APPENDIX

9 Performing a Sound Level Measurement

Due to the many features of the System 824 and the variety of measurements it is capable of performing, there is a great deal of instructive material in the preceding chapters. In this chapter, to assist the new user in performing a basic sound level measurement, we work our way through the specific steps necessary to perform an accurate measurement.

Configuration of the System

The System 824 should be configured as shown in Figure 1-1 on page -1-10 with the preamplifier connected to the front of the instrument and the microphone connected to the end of the preamplifier. If desired, a microphone extenstion cable may be connected between the preamplifier and the body of the 824. For more details on the positioning of the 824 and the permitted length of the extension cable, see ”Positioning the Meter” on page 9-7.

Selecting a Measurement Mode

The System 824 can measure sound pressure level using using any of the following modes:

- **Integrating Sound Meter (ISM)** measures sound level parameters, which are stored manually by the operator.

- **Logging SLM (LOG)** measures sound level parameters and automatically stores the data based on a number of different user-configured data logging methodologies such as Time History, Intervals, Exceedance History and Daily History).

- **Sound Spectrum Analyzer (SSA)** which simultaneously measures sound level parameters and real-time frequency spectra (1/1 or 1/3 octave bandwidths). These data can be stored manually by the operator or automatically using the Time History and/or Interval methodologies.

Details on the funtionality of each of these see “System 824 Virtual Instruments” on page 6-1.

Select the desired measurement mode (ISM, LOG or SSA) as described in section ”Selecting and Modifying Instrument Definitions (IDs)” on page 4-12. If you are just beginning to use the instrument, there will be only one ID (permanent) available for each of these modes. However, if other IDs have been created and stored using parameters different from the default values used in the permanent setups, these will also appear with the name defined for each at the time of storage.

Selecting a Measurement ID

If a previous setup had been created and saved, this setup can be recalled by following the procedure described in ”Selecting a Measurement Setup” on page 2-6.

Editing the Microphone Parameters

The microphone to be used will either be a traditional condenser microphone, which requires a polarization voltage, or it will be an electret (prepolarized) microphone. Further, if it is a free-field microphone and the measurement is best performed using a random incidence microphone, the user can select to implement a random incidence correction to the measurement.

The procedure for selecting these parameters is described in section ”Customizing Settings” on page 7-2, specifically the sections ”Transducer Setting - (SSA, LOG, ISM)” on page 7-8 and ”Random Incidence Microphone Correction - (Available to all Instrument types)” on page 7-8.

Calibration

The System 824 automatically changes the frequency weighting to C-Weighting during the calibration process. Therefore, calibrators having frequencies which correspond to the flat region of the C-weight curve (200 Hz - 1.25 kHz) may be used. Larson Davis recommends the following sound level calibrators:

- Larson Davis Model CAL200; 94/114 dB @ 1 kHz
- Larson Davis Model CAL250: 114 dB @ 250 Hz

The procedure for performing a calibration is described in detail in section ”Turning On and Calibrating the System 824” on page 4-1.

If the **Cal Level** is not already set to the level provided by the calibrator being used, this level must be changed by the user. To do this, use the ▼ key to highlight **Cal Level** and press the ✓key. Use the horizontal and vertical arrow keys to edit the level to match that of the calibrator and press the ✓key to enter the new value.

Entering the Noise Floor Values

When measuring low levels of sound, substantial errors can occur when the sound level to be measured is near that of the noise floor of the measuring instrument. An accurate measurement is obtained when the measured sound level is at least 10 dB above the noise floor. When this condition is not fulfilled, we say the instrument is in an **Under Range** condition. which we indicate on the display. The noise due to the front end electronics and the microphone preamplifier are known, but the thermal noise of the microphone must be entered by the user based on specifications provided by the manufacturer. The A-weighted noise floor values for Larson Davis microphones are presented in the following table.

Microphone Model Number	**2520**	**2530**	**2540**	**377B41**	**2559**	**377A 60**	**2570**	**2575**
Nominal Thermal Noise, dB(A)	**30**	**31**	**20**	**15**	**18**	**15**	**10**	**10**

The procedure for entering the noise floor value for the microphone to be used is described in the section ”TTools Key” on page 3-18, subsection ”Calibration” on page 3-22 under the heading **Noise Floor**.

Editing the Measurement Parameters

NOTE: If you are recalling a measurement ID which has already been configured for the measurement you wish to perform, then you can skip to the next section.

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

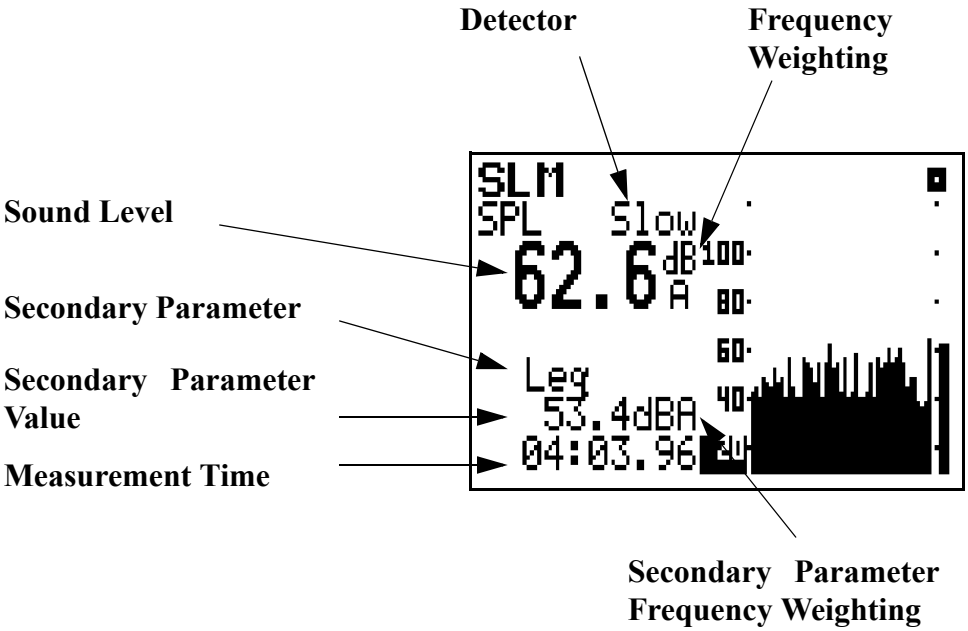
	Leq	Peak	Live SPL			Lmax			Lmin		
			Detectors			Detectors			Detectors		
			Slow	Fast	Impl	Slow	Fast	Impl	Slow	Fast	Impl
A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

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

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

The SLM display is shown below



Although the System 824 measures the sound pressure level using multiple values of detector and frequency weighting, it only displays a single value as shown above. For this parameter, you have a choice of three detectors (averaging time)

- Slow
- Fast
- Impulse

and you have a choice of three frequency weightings

- A-weight
- C-weight
- Flat

Similarly, you have a choice of three frequency weightings to be used for the display of the peak level.

- A-weight
- C-weight
- Flat

The procedure for selecting these parameters is described in section ”Customizing Settings” on page 7-2, specifically the sections, ”Weighting Setting - (SSA, LOG, ISM)” on page 7-6 and ”Pk Weighting - (SSA, LOG, ISM)” on page 7-9.

Positioning the Meter

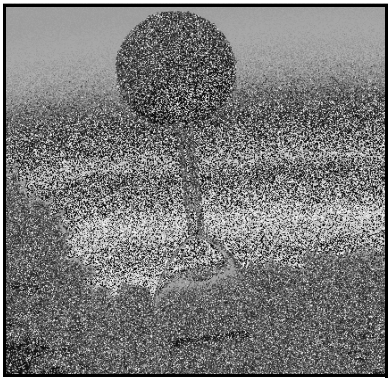
The meter will be either mounted upon a tripod or held in the hand. In order to avoid the effect of sound reflections from the body of the operator interfering with the measurement, the meter should be located as far as possible from the body. Thus, when actually performing the measurement, the operator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

If desired, a microphone extension cable may be placed between the meter and the preamplifier/microphone. When doing so, take care that the preamplifier/microphone is held or mounted in such a way to minimize the effect of reflections on the sound field near the microphone.

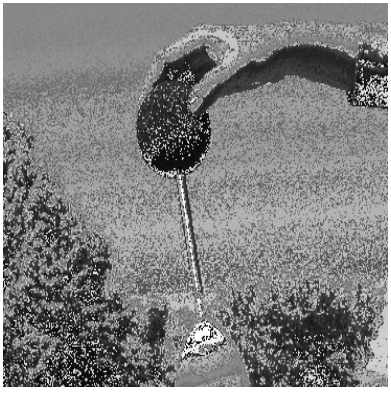
Use of a Windscreen

Wind blowing across the microphone generates pressure fluctuations on the microphone diaphragm which can produce errors in the measurement. As a result, when performing measurements in the presence of low level airflows, it is recommended that a windscreen be placed over the microphone. Larson Davis provides the WS001 windscreen, a 3 1/2” diameter ball made of open cell foam

which can be placed over the microphone and preamplifier as shown below.



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



Selecting the SLM Display

For sound level measurement, press the key, use the key to highlight SLM and press the key to obtain the display shown in ”Editing the Measurement Parameters” on page 9-5

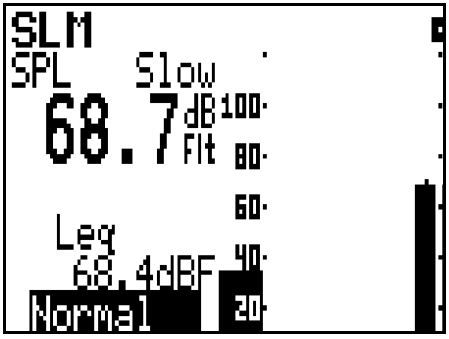
Selecting the Measurement Range

ISM and LOG Modes

In the ISM mode, there are three range setting available:

- Low
- Normal
- High

Although the range setting does not always appear on the SLM display, it can be found by repeatedly pressing either the or key until the highlight is located in the lower right corner of the display as shown below.



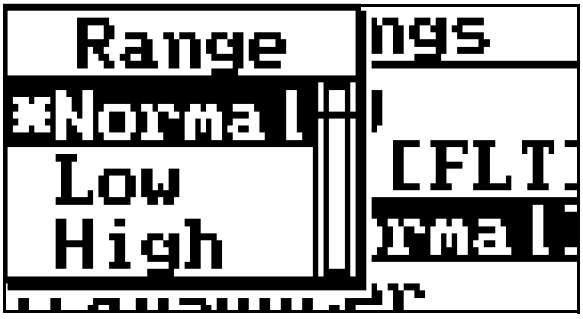
The upper and lower limits of sound pressure level which can be measured for each of these scales are indicated in the ”RMS Measurement Range (LOG and ISM modes only)” on page C-11.

Selecting the Range Setting

When the range is highlighted as shown in the above graphic, the range can be toggled between Normal and Low by pressing the ▶ or ◀ keys. If the approximate level is known, select the range setting for which that level falls nearest the middle of the measurement range. If it is not known, select the Normal range which is usually adequate for the majority of common measurements.

The range setting can also be selected using the setup menu. In fact, this is the only way to select the High range.

Press the ✎ key, the ▶ key, highlight **SLM**, press the ✓ key, highlight **Range**, and press the ✓ key to obtain the following display



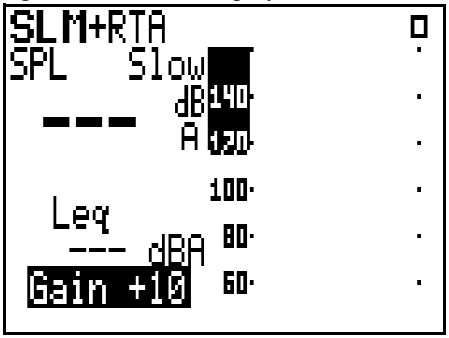
Highlight the desired range and press the ✓ key to make the selection.

SSA Mode

The SSA Mode has a smaller measurement range than the ISM and LOG Modes. As a result, rather than select a range setting from among three choices, as done for the ISA and LOG Modes, we will select a gain value which can range from -20 to + 50 dB in steps of 10 dB. The usual practice is to set the gain to 0 dB and later modify that as required to obtain a good measurement without overload or under range conditions.

Although the gain setting does not usually appear on the SLM display, it can be found by repeatedly pressing either

the ⏶ or ⏷ key until the highlight is located in the lower right corner of the display as shown below.



When the gain setting is highlighted, this can be changed by repeatedly presssing the ⏶ or ⏷ key until the desired value of Gain appears.

Performing a Measurement

The procedure for performing a measurement is described in the section ”Performing a Measurement; SLM&RTA (SSA)” on page 2-7. Among the important aspects covered are the following:

- Stop, Pause and Erase Functions in section ”Stop, Pause and Back Erase Functions” on page 2-8.
- Changing the Detector of the displayed SPL value in section ”Changing the detector of the displayed SPL value” on page 2-8.
- Changing the Frequency Weighting of the displayed SPL value in section ”Changing the frequency weighting of the displayed SPL value” on page 2-9.
- Changing the Displayed Secondary Parameter in section ”Changing the displayed secondary parameter” on page 2-10.
- Changing the Frequency Weighting of the Displayed Lpeak value in section ”Changing the frequency weighting of the displayed Lpeak value” on page 2-10.

After reaching equilibrium with the ambient environment and switching the power on, the elapsed time until the meter may be used to measure the sound level is as follows:

- < 10 seconds using a prepolarized (electret) microphone
- < 1 minute using a traditional condenser microphone requiring a polarization voltage.

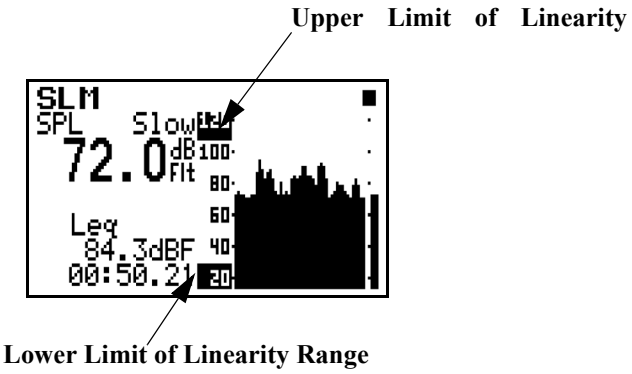
When performing an integrating measurement, the data is available during and immediately following the measurement time interval.

Averaging Time

The averaging time is determined by how long the measurement is allowed to run, as indicated by the digital display in the lower left of the screen. For low level measurements where the measured level may be affected by the system noise floor, it is recommended that an averaging time of at least 30 seconds be used. For timed measurements, the value of the averaging time can be preset and the instrument configured to stop automatically after that time as described in the section ”Measuring for a Preset Integration Time” on page 9-16.

Linearity Range

When making a measurement, the upper and lower linearity range limits of the instrument for the setting presently in effect are indicated by the dark regions with light numbers as indicated below.

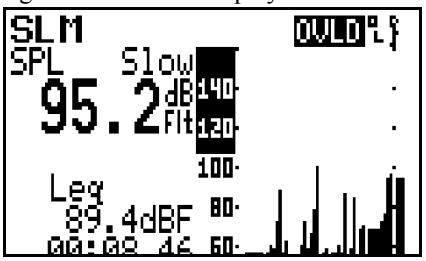


Changing the range (ISM and LOG Modes) or gain (SSA Mode will change these limits. For very low (high) level measurements, it may be necessary to utilize a microphone having a higher (lower) value of sensitivity in order to perform a measurement within the linearity range of the instrument.

Overload and Under Range Conditions

Overload Condition

When the input signal is too high, the electronics will overload. This is indicated by a flashing **OVLD** text message, as well as a flashing OL (for overload) in the upper right corner of the display as shown below.



This text message will continue as long as the overload conditions continues, but it will disappear when the input level drops below the overload level. However, the flashing OL display will continue to appear in the same position as shown below. This indicates that the data measured may not be accurate due to the overloaded condition which occurred during the measurement interval.

Reset

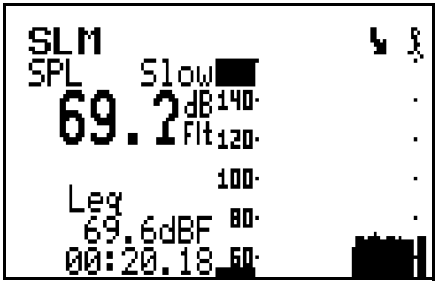
Press the ⏏ key to reset the measurement. This function is described in greater detail in the section ”R Reset Key” on page 3-9. The reset facility clears an overload indication and there is no delay time between the operation of the reset facility and the re-initiation of a measurement.

Under Range Condition

NOTE: The noise level corresponding to the microphone being used must have been entered by the user, as described in section ”Entering the Noise Floor Values” on page 9-4, in order for this feature to function correctly.

When the sound level being measured is within 10 dB of the noise floor, this will be indicated by a flashing downward

directed arrow in the upper right corner of the display as shown below.



To avoid this condition, select a lower range (ISM or LOG Mode) are a higher value of Gain (SSA Mode).

Max, Min and Peak Values

As stated in ”Editing the Measurement Parameters” on page 9-5, Lmax and Lmin are measured for all combinations of frequency weighting (A, C and Flat) and detection (Slow, Fast and Impulse). Peak values are measured for A, C and Flat frequency weighting. These max values represent the highest value of each which was measured during the measurement time interval and the min. values represent the lowest values measured during the same time interval. A reset operation will reset these values to the values being measured at the instant the reset operation is activated.

The nominal range for the measurement of Peak values using A, C or Flat weighting are specified in the section ”Peak Measurement Range (LOG and ISM modes only)” on page C-12.

Measuring for a Preset Integration Time

The System 824 can perform an integrated measurement over a preset time in either the LOG or SSA Mode by making use of the Interval measurement feature. For a detailed description of setting up for an interval measurement, see the section ”LOG and SSA Interval Settings” on page 7-36.

To measure a single interval, set Interval Autostop (Intv Auto Stop) to **On** as described in the section ”Intv Auto Stop - (LOG, SSA)” on page 7-38. To measure and store data over a series of equal time intervals, set Interval Autostop (Intv Auto Stop) to **Off.**

The interval time can be set from 00:00:01 hr:min:sec to 99:59:59 in steps of 1 second.

Timer Mode

The Clock/Timer Mode is used when it is desired that the measurement begin at a preset date and time. This can initiate either a single interval measurement or a sequence depending upon whether the Interval Auto Stop is set to On or Off, respectively.

Setup the measurement using the Clock/Timer Menu which is accessed by pressing the ⊘key, using the ⏶ or ⏷ keys to highlight **Clock/Timer** and pressing the ⊘key. For details on the use of this menu see the section ”Clock/Timer” on page 3-23.

Measuring using User-Selectable Thresholds

The System 824 can be setup to measure data associated with Exceedance Events, defined as instances where the sound pressure level exceeds a user-selected threshold. For a detailed description of setting up the System 824 to measure Exceedance Events, see the section ”Logging SLM Exceedance History Settings” on page 7-40.