System 814

User Manual

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System 814 Serial # ______________________
Microphone Model ______________________
Microphone Serial # ____________________

Index

CHAPTER

1 Introduction

Welcome to the Larson•Davis System 814. This versatile instrument, with graphic display, performs the functions of several instruments. It is a simple “point and shoot” Sound Level Meter (SLM), an integrating SLM with data logging, and an Octave Band Analyzer (OBA) with automatic scanning. Although many users discover the features and operation of the System 814 by glancing at its keypad, we invite you to read this manual to get the most out of your new Larson•Davis sound level meter.

About This Manual

This manual has 5 chapters and 3 appendices covering the following topics:

Chapters

- Chapter 1 - Introduction*:* overview of this user manual and the System 814’s features, functions and measurement capabilities; unpacking the System 814; quick start procedures.
- Chapter 2- Reference*:* overall system setup; description of each key along with its function and displays; working with menus.
- Chapter 3- OBA (octave band analyzer): Setting up, viewing displays, and using the OBA.
- Chapter 4- sSLM (simple sound level meter): Setting up, viewing displays, and using the sSLM.

- Chapter 5- ∫SLM (data logging sound level meter): Setting up, viewing displays, and using the ∫SLM.

Appendices

- Appendix A - System Layout*:* layout of instrument menus and displays.
- Appendix B - Integrated Level Calculations*:* basic and SEL calculations, dose and projected dose calculations.
- Appendix C- Technical Specifications*:* listing of acoustic, electronic, environmental, and physical characteristics of the System 814.

About This Chapter

Specifically, this introductory chapter covers the following topics:

- Formatting Conventions: explanation of the fonts and other formatting conventions used in this manual.
- Features*:* overview of the System 814 keypad, functions and measurement capabilities.
- Getting Started*:* instructions for unpacking, inspecting and initially assembling the System 814.

Formatting Conventions

This manual uses the following format conventions:

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

There are four steps to setting up the sSLM instrument:

1) Go to the *Setup menu*. 2) Select the SIMPLE SSM. 3) Return to the *Setup menu*. 4)Then enter the *Settings menu*.

SSM indicates that the ID is a simple Sound Level Meter setup

Information or messages that are shown on the System 814's LCD display are shown in a bold sans serif font. For example:

…as indicated by a "**Calculating**" status message.

Keys to press on the System 814 are shown in a font representing the appropriate key. For example:

Press the ⏻ key

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

Detector **[Slow]**

Features

The Larson•Davis System 814 has the following features: general, OBA, simple SLM, and logging SLM.

General

- Large backlit true bitmapped graphics display
- Soft rubber backlit keys
- Pop-up menus with scroll bars
- Pick and choose setup...just click and run!

- Three instruments in one: simple sound level meter, octave band analyzer, and data logging sound level meter

- File management system (stores multiple measurements)

- Type 1 precision integrating sound level meter (satisfies IEC 651-1979, 804-1985, draft standard IEC 1672 and ANSI S1.4 1983) with optional integrated, autoscanned 1/1 and 1/3 octave filters

- Exceptionally large dynamic range (up to 110 dB)

- Slow, Fast, and Impulse RMS detectors

- Dual Peak detectors

- Standard memory (256 KB) sufficient to store:
  - 6,564 1/1 octave spectra
  - 3,200 1/3 octave spectra
  - 5,688 simple SLM snapshots
  - 7,529 intervals without L_n
  - 4,923 intervals with L_n
  - 240,000 point time history

- Optional memory:
  - 512 KB (814 OPT-90 - .5)
  - 1.25 MB (814 OPT-90 - 1)
  - 2.0 MB (814 OPT-90 - 2)

- AC output with gain control: -6 to +20 dB

- DC output

- Flash memory for in-field firmware upgrades

- Environmentally friendly low power usage battery with life up to 40 hours

- Multi-tasking real-time operating system: continue to measure while viewing, transferring, or printing data

- RS-422 serial 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

OBA Features

- Automatic filter scanning
- Live, current, and overall spectra graphs
- Interval history of spectra
- Filter sets:
  - 31.5Hz to 8KHz, octave and filters (814 OPT-30)
  - 31.5Hz to 16KHz octave and filters and 25Hz to 20 KHz one-third octave filters (814 OPT-31)

Simple SLM Features

- Quick on-screen setting adjustment
- Back-erase (up to 50 seconds)
- Snapshot memory (Snapshots of data stored to memory)

Logging SLM Features

- Overall SLM
- Current SLM, resetable for making spot checks during measurements
- Functions measured: SPL, Lmax, Lmin, Lpeak I, Lpeak II, TWA, SEL, elapsed time, start time, end time, six Ln values (0.01 to 99.9%), time stamps for single events (Lmax, Lmin, etc.).
- Interval statistics history (includes 6 Ln values)
- Time history
- Ln statistic graph (1 to 99%)
- Printable distribution and cumulative histograms

Overall & Current measurements

- Contains two independent data buffers (primary and secondary)
- Primary buffer contains data referred to as the "overall" measurements
- Secondary buffer contains data referred to as the "current" measurement

System 814 Components

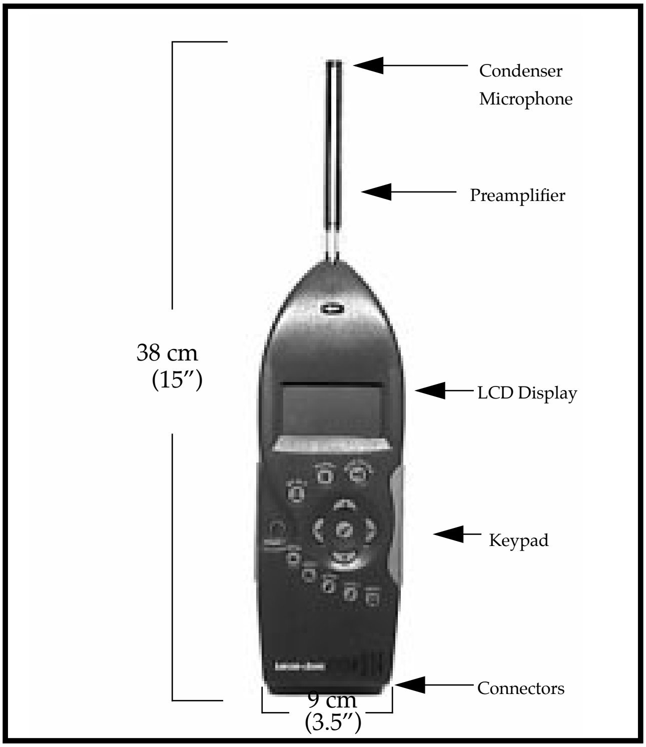


Figure 1-1 *System 814.* The System 814 is a convenient hand-held sound level meter with a simple user interface.

The standard System 814 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 output gain control, AC/DC output, control, serial, and external power connectors (shown in figure Figure 1-2)
- True "hand held" instrument with "sure grip" pads
- Sealed to prevent electrical shorts due to weather

Figure 1-2 ***System 814 Connectors.*** The System 814 has a series of connectors located at the bottom of the device consisting of an AC and DC output connection, AC output gain adjustment, control connector, serial interface connector, and external DC power connector.

The following is a layout of the control connector, serial connector and the AC/DC output connector:

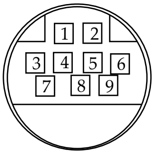


Figure 1-3 ***Control Connector:*** The control connector is a 9 pin mini DIN connector.

1 - Ground, Control
2 - Logic output (0 to +5 volts, active high)
3 - Logic input (0 to +5 volts, active high)
4 - Wind speed input (.05 to 10 volts AC peak to peak)
5 - Wind direction A:D input (0 to +5 volts DC)
6 - Wind direction power (+5 volts DC through 250 ohms)
7 - Calibrator control output (0 or +5 volts DC)
8 - Heater control output (open collector, +50 volts DC max, - .3 DC min 100mA)
9 - External power Input/Output (+8 to +15 volts DC)

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

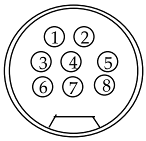


Figure 1-4 ***Serial Connector:*** The serial connector is an 8 pin mini DIN connector (AppleTalk ™ compatible pinout).

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)

The AC/DC output connector is used to output the signal from the System 814 microphone to external devices such as DAT recorders, other sound level meters, or other sound/vibration equipment.

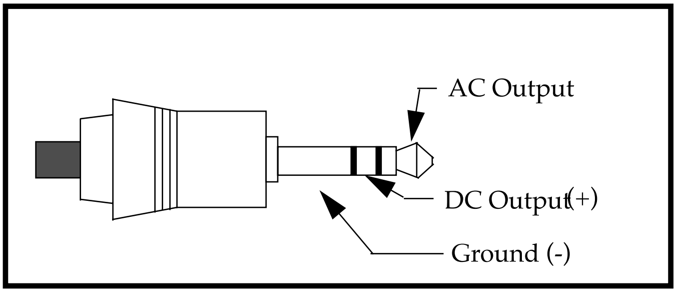


Figure 1-5 ***AC/DC output connector***

System Diagram

Figure 1-6, which follows, illustrates the acoustic-to-digital signal path in the System 814. As you can see, incoming sound is first converted to an electrical signal by the microphone. This electrical signal is filtered, detected (true RMS detector) and in turn 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 32 Hz).

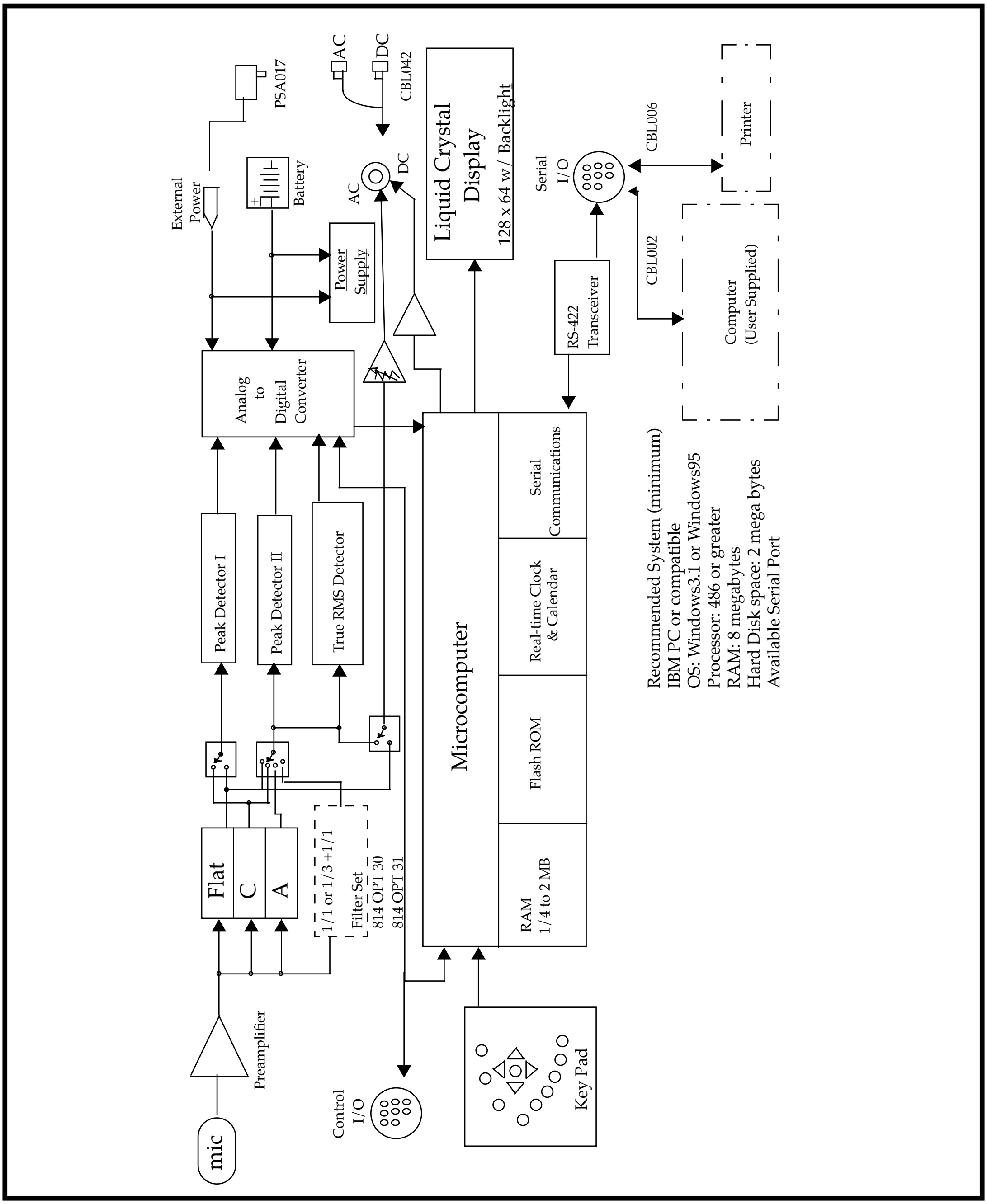


Figure 1-6 ***System Diagram.***

Overall and Current Measurements

The System 814 contains 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.

When a new measurement is initiated, the data in the "overall" and "current" buffers will be identical until the "current" buffer is reset. Following the reset, the data in the "current" buffer represents a new measurement originating at that instant while the "overall" buffer continues with the original measurement.

Getting Started

This section outlines the steps to follow when you first receive and unpack the System 814. The following topics are covered:

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

You will then be ready to use the System 814 for actual measurements.

Unpacking and Inspection

Your System 814 has been shipped in protective packaging. Please verify the package contents with the following list (Accessories and Optional Equipment) and retain the shipping containers for safe shipment at a future date. Report any damage or shortage immediately to Larson•Davis, Inc. at (801) 375-0177.

If you have not already done so, please record your instrument's serial number (located on the label on the back of the System 814), the microphone model and serial number (located on the inside ring of the microphone, and on the side of the pre-amplifier), and the purchase date at the beginning of this manual (see the copyright page). You may be asked to give this information in any future communications you may have with Larson•Davis, Inc.

Accessories and Optional Equipment

The System 814 is delivered with the following *standard* accessories:

- System 814 instrument
- Model PRM904 microphone preamplifier
- Air condenser microphone
- Alkaline batteries, 3 x AA 1.5 volt
- 3″ diameter windscreen (L•D # WS001)

Wind noise can adversely affect measurements. Using the windscreen on the microphone reduces wind noise and protects the element from dust and bumps.

- User manual (L•D #I814.01)
- Serial cable to computer (L•D # CBL006)
- Serial cable to printer (L•D # CBL002)
- AC/DC out cable 1/8″ miniphone to dual BNC (L•D #CBL042)
- AC power adapter (US only) 115 volts AC to 9 volts DC (L•D # PSA017)
- Hard case 15″x19″x7″ (L•D #CCS001)
- 814 utility software (Windows™)

The following *optional* equipment is also available:

- CAL200 Sound Level Calibrator (IEC 942-1988 Class 1L)
- CAL250 Sound Level Calibrator (IEC 942-1988 Class 1L)
- Outdoor preamplifier (L•D # PRM2101)
- 20 foot microphone extension cable (L•D # EXL020)
- Direct BNC microphone input adapter (L•D #ADP005)

Connecting Internal or External Power

To insert the three AA batteries in the System 814, unscrew the battery cover at the back of the System 814 by hand or using a flat blade screwdriver. Insert the batteries so that the markings in the battery compartment match those found on the batteries. For greatest battery life use alkaline AA batteries. (Refer to the key description in *Chapter 2* and *Appendix C* of this manual for additional battery information.)

WARNING! Inserting the batteries incorrectly can cause damage to the unit!

Figure 1-7 ***Internal Battery Source.***

If the System 814 is not being used for long periods of time (3 months or more), it is recommended that the batteries be removed to avoid damage to the instrument.

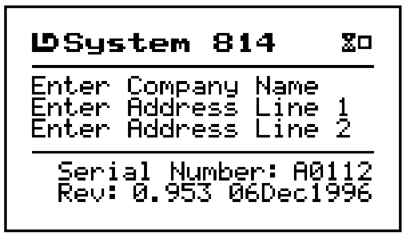
Alternatively, you may use an external power source via the external power connector using the provided power adapter. The System 814 accepts 8V to 15V DC and is internally fused at 0.5 A.

Quick Start

This section will help you turn on the System 814 (Step 1), check the battery level (Step 2), calibrate the instrument (Steps 3-5), activate a specific instrument definition ID (Steps 6-7), take a sample reading (Step 8), and finally turn off the instrument.

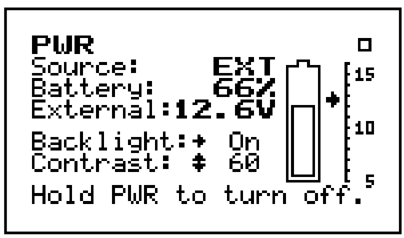
This screen displays three lines of user information which may be defined as name and address settings. This display also shows the serial number of the instrument and the firmware version and date. The System 814 then loads the last instrument definition (ID) selected.

Step 1 Turn on the System 814. To do this, press the ⏻ key (located on the left portion 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:

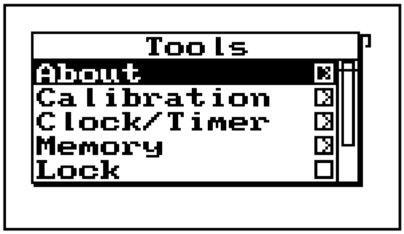


This screen shows you the current power source, battery level, and external power voltage.

Step 2 Check the battery level. After the System 814 is turned on, you can check the battery level. To do this, press the ⏻ key again. The following screen appears:

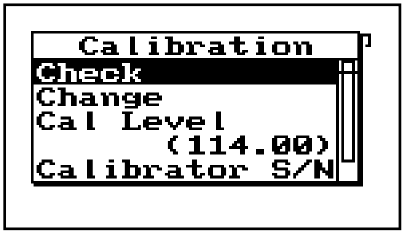


Step 3 Calibrate the instrument. To do this, press the TOOLS key. The following menu appears:



Press the key to edit the Calibration settings.

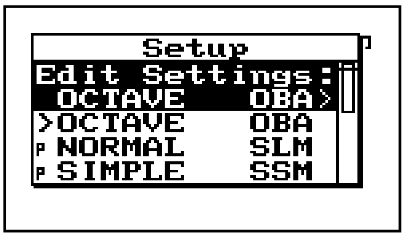
Step 4 Using the key, highlight the *Calibration* menu item, then press the key. The following screen appears:



If you select 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.

Step 5 Using the key again, highlight the *Change* menu item. Press the key to accept the *Calibration* settings. Activate the calibrator (*optional equipment)* and follow the on-screen instructions.

Step 6 Activate an instrument ID. To do this, press the SETUP key and the following *Setup* menu screen appears:

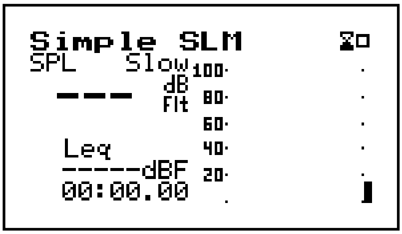


You may be prompted at this time to save the last ID used or data.

If this is your first time using the System 814 and you have not set up any ID's, or have not taken any readings, select "no" if prompted to save last ID or to save data.

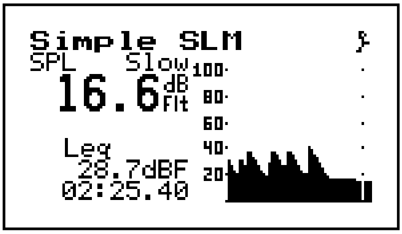
The Simple Sound Level Meter is now ready to use.

Step 7 Using the or keys, highlight the "SIMPLE" ID (SSM). Then, press the key to select it. The following screen appears:



Step 8 Take a sample reading. To take a sample reading press the RUN/STOP key to start taking measurements. A screen similar to the following appears:

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



Let the instrument continue to take measurements for about three minutes.

The instrument shows a black box symbol (upper right had corner) when the instrument is stopped and not taking measurements.

Step 9 Press the RUN/STOP key again to stop the instrument.

Step 10 Turn off the instrument. To do this, press and hold the key until you are prompted to release it. The instrument then turns off.

Environmental Considerations

The System 814 sound level meter can be used and stored in a wide range of temperatures, which are free of moisture and condensing humidity conditions. However, common-sense precautions should be taken. For example, allow the System 814 ample time to adjust to abrupt temperature changes. Condensation may form inside a cold instrument if it is brought into a warm room or vehicle and may persist long after the outside case has adjusted to the ambient temperature.

Temperatures inside closed vehicles can also reach excessive levels. *Therefore, do not leave the instrument in direct sunlight in a vehicle.* A simple safeguard is to keep the instrument inside its sealed foam insulated case with desiccant silica gel, available at photographic equipment stores.

CHAPTER

2 Reference

This chapter contains information on the functions which are accessed through the System 814 keypad (see Figure 2-1 below):

Figure 2-1 ***System 814 Keypad.***

The 14 keys on the System 814 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 814.

Measurement Keys

RUN/ STOP	Begins and ends measurements.
PAUSE	Pauses readings.
RESET	Resets data. (Current, Overall, Options, etc.)

Navigation Keys

lr ARROW	Used to move through System 814 menus and change settings.
SELECT	Selects highlighted menu items (like a button on a mouse), concludes data entry (like the Enter key on a PC key-board) and activates context specific menus (called *Check* menus).

Control Keys

VIEW	Changes views in sSLM, OBA, or ∫SLM modes. Selects data to view.
DATA	Displays the *Data Files* menu.

SETUP	Displays the *Setup* menu. Allows you to view and change system modes and configurations within a chosen mode.
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.

The functions and displays associated with the above keys are next described. In addition, relevant reference material is included for parameters and options which may be available for keys on the System 814 keypad.

NOTE: The reference information in this chapter is organized according to functions, rather than by tasks (which can use several functions). We therefore invite you to also read the tasks which are outlined in Chapters 3-5 of this manual.

Power Key

The purpose of the POWER key on the System 814 is to turn the power on or off, exit and close menus, and display the remaining battery life. Once the System 814 is turned on, pressing the key again will activate a *PWR* display which allows you to 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:

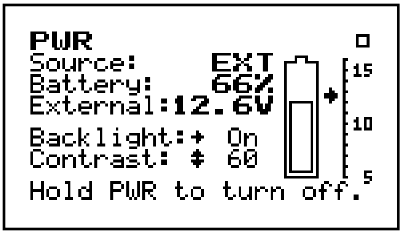
Step 1 Press the key.

Step 2 Allow the instrument to stabilize (warm up) as indicated by the hourglass symbol in the screen's upper right hand corner.

Step 3 After the instrument has finished stabilizing (as indicated by the black box symbol in the screen's upper right hand corner), the System 814 is ready for operation.

After the System 814 is turned on, you can view the battery life and display settings through the *PWR* display. To do this:

Step 4 Press the key so the following *PWR* display appears:

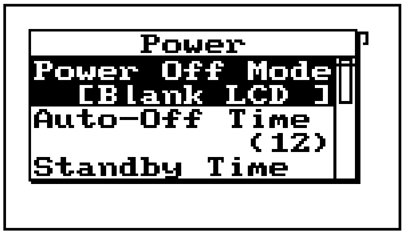


a. *Pressing the key again will return you to the previous display.*

b. *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.*

This simple display indicates that the System 814 is not plugged into an external source which is 0.0 volts; the battery is 66% full; the backlight is off; and contrast is at 60%.

Step 5 From the *PWR* display, you can adjust the *Power* setting. To do this, press the key. The following *Check* menu appears:



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

b. *Using the* or *arrow keys, select the desired menu item then press the key to make changes to the setting.*

This 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
- 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.

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 seven options:

Menu Items	Available Settings Options	Description
Power Off Mode	Blank LCD Auto Off Manual Off	Blank LCD - The instrument LCD display will turn off as well as the serial communication port after the keyboard and serial port have been inactive for the period of time set by the “Standby Time” option. Auto Off - If the instrument is stopped with no reports printing, and the instrument remains inactive for the period of time set by the *Auto-Off Time* setting (i.e with no serial interface commands or key presses), the instrument will turn off. Manual Off - No automatic power reduction features are enabled.
Auto Off Time	0 - 99 minutes	Time (in minutes) when “Auto Off” power save is activated. When activated, the System 814 powers down.
Standby Time	0 - 99 minutes	Time (in minutes) when “Standby Time” power save is activated. When activated, the System 814 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.
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%	Adjusts the 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	Allows the user to select the source of power consumption, either AC or battery. AC Pwr - Indicates that the external power source is not a battery. In this mode, if the external voltage is less than the internal battery voltage, then the internal batteries will supply power for the instrument. Battery - Indicates that the external power source is a battery (which should not be allowed to deep-discharge).

Extra Notes on Power Conservation

If you are using an external power supply, rather than a battery, the ⏻ key will display the constant voltage coming from the power supply. The System 814 can operate for approximately 40 four hours when it is running from new alkaline batteries. The instrument can be set to conserve the internal batteries for memory retention only if it is to be powered by an external power source by setting *Ext Power* to [Battery]. If the external supply ever drops below the voltage set by the *Cut Off Volts* setting, or reverts to internal battery, the unit stops and turns off. This cut-off voltage is usually set to 10.8V which is the lowest voltage recommended for 12V sealed lead-acid batteries. Discharging batteries deeply will greatly shorten their service life.

Run/Stop Key

Use the RUN/STOP key to toggle the data taking 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 symbol if the instrument is running, or a black box symbol if the instrument is stopped.

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 both the current and overall measurements and the respective integrated levels (time weighted averages) will represent data measured since the last reset.

NOTE: The System 814 contains 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.

Reset Key

Use the RESET key to clear out the data of the current measurement.

Pressing the RUN/STOP key after beginning a measurement will stop the measurement, then restart it without resetting the data buffer. 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 the data including the accumulated measurement values such as L_{eq}.

NOTE: The System 814 contains 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.

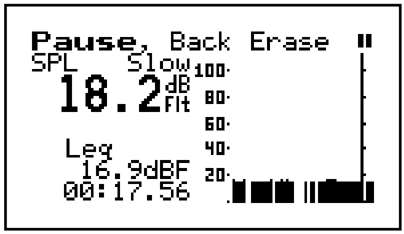
For the other instrument types, the System 814 gives additional flexibility when resetting the data. If you press the RESET key while the instrument is running, the instrument will reset its data buffer for the current measurement (i.e. the secondary SLM) and set the elapsed time for the current measurement to zero without affecting the data in the overall buffer.

On the other hand, 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, the overall data, or both current and overall data together with the appropriate elapsed time counters.

When editing system or instrument settings containing a string of 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

Use the PAUSE key to pause the measurement of acoustic data. It is used to hold a displayed value or prevent some undesired sound from affecting the measurement. In the sSLM mode, you can use pause to extract the last measured data (up to 50 seconds) by moving the cursor back in time on the graph, to remove contaminated data. This can be accomplished in the *Pause, Back Erase* screen. To activate this screen, press the PAUSE key when the instrument is running or actively taking measurements. The following screen appears:

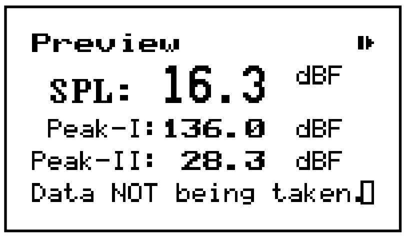


Moving the bar left is like moving back in time.

Use the and arrow keys to move the vertical bar across the graph. As the vertical bar moves, the SPL value from the time history display is shown digitally on the left of the screen. Once it is at the desired point, press the key to continue.

Like the “stop” command, a “pause” ignores incoming signals; however, unlike the stop command, when a “pause” changes to the “run” command, the instrument does not begin a new record.

Pressing the PAUSE key when a instrument is “stopped” brings up a *Preview* display (shown below), which allows the user to view the SPL and instantaneous peak levels 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 measurements again).



Arrow Keys

Use the and (Up and Down) arrow keys to move from one item to another in a menu, or from one record to another when displaying history data. Holding the key for a period of time will repeat the actuation of the key; the longer it is held the faster it repeats.

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.

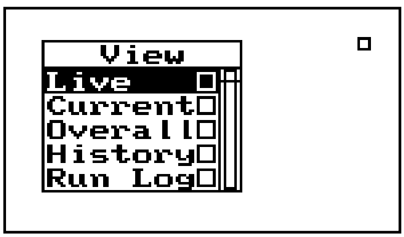
Use the and (Left and Right) arrow keys to move between data displays, to move between characters of a setting being modified, and to move through menus. Use the arrow key to move from the current menu into a sub-menu or to modify a setting. Use the arrow key to move out of a setting, to move from a sub-menu back to its parent menu, or to move back to a previous menu or display. Holding the key for a period of time will repeat the actuation of the key; the longer it is held the faster it repeats.

Check Key

Use the key to choose an item from a menu or to confirm the entry of a setting. Pressing in some displays will bring up a menu that will allow you to make changes to settings appropriate to that display.

View Key

Use the VIEW key to select the particular data display you wish to view. When you press the VIEW key, a menu containing the available data displays will appear. The following example is a *View* menu for the OBA (Octave Band Analyzer) instrument:

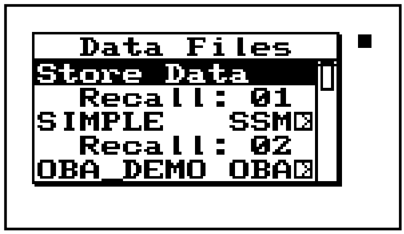


Use the or keys and key to select the display desired. While viewing data, often more than one display screen is available. You can use the and arrow keys to move from one screen to another.

Data Key

Use the DATA key to control the storing and recalling of measurements from memory. Each measurement may contain cumulative data, time history, interval history, and histogram tables that can be stored and segregated in memory from other measurements with their data and histories. A list of all stored 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:



From this menu you can store data, view stored data (or *Snapshots* if you are using the simple sound level meter) or recall 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 Data* (*Store SnapShot* is also available if using the simple sound level meter) using the or keys. Press the key to select. The instrument will beep twice to signify that the measurement has been stored.

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

To exit the Data Records view, use the VIEW key .

Pressing the key from this menu 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.

To view a *Data File*, use the or keys to select the desired data file. Each data file is marked with a number (e.g.: *Recall: 01*) and the instrument used (e.g.: *SIMPLE SSM*). An entry with a * next to it indicates that the data file is still in memory or that the data file is currently recalled. Use the key to view a summary of the data file. The following screen appears:

```
Data Records       ■
              1/ 12
SIMPLE
Simple Sound Level Me
   06Mar97 15:19:18
 to 06Mar97 15:19:22
          417 bytes
```

The *Data Records* screen shows the currently selected record number (*1/12*), start / stop dates and times, and the total bytes used by the record.

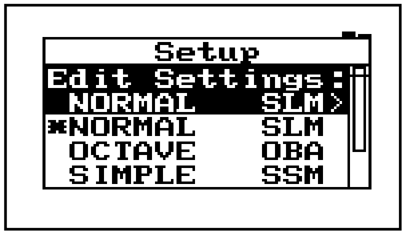
When recalling a data file, the System 814 will switch to the instrument that the data file was stored as (i.e. OBA to sSLM, if the user was currently using the OBA instrument and recalled an sSLM data file).

Using the key after highlighting a data file from the *Data Files* menu, allows you to recall previously stored measurements. The menu will then close, and the previously active data display will be shown.

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 locked symbol indicates that the ID is locked which protects the ID from being easily deleted.
The 'p' symbol indicates that the ID is permanent and pre-defined.
*The ' *' symbol indicates that the ID has changed and is 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 that are available for use. To access the *Setup* menu, press the key. The following screen appears:

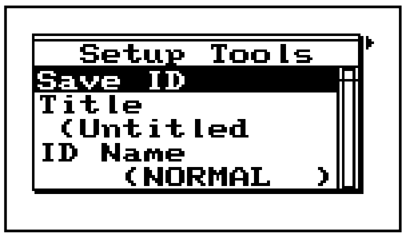


An ID defines the data that is to be measured for a particular project or type of application. The defined project IDs are listed in the *Setup* menu. Using this menu you can create, edit, copy, and delete these project settings. You can also define a project ID on a computer and then install it into the instrument where it may be selected for use. For example, one project may be the “simple SLM” (sSLM) 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.

If data from a previous ID was not saved, you will be prompted to do so at this time. This can include data that was accumulated from measurements or changes in ID settings.

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

Use the *Setup Tools* menu to create new IDs. To do this, press the TOOLS key from the *Setup* menu. The following screen appears:



The *Setup Tools* menu allows you to 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 a ID
Title	Description of ID
ID Name	Name of ID

Save ID

The *Save ID* menu item creates a new ID. Use the or keys to highlight "Save ID", then press . You will then be prompted to enter a name for the ID. The *ID name* field is capable of holding up to 8 characters. Any spaces will be replaced with a "_" character.

Title

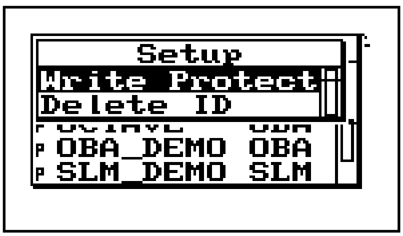
The *Title* menu item allows you to attach a description to your ID. This description can be used on printed reports and other items. The *Title* field is capable of holding up to 30 characters.

ID Name

The *ID Name* menu item allows you 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.

Write Protect, Delete, Write Enable IDs

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. Then press the TOOLS key, and the following screen appears:



Permanent IDs (marked with a 'p' Setup menu) cannot be write protected, modified, or deleted.

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 the ID in the *Setup* menu symbolizing that this ID is "Write Protected". Once the ID is write protected, it cannot be changed or deleted until it is "Write Enabled".

Permanent IDs (marked with a 'p' symbol on the Setup menu) or write protected IDs (marked with a locked symbol ▯ on the Setup menu) cannot be deleted.

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

Use the TOOLS key to access controls and operations such as calibration, battery usage, memory usage, setting date and time, timer, or computer port settings. 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).

Press the TOOLS key to access the *Tools* menu. Pressing the key on a menu item from the *Tools* menu allows you to modify settings. Pressing the key on a menu item from the *Tools* menu allows you to view current settings and other displays.

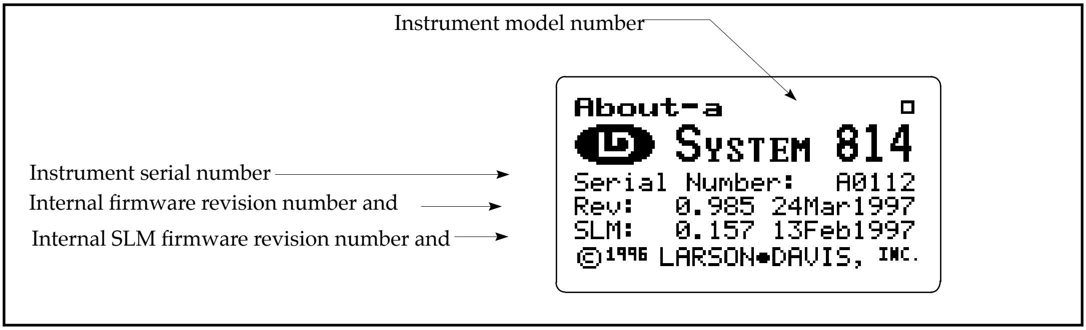
The *Tools* menu provides the following seven options, which are afterwards described in greater detail:

Menu Items	Available Settings Options (▶ key from *Tools* menu)	Setting Screens (✓ key from *Tools* menu)
About	Name Name Name Title	a - System date and numbers b - User information c - Installed options
Calibration	Check Change Cal Level Calibrator S/N	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 until next action b - Timer mode status and settings
Memory	Purge All Allocated ID's Create EEPROM Backup	a - Memory status & current instrument memory information b - Overall memory status
Lock	On/Off	Lock status
Power Monitor	Power Off Mode Auto-Off Time Standby Time Backlight Time Backlight LCD Contrast External Power	Battery - Power status and information

Communication	Baud Rate Serial Address Flow Control	Communications - List of bytes sent and received, standby timer

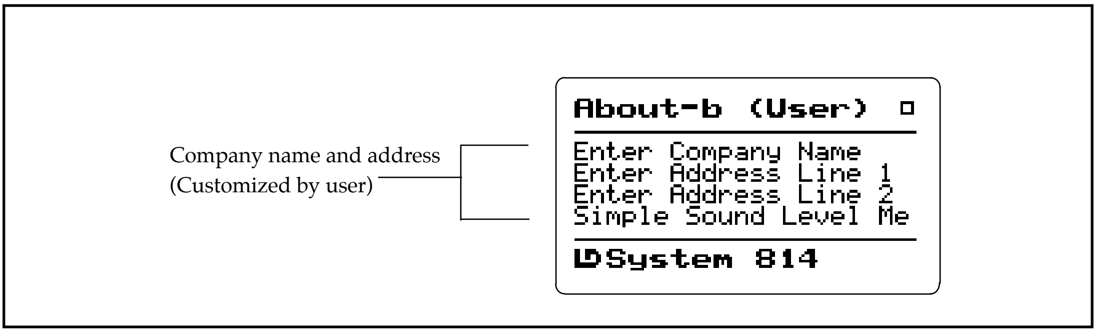
About

To access the *About* displays, 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.

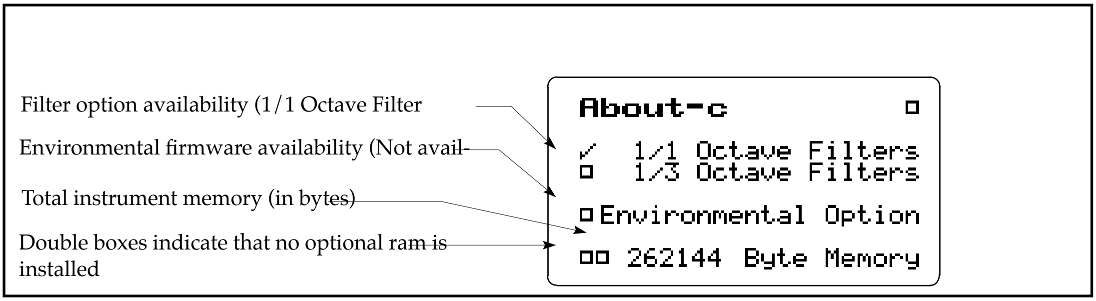
Pressing the key moves to the *About-b* screen. The following appears:



The *About-b* display shows the instrument's custom name based on title fields used for System 814 reports.

The fields are generally set to the owner's name and address. The name field is used on summary data reports.

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



The *About-c* display shows the instrument's total memory as well as the availability of the optional filter module and environmental noise analyzer firmware.

To access 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 814 reports.

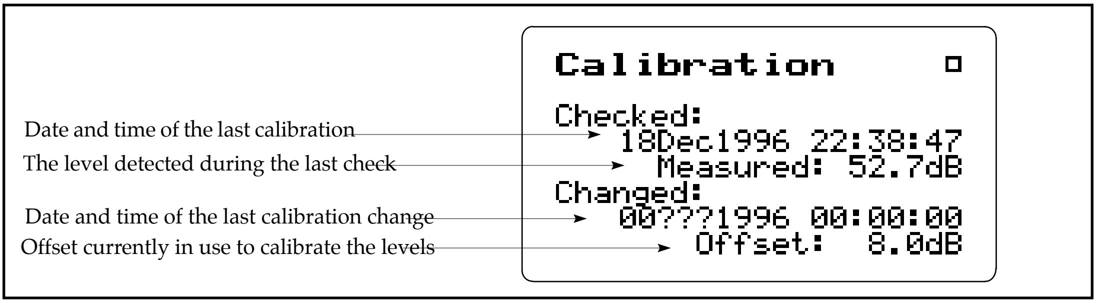
Settings can also be accessed by pressing the ✓ key from the setting screens (previously described).

Name, Name, Name - There are three *name* lines available for user specific data. Each *Name* field provides 30 alpha/numeric characters, and is used to describe the instrument or the organization to whom it belongs.

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

Calibration

To access the *Calibration* display, use the ▲ or ▼ key to select *Calibration* from the *Tools* menu, then press the ✓ key. The following 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 access the *Calibration* settings, use the or key to select *Calibration* from the *Tools* menu, then press the key. The *Calibration* has these four following settings:

Settings can also be accessed by pressing the key from the setting screens (previously described).

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

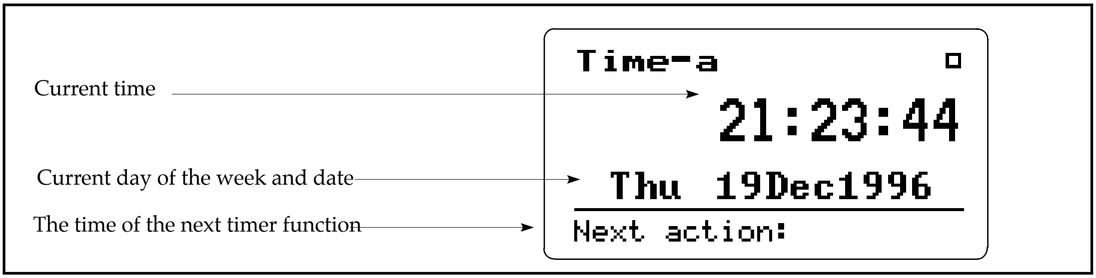
Change - Activates the calibration change (adjust) process.

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

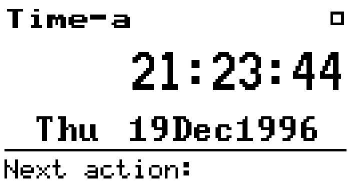
Calibrator S/N - Enables the user to record the serial number of the calibrator (for reference).

Clock/Timer

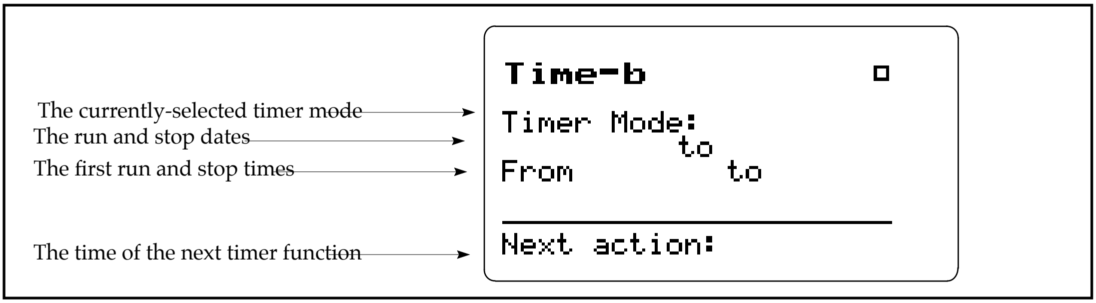
To access the *Clock/Timer* display, use the ▲ or ▼ key to select *Clock/Timer* from the *Tools* menu, then press the √ key. The following appears:



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



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 all run and stop times and dates.

Settings can also be accessed by pressing the √ key from the setting screens (previously described).

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

The *Clock / Timer* menu allows you to 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.

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 System 814 has four timer modes selected by the *Timer Mode* setting:

- **Off** - The timer is disabled.
- **1/Day** - The timer will automatically turn the instrument on and initiate one run/stop cycle per day.
- **2/Day** - The timer will automatically turn the instrument on and initiate two run/stop cycles per day.
- **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.

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 - The run date is used to enable the timer mode when set to *1/Day*, *2/Day*, or *Block*.

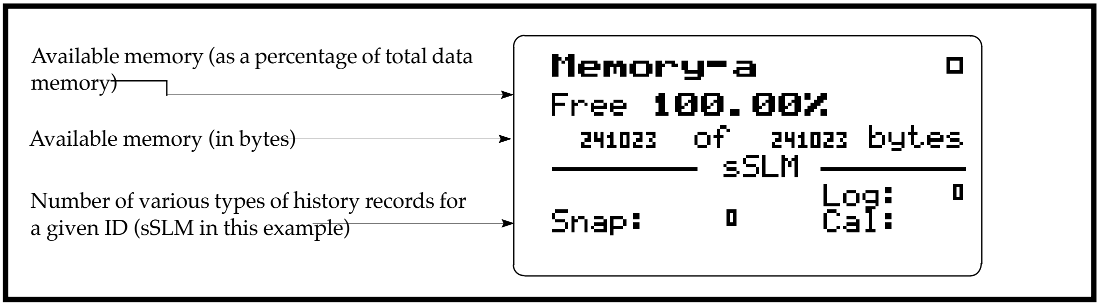
Stop Date - The run date is used to disable the timer mode when set to *1/Day*, *2/Day*, or *Block*.

Run Time 1 / Stop Time 1 - If you have selected the block mode, the timer will automatically turn the instrument on. This setting allows the user to specify the beginning and ending times of a measurement.

Run Time 2 / Stop Time 2 - Used to specify a second measurement beginning and ending times in the 2/ day timer mode.

Memory

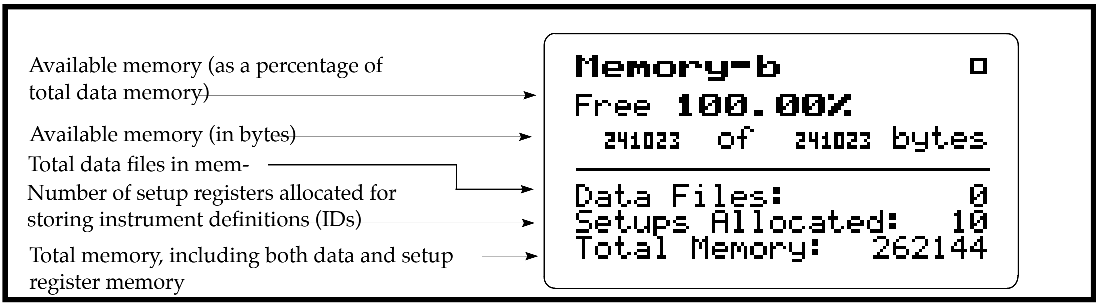
To access the *Memory* display, use the or key to select *Memory* from the *Tools* menu, then press the key. The following appears:



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 setup registers.)

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

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



The default value of this setting is 10 allocated setup registers (which uses 5120 bytes of memory). The maximum value of this setting is 50 allocated setup registers. The System 814 has five pre-defined ID registers that are stored in permanent memory. 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.

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 which has been allocated for setup registers.

Settings can also be accessed by pressing the key from the setting screens (previously described).

To access the *Memory* settings use the or key to select *Memory* from the *Tools* menu, then press the 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.

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 - Creates a permanent record of the most recently used OBA, simple SLM, and logging SLM IDs so that they may be recreated in the event of a memory loss.

Lock

The Lock function is used to limit unauthorized control of the instrument. The *Lock* menu provides access to the password setting and to the settings which lock various operations.

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

The *Lock* display shows the lock status and restrictions. If the instrument is currently locked, the display prompts you for the unlock password.

Settings can also be accessed by pressing the √ key from the setting screens (previously described).

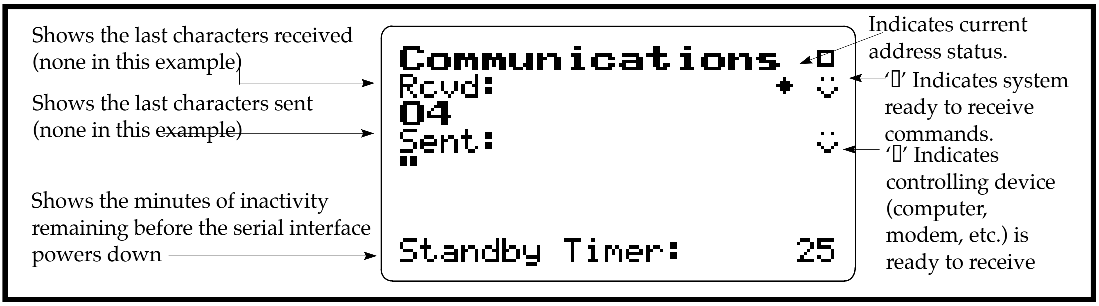
To change one of these *Lock* settings, highlight the desired item and then press the ▶ key.

Power Monitor

This menu allows you to adjust the auto-power on or off, adjust the contrast (or viewing angle), turn the backlight on or off, and adjust settings that control the power-conservation features. Refer to the ⏻ key (earlier in this chapter) for a full description of the *Power Monitor* menu and displays.

Communication

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



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.

To access the *Communication* settings, use the or key to select *Communication* from the *Tools* menu, then press the key.

Baud Rate - Speed at which the System 814 communicates with controlling devices (computer, modem, etc.) through the serial port. The baud rate has a range from 300 to 115000 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 is used to identify a particular instrument on a network of instruments.

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.

Print Key

Use the PRINT key to print graphical and tabular data reports directly from the instrument to a printer. You can create high-resolution presentation-quality reports when printing to a laser printer because of the instrument's PDL (page description language) capabilities. Draft-quality tabular data reports can also be printed on virtually any 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 and is common to all "instrument" types (i.e. sSLM, OBA, and ∫SLM).

With an appropriate printer connection, you can print any of the four indicated reports by highlighting the corresponding menu item and pressing the √ key. Use any one of the first three menu items to print the corresponding standardized report. The three reports are the same, regardless of the current instrument type.

Use the fourth menu item, Tailored Report, to print the custom reports that are defined as part of an instrument definition.

You can also request reports from a computer and then print them using the computer's printer.

Before you print a report, you can also select the *Print Option* sub-menu which allows you to further customize a report. In this sub-menu you can selecting 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 the *Print Options* item then press the ▶ key.

CHAPTER

3

OBA Octave Band Analyzer

This chapter will help you better understand the System 814's OBA (Octave Band Analyzer). Specifically, this chapter covers the following topics:

- Setting up the OBA: overview of the possible settings and configurations of the System 814 in OBA mode.
- Understanding OBA Displays: overview of the displays used in OBA mode and simple explanations of how to read them.
- Using the OBA: simple applications that can be used with the System 814 in OBA mode.

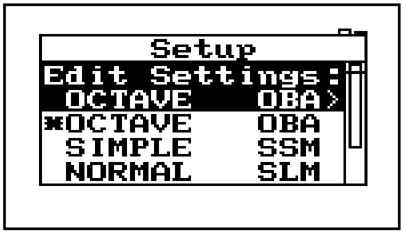
Setting up the OBA

There are four general steps for setting the System 814 to OBA mode: 1) Go to the *Setup* menu. 2) Select the OCTAVE OBA. 3) Return to the *Setup* menu. 4)Then enter the *Settings* menu.

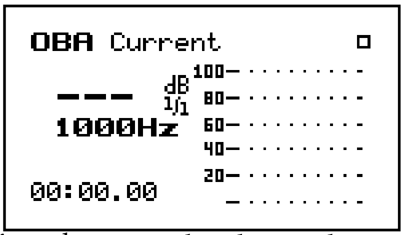
This procedure is discussed in more detail below:

If the 814 is already in OBA mode, there will be a '>' to the left of OCTAVE OBA. In which case, skip to Step 4 below.

Step 1 Press the SETUP key. A menu similar to the following appears:



Step 2 Select OCTAVE OBA from the menu by pressing the or keys and then pressing the key. The OBA screen which was last accessed appears. For example, this particular OBA screen may appear.

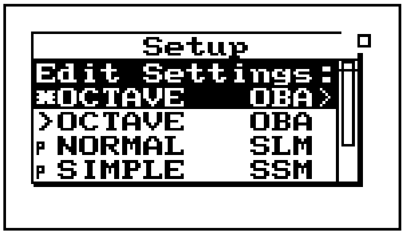


If you have not already saved your data, you will be prompted to save it at this step.

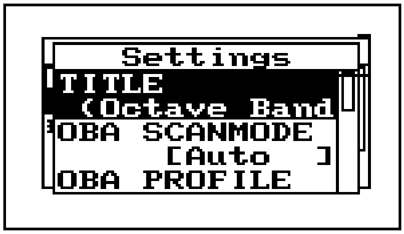
Step 3 The 814 is now set to the OBA mode.

In this example, the Title setting is selected and Octave Band Analyzer is the current title. To change the title, use the arrow keys described in the "Title" section (discussed later).

Step 4 To access the OBA *Settings* menu, press the key. The *Edit Settings: *OCTAVE OBA* is highlighted as the *Setup* menu:



Step 5 Press the key and the *Settings* menu appears:



Available 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 814 offers a number of OBA settings for controlling, gathering, and logging spectral data. The following is a chart of these settings. Each setting is then described later in greater detail.

Menu Items	Available Settings Options
Title	Title
OBA ScanMode	Manual Auto Timed
OBA Profile	Normal Short Long Custom

OBA Bandwidth	1/1 1/3
Range	Normal Low High
Transducer	Condnsr Elctret Direct
Intv Enable	No Yes
Intv Period	(hh:mm:ss)
Intv Time Sync *(Time Sync)*	No Yes
Intv Auto Stop *(Auto Stop)*	No Yes
AC Out Weight	Flat Wght

Title Setting

To change the Title, use the and keys to select each character. Use the and keys to replace the selected letter. Pressing the key clears all characters from the cursor to the end of the field.

Menu Items	Available Settings Options
Title	Title
OBA ScanMode	Manual Auto Timed
OBA Profile	Normal Short Long Custom

OBA Bandwidth	1/1 1/3
Range	Normal Low High
Transducer	Condnsr Elctret Direct
Intv Enable	No Yes
Intv Period	(hh:mm:ss)
Intv Time Sync *(Time Sync)*	No Yes
Intv Auto Stop *(Auto Stop)*	No Yes
AC Out Weight	Flat Wght

Use the *Title* setting to create a title or header for printed reports. This title/header will be placed at the top of each OBA report you print.

OBA ScanMode Setting

You can change the filter by using the ◀ and ▶ keys.

Use the *OBA ScanMode* setting to set the method for scanning the octave or third octave filters. This setting provides the following three options:

Manual - By selecting "Manual," you control the timing and the order of the filters measured. The 814 does not automatically change filters as with the other options; instead, the 814 measures using the filter that you have selected.

Auto - By selecting "Auto," the instrument measures each filter for a selected time (see OBA profile on page 3-6) to ensure an accurate reading and then steps to the next filter automatically, repeating all filters continuously.

Timed - By selecting “Timed,” the instrument automatically steps from one filter to the next. This is similar to the “Auto” option except the measurement stops when the elapsed run time is equal to the programmed measurement run time.

OBA Profile Setting

Use the OBA Profile setting to set the length of time that the instrument measures the output for each filter before moving on to the next. The profile is only used when the OBA Scan mode is set to Auto or Timed. The total time it takes to make one complete cycle through the filters is based on the selected profile as shown in the table below:

	Bandwidth = 1/1		Bandwidth = 1/3	
Profile	Cycle Time	Confidence Limits	Cycle Time	Confidence Limits
Short	20 seconds	98% " 1.0 dB	2 minutes	98% +/- 1.0 dB
Normal	1 minute	98% " 0.6 dB	5 minutes	98% +/- 0.6 dB
Long	2 minutes	98% " 0.4 dB	10 minutes	98% +/- 0.4 dB

For example, if the interval period setting was 15 minutes and the scan rate for 1/3 octaves was Normal (5 minutes), then a spectrum would be stored every 15 minutes which represented three scans through the complete range of filters. At the end of each 15 minute interval period, the accumulator would be reset and prepared to begin accumulating spectral data over the next 15 minute period.

When you define a profile, you can effectively remove one or more filters from the scan sequence by setting the corresponding stabilize and dwell times to zero seconds.

Custom - Using a personal computer, you can create and download to the System 814 a user defined profile of stabilization and scan times for each filter.

Each of the three standard options, *Norm*, *Short* and *Long*, have the same stabilization time profile. However, each option provides for a different dwell time (i.e. the time that the filter is active and providing accurate data). In addition, the custom option allows you to choose a previously defined user scan profile that you can create and download to the System 814 with a personal computer.

OBA Bandwidth Setting

Third octave requires that OPT-31 be installed.

Use the *Bandwidth* setting to select either full-octave or third-octave filters. This setting provides the following two options:

- **1/1** - The instrument uses octave filters.
- **1/3** - The instrument uses third-octave filters.

Range Setting

Use the *Range* setting to select the desired measurement range 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 20 dB to 130 dB when using a Larson•Davis high-sensitivity microphone.

Low - The instrument's input circuitry provides an additional 20 dB of gain which has the effect of moving the instrument's available dynamic range downward relative to the "normal" range (see below). The net effect is that you can measure lower-level sounds effectively. The degree of benefit varies depending upon the weighting or octave filter that you are using.

Not available for electret or direct transducer types.
(see "Transducer Settings" below).

High - The instrument's sensitivity is reduced by 20 dB which has the effect of moving the instrument's available dynamic range upward relative to the "normal" range (see above). The net effect is that 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 814's large dynamic range (110dB) 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 sound levels.

Transducer Setting

Use the *Transducer* setting to select the desired transducer. This setting provides the following three settings:

Condnsr - Indicates that the microphone being used is an air condenser type and the System 814 will generate the appropriate polarization voltage to make it function properly.

Elctret - Indicates that the microphone being used is an "electret" (pre-polarized) microphone. The instrument will not generate any polarization voltage.

Direct - Indicates that no microphone is being used and that electrical signals are being injected directly into the preamp.

Intv Enable Setting

Use the *Intv Enable* setting to either enable or disable the automatic storage of spectral time-history records. The OBA instrument has the ability to store the spectral data at a user-determined interval. This setting provides the following two options:

Yes - Time-history storage is enabled.

No - Time-history storage is disabled.

Intv Period Setting

For example, if you want to set the Intv Period to 1 hour 45 minutes and 30 seconds, it would be expressed as: "01:45:30".

Use the *Intv Period* setting to set the time interval between successive spectral time history storage operations. These storage operations continue either until the instrument is stopped or it runs out of memory. This setting can take on any time value within the following range:

(hh:mm:ss) - 00:00:01 - 99:59:59

Intv Time Sync Setting

Use the *Intv Time Sync* setting to either enable or disable the time-history sync feature. When enabled, this feature causes the time history storage operations to be synchronized with the real-time of day clock. This synchronization can occur on an hourly, 30 min., 20 min., 15 min., 5 min., or 1 min. basis. Please note that 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 begins.

If the Interval Period is set to the time shown in the first column then the first interval after a run will end at the time shown in the second column (the hh means any hour and the hh:m means any hour and tens of minutes).

Intv Period	Sync on
01:00	hh:00
00:30	hh:00, hh:30
00:20	hh:00, hh:20, hh:40
00:15	hh:00, hh:15, hh:30, hh:45

00:10	hh:m0
00:05	hh:m0, hh:m5
00:0x	hh:mm (sync to nearest minute

This setting provides the following two options:

Yes - Time sychronization is enabled.

No - Time sychronization is disabled.

Intv Auto Stop Setting

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 either enable or disable the Auto Stop feature. When enabled, this feature causes the instrument to automatically stop the measurement at the end of each history storage interval. This allows you to precisely time a series of manual measurements. To start a new measurement after an automatic stop, simply press the RUN key.

This setting provides the following two options:

Yes - Automatic stopping after the time interval is enabled.

No - Automatic stopping after the time interval is disabled.

AC Out Weight Setting

Use the *AC Out Weight* setting to set the frequency characteristics of the AC output signal. The AC output signal is derived from the actual signal the instrument is measuring. This signal is available for external use at the base of the System 814.

This setting provides the following two options:

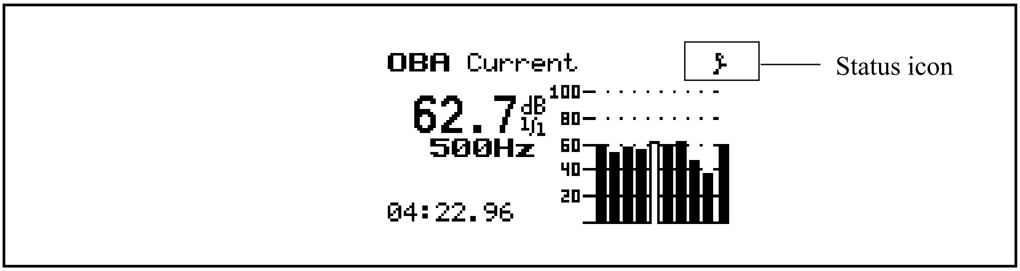
Flat - The AC output signal has the flat frequency weighting applied to it.

Wght - The AC output signal has the same frequency characteristics as the displayed RMS level.

Understanding OBA Displays

The System 814 has five displays for the OBA instrument. Understanding each of these displays allows you to take full advantage of the instrument.

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 list describes each icon which may appear:

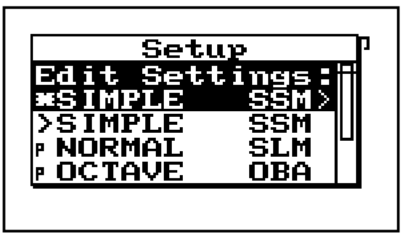
Status Icon	Description
▯	Animated Running Figure - Instrument is running and acquiring data.
▯	Solid Box - Instrument is stopped, data is available.
▯	Open Box - Instrument is stopped, and reset.

□	Double Bar - Instrument is paused.
□	Play Symbol - Instrument is ready to run (as soon as stabilization completes).
□	Bar and Play Symbol - Current SPL and peak levels displayed, but no data is being acquired.
□	Animated Hourglass - Instrument is stabilizing to ensure accurate measurement.
□	Animated Draining Battery - Battery is low, and the instrument will shut off soon.
□	O.L. - Instrument is overloaded; measurement may not be accurate due to an overload condition at some time during the measurement.
□	Animated Clock - Indicates that the automatic *run/stop timer* is active.

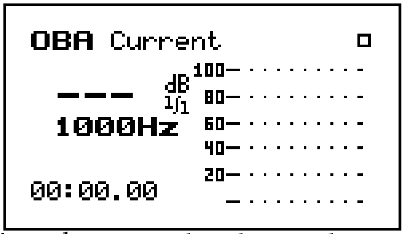
In order to view the OBA displays, switch the device to OBA mode. To do this:

If the 814 is already in OBA mode, there will be an asterisk to the left of OCTAVE OBA. If this so, skip to Step 3.

Step 1 Press the SETUP key. A menu similar to the following appears:



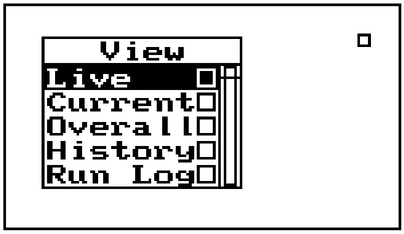
Step 2 Select *OCTAVE OBA* from the menu by pressing the ▲ or ▼ keys and then pressing the √ key. The OBA screen which was last accessed appears. For example, this particular OBA screen may appear:



If you have not already saved your data, you will be prompted to Save it at this point.

Using the ▲ and ▼ arrow keys, select the desired display then press the √ key to bring up that display.

Step 3 Press the ◉ key to access the *View* menu. The following screen appears:



Available OBA Displays

Following is a list of the five possible displays. Each display is then described in greater detail.

Menu Item	Purpose
Live	Leq of each filter’s latest sample.
Current	Leq spectrum of the Current buffer.
Overall	Leq spectrum of the OverAll buffer.
Interval History	Shows a running log of past measurements.

Run Log	Logs key functions.

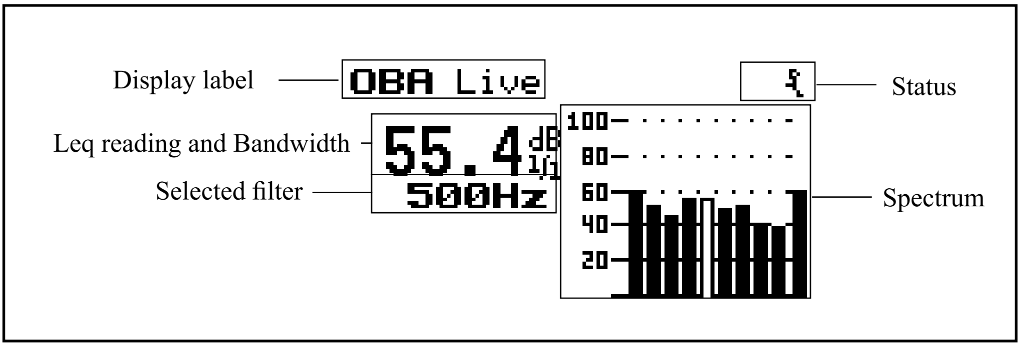
Live

To switch between the OBA displays (Live, Current and Overall) use the and keys.

The *Live* display shows the most recently sampled levels for each filter. It consists of five major components:

- Display label
- Leq reading and Bandwidth
- Selected filter
- Status
- Spectrum

The following information explains each of these components:



Display label - Indicates what display is currently being shown. The first three letters (OBA) describes the instrument being used. The second word (Live) describes the particular display being used.

Leq reading and Bandwidth - Displays the “Live” Leq for the filter that is highlighted by the cursor or the Leq that was accumulated when the filter highlighted was last active.

Use the ◀ and ▶ arrow keys to move the cursor from one filter to the next.

Selected filter - The center frequency of the highlighted filter. The following table shows the range of this selection:

Filter	Frequency
OPT-30 filter set 1/1 Octave filter	 31.5 Hz to 8000 Hz (9 filters)
OPT-31 filter set 1/1 Octave filter 1/3 Octave filter	 31.5 Hz to 16 kHz (10 filters) 25 Hz to 20 kHz (30 filters)

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

Use the ◀ and ▶ arrow keys to move the cursor from one filter to the next.

Spectrum - Shows the spectrum of live filter data that are continuously updated as the instrument scans (either manually or automatically) from one filter to the next. The resulting spectral bars show the Leq for each filter during the period that a particular filter is active.

The far right bar is not part of the spectrum, but instead shows the SPL of the filter the instrument is currently measuring.

The bar for the filter that the instrument is currently measuring shows the Leq as it is accumulated. Every other bar holds its previous level until the corresponding filter again becomes the active filter. When a filter becomes active, the instrument begins a new Leq accumulation for that filter.

When you move the cursor from one filter to the next, you will notice a slight pause before the data is updated because of the need to ignore the transient effects of switching between filters. The status will show an hour glass during this delay.

If you have selected the Manual OBA mode, the filter you select with the cursor will also become the active filter. The Leq for the active filter will continue to accumulate until you move the cursor to a new filter.

If you have selected Manual mode, you will not be able to move the cursor to the far right bar.

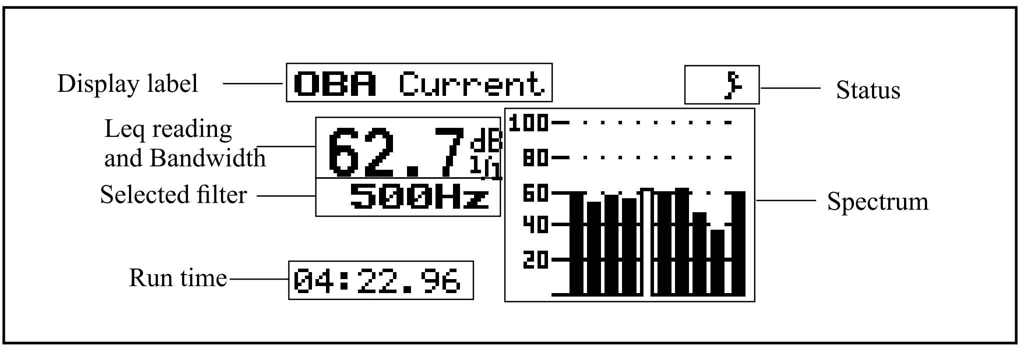
If you have selected one of the automatic scan modes, you can also move the cursor to the far right bar which shows the SPL of the filter the instrument is currently measuring. When you move the cursor to this bar, the display shows the Leq and center frequency of the filter currently being measured. The displayed Leq and center frequency then automatically update as the instrument scans from one filter to the next.

Current

The System 814 contains 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.

- The *Current* display shows live data being stored in the Current buffer. It consists of six major components:
  Display label
- Leq reading and Bandwidth
- Selected filter
- Status
- Run time
- Spectrum

The following information explains each of these components:



Display label - Shows the display currently being used. The first three letters (OBA) describes the instrument being used. The second word (Current) describes the particular display being used.

Leq reading and Bandwidth - Displays the *Current* Leq accumulated for the filter that is highlighted by the cursor since the last current reset.

Use the ◀ and ▶ arrow keys to move the cursor from one filter to the next.

Selected filter - The center frequency of the highlighted filter. The range of this selection is as follows:

Filter	Frequency
OPT-30 filter set 1/1 Octave filter	 31.5 Hz to 8 kHz (9 filters)
OPT-31 filter set 1/1 Octave filter 1/3 Octave filter	 31.5 Hz to 16 kHz (10 filters) 25 Hz to 20 kHz (30 filters)

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

Run time - The run time clock displays the time that has elapsed since the last “current” reset. The clock updates when the OBA is running (or active).

Use the ◀ and ▶ arrow keys to move the cursor from one filter to the next.

The far right bar is not part of the spectrum, but instead shows the SPL of the filter currently being measured.

Spectrum - Shows the spectrum of Leq accumulation since the last “current” reset. The accumulation continues through each period of filter activity as the filters are scanned (either manually or automatically).

When you move the cursor from one filter to the next, you will notice a slight pause before the data is updated because of the need to ignore the transient effects of switching between filters.

If you have selected the *Manual OBA* mode, the filter you select with the cursor will also become the active filter. The Leq for the active filter will continue to accumulate until you move the cursor to a new filter.

If you have selected Manual mode, you will not be able to move the cursor to the far right bar.

If you have selected one of the automatic scan modes, you can also move the cursor to the far right bar which shows the SPL of the filter the instrument is currently measuring. When you move the cursor to this bar, the display shows the Leq and center frequency of the filter currently being measured. The displayed Leq and center frequency then automatically update as the instrument scans from one filter to the next.

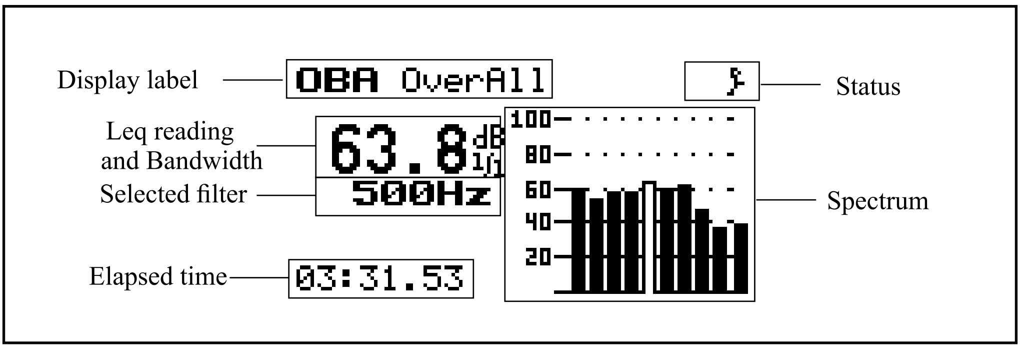
OverAll

The System 814 contains 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.

The *OverAll* display shows live data being stored in the Overall buffer. It consists of six major components:

- Display label
- Leq reading and Bandwidth
- Selected filter
- Elapsed time
- Status
- Spectrum

The following information explains each of these components:



Display label - Shows the display currently being used. The first three letters (OBA) describe the instrument being used. The second word (OverAll) describes the particular display being used.

Leq reading and Bandwidth- Displays the "OverAll" Leq for the filter that is highlighted by the cursor or the

Leq that was accumulated when the highlighted filter was last active.

Use the and arrow keys to move the cursor from one filter to the next.

Selected filter *- The center frequency of the cursor filter.*

The range of this selection is follows:

Filter	Frequency
OPT-30 filter set 1/1 Octave filter	 31.5 Hz to 8000 Hz (9 filters)
OPT-31 filter set 1/1 Octave filter 1/3 Octave filter	 31.5 Hz to 16 kHz (10 filters) 25 Hz to 20 kHz (30 filters)

Elapsed time - The elapsed time clock displays the time that has elapsed since the "overall" reset. The clock updates when the OBA is running (or active).

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

Use the and arrow keys to move the cursor from one filter to the next.

The far right bar is not part of the spectrum, but instead shows the SPL of the filter currently being measured.

When you move the cursor from one filter to the next, you will notice a slight pause before the data is updated because of the need to ignore the transient effects of switching between filters.

If you have selected Manual mode, you will not be able to move the cursor to the far right bar.

Spectrum - Shows the spectrum of Leq accumulations since the last "overall" reset. The accumulation continues through each period of filter activity as the filters are scanned (either manually or automatically).

If you have selected the Manual OBA mode, the filter you select with the cursor will also become the active filter. The Leq for the active filter will continue to accumulate until you move the cursor to a new filter.

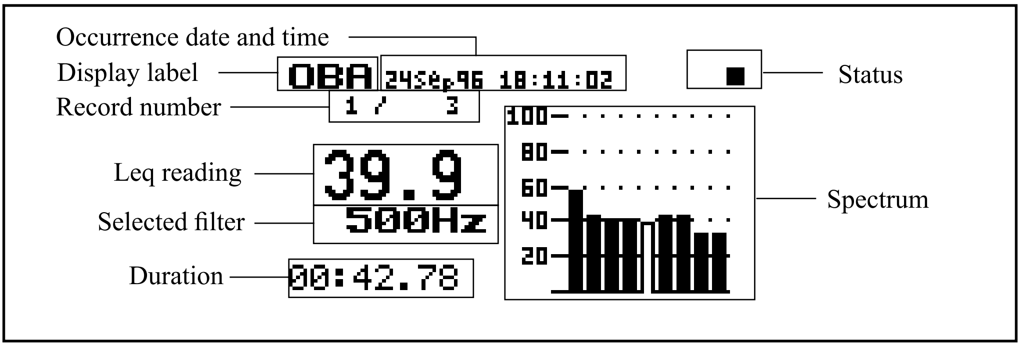
If you have selected one of the automatic scan modes, you can also move the cursor to the far right bar which shows the SPL of the filter the instrument is currently measuring. When you move the cursor to this bar, the display shows the Leq and center frequency of the filter currently being measured. The displayed Leq and center frequency then automatically update as the instrument scans from one filter to the next.

Interval History

The interval history is a spectral time history for fixed periods of time. The *OBA Interval History* display allows you to view a time profile of the sound measured by giving you access to a sequence of spectra that have been stored at set intervals. The *Interval History* display consists of eight major components:

- Occurrence date and time
- Display label
- Record number
- Leq reading
- Selected filter
- Duration
- Status
- Spectrum

The following information explains each of these components:



Occurrence date and time - Date and time of the currently displayed history record.

Display label - Shows what display is currently being used. The first three letters (OBA) describes the instrument being used.

Use and keys to move from one stored record to another.

Record number - The "1 / 3" indicates the record currently being viewed and the total number of records stored (in this example, "1 / 3" represents the first record of three total possible records).

Leq reading - Displays the Leq for the selected filter of this interval record.

Selected filter - The center frequency of the cursor filter. The range of this selection is changeable. You can choose the following:

Filter	Frequency
OPT-30 filter set 1/1 Octave filter	 31.5 Hz to 8000 Hz (9 filters)
OPT-31 filter set 1/1 Octave filter 1/3 Octave filter	 31.5 Hz to 16 kHz (10 filters) 25 Hz to 20 kHz (30 filters)

Duration - The duration clock displays the duration or elapsed time for this interval history record. This time will be the programmed interval time unless it is the last record before a stop was performed, or the first record if "Intv Time Sync" was enabled.

Use the and arrow keys to move the cursor from one filter to the next.

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

Spectrum - Shows the spectrum of filter data. The *OBA Interval History* display allows you to view a time profile of the sound measured by giving you access to a sequence of spectra that have been stored at set intervals.

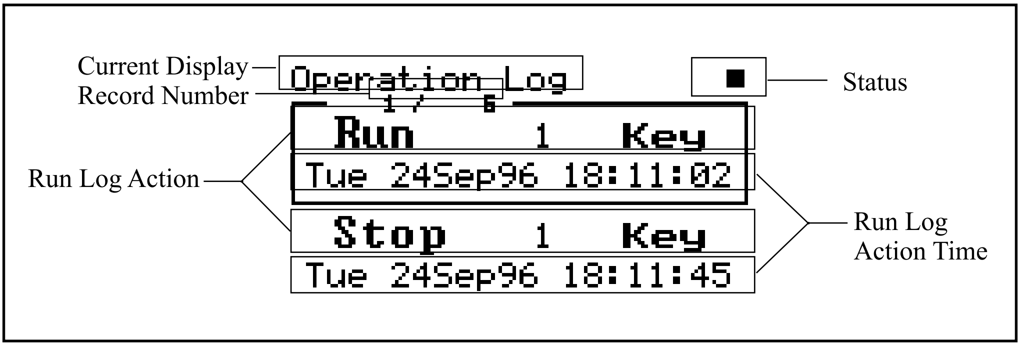
The bar for the filter that the instrument is currently measuring shows the Leq as it was accumulated.

Run Log

The *Run log* display is a log of operations that affect the measurements taken by the OBA instrument. It consists of five major components:

- Current Display
- Record Number
- Run Log Action
- Status
- Run Log Action Time

The following information explains each of these components:



Current Display - Shows what display is currently being used (in this case the *Operation Log*).

Pressing the ▲ and ▼ keys allows you to move from one stored log to another.

Record Number - Shows the number of the current record being displayed, followed by the total number of records. (In this example, the displayed screen is record 1 of 6 possible records.)

In the screen on page 3-28, there are two logs:
1. Run 1 Key
2. Stop 1 Key

Run Log Action - The run log action consists of three parts: action, measurement number, and cause. The first part displays what action took place (Run, Stop, Pause, Continue, Reset, and Mark -- M8 command, M6 command). The second part displays what measurement number or record was affected by the action. The third part displays what caused the log (Key, I/O, Timer, Battery (low), Intv (auto-stop), Logic, and Calibration).

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

In this example, the RUN/STOP key was pressed at 18:11:02 and again at 18:11:45, both on 24 Sept. 1996.

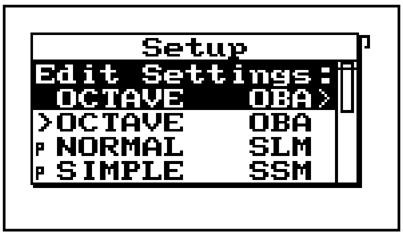
Run Log Action Time - The Run Log Action Time shows the day, date, and time that the run log action occurred.

Using the OBA

This section gives a step by step example of a possible scenario using the OBA instrument. In this scenario, you will select the Octave OBA instrument and take 3 measurements. You will then view the results of these three measurements.

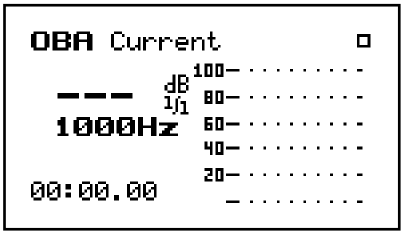
Simple OBA Scan

Step 1 Press the SETUP key. A menu similar to the following appears:



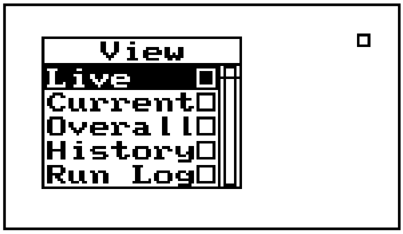
If the 814 is already in OBA mode, there will be an asterisk to the left of OCTAVE OBA. If so, skip to Step 3.

Step 2 Select *OCTAVE OBA* from the menu by pressing the or keys and then pressing the key. The *OBA Default* screen appears:



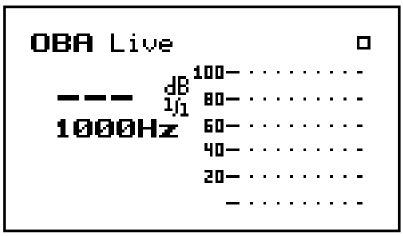
If you have not already saved your data, you will be prompted to save now.

Step 3 Press the VIEW key to access the *View* menu. The following screen appears:

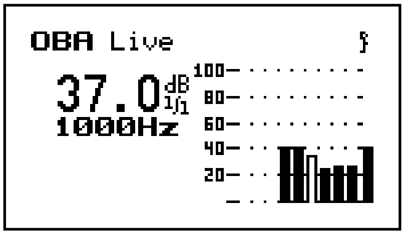


Using the arrow keys, you can select the desired display. Then press the key to bring up the display.

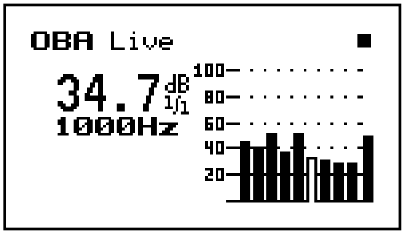
Step 4 Using the and keys select *Live*, then press to select. The following screen appears:



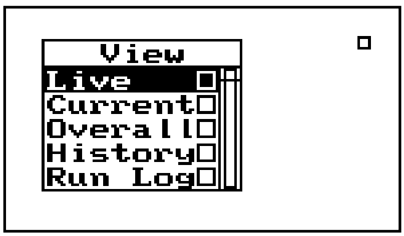
Step 5 Press the RUN/STOP key to begin taking readings. A screen similar to the following appears:



Step 6 Run the measurement for about 2 minutes. Press the RUN/STOP key to halt the measurement. A solid box will appear in the upper right hand corner:

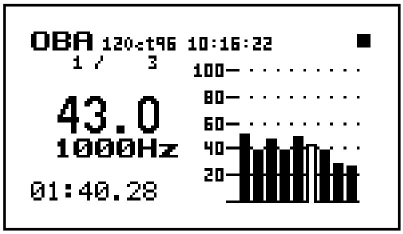


Step 7 Repeat **Steps 5 and 6** two more times to take two more measurements. Then, press the VIEW key to access the *View* menu. The following screen appears:



Notice that the record number (1/3) in this example shows that the first history record of 3 possible records is currently being displayed.

Step 8 To view the history of these runs, use the and keys to select *History*, then press to select. The following screen appears:



Step 9 Use the and keys to move from one history to the next.

CHAPTER

4

sSLM-simple Sound Level Meter

This chapter will help you better understand the System 814 sSLM (simple Sound Level Meter). Specifically, this chapter covers the following topics:

- Setting up the sSLM: overview of the settings and configurations of the System 814 in sSLM mode.
- Understanding sSLM Displays: overview of the displays used in sSLM mode and explanations about how to read them.
- Using the sSLM: simple applications that can be used with the System 814 in sSLM mode.

Introduction to the Simple SLM Mode

The Simple SLM Mode of the Model 814 provides the functionality of a precision sound level meter for “point-and-shoot” type measurements where a single measurement is taken and the data stored manually. For sound measurements where data are to be measured and stored automatically, such as commonly done for environmental noise monitoring applications, the Logging SLM Mode should be utilized.

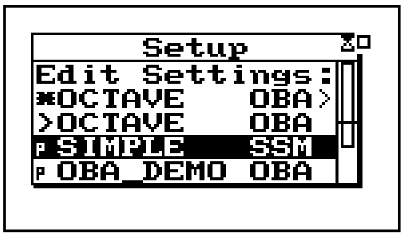
The sound pressure level is measured using one selection of broadband frequency weighting (A,C or Flat) and one selection of RMS detector (Fast, Slow or Impulse). For versions of the instrument equipped with 1/1 octave or 1/3 octave filters, it is also possible to utilize a single bandpass filter instead of a broad-band frequency weighing.

Peak sound levels are measured using two parallel peak detectors; Peak 1 whose frequency weighting can be selected to be either C or Flat and Peak 2 whose frequency weighting is the same as the frequency weighting selected for use with the RMS detector for sound pressure level measurements (A, C, Flat or bandpass) as mentioned above.

In addition to the measurements described above, the following data are obtained: Leq, SEL, Lmax and Lmin. During the measurement, a Time History graphic based on one second Leq values is drawn across the display. A back erase feature is available for the removal of unwanted data segments which may occur during the measurement period.

Selecting the permanent Simple SLM setup

Step 1 Press the Setup Key to obtain a menu of stored instrument setups similar to the following.



The setup listed at the top of the list, along with the text string “Edit Settings”, is the setup presently active in the instrument. Those listed below are existing setups available for selection and use. Those which have a letter “p” to the left of the setup name are permanent setups, whose parameters cannot be modified. Of course the user can select a permanent setup, modify the parameters, and then store it under another name, leaving the permanent setup unmodified. Once an existing setup, permanent or not, has been made the active setup, the symbol “>” will appear to the left of the name instead of the letter “p”.

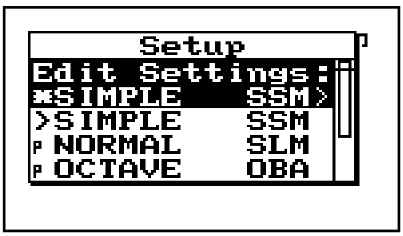
Step 2 If the active setup in the instrument is not entitled SIMPLE SSM, then search further down the list and use the and keys to highlight the setup with that name which has the small letter “p” to the left side of the setup name.

If the presently active setup is entitled SIMPLE SSM, then search further down the list to find and highlight the setup with that name which has the “>” symbol to the left of the name.

Step 3 Press the which will bring to the screen the Simple SLM display.

Utilizing the Simple SLM setup when it is the active setup

If the active setup is entitled SIMPLE SSM, this means that the permanent Simple SLM setup was previously selected and that some or all of the parameters may have been changed. The user can select to use this rather than the permanent Simple SLM setup simply pressing to exit to the Simple SLM display. It will be seen later that the use of the key when the active setup is highlighted leads to the Standard form of editing via the Setup Menu.



Editing the Simple SLM setup

There are two ways to modify the Simple SLM setup.

- Standard Setup, via the Setup Menu, which permits the selection and modification of all the available parameters.
- Quick Keys, which permit the selection and modification of the frequency weighting, RMS detector, peak weighting, secondary parameter to be displayed and to select the amplitude range (Low or Normal).

Due to its simplicity, we will describe the use of the Quick Keys in the next section, followed by a detailed presentation of the Standard Setup procedure.

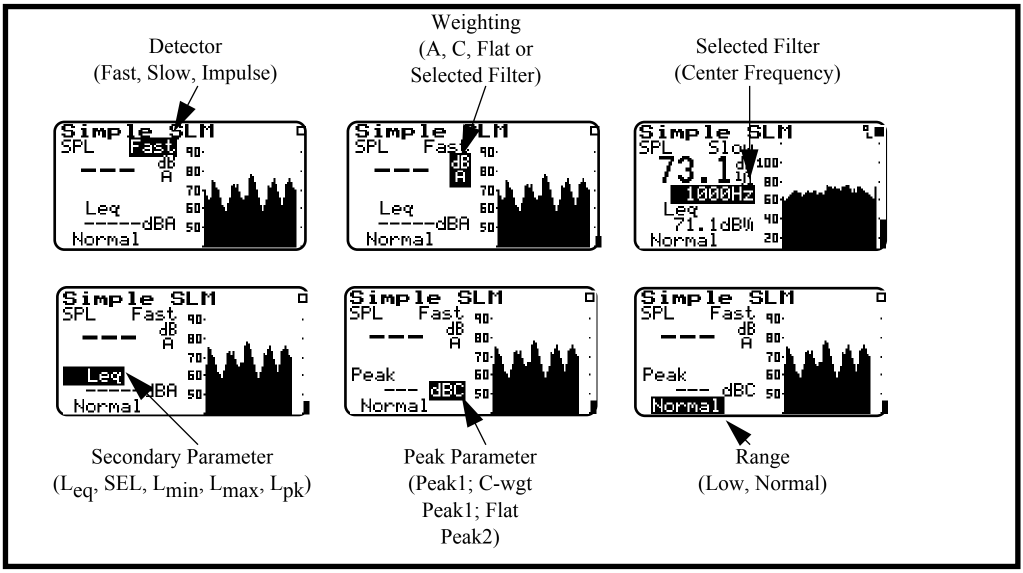
Quick Keys

The default parameters associated with the permanent Simple SLM setup are as follows:

- Frequency weighting: Flat
- RMS detector: Slow
- Secondary displayed parameter: Leq
- Peak weighting: Flat
- Range: Normal

Simply pressing the key will begin a measurement using those parameters.

However, using the Quick Keys it is possible to edit the parameters of the Simple SLM measurement *On the Fly* from this display screen. Using the and keys, a highlighting window can be moved about the screen as shown below. For each highlighted position, the and keys are used to page through a series of available parameter choices, also shown below. After selecting a new parameter in a particular highlighted position, the user can either move the highlighted window to another position or wait approximately four seconds for the highlight window to close.

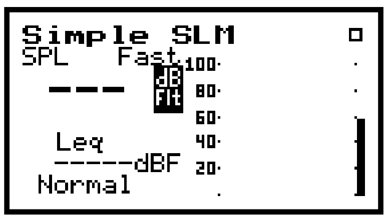


A reset is automatically performed when the frequency weighting, RMS detector or Range are changed. No reset is required when changing the secondary displayed parameter, LEQ, SEL, Lmin, Lmax, or Lpk since this does not represent a change in the measurement itself.

Note that these parameters can be edited while a measurement is in progress.

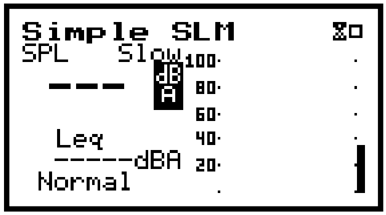
Example 1 Changing the frequency weighting from “Flt” to “A”.

Step 1 Use the ▲ and ▼ keys to position the highlight window over the frequency weighting parameter as shown below.



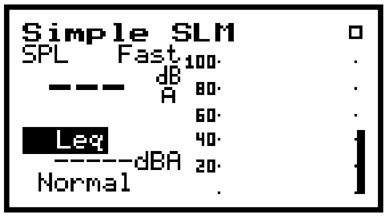
Step 2 Use the ◀ and ▶ keys to bring the desired frequency weighting choice, “A”, into the highlighted window, as shown below, then either move the position of the high-

lighted window or wait four seconds for it to close.

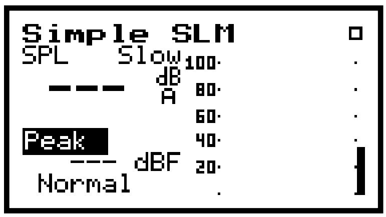


Example 2 Selecting the Secondary Display Parameter to be Peak with C-weighting.

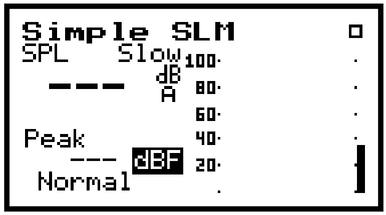
Step 1 Use the and keys to position the highlight window over the Secondary Display Parameter as shown below.



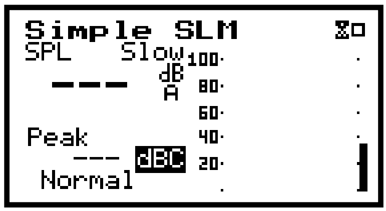
Step 2 Use the and keys to bring the secondary displayed parameter choice “Peak” into the highlighted window, as shown below.



Step 3 Use the and keys to position the highlight window over the Peak Weighting parameter as shown below.



Use the and keys to bring the Peak Weighting choice "C" into the highlighted window, as shown below.



Editing Using the Setup Menu

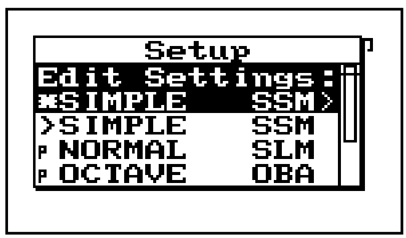
SSM indicates that the ID is a simple Sound Level Meter setup.

There are four general steps to setting up the sSLM instrument: 1) Go to the *Setup* menu. 2) Select the *SIMPLE SSM*. 3) Return to the *Setup* menu. 4)Then enter the *Settings* menu.

This procedure is discussed in more detail below:

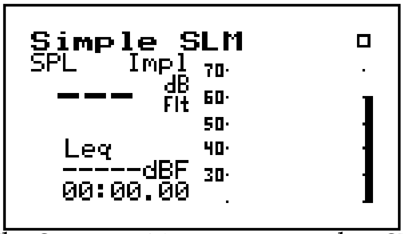
If the 814 is already in sSLM mode, there will be a '>' to the left of SIMPLE SSM. In which case, skip to Step 4 below.

Step 1 Press the key. A menu similar to the following appears:



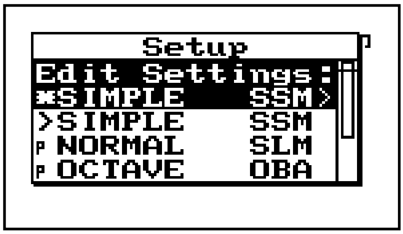
If you have not already saved your data, you will be prompted to save it at this step.

Step 2 Select *SIMPLE SSM* from the menu by using the or keys and then pressing the key. The sSLM screen appears:

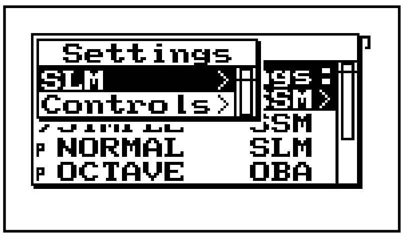


The System 814 is now set to the sSLM instrument.

Step 3 To access the *Settings* menu, press the key. The *Edit Settings: *SIMPLE SSM* is highlighted as the *Setup* menu appears:



Step 4 Press the or key and the *Settings* menu appears:



The *Settings* menu gives a list of sub-menus. The following is a table of the settings sub-menus:

Sub-Menu Items	Purpose
SLM	Specific Sound Level Meter settings
Controls	System 814 Controls for the sSLM

Step 5 Use the ▲ or ▼ keys to select the desired sub-menu, then press the ▶ key to view available settings for the sub-menu.

The following sections discuss the sSLM's settings sub-menus and their corresponding menu items in more detail.

sSLM Settings Menu

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 *sSLM Settings* menu has 7 items. Each setting is later described in greater detail.

Menu Items	Available Settings Options
Detector	Slow Fast Impl
Weighting	A C FLT OCT 1/3
Range	Normal Low High
Transducer	Condnsr Elctret Direct

Pk-1 Weighting	Flat C
Current Exchange	3dB 4dB 5dB 6dB
Current Thresh-old	(0)dB - (255) dB

Detector Setting

Use the *Detector* setting to set the time weighting characteristics of the instrument's RMS detector. This setting provides the following three options:

Slow - The instrument uses exponential averaging with a one second time constant.

Fast - The instrument uses exponential averaging with a 1⁄8 second time constant which allows more variability to appear in the measurement.

Impl - The instrument uses impulse weighting which has a fast rise time but a very slow decay time.

Weighting Setting

Use the *Weighting* setting to select the desired frequency weighting for the RMS and secondary peak detectors.

This setting can be changed from the default sSLM screen by pressing the or keys to select the desired setting and the or keys to adjust.

The *Weighting* setting provides the following five options:

A - The instrument uses an A-weight input filter.

C - The instrument uses an C-weight input filter.

FLT - The instrument uses Flat weighting (see specifications for passband frequency in Appendix C).

OCT - The instrument becomes a single-octave sound level meter (for the octave specified in the *Filter* setting).

1/3 - The instrument becomes a single third-octave sound level meter (for the third octave specified in the *Filter* setting).

Range Setting

Use the *Range* setting to select the desired measurement range 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 20 dB to 130 dB when using a Larson•Davis high-sensitivity microphone.

Not available for electret or direct transducer types (see "Transducer Settings" below).

Low - The instrument's input circuitry provides an additional 20 dB of gain which has the effect of moving the instrument's available dynamic range downward relative to the "normal" range (see below). The net effect is that you can measure lower-level sounds effectively. The degree of benefit varies depending upon the weighting or octave filter that you are using.

High - The instrument's sensitivity is reduced by 20 dB which has the effect of moving the instrument's available dynamic range upward relative to the "normal" range (see above). The net effect is that 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 814's large dynamic range (110 dB) 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 sound levels.

Transducer Setting

Use the *Transducer* setting to select the desired transducer. This setting provides the following three settings:

Condnsr - Indicates that the microphone being used is an air condenser type and the System 814 will generate the appropriate polarization voltage to make it function properly.

Elctret - Indicates that the microphone being used is an "electret" (pre-polarized) microphone. The instrument will not generate any polarization voltage.

Direct - Indicates that no microphone is being used and that electrical signals are being injected directly into the preamp.

Pk-I Weighting Setting

The primary peak detector (i.e. Pk-I) measures the greatest instantaneous (i.e. non-time-averaged as in RMS) level (L_{pk}) that has occurred since the last current or overall reset. As stated above, this primary *peak detector is weighted according to the state of the Peak-I Weighting setting. In contrast, the* secondary *peak detector is a separate peak detector which is weighted the same as the RMS detector according to the state of the Weighting setting.*

Use the *Peak-I Weighting* setting to apply either Flat or C weighting to the primary peak detector.

This setting provides the following two options:

Flat - The primary peak detector uses no weighting and the signal passes through the input circuitry unmodified.

C - The primary peak detector uses a C-weight input filter that meets Type 1 sound level meter specifications.

This setting gives you the flexibility of having various configurations of peak-detector weightings using both the Pk-I and the Pk-II detectors. For example, you could have two simultaneous but independent peak detectors—one with A weighting and the other with C weighting.

Current Exchange Setting

This setting effects the System 814 current buffer.

Use the *Current Exchange* rate setting to set the exchange rate (sometimes called the "doubling rate") that is used to calculate the TWA (Time Weighted Average). 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 default 3dB option is the most commonly used and results in the L_{eq} time weighted average which is used worldwide 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.

The formulas for calculating TWA are found in Appendix B.

Current Threshold Setting

This setting effects the System 814 current buffer.

Use the *Threshold* setting to set the threshold for computing the current 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)dB - (255)dB

For hearing conservation purposes, set the threshold to 80dB. For most community noise purposes, set the threshold to 0dB.

Controls Settings Menu

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.

Menu Items	Available Settings Options
AC Out Filter	Flat Wght
Logic-In Mode	None Pause Toggle Level Alarm
Output 1 Logic	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
Output 1 Timer	0 ~ 255 sec

The *Control Settings* menu has 4 items. Each setting is later described in greater detail.

AC Out Filter Setting

Use the *AC Out Filter* setting to select the frequency characteristics of the AC output signal. The AC output signal is derived from the actual signal the instrument is measuring. This signal is available for external use via a connector at the base of the System 814.

This setting provides the following two options:

Flat - The AC output signal has the flat frequency weighting applied to it.

Wght - The AC output signal has the same frequency characteristics as the displayed SPL level: A, C or Flat.

Logic Input Setting

Use the *Logic Input* setting to select the functionality of the logic input pin on the control connector (pin 3). This logic input 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 (which is also available on the control connector on pin 6) or leave the pin unconnected. This signal may also be supplied from another device that can supply a 0 to +5 volt logic signal (input loading is 100K ohms). The resulting logical state (either on or off) 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 +5V (e.g. when a push-button switch is pressed), the instrument pauses if it is in the run mode.

Toggle - Each time the logic input is connected to +5V (e.g. when a push-button switch is pressed), the instrument runs or stops. The effect is the same as pressing the key.

Level - When the logic input is connected to +5V (e.g. when a push-button switch is pressed), the instrument runs. When the logic input is disconnected from +5V (e.g. when a push-button switch is released), the instrument stops.
Caution: This function will override the key and I/O RUN/STOP commands.

Alarm - When the logic input is connected to +5V (e.g. when a push-button switch is pressed), 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.

Output 1 Logic Setting

Use the *Logic Output* setting to select the functionality of the logic output pin on the control connector (pin 2 referenced to ground on pin 1). You can use this *Logic Output* to actuate external devices as a function of certain events or combinations of events that occur in the instrument. The option you select will determine which event or combination of events will turn on the logic output line.

Once the *Logic Output* turns on, it will stay on for the length of time set by the *Logic Output Time* setting.

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 17 options (many of which will be functional in the near future):

Off - The *Logic Output* is always off (i.e. it 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 either of the thresholds set by the *SPL Trigger-Level* settings.

Peak - The *Logic Output* turns on when a Pk-II exceedance event occurs. A Pk-II exceedance event occurs when the Pk-II level exceeds the threshold set by the *Pk-II Trigger Level* setting.

R+P - The *Logic Output* turns on when either an RMS or Pk-II 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.

Currently NOT available on the System 814.

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 wind monitoring.

Currently NOT available on the System 814.

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.

Currently NOT available on the System 814.

P+A - The *Logic Output* turns on when a Pk-II exceedance event occurs or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

R+P+A - The *Logic Output* turns on when either an RMS or Pk-II exceedance event occurs or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

I+A - The *Logic Output* turns on when each interval begins or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

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.

Currently NOT available on the System 814.

P+I+A - The *Logic Output* turns on when a Pk-II exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

R+P+I+A - The *Logic Output* turns on when either an RMS or Pk-II exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

Note that the output hold time does not apply when you select this particular option *(see "Output Hold Time Setting" later in this chapter).*

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.

Output 1 Timer Setting

Use the *Logic Output Time* setting to set the number of seconds that the logic output will remain turned on or remain asserted following a triggering event. Accordingly, this setting can take on any integral value within the following range:

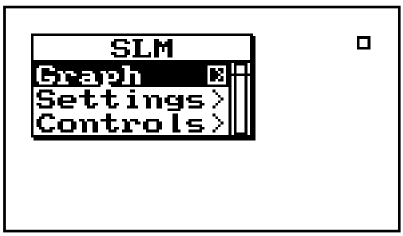
(0) sec to (255) sec

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 line 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).

Check Menu

In addition to the on-screen controls, a menu of associated settings is available as a *Check* menu by pressing the ✓ key. This menu allows you to change the *Detector* setting and the *Weighting* setting from the sSLM display. To change the display settings, do the following:

Step 1 From the sSLM display, press the ✓ key to access the *Check* menu. The following appears:



Following is a chart of the SLM settings. Each setting is then described in greater detail.

Menu Items	Purpose
Graph	Change the scaling of the sSLM SPL history graph
Settings	Specific Sound Level Meter settings
Controls	System 814 Controls for the sSLM

Graph Menu

There are two s*SLM Graph* 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

Menu Items	Available Settings Options
Graph Level	(0) 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:

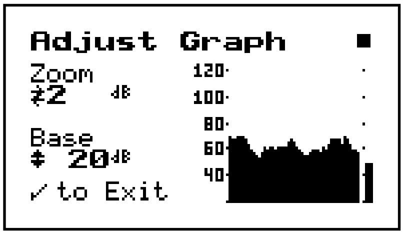
0 - 255

Graph Level may also be changed interactively with the Adjust Graph display (described next).

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 ✓ key on *Graph* menu item (from the SLM *Check* menu) allows you to graphically and interactively adjust the sSLM *Graph* settings. The following screen 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.

Settings

Refer to “sSLM Setting” (described at the beginning of this chapter) for details on this menu.

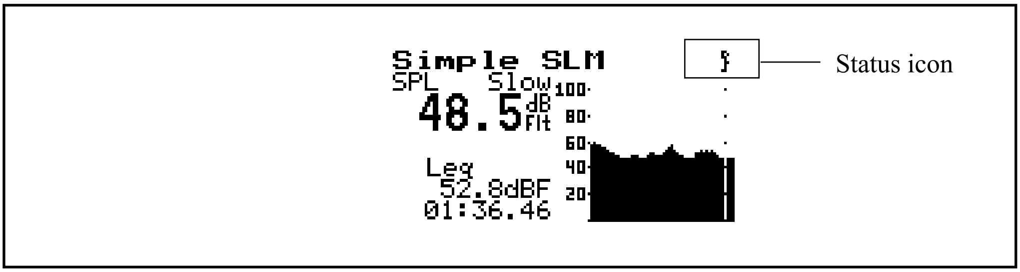
Controls

Refer to “Controls Setting Menu” (described at the beginning of this chapter) for details on this menu.

Understanding sSLM Displays

The System 814 has two displays for the sSLM instrument. Understanding these displays allows you to take full advantage of the instrument.

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 is list and description of icons which may appear:

Status 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.
	Double Bar - The instrument is paused.
	Play Symbol - The instrument is ready to run (as soon as stabilization completes).
	Bar and Play Symbol - The instrument is in preview. Current SPL and peak levels are displayed, but no data is being acquired.
	Animated Hourglass - The instrument is stabilizing to ensure accurate measurement.
	Animated Draining Battery - The battery is low, and the instrument will shut off soon.

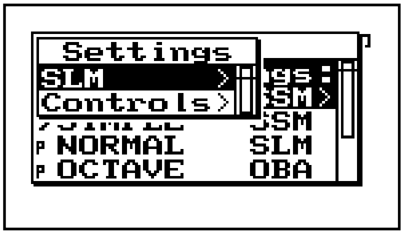
▯	O.L. - The instrument is overloaded; measurement may not be accurate due to an overload condition having occurred some time during the measurement.
▯	Animated Clock - Indicates that the automatic *run/stop timer* is active.

If the 814 is already in sSLM mode, there will be a '>' to the left of SIMPLE SSM.

In order to view the displays on the System 814 in sSLM mode, switch the device to sSLM mode. To do this:

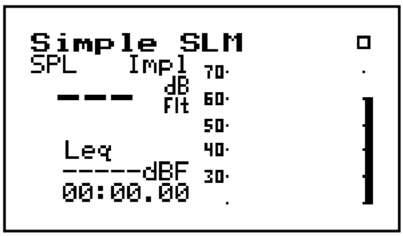
If you have not already saved your data, you will be prompted to Save it here.

Step 1 Press the ✎ key. A menu similar to the following appears:

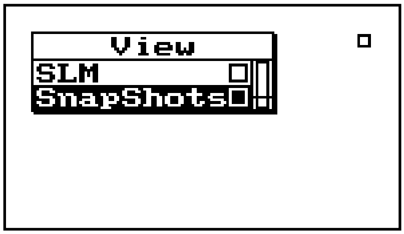


*Using the ⏶ and*d *arrow keys, select the desired display and then press the* ✓ *key to bring up that display.*

Step 2 Select SIMPLE SSM from the menu by pressing the ⏶ or ⏷ keys and then pressing the ✓ key. The sSLM Default screen appears:



Step 3 Press the key to access the *View* menu. The following screen appears:



Available sSLM Displays

There are two sSLM displays. Each display is later described in greater detail.

Menu Items	Purpose
SLM	Main simple Sound Level Meter display.
SnapShots	A SnapShot of all simple SLM measurements stored at a specific time.

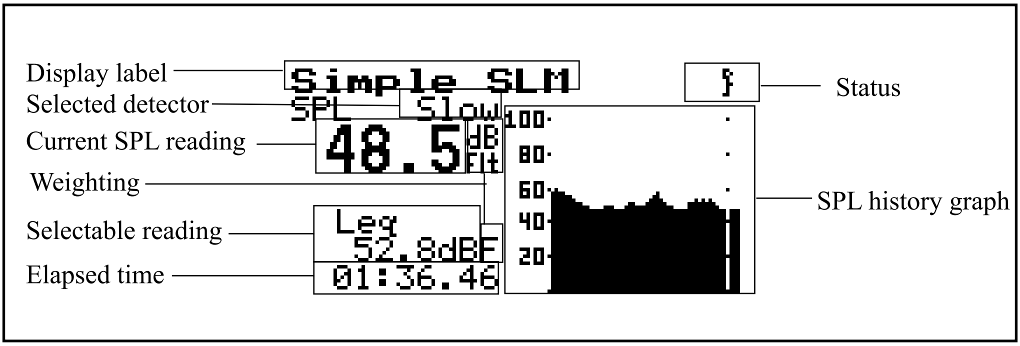
SLM

The *SLM View* sub-menu consists of eight major components:

- Display label
- Selected detector
- Current SPL reading
- Selectable Leq reading
- Weighting
- Elapsed time

- Status
- SPL history graph

The following information explains each of these components.



Display label - Shows the display currently being used. In this display, *Simple SLM* states that you are using the simple sound level meter.

Selected detector - The selected detector determines the speed at which the SPL history graph scrolls from right to left.

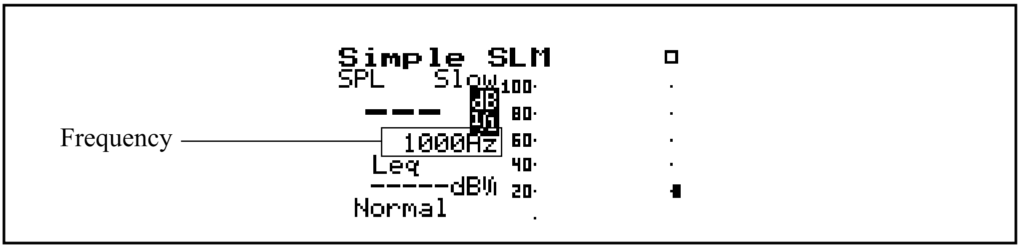
Option: Takt3 and Takt5 are also available if "German" functionality has been enabled (factory setting).

Current reading - Displays the current SPL reading (also the level of the moving bar on the far right of the SPL history graph). The frequency weighting for SPL can be changed to: A, C, FLT, OCT, or 1/3.

Selectable reading - The selectable reading allows you to view a second level which can be Leq, SEL, Lmin, Lmax, or Lpeak.

Weighting - When the selectable reading is showing Lpeak, the weighting for the Lpeak can be set to: A, C or Flat (depending on the current SPL frequency weighting).

When weighting is set to *1/1* or *1/3* octave, then the filter frequency is displayed:



Elapsed time - Displays the length of time current readings have been running. It will reset to zero when the RESET key is pressed. 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 hhhhh:mm.

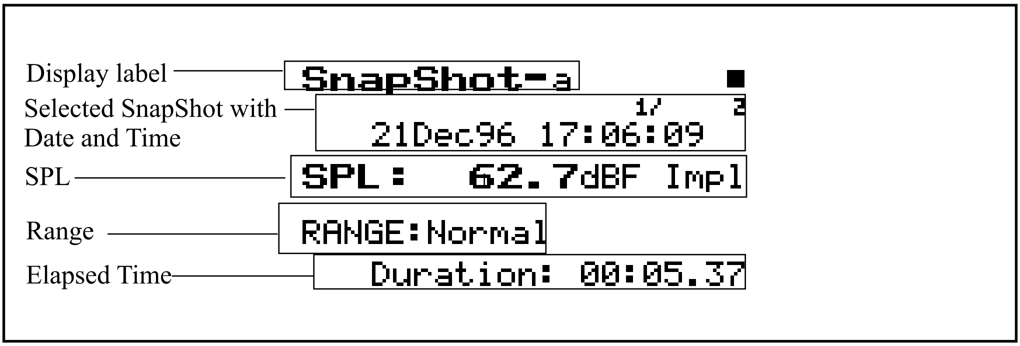
Status - Represents the state of the instrument (as described at the beginning of this section).

SPL history graph - Shows history of SPL readings. The far right bar moves and displays the current one second Leq reading. 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.

SnapShot

SnapShots can be captured by pressing the key, then selecting Store SnapShot and pressing the key (see Chapter 2).

The *SnapShot View* sub-menu displays *SnapShots* of sSLM readings. The SnapShot view consists of five screens. Each of the five screens are similar to the following:



Each screen displays the date and time of the *SnapShot*, the duration and the current *SnapShot* record being displayed, and the current record number over total number of SnapShot record stored (shown above is record 1 of 2). The following table describes each of the five SnapShot screens:

Use the ◀ or ▶ arrow keys to move between SnapShots a, b, c, d, and e and the ▲ and ▼ arrow keys to move between different SnapShot record numbers.

Screen	Displays
SnapShot -a	SPL and range
SnapShot -b	TWA exchange rate SEL
SnapShot -c	Lmax Lmin
SnapShot -d	Lpeak - I Lpeak - II
SnapShot -e	Number of times overloaded

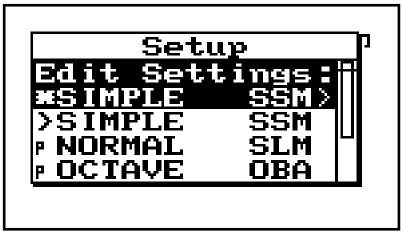
Using the sSLM

This section gives a step by step example of a possible scenario using the sSLM instrument. In this scenario, you will select the Simple SLM instrument and take 3 measurements (or “SnapShots” of measurements). You will then view the results of these three measurements.

Simple sSLM Scan

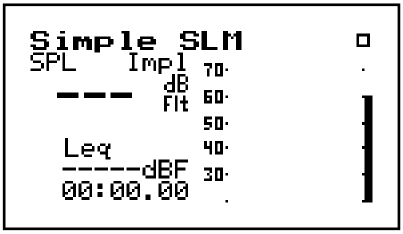
If the 814 is already in sSLM mode, there will be a ‘>’ to the left of Simple SSM. If so, skip to Step 4.

Step 1 Press the key. A menu similar to the following appears:

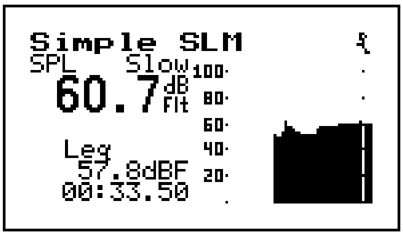


If you have not already saved your data, you will be prompted to save it here.

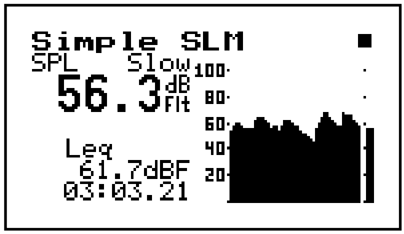
Step 2 Select SIMPLE SLM from the menu by pressing the or keys and then pressing the key. The Simple SLM screen appears:



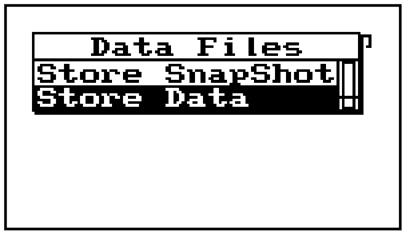
Step 3 Select SIMPLE SLM from the menu by pressing the or keys and then pressing the key. The Simple SLM screen appears:



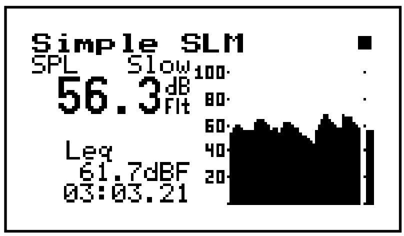
Press the key to begin taking readings. Run for about 3 minutes. A screen similar to the following appears:



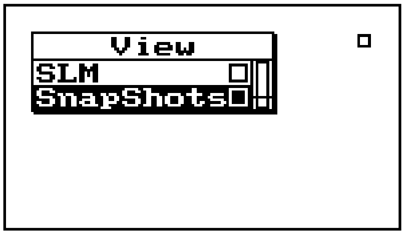
Step 4 After 1 minute press the key. Select *Store-SnapShot* and press the key. This will store a snap shot. Repeat every minute (for a total of 3 *SnapShots* in this one measurement).



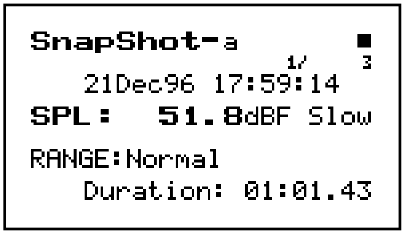
Step 5 Press the key to halt the readings. A solid box will appear in the upper right hand corner:



Step 6 To view the SnapShots of these runs, press the key. The following screen appears:



Step 7 Use the and keys to select *SnapShots*, then press to select. A screen similar to the following appears:



Step 8 Using the or keys, you can move from one SnapShot to the next (i.e. view all 3 SnapShots).Use the or arrow keys to view additional SnapShot data.

CHAPTER

5 ∫SLM-Logging Sound Level Meter

This chapter will help you better understand the System 814 ∫SLM (Logging Sound Level Meter). Specifically this chapter covers the following topics:

- Setting up the ∫SLM: overview of the settings and configurations of the System 814 in ∫SLM mode.
- Understanding ∫SLM Displays: overview of the displays used in ∫SLM mode and simple explanations of how to read the displays.
- Using the ∫SLM: simple applications that can be used with the System 814 in ∫SLM mode.

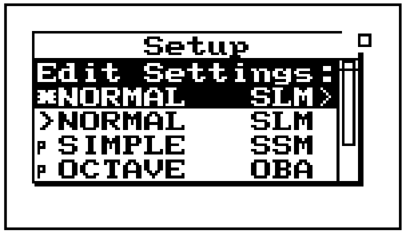
Setting up the ∫SLM

There are four general steps to setting up the System 814 in ∫SLM mode: 1) Go to the *Setup* menu. 2) Select the *NORMAL SLM*. 3) Return to the *Setup* menu. 4)Then enter the *Settings* menu.

This procedure is discussed in more detail below:

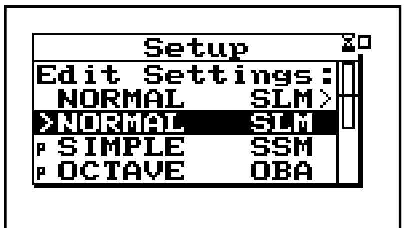
If the 814 is already in ∫SLM *mode, there will be a '>' to the left of NORMAL SLM. In which case, skip to Step 3 below.*

Step 1 Press the key. A menu similar to the following appears:



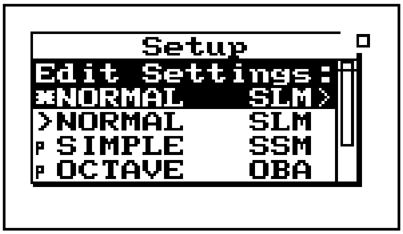
If you have not already saved your data, you will be prompted to save it at this step.

Step 2 Select *NORMAL SLM* from the menu by pressing the or keys and then pressing the key. The ∫SLM Default screen appears:

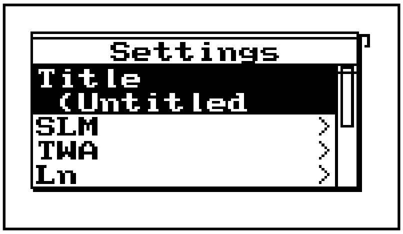


The 814 is now set to the ∫SLM instrument.

Step 3 To access the *Settings* menu, press the key. The *Edit Settings: NORMAL SLM* is highlighted as the *Setup* menu appears.



Step 4 Press the key and the *Settings* menu appears:



Step 5 Use the or keys to select the desired sub-menu, then press the key view available settings of the sub-menu.

The *Settings* menu gives a list of sub-menus. The following is a table of the *Settings* sub-menus:

Sub-Menu Items	Purpose
Title	Title of ID settings
SLM	Specific Sound Level Meter settings
TWA	Time Weighted Average settings
Ln	Percentile Level settings
Triggering	Set Peak and SPL triggers
Time History	Time History settings

Intervals	Statistical History settings
Define Report	Report settings
Controls	Controls for the ∫SLM

The following sections discuss the ∫SLM's Settings sub-menus and their corresponding menu items in more detail.

Title Setting

To change the Title, use the and keys to select each character. Use the and keys to replace the selected character. Pressing the key clears all characters from the cursor to the end of the field

The *Title* setting allows you to change the title of this ∫SLM Instrument Definition (ID) which describes the measurement on printed reports. You may use a title that is 30 alpha/numeric characters.

SLM Settings Menu

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 *SLM* settings menu has 5 items. Each setting is later described in greater detail.

Menu Items	Available Settings Options
Detector	Slow Fast Impl
Weighting	A C FLT OCT 1/3
Range	Normal Low High

Transducer	Condnsr Elctret Direct
Pk-1 Weighting	Flat C
OBA Filter	30

Detector Setting

Use the *Detector* setting to set the characteristics of the instrument's RMS detector. This setting provides the following three options:

Slow - The instrument uses exponential averaging with a one second time constant.

Fast - The instrument uses a shorter 1⁄8 second time constant which allows more variability to appear in the measurement.

Impl - The instrument uses impulse weighting which has a fast rise time but a very slow decay time.

The Slow option is normally used for OSHA measurements. Either the Slow option or the Fast option can be used for environmental measurements.

Weighting Setting

This setting can be changed from the default sSLM screen by pressing the or keys to select the desired setting and the or keys to adjust.

Use the *Weighting* setting to select the desired frequency response for the RMS detector and secondary peak detector.

The *Weighting* setting provides the following five options:

A - The instrument uses an A-weight input filter that meets Type 1 sound level meter specifications.

C - The instrument uses a C-weight input filter that meets Type 1 sound level meter specifications.

FLT - The instrument uses FLAT weighting (see specifications for passband frequency in Appendix C).

OCT - The instrument becomes a single-octave sound level meter (for the octave specified in the *Filter* setting).

1/3 - The instrument becomes a third-octave sound level meter (for the third octave specified in the *Filter* setting).

Range Setting

Use the *Range* setting to select the desired measurement range 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 (see below). The net effect is that you can measure lower-level sounds effectively. The degree of benefit varies depending upon the weighting or octave filter that you are using.

Not available for electret or direct transducer types (see "Transducer Setting" below).

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 (see above). The net effect is that you can measure higher-level sounds effectively. The benefit varies depending upon the weighting or octave filer 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 814's large dynamic range (110dB) 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 sound levels.

Transducer Setting

Use the *Transducer* setting to select the desired transducer. This setting provides the following three settings:

Condnsr - Indicates that the microphone being used is an air condenser type and the System 814 will generate the appropriate polarization voltage to make it function properly

Elctret - Indicates that the microphone being used is an “electret” (pre-polarized) microphone. The instrument will not generate any polarization voltage.

Direct - Indicates that no microphone is being used and that electrical signals are being injected directly into the preamp.

Pk-I Weighting Setting

The primary peak detector (i.e. Pk-I) measures the greatest instantaneous averaged as in level (L_{pk}) that has occurred since the last current or overall reset. As stated earlier, this primary *peak detector is weighted according to the state of the Peak-I Weighting setting. In contrast, the* secondary *peak detector is a separate peak detector which is weighted according to the state of the Weighting setting.*

Use the *Peak-I Weighting* setting to apply either Flat or C weighting to the primary peak detector.

This setting provides the following two options:

Flat - The primary peak detector uses no weighting and the signal passes through the input circuitry unmodified.

C - The primary peak detector uses a C-weight input filter that meets Type 1 sound level meter specifications.

This setting gives you the flexibility of having various configurations of peak-detector weighting using both the Pk-I and the Pk-II detectors. For example, you could have two simultaneous but independent peak detectors—one with A weighting and the other with C weighting.

OBA Filter

This setting works in conjunction with the weighting menu when 1 octave or 1/3 octave is selected. Enter filter # 1 through 30 to select the bandpass filter for the RMS detector and the secondary peak detector.

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 chart of the *TWA* settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
Ovll Exchange	3dB 4dB 5dB 6dB
Ovll Threshold	0 to 255 dB
Ovll Criterion	0 to 255 dB
Criterion Time	0 to 99 hours
Crnt Exchange	3dB 4dB 5dB 6dB
Crnt Threshold	0 to 255 dB
Crnt Criterion	0 to 255 dB

Overall Exchange Setting

This setting affects the System 814's primary or overall buffer.

Use the *Overall Exchange* rate setting to set 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:

3dB - The default 3dB 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.

Overall Threshold Setting

This setting affects the System 814's primary or overall buffer.

Use the *Threshold* setting to set 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)dB - (255)dB

For hearing conservation measurements, set the threshold to 80dB. For most community noise measurements, set the threshold to 0dB.

Overall Criterion Level Setting

Use the *Overall Criterion Level* setting to set 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)dB 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%.

Current Exchange Setting

This setting affects the System 814's secondary or current buffer.

Use the *Current Exchange* rate setting to set the exchange rate (sometimes called the "doubling rate") that is used to calculate 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:

3dB - The default 3dB 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.

The calculation formulas for TWA are provided in Appendix B of this manual.

Current Threshold Setting

This setting affects the System 814's secondary or current buffer.

Use the *Threshold* setting to set the threshold for computing the current 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) dB - (255) dB

For hearing conservation measurements, set the threshold to 80 dB. For most community noise measurements, set the threshold to 0 dB or slightly above the noise floor.

Current Criterion Level Setting

Use the *Current Criterion Level* setting to set 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) dB 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%.

L_N Menu

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. The settings are then described in greater detail.

Menu Items	Available Settings Options
Lnn 1 Percent	.01 to 99.99%
Lnn 2 Percent	.01 to 99.99%
Lnn 3 Percent	.01 to 99.99%
Lnn 4 Percent	.01 to 99.99%
Lnn 5 Percent	.01 to 99.99%
Lnn 6 Percent	.01 to 99.99%

Use the six L_N percentile settings to select the six percentile values to be measured, logged (if selected) and shown in the "∫SLM L_N-a" display. Using these six settings, you can select any six percentile values to be utilized 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 measured. The value of $L_{10.5}$ is the level that has been exceeded 10.5% of the time during the time of overall measurement. As shown above, these settings can each take on any value within the following range:

(.01) to (99.99)

NOTE: Whenever you change any percent value, the instrument sorts and reorders the L_N levels and the associated percent values into ascending order as demonstrated in the following example.

Example: Suppose you change L_{nn} 3 from 30.0 to 5.0. The original setting values will then be automatically sorted into ascending order and reassigned as shown in the table below:

Original Setting	After Change and Sort
L_{nn} 1 Percentile = 10.0	*L_{nn} 1 Percentile = 5.0
L_{nn} 2 Percentile = 20.0	L_{nn} 2 Percentile = 10.0
*L_{nn} 3 Percentile = 30.0	L_{nn} 3 Percentile = 20.0
L_{nn} 4 Percentile = 40.0	L_{nn} 4 Percentile = 40.0
L_{nn} 5 Percentile = 50.0	L_{nn} 5 Percentile = 50.0
L_{nn} 6 Percentile = 60.0	L_{nn} 6 Percentile = 60.0

Triggering Menu

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 for counting the number of exceedances during the measurement period, which are displayed in the Stats-a and b displays, and are also for the initiation of noise event measurements when using the Logging SLM Mode.

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 chart of the *Triggering Menu* settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
SPL Excd Lvl 1	0.0 to 255.99 dB
SPL Excd Lvl 2	0.0 to 255 dB
Pk-1 Excd Lvl	0.0 to 255 dB
Pk-2 Excd Lvl	0.0 to 255 dB
Hysteresis	0 to 9 dB

SPL Trigger Level 1 Setting

Use the *SPL Exceedance Level 1* setting to set the lowest SPL trigger level. 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.

This setting can take on any value within the following range:

(0.0) dB to (255.9) dB

This setting, unlike the other trigger level settings, has an additional decimal place of accuracy.

SPL Trigger Level 2 Setting

Use the *SPL Exceedance Level 2* setting to set the higher trigger level. When the SPL exceeds the level set by this setting, the 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.

This setting can take on any integer value within the following range:

(0) dB to (255) dB

Peak I Trigger Level Setting

Use the *Peak I Exceedance Level* setting to set the trigger level for the primary peak detector (i.e. Pk-I). When the primary peak detector level exceeds the threshold set by this setting, 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.

This setting can take on any integer value within the following range:

(0) dB to (255) dB

Peak II Trigger Level Setting

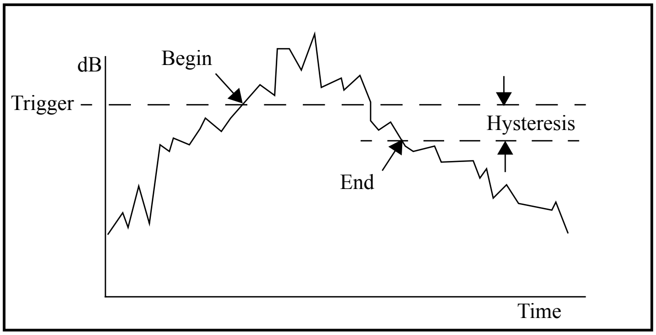
Use the *Peak II Exceedance Level* setting to set the trigger level for the secondary peak detector (i.e. Pk-II). When the secondary peak detector level exceeds the threshold set by this setting, the corresponding Pk-II exceedance count is incremented once. You can view this count on the *Stats-b* display. This count is associated with the overall measurement data and is reset when the overall measurement is reset.

This setting can take on any integer value within the following range:

(0) dB to (255) dB

Hysteresis Setting

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 take on an integer value within the following range:

(0) dB to (9) dB

Time History Menu

Time history recording is used to store only the value of the SPL and, if selected, one additional user-selected parameter such as Lpk or Lmax. Levels can be stored rapidly, up to 32 samples per second. 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 utilize 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 is a chart of the *Time History* settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
Hist Enable	No Yes
Hist Period	1 to 255
Period Units	1/32s 1.0s 10.0s 60.0s
Other Level	No Pk-II Pk-I Lmax
Resolution	0.1 dB 1.0 dB

History Enable Setting

Use the *History Enable* setting to either enable or disable the automatic storage of simple time-history records. The instrument has the ability to store data at a user-determined rate. You can then view these history records at a later time.

This setting provides the following two options:

No - Time-history storage is disabled.

Yes - Time-history storage is enabled.

Hist Period Setting

This setting is used in conjunction with the "Period Units Setting" (below).

Use the time *History Period* setting to set the number of history periods that transpire between successive time history samples. These samples continue either until the instrument is stopped or runs out of memory. This setting can take on any integral value in the following range:

(1) to (255)

Period Units Setting

Use the time history *Period Units* setting to select 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 the *Time History Period* setting (see the previous "Hist Period Setting" and the following example).

This setting provides the following four options:

Example: To measure 2 sample per second, set Hist Period to 16 and Period Units to 1/32s (16/32=1/2).

1/32s - The instrument uses its 1/32 second internal sample period as the history period unit. 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 - The instrument uses one second as the history period unit.

10.0s - The instrument uses ten seconds as the history period unit.

60.0s - The instrument uses one minute as the history period unit.

Other Level Setting

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:

No - 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 *Peak I 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.

Resolution Setting

In order to double the memory 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 full resolution which requires 2 bytes of memory per level.

1.0dB - Leq and the optional Other Level are stored with 1dB 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).

Intervals Menu

The Interval menu sets the following parameters to automatically stored to memory at regular time periods: Leq, SEL, Lmax, Lmin, Lpk1, LpkII, and six Ln values. The interval time period can range from one second to 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.

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 chart of the *Intervals* settings. Each setting is then described in greater detail.

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

Use the *Interval Enable* setting to either enable or disable the automatic storage of interval statistical records.

This setting provides the following two options:

No - Interval storage is disabled.

Yes - Interval storage is enabled.

Interval Period Setting

Use the time *Interval Period* setting to set the time interval between successive interval storage operations. These storage operations continue either until the instrument is stopped or runs out of memory. This setting can take on any time value in the following range:

00:00:01 to 99:59:59 (i.e. one minute to 99 hours, 59 minutes and 59 seconds).

Interval Sync Enable Setting

Use the *Intv Time Sync* setting to either enable or disable the time-history sync feature. When enabled, this feature causes the time history storage operations to be synchronized with the real-time of day clock. This synchronization can occur on an hourly, 30 min., 20 min., 15 min., 5 min., or 1 min. 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 - Interval synchronization is disabled.

Yes - Interval synchronization is enabled.

Interval L_N Enable Setting

Use the *Interval L_N Enable* setting to either enable or disable 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.

Interval Auto-Stop Enable Setting

Do not use this feature with the time sync feature, or you may not get the full time period you desire.

Use the *Auto-Stop* setting to either 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 ▶‖ key.

This setting provides the following two options:

No - Automatic stop feature is disabled.

Yes - Automatic stop feature is enabled.

Interval Threshold Setting

Use the *Interval Threshold* setting to set 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 overall TWA. Accordingly, this setting can take on any integral value within the following range:

(0) dB to (255) dB

For hearing conservation measurements, set the threshold to 80 dB. For most community noise measurements, set the threshold to 0 dB or slightly above the noise floor.

Interval Exchange Rate Setting

Use the *Interval Exchange Rate* setting to set 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 5 dB, for example, means that 5 dB 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 3 dB (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.

Define Report Menu

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 chart of the *Define Report* settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
Data 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 Setting

Use the *Data Report Enable* setting to either enable or disable 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.

SPL Histogram Report Setting

Use the *SPL Histogram Report* enable setting to either enable or disable 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-I Histogram Setting

Use the *Peak I Histogram* setting to either enable or disable 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-II Histogram Setting

Use the *Peak II Histogram* setting to either enable or disable the printing of the Peak I histogram report. The histogram report contains a histogram of the Peak II levels that have occurred during the overall measurement. This setting provides the following two options:

No - The peak II histogram report will not print.

Yes - The peak II histogram report will print.

Intv Report Setting

Use the *Interval Report* setting to either disable the printing of the interval report or enable 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, and exceedances) will print.

Hist Report Setting

Use the *History Report* setting to either enable or disable the printing of the Time history report. The history report contains the Leq, 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.

Controls Settings Menu

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 chart of the *Control* settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
AC Out Filter	Flat Wght

Logic-In Mode	None Pause Toggle Level Alarm
Logic Output	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 Output Timer	0 sec ~ 255 sec

AC Out Filter Setting

Use the *AC Out Filter* setting to select the frequency characteristics of the AC output signal. The AC output signal is derived from the actual signal the instrument is measuring. This signal is available for external use via a connector at the base of the System 814.

This setting provides the following two options:

Flat - The AC output signal has the flat frequency weighting applied to it.

Wght - The AC output signal has the same frequency characteristics as the 0SPL level: A, C or Flat.

Logic Input Setting

Use the *Logic Input* setting to select the functionality of the logic input pin on the control connector (pin 3).

This logic input 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 (which is also available on the control connector on pin 6) or leave the pin unconnected. This signal may also be supplied from another device that can supply a 0 to +5 volt logic signal (input loading is 100K ohms). The resulting logical state (either on or off) 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 +5V (e.g. when a push-button switch is pressed), the instrument pauses if it is in the run mode.

Toggle - Each time the logic input is connected to +5V (e.g. when a push-button switch is pressed), the instrument runs or stops. The effect is the same as pressing the key.

Caution: This function will override the key and I/O RUN/STOP commands.

Level - When the logic input is connected to +5V (e.g. when a push-button switch is pressed), the instrument runs. When the logic input is disconnected from +5V (e.g. when a push-button switch is released), the instrument stops.

Alarm - When the logic input is connected to +5V (e.g. when a push-button switch is pressed), 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.

Logic Output Setting

Use the *Logic Output* setting to select the functionality of the logic output pin on the control connector (pin 2 referenced to ground on pin 1). You can use this *Logic Output* to actuate external devices as a function of certain events or combinations of events that occur in the instrument. The option you select will determine which event or combination of events will turn on the logic output line.

Once the *Logic Output* turns on, it will stay on for the length of time set by the *Logic Output Time* setting.

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 17 options, many of which will be available in the future.

Off - The *Logic Output* is always off (i.e. it 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 either of the thresholds set by the SPL trigger level settings.

Peak - The *Logic Output* turns on when a Pk-II exceedance event occurs. A Pk-II exceedance event occurs when the Pk-II level exceeds the threshold set by the Pk-II trigger level setting.

R+P - The *Logic Output* turns on when either an RMS or Pk-II 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.

Currently NOT available on the System 814.

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 wind monitoring.

Currently NOT available on the System 814.

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.

Currently NOT available on the System 814.

P+A - The *Logic Output* turns on when a Pk-II exceedance event occurs or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

R+P+A - The *Logic Output* turns on when either an RMS or Pk-II exceedance event occurs or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

I+A - The *Logic Output* turns on when each interval begins or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

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.

Currently NOT available on the System 814.

P+I+A - The *Logic Output* turns on when a Pk-II exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

Currently NOT available on the System 814.

R+P+I+A - The *Logic Output* turns on when either an RMS or Pk-II exceedance event occurs, when each interval begins, or when an event occurs on one of the A:D channels.

Note that the output hold time does not apply when you select this particular option *(see "Output Hold Time Setting" later in the chapter).*

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 Timer Setting

Use the *Logic Output Time* setting to set the number of seconds that the logic output will remain turned on or remain asserted following a triggering event. Accordingly, this setting can take on any integral value within the following range:

(0) sec to (255) sec

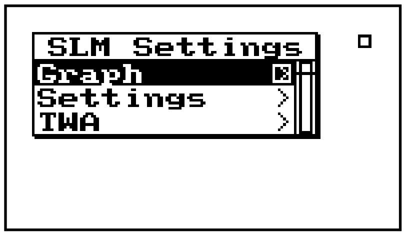
NOTE: If set below 5 seconds, the output will remain on as long as the conditions are true and turn off x seconds (0 to 5) after the condition. If set to 6 seconds or greater, the line will stay on for at least 5 seconds but will turn off as soon as the condition becomes false or the condition has lasted the number of set seconds (i.e. 0-5 minimum time, 6-255 maximum time).

Check Menus

The ∫SLM on the System 814 also has a shortcut to menus that access the settings associated with data being displayed. The following shows the steps that are necessary to access the *Detector* or *Freq. Weighting* settings using a *Check* menu. To do this:

Step 1 can also be performed from any Current or Overall display and achieve the same result.

Step 1 From a ∫SLM display, press the ✓ key to access the *Check* menu. The following appears:



Following is a chart of the SLM settings. Each setting is then described in greater detail.

Menu Items	Purpose
Graph	Change view of the ∫SLM SPL history graph
Settings	Specific Sound Level Meter settings
TWA	System 814 Controls for the SLM

Graph Menu

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 chart of the ∫SLM Graph settings. Each setting is then described in greater detail.

Menu Items	Available Settings Options
Graph Level	(0) to (255)
Graph Scale	2, 1, 1/2, 1/4, 1/8

Graph Level

Graph Level may also be changed interactively with the Adjust Graph display (described next).

The *Graph Level* setting allows you to change the base level of the SPL history graph. The following is the possible setting range:

0 - 255

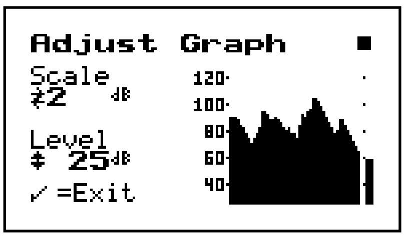
Graph Scale

Graph Level may also be changed interactively with the Adjust Graph display (described next).

The *Graph Scale* setting allows you to change the size of the scrolling SPL history graph. The following are the possible settings:

2, 1, 1/2, 1/4, 1/8 dB per dot (pixel)

Pressing the key on *Graph* (from the ∫SLM shortcut menu), will allow you to graphically change the ∫SLM *Graph* settings. The following screen 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.

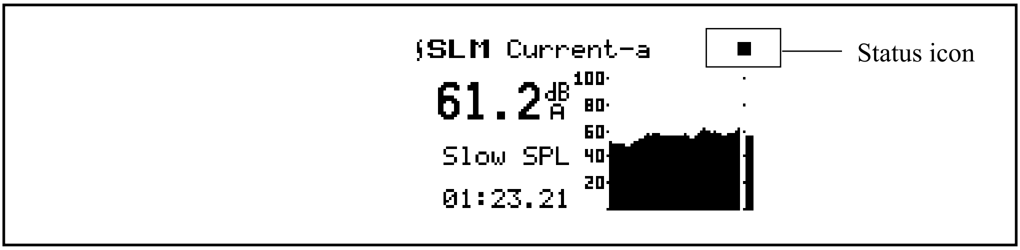
Settings Refer to “SLM Setting” (described earlier in this chapter) for details on this menu.

TWA Refer to “TWA Setting” (described earlier in this chapter) for details on this menu.

Understanding ∫SLM Displays

The System 814 has many displays for the ∫SLM instrument. Understanding these displays allows you to take full advantage of the instrument.

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 is list and description of icons which may appear:

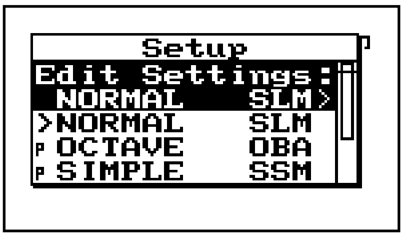
Status Icon	Description
▯	Animated Running Figure - Instrument is running and acquiring data.
▯	Solid Box - The instrument is stopped, data available.
▯	Open Box - The instrument is stopped, and reset.
▯	Double Bar - The instrument is paused.

▯	Play Symbol - The instrument is ready to run (as soon as stabilization completes).
▯	Bar and Play Symbol - The instrument is in preview. Current SPL and peak levels are displayed, but no data is being acquired.
▯	Animated Hourglass - The instrument is stabilizing to ensure accurate measurement.
▯	Animated Draining Battery - The battery is low, and the instrument will shut off soon.
▯	O.L. - The instrument is overloaded; measurement may not be accurate due to an overload condition having occurred some time during the measurement.
▯	Animated Clock - Indicates that the automatic *run/stop timer* is active.

In order to view the displays on the System 814 in ∫SLM mode, switch the device to ∫SLM mode. To do this:

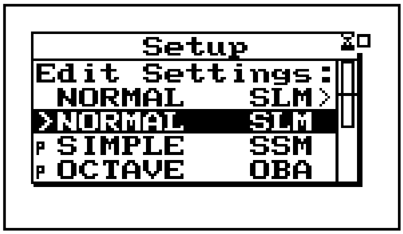
If the 814 is already in Logging SLM mode, there will be a '>' to the left of NORMAL SLM.

Step 1 Press the SETUP key. A menu similar to the following appears:



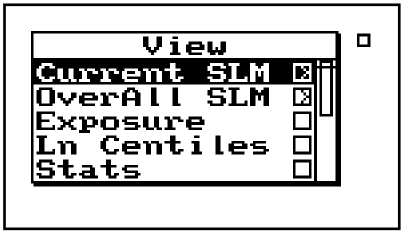
If you have not already saved your data, you will be prompted to Save it here.

Step 2 Select *NORMAL SLM* from the menu by pressing the ▲ or ▼ keys and then pressing the √ key. The ∫SLM Default screen appears:



Using the ▲ and ▼ arrow keys, select the desired display then press the √ key to bring up that display.

Step 3 Press the ◉ key to access the *View* menu. The following screen appears:



Available ∫SLM Displays

There are six Logging SLM main displays and five additional displays. Each display is described in greater detail.

Main Displays:

Display	Purpose
Current SLM	Maintains an accumulation of data that may be reset immediately.
OverAll SLM	Maintains an accumulation of data over the entire measurement period and is reset when the entire measurement is reset.
Exposure	The exposure display shows either dose and projected dose, or the sound exposure (E).

Ln Centiles	Display shows six selected L_n values, a graph of L_1 to L_{99}, a graph of the percent greater than level, and graph of level distribution in percent.
Stats	Shows the number of overloads, and the number of events detected.
LDL	Shows the TWA, SEL, dose and projected dose as recalculated with an adjustable threshold, exchange rate, criterion level and criterion time.

Additional Displays:

Display	Purpose
Time History	Shows the time history of L_{eq} and optionally either L_{max} or L_{pk} over short duration periods.
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.
Run Log	Shows a listing of each run, stop, pause, continue, and mark actions with their cause, and date/time of occurrence.
PassBy	Shows the largest single 10dB passby event detected (not present).
Wind/Tach	Shows wind or tachometer measurements (not present).

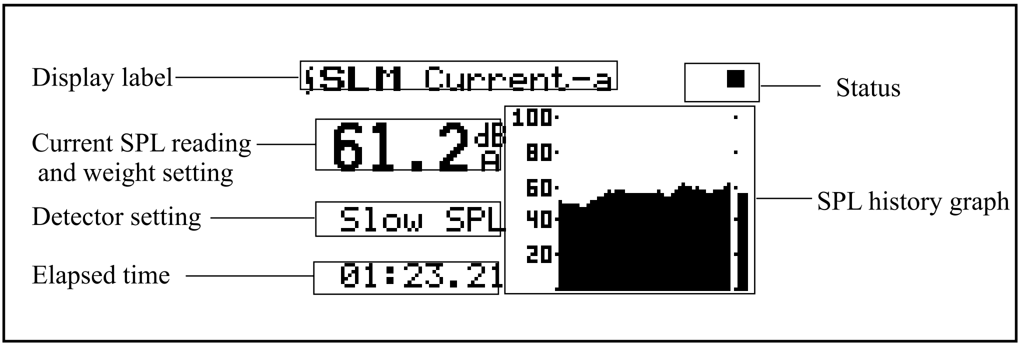
Current / Overall -a SLM Displays

The System 814 contains 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.

The *Current / Overall - a SLM* display consists of six major components:

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

The following information explains each of these components.



Display label - Shows the display currently being used (in this example, *SLM Current-a*). The display represents both Current and Overall -a display. The only difference is where the data are being stored in memory.

Current reading and weight setting - Displays the current SPL reading for the moving bar on the far right of the SPL history graph. This displays the SPL measurement while the ∫SLM instrument is running. The frequency weighting for SPL can indicate: A, C, FLT, OCT, 1/3 (see SLM settings above).

Detector setting - The current detector is indicated (for example, *Slow SPL*).

Elapsed time - Displays the length of time current or overall measurements have been running. It will restart at zero when the key is pressed. It will also pause when the key is pressed and then continue when it is pressed again. The timer is displayed as mm:ss.ss, hh:mm:ss or hhhhh:mm.

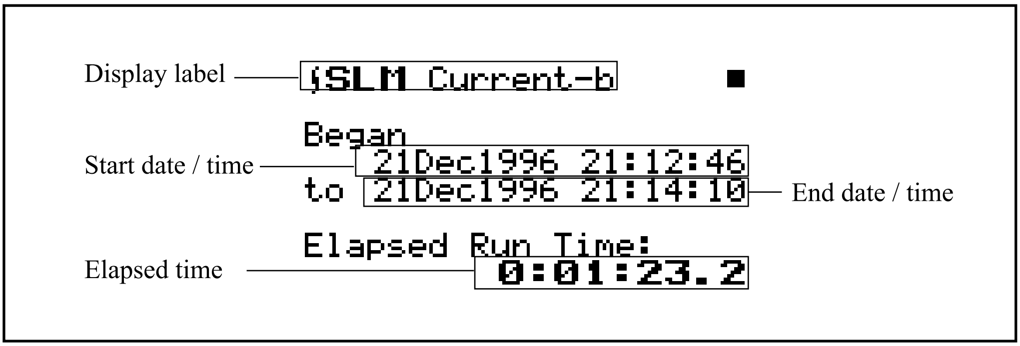
SPL history graph - Shows a recent history of SPL readings. The far right bar moves and displays the current SPL reading. As readings are taken, they are placed onto the scrolling graph from right to left one time per second.

Current / Overall -b SLM Display

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

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

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Current-b*). The display represents both Current and Overall -b display. The only difference is where the data are being stored in memory.

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

Elapsed time - The Elapsed Time displays the length of time current or overall measurements have been running. It will restart at zero when the key is pressed. It will also pause when the key is pressed and then continue when it is pressed again. The timer is displayed as mm:ss.ss, hh:mm:ss or hhhhh:mm

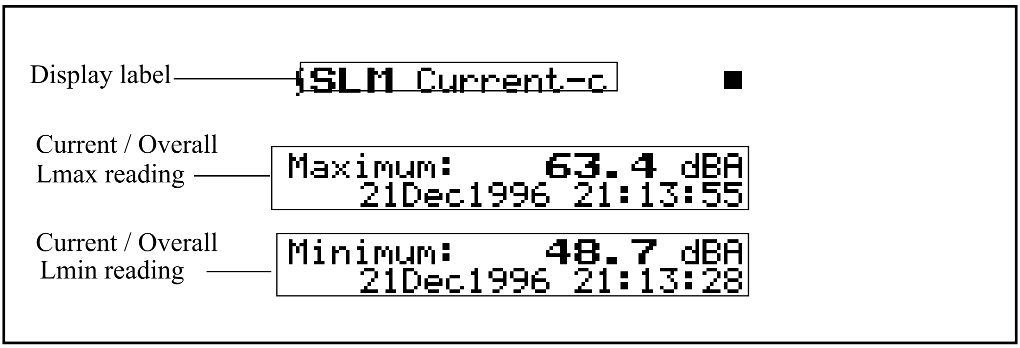
End date/time - Date and time the current/overall measurement ended (or current time if still running).

Current /Overall -c SLM Displays

The *Current/Overall - c SLM* Display consists of three major components:

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

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Current-c*). The display represents both Current and Overall -c display. The only difference is where the data are being stored in memory.

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

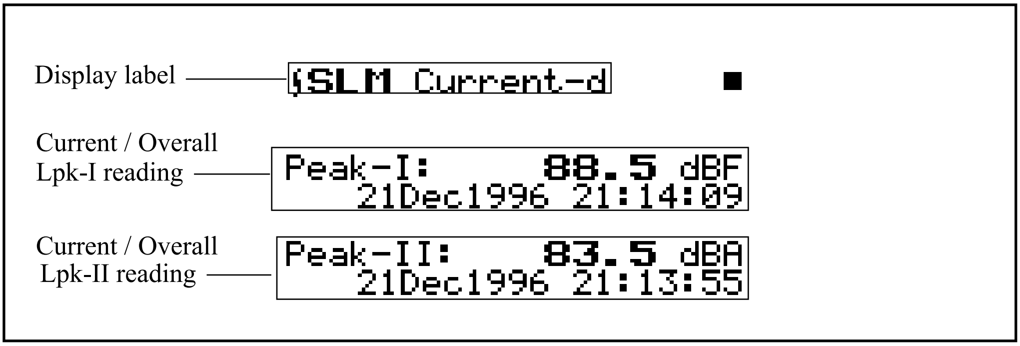
Current / Overall Lmin reading - Displays Lmin or minimum level that occurred, and the date and time when it occurred.

Current / Overall -d SLM Displays

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

- Display label
- Current / Overall Lpk-I reading
- Current / Overall Lpk-II reading

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLMCurrent-d*). The display represents both Current and Overall -d display. The only difference is where the data are being stored in memory.

Current / Overall Lpk-I reading - Shows the largest instantaneous peak levels detected by the primary (Peak-I) peak detector, and the date and time when it occurred.

This primary peak detector is weighted according to the state of the *Peak-I Weighting* setting.

Current / Overall Lpk-II reading - Shows the largest instantaneous peak levels detected by the secondary (Peak-II) peak detector and the date and time when it occurred.

The secondary peak detector is weighted according to the state of the RMS *Weighting* setting.

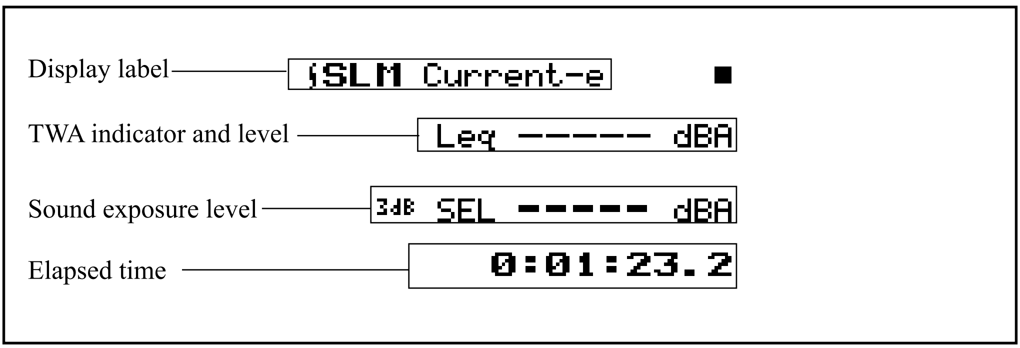
With these two separate peak detectors, the System 814 gives you the flexibility of having various configurations of peak-detector weighting. For example, you could have two simultaneous but independent peak detectors—one with A weighting and the other with C weighting.

Current / Overall - e SLM Displays

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

- Display label
- TWA indicator and level
- Sound exposure level
- Elapsed time

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Current-e*). The display represents both Current and Overall -e display. The only difference is where the data are being stored in memory.

TWA indicator and level - Indicator based on the exchange rate (3dB: Leq, 4dB: Leq, etc.) and the Time Weighted Average Level.

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

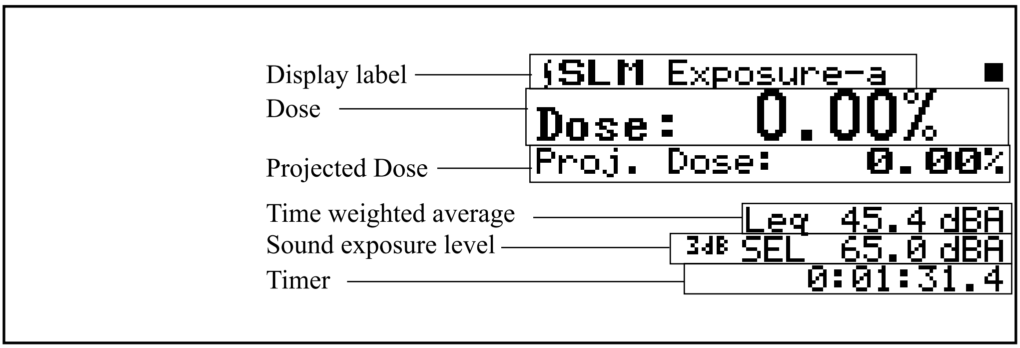
Elapsed time - Shows the elapsed run time accumulated since the last current reset. This is the time over which the current TWA is averaged.

Exposure-a Display

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

- Display label
- Dose
- Projected dose
- Time weighted average
- Sound exposure level
- Timer

The following information explains each of these components:



Display label - Shows the display currently being used (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 - Time Weighted Average (TWA) measured in dB.

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

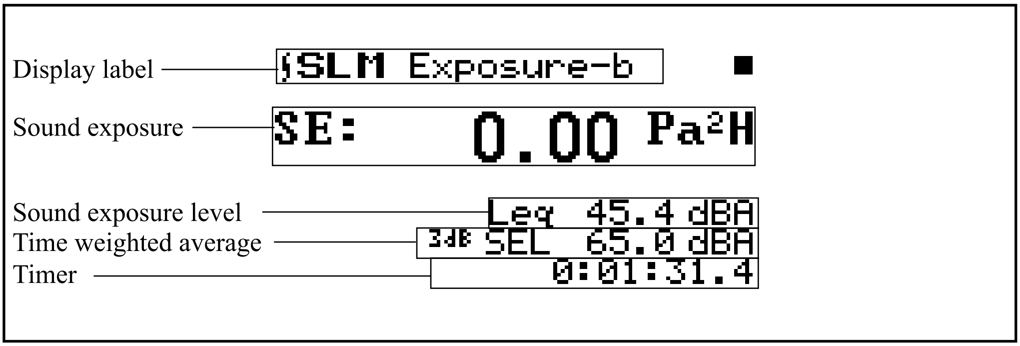
Timer - The timer displays shows the elapsed run time accumulated since the last current reset. This is the time over which the current TWA is averaged.

Exposure-b Display

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

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

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Exposure-b*).

Sound exposure - Sound Exposure (E) in Pascal squared hours (Pa^2H). The Sound Exposure (E) is a function of the L_{eq} and the elapsed time of the overall measurement.

Time weight average - Time Weighted Average (TWA) measured in dB.

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

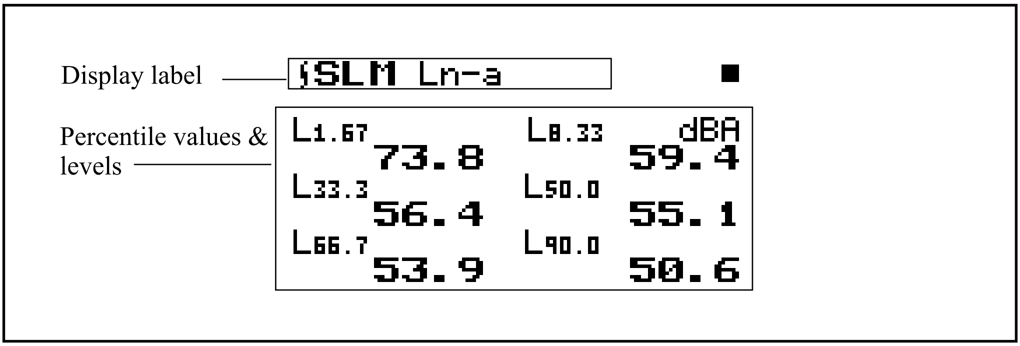
Timer - Shows the elapsed run time accumulated since the last current reset. This is the time over which the current TWA is averaged.

Ln-a Display

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

- Display label
- Percentile values & levels

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM 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.

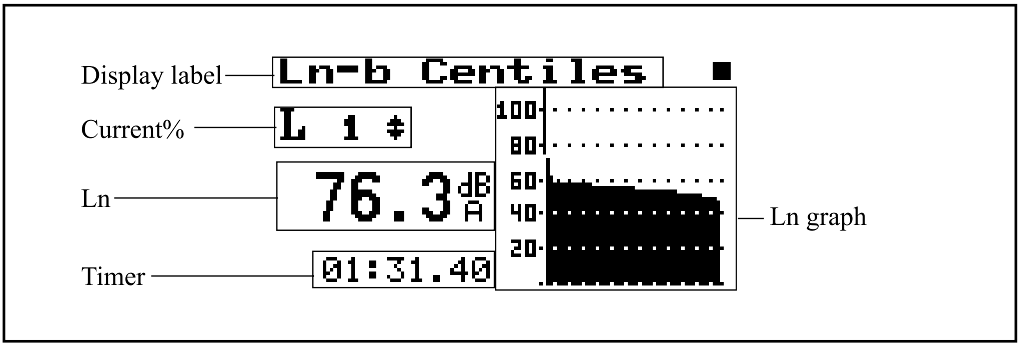
Percentile values & levels - The L_n (percentile levels) level is that which was exceeded 'n' percent of the measurement time. By modifying the six settings you can select any six percentile values to be displayed at a time. For example, if you set one of these settings to 10.5, then $L_{10.5}$ would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

The following information explains each of these components:



Display label - Shows what display currently being used (for example, *Ln-b Centiles*).

Current% - Selects % of Ln to display (1 to 99), using the ▲ and ▼ arrow keys to move from one Centile to another.

Ln - Current Ln value.

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

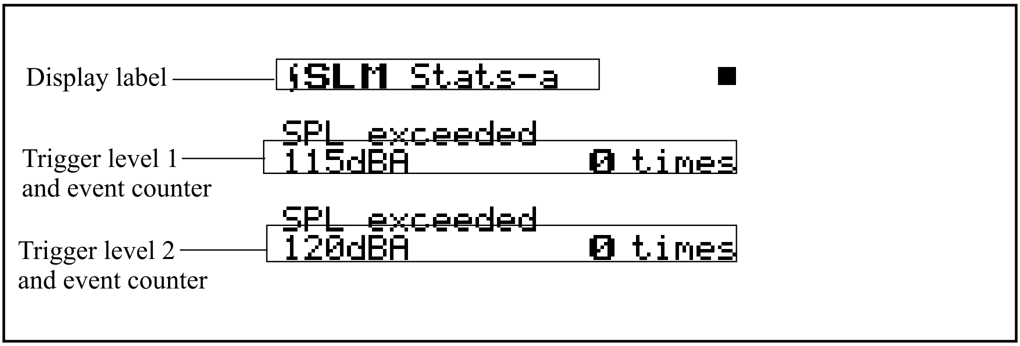
Ln graph- Graph of Ln's from 1 to 99 (1 being on the left, 99 on the right).

Stats-a Display

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

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

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Stats-a*).

Trigger level 1 and event counter - 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 to be individual events.

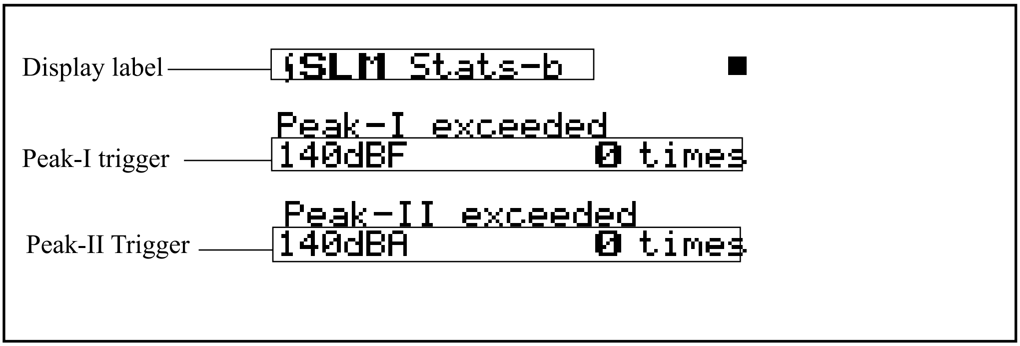
Trigger level 2 and event counter - Summary of the number of times during the overall measurement that the SPL exceeded the pre-programmed trigger level 2. In this example, trigger level 1 is set to 120 dBA and the SPL exceeded this threshold 0 times. These may be considered to be individual events.

Stats-b Display

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

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

The following information explains each of these components:



Display label - Shows the display currently being used (for example, *SLM Stats-b*).

Peak-I trigger - 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 140dBA and the peak-I level exceeded this threshold 0 times. These may be considered to be individual events.

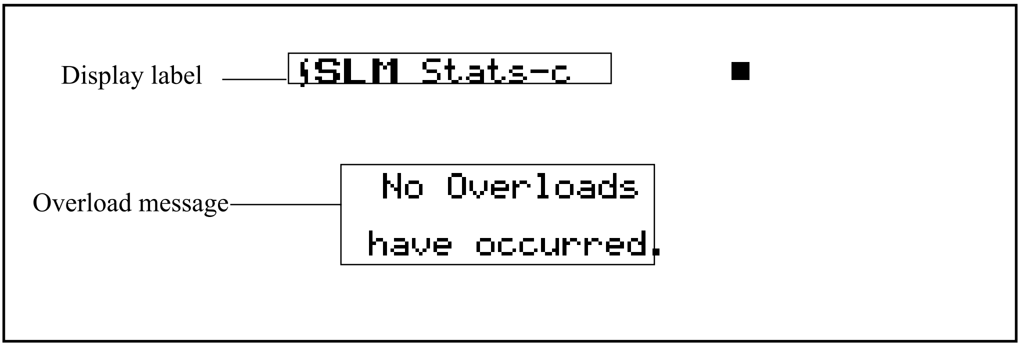
Peak-II trigger - Summary of the number of times during the overall measurement that the peak-II level exceeded its pre-programmed trigger level. In this example, peak-II's trigger level is set to 140dBA and the peak-II level exceeded this threshold 0 times. These may be considered to be individual events.

Stats-c Display

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

- Display label
- Overload message

The following information explains this component:



Display label - Shows the display currently being used (for example, *SLM Stats-c*).

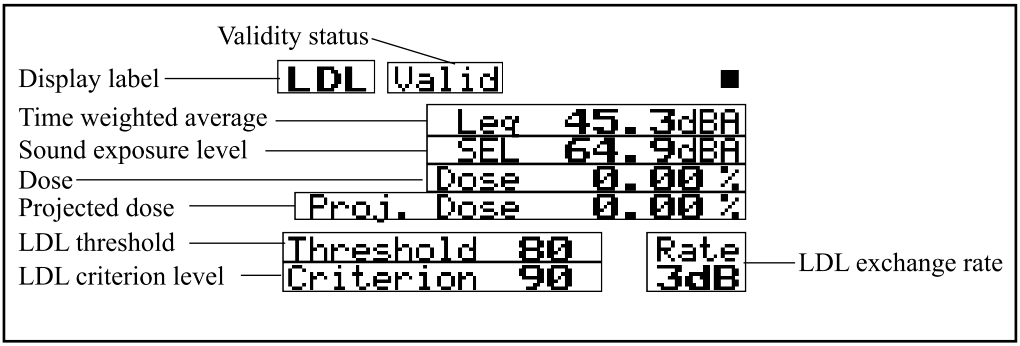
Overload message - The *Stats-c* display indicates the occurrence of instrument overloads during the measurement. If one or more overloads have occurred, the display will show the total number of overloads. If no overloads have occurred, the display will show a No Overloads have occurred message instead.

LDL Display

The *LDL* (Logged Data Logic) display consists of nine major components:

- Display label
- Validity status
- Time weighted average
- Sound exposure level
- Dose
- Projected dose
- LDL threshold
- LDL criterion level
- LDL exchange rate

The following information explains each of these components:



These LDL settings are completely independent of the corresponding “overall” settings which are used to calculate the conventional dose. You can modify the LDL settings using the LDL shortcut menu by pressing the ✓ key.

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

Validity status - The logged data logic (LDL) recalculator is useful for precise recalculation of dose and TWA to perform a “what if” type analysis on the data that the instrument has already collected or is currently collecting. If the instrument is running, it will automatically calculate a new dose every five seconds as indicated by a Calculating status message on the display. After the calculation, the display will show a LDL Valid status message for a short period of time. The display will then show an LDL Invalid status message as new data is added until the next calculation begins. Whenever you change any of the LDL settings, the recalculation begins immediately.

Time weighted average - Time Weighted Average (TWA) measured in dB.

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

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 would occur if current noise levels continue for the entire criterion time.

LDL threshold - Threshold rate that is currently being used to calculate the time weighted average.

LDL criterion level - Used to set 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.

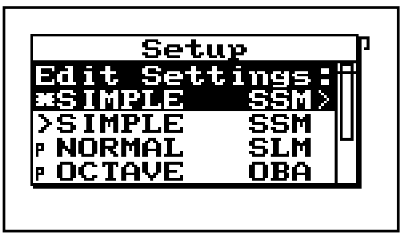
LDL exchange rate -Exchange rate that is currently being used to calculate the time weighted average.

Using the ∫SLM

This section gives a step by step example of a possible scenario using the ∫SLM instrument. In this scenario, you will select the Logging SLM instrument and take three measurements. You will then view the results of these three measurements. In this example, SLM_DEMO SLM will be used. This is a demo version of the Logging SLM instrument which already contains Interval and Time History data.

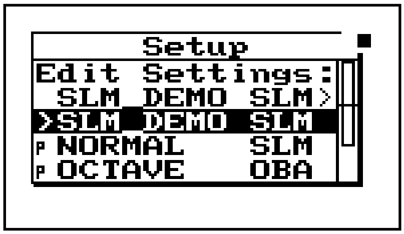
Simple ∫SLM Scan

Step 1 Press the SETUP key. A menu similar to the following appears:



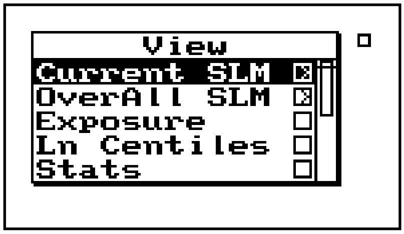
If the 814 is already in ∫SLM demo mode, there will be a '>' to the left of SLM_DEMO SLM

Step 2 Select SLM_DEMO SLM from the menu by pressing the or keys and then pressing the key. A ∫SLM screen appears:



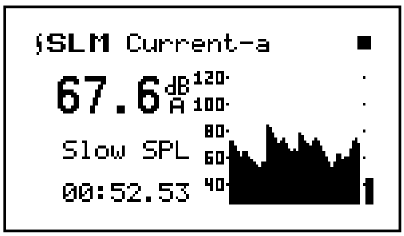
If you have not already saved your data, you will be prompted to save it.

Step 3 Press the VIEW key to access the *View* menu. The following screen appears:

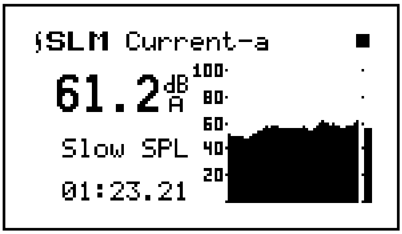


Using the arrow keys, you can select the desired display. Then press the arrow key to bring up the display.

Step 4 Using and keys select *Current SLM*, then press to select. The following screen appears:



Step 5 Press the RUN/STOP key to begin taking a measurement. Run for about 3 minutes. A screen similar to the following appears:



Pressing the VIEW key also allows you to view more detailed information about this measurement.

Step 6 Press the RUN/STOP key to stop taking readings. Use the , , , keys to move to other Logging SLM displays (to view more detailed information about this measurement).

CHAPTER

6 Printing Reports from the 814

The System 814 allows you to print a report from data collected during a measurement. This chapter will discuss the following aspects of printing reports:

- Connecting the 814 to a Serial Printer
- Printing Normal SLM Reports
- Printing Simple SSM Reports
- Printing Octave OBA Reports

While most users will normally print 814 data using a computer, it is possible to print both graphical and tabular data reports directly from the 814 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 (page description language) capabilities to draft-quality tabular data reports that can also be printed to a serial printer.

Connecting the 814 to a Serial Printer

Make sure the System 814 and your printer are turned off before initiating any of the following steps.

Step 1 Connect the provided serial cable's 8-pin min DIN connector to the System 814 serial port.

Step 2 Connect the serial cable's 25-pin male "D" connector to your printer's serial port.

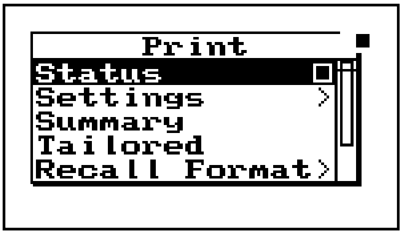
Step 3 Turn on both your printer and the System 814.

Printing Normal SLM Reports

Depending on whether you have selected Normal SLM, Simple SSM, or Octave OBA from the Setup menu you will have a different Print menu available.

Step 1 Press the Data key and use the ***Data Files*** menu to recall the Normal SLM measurement record that you want to print.

Step 2 To print the data file press the Print key. The following screen appears:



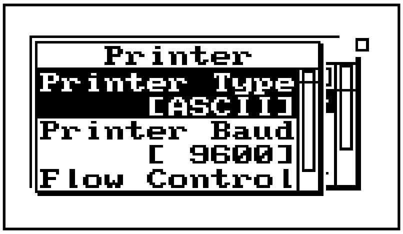
The Print menu provides the following options depending upon whether you have selected normal SLM, simple SSM, or Octave OBA from the menu. he following table shows the options for the Normal SLM Report menu:

Status	Options
Settings	Printer Type Printer Baud Flow Control
Summary	[prints a summary report]
Tailored	[prints the tailored report]
Recall Format	Summary Tailored All, short All, long None enabled

Customize	Unformatted Data Report Log Report Setup Report SPL Histogram Intv Report Hist Report Print Range Histograms
Print	[prints the selected report(s)]

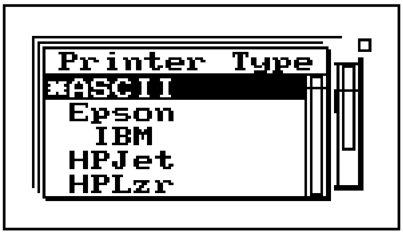
Make sure your printer has serial capabilities as most printers are parallel. If you have any questions about which printers work with the 814, contact the Larson•Davis marketing department.

Step 3 Use the ▲ and ▼ arrow keys to highlight Settings, then press the ▶ arrow key or ✓ key to select it. The following menu appears:



Depending on your printer configuration you may also have to modify the Printer Settings for Printer Baud and Flow Control also.

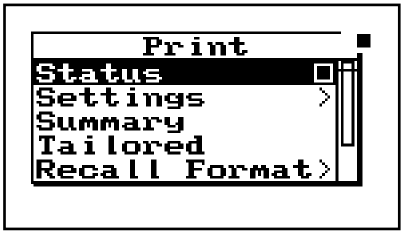
Step 4 Use the ▲ and ▼ arrow keys to highlight the ***Printer Type*** item, then press the ▶ arrow key or ✓ Check key to select it. The following menu appears:



Step 5 Use the ▲ and ▼ arrow keys to highlight the appropriate printer type that matches the printer that your System 814 is connected to, then press the ▶ arrow key or ✓ Check key to select it.

Step 6 Use the arrow key to return to the main ***Print*** menu.

Step 7 Use the and arrow keys to highlight the ***Summary*** or ***Tailored*** item, then press the arrow key or Check key to select it.



The title printed on your report will correspond to the Title setting you have configured in the Setup menu for the selected Instrument ID.

Step 8 Your reports will now print.

Defining and Printing Tailored Reports

Using the SETUP key you can access the Setup menu where you can select, create, and manipulate groups of instrument settings known as "instrument definitions" (ID). The instrument ID defines the data that is to be measured for a particular project or type of application. It is also where the definition of the tailored report is created.

With the System 814 you can create a tailored report setting for your instrument IDs (e.i. each instrument user can set up their own user-defined instrument settings). Therefore, each instrument ID can have its own pre-set customized report settings. This section discusses how to define and print tailored reports for an instrument ID.

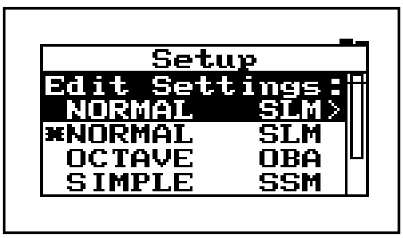
The following Tailored Report settings are available through the Defined Reports menu in the Settings menu.

Defined Reports Menu

Menu Items	Options
Data Report	Yes No
SPL Histogram	Yes No
Pk-1 Histogram	Yes No
Pk-2 Histogram	Yes No
Intv Report	No Short Long
Hist Report	Yes No

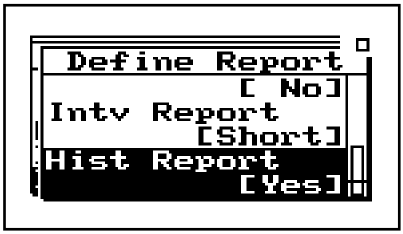
The following provides an example of how to define and print a tailored report:

Step 1 Press the Setup key to bring up the ***Setup*** menu. Highlight the ***Edit Settings*** item and press arrow key or the Check key to select it.



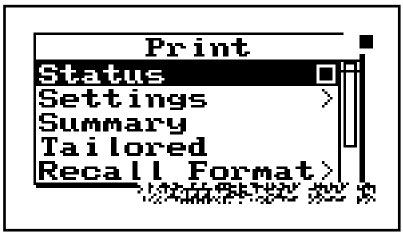
It is in the Define Report item that you define the reports to be printed in the tailored report for the selected instrument ID.

Step 2 Use the and arrow keys to highlight the ***Define Report*** item, then select it using the arrow key or the Check key. The following screen appears:



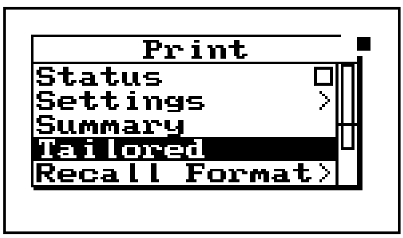
Step 3 Use the and arrow keys to scroll through available report settings. Use the Check key to toggle between available options for each type of report.

Step 4 Use the SETUP key to completely back out of all of the ***Setup*** menu screens, then press the Print key to bring up the ***Print*** menu.



For your report to print properly your printer must be properly connected and configured as discussed in the "Printing Normal SLM Reports" section.

Step 5 Using the and arrow keys highlight the ***Tailored*** item, then select it using the arrow key or the Check key. Your tailored report will now print.



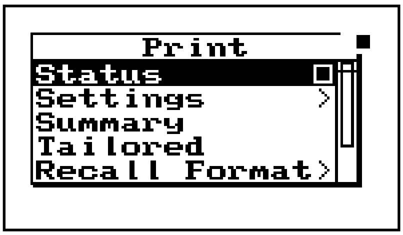
NOTE: Make sure you save your instrument ID before you change to a different Instrument ID, otherwise all your newly defined tailored print settings will be lost.

Using the Recall Format

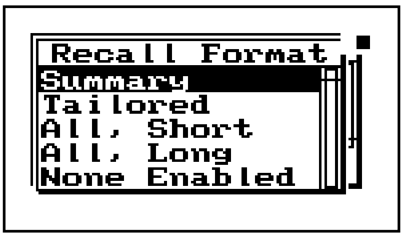
The Recall Format menu allows you to customize the ***summary*** report or the ***tailored*** report and gives you two more customized reports called ***All,Long*** and ***All,Short***. When the summary report is recalled the Customize menu is changed to reflect those parameters which will be printed in the summary report.

The Customize menu is a template for each report selected in the Recall Format menu. You can choose to print the default template that is recalled for each report or you can go into the Customize menu and make further changes to the template.

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, or All,Long.

Default Settings Values for the Recall Format Reports

The following tables shows 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” below.

Summary Report Template

Report Settings	Lower Level Report Settings	Description
Unformatted [No]		
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]		Lists settings and their values on the 814.
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.
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.

Summary Report Template		
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 includes the Data Report, the Log Report, the Setup Report, the Interval Report and the History Report. After selecting the template you can modify it as explained in “Printing a Custom Report” below.

Tailored Report Template		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		
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]		Lists settings and their values on the 814.

Tailored Report Template		
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.
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,Sort 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" below.

All,Short Report Template

Report Settings	Lower Level Report Settings	Description
Unformatted [No]		
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]		Lists settings and their values on the 814.
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.
Histograms	SPL Histogram [Yes]	You can customize the SPL Histogram report by choosing the long or short report.

All,Short Report Template		
	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” below.

All,Long Report Template		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		
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]		Lists settings and their values on the 814.
SPL Histogram [Yes]		The 6 Ln values, Lmax, Lmin, and a bargraph of the level distribution.

All,Long Report Template		
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" below.

None Enabled Report		
Report Settings	Lower Level Report Settings	Description
Unformatted [No]		
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]		Lists settings and their values on the 814.
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.
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.

None Enabled 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

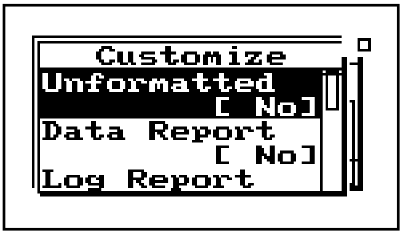
Printing a Custom Report

In addition to being able to print your own pre-established reports for data taken with you 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 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 properly connected and configured as discussed in the "Printing Normal SLM Reports" section.

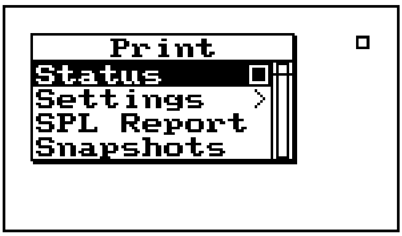
Step 4 Use the arrow key to completely back out of the ***Customize*** menu screen, then use the and arrow keys highlight the ***Print t*** item, then select it using the arrow key or the Check key. Your Customized report will now print.

Printing Simple SSM Reports

Step 1 Press the Data key and use the ***Data Files*** menu to recall the Simple SSM measurement record that you want to print.

Depending on whether you have selected Normal SLM, Simple SSM, or Octave OBA from the Setup menu you will have a different Print menu available.

Step 2 To print the data file press the Print key. The following screen appears:



The following table shows the options for the Simple SSM Report menu:

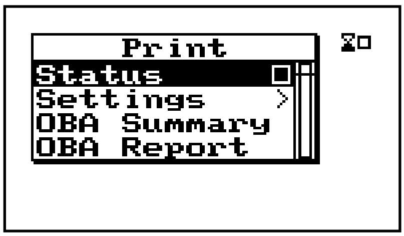
Status	Options
Settings	Printer Type Printer Baud Flow Control
SPL Report	[Prints the Simple SLM report which includes Lmin, Lmax, Pk-1, Pk-2, Leq, SEL, time, date, and the runtime.]
Snapshots	[Prints the Leq, SEL, Lmin, Lmax, Pk-1, Pk-2 at the specific point in time.]

Printing Octave OBA Reports

Depending on whether you have selected Normal SLM, Simple SSM, or Octave OBA from the Setup menu you will have a different Print menu available.

Step 1 Press the Data key and use the ***Data Files*** menu to recall the Octave OBA measurement record that you want to print.

Step 2 To print the data file press the Print key. The following screen appears:



The following table shows the options for the Simple SSM Report menu:

Status	Options
Settings	Printer Type Printer Baud Flow Control
OBA Summary	[Prints the overall and current spectra for the amount of time the instrument was run. A level and a bargraph is displayed for each filter frequency. It also shows the Run/Stop log.]
OBA Report	[Prints a Summary report and the Interval report.]

CHAPTER

7 Using the 814 Utility Software

You use the 814 utility software that comes with the System 814 to create and edit 814 setups, download measurements from the 814 and store the measurement to a file. You can then translate and export the downloaded measurement files to either a text file, or a file that can be used and analyzed using a spreadsheet program.

814 Utility software requires 814 firmware version 1.011 or greater. The 814 must be set to communicate at 9600 baud.

Connecting the 814 to Your Computer

To connect the 814 to a computer, use the CBL006 cable. The round 8-pin connector connects into the Serial port of the 814 and the 9-pin connector connects to the serial port of your computer.

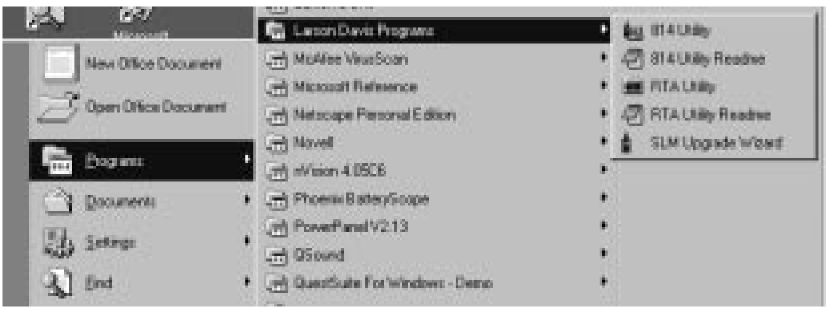
814 Utility Installation

To install the 814 Utility software package place the disk labeled "disk 1" into the floppy drive. From Windows 95 press ***START*** and then select the ***RUN*** menu item. A prompt will appear to enter the program name. Enter "A:\SETUP.EXE".

The 814 utility software will automatically begin the installation process. The installer program will prompt you through the installation. A prompt will appear asking to place disk 2 into the floppy drive. Place the "disk 2" into the floppy drive. A message will appear indicating that the software was successfully installed.

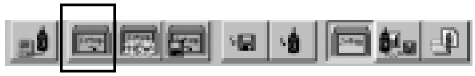
Starting the 814 Utility Software

To start the 814 Utility software in Windows 95, press ***START*** and then select the ***Programs/Larson-Davis/814Util*** submenu item.



814 Setups

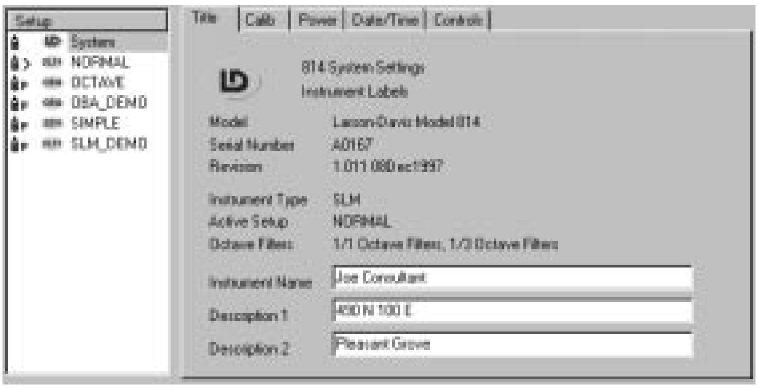
Setups stored in the 814 can be retrieved by clicking on the Get Setup button on the tool bar or by selecting ***Get Setups From 814*** from the ***File*** Menu.



Setups will be retrieved from the 814 and will be displayed in the ***Select Setup*** listbox.

Selecting the Setup tab displays the ***Connect*** window to establish communication with the 814, so that setups can be retrieved from the 814.

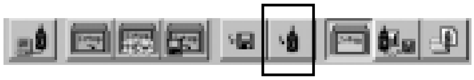
In the list of setup files, the system setup is the first setup followed by all of the permanent and user-defined setups. Highlighting one of the setups in the list, displays all of the available settings on the right side of the window. The setups are organized and grouped similar to the 814 menu structure in the instrument.



Modifying and Uploading Setups to the 814

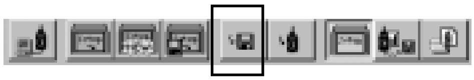
With the 814 Utility software you can make modifications to any the setup settings. For example, in the System screen shown above, you could change any of the parameters for the Title, Calib, Power, Date/Time or Controls and then send the modified setup to the 814.

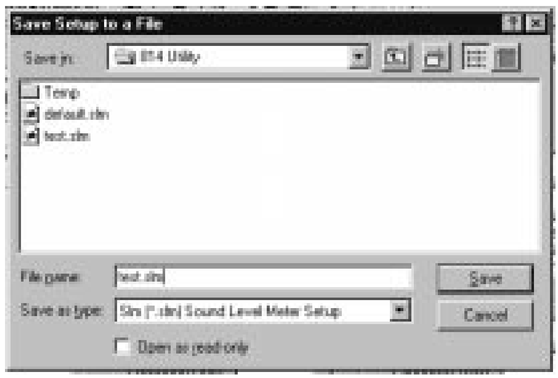
To upload the modified setup, you select the ***Save Setup to 814*** menu item from the ***File*** menu or click on the ***Upload*** button on the tool bar.



Saving Setups to Disk Files

You can also store the setup to a disk file by selecting the ***Save Setup to a File*** menu item from the File menu or by clicking on the Save to File button on the tool bar.



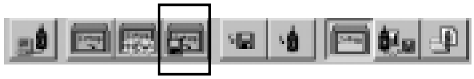


Note that the system setup can be modified and stored back into the 814, but cannot be saved to a disk file.

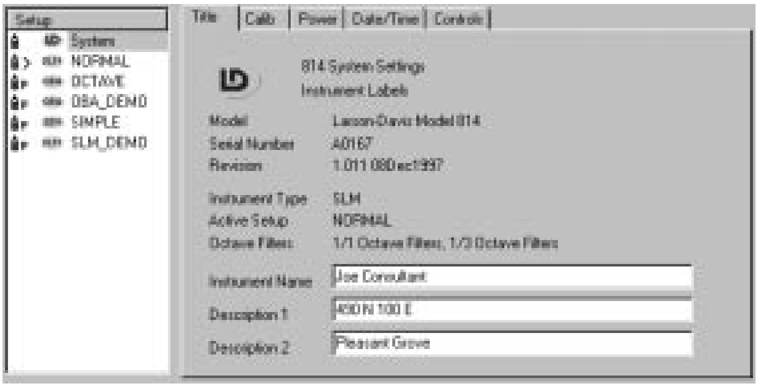
When saving a setup to a disk file, each setup requires a different filename. There is one file per saved setup. Sound Level Meter setup names should be followed by the .slm extension. Simple Sound Level Meter setup names should be followed by the .ssm extension. Octave Band Analyzer setup names should be followed by the .oba extension.

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.



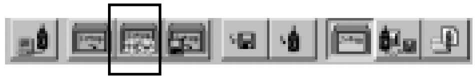
The setup appears in the ***Select Setup*** list. You can then select (highlight) the setup in the list. The highlighted setup can then be sent to the 814 by selecting the ***Save Setup to 814*** menu item from the ***File*** menu.



Other menu items available in the ***Setup*** Menu, include renaming, locking, unlocking, deleting, or making the selected setup the active setup(?). You can also access these menu items by pressing the right mouse button while within the ***Select Setup*** list box. The ***Setup Menu*** items will appear enabled or disabled depending on the setup selected. For example, it isn't possible to delete a permanent 814 setup, so the ***Delete Setup*** menu item will be disabled if a permanent 814 setup is selected.

Creating a New Setup

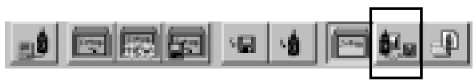
You create new setups by selecting the ***New Setup*** menu item from the File menu or by selecting the New Setup button on the tool bar.



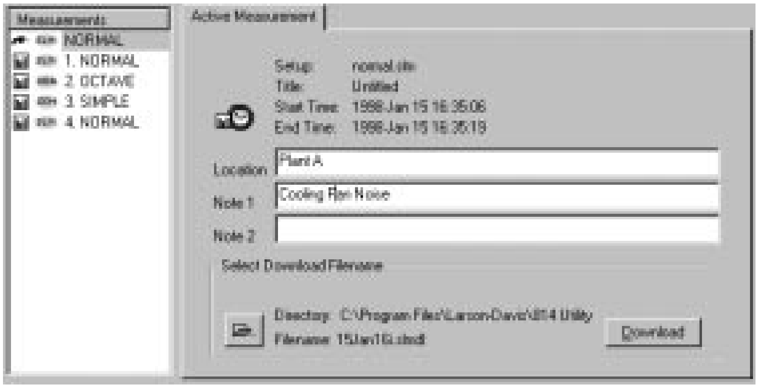
A dialog box will be displayed to allow the type of the new setup to be selected, (SLM, SSM, OBA). After creating a new setup, you can store it to a disk file, or send it to the 814.

Downloading Measurement Data

To display measurement data stored in the 814, 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 814 and displayed in the Download View window.



The first entry in the ***Measurement*** list box displays information about the current 814 measurement. Following the current measure is a list of all other measurements stored in the 814. To download a measurement, highlight the measurement in the Measurement list box and click the Download button. The data is saved to a binary file.

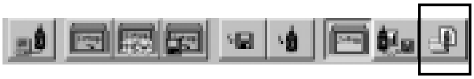


The resulting binary download file must be translated by the 814 utility software to be viewable. A download file should be stored with the file extension slmdl (Sound Level Meter Down-load). The ***Download*** window displays 3 note fields associated with the measurement.

The default directory and filename show the location and filename that the measurement data will be saved to. This directory and filename can be changed before the ***Download*** button is pressed. If the directory and filename already exist, and the Download button is pressed, you will be prompted asking whether to overwrite the file or cancel. At that point you could select a different filename that is not in use.

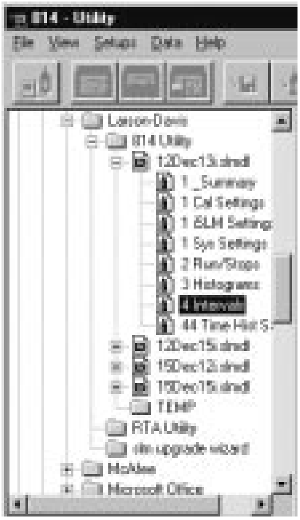
Translating Measurement Data from a Downloaded File

Selecting "Translate View" from the *View* Menu or pressing the Translate button on the tool bar will display the Translation View.



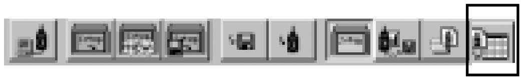
You use the ***Translate view*** to select a downloaded file with the file extension .slmdl to translate and view the file on the screen, or to print the file. The default path for the downloaded files is

C:\program files\LarsonDavis\814Utility.



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 Translate button on the tool bar.



When you select the ***View Data in Spreadsheet*** menu item, the 814 utility program will attempt to launch the program associated with the ".csv" file extension. If you have installed a spreadsheet program, your Window® system will most likely have this file type linked to a spreadsheet program.

You can export and/or save the translated data to a file, by selecting the ***Export Data*** menu item from the ***File*** menu.

APPENDIX

A System Layout

The System 814 is a complex instrument containing many settings and displays, which allows you to take full advantage of the instrument in many different situations. The purpose of this appendix is to help you quickly navigate through these settings and displays by laying out a diagram that is quick and easy to read. The following two sections will be covered:

- System Menus
- System Displays

System Menus

This section lays-out the sections, menu items, and settings of the following instruments:

- Octave Band Analyzer
- Simple Sound Level Meter
- Logging Sound Level System Menus

Menu Item	Setting
Title	Title
OBA ScanMode	Manual Auto Timed
OBA Profile	Normal Short Long Custom
OBA Bandwidth	1/1 1/3
Range	Normal
Transducer	Condnsr Electret Direct
Intv Enable	No Yes
Intv Period	(hh:mm:ss)
Intv Time Sync *(Time Sync)*	No Yes
Intv Auto Stop *(Auto Stop)*	No Yes
AC Out Weight	Flat Wght

Section	Menu Items	Available Settings Options
SLM	Detector	Slow Fast Impl
	Weighting	A C FLT OCT 1/3
	Range	Normal Low High
	Transducer	Condnsr Elctret Direct
	Pk-1 Weighting	Flat C
	Current Exchange	3dB 4dB 5dB 6dB
	Current Thresh-old	(0)dB - (255) dB

Controls	AC Out Filter	Flat Wght
	Logic-In Mode	None Pause Toggle Level Alarm
	Output 1 Logic	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
	Output 1 Timer	0 ~ 255 sec

Logging SLM System Menus

Section	Menu Items	Available Settings Options
Title		Title
SLM	Detector	Slow Fast Impl
	Weighting	A C FLT OCT 1/3
	Range	Normal Low High
	Transducer	Condnsr Elctret Direct
	Pk-1 Weighting	Flat C
	OBA Filter	Filter #

(Logging Sound Level Meter continued on next page)

Logging SLM System Menus (cont.)

TWA	Ovll Exchange	3dB 4dB 5dB 6dB
	Ovll Threshold	0 to 255 dB
	Ovll Criterion	0 to 255 dB
	Criterion Time	0 to 99 hours
	Crnt Exchange	3dB 4dB 5dB 6dB
	Crnt Threshold	0 to 255 dB
	Crnt Criterion	0 to 255 dB
Ln	Lnn 1 Percent	.01 to 99.9
	Lnn 2 Percent	.01 to 99.9
	Lnn 3 Percent	.01 to 99.9
	Lnn 4 Percent	.01 to 99.9
	Lnn 5 Percent	.01 to 99.9
	Lnn 6 Percent	.01 to 99.9
Triggering	SPL Excd Lvl 1	0.0 to 255.9 dB
	SPL Excd Lvl 2	0.0 to 255.9 dB
	Pk-1 Excd Lvl	0.0 to 255.9 dB
	Pk-2 Excd Lvl	0.0 to 255.9 dB
	Hysteresis	0 to 9 dB

(Logging Sound Level Meter continued on next page)

Time History	Hist Enable	No Yes
	Hist Period	1 to 255
	Period Units	1/32s 1.0s 10.0s 60.0s
	Other Level	No Pk-II Pk-I Lmax
	Resolution	0.1dB 1.0dB
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 to 255
	Intv Exchange	3dB 4dB 5dB 6dB

(Logging Sound Level Meter continued on next page)

Logging SLM System Menus (cont.)

Define Report	Data 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

(Logging Sound Level Meter continued on next page)

Controls	AC Out Filter	Flat Wght
	Logic-In Mode	None Pause Toggle Level Alarm
	Output 1 Logic	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
	Output 1 Timer	0 sec ~ 255 sec

System Displays

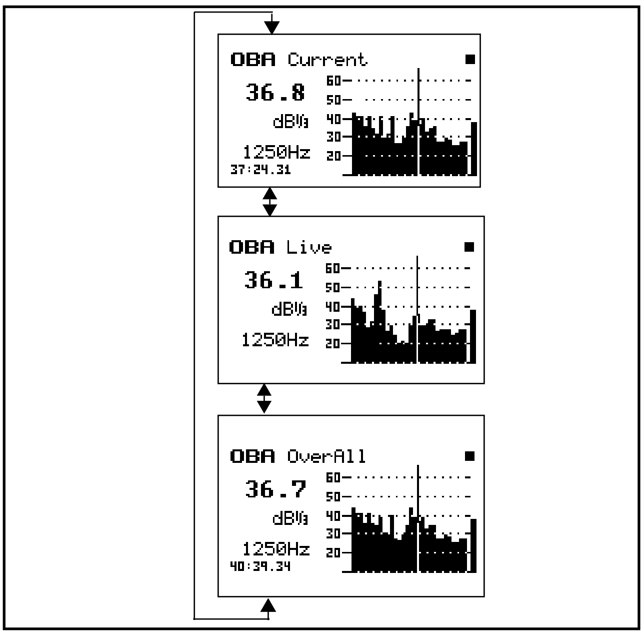
The System 814 has many displays that allows you to take full advantage of the instrument. This section covers the following displays:

- Octave Band Analyzer
- Simple Sound Level Meter
- Logging Sound Level Meter

The following displays are setup in a manner that is similar to that of the instrument. Displays can be change from one to another by using the arrow keys (, , ,).

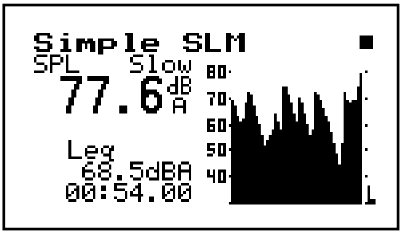
Octave Band Analyzer

The Octave Band Analyses contains the following three screens:



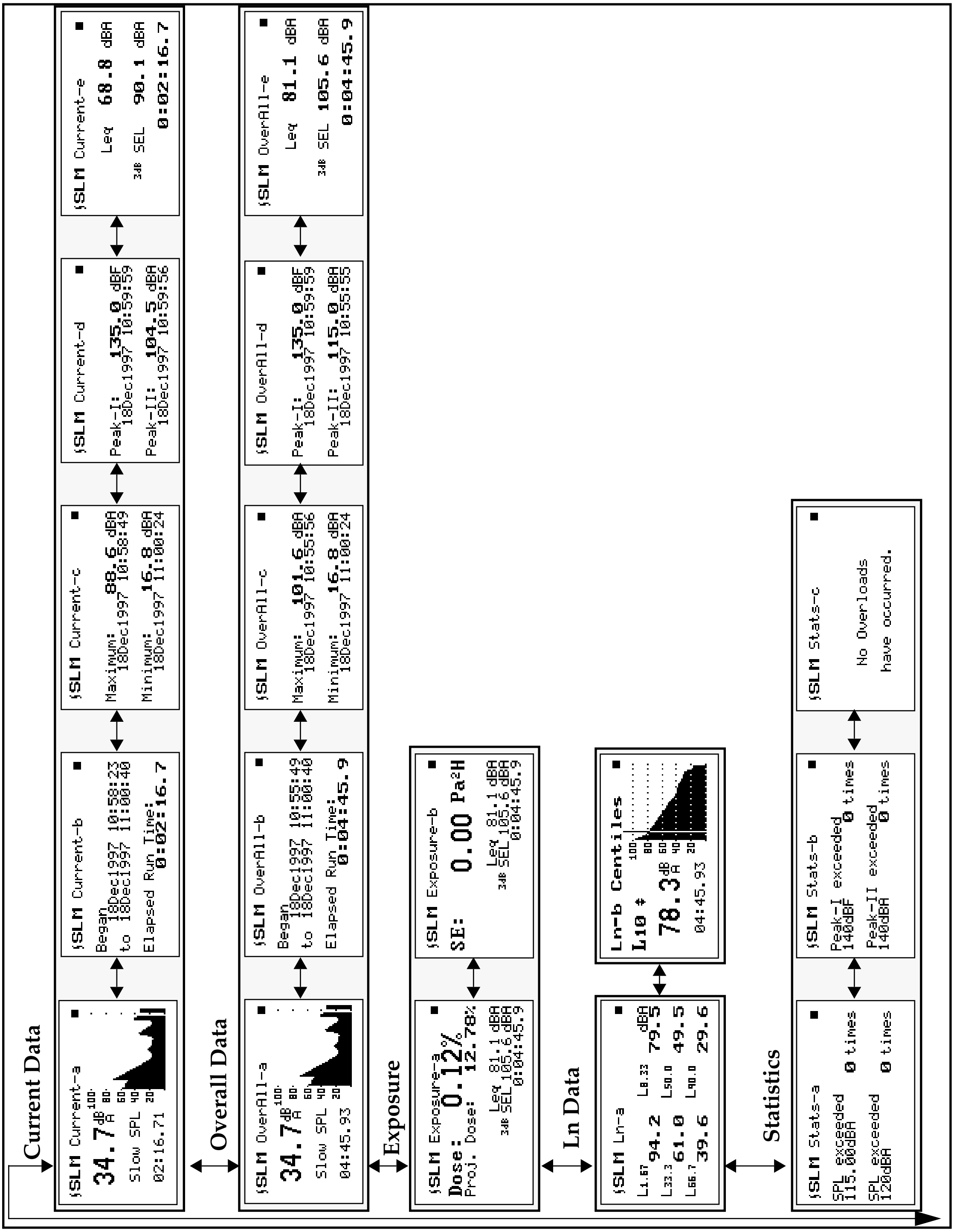
Simple Sound Level Meter

The Simple Sound Level Meter contains the following screen:

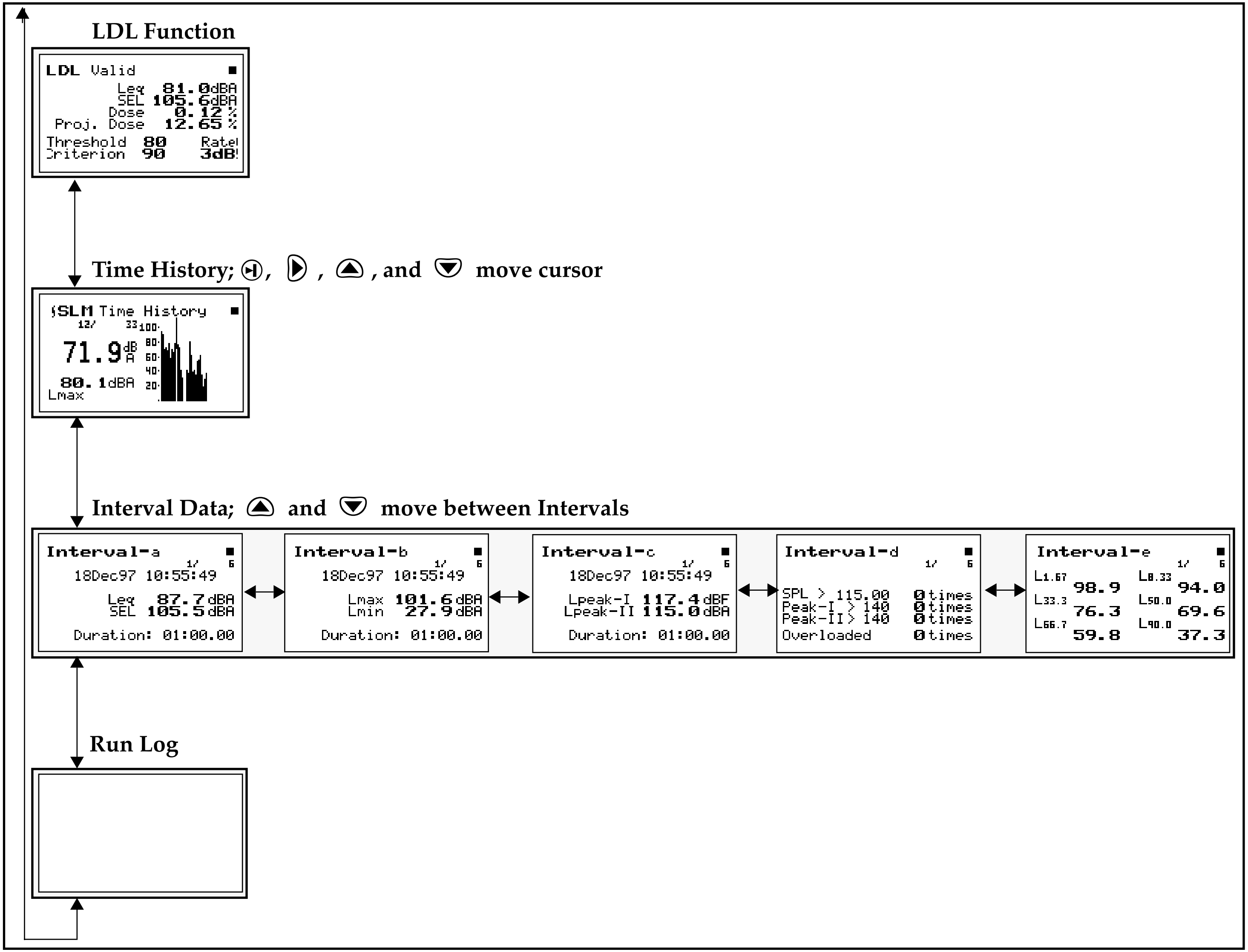


Logging Sound Level Meter

The Logging Sound Level Meter contains 18 screens. The following 2 charts show how to access each of the available screens. You use the and keys to change to screens shown along rows and and to change to screens shown on the rows above or below the one being displayed.



Current Data
Overall Data
Exposure
Ln Data
Statistics
SLM Current-a
34.7 dB A
Slow SPL
02:16.71
SLM Current-b
Began 18Dec1997 10:58:23
to 18Dec1997 11:00:40
Elapsed Run Time: 0:02:16.7
SLM Current-c
Maximum: 88.6 dBA 18Dec1997 10:58:49
Minimum: 16.8 dBA 18Dec1997 11:00:24
SLM Current-d
Peak-I: 135.0 dBF 18Dec1997 10:59:59
Peak-II: 104.5 dBA 18Dec1997 10:59:56
SLM Current-e
Leq 68.8 dBA
3dB SEL 90.1 dBA
0:02:16.7
SLM OverAll-a
34.7 dB A
Slow SPL
04:45.93
SLM OverAll-b
Began 18Dec1997 10:55:49
to 18Dec1997 11:00:40
Elapsed Run Time: 0:04:45.9
SLM OverAll-c
Maximum: 101.6 dBA 18Dec1997 10:55:56
Minimum: 16.8 dBA 18Dec1997 11:00:24
SLM OverAll-d
Peak-I: 135.0 dBF 18Dec1997 10:59:59
Peak-II: 115.0 dBA 18Dec1997 10:55:55
SLM OverAll-e
Leq 81.1 dBA
3dB SEL 105.6 dBA
0:04:45.9
SLM Exposure-a
Dose: 0.12%
Proj. Dose: 12.78%
Leq 81.1 dBA
3dB SEL 105.6 dBA
0:04:45.9
SLM Exposure-b
SE: 0.00 Pa²H
Leq 81.1 dBA
3dB SEL 105.6 dBA
0:04:45.9
SLM Ln-a
dBA
L1.67 94.2 L8.33 79.5
L33.3 61.0 L50.0 49.5
L66.7 39.6 L90.0 29.6
Ln-b Centiles
L10
78.3 dB A
04:45.93
SLM Stats-a
SPL exceeded 115.00dBA 0 times
SPL exceeded 120dBA 0 times
SLM Stats-b
Peak-I exceeded 140dBF 0 times
Peak-II exceeded 140dBA 0 times
SLM Stats-c
No Overloads have occurred.



LDL Function
LDL Valid
Leq 81.0dBA
SEL 105.6dBA
Dose 0.12 %
Proj. Dose 12.65 %
Threshold 80 Rate
Criterion 90 3dB
Time History; , , , and move cursor
SLM Time History
71.9 dB A
80.1dBA
Lmax
Interval Data; and move between Intervals
Interval-a
18Dec97 10:55:49
Leq 87.7dBA
SEL 105.5dBA
Duration: 01:00.00
Interval-b
18Dec97 10:55:49
Lmax 101.6dBA
Lmin 27.9dBA
Duration: 01:00.00
Interval-c
18Dec97 10:55:49
Lpeak-I 117.4dBF
Lpeak-II 115.0dBA
Duration: 01:00.00
Interval-d
SPL > 115.00 0times
Peak-I > 140 0times
Peak-II > 140 0times
Overloaded 0times
Interval-e
L1.67 98.9
L8.33 94.0
L33.3 76.3
L50.0 69.6
L66.7 59.8
L90.0 37.3
Run Log

APPENDIX

B Integrated Level Calculations

Basic Integrated Level Calculations

The Larson•Davis System 814 calculates all of its integrated levels based on equations of 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

$$L_{\mathrm{Aeq,T}} = 10\mathrm{lg}\left\{\left(\frac{1}{T}\int_{t_1}^{t_2} p_A^2(t)dt\right) \div p_0^2\right\}\mathrm{dB}$$

where:

$L_{Aeq,\mathrm{T}}$ 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, optionally, 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:

$$L_{\mathrm{Ceq,T}} = 10\lg\left\{\left(\frac{1}{T}\int_{t_1}^{t_2} p_C^2(t)\,dt\right) \div p_0^2\right\}\mathrm{dB}$$

If no frequency weighting is used, the quantity is simply called equivalent continuous sound pressure level.

The Larson•Davis System 814 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

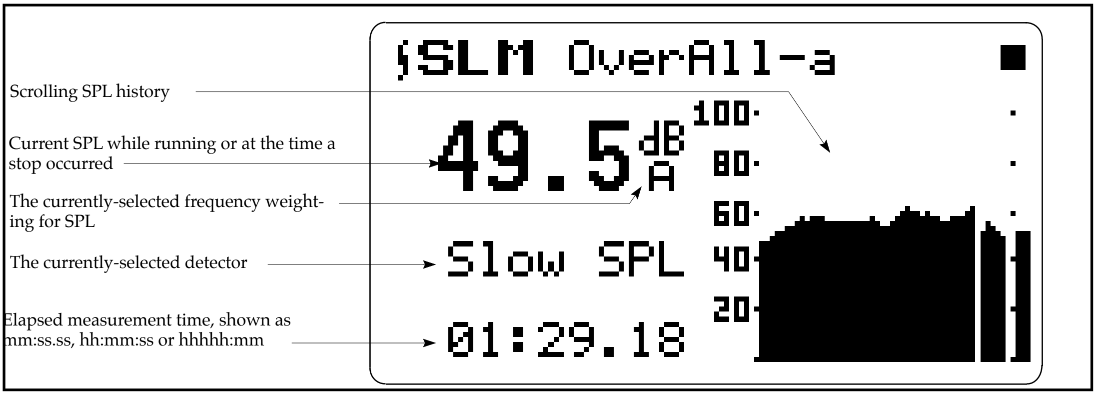
Exchange-rates, or "doubling rates" can be entered that effect certain TWA measurements

Certain TWA measurements include a programmable threshold with only levels above this threshold contributing to the measurement

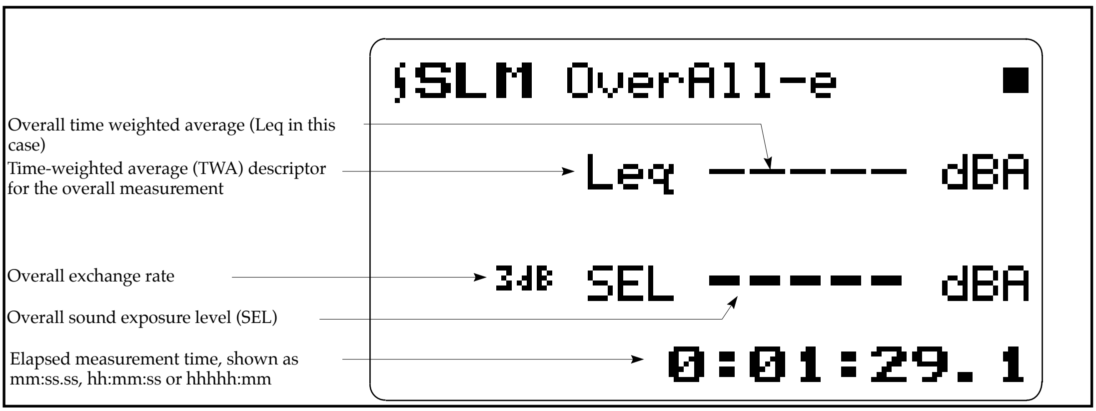
The titles for the measurements are designed to indicate the current exchange rate in force: "L_{eq}" is used to designate TWAs based upon a 3dB exchange rate, "L_{DOD}" (for United States Department of Defence) is used to designate TWAs based upon a 4dB exchange rate, "L_{OSHA}" (for the United States 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 814's ∫SLM Overall-a display shows the current SPL (Sound Pressure Level) in 1/10th decibel (dB) resolution. The actual real-time resolution is 1/32nd dB. The displayed SPL It is followed by the text "dB" and then the frequency weighting in effect—set to **A** in this example.



The System 814's ∫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 599:43:25.4 (599 hours, 43 minutes, and 25.4 seconds).



The actual equations used within the analyzers are based on that for IEC-804 and are implemented according to this equation:

$$L_{TWA} = L_{cal} + k \bullet \log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \log(n)$$

where:

$L_{(s)}$ is the current SPL at sample s (for measurements that include a threshold, $L_{(s)}$ is set to -∞ if $L_{(s)}$ is less than the Threshold Level L_t)

k is the exchange rate constant which is equal to:

10.00 for an exchange rate of 3dB (L_{eq}, or ≈ 3dB/log(2))

13.29 for an exchange rate of 4dB (L_{DOD}, or = 4dB/log(2))

16.61 for an exchange rate of 5dB (L_{OSHA}, or = 5dB/log(2)

20.00 for an exchange rate of 6dB (L_{Avg}, or ≈ 6dB/log(2)),

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 814. 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 814) for the maximum number of samples. Using large fixed point variables prevents the inaccuracies obtained in systems based upon floating point variables.

The following data indicates which settings are associated with which TWA data variables:

Variable Name	Location[a]	Settings
OverAll Lint or TWA (Lint = Integrated Level)	SLM-a, SLM-b, DOSE-a (TWA) Data Report: Overall IO Command: R9 Overall Runtime: R5 Title Text: R10	#48, Overall Exchange Rate #49, Overall Threshold
Overall TWA is reset only by a RES-ALL key or the S1,1 IO Command.		
Current Lint or TWA	SLM-a, SLM-b, DOSE-a (SLM window #3) Data Report: Current IO Command: R11 Current Runtime: R7 Title Text: R12	#45, Current Exchange Rate #46, Current Threshold
Current TWA is reset by the RESET key or the M7 IO Command.		
Overall L_{eq}	NOISE-a (LEQ) Data Report: Overall L_{eq} IO Command: R57 Overall Runtime: R5	Always 3dB Exchange Rate No Threshold
Overall Leq is reset only by a RES-ALL key or the S1,1 IO Command.		
Daily L_{eq}	NOISE-a (not displayed on LCD) Data Report: Daily Leq IO Command: R58 Daily Runtime: unavailable	Always 3dB Exchange Rate No Threshold
Reset when a new day begins or the RES-ALL key or the S1,1 IO Command.		
Hourly L_{eq}	NOISE-a (not displayed on LCD) See Daily History HNL IO Command: R59 Daily Runtime: unavailable	Always 3dB Exchange Rate No Threshold
Reset at the end of the current hour or a RES-ALL.		
Exceedance History TWA	EXCD-a (EXCD-c) Exceedance Report IO Command: E3 Event Duration: E2	#67, EXCD Exchange Rate #61, RMS Excd Level 1
Exceedance L_{eq}	NOISE-b (LDN-b) Data Report: Excd Leq IO Command: R68 Total Excd Time: R69	#67, EXCD Exchange Rate #61, RMS Excd Level 1
Reset by RES-ALL key or S1,1 IO Command. Includes only qualified Exceedances for which an EXCD record is stored in the EXCD history.		
Background L_{eq}	NOISE-b (LDN-b) Data Report: BkGnd Leq IO Command: R70 Background Time: R156	#67, EXCD Exchange Rate
Reset by RES-ALL key or S1,1 IO Command. This value is the Overall Leq less Exceedance Leq. It will be incorrect if setting 67 is not set to 3dB.		
Interval L_{eq}	INTV-a (INTV-c) INTV Report IO Command: I3 Interval Duration: I2	#73, INTV Exchange Rate #74, INTV Threshold #75, INTV Period (hh:mm)
Logged into interval history record at end of measurement interval (can be programmed from 1 second to 99 hours 59 minutes).		
History L_{eq}	History Report (HIST) IO Command: H1 Time as set by #83 & 84	Always 3dB Exchange Rate No Threshold #83, History Period #84, History Period Units

Variable Name	Location[a]	Settings
Logged into time history record at end of measurement interval (can be programmed for periods from 1/32nd of a second to 255 minutes).		

a. The display title within parenthesis () indicates the Model 820 display location.

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 3dB.

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, or equals $-\infty$ 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 3dB exchange rate

q = 5/log(2) for a 5dB exchange rate

q = 4/log(2) for a 4dB exchange rate

The factor of 100 in the equation produces a result that is a percentage.

Dose is obtained from the accumulations made for TWA and SEL using the formula:

where,

$L_{(s)}$ is the current SPL at sample s; for measurements that include a threshold $L_{(s)}$ is set to ∞ if $L_{(s)}$ is less than the Threshold Level L_t

$$DOSE = 10^{\left[\log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \frac{L_c}{k} - \log(T_c 115200) + \log(100)\right]}\%$$

k is the exchange rate constant which is equal to:

10.00 for an exchange rate of 3dB (L_{eq}, or ≈ 3dB/log(2))

13.29 for an exchange rate of 4dB (L_{DOD}, or = 4dB/log(2))

16.61 for an exchange rate of 5dB (L_{OSHA}, or = 5dB/log(2))

20.00 for an exchange rate of 6dB (L_{Avg}, or ≈ 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 814'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 814'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:

$$\boxed{\mathrm{PROJDOSE} = 10^{\left[\log\left(\sum_{s=1}^{n} 10^{\frac{L_{(s)}}{k}}\right) - \frac{L_C}{k} - \log(n) + \log(100)\right]}\%}$$

where the log(n) is the actual time factor, n being the total number of samples taken.

APPENDIX

C Serial Port Interface Remote Control

The Model 814 is fully controllable remotely via Serial Port interface. Settings and operational mode can be altered. Data can also be downloaded to and settings queried and set by the controlling computer.

The Model 814 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 Model 814 and the various interface commands with their syntax. Modem control is also covered. These commands are similar to the Larson•Davis Model 870 commands. Those familiar with the Model 870 or 820 family sound level meters will find the 814 commands very similar.

Interface Cables

Serial Port communications are made through the 8-pin connector at the base of the Model 814. The instrument's signals conform to the RS-422 standard and are compatible with RS-232C. The cables use the same pin out and connectors as Apple® Macintosh® computers.

CBL006	Computer cable
CBL002	
CBL003	
CBL00?	HP LaserJet 9 pin cable

Step 1 With the instrument turned off, insert the cable connector in the 5-pin port.

Step 2 Connect the cable to the of the computer, using the supplied 9-25 pin adapter if necessary.

Baud rate, Serial Port address and handshaking protocol are selected using settings 9, 10 and 12.

Signal 5-Pin configurations for the INT002 follow:

814 8-pin Connector End		Type		Computer 9-pin RS-232C Connector End		Type
HSO	Pin 1 Handshake Out	O	RS-232	DSR CTS	Pin 6 DataSet Ready Pin 8 Clear to Send	I I
HSI	Pin 2 Handshake In	O	RS-232	CD DTR	Pin 1 Carrier Detect Pin 4 Data Terminal Ready	I 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	X

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, such as the CBL040, and each may be controlled individually. Each is given a unique address (setting or item 10). By default, all 814s 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 128 to 228 representing address 1 to 100 respectively (address plus 128), while addresses 101 through 127 are reserved. At power-on all 814s are address enabled (as if they had received 127).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 if data transfer is required. 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 same time.

These devices cannot be just paralleled together. That would short outputs together and damage the instruments. Use the designated cables.

814 Network, Addressing Commands

The addressing of multiple 814s on a RS-422 network has been enhanced so as to allow binary data blocks to be sent to the 814 (and not be interpreted as an address), to automatically identify all 814s on the network, and to control the baud rate from the computer more easily. The command details follow:

Command	Description
0	Address 0 ($80) will enable addressing of all 814s on the net in a broadcast receive mode. Only the 814 with address 1 will respond; all will receive the command.
127	Address 127 ($FF) will enable all 814s to receive and respond to commands; in other words it will disable the addressing feature of all 814s on the net. Useful when only one device is connected.
126	Address 126 ($FE) will disable all 814s and none will respond to commands received. This is useful when trying to communicate with one device on the net that has addressing disabled by having its address set to zero.
125	Address 125 ($FD) will lock the current addressing of all 814s on the net so that binary setting data may be sent to the currently addressed 814. To cancel the lock so that addressing may be changed a <break> is sent.
124	Address 124 ($FC) will initiate an Auto-Identification of all 814s 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 814s 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 to accommodate a unit set at 300 bps.

Commands

The commands are a series of ASCII characters with an alpha command and one or two numeric operands followed by a charge 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 is added to ensure proper command data transferal. See Error Checking Protocol on page 34.

The following tables summarize all of the commands and are listed in this order: mode control commands first, setting commands next, data extraction command and report/data download command last.

[.] Square brackets indicate optional characters or operands.

Syntax	Response
R[ead] variable_number 0, operand_2]	variable_value
S[et] setting_number, setting_value	acknowledge
S[et] setting_number, fixed_setting_option	acknowledge
S[et] setting_number; fixed_setting_prompt	acknowledge i.e. "Set 8; [Thu]" will set day of week to Thursday
Q[uery] setting_number 0, option_flags]	setting_value

Option flags may be added for combined effect.

32-Option Number	
8-Tab over response	
2-print in braces	
1-Print setting name	
K[ey] key_simulation_string	acknowledge
M[ode] mode_number	acknowledge

History Oriented Commands

Histories are records of stored data for a sampling 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 settings???? Each history is assigned a number (history_number) so that it can be identified explicitly with the Advance, Backup, and Find commands and it is shown in the first column in the section below.

1	E[xceedance] variable_number [,relative_rec#]	variable_value	Env Option Only
1	E[xceedance] variable_number [,time_hist_num]	variable_value	Env Option Only
2	I[nterval] variable_number [,relative_rec#]	variable_value	
3	D[aily] variable_number [,hour_num]	variable_value	Env Option Only
4	L[og] variable_number [,relative_rec0,	variable_value	
5	C[alibration] variable_number	variable_value	
6	&F[iles] variable number [,relative_rec#]	variable_value	
7	H[istory] variable_number [,relative_rec#]	variable_value	SLM, ENV instruments only
8	T[ables] variable_number [, table]	variable_value	SLM, ENV instruments only
	A[dvance] range [,history_number]	acknowledge	advances one record in the history
	B[ackup] range [,history_number]	acknowledge	backups one record in the his-tory
	F[ind] record_number [,history_number]	acknowledge	find the indicated history number

Locating History Records

The Find command is the primary method of locating a history record for random (non-sequential) access. For example, to find the one hundred twenty-fifth Exceedance record send the command F125,1 the [,1] specifies that it is an exceedance record to be found as defined in the “history_number” column above. The Advance and Backup commands are generally used next to 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 for-ward or back from the current record number without changing that record number; it is a signed 8-bit value, i.e. 1 to 127 is positive while 128 to 255 is -128 to -1 respectively. Refer to the settings 211 through 216 to query the current record number. Setting these settings to a desired record number is an alternate form of the find command.

Control Oriented Commands

K[ey] <key_simulation_string	acknowledge	
M[ode] mode_number	acknowledge	
P[rint] report_number	acknowledge	
X operand_1	acknowledge	initiate XMODEM download, or 814 Xfer

Remote Control Commands (Detailed)

Mode Commands

Format for the Mode Commands is:

Command	Description
M 1	Power On (clear error message list and reset display functions to “–a” windows)
M 2	Power Off (cease sending further commands or the 814 will power back on)
M 3	Run (begin to accumulating data)
M 4	Stop (stop accumulating data)
M 5	View (view the current Sound Pressure Level without accumulating data)
M 6	Mark (place a marker in the Time History to indicate some event occurred
M 7,0	Current Reset (Resets only the current SLM function)
M 7,1	Overall Reset (Resets only the Current and Overall SLM function and histories [synonym of S1,1 Reset-All command])
M 7,2	Purge All (Resets ALL data and erases ALL data files [To purge, error checking must be on; the checksum for M7,2 is “b”; therefore, the complete purge command is M7,2b (watch the case!)])
M 7	Reset Current Data (instantly resets the current data set)
M 8	Reset Histories Only (clears all histories and places a RESET (to I/O channel only))
M 9,1	Enable High Resolution Levels (nnn.nn for all sound level data (to I/O channel only))

M 10	Lock 814 (leaves 814's power on)
M 11	Lock 814 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)
.	Scan for Filter options (use M2222 afterward to make it permanent. See R1,1 command to read current options.)

"Read" Command (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, variable's label, routine to display variable and instrument types for which it is valid. Some of the Read commands also utilize a second operand.

Syntax	Variable	Description	Response
R 1	_DEVTYPE	Device manf. and model (30 characters)	String

R1, 1	_DEVTYPE	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 like this: “F1 E0 M0”. 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). There are 4 configurations of memory on the 814. Standard 1/4 megabyte (M0), 1/2 megabyte (M1), 1.25 megabyte (M2) and 2 megabyte (M3). Example: “F1 E0 M0” means there is a 1/1 octave filter installed, there is no ENV option, and the memory is the standard 1/4 megabyte.	
R1,2	_DEVTYPE	Read Filter Model string 814" or “824”	
R1,3	_DEVTYPE	Read Flash Identification “hhhh” Manf/ Device Code	
R1,128	_DEVTYPE	Read ConfigFlag “hh” (in hex)	
R1,256	_DEVTYPE	Read AnalogConfig “hh” (in hex)	
R1,129-255	_DEVTYPE	Test selected bits in Configflag.	
R1,257-511	_DEVTYPE	Test selected bits in AnalogConfig.	

Selected bits in ConfigFlag and AnalogConfig can also 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 and AnalogConfig can be tested. (The binary number shown is the binary value of the decimal operand of the R1 command.)

Command	Binary Value	ConfigFlag Bits Tested
R1,129	10000001	0
R1,130	10000010	1
R1,132	10000100	2

R1,192	11000000	6
R1,170	10101010	1,3,5

NOTE: the 7th bit of ConfigFlag cannot be tested. The MSB of the operand is set to indicate that ConfigFlag is to be tested.

Command	Binary Value	AnalogConfig Bits Tested
R1,257	100000001	0
R1,258	100000010	1
R1,260	100000100	2
R1,384	110000000	7
R1,426	110101010	1,3,5,7

NOTE: This bit is set to indicate that, AnalogConfig is being tested.

Syntax	Variable	Description	Response
R 2	_DT.TM	Current Date and Time	ddd ddmmmyyyy hh:mm:ss
R 3	_STAT	Status	RUN/PAUSE/STOP/RESET-C/RESET-O, LOCKED
R 3,1	_STAT	Short status string	Stabilize-Ru, Locked
R 3,1	_STAT	Short status string and reset alarm tripped status	

A short status string for R3,1 and R3,2 has a 5 character response (cccccc).

- The first is an “s” when stabilizing or a space when stable.
- The second 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.
- The sixth character is the modified status of the active setup (ID), a space for unmodified and “A” for archive.

R 4	_C.SPL	Current SPL	nnn.nn dB
R 5	_O.RTIME	OverAll Runtime	hhhhh:mm:ss.s
R 6	_O.STIME	OverAll Start Date and Time	ddmmmyy hh:mm:ss
R 7	_C.RTIME	Current Runtime	hhhhh:mm:ss.s
R 8	_C.STIME	Current Start Date and Time	ddmmmyy hh:mm:ss
R 9	_O.TWA	Overall TWA (Time Wght Avg)	nnn.n dB
R 10	_O.XR	Overall Exchange Rate Text	ccccc
R 11	_C.TWA	Current TWA (Time Wght Avg)	nnn.n dB
R 12	_C.XR	Current Exchange Rate Text	ccccc
R 13	_O.SEL	Overall SEL	nnn.n dB
R 14	_C.SEL	Current SEL	nnn.n dB
R 15	_O.LMIN	OverAll Minimum Level	nnn.n dB
R 16	_O.TMIN	OverAll Lmin Date and Time	ddmmmyy hh:mm:ss
R 17	_C.LMIN	Current Minimum Level	nnn.n dB
R 18	_C.TMIN	Current Lmin Date and Time	ddmmmyy hh:mm:ss
R 19	_O.LMAX	OverAll Maximum Level	nnn.n dB
R 20	_O.TMAX	OverAll Lmax Date and Time	ddmmmyy hh:mm:ss
R 21	_C.LMAX	Current Maximum Level	nnn.n dB
R 22	_C.TMAX	Current Lmax Date and Time	ddmmmyy hh:mm:ss

R 23	_O.LPEAK	OverAll Peak Level	nnn.n dB
R 24	_O.TPEAK	OverAll Lpeak Date and Time	ddmmmyy hh:mm:ss
R 25	_C.LPEAK	Current Peak Level	nnn.n dB
R 26	_C.TPEAK	Current Lpeak Date and Time	ddmmmyy hh:mm:ss
R 27	_O.LUWPK	OverAll UWPk Level	nnn.n dB
R 28	_O.TUWPK	OverAll Luwpk Date and Time	ddmmmyy hh:mm:ss
R 29	_C.LUWPK	Current UWPk Level	nnn.n dB
R 30	_C.TUWPK	Current Luwpk Date and Time	ddmmmyy hh:mm:ss
R 31	_RMSCNT	OverAll RMS Exceedances #1	nnnnn
R 32	_RMSCNT2	OverAll RMS Exceedances #2	nnnnn
R 33	_PEAKCNT	OverAll Peak Exceedances	nnnnn
R 34	_UWPKCNT	OverAll UWPk Exceedances	nnnnn
R 35	_OVLDCNT	Overloads	nnnnn
R 36	_PSECNT	Number of PAUSES	nnnnn
R 37	_PTIME	PAUSE Time (OFF not inc.)	hhhhh:mm:ss
R 38	_LN1	Ln 1	nnn.n dB
R 39	_LN2	Ln 2	nnn.n dB
R 40	_LN3	Ln 3	nnn.n dB
R 41	_LN4	Ln 4	nnn.n dB
R 42	_LN5	Ln 5	nnn.n dB
R 43	_LN6	Ln 6	nnn.n dB
R 44	_O.DOSE	Overall Dose	nnnnn.n%
R 45	_C.DOSE	Current Dose	nnnnn.n%
R 46	_O.PROJ	Overall Projected Dose	nnnnn.n%
R 47	_C.PROJ	Current Projected Dose	nnnnn.n%
R 48	_LDLDOSE	LDL Dose	nnnnn.n%
R 49	_LDLPROJ	LDL Projected Dose	nnnnn.n%

R 50	_LDLLITWA	LDL Time Weighted Average	nnn.n dB
R 51	_LDLSEL	LDL SEL	nnn.n dB
R 52	_LDLXR	LDL Exchange Rate Text	ccccc
R 53	_LDLVALID	LDL Valid display (see note below)	cccccc
R 54	_RELLVL	Last Level Relative to REFLVL	-nnn.n
R 55	_TABLE	Display Histogram Selected	ccc
R 56	_COUNT	Display Overall Count	nnnnnk
R 57	_O.LEQ	Overall Leq	nnn.n dB
R 58	_D.LEQ	Daily Leq	nnn.n dB
R 59	_H.LEQ	Hourly Leq	nnn.n dB
R 60,h	_HNL	Hourly Leq 0-23	nnn.n dB
R 61,h	_HNLPART	Hourly Leq partial indicator nnn.n dB	
R 62	_O.LDN	Overall LDN	nnn.n dB
R 63	_D.LDN	Daily LDN	nnn.n dB
R 64	_H.LDN	Hourly LDN	nnn.n dB
R 65	_O.CNEL	Overall CNEL	nnn.n dB
R 66	_D.CNEL	Daily CNEL	nnn.n dB
R 67	_H.CNEL	Hourly CNEL	nnn.n dB
R 68	_EXLEQ	Total EXCD Leq	nnn.n dB
R 69	_EXTIM	Total EXCD Time	hhhhh:mm:ss.s

NOTE: An LDL (Logged Data Logic) recalculation can be started with a _LDLVALID I/O Read Command. When the Model 814 is RUNNING the Valid condition will remain in effect for 1 second. The _LDLVALID Read Command provides three responses, LDL Valid, Calculating, and LDL Invalid.

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.

R 70	_BGLEQ	Background Leq	nnn.n dB
R 71	_C.AD1	A:D(1) Current Value	-nnnnn.
R 72	_O.AD1	A:D(1) Average Value	-nnnnn.
R 73	_AD1MAX	A:D(1) Max Value	-nnnnn.
R 74	_AD1MIN	A:D(1) Min Value	-nnnnn.
R 75	_AD1EX	A:D(1) Exceedances	nnnnn.
R 76	_C.AD2	A:D(2) Current Value	-nnnnn.
R 77	_O.AD2	A:D(2) Average Value	-nnnnn.
R 78	_AD2MAX	A:D(2) Max Value	-nnnnn.
R 79	_AD2MIN	A:D(2) Min Value	-nnnnn.
R 80	_AD2EX	A:D(2) Exceedances	nnnnn.
R 81	_C.AD3	A:D(3) Current Value	-nnnnn.
R 82	_O.AD3	A:D(3) Average Value	-nnnnn.
R 83	_AD3MAX	A:D(3) Max Value	-nnnnn.
R 84	_AD3MIN	A:D(3) Min Value	-nnnnn.
R 85	_AD3EX	A:D(3) Exceedances	nnnnn.
R 86	_BATT	Battery Level	nnn%
R 87	_BATTSRC	Battery Source (INT/EXT)	ccc
R 88	_TEMP	Temperature	-nnn.n
R 89	_SERNUM	Serial Number	ccccc
R 90	_REVNUM	Software Rev. & Rev. Date	n.nnn ddmmmyyyy
R 91	_FREEMEM	Free Memory	nnnnnnn
R 92	_RECLOG	Number of RUN/STOP Records	nnnnn
R 93	_RECEXCD	Number of EXCD Records	nnnnn
R 94	_RECINTV	Number of INTV Records	nnnnn
R 95	_RECHIST	Number of HIST Records	nnnnn
R 96	_RECDALY	Number of Daily Records	nnnnn

R 97	_RECCAL	Number of Daily Records	nnnnn
R 98,n	_ERRMSG	Error Message List	cccccccccccccccccccccc(n) is the error list number, 1-8, 1 being latest error, or nnn, nnn...nnn if n=0 or omitted then the 8 error codes are output as number.
R 99	_LOGIC1	Logic Output 1 State	{On/Off} unused
R 100	_LOGIC2	Logic Output 2 State	{On/Off} unused
R 101	_REPORT	Report Number	nnnnn
R 102	_PAGE	Page Number	nnnnn
R 103	_PRNLINE	Printer Line Number	nnn
R 104	_CALTIME	Calibration Date/Time	ddmmmyy hh:mm:ss
R 105	_CHKTIME	Cal Check Date/Time	ddmmmyy hh:mm:ss
R 106	_OFFSET	Cal Offset	nnn.n
R 107	_CHKLVL	Cal check Level	nnn.n + OFFSET
R 108	_RMSEX	RMS Exceedance Flag 1	*
R 109	_RMSEX2	RMS Exceedance Flag 2	*
R 110	_PKEX	PEAK Exceedance Flag	*
R 111	_UWPKEX	UWPK Exceedance Flag	*
R 112	_OVLD	System Overload Flag	*
R 113	_EXXR	Excd Exchange Rate Text	ccccc
R 114	_IVXR	Intv Exchange Rate Text	ccccc
R 115	_AUTOADV	Auto-Advance History Ind.	+
R 116	_WINDSPD	Current Wind Speed	nnn.n
R 117	_WDIRCUR	Current Wind Direction	ccc (i.e. ENE, NNW)
R 118	_WINDAV	Overall Average Wind Speed	nnn.n
R 119	_WINDMAX	Overall Maximum Wind Speed	nnn.n
R 120	_WDIRMAX	Wind Direction at Overall Max Gust	ccc
R 121	_WMAXTIME	Time at Overall Max Gust	ddmmmyyyy hh:mm:ss

R 122	_WINDEX	Number of Overall Wind Exceedances	nnnnn
R 123	_WINDY	Overall Windy Percentage	nnn
R 124	_WDIRPCT	Wind Direction Percent (OPR2=1 to 8)	cccnnn (ccc=dir, nnn=%: ESE 25)
R 125	_DYWINDAV	Today's DAILY Average Wind Speed	nnn.n
R 126	_DYWINDMX	Today's DAILY Maximum Wind Speed	nnn.n
R 127	_DYWINDDR	Today's DAILY Wind Dir at Max Gust	ccc
R 128	_DYWINDTM	Today's DAILY Time at Max Wind Gust	ddmmmyyyy hh:mm:ss
R 129	_DYWINDEX	Today's Number of DAILY Wind Excd's	nnnnn
R 130	_DYWINDY	Today's Windy Percentage	nnn
R 131	_DYWDIRPCT	Today's Wind Direction Percent (OPR2)	cccnnn
R 132	_DYMIN	Today's Minimum Level	nnn.n dB
R 133	_DYMAX	Today's Maximum Level	nnn.n dB
R 134	_DYPEAK	Today's Peak Level	nnn.n dB
R 135	_DYUWPK	Today's UWPk Level	nnn.n dB
R 136	_DYRNTIM	Today's Runtime	hh:mm:ss | mm:ss.ss
R 137	_ALMTIM	Next Alarm Time	hh:mm
R 138	_IVTIME	Interval Date and Time of Occurrence	ddmmmyy hh:mm:ss
R 139	_IVDUR	Interval Duration	hh:mm:ss / mm:ss.ss
R 140	_IVLINT	Interval Lint	nnn.n dB
R 141	_IVSEL	Interval SEL	nnn.n dB
R 142	_IVMAX	Interval Lmin	nnn.n dB
R 143	_IVMIN	Interval Lmax	nnn.n dB
R 144	_IVPEAK	Interval Lpeak	nnn.n dB
R 145	_IVUWPK	Interval UnWeighted Peak	nnn.n dB
R 146	_HISTLEQ	AUTO-SEND HISTORY LEQ	nnn.n dB
R 147	AD1EXF	AD1 Exceedance Flag	*

R 148	AD2EXF	AD2 Exceedance Flag	*
R 149	AD3EXF	AD3 Exceedance Flag	*
R 150	_RUNCNT	Number of RUNS & CONTINUES	nnnnn
R 151	_POFAULT	Power On Fault Cause Character	c D Data Checksum Corrupt E EEPROM Checksum Corrupt K Key Reset (+ +) P setting Checksum Corrupt O Opcode Error R RAM Setup Register Corrupt T Test Memory Corrupt W Watchdog Reset

An indicator has been added to the ON display on the top line of the 814'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. The indicators are:

R 152	_INRMS	Internal RMS detector level	nnn.nn dB
R 153	_INPEAK	Internal PEAK detector level	nnn.nn dB
R 154	_INUWPK	Internal UwPk detector level	nnn.nn dB
R 155	_KEYCNT	Free Bytes in Keyboard Stack	nnn

The number of keys in the keyboard stack is available with the R155 command. This is used with keyboard simulation to prevent the loss of keys.

R 156	_BGTIM	Background Leq Time	hhhhh:mm:ss.ss
R 157	_CALSTAT	Calibration Status	<<UnStable>>
R 158	_MEMSIZ	Total number of bytes for histories	nnnnnnn
R 159	_MEMUSE	Memory Available in percent	nnn.nn
R 160	_O.OVLD	OVERALL OVERLOAD FLAG	c
R 161	_RECRTA	Number of RTA Records	nnnnn
R 162	_O.SE	Overall Sound Exposure	nnnnn.n P^2H

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:

$E = T \bullet (10\text{\textasciicircum}(Leq/10)) \bullet 20\mu Pa^2$,

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.*

R 163	_TAKT3	TAKT 3	nnn.n dB
R 164	_TAKT5	TAKT 5	nnn.n dB
R 165	_PsByTim	PassBy Time of Occurrence	ddmmmyy hh:mm:ss
R 166	_PsByDur	PassBy Event Duration	hh:mm:ss / mm:ss.ss
R 167	_PsByMax	PassBy Lmax	nnn.n
R 168	_PsByLeq	PassBy Leq	nnn.n
R 169	_PsBySel	PassBy SEL	nnn.n
R 170	_BATT_EXT	External Battery Level in Volts	nn.n
R 171	_OBA_LIVE	OBA filter - LIVE Leq	nnn.n dB
R 172	_OBA_CURRENT	OBA filter - CURRENT Leq	nnn.n dB
R 173	_OBA_OVERALL	OBA filter - OVERALL Leq	nnn.n dB
R 174	_OBA_FREQ	OBA filter selected frequency	31.5
R 175	_O.ETIME	OverAll End Date and Time	ddmmmyy hh:mm:ss
R 176	_C.ETIME	Current End Date and Time	ddmmmyy hh:mm:ss
R 177	_O.ResetBegan	OverAll Reset/Began Text	“Reset” or “Began”
R 178	_C.ResetBegan	Current Reset/Began Text	“Reset” or “Began”
R 179	_Total_RAM	Total bytes of RAM installed in the SLM	nnnnnnn
R 180	_InstType	Current Instrument Type	nnnnnnn
R 181	_RecFile	Number of Data File Records	nnn

R 182	_Marker1Level	OBA Marker Level #1	nnn.n
R 183	_Marker2Level	OBA Marker Level #2	nnn.n
R 184	_Marker1Filter	OBA Marker #1 Filter	nnnnn
R 185	_Marker2Filter	OBA Marker #2 Filter	nnnnn
R 186	_RevNumSLM	SLM Firmware Rev. Number & Revision Date	n.nnn ddmmmyyyy

Other Read Commands

Other read commands are macro commands that send multiple “R” variables, so multiple data can be retrieved from the 814 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 814’s LCD Display, bit mapped in a binary format	• <SOH><HIGH_COUNT><LOW_COUNT><...data...><CHKSM><CR><LF> • 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

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}.

The Group command can be programmed to automatically send the group data at a periodic rate as set by the Auto-Send Leq function. If the first variable of the group is programmed to be R 146, the AUTO-SEND HISTORY LEQ, with a G1,146 command then the entire group will be sent out automatically when the Auto-Send functions sends it's Leq. This function is enabled with setting #151, AUTO-SEND HISTORY [No | Yes] or the S151,1 command.

Settings

The Settings select what functions are enabled and determine how the measurements are performed. Settings can be both set (S) and queried (Q). The settings numbers provided below in the "Settings List" section are for both the Set (S) and Query (Q) commands.

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).

The current setting is retrieved with the Query (Q) command. The syntax for the query command is Q[uery]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.

All commands begin with S. See Chapter 8 for a list of all the settings and their options. There are four types of settings:

- 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 and operands.

<cr> = carriage return; <lf> = line feed; _ = space

Querying Settings

When querying a setting begin the query commands with Q. Brackets indicate optional characters and operands. <cr> = carriage return; <lf> = line feed; _ = space

Syntax	Response
Q[uery]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.Q66	No
2.Q66, 1	Excd History Enable=No
3.Q66, 2	[_No]
4.Q66, 32	0
5.Q66, 3	Excd History Enable=[_No]

Responses are denoted by (x) if Yes/No or (n) if numerical.

Entering Settings

Option Settings

Option settings can be set in two ways: a. option number and b. actual option settings value.

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: S66, 1	sets Excd History Enable to Yes.
Example: S84, 0	sets Hist Period Units to _1/32s
Example: S84, 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: S66; [Yes]	sets Excd History Enable to Yes.
Example: S84; [_1/32s]	sets Hist Period Units to 1/32s
Example: S84; [_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

_Date

The month, day, and year are entered in that order and are separated by "/". The display shows day, month(abbreviated), and year in that order.

Syntax	Response
S[et]item_number; mm/dd/yy	<cr><lf>

S22, 05/23/89	sets Timer Run Date to 23May1989.

_Time

The hour, minutes, and seconds are entered in that order and are separated by “:”. Military (24 hour clock) time is used: i.e. add 12 to afternoon hours.

Syntax	Response
S[et]item_number; hh:mm:ss	<cr><lf>
Example: S24, 14:25:33	sets Timer Run Time 1 to 14:25:33.

Setting List

Com-mand	Variable	Description	Comment
1	Q.RESALL	RESET-ALL	
2	Q.HDG1	HEADING LINE #1	
3	Q.HDG2	HEADING LINE #2	
4	Q.HDG3	HEADING LINE #3	
5	Q.TITLE	MEASUREMENT TITLE	
6	Q.TIME	CURRENT TIME	
7	Q.DATE	CURRENT DATE	
8	Q.DAY	DAY OF WEEK	
9	Q.BAUD	Serial Communications Baud Rate	
10	Q.SADDR	Serial Communications Address	
11	Q.C1SWHS	Serial Communications Output Flow Control	
12	Q.PrnBaud	Printer Serial Bit Rate	
13	Q.PrnHsk	Printer Serial Output Flow Control	
14	Q.LOGIC1	Logic-Output, Activation Mode	
15	Q.OUT1TIM	Logic-Output Line Timer	
16	Q.LOGIC2	Logic-Output Line #2, Activation Mode {Heater control line}	
17 M	Q.OUT2TIM	Logic-Output Line #2 Timer	

18	Q.HALT	LOGIC-IN LINE MODE	LOGIC-IN LINE Mode Q18 has a [None] state available. This allows systems with intrusion alarm hardware to be disabled during servicing. The choices are: [None | Pause | Toggle | Level | Alarm]. The Model 814 dials out when in the Modem Mode and remaining memory gets below 5000 bytes. It now uses RMS Threshold #2 to dial out on EXCD events.

19	Q.PWRMD	External Power Type [AC Pwr | Battery | Battery]	Protects External Battery
20	Q.PwrExtVolt	External Power-Off Voltage	
21	Q.PWRSV	POWER SAVE OPTIONS [Blank LCD / Auto Off / Manual Off]	
22	Q.PwrSt-byTim	Standby Time (LCD Blank & Comm Off) (nn)	minutes
23	Q.PwrOff-Time	Auto-Off Time (nn)	minutes
24	Q.PwrBklt-Tim	Backlight Power Off Time (nn)	seconds
25	Q.BkLite	Backlight On/Off	
26	Q.Contrast	LCD Contrast 0 to 99% (nn)	
27	Q.TIMMD	TIMER MODE	
28	Q.RUND	TIMER RUN DATE	
29	Q.STOPD	TIMER STOP DATE	
30	Q.RUNT1	TIMER RUN TIME1	
31	Q.STOPT1	TIMER STOP TIME 1	
32	Q.RUNT2	TIMER RUN TIME 2	
33	Q.STOPT2	TIMER STOP TIME 2	

34	Q.LKCOMB	LOCK COMBINATION	
35	Q.LKRS	LOCK R/S KEY	
36	Q.LKSU	LOCK SETUP	
37	Q.LKFN	LOCK FUNCTION	
38	Q.LKRES	LOCK RESET	
39	Q.LKPWR	LOCK THE 'ON' KEY	
40	Q.LKIO	LOCK I/O	
41	Q.CALLVL	CAL LEVEL	
42	Q.CALSN	CALIBRATOR S/N	
43	Q.AUTOCAL	AUTO-CALIBRATION MODE	
44	Q.CALTIM	AUTO CAL TIME	
45	Q.DETC	DETECTOR	
46	Q.WGHT	FREQUENCY WEIGHTING	
47	Q.FILTER	FILTER NUMBER (14-43)	
48	Q.ACOUT	Ac Out Weighting (Flat | Wght)	
49	Q.PkWght	UwPk Detector Weighting [Flat | C]	
50	Q.RANGE	RANGE [Normal | Low | High]	
51	Q.TRANS-DUCER	Transducer Type [Air Condenser| Electret | Direct}	
52	Q.DispVal	Simple SLM Displayed Value	
53	Q.CXRATE	CURRENT EXCHANGE RATE	
54	Q.CTHOLD	CURRENT THRESHOLD	
55	Q.CCRIT	CURRENT CRITERION	
56	Q.OXRATE	OVERALL EXCHANGE RATE	
57	Q.OTHOLD	OVERALL THRESHOLD	
58	Q.OCRIT	OVERALL CRITERION	
59	Q.DOSET	CRITERION TIME (HOURS)	

60	Q.LDLXRAT E	LDL EXCHANGE RATE	
Q61	Q.LDLTHOL D	LDL THRESHOLD	
62	Q.LDLCRIT	LDL CRITERION	
63	Q.LNN1	Lnn 1 PERCENT	
64	Q.LNN2	Lnn 2 PERCENT	
65	Q.LNN3	Lnn 3 PERCENT	
66	Q.LNN4	Lnn 4 PERCENT	
67	Q.LNN5	Lnn 5 PERCENT	
68	Q.LNN6	Lnn 6 PERCENT	
69	Q.RMSTH1	SPL Exceedance Level 1	
70	Q.RMSTH2	SPL Exceedance Level 2	
71	Q.PKTH	Peak-II Exceedance Level	
72	Q.UWTH	Peak-I Exceedance Level	
73	Q.HYST	EXCD HYSTERESIS	
74	Q.EXENB	ENABLE EXCD HISTORY	
75	Q.EXXRT	EXCD EXCHANGE RATE	
76	Q.EXMIN	EXCD MINIMUM DURATION	
77	Q.EXHENB	EXCD TIME-HIST ENABLE	
78	Q.EXPER	EXCD TIME-HIST PERIOD	
79 Reserved setting			
80	Q.EXTrig	EXCD Passby Trigger Mode	
81	Q.ExTime	EXCD Occurrence Time [Start	Max]	
82	Q.IVENB	TIMED EXCD PERIOD	
83	Q.IVXRT	ENABLE INTV HISTORY	
84	Q.IVTHOLD	INTV EXCHANGE RATE	
85	Q.IVPER	INTV THRESHOLD	

86	Q.IVSYNC	INTV PERIOD	
87	Q.IVLN	INTV TIME SYNC	
88	Q.IVSYNC	INTV SAVE Ln'S	
89	Q.NI??	RESERVED setting	
90	Q.IVSTOP	INTV AUTO STOP	
91	Q.HSTENB	ENABLE TIME HIST	
92	Q.HSTRES	HIST RESOLUTION	
93	Q.HSTPK	HIST SAVE Another Level	
94	Q.HSTPER	HIST PERIOD	
95	Q.HSTUNIT	HIST PERIOD UNITS	
96	Q.HSTBASE	HIST BASE	
97	Q.HSTMODE	HIST BASE MODE	
98	Q.HGRES	HISTOGRAM TABLE RESOLUTION	
99	Q.DYENB	ENABLE DAILY LDN HISTORY	
100	Q.DYLNENB	SAVE 6 DAILY Ln VALUES	
101	Q.RPT_Data	DATA REPORT	
102	Q.RPT_Log	R/S AND CAL LOG	
103	Q.RPT_Setup	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–). 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.

104	Q.RPT_Htgm	SPL HISTOGRAM TABLE	(x)

105	Q.RPT...	SPL HISTOGRAM TABLE LOW VALUE	(n)
106	Q.RPT...	SPL HISTOGRAM TABLE HI VALUE	(n)
107	Q.RPT...	SPL HISTOGRAM TABLE RESOLUTION	(x)
108	Q.RPT_Pk2Hg	PEAK-II HISTOGRAM TABLE	(x)
109	Q.RPT...	PEAK-II HISTOGRAM TABLE LOW VALUE	(n)
110	Q.RPT...	PEAK-II HISTOGRAM TABLE HI VALUE	(n)
111	Q.RPT...	PEAK-II HISTOGRAM TABLE RESOL	(x)
112	Q.RPTPk1Hg	PEAK-I HISTOGRAM TABLE	(x)
113	Q.RPT...	PEAK-I HISTOGRAM TABLE LOW VALUE	(n)
114	Q.RPT...	PEAK-I HISTOGRAM TABLE HI VALUE	(n)
115	Q.RPT...	PEAK-I HISTOGRAM TABLE RESOL	(x)

Tailored Report

116	Q.RPT_Excd	EXCD REPORT	
117	Q.RPT_Intv	INTV REPORT	
118	Q.PRN...	HIST REPORT	
119	Q.PRN...	DAILY NOISE REPORT	
120-147 Reserved settings			

Miscellaneous

148	Q.SCAN	OBA SCANMODE [Manual ǀ Auto ǀ Timed]	
149	Q.PROF	OBA PROFILE [Normal ǀ Short ǀ Long ǀ Custom]	
150	Q.BAND	OBA BANDWIDTH [1/1 ǀ 1/3]	
151	Q.ALLO-CATED	Number of Allocated RAM Slots	
152	Q.EAON	ELECTROSTATIC ACTUATOR OFF/ON	

153	Q.HEATER	HEATER LINE OFF/ON	
154	Q.MDMMD	MODEM MODE	
155	Q.DIAL	MODEM DIAL OUT MODE	
156	Q.PHONE	MODEM PHONE NUMBER	
157	Q.MONNUM	Monitor Number	
158	Q.MDMI	MODEM INIT STRING	

Special Functions - Advanced use only. Remaining commands are not available on SETUP menu.

159-166 Reserved settings			
167	Q.REFLVL	RELATIVE LEVEL REFERENCE	
168	Q.RTEXCD	REAL-TIME EXCD REPORT	(x)
169	Q.RTINTV	REAL-TIME INTV REPORT	(x)
170	Q.RTHIST	REAL-TIME HIST REPORT	(x)
171	Q.RTLOG	REAL-TIME RUN-LOG RPT	(x)
172	Q.RTDAY	REAL-TIME DAILY REPORT	(x)
173	Q.RTCAL	REAL-TIME CAL REPORT	(x)
174	Q.RTFRMT	UNFORMATTED REPORTS	(x)
175 Reserved setting			
176	Q.PTYPE	PRINTER TYPE	(x)
177	Q.Prn_Data	DATA REPORT	(x)
178	Q.Prn_ Log	R/S AND CAL LOG	(x)
179	Q.Prn_Setup	SETUP REPORT	(x)
180	Q.Prn_ SPL_Hs	RMS HISTOGRAM TABLE	(x)
181	Q.SPL_Low	RMS HISTOGRAM TABLE LOWEST VALUE	(n)
182	Q.SPL_Hi	RMS HISTOGRAM TABLE HIGHEST VALUE	(n)

183	Q.SPL_Res	RMS HISTOGRAM TABLE RESOLUTION	(x)
184	Q.Prn_Pk2_Hs	PEAK-II HISTOGRAM TABLE	(x)
185	Q.Pk2_Low	PEAK-II HISTOGRAM TABLE LOWEST VALUE	(n)
186	Q.Pk2_Hi	PEAK-II HISTOGRAM TABLE HIGHEST VALUE	(n)
187	Q.Pk2_Res	PEAK-II HISTOGRAM TABLE RESOL	(x)
188	Q.Prn_Pk1_Hs	PEAK-I HISTOGRAM TABLE	(x)
189	Q.Pk1_Low	PEAK-I HISTOGRAM TABLE LOW VALUE	(n)
190	Q.Pk1_Hi	PEAK-I HISTOGRAM TABLE HI VALUE	(n)
191	Q.Pk1_Res	PEAK-I HISTOGRAM TABLE RESOL	(x)
192	Q.Prn_Excd	EXCD REPORT	(x)
193	Q.Excd_Low	EXCD REPORT LOWEST RECORD	(n)
194	Q.Excd_Hi	EXCD REPORT HIGHEST RECORD	(n)
195	Q.Prn_Intv	INTV REPORT	(x)
196	Q.Intv_Low	INTV REPORT LOWEST RECORD	(n)
197	Q.Intv_Hi	INTV REPORT HIGHEST RECORD	(n)
198	Q.Prn_Hist	HIST REPORT	(x)
199	Q.Hist_Low	HIST REPORT LOWEST RECORD	(n)
200	Q.Hist_Hi	HIST REPORT HIGHEST RECORD	(n)
201	Q.Prn_Daily	DAILY NOISE REPORT	(x)
202	Q.CALMODE	CALIBRATION MODE [Off | Check | Change | Chk NF]	
203	Q.ULCOMB	UNLOCK PASSWORD	
204	Q.IONAME	SETUP FILENAME	
205	Q.ERCHK	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.

206 Reserved setting			
207	Q.NFLVL	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 Model 814 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 <u>always</u> turned off with a CAL Change.

208	Q.NFMODE	NOISE FLOOR COMP MODE	
209 Reserved setting			
210	Q.CNTLREG	AUX CONTROL REG	
211	Q.EXREC	EXCD RECORD NUMBER	

212	Q.IVREC	INTV RECORD NUMBER	
213	Q.HSTREC	HIST RECORD NUMBER	
214	Q.LOGREC	RUN-LOG RECORD NUMBER	
215	Q.DYREC	DAILY RECORD NUMBER	
216	Q.CALREC	CALIBRATION RECORD NUMBER	
217	Q.TBLLVL	HISTOGRAM TABLE LEVEL	
218	Q.FileRec	Data File Record Number	
219	Q.GphScl	Graph Vertical Scale, dB per pixel	
220	Q.GphBase	Graph Base Level (range from -99 to +999)	
221	Q.RTS_Mode	Request to send Output Control Mode	
222	Q.RMS_Scale	SPL SCALE (uses 225.48 lock)	
223	Q.PK2_Scale	PEAK2 SCALE (uses 225.48 lock)	
224	Q.PK1_Scale	PEAK1 SCALE (uses 225.48 lock)	
225	Q.TSCL	TEMPERATURE SCALE FACTOR	
226 Reserved setting			
227	Q.RMSOS	OVERALL CALIBRATION OFFSET (uses 225.48 lock)	
228	Q.PKOS	Peak-II To RMS CAL OFFSET (uses 225.48 lock)	
229	Q.UWPKOS	Peak-I To RMS CAL OFFSET (uses 225.48 lock)	
230	Q.BIAS	BIAS OFFSET - For High Range Calibration (uses 225.48 lock)	
231 Reserved setting			
232	Q.TempCal	Temperature Calibration (Cal level must be 225.48)	
233	Q.SERNUM	SERIAL NUMBER Entry (secured setting)	
234	Q.MODEL	Model Number Entry (secured setting)	
235	NoPrm	Invalid Setting’s data block	

History Records

The various histories of the Model 814 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 above). 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 214 to query the current record number. Setting these settings 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

Denoted in syntax by history_no:
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_no]	<cr><lf>
Example: A9,5	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
[Backup][num_record][, history_no]	<cr><lf>
Example: B9,5	Backs up the calibration history by 9 records from the current calibration history

Find

Find record number directly.

Syntax	Response
F[ind]rec_no[, history_no]	<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)

E 1	Date and Time of Occurrence	ddmmmyy hh:mm:ss
E 2	Duration	hh:mm:ss / mm:ss.ss
E 3	TWA	nnn.n dB
E 4	SEL	nnn.n dB
E 5	Lmax	nnn.n dB
E 6	Lpeak	nnn.n dB
E 7	UnWeighted Peak	nnn.n dB
E 8	Peak Exceedance Count	nnn
E 9	Overload Counts	nnn
E 10	Illegal Indication	BEEP$+"ILLEGAL"
E 11	A:D(1) Max (Reserved for future ENV use)	-nnnnn.
E 11	A:D(1) Min (Reserved for future ENV use)	-nnnnn.
E 11	A:D(2) Max (Reserved for future ENV use)	-nnnnn.
E 11	A:D(2) Min (Reserved for future ENV use)	-nnnnn.
E 11	A:D(3) Max (Reserved for future ENV use)	-nnnnn.
E 11	A:D(1) Min (Reserved for future ENV use)	-nnnnn.
E 17	Excd Time-Hist Samples	nnn
E 18<,n>	Excd Time-History	nnn.n dB
E 19<,n>	Excd T.H. Time	-sss.ss
E 20<,n>	Excd T.H. Number	-nnn
E 21<,n>	Excd T.H. Bargraph	*********************
E 22	AVG WIND SPEED	nnn.n

E 23	MAX WIND SPEED	nnn.n
E 24	WIND DIRECTION @ MAX	ccc
E 25	EXCD SYMETRY	nnn.nn%
E 101	Excd Macro Variables 1-10, 25	Macro
E 102	Excd Macro Time-Hist 17, 18...	Macro
E 103	Excd Macro Wind	22-24

Interval History Variables

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

I 1	Date and Time of Occurrence	ddmmmyy hh:mm:ss
I 2	Duration	hh:mm:ss / mm:ss.ss
I 3	TWA	nnn.n dB
I 4	SEL	nnn.n dB
I 5	Lmin	nnn.n dB
I 6	Lmax	nnn.n dB
I 7	Lpeak	nnn.n dB
I 8	UnWeighted Peak	nnn.n dB
I 9	RMS Exceedance Count	nnn
I 10	Peak Exceedance Count	nnn
I 11	UnWeighted Peak Excd Count	nnn
I 12	Overload Counts	nnn
I 13	Intv Ln 1 Percent	nn
I 14	Intv Ln 1 Level (dB)	nnn.n
I 15	Intv Ln 2 Percent	nn
I 16	Intv Ln 2 Level (dB)	nnn.n

I 17	Intv Ln 3 Percent	nn
I 18	Intv Ln 3 Level (dB)	nnn.n
I 19	Intv Ln 4 Percent	nn
I 20	Intv Ln 4 Level (dB)	nnn.n
I 21	Intv Ln 5 Percent	nn
I 22	Intv Ln 5 Level (dB)	nnn.n
I 23	Intv Ln 6 Percent	nn
I 24	Intv Ln 6 Level (dB)	nnn.n
I 25	A:D(1) Average Value (Reserved for future ENV use)	-nnnnn.
I 26	A:D(1) Max Value (Reserved for future ENV use)	-nnnnn.
I 27	A:D(1) Min Value (Reserved for future ENV use)	-nnnnn.
I 28	A:D(2) Average Value (Reserved for future ENV use)	-nnnnn.
I 29	A:D(2) Max Value (Reserved for future ENV use)	-nnnnn.
I 30	A:D(2) Min Value (Reserved for future ENV use)	-nnnnn.
I 31	A:D(3) Average Value (Reserved for future ENV use)	-nnnnn.
I 32	A:D(3) Max Value (Reserved for future ENV use)	-nnnnn.
I 33	A:D(3) Min Value (Reserved for future ENV use)	-nnnnn.
I 34	Average Wind Speed	nnn.n
I 35	Max Wind Speed	nnn.n
I 36	Wind Direction @ Max	ccc
I 101	Intv Macro Variables 1-24	1-24
I 102	Intv Macro Wind	34-36

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	Date	ddd	ddmmmyyyy
D 2	Daily Leq	nnn.n dB	
D 3	Daily LDN	nnn.n dB	
D 4	Daily CNEL	nnn.n dB	
D 5,hn	HNL	(for hour 0-23)	nnn.n dB
D 6,hn	HNL partial hour indicator	c	
D 7	Daily Lmin	nnn.n dB	
D 8	Daily Lmax	nnn.n dB	
D 9	Daily Lpeak	nnn.n dB	
D 10	Daily Luwpk	nnn.n dB	
D 11	Daily Run Time	hh:mm:ss | mm:ss.ss	
D 12	Daily Avg Wind Speed	nnn.n or nnnnn	unused
D 13	Daily Gust	nnn.n or nnnnn	unused
D 14	Daily Gust Direction	ccc	unused
D 15	Daily Gust Time	hh:mm:ss	unused
D 16	Daily Wind Excd Count	nnnnn	unused
D 17	Daily Windy Percentage	nnn	unused
D 18,n	Daily Direction% (n=1-8)	cccnnn	unused

D 19	Daily Ln Table in hexa-decimal	hhhhhh, hhhhhh,...hhhhhh <ih>	
D 101	Daily Variables 1-4, 7-11	Macro	
D 102	Daily HNLs 5(0-23),6(0-23)	Macro	
D 103	Daily Wind 12-17, 18(1-8)	Macro	unused

Run Log Variables

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

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 (Logging SLM)

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
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[able]var_no[, table]	table_var
Example: T1,1	-75.0 (RMS current bin level)

T 1,n[a]	Level of current bin	nnn.n dB
T 2,n	Count of samples	nnnnnc (c= K or M for Kilo or Mega)
T 3,n	Percent of total	nnn.nn%
T 5 [, n]	Prints the accumulated timer for the current level/bin. The table number is optional.	hhhhh:mm:ss.s

a. Where n equals the table number: 1-RMS, 2-Peak, & 3-UnWeighted Peak.

Print Commands

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

Syntax	Description
P 0	Standard Report (Formatted from normal setup settings 89-113)
P 1	Data Report
P 2	Data & Histograms
P 3	Short Full Report (Histories with SHORT option)
P 4	Long Full Report (Histories with LONG option)

P 9	All Report Enables Turned OFF
P 10	Select All except Histograms in Unformatted Style
P 11	Select All including Histograms in Unformatted Style
P 100	Begin Printing through current I/O command channel (See X100 Command)
P 101	Begin Printing through channel selected by "Print Command"
P 999	Abort Printing
X 100	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 814; 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	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	"ILLEGAL EXCHANGE RATE"
5	"UNKNOWN INTERRUPT"
6	"WATCHDOG RESET"
7	"OPCODE ERROR"

All warning messages begin with: CHR$(7), "WARNING - "

Add 128 to these numbers to get the actual warning number.

Warning Code	Message
128	"Out of Memory"
129	"Battery Low"
130	"POWER FAILURE"
131	"DIVISION BY ZERO"
132	"Operand-1 Range"
133	"Operand-2 Range"
134	"DPC Format"
135	"Key Has No Effect"
136	"Stop Required"
137	"Key Has No Effect In "VIEW""
138	"Setting Entered Wrong"
139	"RESET-ALL Required"
140	"Use ARROWS, (ON) to Exit"
141	"Use NEXT/PREV or ENTER"
142	"Invalid Numeric Entry"
143	"OPEN #"
144	"Already Open"
145	"No History Yet"
146	"At End of History"
147	"At Start of History"
148	"History Format Error"
149	"Unknown I/O Command"
150	"I/O Operand Invalid"
151	"Unable to Calibrate"
152	"EEPROM Write Error"

153	"Memory was Lost, Data Reset!"
154	"RECALL- Not Found"
155	"Function Not Implemented"
156	"System Locked"
157	"A:D Stack Full"
158	"A:D Over-Run"
159	"Serial Port Framing"
160	"Serial Port Line Noisy"
161	"Serial Port Over-Run"
162	"Wait for Stabilization"
163	"Power Turned Off"
164	"Time/Date Not Set!"
165	"Printer Already BUSY"
166	"Lithium Battery Low"
167	"Timer ON Pending"

Modem Control Mode

The modem control mode enables the Model 814 to automatically dial out upon an exceedance or a low memory condition. This mode also enables the Model 814 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). Setup settings 154 to 157 control this feature.

Modem Mode (154)

If the Modem Mode is [Yes], the Model 814 will dial the Phone# on the events selected by the Dial Out Mode defined below.

Dial Out Mode (155)

- None: The Model 814 will not dial a computer for any reason.
- Excd: The Model 814 will dial a computer to report when an illegal exceedance is logged into memory. An illegal exceedance is when Excd Lmax > RMS Excd Level 2 (setting 62).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 814 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.

814 Phone Dialing Procedure

The Model 814 dialing process is as follows:

Step 1 The Model 814 recognizes an exceedance or low memory condition.

Step 2 The Model 814 asks the modem to dial the phone number.

Example: `814: ATDT 1-555-1234(Enter)`

Step 3 The modem informs the Model 814 that a connection has been made. The Model 814 modifies its baud rate to that of the connected modem. If the connection is unsuccessful, the procedure is retried in 4 min.

Modem: 10(Enter)

Step 4 The Model 814 sends the following announcement: "*814: 814A0123:001:2*" (enter), where (0123) is the Model 814'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.

Step 5 The Model 814 awaits a response code, which should be: "814 A0123:11111111" (enter), where (0123) is the Model 814's serial number and (11111111) is the Lock Combination (setting 28) which is required whether or not the Model 814 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 814 to hang up.

Step 6 When a correct response is received, the Model 814 indicates it is ready to send data when requested with "814:Ready"(enter).

Model 814 Answering Procedure

Step 1 The modem informs the Model 814 that a connection has been requested; that is, the phone is ringing.

Modem:2 (enter)

Step 2 The Model 814 answers the phone.

814: ATA (enter)

Step 3 The modem informs the Model 814 that a connection has been made. The Model 814 modifies its baud rate to that of the connected modem. If the connection is unsuccessful, the procedure is retried in 4 min.

Modem: 10 (enter)

Step 4 The Model 814 sends the following announcement: “814:814A0123:001:0” (enter), where (0123) is the Model 814’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.

Step 5 The Model 814 awaits a response code, which should be: “814A0123:11111111” (enter), where (0123) is the Model 814’s serial number and (11111111) is the Lock Combination (setting 28) which is required whether or not the Model 814 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 814 to hang up.

Step 6 When a correct response is received, the Model 814 indicates it is ready to send data when requested with “814: Ready” (enter).

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 814's memory from address (a) and bank (b)
^	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. 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.
@	Enable IO Error Check Scheme. S205,0F or 2 <CR> in a row to disable.

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	cccccccccccccccccccccccccccccc
&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 all &F variables in one macro	
&F102	Recall a FILE into active memory	
&F103	Store the current data (in active memory) to a FILE	

Name restrictions & conventions for IDs (Instrument Definitions)

WARNING! The commands documented below are for internal use, programming support/assistance is unavailable

Name format: "cccccccc.ccc" The first 8 characters form the name and the last three are the extension that indicate the instrument type and can be

OBA, SSM, SLM, or ENV for the 814 or SSA, SSM, SLM, ENV, RTA, FFT, AUD, and INT for the 824. The name does not have to be a full 8 characters long. The extension is optional; if it is not provided the first occurrence of the name will be used -- this may not be the desired instrument definition if there is a naming ambiguity.

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). The name ends when a dot (.) or <CR> is encountered.

The allowed characters in names for IDs is compatible with DOS. The following characters are NOT allowed:

“* + , . / : ; < = > ? [\ ] |

Directory Listing requests can have the “*” wild card for either the end of the name or as the extension, i.e. “de*.*”, “demo.*”, “*.oba”.

Instrument Definition (ID) commands

I/O error checking is required!

Syntax: &In,filename

where n is the number from 1 to 8
where filename is as described above

&I1 Directory of IDs	Will send a listing of ID(s) as specified by the name given, ambiguous file names are allowed.
&I2 Recall ID	Will take a stored ID (specified by the name given) and copy it to the “active” settings.
&I3 Store ID	Will send specified ID(s) to the computer. Ambiguous file names are allowed.
&I4 Download ID	Will take the “active” settings a copy (store) them to the ID named.
&I5 Upload ID	Will receive the specified ID from computer and overwrite an existing ID by that name or create a new one. If an ID Type extension is not provided or the ID Type in the Uploaded data is not the same it is possible to create two IDs with the same name; care in the programming of the software is needed to avoid this conflict.
&I6 Delete ID	Will delete the specified ID. The only ambiguous name allowed is “*.*” to delete all IDs.
&I7 Make ID Read Only	Will mark the specified ID as read-only (cannot be over-written or deleted), ambiguous file names are allowed.
&I8 Make ID Read/Write	Will mark the specified ID as read-write (can be over-written or deleted), ambiguous file names are allowed.

Sending Binary Data to the 814

When sending binary data to the 814, it is sent in a specific format and protocol: Computer sends command (such as upload ID, the ‘c’ represents the check character):

&I5c<CR>The 814 sends notification that the command was received and understood:

> Send Binary!c<CR><LF>

814 Sends Not Acknowledge to request a block:

> <NAK><Block><not Block><$ff>

Computer sends data block (one of many):

> <STX><length><block><...data bytes...><CRC><CR>

814 Sends acknowledge if the block was received OK:

> <ACK><Block><not Block><0>

to request the next block or the 814 Sends Not Acknowledge if there was an error:

> <NAK><Block><not Block><$ff>

to request the block be resent.

When all that are needed have been received then a concluding acknowledge or a concluding Not Acknowledge block is sent; these do not have a block number but rather a null or an error number respectively:

> <ACK><0><0><0>

or

> <NAK><ErrNum><ErrNum><$ff>

please note that if the block number and not block number bytes of the NAK block are the same then this is a concluding NAK block indicating that there was an error. These errors are command dependent:

#1	;Revision Num Wrong for all commands &I5, & &S1 to 3
#2	;Block length error for all commands &I5, & &S1 to 3
#3	;setting error for command &I5
#3	;Cal. Block CRC error for command &S1

Once a concluding ACK block is received the command is done, once a concluding NAK block is received the process is restarted at the top by NAKing the zero block again. The number of retries is 5.

If the 814 receives <CAN> (ascii 24) instead of <STX> it will abort the command and restart IOP Task.

Data Block format

<STX><1 byte length><block #><...data bytes...><2 byte CRC><CR>	<STX> is ASCII 2, or chr$(2)
<length>	is one byte indicating the number of bytes in this record, which includes all byte from <STX> to <CR>.
<block>	is a one byte block number starting at 0 and incrementing with each acknowledged block.
<CRC>	is the 16 bit (2 byte) CRC using XMODEM's standard calculation
<CR>	is Enter, carriage return, ascii 13 or chr$(13) (whatever)
<NAK>	is Not Acknowledge or ascii 21
<ACK>	is Acknowledge or ascii 6
<$ff>	is character 255, chr(255)

There is a limit on the length of data that can be received by the instrument of 64 bytes total (which is the receive buffer length). 32 bytes is the recommended record length for data sent to the 814.

ID upload

The structure for each directory entry is:

<STX><length>nnnnnnnn.eee
dddddddddddddddddddddddddddddd
pra<crc><cr>

where:

nnnnnnnn	is the 8 character name (padded on right with spaces)
eee	is the instrument type Extension (i.e. OBA)
dddddddddddddddddddddddddddddd	is the 30 character description of the ID
p	is the Permanent ROM ID flag (space or “P”)
r	is the read-only flag (space or “R”)
a	is the Reachieve flag (space or “A”) meaning that it needs to be uploaded into the computer.

followed by the number of directory entries sent:

<STX><length>b<crc><cr>

NOTE: If there is a name error, a name error is reported and the receive binary mode is never entered. If there are no empty ID slots and error is reported and command aborts. If after the data is received and more data is received than is needed or if the revision number is wrong, a setting error is reported.

ID Structures

For the structure definition refer to “Measurement Settings” (Section C) in “814_doc.ad” (internal documentation only). The ID is 512 bytes long (The Setting Structure Revision Number is not a part to the 512 byte ID but precedes it in the Upload data structure). The structure definition mentioned fills up the first 130 bytes. The remaining bytes are RESERVED (much will be for a full screen instruction sheet to describe how to use the setup). The last two bytes (511 and 512) are a CRC of the ID.

Receiving binary data from the 814

To allow faster and more robust setting options from the computer, a binary I/O format has been established. There are 2 forms, one for short strings (less than 256 bytes) and one for long strings (256 bytes or more). The short format is used for 814 output and input, the long format is only used by the 814 to output data.

When receiving binary data from the 814, it is sent in a specific format (the ID directory command is an example of one that sends binary data):

The computer sends the command (such as ID directory command, the 'c' represents the check character):

&I1c<CR>

The 814 sends notification that the command was received and understood:

Recv Binary!c<CR><LF>

Then the 814 send the binary data blocks (1 or more):

<STX><length><block><...data bytes...><CRC><CR>

<STX><length><block><...data bytes...><CRC><CR>

<STX><length><block><...data bytes...><CRC><CR>

For long blocks of data the record structure is varied:

<SOH><length><block><...data bytes...><CRC><CR>

<SOH> is Start of Header (ascii 1) and the length is now 2 bytes long.

Followed by the termination block:

<STX><length><block><number of blocks sent><CRC><CR>

The data portion is a structure dependent upon the particular type of data being transferred. See the file "814equ_p.ai" for details.

The Binary Query and Set commands (&Q and &S) allow the downloading and uploading of binary setting data.

The &Qx command will Query various binary data blocks in the form described above. The 3 Query commands (&Q1 to &Q3) pair directly to 3 Set commands (&S1 to &S3) and are:

&Q1	Query Calibration Block command
&Q2	Query System Settings Block command
&Q3	Query Measurement Settings Block

&S1 – Set Calibration Block command

The Calibration block is 128 bytes long. The last 2 bytes are a 16-bit CRC calculated from the first 126 bytes using the same algorithm as XMODEM except that it has an initial seed of $CA53. This is to provide security against accidental calibration changes and to detect further communications and software errors.

For the structure definition refer to "Calibration Settings" in "814_doc.ad"

&S2– Set System Settings Block command

The System Settings can be controlled with this command. This would include the 3 lines of Name that appear on reports, the baud rate and other system settings.

For the structure definition refer to “System Settings” in “814_doc.ad”

&S3 – Set Measurement Settings Block

The Measurement Settings, for each instrument type, can be set with this command.

For the structure definition refer to “Measurement Settings” in “814_doc.ad”

Keyboard Simulation

The keys on the 814's keyboard may be simulated with the ‘K’ I/O command.

Each key is given an ASCII character as shown in the table below. To simulate the repeat value that is generated by varying the force on the keys:

Send the tilde character ‘~’ followed by the number of key steps to move in the form of one ASCII character starting at space (“ ” or ASCII 32). For example if steps of 4 are desired for the left arrow, send “K ~$7”. The dollar sign #” is the space character plus 4 and the 7 key is the left arrow.

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)

Creating Bitmap of 814 Screen

The 814's LCD screen can be extracted by I/O command "O4".

The data comes out as a binary string with the format of:

<SOH><HIGH_COUNT><LOW_COUNT><type><...1024_data_bytes...><CHKSM><CR>

The 1024_data_bytes are the pixels of the screen with 8 pixels per byte organized in 8 rows of 128 bytes. The byte is vertically oriented with the lsb (least significant bit) as the top pixel. The first byte is the top left corner of the screen and proceeds from left to right for each row successively.

Operation Notes

Step 1 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 814 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 814 toggles between RUN and STOP modes.

Step 2 An LDL (Logged Data Logic) recalculation can be started with an _LDLVALID I/O Read Command. When the 814 is RUNNING the Valid condition will remain in effect for 1 second. The _LDLVALID Read Command provides three responses:

“LDL Valid “, “Calculating”, and “LDL Invalid”.

APPENDIX

D Technical Specifications

Specifications are subject to change without notice. Numerical values given are typical. Refer to specific calibration or test results for accurate data on a specific unit.

System 814 Main Characteristics:

• Type 1 Precision Integrating Sound Level Meter with integrated, autoscanned 1/1 and 1/3 Octave Filters (optional)
• 256KB standard memory (512KB, 1.25MB and 2MB optionally available)
• 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
• Dual Peak Detectors: weighted/(flat or C-weighted)
• 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) provide remote operation via modem, secured modem access, 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

Analog Filters (Optional)

OPT 30: 1/3 Octave Filters	31.5Hz - 8kHz (9 filters)
OPT 31: 1/1 and 1/3 Octave Filters:	1/1 Octaves 31.5Hz - 16kHz (10 filters) 1/3 Octaves 2Hz - 20kHz (30 filters)

Time Weighting

Response:	Slow, Fast, Impulse

Frequency Weighting

RMS:	A, C, Flat (20Hz - 20kHz)
Peak-I:	C, Flat (20Hz - 20kHz)
Peak-II:	same as RMS

FLAT Frequency Response					
Nominal Frequency Hz	FLAT Weighting - dB	Nominal Frequency Hz	FLAT Weighting - dB	Nominal Frequency Hz	FLAT Weighting - dB
10	-11.6	250	0.0	6300	0.0
12.5	-7.8	315	0.0	8000	0.0
16	-4.3	400	0.0	10000	0.0
20	-1.7	500	0.0	12500	0
25	-0.5	630	0.0	16000	-0.2
31.5	-0.1	800	0.0	20000	-1.0
40	0.0	1000	0.0	25000	-4.1
50	0.0	1250	0.0	31500	-7.4
63	0.0	1600	0.0		
80	0.0	2000	0.0		
100	0.0	2500	0.0		
125	0.0	3150	0.0		
160	0.0	4000	0.0		
200	0.0	5000	0.0		

Measuring Ranges

The measurement range extends from the level corresponding to overload down to the level at which the differential linearity is no longer within IEC and ANSI Type 1 tolerances. These data are typical for use with the Model 2541 or 2560 high sensitivity microphone (47.5 mV/Pa).

Measuring Range, RMS detection

Frequency Weighting	High Range	Normal Range	Low Range	Noise Floor[a]
A-weight broadband	44–149dB	24 –129dB	18–109dB	9dB
C-weight broadband	44–149dB	24 –129dB	25–109dB	13dB
Flat (20Hz–20kHz)	47–149dB	27 –129dB	25–109dB	15dB
31.5Hz octave band	60–148dB	40 –128dB	23–108dB	10dB
63Hz octave band	53–148dB	33 –128dB	20–108dB	8dB
125Hz octave band	53–148dB	33 –128dB	21–108dB	7dB
250Hz octave band	54–148dB	34 –128dB	20–108dB	7dB
500Hz octave band	54–148dB	34 –128dB	18–108dB	6dB
1Hz octave band	55–148dB	35 –128dB	19–108dB	6dB
2Hz octave band	58–148dB	38 –128dB	19–108dB	7dB
4Hz octave band	60–148dB	40 –128dB	20–108dB	8dB
8Hz octave band	61–148dB	41 –128dB	22–108dB	10dB

a. Electrical Noise floor for Low Range

Dynamic Range > 110 dB

The dynamic range extends from the level corresponding to overload down to the A-Weighting electrical noise floor of the instrument. Test is performed in normal range.

Peak Measuring Range (General)

The peak measurement ranges extend from the level corresponding to overload down to the level at which the linearity error exceeds ±0.7dB.	
Rise Time:	< 25 microseconds

Peak-I Measuring Range

(Peak-I detector frequency weighting is selected independent from the RMS weighting.)

Frequency Weighting	High Range	Normal Range	Low Range
C-weighted; 1kHz	73–152dB	53 –132dB	41 – 112dB
C-weighted; 8kHz	95–152dB	75 –132dB	54 – 112dB
Flat (20Hz–20kHz); 1kHz	71–152dB	51 –132dB	46 – 112dB
Flat (20Hz–20kHz); 8kHz	94–152dB	72 –132dB	50 – 112dB
NOTE: Data are presented for both 1kHz and 8kHz because the linearity range for this detector decreases with increasing frequency.			

Peak-II Measuring Range

(Peak-II detector frequency weighting is the same as the RMS weighting.)

Frequency Weighting	High Range	Normal Range	Low Range
A-weighted	68–152dB	48 –132dB	41 – 112dB
C-weighted	67–152dB	47 –132dB	41 – 112dB
Flat (20Hz–20kHz)	67–152dB	47 –132dB	44 – 112dB

Broadband Data Acquisition Features

Interval History (automatic logging)

Logged values:	L_{max}, L_{min}, L_{pk}-I, L_{pk}-II, SEL
	L_{eq} (q=3dB) or TWA (q=4, 5, or 6dB)
Other logged quantities:	Six L_n values with 0.1dB resolution (as per user-entered percentiles with 0.01% resolution)
	Time duration of interval
Logging time intervals:	1 second to 99 hours (hh:mm:ss)—user selected

Time History (automatic logging)

Logged Parameters:	L_{eq} and either L_{max}, L_{pk}-I or L_{pk}-II
Logging time intervals:	1/32 seconds to 255 minutes—user selected

Histograms

Bin resolutions (user selectable):	RMS level, L_{pk}-I and L_{pk}-II
Statistical Measurements:	Number of samples, Percent of total, and Elapsed time for each bin*.

*Each of these measurements are also available for all levels greater than or less than the current bin.

Noise Exposure

Methods:	Sound exposure (E) in Pa^2Hr or dose and projected dose in %
Exchange rates:	3, 4, 5 or 6dB

Spectral Measurement Features

(Available only with optional 1/1 and 1/3 analog octave band filters

• Automatic scanning through filters using constant confidence averaging times.
• Scan using complete or limited set of contiguous filters.
• Minimum Scan time through octave bands: 20s.
• Scan repeats until stopped manually.
• Timed automatic scan, stops after user-programmed time interval.
• Manual scanning through filters, dwell time in each filter user-controlled.
• Interval Time History mode.
• Similar to automatic scan mode, averaged spectra are stored sequentially at regular time intervals (1 minute - 99 hours).
• Interval History can be displayed as a sequence of spectra or by frequency band in a level versus time format.
• Full spectrum presentation on graphic LCD display, each band updated as new spectral data are obtained.
• Digital indication of level and frequency in either a selected frequency band or the frequency band being scanned.
• A second digital indication of the level and frequency of a marked frequency band.

Outputs

The output impedance is 600 Ω for both the Analog AC output and the Analog DC output of the System 814. For minimal error use instruments with $ 100 kΩ input impedance when making AC or DC output measurements.

Analog AC Output

Frequency weighting:	Flat or same as RMS detector weighting—user selected
Gain:	–6dB to +20dB—manual adjustment (see specifications below)
Output Impedance	600 Ω
Lower limit:	The input level for which the total harmonic distortion of the AC output exceeds 1% over the frequency range 31.5Hz - 8kHz
Upper limit:	The input level corresponding to overload.

Analog AC Output Range

Gain Settings	High Range	Normal Range	Low Range
-6dB	64 – 149dB	44 –129dB	30 – 110dB
+20dB	68 – 128dB	48 –108dB	33 – 88dB

Analog DC output

Generated digitally from the CPU to be proportional to SPL or Leq (user-selected)	
Output Impedance:	600 Ω
Voltage Range:	0 to 3 volts

Serial Digital Output

Type:	RS-422 (RS-485 and RS-232 compatible) multi-drop interface for computer, modem, and printer communication
Baud Rate:	Up to 115.2KB
Modem capabilities:	Security feature and autodial out available with optional firmware package
Computer Interface Cable:	Use LD part #CBL006

Standards

Sound Level Meter

Conforms to ANSI S1.4-1983 Type 1
Conforms to IEC 651-1979 Type 1
Conforms to IEC 804-1985 Type 1

Electromagnetic Compatibility

Pursuant to the standards route to compliance of the Electromagnetic Compatibility Regulations 1992, as amended by the Electromagnetic Compatibility (Amendment) Regulations 1994, Larson Davis, Inc. certifies that the following relevant apparatus:
Model 814 Sound Level Meter
has been tested in representative configuration with:
PRM904 preamplifier and 2560 microphone
in relation with the following applicable EMC standards:
BS EN 50081-1:1992 Electromagnetic compatibility - Generic emission standard, Part 1. Residential, commercial and light industry
BS EN 50082-1:1992 Electromagnetic compatibility - Generic immunity standard, Part 1. Residential, commercial and light industry
and when used in accordance with the intended purpose as contained in its instruction manual, including: a) measurements may be performed with connection to PC, b) for battery operation only and c) no exposure to electromagnetic fields exceeding those specified in listed immunity standard(s) as may for example occur within 1m of hand held radio transmitting equipment, or near other RF generating equipment such as RF sealers, welders, etc.
has been found to conform with the general protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Issued in the United Kingdom.

Manufacturer's Specification for Acceptable Level of Performance

The Model 814 Sound Level Meter equivalent SPL deviation limits under the above immunity test conditions would be within (0.5 dB of nominal level for L_{avg} greater than 25, L_{max} greater than 25 and L_{peak} greater than 40 dB A-weighted (fast detector).

Reference Data

Reference Level and Frequency

Reference Level:	114.0 dB SPL
Reference Frequency	1000 Hz

Reference Direction

Free Field Microphone in Free Field:	The microphone should be pointed directly at the source.
Random Incidence Microphone in a Free Field:	The microphone should be pointed 80 degrees off axis of the source of the sound.
Random Incidence Microphone in a Random Field:	The microphone may be pointed in any direction.

Positioning of Instrument and Observer for Best Measurements

Measurements can be made with the System 814 held in one hand, with the arm extended away from the body; however, better measurements can be made with the System 814 placed on a tripod.

Microphone Polarization Voltage

The microphone polarization voltage can be set to 0, 20, or 200 volts. The voltage is controlled using the Transducer and Range settings.

Stabilization Time

The System 814 will not proceed to a running condition until it is allowed to stabilize. At power-on, with a condenser microphone, the stabilization time is approximately 45 seconds. With an electret microphone or with a direct input, the stabilization time is required when changing to and from the High range.

A short stabilization time (less than 10 seconds) is also invoked when certain settings (Weighting, Detector, etc.) are changed.

Microphone Electrical Impedance

The following adapters should be substituted for the microphones listed, when performing electrical tests on the System 814

LD Condenser Microphone	Microphone Capacitance	LD Microphone Adapter
1/2”	18 pf	ADP005
1/4”	6.8 pf	ADP002
1”	47 pf	ADP006

Mechanical Specification

Dimensions

Dimension	Without preamp & mic	With preamp & mic
Length	9.9 inch (25.1 cm)	14.6 inch (37 cm)
Width	3.4 inch (8.6 cm)	3.4 inch (8.6 cm)
Depth	1.6 inch (4.0 cm)	1.6 inch (4.0 cm)

Power

Internal

Internal Batteries:	Three AA cells, Alkaline
Operating Time:	> 24 hours

External

Voltage Range:	8 to 15 Vdc
Reference Frequency:	Without backlight < 80 mA With backlight < 200 mA
Connector:	5.5 mm x 2.5 mm coaxial power plug
Fuse:	0.5 A internal (not user serviceable)
AC Power Adapter:	For 115 Vac use LD part# PSA017 For 220 Vac use LD part# PSA002

Resolution

Levels:	0.1 dB (0.01 dB via I/O)
Dose:	0.01%
Elapsed Time:	0.1 seconds
Elapsed Time Format:	hhhhh:mm:ss.s
Real Time Clock Resolution:	1 second
Real Time Clock Format	hh:mm:ss (24 hour, midnight is 00:00:00)
100 year calendar	01Jan1996 through 31Dec2095

Environmental

Effect of temperature:	<±0.5 dB error, -10 ^{o}C to 50 ^{o}C (14 ^{o}F to122 ^{o}F)
Effect of humidity:	<± 0.5 dB error, 30 to 90% RH at 40 ^{o}C (104 ^{o}F)
Operating:	-10 ^{o}C to 50 ^{o}C (14 ^{o}F to 122 ^{o}F)
Storage:	-10 ^{o}C to 60 ^{o}C (14 ^{o}F to 140 ^{o}F)

Included Accessories

Larson-Davis 1/2" microphone (one of: 2540, 2541, 2559, or 2560)
PRM904 1/2" microphone preamplifier
CBL002 serial printer cable; 6 foot with 25-pin D connector
CBL006 serial interface cable; 10 foot with 9-pin D connector
CBL042 AC/DC output cable; 5 foot with 2 x BNC connectors
WS001 3 1/2" windscreen
PSA017 DC power supply; 9Vdc/500 mA from 115 Vac/60 Hz (US only)
Hand strap
3 x AA batteries, Alkaline
Hard shell carrying case, CCS001, 32 cm x 39 cm x 18 cm (12 1/2" x 15 1/4" x 7")

Available Options

Larson-Davis 1" air condenser microphone; ADP008 adapter required.
Larson-Davis 1/4" air condenser microphone; ADP011 adapter required.
EXLXXX microphone extension cable; 5-pin LEMO connectors (maximum cable length, for Type 1 response to maximum signal levels, is 20 feet)
CAL200 sound level calibrator
CAL250 sound level calibrator

APPENDIX

E 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

$$T_i = \frac{T_c}{2^{(L_{avg} - L_c)/Q}} = \frac{T_c}{10^{(L_{avg} -}}$$

where L_c is the Criterion Level, T_c is the Criterion Duration, Q is the Exchange Rate, K is the Exchange Rate Factor and L_{avg} is the Average Sound Level.

E*xample*: If $L_c = 90$, $T_c = 8$, $Q = 3$ and $L_i = 95$ then

$$\frac{8}{10^{(95-90)/10}} = \frac{8}{2^{(95-90)/3}} = 5.656 = \text{5 hours and 39 minutes}$$

This means that if a person is in this area for 5 hours and 39 minutes he will have accumulated a Noise Dose of 100%.
Standard: ANSI S12.19

Average Sound Level (L_{avg})

It is the logarithmic average of the sound during a Measurement Duration (specific time period), using the chosen Exchange Rate Factor. Exposure to this sound level over the period would result in the same noise dose and the actual (unsteady) sound levels. If the Measurement Duration is the same as the Criterion Duration, then L_{avg}=$L_{TWA(LC)}$

$$L_{avg} = qLog_{10}\left(\frac{1}{T}\int_{T_1}^{T_2} 10^{(L_p(t))/q}\right.$$

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

Calibration

Adjustment of a sound or vibration measurement system so that it agrees with a reference sound or vibration source. It should be done before each set of measurements.

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

$$\left. 10^{(L_i+10)/10} + \sum_{0700}^{1900} 10^{L_i/10} + \sum_{1900}^{2200} 10^{(L_i+5)/10} + \sum_{2200}^{2400} 10^{(L_i+10)/10} \right]$$

The continuous equivalent sound level is generally calculated on an hourly basis and is shown in the equation as L. The levels for the hourly periods from midnight to 7 a.m. have 10 added to them to represent less tolerance for noise during sleeping hours. The same occurs from 10 p.m. to midnight. The levels for the hourly periods between 7 p.m. and 10 p.m. have 5 added to them to represent a lessened tolerance for noise during evening activities. They are energy summed and converted to an average noise exposure rating.

Criterion Duration (T_c)

It is the time required for a constant sound level equal to the Criterion Level to produce a Noise Dose of 100%. Criterion Duration is typically 8 hours.
Example: If the Criterion Level = 90 dB and the Criterion Duration is 8 hours, then a sound level of 90 dB for 8 hours, will produce a 100% Noise Dose. See Noise Dose. *Standard*: ANSI S12.19

Criterion Sound Exposure (CSE)

The product of the Criterion Duration and the mean square sound pressure associated with the Criterion Sound Level when adjusted for the Exchange Rate. It is expressed in Pascals-squared seconds when the exchange rate is 3 dB.
where q is the Exchange Rate Factor. See Exchange Rate.

$$CSE = T_c 10^{L_c/q}$$

Standard: ANSI S1.25

Criterion Sound Level (L_c)

It is the sound level which if continually applied for the Criterion Duration will produce a Noise Dose of 100%. The current OSHA Criterion Level is 90 dB.
Standard: ANSI S12.19

Daily Personal Noise Exposure ($L_{EP,d}$)

It is the level of a constant sound over the Criterion Duration that contains the same sound energy as the actual, unsteady sound over a specific period. The period is generally shorter, so the sound energy is spread out over the Criterion Duration period.
Example: If the Criterion Duration = 8 hours and the specific period is 4 hours and the average level during the 4 hours is 86 dB, then the $L_{EP,d}$ = 83 dB.

Day-Night Average Sound Level (DNL, L_{dn})

A rating of community noise exposure to all sources of sound that differentiates between daytime and night-time noise exposure. The equation for it is

$$= 10Log_{10}\left[\sum_{0000}^{0700} 10^{(L_i + 10)/10} + \sum_{0700}^{2200} 10^{L_i/10} + \sum_{2200}^{2400} 10^{(L_i + 10)/10}\right]$$

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, typically used in sound and vibration measurements. Whenever the word *level* is used it implies this logarithmic form. The relationship is relatively simple, but the mathematics can become complex. It is widely used and was developed so that the very wide range of any quantity could be represented more simply. It is not possible to directly add or subtract physical quantities when expressed in decibel form. The word level is always attached to a physical quantity when it is expressed in decibels; for example L_p represents the sound pressure level. The table below shows the actual value of a specific item, such as sound pressure, for which the level is to be determined. First the value is put into exponential form in powers of ten; the exponent is the Bel. The exponent is then multiplied by ten to yield the decibel. This procedure converts multiplication into addition; every time 10 is *added* to the level, the value is *multiplied* by 10. When the value is not a even multiple of ten the exponent is more complicated as shown in the table. Every time the level increases by 3 dB, the value is multiplied by 2 (doubled). These two rules are worth remembering.

Linear form		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
1000	10^3	30
10000	10^4	40
100000	10^5	50
1000000	10^6	60

The definition of decibel is intended for power-like quantities (W). Sometimes power is represented by the square of a measured quantity and this results in a different form of the equation (See Sound Pressure Level).

$$L = 10Log_{10}\left[\frac{W}{W_0}\right] \qquad W = W_0 10^{L/10}$$

The value of the item in the table is not the value of the quantity itself but the ratio of that quantity to a reference quantity. So for every level in decibels there must be a reference quantity. When the quantity equals the reference quantity the level is zero. To keep the values above zero, the reference is generally set to be the lowest value of the quantity.

Department of Defense Level (L_{DOD})

The Average Sound Level calculated in accordance with Department of Defense Exchange Rate and Threshold Level. See Average Sound Level

Dose

(See Noise Dose)

Detector

The part of a sound level meter that converts the actual fluctuating sound or vibration signal from the microphone to one that indicates its amplitude. It first squares the signal, then averages it in accordance with the time-weighting characteristic, and then takes the square root. This results in an amplitude described as rms (root-mean-square).

Eight Hour Time-Weighted Average Sound Level ($L_{TWA(8)}$)

It is the constant sound level that would expose a person to the same Noise Dose as the actual (unsteady) sound levels. The equation for it is

$$L_{TWA(8)} = L_c + qLog_{10}\left(\frac{D}{100}\right)$$

NOTE: This definition applies only for a Criterion Duration of 8 hours.
Standard: ANSI S12.19

Energy Equivalent Sound Level (L_{eq})

The level of a constant sound over a specific time period that has the same sound energy as the actual (unsteady) sound over the same period.

$$L_{eq} = 10Log_{10}\left[\frac{\int_{T_1}^{T_2} p^2(t)dt}{p_o^2 T}\right]$$

where p is the sound pressure and the Measurement Duration (specific time period) $T=T_2-T_1$. See Sound Exposure Level.

Exchange Rate (Q), Exchange Rate Factor (q), Exposure Factor (k)

It is defined in ANSI S1.25 as "the change in sound level corresponding to a doubling or halving of the duration of a sound level while a constant percentage of criterion exposure is maintained." The rate and the factors are given in the table below.
Standard: ANSI S12.19

Exchange Rate, Q	Exchange Rate Factor, q	Exposure Factor, k
3.01	10	1
4	13.333	.75
5	16.667	.60
6.02	20	.50

Far Field

There are two types of far fields: the *acousti*c far field and the *geometric* far field.

Acoustic Far Field: The distance from a source of sound is greater than an acoustic wavelength. In the far field, the effect of the type of sound source is negligible. Since the wavelength varies with frequency (See the definition of Wavelength), the distance will vary with frequency. To be in the far field for all frequencies measured, the lowest frequency should be chosen for determining the distance. For example, if the lowest frequency is 20 Hz, the wavelength at normal temperatures is near 56 ft. (17 m); at 1000 Hz, the wavelength is near 1.1 ft. (1/3 m). See the definition of Acoustic Near Field for the advantages of in the acoustic far field.

Geometric Far Field: The distance from a source of sound is greater than the largest dimension of the sound source. In the far field, the effect of source geometry is negligible. Sound sources often have a variety of specific sources within them, such as exhaust and intake noise. When in the far field, the sources have all merged into one, so that measurements made even further away will be no different. See the definition of Geometric Near Field for the advantages of being in the geometric far field.

Free Field

A sound field that is *free* of reflections. This does not mean that the sound is all coming from one direction as is often assumed, since the source of sound may be spatially extensive. See the definitions of near and far fields for more detail. This definition is often used in conjunction with reverberant field.

Frequency (Hz, rad/sec)

The rate at which an oscillating signal completes a complete cycle by returning to the original value. It can be expressed in cycles per second and the value has the unit symbol Hz (Hertz) added and the letter f is used for a universal descriptor. It can also be expressed in radians per second, which has no symbol, and the greek letter ω is used for a universal descriptor. The two expressions are related through the expression $\omega=2\pi f$.

Frequency Band Pass Filter

The part of certain sound level meters that divides the frequency spectrum on the sound or vibration into a part that is unchanged and a part that is filtered out. It can be composed of one or more of the following types:

Low Pass: A frequency filter that permits signals to pass through that have frequencies below a certain fixed frequency, called a *cutoff frequency*. It is used to discriminate against higher frequencies.

High Pass: A frequency filter that permits signals to pass through that have frequencies above a certain fixed frequency, called a *cutoff frequency*. It is used to discriminate against lower frequencies.

Bandpass: A frequency filter that permits signals to pass through that have frequencies above a certain fixed frequency, called a lower cutoff frequency, and below a certain fixed frequency, called an *upper cutoff frequency*. The difference between the two cutoff frequencies is called the *bandwidth*. It is used to discriminate against both lower and higher frequencies so it passes only a band of frequencies.

Octave band: A bandpass frequency filter that permits signals to pass through that have a bandwidth based on octaves. An *octave* is a doubling of frequency so the upper cutoff frequency is twice the lower cutoff frequency. This filter is often further subdivided in 1/3 and 1/12 octaves (3 and 12 bands per octave) for finer frequency resolution. Instruments with these filters have a sufficient number of them to cover the usual range of frequencies encountered in sound and vibration measurements.The frequency chosen to describe the band is that of the center frequency. Note table in Frequency Filter - Frequency Weighting.

Frequency Filter - Weighted

A special frequency filter that adjusts the amplitude of all parts of the frequency spectrum of the sound or vibration unlike band pass filters. It can be composed of one or more of the following types:

A-Weighting: A filter that adjusts the levels of a frequency spectrum in the same way the human ear does when exposed to low levels of sound. This weighting is most often used for evaluation of environmental sounds. See table below.
B-Weighting: A filter that adjusts the levels of a frequency spectrum in the same way the human ear does when exposed to higher levels of sound. This weighting is seldom used. See table below.
C-Weighting: A filter that adjusts the levels of a frequency spectrum in the same way the human ear does when exposed to high levels of sound. This weighting is most often used for evaluation of equipment sounds. See table below.
Flat-Weighting: A filter that does not adjust the levels of a frequency spectrum. It is usually an alternative selection for the frequency-weighting selection.

Center Frequencies, Hz		Weighting Network Frequency Response		
1/3 Octave	1 Octave	A	B	C
20		-50.4	-24.2	-6.2
25		-44.7	-20.4	-4.4
31.5	31.5	-39.4	-17.1	-3.0
40		-34.6	-14.2	-2.0
50		-30.2	-11.6	-1.3
63	63	-26.2	-9.3	-0.8
80		-22.5	-7.4	-0.5
100		-19.1	-5.6	-0.3
125	125	-16.1	-4.2	-0.2
160		-13.4	-3.0	-0.1
200		-10.9	-2.0	0
250	250	-8.6	-1.3	0
315		-6.6	-0.8	0
400		-4.8	-0.5	0
500	500	-3.2	-0.3	0
630		-1.9	-0.1	0
800		-0.8	0	0
1000	1000	0	0	0
1250		0.6	0	0
1600		1.0	0	-0.1
2000	2000	1.2	-0.1	-0.2
2500		1.3	-0.2	-0.3
3150		1.2	-0.4	-0.5
4000	4000	1.0	-0.7	-0.8
5000		0.5	-1.2	-1.3
6300		-0.1	-1.9	-2.0
8000	8000	-1.1	-2.9	-3.0
10000		-2.5	-4.3	-4.4
12500		-4.3	-6.1	-6.2
16000	16000	-6.6	-8.4	-8.5
20000		-9.3	-11.1	-11.2

L_{eq}

See “Energy Equivalent Sound Level”, “Sound Level”, Energy Average”, and “Time Weighted Average”

Level (dB)

A descriptor of a measured physical quantity, typically used in sound and vibration measurements. It is attached to the name of the physical quantity to denote that it is a logarithmic measure of the quantity and not the quantity itself. The word *decibel* is often added after the number to express the same thing. When frequency weighting is used the annotation is often expressed as dB(A) or dB(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

Microphone Guidelines, cont.response to a force acting on it. The force can be caused by a number of sources only one of which are we interested: sound. Non-sound forces are: (1) direct physical contact such as that with a finger or a raindrop; (2) those caused by the movement of air over the diaphragm such as environmental wind or blowing; (3) those caused by vibration of the microphone housing; and (4) those caused by strong electrostatic fields.

Rules:

1. Do not permit any solid or liquid to touch the microphone diaphragm. Keep a protective grid over the diaphragm.
2. Do not blow on a microphone and use a wind screen over the microphone to reduce the effect of wind noise.
3. Mount microphones so their body is not subject to vibration, particularly in direction at right angles to the plane of the diaphragm.
4. Keep microphones away from strong electrical fields.

A microphone measures forces not pressures. We would like the microphone to measure sound pressure (force per unit area) instead of sound force. If the pressure is applied uniformly over the microphone diaphragm a simple constant (the diaphragm area) relates the two, but if the pressure varies across the diaphragm the relationship is more complex. For example, if a negative pressure is applied on one-half the diaphragm and an equal positive pressure is applied to the other half, the net force is zero and essentially no motion of the diaphragm occurs. This occurs at high frequencies and for specific orientations of the microphone.

Rules:

1. Do not use a microphone at frequencies higher than specified by the manufacturer; to increase the frequency response choose smaller microphones.
2. Choose a microphone for *free field* or *random incidence* to minimize the influence of orientation.

A microphone influences the sound being measured. The microphone measures very small forces, low level sound can run about one-billionth of a PSI! Every measurement instrument changes the thing being measured, and for very small forces that effect can be significant. When sound impinges directly on a microphone the incident wave must be reflected since it cannot pass through the microphone. This results in the extra force required to reflect the sound and a microphone output that is higher than would exist if the microphone were not there. This is more important at high frequencies and when the microphone is facing the sound source.

Rules:

1. Do not use a microphone at frequencies higher than specified by the manufacturer; to increase the frequency response choose smaller microphones.
2. Choose a microphone for *free field* or *random incidence* to minimize the influence of orientation.

A microphone measures what is there from any direction: Most measurements are intended to measure the sound level of a specific source, but most microphones are not directional so they measure whatever is there, regardless of source.

Rules:

1. When making hand-held measurements, keep your body at right angles to the direction of the sound you are interested in and hold the meter as far from your body as possible. Use a tripod whenever possible.
2. Measure the influence of other sources by measuring the background sound level without the source of interest. You may have to correct for the background.

Near Field

There are two types of near fields: the *acoustic near field* and the *geometric near field*.

Acoustic Near Field: The distance from a source of sound is less than an acoustic wavelength. In the near field, the effect of the type of sound source is significant. Since the wavelength varies with frequency (See the definition of Wavelength), the distance will vary with frequency. The most common example of a near field is driving an automobile with an open window. As you move your ear to the plane of the window, the sound pressure level builds up rapidly (wind noise) since most of the pressure changes are to move the air and very little of it compresses the air to create sound. Persons not far way, can hardly hear what you hear.

The acoustic near field is characterized by pressures that do not create sound that can be measured in the far field. Therefore measurements made here are not useful in predicting the sound levels far way or the sound power of the source.

Geometric Near Field: The distance from a source of sound is less than the largest dimension of the sound source. In the near field, effect of source geometry is significant. Sound sources often have a variety of specific sources within them, such as exhaust and intake noise. When in the near field, the sound of a weaker, but close, source can be louder than that of a more distant, but stronger, source. Therefore measurements made here can be used to separate the various sources of sound, but are not useful in predicting the sound levels and sound spectrum far from the source.

Noise

Typically it is *unwanted* sound. This word adds the response of humans to the physical phenomenon of sound. The descriptor should be used only when negative effects on people are known to occur. Unfortunately, this word is used also to describe sounds with no tonal content (random):

Ambient: The all encompassing sound at a given location caused by all sources of sound. It is generally random, but need not be.
Background: The all encompassing sound at a given location caused by all sources of sound, but excluding the source to be measured. It is essentially the sound that interferes with a measurement.
Pink: It is a random sound that maintains constant energy per octave. Pink light is similar to pink noise in that it has a higher level at the lower frequencies (red end of the spectrum).
White: It is a random sound that contains equal energy at each frequency. In this respect, it is similar to white light.

Noise Dose (D)

It is the percentage of time a person is exposed to noise that is potentially damaging to hearing. Zero represents no exposure and 100 or more represents complete exposure. It is calculated by dividing the actual time of exposure by the allowed time of exposure. The allowed time of exposure is determined by the Criterion Duration and by the sound level (the higher the level, the shorter the allowed time). The sound levels must be measured with A-frequency weighting and slow exponential time weighting. See Projected Noise Dose.

$$D = 100\frac{T}{T_i} = \frac{100T}{T_c}10^{(L_i - L_c)/Q}$$

where T is the Measurement Duration and T_i is the Allowed Exposure Time.
Standard: ANSI S12.19

Noise Exposure

(See Sound Exposure)

OSHA Level (L_{OSHA})

The Average Sound Level calculated in accordance with the Occupational Safety and Health Administration Exchange Rate and Threshold Level.

Preamplifier

A part of the sound level meter that matches a particular model of microphone to the meter. It must be chosen in conjunction with a microphone and a cable that connects them.

Projected Noise Dose

It is the Noise Dose expected if the current rate of noise exposure continues for the full Criterion Duration period.

Single Event Noise Exposure Level (SENEL, L_{AX})

The total sound energy over a specific period. It is a special form of the Sound Exposure Level where the time period is defined as the start and end times of a noise event such as an aircraft or automobile passby.

Sound

The rapid oscillatory compressional changes in a medium (solid, liquid or gas) that propagate to distant points. It is characterized by changes in density, pressure, motion, and temperature as well as other physical quantities. Not all rapid changes in the medium are sound (wind noise) since they do not propagate.
The auditory sensation evoked by the oscillatory changes.

Difference between sound and noise: Sound is the physical phenomenon associated with acoustic (small) pressure waves. Use of the word *sound* provides a neutral description of some acoustic event. Generally, noise is defined as unwanted sound. It can also be defined as sound that causes adverse effects on people such as hearing loss or annoyance. It can also be defined as the sound made by other people. In every case, noise involves the judgment of someone and puts noise in the realm of psychology not physics.

Rules:

1. Use word *sound* to describe measurements to remove the emotional overtones associated with the word *noise*. Some sound metrics use noise in their name and it is proper to use the name as it is.

Sound Exposure (SE)

It is the total sound energy of the actual sound during a specific time period. It is expressed in Pascals-squared seconds.

$$SE = \int_{T_1}^{T_2} p_A^2(t)dt$$

where p_A is the sound pressure and T_2 - T_1 is the Measurement Duration (specific time period).

When applied to hearing damage potential, the equation is changed to

$$SE = \int_{T_1}^{T_2} [p_A^2(t)]^k dt$$

where k is the Exposure Factor. See Exchange Rate.

Standard: ANSI S1.25

Sound Exposure Level (SEL, L_{ET})

The total sound energy in a specific time period. The equation for it is

$$SEL = 10Log_{10}\left[\frac{\int_{T_1}^{T_2} p^2(t)dt}{p_0^2 T}\right]$$

The sound pressure is squared and integrated over a specific period of time (T_2-T_1) this is called the sound exposure and has the units Pascal squared- seconds or

Pascal squared- hours. P0 is the reference pressure of 20 μPa and T is the reference time of 1 second. It is then put into logarithmic form. It is important to note that it is not an average since the reference time is not the same as the integration time.

Sound Pressure

The physical characteristic of sound that can be detected by microphones. Not all pressure signals detected by a microphone are sound (e.g., wind noise). It is the amplitude of the oscillating sound pressure and is measured in Pascals (Pa), Newtons per square meter, which is a metric equivalent of pounds per square inch. To measure sound, the oscillating pressure must be separated from the steady (barometric) pressure with a detector. The detector takes out the steady pressure so only the oscillating pressure remains. It then squares the pressure, takes the time average, and then takes the square root (this is called rms for root-mean square). There are several ways this can be done.

Moving Average: The averaging process is continually accepting new data so it is similar to an exponential moving average. The equation for it is

$$p_{rms} = \sqrt{\frac{1}{T}\int_{t_s}^{t} p^2(\xi)e^{-(t-\xi)/T}d\xi}$$

The sound pressure is squared and multiplied by a exponential decay factor so that when the time of integration is near the current time (t) it is essentially undiminished. For times older (less) than the current time, the value is diminished and so becomes less important. The rate at which older data are made less influential is expressed by the constant T. The larger is it the slower the decay factor reduces and the slower the response of the system to rapid changes. These are standardized into three values called Time Weighting. See the values below.

Fixed Average: The averaging process is over a fixed time period. The equation for it is

$$p_{rms} = \sqrt{\frac{1}{(T_2 - T_1)} \int_{T_1}^{T_2} p^2(t)dt}$$

The sound pressure is squared and averaged over a fixed time period. Unlike the moving average, the sound pressures in all time intervals are equally weighted.

Sound Pressure Level (SPL, L_p)

The logarithmic form of sound pressure. It is also expressed by attachment of the word decibel to the number. The logarithm is taken of the ratio of the actual sound pressure to a reference sound pressure which is 20 MicroPascals (μ Pa). There are various descriptors attached to this level depending on how the actual sound pressure is processed in the meter:

Instantaneous: The time varying reading on a meter face on in a meter output due to changes in the sound pressure. The reading will depend on the time-weighting applied.

The fundamental relationship between the two is logarithmic

$$L_p = 20\log_{10}\left[\frac{p_{rms}}{p_0}\right] \qquad p_{rms} = p_0 10^{L_p/20}$$

where p_0 is the reference sound pressure of 20 μPa. The square of the sound pressure is a power-like quantity that can be expressed in the original form of the level definition

$$L_p = 10\log_{10}\left[\frac{p_{rms}^2}{p_0^2}\right] \qquad p_{rms}^2 = p_0^2 10^{L_p/10}$$

Sound Pressure Level can be converted to sound pressure as follows. If the sound pressure is 1 Pascal, then the sound pressure level is

$$g_{10}\left[\frac{1}{20 \bullet 10^{-6}}\right] = 20\log_{10}[50000] = 20[4.699] = 94.0dB$$

Calibrators often use a level of 94 dB so they generate a sound pressure of 1 Pascal.

If the sound pressure level = 76.3 dB, then the sound pressure is

$$^{76.3/20} = 20 \bullet 10^{3.815 - 6} = 20 \bullet 10^{-2.185} = 20[0.0065] = 0.13$$

Energy Average (L_{eq}): The value of a steady sound measured over a fixed time period that has the same sound energy as the actual time varying sound over the same period. This descriptor is widely used. It is a fixed average (See Sound Pressure).

Impulse: The value of an impulsive sound. The reading will depend on the time-weighting applied.

Unweighted Peak: The peak value of a sound with a meter that has flat frequency weighting and a peak detector.

Weighted Peak: The peak value of a sound with a meter that has a frequency weighting other than flat and a peak detector.

Sound Power(W)

The sound power emitted by a sound source. It is measured in Watts.

Sound Power Level (PWL, L_W)

The logarithmic form of sound power. It is also expressed by attachment of the word decibel to the number. The logarithm is taken of the ratio of the actual sound power to a reference sound power, which is 1 pico-watt. Sound power level cannot be measured directly, but can only be deduced through measurements of sound intensity or sound pressure around the source. The equation for it is

$$L_w = 10\log_{10}\left[\frac{W}{W_0}\right] \qquad W = W_0 10^{L_w/10}$$

Sound Speed, (c,)

The speed at which sound waves propagate. It is measured in meters per second. It should not be confused with sound or particle velocity which relates to the physical motion of the medium itself.

$$c = 20.05\sqrt{degC + 273} \quad m/s$$

$$c = 49.03\sqrt{degF + 460} \quad ft/sec$$

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}.

$$TWA(TC) = K\log_{10}\left(\frac{1}{T}\int_{T_1}^{T_2} 10^{(L_p(t))/K} dt\right)$$

where $T_c=T_2-T_1$ and K is the Exchange Rate Factor. It is used for hearing damage risk assessment.
Standard: ANSI S12.19

Time Weighting

The response speed of the detector in a sound level meter. There are several speeds used.

Slow: The time constant is 1 second (1000 ms). This is the slowest and is commonly used in environmental noise measurements.

Fast: The time constant is 1/8 second (125 ms). This is a less commonly used weighting but will detect changes in sound level more rapidly.

Impulse: The time constant is 35ms for the rise and 1.5 seconds (1500 ms) for the decay. The reason for the double constant is to allow the very short signal to be captured and displayed.

Vibration

The oscillatory movement of a mechanical system (generally taken to be solid). It is used as a broad descriptor of oscillations.

Wavelength (l)

The distance between peaks of a propagating wave with a well defined frequency. It is related to the frequency through the following equation

$$\lambda = \frac{c}{f}$$

where c is the sound speed and f is the frequency in Hz. It has the dimensions of length.

Wavenumber (k)

A number that is related to the wavelength of sound and is used to compare the size of objects relative to the wavelength or the time delay in sound propagation. It is related to wavelength through the following equation

$$k = \frac{2\pi}{\lambda} = \frac{2\pi f}{c} = \frac{\omega}{c}$$

where λ is the wavelength, c is the sound speed, f is the frequency in Hz, and ω is the radian frequency. It has the dimensions of inverse length.

Yearly Average Sound Level (YDNL, L_{ydn})

The Day-Night Average Sound Level for each day is averaged over the entire year. It is calculated as follows

$$L_{ydn} = 10\log\left[\frac{1}{365}\sum_{i=1}^{365} 10^{Ldn_1/10}\right]$$

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