for each setting or display mode will identify in parentheses the particular System 824 instruments to which they pertain, as shown in the following example.

Example: Title Setting - (SSA, LOG, ISM)

Common SLM Settings

The SSA, ISM, and LOG instrument types include standard SLM functions. This section covers the available SLM settings for these instruments.

Title Setting - (SSA, LOG, ISM)

To change the Title, use the  and  keys to select each character. Use the  and  keys to replace the selected letter. Pressing the  Reset key clears all characters from the cursor to the end of the field.

Use the **Title** setting to create a title or header for printed reports. This title/header will be placed at the top of each report you print.

Detector Setting - (SSA, LOG, ISM)

The 824 measures all three frequency weightings with three detectors simultaneously and all nine of these levels can be viewed.

Detector - selects the detector rate of the instrument’s RMS detector. This setting provides the following three options:

Slow - An exponential average with a one second time constant.

Fast - An exponential average with a 1/8 second time constant.

There are certain features (such as event counting) that function only with one selection of frequency weighting and one selection of detector, both user selected. These same weighting and detector selections also determine the metrics used for features such as L_N , Intervals, Exceedances, etc.

Weighting Setting - (SSA, LOG, ISM)

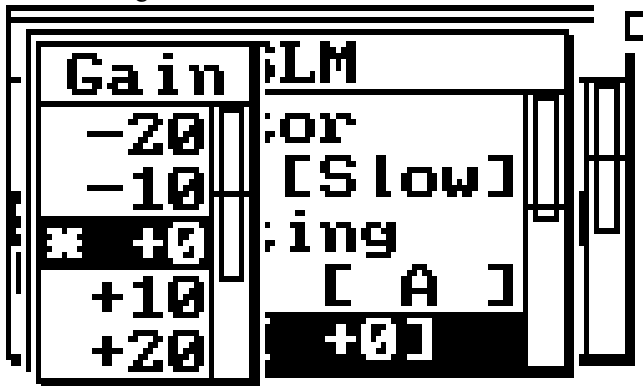
Weighting - selects the desired frequency weighting for the RMS and secondary peak detectors. The **Weighting** setting provides the following three options:

- A - The instrument uses an A-weighted input filter.
- C - The instrument uses a C-weighted input filter.
- FLT - The instrument uses Flat weighting (see specifications for passband frequency in Appendix C).

Gain Setting - (SSA)

The Gain setting is only available in the SSA instrument. The -10 and -20 dB gain settings are not available for electret or direct transducer types (see "Transducer").




Gain - The gain setting sets the measuring range of the instrument in 10 dB steps by adjusting the amplification of the microphone's signal. The gain is set from the **SSA Setup Menu**, highlighting and selecting **SLM**, then **Gain** to obtain the following **Gain Menu**.



In the display, the lowest and highest levels that can be measured accurately are indicated by each live display's graph scale. The following selections are available:

NOTE: If Gain is set to -10 or -20 dB and the microphone type is not condenser then the gain is set to 0 dB and the warning "Setting Conflict" is displayed.

-20, -10, 0, +10, +20, +30, +40, +50

Use the  and  keys to highlight the desired value of gain and press  Check key.

Range Setting - (LOG, ISM)

The Range setting is only available to the LOG and ISM instrument.

NOTE: If Range is set to "Low" and the microphone type is not condenser then the range is set to "Normal" and the warning "Setting Conflict" is displayed.

High Range is not available for electret or direct transducer types (see "Transducer Setting" below).

Range selects the measurement range you desire for the instrument. This setting provides the following three options:

Normal - The instrument's available dynamic range is positioned in the "normal" range which is typically 20dB to 130dB when using a Larson•Davis high-sensitivity microphone.

Low - The instrument's input circuitry provides an additional 20dB of gain which has the effect of moving the instrument's available dynamic range downward relative to the "normal" range. The net effect is that you can measure lower-level sounds effectively. The degree of benefit varies depending upon the weighting or filter that you are using.

High - The instrument's sensitivity is reduced by 20dB, which has the effect of moving the instrument's available dynamic range upward relative to the "normal" range. Therefore you can measure higher-level sounds effectively. The benefit varies depending upon the weighting or octave filter that you are using.

NOTE: The Range setting is not meant to be switched dynamically in real time—in part because selecting the “High” option requires a stabilization period. Furthermore, the System 824’s large dynamic range (110dB) often makes dynamic range switching unnecessary. The Range setting merely allows you to move the available dynamic range either up or down when you need to measure extremely high or low sound levels.

Transducer Setting - (SSA, LOG, ISM)

NOTE: Using an electret microphone with the polarization voltage supplied with the “condnsr” option, will change the microphones sensitivity and frequency response characteristics.

NOTE: The frequency characteristics of the 377B41 & 377A60 microphones change sufficiently enough in high range as to no longer meet Type 1 standards. Thus we recommend using the normal sensitivity microphones, such as 2540 & 2559 to measure high amplitude signals.

NOTE: The transducer setting is a system setting that is not saved or recalled with an ID even though it appears in the SETUP menu.

Random Incidence Microphone Correction - (Available to all Instrument types)

Transducer sets the desired transducer. This setting provides the following three settings:

Condnsr - This indicates that the microphone being used is an air condenser type and the System 824 will generate the appropriate polarization voltage to make it function properly.

Electret - This indicates that the microphone being used is an “electret” (pre-polarized) microphone. The instrument will not generate any polarization voltage.

Direct - This indicates that no microphone is being used and that electrical signals are being injected directly into the preamp. The instrument will not generate any polarization voltage.

The Random Corr setting gives you the option of turning on a digital filter to provide the correction necessary to provide a random incidence response when measuring with a 2540 or 377B41 free-field microphone.

See "Random Incidence Microphone Correction" on page C-24 for the random incidence correction filter's response.

No - Random incidence correction is turned off.

Yes - Random incidence correction is turned on.

NOTE: **Interval** Spectral LNs will not be available when R.I. Correction is turned on. **Overall** Spectral LNs will only be available when the 824 is stopped. This means that the overall Spectral LN data will not be viewable when the 824 is running. If you try to view the overall Spectral LN data while the 824 is running the message "Calculating/Stop to View" will be displayed.

Pk Weighting - (SSA, LOG, ISM)

The 824 has peak detectors for A, C, and Flat frequency weighting that measure simultaneously the greatest instantaneous level (L_{pk}) that has occurred since the last current or overall reset. Some histories and event counters are only able to evaluate one of the three peak detectors. The Peak Weighting Setting selects which is to be used for these features.

PK-II uses the normal weighting setting.

Peak Weighting allows you to select either A, C, or Flat weighting for the primary peak detector, PK-I.

This setting provides the following three options:

A - The A-weighted peak detector is used.

C - The C-weighted peak detector is used.

Flat - The Flat Weighted peak detector is used.

RTA Detector Setting - (SSA)

With the **RTA Detector** setting you can set the time averaging characteristics for real-time frequency analysis. This setting provides the following two options:

Slow - The frequency analysis uses exponential averaging with a one second time constant.

Fast - The frequency analysis uses exponential averaging with a 1/8 second time constant which allows more variability to appear in the measurement.

RTA Weighting - (SSA)

The *RTA Weighting* setting allows you to display an A, C, or Flat weighted spectrum. An overall reset is required before this parameter can be changed.

A - Display's an A weighted spectrum

C - Display's a C weighted spectrum

FLT - Display's a Flat weighted spectrum

Bandwidth Setting - (SSA)

The *Bandwidth* setting provides displaying of either full-octave or third-octave bandwidth filters for real-time frequency analysis. This setting has the following two options:

NOTE: The SSA instrument only measures data using 1/3 octave filters. When 1/1 octave filtered data have been selected, the energy in 1/3 octave band data are summed to give octave filter data. When using the translator function in the 824Util program both 1/1 and 1/3 octave data are provided.

1/1 - Display's octave band filters.

1/3 - Display's third-octave band filters.





Common Control Settings

Control settings are also available from some check menus as discussed later in this chapter. The Control settings are available on most System 824 instruments. The Control settings are available on most System 824 instruments.





Control Settings - (ISM)

For the ISM instrument, the control settings can be accessed through the "Edit Settings" menu as the last selectable menu item, *Controls*.





Control Settings _(SSA, LOG)

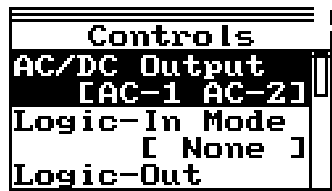
Use the  and  keys to move from one setting to the next. Then use the  key to change the selected setting. The  key is used to return to previous menus.

Triggering for the SSA instrument is for Logic out only. If Logic-Out is set to "RMS", the 824 looks at the level set under "SPL Excd Lvl 1". See the section "LOG and SSA Triggering Settings" on page 7-23.

For the SSA and Logging instrument, the control settings are also accessed through the "Edit Settings" menu, except that the last selectable menu item is **Advanced**. Using the  and  arrow keys, highlight the **Controls** item, then select it using the  arrow key or the  Check key.



Using the  and  arrow keys, highlight the **Controls** item, then select it using the  arrow key or the  Check key. Whether for the ISM, SSA or LOG instrument, the Controls menu will be as shown below.



The following is the menu layout for the control settings:

Menu Items	Available Settings Options
AC/DC Output	AC-1 AC-2 AC-1 DC AC-2 DC AC-2 AC-1
Logic-In Mode	None Pause Toggle Level Alarm

NOTE: Menu items Logic-In Mode through Logic-Out #2 Timer are system settings that are not stored or saved with an ID even though they appear in the SETUP menu

Logic-Out	Off RMS Peak R+P Intv R+I P+I R+P+I A:D R+A P+A R+P+A I+A R+I+A P+I+A R+P+I+A R/S Excd
Logic-Out Time	0 - 255 sec
Logic-Out #2	Same settings as Logic-Out
Logic-Out #2 Timer	0 - 255 sec
Heater On	Yes/No
E.A. Cal Tone	Yes/No

NOTE: The Logic-out #2, uses the Heater output line if set to something other than off.

AC/DC Output Settings - (SSA, LOG, ISM)

The **AC/DC Output** on the 824 allows the user to select what type of signal will be sent out the 3.5mm connector at the base of the instrument. See the section "AC/DC Output" on page 6-5 for more details.

Logic Input Setting - (SSA, LOG, ISM)


The SSA instrument can access the Logic-input Mode setting through either the Check or the Setup menus.

The **Logic Input** sets the functionality of the logic input pin on the control connector (pin 3). This pin is intended to be connected to an external switching device—possibly a push-button switch. The external switching device will either connect the pin to +5V (pin 6) or unconnected. This signal may also be supplied from another device that can supply a 0

to +5 volt logic signal (input load impedance is 100K ohms). The resulting logical state (high or low) will determine what occurs inside the instrument as a function of this **Logic Input** setting. Accordingly, the setting provides the following five options:

None - The state of the logic input pin has no effect.

Pause - Whenever the logic input is connected to +5 V (e.g. when a push-button switch makes contact), the instrument pauses when in the run mode.

Toggle - Each time the logic input is connected to +5 V, (e.g. switch makes contact) the instrument runs or stops. The effect is the same as pressing the  Run/Stop key.

Level - When the logic input is connected to +5 V, (e.g. switch makes contact) the instrument runs. When the logic input is disconnected from +5 V (e.g. switch breaks contact), the instrument stops.

Alarm - When the logic input is connected to +5 V (e.g. switch makes contact), the instrument initiates a *dial-out* sequence. This option is intended for use only with advanced remote monitoring applications where the instrument is paired with a modem.

Caution: *The Level setting overrides the RUN/STOP key and I/O Run/Stop function commands.*

Logic Output Setting - (SSA, LOG, ISM)

The **Logic Output** (2 outputs are available) selects the functionality of the **logic output** pin on the control connector (pin 2 referenced to ground, which is on pin 1) and the heater output (pin 8, pulled to ground). You can use these **Logic Outputs** to actuate external devices during certain events or combinations of events that occur in the instrument. The option you select determines which types of events will trigger a logic output line.

NOTE: In many of the options below, notice the use of a shorthand identifier which includes the first letters of the various events along with the plus + symbol. The plus symbol indicates a logical "OR" function between events. In other words, if for a given option, any one of the listed events occurs alone or in combination with another event, the logic output will turn on.

The **Logic Output** setting provides the following options:

Off - The **Logic Output** is disabled.

RMS - The **Logic Output** turns on when an RMS exceedance event occurs. An RMS exceedance event occurs when the RMS sound pressure level (SPL) exceeds the threshold set by the **SPL Trigger Level** setting. The Any-Data SPL used is the one specified by the Weight and Detector settings

Peak - The **Logic Output** turns on when the instantaneous peak level (Peak-I) specified by the Peak Weight setting is over the **Peak-1 Exceedance Level**, or when the instantaneous weighted peak level (Peak-II) specified by the Weight setting is over the **Peak-2 Exceedance level**.

R+P - The **Logic Output** turns on when either an RMS or Peak exceedance event occurs.

Intv - The **Logic Output** turns on when an interval begins.

R+I - The **Logic Output** turns on when an RMS exceedance event occurs or when an interval begins.

P+I - The **Logic Output** turns on when any peak exceedance event occurs or when an interval begins.

R+P+I - The **Logic Output** turns on when either an RMS or peak exceedance event occurs or when each interval begins.

A:D - The **Logic Output** turns on when an event on one of the A:D channels occurs. These A:D channels are typically used for weather monitoring.

R+A - The **Logic Output** turns on when an RMS exceedance event occurs or when an event occurs on one of the A:D channels.

The A:D (or 'A') functions are for compatibility with systems that have analog data acquisition, generally used to record weather metrics.

P+A - The *Logic Output* turns on when a Peak exceedance event occurs or when an event occurs on one of the A:D channels.

R+P+A - The *Logic Output* turns on when either an RMS or Peak exceedance event occurs or when an event occurs on one of the A:D channels.

I+A - The *Logic Output* turns on when each interval begins or when an event occurs on one of the A:D channels.

R+I+A - The *Logic Output* turns on when an RMS exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

P+I+A - The *Logic Output* turns on when a Peak exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

R+P+I+A - The *Logic Output* turns on when either an RMS or Peak exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

R/S - The *Logic Output* turns on when the instrument is in run mode and turns off when the instrument is in stop mode.

Excd - The *Logic Output* turns on when a valid exceedance is detected and after it's minimum duration has been met.

Logic Output Time Setting - (SSA, LOG, ISM)

The *Logic Output Time* sets the number of seconds that the logic output will remain turned "ON" following a triggering event. Accordingly, this setting can take on any integral value within the following range:

(0)sec to (255)sec

NOTE: If set below 5 seconds, the output will remain “ON” as long as the conditions are true, and turn “OFF” x seconds (0 to 5) after the condition; if set to 6 seconds or greater, the output will stay “ON” for at least 5 seconds but will turn “OFF” as soon as the condition becomes false or the condition has lasted the number of set seconds (i.e. 0-5 minimum time, 6-255 maximum time).

Logic Output #2

Logic-Out #2 works the same as Logic Output and has the same options as shown above.

NOTE: When Logic-Out #2 is not off then the Heater Control setting has no effect. It is overridden by Logic-Out #2.

Logic Output #2 Time Setting

The **Logic Output #2** Time sets the number of seconds that the output will remain turned “ON” following a triggering event. See **Logic Output Time** setting above.

Heater On

The **Heater Control output** selects the functionality of pin 8 of the control connector. It is an “open drain” output such that when asserted, the Heater output sinks current to ground; when unasserted no current flows. It has a maximum rating of 40 volts.

The “**Heater On**” setting provides the following options:

No - Is unasserted; which is considered OFF (line can be used as Logic output #2)

Yes - Is asserted; which is considered ON

E. A. Cal Tone

The **E. A. Cal Tone** setting is used to manually control the Electrostatic Actuator (E. A.) of an outdoor microphone system. It is a CMOS output that drives from 0 to +5 volts through a 10,000 ohm current limiting resistor to pin 7 of the control connector; +5 volts is the asserted state.

Logging SLM TWA Settings

The Time Weighted Average (**TWA**) settings are available to the Logging SLM (LOG) instrument. In a few cases, the ISM instrument also provides access to a few of the TWA settings.

Use the ▲ and ▼ keys to move from one setting to the next. Then use the ► key to change the selected setting. The ◀ key is used to return to previous menus.

The following table shows the **TWA** settings as found in the LOG instrument. Each setting is later described in greater detail.

Menu Items	Available Settings Options
Ovll Exchange	3dB 4dB 5dB 6dB
Ovll Threshold	0 - 255 dB
Ovll Criterion	0 - 255 dB
Criterion Time	0 - 99 hours
Crnt Exchange	3dB 4dB 5dB 6dB
Crnt Threshold	0 - 255 dB
Crnt Criterion	0 - 255 dB

Ovll Exchange - (LOG)

This setting affects the System 824's primary or overall memory buffer.

The **Overall Exchange** rate setting sets the exchange rate (sometimes called the “doubling rate”) that is used to calculate the overall TWA. The exchange rate reflects the relationship between the permitted exposure levels and the exposure duration. Selecting an exchange rate of 5dB, for example, means that 5dB may be added to the permissible

exposure level every time the exposure duration is cut in half. This setting provides the following four options:

The formulas for TWA can be found in "Integrated Level Calculations" on page B-1.

3dB - The default 3dB option is the most commonly used and results in the L_{eq} time weighted average. (When a threshold of 0 is used.) It is used internationally and for measurements that comply with U.S. Environmental Protection Agency (EPA) regulations.

4dB - The 4dB option results in the L_{DOD} time weighted average which is used for measurements that comply with U.S. Department of Defense (DOD) regulations.

5dB - The 5dB option results in the L_{OSHA} time weighted average which is used for measurements that comply with U.S. Occupational Safety and Health Administration (OSHA) regulations.

6dB - The 6dB option results in the L_{Avg} time weighted average which is merely a convenient representation of the long-term average noise level as opposed to the RMS noise level.

Ovll Threshold - (LOG)

This setting affects the System 824's primary or overall buffer.

The ***Ovll Threshold*** setting sets the threshold for computing the overall time weighted average (TWA).

As per the requirements of various regulatory agencies, only those sound levels which are above a certain threshold level are used when computing the TWA. Accordingly, this setting can take on any integer value within the following range:

0 - 255 dB

For hearing conservation measurements, set the threshold to 80dB. For most community noise measurements, set the threshold to 0dB. (When set to 0, all levels are included)

Ovll Criterion - (LOG)

The ***Ovll Criterion*** setting sets the TWA level which constitutes 100% dose for the overall measurement. The 100% dose occurs if a person is exposed to that level for the criterion time. Accordingly, this setting can take on any integer value within the following range:

0 to 255 dB

Exposures at higher levels than the overall criterion level will result in a 100% dose in less time; or, if exposure continues, the overall dose will exceed 100%.

Criterion Time - (LOG)

The *Criterion Time* determines how long exposure to the set TWA level can occur before 100% dose occurs for the overall measurement.

Crnt Exchange - (SSA, ISM, LOG)

In the ISM instrument the Crnt Exchange setting is a submenu to the SLM menu selection.

The *Crnt Exchange* rate setting sets the exchange rate (sometimes called the “doubling rate”) that calculates the current TWA. The exchange rate reflects the relationship between the permitted exposure levels and the exposure duration. Selecting an exchange rate of 5dB, for example, means that 5dB may be added to the permissible exposure level every time the exposure duration is cut in half. This setting provides the following four options:

This setting affects the System 824's secondary or current buffer.

3dB - The *Crnt Exchange* defaults to the 3dB option. This provides a L_{eq} time weighted average in accordance with European common usage in addition to compliance with U.S. Environmental Protection Agency (EPA) regulations.

4dB - The 4dB option results in the L_{DOD} time weighted average which complies with U.S. Department of Defense (DOD) regulations.

5dB - The 5dB option results in the L_{OSHA} time weighted average which complies with U.S. Occupational Safety and Health Administration (OSHA) regulations.

6dB - The 6dB option results in the L_{Avg} time weighted average which provides a convenient representation of the long-term average noise level as opposed to the RMS noise level.

Crnt Threshold (SSA, ISM, LOG)

In the ISM instrument the Crnt Threshold setting is a submenu to the SLM menu selection.

This setting affects the System 824's secondary or current buffer.

The **Crnt Threshold** sets the threshold for computing the current time weighted average (TWA).

In compliance with the requirements of various regulatory agencies, only those sound levels which are above a certain threshold level are used when computing the TWA. Accordingly, this setting can take on any integer value within the following range:

0 - 255 dB

For hearing conservation measurements, set the threshold to 80dB. For most community noise measurements, set the threshold to 0dB.

Crnt Criterion (LOG)

The **Crnt Criterion** sets the TWA level which constitutes 100% dose for the current measurement. The 100% dose occurs if a person is exposed to that level for the criterion time or full dose hours. Accordingly, this setting can take on any integer value within the following range:

0 to 255 dB

Exposures at higher levels than the current criterion level will result in a 100% dose in less time; or, if exposure continues, the current dose will exceed 100%.

LOG and SSA Ln Settings

Ln Settings are available in the Logging SLM (LOG) and SLM&RTA (SSA) instruments.

Ln is the SPL which was exceeded n% of the time. The Ln's are computed from the overall level distribution histogram or each Interval's level histogram. The measured and displayed Ln percentage settings may be changed during the measurement. The six Ln's are automatically listed in increasing order.

Use the ▲ and ▼ keys to move from one setting to the next. Then use the ► key to change the selected setting. The ◀ key is used to return to previous menus.

The following is a table of the L_N settings:

Menu Items	Available Settings Options
Enable Ln (SSA only)	No Yes
Start Level	0-99 dB
Ln 1 Percent	0.00 to 99.99%
Ln 2 Percent	0.00 to 99.99%
Ln 3 Percent	0.00 to 99.99%
Ln 4 Percent	0.00 to 99.99%
Ln 5 Percent	0.00 to 99.99%
Ln 6 Percent	0.00 to 99.99%
Spectral Ln (SSA only)	None Overall Interval NOTE: Interval Spectral LNs will not be available when R.I. Correction is turned on.

NOTE: An Ln percentage of 0 provides L_{max} for the Ln level.

Enable Ln

This function turns on or off the automatic storage of the six Ln percentile levels for the overall measurement.

No - The six Ln levels are not stored for the overall measurement.

Yes - The six Ln levels are stored for the overall measurement.

NOTE: If Lns are enabled in the SSA instrument, then the Back-Erase feature is no longer available. (See the section "Pause, Back Erase" on page 3-10 for information on the Back-Erase feature)

Start Level

The Start Level allows you to set the minimum decibel level to be included in the statistical histogram and calculated Ln Percentiles.

Ln's

The L_N Centiles set the six percentile values to be measured, logged (if selected) and shown in the Ln displays. Using these six settings, you can select any six percentile values. As shown above, these settings can each take on any value within the following range:

0.00 to 99.99%

Whenever you change any percentile value, the instrument sorts and reorders the percentile values into ascending order as demonstrated in the following example:

Example: Suppose you change L_n 3 from 30.0* to 5.0*. The original setting values will then be automatically sorted into ascending order and re-assigned as shown in the table below:

Original Setting	After Change and Sort
L_n 1 Percentile = 10.0	* L_n 1 Percentile = 5.0
L_n 2 Percentile = 20.0	L_n 2 Percentile = 10.0
* L_n 3 Percentile = 30.0	L_n 3 Percentile = 20.0
L_n 4 Percentile = 40.0	L_n 4 Percentile = 40.0
L_n 5 Percentile = 50.0	L_n 5 Percentile = 50.0
L_n 6 Percentile = 60.0	L_n 6 Percentile = 60.0

Spectral Ln's (SSA only)

Spectral Lns can be enabled as an Overall measurement or as a function of each Interval History record.

To store interval spectral Ln levels, set "Spectral Ln" to "Interval", enable Ln and Interval histories and set "Intv Save Ln" to "Yes".

The **Spectral Ln** setting is used to measure six Ln values for each 1/3 octave. The setting options provided are:

None - Spectral Ln's are turned off.

Overall - Spectral Ln's are computed for the overall measurement.

Interval - Spectral Ln's are computed for each interval period.

NOTE: If Random Corr. is set to [Yes] and Spectral Ln is set to [Interval] then Spectral Ln will be set to [None] and the warning "Setting Conflict" is displayed.

LOG and SSA Triggering Settings

For the SSA instrument, these trigger settings are used to control the logic output line.

The Stats displays are only available to the LOG instrument.

Use the ▲ and ▼ keys to move from one setting to the next. Then use the ► key to change the selected setting. The ◀ key is used to return to previous menus.

Trigger levels can be set as follows: two for the SPL (RMS value) and one each for Peak I and Peak II. These levels are used with the LOG instrument to count the number of exceedances during the measurement period and display that number in the **Stats-a** and **Stats-b** displays. They also define the triggering of noise events or exceedances when using the Logging SLM Mode.

The following is a table of the **Triggering Menu** settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
SPL Excd Lvl 1	0 to 255 dB
SPL Excd Lvl 2	0 to 255 dB
Pk-1 Excd Lvl	0 to 255 dB
Pk-2 Excd Lvl	0 to 255 dB
Hysteresis	0 to 9 dB

SPL Excd Lvl 1 - (LOG, SSA)

NOTE: In the SSA instrument the logic output is asserted when it reaches this level. See the section "Common Control Settings" on page 7-10 for more details.

SPL Excd Lvl 2 - (LOG, SSA)

The **SPL Excd Lvl 1** sets the SPL trigger level that exceedance records are triggered from (LOG only). You can also view a count of the SPL events on the **Stats-a** display. This count is associated with the overall measurement data and is reset when the overall measurement is reset.

This setting can take on any value within the following range:

0 to 255 dB

The **SPL Excd Lvl 2** sets a second trigger level. When the SPL exceeds the level set by this setting, a corresponding count is incremented once. You can view this count on the **Stats-a** display. This count is associated with the overall measurement data and is reset when the overall

measurement is reset. A special flag is set with all exceedance records whose L_{MAX} is greater than this level.

This setting can take on any integer value within the following range:

0 to 255 dB

PK Excd Lvl 1 - (LOG, SSA)

The *Pk Excd Lvl 1* sets the trigger level for the primary peak detector (Pk-I). When the primary peak detector level exceeds this threshold, the corresponding Pk-I exceedance count is incremented once. You can view this count on the *Stats-b* display. This count is associated with the overall measurement data and is reset when the overall measurement is reset.

NOTE: The data for this comes from the instantaneous peak level, selected by the Weight setting.

This setting can include any integer value within the following range:

0 to 255 dB

Pk Excd Lvl 2 - (LOG, SSA)

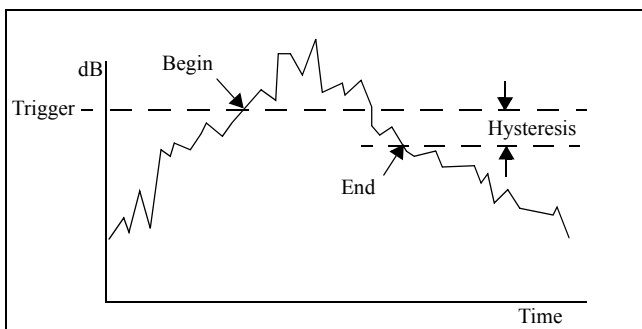
The *Pk Excd Lvl 2* sets the trigger level for the secondary peak detector (Pk-II). When the secondary peak detector level exceeds this threshold, the corresponding Pk-II exceedance count is incremented once. You can view this count on the *Stats-b* display. This count is associated with the overall measurement data and is reset when the overall measurement is reset.

This setting can include any integer value within the following range:

0 to 255 dB

Hysteresis - (LOG, SSA)

To prevent multiple triggering/counting of the same event, a hysteresis value may be entered. The event is triggered when a level goes over a corresponding trigger level, but does not become re-armed until the level drops below the value of the trigger level minus the hysteresis value.



This setting can include any integer value within the following range:

0 to 9dB

LOG and SSA Wind/Tach Settings

Other transducers providing similar pulse trains and DC voltages representing measured parameters could also be utilized in this manner. For example, engine tachometers frequently output such pulse trains and throttle position indicators usually output DC voltages. The setup permits the selection of units for both parameters which would be consistent with this alternative to windspeed/wind direction.

This feature is used most frequently with external weather transducers providing an analog pulse train whose frequency is proportional to windspeed and a DC voltage proportional to wind direction. However, other transducers could be utilized as explained in the left column. In the following description, it shall be assumed that windspeed and wind direction transducers are being used.

For the LOG instrument, these data are logged with the Daily, Advanced Time History, Interval and Exceedance records as selected by option settings.

For the SSA instrument, these data are logged with the Advanced Time History and Interval records as selected by option settings.






The Wind/Tach feature requires the optional firmware 824-WND. If it is not installed, attempting a setup will display the message shown to the right.

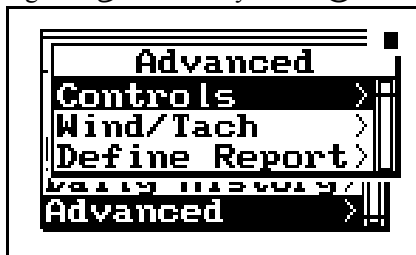
Wind/Tach
Not Available





This option may be purchased. Please contact Larson Davis

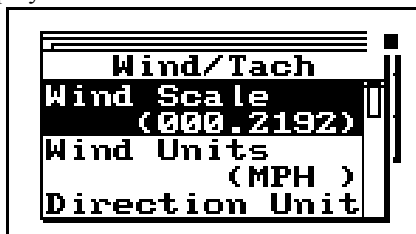
Phone: 801.375.0177

Setup of Wind/Tach Function

With either the LOG or SSA instrument active, press the  SETUP key to access the “Edit Setup Menu”. Using the  and  arrow keys, highlight the *Advanced* item and select it using the  arrow key or the  Check key.



Using the  and  arrow keys, highlight the *Wind/Tach* item and select it using the  arrow key or the  Check key to display the Wind/Tach menu.



Menu Items	Available Settings Options
Wind Scale	[nnn.nnn]
Wind Units	[cccc]

Menu Items	Available Settings Options
Direction Unit	Compass Degrees Percent Volts Number
Wind/Tach	No Yes
Windy Threshold	[nnn.n] or [nnnnn]
Wind Excd Level	[nnn.n] or [nnnnn]
Windy Hysteresis	[nnn.n] or [nnnnn]
Windy Pause Enable	No Yes
Pulse Trigger Voltage	0.0 2.5
Pulse Trigger Source	Int Ext

Wind Scale

Wind Scale is a scale factor which provides the wind speed (tach) when multiplied by the frequency of the wind speed (tach) signal from the external transducer. Limits to parameters associated with this factor are as follows:

Max. Input Freq.	25000 Hz
Max. Display Value	65535 units
Min. Input Freq.	1 Hz
Resolution	
Min. Display Value	0.01 units

Examples:

Type	Speed/Frequency	Wind Scale
YOUNG Wind Sentry	400.0 mph/235 Hz	1.7
YOUNG Wind Monitor	400.0 mph/1825 Hz	0.22
1 pulse/rev	30000 rpm/500 Hz	60
16 pulse/rev	30000 rpm/8000 Hz	3.75
600 pulse/rev	2500 rpm/25000 Hz	0.10

Wind Units

Wind Units is a four character alphanumeric field (e.g. mph, m/s, ft/s, etc.)

Direction Units

Direction Units. are used for describing Wind Direction or Throttle Position. There are five options available.

Compass

Compass reports wind direction using the following sixteen ordinate points: N, NNE, NE, ENE, E, ESE, SE, S, SSW, SW, WSW, W, WNW, NW, NNW.

Degrees

Degrees reports wind direction in degrees from 0 to 360°.

Percent

Percent would typically be used to report throttle position over the range 0 to 100% as a percent of full throttle.

Voltage

Voltage reports this parameter as a DC voltage over the range 0 to 2.49 volts.

Number

Number reports this parameter in numeric form between 0 and 255.93

Wind/Tach Enable

Note that when the Wind/Tach feature is enabled, Ln will automatically be enabled as well. When this occurs, the message "Setting Conflict" will be shown.

Select **Yes** to enable the Wind/Tach function. If disabled by selecting **No**, Wind/Tach data will not be measured and no corresponding data will be displayed in Views or presented in measurement results.

Windy Threshold

"Windy" is a condition defined by wind speed above a user-defined threshold value. Since wind can influence the propagation of sound, it is useful to note measurements which were made during periods of higher wind levels. The threshold level is entered as a number field using the Wind Units defined above.

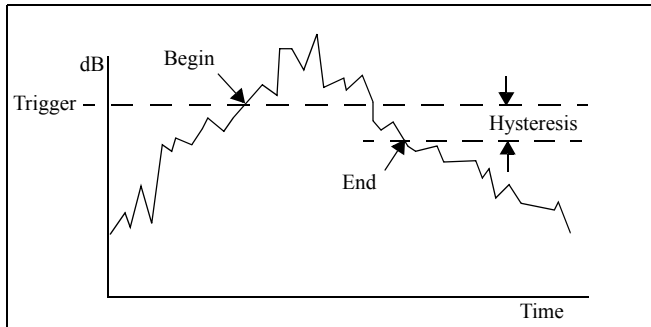
Wind Exceedance Level

The wind exceedance level represents a second threshold level, higher than that associated with Windy. Most often this is defined to be the wind level above which airflow over the microphone generates pressure variations not associated with actual acoustic signals. These pseudo-sound signals are detected by the microphone, producing erroneous results.

The System 824 can be set to pause sampling of the sound signal when the measured wind levels exceed this level. The instrument will also count the number of times the wind exceeds this level.

Windy Hysteresis

To prevent multiple triggering/counting of the same Wind exceedance event, a hysteresis value may be entered. The event is triggered when the wind level goes over the Wind exceedance level, but does not become re-armed until the level drops below the value of the exceedance level minus the hysteresis value.



Wind Pause Enable

Select **Yes** to enable the Wind Pause Function. This will cause the System 824 to pause sampling of the input signal whenever the wind speed is above the Wind Exceedance Level. Select **No** to disable this function.

Pulse Trigger Voltage

Select **0.0 V** for bipolar trigger signals which are essentially AC; triggering occurs on the zero crossing.

Select **2.5 V** for unipolar trigger signals, such as those based upon 0-5 volt logic.

Pulse Source





Generally the trigger signal for windspeed detection will be from an external transducer connected to the 9-pin connector labeled CONTROL. In this case, select **Ext**.

If **Int** is selected, the signal connected to the System 824 input will be used to determine the Wind/Tach level. This setting will allow the measurement of the frequency of an acoustic signal.

LOG and SSA Time History Settings

Time History Settings are available to both the Logging SLM (LOG) and SLM&RTA (SSA) instruments.

The time history recording stores an L_{EQ} , and if desired, one or more additional user-selected measurements, such as Lpk or Lmax. Levels can be stored rapidly, up to 32 samples per second with the LOG instrument and 8 samples per second with the SSA instrument. Since this function continues storing data as long as the measurement is in progress, the combination of a fast storage rate and a long measurement time can consume a large amount of data memory.

Use the  and  keys to move from one setting to the next. Then use the  key to change the selected setting. The  key is used to return to previous menus.

The following tables show the **Time History** settings for the LOG and SSA instruments. Each setting is described later in greater detail.

Menu Items (LOG instrument)	Available Settings Options
Hist Enable	No Yes
Hist Period	1 to 255
Period Units	1/32s 1.0s 10.0s 60.0s
Other Level	None Pk-II Pk-I Lmax Advc (See Adv TH)
Resolution	0.1 dB 1.0 dB
Adv TH	Activates a set of 3 displays used to configure what time history data will be stored. See page 7-26.
Marker Text	Marker 1 (Aircraft)
	Marker 2 (Automobile)
	Marker 3 (Truck)
	Marker 4 (Train)
	Marker 5 (Animal)

Menu Items (SSA instrument)	Available Settings Options
Hist Enable	No Yes
Hist Period	1 to 255
Period Units	1/32s 1.0s 10.0s 60.0s
Resolution	0.1 dB 1.0 dB
TH Setup	Activates a set of 3 displays used to configure what time history data will be stored. See "Advanced Time History - (LOG, SSA)" on page 7-35.
Marker Text	Marker 1 (Aircraft)
	Marker 2 (Automobile)
	Marker 3 (Truck)
	Marker 4 (Train)
	Marker 5 (Animal)

Hist Enable - (LOG, SSA)

This setting provides the following two options:

No - Time history storage is disabled.

Yes - Time history storage is enabled.

Hist Period (LOG, SSA)

This setting is used in conjunction with the “Period Units Setting” (below).

Hist Period sets the number of history **period units** that transpire between successive time history samples. These samples continue either until the instrument is stopped or runs out of memory. This setting can include any integer value in the following range:

(1) to (255)

Period Units - (LOG, SSA)

Period Units selects the type of units the instrument uses to calculate the time which transpires between successive time history storage operations. To calculate the timer period, the instrument multiplies the units selected in this setting by the number set in **Hist Period** setting (see the previous “Hist Period” setting and the following example).

Example: To measure 2 samples per second, set Hist Period to 16 and Period Units to 1/32s ($16/32=1/2$).

This setting provides the following four options:

When Takt functionality is enabled, the history period will be rounded to the nearest 5 second interval, and a warning, “Setting Conflict”, will appear. If the “Period Units” equal 1/32nd of a second, then the period will be forced to a count of 160 (5 seconds).

In the SSA instrument, the shortest time history period is 1/8th of a second. If the period is set to [1/32] of a second the history period will be forced to multiples of 4 to support the maximum data rate of 8 samples per second and the warning “Setting Conflict” is displayed.

1/32s - This sets the History Period Unit to 1/32 second intervals. Since the instrument samples the detector 32 times per second, this is the smallest resolution time period that you can use. If you set the time history period to 1/32 second (i.e. period setting = 1 and unit setting = Sample = 1/32s), the instrument will store every sample it takes.

1.0s - This sets the history period unit to one second.

10.0s - This sets the history period unit to ten seconds.

60.0s - This sets the history period unit to sixty seconds.

Other Level - (LOG only)

Use the **Other Level** setting to select the second measurement level stored in each time history record along with the L_{eq} . This setting provides the following options:

None - The instrument stores the L_{eq} but does not store a second level.

Pk-I - The second level the instrument stores is the greatest instantaneous level (L_{pk}) detected by the primary peak detector that occurred during the time history period. The primary peak level is weighted according to the state of the **Pk Weighting** setting.

Pk - II - The second level the instrument stores is the greatest instantaneous level (L_{pk}) detected by the secondary peak detector that has occurred during the time history period. The secondary peak level is weighted according to the state of the **Weighting** setting.

Lmax - The second level the instrument stores is the maximum level (L_{max}) that has occurred during the time history period.

The “Any Data” information stored with the Time History is accessed through the Time History menu under the “View” key.

Advc - Stores up to 38 different parameters with each time history period which are user selectable, such as: Leq, Peak, Max, Min, Takt maximal, battery voltage and temperature. See Advanced Time History screens below.

Resolution - (LOG, SSA)

In order to double the time history storage capacity, it is possible to reduce the resolution of the Time History record from 0.1dB to 1.0dB.

0.1dB - Leq and the optional Other Level are stored with the highest resolution (0.1dB) which requires 2 bytes of memory per level.

1.0dB - Leq and the optional Other Level are stored with 1.0dB resolution which requires only 1 byte per level stored. Levels are rounded to the nearest integer (85.5 would be stored as 86dB and 85.4 would be stored as 85dB).

Advanced Time History - (LOG, SSA)

Up to 40 different parameters can be stored (LOG and SSA) with each time history period including Wind/Tach data and spectral data (SSA only). These are all user selectable in the Advanced Time History displays.

The *Advanced Time History* displays are shown below:

```

Adv TH Setup-a
Le Pk  s  F  I  s  F  I
A:  0  0  /  0  0  /  0  0
C:  /  /  0  0  0  0  0
F:  0  /  0  0  0  0  0
Next Done
    
```

SSA & LOG

```

Adv TH Setup-b
Live
s  F  I
A:  0  0  0  LAFTMS
C:  0  0  0  RTA Leq
F:  0  0  0  RTA Live
Next Done
    
```

SSA only if Takt is ON

```

Adv TH Setup-c
Wind / Tach /
Temperature
External Volt
Battery Volt
Next Done
    
```

SSA & LOG

```

Adv TH Setup-b
Live
s  F  I
A:  0  0  0
C:  0  0  0  RTA Leq
F:  0  0  0  RTA Live
Next Done
    
```

SSA only if Takt is OFF

```

Adv TH Setup-b
Live
s  F  I
A:  0  0  0
C:  0  0  0
F:  0  0  0
Next Done
    
```

LOG only with Takt OFF

```









Adv TH Setup-b
Live
s  F  I
A:  0  0  0  LAFTMS
C:  0  0  0
F:  0  0  0
Next Done
    
```

LOG only with Takt ON

NOTE: RTA Leq and RTA Live are mutually exclusive, allowing you to choose only one for each time history period. (SSA only)

NOTE: If Spectral Ln is set to [Interval] and Interval Ln's is enabled and the Interval Period is 00:00:00 then the Interval Period is set to 00:00:01 (one second) and the warning "Setting Conflict" is displayed.

Once the Advanced Time History displays have been selected, do the following to navigate through and setup each display.

- Use the up  and down  and left  and right  arrow keys to move the cursor between each selection or check box.
- The Check  key toggles the selection on or off. The Reset key  will uncheck all the items on the current display.
- To move to the next screen, (a, b, or c), highlight "Next" and press the Check  key.
- When all of your selections have been made, highlight "Done" and press the Check  key.

Marker Text - (LOG, SSA)

One of the features of the 824 is the ability to **mark** or annotate the SLM Time History as the instrument is running. This allows the user to identify each noise source as the measurement is being taken. There are 5 **Markers** and each

marker can be assigned an 8 character description. See page 7-55 for a description of the **Marker** display.

LOG and SSA Interval Settings

Interval Settings are available on the LOG and SSA instruments.

The **Intervals** menu sets the System 824 to automatically store at regular time periods, Leq, SEL, Lmax, Lmin, L_{pkI}, L_{pkII}, and the six Ln levels. The Interval time period can range from one second to nearly one hundred hours. The Interval feature is particularly useful when monitoring noise levels for extended periods of time because you can determine how the statistical makeup of the acoustic environment has changed over time.

The ▲ and ▼ keys move from one setting to the next. The ▶ key changes the selected setting. The ◀ key is used to return to previous menus.

*The following table shows the available **Intervals** settings. Each setting is described later in greater detail.*

T

Menu Items	Available Settings Options
Intv Enable	No Yes
Intv Period	hh:mm:ss
Intv Time Sync	No Yes
Intv Save Ln's	No Yes

Intv Auto Stop	No Yes
Intv Threshold	0 to 255
Intv Exchange	3dB 4dB 5dB 6dB
Intv Spectrum (SSA only)	None @Max Mins

To store interval spectral Ln levels, set “Spectral Ln” to “Interval”, enable Ln and Interval histories and set “Intv Save Ln” to “Yes”.

Intv Enable - (LOG, SSA)

Intv Enable enables or disables the automatic storage of interval statistical records.

This setting provides the following two options:

No - Disables interval storage.

Yes - Enables interval storage.

NOTE: If Intervals are enabled and Interval Ln’s are enabled and Ln’s are not enabled then Ln’s are turned on and the warning “Setting Conflict” is displayed.

Intv Period - (LOG, SSA)

Intv Period sets the time interval between successive interval storage operations. These storage operations continue either until the instrument is stopped or runs out of memory. You can set this to any time value in the following range:

NOTE: If set to 00:00:00 then the period is 0.125 seconds for SSA and infinite for LOG.

00:00:01 to 99:59:59 (i.e. one second to 99 hours, 59 minutes and 59 seconds)

Intv Time Sync - (LOG, SSA)

Intv Time Sync setting either enables or disables the time interval sync feature. When enabled, this feature causes the Interval history storage operations to be synchronized with

the real-time of day clock. This synchronization can occur on a 1, 5, 10, 15, 20, 30, or 60 minute basis. The **Intv Period** setting should also be set accordingly so that the synchronization works properly. When you start a measurement, the initial storage interval will last for only a fraction of the determined synchronization until the start of the next time segment; at which time a new, synchronized storage interval will begin.

This setting provides the following two options:

No - Disables interval synchronization.

Yes - Enables interval synchronization.

Intv Save Ln's - (LOG, SSA)

Intv Save Ln's either enables or disables the automatic storage of the six L_N percentile levels in the interval record.

This setting provides the following two options:


No - The six L_N levels are not stored with the interval record.

Yes - The six L_N levels are stored with the interval record.

NOTE: If Intervals are enabled and Interval Ln's are enabled and Ln's are not enabled then Ln's are turned on and the warning "Setting Conflict" is displayed.

Intv Auto Stop - (LOG, SSA)

NOTE: Do not use this feature with the Time Sync feature, or you will not get the full time period you desire.

Use the **Intv Auto Stop** setting to enable or disable the auto-stop feature. When enabled, this feature causes the instrument to automatically stop the measurement at the end of each storage interval. This allows you to precisely time a series of manual measurements. To start a new measurement after an automatic stop, just press the  Run/Stop key.

This setting provides the following two options:

No - Disables the automatic stop feature.

Yes - Enables the automatic stop feature.

Intv Threshold - (LOG, SSA)

Intv Threshold sets the threshold for computing the interval time weighted average (TWA). As per the requirements of various regulatory agencies, only those sound levels which are above a certain threshold level are used when computing the TWA. Accordingly, this setting can take on any integral value within the following range:

0 to 255 dB

For hearing conservation measurements, set the threshold to 80dB. For most community noise measurements, set the threshold to 0dB.

Intv Exchange - (LOG, SSA)

The *Intv Exchange* sets the exchange rate (sometimes called the “doubling rate”) that is used to calculate the interval TWA. The exchange rate reflects the relationship between the permitted exposure levels and the exposure duration. Selecting an exchange rate of 5dB, for example, means that 5dB may be added to the permissible exposure level every time the exposure duration is cut in half. This setting provides the following four options:

3dB - The 3dB (default) option is the most commonly used and results in the L_{eq} time weighted average which is used in Europe and for measurements that comply with U.S. Environmental Protection Agency (EPA) regulations.

4dB - The 4dB option results in the L_{DOD} time weighted average which is used for measurements that comply with U.S. Department of Defense (DOD) regulations.

5dB - The 5dB option results in the L_{OSHA} time weighted average which is used for measurements that comply with U.S. Occupational Safety and Health Administration (OSHA) regulations.

6dB - The 6dB option results in the L_{Avg} time weighted average which is merely a convenient representation of the long-term average noise level as opposed to the RMS noise level.

Intv Spectrum - (SSA only)

The Intv Spectrum allows you the choice of storing spectral data with the interval. It will always give you the L_{eq}

spectra and one other spectra. This setting provides the following three options:

None - Does not store any spectral data besides the Leq spectra with the interval.

@Max - Stores the spectra associated with the maximum broadband level during the interval period.

Min - Stores the minimum level obtained by each filter. This is a bin by bin minimum level.

Logging SLM Exceedance History Settings

Exceedance History Settings are only available to the Logging SLM (LOG) instrument.

Exceedance History settings allow you to select what data will be saved in memory during an exceedance. An exceedance is defined as an acoustic event characterized by the instantaneous rms sound pressure level or peak level (Pk-1 or Pk-2) going above or exceeding a predetermined level. For further detail see the section "LOG and SSA Triggering Settings" on page 7-23.

Triggering - (LOG)

The Triggering menu defines event triggering used to initiate an exceedance or event. See "Logging SLM Triggering Setting" earlier in this chapter.

Excd Enable - (LOG)

The **Excd Enable** setting allows you determine whether or not exceedance data will be stored in memory when exceedance trigger conditions are met. This setting provides the following two options:

Yes - Exceedance data will be stored in memory when exceedance conditions are met.

No - Exceedance data will not be measured or stored in memory when exceedance conditions are met.

Min Duration - (LOG)

The **Min Duration** setting allows you to determine the minimum number of seconds an exceedance must last for it to be logged. This setting can take on any time value in the following range:

0-255 second

Excd Time Hist - (LOG)

The *Excd Time Hist* setting enables you to indicate whether or not to have an Exceedance Time History saved as part of the exceedance. This setting provides the following two options:

Yes - The Exceedance Time History will be saved.

No - The Exceedance Time History will not be saved.

T.H. Period - (LOG)

The *T.H. Period* setting allows you to set the period of time for the Leq stored in the Exceedance Time History, in steps of 1/32 seconds. This setting can take on any time value in the following range:

1/32 - 32/32 seconds

Excd Trigger - (LOG)

The *Excd Trigger* setting enables you to select whether the Exceedance Trigger utilizes the fixed trigger levels or uses a special 10 dB rise then fall Passby trigger. This setting provides the following two options:

Level - Enables fixed level triggering.

PassBy - Enables 10 dB Passby triggering.

Note: Minimum duration is not considered when using the Exceedance Trigger in Passby Mode.

Excd Time - (LOG)

Using the symmetry data provided with every exceedance it is possible to calculate the time of the Max even though you choose to record the start time of the event.

The *Excd Time* setting allows you to select whether the time reported for the exceedance is the time that it started or the time of the maximum level. This setting provides the following two options:

Start - The exceedance time will be logged at the beginning of the exceedance event.





Max - The exceedance time will be logged at the maximum level of the exceedance event.

Timed Excd Period - (LOG)

This setting will extend an event to be at least as long as the time set (mm:ss) if it is over the threshold for at least the minimum duration.

NOTE: This setting is only available through the serial port. using the command S76, see table "Setting Commands" on page A-30Logging SLM Daily History Settings

Daily History Settings are only available to the Logging SLM (LOG) instrument.

Use the  and  keys to move from one setting to the next. Then use the  key to change the selected setting. The  key is used to return to previous menus.

The Model 824 automatically calculates daily sound statistics including: L_{eq} 24, L_{dn} , CNEL, L_{peak} , L_{uwpk} , L_n 's, L_{max} , and L_{min} ; and for each hour of the day the hourly L_{eq} , the hourly EXCD L_{eq} and the resultant Background L_{eq} .

Menu Items	Available Settings Options
Daily Enable	Yes No
Daily L_n 's	Yes No

Daily Enable - (LOG)

Daily Enable allows you to store daily data such as listed above. This setting provides the following two options.

Yes - Storage of daily history data will occur.

No - Daily data will not be stored.

Daily L_n 's - (LOG)

Daily L_n 's allows you to store six L_n percentiles with the Daily History data. This setting provides the following options:





Yes - Storage of daily data for L_n 's percentile will occur.

No - Daily Data will not be stored for the L_n 's percentiles.

Logging SLM Define Report Settings

Define Report Settings are also available to the SSA instrument. For more details on Reporting, see "Printing a Report" on page 8-1

Define Report allows you to determine which individual reports will be included in the "Tailored" report. This allows you to tailor the measurements and the reports desired to your requirements.

Use the  and  keys to move from one setting to the next. Then use the  key to change the selected setting. The  key is used to return to previous menus.

The following is a table of the **Define Report** settings. Each setting is described later in greater detail.

Menu Items	Available Settings Options
Data Report	No Yes
Setup Report	No Yes
SPL Histogram	No Yes
Pk-1 Histogram	No Yes
Pk-2 Histogram	No Yes
Intv Report	No Short Long
Hist Report	No Yes

Data Report - (LOG, SSA)

The **Data Report** setting either enables or disables the printing of the data report. The data report contains all the basic measurement parameters for both the overall and current measurements. This setting provides the following two options:

No - The data report will not print.

Yes - The data report will print.

Setup Report - (LOG, SSA)

The Setup Report setting either enables or disables the printing of the setup report. The setup report shows each of the parameters and how they are set. This setting provides the following two options:

No - The data report will not print.

Yes - The data report will print.

SPL Histogram - (LOG)

SPL Histogram either enables or disables the printing of the SPL histogram report. The histogram report contains a histogram of the SPL levels that have occurred during the overall and current measurements. The report also prints a table of all (1 to 99%) L_N percentiles. This setting provides the following two options:

No - The SPL histogram report will not print.

Yes - The SPL histogram report will print.

Pk-1 Histogram - (LOG)

The *Pk-1 Histogram* setting either enables or disables the printing of the Peak I histogram report. The histogram report contains a histogram of the Peak I levels that have occurred during the overall measurement. This setting provides the following two options:

No - The peak I histogram report will not print.

Yes - The peak I histogram report will print.

Pk-2 Histogram - (LOG)

The *Pk-2 Histogram* either enables or disables the printing of the Peak 2 histogram report. The histogram report contains a histogram of the Peak 2 levels that have occurred during the overall measurement. This setting provides the following two options:

No - The peak 2 histogram report will not print.

Yes - The peak 2 histogram report will print.

Intv Report - (LOG, SSA)

The *Intv Report* either disables the printing of the interval report or enables either the “long” or the “short” version of this report. The “short” interval report contains all the basic measurement parameters for each interval period in a specified range of records. The “long” interval report contains everything the short report contains plus some additional information.

This setting provides the following three options:

No - The interval report will not print.

Short - The “short” interval report (including L_{\max} , L_{\min} , SEL, L_{eq} , Pk-I, Pk-II, overloads, and exceedances) will print.

Long - The “long” interval report (including L_{max} , L_{min} , SEL, L_{eq} , Pk-I, Pk-II, overloads, exceedances, and six Ln Percentiles) will print.

Hist Report - (LOG, SSA)

The **Hist Report** either enables or disables the printing of the Time history report. The history report contains the L_{eq} , and optionally one selectable level (Lpk-I, Lpk-II, or Lmax) basic measurement parameter for each time history period.

This setting provides the following two options:

No - The history report will not print.

Yes - The history report will print.

Menu Layout of SSA Settings

The SLM&RTA **Edit Settings** menu has 49 configurable items. Provided in this section is a table depicting the menu layout of the SLM&RTA instrument’s Settings.

Menu Items	Submenu	Available Settings Options
Title		User customized text entry

SLM	Detector	Slow Fast Impl
	Weighting	A C FLT
	Gain	A C FLT
	Transducer	Condnsr Elctret Direct
	Random Corr	No Yes
	Pk Weighting	A C FLT
RTA	RTA Detector	Slow Fast
	RTA Weighting	A C FLT
	Bandwidth	1/1 1/3

Intervals	Intv Enable	No Yes
	Intv Period	hh:mm:ss
	Intv Time Sync	No Yes
	Intv Save Ln's	No Yes
	Intv Auto Stop	No Yes
	Intv Threshold	0 - 255 dB
	Intv Exchange	3dB 4dB 5dB 6dB
	Intv Spectrum	None @Max Min

Time History	Hist Enable	No Yes
	Hist Period	0 - 255 (default: 60)
	Period Units	1/32s 1.0s 10.0s 60.0s
	Resolution	0.1db 1.0db
	TH Setup	Activates a set of 3 displays used to configure what time history data will be stored. See the section "Advanced Time History - (LOG, SSA)" on page 7-35.
	Marker Text	Marker 1 (Aircraft) Marker 2 (Automobile) Marker 3 (Truck) Marker 4 (Train) Marker 5 (Animal)

Ln	Enable	No Yes
	Start Level	0-99dB (default 15dB)
	Ln 1 Percent	Selectable (default: 1.67%)
	Ln 2 Percent	Selectable (default: 8.33%)
	Ln 3 Percent	Selectable (default: 33.33%)
	Ln 4 Percent	Selectable (default: 50%)
	Ln 5 Percent	Selectable (default: 66.67%)
	Ln 6 Percent	Selectable (default: 90%)
	Spectral LN	None Overall Interval
Triggering	SPL Excd Lvl 1	0 - 255 dB (default: 115dB)
	SPL Excd Lvl 2	0 - 255 dB (default: 120dB)
	Pk-1 Excd Lvl	0 - 255 dB (default: 140dB)
	Pk-2 Excd Lvl	0 - 255 dB (default: 140dB)
	Hysteresis	0 - 9 dB (default: 2dB)
Advanced	See "Advanced Menu Layout" on page 7-56	

Menu Layout of Integrating SLM (ISM) Settings

The Integrating SLM (ISM) *Edit Settings* menu has 16 configurable items. Provided in this section is a table depicting the menu layout of the ISM instrument's Standard Settings.

ISM Setting

Menu Items	Submenu	Available Settings Options
Title		User customized text entry

SLM	Detector	Slow Fast Impl
	Weighting	A C FLT
	Range	Normal Low High
	Transducer	Condnsr Elctret Direct
	Random Corr	No Yes
	Pk Weighting	A C FLT
	Crnt Exchange	3dB 4dB 5dB 6dB
	Crnt Threshold	0 - 255 dB
Advanced	See "Advanced Menu Layout" on page 7-56	

Menu Layout of Logging SLM Settings

The Logging SLM (LOG) *Edit Settings* menu has 66 configurable items. Provided in this section is a table depicting the menu layout of the LOG instrument's Standard Settings.

LOG Settings

Menu Items	Submenu	Available Settings Options
Title		User customized text entry
SLM	Detector	Slow Fast Impl
	Weighting	A C FLT
	Range	Normal Low High
	Transducer	Condnsr Elctret Direct
	Random Corr	No Yes
	Pk Weighting	A C FLT

TWA	Ovll Exchange	3dB 4dB 5dB 6dB
	Ovll Threshold	0 - 255 dB (default: 80dB)
	Ovll Criterion	0 - 255 dB (default: 90dB)
	Criterion Time	0 - 99 hours (default: 8 hours)
	Crnt Exchange	3dB 4dB 5dB 6dB
	Crnt Threshold	0 - 255 dB (default: 80dB)
	Crnt Criterion	0 - 255 dB (default: 90dB)
Ln	Start Level	0 - 99dB (default 15dB)
	Ln 1 Percent	Selectable (default: 1.67%)
	Ln 2 Percent	Selectable (default: 8.33%)
	Ln 3 Percent	Selectable (default: 33.33%)
	Ln 4 Percent	Selectable (default: 50%)
	Ln 5 Percent	Selectable (default: 66.67%)
	Ln 6 Percent	Selectable (default: 90%)
Triggering	SPL Excd Lvl 1	0 - 255 dB (default: 115dB)
	SPL Excd Lvl 2	0 - 255 dB (default: 120dB)
	PK-1 Excd Lvl	0 - 255 dB (default: 140dB)
	PK-2 Excd Lvl	0 - 255 dB (default: 140dB)
	Hysteresis	0 - 9 dB (default: 2dB)

Time History	Hist Enable	Yes (default) No
	Hist Period	0 - 255 (default: 60)
	Period Units	1/32s 1s (default) 10s 60s
	Other Level	None (default) Pk-II Pk-I Lmax Advc
	Resolution	0.1dB (default) 1.0dB
	Adv TH	Activates a set of 3 displays used to configure what type of time history data will be stored. See "Advanced Time History - (LOG, SSA)" on page 7-35.
	Marker Text	Marker 1 (Aircraft) Marker 2 (Automobile) Marker 3 (Truck) Marker 4 (Train) Marker 5 (Animal)

Intervals	Intv Enable	Yes (default) No
	Intv Period	0-24:0-60:0-60 (hh:mm:ss)
	Intv Time Sync	Yes (default) No
	Intv Save Ln's	Yes (default) No
	Intv Auto Stop	Yes No (default)
	Intv Threshold	0 - 255 dB
	Intv Exchange	3dB (default) 4dB 5dB 6dB
Excd History	Triggering	SPL Excd Lvl 1 SPL Excd Lvl 2 PK-1 Excd Lvl PK-2 Excd Lvl Hysteresis
	Excd Enable	Yes No (default)
	Min Duration	0 - 999 seconds
	Excd Time-Hist	Yes No (default)
	T.H. Period	0 - 255 seconds 9 multiplied by 1/32s
	Excd Trigger	Level PassBy
	Excd Time	Start Max

Daily History	Daily Enable	Yes No (default)
	Daily Ln's	Yes No (default)
Define Report	Data Report	Yes (default) No
Advanced	See Advanced Menu (below)	

Advanced Menu Layout


Menu Items	Submenu	Available Settings Options
Controls (See also "Control Settings (SSA, LOG)" on page 7-11)	AC/DC Output	AC-1 AC-2 AC-1 DC AC-2 DC AC-2 AC-1
	Logic-In Mode	None Pause Toggle Level Alarm

Menu Items	Submenu	Available Settings Options
Controls (Continued)	Logic-Out	Off RMS Peak R+P Intv R+I P+I R+P+I A:D R+A P+A R+P+A I+A R+I+A P+I+A R+P+I+A R/S Excd
	Logic-Out Time	0 - 255 sec
	Logic-Out #2	Off RMS Peak R+P Intv R+I P+I R+P+I A:D R+A P+A R+P+A I+A R+I+A P+I+A R+P+I+A R/S Excd
	Logic-Out #2 Time	0 - 255 sec

Menu Items	Submenu	Available Settings Options
Controls (Continued)	Heater On	No Yes
	E. A. Cal Tone	No Yes
Wind/Tach (See also "LOG and SSA Wind/Tach Settings" on page 7-25) This is an optional feature requiring the firmware 824-WND	Wind Scale	0.015 - 255.99
	Wind Units	4 alphanumeric characters
	Direction Units	Compass; 16 ordinates Degrees; 0 -360 Percent; 0 - 100 Volts: 0 - 2.49 Number; 0 - 255.93
	Wind/Tach	No Yes
	Windy Threshold Level	0.0 - 65,535
	Windy Exceedance Level	0.0 - 65,535
	Windy Hystereses	0.0 - 65,535
	Windy Pause Enable	No Yes
	Pulse Trigger Voltage	0.0 2.5
	Pulse Source	Int Ext
Define Report	Data Report	No Yes
	Setup Report	No Yes

Menu Items	Submenu	Available Settings Options
Define Report (Continued)	SPL Histogram	No Yes
	Pk-I Histogram	No Yes
	Pk-II Histogram	No Yes
	Interval Report	No Short Long
	History Report	No Yes
	Exceedance Report	No Short Long
	Daily Report	No Short Long

Check Menus

In addition to being able to modify an instrument ID's settings through the *Edit Settings* item in the *Setup* menu, selected settings can also be modified through what is known as a Check menu which is specific to the current display function. The Check menu is accessed simply by pressing the  Check key from within the System 824's different views.


The available Check menu options vary between an instrument ID's different views. The options available from each display allows the user to change settings peculiar to that display function. In many cases they are shortcuts to other displays. In some cases the check menu allows you to





toggle between a views tabular mode or graphical spectrum mode.


This section will present the following:

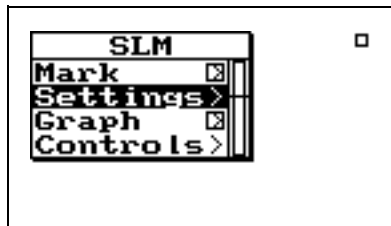
- Check Menu Example
- SLM Check Menu Options
- Other SSA Check Menus
- Other Logging (LOG) Check Menus

Check Menu Example

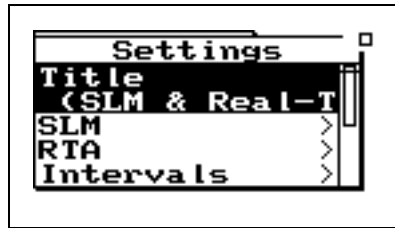
The Check menu is accessed by simply pressing the  Check key from within an Instrument ID's view. The following is an example of using the Check menu from a SLM view to change the **Detector** setting from the selected instrument's SLM display:

Use the  and  keys to move from one setting to the next. Then use the  key to change the selected setting. The  key is used to return to previous menus

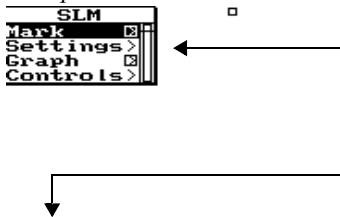
Step 1 From the Instrument's SLM (LOG or SSA) view display, press the  key to access the **Check** menu. A menu similar to the following appears:



Step 2 Use the \blacktriangle and \blacktriangledown arrow keys to highlight *Settings*, then press the \checkmark Check key or the \blacktriangleright arrow key. A menu similar to the following appears:

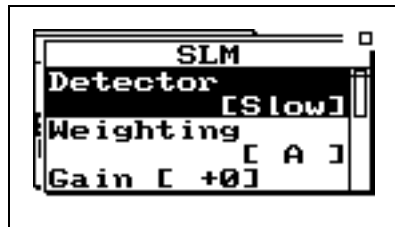


Pressing the right \blacktriangleright arrow key takes you to a different place than pressing the check \checkmark key. See example below:

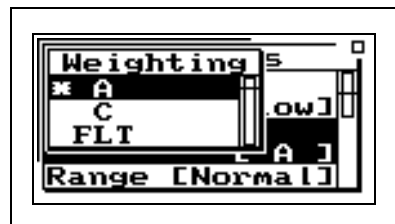


A box with an arrow next to a menu item indicates that you use the right arrow key to access another display or menu. The check \checkmark key takes you to a different place. An empty box indicates that a check \checkmark takes you to the same place as the right \blacktriangleright arrow key.

Step 3 Use the \blacktriangle and \blacktriangledown arrow keys to highlight *SLM*, then press the \checkmark Check key or the \blacktriangleright arrow key. A menu similar to the following appears:



Step 4 Use the \blacktriangle and \blacktriangledown arrow keys to highlight *Weighting*, then press the \checkmark Check key or the \blacktriangleright arrow key. A menu similar to the following appears:



Step 5 Highlight the desired weighting and press the \checkmark Check key.

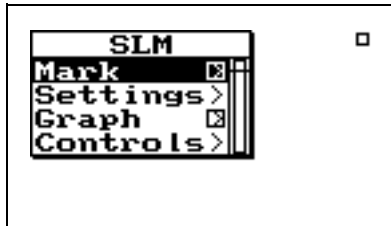
SLM Check Menu Options (SSA and LOG)

The Check menu's Controls and Settings items correspond to those described earlier in the Settings descriptions section of this chapter.


The SLM display check menus for the SSA and LOG instruments are identical. The following describes the Check Menu setting.

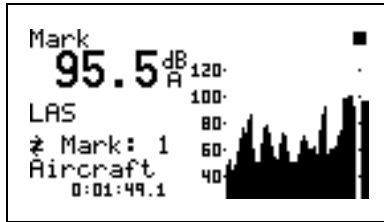
Menu Items	Purpose
Mark	Puts a marker in the time history
Settings	Modifies the SLM settings for the selected instrument
Graph	Changes the scaling of the instrument's SLM history graph
Controls	Modifies the Control menu for the selected instrument

The following screen appears when accessing the Check menu from the SLM view.



Mark Display

Pressing the right  arrow key when "Mark" is highlighted puts you in the "Mark" display. The following screen appears:



The “Mark” display shows the current SPL level and a time history of the SPL level is shown graphically. This enables you to set a marker in the time history. To set a marker in the time history, press the Check (✓) key. The following menu appears:



When “Set Mark” is initiated by pressing the Check (✓) key, a marker is placed into the time history record at that point in time.

With “Set Mark” highlighted, press the Check (✓) key to place a marker in the time history.

The Settings menu item in the “Mark” Check menu allows you to access the “Settings” menu in the marker area in order to change the marker descriptions.

The Graph menu item allows you to change the scaling of the Mark graph. (See below)

Graph Menu

There are two **Graph** settings available:

Menu Items	Available Settings Options
Graph Level	-39 to 799
Graph Scale	2, 1, 1/2, 1/4, 1/8


Graph Level may also be changed interactively with the Adjust Graph display (below).

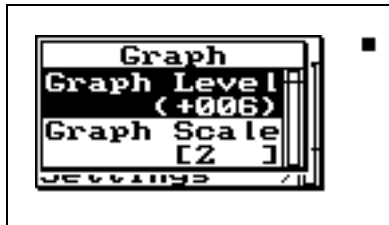
The **Graph Level** setting allow you to change the base level of the SPL history graph. The following is the possible setting range:






-39 to 799


The **Graph Scale** setting allows you to change the vertical range of the SPL history graph, using the following possible settings:

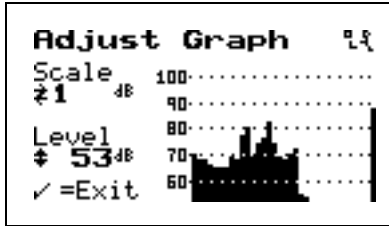
2, 1, 1/2, 1/4, 1/8 dB per dot (pixel)

Pressing the  arrow key on the Graph menu item allows you to adjust the graph settings through a menu. A screen similar to the following appears:




*The  or  key allows you to adjust the **Graph Level**. The  or  key allows you to adjust the **Graph Scale**. When you are finished customizing the settings of the graph, press the  key to finish.*

Pressing the  key on **Graph** menu item (from the SLM **Check** menu) allows you to graphically and interactively adjust the **Graph** settings. A screen similar to the followings appears:




Settings

The Settings menu allows you access to the SLM settings area that is usually accessed from the SETUP  key. (This is a shortcut to the SLM settings so you can modify the items in the SLM menu)


NOTE: Refer to the Settings Description section and the individual instrument's Settings Menu Layout sections for details on the configuration options for this menu.

Controls Settings Menu


Allows you access to the Settings menu in the Controls area that is usually accessed from the SETUP  key. (This is a shortcut to the Controls settings so you can modify the items in the Controls menu)

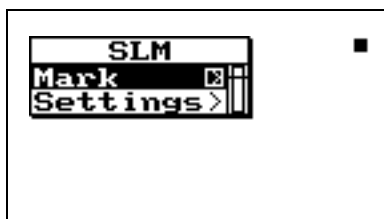
Other SSA Check Menus

NOTE: The SSA "Any Data" check menu is the same for the LOG instrument.

This section will present the Check menu screens that display when pressing  Check key from within the System 824 SSA instrument definition.

Any Data Check Menu

The following Check menu is accessible from the "Any Data" screen. Press the Check  key and the following appears:

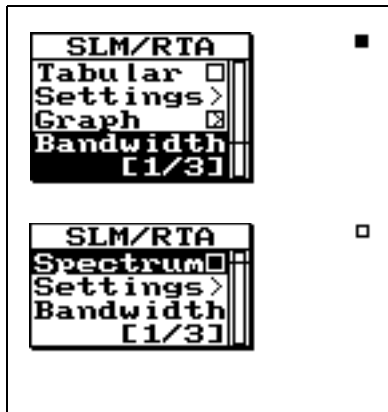


Following is a chart of the check menu with a description of each menu item:

Menu Items	Purpose
Mark	Puts a marker in the time history.
Settings	Modifies the SLM settings for the selected instrument.

RTA Check Menu

The following Check menus are accessible from the *RTA Live*, *RTA Leq*, *RTA Max* and *RTA Min* views:



Following is a chart of the check menu with a description of each menu item:

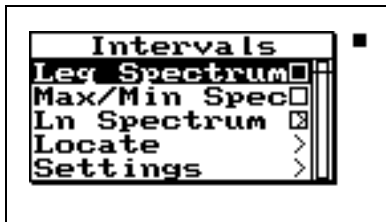
Menu Items	Purpose
Tabular/ Spectrum	Enables switching between spectrum (graphical) view and Tabular view.
Settings	Modifies the SLM settings for the selected instrument.

Graph	Changes the scaling of the instrument's SLM history graph
Bandwidth	Selects either 1/1 or 1/3 octave filters.

Intervals Check Menu

The intervals displays have three different check menus depending upon which display you are viewing.

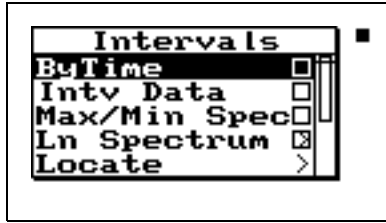
When viewing the displays *Interval-a* through *Interval-e* the following menu appears after pressing the Check (✓) key:



Following is a chart of the check menu with a description of each menu item:

Menu Items	Purpose
Leq Spectrum	Allows you to view the Leq spectral data
Max/Min Spectra	Allows you to view the Max or Min spectral data
Ln Spectrum	Allows you to view the Spectral Ln data
Locate	Locates a specific interval record
Settings	Modifies the interval settings


In the “Leq Spectrum” display press the Check (✓) key and the following menu appears:

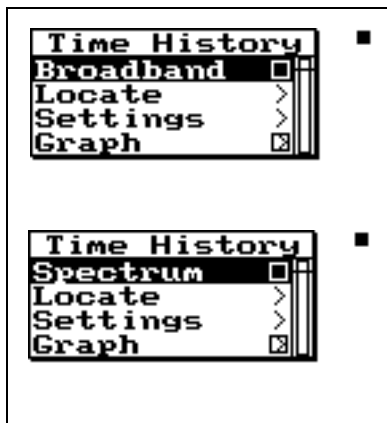


Following is a chart of the “Leq Spectrum” check menu with a description of each menu item:

Menu Items	Purpose
ByTime	Allows you to view the Leq for each interval over time
Intv Data	Allows you to view the <i>Interval-a</i> through <i>Interval-e</i> displays
Max/Min Spectra	Allows you to view the Max or Min spectral data
Ln Spectrum	Allows you to view the Spectral Ln data
Locate	Locates a specific interval record
Settings	Modifies the interval settings
Graph	Changes the scaling of the “Leq Spectra” graph
Bandwidth	Changes the filters to either 1/1 or 1/3 octave

Time History Check Menu

Press the Check  key while viewing either of the Time History displays and the following check menus appear:



Following is a chart of the Time History check menu with a description of each menu item:

Menu Items	Purpose
Broadband/ Spectrum	Allows you to view the broadband history graph or the spectral data
Locate	Locates a specific time history record
Settings	Modifies the time history settings
Graph	Changes the scaling of the instrument's time history graph.

Run Log Check Menu

Press the Check (✓) key while viewing the Run Log display and the following check menu appears:



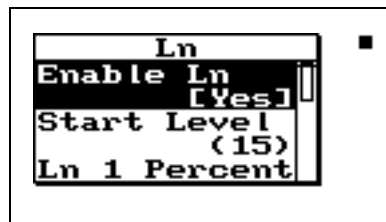
Following is a chart of the Run Log check menu with a description of each menu item:

Menu Items	Purpose
First	Locates the first Run Log record
Last	Locates the last Run Log record
Find	Finds the specified Run Log record
Locate T.H.	Displays the Time History

Ln Centiles Check Menus

There are three different Check menus contained within the Ln Centiles views.

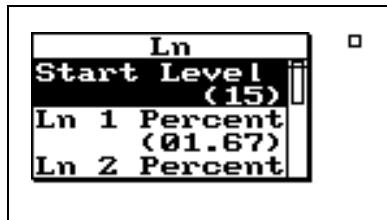
Press the Check (✓) key while viewing the Ln Centile's **broadband** displays and the following check menu appears:



Following is a chart of the Ln Centiles broadband check menu with a description of each menu item:

Menu Items	Purpose
Enable Ln	Enables or disables Ln data
Start Level	Sets the minimum dB level to be calculated in the Ln data
Ln 1 Percent	Changes the percentage for Ln 1
Ln 2 Percent	Changes the percentage for Ln 2
Ln 3 Percent	Changes the percentage for Ln 3
Ln 4 Percent	Changes the percentage for Ln 4
Ln 5 Percent	Changes the percentage for Ln 5
Ln 6 Percent	Changes the percentage for Ln 6
Spectral LN	None Overall Interval

Press the Check (✓) key while viewing the Ln Centile's **spectral** displays and the following check menu appears:



Following is a chart of the Ln Centiles **spectral** check menu with a description of each menu item:

Menu Items	Purpose
Start Level	Sets the minimum dB level to be calculated in the Ln data
Ln 1 Percent	Changes the percentage for Ln 1
Ln 2 Percent	Changes the percentage for Ln 2
Ln 3 Percent	Changes the percentage for Ln 3
Ln 4 Percent	Changes the percentage for Ln 4
Ln 5 Percent	Changes the percentage for Ln 5
Ln 6 Percent	Changes the percentage for Ln 6

Press the Check (✓) key while viewing the Ln Centile's spectrum displays and the following check menu appears:



Menu Items	Purpose
Settings	Modifies the spectral Ln settings. (See table above, “spectral check menu items”, for a description of the settings)
Graph	Changes the scaling of the instrument's spectrum graph.

Other Logging (LOG) Check Menus

See "SLM Check Menu Options (SSA and LOG)" on page 7-62 for a description of the (LOG) SLM check menu.

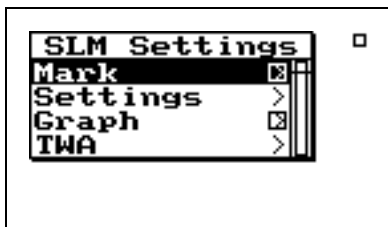
This section presents the LOG instrument's available Check menus that are in addition to the SLM Check menu previously described in this chapter.

Any Data Check Menu

See "Any Data Check Menu" on page 7-73 for a description

Current SLM / Overall SLM Check Menu

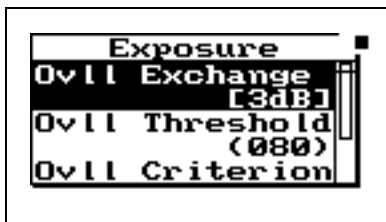
Current SLM and *Overall SLM* views have access to the following Check menu:



Menu Items	Purpose
Mark	Puts a marker in the time history record if the check C key is pressed. If the right arrow key is pressed it puts you in the Marker screen.
Settings	Modifies the SLM settings for the selected instrument.
Graph	Changes the scaling of the instrument's SLM history graph.
TWA	Modifies the TWA settings for the selected instrument.

Exposure Check Menu

The *Exposure* view has access to the following Check menu:



Menu Items	Purpose
Ovll Exchange	Sets the exchange rate that is used to calculate the overall TWA.
Ovll Threshold	Sets the threshold for computing the overall time weighted average (TWA)
Ovll Criterion	Sets the TWA level which constitutes 100% dose for the overall measurement.
Criterion Time	Sets how long of an exposure time for the TWA level you can have before 100% dose occurs for the overall measurement.

LN Centiles Check Menu

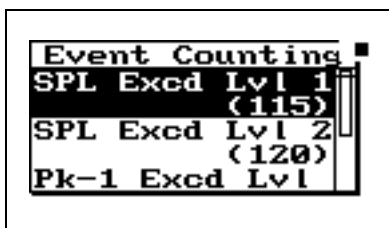
The *Ln Centile* view has access to the following Check menu:



Menu Items	Purpose
Settings	Modifies the Ln percentiles settings for the selected instrument.
Graph	Changes the scaling of the instrument's Ln-b Centiles graph

Stats Check Menu

The *Stats* view has access to the following Check menu:



Menu Items	Purpose
SPL Excd Lvl 1	Sets the lowest SPL trigger level.
SPL Excd Lvl 2	Set the higher trigger level.
Pk-1 Excd Lvl	Sets the trigger level for the primary peak detector (i.e. Pk-I).
Pk-2 Excd Lvl	Sets the trigger level for the secondary peak detector (i.e. Pk-II).
Hysteresis	Sets a hysteresis value to prevent multiple triggering/counting of the same event

Run Log Check Menu

See "Run Log Check Menu" on page 7-75 for a description of the Run Log check menu for the LOG instrument.

Time History Check Menu

The *Time History* view has access to the following Check menu:



Menu Items	Purpose
Mark	Puts a marker in the time history record
Locate	Allows you to locate a time history record
Settings	Modifies the Time History Settings.
Graph	Adjusts the scaling of the Time History graph

Intervals Check Menu

The *Intervals* view has access to the following Check menu:

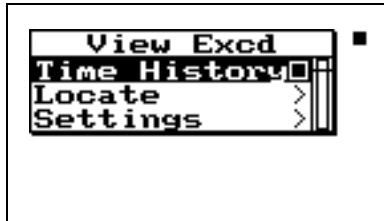


Menu Items	Purpose
Locate	Locates an interval record
Settings	Modifies the Interval Settings.

Excd History Check Menu

The *Excd History* displays have two different check menus depending upon which display you are viewing.

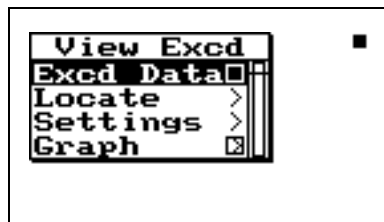
When viewing the displays *Excd-a* through *Excd-b* the following menu appears after pressing the Check (✓) key:



Following is a chart of the check menu with a description of each menu item:

Menu Items	Purpose
Time History	Displays the Excd time history graph
Locate	Locates a specific Exceedance record
Settings	Modifies the Exceedance settings

In the "Excd Time History" display press the Check (✓) key and the following menu appears:



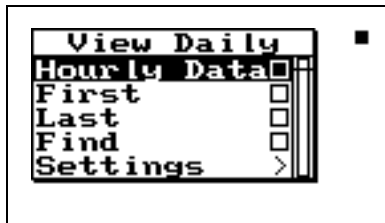
Following is a chart of the “Excd Time History” check menu with a description of each menu item:

Menu Items	Purpose
Excd Data	View Excd-a and Excd-b displays
Locate	Locates a specific Exceedance record
Settings	Modifies the Exceedance settings
Graph	Adjusts the scaling of the Excd Time History graph

Daily History Check Menu

The *Daily History* display has two different check menus, one for the Daily data and one for the Hourly data.

When viewing the Daily History the following menu appears after pressing the Check (✓) key:



Following is a chart of the “Daily History” check menu with a description of each menu item:

Menu Items	Purpose
Hourly Data	Displays hourly data
First	Displays the first hourly record
Last	Displays the last hourly record
Find	Displays a specific record
Settings	Modifies the Daily History settings

In the “Hourly” display press the Check (✓) key and the following menu appears:



Following is a chart of the “Hourly History” check menu with a description of each menu item:

Menu Items	Purpose
Daily Data	Displays Daily data
First	Displays the first hourly record
Last	Displays the last hourly record
Find	Displays a specific record
Settings	Modifies the Daily History settings
Graph	Adjusts the scaling of the Hourly Leq graph

*NOTE: Check menus are not available for the **Metrics**, **PassBy**, and **Wind / Tach** views.*

Printing a Report

The System 824 allows you to print a report from data collected during a measurement. This chapter will discuss the following aspects of printing reports:

- Connecting the 824 to a Serial Printer
- Printing Reports
- Defining and Printing Tailored Reports
- Printing a Custom Report

While most users will normally print 824 data using a computer, it is possible to print both graphical and tabular data reports directly from the 824 to virtually any serial printer. Printouts range from high resolution presentation quality reports when printing to a laser printer because of the instrument's PDL-3 (page description language) capabilities, to draft-quality tabular data reports that can also be printed to a dot matrix printer.

Connecting the 824 to a Serial Printer

Another cable is available for certain printers that have a 9-pin female "D" connector (CBL091).


If your printer does not have either of these connectors, it is likely not a serial printer. Do not attempt to connect the 824 as damage may result.

Make sure the System 824 and your printer are turned off before initiating any of the following steps.

- Step 1** Connect the provided (CBL002) serial cable's 8-pin mini DIN connector to the System 824 serial port.
- Step 2** Connect the serial cable's 25-pin male "D" connector to your printer's serial port.

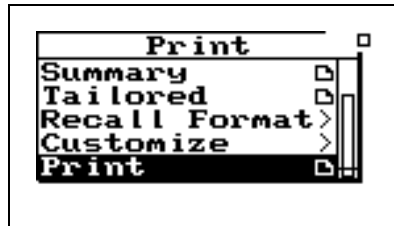
Step 3 Turn on your printer and the System 824.

Printing Reports

Step 1 Press the  Data key and use the **Recall Files** menu to recall the measurement record that you want to print. You may not need to recall a file if you want to print something in memory that has not been stored.

Depending on whether you have selected an SSA, ISM, LOG, or RTA instrument from the Setup menu you will have a different Print menu available. The screen shown is for the SSA instrument.

Step 2 Press the  Print key. The following screen appears:



The TAL and FFT instruments do not generate any reports.

The Print menu provides different options depending on instrument type.

The following table shows the menu options for the SSA, ISM, LOG and RTA Print menus:

Menu Item	Options/Description	Available To:
Status	[shows the status of the printing job]	SSA, ISM, LOG, RTA
Settings	Printer Type Printer Baud Flow Control	SSA, ISM, LOG, RTA
SPL Report	[prints an SPL report]	ISM
Summary	[prints a summary report]	SSA, LOG, RTA
Tailored	[prints the tailored report]	SSA, LOG

Recall Format	Summary Tailored All, short All, long None enabled	SSA, LOG
Customize	[allows you to select the print options for an instrument ID and customize your reports - see the section on “Printing a Custom Report”]	SSA, LOG, RTA
Print	[prints the report]	SSA, ISM, LOG, RTA




Step 3 Use the ▲ and ▼ arrow keys to highlight Settings, then press the ► arrow key or ✓ Check key to select it. The following menu appears:

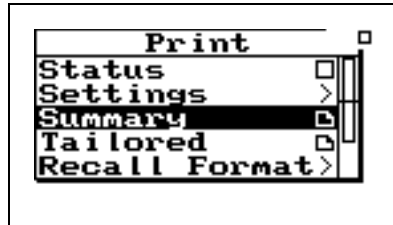


Depending on your printer configuration you may have to modify the Printer Settings for Printer Baud Rate and Flow Control.

Use the table below to set up the printer settings by using the ▲ and ▼ arrow keys to highlight “Printer Type”, “Printer Baud”, and “Flow Control” and then press the ✓ Check key to select the correct option for each.

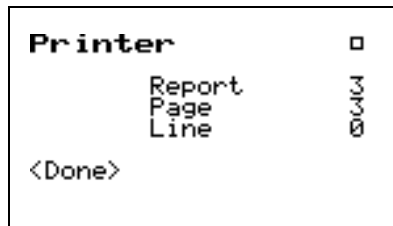
Menu Item	Options
Printer Type	ASCII, Epson, IBM, HPJet, HPLzr
Printer Baud	300, 1200, 2400, 9600, 19200, 28800, 57600, 115 K
Flow Control	None, Hdwr, XOff, Both


- Step 4** Use the  arrow key to return to the main *Print* menu. You will notice that there is a paper page icon  next to the “Summary” menu item. This means that a report will be printed by highlighting “Summary” and pressing the Check  key.



The title printed on your report will correspond to the Title setting you have configured in the Setup menu for the selected ID.

- Step 5** Your Report will now begin printing and the Status screen will appear.



Press the  check key to abort the printing job.

Defining and Printing Tailored Reports

In the System 824, Tailored Reports are available to the SSA and LOG instruments.

Selecting "Tailored Report" under the Print menu copies the report settings under "Define Report" from the Setup Menu for the SSA and LOG instruments for printing.




With the System 824, a tailored report setting for each SSA or LOG instrument ID can be created (i.e. each user can set up their own user-defined print settings). Therefore, each SSA or LOG instrument ID can have its own pre-set customized report settings. This section discusses how to define and print tailored reports for the SSA and LOG instruments.

The following table shows the available settings for a Tailored report for the SSA instrument:





Menu Item	Options
Unformatted	No Yes
Data Report	No Yes
Setup Report	No Yes
Intv Report	No Short Long
History Report	No Yes

The settings for a LOG instrument Tailored report are shown under "Tailored Report Template (LOG instrument)" on page 8-13.





The following provides an example of how to define and print a tailored report:

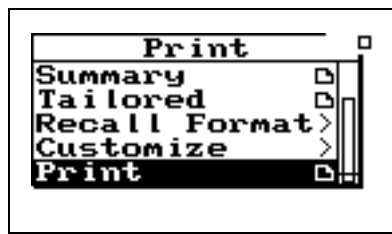
- Step 1** Press the  Setup key to bring up the *Setup* menu. Highlight the *Edit Settings* menu item and press  arrow key or the  Check key to select it.







- Step 2** Using the  and  arrow keys, highlight the *Advanced* item, then select it using the  arrow key or the  Check key. The following screen appears:







- Step 3** Using the  and  arrow keys, highlight the *Define Report* item, then select it using the  arrow key or the  Check key. The following screen appears:

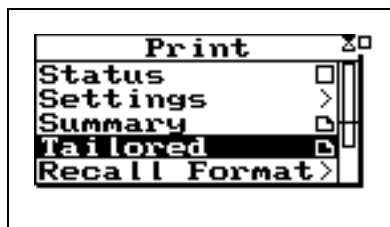


- Step 4** Use the  and  arrow keys to scroll through the available report settings. Use the  Check key to select and change the options for each type of report.

Step 5 Press the  Print key to bring up the **Print** menu.

For your report to print properly, your printer must be connected as described in "Connecting the 824 to a Serial Printer" on page 8-1 and configured as described in "Printing Reports" on page 8-2.

Step 6 Using the  and  arrow keys highlight the **Tailored** item, then select it using the  arrow key or the  Check key and your "Tailored" report will begin printing.




NOTE: Make sure you save your Instrument ID before you change to a different Instrument ID, otherwise all your newly defined tailored print settings will be lost.

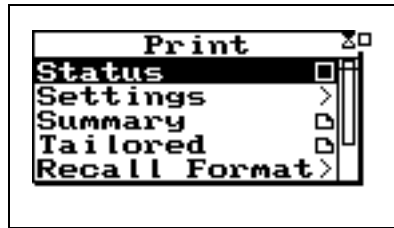
Using the Recall Format (SSA and LOG instruments only)




The Recall Format menu allows you to customize the **Summary** report or the **Tailored** report and gives you two more customized reports called **All, Long** and **All, Short**. When the summary report is recalled, the Customize menu is changed to reflect those parameters which will be printed in the summary and tailored reports.

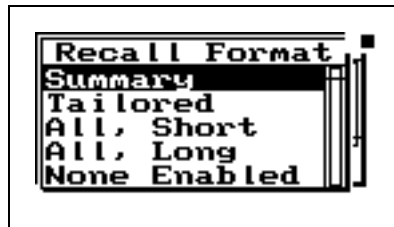
The Customize menu is formatted with all of the parameters for each report selected in the Recall Format menu. You can choose to print the default parameters that are recalled for each report or you can go into the Customize menu and make further changes to the parameters.



Before beginning to Print, always recall the file and select the data that you would like to print. The following shows how to print from the Recall Format:

- Step 1** To print from the Recall Format menu press the  PRINT key. The following screen appears:



- Step 2** Use the  and  arrow keys to highlight the Recall Format menu. Press the  key and the following screen appears:



- Step 3** Use the  and  arrow keys and select the report that you want to print (Summary, Tailored, All, Short, All, Long, or None Enabled).

Default Settings Values for the Recall Format Reports

The following tables show the default settings for each of the templates available from the Recall Format menu (Summary, Tailored, All, Long, All, Short, and None Enabled).

Summary Report Template

This template shows the default settings for the Summary Report. The Summary Report includes the Data Report and the Log Report.

After selecting the template, you can modify it as explained in "Printing a Custom Report" on page 8-23.

Summary Report Template (SSA instrument)


Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read, Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Setup Report [No]		Print the settings and their values for the SSA instrument.
Intv Report [No]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values and Spectral LNs for the Interval.
Hist Report [No]		Leq for each time history period.
Print Range	Intv Report [No]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [No]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [No]	Prints SPL histogram and overall Spectral LN report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.

Summary Report Template (SSA instrument)		
Histograms	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

Summary Report Template (LOG instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Log Report [Yes]		The run/stop log and with the date and time of each run/stop.
Setup Report [No]		Print the settings and their values for the LOG instrument.
SPL Histogram [No]		Shows 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.
Excd Report [No]		Lists Number of Record, Exchange Rate, Minimum Duration Time, Period, Mode, Start Time, Leq, Max, Peak, Overloads, Unweighted Peak, Duration, SEL, and Spectrum.
Intv Report [No]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values for the Interval period.
Hist Report [No]		Leq for each time history period.
Daily Report [No]		Lists date, duration, Leq, Peak, Uwpk, Ldn, Lmax, CNEL, and Lmin.
Print Range	Excd Report [No]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest exceedance record to be printed.
	Highest Record (65535)	Selects the highest exceedance record to be printed.
	Intv Report [No]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [No]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.

Summary Report Template (LOG instrument)		
Histograms	SPL Histogram [No]	You can customize the SPL Histogram report by choosing the long or short report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

Tailored Report

This template shows the default settings for the Tailored Report. The Tailored Report uses the settings from the “Define Report” menu under the  Setup key. This allows you to create a custom report for any SSA or LOG instrument ID.

The Tailored Report includes the Data Report, Log Report, Setup Report, Interval Report (Short), Exceedance Report, and the Daily Report.

After selecting the template you can modify it as explained in "Printing a Custom Report" on page 8-23.

Tailored Report Template (SSA instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Setup Report [Yes]		Print the settings and their values for the SSA instrument.
Intv Report [Short]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values and Spectral LNs for the Interval period.
Hist Report [No]		Leq for each time history period.
Print Range	Intv Report [Short]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed
	Hist Report [No]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (>99999)	Selects the highest interval record to be printed
Histograms	SPL Histogram [No]	Prints SPL histogram and overall Spectral LN report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.

Tailored Report Template (SSA instrument)		
Histograms	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (140)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

Tailored Report Template (LOG instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Log Report [Yes]		The run/stop log and with the date and time of each run/stop.
Setup Report [No]		Print the settings and their values for the LOG instrument.
SPL Histogram [No]		The 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.
Intv Report [Short]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values for the Interval period.
Hist Report [Yes]		Leq for each time history period.
Excd Report[Short]		Lists number of Record, Exchange Rate, Minimum Duration Time, Period, Mode, Start Time, Leq, Max, Peak, Overloads, Unweighted Peak, Duration, SEL, and Spectrum.
Daily Report[Short]		Lists date, duration, Leq, Peak, Unweighted Peak, Ldn, Lmax, CNEL, and Lmin.

Tailored Report Template (LOG instrument)		
Print Range	Intv Report [Short]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [Yes]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [No]	You can customize the SPL Histogram report by choosing the long or short report.
	Lowest Level (040)	Selects the lowest SPL histogram level to be printed.
	Highest Level (090)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (140)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

All, Short Report

This template shows the default settings for the All, Short Report. The All, Short Report prints all of the reports. Those reports with a Short version are printed in the short form.

After selecting the template you can modify it as explained in "Printing a Custom Report" on page 8-23.

All, Short Report Template (SSA instrument)

Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read, Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Setup Report [Yes]		Print the settings and their values for the SSA instrument.
Intv Report [Short]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values and Spectral LNs for the Interval period.
Hist Report [Yes]		Leq for each time history period.
Print Range	Intv Report [Short]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [Yes]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [Yes]	Prints SPL histogram and overall Spectral LN report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [Yes]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [Yes]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.

All, Short Report Template (SSA instrument)		
Histograms	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

All, Short Report Template (LOG instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Log Report [Yes]		The run/stop log and with the date and time of each run/stop.
Setup Report [Yes]		Print the settings and their values for the LOG instrument.
SPL Histogram [Yes]		The 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.
Intv Report [Short]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values for the Interval period.
Hist Report [Yes]		Leq for each time history period.
Print Range	Intv Report [Short]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [Yes]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.

All, Short Report Template (LOG instrument)		
Histograms	SPL Histogram [Yes]	You can customize the SPL Histogram report by choosing the long or short report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [Yes]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [Yes]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

All, Long Report

This template shows the default settings for the All, Long Report. The All, Long Report prints all of the reports. Those reports with a long version are printed in the long form.

After selecting the template, you can modify it as explained in "Printing a Custom Report" on page 8-23.

All, Long Report Template (SSA instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Setup Report [Yes]		Print the settings and their values for the SSA instrument.

All, Long Report Template (SSA instrument)		
Intv Report [Long]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values and Spectral LNs for the Interval period.
Hist Report [Yes]		Leq for each time history period.
Print Range	Intv Report [Long]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [Yes]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [Yes]	Prints SPL histogram and overall Spectral LN report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (1.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [Yes]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (140)	Selects the highest Peak1 histogram level to be printed.
	Resolution (1.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [Yes]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (1.0)	Selects the Peak2 histogram resolution

All, Long Report Template (LOG instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.

All, Long Report Template (LOG instrument)		
Data Report [Yes]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Log Report [Yes]		The run/stop log and with the date and time of each run/stop.
Setup Report [Yes]		Print the settings and their values for the LOG instrument.
SPL Histogram [Yes]		The 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.
Intv Report [Long]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values for the Interval period.
Hist Report [Yes]		Leq for each time history period.
Print Range	Intv Report [Long]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [Yes]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [Yes]	You can customize the SPL Histogram report by choosing the long or short report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (1.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [Yes]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (140)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [Yes]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (1.0)	Selects the Peak2 histogram resolution

None Enabled Report

When “None Enable” is selected from the Recall Format menu then all of the reports are disabled and will not be printed. This allows you greater ease in printing only a selected number of reports.

After selecting this template you can modify it as explained in "Printing a Custom Report" on page 8-23.

None Enabled Report Template (SSA instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [No]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Setup Report [No]		Print the settings and their values for the SSA instrument.
Intv Report [No]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values and Spectral LNs for the Interval period.
Hist Report [No]		Leq for each time history period.
Print Range	Intv Report [No]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [No]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.

None Enabled Report Template (SSA instrument)		
Histograms	SPL Histogram [No]	Prints SPL histogram and overall Spectral LN report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution

None Enabled Report (LOG instrument)		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		A dump of all Read , Query and Interval remote commands. Multiple values are comma delimited.
Data Report [No]		This shows general information such as Leq, SEL, Dose, Projected Dose, Lmin, Lmax, Peak, Ln's, exceedance, and calibration logs.
Log Report [No]		The run/stop log and with the date and time of each run/stop.
Setup Report [No]		Print the settings and their values for the LOG instrument.
SPL Histogram [No]		The 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.
Intv Report [No]		Leq, SEL, Lmin, Lmax, Peak, Uwpk, exceedances, time, date, and duration in the short report. The Long reports adds the Ln values for the Interval period.
Hist Report [No]		Leq for each time history period.


None Enabled Report (LOG instrument)		
Print Range	Intv Report [No]	You can customize the interval report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest interval record to be printed.
	Highest Record (65535)	Selects the highest interval record to be printed.
	Hist Report [No]	You can customize the time history report by choosing the long or short report.
	Lowest Record (00000)	Selects the lowest time history record to be printed.
	Highest Record (>99999)	Selects the highest time history record to be printed.
Histograms	SPL Histogram [No]	You can customize the SPL Histogram report by choosing the long or short report.
	Lowest Level (045)	Selects the lowest SPL histogram level to be printed.
	Highest Level (095)	Selects the highest SPL histogram level to be printed.
	Resolution (5.0)	Selects the SPL histogram resolution
	Pk-1 Histogram [No]	You can customize the Peak1 Histogram report by choosing the long or short report.
	Lowest Level (110)	Selects the lowest Peak1 histogram level to be printed.
	Highest Level (160)	Selects the highest Peak1 histogram level to be printed.
	Resolution (5.0)	Selects the Peak1 histogram resolution
	Pk-2 Histogram [No]	You can customize the Peak2 Histogram report by choosing the long or short report.
	Lowest Level (070)	Selects the lowest Peak2 histogram level to be printed.
	Highest Level (120)	Selects the highest Peak2 histogram level to be printed.
	Resolution (5.0)	Selects the Peak2 histogram resolution




Printing a Custom Report

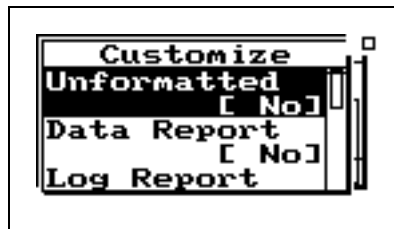
The ISM instrument does not allow printing customized reports.




In addition to being able to print your standard reports for data taken with the SSA, LOG, or RTA instruments, you can also further customize your report definitions at print time with the **Print** menu's **Customize** option.

The following provides an example of printing a customized report:




Step 1 Press  key to bring up the **Print** menu.

Step 2 Use the  and  arrow keys to highlight the **Customize** item, then select it using the arrow key or the  Check key. The following screen appears:



Step 3 Use the  and  arrow keys to scroll through the available report settings. Use the  Check key to select the settings that you want to modify, then make the modifications.

For your report to print properly, your printer must be connected as described in "Connecting the 824 to a Serial Printer" on page 8-1 and configured as described in "Printing Reports" on page 8-2.

Step 4 Use the  arrow key to completely back out of the **Customize** menu screen, then use the  arrow key to highlight the **Print** item, then select it using the  Check key. Your Customized report will now print.

The following table shows the available options under the *Customize* menu for the SSA instrument:

Spectral LNs are printed in the Long Intv Report.

Menu Items	Options
Unformatted	No Yes
Data Report	No Yes
Setup Report	No Yes
Intv Report	No Short Long
Hist Report	No Yes
Print Range	Intv Report (No, Short, Long) -Lowest Record -Highest Record Hist Report (No, Yes) -Lowest Record -Highest Record
Histograms	SPL Histogram (No, Yes) Lowest Level Highest Level Resolution Pk-1 Histogram (No, Yes) Lowest Level Highest Level Resolution Pk-2 Histogram (No, Yes) Lowest Level Highest Level Resolution

The following table shows the available options under the *Customize* menu for the LOG instrument:

Menu Items	Options
Unformatted	No Yes
Data Report	No Yes
Log Report	No Yes
Setup Report	No Yes
SPL Histogram	No Yes
Excd Report	No Short Long
Intv Report	No Short Long
Hist Report	No Yes
Daily Report	No Yes

Print Range	Excd Report (No, Short, Long) -Lowest Record -Highest Record Intv Report (No, Short, Long) -Lowest Record -Highest Record Hist Report (No, Yes) -Lowest Record -Highest Record
Histograms	SPL Histogram (No, Yes) Lowest Level Highest Level Resolution Pk-1 Histogram (No, Yes) Lowest Level Highest Level Resolution Pk-2 Histogram (No, Yes) Lowest Level Highest Level Resolution

NOTE: See the section "Summary Report Template" on page 8-8 descriptions of each report for the SSA and LOG instruments.

The following table shows the available options under the **Customize** menu for the RTA instrument:

(RTA instrument)		
Report	Options	Description
Data Report	No Yes	Name and Address of Company and date printed.
Live	No Yes	Shows beginning and ending date and time, runtime, type of Averaging, sample rate, trigger phase ad Live Spectrum.
Leq	No Yes	Shows beginning and ending date and time, runtime, type of Averaging, sample rate, trigger phase ad Leq Spectrum.
Max	No Yes	Shows beginning and ending date and time, runtime, type of Averaging, sample rate, trigger phase ad Max Spectrum.
Min	No Yes	Shows beginning and ending date and time, runtime, type of Averaging, sample rate, trigger phase ad Min Spectrum.

(RTA instrument)		
Autostore Rpt	No Short Long	The Short report prints the Leq, Lmax and Lmin spectrum. In addition, the ByTime Spectrums are included in the Long report.
Lowest Record	0 - 65535	The lowest Autostore Record to print.
Highest Record	0 - 65535	The highest Autostore Record to print.
Lowest ByTime	0 - 65535	The lowest ByTime Spectrum to print.
Highest ByTime	0 - 65535	The highest ByTime Spectrum to print.
RT-60 Report	No Yes	Prints the calculated RT60 for every octave or 1/3 octave band.
Avg Hist	No Yes	Spatial Average History
Lowest Record	0 - 65535	The lowest Spatial Average History Spectrum to print
Highest Record	0 - 65535	The highest Spatial Average History Spectrum to print
Setup Report	No Yes	Print the settings and their values for the RTA instrument.

9

Performing a Sound Level Measurement

Due to the many features of the System 824 and the variety of measurements it is capable of performing, there is a great deal of instructive material in the preceding chapters. In this chapter, to assist the new user in performing a basic sound level measurement, we work our way through the specific steps necessary to perform an accurate measurement.

Configuration of the System

The System 824 should be configured as shown in Figure 1-1 on page 1-10 with the preamplifier connected to the front of the instrument and the microphone connected to the end of the preamplifier. If desired, a microphone extension cable may be connected between the preamplifier and the body of the 824. For more details on the positioning of the 824 and the permitted length of the extension cable, see "Positioning the Meter" on page 9-7.

Selecting a Measurement Mode

The System 824 can measure sound pressure level using any of the following modes:

- **Integrating Sound Meter (ISM)** measures sound level parameters, which are stored manually by the operator.

- **Logging SLM (LOG)** measures sound level parameters and automatically stores the data based on a number of different user-configured data logging methodologies such as Time History, Intervals, Exceedance History and Daily History).
- **Sound Spectrum Analyzer (SSA)** which simultaneously measures sound level parameters and real-time frequency spectra (1/1 or 1/3 octave bandwidths). These data can be stored manually by the operator or automatically using the Time History and/or Interval methodologies.

Details on the functionality of each of these see “System 824 Virtual Instruments” on page 6-1.

Select the desired measurement mode (ISM, LOG or SSA) as described in section “Selecting and Modifying Instrument Definitions (IDs)” on page 4-12. If you are just beginning to use the instrument, there will be only one ID (permanent) available for each of these modes. However, if other IDs have been created and stored using parameters different from the default values used in the permanent setups, these will also appear with the name defined for each at the time of storage.

Selecting a Measurement ID

If a previous setup had been created and saved, this setup can be recalled by following the procedure described in “Selecting a Measurement Setup” on page 2-6.

Editing the Microphone Parameters

The microphone to be used will either be a traditional condenser microphone, which requires a polarization voltage, or it will be an electret (prepolarized) microphone. Further, if it is a free-field microphone and the measurement is best performed using a random incidence microphone, the user can select to implement a random incidence correction to the measurement.




The procedure for selecting these parameters is described in section "Customizing Settings" on page 7-2, specifically the sections "Transducer Setting - (SSA, LOG, ISM)" on page 7-8 and "Random Incidence Microphone Correction - (Available to all Instrument types)" on page 7-8.

Calibration

The System 824 automatically changes the frequency weighting to C-Weighting during the calibration process. Therefore, calibrators having frequencies which correspond to the flat region of the C-weight curve (200 Hz - 1.25 kHz) may be used. Larson Davis recommends the following sound level calibrators:

- Larson Davis Model CAL200; 94/114 dB @ 1 kHz
- Larson Davis Model CAL250: 114 dB @ 250 Hz

The procedure for performing a calibration is described in detail in section "Turning On and Calibrating the System 824" on page 4-1.

If the **Cal Level** is not already set to the level provided by the calibrator being used, this level must be changed by the user. To do this, use the  key to highlight **Cal Level** and press the  key. Use the horizontal and vertical arrow keys to edit the level to match that of the calibrator and press the  key to enter the new value.

Entering the Noise Floor Values

When measuring low levels of sound, substantial errors can occur when the sound level to be measured is near that of the noise floor of the measuring instrument. An accurate measurement is obtained when the measured sound level is at least 10 dB above the noise floor. When this condition is not fulfilled, we say the instrument is in an **Under Range** condition, which we indicate on the display. The noise due to the front end electronics and the microphone preamplifier are known, but the thermal noise of the microphone must be entered by the user based on specifications provided by the manufacturer. The A-weighted noise floor values for Larson Davis microphones are presented in the following table.

Microphone Model Number	2520	2530	2540	377B41	2559	377A 60	2570	2575
Nominal Thermal Noise, dB(A)	30	31	20	15	18	15	10	10

The procedure for entering the noise floor value for the microphone to be used is described in the section "Tools Key" on page 3-18, subsection "Calibration" on page 3-22 under the heading **Noise Floor**.

Editing the Measurement Parameters

NOTE: If you are recalling a measurement ID which has already been configured for the measurement you wish to perform, then you can skip to the next section.

The design of the System 824 permits the simultaneous measurement of the following sound level parameters, a feature we call “Any Data”:

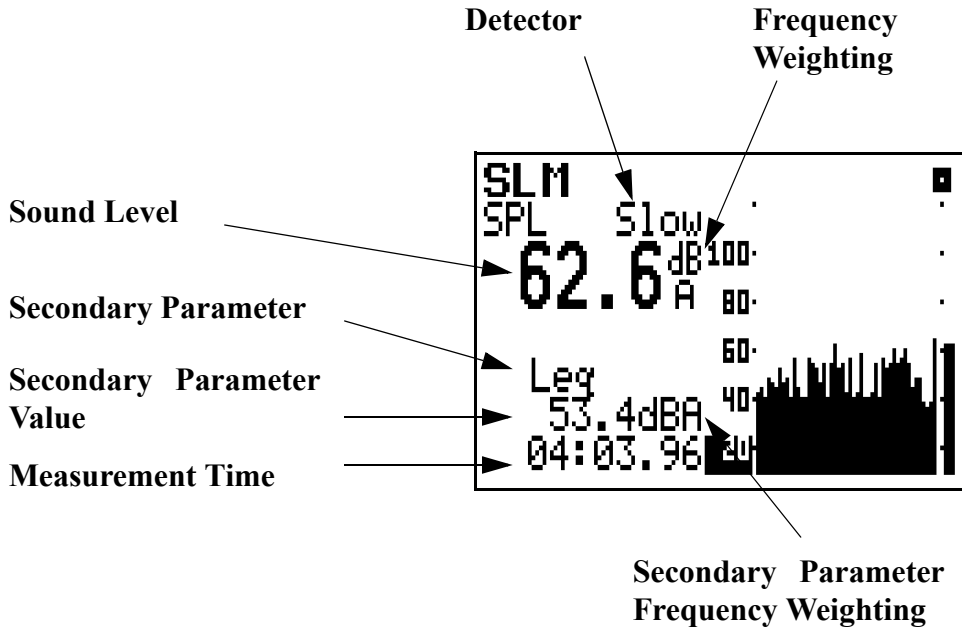
	Leq	Peak	Live SPL			Lmax			Lmin		
			Detectors			Detectors			Detectors		
			Slow	Fast	Impl	Slow	Fast	Impl	Slow	Fast	Impl
A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: The detector used to create Leq is a pure integrating true RMS detector which integrates the energy over a specific period of time. It may be as short as 1/32 second, in a time history which may be as long as 24 hours. As a result, it does not include decay artifacts of older instruments that integrate the output of the SLOW or FAST detectors.

Peak Sound Pressure Level (L_{peak}) with A, C and Flat weighting.

Equivalent Continuous Sound Pressure Level (L_{eq}) with A, C and Flat weighting. A time history record can be enabled to capture samples at periods as short as 1/8th of a second.

The SLM display is shown below



Although the System 824 measures the sound pressure level using multiple values of detector and frequency weighting, it only displays a single value as shown above. For this parameter, you have a choice of three detectors (averaging time)

- Slow
- Fast
- Impulse

and you have a choice of three frequency weightings

- A-weight
- C-weight
- Flat

Similarly, you have a choice of three frequency weightings to be used for the display of the peak level.

- A-weight
- C-weight
- Flat

The procedure for selecting these parameters is described in section "Customizing Settings" on page 7-2, specifically the sections, "Weighting Setting - (SSA, LOG, ISM)" on page 7-6 and "Pk Weighting - (SSA, LOG, ISM)" on page 7-9.

Positioning the Meter

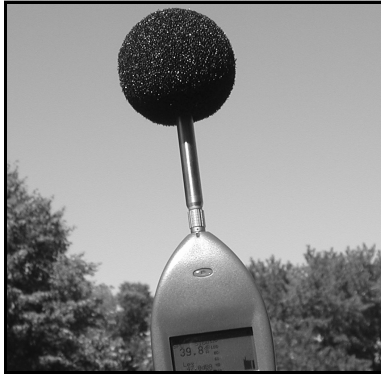
The meter will be either mounted upon a tripod or held in the hand. In order to avoid the effect of sound reflections from the body of the operator interfering with the measurement, the meter should be located as far as possible from the body. Thus, when actually performing the measurement, the operator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

If desired, a microphone extension cable may be placed between the meter and the preamplifier/microphone. 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.



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.



Selecting the SLM Display

For sound level measurement, press the \odot key, use the \blacktriangle key to highlight SLM and press the \checkmark key to obtain the display shown in "Editing the Measurement Parameters" on page 9-5

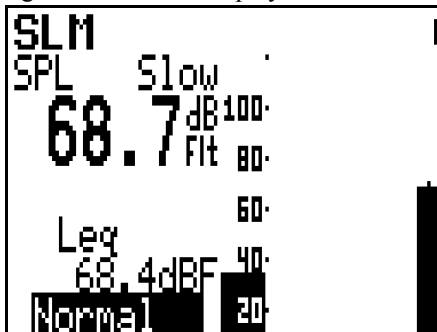
Selecting the Measurement Range

ISM and LOG Modes

In the ISM mode, there are three range setting available:

- Low
- Normal
- High

Although the range setting does not always appear on the SLM display, it can be found by repeatedly pressing either the \blacktriangle or \blacktriangledown key until the highlight is located in the lower right corner of the display as shown below.



The upper and lower limits of sound pressure level which can be measured for each of these scales are indicated in the "RMS Measurement Range (LOG and ISM modes only)" on page C-11.

Selecting the Range Setting

When the range is highlighted as shown in the above graphic, the range can be toggled between Normal and Low by pressing the \blacktriangleright or \blacktriangleleft keys. If the approximate level is known, select the range setting for which that level falls nearest the middle of the measurement range. If it is not known, select the Normal range which is usually adequate for the majority of common measurements.

The range setting can also be selected using the setup menu. In fact, this is the only way to select the High range.

Press the F key, the \blacktriangleright key, highlight **SLM**, press the Y key, highlight **Range**, and press the Y key to obtain the following display



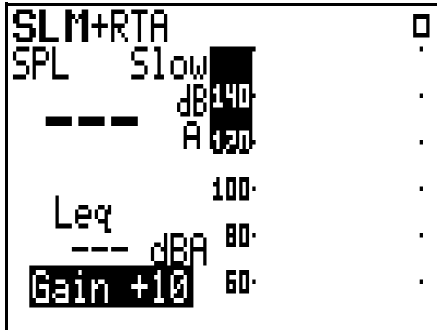
Highlight the desired range and press the Y key to make the selection.

SSA Mode

The SSA Mode has a smaller measurement range than the ISM and LOG Modes. As a result, rather than select a range setting from among three choices, as done for the ISA and LOG Modes, we will select a gain value which can range from -20 to + 50 dB in steps of 10 dB. The usual practice is to set the gain to 0 dB and later modify that as required to obtain a good measurement without overload or under range conditions.

Although the gain setting does not usually appear on the SLM display, it can be found by repeatedly pressing either

the ▲ or ▼ key until the highlight is located in the lower right corner of the display as shown below.



When the gain setting is highlighted, this can be changed by repeatedly pressing the ▲ or ▼ key until the desired value of Gain appears.

Performing a Measurement

The procedure for performing a measurement is described in the section "Performing a Measurement; SLM&RTA (SSA)" on page 2-7. Among the important aspects covered are the following:

- Stop, Pause and Erase Functions in section "Stop, Pause and Back Erase Functions" on page 2-8.
- Changing the Detector of the displayed SPL value in section "Changing the detector of the displayed SPL value" on page 2-8.
- Changing the Frequency Weighting of the displayed SPL value in section "Changing the frequency weighting of the displayed SPL value" on page 2-9.
- Changing the Displayed Secondary Parameter in section "Changing the displayed secondary parameter" on page 2-10.
- Changing the Frequency Weighting of the Displayed Lpeak value in section "Changing the frequency weighting of the displayed Lpeak value" on page 2-10.

After reaching equilibrium with the ambient environment and switching the power on, the elapsed time until the meter may be used to measure the sound level is as follows:

- < 10 seconds using a prepolarized (electret) microphone
- < 1 minute using a traditional condenser microphone requiring a polarization voltage.

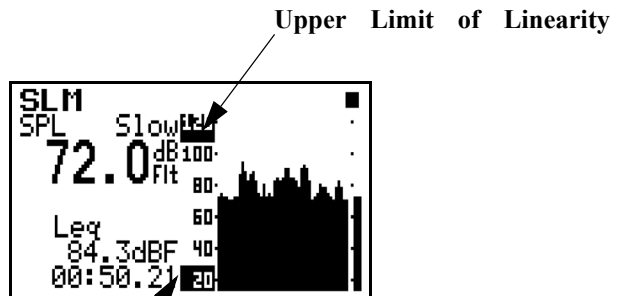
When performing an integrating measurement, the data is available during and immediately following the measurement time interval.

Averaging Time

The averaging time is determined by how long the measurement is allowed to run, as indicated by the digital display in the lower left of the screen. For low level measurements where the measured level may be affected by the system noise floor, it is recommended that an averaging time of at least 30 seconds be used. For timed measurements, the value of the averaging time can be preset and the instrument configured to stop automatically after that time as described in the section "Measuring for a Preset Integration Time" on page 9-16.

Linearity Range

When making a measurement, the upper and lower linearity range limits of the instrument for the setting presently in effect are indicated by the dark regions with light numbers as indicated below.



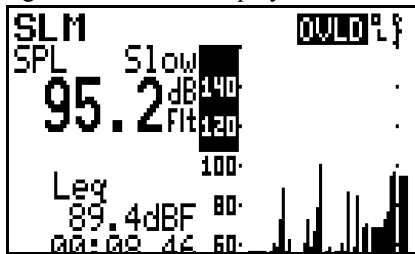
Lower Limit of Linearity Range

Changing the range (ISM and LOG Modes) or gain (SSA Mode) will change these limits. For very low (high) level measurements, it may be necessary to utilize a microphone having a higher (lower) value of sensitivity in order to perform a measurement within the linearity range of the instrument.

Overload and Under Range Conditions


Overload Condition

When the input signal is too high, the electronics will overload. This is indicated by a flashing **OVLD** text message, as well as a flashing OL (for overload) in the upper right corner of the display as shown below.



This text message will continue as long as the overload conditions continues, but it will disappear when the input level drops below the overload level. However, the flashing OL display will continue to appear in the same position as shown below. This indicates that the data measured may not be accurate due to the overloaded condition which occurred during the measurement interval.

Reset

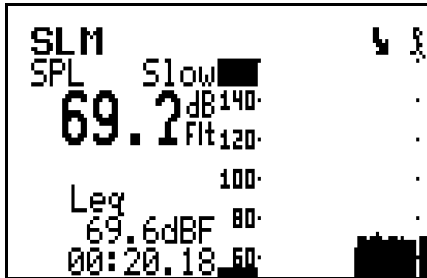
Press the  key to reset the measurement. This function is described in greater detail in the section "R Reset Key" on page 3-9. The reset facility clears an overload indication and there is no delay time between the operation of the reset facility and the re-initiation of a measurement.

Under Range Condition

NOTE: The noise level corresponding to the microphone being used must have been entered by the user, as described in section "Entering the Noise Floor Values" on page 9-4, in order for this feature to function correctly.

When the sound level being measured is within 10 dB of the noise floor, this will be indicated by a flashing downward

directed arrow in the upper right corner of the display as shown below.



To avoid this condition, select a lower range (ISM or LOG Mode) are a higher value of Gain (SSA Mode).

Max, Min and Peak Values

As stated in "Editing the Measurement Parameters" on page 9-5, Lmax and Lmin are measured for all combinations of frequency weighting (A, C and Flat) and detection (Slow, Fast and Impulse). Peak values are measured for A, C and Flat frequency weighting. These max values represent the highest value of each which was measured during the measurement time interval and the min. values represent the lowest values measured during the same time interval. A reset operation will reset these values to the values being measured at the instant the reset operation is activated.

The nominal range for the measurement of Peak values using A, C or Flat weighting are specified in the section "Peak Measurement Range (LOG and ISM modes only)" on page C-12.

Measuring for a Preset Integration Time





The System 824 can perform an integrated measurement over a preset time in either the LOG or SSA Mode by making use of the Interval measurement feature. For a detailed description of setting up for an interval measurement, see the section "LOG and SSA Interval Settings" on page 7-36.

To measure a single interval, set Interval Autostop (Intv Auto Stop) to **On** as described in the section "Intv Auto Stop - (LOG, SSA)" on page 7-38. To measure and store data over a series of equal time intervals, set Interval Autostop (Intv Auto Stop) to **Off**.

The interval time can be set from 00:00:01 hr:min:sec to 99:59:59 in steps of 1 second.

Timer Mode

The Clock/Timer Mode is used when it is desired that the measurement begin at a preset date and time. This can initiate either a single interval measurement or a sequence depending upon whether the Interval Auto Stop is set to On or Off, respectively.

Setup the measurement using the Clock/Timer Menu which is accessed by pressing the  key, using the  or  keys to highlight **Clock/Timer** and pressing the  key. For details on the use of this menu see the section "Clock/Timer" on page 3-23.

Measuring using User-Selectable Thresholds

The System 824 can be setup to measure data associated with Exceedance Events, defined as instances where the sound pressure level exceeds a user-selected threshold. For a detailed description of setting up the System 824 to measure Exceedance Events, see the section "Logging SLM Exceedance History Settings" on page 7-40.

Using the 824 Utility Software

The 824 Utility software is a powerful tool for use with the System 824 from Larson Davis. This software will allow you to control, setup, download and translate your 824 measurement data quickly and easily.

The 824 Utility program has three sections that perform the functions on the 824.

- The setup section provides support for creating, editing, storing and retrieving setups from the 824 and from files.
- The download section provides a means by which to retrieve the measurement data from the 824.
- The translate section provides support for translating the downloaded measurement data, and displaying or printing it in a text format, or exporting the measurement data to a spreadsheet program.

In this chapter we will discuss installing the software, getting the software started on your computer, connecting the 824 to the serial port of your computer, explain the Main Screen Toolbar functions, and then go onto discuss each of the three functions of the software in greater depth.

824 Utility Installation

To install the 824 Utility software package place the disk (CD) into your CD-ROM drive. From Windows 95 press

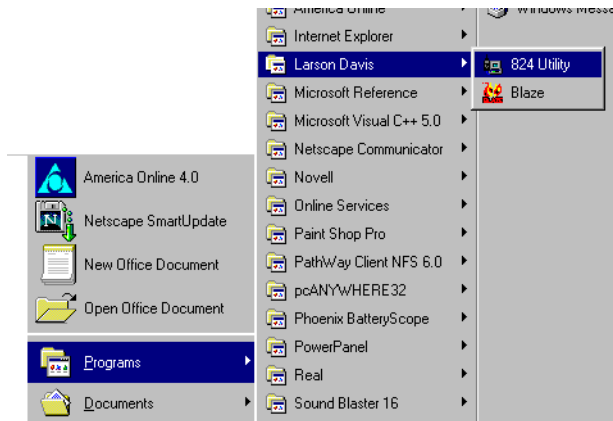
START and then select the **RUN** menu item. A prompt will appear to enter the program name. Enter “E:\824auto.exe”.

A new screen will appear with several menu items to choose from.

Select “Install Software” from the menu items. Another screen will appear with several more choices. Select “INSTALL 824 Utility Software”. The 824 utility software will automatically begin the installation process. The installer program will prompt you through the installation. A message will appear indicating that the software was successfully installed.

Starting the 824 Utility Software

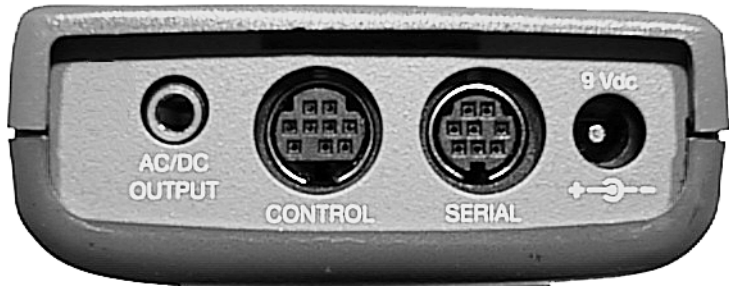
To start the 824 Utility software in Windows TM, press **START** and then select the **Programs/Larson Davis/824Util** menu item.



Connecting to Your Computer

To connect the 824 to a computer, use the CBL006 cable included with your System 824. The round 8-pin connector

plugs into the Serial port of the 824 and the 9-pin connector plugs into a serial port on your computer.



You do not need to be connected to the 824 in order to translate files which have already been downloaded.

Before any functions can be performed on the 824, you must connect the 824 to the 824 Utility software. To connect to the 824:

Step 1 Attach the CBL006 to the 824 and to the serial port on the computer as described earlier.

Step 2 Start the 824 Utility program.

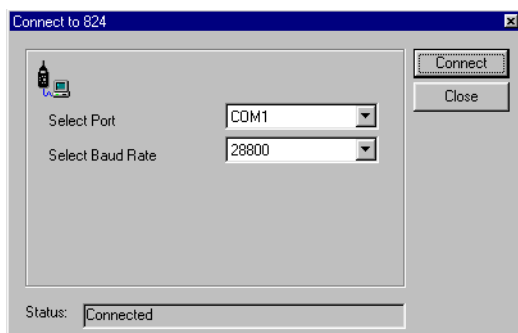
Step 3 Power on the 824.

Step 4 Press the Connect button on the tool bar.

NOTE: The 824 will power on when it senses anything on the serial connector. You may notice the 824 powering on automatically before you press the power button.



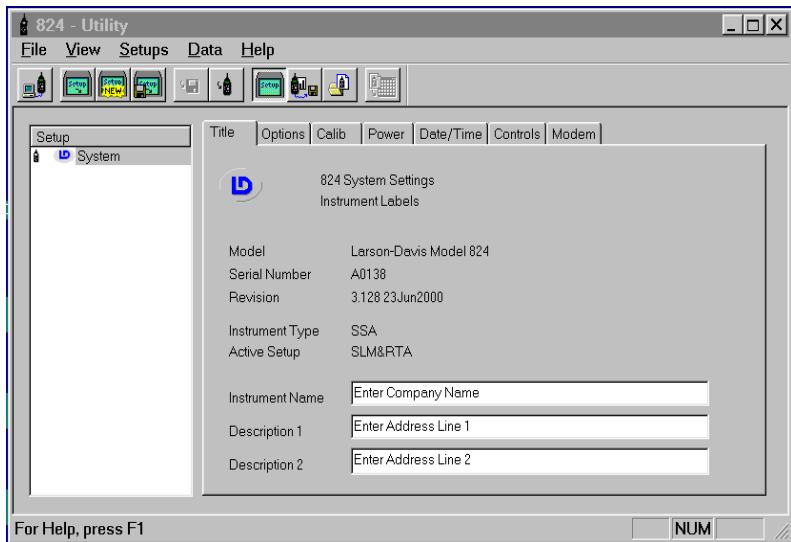
Step 5 The connect dialog box will appear.



NOTE: See "Communication" on page 3-34 for details on changing the communication parameters on the 824.

Step 6 Select the comport that your 824 is connected to, select the baud rate, and press the connect button.








After a successful connection, the setup window will appear with a system setup in the setup list box. The 824's serial number and title will be displayed on the setup dialog box screen.






824 Utility Tool Bar

The tool bar for the 824 Utility program provides support for the main functions of the 824 Utility program. All Toolbar functions can also be performed from the pull down menus at the top of the 824 Utility Software screen.



	<p>Connect button. This button is used to establish a connection to the 824. Pressing this button will bring up the connect dialog box where the connection parameters can be defined.</p>
	<p>Retrieve Setups from 824. This button will retrieve all current setups in the 824.</p>
	<p>Create new setup button. This button will allow the user to create a new setup that can then be saved to disk, or saved in the 824.</p>
	<p>Open a setup from a computer file. This button will allow the user to retrieve previously stored setup files.</p>
	<p>Store setup to disk. This button will allow the user to store a setup to a disk.</p>
	<p>Store setup in 824. This button will store the setup in the 824. This function must be performed before the setup can be used inside the 824.</p>
	<p>Setup window button. This button will activate the setup window portion of the 824 Utility Program</p>

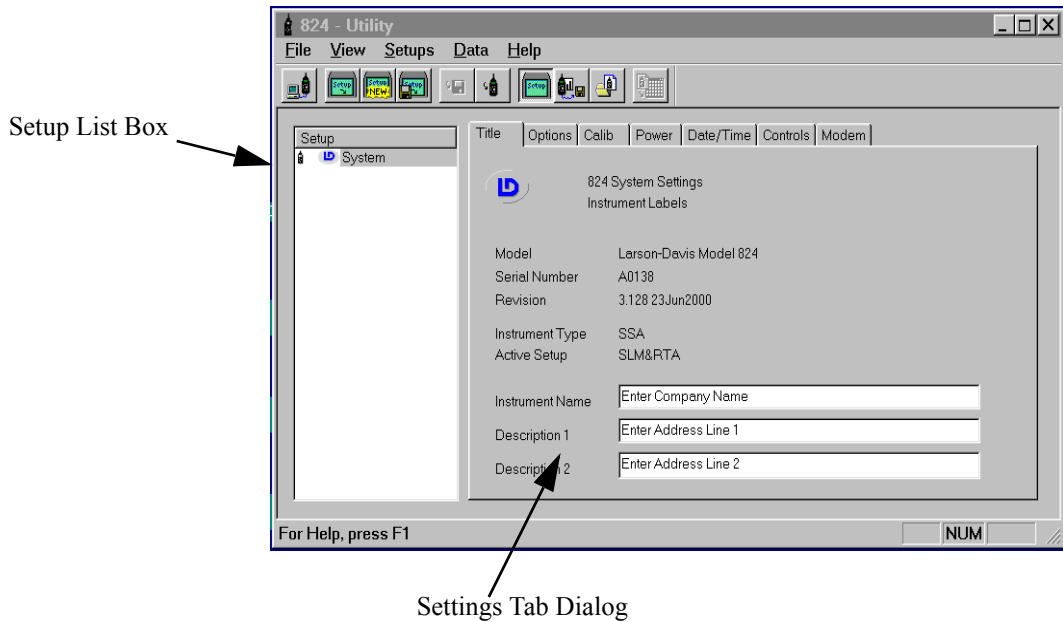
	<p>Download window button. This button will open the download section of the 824 Utility program.</p>
	<p>Translate window button. This button will open the translate section of the program. It will provide a file tree where the contents of the downloaded measurement files can be viewed.</p>
	<p>Export measurement button. Exports the currently selected measurement file to a user defined spreadsheet program. This button will only be active when you are in the translate section of the program, and there is a measurement file being displayed.</p>

824 Utility Setup Window

The setup window is the default window that will open up when the 824 Utility program is started. The setup window will allow you to edit existing setups, retrieve setups from the 824 or a file, create new setups, and store setups to the 824 or to a file.

The main setup window has 2 sections: the setup list box, and the settings dialog section. The setup list box will list all setups that have either been created or retrieved from the

824 or a disk file. The settings dialog section will allow you to manipulate the setup.

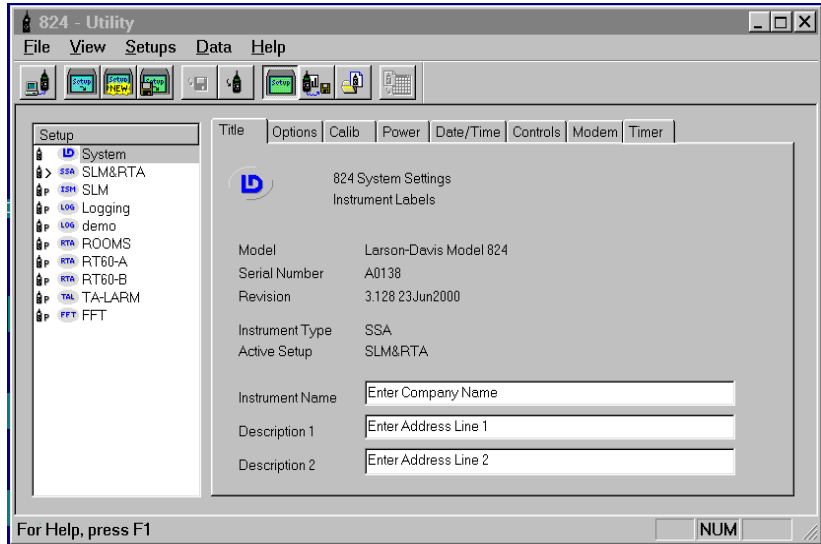


Retrieving setups from the 824

Setups stored in the 824 can be retrieved by clicking on the Get Setup button on the tool bar or by selecting *Get Setups From 824* from the *File* Menu.



Setups will be retrieved from the 824 and will be displayed in the *Setup* listbox.



In the list of setup files, the system setup is the first setup and is followed by all of the permanent and user-defined setups. In the setup list box, there are several parts of the Setup title that can be used to identify the setup type.

The name of the ID is listed in the right hand column. For the permanent ID's, this will be the Larson Davis instrument type. For a user defined ID, this can be anything that the user defines.

The three letter Larson Davis assigned name is listed in the blue Ovals. This indicates the type of instrument ID for which the setup was created.

P stands for a permanent ID. This would be an original setup defined at Larson Davis and cannot be modified.

A lock icon in this place indicates a user ID that has been locked so it cannot be modified.

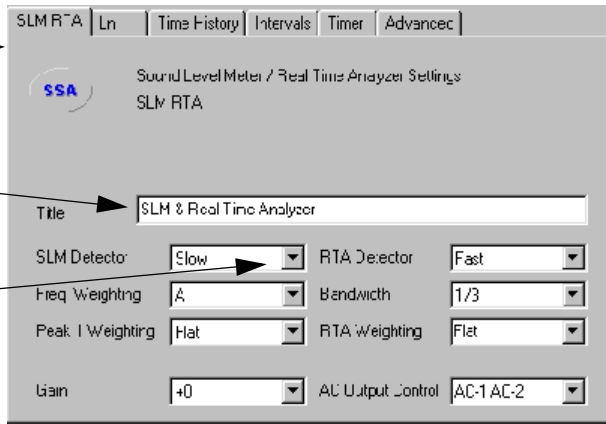
No letter or an arrow indicates a modifiable User defined ID.

Highlighting one of the setups in the list displays all of the available settings in the setup dialog box (right side of the

window). The setups are organized and grouped similar to the 824 menu structure in the instrument. Click on the different tabs to access all of the setup parameters.

Select different tabs to access all of the setup functions.

Parameters can be entered manually, or the pull down selections can be used.



Modifying and Storing Setups to the 824

NOTE: If you change settings in the Utility program to an active setup in the 824, those changes will not take effect in the 82 unless the modified setup is re-selected.

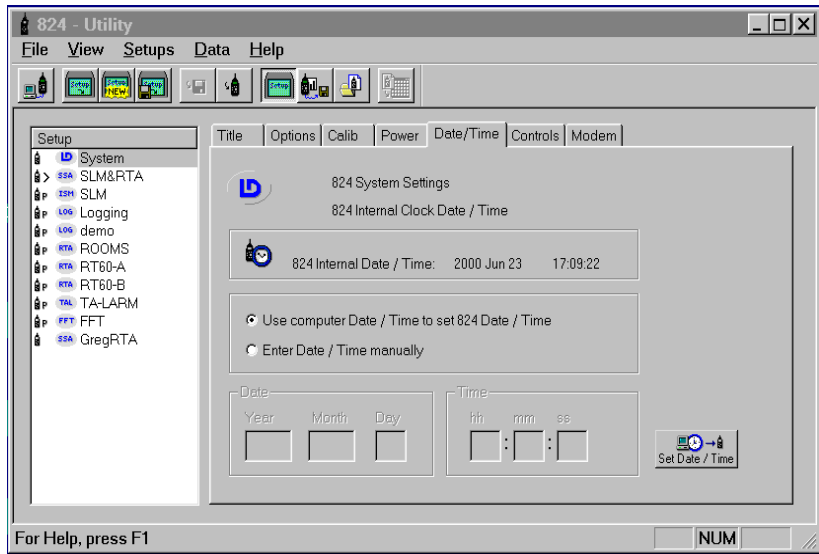
With the 824 Utility software you can make modifications to any of the user defined setups and the system setup. For example, in the System setup, you can change any of the parameters for the Title, Calibration, Power, Date/Time, Controls or Modem and then send the modified setup to the 824. To store the modified setup, select the **Save Setup to 824** menu item from the **File** menu or click on the **Store Setup in 824** button on the tool bar.



Changing System Settings

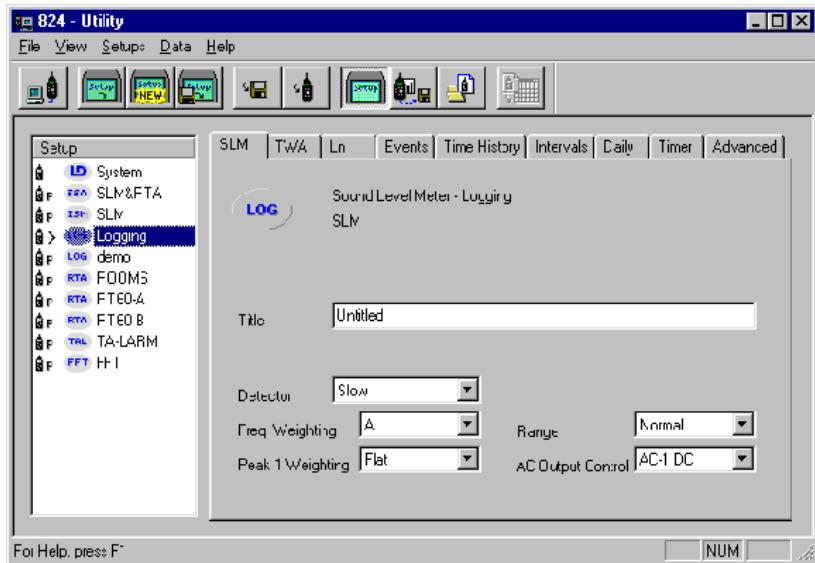
**The Option Settings show what options were purchased for this instrument and can't be changed. To purchase an option, contact your Larson Davis representative.*

The system selection on the setup list box contains the general settings for the 824. The selections here include, Title, Options*, Calibration, Power, Date and Time, Controls and Modem. To change one of these settings, click on the appropriate tab, and enter the changes.



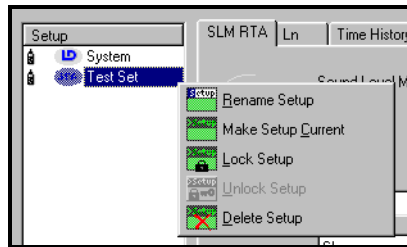
Manipulating a Setup

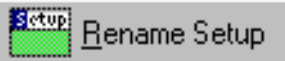

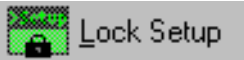


To change any of the variables for a particular user defined setup, select the setup. The appropriate setup tab dialog will appear at the right of the setup list box. Select the setting you wish to change and enter the new value.



You can also access several setup functions by right clicking on the Setup in the Setup list box.

The following functions can be accessed by pressing the right mouse button while within the **Setup** list box. The **Setup Menu** items will appear enabled or disabled depending on the setup selected. For example, it is not possible to delete a permanent 824 setup, so the **Delete Setup** menu item will be disabled if a permanent 824 setup is selected.



	<p>The Rename Setup button allows you to rename the selected user defined setup.</p>
	<p>The Make Setup Current button will cause the selected setup to become the Active setup in the 824.</p>
	<p>The Lock Setup button will write-protect the selected setup in the 824.</p>
	<p>The Unlock Setup button will write-enable the selected setup in the 824.</p>
	<p>The Delete setup button will delete the selected user defined setup from the 824.</p>

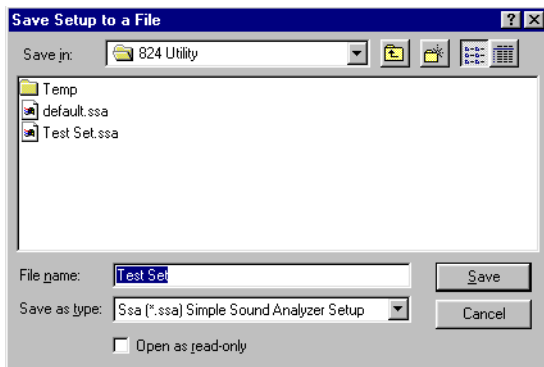
Saving Setups to Disk Files

Once you have created or modified a setup, you can store the setup to a file. Select the **Save Setup to a File** menu item from the File menu or click on the Save to File button on the tool bar.



NOTE: The system setup is automatically updated each time the 824 Utility is connected to the 824.

The 824 Utility program will bring up a standard windows save dialog box, where the file name and location of the setup can be specified.



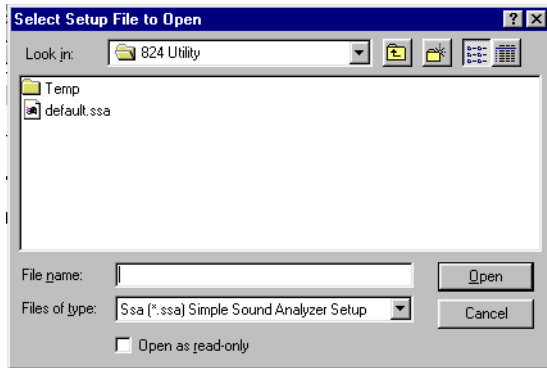
The System setup can be modified and stored back into the 824, but cannot be saved to a disk file.

Opening Setup Disk Files

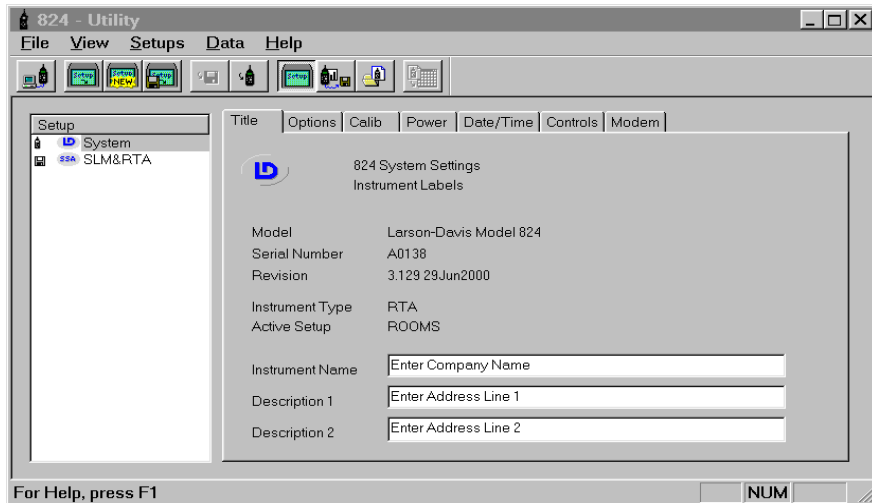
To open a setup disk file select the **Open Setup File** menu item from the **File** menu or click on the Open File button on the tool bar.



A standard windows Open File box will appear. Select the file folder that contains the file and select the setup file you want.



The setup appears in the **Select Setup** list box. You can then select (highlight) the desired setup in the list. The highlighted setup can then be sent to the 824 by selecting the **Save Setup to 824** menu item from the **File** menu.



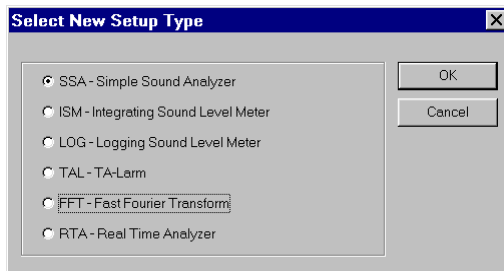
Other menu items available in the **Setup** Menu include renaming, locking, unlocking, deleting, or making the selected setup the active setup.

Creating a New Setup

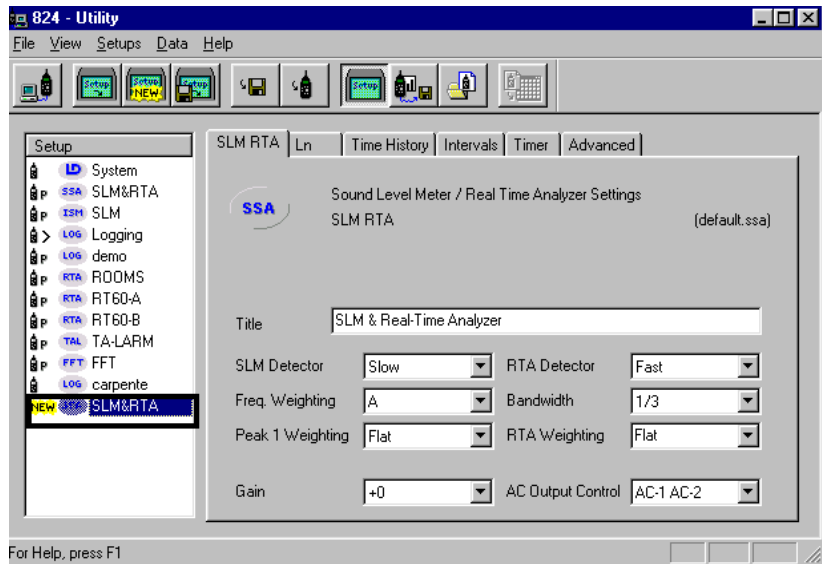
You create new setups by selecting the *New Setup* menu item from the File menu or by selecting the New Setup button on the tool bar.



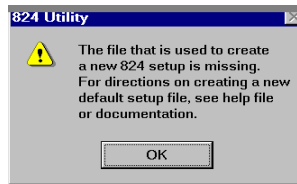
From the displayed dialog box, select the **type** of new setup.



Press the **OK** button and you will now see the new setup in the *Setup List* box.



If a message window occurs after pressing the **OK** button like that shown below,



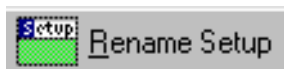
you will have to create a default setup file by following this procedure:

- Select the permanent setup for the desired instrument type.
- Under the File menu select "Save setup to a file".
- In the "Save setup to a file" window type in "default" under File name and select "Save".

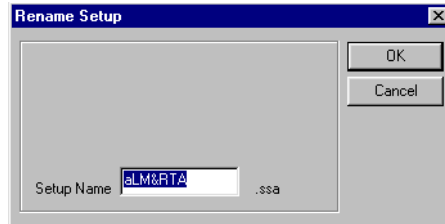
The new setup is now defined for a particular instrument ID, and can be modified from the Setup List box. After creating a new setup, you can store it to a disk file, or send it to the 824.

Renaming an Existing Setup

To rename an existing user defined setup, right click on the setup in the left hand side of the screen and select **Rename Setup** from the popup menu.



A dialog box will be displayed to allow you to change the name of the selected setup.



Enter the new name for the setup, and press the OK button.

NOTE: The permanent setup ID's in the 824 cannot be renamed.

After renaming a setup, you can store it to a disk file, or send it to the 824.

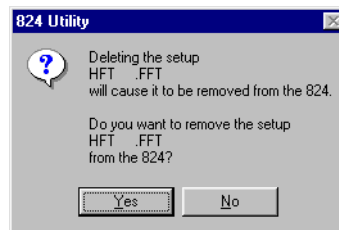
Deleting an Existing Setup

To delete an existing setup, right click on the user defined setup in the left hand side of the screen and select **Delete Setup** from the popup menu.



NOTE: This section applies only to setups that exist on the 824. If a new setup or a setup that is stored to disk is deleted, this message will not appear.

Pressing the Delete Setup button will bring up a prompt asking if you are sure you want to delete the setup.



WARNING!

The setup will be deleted from the 824 and the Utility program.

Locking and Unlocking Setups

To prevent accidentally deleting a user defined setup, right click on the desired setup and select **Lock Setup** from the popup menu. Note that if you have just created a new setup, the setup must first be stored to the 824 before it can be locked.

Downloading Measurement Data

To display measurement data stored in the 824, select **Download View** from the **View** menu or hit the Download View button from the tool bar.



All stored measurement information is retrieved from the 824 and displayed in the Download View window.

The screenshot shows the '824 - Utility' window with a menu bar (File, View, Setups, Data, Help) and a toolbar. The 'Data File' window is open, displaying measurement data. Annotations on the left point to specific UI elements:

- Pull down menu**: Points to the 'Show Files of Type:' dropdown menu.
- First entry in list shows the active measurement**: Points to the 'FFT FFT' entry in the 'Measurements' list.
- Measurement list box**: Points to the entire 'Measurements' list box.

The 'Data File' window displays the following information:

- Data File: 5.ftt
- Title: FFT Analyzer
- Start Time: 2000 Jun 28 17:32:14
- End Time: 2000 Jun 28 17:32:19
- Size: 1022 bytes
- Location: [Text Field]
- Note 1: [Text Field]
- Note 2: [Text Field]
- Select Download Filename: [Text Field]
- Directory: C:\Program Files\Larson Davis\824 Utility
- Filename: 28Jun17f.smdl
- [Download] button

At the bottom of the window, it says 'For Help, press F1' and 'NUM'.

Above the measurement list box is a pull down menu listing the possible file types that can be displayed. This allows you to select only the files you want for download. You can also select “ALL <binary>” which will download all the files in the 824 simultaneously for translation at a later date. If you are selecting a specific file type such as “SSA” the measurement list box will show only SSA files.

The first entry in the Measurement list box displays information about the active measurement currently in the 824. Following the active measurement is a list of all other Data Files stored in the 824.

The measurements are identified the same way the setups were identified in the *Setup List Box* in the setup portion of the 824 Utility manual.

The name of the ID is listed in the right hand column. For the permanent ID's, this will be the Larson Davis instrument type. For a user defined ID, this can be anything that the user defines.

The three letter Larson Davis assigned name is listed in the blue Ovals. This indicates the type of instrument ID for which the setup was created.

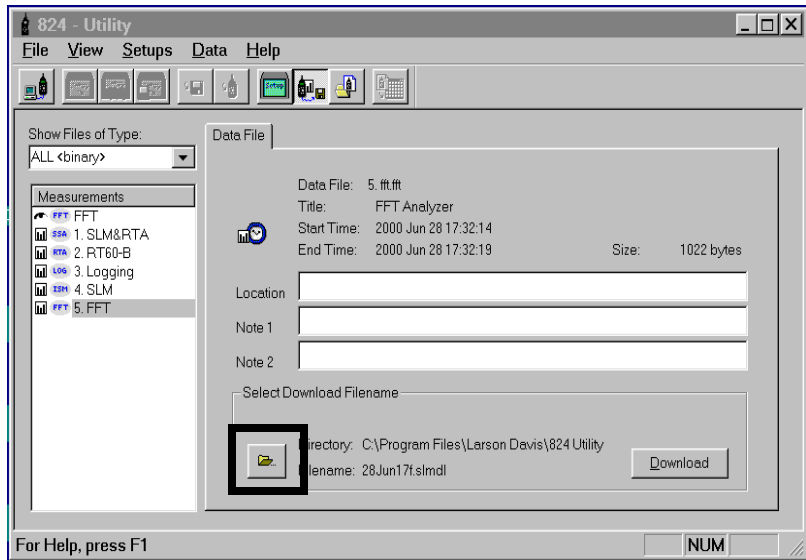
The file number as stored in the 824.

Instrument Type	File Name
ROOMS	ROOMS
SSA	1. Test Set
SSA	2. Test Set
SSA	3. Test Set
SSA	4. Test Set
FFT	5. HFT
LOG	6. Logging
RTA	7. ROOMS

Specifying a Destination File

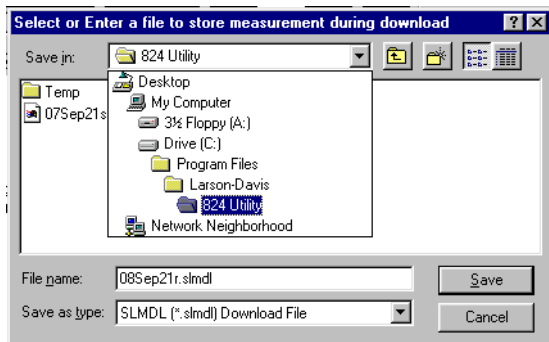
You can tell the 824 Utility program where you want the downloaded measurements to be stored. From the Download

window, press the File folder button, next to the Directory entry.



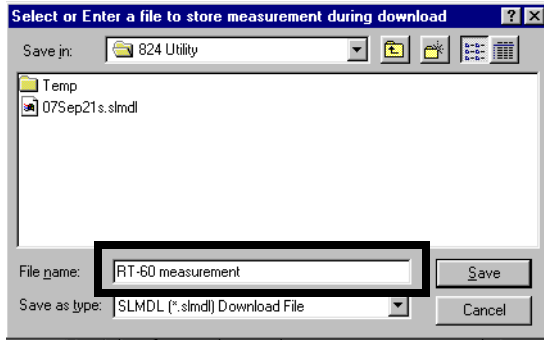
NOTE: The 824 Utility program will download the files with the date the file was created as the file name as a default. It will also download the file to the 824 Utility Folder as a default. The option to specify a file name and destination folder is an optional selection, and is not necessary for download.

A standard Windows file selection dialog box will appear. Select the destination directory you wish.



Changing the Download File Name

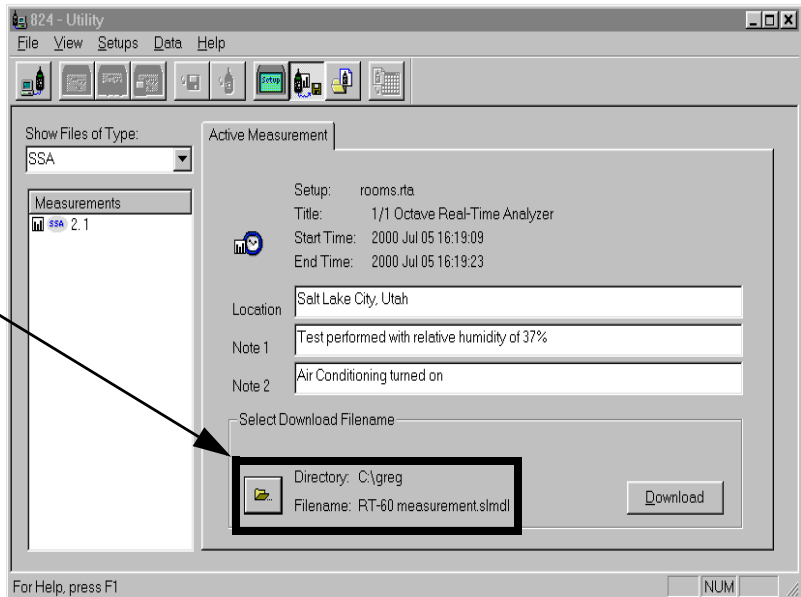
To change the name of the downloaded file, enter a new name in the “File name” area.



Press the Save button to return to the download section of the 824 Utility software.

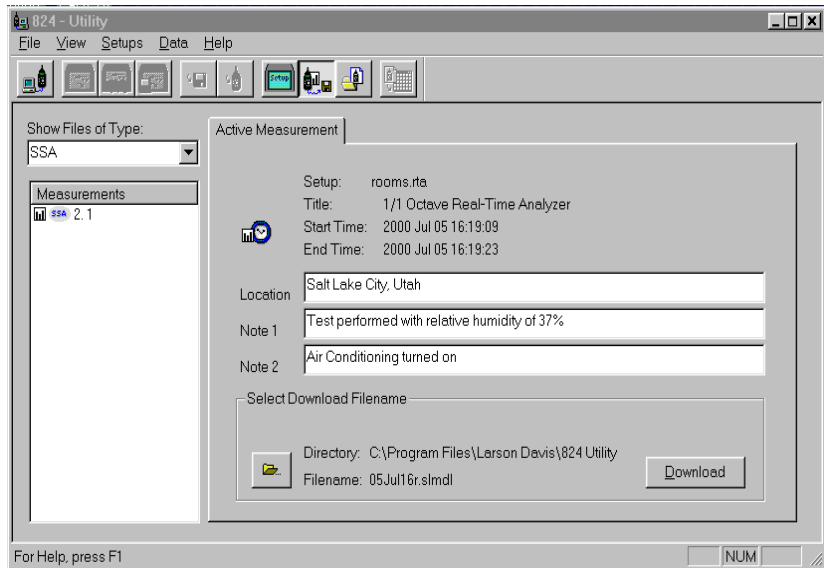
Our new file name and the path to the specified directory now show on the download screen. These settings will only apply for the currently selected measurement.

NOTE: This process will have to be repeated for each measurement to be downloaded if you wish to specify a file name and destination folder for each measurement. For multiple file download, each measurement will use the file name as its base name. For example, if the file name is “Roadtest” then the download file will be named “Roadtest-



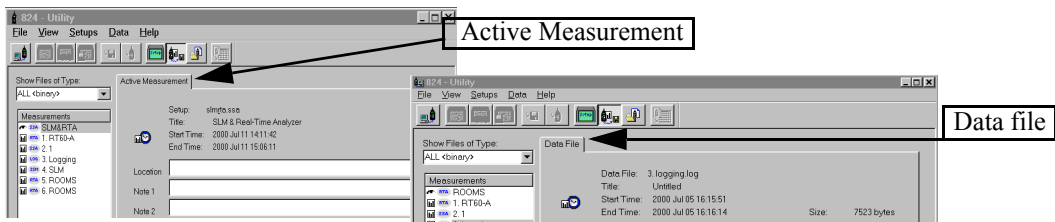
Adding Notes to a download file

Information can be entered into the note fields provided for each measurement. The information will be tagged onto the translated reports for each measurements.



Selecting Active Measurements or Data Files

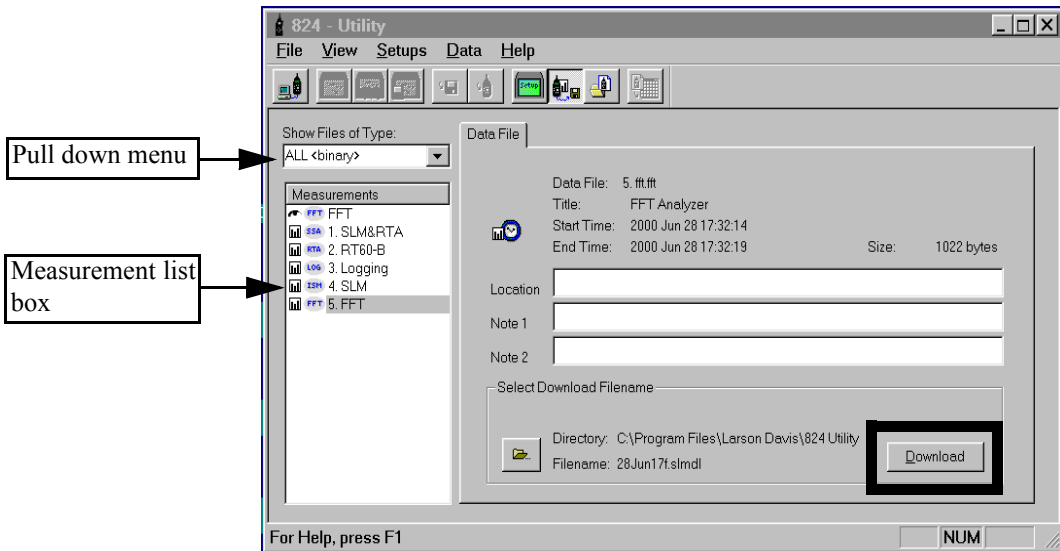
There are two types of measurements that can be downloaded. The first measurement in the list is the Active measurement, and is reported as Active Measurement on the tab of the download windows. The other measurements are stored as Data Files (on the 824), and will be reported as such on the tab of the download window.



Downloading the Measurement

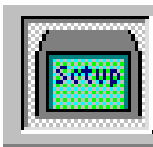
The 824 Utility software has **multiple file download** capability by selecting “ALL <binary>” from the pull down menu and highlighting one or more of the files from the measurement list for download or selecting files of one type and highlighting one or more of the files from the list.

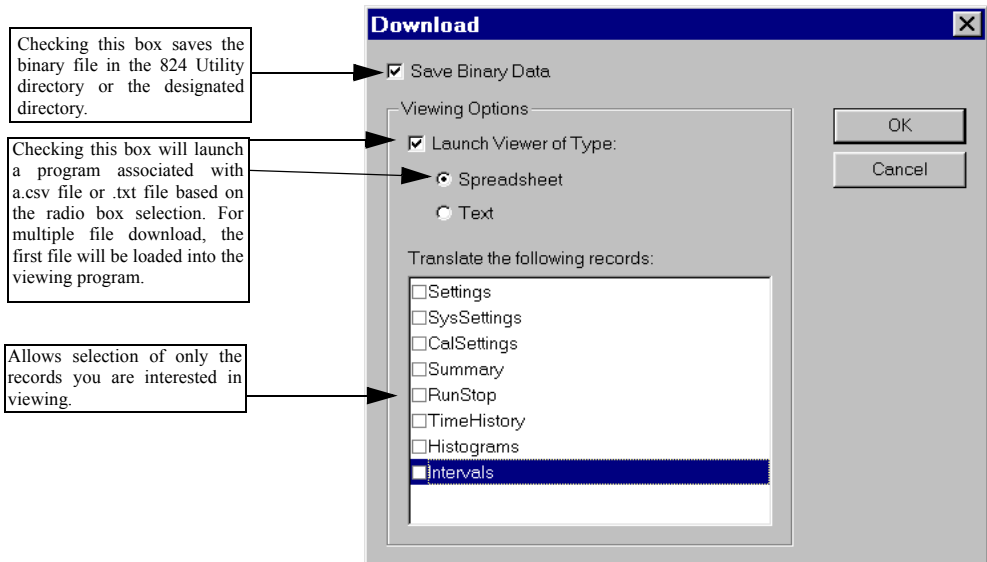
To download a measurement, first select the file type from the pull down menu. You may choose to view all of them simultaneously by selecting “ALL <binary>” or you can select the file type from the list. If you selected “ALL <binary>”, highlight one or more of the files in the measurement list box and click the Download button. All the selected files will be downloaded in their binary form.



To get back to the setup screen press the “setup” button on the toolbar.

If you selected files of the types (SSA, ISM, LOG, TAL, FFT, or RTA) only this file type will be listed in the measurement list box. Select one or more of the files and click the Download button. The following window will appear:



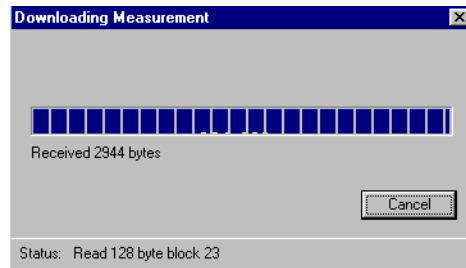


The download window gives you the following options:

- You can save only the binary data and translate the file later, or
- You can save the binary data and the selected records from the translated file (saved as .csv or .txt), launch a spreadsheet or text editor, or
- You can save only the selected records from the translated file (saved as .csv or .txt) and launch a spreadsheet or text editor.

Once you have selected the data viewing options, click on the OK button to start the download process.

The download status window will appear and report the status of the download.



The next file can now be selected, the destination folder specified, the file name entered, and the data downloaded.

A downloaded file will be stored with the file extension slmdl (Sound Level Meter Down-load).

If you only selected “Save Binary Data” the downloaded file must be translated by the 824 utility software to be viewable.

The first file in the measurement list will be viewable in the spreadsheet or text program. To view the other records, they will have to be selected and opened in the viewer program from the directory where they are stored.

If you selected “Save Binary Data” and “Launch Viewer of Type” the Binary file will be saved and a spreadsheet program or text file program will automatically be opened.

If you selected only “Launch Viewer of Type”, the Binary file will not be saved and a spreadsheet program or text file program will automatically be opened.

Explanation of files in the 824 Utility Directory

In the 824 Utility directory (C:\ProgramFiles\LarsonDavis\824 Utility) you will notice 3 different types of files:

- .slmdl (binary)
- .csv (spreadsheet file)
- .txt (text file)

The binary files for each virtual instrument (ISM, SSA, LOG, RTA, FFT, AUD, TAL) have the following default file designations:

28Jun15i.slmdl

Designates which instrument type was used for the measurement.

The default file name uses the date on which the data was taken. The file name can be changed to any name that you choose.

- 28Jun15i.slmdl (ISM)
- 28Jun15s.slmdl (SSA)
- 28Jun15l.slmdl (LOG)
- 28Jun15r.slmdl (RTA)
- 28Jun15f.slmdl (FFT)
- 28Jun15a.slmdl (AUD)
- 28Jun15t.slmdl (TAL)

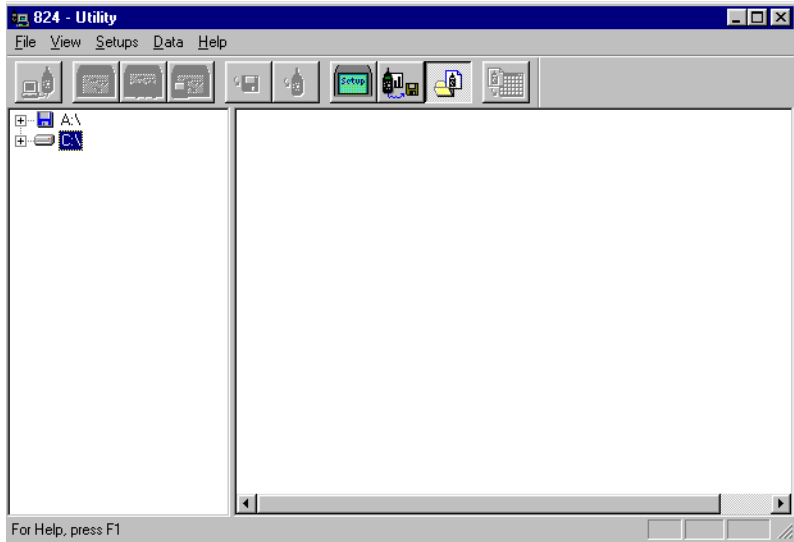
The translated files will have either a .csv extension or a .txt extension depending on the choice made in the download window.

Translating Data from a Downloaded Binary File

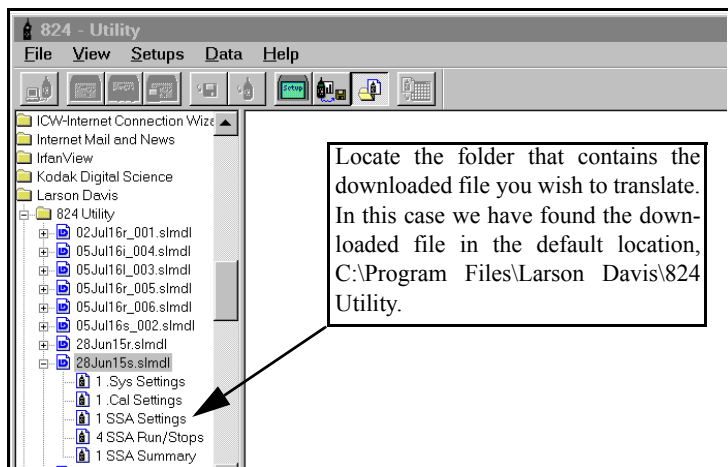
Selecting “Translate View” from the *View* Menu or pressing the Translate button on the tool bar will display the Translation View.



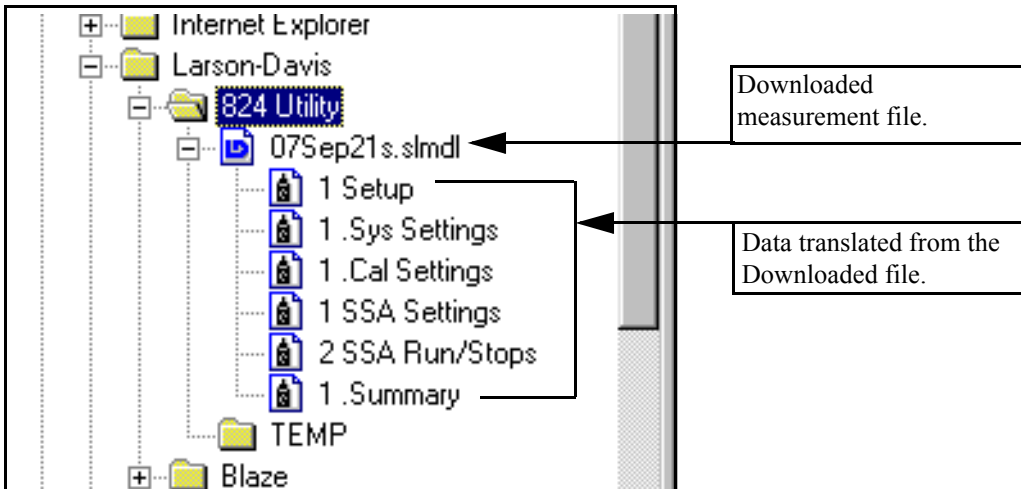
You use the **Translate view** to select a downloaded file with the file extension.slmndl to translate and view the desired records from the file on the screen, or to print the desired records from the file.



The left portion of the Translate window functions as a Windows file tree. Select the folder that contains the downloaded measurement files that you wish to translate.

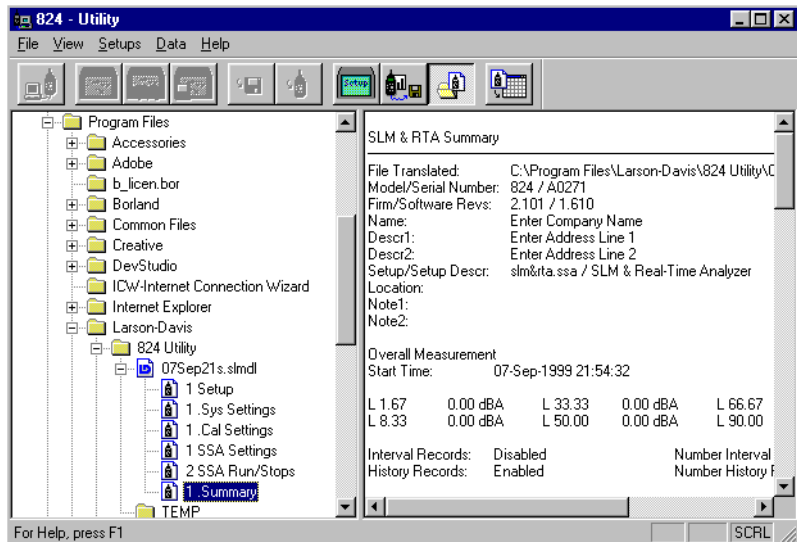


Each downloaded file will contain several records, depending on the type of setup used, and the data stored.

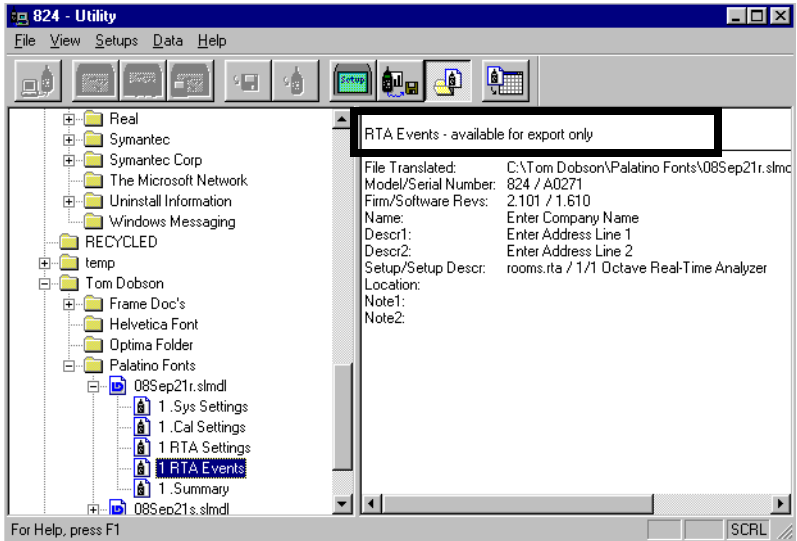


Selecting a Data set to view

After the downloaded file is located, click on the data you wish to view.

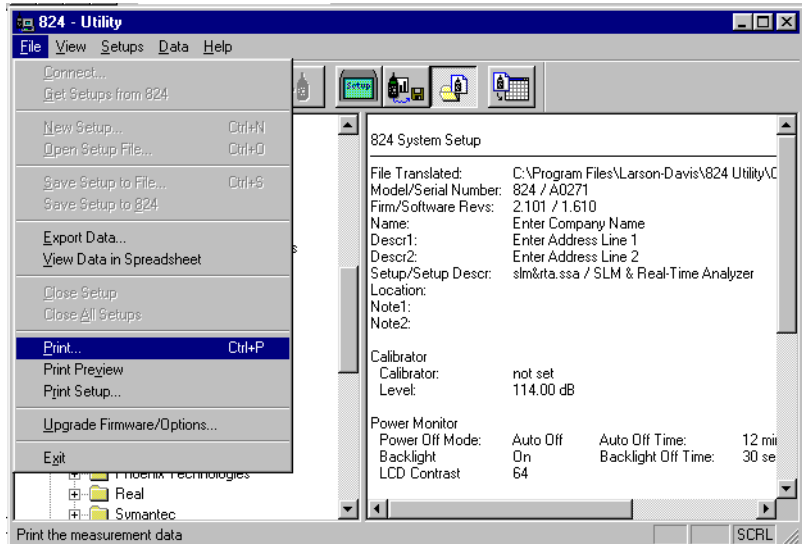


The data is displayed on the right side of the screen. If the data record is too large to be effectively displayed in that area, a message will appear at the top of the displayed record indicating that it is available for export only.



Printing a Translated File

To print the translated data, select the file that you wish to print from the translate window . Display the file as described earlier. Select Print from the **File** menu.



The default Windows printer dialog box will be displayed.
 The report will be printed in a text format similar to that
 shown below.

```

SLM & RTA Summary                                10 Jul 2000, 16:59:33

File Translated:                                C:\Program Files\Larson Davis\824 Utility\28Jun15s.slm1
Model/Serial Number:                            824 / A0138
Firmware/Software Revs:                        3.128 / 2.610
Name:                                           Enter Company Name
Descr1:                                         Enter Address Line 1
Descr2:                                         Enter Address Line 2
Setup/Setup Descr:                             slm&rtas.ssa / SLM & Real-Time Analyzer
Location:
Notel:
Note2:

Overall Measurement
Start Time:                                     28-Jun-2000 15:45:51

Ln Start Level:                                15 dB
L1.00      0.0 dBA      L50.00      0.0 dBA      L95.00      0.0 dBA
L5.00      0.0 dBA      L90.00      0.0 dBA      L99.00      0.0 dBA

Interval Records:                             Disabled      Number Interval Records:    0
History Records:                             Disabled      Number History Records:     0

Current Any Data
Start Time:                                     28-Jun-2000 15:45:51
Elapsed Time:                                   00:00:12.7

Leq:      A Weight      C Weight      Flat
          43.2 dBA      63.8 dBC      66.7 dBF
SEL:      54.3 dBA      74.9 dBC      77.7 dBF
Peak:     71.1 dBA      78.5 dBC      81.6 dBF
          28-Jun-2000 15:46:27      28-Jun-2000 15:45:55      28-Jun-2000 15:45:55

Lmax (slow): 56.2 dBA      71.7 dBC      74.6 dBF
          28-Jun-2000 15:46:27      28-Jun-2000 15:46:27      28-Jun-2000 15:45:52
Lmin (slow): 42.4 dBA      62.5 dBC      65.0 dBF
          28-Jun-2000 15:45:57      28-Jun-2000 15:45:52      28-Jun-2000 15:45:52

Lmax (fast): 49.4 dBA      69.5 dBC      71.9 dBF
          28-Jun-2000 15:45:57      28-Jun-2000 15:45:55      28-Jun-2000 15:45:55
Lmin (fast): 41.3 dBA      60.3 dBC      62.7 dBF
          28-Jun-2000 15:46:29      28-Jun-2000 15:45:52      28-Jun-2000 15:45:52

Lmax (impulse): 52.7 dBA      73.2 dBC      75.1 dBF
          28-Jun-2000 15:45:57      28-Jun-2000 15:45:55      28-Jun-2000 15:45:55
Lmin (impulse): 42.0 dBA      62.8 dBC      65.3 dBF
          28-Jun-2000 15:46:29      28-Jun-2000 15:45:52      28-Jun-2000 15:45:52

Spectra
Date      Time      Run Time
28-Jun-2000 15:45:51 00:00:12.7

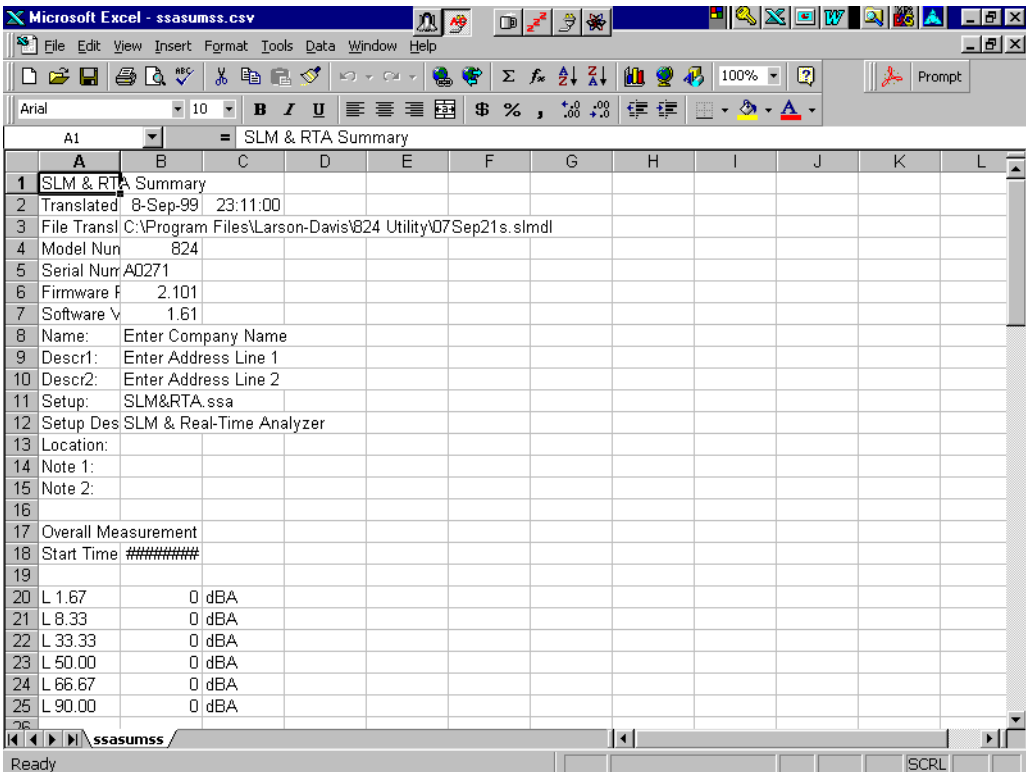
      Hz  Leq1/3  Leq1/1  Max1/3  Max1/1  Min1/3  Min1/1  Hz  Leq1/3  Leq1/1  Max1/3  Max1/1  Min1/3  Min1/1
12.5  56.7      0.0      0.0      48.0      630  35.0      37.2      31.7
16.0  51.8      62.2      0.0      4.8  40.7  53.9  800  32.7      31.1      30.2
20.0  60.1      0.0      0.0      52.3      1000 33.2  36.6  29.9  34.3  29.5  33.6
25.0  53.3      0.0      0.0      44.0      1250 27.9      26.2      25.5
31.5  65.3      65.9      0.0      4.8  63.6  63.8 1600 26.0      23.2      22.2
40.0  54.4      0.0      0.0      50.3      2000 27.3  31.0  22.9  27.5  22.9  27.0
50.0  51.1      0.0      0.0      47.3      2500 25.1      22.1      21.3
63.0  53.1      55.5      0.0      4.8  47.9  50.8 3150 24.9      21.8      21.7
80.0  43.4      0.0      0.0      35.8      4000 23.5  28.8  19.8  25.5  19.6  25.1
100   34.8      0.0      0.0      28.9      5000 23.5      20.3      19.4
125   37.5      43.5      0.0      4.8  33.2  39.5 6300 22.3      20.1      19.2
160   41.4      0.0      0.0      37.8      8000 22.8  28.0  19.8  25.0  19.5  24.4
200   46.6      0.0      0.0      43.0      10000 24.3      20.6      20.1
250   41.8      48.3      0.0      4.8  38.9  44.9 12500 24.3      21.1      20.8
315   37.8      0.0      0.0      35.0      16000 25.0  29.4  22.2  27.3  22.0  27.1
400   34.1      0.0      37.2      27.7      20000 24.6      23.9      23.6
  
```


Viewing a Translated File Within a Spreadsheet Program

To view the translated data with a spreadsheet program, select the **View Data in Spreadsheet** menu item from the **File** menu or the Launch Spreadsheet button on the tool bar.



When you select the **View Data in Spreadsheet** menu item, the 824 utility program will attempt to launch the program associated with the .csv” file extension (comma separated variables). If you have installed a spreadsheet program, your Windows system will most likely have this file type linked to that spreadsheet program.



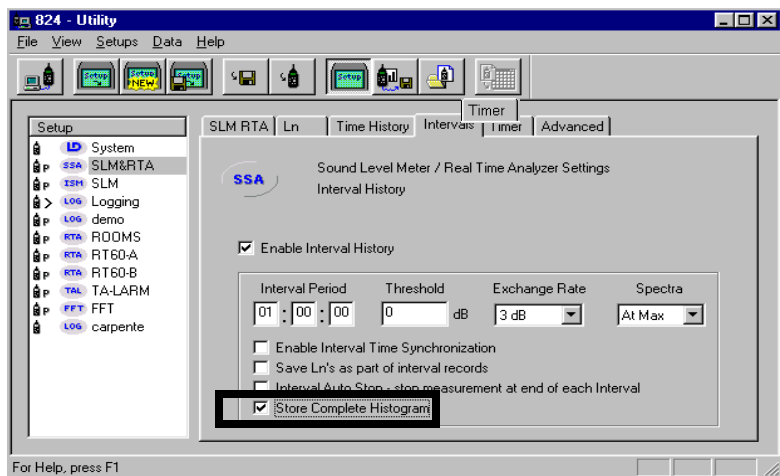
Once the data is in the spreadsheet program it can be manipulated, stored, and graphed using the standard spreadsheet functions.

You can also export and/or save the translated data to a text file, by selecting the *Export Data* menu item from the *File* menu.

Additional Features

Store Histograms for Overall and Interval Data

One of the features of the 824 Utility software is the ability to store histograms in both the LOG and SSA virtual instruments for overall, interval, and daily data (LOG only).



These settings can only be made from the 824 Utility software.

To store an interval histogram for the SSA instrument, select SLM&RTA from the measurement list, click on the “Interval tab” and check the box by “Store complete Histogram”.

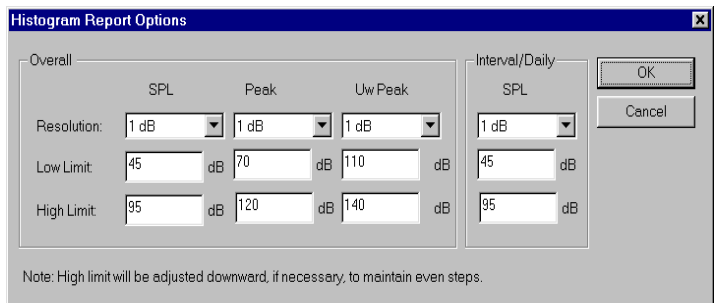
NOTE: Storing interval or daily histograms for the LOG instrument is done in a similar manner.

Histogram Options Window

These settings only affect how the data is displayed and not how they are stored.

The histogram options window allows more flexibility in viewing the histograms.

Here you can set the parameters to fit your particular needs. To access the histogram options window, go under the “View” menu item and select “Histogram Options”.



When viewing the histogram data, the changes made in this window will be immediately displayed.

The “Overall” area allows you to set the viewing parameters for the overall SPL, Peak, and Unweighted Peak histograms.

The daily data is only available to the LOG instrument.

The “Interval/Daily” column sets the parameters for displaying the SPL histogram for the interval period for either the SSA or LOG instruments and also for the daily period data for the LOG instrument.

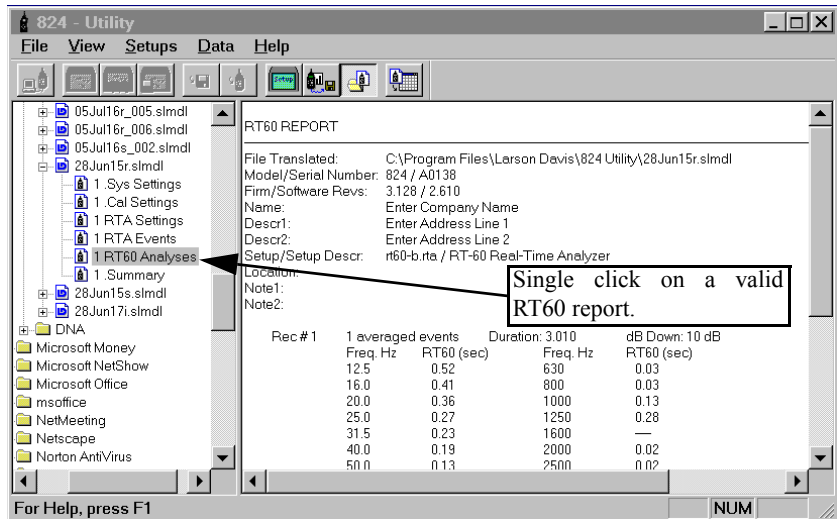
NOTE: Storing the complete histogram for each interval and daily record greatly reduces the number of events that can be stored.

RT60 Select Options

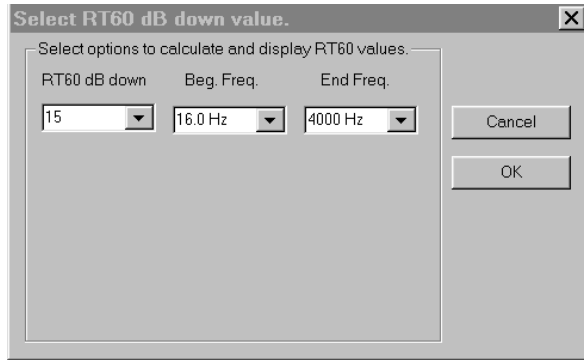
The 824 Utility software can calculate an RT60 for each 1/3 octave frequency from the autostore ByTime data taken by the RTA instrument.

The software gives you the flexibility to set the options for the calculation and display of the RT60 values.

You must first take an autostore ByTime measurement. Download the measurement and go to the *Translate view* and select an RT60 report.



To change the RT60 calculated and displayed parameters, go under the “View” menu item and select “Set RT60 Options”. The following window will appear:



RT60 Measurements

Both the 824 instrument and the 824 Utility software round the RT60 values to two decimal places. However, because the 824 uses logarithmic arithmetic to calculate the RT60 value and the 824 Utility software uses double precision to calculate the value, there may be small differences in the values as reported by the 824 instrument and by the 824 Utility software.

RTA (optional)

Welcome to the System 824 Real-Time Analysis Firmware Option. This option adds high speed spectral data gathering to the System 824 and will enable you to perform the following measurements:

- Architectural Acoustics
- On-board RT60 analysis
- Room Criterion
- Acoustic Impulse Event Analysis
- Pass-by Event analysis

The **824 RTA** option provides the following features:

- RTA for fast spectral data
- Performs room acoustics: RT60, RC, NCB, HTL
- Averages any number of spectra
- Uses measurement triggering for flexible acquisition
- Autostores up to 400 spectra per second (one spectrum every 0.0025 seconds)
- Has both exponential and linear detectors
- Direct printing of calculated RT60 for every 1/1 octave or 1/3 octave band.

Settings Menu


ROOMS.RTA is setup to be a 1/1 octave analyzer that takes 10 second measurements for NCB and RC analysis.





RT60-A.RTA is set to be a 1/3 octave analyzer for the measurement of RT-60 with the room being excited with pink noise.

RT60-B.RTA is set to be a 1/3 octave analyzer for the measurement of RT-60 with the room being excited with impulsive noise such as from a pistol, balloon pop, etc.

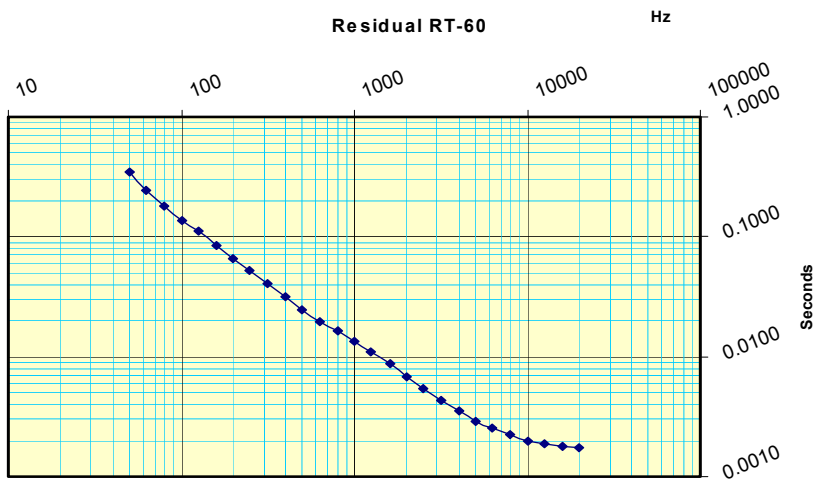
Minimum RT-60 Value

The minimum RT-60 which can be measured, also referred to as the “Residual RT-60”, is a function of 1/3 octave response time as shown in the following graph.

The Settings menu for the RTA instrument is accessed from the  SETUP key. There are three permanent RTA instrument definitions (ID) available: ROOMS.RTA, RT60-A.RTA, and RT60-B.RTA.

To select an RTA instrument press the  SETUP key, scroll down to RTA and press the  check key. The RTA Live view will now be displayed. Press the  SETUP key again to return to the SETUP menu. At the top of the Setup menu “Edit Settings” will be highlighted. Press the  check key to edit the RTA settings menu.

See chapter 5 of this Manual for more details on selecting instrument IDs.



For other information pertaining to the RTA instrument, see the following in this manual:

- For data storage, see "Taking Measurements and Storing Data" on page 4-5.
- For printing RTA reports, see "Printing Reports" on page 8-2.
- For I/O commands, see "Serial Port Interface Remote Control" on page A-1
- For RTA specifications, see "RTA Mode Specifications" on page C-18.

The menu layout of the RTA settings is shown in the table below:

Menu Items	Submenu	Available Settings Options	Available Settings Options
Title		User customized text entry	
RTA	Gain (dB)	-20 -10 +0 +10 +20 +30 +40 +50	
	Bandwidth	1/1 1/3	
	Detector	Lin Exp	
	Lin Detc Time	0.0025 to 99.9975 sec	
	Exp Detc Time (seconds)	1/32 1/16 1/8 1/4 1/2 1 2 4 8 16 32 64	
	Exp Store Rate	1/2 second 1/8 second	
	Transducer	Condnsr Electret Direct	
	Random Corr	No Yes	
Autostore	Autostore	No Yes	
	Pretrigger #	0-400 samples	
	Save ByTime	No Yes	
Trigger Setup	Triggering	No Yes	
	Trigger Source	Any 1/1 or 1/3 octave filter Flat	

Menu Items	Submenu	Available Settings Options	Available Settings Options
Trigger Setup (continued)	Arm	Arm Mode	Now L < L = L > Input Time Count
		Arm Level	0.0 - 255.9 dB
		Arm Time	00.0000 to 99.9975 sec
		Arm Samples	0 - 65535
		Arm Logic In	Low High
	Trigger	Trigger Mode	Now L < L = L > Input Time Count
		Trigger Level	0.0 - 255.9 dB
		Trigger Time	00.0000 to 99.9975 sec
		Trig Samples	0 - 65535
		Trig Logic In	Low High
	End	End mode	Never L < L = L > Input Time Count
		End Level	0.0 - 255.9dB
		End Time	00.0000 to 99.9975 sec
		End Samples	0 - 65535
		End Logic In	Low High
	Then	End Then	Stop Repeat Average
		Repeat Count	0 - 255
		Average Count	0 - 9
	Run on Input	No Yes	

Menu Items	Submenu	Available Settings Options	Available Settings Options
Trigger Setup (continued)	Run Logic In	Low High	
	Logic Out	0 - 65535	
RT60 dB Down		5 10 15 20 25 30	
Auto RT60		No Yes	
Note		8 Characters	

Settings Descriptions

Title Setting

Use the title setting to create a title or heading for printed reports. This title will be placed at the top of each RTA report you print.

RTA Settings Menu

Gain Setting

Gain adjusts the voltage level delivered to the measuring portion of the meter from the microphone and preamplifier.

Bandwidth Setting

Selects 1/1 or 1/3 octave filter bandwidth for real-time analysis.

Detector Setting

Selects the averaging method to be used.

- Linear

- Exponential

Linear Detector Time

The Linear Detector Time will be adjusted to an integer multiple of 0.0025 seconds (2.5mS).

Allows the user to select the averaging time when the linear detector is used. Also sets the storage rate for the Autostore ByTime records.

- 0.0025 to 99.9975 seconds

Exponential Detector Time

When an exponential detector is selected, this parameter sets the exponential decay time.

- 1/32 to 64 seconds

Exponential Store Rate

The Exponential Detector Time multiplied by the Exponential Store Rate gives the total Auto Store time.

Selects the rate at which spectral samples are output and stored when the detector is exponential. The interval time, time between successive samples, is equal to the exponential detector time multiplied by the exponential store rate.

- 1/2
- 1/8

NOTE: For example, if the detector time is 1/8 and the store rate is 1/2, then the 824 would generate spectra samples at a rate of 16 times per second.

Transducer

When a condenser microphone is used, the 824 requires a stabilization time of approximately 45 seconds before a measurement can be taken.

- **Condenser** - This indicates that the microphone being used is an air condenser type and the 824 will generate the appropriate polarization voltage.
- **Electret** - This indicates that the microphone being used is an “Electret” (pre-polarized) microphone. The 824 will not generate any polarization voltage.
- **Direct** - This indicates that no microphone is being used and electrical signals are being injected directly into the preamplifier. No polarization voltage is generated.

By default, the RT60-A and RT60-B instruments have Autostore and ByTime enabled.

See "Random Incidence Microphone Correction" on page C-24 for the random incidence correction filter's response.

Random Correction

The Random Corr setting gives you the option of turning on a digital filter to provide the correction necessary to provide a random incidence response when measuring with a 2540 or 377B41 free-field microphone.

No - Random incidence correction is turned off.

Yes - Random incidence correction is turned on.

Autostore Settings Menu

When a linear detector is selected, the store rate is that of the linear detector.

When an exponential detector is selected, samples are stored every (exponential detector time) multiplied by the (exponential store rate).

Pretrigger samples are only available when the trigger function is used to start the measurement.

Autostore

Turns the Autostore function on or off. It allows the 824 to measure and store basic information such as the Leq, Max, and Min spectra when a measurement is ended by the triggering setup or by pushing the run/stop key. When Autostore is on, ByTime data is automatically stored in the Autostore record if Save ByTime is set to Yes. For setups with a linear detector, spectra are stored once every linear detector time.

For setups with an exponential detector, samples are stored every 1/256 of a second (0,004 second) to every 32 seconds.

Pretrigger

Allows the user to select the number of pretrigger samples that are stored with an Autostore ByTime record. The 824 keeps a circular buffer of the most recent 400 samples. The buffer is reset every time a new run is started. The number of spectra in the buffer is displayed in the Trigger Status view. This setting determines how many of these spectra to copy into the beginning of the Autostore record.

- 0 - 400 samples

When Autostore is turned on, ByTime records are automatically stored.

A typical trigger having the following settings,

Trigger Source: 1 kHz

Arm Level: 80.0 dB

Arm Mode: L >

Arm Time: 2.0 second

would transition to arm after the 1 kHz filter level was greater than 80 dB for 2 seconds.

Save ByTime

This feature allows the user to enable or disable storage of ByTime data in an autostore record. With this feature turned off and the Autostore function turned on, the 824 will only store Leq, Max, and Min spectra.

Triggering

Turns triggering **on** or **off**. There are four parts to triggering: **Arm**, **Trigger**, **End**, and **Then**. Arm and Trigger work in tandem to create a two step trigger to start an Autostore. End and Then work together to determine when to stop measuring.

Trigger Source

Allows the user to select a filter or flat overall level as a trigger source.

Arm Settings Menu

Elapsed time and qualifying times are evaluated only when a new ByTime sample is created. This causes the minimum effective time resolution to become the same as the update interval.

“L” indicates the level of the filter specified by the Trigger Source setting.

Arm Mode

The 824 becomes armed when the following conditions are met:

- **Now** - The 824 will arm immediately.
- **L <** - When the level is less than the “Arm Level” for the “Arm Time”, then, the 824 will arm.
- **L =** - When the level is equal to the “Arm Level”, +/-0.5 dB, for “Arm Time” then the 824 will arm.
- **L >** - When the level is greater than the “Arm Level” for “Arm Time”, then, the 824 will arm.
- **Input** - The 824 arms when the logic input line changes to “Arm Logic In” state.

- **Time** - The 824 arms after the “Arm Time” seconds in the ready mode.
- **Count** - The 824 arms after “Arm Count” samples of data have been received.

Arm Level

Arm Time is used in conjunction with Arm Level as a qualifier for the level setting. See example below.

This trigger level is used when the “Arm Mode” is set to a level state (**L<**, **L=**, **L>**). This level must be reached before the 824 will arm.

- 0.0 - 255.9 dB

Arm Time

When the “Arm Mode” is set to **Time**, the “Arm Time” must expire before the 824 will arm.

This is also a qualifier for the level settings. If the time is non-zero, then the level condition must be met for the specified time before Arm Mode is entered.

- 00.0000 to 99.9975 seconds

Arm Samples

When the “Arm Mode is set to **Count**; “Arm Samples” is the number of samples that will be taken before the 824 is armed.

- 0 - 65535

Arm Logic In

When the “Arm Mode” is set to **Input**, the 824 will arm when the state of the Logic In line changes to this level. Logic In is sampled 32 times each second.

- Low
- High

Trigger Settings Menu

Trigger Mode

The 824 triggers and starts recording an Autostore record when Armed and the following conditions are met:

- **Now** - The 824 starts recording an Autostore immediately.
- **L <** - When the level is less than the “Trigger Level” for “Trigger Time”, then, the 824 begins recording an Autostore.
- **L =** - When the level is equal to the “Trigger Level”, +/- 0.5 dB, for “Trigger Time”, then, the 824 begins recording an Autostore.
- **L >** - When the level is greater than the “Trigger Level” for “Trigger Time”, then, the 824 begins recording an Autostore.
- **Input** - The 824 starts recording an Autostore when the logic input line changes to “Trigger Logic In” state.
- **Time** - The 824 starts recording an Autostore after “Trigger Time” seconds.
- **Count** - The 824 starts recording an Autostore after “Trig Samples” of data have been received.

Trigger Level

“**L**” indicates the level of the filter specified by the Trigger Source setting.

This level is used when the “Trigger Mode” is set to **Level (L<, L=, L>)**. This is the amplitude in dB at which the 824 will start recording an Autostore record. It must be valid for the period of time set by “Trigger Time”.

- 0.0 - 255.9 dB

Trigger Time

When the “Trigger Mode” is set to **Time**, this is the time that must pass before the 824 starts recording an Autostore record. This is also a qualifier for the level settings. If the

time is non-zero, then the level condition must be met for the specified time before the trigger will occur.

- 00.0000 to 99.9975 seconds

Trig Samples

When the “Trigger Mode” is set to **Count**; “Trig Samples” is the number of samples that will be taken before the 824 starts recording an Autostore record.

- 0 - 65535

Trig Logic In

When the “Trigger Mode” is set to **Input**, the 824 starts recording an Autostore record when the logic input line changes to the “Trig Logic In” state.

- Low
- High

End Settings Menu

End Mode

The measurement ends when the following conditions are met:

- **Never** - The measurement continues until the run/stop key is pressed.
- **L <** - When the level is less than the “End Level” for “End Time”, then the 824 stops recording an Autostore.
- **L =** - When the level is equal to the “End Level”, +/-0.5 dB, then the 824 stops recording an Autostore.
- **L >** - When the level is greater than the “End Level” for “End Time”, then the 824 stops recording an Autostore.
- **Input** - The 824 stops recording an Autostore after the logic input line changes to “End Logic In” state.

- **Time** - The 824 stops recording an Autostore after “End-Time”.
- **Count** - The 824 stops recording an Autostore after “End Samples” of data have been received.

End Level

This level is used when the “End Mode” is set to **Level (L<, L=, L>)**. It is the amplitude in dB at which the 824 will stop recording an Autostore record.

- 0.0 - 255.9 dB

End Time

The 824 stops recording an Autostore record when the “End Time” has been satisfied.

- 00.0000 to 99.9975 seconds

End Samples

The 824 stops recording an Autostore after “End Samples” has been satisfied.

- 0 - 65535

End Logic In

When the “End Mode” is set to **Input**, the 824 stops recording an Autostore record when the L logic In line changes to “End Logic In” state.

- Low
- High

If set to 0 seconds, triggering will repeat “forever”, and the measurement will end when stopped or out of memory.

If set to 0 samples, the measurement will stop after the first event is captured.

Then Settings Menu

End Then

After the measurement ends, the 824 may do the following:

- **Stop** - The measurement ends.
- **Repeat** - The measurement repeats when the Arm and Trigger settings have been satisfied. A new Autostore record is created for each repeated measurement.
- **Average** - The measurement repeats (like repeat above) except that the spectra are averaged with the preceding spectra.

*Repeat Averaging requires the **End Mode** to be set to Time or Count so that all records are the same length.*

Repeat Count

Allows the user to select how many times the measurement will repeat when the “End Then” setting is set to **Repeat**.

- 0 - 255

Average Count

This is the number of times the measurement is repeated and averaged when the “End Then” setting is set to **Average**.

- 0 - 9

Trigger Settings Menu (continued)

Run on Input

When set to Yes the instrument will run when the logic input line changes to the “Run Logic In” state.

- No
- Yes

Run Logic In

- Low

- High

Logic Out

The Logic Out bit value determines which lines (heater, cal, or logic) will be used on the control connector to indicate each of the five states.

- 0 - 65535

These lines can be used to control lights in a remote control device to indicate the current state.

The setting for the Output Logic state selection is combined into one 15-bit setting that has 3 bits (one for each output line-Logic Out, Heater Out, and Cal Out) for each of the five states (Stop, Ready, Armed, Triggered, Ended).

Use the table below to determine how these will be set up.

Ended			Triggered			Armed			Ready			Stop		
16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Heat	Cal	Logic Out	Heat	Cal	Logic Out	Heat	Cal	Logic Out	Heat	Cal	Logic Out	Heat	Cal	Logic Out

The default setting indicates the following:

Ended state is output on logic out.

Triggered state is output on logic out.

Armed state is output on cal.

Ready state is output on heat.

Stop state is not output.

The default setting is 04768 which is shown by the bolded squares in the table above.

The Logic output is on pin 2 of the control connector and will be driven to +5 volts through a 1000 ohm resistor when asserted or zero volts when not asserted. Pin 1 is the ground signal.

The Cal output is on pin 7 of the control connector and will be driven to +5 volts through a 10,000 ohm resistor when asserted and to zero volts when not asserted.

For more information on the Control Connector, see the section "System 824 Components" on page 1-10

The Heater control output is on pin 8 of the control connector and will conduct current to ground when asserted and not conduct when not asserted; uses an open drain 'N' channel transistor. Maximum voltage is +40 VDC and -0.5

VDC and the maximum current is 100 mA. Return current path is through pin 1, control ground.

RT60 Reverberation Time Settings



RT60 dB Down

The automatic RT60 algorithm will search for a point 5 or more dB down from the maximum sample and then calculate an RT60 between that point and the next point, “RT60 dB Down”.

Example: If “RT60 dB Down” is set to 30 dB, the RT60 will be calculated for the data between 5 and 35 dB down from the max. The available selections are:

- 5 dB
- 10 dB
- 15 dB
- 20 dB
- 25 dB
- 30 dB

Auto RT60

The Auto RT60 setting, when enabled, automatically calculates the RT60 for each filter, on screen, as the user moves between filters using the up  and down  arrow keys.

Note

If Note ends with a numeral it will be incremented automatically with each spatial average snapshot taken or stored.

An 8 character note field is provided to annotate a spatial average. This is useful when describing the measurement you are taking and keeping track of different measurements or their location.

RT60-A and RT60-B Instrument Definition

The RT60-A Setup is configured for the use of a steady-state noise source which is shut-off to initiate the decay. The RT60-B Setup is configured for the use of a noise burst such as a balloon bursting.

Although the settings are predefined in RT60-A and RT60-B, they can be changed at any time and used as customized setups for a personalized RT60 measurement.

The System 824 contains two special RTA IDs on the setup menu which will simplify making an RT60 measurement. Both of these setups load the RTA instrument but with the triggering, arm, and end menus configured for two types of measurements.

The RT60-A and RT60-B RTA instruments are accessed from the  SETUP key.

RT60-A

The RT60-A setup is designed to gather data to measure an RT60 by exciting a room with a steady state noise. It is configured in the following way:

- Detector: Linear
- Detector Time: 0.01 seconds
- Autostore: Yes
- PreTrigger: 50
- Save ByTime: Yes
- Triggering: Yes
- Trigger Source: 1 kHz
- Arm Mode: L >
- Arm Level: 80.0 dB
- Arm Time: 2.0 second
- Trigger Mode: L <
- Trigger Level: 80.0 dB
- Trigger Time: 00.0000 seconds
- End Mode: Time
- End Time: 3.0 seconds

- Then: Stop

RT60-B

The RT60-B setup is designed to measure an RT60 by exciting a room with impulsive noise such as a gunshot or a balloon popping and is configured in the following way:

- Detector: Linear
- Detector Time: 0.01 seconds
- Autostore: Yes
- PreTrigger: 10
- Save ByTime: Yes
- Arm Mode: Now
- Triggering: Yes
- Trigger Source: 1 kHz
- Trigger Mode: L>
- End Mode: Time
- End Time: 3.0 seconds
- Then: Stop

Qualifying Background Noise: Rooms [RTA] ID


This ID sets up the System 824 to measure and evaluate background noise according to the RC and NCB room noise criteria.

The System 824 has an Instrument Definition that makes it easy to measure room criteria, NCB and RC, using the RTA in 1/1 octave bandwidth. The setup is configured to take data for 10 seconds at each location in a room. Each measurement is automatically stored in the Autostore ByTime history.



ROOMS.RTA is configured in the following way:

- Bandwidth: 1/1 octave
- Detector: Linear
- Linear Detector Time: 00.1000 seconds
- Autostore: Yes
- ByTime: No
- Triggering: ON
- Trigger Mode: Now
- End Mode: Time
- End Time: 10.0000 seconds
- End Then: Stop


Display Views



This next section will explain the various displays available under the  View key. Once a measurement has been taken, the 824 allows you to view the results and manipulate the data.

RTA Views


The RTA Display Views are accessed through the  View key. To select the RTA Display Views press the  View key. The following menu will appear:



Now press the  right arrow key to bring up the “View RTA” display view menu.

Use the  up and  down arrow keys to highlight the desired display.

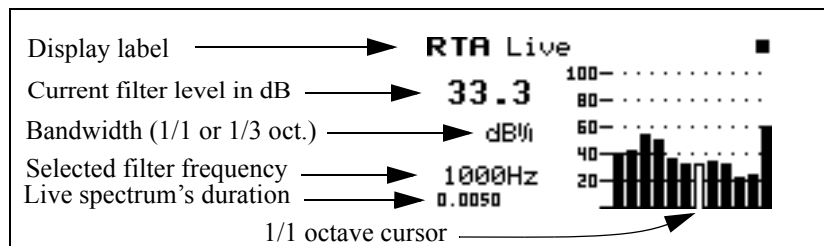


The RTA display view menu offers 5 choices: Live, Leq, Max, Min, and Times. Use the  check key to select the **Live** display.





Live

If the sample time is greater than 0.25 seconds a display spectrum is generated and displayed to keep the live data current. If the sample time is less than 0.25 seconds, the display still updates every 1/4 second.

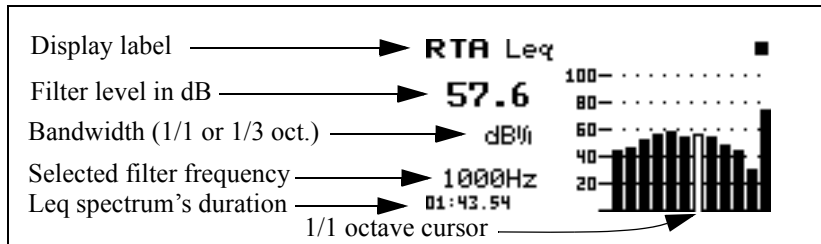
The **RTA Live** display shows the live spectrum and is the current sampled data with a sample time based upon the detector, detector time and detector store rate settings. The Live display is updated regularly when the 824 is running.




Leq

Press the  View key again to display the “View RTA” menu. Press the  up and  down arrow keys to highlight the desired display and press the  check key to select the highlighted display.

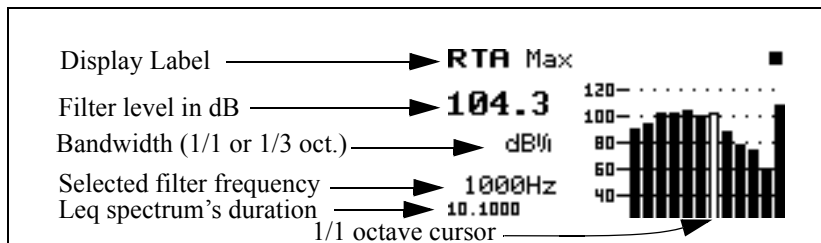
The **Leq** display shows the equivalent level of all the samples. A current or overall reset will reset the Leq.





NOTE: Leq, Max, and Min are measured only while triggered, if triggering is enabled. If triggering is disabled they are measured while the 824 is running by pressing the  R/S key. If Autostore is enabled, Leq, Max, and Min will be reset at every trigger (or run if Triggering is off), otherwise they will accumulate for each R/S measurement until manually reset.

Max

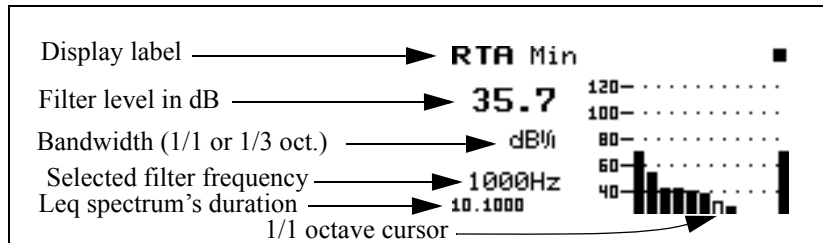
The **Max** spectrum shows the maximum level obtained by each filter and the maximum broadband (Flat) level. This is a bin-by-bin maximum level. The Max spectrum is reset by a current or overall reset and the R/S key when Autostore is enabled.



Min

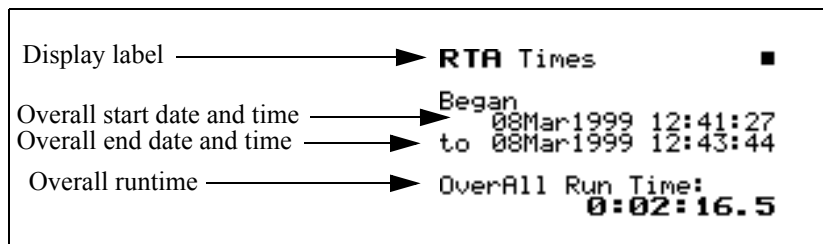
Once in a display view, you can simply use the  up and  down arrow keys to move between the views.

The **Min** spectrum shows the minimum level obtained by each filter along with the minimum broadband (Flat) level. This is a bin-by-bin minimum level. The Min spectrum is reset by a current or overall reset and the R/S key when Autostore is enabled.





Times



The Times display shows the date and time when the overall measurement began and the date and time when the last measurement ended. These times are not affected by the automatic reset or the manual “Current” reset, but are reset with an “OverAll” reset. The total running time is also displayed. This is the total elapsed time of all measurements since the previous “OverAll” reset.




Trigger Views


The Trigger Display Views are accessed through the  View key. To select the Trigger Display Views press the  View key. The following menu will appear:



Use the  up and  down arrow keys to highlight “Trigger”.

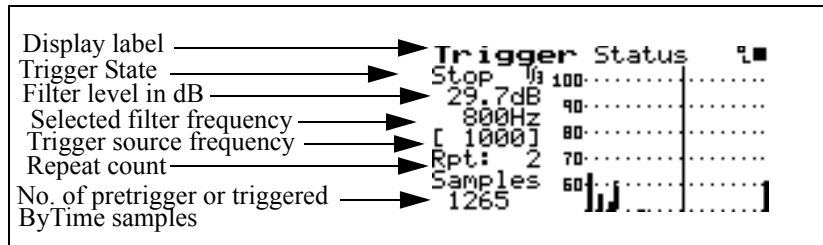
Now press the  right arrow key to bring up the “View Trigger” display view menu.



The Trigger display view offers 2 choices: Status and Setup. Use the  check key to select the **Status** display.

Status

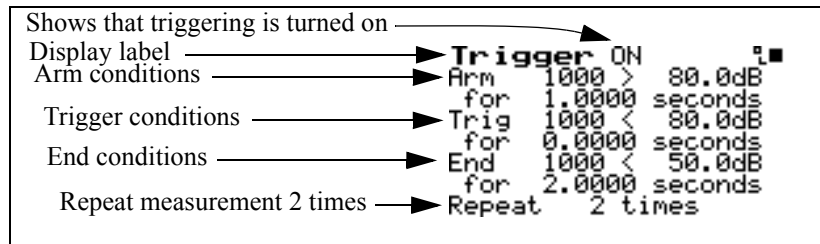
The Trigger status display shows the current state of the RTA, showing either Stopped, Ready, Armed, Triggered, or End. This display shows a copy of the Live spectrum and its graph. Also displayed is the repeat count when set to repeat or repeat with average, and the number of samples gathered pre or post trigger.



Setup

Use the down arrow key to move to the Setup display or press the VIEW key, highlight **Setup** and press the Check key.

The Trigger Setup display shows the trigger settings in an interpretive way. Only applicable settings are displayed.



The interpretation of the Trigger Setup display is as follows:

- The 824 will arm when the 1 kHz filter is greater than 80.0 dB for a period of 1 second.
- When the level of the 1 kHz filter drops below 80.0 dB for 0 seconds (immediately), the 824 is triggered and begins taking a measurement.
- The measurement continues until the End condition is met which means that the level must drop below 50 dB for 2 seconds.

Pressing the Check key provides quick access to the trigger settings.

- The measurement will repeat 2 more times before stopping for a total of 3 measurements.

As the settings are changed the Trigger Setup display will show the relevant settings in an easy to read form.

Autostore Views

*If triggering is enabled, the record is stored when the End condition is met or when the **▶** R/S key stops the measurement. If triggering is not enabled the record is stored when the **▶** R/S key stops the measurement.*

*If you just came from the Trigger Setup display, press the **◀** left arrow key to back out to the main VIEW menu.*

An Autostore is a historical record of triggered data that is stored automatically when the Autostore setting is set to **Yes**. The Autostore includes summary data (Leq, Max, and Min spectra) covering the entire duration of the Autostore and, optionally, ByTime spectra. RT-60 analysis of the ByTime spectral time history is also provided.



The Autostore Display Views are accessed through the **◂** VIEW key. To select the Autostore Display Views, press the **◂** VIEW key and the **▲** up and **▼** down arrow keys to highlight “Autostore”. The menu will appear like this:




Now press the **▶** right arrow key to bring up the “View Autostore” view menu.



Press the **▶** right arrow key to select the available Autostore summary data views which are Leq, Max, and

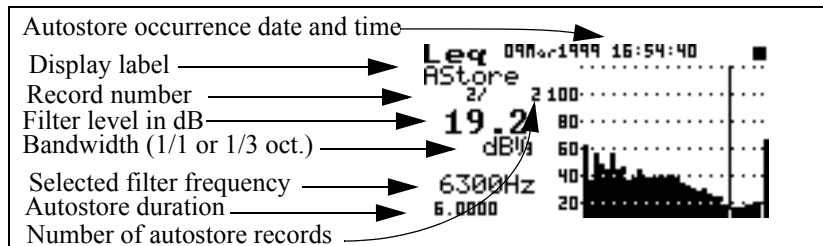
Min. Use the  up and  down arrow keys to highlight the desired display.





Press the  check key to view the **Leq** display.

Leq

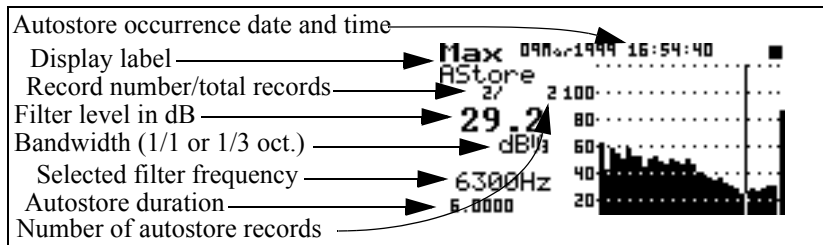
The autostore **Leq** display shows a bin by bin equivalent level of all samples while the Autostore is triggered.



To move to the next Autostore display, press the  check key and then the  right arrow key.

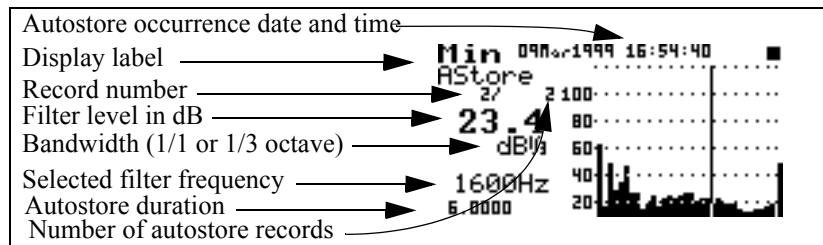
Max


The Autostore **Max** display shows the maximum level obtained by each filter and the broadband maximum level of all samples while the Autostore is triggered.





Min

The Autostore **Min** display shows the minimum level obtained by each filter and the broadband minimum level of all samples while the Autostore is triggered.




Pressing the  check key twice while in any of these display views will toggle you between the Leq, Max, and Min autostore displays.



The  up and  down arrow keys will move you to the next or previous Autostore records.

Press the  View key to return to the “View Autostore” sub- menu.




Press the  left arrow key to back out to the main “View Autostore” menu showing Autostore, ByTime, and RT-60 menu items.



Use the  down arrow key to highlight the “ByTime” menu item and press the  right arrow key to access the “ByTime” menu and displays.

The following “View ByTime” menu appears:



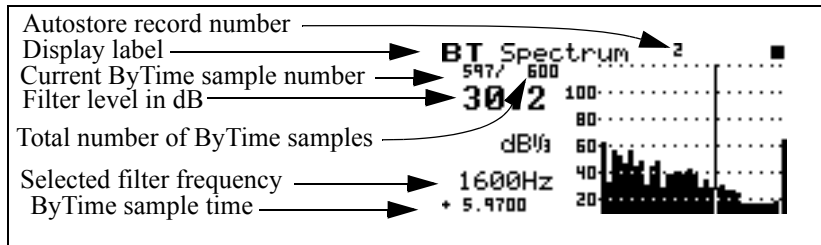
Press the  check key to view the ByTime spectrums recorded during the Autostore.

Autostore ByTime Spectral History


The Autostore ByTime spectral history has two displays for viewing the time history data. The first is called the **ByTime Spectrum** and the second is called the **ByTime Graph**.





ByTime Spectrum

The Autostore ByTime Spectrum display shows just one sample in time and the entire frequency spectrum with frequency on the horizontal axis.



This ByTime display shows that 600 spectra were taken and we are currently looking at record number 597.

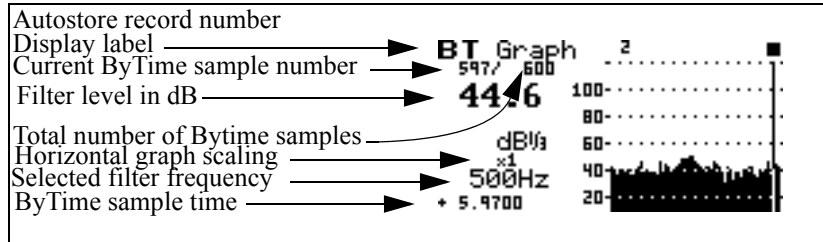
To move to the ByTime Graph display, press the  check key twice.

With the  up and  down arrow keys you can view each ByTime spectrum sample that was recorded. Use the  left and  right arrows to move the cursor to look at each individual frequency.

NOTE: Notice as you move through each ByTime sample that the sample time changes. A minus sign in front of the time indicates that they are pretrigger samples. 0 is the point where the trigger occurred.

ByTime Graph

The Autostore ByTime Graph display is a time graph of just one filter frequency, plotted with time as the horizontal axis. This graph is useful in seeing the level “rise or fall” characteristics of each individual filter.



The up and down arrow keys move you through each filter. The left and right arrow keys move to the previous and next ByTime sample.

ByTime Spectrum Check Menu

As discussed earlier, in order to move between the ByTime spectrum display and the ByTime Graph display you pressed the check key twice (toggling between the ByTime Spectrum view and the ByTime Graph view). Pressing the check key once when viewing the ByTime spectrum display puts you in the check menu. The check menu is shown below:



The check menu offers the following options:

- **ByTime Graph** - View the time graph of one filter
- **Autostore** - View the Autostore Leq, Max, and Min spectra
- **Locate** - Locate an Autostore/ByTime record
 - **Next** - The next Autostore record
 - **Prev** - The previous Autostore record
 - **First** - The first ByTime record
 - **Last** - The last ByTime record
 - **Find** - Finds the specified ByTime record


The Locate menu helps you find the record you would like to view.

The Spatial Averaging displays and menus are covered later in this chapter.

If 1/3 octave filters are selected, the Rooms display gives you the Hearing Threshold Level or HTL for this spectrum.

- **Average** - Add spectrum to spatial average or view spatial spectra average
- **Rooms** - View NCB and RC Room Criteria for this spectrum (for 1/1 octave filters)
- **Graph** - Adjusts the graph scale and offset (See 824 Reference Manual)
 - **Graph Level** -Allows numerical entry of graph level in dB.
 - **Graph Scale** - Allows numerical entry of graph scale

ByTime Graph Check Menu

Pressing the  check key once when viewing the ByTime spectrum display puts you in the check menu. The check menu is shown below:



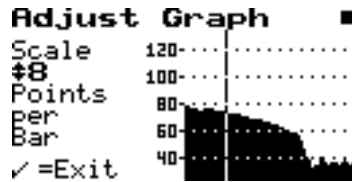
The check menu gives you the following options:

- **ByTime Spectrum** - View the Bytime spectrum
- **Autostore** - View the Autostore Leq, Max, and Min spectrum
- **Locate** - Locate an Autostore ByTime record
 - *Next* - The next Autostore record
 - *Prev* - The previous Autostore record
 - *First* - The first ByTime record
 - *Last* - The last ByTime record
 - *Find* - Finds the specified ByTime record
- **Graph-V** - Adjusts the vertical graph scale and offset
 - **Graph Level** -Allows numerical entry of graph level in dB.
 - **Graph Scale** - Allows numerical entry of graph scale

The Locate menu helps you find the record you would like to view.

The horizontal graph adjustment, (Graph-H), provides a useful feature that allows you to view a large amount of time data in the ByTime Graph view. A scale factor of 1 to 1024 can be selected. A scale factor of greater than 1 will cause multiple pieces of time data to be graphed to 1 bar. The measured data can be viewed by pressing the ◀ left or ▶ right arrow keys. The cursor will not move to the next graph point until the selected number of data points have been displayed numerically. This facility allows up to 1024 numeric data points to be displayed for each graph cursor point and allows the user to observe an overall shape of the measured data on screen without the need for scrolling.

- **Graph-H** - Adjusts the horizontal graph scale

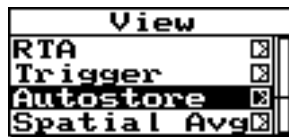


Press the ▲ up and ▼ down arrow keys to adjust the horizontal scale factor.

Press the ✓ check key to exit.

RT-60

The RT-60 display is accessed by pressing the ⌂ View key and highlighting “Autostore”. The menu appears like this:



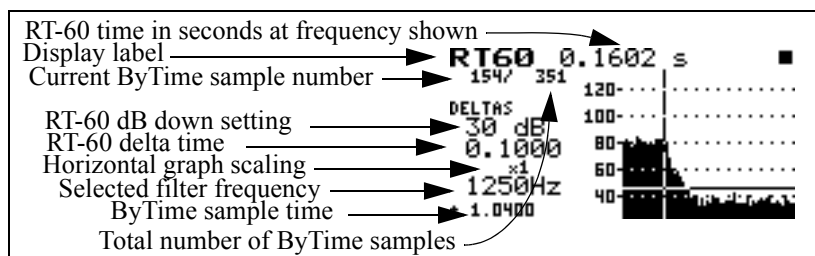
Press the ▶ right arrow key to bring up the “View Autostore” display view menu.



Highlight “RT-60” and press the \odot check key.

RT60

The RT-60 analysis display uses the ByTime history to calculate a room decay time. This time is calculated from the cursor position to a point a number of dB down as set by the “RT60 dB Down” setting and then extrapolated to a drop of 60 dB using a “Least Squares” slope calculation method.




The \blacktriangle up and \blacktriangledown down arrow keys move you to the next higher and lower filter frequency. The \blacktriangleleft left and \blacktriangleright right arrow keys move you to the previous and next ByTime sample.

If auto RT60 is set to “Yes”, the auto-select routine will be performed whenever a new filter is selected.

An auto-select routine will automatically locate the cursor to be 5 dB below the maximum level. The auto-select is executed on demand from the check menu and the first time the RT-60 display is selected. There is a vertical line for the cursor specifying the beginning of the measurement and a horizontal line drawn at the dB down level.

Auto-select also sets the horizontal zoom so that the whole decay fits on screen.

RT60 Check Menu

Pressing the  check key when viewing the RT60 display puts you in the RT60 check menu. The check menu is shown below:





The check menu offers the following options:

- **RT60 dB Down** - dB down setting for RT-60 calculation
- **Auto RT60** - Setting to enable an auto-select of RT60 whenever a new filter is selected
- **Auto-Select** - Auto-Select cursor position
- **Graph-V** - See page 2-13 for explanation
- **Graph-H** - See page 2-13 for explanation
- **View Back** - Returns you to the previous display

Spatial Avg Views

The Spatial Averaging facilities allow user selected spectra to be averaged on an equal weighting basis. It is often used to average the spectra that were measured at various locations around a noise source or across the length of a wall or partition. The resulting average is displayed and can be stored into a history for later viewing.

The Spatial Avg Display Views are accessed through the  View key. To select the Spatial Avg Display Views press the  View key and highlight “Spatial Avg”. The following menu will appear:



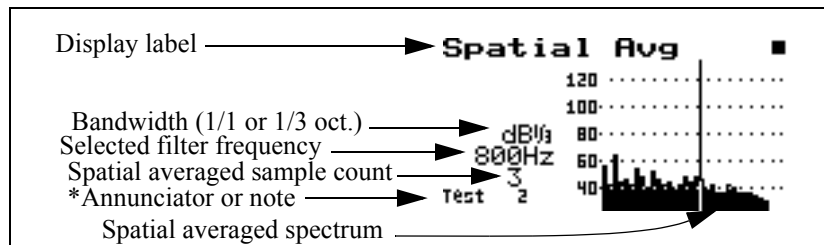
Now press the right arrow key to bring up the “View Avg” display view menu.



The “View Avg” display view menu offers 2 choices: Spatial Avg and Avg History. Use the check key to select the **Spatial Avg** display.

Spatial Avg

The “Spatial Avg” display shows the spectra which have been currently averaged.



*NOTE: *If the right digit of the annunciator is numeric then it will auto-increment with each spatial average store operation from the check menu.*

Any display which shows a spectrum can be averaged using the “+Average” item on its check menu.

There is effectively no limit on the number of spectra that may be averaged.


Each display that can show a spectrum has a check menu item, “+Average”, that, when selected, will prompt the user “Add to Average?”. It then offers the following choices:

- **Yes** - averages the spectrum being viewed to those previously averaged.
- **No** - the spectrum is not averaged into the previous average but the spatial average display is shown
- **Cancel** - nothing happens and the previous display is shown

Once, one or more spectra have been averaged, they can be stored into the “Avg History”.

Spatial Avg Check Menu

The Spatial Avg check menu is shown below:

To access the check menu simply press the  check key when in the “Spatial Avg” display.



The check menu offers the following options:


- **Note**- Note is used to describe this average which is to be stored to the Avg History
- **Store** - Store Spatial Average in Spatial Average History
- **Reset** - Resets the Spatial Average buffer
- **Avg History** - View the Spatial Average History
- **Rooms** - View Room Criteria for this spectrum

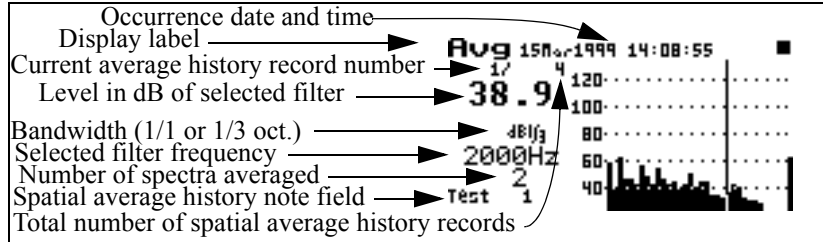
The 824 will prompt you to reset the “Spatial Avg” buffer. This does not reset the “Avg History”.

- **View Back** - Return to the previous display
- **Graph** - Adjusts the vertical graph scale and offset



Avg History

If the data being viewed has come from a stored file, the +average function is not available and will beep instead of bringing up the prompt “Add to Average?”.

The Avg History display shows a history of the spatial averages which have been stored using the “Store” function in the “Spatial Avg” check menu. Use the  View menu or the “Spatial Avg” check menu to access the “Avg History” display.



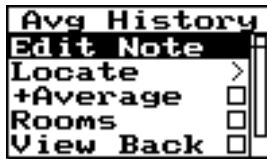
In order to clear the “Avg History” records, an overall reset is required.

Use the  up and  down arrow keys to move to the previous and next spatial average history records.

To manipulate the “Avg History” records, press the  check key to access the “Avg History” check menu.

Avg History Check Menu

The “Avg History” check menu is shown below:



The check menu offers the following options:

- **Edit Note** - Edit the note of this stored record.
- **Locate** - Locate a Spatial Avg history record
 - **First** - The first Spatial Avg history record
 - **Last** - The last Spatial Average history record
 - **Find** - Finds the specified Spatial Average history record
- **+Average** - Add spectrum to spatial average
- **Rooms** - View Room Criteria for this spectrum
- **View Back** - Return to the previous display
- **Graph** - Adjusts the vertical graph scale and offset

If you are viewing an “Avg History” record use the +average function to average records which are already in the average history together. Remember that all records are weighted equally. If you have an average history record which was comprised of 100 samples it will be averaged as one record.

Rooms Views

NCB and RC are calculated and displayed from any spectral display including snapshot or Averaged Spectrum and are accessed from their individual check menus.

The Rooms Views are accessed from the check menu of every display that can show a spectrum.

The Rooms displays consist of RC, NCB and HTL. All these measurements are based on ANSI S12.2-1995.

The NCB and RC Criteria for 1/1 octave data calculates the following:

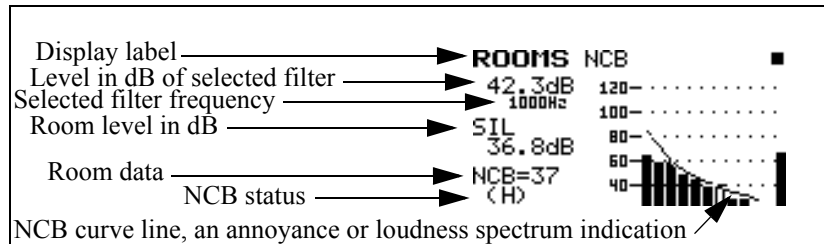
- SIL - speech interference level
- Pass/Fail on Rumble check
- Pass/Fail on Hiss check
- Mid-frequency average Lmf and RC
- Neutral, Hiss, Rumble or Vibration/Rumble check

RC, NCB and HTL are accessed in the “Rooms” display from any spectrum’s check menu.

NCB and RC are only displayed when using 1/1 octave filters.

Rooms NCB

The **Rooms NCB** display calculates the noise criterion for the spectrum being displayed when “Rooms” is chosen from any spectrum check menu.



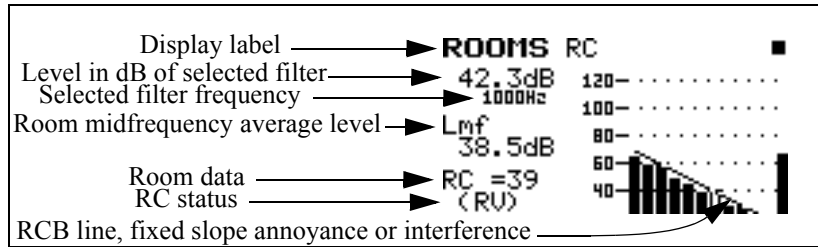
The “NCB status” indicator can show the following:

- **Under** - indicates that SIL (speech interference level) is under the defined range for NCB
- **Over** - indicates that SIL is above the defined range for NCB
- **(H)** - indicates the NCB Hiss check failed
- **(R)** - indicates the NCB Rumble check failed

Rooms RC

Use the ▲ up and ▼ down arrow keys to move between the RC and NCB displays.

The **Rooms RC** display calculates the noise criterion for the spectrum being displayed when “Rooms” is chosen from a check menu.



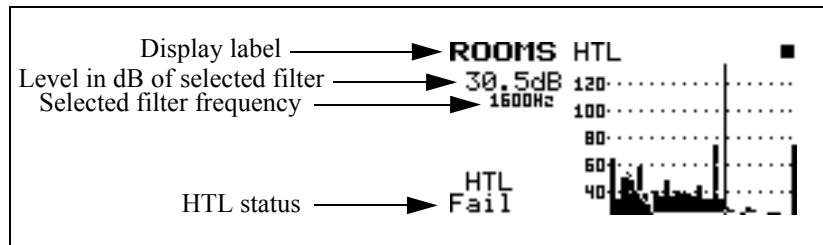
The “RC status” indicator can show the following:

- **Under** - indicates that Lmf (mid frequency average level) is under the defined range for RC
- **Over** - indicates that Lmf is above the defined range for RC
- **(N)** - indicates the RC is Neutral
- **(RV)** - indicates the RC Vibration/Rumble check failed
- **(R)** - indicates the RC Rumble check failed.

Rooms HTL

The “Rooms HTL” display is only available when 1/3 octave filters are selected.

The **Rooms HTL** display calculates the Hearing Threshold Level for the spectrum being displayed when “Rooms” is chosen from any spectrum’s check menu.



The “HTL status” indicator can show the following:

- **Pass** - indicates the recording environment is suitable to produce recordings without audible background noise
- **Fail** - indicates the recording environment is NOT suitable to produce recordings without audible background noise

FFT (Optional)


The FFT option gives the 824 the ability to do narrow band frequency analysis using the Fast Fourier Transform. This chapter describes the features and functions of this option.






Features

The FFT option has the following features:

- 400 line FFT (1 Hz to 20 kHz)
- Hanning, Flat-Top or Rectangular window
- Bandwidths of 200Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz, and 20kHz
- Count averaging (1 to 16384)
- Snapshot data storage (no ByTime autostore)
- Display zoom with a factor of 2, 4, or 8
- Total Harmonic Distortion
- User defined Linear Units

Settings Menu

The Settings menu for the FFT instrument is accessed from the SETUP  key.

To select the FFT instrument, press the SETUP  key, scroll down to the FFT instrument and press the Check  key. The FFT display will appear. Press the SETUP  key again to return to the SETUP menu. At the top of the Setup menu “Edit Settings” will be highlighted. Press the Check  key or the right  arrow key to edit the FFT settings menu.

NOTE: See "System 824 Virtual Instruments" on page 6-1 for a more detailed explanation on selecting instrument definitions.

The menu layout of the FFT settings is shown in the table below:

Menu Items	Available Settings Options
Title	User customized text entry
Gain (dB)	-20 -10 +0 +10 +20 +30 +40 +50
Bandwidth (Hz)	200 500 1k 2k 5k 10k 20k
Avg Count	1 to 16384
Repeat	No Yes
Window	Rectngl Hanning Fit-top
Overload Skip	No Yes
Transducer	Condnsr Elctret Direct
Random Corr	No Yes
Linear Units	4 characters of text
Linear Scale	-128.99 to 127.99
Auto Snapshot	No Yes

Settings Descriptions

Title Setting

Use the title setting to create a title or heading for printed reports. This title will be placed at the top of each FFT report you print. You are allotted 30 characters. Printing of FFT reports is not currently available.

Gain Setting

-20 & -10 dB gain are achieved by desensitizing the microphone by reducing its polarization voltage from 200 volts to 20 volts. See "Gain Setting - (SSA)" on page 7-6 for more details.

The gain setting sets the measuring range of the instrument in 10 dB steps by adjusting the amplification of the microphone signal. This setting provides the following options:

-20, -10, 0, +10, +20, +30, +40, +50

Bandwidth

The frequency resolution for each line is the bandwidth divided by the lines setting. With the bandwidth set to 20kHz and 400 lines, the frequency resolution is 50 Hz/line.

The frequency range of a baseband FFT analysis extends upwards from zero to a selected maximum frequency. Thus, the bandwidth, or the frequency range covered by the analysis, can range from a maximum of 20kHz to a minimum of 200Hz. This setting provides the following options:

200Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz, 20kHz

The following table shows resolution and FFT calculation times as a function of the frequency bandwidth.

Bandwidth, Hz	200	500	1k	2k	5k	10k	20k
Resolution, Hz/line	0.5	1.25	2.5	5	12.5	25	50
Calculation Time, Seconds	0.50	0.20	0.10	0.05	0.02	0.01	0.05

Avg Count

The 824 FFT is guaranteed to have no more than 75% overlap.

The average count is the number of FFTs taken and averaged together.

- 1 to 16384

FFT Repeat

Once the average count is completed you can choose to continue repeating the FFT or have the FFT stop.

- No - Stops the count when the average count has been reached.
- Yes - Repeats the count continuously.

Window

The Hanning window is typically used for most measurements.

The time weighting window can be the following:

- Rectangular; provides finest frequency resolution.
- Hanning; good compromise between amplitude accuracy and frequency resolution. Most commonly used for general measurements.
- Flat-top; provides best amplitude accuracy. Often used for calibration.

The Rectangular window provides the best frequency discrimination but can have significant filter leakage or effects of a truncated series. The Hanning window minimizes the filter leakage with the cost of a wider main lobe. The Flat-top window gives better amplitude accuracy in the passband.

Overload Skip

Overload skip allows you to throw away or keep spectra that contain overloaded data.

- No - Averages in spectra with overload data.
- Yes - Does not average spectra in that contains overloaded data.

When a condenser microphone is used, the 824 requires a stabilization time of approximately 45 seconds before a measurement can be taken.

Gains of -20 and -10 dB are only available for condenser microphones.

See "Random Incidence Microphone Correction" on page C-24 for the random incidence correction filter's response.

If this field is left blank then no linear value will be displayed. See the section "Displaying Amplitude in Linear Units" on page 12-14 for more details.

Transducer

- Condenser - This indicates that the microphone being used is an air condenser type and the 824 will generate the appropriate polarization voltage.
- Electret - This indicates that the microphone being used is an "Electret" (pre-polarized) microphone. The 824 will not generate any polarization voltage.
- Direct - This indicates that no microphone is being used and electrical signals are being injected directly into the preamplifier. No polarization voltage is generated. This is the choice when using an accelerometer as the transducer

Random Correction



The Random Corr setting gives you the option of turning on a digital filter to provide the correction necessary to provide a random incidence response when measuring with a free-field microphone.

No - Random incidence correction is turned off.

Yes - Random incidence correction is turned on.

NOTE: Random incidence correction can be used with the 2540, 377B41 and 2551 microphones.

Linear Units

Four characters of text are provided so the user can enter the type of units being used for the measurement. It accepts any alphanumeric character that can be found by scrolling with the up  and down  arrow keys.

Linear Scale



Allows you to enter the sensitivity of a transducer in decibels relative to volts.

- -128.99 to 127.99

Auto Snapshot


This feature allows you to automatically capture an FFT Snapshot on the completion of each FFT. If Repeat is set to “Yes”, then it creates a pseudo Time History. The time interval between spectra Snapshots will equal the FFT calculation time (see "Bandwidth" on page 12-3) multiplied by the number of counts selected for Count Averaging. For more detail on Snapshots, see "Snapshot" on page 12-11.

FFT Display

The FFT data displays are accessed through the View  key. To select the FFT displays press the View  key. The following menu will appear:

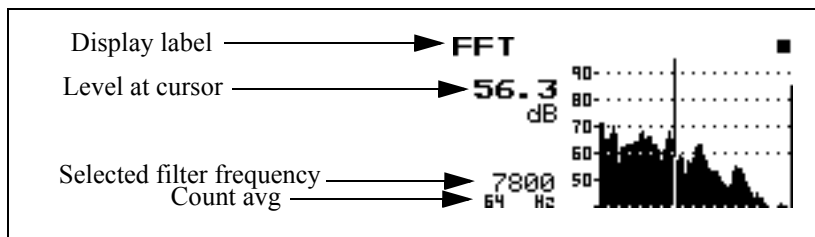


“FFT” accesses the live FFT spectrum and “Snapshot” displays the FFT snapshot data.

With “FFT” highlighted, press the Check  key to enter the FFT display.

FFT

The FFT display shows a live FFT spectrum.



The left ◀ and right ▶ arrow keys move the cursor to change the frequency and level displayed.

FFT Zoom

You can view approximately 80 bars of the FFT at once. When you are zoomed out you will notice that each bar represents several frequencies or lines. Pressing the right ▶ arrow key moves to the next line. The cursor will not move to the next bar until it shows all of the lines represented by that bar of the graph.

The FFT zoom on the 824 allows you to view a representation of all 400 lines or a portion of the 400 lines on the display. This is called a display zoom.

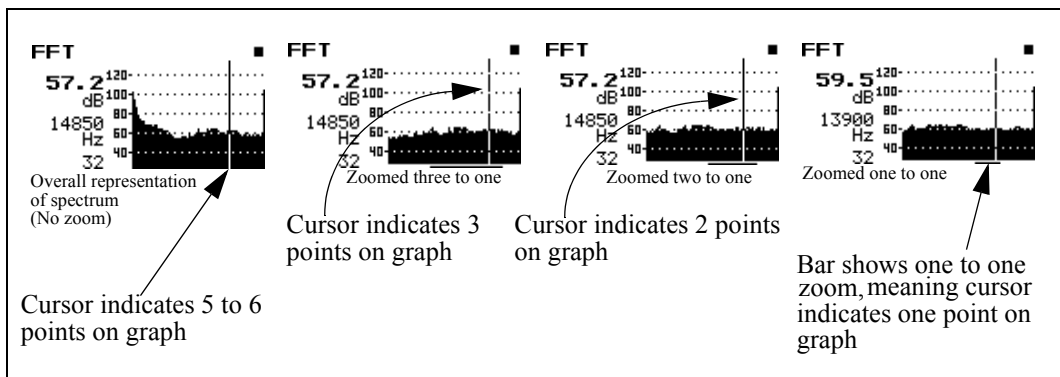
The up ▲ arrow key will zoom in the display by a factor of 2 to 8. This means that a zoom factor of 2 shows one half of the 400 lines on the display. A zoom factor of 8 would show one eighth of the 400 lines on the display. The down ▼ arrow key zooms out to a full screen display of the FFT.

The zoom factor is shown graphically as a horizontal bar at the bottom of the bar graph. The shorter the bar, the greater the zoom.

The location of the zoom bar indicates the position of the displayed area of the spectrum.

NOTE: When more than one frequency is represented by a single bar, the largest bar is represented on the display. As you press the right and left arrow keys to move the cursor across the display, you will notice that the cursor does not move until all of the frequencies represented by that bar have been displayed.

Some examples of zoomed displays are shown below:



While zoomed, the display will scroll when the cursor nears either the left or right edge of the display.

FFT Check Menu

Pressing the Check (✓) key while in the “FFT” display puts you in the check menu shown below:



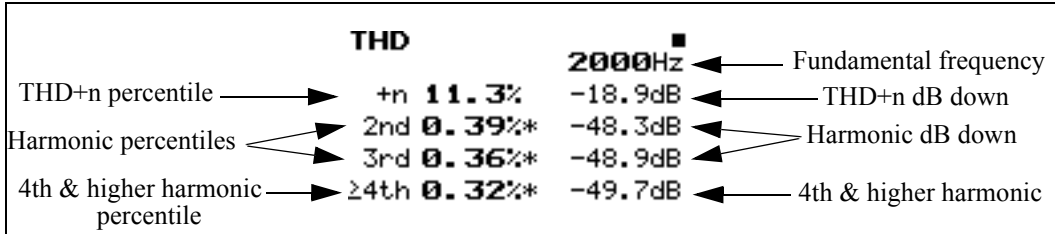
The check menu offers the following options:

- Store Snapshot - Stores the current FFT spectrum at that moment in time.
- THD - Activates the THD display which shows the calculated THD.
- Settings - Activates the FFT settings menu.
- Graph - Adjusts the vertical graph scale and offset (See 824 Reference Manual)
 - *Graph Level* - Allows numerical entry of graph level in dB.
 - *Graph Scale* - Allows numerical entry of graph scale

The THD as calculated in the 824 satisfies all of the requirements for ANSI S3.6.

THD (Total Harmonic Distortion)

The THD display shows the results of the THD calculations.



THD information is only available on screen at the time of the measurement and is not stored with a file or printed to a report.

Entering the THD display will auto-position the cursor to the fundamental frequency on the FFT screen.

Results are reported in dB down difference and units of percentile. The dB down difference is calculated by subtracting the harmonic level from the fundamental level. The percentage is equal to one hundred times ten raised to the power of the result of the dB down difference divided by twenty.

THD is calculated by scanning the full spectrum to find the fundamental frequency and selecting the highest peak. The actual frequency is extrapolated from the fundamental bin frequency and the highest sideband bin frequency. The second harmonic is found by doubling the fundamental frequency, then finding the nearest bin frequency and summing its level with its side-band levels. The third harmonic is found by tripling the fundamental frequency, then finding the nearest bin frequency and summing its level with its side-band levels. The fourth and higher harmonics are found by the process described above for the second and third harmonics.

THD+n is calculated by summing the energy of the fundamental bin with the five bins on each side, then subtracting the energy sum of all the other levels.

For THD to be calculated, the following criteria must be met:

- The window must be in Hanning mode after an overall reset. If not, “Available only in Hanning Window” is shown.
- The fundamental must be above the 4th bin or 10 Hz whichever is higher. In the case where the fundamental frequency is near the 5th bin and it’s skirt extends into some or all of the first four bins, the fundamental energy sum calculation will include only the 3rd and/or 4th bins but not the 1st or 2nd bin. In any case the noise energy sum calculation will never include the first four bins.
- The fundamental must be higher than any of the first four bins. There must not be excessive DC or near DC levels.
- THD+n must be at least 10 dB below the fundamental level. There must be an identifiable tone.
- The fundamental frequency will be displayed whether there is an identifiable tone or not.
- If a harmonic is less than 10 dB above the noise floor, the level of the harmonic is marked with an asterisk. The noise floor is calculated as the maximum of the minimum in the two adjacent valleys.
- If one of the harmonic’s side-bands is higher than the harmonic then the harmonic is marked with an asterisk.

THD Check Menu

Pressing the Check (✓) key while in the “THD” display puts you in the check menu. The check menu is shown below:



The check menu offers the following options:


- View FFT - Takes you back to the FFT display

The bandwidth for each line is the bandwidth setting divided by the lines setting.


- Bandwidth - Allows you to reduce the frequency bandwidth from 20kHz to 200Hz. This setting provides the following options:

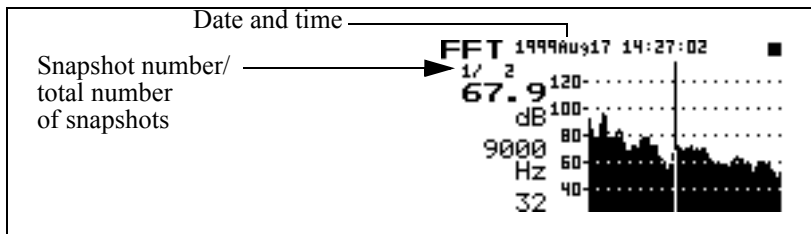
200Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz, 20kHz



Snapshot

Once you have stored an FFT snapshot by accessing “Store Snapshot” from the FFT check menu, you can view the snapshot data by pressing the View  key. The following menu appears:



Highlight “Snapshot” and press the Check  key to access the snapshot data.



Use the up  and down  arrow keys to scroll through each record.

Use the check menu to control the HORIZONTAL SCALE.

The **date** and **time** records when the snapshot was taken.

Snapshot Check Menu

To access the snapshot check menu, press the Check (Ⓢ) key while viewing the snapshot data. The following menu appears:



The check menu offers the following options:

- Locate - Locate Snapshot record
 - *First* - The first Snapshot record
 - *Last* - The last Snapshot record
 - *Find* - Finds the specified Snapshot record
- Graph - Adjusts the graph scale and offset (See 824 Reference Manual)
 - *Graph Level* - Allows numerical entry of graph level in dB.
 - *Graph Scale* - Allows numerical entry of graph scale.
- Zoom in - Allows you to see FFT spectrum with more detail. (See page 6 for more information)
- Zoom out - Allows you to see FFT spectrum with less detail. (See page 6 for more information)

FFT Calibration

The FFT spectrum always displays the measured level in decibels on a logarithmic scale. In fact, the use of the term “level” implies a decibel value relative to a defined reference value.

Acoustic measurements are in dB relative to 20 μPa

When the System 824 has been calibrated using an acoustic calibrator, whether from the ISM, SSA, LOG or FFT instrument, the decibel levels are relative to 20 μPa (20 micro-Pascal).

Note, however, that it is possible to provide a digital readout of the amplitude at the cursor position in linear units as shown below in the section “Displaying Amplitude in Linear Units” on page 12-14

Calibrating dB to a Different Reference

For measurements of non-acoustical parameters such as acceleration, it is more appropriate to express the measurement in decibels relative to a different reference using units typical for that parameter. This is easily done using a calibrator to excite the transducer to a known value.

The decibel level of a measured parameter is calculated as follows:

$$L_V = 20 \text{Log}_{10} [V/V_{\text{ref}}]$$

where V = measured parameter

and V_{ref} = reference value, same units as the measured parameter

Calibrating to measure acceleration in decibel units relative to an acceleration unit (e.g. g, m/s², ft/s², etc.)

For example, if we prefer to express acceleration in units of “g”, we may select to represent the “acceleration level” in decibels relative to 1 μg. Using an accelerometer calibrator which excites the accelerometer at an rms amplitude of 1 g, such as the PCB 394C06 Portable 1g Handheld Shaker, we

will perform a calibration and calculate that the level we measure should be

$$L_v = 20\text{Log}_{10}[1.0/(1.0 \times 10^{-6})] = 120 \text{ dB.}$$

Thus, prior to performing the calibration using the calibration item in the Tools menu, we set the **Cal. Level** to 120.

Similarly, should we wish to use the same calibrator to measure in units of dB relative to 1 μm , we would set the **Cal. Level** to

$$L_v = 20\text{Log}_{10}[9.86/(1.0 \times 10^{-6})] = 139.9 \text{ dB}$$

Displaying Amplitude in Linear Units

Providing a digital readout of the measured amplitude at the cursor position in linear units.

Although the measured level is always displayed in decibels on a logarithmic scale with a digital readout at the cursor position in dB, a second digital readout can be created which will show the amplitude in linear units. This is particularly useful when using an accelerometer and desiring to readout the amplitude in units such as g, m/s², ft/s², etc. The accuracy of the linear units value will be +/- 5 % of the true value.

This procedure requires evaluating the sensitivity of the transducer in decibels relative to volts. The sensitivity of the transducer is usually provided in the manufacturers specifications. To convert sensitivity to decibels use the following formula:

When the linear scale is set to zero the 824 will read the rms input voltage.

$$\text{Linear Scale (dB)} = 20\text{Log} (\mathbf{1 \text{ volt} / \text{sensitivity}})$$

Obtaining a readout in units of “g”.

Example: The sensitivity of an accelerometer is typically provided in units of V/g. Using an accelerometer having a sensitivity of 50 mV/g, the Linear Scale would be calculated as follows:

$$+26.0 \text{ dB} = 20\text{Log} [\mathbf{1 \text{ volt} / 0.05V}]$$

The following table gives some examples of some typical Linear Scale values for common accelerometer sensitivities.:

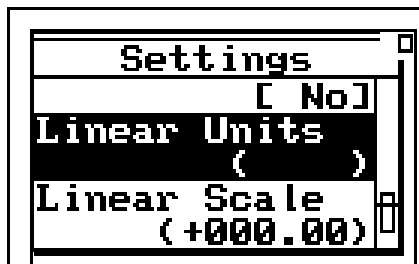
Sensitivity	Linear Scale (dB)	Units
100 mV/g	20 dB	g
50 mV/g	26 dB	g
25 mV/g	32 dB	g
10 mV/g	40 dB	g
5 mV/g	46 dB	g
14.0 mV/Pa	37.08 dB	Pa (2540)
44.5 mV/Pa	27.03 dB	Pa (377B41)
11.7 mV/Pa	38.64 dB	Pa (2559)
47.5 mV/Pa	26.47dB	Pa (377A60)

Obtaining a readout in units other than “g”.

If the desired linear units are different from those provided by the manufacturer, m/s^2 for example, calculate the sensitivity in those units, Volt/ m/s^2 , and use that value in the equation for Linear Scale.

Setup of Linear Units Readout.

The items to be defined to implement this feature are “Linear Units” and “Linear Scale” which appear in the FFT Edit Settings menu as shown in “Settings Menu” on page 12-1 and on the screen as shown below.



Linear Units

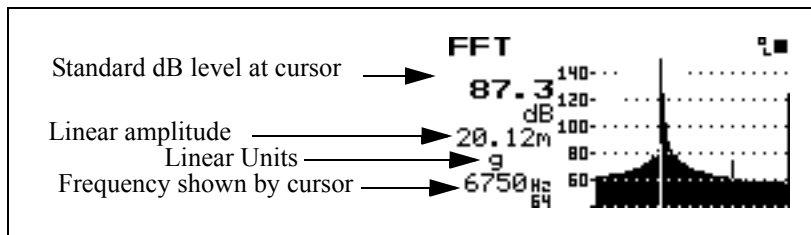
Linear Units is simply 4 alphanumeric characters defining the units name as it will appear on the screen.

Linear Scale

Linear Scale is the value of Linear Scale calculated as shown in the preceding sections.

Input the desired values for both Linear Units and Linear Scale by highlighting the item, pressing the Check (✓) key, entering the values and pressing the Check (✓) key again to close the menu.

Below is an example of the FFT live display with linear units:



The following explains each of the display's components:

In this case it shows 20.12 milli-g acceleration.

Standard dB level at cursor - This is the dB display which appears whether or not the linear amplitude is displayed.

Read out at cursor - This is the linear units level at the cursor.

NOTE: The units level is displayed in engineering exponential notation.

Linear Units - This is the unit entered by the user in the menu for "Linear Units". In this particular case we have entered "g" for acceleration.

Frequency shown by cursor - This is the frequency as shown by the cursor.

NOTE: The linear units level is displayed in engineering exponential notation. This notation expresses the exponent with a single character: “n” for nano (10^{-9}), “μ” for micro (10^{-6}), “m” for milli (10^{-3}), a space for no exponent, “k” for kilo (10^3), “M” for mega (10^6) and “G” for giga (10^9).

Frequently Asked Questions Concerning FFT

What is the reference level for decibels (dB) levels in the FFT option of the 824?

The decibel levels displayed by the FFT option of the 824 are the same as those for SPL in other instruments such as SSA or ISM and is 20 micro-Pascal (set during your microphone calibration process). Now, that may not mean much if you are viewing the output of an accelerometer rather than a microphone. The linear units are available to view the output of the accelerometer but the dB level may be of use.

To calibrate the dB level to some usable value for acceleration requires the use of an accelerometer calibrator. We use the PCB 394C06 Portable 1g Handheld Shaker. Set the calibration level to something like 140dB and run through the calibration procedure. Then the 824 FFT will read 140 dB when it is excited with 1g. This provides a reference of 0.1 micro-g (also 1 micrometer per second squared).

How do I get the DNA software to read FFT data in linear units.

To get DNA to read FFT data in a linear unit such a g or m/s the data must be converted from the decibel numbers that DNA receives from the 824 to that linear units value. To do this you need to know a reference level for the decibel reading that the 824 provides. It will change depending on the current calibration offset in the 824. The answers to the next two questions will help you accomplish this calculation.

How can I convert decibels (dB) levels from the FFT option of the 824 into linear units in my spreadsheet?

There are two ways to calculate the linear units from decibels.

Method 1:

With the FFT instrument in the 824 the data can be outputted to the display in linear values such as 'g' (gravity), or meters/second, volts or Pascal. The 824 makes this calibration using a setting that the user enters. This setting is the sensitivity of the unit relative to 1 volt and entered in dB into the Linear Scale setting (for example a 50mv/g accelerometer would have a Linear Scale of 20 LOG(1/0.05) or +26.02dB). The Linear Unit setting is a text field so that the units may be announced as desired.

The Linear Value is calculated in this way:

1. Take the dB reading
2. Subtract off the calibration offset (this makes the number bigger since the cal. offset is negative)
3. Subtract 167 dB from the previous result and the number is now in dB volts
4. Add the Linear Scale setting
5. Divide by 20
6. Take 10 to this power, this is the Linear Value

Here is an example:

The calibration offset is -45.41dB

The Linear Scale is +26dB (for a 50mV/g accelerometer)

The FFT displays a level of 121.7dB and 20.17g linear value

1. 121.7dB Take the dB reading
2. $121.7 - (-45.41) = 167.11$ dB Subtract calibration offset

3. $167.11 - 167 = 0.11$ dBV subtract 167 dB (180-13, dB volts)
4. $0.11 + 26 = 26.11$ dBg Add the Linear Scale setting
5. $-26.11 / 20 = 1.3055$ divide by 20
6. $10^{1.3055} = 20.21$ take 10 to this power (result will be close to the FFT display)

The difference (+0.2%) between the 824 display and this calculation are primarily due to the precision of math done in the 824 versus precision of the math functions in the calculator.

Method 2:

Take any FFT display reading that shows a dB and a linear level directly from the 824 display.

Calculate the linear reference level (what linear level gives 0dB) using this formula:

$$R = L / (10^{(D/20)})$$

where R is the linear reference level for the current calibration settings of the measurement,

where L is the linear level displayed (i.e. g or m/s), and

where D is the decibel level displayed.

Here's an example. I have an 824 connected to a signal generator supplying 0.5 volts RMS, the Linear Units setting is "g" and the Linear Scale setting is "-26.00" dB. I run the 824 FFT for a while and press stop, the display now shows a dB level of 121.7dB and a linear level of 50.87 milli-g.

$$R = L / (10^{(D/20)})$$

$$R = .05087g / (10^{(121.7dB/20)})$$

$$R = .05087g / 10^{(6.085)}$$

$$R = .05087g / 1216186$$

$$R = 4.182748 \times 10^{-8}$$

now use this R as the reference to get the readings in linear units from dB like this:

$$L = R * 10^{(D/20)}$$

$$L = 4.182748g \times 10^{-8} * 10^{(121.7dB/20)}$$

$$L = 4.182748g \times 10^{-8} * 10^{(6.085)}$$

$$L = 4.182748g \times 10^{-8} * 1216186$$

$$L = 0.05087g$$

Another example, this time down 20 dB:

$$L = 4.182748g \times 10^{-8} * 10^{(101.7dB/20)} = 5.087 \times 10^{-3} = .005087g$$

How can I manually enter a calibration offset so that the decibel levels (dB) from the FFT option of the 824 are relative to 1 micro-meter per second squared?

The calibration offset is calculated with this formula ($\pm 5\%$ accurate):

$$LCAL = 20 \log(4.467 \text{ nanovolts} / V_{ref})$$

Where LCAL is the calibration offset being calculated, V_{ref} is the desired reference voltage (the voltage that would read 0 dB) and 4.467 nanovolts is a constant set by the 824's electronic design (4.467×10^{-9}).

Example: It is desirable to display 140dB for 1 g due to the relationship that 1 g is 10 meters per second squared (m/s^2) and 1 micrometer per second squared (mm/s^2) is a common reference level. Given that an accelerometer with a sensitivity of 0.1V/g has a sensitivity of 0.01 volts per meter per second squared (10 mV/ m/s^2). The voltage at 1 mm/s^2 would be 0.01 microvolt (calculated ratio-metrically since

1m/s² outputs 0.01V then 1m m/s² will have an output of 0.01mV).

$$\text{LCAL} = 20 \log(4.467 \text{ nV} / 0.01\text{mV}) = 20 \log(0.4467) = -7.00\text{dB}$$

LCAL is stored with these steps for instruments that have firmware version 4.065 or newer:

Press the TOOLS key

Highlight Calibration and press the right arrow key

On the Calibration menu scroll to the bottom of the list and highlight Advanced

Press the right arrow key to open the Advanced calibration menu

Highlight the ----Secure---- line and press the check key, this will change the Cal Level value setting to a special key value of 224.48 that allow the calibration settings to be entered directly (the key is to prevent accidental calibration alteration)

Highlight the CAL Offset setting line and press the check key

Enter the LCAL value calculated above and press the check key

Highlight the ----Secure---- line again and press the check key, this will change the Cal Level value setting back to 114.00 and secure the calibration settings.

Exit the menu by pressing the power key, pressing the left arrow or pressing TOOLS

For firmware versions prior to 4.065 the calibration offset (LCAL) is entered using a computer and the following steps.

LCAL is then entered via computer by these I/O commands using HyperTerminal:

Command: "S1,1"Response: ""// Overall Reset

Command: "S 41,225.48"Response: ""// Key, unlock the S227 command

Command: "S227,-7"Response: ""// Send LCAL, enter your LCAL value

Command: "Q227"Response: " -7.00"// Verify LCAL, verify your LCAL value

Command: "S 41,114"Response: ""// Restore Calibrator Level

Here are typical Calibration Offset Levels (dB) for several accelerometer sensitivities (re. 1mm/s²):

Sensitivity 1mV/g 10 mV/g 100 mV/g 1 V/g 10 V/g

Cal. Offset 23.00 dB 13.00 dB -7.00 dB -27.00 dB -47.00 dB

AUD (Optional)

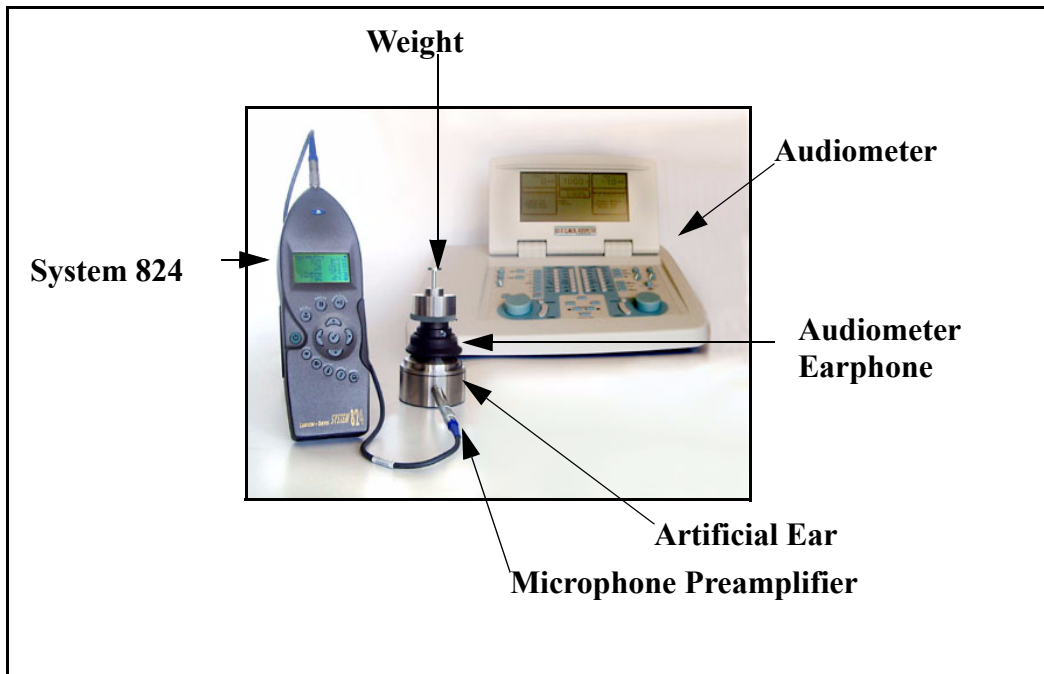
The System 824 precision sound level meter with the 824-AUD firmware option is the heart of the Larson-Davis audiometer calibration system. This instrument and its firmware maintain and exceed the performance of previous Model 800B-based systems when used with the AUDit™ software. However, the System 824 with 824-AUD firmware alone still possesses numerous analysis features useful for audiometer testing tasks such as:

- Level
- Frequency
- Linearity
- Total harmonic distortion
- Pulse measurements
- Crosstalk
- Frequency modulation
- Narrow band, broad band and speech noise

Some of these tests are slightly more tedious when performed manually. The following overview of the 824-AUD instrument should be augmented by familiarizing yourself with the 824 Reference Manual.

Connecting the Test System

For performing audiometric calibration measurements, connect the components as shown below.

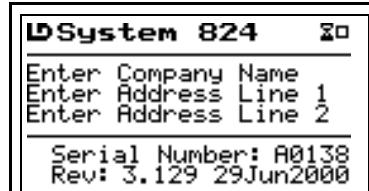


The microphone is threaded into a connection inside the artificial ear and the microphone preamplifier is inserted into the opening on the side of the artificial ear base and threaded into place. A microphone extension cable connects the microphone preamplifier to the input of the System 824.

One of the audiometer earphones, connected to the audiometer via a cable (not visible here), is placed on top of the artificial ear and then the weight is placed on top to hold it firmly in place.

Selecting the 824-AUD Operation Mode

To enable the 824 audiometer testing firmware option, turn on the 824.



After the start screen is appears, press **Ⓢ** SETUP and use the arrow keys up/down arrows **⬆** **⬇** to highlight the AudTest.AUD setup (or your customized AUD setup).




Press the check key **Ⓢ** to retrieve the AudTest.AUD setup. The Linearity FFT display will appear.

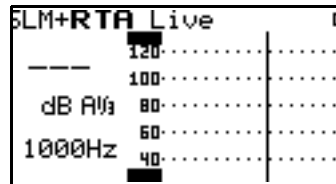


Microphone Sensitivity Calibration

Press the VIEW key  to open the View Menu.








Highlight SLM/RTA and press the check key  to obtain the SLM+RTA Live screen shown below.



A more detailed description of the calibration procedure can be found in the section "Turning On and Calibrating the System 824" on page 4-1.

This screen shows the third octave spectrum. In this example, the measurement is reset and the cursor is placed on the 1000 Hz third octave frequency. At this time, the instrument should be calibrated manually.



Press the Tools key , use the down  arrow key to highlight "Calibration", press the check key  twice, use the down  arrow key to highlight "Change" and press the check key . Follow the prompts to perform the calibration.. Please refer to the 824 Reference Manual for information on calibrating the instrument.

AUD Modes


There are three measurement modes for the AUD instrument:

- SLM+RTA — used to measure 1/3 octave spectra and broadband weighted SPL.
- FFT — used to measure constant bandwidth narrow band spectra with special functions to perform attenuator linearity, frequency flatness and harmonic distortion measurements.

- Pulse/FM — used to measure pulse and frequency modulation functions of the audiometer.


The mode is controlled by the display being shown. The View menu is divided into three sections for the three modes and can be used to select the display needed for a particular measurement. Most of the displays are also grouped together and alternately accessed by pressing the up  and down  arrow keys.

View Menu

The structure of the View menu is described below. Press the VIEW key  to open the View Menu.




SLM/RTA Submenu

Highlighting SLM/RTA and pressing the right arrow key  will produce the SLM+RTA Submenu.




FFT Submenu


Highlighting FFT and pressing the right arrow key  will produce the FFT Submenu.

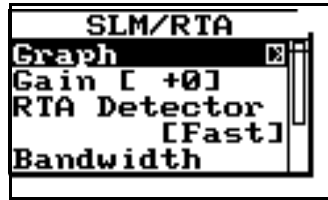


Pulse/FM Submenu

Pulse/FM has no submenu. Pressing the right arrow key  will produce the Pulse/FM - a display screen.

The display screens associated with these menus will be described in detail in the following sections.

The check menu (accessed by pressing the check key  while this display is active) provides the setting choices shown in the next two screen shots.



SLM+RTA Live Check Menu

The SLM+RTA Live check menu items are:

- **Graph** -Allows control over the resolution and scaling of the spectrum graph.
- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL. The Auto Gain Control (AGC) function of the linearity displays step between 0 and 30 dB gain, if the gain setting is something other than 0 or 30 the AGC function is inhibited.
- **RTA Detector** -This setting controls the rate of change of RTA filter output, Slow or Fast, which provides 1 second or 1/8th second exponential time constants, respectively.
- **Bandwidth** -The fractional octave bandwidth of 1/1 or 1/3 are selected with this setting.
- **RTA Weighting** -This setting selects either A, C or Flat frequency weighting as a filter prior to fractional octave filtering.

To measure the level in dB (re. 20 micro Pascals), place the cursor on the frequency of interest and read the frequency and value on the left hand side of the screen. Levels must be


corrected by using coupler/earphone RETSPLs and microphone or other such corrections to arrive at the dB HL value.

Several different linearity measurements can also be performed as described in "Linearity RTA Display" on page 13-10, "Linearity FFT Display" on page 13-14 and "Flatness FFT Display" on page 13-18.


Linearity evaluation can easily be performed by placing the cursor on the audiometric presentation frequency, then varying the hearing level output and monitoring the measured level on the 824.

Similarly, cross talk measurements are performed with the non-test earphone being measured, then comparing the test earphone level to that measurement.

Any Level -a, -b and -c Displays

The Any Level Displays -a, -b and -c are accessed from the SLM+RTA Live display by pressing the down arrow key 


The Any Level -a display, shown below, displays Flat weighted broadband SPL values for Fast and Slow simultaneously.



The screenshot shows the 'Any Level -a' display with the following data:

Any Level-a		⌘
SPL Fast	85.7	dBFB
SPL Slow	85.6	dBFB
Frequency	1004.7	Hz
Period	0.99	ms

The Any Level -b display, shown below, displays the Fast SPL for A, C and Flat frequency weightings simultaneously.



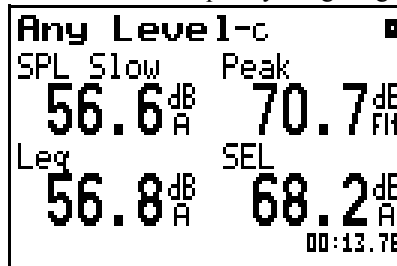
The screenshot shows the 'Any Level -b' display with the following data:

Any Level-b		⌘
SPL Fast	85.4	dBFB
	85.5	dBBC
	85.4	dBFA
Frequency	1004.6	Hz
Period	0.99	ms

Frequency is also available on the FFT mode displays using a more stable FFT frequency calculator.

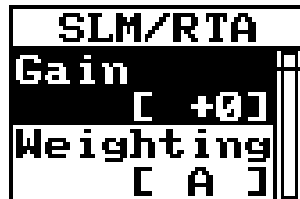
Both the -a and -b displays show the output of the frequency counter, showing Frequency and Period. The frequency counter is a hardware count based on zero crossing; significant amplitude is needed to ensure an accurate reading.

The Any Level -c display, shown below, displays the Slow SPL, Leq and SEL for the selected frequency weightings and the peak level with its frequency weighting.



Use the right and left arrow keys to step between the -a, -b and -c displays.

Press the check key \checkmark to access the check menu, shown below.




Any Level Check Menu

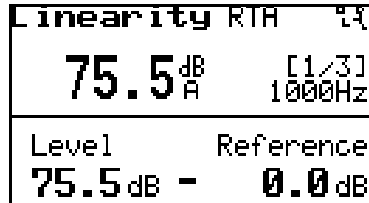
The Any Level check menu items are:

- **Gain** -Changes the gain setting of the instrument.
- **Weighting** -This setting selects either A, C or Flat frequency weighting for the sound level meter and FFT (not used by the Any Level displays).


Linearity RTA Display

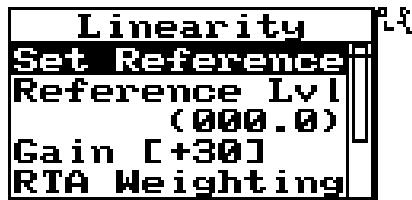
The Linearity RTA display can also be accessed from the View Menu as shown in "View Menu" on page 13-5.


The Linearity RTA display, shown below, is accessed from the Any Level a and b Displays by pressing the down arrow key .



The Linearity RTA display shows the level of the highest fractional octave RTA data relative to a set reference level. Also shown are the filter frequency of the selected level and the RTA Bandwidth setting. The frequency weighting set by the RTA Weighting setting is used; Flat by default. For testing attenuator linearity at 1 kHz, it is recommended to use A weighting to reduce low frequency ambient noise that may be coupled into the microphone.

Set the reference level to the current level by pressing the check key . This will open the Linearity RTA check menu, shown below.



Highlight "Set Reference" and press the check key  again.

The reference can also be set to an absolute level using the "Reference Lvl" setting on the check menu.

Once the reference has been set the level is shown relative to the reference level as shown below.

Linearity RTA		ⓧ
0.0 dB	[1/3]	
A	1000Hz	
Level	Reference	
75.5 dB	-	75.5 dB

This display is used to measure the attenuator linearity of an audiometer. The highest amplitude fractional octave RTA bin is found and displayed in the lower left corner of the display. The chosen reference level is displayed in the lower right corner.

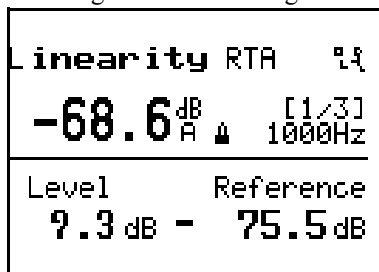
This display has a manual and an automatic filter lock feature to lock to the desired filter frequency when going to low amplitudes when other noise signals—ambient noises or vibrations present in the environment—may be higher than the signal being output by the audiometer. The right and left arrow keys control the lock mode. Press right once to manually lock to the current frequency; a lock icon will appear. Press the left arrow key once to activate the automatic lock mode, a diamond shaped icon will appear.

Auto Icon		
Linearity RTA		⬢
0.0 dB	[1/3]	
A	1600Hz	
Level	Reference	
77.8 dB	-	77.8 dB

The lock mode will step in sequence from unlocked to manual locked to automatic and back to unlocked with the right arrow. The left arrow will sequence through the modes in the reverse order.

Manual Lock

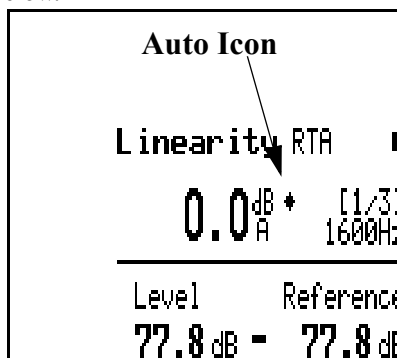
For manual operation select unlock while at a high amplitude (70dB HL or above) where the highest amplitude filter can be detected easily. When the correct frequency is displayed press the right arrow to manually lock the filter so that it does not change when measuring low amplitudes.



AGC is not active in the manual unlock or lock modes.

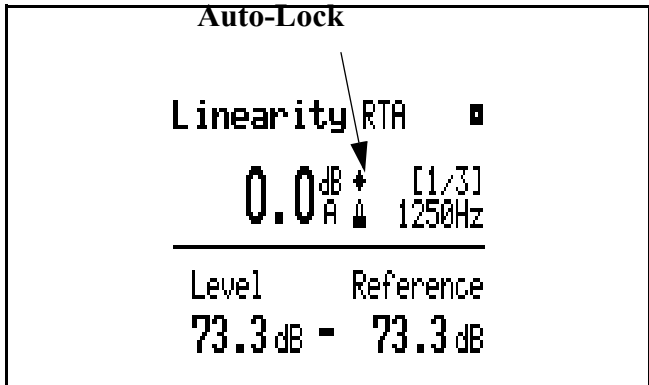
Automatic Lock

For automatic operations select the auto mode by pressing the left (or right) arrow key until the diamond icon appears as shown below.



A trigger level setting is found on the check menu that defines the amplitude below which the lock is set. When above the trigger level the filter frequency will track the highest amplitude signal. When the level of that filter drops below the trigger level the lock is activated and the filter

frequency is unchanged. The icons will show this condition with the lock and diamond icons as shown below.

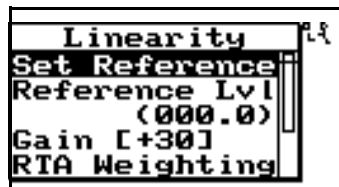


Note: To change to another filter in auto mode, just increase the amplitude until the level is above the trigger level.

When in automatic mode the Automatic Gain Control will be activated. When the gain is set to 0dB, it will be changed to +30dB when the signal is more than 45dB below the overload level for 1.5 seconds. When the gain is set to +30dB, the gain will be changed to 0dB whenever the instrument becomes overloaded or the level is within 8dB of the overload level for 1.5 seconds. The instrument will beep once when the gain is changed automatically to 0dB and twice when it is automatically changed to +30dB.

Linearity RTA Check Menu

Press the check key \checkmark to open the Linearity RTA check menu, shown below.




The Linearity RTA check menu contains the following items:

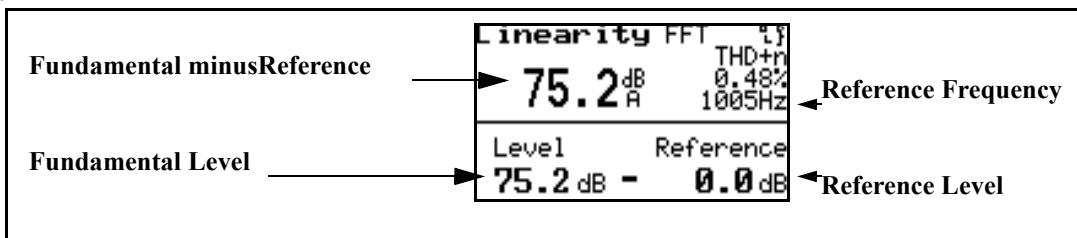
- **Set Reference** -Set the reference level to the current level, i.e. zero the display.
- **Reference Lvl** -Reference level setting that may be entered manually.

- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL. The Auto Gain Control (AGC) function of the linearity displays step between 0 and 30 dB gain, if the gain setting is something other than 0 or 30 the AGC function is inhibited.
- **RTA Weighting** -This setting selects either A, C or Flat frequency weighting as a filter prior to fractional octave filtering.
- **Trigger Level** -The Trigger Level setting defines the level below which the automatic frequency lock becomes active.

Linearity FFT Display

The Linearity FFT display can also be accessed from the View Menu as shown in "View Menu" on page 13-5.

The Linearity FFT display, shown below, is accessed from the Linearity RTA display by pressing the down arrow key  to produce the display shown below.

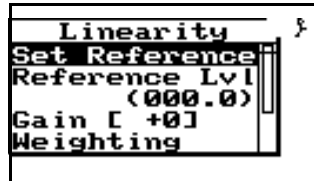


The Linearity FFT display shows the relative level of the highest FFT bin and the true frequency of the input signal derived from FFT data. The frequency weighting selected by the Weighting setting is used, A by default, to offer reduced out of band noise influence.

This display is used to measure the attenuator linearity of an audiometer. The highest amplitude FFT bin is found and its level is displayed in the lower left corner of the display. The chosen reference level is displayed in the lower right corner. A precise measurement of the frequency is displayed to the center right of the display. If the level is greater than the

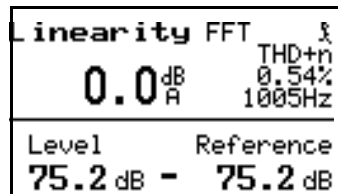
trigger level setting the THD plus noise value will be displayed in the upper right corner.

To set the reference level to the current level first press the check key \checkmark to display the check menu shown below.



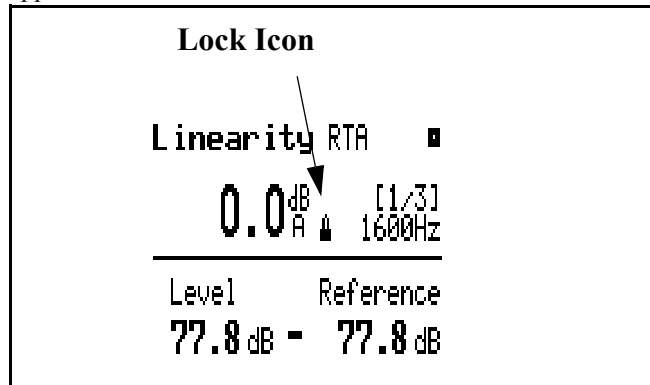
Then highlight "Set Reference" and press the check key \checkmark once more. The reference can also be set to an absolute level using the "Reference Lvl" setting on the check menu. This zero level may be set at the 70dB HL point as a reference.

Once the reference has been set the level is shown relative to the reference level as shown below.



This display has a manual and an automatic filter lock feature to lock to the desired filter frequency when going to low amplitudes where other noise signals—ambient noises or vibrations present in the environment—may be higher than the signal being output by the audiometer. The right and left arrow keys control the lock mode. Press right once to

manually lock to the current frequency; a lock icon will appear as shown below.



Press the left arrow key once to activate the automatic lock mode, a diamond shaped icon will appear. The lock mode will step in sequence from unlocked to manual locked to automatic and back to unlock with the right arrow. The left arrow will sequence through the modes in the reverse order.

Manual Lock

For manual operation select unlock while at a high amplitude (70dB HL or above) where the highest amplitude filter can be detected easily. When the correct frequency is displayed press the right arrow to manually lock the filter so that it does not change when measuring low amplitudes. AGC is not active in the manual unlock or lock modes.

Automatic Lock

For automatic operations select the auto mode by pressing the left (or right) arrow key until the diamond icon appears. A trigger level setting is found on the check menu that defines the amplitude below which the lock is set. When above the trigger level the filter frequency will track the highest amplitude signal. When the level of that filter drops below the trigger level the lock is activated and the filter frequency is unchanged. The icons will show this condition with the lock and diamond icons.

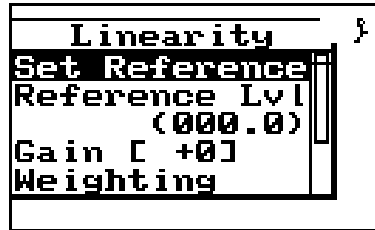
Note: To change to another filter in auto mode, just increase the amplitude until the level is above the trigger level.

When in automatic mode the Automatic Gain Control will be activated. When the gain is set to 0dB, it will be changed to +30dB when the signal is more than 45dB below the overload level for 1.5 seconds. When the gain is set to

+30dB, the gain will be changed to 0dB whenever the instrument becomes overloaded or the level is within 8dB of the overload level for 1.5 seconds. The instrument will beep once when the gain is changed automatically to 0dB and twice when it is automatically changed to +30dB.

Linearity FFT Check Menu

Press the check key \checkmark to open the Linearity FFT check menu, shown below.



The Linearity FFT check menu contains the following items:

- **Set Reference** -Set the reference level to the current level, i.e. zero the display.
- **Reference Lvl** -Reference level setting that may be entered manually.
- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL. The Auto Gain Control (AGC) function of the linearity displays step between 0 and 30 dB gain, if the gain setting is something other than 0 or 30 the AGC function is inhibited.
- **Weighting** -This setting selects either A, C or Flat frequency weighting as a filter prior to FFT filtering.
- **Trigger Level** -The Trigger Level setting defines the level below which the automatic frequency lock becomes active.

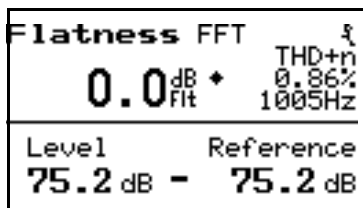
Note: The Linearity FFT display when using A or C weighting should not be used to measure frequency response and is not good to use for absolute amplitude measurement. Always zero the display at your reference point and use the relative level to see changes in amplitude relative to that reference. Note also that the FFT's A and C weighting filters

may have up to ± 0.2 dB variation compared to the FFT Flat weighting (due to component variations and tolerance).

Flatness FFT Display

The Flatness FFT display can also be accessed from the View Menu as described in "View Menu" on page 13-5.

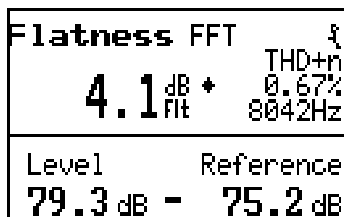
The Flatness FFT display, shown below, is can be accessed from the Linearity FFT display by pressing the down arrow key \blacktriangledown .

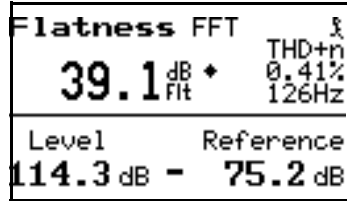


The Flatness FFT display shows the relative level of the highest FFT bin, the true frequency of the input signal derived from the FFT data and the THD plus noise metric. The frequency weighting for this display is forced to Flat regardless of the Weighting setting.

This display is used to measure the frequency response of an audiometer. The highest amplitude FFT bin is found and its level is displayed in the lower left corner of the display. The chosen reference level is displayed in the lower right corner. A precise measurement of the frequency is displayed to the center right of the display. If the level is greater than the trigger level setting the THD plus noise value will be displayed in the upper right corner.

The example display shown above is for a measurement at 1kHz. Measurements at 8kHz and 125Hz would appear as shown below.

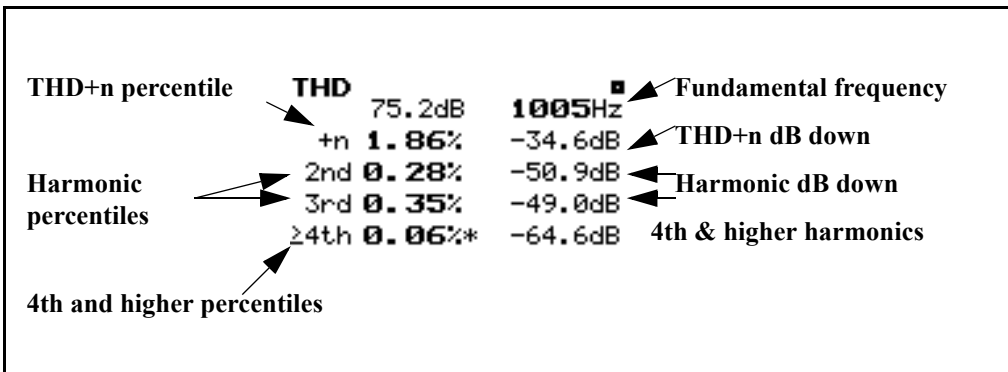




The operation and menus for this display are the same as Linearity FFT; please refer above for operation instructions.

THD Display

The THD display, shown below, is accessed from the Flatness FFT display by pressing the down arrow key ▼



The THD display provides harmonic distortion measurements of an audiometer and its phones. The FFT capabilities of the 824 are used to measure the fundamental level, fundamental frequency and harmonics. THD data is output in dB down from the fundamental level and in percent. The display also shows the level and frequency of the fundamental. An asterisk following a THD percentage indicates that influences of system noise floor are present.

Results are reported in dB down difference and units of percentile. The dB down difference is calculated by subtracting the harmonic level from the fundamental level. The percentage is equal to one hundred times ten raised to

the power of the result of the dB down difference divided by twenty.

Entering the THD display will auto-position the cursor to the fundamental frequency on the FFT screen.

THD is calculated by scanning the full spectrum to find the fundamental frequency and selecting the highest peak. The actual frequency is extrapolated from the fundamental bin frequency and the highest sideband bin frequency. The second harmonic is found by doubling the fundamental frequency, then finding the nearest bin frequency and summing its level with its side-band levels. The third harmonic is found by tripling the fundamental frequency, then finding the nearest bin frequency and summing its level with its side-band levels. The fourth and higher harmonics are found by the process described above by summing the energy of these harmonics.

THD+n is calculated by summing the energy of the fundamental bin with the five bins on each side, then subtracting the energy sum of all the other levels.

The THD as calculated in the 824 satisfies all of the requirements for ANSI S3.6.

For THD to be calculated, the following criteria must be met:

- The window must be in Hanning mode after an overall reset. If not, “Available only in Hanning Window” is shown.
- The fundamental must be above the 4th bin or 10 Hz, whichever is higher. In the case where the fundamental frequency is near the 5th bin and its skirt extends into some or all of the first four bins, the fundamental energy sum calculation will include only the 3rd and/or 4th bins but not the 1st or 2nd bin. In any case the noise energy sum calculation will never include the first four bins.
- The fundamental must be higher than any of the first four bins. There must not be excessive DC or near DC levels.
- THD+n must be at least 10 dB below the fundamental level. There must be an identifiable tone.
- The fundamental frequency will be displayed whether there is an identifiable tone or not.

- If a harmonic is less than 10 dB above the noise floor, the level of the harmonic is marked with an asterisk. The noise floor is calculated as the maximum of the minimum in the two adjacent valleys.
- If one of the harmonic's side-bands is higher than the harmonic then the harmonic is marked with an asterisk.

THD Check Menu

Press the check key $\text{\textcircled{V}}$ to open the THD check menu. This menu contains the following items.

- **View FFT** -View the current FFT spectrum.
- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL. The Auto Gain Control (AGC) function of the linearity displays step between 0 and 30 dB gain, if the gain setting is something other than 0 or 30 the AGC function is inhibited.
- **Bandwidth** -Setting to select the FFT bandwidth, choices are include 200, 500, 1k, 2k, 5k, 10k and 20k Hertz. The default is 10kHz. If the THD of signals with fundamental frequencies above 2500Hz is to be measure, choose a Bandwidth of 20kHz so that the 2nd through 4th harmonics are captured.

Pulse/FM Display

The Pulse/FM displays provide measurements to qualify the pulsed amplitude and frequency modulation (FM) response of an audiometer.

There are two Pulse/FM displays. The Pulse/FM-a display, shown below, is accessed from the THD display by pressing the down arrow key \blacktriangledown

“ $\geq 20\text{dB}$ ” indicates that the On/Off level ratio is greater than 20 dB.

Pulse/FM-a		
$\geq 20\text{dB}$	Rise	34.0 ms
	Fall	36.0 ms
	On	210.5 ms
	Off	188.5 ms
	Plateau	183.0 ms
	OverShoot	0.1 dB
	SPL	75.5 dB

The Pulse/FM-b display is obtained by pressing the right arrow key.

Pulse/FM-b	
Stable	
Carrier	4016.55 Hz
Max	4177.69 Hz
Min	3853.64 Hz
Mod Rate	4.80 Hz
SPL	82.5dB

The left and right arrow keys left or right arrow \blacktriangleleft \blacktriangleright can be used to toggle between the Pulse/FM-a and the Pulse/FM-b displays.

Pulse/FM-a Display

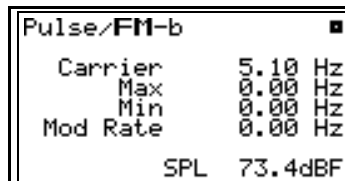
The Pulse/FM-a display shows all the required values for the calibration of the pulsed tone capabilities of an audiometer. Present the pulsed tone at a proper level and press the RUN/STOP key \blacktriangleright . The stability of the measurement can be evaluated visually. To retrieve data, press RUN/STOP again \blacktriangleleft and read the values from the screen.

The following values are displayed: rise time, fall time, on time, off time, plateau duration, in milliseconds, as well as overshoot in dB.

See Figure 13-1 on page 13-23 for greater clarification of the values displayed.

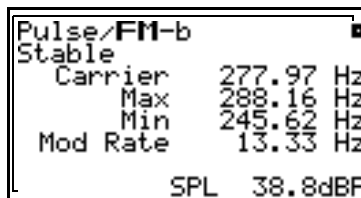
- **Rise Time** (B-C) - time in milliseconds between the -20 dB point (referred to the maximum level) and -1 dB point on the rising edge of the pulsed signal envelope, nominally between 20 and 50 ms
- **Fall Time** (E-G) - time in milliseconds between the -1 dB point and -20 dB point on the falling edge of the pulsed signal envelope, nominally between 20 and 50 ms

Pulse/FM-b Display



This screen displays required values for the calibration of the frequency modulated tone capabilities of an audiometer. Present the frequency modulated tone at an appropriate level and press the RUN/STOP key (⏸).

When the “stable” message is displayed, as shown below, press RUN/STOP (⏸) again and read the values from the screen.

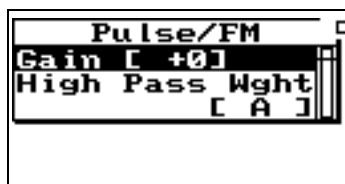


The following values are displayed, all in units of Hz:

- **Carrier frequency**
- Maximum frequency
- Minimum frequency
- Modulation rate

Pulse/FM Check Menu



While in either the Pulse/FM-a screen or Pulse/FM-b screen the check menu can be accessed by pressing the check key (✓).

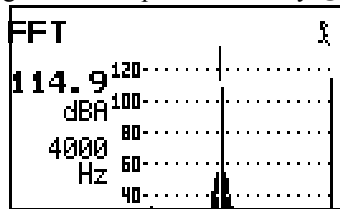


This menu contains the following items.

- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL.
- **High Pass Wght** -This setting enables the high pass filter section of the A or C weight filters which provide low frequency noise reduction while measuring pulses or FM signals; can be set to Flat weighting also. The default is A weighting high pass.


FFT Display

The FFT display will show the FFT spectrum. This display, shown below, is activated via the VIEW menu, Press VIEW key , highlight FFT and press check key .



It can also be activated from the THD check menu. The right and left arrow keys control the frequency cursor and the up and down arrow keys control the display horizontal zoom feature.

FFT Check Menu

Press the check key  to open the FFT check menu. This menu contains the following items.

- **View THD** -View the THD of the current FFT spectrum.
- **Gain** -Changes the gain setting of the instrument. Generally use 0dB gain for levels at 70dB SPL and above, and 30dB gain for levels less than 70dB SPL. The Auto Gain Control (AGC) function of the linearity displays step between 0 and 30 dB gain, if the gain setting is something other than 0 or 30 the AGC function is inhibited.
- **Bandwidth** -Setting to select the FFT bandwidth, choices are include 200, 500, 1k, 2k, 5k, 10k and 20k Hertz. The default is 10kHz. If the THD of signals with

fundamental frequencies above 2500Hz is to be measure, choose a Bandwidth of 20kHz so that the 2nd through 4th harmonics are captured.

- **Window** -Setting for the FFT window type. Choices are Rectangular, Hanning and Flat-top. Hanning is required for THD and frequency calculations.
- **Weighting** -Frequency weighting setting for the FFT. This setting controls an analog filter prior to analog to digital conversions whereas the RTA/SLM and Pulse/FM mode use Flat analog weighed electronics and digital filtering. The default value is A weighting so that the Linearity FFT display has the greatest noise rejection. The Flatness FFT display overrides this setting and forces the electronics to be Flat weighted.

Note: The Linearity FFT display when using A or C weighting should not be used to measure frequency response and is not good to use for absolute amplitude measurement. Always zero the display at your reference point and use the relative level to see changes in amplitude relative to that reference. Note also that the FFT's A and C weighting filters may have up to ± 0.2 dB variation compared to the FFT Flat weighting (due to component variations and tolerance).

To make absolute or flat weighted measurements, ensure that the Weighting setting is set to Flat.



Serial Port Interface Remote Control

The System 824 is fully controllable remotely via the Serial Port interface. Settings and the operational mode can be changed by sending commands through the serial port. Data can also be downloaded to and settings queried and set by the controlling computer.

The System 824 may be connected to the computer directly or through a modem. A network of many instruments can be formed, all controlled by one computer by using the address-ability mode.

This chapter will describe the Serial Port interfacing of the System 824 and the various interface commands with their syntax. Modem control is also covered.

Command text files and programming examples are available upon request via email to techsupport@LarsonDavis.com.

Interface Cables

The communication parameters are the following: The baud rate is adjustable from 300 to 115200 baud, 8 data bits, parity is "None" and stop bits are "1". See section Communication on page 3-34 for a description of the communication parameters)

Serial Port communications are made through the 8-pin connector at

the base of the Model 824. The instrument's signals conform to the RS-422 standard and are compatible with RS-232C. The connectors use the same pin out and cables as Apple® Macintosh® computers.

CBL006	824 to computer cable (9 pin female 'D')
CBL002	824 to serial printer (25-pin male 'D')
CBL003	824 to modem cable (25 pin male 'D')
CBL091	824 to HP LaserJet (9 pin male 'D')

Connection to a computer using CBL006

Step 1 With the instrument turned off, insert the cable connector in the instrument's 8-pin port.

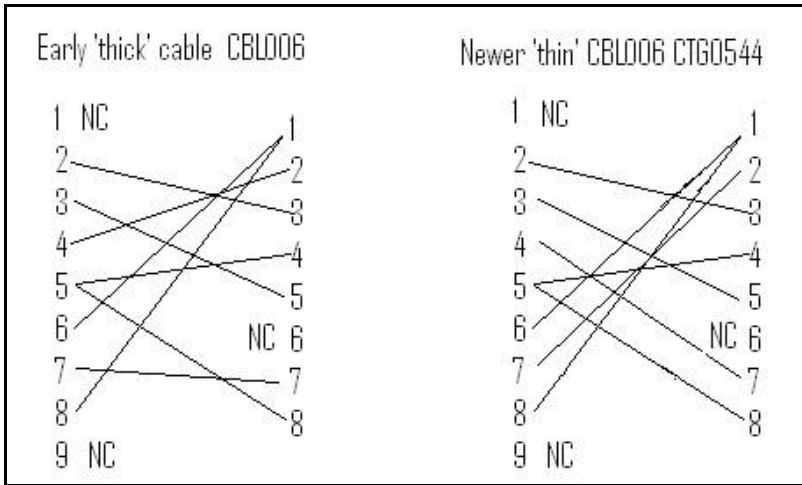
Step 2 Connect the CBL006 cable to the serial port of the computer, using the supplied 9 to 25 pin adapter as necessary.

Pin configurations for the CBL006

824 8-pin Connector End		Type		Computer 9-pin RS-232 Connector End		Type
HSO	Pin 1 Handshake Out	O	RS-232	DSR CTS	Pin 6 DataSetReady Pin 8 Clear to Sent	I O
HSI	Pin 2 Handshake In	O	RS-232	DTR	Pin 4 Data Terminal Ready	O
TXD-	Pin 3 Transmitted Data (-)	O	RS-422	RD	Pin 2 Receive Data	I
GND	Pin 4 Ground	X	RS-422	GND	Pin 5 Ground	X
RXD-	Pin 5 Received Data (-)	I	RS-422	SD	Pin 3 Send Data	O
TXD+	Pin 6 Transmitted Data (+)	O	RS-422		No Connection	
CXI	Pin 7 Com. Extra Input	I	RS-232		No Connection	
RXD+	Pin 8 Received Data (+)	I	RS-422	GND	Pin 5 Ground	

Note that the pin configurations for the newer "thin" CBL006 with the wrap-around label are slightly different as

shown below. Both versions work properly with the Model 824.



'Daisy Chain Addressing

The following instruments are compatible on a common network: Models 712, 720, 812, 814, 824, 870, and TAC100. Future instruments may also be compatible with this network.

A network of instruments may be interconnected to one computer using the appropriate cabling, and each may be controlled individually. Each is given a unique address. By default, all 824s are given an address based on their serial number from 1 to 100. Serial numbers that end with two zeros will be addressed as 100. The addresses are sent as a single byte ranging in value from 129 to 228 representing address 1 to 100 respectively (address plus 128), while addresses 101 through 127 are reserved. At power-on all 824s are address enabled (as if they had just received their address). Whenever an address byte is received, only the corresponding instrument is enabled to receive and respond to commands.

A broadcast command can be sent. By sending an address of zero, CHR\$(128), all units on the chain will become addressed and accept the commands that follow. Only the device with an address of 1 will respond to the commands. This will allow all units to be started at the same moment, or to have the same setting sent to all devices with one command, i.e. set all clocks to the current time.

824 Network, Addressing Commands

NOTE: Hexidecimal notation: The dollar symbol "\$" is used to indicate hexidecimal notation. Example: \$1A is the hexidecimal notation for the decimal value of 26.

The addressing of multiple 824s on a RS-422 network has been enhanced so as to allow binary data blocks to be sent to the 824 (and not be interpreted as an address), to automatically identify all 824s on the network, and to control the baud rate from the computer more easily. The command details follow:

Command	Description
0	Address 0 (\$80), Broadcast, will enable addressing of all 824s on the net in a broadcast receive mode. Only the 824 with address 1 will respond; all will receive the command.
127	Address 127 (\$FF), Address All, will enable all 824s to receive and respond to commands; in other words it will disable the addressing feature of all 824s on the net. Useful when only one device is connected.
126	Address 126 (\$FE), Disable All, will disable all 824s and none will respond to commands received. This is useful when trying to communicate with one device on the net that has addressing disabled by having its address set to zero.
125	Address 125 (\$FD), Lock, will lock the current addressing of all 824s on the net so that binary setting data may be sent to the currently addressed 824. To cancel the lock so that addressing may be changed a <break> is sent.

124	Address 124 (\$FC), Auto ID, will initiate an Auto-Identification of all 824s on the net using a timing scheme based on each unit's address. The data received will be the address byte from every device on the net delayed by 10mS times the address; thus it will take a maximum of 1 second to receive the byte from unit 100.
<break>	A short break will cancel the addressing lock initiated with the 125 address command, so that addressing may be changed.
<break> <break>	Two breaks in a row will re-initialize the I/O and Printer tasks and the clear the data and command buffers. It will also address all instruments (first command should be an address).
<break> <break> <break>	Three breaks in a row will cause all 824s on the network to temporarily change to 9600 baud to ensure that all devices on the net can be communicated with. Note: The baud rate is not changed if in modem mode and connected. These should be "Long" breaks (>50ms) to accommodate a unit set at 300 bps. Use the S2283, n command to temporarily set the I/O baud rate where 'n' indicates the new rate (see pg. B-30)

Commands

The commands are a series of ASCII characters with an alpha command and one or two numeric operands followed by a carriage return, ASCII 13. The commands may be spelled out though only the first character is significant. i.e. READ 123 may be abbreviated to R123. Every command has a response to acknowledge that it was received correctly and to provide data requested. For high reliability systems there is an error-checking protocol that will ensure proper command data transferal. See “Error Checking Protocol”.

Commands will be discussed according to the following list:

Commands	Symbol
Mode Commands	M
Read Commands	R
Settings Commands	S
History Oriented Commands	E, I, D, L, C, H, T
Print Commands	P
Error Messages & Warnings Commands	
Modem Control Commands	
Miscellaneous Commands (unsupported)	
Key Simulation Commands	K

Remote Control Commands (Detailed)

Mode Commands

Format for the Mode Commands is:

Command	Description
M1	Power On (clear error message list and reset display functions to “-a” windows)
M2	Power Off (cease sending further commands or the 824 will power back on)
M3	Run (begin accumulating data)
M4	Stop (stop accumulating data)
M4,1	Pause/Continue or View/End view (if stopped) (See R152 through R154)
M5	View (view the current Sound Pressure Level without accumulating data)
M6 or M6,0	Set standard mark
M6,1	Set mark 1, Aircraft
M6,2	Set mark 2, Automobile
M6,3	Set mark 3, Truck
M6,4	Set mark 4, Train
M6,5	Set mark 5, Animal
M7 or M7,0	Reset current data (instantly resets the current data set)
M7,1	Overall Reset (Resets the Current and Overall SLM function and histories [synonym of S1,1 Reset-All command])
M7,2	Purge All (Resets ALL data and erases ALL data files [To purge, error checking must be on; the check character for M7,2 is “b”; therefore, the complete purge command is M7,2b (case is significant!)]
M 8	Reset Histories Only (clears all histories and places a RESET record in the run log)

M 9,1	Enable High Resolution Levels (nnn.nn for all sound level data (to I/O channel))
M 10	Lock 824 (leaves 824's power on)
M 11	Lock 824 and Power Off (cease sending further commands)
M 12	Disconnect Modem (terminate connection and hang up)
M 13	Extend Modem Connect Time-out (can be set up to 255 seconds and allows time for modem diagnostics)
M1000	Test RAM (non-destructive walking bit test; data left intact)
M1001	Test RAM (destructive pattern fill & test, setup recalled from EEPROM)
M2222	Store current setup to EEPROM (Response ("Stored!") takes ~20 seconds)
@	Enable I/O Error Check Scheme (documentation available on request. S205,0F or 2 to 3 <CR> in a row will disable Error Checking)

“Read” Commands (Reads out data variables)

The various read commands are detailed in the following tables. The tables list the variable number, the variable name, a description, data format, and instrument types for which it is valid. Some of the Read commands also utilize a second operand.

Syntax	Instru- ment Type	Description	Response
R 1	All	Device manf. and model (30 characters)	String

R1, 1	All	Option feature identification. (8 characters) Used to determine optional features of the system. The returned string will show the availability of a filter card, the ENV firmware option and the memory options. The filter has 3 options: None (F0), 1/1 octave filters (F1) and 1/1 plus 1/3 octave filters (F3). The Environmental noise analyzer option is either present (E1) or not (E0). The memory has 4 options. Standard 1/2 megabyte (M0), 1 megabyte (M1), 1.5 megabyte (M2) and 2 megabyte (M3). Example: “F3 E0 M3” means there is a 1/3 octave filter installed, there is no ENV option, and the memory is the standard 2 megabytes.	F3 E0 M3
R1,2	All	Read Model string “824”	824
R1,3	All	Read Flash Identification “hhhh” Manf/Device Code (IF 13)	IF 13
R1,4	All	hhhh (options installed in hex)	
R1,5	All	Reads out the RTC’s (real-time clock) serial number in hexadecimal	
R1,128	All	Read ConfigFlag “hh” (in hex)	
R1, n	All	Test selected bits in Configflag. (n=129-255)	

Selected bits in ConfigFlag can be tested. If any of the specified bits are set = 1, then the response will be “Yes” otherwise the response is “No”. The following examples show how bits in ConfigFlag can be tested. (The binary number shown is the binary value of the decimal operand of the R1 command.)

Command	Instrument Type	Binary Value	ConfigFlag Bits Tested
R1,129	All	10000001	0
R1,130	All	10000010	1

R1,132	All	10000100	2
R1,192	All	11000000	6
R1,170	All	10101010	1,3,5

NOTE: the 7th bit of ConfigFlag cannot be tested.

Syntax	Instrument Type	Description	Response
R2	ALL	Current Date and Time	ddd ddmmmyyyy hh:mm:ss
R3	ALL	Status	Run mode, Lock, Logic In, Alarm, Archive 0
R3,1	ALL	Short status string	cccccc
R3,2	ALL	Short status string and reset alarm tripped status	cccccc

A short status string for R3,1 and R3,2 has a 6 character response (cccccc).

- The first character is an “s” when stabilizing or a space when stable.
- The second character is the current mode: “S” for Stopped, “R” for Running, “P” for Paused, “C” for Calibrating, “V” for View mode, “O” for stopped with overall data reset and “C” for stopped with Current data set reset.
- The third character is the instrument Lock Status and is either an “L” or a “U”.
- The fourth character is the Logic Input Status and is a “1” if high and a “0” if low.
- The fifth character will be an “a” if an Alarm has been detected, otherwise it will be a space.
- The sixth character is the modified status of the active setup (ID), space for unmodified and “A” for archive.

R3,3	ALL	Status of Active ID Archive Status, "A" indicates that it has been modified since being uploaded. Changed Status, "C" indicates that it has been changed and not saved back to it's ID. ID from file, "F" indicates that it has been recalled from a data file.	ccc
R3,4	ALL	Active File Number	ccc
R3,5	ALL	Reads out the number of DEMOs used	xx
R4,x	ALL	Current SPL	nnn.nn dB
R5	ALL	OverAll Runtime	hhhhh:mm:ss.s
R6	ALL	OverAll Start Date and Time	ddmmmyy hh:mm:ss
R7	ALL	Current Runtime	hhhhh:mm:ss.s
R8	ALL	Current Start Date and Time	ddmmmyy hh:mm:ss
R9,w	LOG	Overall TWA (Time Wght Avg)	nnn.n dB
R10	SSA, ISM, LOG	Overall Exchange Rate Text	ccccc
R11,w	SSA, ISM, LOG	Current TWA (Time Wght Avg)	nnn.n dB
R 12	SSA, ISM, LOG	Current Exchange Rate Text	ccccc
R13,w	LOG	Overall SEL	nnn.n dB
R14,w	SSA, ISM, LOG	Current SEL	nnn.n dB
R15,x	LOG	OverAll Minimum Level	nnn.n dB
R16,x	LOG	OverAll Lmin Date and Time	ddmmmyy hh:mm:ss

R17,x	SSA, ISM, LOG	Current Minimum Level	nnn.n dB
R18,x	SSA, ISM, LOG	Current Lmin Date and Time	ddmmyy hh:mm:ss
R19,x	LOG	OverAll Maximum Level	nnn.n dB
R20,x	LOG	OverAll Lmax Date and Time	ddmmyy hh:mm:ss
R21,x	SSA, ISM, LOG	Current Maximum Level	nnn.n dB
R22,x	SSA, ISM, LOG	Current Lmax Date and Time	ddmmyy hh:mm:ss
R23,w	LOG	OverAll Peak Level	nnn.n dB
R24,w	LOG	OverAll Lpeak Date and Time	ddmmyy hh:mm:ss
R25,w	SSA, ISM, LOG	Current Peak Level	nnn.n dB
R 26,w	SSA, ISM, LOG	Current Lpeak Date and Time	ddmmyy hh:mm:ss
R27,w	LOG	OverAll UWPk Level (Peak Level 1)	nnn.n dB
R28,w	LOG	OverAll Luwpk Date and Time	ddmmyy hh:mm:ss
R29,w	SSA, ISM, LOG	Current UWPk Level (Peak Level 1)	nnn.n dB
R30,w	SSA, ISM, LOG	Current UWPk Date and Time	ddmmyy hh:mm:ss
R31	LOG	OverAll RMS Exceedances #1	nnnnn
R32	LOG	OverAll RMS Exceedances #2	nnnnn
R33	LOG	OverAll Peak Exceedances	nnnnn
R 34	LOG	OverAll UWPk Exceedances	nnnnn
R35	ALL	Overloads	nnnnn
R36	ALL	Number of PAUSES	nnnnn

R37	ALL	PAUSE Time (OFF Time not inc.)	hhhhh:mm:ss
R38	LOG, SSA	Ln 1	nnn.n dB
R39	LOG, SSA	Ln 2	nnn.n dB
R 40	LOG, SSA	Ln 3	nnn.n dB
R 41	LOG, SSA	Ln 4	nnn.n dB
R42	LOG, SSA	Ln 5	nnn.n dB
R43	LOG, SSA	Ln 6	nnn.n dB
R44	LOG	Overall Dose	nnnnn.n%
R45	SSA, ISM,	Current Dose	nnnnn.n%
R46	LOG	Overall Projected Dose	nnnnn.n%
R47	SSA, ISM, LOG	Current Projected Dose	nnnnn.n%
R54	ALL	Last Level Relative to REFLVL	-nnn.n
R55	LOG	Display Histogram Selected	ccc
R 56	LOG	Display Total Counts in Ln Table	nnnnnk
R 57	LOG	Overall Leq	nnn.n dB
R 58	LOG	Daily Leq	nnn.n dB
R 59	LOG	Current Hourly Leq	nnn.n dB
R60,h	LOG	Hourly Leq (h= 0-23)	nnn.n dB
R61,h	LOG	Hourly Leq partial indicator(h=0-23)	nnn.n dB
R62	LOG	Overall LDN	nnn.n dB
R63	LOG	Daily LDN	nnn.n dB
R64	LOG	Hourly LDN	nnn.n dB
R65	LOG	Overall CNEL	nnn.n dB
R66	LOG	Daily CNEL	nnn.n dB

R67	LOG	Hourly CNEL	nnn.n dB
R68	LOG	Total EXCD Leq	nnn.n dB
R69	LOG	Total EXCD Time	hhhhh:mm:ss.s

NOTE: The exceedance Leq, R68, and exceedance time, R69, include data from qualified events that are stored in the EXCD History. If an event is discarded because it was shorter than the minimum duration then it will not be included in these values.

R70	LOG	Background Leq	nnn.n dB
R86	ALL	Battery Level	nnn%
R87	ALL	Battery Source (INT/EXT)	ccc
R88	ALL	Temperature	-nnn.n
R89	ALL	Serial Number	cccc
R90	ALL	Firmware Rev. & Rev. Date	n.nnn ddmmmyyyy
R91	ALL	Free Memory	nnnnnnn
R92	LOG	Number of RUN/STOP Records	nnnnn
R93	LOG	Number of EXCD Records	nnnnn
R94	ALL	Number of INTV Records	nnnnn
R95	LOG	Number of HIST Records	nnnnnnn
R96	LOG	Number of Daily Records	nnnnn
R97	LOG	Number of Cal Records	nnnnn
R98,n	ALL	Error Message List (n= 1 to 8)	cccccccccccccccccccc n = 1 to the last error. If n=0 or omitted then the 8 error codes are output as number. (nnn, nnn, . . . nnn).

R99	ALL	Logic Output 1 State	[On/Off}
R100	ALL	Logic Output 2 State	[On/Off}
R101	ALL	Report Number	nnnnn
R102	ALL	Page Number	nnnnn
R103	ALL	Printer Line Number	nnn
R104	ALL	Calibration Date/Time	ddmmmyy hh:mm:ss
R105	ALL	Cal Check Date/Time	ddmmmyy hh:mm:ss
R106	ALL	Cal Offset	nnn.n
R107	ALL	Cal check Level	nnn.n + OFFSET
R108	SSA, ISM, LOG	RMS Exceedance Flag 1	*
R109	SSA, ISM, LOG	RMS Exceedance Flag 2	*
R110	SSA, ISM, LOG	PEAK Exceedance Flag	*
R111	SSA, ISM, LOG	UWPK Exceedance Flag	*
R112	ALL	System Overload Flag	*
R113	LOG	Excd Exchange Rate Text	ccccc
R114	LOG	Intv Exchange Rate Text	ccccc
R115	ALL	Auto-Advance History Indicator	+
R116	ALL	Current Wind Speed, Frequency or Tach	nnn.n or nnnnn
R132	LOG	Today's Minimum Level	nnn.n dB
R 133	LOG	Today's Maximum Level	nnn.n dB
R 134	LOG	Today's Peak Level	nnn.n dB
R135	LOG	Today's UWPK Level	nnn.n dB
R136	LOG	Today's Runtime	hh:mm:ss mm:ss.ss
R137	SSA, LOG	Next Alarm Time	hh:mm

R138	SSA, LOG	Interval Date and Time of Occurrence	ddmmmyy hh:mm:ss
R139	SSA, LOG	Interval Duration	hh:mm:ss / mm:ss.ss
R140	SSA, LOG	Interval Lint	nnn.n dB
R141	SSA, LOG	Interval SEL	nnn.n dB
R142	SSA, LOG	Interval Lmin	nnn.n dB
R143	SSA, LOG	Interval Lmax	nnn.n dB
R144	SSA, LOG	Interval Lpeak	nnn.n dB
R145	SSA, LOG	Interval UnWeighted Peak	nnn.n dB
R146	SSA, LOG	AUTO-SEND HISTORY LEQ	nnn.n dB
R150	ALL	Number of RUNS & CONTINUES	nnnnn
R151	ALL	Power On Fault Cause Character D - Data Checksum Corrupt E - EEPROM Checksum Corrupt K - Key Reset (⊕+ I+ v) P - setting Checksum Corrupt O - Opcode Error R - RAM Setup Register Corrupt T - Test Memory Corrupt W - Watchdog Reset	c

An indicator has been added to the ON display on the top line of the 824's display to show faults that were detected by the power on test procedure. The R151 command will display the fault character to a computer:

R152	ALL	Internal RMS detector level	nnn.nn dB
R153	ALL	Internal PEAK detector level	nnn.nn dB

R154	ALL	Internal UwPk detector level	nnn.nn dB
R155	ALL	Number of Bytes in Keyboard Stack This is used with keyboard simulation to prevent the loss of keys.	nnn

R156	LOG	Background Leq Time	hhhhh:mm:ss.ss
R157	ALL	Calibration Status	Done, Wait, Waiting, Stable, Unstable, Too High, Too Low.
R158	ALL	Total Memory Available	nnnnnn
R159	ALL	Memory Available in percent	nnn.nn
R160	ALL	OVERALL OVERLOAD FLAG	c
R161	RTA	Number of RTA Records	nnnnn
R162	LOG	Overall Sound Exposure	nnnnn.n P ² H

Sound Exposure (E) is calculated and displayed in pascal squared hours as needed in some of the European Countries. This value is read with the R162 command and is available in the top line of the DOSE-a display. The formula used is:

$$E = T \cdot (10^{(Leq/10)}) \cdot 20\mu Pa^2,$$

where E is the Exposure, T is the elapsed time in hours, and $20\mu Pa^2$ is the reference sound pressure 20 micro pascal squared.

R163,x	SSA, ISM, LOG	TAKT 3	nnn.n dB
R164,x	SSA, ISM, LOG	TAKT 5	nnn.n dB
R165	LOG	PassBy Time of Occurrence	ddmmmyy hh:mm:ss
R166	LOG	PassBy Event Duration	hh:mm:ss / mm:ss.ss
R167	LOG	PassBy Lmax	nnn.n
R168	LOG	PassBy Leq	nnn.n
R169	LOG	PassBy SEL	nnn.n
R170	ALL	External Battery Level in Volts	nn.n V
R171,f	SSA, AUD, TAL	RTA filter - LIVE Level *f is ANSI filter	nnn.n dB
R172,f	SSA, TAL	RTA filter - CURRENT Leq *f is ANSI filter	nnn.n dB
R173,f	SSA, TAL	RTA filter - OVERALL Leq *f is ANSI filter	nnn.n dB
R174,f	SSA, LOG, RTA, AUD, TAL	RTA filter selected frequency *f is ANSI filter	ccccHz

R175	ALL	OverAll End Date and Time	ddmmmyy hh:mm:ss
R176	ALL	Current End Date and Time	ddmmmyy hh:mm:ss
R177	ALL	OverAll Reset/Began Text	“Reset” or “Began”
R178	ALL	Current Reset/Began Text	“Reset” or “Began”
R179	ALL	Total bytes of RAM installed in the SLM	nnnnnnn
R180	ALL	Current Instrument Type	ccc
R181	ALL	Number of Data File Records	nnn
R182	ALL	Data File History Record Size	nnnnnnn
R187	ALL	SLM Firmware Rev. Number & Revision Date	n.nnn ddmmmyyyy
R188	SSA	RTA Spectra at Lmax	nnn.n dB
R189	ALL	Logic Input State	‘On’ or ‘off’
R190	ALL	Noise Floor Indicators	c or cccc, flags
R191	AUD	Audiometric Test, Rise Time	nnnnn.nn
R192	AUD	Audiometric Test, Fall Time	nnnnn.nn
R193	AUD	Audiometric Test, On Time	nnnnn.nn
R194	AUD	Audiometric Test, Off Time	nnnnn.nn
R195	AUD	Audiometric Test, Plateau Time	nnnnn.nn
R196	AUD	Audiometric Test, Overshoot Level	nnn.n
R197	AUD	Audiometric Test, Level	nnn.n
R198	AUD	Audiometric Test, FFT Frequency	nnnnn.nn
R199	AUD	Audiometric Test, Carrier Frequency	nnnnn.nn
R200	AUD	Audiometric Test, Max Frequency	nnnnn.nn

R201	AUD	Audiometric Test, Min Frequency	nnnnn.nn
R202	AUD	Audiometric Test, Modulation Frequency	nnnnn.nn
R203,l	AUD	FFT Live Spectrum Level (,line_number) l=line#, 0 - 400	nnn.nn
R204,l	AUD	FFT Live Spectrum Frequency (,line_number) l=line#, 0 - 400	nnnnn
R205	FFT, AUD	FFT Live Broadband Level	nnn.n
R206,f	SSA	RTA Minimum Level per Spectrum Filter	nnn.n
R207,f	RTA	Live Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R208	RTA	Live Spectrum's Duration	s.ssss
R209	RTA	Live Spectrum's Overload Status	'Ovld'
R210,f	RTA	Leq Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R211	RTA	Leq Spectrum's Duration	hhhhh:mm hh:mm:ss mm:ss.ss ss.ssss
R212	RTA	Leq Spectrum's Overload Status	'Ovld'
R213,f	RTA	Lmax Spectrum ,n (n=ANSI filter number or -1 for Flat)	nnn.n
R214,f	RTA	Lmin Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R215	RTA	Trigger State	'Stop, Ready, Armed, Trigd, Ended'
R216	RTA	Pre-Trigger Samples	nnn
R217	RTA	Triggered ByTime Samples	
R218, n	RTA	Triggering String (,n) 1&2=ARM, 3&4=Trig, 5&6=End, 7=Repeat 21 character string, 0=all strings	character string

R219,f	RTA	Spatial Averaged Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R220	RTA	Spatial Averaged sample count	nnnnnk
R221,f	RTA	Room Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R222,f	RTA	Room Class Spectrum (f=ANSI filter number or -1 for Flat)	nnn.n
R223	RTA	Room Level, SIL or Lmf in dB	nnn.n
R224	RTA	Room Data, NCB or RC	nn
R225	RTA	Room Flags: Over/Under/Hiss/Rumble/Vibra	ccccc
R226,n	ALL	Display the Last history record type 0 - Last record type string 1 - Date/Time of last record 2 - Duration/Runtime of last rec. 3 - Record Size (bytes) 4 - Instrument type of record	cccccccc ddmmmyyyy, hh:mm:ss hhhh:mm, hh:mm:ss, mm:ss.ss nnnnnnn ccc
R227	TAL	Tonal Frequency in Hz	nnnnn
R228	TAL	Tonal delta Frequency in Hz	nnnnn
R229	TAL	Tonal Level	nnn.n
R230	TAL	Tonal Group Level	nnn.n
R231	TAL	Tonal Background Level	nnn.n
R232	TAL	A weight Impulse Leq, Overall	nnn.n
R233	TAL	Tonality Run Time	hh:mm:ss
R233	LOG	Excd Duration	mm:ss.ss
R234,f	SSA	Ln 1 Spectrum, dB (f=ANSI filter number)*	nnn.n

R235,f	SSA	Ln 2 Spectrum, dB (f=ANSI filter number)*	nnn.n
R236,f	SSA	Ln 3 Spectrum, dB (f=ANSI filter number)*	nnn.n
R237,f	SSA	Ln 4 Spectrum, dB (f=ANSI filter number)*	nnn.n
R238,f	SSA	Ln 5 Spectrum, dB (f=ANSI filter number)*	nnn.n
R239,f	SSA	Ln 6 Spectrum, dB (f=ANSI filter number)*	nnn.n
R240,n	SSA	Ln percentage stored with the spectra (n=the percentage number from 1 to 6)**	nn.nn
R241,n	AUD, FFT	Total harmonic distortion & frequency	see following commands
R241,512	AUD, FFT	Extract harmonic distortion data from FFT Live	no output data
R241,1024	AUD, FFT	Extract harmonic distortion data from FFT Snapshot	no output data
R241,0	AUD, FFT	Show precise frequency of fundamental	nnnnnn Hz
R241,256	AUD, FFT	Show level of fundamental	nnn.n dB
R241,n	AUD, FFT	Show distortion of harmonic 'n', n=1 to 20	n.nn %
R241,n+256	AUD, FFT	Show harmonic levels minus fundamental level 'n', n=1 to 20	-nnn.n dB
R241,n+512	AUD, FFT	Show distortion of harmonic levels 'n' and above	n.nn %
R241,n+768	AUD, FFT	Show distortion of harmonic 'n', and above minus fundamental level, n=1 to 20	-nnn.n dB

R241, n+1024	AUD, FFT	Show noise floor influence indicator for harmonic 'n', n=1 to 20 (valleys have less than 10 dB from harmonic)	“ “ if no influence “*” if influence detected
R242	ISM, LOG, SSA, AUD, TAL	Live Leq detector sample (Weight setting applies)	nnn.n dB
R243	ISM, LOG, SSA, AUD, TAL	Live Lmax detector sample (Weight and Detector settings apply)	nnn.n dB

*If f=0 then all 33 filter levels will be output in a comma delimited string.

**If n=0 then all 6 percentages will be output in a comma

“ANY DATA” READ COMMANDS

The 824 measures SPL data with three frequency weightings and with three time weighting detectors simultaneously, as well as peak and integrated levels with three frequency weightings. To access this additional data use these Read Commands using the second operand indicated:

{SSA, ISM, LOG and ENV instruments only}				
R 4,x	SSA, ISM, LOG	Current SPL	(Any Wght/ Dect)	nnn.n dB
R 9,w	SSA, ISM, LOG	OVERALL TWA	(Any Wght)	nnn.n dB
R 11,w	SSA, ISM, LOG	CURRENT TWA	(Any Wght)	nnn.n dB
R 13,w	SSA, ISM, LOG	OVERALL SEL	(Any Wght)	nnn.n dB

R 14,w	SSA, ISM, LOG	CURRENT SEL	(Any Wght)	nnn.n dB
R 15,x	SSA, ISM, LOG	OverAll Minimum Level	(Any Wght/ Dect)	nnn.n dB
R 16,x	SSA, ISM, LOG	OverAll Lmin Date and Time	(Any Wght/ Dect)	ddmmmyy hh:mm:ss
R 17,x	SSA, ISM, LOG	Current Minimum Level	(Any Wght/ Dect)	nnn.n dB
R 18,x	SSA, ISM, LOG	Current Lmin Date and Time	(Any Wght/ Dect)	ddmmmyy hh:mm:ss
R 19,x	SSA, ISM, LOG	OverAll Maximum Level	(Any Wght/ Dect)	nnn.n dB
R 20,x	SSA, ISM, LOG	OverAll Lmax Date and Time	(Any Wght/ Dect)	ddmmmyy hh:mm:ss
R 21,x	SSA, ISM, LOG	Current Maximum Level	(Any Wght/ Dect)	nnn.n dB
R 22,x	SSA, ISM, LOG	Current Lmax Date and Time	(Any Wght/ Dect)	ddmmmyy hh:mm:ss
R 23,w	SSA, ISM, LOG	OverAll Pk Level	(Any Wght)	nnn.n dB
R 24,w	SSA, ISM, LOG	OverAll Lpk Date and Time	(Any Wght)	ddmmmyy hh:mm:ss
R 25,w	SSA, ISM, LOG	Current Pk Level	(Any Wght)	nnn.n dB
R 26,w	SSA, ISM, LOG	Current Lpk Date and Time	(Any Wght)	ddmmmyy hh:mm:ss
R163,x	SSA, ISM, LOG	TAKT 3	(Any Wght/ Dect)	nnn.n dB
R164,x	SSA, ISM, LOG	TAKT5	(Any Wght/ Dect)	nnn.n dB

Where “x” indicates a number to represent a combination of weighting and detector which has these values:

1	A weight, Slow detector
2	A weight, Fast detector
3	A weight, Impl detector
4	C weight, Slow detector
5	C weight, Fast detector
6	C weight, Impl detector
7	Flat weight, Slow detector
8	Flat weight, Fast detector
9	Flat weight, Impl detector

If “x” is not provided or it is zero then the value indicated by the Wght and Detc settings is given.

NOTE: Impulse detector is not applicable for Takt levels

Where “w” indicates a number to represent the weighting which has these values (Detector is not applicable for these measurements):

1	A weight
2	C weight
3	Flat weight

If “w” is not provided or it is zero then the value indicated by the Wght settings is given.

Other Read Commands

Other read commands are macro commands that send multiple “R” variables, so multiple data can be retrieved from the 824 with one command. Other commands O 1, O 2, and O 4 are preprogrammed macros while O 3 is a user-defined macro which is programmed by the Group command.

Code	Description	Response
O 1	Read SLM data	nnn.n, nnn.n, nnn.n, nnn.n<CR><LF> R 4 (SPL), R 11 (TWA), R 17, (Lmin), R 21 (Lmax)<CR><LF>
O 2	Read Wind Data	nnn.n, ccc, nnn.n, nnn.n, ccc<CR><LF>
O 3	Read Group of “R” variables programmed by the group programming command G n,r	<as programmed>
O 4	Read 824’s LCD Display, bit mapped in a binary format	<SOH><HIGH_COUNT><LOW_COUNT><...data...><CHKSUM><CR><LF> <ul style="list-style-type: none"> • There are 1024 bytes of screen data (8 lines of 128 bytes each) • Bits in each byte represent a vertical column of 8 pixels with the lsb on top
O 6	All History Records: R92 (Run Log), R93 (Excd), R94 (Intv), R95 (Time History), R96 (Daily), R97 (Cal. Log)	nnnnnn,nnnnnn,nnnnnn,nnnnnn,nnnnnn,nnnnnn

Code	Description	Response
O 8	AUD, FFT	Read THD data: Fund. Frequency, Fund Level, THD+n, 2nd, 3rd, 4th, 5th and above. nnnnnn, nnn.n, n.nn,n.nn,n.nn,n.nn
O 9	AUD, FFT	Read Fund. Frequency and Fund. Level nnnnnn, nnn.n

Group Read Programming

The group command permits the programming of a user-defined macro with up to eight (8) Read variables. The macro is executed with the G0 or O[ther] 3 commands which returns the list of defined read variables.

Use the following command syntax to program each desired read variable and its position in the macro.

Syntax	Response
G[roup]n, var_no	<cr><lf>
Example: G1, 4 <cr>	assigns the current SPL to the first group option
Example: G2, 15 <cr>	assigns Lmin to the second option
Example: G3, 19 <cr>	assigns Lmax to the third option
Example: G4, 0 <cr>	terminates group command programming

Where n is from 1 to 8, indicating the macro position and var_no is the number of the “R” variable associated with the position. Use a var_no of “0” to define the last position when less than eight are desired.

After programming this group read list, the response to G0 is 59.5, 38.6, 102.2; the SPL, L_{\min} and L_{\max} .

Setting Commands

The Settings select what functions are enabled and determine how the measurements are performed. Settings can be both set (S) and queried (Q). The setting numbers provided below in the “Setting List” section are for both the Set (S) and Query (Q) commands.

- Option e.g. [Sun|Mon|Tues...|Sat]
- Numeric e.g. (123.45)
- Character e.g. (Gas Flare, Test 1); can be up to 30 characters
- Template e.g. (hh:mm:ss)

Brackets [] indicate optional characters or operands.

<cr> = carriage return; <lf> = line feed; _ = space

Querying Settings

The current setting is retrieved with the Query (Q) command. The syntax for the query command is Q[query]setting_number[,options] where setting_number is the number of the desired setting and options is a number to select the appearance of the response.

Brackets [] indicate optional characters or operands. <cr> = carriage return; <lf> = line feed; _ = space

Syntax	Response
Q[query]item_number[,flag]	Depends on flag

Option flags elicit the following responses:

Flag	Response
none	Current setting
1	Setting name and current setting
2	Current setting (including spaces) in brackets or parentheses
3	Setting name and current setting (including spaces) in brackets or parentheses
32	Option number for option setting

Flag values may be added together
for desired combinations:

Example:	Response
1.Q74	No
2.Q74, 1	Excd History Enable=No
3.Q74, 2	[_No]
4.Q74, 32	0
5.Q74, 3	Excd History Enable=[_No]

Responses are denoted by (x) if Yes/
No or (n) if numerical.

Ln Query Commands (SSA)

Commands	Instru- ment Type	Description	Comments
Q 63	SSA	Ln 1 Percent	nn.nn
Q 64	SSA	Ln 2 Percent	nn.nn
Q 65	SSA	Ln 3 Percent	nn.nn
Q 66	SSA	Ln 4 Percent	nn.nn
Q 67	SSA	Ln 5 Percent	nn.nn
Q 68	SSA	Ln 6 Percent	nn.nn
Q 139	SSA	Enable Lns	[No/Yes]
Q 224	SSA	Start Level	nn

Entering Settings

Option Settings

Settings are entered with the Set command. The syntax for the Set command is S[ET]setting_number, setting_value or S[ET]setting_number;option_text where setting_number is the setting number, setting_value is the desired setting, and option_text is the textual setting for the option settings (those that have one setting from a list of possible settings).

Option settings can be set in two ways: a. option number and b. actual option settings text.

a.Option Number

Syntax	Response
S[et]item_number,option_number	<cr><lf>
Example: S9, 3	sets setting 9:Baud Rate to option 3 which sets the baud rate to 9600
Example: S674, 1	sets Excd History Enable to Yes.
Example: S95, 0	sets Hist Period Units to _1/32s
Example: S95, 1	sets Hist Period Units to _1.0s

b.Option Setting Text

Querying an option with a flag of 2 will return the setting's value enclosed in brackets as needed when using the option text syntax.

Option settings texts is preceded by a semicolon and enclosed by brackets. Option settings text must include the same number of characters that are given when queried, including spaces, which are indicated below with “_”.

Syntax	Response
S[et]item_number; [option_text]	<cr><lf>
Example: S9; [_9600]	sets Baud Rate to 9600.

Example: S74; [Yes]	sets Excd History Enable to Yes.
Example: S95; [_ 1/32s]	sets Hist Period Units to 1/32s
Example: S95; [_ 1.0s]	sets Hist Period Units to 1.0s

Numeric Settings

Syntax	Response
S[et]item_number, setting_value	<cr><lf>
Example: S62, 120	sets RMS Excd Level 2 to 120.

Character String Settings

To include leading spaces in a character string setting, precede the character string with a “” (leading single quote or grave accent, ASCII 96 or hexadecimal 60).

Syntax	Response
S[et]item_number, character_string	<cr><lf>
Example: S2; ` ABC Acoustics	sets Name to ABC Acoustics.

Template Settings

For example, when entering a date, the month, day, and year are entered in that order; two numeric digits each and are separated by “/”. The display shows date, month (abbreviated), and year in that order normally, or in year, month and date for ISO-8601 format (ddmmyyyy or yyyymmdd).

Syntax	Response
S[et]item_number; mm/dd/yy	<cr><lf>
S28, 05/23/89	sets Timer Run Date to 23May1989.

Times are entered in hour, minutes, and seconds order and are separated by “:”. (24 hour clock time is used: i.e. hours 0 to 23.

Syntax	Response
S[et]item_number; hh:mm:ss	<cr><lf>
Example: S30, 09:25:00 Example: S6, 23:05:33	sets Timer Run Time 1 to 09:25:00. sets current time to 23:05:33 (11:05:33pm)

Setting List

Com- mand	Instrument Type	Description	Comment
S1,x	ALL	RESET-ALL	
S2,c	ALL	HEADING LINE #1	
S3,c	ALL	HEADING LINE #2	
S4,c	ALL	HEADING LINE #3	
S5,c	ALL	MEASUREMENT TITLE	
S6,t	ALL	CURRENT TIME	
S7,t	ALL	CURRENT DATE	
S8,x	ALL	DAY OF WEEK	
S9,x	ALL	Serial Communications Baud Rate	
S10,n	ALL	Serial Communications Address	
S11,x	ALL	Serial Communications Output Flow Control	
S12,x	ALL	Printer Serial Bit Rate	
S13,x	ALL	Printer Serial Output Flow Control	
S14,x	ALL	Logic-Output, Activation Mode	
S15,n	ALL	Logic-Output Line Timer	
S16,x	ALL	Logic-Output Line #2, Activation Mode {Heater control line}	
S17,n	ALL	Logic-Output Line #2 Timer	
S18,x	ALL	LOGIC-IN LINE MODE [None Pause Toggle Level Alarm]	

Where c = character, t = template, n
= numeric, and x = option index.

S19	ALL	External Power Type [AC Pwr Battery]	Protects External Battery
S20	ALL	External Power-Off Voltage	
S21	ALL	POWER SAVE OPTIONS [Blank LCD / Auto Off / Manual Off]	
S22	ALL	Standby Time (LCD Blank & Comm Off) (nn)	0 to 99 minutes
S23	ALL	Auto-Off Time (nn)	0 to 99 minutes
S24	ALL	Backlight Power Off Time (nn)	0 to 99 seconds
S25	ALL	Backlight On/Off	
S26	ALL	LCD Contrast 0 to 99% (nn)	
S27	SSA, LOG	TIMER MODE	
S28	SSA, LOG	TIMER RUN DATE	
S29	SSA, LOG	TIMER STOP DATE	
S30	SSA, LOG	TIMER RUN TIME1	
S31	SSA, LOG	TIMER STOP TIME 1	
S32	SSA, LOG	TIMER RUN TIME 2	
S33	SSA, LOG	TIMER STOP TIME 2	
S34	ALL	LOCK COMBINATION	
S35	ALL	LOCK R/S KEY	
S36	ALL	LOCK SETUP	
S37	ALL	LOCK FUNCTION	
S38	ALL	LOCK RESET	
S39	ALL	LOCK THE 'ON' KEY	

S40	ALL	LOCK I/O	
S41	ALL	CAL LEVEL	
S42	ALL	CALIBRATOR S/N	
S43	LOG	AUTO-CALIBRATION MODE	
S44	LOG	AUTO CAL TIME	
S45	SSA, ISM, LOG, AUD	DETECTOR	
S46	SSA, ISM, LOG, AUD	FREQUENCY WEIGHTING	
S48	ALL	AC/DC Output Control [AC-1 AC-2 AC-1 DC AC-2 DC AC-2 AC-1]	
S49	SSA, ISM, LOG, AUD	Pk Detector Weighting [A C Flat]	
S50	SSA, ISM, LOG	RANGE [Normal Low High]	
S51	ALL	Transducer Type [Air Condenser Elec- tret Direct}	
S52	SSA, ISM, LOG, AUD	Simple SLM Displayed Value	
S53	SSA, ISM, LOG	CURRENT EXCHANGE RATE	
S53	RTA	RTAf FILTER BANDWIDTH	[1/1, 1/3] OCTAVE
S54	SSA, ISM, LOG	CURRENT THRESHOLD	
S54	RTA	RTAf DETECTOR	[LIN, EXP] TIME WEIGHTING
S55	LOG	CURRENT CRITERION	
S55	RTA	LINEAR DETECTOR TIME	SS.SSS SECONDS
S56	LOG	OVERALL EXCHANGE RATE	

S56	RTA	RTAf EXPONENTIAL DETECTOR TIME	[1/64, 1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8, 16, 32, 64] SECONDS
S57	LOG	OVERALL THRESHOLD	
S57	RTA	RTAf EXPONENTIAL DETECTOR STORAGE RATE	[1/2, 1/8] SECONDS
S58	LOG	OVERALL CRITERION	
S58	RTA	RTAf RTAf AUTOMATIC RESET AT TRIGGER	[NO, YES]
S59	LOG	CRITERION TIME (HOURS)	
S59	RTA	RTAf AUTOMATICALLY STORE EVENT RECORDS	[YES, NO]
S60	LOG	LDL EXCHANGE RATE	
S60	RTA	RTAf ENABLE EVENT BYTIME HISTORY	[NO, YES]
S61	LOG	LDL THRESHOLD	
S61	RTA	RTAf EVENT BYTIME PRETRIGGER SAMPLES	(NNN)
S62	LOG	LDL CRITERION	
S62	RTA	RTAf EVENT TRIGGERING ENABLE	[NO, YES]
S63	LOG	Lnn 1 PERCENT	
S63	RTA	RTAf TRIGGER SOURCE LEVEL	[12.5, 16.0 . . . 16.0K, 20.0K, FLAT] Hz.
S64	LOG	Lnn 2 PERCENT	
S64	RTA	RTAf ARM MODE	[NOW, L<, L=, L>, INPUT, TIME, COUNT]
S65	LOG	Lnn 3 PERCENT	
S65	RTA	RTAf ARM LEVEL	(NNN.N) dB

S66	LOG	Lnn 4 PERCENT	
S66	RTA	RTAf ARM TIME	(SS.SSSS) SECONDS (FOR LEVEL AND TIME ARM MODE CONDI- TIONS)
S67	LOG	Lnn 5 PERCENT	
S67	RTA	RTAf ARM SAMPLES	(NNNN)
S68	LOG	Lnn 6 PERCENT	
S68	RTA	RTAf ARM LOGIC INPUT TRUE LEVEL	[LOW, HIGH]
S69	SSA, ISM, LOG	SPL Exceedance Level 1	
S69	RTA	RTAf TRIGGER MODE	[NOW, L<, L=, L>, INPUT, TIME, COUNT]
S70	SSA, ISM, LOG	SPL Exceedance Level 2	
S70	RTA	RTAf TRIGGER LEVEL	(NNN.N) dB
S71	SSA, ISM, LOG	Peak-II Exceedance Level	
S71	RTA	RTAf TRIGGER TIME	(SS.SSSS) SECONDS
S72	SSA, ISM, LOG	Peak-I Exceedance Level	
S72	RTA	RTAf TRIGGER SAMPLES	(NNNN)
S73	SSA, ISM, LOG	EXCD HYSTERESIS	
S73	RTA	RTAf TRIGGER LOGIC INPUT TRUE LEVEL	[LOW, HIGH]
S74	LOG	ENABLE EXCD HISTORY	
S74	RTA	RTAf RUN MODE LOGIC INPUT TRUE LEVEL	[LOW, HIGH]

S75	LOG	EXCD EXCHANGE RATE	
S75	RTA	RTAf LOGIC OUTPUTS CONTROL SETTING	(BIT MAPPED WORD: 3 OUTPUTS BY 5 STATES)
S76	LOG	EXCD MINIMUM DURATION	
S76	RTA	RTAf END MODE	[NEVER, L<, L=, L>, INPUT, TIME, COUNT]
S77	LOG	EXCD TIME-HIST ENABLE	
S77	RTA	RTAf END LEVEL	(NNN.N) dB
S78	LOG	EXCD TIME-HIST PERIOD	
S78	RTA	RTAf END TIME	(SS.SSSS) SECONDS
S79	RTA	RTAf END SAMPLES	(NNNNN)
S80	LOG	EXCD Passby Trigger Mode	
S80	RTA	RTAf END LOGIC INPUT TRUE LEVEL	[LOW, HIGH]
S81	LOG	EXCD Occurrence Time [Start Max]	
S81	RTA	RTAf END THEN, REPEAT MODE	[STOP, REPEAT, AVERAGE]
S82	LOG	TIMED EXCD PERIOD	MM:SS
S82	RTA	RTAf REPEAT COUNT	(NNN) 0 TO 255 TIMES
S83	SSA, LOG	ENABLE INTV HISTORY	
S83	RTA	RTAf AVERAGE COUNT	(N) 0 TO 9 TIMES
S84	SSA, LOG	INTV EXCHANGE RATE	
S84	RTA	RTAf ANNUNCIATOR	(CCCCCCCC) IF RIGHT DIGIT IS NUMERIC IT WILL AUTO-INCREMENT
S85	SSA, LOG	INTV THRESHOLD	

S85	RTA	RTAf RT-60 CALCULATION dB DOWN SETTING	[5, 10, 20, 30]
S86	SSA, LOG	INTV PERIOD	
S86	RTA	HORIZONTAL GRAPH SCALING	[1, 2, 3, 4, 6, 8, 11, 16, 23, 32, 45, 64, 90, 128, 181, 256, 362, 512, 724, 1024]
S87	SSA, LOG	INTV TIME SYNC	
S88	LOG	INTV SAVE Ln'S	
S90	SSA, LOG	INTV AUTO STOP	
S91	LOG	ENABLE TIME HIST	
S92	LOG	TIME HISTORY RESOLUTION	
S93	LOG	Other TIME HISTORY Level	
S94	LOG	TIME HISTORY PERIOD	
S95	LOG	TIME HISTORY PERIOD UNITS	
S96	LOG	HIST BASE	
S97	LOG	HIST BASE MODE	
S98	LOG	HISTOGRAM TABLE RESOLU- TION	
S99	LOG	ENABLE DAILY LDN HISTORY	
S100	LOG	SAVE 6 DAILY Ln VALUES	
S101	ALL	DATA REPORT	
S102	SSA, LOG	R/S AND CAL LOG	
S103	ALL	SETUP REPORT	

Histogram Reports

The RMS, Peak and UWPk histogram reports have been implemented with this revision. The unformatted reports have also been developed and the format is the level of the first bin followed by the number of samples in each bin (in hex, 0-9 & a-F). There are 1024 RMS bins and 128 Peak and UWPk bins, this corresponds to 1/8th dB resolution for RMS and 1dB resolution for the peak tables.

S104	LOG	SPL HISTOGRAM TABLE	(x)
S105	LOG	SPL HISTOGRAM TABLE LOW VALUE	(n)
S106	LOG	SPL HISTOGRAM TABLE HI VALUE	(n)
S107	LOG	SPL HISTOGRAM TABLE RESOLUTION	(x)
S108	LOG	PEAK-II HISTOGRAM TABLE	(x)
S109	LOG	PEAK-II HISTOGRAM TABLE LOW VALUE	(n)
S110	LOG	PEAK-II HISTOGRAM TABLE HI VALUE	(n)
S111	LOG	PEAK-II HISTOGRAM TABLE RESOL	(x)
S112	LOG	PEAK-I HISTOGRAM TABLE	(x)
S113	LOG	PEAK-I HISTOGRAM TABLE LOW VALUE	(n)
S114	LOG	PEAK-I HISTOGRAM TABLE HI VALUE	(n)

S115	LOG	PEAK-I HISTOGRAM TABLE RESOL	(x)
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Tailored Report

S116	RTA	EXCD REPORT	
S117	SSA, ISM, LOG	INTV REPORT	
S118	LOG	HIST REPORT	
S119	LOG	DAILY NOISE REPORT	
S120-142 Reserved settings			

Miscellaneous

S143	AUD	Audiometric Calibrator Mode [SLM/ RTA FFT Pulse/FM]	
S144	FFT	FFT Lines [100 200 400]	
S145	AUD, FFT	FFT Bandwidth [200 to 20KHz]	
S146	FFT	FFT Averaging Count (1 to 65535)	
S147	AUD, FFT	FFT Window Type [Rectangular Hanning]	
S148	SSA, RTA, FFT, AUD, INT	RTA Gain (Range control for SLM/ RTA instruments) [-20 -10 +0 +10 +20 +30 +40 +50]	
S149	SSA, AUD	RTA Detector Rate [Slow Fast]	
S150	SSA, ISM, AUD	RTA BANDWIDTH [1/1 1/3]	
S151	ALL	Number of Allocated RAM Slots	
S152	ALL	ELECTROSTATIC ACTUATOR OFF/ON	

S153	ALL	HEATER LINE OFF/ON	
S154	ALL	MODEM MODE	
S155	ALL	MODEM DIAL OUT MODE	
S156	ALL	MODEM PHONE NUMBER	
S157	ALL	Monitor Number	
S158	ALL	MODEM INIT STRING	

Special Functions - Advanced use only. Remaining commands are not available on SETUP menu.

S159-166 Reserved settings			
S167	ALL	RELATIVE LEVEL REFERENCE	
S174	ALL	UNFORMATTED REPORTS	(x)
S175 Reserved setting			
S176	ALL	PRINTER TYPE	(x)
S177	ALL	DATA REPORT	(x)
S178	SSA, LOG	R/S AND CAL LOG	(x)
S179	ALL	SETUP REPORT	(x)
S180	LOG	RMS HISTOGRAM TABLE	(x)
S181	LOG	RMS HISTOGRAM TABLE LOW-EST VALUE	(n)
S182	LOG	RMS HISTOGRAM TABLE HIGH-EST VALUE	(n)
S183	LOG	RMS HISTOGRAM TABLE RESOLUTION	(x)
S184	LOG	PEAK-II HISTOGRAM TABLE	(x)

S185	LOG	PEAK-II HISTOGRAM TABLE LOWEST VALUE	(n)
S186	LOG	PEAK-II HISTOGRAM TABLE HIGHEST VALUE	(n)
S187	LOG	PEAK-II HISTOGRAM TABLE RESOL	(x)
S188	LOG	PEAK-I HISTOGRAM TABLE	(x)
S188	RTA	RTAf PRINT LIVE SUMMARY OR EVENT DATA	[NO, YES]
S189	LOG	PEAK-I HISTOGRAM TABLE LOW VALUE	(n)
S189	RTA	RTAf PRINT LEQ SUMMARY OR EVENT DATA	[NO, YES]
S190	LOG	PEAK-I HISTOGRAM TABLE HI VALUE	(n)
S190	RTA	RTAf PRINT MAX SUMMARY OR EVENT DATA	[NO, YES]
S191	LOG	PEAK-I HISTOGRAM TABLE RESOL	(x)
S191	RTA	RTAf PRINT MIN SUMMARY OR EVENT DATA	[NO, YES]
S192	LOG	EXCD REPORT	(x)
S192	RTA	EVENT WORKING REPORT ENABLE	[NO, SHORT, LONG]
S193	LOG, RTA	EXCD REPORT LOWEST RECORD	(n)
S194	LOG, RTA	EXCD REPORT HIGHEST RECORD	(n)
S195	SSA, ISM, LOG	INTV REPORT	(x)
S195	RTA	SPATIAL AVERAGE HISTORY REPORT ENABLE	[NO, YES]

S196	SSA, ISM, LOG	INTV REPORT LOWEST RECORD	(n)
S197	SSA, ISM, LOG	INTV REPORT HIGHEST RECORD	(n)
S198	LOG	HIST REPORT	(x)
S199	LOG	HIST REPORT LOWEST RECORD	(n)
S199	RTA	EVENT BYTIME REPORT LOW- EST RECORD	[0 . . . 65535]
S200	LOG	HIST REPORT HIGHEST RECORD	(n)
S200	RTA	EVENT BYTIME REPORT HIGH- EST RECORD	
S201	LOG	DAILY NOISE REPORT	(x)
S201	RTA	TEMPORARY NOTE FIELD FOR SPATIAL AVERAGE	[0 . . . 65535]
S202	ALL	CALIBRATION MODE [Off Check Change Chk NF]	
S203	ALL	UNLOCK PASSWORD	
S204	ALL	SETUP FILENAME	
S205	ALL	ENABLE ERROR CHECKING I/O	

Error Checking I/O

The error checking I/O protocol verifies that commands and data are transferred without errors.

- To enable error checking the @ command or S205,1 command is used.
- To disable error checking two <CR> characters in a row may be sent (if not in the Modem Mode) or the S205, 0F command is sent.

The “F” is the check character for the S205, 0 command. A detailed description of the protocol is available from Larson•Davis and the latest revisions of software utilize the protocol.

S206 Reserved setting			
S207	ALL	NOISE FLOOR LEVEL	

This setting is set to the noise floor of the instrument so that it can properly indicate “Near Noise Floor” messages when within 10dB of the noise floor. It is also used with NF Compensate, Q208, which will place the System 824 in an extended Linearity Range Mode. The true noise floor of the entire system must be measured and entered in Q207. This will vary with the selected input weighting or microphone sensitivity. An equivalent microphone capacitance can be used after calibration to determine the noise floor. It may also be possible to remove the microphone bias to obtain this value. When properly set up the linearity range can be increased by 10dB.

NOTE: The mode is always turned off with a CAL Change.

S208	SSA, ISM, LOG	NOISE FLOOR COMP MODE	
S209 Reserved setting			
S210	ALL	AUX CONTROL REG	
S211	LOG	EXCD RECORD NUMBER	

S212	SSA, ISM, LOG, RTA	INTV RECORD NUMBER	
S213	LOG	HIST RECORD NUMBER	
S213	RTA	BYTIME HISTORY RECORD	(NNNNN)
S214	LOG	RUN-LOG RECORD NUMBER	
S215	LOG	DAILY RECORD NUMBER	
S216	LOG	CALIBRATION RECORD NUMBER	
S217	LOG	HISTOGRAM TABLE LEVEL	
S218	ALL	Data File Record Number	
S219	ALL	Graph Vertical Scale, dB per pixel	
S220	ALL	Graph Base Level (range from -99 to +999)	
S221	ALL	Request to send Output Control Mode	
S224	LOG, RTA	Start Level (nn) for Ln and ExTH	
S227	ALL	OVERALL CALIBRATION OFFSET (uses 225.48 lock)	
S230	ALL	BIAS OFFSET - For High Range Cali- bration (uses 225.48 lock)	
S231 Reserved setting			
S232	ALL	Temperature Calibration (Cal level must be 225.48)	
S233	ALL	SERIAL NUMBER Entry (secured set- ting)	
S234	ALL	Model Number Entry (secured setting)	
S235	ALL	Invalid Setting's data block	

RTA Settings Commands

S53	RTA	Filter Bandwidth [1/1 1/3]	
S54	RTA	Detector [Lin Exp] Time Weighting	
S55	RTA	Linear Detector Time (ss.ssss) seconds	
S56	RTA	Exponential Detector Time [1/64 1/32 1/16 ... 32 64]	
S57	RTA	Exponential Detector Sample Rate [1/2 1/8]	
S58	RTA	Auto-Store Records [No Yes]	
S59	RTA	Event By-Time Pretrigger Samples (nnn)	
S60	RTA	Event Triggering Enable [No Yes]	
S61	RTA	Trigger Source Level [12.5 16.0 ... 16.0K 20.0K Flat] Hz	
S62	RTA	Store By-Time Samples of Event [No Yes]	
S63	RTA	Arm Mode [... L < L = Input Time Count]	
S64	RTA	Arm Level (nnn.n) dB	
S65	RTA	Arm Time (ss.ssss) Sec (for Level and Time Arm Mode Conditions)	
S66	RTA	Arm Samples (nnnn)	
S67	RTA	Arm Logic Input TRUE Level [Low High]	
S68	RTA	Trigger Mode [... L < L = Input Time Count]	
S69	RTA	Trigger Level (nnn.n) dB	
S70	RTA	Trigger Time (ss.ssss) Sec	

S71	RTA	Trigger Samples (nnnnn)	
S72	RTA	Trigger Logic Input TRUE Level [Low High]	
S73	RTA	Run via Logic Input [no, Yes]	
S74	RTA	Run Mode Logic Input TRUE Level [Low High]	
S75	RTA	Logic Outputs Control Setting (bit mapped word: 3 outputs X 5 states)	
S76	RTA	End Mode [Never L < L = Input Time Count]	
S77	RTA	End Level (nnn.n) dB	
S78	RTA	End Time (ss.ssss) Sec	
S79	RTA	End Samples (nnnnn)	
S80	RTA	End Logic Input TRUE Level [Low High]	
S81	RTA	End Then, Repeat Mode [Stop Repeat Average]	
S82	RTA	Repeat Count (nnn) 0 to 255 times	
S83	RTA	Average Count (n) 0 to 9 times	
S84	RTA	Annunciator (ccccccc) if right digit is numeric it will auto-increment	
S85	RTA	RT-60 calculation dB down setting [5 10 20 30]	
S86	RTA	Horizontal Graph Scaling [1, 2, 3, 4 ... , 725, 1024]	
S188	RTA	Print Live Summary or Event Data [No Yes]	
S189	RTA	Print Leq Summary or Event Data [No Yes]	

S190	RTA	Print Max Summary or Event Data [No Yes]	
S191	RTA	Print Min Summary or Event Data [No Yes]	
S192	RTA	Event working report enable [No Short Long]	
S199	RTA	Event ByTime REPORT LOWEST RECORD	nnnnn
S200	RTA	Event ByTime REPORT HIGHEST RECORD	nnnnn
S213	RTA	ByTime History Record	(nnnnn)
S195	RTA	Spatial Average History Report Enable	
S201	RTA	Temporary Note Field for Spatial Average	
S139	RTA	FFT Repeat on Count complete [0 = No, 1 = Yes]	
S138	RTA	FFT Enable Overload Skipping [0 = No, 1 = Yes]	

History Records

Histories are records of stored data based on time or a particular event. One record is available at a time. The current record number is selected by using the Advance, Backup, and Find commands (see below) or the Setting S211 through S217.

The various histories of the System 824 are each accessed in a similar fashion. The Find command is the primary method of locating a history record for random (nonsequential) access. For example, to find the one hundred twenty-fifth Exceedance record you send the command F125,1 <cr> where the [,1] specifies that it is an Exceedance record to be found (as defined in the “history_number” column below). The Advance and Backup commands are generally used next. They extract data after the initial find command.

The Find command takes longer to execute as the record number increases in size, therefore, for sequential data extraction locate the first desired record with the Find command and then use the Advance command. The [,relative_rec] option can be used to retrieve data forward or backward from the current record number without changing that record number; it is a signed 8-bit value, i.e. 1 to 127 is positive 1 to 127 while 128 to 255 is -128 to -1 respectively. Refer to settings 211 through 217 to query the current record number. Setting these to a desired record

number is an alternate form of the Find command.

Brackets in the syntax indicate optional characters and operands.

<cr> = carriage return; <lf> = line feed

Types of History

Each history is assigned a number (history_number) so that it can be identified explicitly with the Advance, Backup, and Find commands and is shown below.

Denoted in syntax by history_number:

- 1=Exceedance (E)
- 2=Interval (I)
- 3=Daily (D)
- 4=Run Log (L)
- 5=Calibration (C)
- 6=Time (H)
- 7=Histogram Table (T)

Advance

Advance a number of records from present record number. If no num_record (number of records) is provided, 1 is assumed.

Syntax	Response
A[dvance][num_record][, history_number]	<cr><lf>
Example: A Example: A5 Example: A9,5	Advance current history 1 record Advance current history 5 records Advances calibration history by 9 records

Backup

Backup a number of records from present record number. If no num_record (number of records) is provided, 1 is assumed.

Syntax	Response
B[ackup][num_record][, history_number]	<cr><lf>
Example: B Example: B5 Example: B9,5	Backup current history by 1 record Backup current history by 5 records Backup the calibration history by 9 records from the current calibration history

Find

Find record number directly.

Syntax	Response
F[ind]num_record[, history_number]	<cr><lf>
Example: F9,5	Locates calibration history record 9

Generally you use the Find command to get to the first record (F1,2) and the Advance command (A) to move up through the records.

History Data Variables

Exceedance History Variables

Brackets in the syntax indicate optional characters and operands.

Syntax	Response
E[xceedance]var_no	Excd_var
Example: E9	__2 (Overload count from current record)

Commands	Instrument Type	Description	Commnet
E1	LOG RTA	Date and Time of Occurrence	ddmmyy hh:mm:ss
E2	LOG, RTA	Duration	hh:mm:ss / mm:ss.ss
E3	LOG	TWA	nnn.n dB
E3,f	RTA	Leq Filter	
E4	LOG	SEL	nnn.n dB
E4,f	RTA	Max filter	
E5	LOG	Lmax	nnn.n dB
E5,f	RTA	Min Filter	
E6	LOG	Lpeak	nnn.n dB
E6	RTA	Overload	

Commands	Instrument Type	Description	Commnet
E7	LOG	UnWeighted Peak	nnn.n dB
E7	RTA	Pretrigger Samples	
E8	LOG	Peak Exceedance Count	nnn
E8	RTA	Trigger Samples	
E9	LOG	Overload Counts	nnn
E9	RTA	Total Samples	
E0	LOG	Illegal Indication	BEEP +”ILLEGAL”
E10	RTA	Pre/ Post Trigger indication	
E11,n	RTA	Sets ByTime Sample	If n<0, no change just report current sample
E12,f	RTA	By Time Sample Filter Level	
E13,n	RTA	ByTime Sample Time	
E14,n	RTA	By Time Sample Duration	
E15,n	RTA	By Time Overload	
E16	RTA	RT60 calculation at current filter. Filter set by E 3, E 4, E 5, or E 12.	
E17	LOG	Excd Time-Hist Samples	nnn
E17,n	RTA	Extracts ByTime History and returns nothing	
E18[n]	LOG	Excd Time-History	nnn.n dB
E18	RTA	RT60 delta time. <i>NOTE: Value is determined by prior E 16, or E 17.</i>	
E19<,n>	LOG	Excd T.H. Time	-sss.ss
E20<,n>	LOG	Excd T.H. Number	-nnn

Commands	Instrument Type	Description	Commnet
E21<,n>	LOG	Excd T.H. Bargraph	***** *
E101	LOG	Excd Macro Variables 1-10, 25	Macro
E102	LOG	Excd Macro Time-Hist 17, 18...	Macro

Interval History Variables (“I” Commands)

The Interval History is a long-duration time history of statistical data. It is enabled by Setting 83, Interval Enable [No|Yes] (see Settings 83 through 90). The period of the interval is selectable from one second up to 99 hours, 59 minutes, and 59 seconds (99:59:59).

Brackets in the syntax indicate optional characters and operands.

Syntax	Response
I[nterval]var_no	Intv_var
Examples: I 1 I 1,-5 I1,5	01Jan1997 01:25:00 01Jan1997 01:20:00 (from 5 previous) 01Jan1997 01:30:00 (from 5 after)

The time syncing feature can be used to synchronize the interval history records to the instruments real-time clock. If the Interval Period is set to the time shown in the first column below, the first interval of each new measurement will end at the real time indicated in the second column (the hh means any hour and the hh:m means any hour and tens of minutes). All subsequent intervals will now be synchronized to the real-time clock:

Intv Period	Sync On	Sync to nearest
01:00	hh:00	hour
00:30	hh:00, hh:30	half hour (30 minutes)
00:20	hh:00, hh:20, hh:40	one-third hour (20 minutes)
00:15	hh:00, hh:15, hh:30, hh:45	one-fourth hour (15 minutes)
00:10	hh:m0	one-sixth hour (10 minutes)
00:05	hh:m0, hh:m5	one-twelfth hour (5 minutes)
00:0x	hh:mm	minute

Commands	Instrument Type	Description	Comments
I0, I101	RTA	or variable greater than 4 will run macro by default.	
I1	SSA, LOG, RTA, FFT, TAL	Date and Time of Occurrence	ddmmmyy hh:mm:ss
I2	SSA, LOG, TAL	Duration	hh:mm:ss / mm:ss.ss

Commands	Instrument Type	Description	Comments
I2	RTA	Number of Samples Averaged	nnnn
I2	FFT	Count	nnn
I3	SSA, LOG	TWA	nnn.n dB
I3	RTA	Spectral or Flat Level (n=ANSI filter#)	nnn.n dB
I3	FFT	OVER LOAD	cccc
I3	TAL	Overload Counts	nnn
I4	SSA, LOG	SEL	nnn.n dB
I4	RTA	Note Field	cccccccc
I4	FFT	Overall Level	nnn.n
I4	TAL	Mode [SLM RTA Tonal]	
I5	SSA, LOG	Lmin	nnn.n dB
I5,n	FFT	FFT Line Level (n=0 to 400)	nnn.n
I5,n	RTA	RTA Live Spectrum Level	nnn.n dB
I6,n	RTA	RTA Leq Spectrum Level	nnn.n dB
I6	SSA, LOG	Lmax	nnn.n dB
I7	SSA, LOG	Lpeak	nnn.n dB
I8	SSA, LOG	UnWeighted Peak	nnn.n dB
I9	SSA, LOG	RMS Exceedance Count	nnn
I10	SSA, LOG	Peak Exceedance Count	nnn
I11	SSA, LOG	UnWeighted Peak Excd Count	nnn
I 12	SSA, LOG	Overload Counts	nnn
I13	LOG	Intv Ln 1 Percent	nn

Commands	Instrument Type	Description	Comments
I14	LOG	Intv Ln 1 Level (dB)	nnn.n
I15	LOG	Intv Ln 2 Percent	nn
I16	LOG	Intv Ln 2 Level (dB)	nnn.n
I17	LOG	Intv Ln 3 Percent	nn
I18	LOG	Intv Ln 3Level (dB)	nnn.n
I19	LOG	Intv Ln 4 Percent	nn
I20	LOG	Intv Ln 4 Level (dB)	nnn.n
I21	LOG	Intv Ln 5 Percent	nn
I22	LOG	Intv Ln 5 Level (dB)	nnn.n
I23	LOG	Intv Ln 6 Percent	nn
I24	LOG	Intv Ln 6 Level (dB)	nnn.n
I37,n	SSA	RTA Filter Leq (n = ANSI filter#)	nnn.n dB
I38,n	SSA	RTA Filter Leq (n = ANSI filter#)	nnn.n dB
I101	SSA, LOG	Intv Macro Variables	1-12, 37-38
I101	RTA	Macro 1 to 4	

“I” Commands for Basic SLM Mode:

Commands	Instrument Type	Description	Comments
I5,n	SSA, LOG	Any SPL; n=1 to 9	nnn.n
I6,n	SSA, LOG	Any Max; n=1 to 9	nnn.n
I7,n	SSA, LOG	Any Leq; n=1 to 9	nnn.n

Commands	Instrument Type	Description	Comments
I8	SSA, LOG	LAFTM5 (Takt5 A Fast)	nnn.n
I9	SSA, LOG	Intv Impulse A Leq (dB)	nnn.n
I10	SSA, LOG	Intv Ln 1 Percent	nn
I11	SSA, LOG	Intv Ln 1 Level (dB)	nnn.n
I12	SSA, LOG	Intv Ln 2 Percent	nn
I13	SSA, LOG	Intv Ln 2 Level (dB)	nnn.n
I14	SSA, LOG	Intv Ln 3 Percent	nn
I15	SSA, LOG	Intv Ln 3 Level (dB)	nnn.n
I16	SSA, LOG	Intv Ln 4 Percent	nn
I17	SSA, LOG	Intv Ln 4 Level (dB)	nnn.n
I18	SSA, LOG	Intv Ln 5 Percent	nn
I19	SSA, LOG	Intv Ln 5 Level (dB)	nnn.n
I20	SSA, LOG	Intv Ln 6 Percent	nn
I21	SSA, LOG	Intv Ln 6 Level (dB)	nnn.n
I22,n	SSA, LOG	Differences 0 to 2 [LAFTM5 - LAeq LCeq - LAeq LAleq - LAeq]	

“T” Commands for Tonal Mode:

Commands	Instrument Type	Description	Comments
I5	TAL	Ftone	nnnnn Hz
I6	TAL	Dfc	nnnnn Hz
I7	TAL	Ltone	nnn.n dB

Commands	Instrument Type	Description	Comments
I8	TAL	Lgroup	nnn.n dB
I9	TAL	Ltone-Lgroup	nnn.n dB

Daily History Variables - (D1-D102)

Brackets in the syntax indicate optional characters and operands.

Syntax	Response
D[aily]var_no[,hour]	daily_var
Example: D5, 5	hourly noise level for hour 5 to 5:59:59 a.m.

D 1	LOG	Date	ddd ddmmmyyyy
D 2	LOG	Daily Leq	nnn.n dB
D 3	LOG	Daily LDN	nnn.n dB
D 4	LOG	Daily CNEL	nnn.n dB
D 5,hn	LOG	HNL (for hour 0-23)	nnn.n dB
D 6,hn	LOG	HNL partial hour indicator	c
D 7	LOG	Daily Lmin	nnn.n dB
D 8	LOG	Daily Lmax	nnn.n dB
D 9	LOG	Daily Lpeak	nnn.n dB
D 10	LOG	Daily Lwupk	nnn.n dB
D 11	LOG	Daily Run Time	hh:mm:ss mm:ss.ss
D 19	LOG	Daily Ln Table in hexadecimal	hhhhhh, hhhhhh,...hhhhhh <ih>

D 20	LOG	Intv Ln 1 Percent	nn
D 21	LOG	Intv Ln 1 Level (dB)	nnn.n
D 22	LOG	Intv Ln 2 Percent	nn
D 23	LOG	Intv Ln 2 Level (dB)	nnn.n
D 24	LOG	Intv Ln 3 Percent	nn
D 25	LOG	Intv Ln 3Level (dB)	nnn.n
D 26	LOG	Intv Ln 4 Percent	nn
D 27	LOG	Intv Ln 4 Level (dB)	nnn.n
D 28	LOG	Intv Ln 5 Percent	nn
D 29	LOG	Intv Ln 5 Level (dB)	nnn.n
D 30	LOG	Intv Ln 6 Percent	nn
D 31	LOG	Intv Ln 6 Level (dB)	nnn.n
D 32,h	LOG	Intv Ln 1 Percent	nn
D 33,h	LOG	Hourly EXCD Leq (h=hour=0-23)	nnn.n dB
D 101	LOG	Hourly BkGd Leq (h=hour=0-23)	nnn.n dB
D 102	LOG	Daily HNLs 5(0-23),6(0-23)	Macro

Run Log Variables (SSA, ISM, LOG, TAL)

Brackets in the syntax indicate optional characters and operands.

Syntax	Response
--------	----------

L[og]var_nolog_var	
Example: L1	Run/Stop number

L 1	Run/Stop Number	nnnnn
L 2	Run/Stop Type	(RUN/STOP/CONT/PAUSE/MARK)
L 3	Cause	(TIMER/KEY/A:D-n/HALT/INTV/ BATT)
L 4	Day, Date and Time	ddd ddmmmyyyy hh:mm:ss
L 101	Run-Log Macro Variables L1-L5	Macro

Calibration History Variables (LOG)

Brackets in the syntax indicate optional characters.

Syntax	Response
C[alibration]var_no	cal_var
Example: C1	114.0 (checked level)

C 1	Checked Level	nnn.n
C 2	Day, Date and Time	ddd ddmmmyyyy hh:mm:ss
C 3	Calibration Mode	[Manual/Auto]
C 4	Cal Status	[OK/Bad]
C 101	Cal Variables 1-4	Macro

Time History Variables (SSA, LOG, TAL)

Brackets in the syntax indicate optional characters and operands.

H 1	SSA, LOG, TAL	Leq (RMS Level)	nnn.n dB
H 2	LOG	Other level (Pk-I, Pk-II, or Lmax)	nnn.n If Other Level is set to Advc then “ ___ ”
H 3	SSA, LOG, TAL	Run time of sample	hhhhh:mm/hh:mm:ss/mm:ss.ss
H 4	SSA, LOG, TAL	HISTORY BARGRAPH	=====
H 5, n	SSA, LOG, TAL	Return the advanced value where ‘n’ comes from a list of available levels	The optional parameter ‘n’ is available only when advanced time history is enabled. When ‘n’ is omitted or 0, all enabled values are transmitted
H 6, n	SSA, LOG, TAL	Return descriptive text for the advanced level	‘n’ is an optional parameter, when it is omitted or equals 0, the descriptive text for all enabled levels is returned.
H 7, n	SSA	Return RTA Leq/Live data from an advanced time history.	‘n’ is the ANSI filter number for requesting a single filter level. When ‘n’ is omitted or equals 0, all filter levels are transmitted.
H 101	SSA, LOG, TAL	Same as doing an H 1 + H 5, 0	
H 102	SSA, LOG, TAL	Same as doing an H 1 and H 6, 0	

For the LOG instrument type H5 and H6 are for when “Other Level” setting is set to [Advc] to enable the advanced time history.

Time History Variables (SSA, LOG, TAL)

Brackets in the syntax indicate optional characters and operands.

Syntax	Response
H[istory]var_no	time_var
H2	123.4 (Peak level in current record)

H 1	Leq (RMS Level)	nnn.n dB ‘n’
H 2	Peak Level	nnn.n dB
H 3	Run Time of Sample (calc)	hhhhh:mm/hh:mm:ss/mm:ss.ss
H 4	HISTORY BARGRAPH	=====

Histogram Table Variables

Brackets in the syntax indicate optional characters and operands.

Table:

- 1=RMS,
- 2=Peak,
- 3=Unweighted Peak.

Default is last used table or RMS.

Syntax	Response
--------	----------

T[table]var_no[, table]	table_var
Example: T1,1	-75.0 (RMS current bin level)

T 1 [n ^a]	LOG	Level of current bin	nnn.n dB
T 2 [n]	LOG	Count of samples	nnnnnc (c= K or M for Kilo or Mega)
T 3 [n]	LOG	Percent of total	nnn.nn%
T 5 [n]	LOG	Prints the accumulated time for the current level/bin. The table number is optional.	hhhhh:mm:ss.s
T n+64	LOG	Shows total of bins less than this level	
T n+128	LOG	Shows total of bins greater than this level, plus resolution	

a. Where n equals the table number: 1-RMS, 2-Peak, & 3-UnWeighted Peak.

Print Command

Brackets in the syntax indicate optional characters.

<cr> = carriage return; <lf> = line feed

Syntax	Response
P[rint]print_no	<cr><lf>

Example: P1	Data Report is printed to computer.
P9 S177,1 S178,1 S192,1 P100	(1) sets all report enables in setup to [No] (2) sets the Data report, Run-log, and EXCD report enables (short) to [Yes] and (3) begins printing to the computer

Syn-tax	Instrument Type	Description
P 0	ISM, SSA, LOG, RTA	Tailored Report (Formatted from normal setup settings 89-113)
P 1	ISM, SSA, LOG, RTA	Data Report
P 2	SSA, LOG	Data & Histograms
P 3	SSA, LOG	Short Full Report (Histories with SHORT option)
P 4	SSA, LOG	Long Full Report (Histories with LONG option)
P 9	ISM, SSA, LOG, RTA	All Report Enables Turned OFF
P 10	SSA, LOG	Select All except Histograms in Unformatted Style
P 11	SSA, LOG	Select All including Histograms in Unformatted Style
P 100	ISM, SSA, LOG, RTA	Begin Printing through current I/O command channel (See X100 Command)
P 101	ISM, SSA, LOG, RTA	Begin Printing through channel selected by "Print Command"
P 999	ISM, SSA, LOG, RTA	Abort Printing

X 100	ALL	XMODEM Begin Printing (same as P100 except through the XMODEM communication protocol) Use with UnFormatted Reports to download a file to be viewed in a spreadsheet program. Also use this to download reports for printing on a computer's printer, rather than directly from the 824; this lets reports to be printed on a nice laser printer connected to a computer without having to disconnect it from the computer.
^X^X	ISM, SSA, LOG, RTA	CANcel transfer mode, 2 in a row (ASCII <CAN> or CHR\$(24))

Error Messages and Warnings

The code listed is the number provided by R98.

All error messages begin with: CHR\$(7), "ERROR - "

Error Code	Message
1	"COUNT OVERFLOW"
2	"EXPONENTIAL OVERFLOW"
3	"RTX TASK SELECT"
4	"BAD EXCHANGE RATE"
5	"UNKNOWN IRQ"
6	"WATCHDOG RESET"
7	"RAM BANK"
8	"OPCODE ERROR"

All warning messages begin with:
CHR\$(7), "WARNING - "

Warning Code	Message
128	"Out of Memory"
129	"Divide by Zero"
130	"Battery Low"
131	"POWER FAILURE"
132	"External Power Failure"
133	"Power Off"
134	"Time Not Set!"
135	"Timer Pending"
136	"Printer is Busy"
137	"DPC Format"
138	"Key No Effect"
139	"Stop Required"
140	"Setting Wrong"
141	"Overall Reset Required"
142	"OPEN #"
143	"Already Open"
144	"No History Yet"
145	"At End of History"
146	"At Start of History"
147	"History Format Bad"

148	“EEPROM Fault”
149	“Out of Memory”
150	“Memory was Lost”
151	“Unimplemented”
152	“System Locked”
153	“A:D Stack Full”
154	“A:D Over-Run”
155	“Serial Port Framing”
156	“Serial Port Line Noisy”
157	“Serial Port Over-Run”
158	“Unknown I/O Command”
159	“Operand 1 Range”
160	“Operand 2 Range”
161	“I/O Overflow”
162	“Can’t Calibrate”
163	“Calibration Invalid”
164	“Analog Calibration Bad”: often an indication of a faulty EPRM
165	“ID is Active”
166	“ID is in ROM”
167	“ID is Read Only”
168	“ID is in a File”
169	“ID has Changed”
170	“ID Space Full”
171	“Purge Required”

172	“No Data”
173	“Not Available”
174	“Demo Mode”
175	“Setting Conflict”

Modem Control Mode (All Instruments)

The modem control mode enables the Model 824 to automatically dial out upon an exceedance or a low memory condition. This mode also enables the Model 824 to answer the phone so that instructions can be received. The modem must be Hayes (TM) compatible and set to respond to commands using numeric codes (non-verboses).

Modem Mode

If the Modem Mode is [Yes], the Model 824 will dial the Phone# on the events selected by the Dial Out Mode defined below.

Dial Out Mode

- None: The Model 824 will not dial a computer for any reason.
- Excd: The Model 824 will dial a computer to report when an illegal exceedance is logged into memory. An illegal exceedance is when $\text{Excd Lmax} > \text{RMS Excd Level 2}$. The phone will also be dialed if the memory is low.

- **Phone#:** The valid characters in Phone# are those recognized by the modem to which the Model 824 is attached and generally include:

W	will wait for another dial tone
P	selects pulse dialing
T	selects tone dialing
,	will pause dialing for 2 s
space or -	used to make the number more readable.
T9W 1-412-555-1212	indicates to use tone dialing, dial 9 for an outside line, wait until the dial tone is detected, and then dial the number.

Monitor Number

The monitor number is used to specifically address the monitor.

824 Phone Dialing Procedure

The Model 824 dialing process is as follows:

Example: 824 sends: ATDT 1-555-1234 (Enter)

Modem sends: 824A0123:001:2 (Enter)

- Step 1** The Model 824 recognizes an exceedance or low memory condition.
- Step 2** The Model 824 asks the modem to dial the phone number.
- Step 3** The modem informs the Model 824 that a connection has been made. The Model 824 modifies its baud rate to that of the connected modem. If the connection is unsuccessful, the procedure is retried in 4 min.
- Step 4** The Model 824 sends the following announcement: "824: 824A0123:001:2" (enter), where (0123) is the Model 824's serial number, (001) is

the monitor number entered, and (2) is a flag: 1-Alarm 2-Exceedance 4-Low Memory. More than one of these can be set at a time, in which case x is the sum of all set flags.

Computer
824A0123:11111111

sends: **Step 5** The Model 824 awaits a response code, which should be: “824A0123:11111111” (enter), where (0123) is the Model 824’s serial number and (11111111) is the Lock Combination (setting 28) which is required whether or not the Model 824 is currently locked. If the response is incorrect, the announcement is resent. Four chances are given to respond correctly. A “3 cr” sequence will cause the Model 824 to hang up.

824 sends: “Ready”

Step 6 When a correct response is received, the Model 824 indicates it is ready to send data when requested with “824:Ready”(enter).

Model 824 Answering Procedure

Modem sends: 2

Step 1 The modem informs the Model 824 that a connection has been requested; that is, the phone is ringing.

Step 2 The Model 824 answers the phone.

Modem sends: 824A0123:001:0

Step 3 The modem informs the Model 824 that a connection has been made. The Model 824 modifies its baud rate to that of the connected modem. If the connection is unsuccessful, the procedure is retried in 4 min.

Modem sends: 10 (enter)

Step 4 The Model 824 sends the following announcement: “824:824A0123:001:0” (enter), where (0123) is the Model 824’s serial number, (001) is the monitor number entered, and (0) is a flag: 1-

Alarm 2-Exceedance 4-Low Memory. More than one of these can be set at a time, in which case x is the sum of all set flags.

Computer
824A0123:11111111

sends: **Step 5** The Model 824 awaits a response code, which should be: “824A0123:11111111” (enter), where (0123) is the Model 824’s serial number and (11111111) is the Lock Combination (setting 28) which is required whether or not the Model 824 is currently locked. If the response is incorrect, the announcement is resent. Four chances are given to respond correctly. A “3 cr” sequence will cause the Model 824 to hang up.

824 sends: “Ready”

Step 6 When a correct response is received, the Model 824 indicates it is ready to send data when requested with “824: Ready” (enter).

Each line ends with a <CR> and line feed <LF>.

Unsupported Miscellaneous Commands

NOTE: Use of these commands is up to the discretion of the programmer; they are considered undocumented and unsupported. Larson Davis makes NO warranties for their proper operation and is unable to support them with further documentation or through customer support. They are used by proprietary Larson Davis software and are documented here on an as-is basis for those who may desire to explore, unaided, these advanced features.

The operation of these commands is subject to change without notice of any kind.

X 16x	XMODEM binary data dump, x = bit flags; Add 1 to 'x' to automatically reset histories at completion of transfer Add 2 to 'x' to inhibit the pause just before sending OverAll data (the pause provides for cohesive data) Add 4 to 'x' to begin where last download ended (always starts at the beginning of stored data if not set) Add 8 to 'x' to disable waiting for acknowledgment at the end of each block transfer (used with error checking modems, i.e. MNP 4 or V.42) Add 16 to enable the Xmodem download at 57.6 kilobaud (Comm. Port 1 ONLY). The resulting binary file structure is undocumented and unsupported. The advantages of the binary features can be obtained by utilizing Larson•Davis software (turnkey application, data translators or function library support is available).
^X^X	CANcel transfer mode, 2 in a row (ASCII <CAN> or CHR\$(24)).
>a,b	Read 824's memory from address (a) and bank (b)

^	<p>Read Excd T.H. Buffer. This command is used to create an SPL vs. Time plot that is time cohesive. Resolution is, by default, 1 dB with one byte/sample being sent. Each byte has 32 added to it to avoid confusion with ASCII control codes, subtract 32 to use. Only the samples taken since the last read are sent, up to the buffer size of 128 samples. The time of day is appended to the end of the string to permit time stamping of the SPL graph. A delimiter byte (ASCII 212 in decimal, which is the letter "T" with 128 added to it) precedes the time string.</p> <p>Full resolution including the fractional part of the level is sent if enabled by the M9,1 command. With full resolution, 2 bytes per level are sent. The first byte being the integer portion, which is the same as described above. The second byte is the fractional portion. it is converted by subtracting 32 from the byte and then dividing it by 128 to make it a fraction. The fractional part is then added to the integer part to form the level.</p>
@	<p>Enable IO Error Check Scheme. S205,0F or 2 <CR> in a row to disable.</p>

Data File Commands

The &F I/O command reads out information about stored data or FILES and has facilities to store and recall files. These work in conjunction with Advance, Backup and Find to navigate through the File records of this history (just like Intervals).

&F1	FILE NAME	cccccccc
&F2	FILE EXTENSION (InstType)	ccc
&F3	FILE DESCRIPTION	cccccccccccccccccccccccccccccccccccc
&F4	CURRENT START TIME	ddmmyy hh:mm:ss
&F5	CURRENT END TIME	ddmmyy hh:mm:ss
&F6	OVERALL START TIME	ddmmyy hh:mm:ss
&F7	OVERALL END TIME	ddmmyy hh:mm:ss
&F8	SIZE OF FILE	nnnnnnn

&F101	Read macro &F variables 1 through 8	
&F102	Recall a FILE into active memory	
&F103	Store the current data (in active memory) to a FILE	

Keyboard Simulation

The keys on the 824's keyboard may be simulated with the 'K' I/O command.

Each key is given an ASCII character as shown in the table below.

A space delimiter following the 'K' is required before non-numeric operands. (i.e. K ;6<)

The keyboard buffer will hold up to 8 keys. (K12345678 is acceptable).

ASCII Character:	Key that is simulated:
0	CHECK KEY
1	POWER KEY
2	RESET KEY
3	PAUSE KEY
4	RUN/STOP KEY
5	UP ARROW
6	DOWN ARROW

7	LEFT ARROW
8	RIGHT ARROW
9	FUNCTION KEY #1 (VIEW)
:	FUNCTION KEY #2 (DATA)
;	FUNCTION KEY #3 (SETUP)
<	FUNCTION KEY #4 (TOOLS)
=	FUNCTION KEY #5 (PRINT)

Operation Notes

When using the Logic Input line in the 'LEVEL' mode both I/O and keyboard Runs and Stops are inhibited. If the line is High the 824 takes data and if the line is Low no data is taken. The 'Pause' mode will pause the data taking process while the line is high; this may be triggered by high wind speed. In the 'Toggle' mode when the Logic Input line goes high the 824 toggles between RUN and STOP modes.

B

Integrated Level Calculations

Basic Integrated Level Calculations

The Larson Davis System 824 calculates all of its integrated levels based on equations from IEC standard 804. IEC-804 Section 3.3 defines L_{eq} as follows:

Equivalent continuous A-weighted sound pressure level (also average A-weighted sound pressure level) is defined as follows

$$L_{Aeq,T} = 10 \lg \left\{ \left(\frac{1}{T} \int_{t_1}^{t_2} p_A^2(t) dt \right) \div p_0^2 \right\} \text{dB}$$

where:

$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level re 20 μPa , determined over a time interval $T=t_2-t_1$

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal

p_0 is the reference sound pressure of 20 μPa

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:

$$L_{Ceq,T} = 10 \lg \left\{ \left(\frac{1}{T} \int_{t_1}^{t_2} p_C^2(t) dt \right) \div p_0^2 \right\} \text{dB}$$

If no frequency weighting is used, the quantity is simply called equivalent continuous sound pressure level.

The Larson Davis System 824 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 804 (above) 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

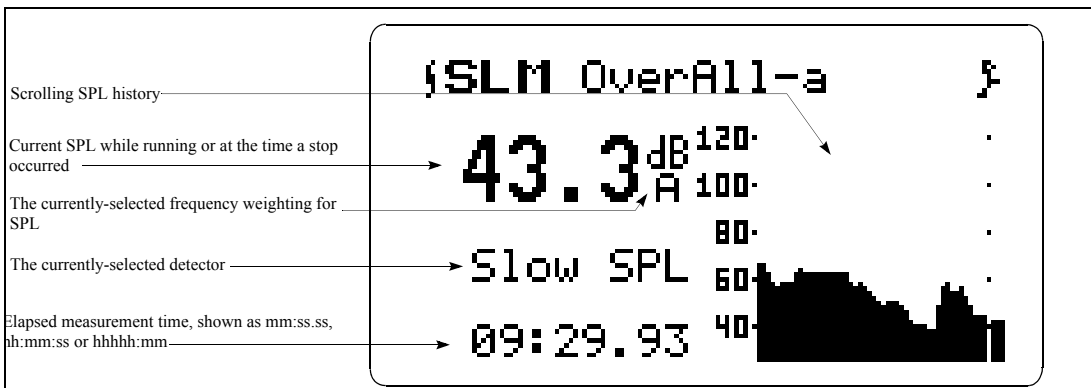
Certain TWA measurements include a programmable threshold with only levels above this threshold contributing to the measurement

The titles for the measurements are designed to indicate the current exchange rate in force: “L_{eq}” is used to designate TWAs based upon a 3dB exchange rate, “L_{DOD}” (for United States Department of Defence) is used to designate TWAs based upon a 4dB exchange rate, “L_{OSHA}” (for the United States Occupational Safety and Health Association) is used to designate TWAs based upon a 5dB exchange rate, “L_{Avg}” (for average) is used to designate TWAs based upon a 6dB exchange rate.

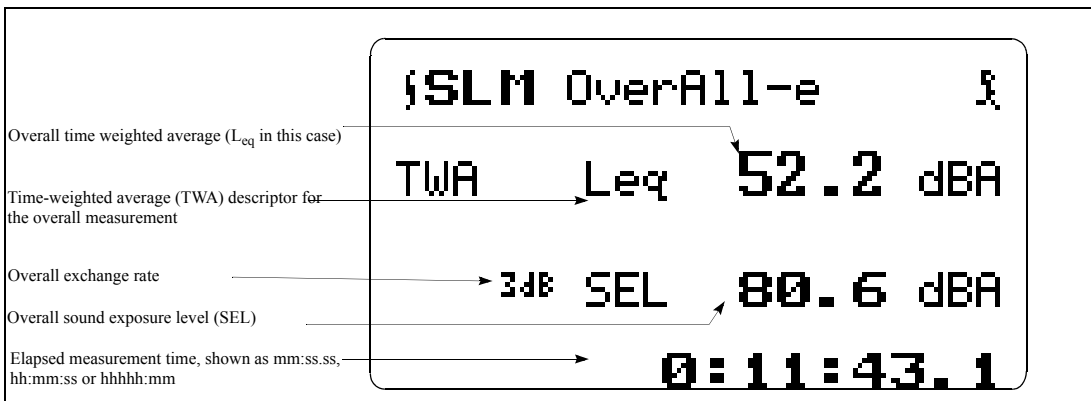
No attempt is made to meet the IEC-804 requirement to title the TWA by frequency weighting and time interval within the analyzer’s display or report system. It is represented

though, by placing the weighting designation following the “dB” units indication associated with the numerical output. The actual measurement time is also provided for each TWA value to fulfil the time interval description requirements.

For example, the System 824’s Logging SLM Overall-a display shows the current SPL (Sound Pressure Level) in 1/10th decibel (dB) resolution. The actual real-time resolution is 1/32nddB. The displayed SPL is followed by the text “dB” and then the frequency weighting in effect—set to A in this example.



The System 824’s Logging SLM Overall-e display shows the overall measurement period and TWA. In this case the measurement is L_{eq} (because of the 3dB exchange rate). The quantity is A-weighted and has a measurement elapsed time of 11:43.1 (11 hours, 43 minutes, and 1 second).



The actual equations used within the analyzers are based on that for IEC-804 and are implemented according to this equation:

$$L_{TWA} = L_{cal} + k \cdot \log \left(\sum_{s=1}^n 10^{\frac{L_{(s)}}{k}} \right) - \log(n)$$

where:

$L_{(s)}$ is the current SPL at sample s (for measurements that include a threshold, $L_{(s)}$ is set to $-\infty$ 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, and

L_{cal} is the calibration offset that corrects for various sensitivities of microphones

Accuracy is maintained by having large fixed point variables for the number of samples and the summation accumulator. The limit of s is 4,294,967,295 samples and is stored in a 32 bit integer variable within the System 824. This limit is greater than 1553 days or greater than 4 years and 4 months. The value that can be stored in the summation accumulator, a 96 bit integer, can be the overload level (maximum allowable signal amplitude into the System 824) for the maximum number of samples. Using large fixed point variables prevents the inaccuracies obtained in systems based upon floating point variables.

SEL Calculations

SEL is available for both the overall and current measurements and is calculated using this formula:

$$L_{TWA} = L_{cal} + k \bullet \log \left(\sum_{s=1}^n 10^{\frac{L_{(s)}}{k}} \right) - \log(32)$$

Since the sample rate is 32 samples per second and SEL is based on time in seconds, the $\log(32)$ is subtracted from the log of the accumulation to perform a division by 32. All of the SEL energy values in the analyzers 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.

Dose and Projected Dose Calculations

Dose is a measure of Sound Exposure and is defined in ANSI S1.25 Section 4.7 as:

$$D(Q) = \left(\frac{100}{T_c} \right) \cdot \int_0^T 10^{\left(\frac{L-L_c}{q} \right)} dt$$

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_t , or equals -x 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

$q = 5/\log(2)$ for a 5 dB exchange rate

$q = 4/\log(2)$ for a 4 dB 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 x 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 which is equal to:

10.00 for an exchange rate of 3 dB (L_{eq} , or \dot{Y} 3 dB/log(2))

13.29 for an exchange rate of 4 dB (L_{DOD} , or = 4dB/log(2))

16.61 for an exchange rate of 5 dB (L_{OSHA} , or = 5dB/log(2))

20.00 for an exchange rate of 6dB (L_{Avg} , or \dot{Y} 6dB/log(2)),

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 System 824's "Criterion Time Hours" setting which by default is set to 8 hours (since the time base for the instrument is 1/32nd samples per second, the number of hours is multiplied by 115200 to make samples per hour—60 minutes/hour times 60 seconds/minute times 32 samples/sec equals 115200 samples/second)

L_C is the criterion sound level as set by the System 824'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 analyzers 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.

C

Technical Specifications

NOTE: Where possible, tests were performed electrically using an ADP005 microphone adapter (18 pF).

The specifications contained in this chapter are subject to change without notice. Please refer to calibration and test results for data on a specific unit.

These specifications are valid for all System 824's using the following options:

- PRM902 preamplifier
- 377B41 (or 377A60) free-field (or random) high sensitivity microphone
- 2540 (or 2559) free-field (or random) normal sensitivity microphones

Standards Met:

- ANSI S1.4 - 1985 Type 1
- IEC 61672-1 Class 1 (tested with 377B41 microphone only)
- IEC 60651 - 1979 Type 1
- IEC 60804 - 1985 Type 1
- IEC 60651 - 1993 Type 1
- IEC 60804 - 1993 Type 1
- IEC 61260 - 1994 Class 1

Declaration of Conformity



Larson Davis Inc. declares that:

Model 824 Sound Level Meter and Realtime Analyzer

having been tested in representative configuration with: PRM902 preamplifier, 377B41 microphone and the following cables: EXA010 microphone extension cable, CBL042 AC/DC output cable, CBL006 serial interface cable

is 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.

NOTE: The 824 does not meet IEC 61672-1, IEC60804 or ANSI S1.4 specifications when used with a high sensitivity microphone (377B41 or 377A60) and a 20 volt bias. The bias is changed to 20 volts for high range measurements in the ISM and LOG modes, and -10dB or -20dB gain in all other modes.

System 824 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.

2MB standard memory

Large backlit graphic display (64 X 128 pixels)

Icon-driven graphic user interface

Soft rubber backlit keys

Large dynamic range

RMS Detectors: Slow, Fast, Impulse

Triple Peak Detectors: A, C, FLat

Interval History (statistical)

Time History

L_n statistics (L0.01 through L99.9 available)

Histogram tables

Direct report printouts to laser printer

Windows™-based software for setup, control, and high speed data download and reporting

Advanced Windows™-based software packages (optional) provides data archiving/search capabilities, post-measurement analysis features, and advanced sorting and graphics/report generation tools.

Multi-tasking processor allows measuring while viewing data, transferring data, or printing

Programmable Run/Stop timer for automatic measurements

AC/DC outputs to recorder






Field-upgradable firmware: keeps instrument current with the latest features via ROM disk upgrades

Two-year limited warranty

General Specifications

Reference level:	114.0 dB SPL
Reference level range	ISM Mode: Normal SSA Mode: 0 dB Gain
Reference frequency:	1000 Hz
Reference direction:	0° for a free field microphone and 80° for a random incidence microphone
Temperature:	≤ ± 0.5 dB error between -10° C and 50°C

Storage temperature:	-10°C to 60°C
Humidity:	≤ ± 0.5 dB error between 30 and 90% relative humidity at 40°C
Equivalent mic impedance:	18 pF for Larson Davis 1/2" microphone
Range level error:	< ±0.1 dB relative to the reference range

Calibration procedure: Using a Larson-Davis CAL200 or equivalent calibrator, insert the microphone fully into the calibrator. Set the calibrator to 114 dB SPL. On the 824 press the tools  key, arrow down to "Calibration" and press the right arrow  key. From the calibration menu use the down arrow  key and highlight "Change". Press the check  key to initiate the calibration. The 824 will prompt you to turn the calibrator on with "Calibrator Active?". Select "Yes" after turning the calibrator on and press the check  key. The 824 performs the calibration change.

Effect of Magnetic Field:	80 A/m (1 Gauss) @ 60 Hz produces a change of < 0.3 dB SPL - passes Class 1 according to IEC 61672
Vibration Sensitivity: (worst case)	73.7 dB with linear- weighting at 1.0 m/ sec ² referenced to 58.1 dB
Warm-up Time:	45 sec
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.
Effect of an extension cable (EXAxxx) on calibration:	none (up to 500 feet)

AC/DC Output

AC output voltage range:	±3 Volts peak
DC output voltage range:	0 to +3 Volts $V_o = \frac{SPL - Start\ level}{0.028}$ $SPL = V_o \times 0.028 \frac{dB}{V} + Start\ level$
AC/DC output impedance:	~600 Ohms, AC output error: <0.1 dB for input impedances > 52 K Ohms (instrument readings are not affected by AC or DC output loading)
AC/DC output connector:	3.5mm stereo jack

Power Supply

Batteries:	3 AA alkaline cells or NiMH battery pack
Internal charge time:	approx. 7 - 10 hours (BAT010 2300 mAh pack) approx. 6 hours (BAT010 1200 mAh pack) depending on capacity at time of charge
DC power input	6-15 Volts at 1/2 amp, max.
Typical DC power	150 mA @ 12 Volts
DC power connector	5.5mm x 2.5mm coaxial power plug

Battery Operating Time (full capacity, continuous operation, reference environmental conditions, individual cells may vary in performance)

Battery Type	ISM or LOG Mode	SSA Mode
BAT010 1200 mAH NiMH Pack (Supplied prior to January 2005) BAT010 2300 mAH NiMH Pack (Supplied after January 2005)	4.1 hours 6.5 hours	3 hours 4.5 hours
Standard Alkaline AA (eg. Duracell MN1500, type LR6)	4.3 hours	2.8 hours
High Drain Rate Alkaline AA (e.g. Duracell Ultra MX1500, type LR6)	> 4.4 hours	4.4 hours
Photo Lithium AA (e.g. Energizer e ² L91)	≥ 7.5 hours	7.5 hours
2000 mAH NiMH AA Fast Recharging (e.g. Ray-O-Vac I-C3 15-minute charging time)	5.5 - 6.8 hours	4.5 - 5.5 hours

Memory Retention

Memory retention without batteries or external power	5 minutes minimum
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Physical Characteristics

Length:	9.9 inches	25.1 cm
Width:	3.4 inches	8.6 cm
Depth:	1.6 inches	4.0 cm
Weight:	18 oz	0.51 kg

Resolution

Levels:	0.1dB (0.01 dB via I/O)
Dose:	0.01%
Elapsed time:	Highspeed RTA, as rapid as every 2.5 mS all other instruments, 0.1 second
Real time clock	1 second
Calendar:	01 Jan 2000 - 31 Dec 2099

Cable Drive Capability (with PRM902 preamp)

Frequencies to 20 kHz:	700 feet	213 meters
Frequencies to 10 kHz:	1000 feet	305 meters

Maximum Input Voltage* (overload)

Gain	VRMS	Vpeak	dBuV
0 dB	2.54	7.2	128
10 dB	0.74	2.1	118
20 dB	0.254	0.72	108
30 dB	0.080	0.227	98
40 dB	0.025	0.072	88
50 dB	0.008	0.023	78

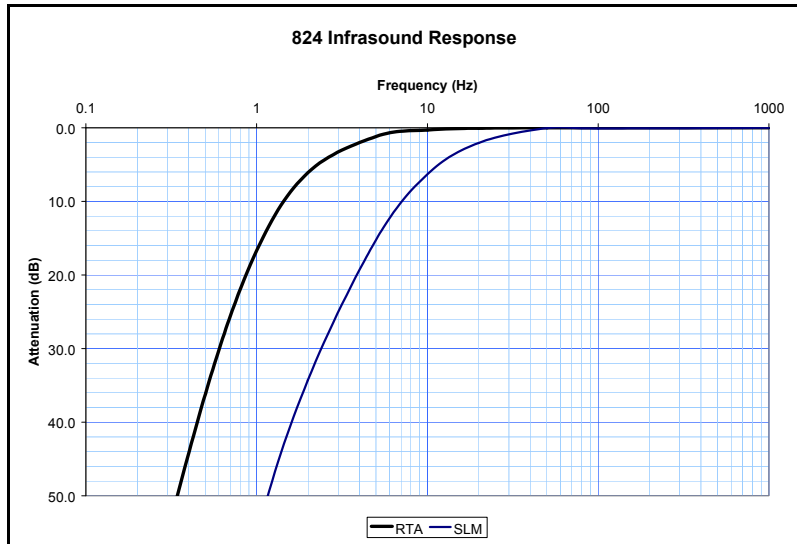
* Absolute maximum AC input voltage: 10Vpp

Permitted DC voltage range: - 3Vdc to + 30Vdc

Frequency Weightings for ISM, SSA, LOG and TAL instruments								
Nominal Frequency.	Exact Frequency.	A Weight	C Weight	Flat	Flat with Random Incidence correction (except SSA)	Flat with Random Incidence correction* (for SSA)	Electrical Tolerance	Microphone Tolerance
10	10.00	-70.4	-14.3	-6.0	-6.0	-0.3	±1.8	±2.2
12.5	12.59	-63.4	-11.2	-4.2	-4.2	-0.2	±1.5	±2.0
16	15.85	-56.7	-8.5	-2.9	-2.9	-0.2	±1.2	±1.8
20	19.95	-50.5	-6.2	-1.9	-1.9	-0.1	±1.0	±1.5
25	25.12	-44.7	-4.4	-1.3	-1.3	-0.1	±0.9	±1.1
31.5	31.62	-39.4	-3.0	-0.8	-0.8	-0.0	±0.7	±0.8
40	39.81	-34.6	-2.0	-0.5	-0.5	-0.0	±0.7	±0.8
50	50.12	-30.2	-1.3	-0.3	-0.3	-0.0	±0.5	±0.5
63	63.10	-26.2	-0.8	-0.2	-0.2	-0.0	±0.5	±0.5
80	79.43	-22.5	-0.5	-0.1	-0.1	-0.0	±0.5	±0.5
100	100.00	-19.1	-0.3	-0.1	-0.1	-0.0	±0.5	±0.5
125	125.00	-16.1	-0.2	0.0	0.0	-0.0	±0.5	±0.5
160	158.50	-13.4	-0.1	0.0	0.0	-0.0	±0.5	±0.5
200	199.50	-10.9	0.0	0.0	0.0	-0.0	±0.5	±0.5
250	251.20	-8.6	0.0	0.0	0.0	-0.0	±0.5	±0.5
315	316.20	-6.6	0.0	0.0	0.0	-0.0	±0.4	±0.6
400	398.10	-4.8	0.0	0.0	0.0	-0.0	±0.4	±0.6
500	501.20	-3.2	0.0	0.0	0.0	-0.0	±0.4	±0.6
630	631.00	-1.9	0.0	0.0	0.0	0.0	±0.4	±0.6
800	794.30	-0.8	0.0	0.0	0.0	0.0	±0.4	±0.6
1000	1000.00	0.0	0.0	0.0	0.0	0.0	±0.4	±0.6
1250	1259.00	0.6	0.0	0.0	0.0	0.0	±0.4	±0.6
1600	1585.00	1.0	-0.1	0.0	0.1	0.1	±0.4	±0.6
2000	1995.00	1.2	-0.2	0.0	0.2	0.2	±0.4	±0.6
2500	2512.00	1.3	-0.3	0.0	0.3	0.3	±0.4	±0.6
3150	3162.00	1.2	-0.5	0.0	0.5	0.5	±0.4	±0.6
4000	3981.00	1.0	-0.8	0.0	0.8	0.8	±0.4	±0.6
5000	5012.00	0.5	-1.3	0.0	1.3	1.3	±0.5	±1.0
6300	6310.00	-0.1	-2.0	0.0	1.9	1.9	0.5, -0.7	1.0, -1.4
8000	7943.00	-1.1	-3.0	0.0	2.8	2.8	0.5, -1.0	1.0, -2.0
10000	10000.00	-2.5	-4.4	0.0	4.0	4.0	0.7, -1.3	1.3, -2.7
12500	12590.00	-4.3	-6.2	0.0	5.4	5.4	1.0, -2.0	2.0, -4.0
16000	15850.00	-6.6	-8.5	0.0	6.9	6.9	1.0, -3.0	2.0, ∞
20000	19950.00	-9.3	-11.2	0.0	8.1	8.1	1.0, -4.0	2.0, ∞

* Flat frequency response for SSA instrument is extended at the low frequency end when Random Incidence Correction is enabled.

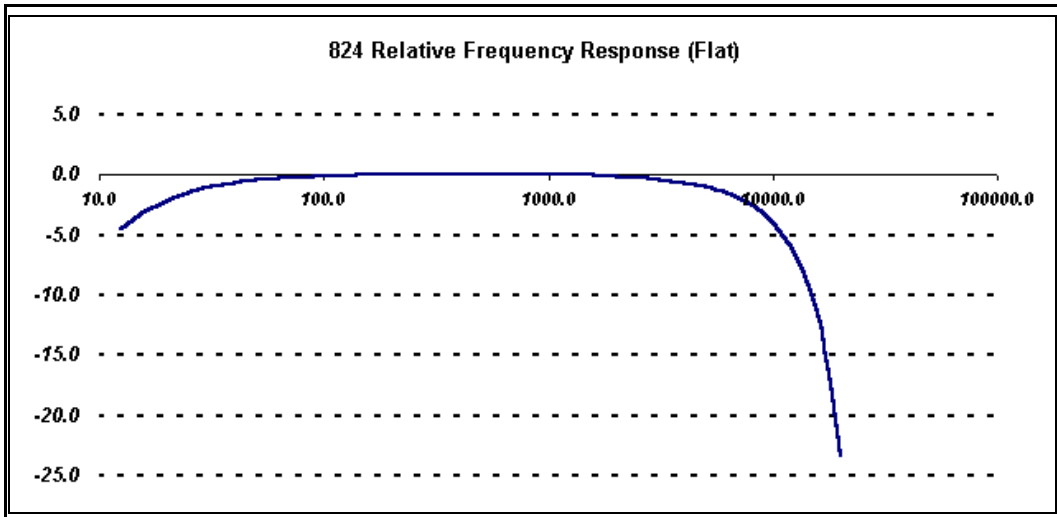
Infrasonic Frequency Response



LOG and ISM Mode Specifications

Time weighting:	Slow, Fast, Impulse, TWA and Peak
Frequency Weightings	A, C and Flat (see table on page C-7)
Dynamic range:	> 115 dBA (Overload to noise floor)
Linearity range:	> 105 dBA
Pulse range:	> 108 dBA
RMS noise floor:	< 16 dBA typical (with PRM902 and 377B41 mic)
Reference range:	Normal range (0 dB gain)
Exchange rates:	3, 4, 5, or 6 dB
Sample rate:	48,000 Hz
Peak rise time	≤ 50 μS

Peak Detector Frequency Response Graph



AC/DC Output (LOG and ISM modes only)

824 Menu	3.5mm Connector Tip	3.5 mm Connector Ring
AC-1 AC-2	Flat AC output	Flat AC output with 30dB gain
AC-1 DC	Flat AC output	Weighted DC output
AC-1 DC	Flat AC output with 30 dB gain	Weighted DC output
AC-2 AC-1	Flat AC output with 30 dB gain	Flat AC output

NOTE: In low range, all AC outputs will provide an additional 20 dB of gain

RMS Measurement Range (LOG and ISM modes only)

	Electrical Noise Floor	Low Limit	High Limit	Range	Pulse Range
A-WT (high)	< 22	< 43	151	> 108	> 108
A-WT (normal)	< 12	< 23	131	> 108	> 108
A-WT (low)	< 10	< 20	111	> 91	> 91
C-WT (high)	< 38	< 48	151	> 103	> 103
C-WT (normal)	< 18	< 28	131	> 103	> 103
C-WT (low)	< 14	< 25	111	> 86	> 86
FLAT (high)	< 40	< 50	151	> 101	> 101
FLAT (normal)	< 20	< 30	131	> 101	> 101
FLAT (low)	< 15	< 25	111	> 86	> 86

NOTE: Ranges are in dB SPL using a typical 377B41 microphone with a sensitivity of 44.5 mV/Pa and a 200V polarization voltage. A 2540 normal sensitivity microphone produces high limit values approximately 10.0 dB higher.

Peak Measurement Range (LOG and ISM modes only)

	Low Limit	High Limit	Range
A-WT (high)	73	148	75
A-WT (normal)	53.0	128.0	75.0
A-WT (low)	53.0	108.0	55.0
C-WT (high)	73	148	75
C-WT (normal)	53.0	128.0	75.0
C-WT (low)	53.0	108.0	55.0
FLAT (high)	80	148	68
FLAT (normal)	60.0	128.0	68.0
FLAT (low)	60.0	108.0	48.0

NOTE: Ranges are in dB SPL using a typical 377B41 microphone with 44.1 mV/Pa sensitivity. The range is measured between a low limit of peak error > 0.5 dB and a high limit of overload.

SSA Mode Specifications (IEC 61260 Class 1)

Broadband Overall time weighting:	Slow, Fast, Impulse, TWA and Peak
1/3 octave filter time weighting:	Slow, Fast
Broadband Frequency Weightings	A, C and Flat (see table on page C-7)
Dynamic range:	> 93 dBA (overload to noise floor)
Linearity range:	> 80 dBA
Pulse range:	> 83 dBA
RMS noise floor:	< 33 dBA typical with PRM902, 377B41 microphone, and 0 dB gain
Reference level range:	0 dB gain
Exchange rates:	3, 4, 5, or 6 dB
Sample rate:	51,200 Hz
1/3 octave band frequencies:	12.5 Hz - 20 kHz

Prefilter Frequency Weightings	A, C and Flat
Filter integrated response:	$\leq \pm 0.15\text{dB}$ for all filters.
Real-time operation:	$\leq 0.3\text{ dB}$ error for all filters tested with a swept sinusoidal input.
Anti-aliasing:	$\geq 75\text{ dB}$
Summation of output signals:	$\pm 1.0\text{ dB}$ ($\pm 0.4\text{ dB}$ typical)
Flat frequency range:	10 Hz - 20 kHz, relative attenuation $< \pm 0.15\text{ dB}$
Filter type:	Digital
Octave frequency ratio:	Base 2 (See IEC 61260 Annex A)

AC/DC Output (SSA mode only)

824 Menu	3.5mm Connector Tip	3.5 mm Connector Ring
AC-1 AC-2	Flat AC output	C-weighted AC output
AC-1 DC	Flat AC output	Weighted DC output
AC-2 DC	C-weighted AC output	Weighted DC output
AC-2 AC-1	C-weighted AC output	Flat AC output

NOTE: AC output gain matches the input gain setting.

Measurement Range (SSA mode only)

	0dB Gain				10dB Gain				20db Gain				30dB Gain				40dB Gain				50dB Gain			
	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range	NF	Start	End	Range
AW	33	48	128	80	24	38	118	80	15	28	108	80	8	23	98	75	7	20	88	68	6	20	78	58
CW	32	48	128	80	23	38	118	80	16	28	108	80	9	23	98	75	8	20	88	68	8	20	78	58
FLA	32	48	128	80	25	38	118	80	21	33	108	75	21	33	98	65	26	33	88	50	23	40	78	38
16.0	2	45	128	83	2	35	118	83	1	25	108	83	2	25	98	73	-1	28	88	60	1	23	78	55
31.5	3	43	128	85	1	35	118	83	1	23	108	85	2	25	98	73	-4	22	88	66	-4	23	78	55
63.0	4	40	128	88	0	33	118	85	1	23	108	85	0	22	98	76	-7	15	88	73	-7	18	78	60
125	2	40	128	88	-2	27	118	91	-3	28	108	80	-2	18	98	80	-9	11	88	77	-8	8	78	70
250	3	37	128	91	-3	25	118	93	-3	15	108	93	-4	15	98	83	-10	8	88	80	-9	8	78	70
500	12	33	128	95	4	25	118	93	-3	15	108	93	-4	13	98	85	-10	6	88	82	-10	8	78	70
1000	10	32	128	96	2	20	118	98	-4	15	108	93	-5	13	98	85	-10	6	88	82	-10	8	78	70
2000	15	32	128	96	6	20	118	98	-2	15	108	93	-5	13	98	85	-8	8	88	80	-8	8	78	70
4000	14	32	128	96	7	20	118	98	0	15	108	93	-2	13	98	85	-6	8	88	78	-6	8	78	70
8000	14	32	128	96	7	20	118	98	1	15	108	93	-1	13	98	85	-2	12	88	76	-3	13	78	65

NOTE: A-weighting, C-weighting, and Flat are measured to ANSI S1.4 and IEC 60651 standards for SLM linearity. 1/3 octave filters listed are measured to the IEC 61260 standard for Class 0 linearity which is ± 0.3 dB. The numbers in the table represent SPL levels with a typical 377B41 microphone which has 44.1 mV/Pa sensitivity.

*NF is electrical noise floor.

AUD Mode Specifications

AC/DC output:	For AUD, AC and DC outputs are undefined.
Pulse mode:	The pulse test output is computed from a Discrete Hilbert Transform which is sampled every 1/2 millisecond. The Discrete Hilbert Transform produces a mathematically correct sample of the input waveform envelope.
Time resolution:	0.5 ms to 1.0 seconds in 0.5 ms increments
Time accuracy:	± 1.0 ms
Hilbert transform magnitude error:	< 0.1 dB
Dynamic range:	> 80 dB
Hilbert transform Sample rate:	2000 Hz

On level computation:	After the "ON" state has been detected, the "ON" level is computed as the average of 32 samples.
Overshoot computation:	Overshoot is calculated as the maximum sample level minus the averaged "ON" level
Measurement conditions:	<p>Conditions that must be met to produce output:</p> <ul style="list-style-type: none"> • ON/OFF modulation must be greater than 20 dB (90%). • The "ON" state must be stable within $\pm 0.5\text{dB}$ for at least 20 ms. • Pulse transition from high to low must occur within 2 seconds of the transition from low to high for the fall time to be calculated. If this time is greater than 2 seconds, the 824 will revert to looking for the pulse rise time.

FM Modulation Tests

The FM modulation test code computes the minimum and maximum periods of the input waveform. The minimum and maximum frequencies are the inverse of the average of the last 8 periods. The carrier frequency is an exponential average of all waveform periods. Signal will be flagged as stable if the carrier period varies less than 8 microseconds for 1 second.

Carrier frequency (F_c):	$20 \text{ Hz} \leq f_c \leq 16000 \text{ Hz}$
Modulating frequency (f_m):	$3 \text{ Hz} \leq f_m \leq 100 \text{ Hz}$
Carrier to modulating frequency ratio:	$f_c > f_m * 5$
Signal amplitude:	Overload -35dB to Overload

SLM/RTA

The 1/3 octave filters used in the audiometric calibration firmware are the same filters as are used in the SSA firmware and meet the same specifications, (page D-8).

400 Line FFT

Averaging:	Count
Window:	Rectangular or Hanning
Linearity range:	>85 dB with Hanning window, 20 kHz bandwidth, and PRM902
Dynamic range:	>100 dB
Flat SPL linearity range:	>75 dB

Highpass frequency vs. filter bandwidth for 824 FFT

Bandwidth	Hz/Bin	-0.2 dB
20,000	50.00	9.5
10,000	25.00	6.5
5,000	12.50	5.5
2,000	5.00	0.85
1,000	2.50	0.85
500	1.25	0.85
200	0.50	0.85

Typical response of AUD A-weight and C-weight high pass filters

Frequency Weightings

Nominal Freq.	Exact Freq.	Flat	A Weight	C Weight
10	10.00	0.0	-72.6	-14.5
12.5	12.59	0.0	-65.5	-11.4
16	15.85	0.0	-58.8	-8.6
20	19.95	0.0	-52.5	-6.3
25	25.12	0.0	-46.8	-4.5
31.5	31.62	0.0	-41.5	-3.1
40	39.81	0.0	-36.6	-2.1
50	50.12	0.0	-32.2	-1.4
63	63.10	0.0	-28.2	-0.9
80	79.43	0.0	-24.5	-0.6
100	100.00	0.0	-21.1	-0.4
125	125.00	0.0	-18.1	-0.2
160	158.50	0.0	-15.3	-0.1
200	199.50	0.0	-12.8	-0.1
250	251.20	0.0	-10.6	-0.1
315	316.20	0.0	-8.6	0.0
400	398.10	0.0	-6.7	0.0
500	501.20	0.0	-5.2	0.0
630	631.00	0.0	-3.8	0.0
800	794.30	0.0	-2.8	0.0
1000	1000.00	0.0	-1.9	0.0
1250	1259.00	0.0	-1.3	0.0
1600	1585.00	0.0	-0.9	0.0
2000	1995.00	0.0	-0.6	0.0
2500	2512.00	0.0	-0.4	0.0
3150	3162.00	0.0	-0.2	0.0
4000	3981.00	0.0	-0.2	0.0
5000	5012.00	0.0	-0.1	0.0
6300	6310.00	0.0	-0.1	0.0
8000	7943.00	0.0	0.0	0.0
10000	10000.00	0.0	0.0	0.0
12500	12590.00	0.0	0.0	0.0
16000	15850.00	0.0	0.0	0.0
20000	19950.00	0.0	0.0	0.0

RTA Mode Specifications

Filter types:	Flat, A or C preweighted 1/3 or 1/1 octave filters with broadband SPL
Averaging	
Exponential:	1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8, 16, 32, 64 seconds
Linear:	0.0025 to 99.995 seconds
Overall time:	> 1 year
Linearity range:	> 80 dB 1/3 octave >75 dB 1/1 octave
Reference level range:	0 dB gain
Sample rate:	51,200 Hz
1/3 octave band frequencies:	12.5 Hz - 20 kHz (33 filters)
1/1 octave band frequencies:	16 Hz - 16 kHz (11 octaves)
Filter integrated response:	$\leq \pm 0.15$ dB for all filters
Real-time operation:	$\leq \pm 0.3$ dB error for all filters tested with a swept sinusoidal input
Anti-aliasing:	≥ 75 dB
Summation of output signals:	$\leq \pm 1.0$ dB (± 0.4 typical)
Flat frequency response:	10 Hz - 20 kHz, relative attenuation $< \pm 0.15$ dB
Filter type:	Digital
Octave frequency ratio:	Base 2

AC/DC output:	AC out 1 is flat weighted and follows the gain (tip); AC out 2 is C-weighted with 0 dB gain (ring)
Measurement range:	Flat is measured to ANSI S1.4 and IEC 60651 standards for SLM linearity. 1/3 and 1/1 octave filters are measured to IEC 1260 standard for Class 0 linearity which is ± 0.3 dB. The numbers in the table represent SPL levels with a typical 377B41 microphone that has 44.1 mV/Pa sensitivity.

Measurement Range (RTA mode only)

	0dB Gain				10dB Gain				20dB Gain				30dB Gain				40dB Gain				50dB Gain			
	NF	Start	End	Rang e	NF	Start	End	Rang e	NF	Start	End	Rang e	NF	Start	End	Rang e	NF	Start	End	Rang e	NF	Start	End	Rang e
FLAT	32	48	128	80	25	38	118	80	21	33	108	75	21	33	98	65	26	38	88	50	23	40	78	38

1/3 Octave Filters

16.0	2	45	128	83	2	35	118	83	1	25	108	83	2	25	98	73	-1	28	88	60	1	23	78	55
31.5	3	43	128	85	1	35	118	83	1	23	108	85	2	25	98	73	-4	22	88	66	-4	23	78	55
63.0	4	40	128	88	0	33	118	85	1	23	108	85	0	22	98	76	-7	15	88	33	-7	18	78	60
125	2	40	128	88	-2	27	118	91	-3	28	108	80	-2	18	98	80	-9	11	88	77	-8	8	78	70
250	3	37	128	91	-3	25	118	93	-3	15	108	93	-4	15	98	83	-10	8	88	80	-9	8	78	70
500	12	33	128	95	4	25	118	93	-3	15	108	93	-4	13	98	85	-10	6	88	82	-10	8	78	70
1000	10	32	128	96	2	20	118	98	-4	15	108	93	-5	13	98	85	-10	6	88	82	-10	8	78	70
2000	15	32	128	96	6	20	118	98	-2	15	108	93	-5	13	98	85	-8	8	88	80	-8	8	78	70
4000	14	32	128	96	7	20	118	98	0	15	108	93	-2	13	98	85	-6	8	88	78	-6	8	78	70
8000	14	32	128	96	7	20	118	98	1	15	108	93	-1	13	98	85	-2	12	88	76	-3	13	78	65
16000	15	36	128	92	9	25	118	93	2	15	108	93	1	15	98	83	0	15	88	73	1	18	78	60

1/1 Octave Filters

16.0	2	50	128	78	2	40	118	78	1	30	108	78	2	30	98	68	-1	33	88	55	1	28	78	50
31.5	3	48	128	80	1	40	118	78	1	28	108	80	2	30	98	68	-4	27	88	61	-4	28	78	50
63.0	4	45	128	83	0	48	118	70	1	28	108	80	0	37	98	61	-7	20	88	68	-7	23	78	55
125	2	45	128	83	-2	32	118	86	-3	31	108	77	-2	23	98	75	-9	26	88	62	-8	13	78	65
250	3	42	128	86	-3	30	118	88	-3	20	108	88	-4	20	98	78	-10	13	88	75	-9	13	78	65
500	12	38	128	90	4	30	118	88	-3	20	108	88	-4	18	98	80	-10	11	88	77	-10	13	78	65
1000	10	37	128	91	2	25	118	93	-4	20	108	88	-5	18	98	80	-10	11	88	77	-10	13	78	65
2000	15	37	128	91	6	25	118	93	-2	20	108	88	-5	18	98	80	-8	13	88	75	-8	13	78	65
4000	14	37	128	91	7	25	118	93	0	20	108	88	-2	18	98	80	-6	13	88	78	-6	13	78	65
8000	14	37	128	91	7	25	118	93	1	20	108	88	-1	18	98	80	-2	17	88	71	-3	18	78	60
16000	15	41	128	87	9	30	118	88	2	20	108	88	1	20	98	78	0	20	88	68	1	23	78	55

* NF is electrical noise floor

1/1 and 1/3 Octave Filters

The 1/1 and 1/3 octave filters (SSA and RTA 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 2 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: 16 Hz to 16 kHz

1/3 Octave Filters: 12.5 Hz to 20 kHz

Filter Shapes:

Filters are characterized by the shape of their filter skirts and the shape of the passbands, which must fit within those specified by the standards. The following figures present these for the 1/3 octave band centered at 1 kHz. Overlaid with these curves are the limit curves associated with IEC 61260:1995 Class 1.

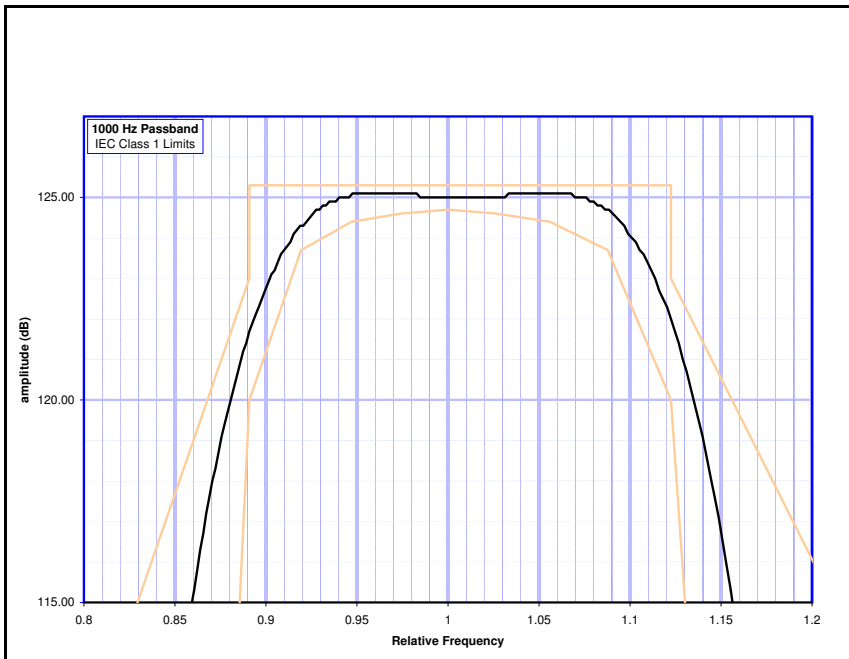


Figure 13-2 Passband of 1kHz 1/3 Octave Filter

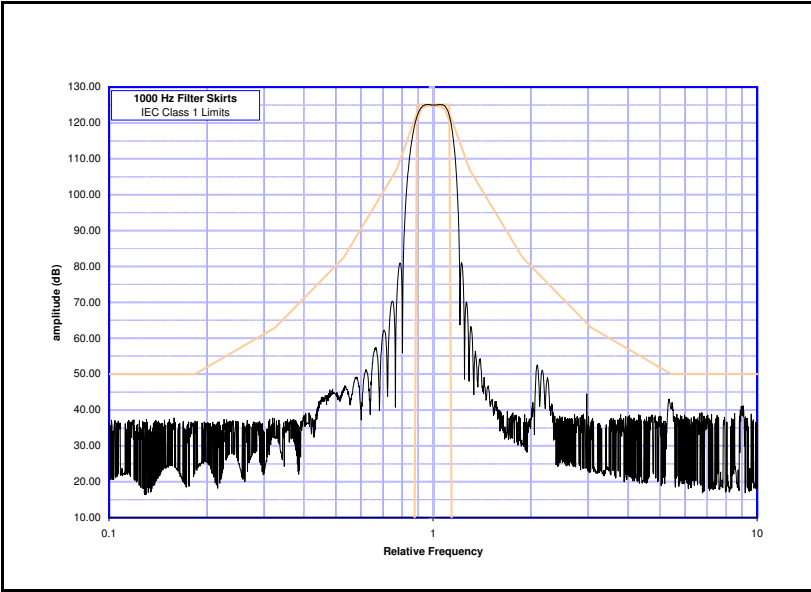


Figure 13-3 Filter Skirts of 1kHz 1/3 Octave Filter

Ambient Pressure Response of Free-Field Microphones

(Variation over Static Pressure)

Pressure	65 kPa	75 kPa	85 kPa	93 kPa	101 kPa	110kPa
2520	.38 dB	.20 dB	.14 dB	.069 dB	0.000	-.047 dB
2540	.34 dB	.24 dB	.15 dB	.08 dB	0.000	-.075 dB
377B41	.43 dB	.31 dB	.19 dB	.099 dB	0.000	-.10 dB

NOTE: Results in dB referenced to 101 kPa

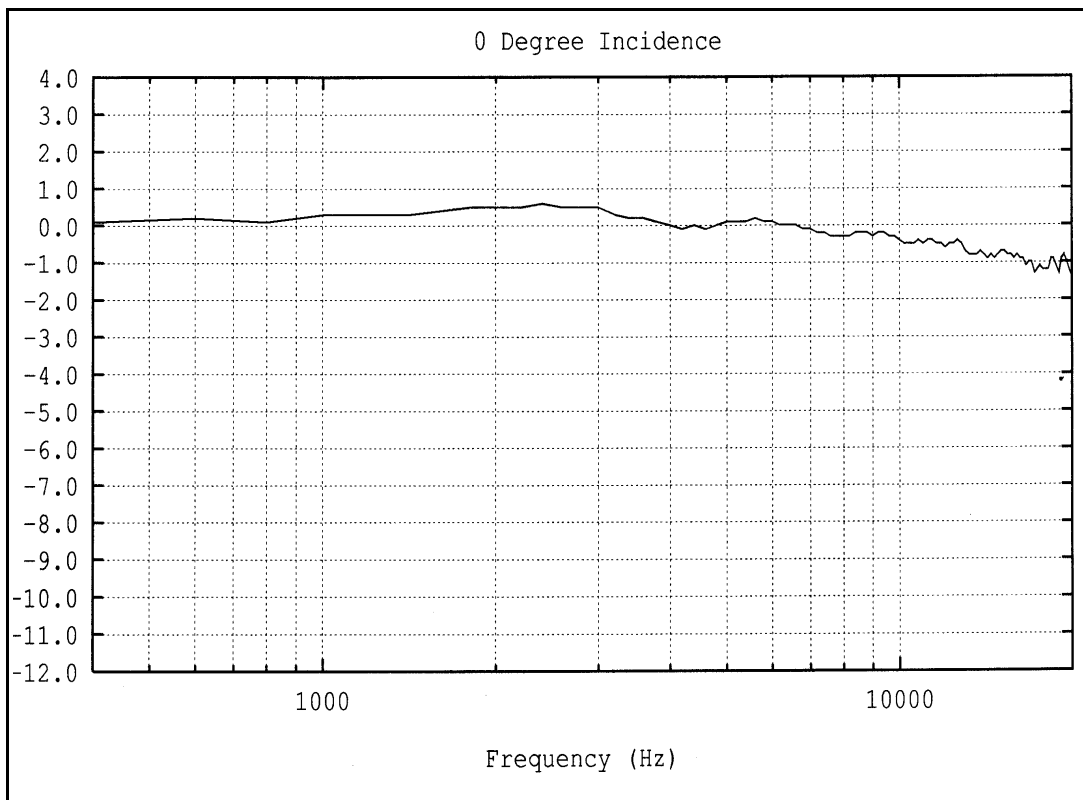
Position of Instrument and Operator:

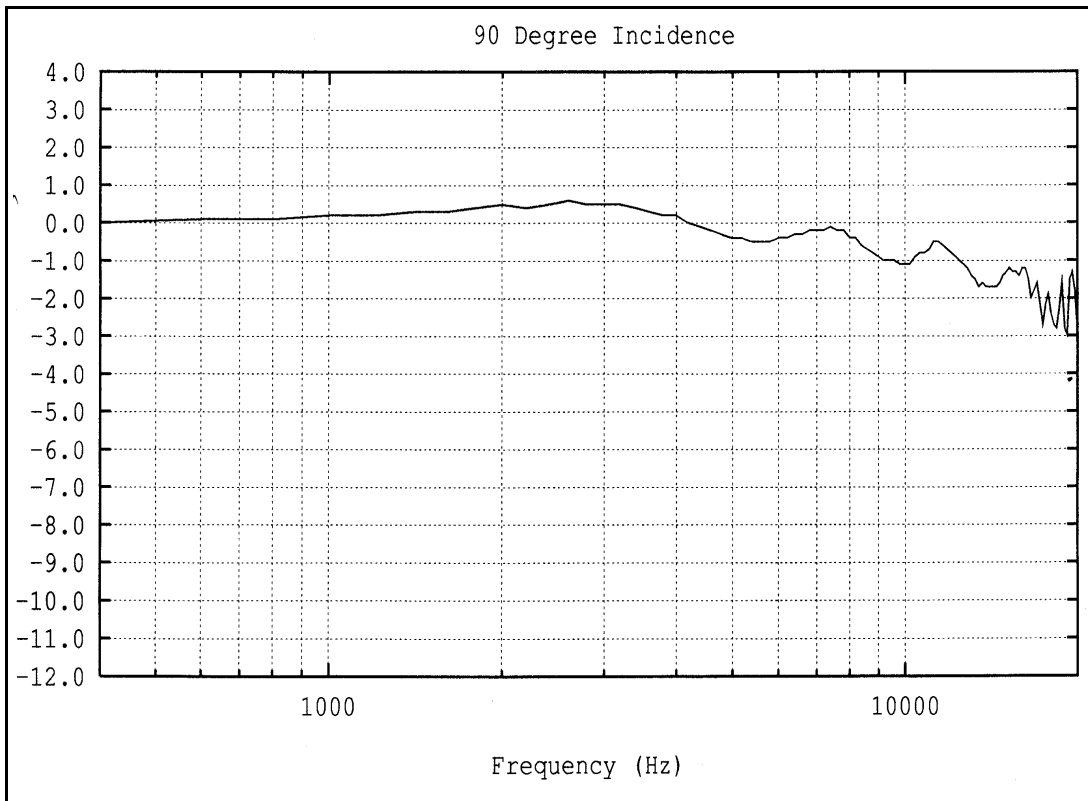
When making a measurement, it is recommended that the observer be positioned as far behind and to the right of the instrument as possible to minimize interference of the sound field at the microphone resulting from body reflections. When using the 824, the meter is held in one hand with the arm extended 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





Frequency Response

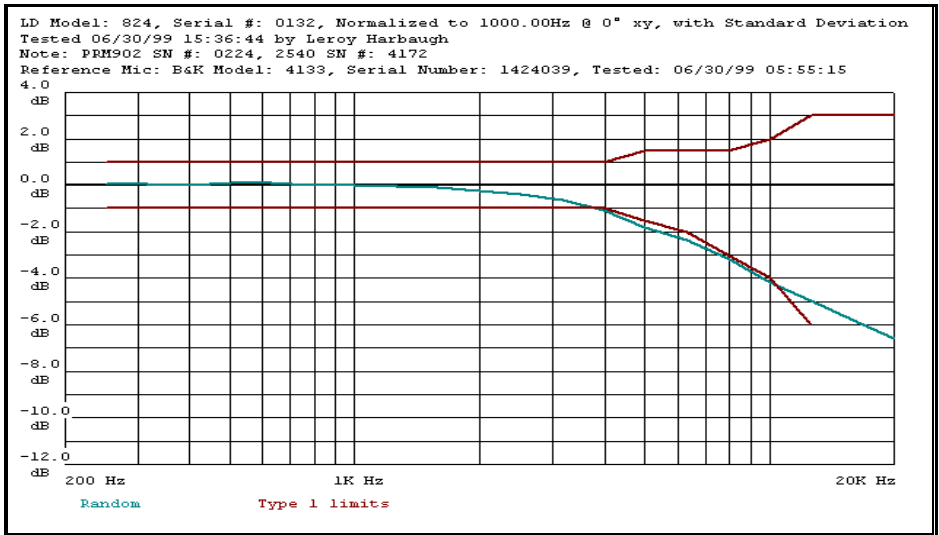
Random Incidence Microphone Correction

When random incidence correction is turned on in the 824, a digital filter is added which gives the necessary correction to provide random incidence response when measuring with a free-field microphone.

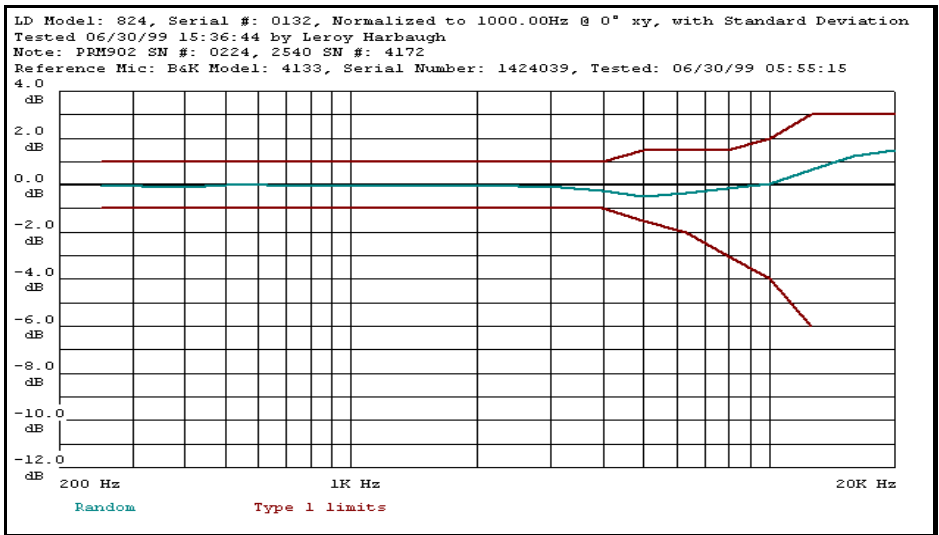
NOTE: Tested with the preamplifier and microphone attached directly to the 824.

The graphs below show the response of the free-field microphones before and after the random incidence correction has been added.

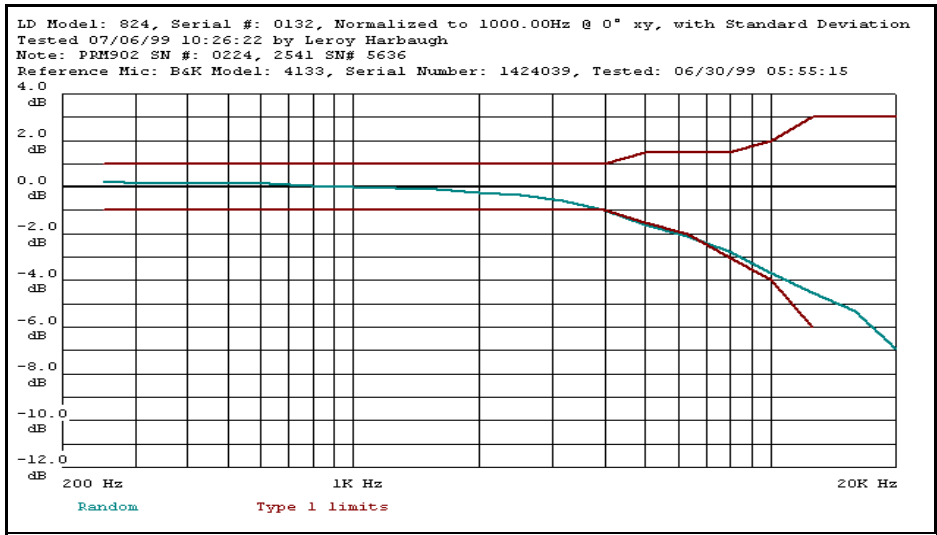
Graph 1 - The 824 in normal range with the 2540 free-field microphone showing the uncorrected random response.



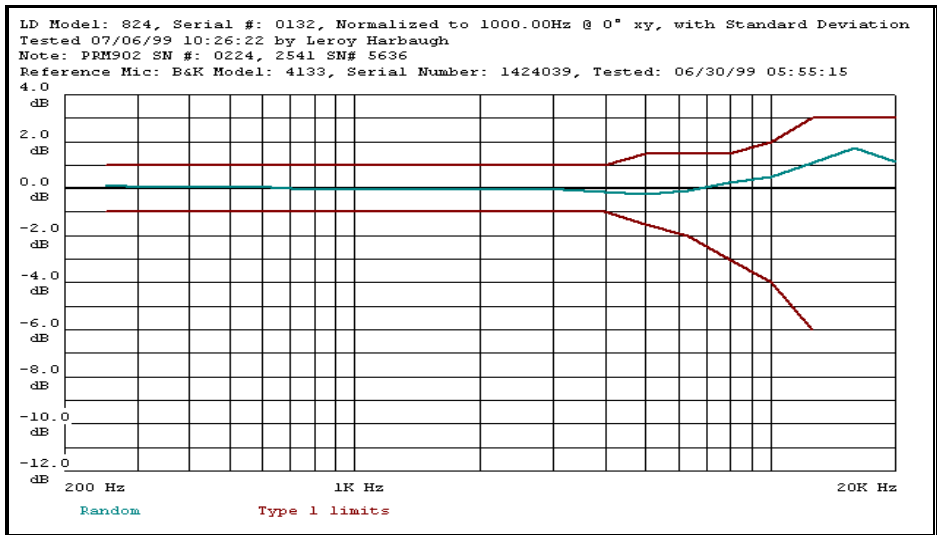
Graph 2 - The 824 in normal range with the 2540 free-field microphone showing the corrected random response.



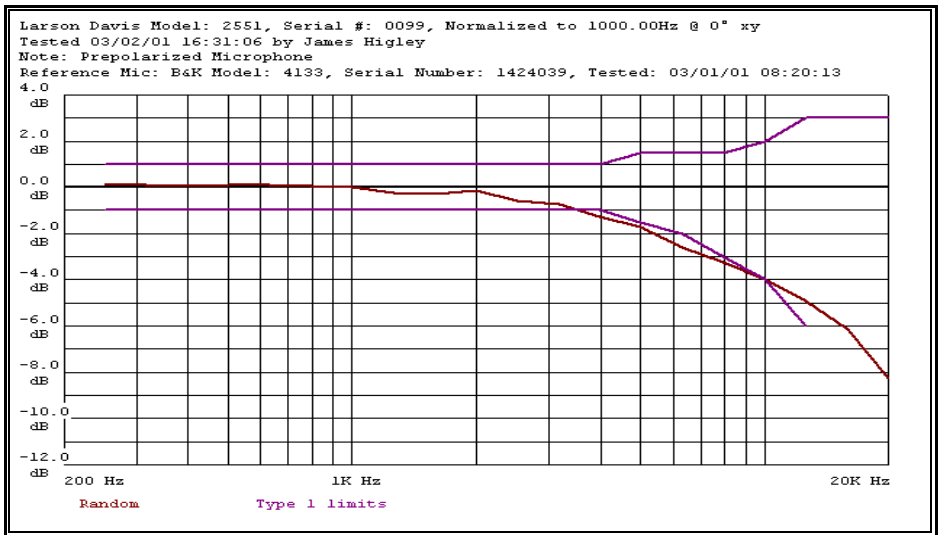
Graph 3 - The 824 in normal range with the 377B41 free-field microphone showing the uncorrected random response.



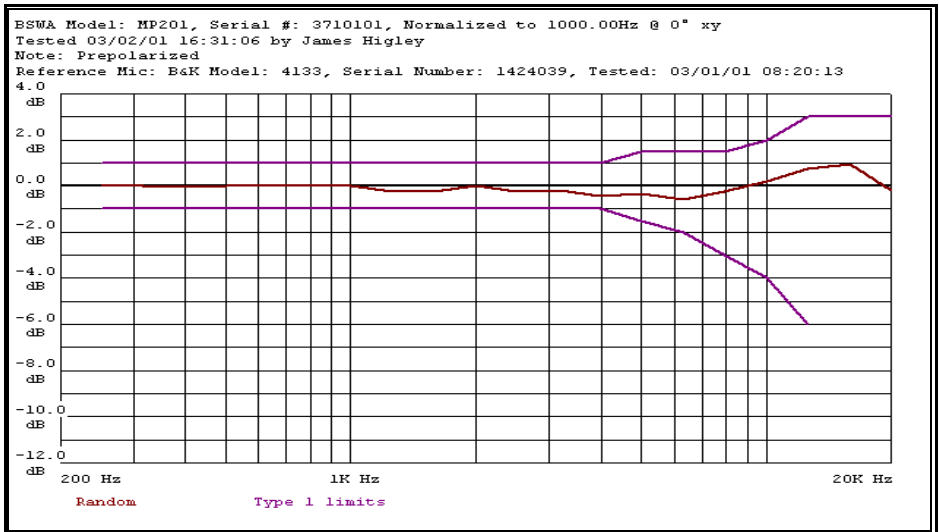
Graph 4 - The 824 in normal range with the 377B41 free-field microphone showing the corrected random response.



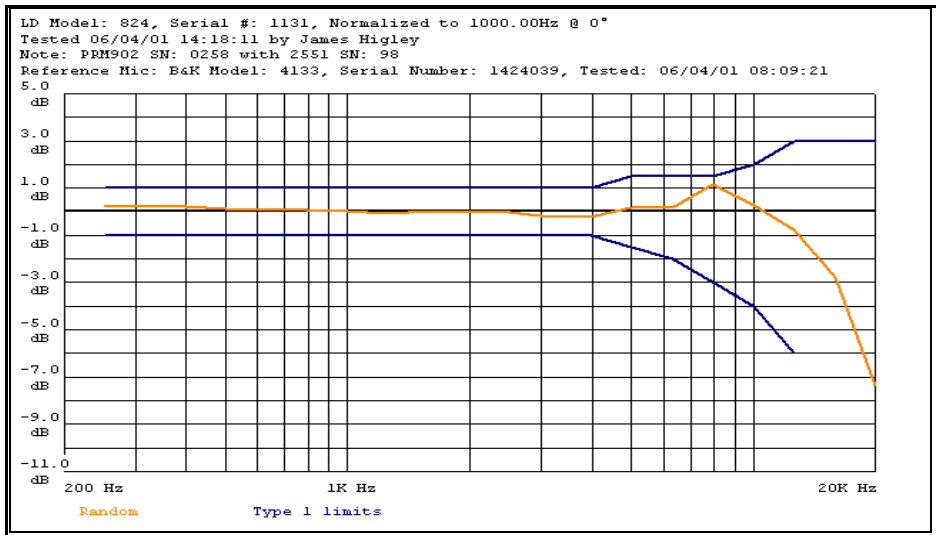
Graph 5 - The 824 in normal range with the 2551 free-field electret microphone showing the uncorrected random response.



Graph 6 - The 824 in normal range with the 2551 free-field electret microphone showing the corrected random response.



Graph 7- The 824 in normal range with the 2551 free-field electret microphone showing random response with the random corrector.



Microphone Response Tests with 824

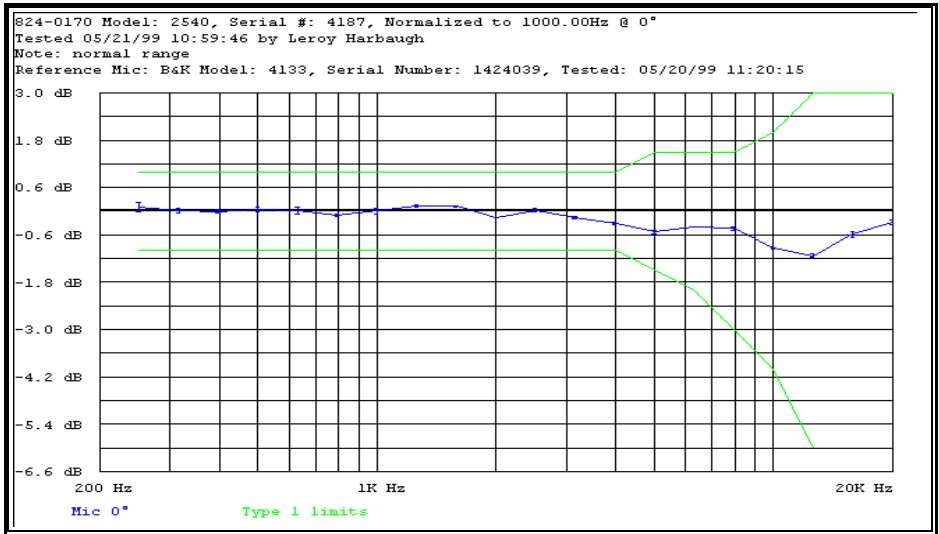
The 824 was oriented with the LCD facing up for these tests.

The following graphs show the effects on the performance of the 824 caused by the following:

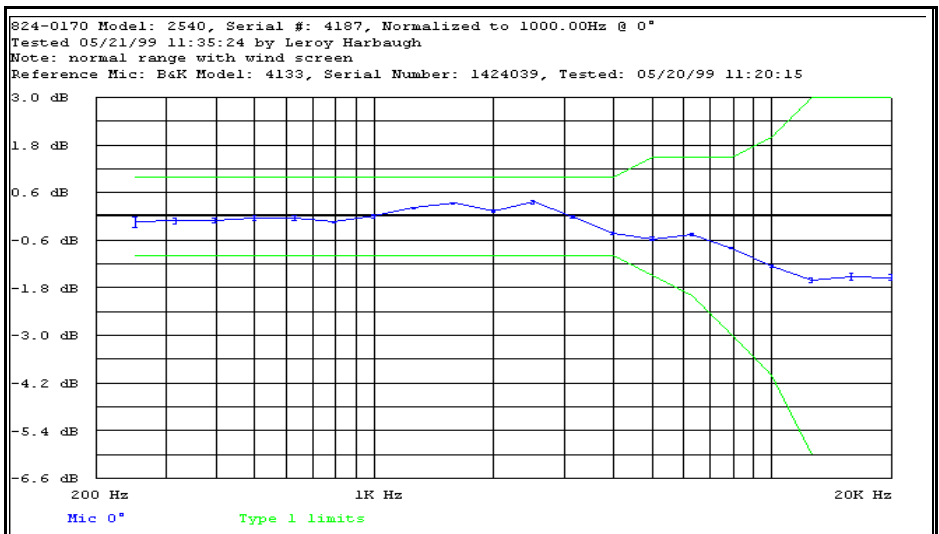
- Windscreen
- Instrument Case
- High Range

NOTE: The graphs below show typical results.

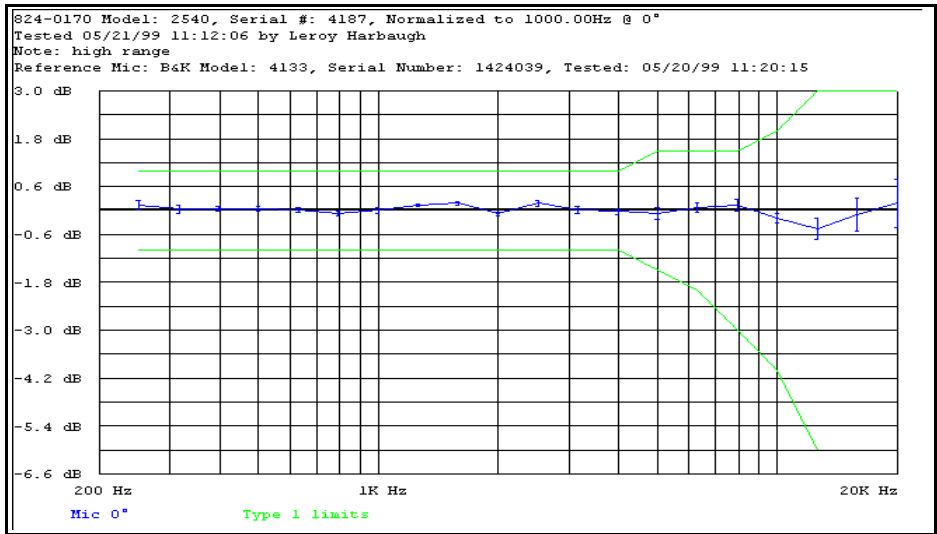
Graph 1 - The 824 in normal range with the 2540 microphone



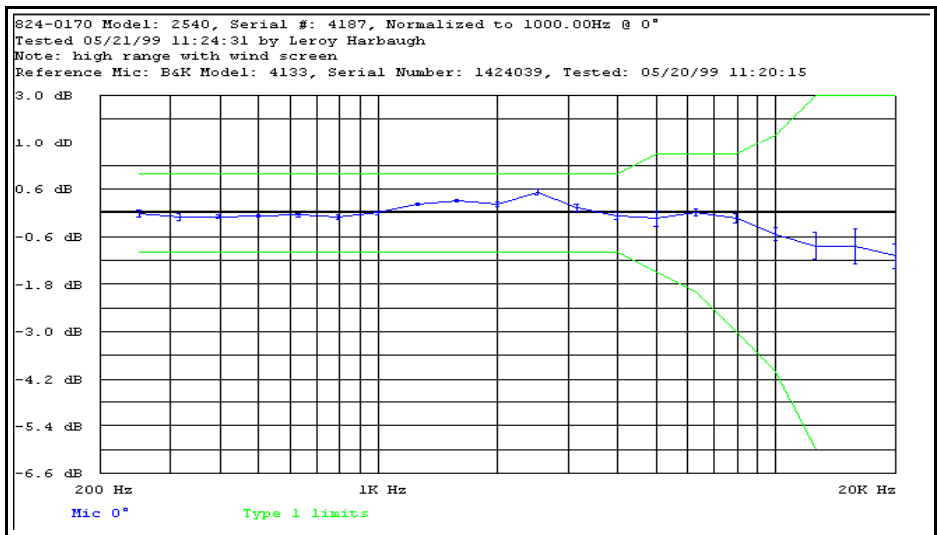
Graph 2 - The 824 in normal range with the 2540 microphone and windscreen



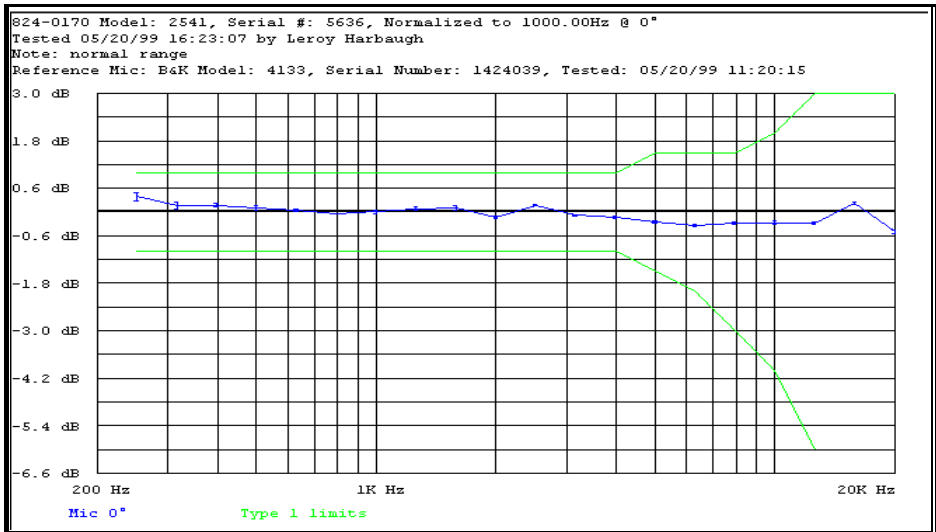
Graph 3 - The 824 in high range with the 2540 microphone



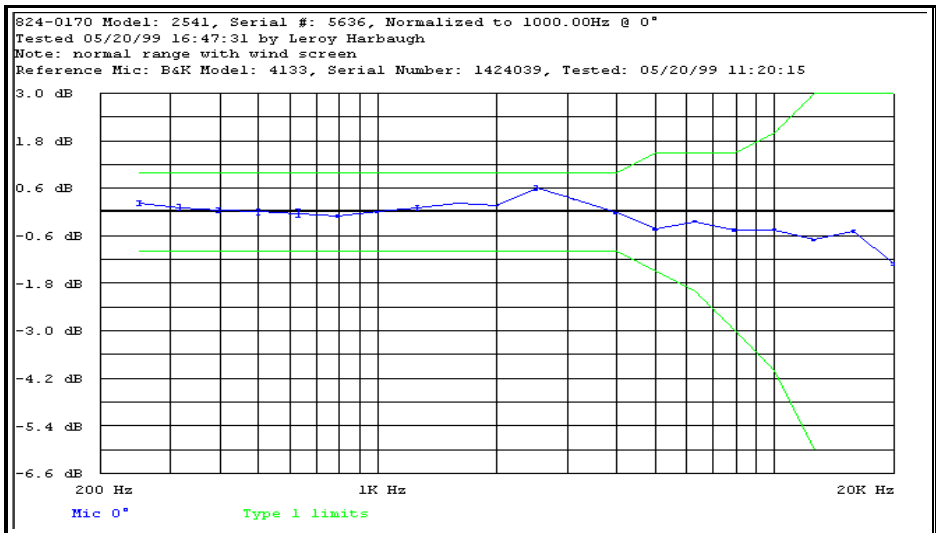
Graph 4 - The 824 in high range with the 2540 microphone and windscreen



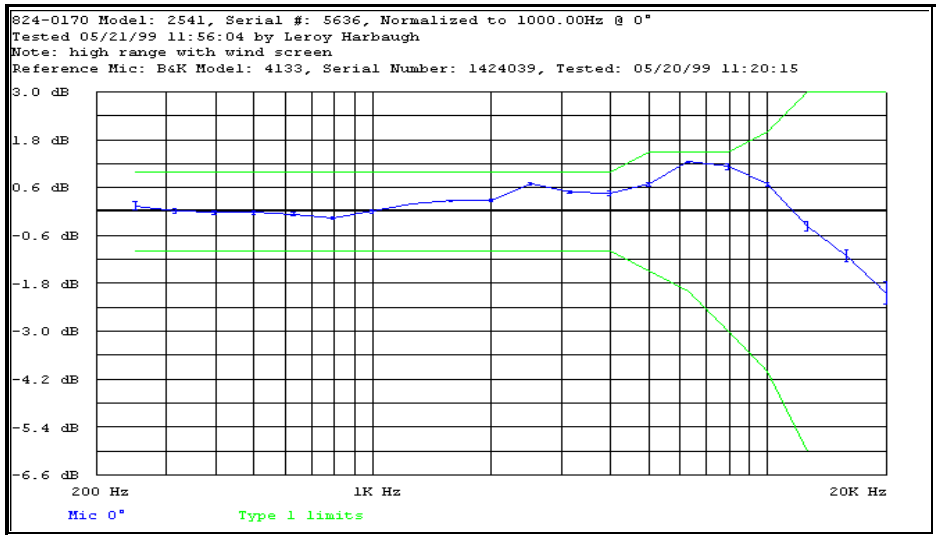
Graph 5 - The 824 in normal range with the 377B41 microphone



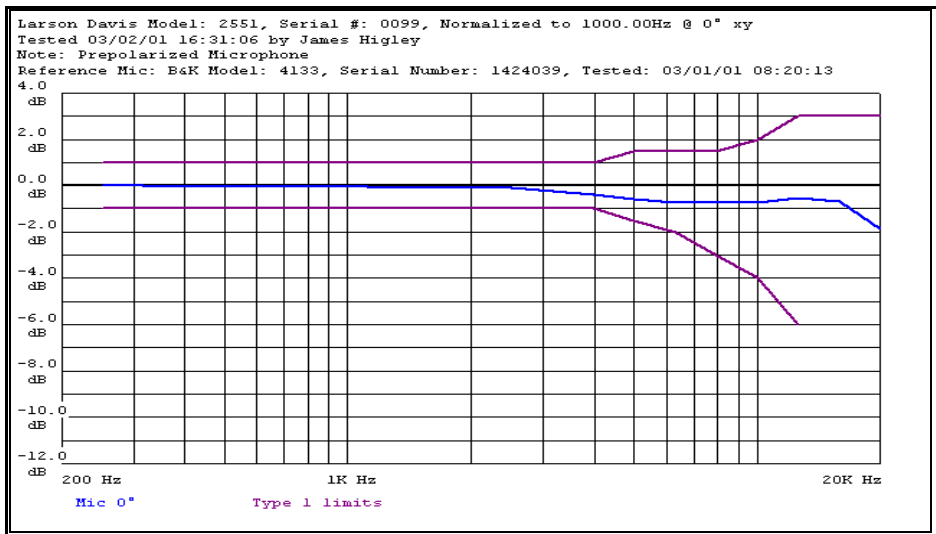
Graph 6 - The 824 in normal range with the 377B41 microphone and windscreen



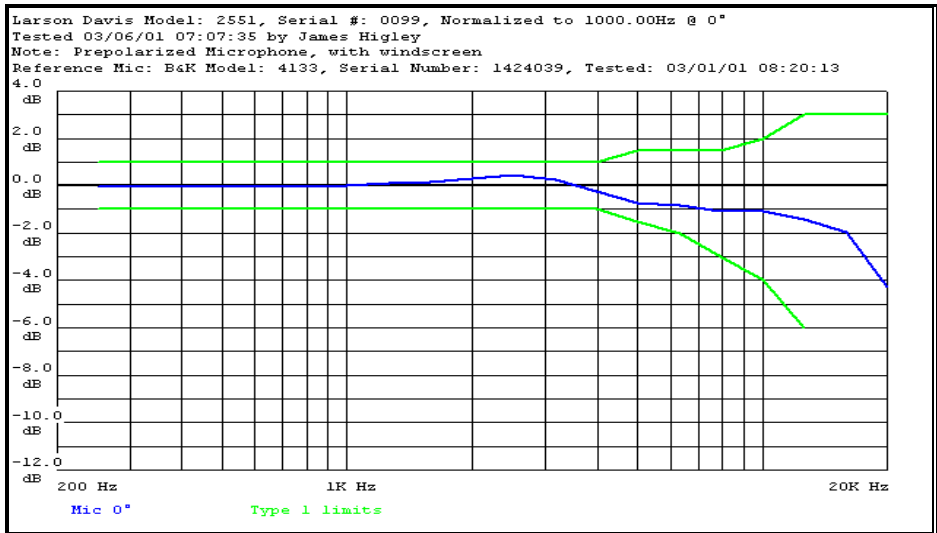
Graph 7 - The 824 in high range with the 377B41 microphone and windscreen



Graph 8 - The 824 in normal range with the 2551 free-field microphone.



Graph 9 - The 824 in normal range with the 2551 free-field microphone and windscreen.



Directional Characteristics of the 824 with the 2540, 377B41 and 2551 free field microphones

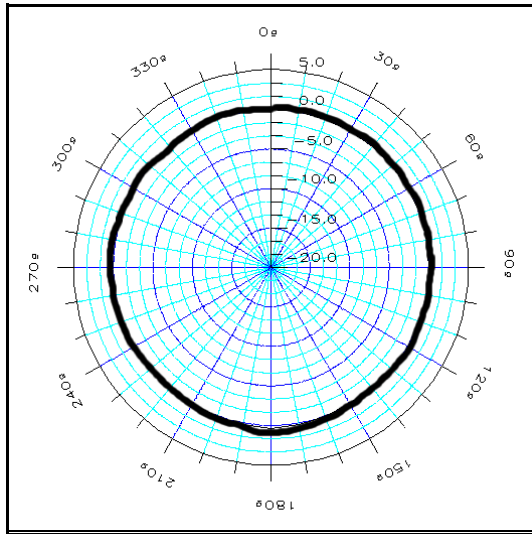
Test Setup

- The 824 was tested in two different configurations as follows:
 - 824 oriented with the LCD facing up
 - 824 oriented on it's side

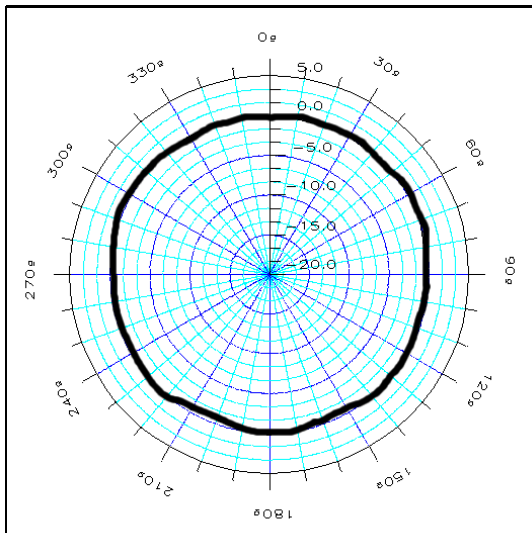
Definitions

- The XY plane is defined as the 824 oriented with it's LCD facing up.
- The YZ plane is defined as the 824 oriented on it's side.

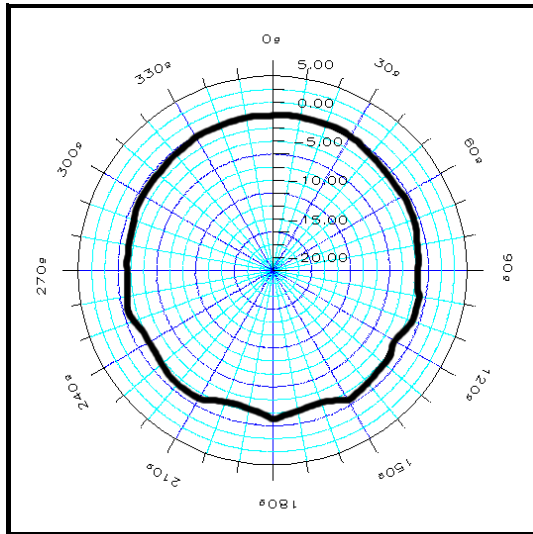
Graph 1 - 824 in the XY plane fitted with the 2540 microphone @ 1 kHz



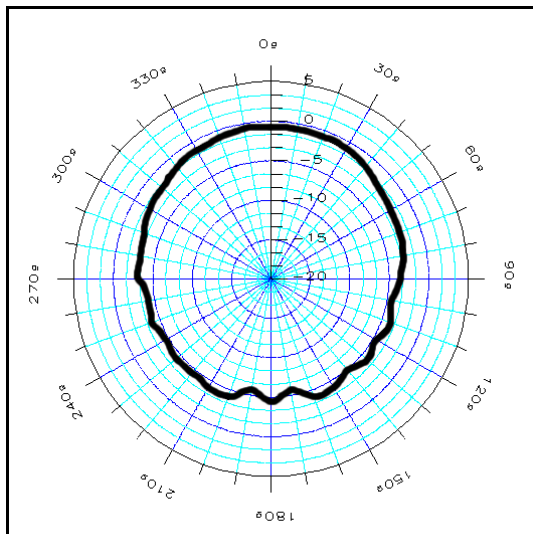
Graph 2 - 824 in the XY plane fitted with the 2540 microphone @ 2kHz



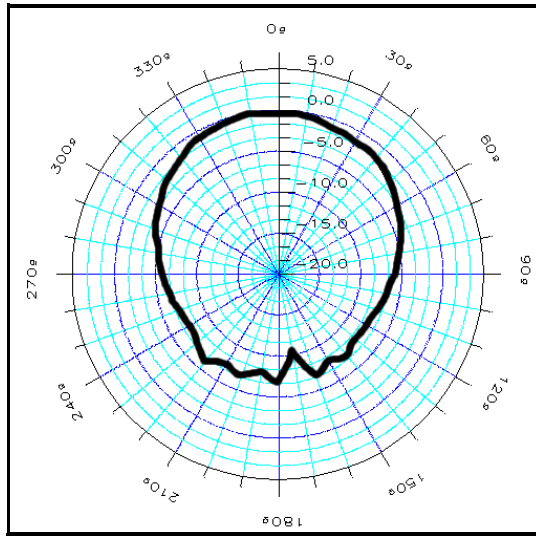
Graph 3 - 824 in the XY plane fitted with the 2540 microphone @ 4 kHz



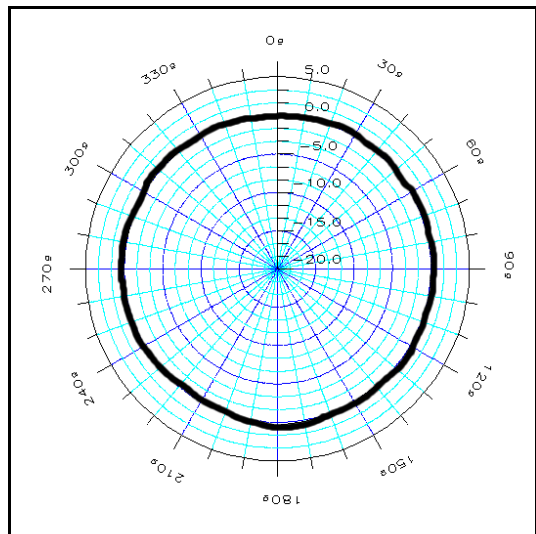
Graph 4 - 824 in the XY plane fitted with the 2540 microphone @ 8 kHz



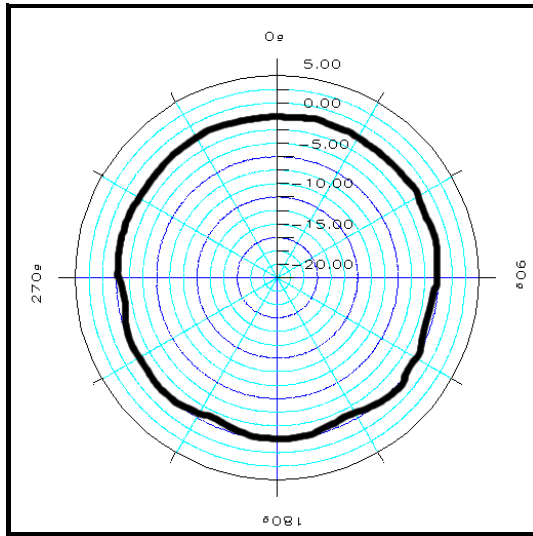
Graph 5 - 824 in the XY plane fitted with the 2540 microphone @ 12.5 kHz



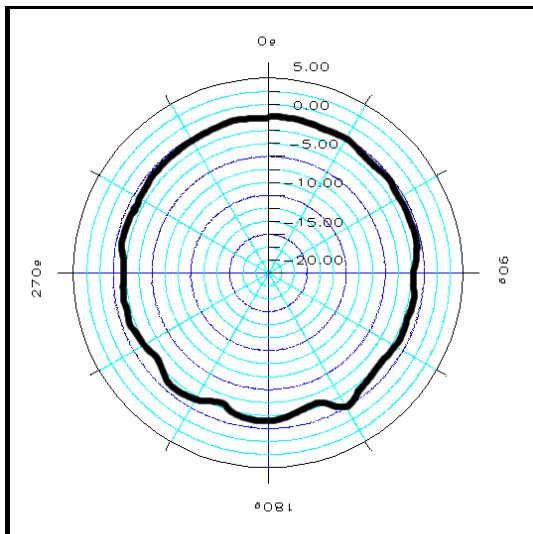
Graph 6 - 824 in the YZ plane fitted with the 2540 microphone @ 1 kHz



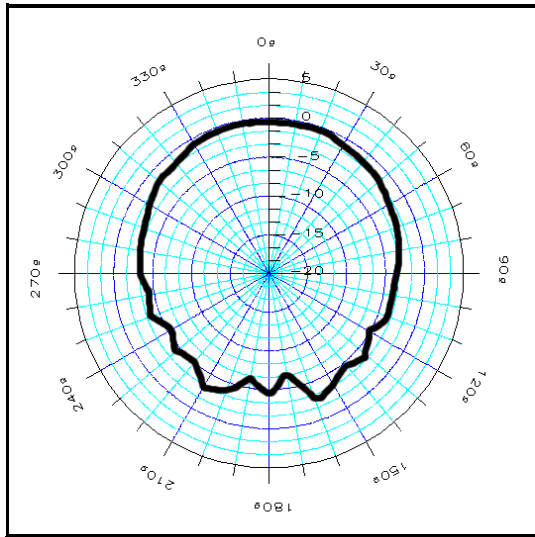
Graph 7 - 824 in the YZ plane fitted with the 2540 microphone @ 2 kHz



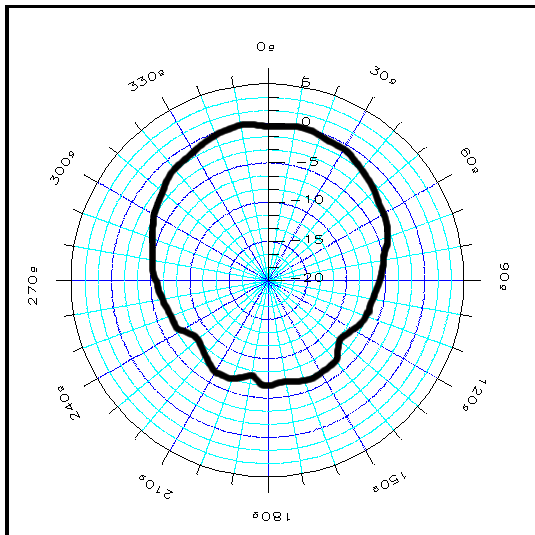
Graph 8 - 824 in the YZ plane fitted with the 2540 microphone @ 4 kHz



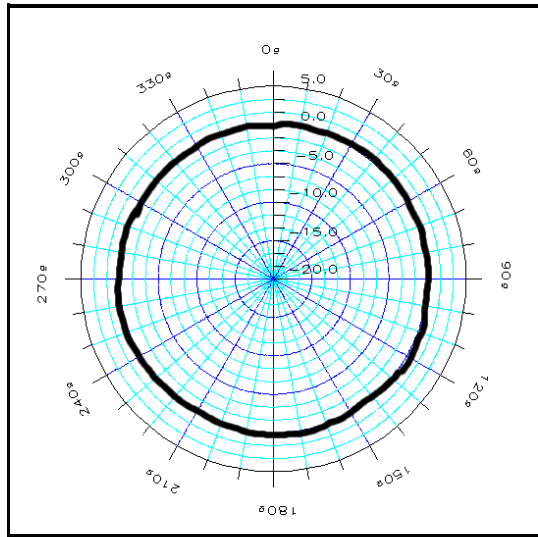
Graph 9 - 824 in the YZ plane fitted with the 2540 microphone @ 8 kHz



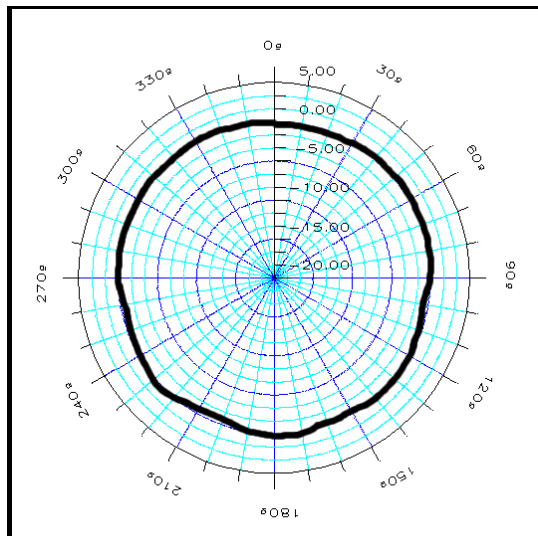
Graph 10 - 824 in the YZ plane fitted with the 2540 microphone @ 12.5 kHz



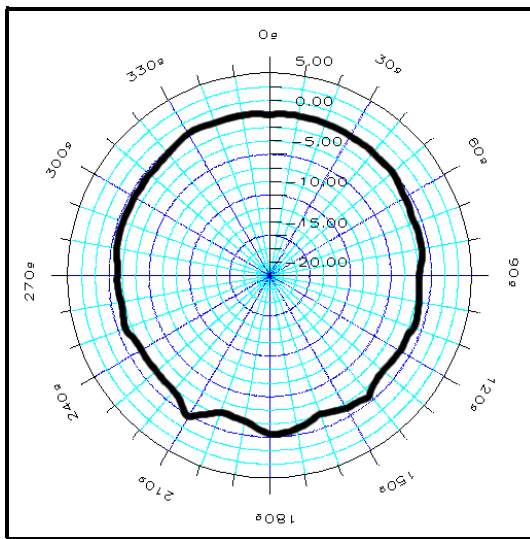
Graph 11 - 824 in the XY plane fitted with the 377B41377B41 microphone @ 1 kHz



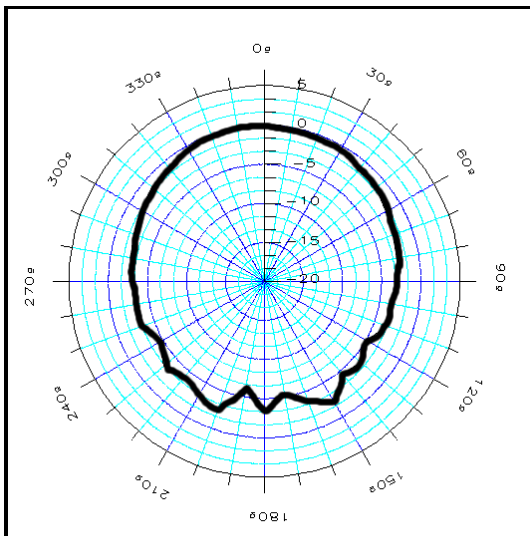
Graph 12 - 824 in the XY plane fitted with the 377B41 microphone @ 2 kHz



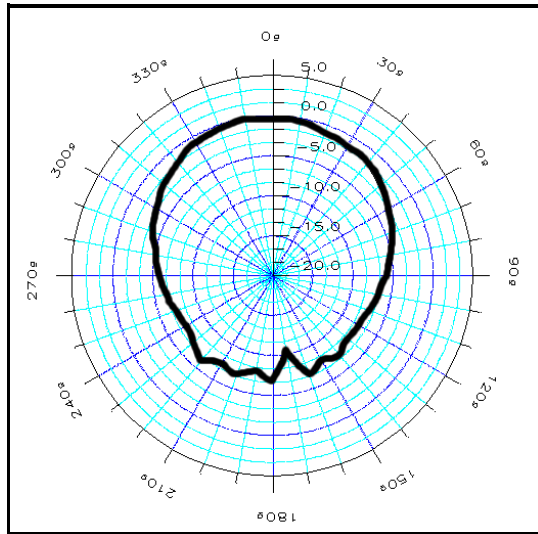
Graph 13 - 824 in the XY plane fitted with the 377B41 microphone @ 4 kHz



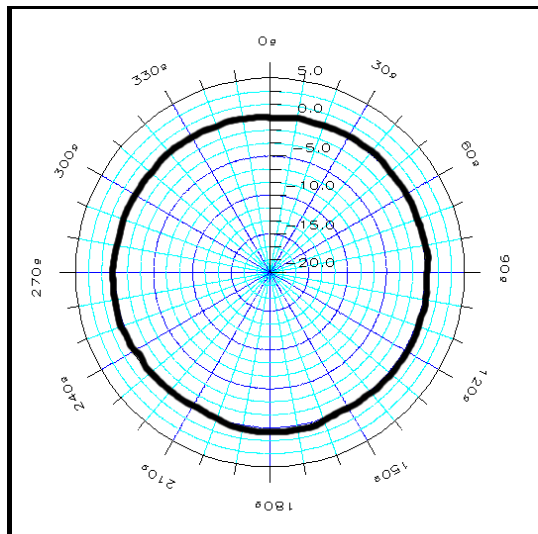
Graph 14 - 824 in the XY plane fitted with the 377B41 microphone @ 8 kHz



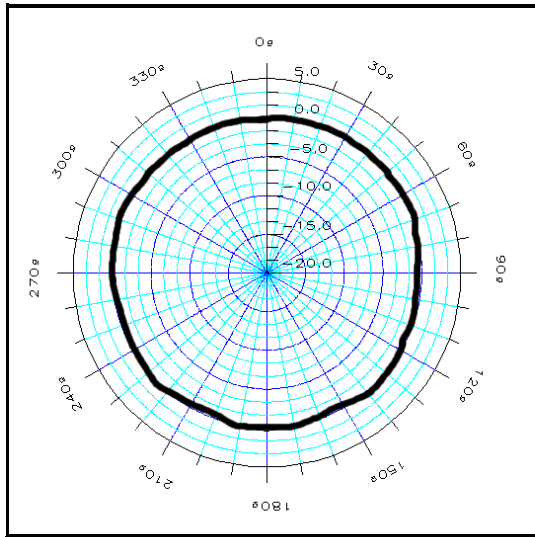
Graph 15 - 824 in the XY plane fitted with the 377B41 microphone @ 12.5 kHz



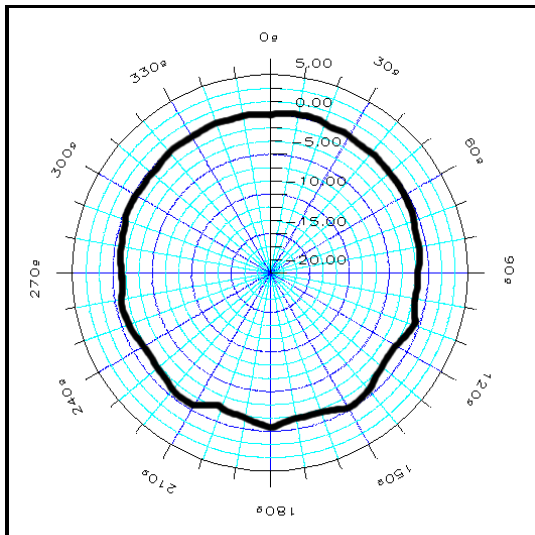
Graph 16 - 824 in the YZ plane fitted with the 377B41 microphone @ 1 kHz



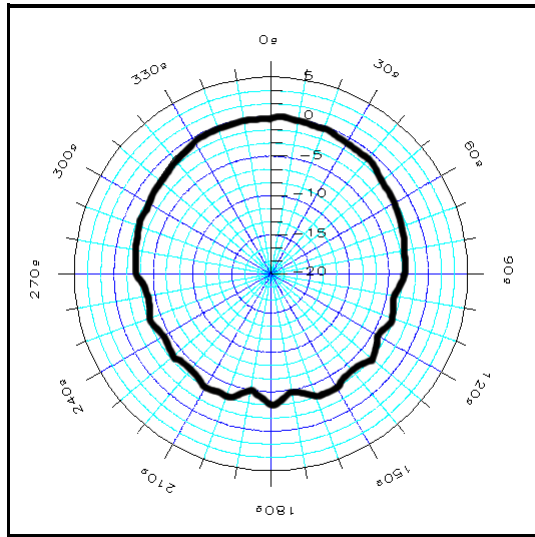
Graph 17 - 824 in the YZ plane fitted with the 377B41 microphone @ 2 kHz



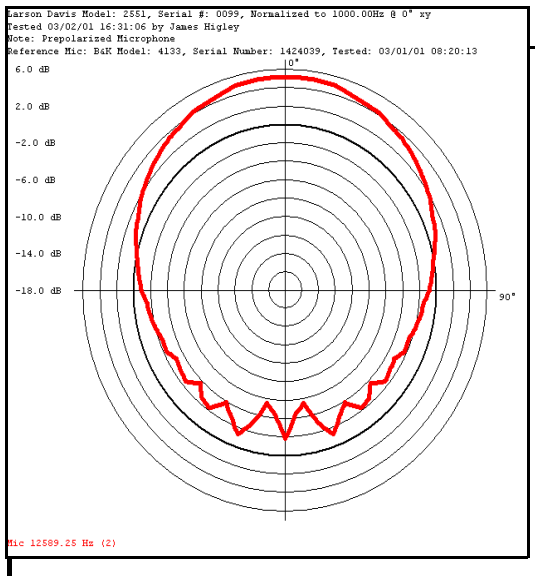
Graph 18 - 824 in the YZ plane fitted with the 377B41 microphone @ 4 kHz



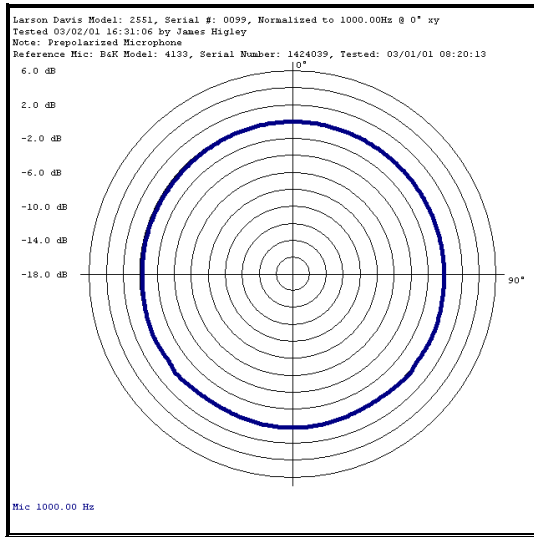
Graph 19 - 824 in the YZ plane fitted with the 2551 microphone @ 8 kHz



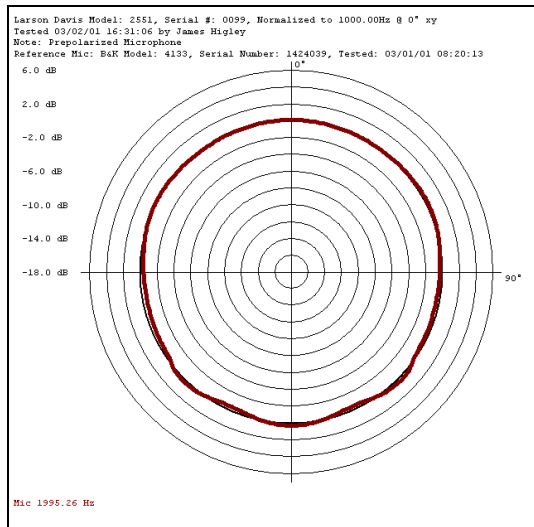
Graph 20 - 824 in the YZ plane fitted with the 377B41 microphone @ 12.5 kHz



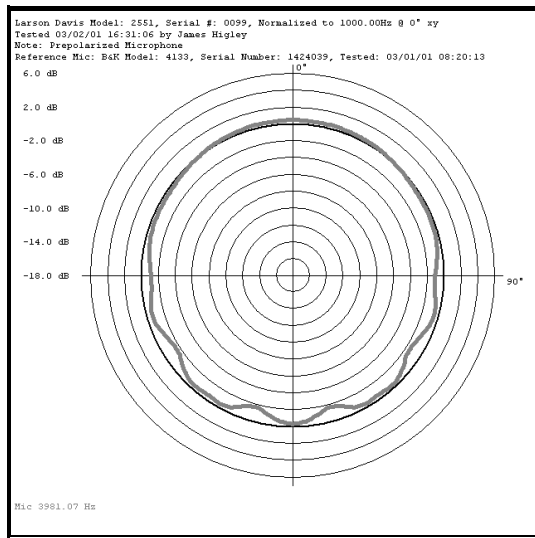
Graph 21 - 824 in the XY plane fitted with the 2551 microphone @ 1 kHz



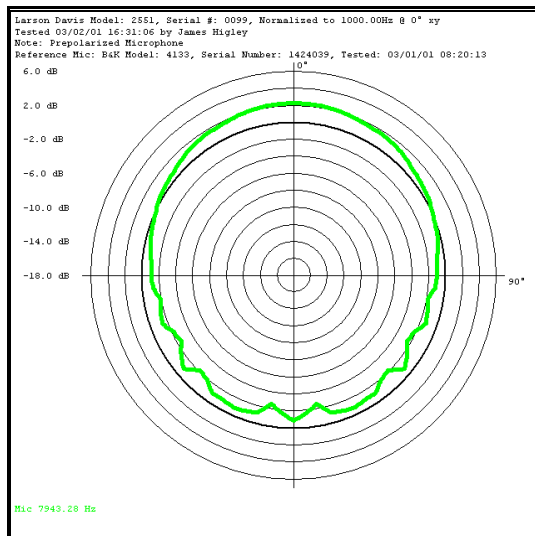
Graph 22 - 824 in the XY plane fitted with the 2551 microphone @ 2 kHz



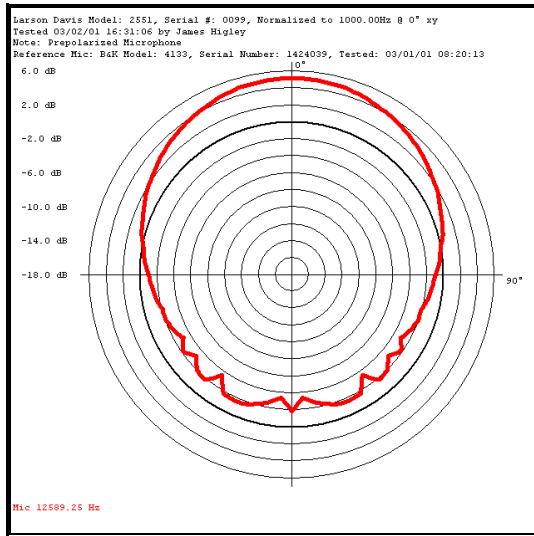
Graph 23 - 824 in the XY plane fitted with the 2551 microphone @ 4 kHz



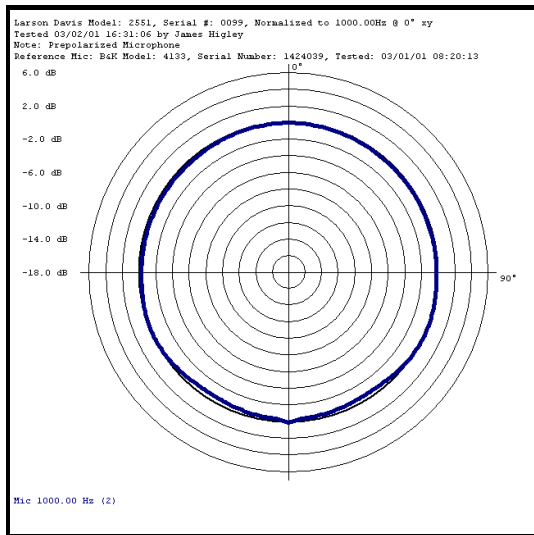
Graph 24 - 824 in the XY plane fitted with the 2551 microphone @ 8 kHz



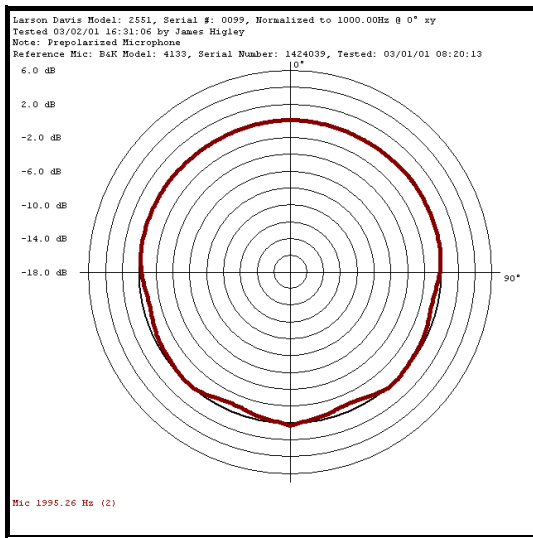
Graph 25 - 824 in the XY plane fitted with the 2551 microphone @ 12.5 kHz



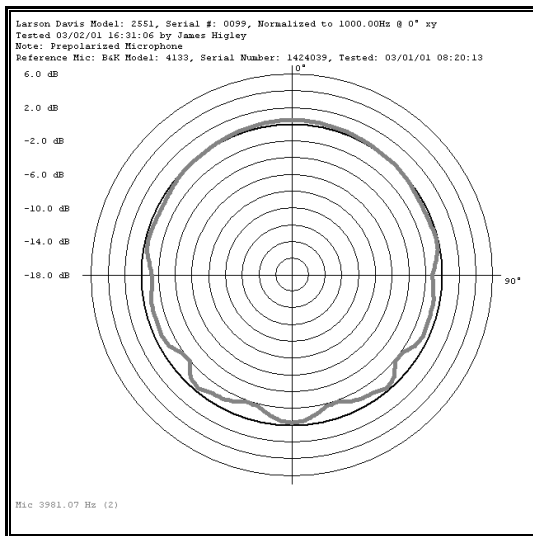
Graph 26 - 824 in the YZ plane fitted with the 2551 microphone @ 1 kHz



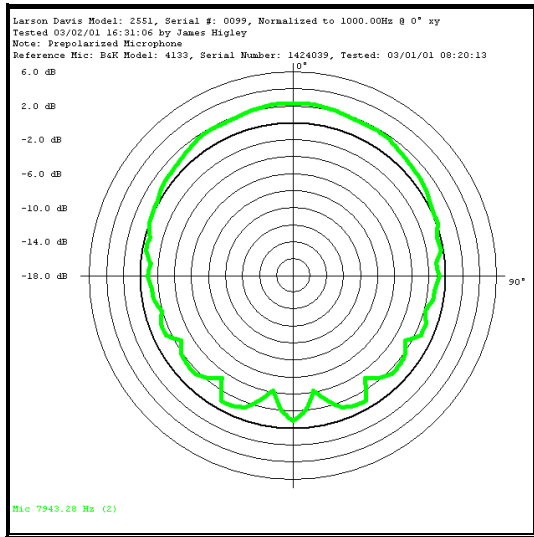
Graph 27 - 824 in the YZ plane fitted with the 2551 microphone @ 2 kHz



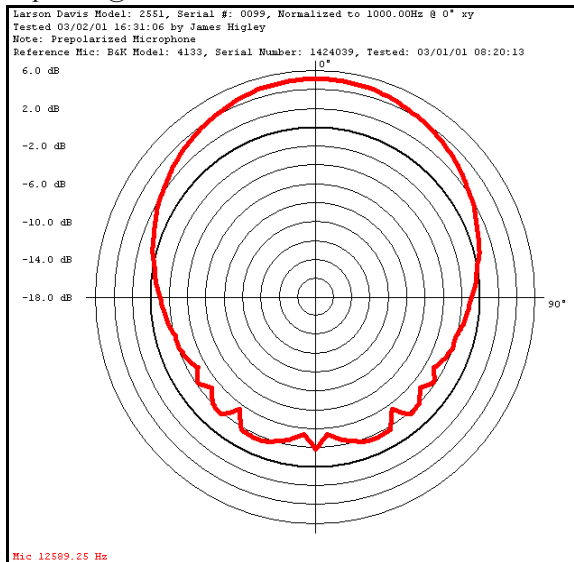
Graph 28 - 824 in the YZ plane fitted with the 2551 microphone @ 4 kHz



Graph 29 - 824 in the YZ plane fitted with the 2551 microphone @ 8 kHz



Graph 30 - 824 in the YZ plane fitted with the 2551 microphone @ 12.5 kHz



Power/Current Draw of 824 Using External Power

		Off	Stopped	LOG Running with backlight OFF	LOG Running with backlight ON	SSA Running with backlight OFF	SSA Running with backlight ON
Power Not Charging		0.012 W	0.96 W	1.28 W	1.73 W	1.72 W	2.21 W
Power Charging		N/A	2.25 W	2.53 W	3.05 W	3.00 W	3.50 W
Current Not Charging	15 V	0.9 mA	65 mA	85 mA	118 mA	116 mA	150 mA
	12 V	1.1 mA	80 mA	107 mA	144 mA	143 mA	184 mA
	9 V	1.3 mA	105 mA	137 mA	191 mA	189 mA	243 mA
Current Charging	15 V	N/A	155 mA	170 mA	204 mA	202 mA	236 mA
	12 V	N/A	187 mA	211 mA	254 mA	248 mA	291 mA
	9 V	N/A	248 mA	278 mA	339 mA	338 mA	402 mA

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.

Example: If $L_c = 90$, $T_c = 8$, $Q = 3$ and $L_i = 95$ then

$$= \frac{8}{10^{(95-90)/10}} = \frac{8}{2^{(95-90)/3}} = 5.656 = 5 \text{ hours and } 39 \text{ min}$$

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 $L_{avg}=L_{TWA(LC)}$

$$L_{avg} = q \text{Log}_{10} \left(\frac{1}{T} \int_{T_1}^{T_2} 10^{(L_p(t))/q} dt \right)$$

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 (LEP,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

$$L_{den} = 10 \log_{10} \left\{ \frac{1}{24} \left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{1900} 10^{L_i/10} + \sum_{1900}^{2200} 10^{(L_i + 5)/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10} \right] \right\}$$

$$L_{dn} = 10 \log_{10} \left\{ \frac{1}{24} \left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{2200} 10^{L_i/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10} \right] \right\}$$

The continuous equivalent sound level (See definition) is generally calculated on an hourly basis and is shown in the equation as L .

The values for the hourly periods from midnight to 7 a.m. have 10 added to them to represent less tolerance for noise during sleeping hours. The same occurs from 10 p.m. to midnight. They are energy summed and converted to an average noise exposure rating.

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 e.g. acoustic measurements.

It is not possible to directly add or subtract physical quantities when expressed in decibel form since the addition of logarithmic values correspond to multiplication of the original quantity.

The word *level* is normally attached to a physical quantity when expressed in decibels; for example, L_p represents the sound pressure level.

The difference between the sound pressure for silence versus loud sounds is a factor of 1,000,000:1 or more, and it is very unpractical to use these large numbers. Therefore, a measure that would relate to “the number of zeros” would help, for example, 100,000 would be equal to 50 and 1000 would be equal to 30 and so on. This is the basic principal of the dB measure.

All dB values are unit free and therefore, the dB value is not the value of the quantity itself, but the ratio of that quantity to an actual reference quantity used. Thus, for every level in decibels there must be a well defined reference quantity. Sound versus vibration uses different references, but the dB principal is the same. When the quantity equals the reference quantity the level is zero. To keep dB values above zero, the reference is generally set to be the lowest value of the quantity that we can imagine or normally wish to use. Before explaining the calculation of dB values, it is useful to remember the following rules of thumb when dB values are used for sound levels:

- Doubling of the Sound Pressure = 6 dB
- Doubling of the Sound Power = 3 dB
- Doubling of the Perceived Sound Level = (approx) 10 dB

Note: The latter is frequency and level dependent, but the value “10 dB” is a good rule of thumb, especially around 1 kHz.

Table 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.

(eq. D-1)

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:

$$dB = 10 \text{Log}_{10} \left[\frac{P^2}{P_0^2} \right] = 20 \text{Log} \left[\frac{P}{P_0} \right] \quad ; p_0 = 20 \mu Pa$$

Table 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

$$L_{TWA(8)} = L_c + q \text{Log}_{10} \left(\frac{D}{100} \right)$$

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.

$$L_{eq} = 10 \text{Log}_{10} \left[\frac{\int_{T_1}^{T_2} p^2(t) dt}{p_o^2 T} \right]$$

where p is the sound pressure and the Measurement Duration (specific time period) T=T₂-T₁. 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

Center Frequencies, Hz		Weighting Network Frequency Response		
1/3 Octave	1 Octave	A	B	C
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(B).

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 away, can hardly hear what you hear. The acoustic near field is characterized by pressures that do not create sound that can be measured in the far field. Therefore measurements made here are not useful in predicting the sound levels far away 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.

$$D = \frac{100T}{T_c} 10^{(L_i - L_c)/q}$$

where

T is Measurement Duration

T_c is Criteria Time

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	<p>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.</p> <p>The auditory sensation evoked by the oscillatory changes.</p> <p><i>Difference between sound and noise:</i> Sound is the physical phenomenon associated with acoustic (small) pressure waves. Use of the word <i>sound</i> 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.</p> <p><i>Rules:</i></p> <p>1. Use word <i>sound</i> to describe measurements to remove the emotional overtones associated with the word <i>noise</i>. Some sound metrics use noise in their name and it is proper to use the name as it is.</p>

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_{ET})

The total sound energy in a specific time period. The equation for it is

$$SEL = 10 \text{Log}_{10} \left[\frac{\int_{T_1}^{T_2} p^2(t) dt}{p_0^2 T} \right]$$

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. P_0 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

$$L_p = 20 \log_{10} \left[\frac{p_{rms}}{p_0} \right] \quad p_{rms} = p_0 10^{L_p/20}$$

where p_0 is the reference sound pressure of 20 μ Pa. The square of the sound pressure is a power-like quantity that can be expressed in the original form of the level definition

$$L_p = 10 \log_{10} \left[\frac{p_{rms}^2}{p_0^2} \right] \quad p_{rms}^2 = p_0^2 10^{L_p/10}$$

Sound Pressure Level can be converted to sound pressure as follows. If the sound pressure is 1 Pascal, then the sound pressure level is

$$L_p = 20 \log_{10} \left[\frac{1}{20 \bullet 10^{-6}} \right] = 20 \log_{10} [50000] = 20 [4.699] = 94.0 \text{ dB}$$

Calibrators often use a level of 94 dB so they generate a sound pressure of 1 Pascal.

If the sound pressure level = 76.3 dB, then the sound pressure is

$$P_a = 20 \bullet 10^{-6} \bullet 10^{76.3/20} = 20 \bullet 10^{3.815-6} = 20 \bullet 10^{-2.185} = 20 [0.0065] = 0.13$$

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

$$L_w = 10 \log_{10} \left[\frac{W}{W_0} \right] \quad W = W_0 10^{L_w/10}$$

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.

$$c = 20.05 \sqrt{\text{degC} + 273} \quad \text{m/sec}$$

$$c = 49.03 \sqrt{\text{degF} + 460} \quad \text{ft/sec}$$

Spectrum (Frequency Spectrum)

The amplitude of sound or vibration at various frequencies. It is given by a set of numbers that describe the amplitude at each frequency or band of frequencies. It is often prefixed with a descriptor that identifies it such as sound pressure spectrum. It is generally expressed as a spectrum level.

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} .

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

$$L_{TWA}(TC) = K \log_{10} \left(\frac{1}{T} \int_{T_1}^{T_2} 10^{(L_p(t))/K} dt \right)$$

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.

*E**Memory Usage*

The System 824 has a memory size of 2 MB. This is generally more than adequate for measurements performed on a day-by-day basis. However, for applications such as noise monitoring where measurements are performed and stored automatically over a period of days or weeks, it is important to be able to calculate the rate at which memory will be consumed in order to download data before the memory capacity is reached. The information in this Appendix will be useful to accomplish this task. Memory usage for the LOG and SSA instruments will be presented separately. An example in the form of a Memory Usage Worksheet will be included for the LOG instrument.

LOG Memory Usage

Each of the 824's History Functions use space out of a common memory. The amount each record takes is based on the options selected. The following information is provided to assist in determining the amount of data that can be stored according to the option desired. The example will be show assuming that all of the memory is available for one measurement though many measurement files may be stored at one time.

Exceedance Records (Exceedance History Enabled)]

Options — add bytes shown if enabled	Bytes
Basic Exceedance Record	32
Excd Time-Hist=[Yes] Ten sample prior to and up to ten following the event will be stored.	+21 plus number of samples based on length of event (129 bytes max)
Binary Accumulator and Count Enabled by "Store Complete Histogram" on "Daily" tab in 824 Utility	+16
Wind/Tach = [Yes]	+3

Table E-1: LOG Memory Use: Exceedance Records

Interval Records (Intv History Enabled)

Options — add bytes shown if enabled	Bytes
Basic Interval Record	34
Intv Save Ln's=[Yes]	+18
Intv Ln Table Enabled by "Store Complete Histogram" setting on "Interval" tab of 824 Utility	+384
Wind/Tach = [Yes]	+5

Table E-2: LOG Memory Use: Interval Records

Daily Records (Daily History Enabled)

Options — add bytes shown if enabled	Bytes
Basic Daily Record	175
Save Daily Ln's=[Yes]	+18
Daily Ln Table Enabled by "Store Complete Histogram" on "Daily" tab in 824 Utility	+440
Wind/Tach = [Yes]	+19

Table E-3: LOG Memory Use: Daily Records

Time History Records (Time History Enabled)

Options		Bytes per record
Hist Resolution	Other Level	
[1.0dB]	[No]	1
[0.1dB]	[No]	2
[1.0dB]	[Peak UwPk Max]	2
[0.1dB]	[Peak UwPk Max]	4
[1.0dB]	[Advc]	1 plus number of ✓ (enabled levels)
[0.1dB]	[Advc]	2 plus 2 times each ✓ (enabled levels)
[1.0dB]	[Advc], Wind/Tach = [Yes]	2
[0.1dB]	[Advc], Wind/Tach = [Yes]	4

Table E-4: LOG Memory Use: Time History Records

Other Histories and Memory Usage

Other Histories and Memory Usage	bytes
Run Log History	20 bytes per record
Calibration Log History	17 bytes per record
LOG File (Store) with Wind/Tach = [No]	7423 each
LOG File (Store) with Wind/Tach = [Yes]	7481 each

Table E-5: LOG Memory Use: Other Histories and Memory Usage

Estimating Memory Usage:

The easiest way to estimate the memory usage is to work on a time basis such as one day. Estimate how many Exceedances will occur in a normal day. Calculate the number of Interval, Time History, Daily, Run Log and Calibration Check records that will be performed in a day. Based on the options chosen calculate the number of bytes required for each record type and multiply by the number of records expected per day, sum these values and this is the number of bytes required per day. Divide this value into the amount of available memory in the 824 (see Tools | Memory display, generally about two million) and this is the number of days that can be gathered.

As an example, let's assume a job requires monitoring the noise made by trucks coming and going from a factory near a residential area. From an initial site survey it is discovered that all trucks are over 65dBA at the boundary of the road and residential property and that there seems to be a truck passing the site every 3 minutes. The occupants of the residential area want to know how many trucks are traveling this road and why they are disturbed by more than others. The Exceedance Function will be used to detect events over 65dBA and there are 20 events per hour expected or 240 per day (20 events/hour time 12 hours/day) assuming that the plant operations will be reduced during the night. Each event is expected to last 20 seconds and the Excd T.H rate is 1 sample per second. Statistics based on hourly intervals and a one minute time history are desired to identify disturbance patterns. The time history will give the A weight Leq normally and we will also get the A Lmax, C Leq and C Lmax. The following completed worksheet shows the calculations for this example:

Excd Time-Hist <small>1 = standard time of samples, 0.29 bytes in a/c</small>	21+n <small>20sec/Excd</small>	✓	41
TOTAL Bytes / Excd	Add lines 1 & 2		78
Anticipated Excd / Day	Enter Number		240
TOTAL Excd Bytes / Day	Multiply lines 3 & 4 – copy to line 25		18,720
Interval Memory Calculation	Bytes	✓ Used	Bytes Needed
Basic Interval Record	34	✓	34
Intv Save Ln's	18	✓	18
Intv Save Ln Table	384		0
TOTAL Bytes / Intv	Sum lines 6 to 8		57
Anticipated Intv / Day	Enter Number Calculated		24
TOTAL Intv Bytes / Day	Multiply lines 10 & 11 – copy to line 26		1,368
Daily History Memory Calculation	Bytes	✓ Used	Bytes Needed
Basic Daily Record	175	✓	175
Daily Save 6 Ln Values	18	✓	18
Daily Save Ln Table	440		0
TOTAL Daily Bytes / Day	Sum lines 12 to 14 – copy to line 27		312

Time History Memory Calculation				
Line	Resolution	Other Level		Bytes per record / Used
16	[1.0dB]	[None]		1
17	[0.1dB]	[None]		2
18	[1.0dB]	[Pk-II] Pk-I Lmax]		2
19	[0.1dB]	[Pk-II] Pk-I Lmax]		4
20	[1.0dB]	[Advc]	1 plus number of <input checked="" type="checkbox"/> (enabled levels)	Calculate
21	[0.1dB]	[Advc]	2 plus 2 times each <input checked="" type="checkbox"/> (enabled levels)	Calculate <i>A Leg & Max, C 8 T</i> <i>Leg & Max</i>
22	TOTAL bytes / Hist Record		Select the appropriate number of bytes from lines 16 to 21 above	<i>8</i>
23	Hist Records / Day <small>24 hours divided by Hist Period in hours</small>		Enter Number Calculated i.e. 24/(60 sec/3600 sec per hour)=1440	<i>1,440</i>
24	TOTAL Hist Bytes / Day		Multiply lines 22 & 23 – copy to line 28	<i>11,520</i>
Memory Use per Day Calculation			Bytes	
25	Exceedance History bytes / day		from line 5 <i>18,720</i>	
26	Interval History bytes / day		from line 11 <i>1,368</i>	
27	Daily History bytes / day		from line 22 <i>312</i>	
28	Time History bytes / day		from line 29 <i>11,520</i>	
29	Run Log bytes / day <small>n = number of Run Log records / day</small>		<u>2</u> x 20 = <small>n x 20 bytes/record</small> <i>40</i>	
30	Calibration Log bytes / day <small>n = number of Cal Log records / day</small>		<u>1</u> x 17 = <small>n x 17 bytes/record</small> <i>17</i>	
31	Setup RAM Registers bytes used <small>n = number of registers stored</small>		<u>0</u> x 506 = <small>n x 506 bytes/record</small> <i>0</i>	
32	TOTAL bytes used / day		Sum lines 25 to 31 <i>31,977</i>	
33	824's Memory Size ≈2,000,000		see TOOLS Memory Enter total memory shown <i>2,047,485</i>	
34	TOTAL Run Time in days until out of memory		divide line 38 by line 37 <i>64 days</i>	

Table E-6: Example LOG Memory Usage Calculation:

824-LOG Memory Usage Worksheet

Line	Exceedance Memory Estimation	Bytes	Used	Bytes Needed
1	Basic Exceedance Record	32		
2	Excd Time-Hist <small>n=estimated number of samples (129 bytes max)</small>	21+n		
3	Wind/Tach=[Yes]	3		
4	TOTAL Bytes / Excd	Add lines 1 thru 2		
5	Anticipated Excd / Day	Enter Number		
6	TOTAL Excd Bytes / Day	Multiply lines 4 & 5 – copy to line 30		

Line	Interval Memory Calculation		Bytes	Used	Bytes Needed
7	Basic Interval Record		34		
8	Intv Save Ln's		18		
9	Intv Save Ln Table		384		
10	Wind/Tach=[Yes]		5		
11	TOTAL Bytes / Intv		Sum lines 7to 10		
12	Anticipated Intv / Day		Enter Number Calculated		
13	TOTAL Intv Bytes / Day		Multiply lines 11& 12- copy to line 31		
Line	Daily History Memory Calculation		Bytes	Used	Bytes Needed
14	Basic Daily Record		175		
15	Daily Save 6 Ln Values		18		
16	Daily Save Ln Table		440		
17	Wind/Tach=[Yes]		19		
18	TOTAL Daily Bytes / Day		Sum lines 14to 17- copy to line 32		
Time History Memory Calculation					
Line	Resolution	Other Level		Bytes per record / Used	
19	[1.0dB]	[None]		1	
20	[0.1dB]	[None]		2	
21	[1.0dB]	[Pk-ll Pk-I Lmax]		2	
22	[0.1dB]	[Pk-ll Pk-I Lmax]		4	
23	[1.0dB]	[AdvC]	1 plus number of ✓ (enabled levels)	Calculate	
24	[0.1dB]	[AdvC]	2 plus 2 times each ✓ (enabled levels)	Calculate	
25	[1.0dB]	[AdvC]	Wind/Tach=[Yes]	2	
26	[0.1dB]	[AdvC]	Wind/Tach=[Yes]	4	
27	TOTAL bytes / Hist Record		Select the appropriate number of bytes from lines 19to 26above		
28	Hist Records / Day <small>24 hours divided by Hist Period in hours</small>		Enter Number Calculated i.e. 24/(60 sec/3600 sec per hour)=1440		
29	TOTAL Hist Bytes / Day		Multiply lines 27& 28- copy to line 33		
Line	Memory Use per Day Calculation			Bytes	
30	Exceedance History bytes / day		from line 6		
31	Interval History bytes / day		from line 13		
32	Daily History bytes / day		from line 18		
33	Time History bytes / day		from line 29		
34	Run Log bytes / day <small>n = number of Run Log records / day</small>		____ x 20 = <small>n x 20 bytes/record</small>		
35	Calibration Log bytes / day <small>n = number of Cal Log records / day</small>		____ x 17 = <small>n x 17 bytes/record</small>		
36	Setup RAM Registers bytes used <small>n = number of registers stored</small>		____ x 506 = <small>n x 506 bytes/record</small>		
37	TOTAL bytes used / day		Sum lines 30 to 36		
38	824's Memory Size ≈2,000,000		see TOOLS Memory Enter total memory shown		
39	TOTAL Run Time in days until out of memory		divide line 38 by line 37		

Table E-7: LOG Memory Usage Worksheet

824-SSA Memory Usage

Interval Records (Intv History Enabled)

Options — add bytes shown if enabled	Bytes
Basic Interval Record, includes Leg Spectrum	100
Intv Spectrum = [@Max] or [Mins]	+66
Intv Save Ln's = [Yes]	+18
Spectral Ln = [Interval]	+396
Intv Ln Table Enabled by "Store Complete Histogram" setting on "Interval" tab of 824 Utility	+384
Wind/Tach = [Yes]	+5

Table E-8: SSA Memory Usage: Interval Records

Time History Records (Time History Enabled)

						Bytes per record		
						Resolution [0.1dB]	Resolution [1dB]	
Basic Leq (selected by the Weighting setting)						2	1	
Leq	A	(option)				2	1	
Leq	C	(option)				2	1	
Leq	Flat	(option)				2	1	
Peak	A	(option)				2	1	
Peak	C	(option)				2	1	
Peak	Flat	(option)				2	1	
Lmax	Slow	A	(option)			2	1	
Lmax	Slow	C	(option)			2	1	
Lmax	Slow	Flat	(option)			2	1	
Lmax	Fast	A	(option)			2	1	
Lmax	Fast	C	(option)			2	1	
Lmax	Fast	Flat	(option)			2	1	
Lmax	Impl	A	(option)			2	1	
Lmax	Impl	C	(option)			2	1	
Lmax	Impl	Flat	(option)			2	1	
Lmin	Slow	A	(option)			2	1	
Lmin	Slow	C	(option)			2	1	
Lmin	Slow	Flat	(option)			2	1	
Lmin	Fast	A	(option)			2	1	
Lmin	Fast	C	(option)			2	1	
Lmin	Fast	Flat	(option)			2	1	
Lmin	Impl	A	(option)			2	1	
Lmin	Impl	C	(option)			2	1	
Lmin	Impl	Flat	(option)			2	1	
Live	SPL	Slow	A	(option)			2	1
Live	SPL	Slow	C	(option)			2	1
Live	SPL	Slow	Flat	(option)			2	1
Live	SPL	Fast	A	(option)			2	1
Live	SPL	Fast	C	(option)			2	1
Live	SPL	Fast	Flat	(option)			2	1
Live	SPL	Impl	A	(option)			2	1
Live	SPL	Impl	C	(option)			2	1
Live	SPL	Impl	Flat	(option)			2	1
Leq Spectrum (option)						66	33	
Live Spectrum (option)						66	33	
Wind/Tach (option)						4	2	
Temperature (internal to instrument) (option)						2	1	
External Power Voltage (option)						2	1	
Battery Voltage (option)						2	1	

Table E-9: SSA Memory Usage: Time History Records

Other Histories and Memory Usage	bytes
Run Log History	20 bytes per record
Calibration Log History	17 bytes per record
SSA File (Store) with 'Enable Ln' = [No]	2503 each file
SSA File (Store) with 'Enable Ln' = [Yes]	7623 each file

Table E-10: SSA Memory Usage: Other Histories and Memory Usage

F

SLM Testing to IEC61672-1

This chapter presents information for testing the sound level meter function of the System 824 according to IEC61672-1 Section 9.3. These data represent the performance of the instrument when used with the Larson Davis Model 377B41 microphone.

Reference Sound Pressure Level:

114 dB

Reference Level Range:

Mode	Reference Level Range
ISM	Normal
SSA	0 dB Gain
LOG	Normal
FFT	0 dB Gain
RTA	0 dB Gain
AUD	0 dB Gain
TAL	0 dB Gain

Microphone Reference Point:

Center of diaphragm of Model 377B41 microphone

Average Frequency Response Corrections

The following table presents the corrections for the average frequency response of the System 824 using a PRM902 preamplifier and a Model 377B41 free-field microphone, with and without a windscreen. This data include the effects of reflections and diffraction.

Frequency, Hz	0 ° Free Field Response dB	0° Free Field Correctons ¹ dB	Effect of Windscreen dB	Windscreen on 824, 0 ° Free Field dB	0 ° Free Field Corrections with Wind Screen on 824 dB ¹	Expanded uncertainty of Corrections @95% dB
251.19	0.0	0.0	0.0	0.0	0.0	0.25
316.23	0.0	0.0	0.0	0.0	0.0	0.25
398.11	0.0	0.0	0.0	0.0	0.0	0.25
501.19	0.0	0.0	0.0	0.0	0.0	0.25
630.96	0.0	0.0	0.0	0.0	0.0	0.25
794.33	0.0	0.0	0.0	0.0	0.0	0.25
1000.00	0.0	0.0	0.0	0.0	0.0	0.25
1059.25	0.0	0.0	0.0	0.0	0.0	0.25
1122.02	0.1	-0.1	0.1	0.1	-0.1	0.25
1188.50	0.1	-0.1	0.0	0.1	-0.1	0.25
1258.93	0.1	-0.1	0.0	0.1	-0.1	0.25
1333.52	0.2	-0.2	0.1	0.3	-0.3	0.25
1412.54	0.2	-0.2	0.1	0.3	-0.3	0.25
1496.24	0.2	-0.2	0.1	0.3	-0.3	0.25
1584.89	0.2	-0.2	0.2	0.3	-0.3	0.25
1678.80	0.2	-0.2	0.1	0.3	-0.3	0.25
1778.28	-0.2	0.2	0.2	0.0	0.0	0.25
1883.65	-0.2	0.2	0.2	0.1	-0.0	0.25
1995.26	-0.3	0.3	0.2	-0.1	0.1	0.30
2113.49	0.1	-0.1	0.3	0.3	-0.3	0.30
2238.72	0.1	-0.1	0.3	0.4	-0.4	0.30
2371.37	0.3	-0.3	0.3	0.6	-0.6	0.30
2511.89	0.2	-0.2	0.3	0.5	-0.5	0.30
2660.73	0.2	-0.2	0.3	0.5	-0.5	0.30
2818.38	0.1	-0.1	0.3	0.4	-0.4	0.30
2985.38	0.1	-0.1	0.3	0.4	-0.4	0.30
3162.28	-0.1	0.1	0.2	0.1	-0.1	0.30
3349.65	-0.1	0.1	0.1	0.0	0.0	0.30
3548.13	0.1	-0.1	0.0	0.1	-0.1	0.30
3758.37	0.4	-0.4	-0.1	0.3	-0.3	0.30
3981.07	0.2	-0.2	-0.2	0.0	0.0	0.35
4216.97	0.0	0.0	-0.2	-0.2	0.2	0.35
4466.84	0.1	-0.1	-0.3	-0.2	0.2	0.35
4731.51	0.0	0.0	-0.3	-0.3	0.3	0.35
5011.87	0.4	-0.4	-0.2	0.2	-0.2	0.35
5308.84	0.1	-0.1	-0.2	-0.1	-0.1	0.35
5623.41	0.0	0.0	-0.1	-0.1	0.1	0.35
5956.62	-0.1	0.1	-0.1	-0.2	0.2	0.35
6309.57	0.3	-0.3	0.0	0.3	-0.3	0.35

Frequency, Hz	0 ° Free Field Response dB	0° Free Field Correctons ¹ dB	Effect of Windscreen dB	Windscreen on 824, 0 ° Free Field dB	0 ° Free Field Corrections with Wind Screen on 824 dB ¹	Expanded uncertainty of Corrections @95% dB
6683.4	0.5	-0.5	-0.2	0.3	-0.3	0.35
7079.46	-0.1	0.1	-0.2	-0.3	0.3	0.35
7498.94	0.1	-0.1	-0.3	-0.2	0.2	0.35
7943.28	0.5	-0.5	-0.5	-0.1	0.1	0.40
8413.95	0.2	-0.2	-0.4	-0.2	0.2	0.40
8952.51	0.5	-0.5	-0.3	0.2	-0.2	0.40
9440.61	0.7	-0.7	-0.5	0.2	-0.2	0.40
1000.00	0.7	-0.7	-0.3	0.5	-0.5	0.45
10592.54	0.5	-0.5	-0.6	0.0	0.0	0.45
11220.18	0.7	-0.7	-0.4	0.3	-0.3	0.45
11885.01	0.7	-0.7	-0.8	-0.1	0.1	0.45
12589.25	0.6	-0.6	-0.6	0.0	0.0	0.50
13335.21	0.1	-0.1	-0.6	-0.5	0.5	0.50
14125.38	0.3	-0.3	-0.7	-0.4	0.4	0.50
14962.36	0.8	-0.8	-0.8	0.0	0.0	0.50
15848.93	1.3	-1.3	-1.0	0.3	-0.3	0.60
16788.04	1.2	-1.2	-1.0	0.2	-0.2	0.60
17782.79	0.9	-0.9	-0.8	0.1	-0.1	0.60
18836.49	0.7	-0.7	-0.7	0.0	0.0	0.60
19952.62	0.5	-0.5	-1.0	-0.5	0.5	0.75

¹ Add numbers in this column to levels read on the 824 to correct the level at a specific frequency

Periodic Testing of A-Weighted Sound Levels

The following table presents adjustment data to be used to determine A-weighted sound levels equivalent to the response to plane sinusoidal sound waves incident from the reference direction produced by a calibrated multi-frequency sound calibrator and an electrostatic actuator.

Frequency, Hz	0 ° Free Field Corrections from B&K4226 Calibrator ¹ dB	0 ° Free Field Corrections with Wnd Screen from B&K4226 Calibrator ¹ dB	0 ° Free Field Corrections from B&K UA0033 Electrostatic Actuator ¹ dB	0 ° Free Field Corrections with Wnd Screen from B&K4226 Calibrator ¹ dB	Expanded uncertainty of Corrections @95% confidence, dB
31.62	0.1	0.1	0.0	0.0	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	0.1	0.1	0.0	0.0	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	-0.2	-0.1	-0.1	0.1	0.30
3981.07	1.3	1.3	1.3	1.3	0.35
7943.28	3.1	3.1	3.6	3.7	0.40
12589.25	6.0	6.0	6.4	6.4	0.50
15848.93	8.2	7.9	7.8	7.5	0.60

¹ Add numbers in this column to levels read on the 824 to correct the level at a specific frequency

A-Weighted Sound Levels at Upper and Lower Limits of the Linear Operating Range

The following table presents the nominal A-weighted sound levels at the upper and lower limits of the linear operating ranges for each level range. The starting point for testing the level linear errors of the reference range is 114 dB.

	31.5 Hz	1 kHz	4 kHz	8 kHz	12.5 kHz
SLM (ISM)					
Normal Range	63 dB to 128 dB	19 dB to 128 dB	18 dB to 128 dB	21 dB to 128 dB	26 dB to 128 dB
Low Range	59 dB to 108 dB	18 dB to 108 dB	18 dB to 108 dB	19 dB to 108 dB	22 dB to 108 dB
SLM&RTA (SSA)					
0 dB Gain	83 dB to 128 dB	43 dB to 128 dB	43 dB to 128 dB	47 dB to 128 dB	49 dB to 128 dB
10 dB Gain	73 dB to 118 dB	33 dB to 118 dB	32 dB to 118 dB	35 dB to 118 dB	39 dB to 118 dB
20 dB Gain	64 dB to 108 dB	24 dB to 108 dB	23 dB to 108 dB	25 dB to 108 dB	29 dB to 108 dB
30 dB Gain	58 dB to 98 dB	19 dB to 98 dB	18 dB to 98 dB	20 dB to 98 dB	23 dB to 98 dB
40 dB Gain	58 dB to 88 dB	18 dB to 88 dB	17 dB to 88 dB	19 dB to 88 dB	22 dB to 88 dB
50 dB Gain	58 dB to 76 dB	18 dB to 78 dB	17 dB to 78 dB	19 dB to 78 dB	22 dB to 78 dB

Electrical Signal Input Device:

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 testing by attaching the included short on the front of the ADP005.

Inherent Noise:

The inherent Noise on the low range in ISM mode or 50 dB gain in SSA mode:

Frequency Weighting	Total Noise ¹	Electrical Noise ²
A	16	7
C	19	13
Flat	24	21

¹ Combination of electronic and 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 adaptor in place of the microphone

Maximum Sound Pressure Level:

The highest sound pressure level the Larson Davis 824 is designed to accommodate at the level of overload is 128 dB. The peak-to-peak voltage at this level is 6.25 V_{pp} input through the ADP005.

Power Supply Voltage Range:

The battery power supply voltage range for which the System 824 conforms to this standard is 2.3 to 4.8 volts.

The System 824 will shut down if the battery is below 2.3 volts when used with alkaline batteries and below 3.3 volts when used with NiMH batteries.

Display Device

The display device will display all levels over the entire linear operating range on all ranges.

Stabilization Time Following Changes of Environmental Conditions:

The typical time interval needed to stabilize after changes in environmental conditions is as follows:

- For a temperature change of 5 °C, the time is 30 minutes
- For a static pressure change of 5 kPa, 15 seconds
- For a humidity change of 30% (non-condensing), 30 minutes

Electric Field Strength Above 10 V/m:

The Larson Davis model 824 was not tested for field strengths greater than 10 V/m.

Greatest Radio Frequency Emission Levels:

NOTE: For the specification of emission of and susceptibility to, radio frequency fields, the System 824 is classified as group X sound level meter.

The mode of operation of the 824 that produced the greatest radio frequency emission levels was with the 824 set to ISM mode and with an EXA010 (10' microphone extension cable) used to connect the PRM902 to the 824. All ranges were the same. Radio frequency emission in other modes

(LOG and SSA) are the same. Adding the RS232 cable did not increase the radio frequencies emission levels.

Effect of Electrostatic Discharges

The System 824 is not affected by electrostatic discharges.

Greatest Susceptibility to AC Power and Radio Frequency Fields:

The mode of operation of the 824 that produced the greatest susceptibility to A.C power frequency and radio frequency fields was with the 824 set to ISM mode, RS232 cable attached and with an EXA010 (10' microphone extension cable) between the PRM902 and the 824.

G

Miscellaneous Information

This appendix contains additional information about the 824 in the form of questions and answers.

Question #1

How can I delete the Instrument Definitions (ID) in the Setup menu that are labeled permanent?

Answer

There are ten permanent IDs that come with the 824 that are the factory default settings for the various instruments in the 824. They are there as a starting point from which to make your own Setups and cannot be deleted. Modify each one that you need and then save that ID with your own unique name.

You may test drive or demo any of the non-purchased permanent SETUP options. Up to 20 demos are available if the instrument is reset (press RESET > Reset Options > Purge All Data Files). Data cannot be stored, downloaded or printed but may be viewed on the display.

You can, however, separate the permanent IDs from your own custom IDs with a special ID whose name is all underscore characters. Your setup menu could look like this:

You can have as many as 50 custom SETUPS besides the 10 permanent setups.

1)	Slow-A	ISM	Integrating SLM set to Slow A weighted SPL
2)	Fast-C	ISM	Integrating SLM set to Fast C weighted SPL
3)	My	ISM	Integrating SLM with my personal preferences
4)	My	SSA	Customized SSA with my personal settings
5)	5s_Hist	SSA	SSA with time histories set for 5 seconds
6)	_____	ISM	(dividing line setup, not used otherwise)
7)	p SLM&RTA	SSA	
8)	p SLM	ISM	
9)	p AudTest	AUD	
10)	p demo	LOG	
11)	p ROOMS	RTA	
12)	p FFT	FFT	
13)	p Logging	LOG	
14)	p RT60B	RTA	
15)	p TA-LARM	TAL	
16)	p RT60-A	RTA	

Menu items 1 through 6 are custom IDs. Note that for ID number 6 underscores were used as a separator to put a break in the list between the permanent settings and the user setting. The list is sorted by what is used most often so if a permanent ID is used it will be seen above the line. In other words, the IDs that are used most often float to the top of the list and those that are not used sink to the bottom.

Hint: *To make the underscore filename easily, do the following:*

1. Recall an ISM instrument (or any other ID as desired).
2. Press SETUP and highlight the top line, “Edit Settings”, and press the TOOLS key.
3. Highlight the top line, “Save ID”, and press the check key.
4. A window pops up labeled “ID Name”.
5. Press the RESET key to clear the old name.
6. Push the right arrow key seven times to get to the last name character.
7. Press the down arrow key about eleven times until the underscore character is showing.
8. Press the check key.
9. Now recall all of the IDs that you want to be above the separator line.

Question #2

What is the power or current drawn by the 824 through the external power jack?

Answer

Here is a sample of external power expectation showing both wattage and current:

		Off	Stopped	LOG Running with backlight OFF	LOG Running with backlight ON	SSA Running with backlight OFF	SSA Running with backlight ON
Power Not Charging		0.012 W	0.96 W	1.28 W	1.73 W	1.72 W	2.21 W
Power Charging		N/A	2.25 W	2.53 W	3.05 W	3.00 W	3.50 W
Current Not Charging	15 V	0.9 mA	65 mA	85 mA	118 mA	116 mA	150 mA
	12 V	1.1 mA	80 mA	107 mA	144 mA	143 mA	184 mA
	9 V	1.3 mA	105 mA	137 mA	191 mA	189 mA	243 mA
Current Charging	15 V	N/A	65 mA	85 mA	118 mA	116 mA	150 mA
	12 V	N/A	80 mA	107 mA	144 mA	143 mA	184 mA
	9 V	N/A	105 mA	137 mA	191 mA	189 mA	243 mA

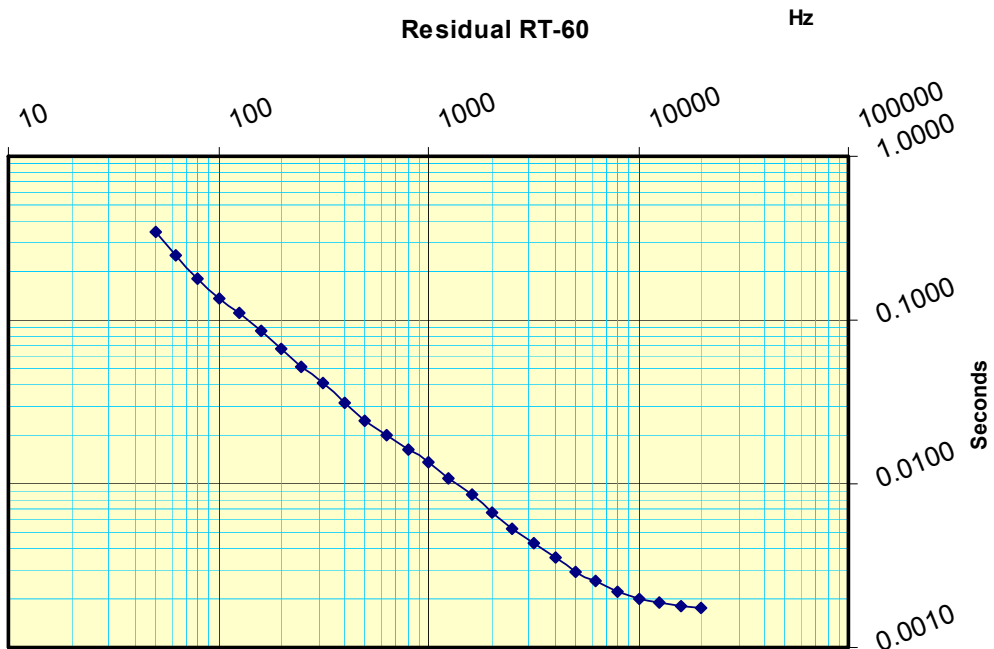
NOTE: Current (milliamperes) draw varies with voltage while the power consumed (watts) is constant.

Question #3

What is the minimum RT-60 that can be measured with the 824 RTA?

Answer

The graph on the next page shows the minimum RT-60 that can be measured. This is also called the “Residual RT-60” and is a function of the 1/3 octave filter response times.



Question #4

What does “**Start Level**” do as found in the SSA and LOG instruments’ “Ln” settings menu?

Answer

The “Start Level” setting indicates where the histogram table from which Ln data is calculated begins. The table only has a range of 128 dB yet the 824 can measure over a 150 dB range when the Gain or Range settings are considered. The default value for “Start Level” is 15 dB and provides Ln data and SPL histograms from 15 dB up to 142.9 dB.

“Start Level” is also used with the main weighted Leq in the Time History. Due to internal data encoding, the range is limited to 127 dB and uses “Start Level” to determine the desired measurement range. Since the time history is a data logging function and the likelihood of changing the Gain or Range setting is slim, this is sufficient range. The other

Advanced Time-History levels do not have such restrictions. Since you can select the main Leq to be A-weighted and also enable another A-weighted Leq (TWA indication in 824 Utility) the two levels will be identical except when the main Leq is limited by “Start Level”. When set to 15 dB the lowest time-history Leq will be 16 dB due to the fact that the lowest value byte (0) is used as a delimiter in the data structure.

What is a good value to set “Start Level” to? 15 dB is a good value for most applications since it is just below the thermal noise rating of most condenser and pre-polarized microphones. If you need to measure lower and have a transducer with a lower noise floor, then reduce the value to just below or at the noise floor. If you are measuring levels that may be above 143 dB then you will want to raise “Start Level” to a higher value (a 1/4” microphone can measure upward of 160 dB so a “Start Level” of 35 dB will give a range of 35 dB up to 162.9 dB).

Question #5

How are Leq values calculated in the 824 and how is that different than traditional non-DSP (Digital Signal Processor) instruments.

Answer

First let's look at the tradition instrument and then the DSP instrument.

In mixed analog/digital instruments (such as the LD 870 or 820, or the B&K 2236 or 2238) Leq is calculated by sampling and integrating the output of a True-RMS detector circuit that has an exponential time constant (generating a voltage proportional to SPL with the Slow or Fast response) with an ADC (Analog to Digital Converter). That sample rate is many times per second to ensure accurate Leq readings. If an Leq time-history is taken in this type of instrument, and the storage rate is fast enough, you will see that the Leq will not decay any faster than the detector rate of the SPL it is sampling.

New DSP based sound level meters do not have the analog detector, but rather detect the SPL and Leq digitally by sampling at a rate that is double the highest desired frequency (Nyquist) and then processing the waveform. The System 824 uses a sample rate of 51,200 samples per

second. The Leq detector and the SPL detectors can be totally isolated without any additional circuitry (the cost to do this with analog circuitry would be very prohibitive). So what is an Leq? It is the energy average of a signal over a period of time. Now with separate digital detectors, the Leq does not have to exhibit the decay of the SPL exponential detector but can be true to its definition. That means that if an Leq time-history is taken in this type of instrument, you will not see any SPL decay effects.

Is this good or bad? It is different more than good or bad, but there are benefits from that difference.

Good: Many scientists feel that this is good because Leq time-histories show the true dynamics of the signal without the residual decay effects of an exponential detector. For example if you measure a sonic boom with a fast Leq time-history, it can show the two impulses of the 'N' wave and possibly even an echo or two. On the other hand, the older instruments will show one pulse that may take upward of 20 seconds to return to the background level.

Bad(?): If you are comparing data from traditional instruments it is important to be aware of this phenomenon, but it is not necessarily bad. If the Leq values being compared are of long duration (one minute or longer) then there is little blur caused by the exponential detectors of the older instruments and the data are very comparable.

Question #6

If I choose to save C-weighted SPLs every two seconds in the LD824's Time-History, what am I getting?

Answer

You get the instantaneous SPL at the end of the two-second period.

Question #7

How does this compare with C-weighted Leqs?

Answer

The Leq is the true equivalent level for that two-second period as if the signal level were constant amplitude.

Detailed Explanation:

So what's the difference between sampled SPL and an Leq for the same period? It depends on whether you are using

fast or slow SPL and the dynamics of the signal, of course, but the concept is still the same. It all goes back to your statistics classes and sampling theories. For an integration to be accurate, it must sample the data sufficiently fast enough so that the errors are minimized for a given data variability. Thus for fast, the amplitude variability is greater so the sample rate must be faster.

Inside the 824 we sample fast enough that the integration is always accurate and gives you the Leq data at the time period desired, i.e. all the energy received for that Leq period is contained within the Leq. The old instruments sampled the SPL detectors and integrated the sample number, so they had to sample them pretty quickly (32 samples per second for the LD 820 & 870).

You indicated that you are looking at a C weighted (the frequency weighting doesn't matter) SPL sampled every two seconds. The worst case error between the Leq and the SPL is with an Impulse whose onset is immediately after a sample has been taken. The decay for Slow is about 4dB per second and fast is 8 times faster at 32dB/s. In two seconds the next sample will read 8dB below that maximum for Slow and 64dB below the maximum for Fast. Mind you that this is worst case. You can plug that sawtooth waveform into a calculator and do an integration to get the Leq, but you see that there can be a great difference potentially. For example if the impulse had a max of 108dB and the sample two seconds after the max was 100dB the Leq would be 105.6 dB; the SPL would be 5.6dB lower than the Leq would be for that worst case signal.

In the real world we do not get that type of signal too often. Lightning might be the closest thing to it. Statistically the confidence can be determined. The timing of these pulses will not fall so precisely with the sampling and there are not such narrow impulses that can form this sawtooth waveform, so we do not see that much error in reality.

Question #8

What is the difference between the Max and Peak level that can be stored in the LD824's Time-History? What is the relationship of SPL, Leq, Max and Peak?

Answer

For further information, see Appendix D on page D-1 and the preceding Question.

SPL is the instantaneous Slow, Fast or Impulse sound pressure level as defined by in the ANSI S1.4 and IEC 651 standards. They are true-RMS (root-mean-squared) levels. The "detector time constant" for Slow is one second and for Fast it is one-eighth of a second. The "detector time constant" for the Impulse detector is 35ms with a fixed decay time of about 3dB per second.

The Leq is the energy average of the waveform encountered during the duration of the time-history period.

The Max level is the maximum SPL obtained for the selected detector during the duration of the time-history period.

The Peak is the instantaneous maximum amplitude of the incoming waveform encountered during the duration of the time-history period. The peak of a continuous sine wave is 3dB higher than its RMS or SPL value.

Question #9

Is it possible to control the 824 'Run' and 'Stop' from an external signal (example 0 to 5 volt)?

Answer

Yes. The Logic Input line on the control connector at the base of the 824 can be set to control the Run/Stop of the instrument. This input takes a zero to five volt digital signal and performs the function selected by the Logic-In setting found in the Controls menu (SETUP > Edit Settings > Controls > Logic-In).

When set to Toggle it works just like the Run/Stop key. You can connect a momentary push-button switch from the five volt wind direction power (pin 6) to the logic input control line (pin 3).

When set to Level it forces the unit to be in run mode when the logic input is high (+5 Volts) and forces a stop when it is low (0 Volts). You can connect a toggle switch from the wind direction power (pin 6) to the Logic Input (pin 3) the 824 will run when the switch is ON and be stopped when the switch is off. Note: The Level setting will override the Run/

Stop key on the instrument and the M3 & M4 I/O commands!!!

The 9-PIN Miniature DIN connector needed can be purchased at www.digikey.com as P/N CP-2090-ND.

Question #10

What is the key sequence to perform a User Reset?

Answer

By holding down the RESET, the CHECK and the POWER keys simultaneously to turn the 824 on will activate a User Reset. This User Reset will perform a complete memory test, reset all data, erase all user setup IDs (Instrument Definition or setup file) and recall from EEPROM one SSA, one LOG and one ISM setup ID. These three setup ID are created from the Tools > Memory > Create EEPROM Backup menu item. You may want to perform a User Reset if the settings stored in the memory of the 824 have become corrupted. A User Reset is performed whenever the firmware is upgraded. It advisable to make archive copies of all setup IDs using 824 Utility software regularly.

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