800B

User Manual

Larson•Davis Inc. 1681 W 820 N Provo, UT 84601 January 31, 1994

Larson•Davis Incorporated
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Provo, Utah 84601
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During the first year warranty period, Larson•Davis will repair, or at its option, replace any defective component(s) without charge for parts or labor if the unit is returned, freight prepaid, to an authorized service center. The product will be returned freight prepaid.

During the second year warranty period, there will be no charge for replacement parts provided the product is returned to a Larson•Davis repair facility.

Product defects caused by misuse, accidents, or user modification are not covered by this warranty.

No other warranties are expressed or implied. Larson•Davis is not responsible for consequential damages.

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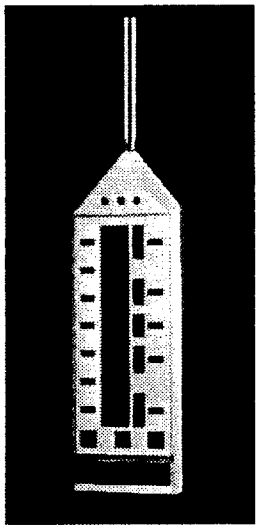
1 Model 800B Introduction

Congratulations on your recent purchase of the Model 800B sound level meter. Larson•Davis Laboratories has designed the 800B to provide you with many years of service in the measurement of acoustic and vibration parameters. Our applications engineers look forward to assist you with your measurement needs and invite your questions regarding 800B system operation or specific applications suggestions. We are dedicated to see that you have an excellent experience using Larson•Davis products.

Overview of System Features



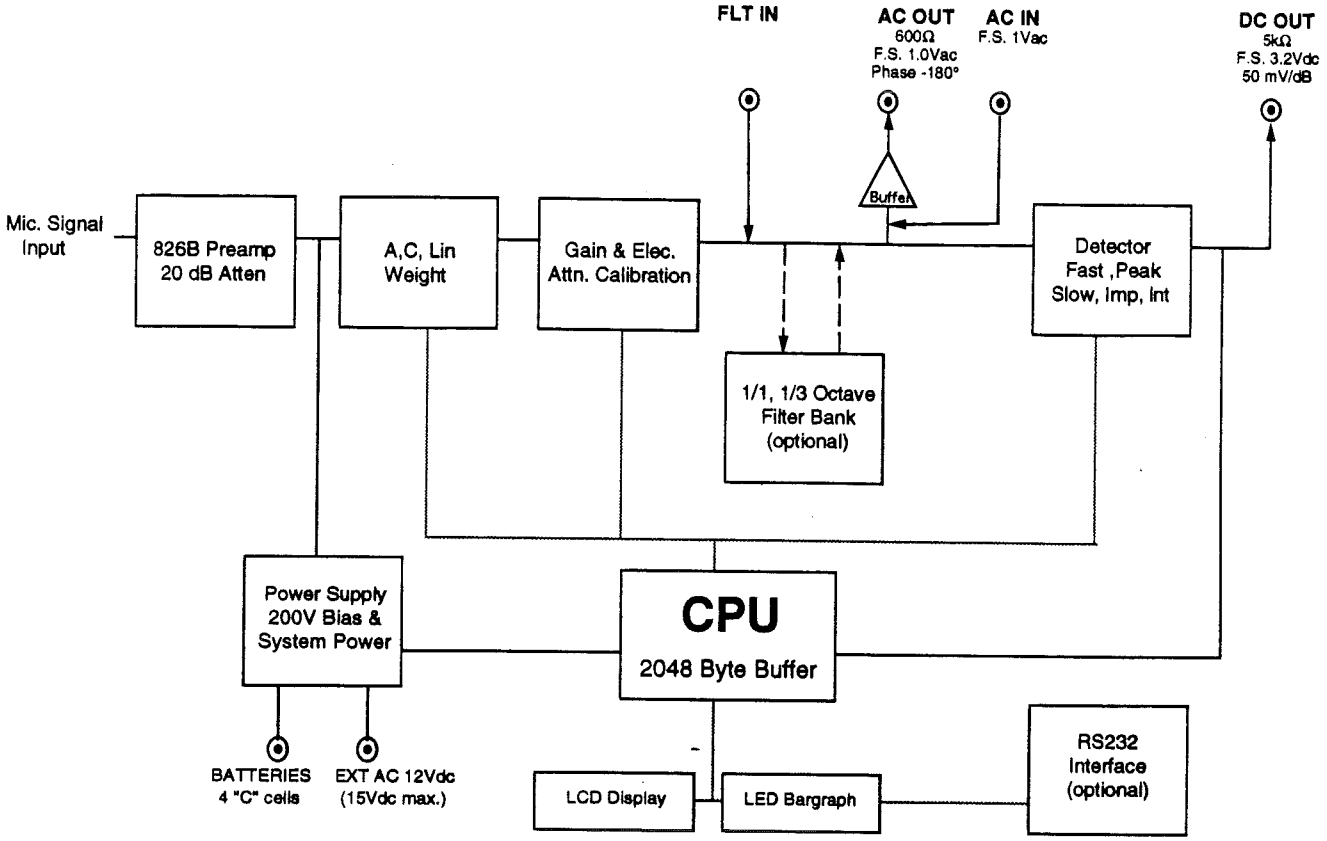
As a manually operated instrument, the Model 800B is as easy to use as an ordinary sound level meter. Front panel controls on the 800B are laid out in a very clean, readable pattern for ease in determining analyzer status at a glance. The large, linear 60 dB display on the 800B minimizes the frequent SPL range changes normally required on many competitive analyzers. For example, you can view from 30 to 90 dB SPL with a single range setting. Offering both RMS and PEAK detectors, the 800B provides FAST, SLOW, PEAK, IMPULSE (IMP) and INTEGRATE (INT) with three switch selectable exchange rates of 3-4-5 dB for the measurement of L_{EQ}, L_{DOD} and L_{OSHA}.

Extended functions such as RT60, Dose calculation and a variety of others allow architectural and industrial acoustics measurements to be made with ease.

With the OPT 30 internal filters, 1/1 and 1/3 octave measurements can be performed under manual or computer control.

As a computer controlled instrument, comparisons between the Model 800B and conventional SPL and LEQ meters end. The computer controlled 800B is even easier to use than a conventional sound level meter because the computer handles all of the system setup tasks automatically. The computer actually simplifies the human interface. An RS232 interface is required, as listed in the following section. Current software includes industrial acoustics and audiometric calibration applications. A complete list of RS232 commands may be found in Chapter 3.

800B Block Diagram



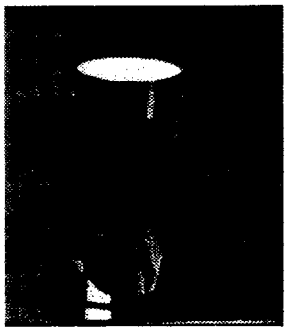
Included Accessories

You should have received the following items with your 800B analyzer:

800B Systems	Included Accessories
800B-10	• Model 2559 1/2" random incidence microphone • Model 826B preamp • WS-1 3 1/2" windscreen • 1/8" phone plug • Calibration tool • Hand strap • Four "C" size alkali battery cells • Operator's manual • AC to 9 Vdc adapter
800B-15	Same as the 800B-10 but with 1" pressure microphone (Model 2575) and Ad020 adapter
800B-20	Same as the 800B-10 but with 1/2" free-field microphone (Model 2540)
800B-25	Same as the 800B-10 but with 1/2" high sensitivity free-field microphone (Model 2541)

Please contact Larson•Davis if you require any information about 800B accessories.

Optional Accessories



AE100 Artificial Ear

The following are optional hardware and software items for your 800B analyzer:

800B Options	Description
AE100	Artificial ear for audiometric calibration. NBS 9A, 6 cc coupler and stand.
800B-OPT 30	Filter bank option with forty-four overlapping 1/1 octave filters and forty-four 1/3 octave band filters covering 1 Hz to 20 kHz. Internal factory installed option.
800B-OPT 50	RS-232 controller interface option. Internal factory installed option.

800B Options	Description
800B-SW7	Environmental/industrial measurement software for PC compatible computers. Automates spectrum scans, Leq time histories and intervals.
800B-SW8	Software for use with PC compatible computers. Performs tests required by ANSI for calibration of audiometers.

Basic 800B Operation

Battery Installation and Test

Before proceeding further with this manual, install the batteries. To install the batteries:

1. Remove the battery cover plate on the rear panel of the 800B, by loosening the two captive screws.
2. Install the four "C" batteries supplied by Larson•Davis, observing the marked polarities.
3. Replace the battery cover, hinging it on the small ridge along the curved edge.
4. Test the batteries by pressing the ON/OFF button down for 3-4 seconds. The LCD display should show an **L9** if the batteries are fresh. The number in the display will decrease as the batteries discharge after time. If the display shows anything approaching an **L-2**, batteries should be replaced.

The 800B will begin to warn the operator of a potential low battery condition when the batteries reach a level of 1/3 of remaining life, or when battery life is approximately 6 hours. Low battery range is indicated when the bar-graph LEDs blink on and off repetitively or the LCD reads **L-2** when it is powered on.

NOTE: Programming codes in Chapter 3 will allow a computer to sample battery condition when the 800B is being remote controlled.

Warm-up Requirements of the 800B

The 800B analyzer will require between 30 and 60 seconds warm-up time to achieve highest accuracy. Circuits in the 800B have been designed to provide accurate, stable readings in very humid and temperature variant climates, as specified in the back of this manual. However, as with all precision electronics, the Model 800B must be protected from sudden changes in environmental conditions. For instance, condensation may form on internal circuits when a cold 800B is brought indoors to a humid factory environment. Such condensation may take some time to evaporate. Therefore, please allow reasonable time for acclimatization to a new environment.

Microphone/Preamp Installation

To attach the microphone and preamp to the 800B:

1. Make sure the 800B is turned off before proceeding. All LEDS should be off and the LCD display blank.

2. Remove the microphone and desiccant from the microphone box and carefully screw the microphone onto the 826B preamplifier. **Do not** over-tighten or cross thread the microphone.

3. Plug the microphone/preamp assembly into the 5-pin jack located at the top of the 800B, observing to match the key slots in the sockets. Push the preamp assembly into the 800B plug until the sockets latch. If you are using an ECxxx extension cable, insert the 826B into the male end of the cable, then insert the female end in the 800B nose connector.

NOTE: The preamp unit is removed from the 800B by depressing the black button (latch release) located at the bottom of the preamp tube and pulling straight out. The 800B generates microphone and preamp bias voltages which may damage the electronics if the preamp is connected or disconnected with the 800B still ON. Do not use "electret" or prepolarized microphones with the 826B.

Calibration

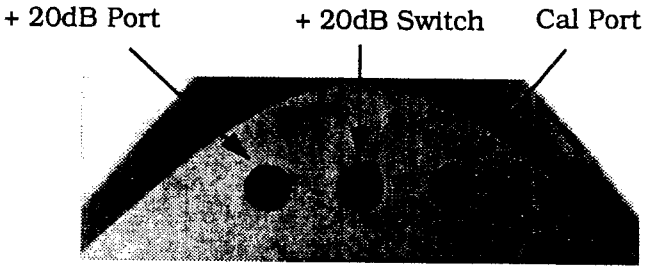
Every Model 800B has been calibrated with its microphone before leaving the factory. Provisions have been made, however, to check the calibration levels to satisfy the requirements of law and to guarantee long term system accuracy. To calibrate the 800B:

1. Turn on the 800B and allow a 60 second warm-up period before calibration.

2. Set the following front panel controls:

Range Control:	80–140 dB
Filter Weighting:	LIN
Display Model:	CONT
Bandpass Filters:	OFF
Detector Mode:	FAST

3. Locate the 3 access holes aligned in a horizontal row at the top of the 800B (see figure 1.1 below). They will be used from right to left.



4. Place the precision calibrator over the 800B microphone and turn it on. If you are using the Larson•Davis CA250 the tone will automatically turn off after about 60 seconds. If possible, release the calibrator and rest the instrument on a stable, isolated surface.Vibrations or shocks may affect the calibration level.

5. Insert the calibration tool (exposed blade) into Cal Port and adjust the trimmer until the LCD reading in dB matches the specified output of the calibrator. For CA250 Larson•Davis calibrators adjust to **114.0 dB** Lin.

NOTE: If your calibrator level is greater than 120dB change the filter weighting switch from **LIN** to **A-weight** and note the reading in the LCD window. An offset of 8.6 dB should be added to the displayed level if your calibrator frequency is 250 Hz.

6. Insert the tool in the +20 dB Switch and push gently to activate the 30 second attenuator timer. Place the tool in the +20 Cal Port and adjust the trimmer until the display reads exactly 20 dB above the level noted in step 5. For the L•D CA250, adjust to **134 dB** Lin. After 30 seconds the 800B will return to normal operating status.

NOTE: It is not recommended to calibrate the 800B when using a high sensitivity microphone and a calibrator that produces a level greater than 120 dB.

To assure the 800B has been properly calibrated, you may recheck the calibration, making sure the following levels are displayed when the CA250 is used:

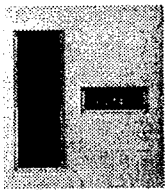
Linear	114.0 dB
C weight	114.0 dB

A weight 105.4 dB

Once the 800B has been calibrated to its Model 826B preamplifier, steps 5 or 6 of the calibration procedures described above will likely not require any significant readjustment. For optimum accuracy it is advisable to follow all steps of the calibration procedure for the 800B, even if adjustments are not necessary. Calibration should be checked before and after a measurement. Please refer to your precision calibrator manual for more information.

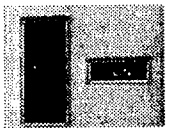
Front Panel Controls

Referring to the front panel of the Model 800B in Fig. 1 above, the controls consist of five slide switches, with selection designators highlighted through open windows on the front panel, and three labeled push button switches that are described individually below. Beginning with the slide switch at the top of the 800B front panel the control functions are briefly described below.



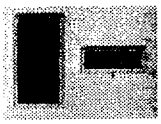
1. Amplitude Range Control

The 5-position AMPLITUDE RANGE CONTROL (1) allows for the selection of measured sound pressure levels from -10 dB to 140dB, with a generous overlap zone between each 60dB display range. Amplitude designators, spaced in 10 dB intervals, appear in the front panel window openings located on the left side of the display screen. OPT 60 offers ranges from +10 dB to 160 dB.



2. Filter Weight Control

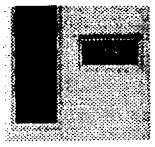
The FILTER WEIGHT CONTROL (2) allows for the selection of A- weight, C-weight, or Linear.



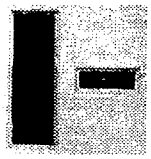
3. Display Mode Control

The DISPLAY MODE CONTROL (3) allows for either a continuously updated (CONT) display, or the display of the largest (HOLD) signal during the most recent sample interval. This "max hold" can be reset with the RESET/HOLD button (8).

4. Bandpass Filter Control



If the 800B is equipped with the 800B OPT 30 octave and 1/3 octave filter card, the BANDPASS FILTER CONTROL (4) allows the operator the choice of using octave band analysis (1/1), third-octave band analysis (1/3), or no bandpass filters in the signal path (OFF). When either octave or third-octave band analysis is selected, the FREQ STEP (7) push-button allows manual selection of any one of 44 available filter center frequencies. The selected filter center frequency is indicated on the display screen by a lighted LED located adjacent to the selected frequency on the 800B display screen.



5. Detector Mode Control

The DETECTOR MODE CONTROL (5) allows the selection of PEAK, INTEGRATE (INT), SLOW, FAST or IMPULSE (IMP). The dynamic range of the detector system is typically in excess of 70dB and has a crest factor up to 73dB with precision accuracies.

6. On/Off Button

Touching the ON/OFF (6) button once will turn the analyzer on. Touching the button a second time will turn the analyzer off. If when the 800B is turned "ON", the ON/OFF button is held down for 3-4 seconds, battery condition is displayed on the LCD and the dB scale of the 800B. Battery condition is OK if the LCD display shows between **L9** to **L-9**. Batteries should be replaced anytime below **L-2**. The 800B can be turned on and off remotely, and battery status can also be sampled remotely by a computer if an interface option is installed.

7. Frequency Step Button

The FREQUENCY STEP CONTROL (**FREQ STEP**) (7) is used in conjunction with the optional octave, third-octave filter bank to manually select the desired filter Center frequency.

8. Reset/Hold/Pause Button

The RESET_HOLD BUTTON (8) performs two unique functions: a) to freeze (pause) or HOLD current readings on the 800B, and b) to RESET the 800B for a new measurement interval. To freeze display readings, push the RESET HOLD button briefly. The 800B will turn on the HOLD LED on the display panel to indicate that it is in the hold, or freeze mode, and not taking data. Push the RESET HOLD button again briefly to continue to take data. For a completely new measurement sequence and to reset the 800B, hold the RESET HOLD button down until the display HOLD LED flashes, indicating a system reset. A new measurement sequence begins when the RESET HOLD button is released.

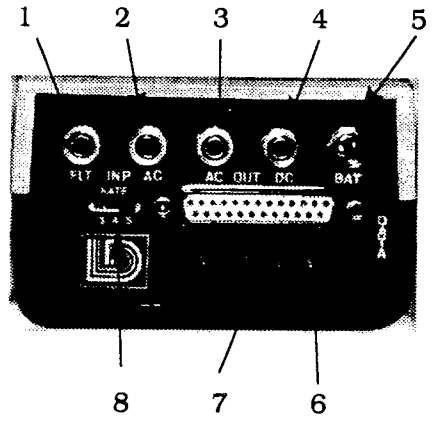
Reading the 800B Displays

High resolution digital information is provided on the 800B liquid crystal display (LCD). The 800B also has a linear bar-graph style display with a 60 dB range and 0.25 dB resolution. Bar- graph LEDs are spaced in 1.0 dB increments on the scale. One LED indicates a full dB step, while two steady-state LEDs indicate a 0.5 dB step between scale markers. A flashing LED located above or below a steady-state LED indicates a plus or minus 0.25 dB increment.

Several LEDs on the 800B display panel indicate system operating status. These are I/O, REMOTE, HOLD and OVERLOAD.

- The I/O LED indicates that the computer has initialized the interface and that the 800B is prepared to operate on computer command.
- When the REMOTE LED is active, the controller has taken over the 800B front panel switches and has locked out all manual operator commands.
- While in REMOTE, the physical positions of the slide switches on the 800B front panel do not necessarily indicate true instrument status. Conversely, when the REMOTE light is off, the 800 is in the local or manual operation mode with all front panel switch settings displaying true instrument status.
- The HOLD LED indicates that a measurement interval has ended and that the 800B is no longer receiving data. The HOLD indicator is off while the 800B is taking data.
- An OVERLOAD indicates that a large signal in excess of the dynamic range of the analyzer has momentarily caused a reading error.
- Pushing RESET clears the OVERLOAD indicator.

Bottom Panel Controls



The 800B is equipped with several signal and data connectors allowing a variety of interfaces with recording equipment, external filters, computers, and other devices. Referring to the numbered labels of Fig. 2 above:

1. Filter Input (FLT-INP)

This input directly accesses the input of the optional 1/1 and 1/3 octave bandpass filter set, bypassing the preamplifier, weighting networks and amplifier chain. The front panel filter switch must be set to 1/1 octave or 1/3 octave if signals are to pass to the AC-OUT and/or detectors. Maximum input is about 1.0 Vac for a full scale display.

2. AC Input (INP-AC)

This input directly accesses the 800B detector system bypassing all other signal conditioning circuits. Full scale input is approximately 1.0 Vac.

NOTE: When the AC input is accessed the input signal from the preamp is deactivated.

3. AC Output (AC-OUT)

This is a buffered 600 ohm output. The AC OUTPUT follows all signal conditioning circuits including the bandpass filters, but is ahead of the AC-INPUT. Additional signal conditioning can be inserted between the AC-OUT and the AC-IN. The AC output can be used to drive the inputs of external signal analyzers such as FFTs. Full scale output is approximately 1.0 Vac.

4. DC Output (OUT-DC)

This output provides a detected DC level. Its value is representative of the display with the exception of the INTEGRATE (INT) and PEAK modes; in which case the output is a sampled and held value of the final result of the last measurement period. This output is used to drive strip chart recorders. Full scale output is 3.2 Vdc.

5. External Battery Input (BAT)

This input bypasses the internal battery. DC voltages between 5 and 15 volts are acceptable. Excessive ripple will prevent proper operation of the instrument. The center conductor is positive. Use of an unregulated DC supply with low ripple is acceptable if the unloaded output voltage does not exceed 15 Vdc.Voltages in excess of 15Vdc may blow the 800B's internal fuse.

6. Parallel Accessory Port

Below is listed the pin configuration of the parallel port is listed below. Logic is positive with HIGH= +5V and LOW = 0V.

PIN	Function
1 to 8	RS-232 control lines
9	High 1.0 msec pulse on TRIGGER
10	Data bit 7
11	Data bit 5
12	Data bit 3
13	Data bit 1
14	GROUND
15	+5Vdc, 5OmA maximum
16	External Reset (manual mode) or Manual Service Request remote mode)
17	DC out (parallel with above)
18	Pulses LOW on RESET
19	HIGH at end of timed sample interval
20	No connection
21	HIGH Data Valid Pulse
22	Data bit 6
23	Data bit 4
24	Data bit 2
25	Data bit 0

7. HP-IL Connectors

These connectors are used for I/O operations for the Hewlett Packard Interface Loop (HP-IL) when option 800-40 is installed. This option is no longer available, since Hewlett-Packard discontinued the HP-IL.

8. Exchange Rate Selector

When the 800B detector mode is set to INTEGRATE (INT), the RATE switch setting determines the exchange, or doubling rate at which data are integrated and accumulated.

Rate	Integrated Level
3	LEQ
4	LDOD
5	LOSHA

Measuring LEQ, LDOD and LOSHA

A very powerful integration processor has been designed into the 800B for the measurement of L_{EQ}, L_{DOD}, and L_{OSHA}, for intervals up to 1999 hours. The built-in PAUSE (HOLD) feature allows for the temporary interrupt of data gathering during measurements. All integration features work with any combination of filter weight, including the 1/1 octave or 1/3 octave bandpass filters.

Manual operation of the integrator function of the 800B is very simple. Because the integrator operates in real-time, you do not have to wait until the end of a measurement interval to obtain the data. During the first one second interval of a new integration measurement, the 800B will take 256 data samples to assure a high level of accuracy even for very short integration periods of a fraction of a second in duration. After the first one second interval the sampling rate continues at 32 samples per second. The 800B will continuously display the current accumulated integrated value on both displays regardless of the elapsed time.

For measuring L_{EQ}, L_{DOD}, or L_{OSHA}, you must set the following parameters on the 800B:

Exchange rate	As required
Range Control	As required
Filter weight	Desired weight (A, C, or Linear)
Display mode	Cont.
Bandpass filter	Off
Detector mode	INT

After selecting the desired exchange rate (3 dB = L_{EQ}, 4 dB = L_{DOD}, 5 dB = L_{OSHA}), filter weight and range, the integrator will begin processing at the instant you select the integrate (INT) detector mode. A new integration sequence begins by holding down the RESET button until the HOLD LED on the display screen begins to flash. At the instant the RESET button is released, the 800B accumulator memories are cleared and a new integration period begins.

An integration PAUSE (HOLD) is initiated with a brief push of the HOLD button. Measurements will continue by again briefly pushing the HOLD button. During an integration PAUSE, the HOLD LED on the display will be on. When the HOLD LED on the display is turned on, the 800B is not analyzing new data.

While in the integrator mode, the function of the DISPLAY MODE SWITCH for CONT and HOLD has a slightly different purpose than with the other 800B measurement modes. A selection of CONT will provide a continuous integration period up to 1999 hours, interrupted only by operator commands.

If HOLD is selected, an integration is put into an automatic PAUSE (HOLD) mode after a 60 second period. Briefly pushing the PAUSE (HOLD) button again will append a new 60 second reading to the first. You may append as many 60 second intervals as desired. A complete RESET (memory clear) in the 60 second mode is performed by holding the RESET button down until the HOLD LED on the display screen flashes. A new 60 second integration period begins at the instant the RESET button is released.

Measuring L_{min}, L_{max}, L_{pk}, SEL and Elapsed Time

During a pause of the 800B, when the hold LED is on, the 800B displays a scrolling set of special information about the measurement as it has occurred to that point. For any desired integrated measurement interval, the 800B will display the integrated level (L_{EQ}, L_{DOD} or L_{OSHA}) plus L_{MIN}, L_{MAX}, L_{PEAK}, SEL and the elapsed time. For other detector measurements such as FAST, SLOW, PEAK or IMPULSE (IMP), the 800B will display the instantaneous level plus L_{MIN} and L_{MAX}.

The alphanumeric LCD on the 800B provides a rotating sequence of several different measured parameters for each measurement interval. To simplify the readout procedure, each measured parameter is announced with alpha characters followed by its numeric value. The abbreviation is displayed for one second followed by the numeric value for two seconds.

To obtain a readout for any of the above measurements, first put the 800B in pause (HOLD) mode. To select the HOLD mode:

1. Press the Reset/Hold button. The "HOLD" LED will go on.
2. Press The Reset/Hold button again to deselect the "Hold" mode.

When the 800B is put into pause (HOLD) mode during a measurement or at the conclusion of a measurement period, the following display sequence occurs.

1. "LE" refers to the SPL level measured during the test sequence. The measured level is a function of the detector selected. For example, if the 800B integrator (INT) is selected, the measured level will be the integrated level. If the selected detector is FAST, SLOW or IMPULSE (IMP)then the measured level (LE) is the instantaneous SPL level measured at the moment the 800B was placed in measurement pause (HOLD) mode. When the PEAK detector is selected, the measured level is the maximum true peak SPL value during the measurement interval. The numeric value of the SPL is displayed for two seconds.

2. "LO" or L_{MIN} refers to the lowest or smallest measured rms signal during the test interval. It is displayed for two seconds.

3. "HI" or L_{MAX} is the highest or largest rms signal measured during the test interval. It is displayed for two seconds.

   The above parameters are displayed in sequence for 800B detector selections of FAST, SLOW, PEAK or IMPULSE (IMP). Additional parameters, measured while the 800B is in the integration mode, are described below.

4. "P" or L_{PK} is the highest true peak signal detected during the measurement interval. A two second display of the numeric L_{PK} follows.

5. "SEL" is the single event level defined below:

   SEL = (L_{EQ}, L_{DOD}, or L_{OSHA}) + 10 Log (T) where T is the measurement duration in seconds

   The numeric value of SEL is displayed for two seconds, immediately followed by the elapsed time for the measurement. For integrated values less than one second elapsed time, SEL is not defined and will not be displayed by the 800B.

800B measurements can be stopped and started any number of times. The rotating display of the integrated value, elapsed time and SEL represent the accumulated *measurement* time only. The sequence of parameters is displayed only when the 800B is in pause mode.

Reading the Elapsed Time

The 800B contains a precision quartz timer for elapsed time applications. During an ongoing integration, the elapsed time is indicated automatically on the LCD at one minute intervals and is flashed alternately with the current reading five times.

Depending on the elapsed time, the LCD will display time with all available resolution ranging from thousandth of a second to 1999 hours. In the following display table S = seconds, M = minutes and H = hours. Note the use of decimals, colons and arrows to differentiate between readings of seconds, minutes or hours.

Format	Example
:S.SSS	:1.999
:SS.SS	:19.99
:MM:SS	:19.59
HH:MM	22:15
HHH.H	199.9
HHHH	L 1999

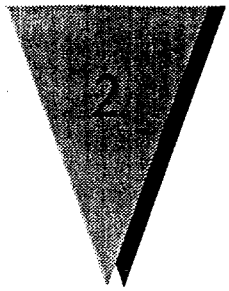
Parallel RMS Integration and Peak Detection

The 800B design incorporates parallel integration mode (rms) and peak mode detectors. These can be read alternately without data interrupt, during or at the conclusion of an integration sequence. Use the Detector mode switch to select between INT and PEAK. Alternating this switch between these two positions will give the current integrated SPL and the maximum PEAK value for the same time interval. During an integration **do not** switch detector modes to FAST, SLOW or IMPULSE (IMP) or an automatic system reset will occur. During integration, the 800B will automatically RESET to start a new integration if the range, filter-weight or frequency of a bandpass filter is changed.

Using ECXXX Extension Cable

Once the microphone has been calibrated to the 800B, the microphone and preamplifier can be remoted from the analyzer on cables up to 150 feet in length without recalibration. Other sound level meters may require recalibration for even short length of cables. High humidity will not cause changes in cable performance.

LARSON•DAVIS provides a complete series of microphone extension cables (part number ECXXX where XXX is a customer specified number of feet of cable length). Microphone and instrument tripods are also available.



Extended Functions

General Information

Sixteen additional measurement functions for the 800B are now standard.

Information on the manual use of these functions is given below, while computer control is covered in the programming section of this manual. The sixteen extended functions are listed in a menu at the top of the 800B display screen. The currently selected menu item is noted with a lit LED to the left of the menu item. This menu select LED is in addition to the normal bar graph LED which displays SPL on the same scale.

Selecting Extended Functions

Selecting extended functions on the 800B requires a special use of the RESET button and the ON/OFF button. To activate the extended functions menu:

1. While holding down the Reset/Hold button, repetitively push the ON/OFF button. As the ON/OFF button is repeatedly pushed, the menu marker LED will step from top to bottom within the extended functions menu.

2. After selecting the desired measurement function, remove fingers from the ON/OFF button first and from the RESET button last.

Exiting From Extended Functions Menu

To exit from the extended functions menu with the 800B analyzer powered on:

1. Push RESET first and while holding the button down push ON/OFF until the HOLD LED, located near the top of the 800B display screen begins to flash rapidly.

2. Release the ON/OFF button first, followed by release of the RESET button. The 800B will now operate in the normal sound level meter mode.

The easiest way to exit the extended functions menu is to turn the 800B off and then on again. During power-up the 800B initializes in the normal sound level meter mode. The drawback of this method is that you must wait for 30-60 seconds for the high-impedance microphone circuit to charge and stabilize for accurate readings.

High-Pass Filter

The high-pass filter option has been provided to help reject low frequency noise from the front end circuitry of the 800B that could otherwise cause an overload condition during the measurement of low-level high frequency signals. When the high-pass filter mode is selected the LCD will display 'HPO' indicating the High Pass filter is OUT (not in use). Pushing RESET once will toggle the LCD to 'HPI' indicating the High Pass filter is in (in use).

When the high pass filter has been selected (HPI), 800B frequency response is determined by the position of the filter weight switch: A, C or LIN. With the switch set to A-weight, the high-pass filter has the exact low frequency response of the A-weight filter but has a flat response from 1 KHz to beyond 30kHz. With a C-weight filter setting, the low frequency response of the 800B takes the exact shape of the C-weight filter below 100 Hz, but has a flat response from 100 kHz to beyond 30kHz. No high-pass filtering occurs when LIN is selected.

When the high-pass filter is operating (HPI), the LED adjacent to HIGH-PASS in the extended functions will remain on until the filter is turned off (HPO), as described above. Other extended functions, or regular 800B functions can be used with the high-pass filter on, but be aware of the modified low frequency response.

Frequency Counter

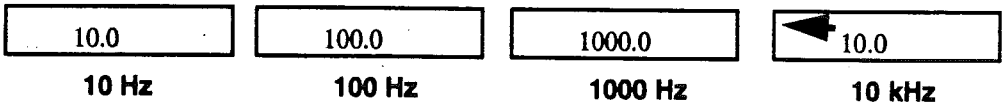
The 800B contains a frequency counter capable of accurate measurements from a few Hertz to beyond 40kHz. Conventional counters have limited input signal range whereas the 800B will analyze frequencies from close to the microphone noise floor (below 0 dB for a 1-inch microphone using 1/3 octave bands) up to 140dB levels; a very significant input range. Most conventional counters are also broadband measuring instruments that are very susceptible to inaccuracy due to interference caused by spurious signals (harmonics, etc.) within the same passband. The 800B can be equipped with a significant array of built-in filters to select and isolate a particular frequency band, while rejecting spurious signal components. In other words, the 800B is a frequency selective frequency counter.

To operate the frequency counter, set the 800B as follows:

Extended Function:	**FREQUENCY**
Range Control:	Select a range that will provide a signal level visible about mid-screen on the LED-bargraph display.
Filter Weight:	Initially select "LIN". If the frequency count appears unstable, try the A-weight or C-weight filters to attempt to stabilize the reading. The frequency of the input signal is displayed in the LCD window.
Display Mode:	Any mode.
Bandpass Filter:	Initially select "Off". Use the 1/3 octave bandpass filters at the desired frequency for optimum results if signal instabilities exist.
Detector Mode:	Any mode.

Fourteen (14) frequencies above 250Hz will update the LCD reading at one second intervals while signals below 250Hz will require several second averaging times for a reading. For rapid low frequency measurements, use the PERIOD function described below.

Signals above 1999Hz are displayed with units of kHz as noted by a left pointing arrow in the LCD window. Signals below this frequency are displayed in Hz.



Period Measurements

Period is defined as the inverse of frequency, or 1/f. Period measurements are performed in the same manner as frequency measurements except that period measurements are given in units of seconds whereas frequency is read in units of Hertz.

As is true with conventional frequency counters, the 800B requires a longer sampling period to accurately measure low frequencies. Above 250Hz, signals are counted in about one second by the 800B, but below 250Hz several seconds may be required. This is why the 800B and many frequency counters contain a period measuring mode. The period of a signal can be measured rapidly and accurately at low frequencies using the 800B. By inverting the period reading, the signal frequency is obtained. Move the menu marker LED to PERIOD using the RESET and ON/OFF buttons.

The only control required to measure the period of a signal is RANGE, which must be adjusted to provide a steady signal level on the 800B display. Complementary filters in the 800B can be used to eliminate spurious and unwanted signals from the measurement.

Linearity

The linearity mode of the 800B has been provided for the measurement of signals relative to any reference signal in the range of -10 to 150 dB. Any 800B signal can be set to a reference of 0.0 dB with all subsequent measurements being made relative to it in plus or minus dB. The signal processor tracks the reference signal through range changes and will provide measurements relative to the reference, up to ±150 dB.

Applications include the measurement of frequency response, harmonic distortion and the linearity of instruments such as audiometers, artificial mastoids and other audio frequency devices. The excellent accuracy of the 800B makes it an ideal tool for the measurement and certification of audio systems.

Two 800B controls are required in the operation of linearity mode. These are RANGE and DETECTOR. The range control is set to provide a stable signal in the 800B display. If necessary, signal stability can be improved using the built-in filters. Either a FAST or SLOW detector must be used for linearity measurements.

1. Select a range to display a stable signal.

2. Select either fast or slow detector. If another detector setting is used, the LCD will read 'E6' (error #6) which indicates that an inappropriate detector has been selected.

3. Select the "LINEARITY" extended function. A "PSE" (pause) will appear in the LCD.

4. Push the RESET button once to set the current reference signal level to 0.0dB.

   If the LCD reading changes with time, this may indicate that the reference signal is unstable, or that unwanted signals are in band. If so, isolate the reference signal with a 1/3 octave bandpass filter to test for spurious signals. Any measurements taken relative to the reference signal are only as accurate as the reference signal is stable.

5. To set a new reference signal level push RESET once to display 'PSE' and then push RESET again to establish the new reference level.

Harmonic distortion is easily measured in 1/3 octave bands by setting the reference to the fundamental tone being measured and then selecting each frequency harmonic separately to observe how many dB down it is from the fundamental. Percent distortion is automatically calculated using the TOTAL HARMONIC DISTORTION function described below.

It is usually difficult to find low noise environments in which to certify audiometer attenuator accuracy to 0 dB even when 1/3 octave filters are used. To overcome this particular problem, attenuator linearity is measured electrically instead of acoustically by replacing the microphone on the 800B preamplifier with adapter AD010. This adapter will allow the direct connection of a male BNC connector clip (Pomona 3789 or LD AD030) to the 800B preamp for direct connection to the earphone leads. Attenuator linearity is then tested as described above. Faulty earphones can also be isolated by comparing the electrical input to the acoustic output of the earphone.

Total Harmonic Distortion (THD)

The THD function is used to measure harmonic distortion as the dB difference between the fundamental and each separate harmonic. The THD measurement mode will sum the effects of each harmonic measured and provide the final answer in percent distortion.

The 800B should be set up as follows to perform a THD measurement:

Extended Function:	**THD**
Range Control:	Set the Range control for a signal level that is high on the display screen, but not so high as to put the 800B into an overload condition.
Filter Weight:	LIN
Display Mode:	CONT
Bandpass Filter:	1/3 octave
Detector Mode:	FAST

If you are not certain which 1/3 octave band filter to use to select the fundamental, the signal can first be counted to accurately determine the frequency.

1. Select the extended function THD. A "1" will appear in the LCD.

2. Press the RESET button once. This will enter the fundamental frequency and a "2" will be displayed.

3. Press the FREQ STEP button to change the 1/3 octave filter frequency to the second harmonic of the fundamental.

   If necessary, change the Range control down one level to bring the input level higher on the LED display. **This must only be done once during a THD measurement.**

4. Press the RESET button once. This will enter the second harmonic frequency and the percent distortion is displayed.

5. Press the RESET button once to display a "3" in the LCD window.

6. Press the FREQ STEP button to change the 1/3 octave filter frequency to the third harmonic of the fundamental, **but only if the range has not yet been increased once already**.

   The signal level of some harmonics may be so low that they will not affect the THD answer.

7. Push RESET to enter the third harmonic and display the percent distortion for both the second and third harmonics. For most audiometer certifications, it is unnecessary to measure THD beyond the third harmonic.

NOTE: One simple rule, if followed, will make THD measurements an easy task. Do not attempt to change a frequency band setting or range unless a harmonic number (an integer 1 through 9) is in the LCD window. If you are displaying a percent distortion reading, push RESET once to advance the harmonic counter before changing the 1/3 octave frequency to that of the next harmonic.

Pulse Measurements

The pulse measuring modes of the 800B have been designed for audiometer calibration applications and not for general electronic circuitry analysis.

The extended function set is used for the following measurements: **Pulse Overshoot, Pulse Period, Pulse width, Rise Time, Fall Time,** and **SISI**. 800B switch settings are the same for all pulse measurements.

Extended Function: THD

Range Control:	Adjust the Range control for an input signal level about mid-screen or higher. The range control setting of the 800B should be selected so that both signal levels for the audiometer for pulse on or pulse off are visible on the bargraph display of the 800B.
Filter Weight:	LIN
Display Mode:	CONT
Bandpass Filter:	1/1 or 1/3 octave with the desired center frequency.
Detector Mode:	The detectors can be set to any position for these tests.

The signal level difference between pulse on and pulse off is called the on/off ratio of the pulse. If a distinct level shift is not visible on the 800B display when the audiometer pulse circuits are active, it may indicate a faulty pulse circuit in the audiometer.

Pulse Overshoot

1. Select the OVERSHOOT extended function by holding the RESET button down and press the on/off key repeatedly until the LED in the extended function display stops next to OVERSHOOT. A "PSE" will appear in the LCD display.

   The audiometer should be in Pulse Mod.

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of dB of overshoot.

   The final answer will be displayed in units of dB of overshoot. For example, 0.0.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a "0" will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer calibration standards allow for a reasonably broad range of pulse variation.

Pulse Period Measurements

Use the standard pulse measurement switch settings.

1. Select the extended function "PULSE PER" by holding the RESET button down and press the on/off key repeatedly until the LED in the Extended Function Display stops next to PULSE PER. A "PSE" will appear in the LCD display.

   The audiometer should be in "Pulse Mode".

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of seconds for the pulse period.

The final answer will be displayed in units of seconds for the pulse period. For example: .420.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a "0" will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer calibration standards allow for a reasonably broad range of pulse variation.

Pulse Width Measurements

To perform a pulse width measurement set up the 800B as for all pulse measurements.

1. Select the extended function "PULSE WIDTH" by holding the RESET button down and press the on/off key repeatedly until the LED in the Extended Function Display stops next to PULSE WIDTH. A "PSE" will appear in the LCD display.

   The audiometer should be in "Pulse Mode".

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of seconds for the pulse width.

   The final answer will be displayed in units of seconds for the pulse width. For example, .191.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a "0" will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer calibration standards allow for a reasonably broad range of pulse variation.

Rise Time Measurements

To perform a rise time measurement set up the 800B as for all pulse measurements

1. Select the extended function RISE TIME by holding the RESET button down and press the on/off key repeatedly until the LED in the Extended Function Display stops next to RISE TIME. A "PSE" will appear in the LCD display.

   The audiometer should be in "Pulse Mode".

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of seconds of rise time.

   The final answer will be displayed in units of seconds of rise time. For example: .068.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a "0" will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer

calibration standards allow for a reasonably broad range of pulse variation.

Fall Time Measurements

To perform a fall time measurement set up the 800B as for all pulse measurements.

1. Select the extended function FALL TIME by holding the RESET button down and press the on/off key repeatedly until the LED in the Extended Function Display stops next to FALL TIME. A "PSE" will appear in the LCD display.

   The audiometer should be in "Pulse Mode".

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of seconds of rise time.

   The final answer will be displayed in units of seconds of rise time. For example: .036.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a "0" will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer calibration standards allow for a reasonably broad range of pulse variation.

SISI Measurements

To perform a SISI measurement set up the 800B as for all pulse measurements.

1. Select the extended function SISI by holding the RESET button down and press the on/off key repeatedly until the LED in the Extended Function Display stops next to SISI. A 'PSE' will appear in the LCD display.

   The audiometer should be in "Pulse Mode".

2. To trigger the measurement sequence from the 'PSE' (pause mode) push RESET once. Several pulse samples will be analyzed automatically by the 800B and a final answer will be displayed in units of dB of SISI.

   The final answer will be displayed in units of dB of SISI. For example: 57.3.

To manually trigger analysis of audiometer pulses using the 800B:

1. With 'PSE' displayed in the LCD, push RESET once; a '0' will now appear indicating that no pulses have yet been analyzed.

2. Manually trigger the audiometer until an answer appears in the LCD window. Normally 3–4 manual pulse samples are required to get an answer.

As seen on the 800B dynamic display, the pulse on/off signal levels should be consistently repeatable if the pulse circuitry of the audiometer is stable and working properly.

After a pulse test has been performed, the test can be repeated by pushing RESET. Due to quality differences in the design of audiometers, some laboratory grade audiometers have very repeatable pulse functions whereas some low-grade portables offer poor repeatability. However, the audiometer calibration standards allow for a reasonably broad range of pulse variation.

Delay Time Measurements

The delay time function of the 800B is designed to measure the acoustic delay time of signals as they travel from a signal source, such as a speaker cluster, to the 800B microphone. In public broadcast systems speech intelligibility, or articulation loss, is a function of the room reverberation time and potentially a function of the room delay time at the position of the listener.

Applications of this measurement include the installation and calibration of digital delay systems to help eliminate the

echo effects of transmitted sound in large rooms and auditoriums.

Reverberation Time - RT60

After 800B warm-up (30-60 seconds), select the RT60 menu item of the 800B by positioning the menu-marker LED to the left of the RT60 menu item.

The letters 'PSE' (pause) will appear in the LCD window to allow time for the user to set the 800B controls to the desired bandwidth and frequency center for the RT60 measurement. Set the switches on the 800B front panel to the following positions:

Extended Function: RT60

Range Control:	Set for input signal level
Filter Weight:	Set to linear (LIN)
Display Mode:	Any switch setting
Bandpass Filter:	Set to your choice of 1/1 octave or 1/3 octave bandwidth and select the lowest frequency of measurement first, using the [FREQ STEP] button.
Detector Mode:	Any switch setting. For RT60 measurements, the 800B uses a special high-speed detector capable of accurate RT60 measurements down to a few milliseconds. When the detector is measuring random noise, the display will have a streaked appearance indicating the maximum to minimum level of the noise.
Range:	The amplitude range must be set to satisfy the following simple criteria.

a. Select a range for which the SPL of the energized room at the frequency of interest is in the uppermost 10 dB of the 800B display window, or higher. In other words, it is acceptable to overload the 800B, but the room signal must have enough energy at the frequency of interest to reach into the top 10 dB of the selected range.

b. Whether the signal used to energize the room is constant, or impulsive (pistol shot, air horn, etc.) the signal must remain in the upper 10 dB window for at least 30 milliseconds to properly initialize the trigger circuits of the 800B.

c. The maximum noise floor of the room in which the RT60 is being measured must fall in the bottom 30dB of the display scale on the 800B at the selected frequency of interest.

For example, if the 30-90dB range is selected, the room background noise is required to be less than 60dB and the signal

source would need to deliver an output level greater than 80dB in the frequency of interest.

RT60 Data Gathering

Having selected a suitable measuring range, bandwidth and frequency you are ready to accumulate up to 128 samples per selected frequency.

To gather data:

1. Make sure the 800B is in RT60 mode. Press and hold down the RESET button and then press the ON/OFF button repeatedly until the LED in the EXTENDED FUNCTIONS display is next to the RT60.
2. With 'PSE' displayed in the LCD window, push RESET. A '0' will be displayed in the LCD, indicating that zero samples have been taken at the selected frequency.
3. Energize the room with noise and then shut the noise source off abruptly.
4. If all range criteria have been met for an RT60 measurement, the LCD on the 800B will indicate the measured value of RT60 in units of seconds. For example: .073.

The room can be repeatedly energized at the same frequency up to 128 times, and the 800B will automatically accumulate each new sample and average it with all prior samples, to give a single multi-sample result. Each time the room is properly energized the 800B LCD will automatically indicate an integer number representing the number of samples already taken at the set frequency.

Data buffers are reset to zero in preparation for a new RT60 measurement if the RESET button is pushed. The LCD will reset to '0' samples. A system reset automatically occurs if the 800B range is changed, or a new center frequency is selected.

SPL Measurements

The SPL mode of extended functions is provided as a user convenience to eliminate the need to exit extended functions in order for the 800B to operate as a normal sound level meter.

There is one basic difference, however, between SPL as an extended function and the operations of the 800B as a basic sound level meter. Programmable instruments using RS-232 use an 8-bit data protocol which limits data resolution of the 800B to ±0.25dB. In SPL extended functions, the 800B will send special "converted" data with resolution of ±0.1 dB over

the normal 8-bit data bus to the computer. Procedures for handling the special high resolution data are given in the programming instructions of the 800B manual.

DOSE Measurements

The DOSE measuring routine of the 800B analyzer is programmed for a 90dB criterion and an 80dB cutoff threshold. Selectable exchange rates of 3, 4, and 5dB are available. Dose measurements in conformance with OSHA standards require use of the 5dB exchange rate. Model 800B switch settings for dose measurements are:

Extended Function:	**DOSE**
Range Control:	80-140dB
Filter Weight:	A-Weight
Display Mode:	CONT
Bandpass Filter:	Off
Detector:	Integrate (INT)

Dose measurement assume an eight-hour interval test sequence with answers displayed in percent of the maximum noise exposure allowed. 100% dose represents a time weighted average of 90dB for the 8 hour measurement period. During an eight-hour dose measurement the 800B will report elapsed time every 60 seconds by alternating the LCD window reading between dose (in percent) and elapsed time. If DOSE is measured for a period of less than 8 hours, the 800B will display a partial dose. It may be possible to extrapolate a "projected dose" from the elapsed time, as discussed in the following sections.

Reading the Elapsed Time

The 800B contains a precision quartz timer for elapsed time applications. During an ongoing integration, the elapsed time is indicated automatically on the LCD at one minute intervals and is flashed alternately with the current reading five times. A PAUSE (HOLD) will also trigger an alternating LCD showing level and elapsed time.

Depending on the elapsed time, the LCD will display time with all available resolution ranging from thousandth of a second to 1999 hours. In the following display table S = seconds, M = minutes and H = hours. Note the use of decimals, colons and arrows to differentiate between readings of seconds, minutes or hours.

Format	Example
:S.SSS	:1.999
:SS.SS	:19.99
:MM.SS	:19.59

Format	Example
HH:MM	22.15
HHH H	199.9
HHHH	1999

The 800B can be placed in pause (hold) mode during a test, as many times as desired, by briefly pushing the RESET/HOLD button. A light LED adjacent to the word HOLD, (located at the top of the 800B) indicates that the instrument is on hold and that no data is being taken. The elapsed time clock also stops while the measurement is on hold.

A new measurement sequence can be started and prior dose data erased by holding down the RESET/HOLD button until the HOLD LED flashes rapidly. The new measurement begins at the instant the RESET/HOLD button is released.

Current sound pressure levels are indicated on the LED bargraph scale of the 800B. If environmental sound levels do not exceed the preset threshold of 80dBA, the dose reading will remain at 0.0% during the measurement period.

Projected Dose Measurements

Projected dose is a mathematical means of estimating an eight-hour dose over a shorter measurement interval. In environments where sound pressure levels remain fairly constant over a normal eight-hour period, projected dose may be used to provide an accurate estimate of the equivalent noise exposure for a much shorter measurement interval. Deviations in answers between a short interval projected dose and full eight-hour dose result from the fact that the shortened interval measurement did not fairly represent sound pressure levels of the full period.

To calculate projected dose, measure a representative partial dose as described in the previous sections. Once the measurement has been paused, read the partial dose and elapsed time from the sequential LCD displays. Note how the minimum, maximum, peak and SEL are also displayed.The projected dose is simply

$$\text{Proj. Dose} = \frac{\text{Displayed Partial Dose} \times 8\,\text{Hours}}{\text{Displayed Elapsed Time}}$$

3 RS-232 Programming Instructions

Communicating Via RS-232 With The Model 800B

The RS-232 interface option for the model 800B permits simple interfacing and programming between the 800B and a host computer. All of the remote control functions previously possible with the HP-IL interface have been retained. In addition to these functions there is a versatile serial protocol, a 2048 byte buffer, and an alphanumeric command set.

Interface Connections

The model 800B with interval RS-232 interface option (OPT-50) is connected to the host computer (or controller) with four wires. The length of this cable can be up to one hundred feet. The typical connections to be made are shown in the table below. These connections are made to the D-25 connector on the base of the 800B. Do not make any connections to any other pins than those shown since they may be used for other purposes. The CTS line enables the 800B to send data to the controller. If this enable signal is not provided by the controller, pin 5 should be connected to a +5 volt to +12 volt level.

A factory supplied cable (800-C02) provides the following typical RS-232 connections:

Model 800B		Host Computer	
Pin	Signal	Pin	Signal
1	Signal Ground	7	Signal Ground
2	TXD (transmit data)	3	RXD (received data)
3	RXD	2	TXD
5	CTS (clear to send)	20	DRT (data term rdy)

Serial Protocols

Data and commands can be received and sent to the model 800B in two ways. The first is the Alpha mode where data is returned as an ASCII string of decimal numerals. Commands are sent as one ASCII character followed by various operand characters. The second is the Binary mode where data and commands are received and sent in single binary bytes, just as they were with HP-IL.

Buffer Memory

The RS-232 interface option allows, close to 2000 data samples to be taken and stored before any interaction is required. The 800B will take a maximum of 30 samples with one buffer. All TRIGGER commands received are accumulated and sent to the analyzer as needed. The TRIGGER command contains an optional number that indicates the number of TRIGGERs to perform. The number of samples programmed into the 800B then sets the size of one data block and the number of TRIGGERs programmed sets how many blocks to take, record, and send.

Although the data block format is different for the Alpha and Binary modes, both are terminated by a carriage return/line feed (<CR><LF>) sequence. In the Alpha mode, one data sample is represented by five characters: three digits, a decimal point and then one digit. The number of data samples returned before the block is terminated is selected by the Samples command. When more than one data sample is sent, they are separated by commas. For example if 6 samples were selected, the following may be returned: 102.3,104.8,105.5,105.0,103.8,103.0<CR><LF>

The SPL data are in absolute dB. This is possible because the interface remembers the range that was last programmed and automatically adds it to the data taken when it is transmitted. In the Binary Data Mode only one character is sent for each data sample taken. This data byte is relative to the present range and must be converted in the host software.

Alpha Commands for the 800B

The Alpha command format consists of a single letter command, one or more operand characters (if required) and a delimiter (space, comma or <CR>). Operands can be numeric (n) or a character (c). If n or c is enclosed in angle brackets (i.e. <n>) it is optional. The value for n is assumed equal to zero if not provided.

Bandwidth B<n>

The bandwidth (BW) of the internal filter can be set with the B command. The bandwidth choices are:

B or B0	– Turn off filter set
B1	– Turn on filter to 1/1 octave BW
B3	– Turn on filter to 1/3 octave BW

Display Mode B<n>

Either Continuous or Hold modes can be selected with the C command. Hold retains the highest value detected.

C or C0	– Hold mode
C1	– Continuous mode

Detector Dn - n = 1 to 8

The D command selects the desired detector. The detectors available are:

D1	– Integrate
D2	– Slow RMS
D3	– Fast RMS
D4	– Impulse
D5	– Peak
D8	– Battery test

Exchange Rate E<n>

The E command allows the selection of 2 exchange rates. The first is the one selected by the rate switch on the bottom plate of the 800B. The second is Leq.

E or E0	– Switch selection
E1	– Leq

Filter F<n> n = 0 to 43

The filter select command, when used with the bandwidth command, can activate one of the 44 narrow-band filters in the 800B. The value for n is the standard ISO frequency band number. This value can be obtained with the formula: n=INT(.S+10*LOG(F_c)) where F_c is the center frequency. Two examples are:

F0	– 1.00 Hz filter selected
F38	– 6.30 KHz filter selected

Get G<n> n = 0 to 255

The Group Execute Trigger command initiates the taking of data within the 800B. Commands can be received by the instrument but no data is taken until a G command is received. Multiple GET commands may be stacked up and are sent to the analyzer as each is completed. The data returned is stored in the memory buffer until the controller requests it to be sent. If a new GET command is received before all previous ones have been executed it is added to those that remain up to a total of 255. The GET command

count can be cleared by sending a RESET HOLD command (X3).

G, G0 or G1	– Take one group of samples
Gn	– Take n groups of samples
G255	– Take 255 (maximum possible)

Interval I<n> 0 to 64 and /2 to /16

The Interval between samples can be programmed with the I command. This period can be from 1/16th of a second to infinity. The following shows all possibilities available:

I or I0	– Infinite(terminated by reset X3, data read by a GET)
I60	– 60 seconds
I30	– 30 seconds
I20	– 20 seconds
I10	– 10 seconds
I64	– 64 seconds
I32	– 32 seconds
I16	– 16 seconds
I8	– 8 seconds
I4	– 4 seconds
I2	– 2 seconds
I1	– 1 second
I/2	– 1/2 second
I/4	– 1/4 second
I/8	– 1/8 second
I/16	– 1/16 second

Menu M<n> n = 0 to 16

The Menu command selects an extended function menu item. Refer to "PROGRAMMING WITH EXTENDED FUNCTIONS" for detail on each function's operation. Each function is selected as follows:

M0	– Exit from menu to normal operation.
M1	– HIGH-PASS
M2	– FREQUENCY
M3	– PERIOD
M4	– LINEARITY
M5	– THD
M6	– OVERSHOOT
M7	– PULSE PERIOD
M8	– PULSE WIDTH
M9	– RISE TIME
M10	– FALL TIME
M11	– SISI
M12	– DELAY TIME
M13	– RT60
M14	– SPL

M15	– DOSE
M16	– PROJECTED DOSE

Selecting a menu item automatically places the 800B in multiple sample mode with no resets, with a sample interval of 1/16 second, 16 samples per trigger and Fast. The menu instruction takes n x 50 milliseconds to execute and M0 requires 1.2 seconds to complete.

Output O<n> n = 0 to 2

The Output enable command informs the interface when it can send data stored in the buffer. Three options are available:

O or O0	– enable output of data for one group (one GET)
O1	– disable output of data
O2	– permanent enable (till O0)

Program P<n> n = 0 to 2

The Program mode command selects what device the commands following it are intended for. The possibilities are:

P or P0	– Program for 800B
P1	– Program for 801 (no longer available)
P2	– Program for 802 (no longer available)

The program mode defaults to the 800B upon power up and after every carriage return.

InQuire Q

This command will return to the status of the RS-232 interface. The information provided is: <buffer count MSB>, <buffer count LSB>, <status byte>, <GET count>. All values are in decimal character strings.

The actual number of data bytes (x) stored in the buffer can be obtained by: x=MSB*256+LSB.

The status byte contains operation flags for the following functions:

7 - output enable flag
6 - permanent output enable flag
5 - BLOCK data flag
4 - buffer overflow flag
3 - Alpha command mode flag
2 - Alpha data send mode flag
1 - (internal function)
0 - (internal function)

The individual bits can be tested in BASIC with a formula similar to:

A=STAT AND 2^X

A will be equal to bit X, where x = 0 to 7 and STAT is the status byte received.

Range R<n> n = 1 to 5 or /1 to /5

The Range command programs the internal range of the analyzer. These ranges are listed below. The range value is also stored and added to the data received from the analyzer. This permits the data to be sent in absolute dB SPL.

After making a Range change in the 800B, perform a system RESET so that the display LCD reads with the correct range offset.

R or R1	– 80 to 140 dB SPL
R2	– 50 to 110
R3	– 30 to 90
R4	– 10 to 70
R5	– minus 10 to 50

For analyzers older than the 800B use the following range instructions:

R/ or R/1	– 90 to 150 dB SP
R/2	– 70 to 130
R/3	– 50 to 110
R/4	– 30 to 90
R/5	– 10 to 70

Sample Sn n = 1,2 to 30 (even)

The S command programs the number of samples taken for each GET. Valid values for n are 1 and all even numbers from 2 to 30. An example is:

S1	– 1 sample per GET
S12	– 12 samples

Trigger Tn n = 1 to 6

Six different Trigger modes are available with the 800B.

T1	– single sample with reset after
T2	– single sample with no reset
T3	– multiple sample w/ initial reset
T4	– multiple sample w/ initial & after resets
T5	– multiple sample w/ no resets count and buffer
T6	– multiple sample w/no initial reset, but with reset after sample

Weight Wn n = 1 to 3

The Weight command permits the programming of the frequency response weighting.

W1	– A weighted response
W2	– C weighted response
W3	– linear frequency response

eXtended X< n> n = 0 to 7

The eXtended control command group implements the miscellaneous control functions needed by the interface. See Menu for extended functions control.

X or X0	– go to LOCAL
X1	– POWER DOWN
X2	– go to REMOTE
X3	– RESET HOLD (clear buffer & GET)
X4	– HOLD
X5	– CLEAR all functions to power on state except for filter
X6	– disable BLOCKing of data
X7	– enable BLOCKing of data (if BLOCKing of data is disabled only one data point will be sent for each Output enable command)
X8	– PAUSE (same as ASCII 102, 50ms delay, 100)
X9	– RESET (same as ASCII 100, 102)

^control group ^<c> <n>

The control command enables an auxiliary group of control operations. These are the programming of a delay between the sending of data bytes, and the selection of Alpha or Binary data and command (cmd) modes.

^<n>	– set delay to n (delay=n*1mS)
^B or B0	– Binary cmd and data mode
^B1	– Binary data only
^B2	– Binary cmd only
^B3	– Alpha cmd and data mode
^R	– Reset entire system

Alpha Commands for the 801[1]

A switch A<n><c> n = 0 or 1, c = T

The operation of switch A in the 801 can be controlled with the A command.

1. The 801 is no longer available.

A or A0	– turn switch A off
A1	– turn switch A on
AT	– enable Toggling with each GET

B switch B<n> n = 0 or 1

The operation of switch B in the 801 can be controlled with the B command.

B or B0	– turn switch B off
B1	– turn switch B on

Frequency F<c><n> c = T or 0, n = 0 or 12 to 44

The Frequency of the internal filter and oscillator of the 801 can be controlled with the F command.

F or F0	– selects full bandwidth (no filter or osc.)
FTn	– turn on filter to one-Third octave bandwidth
FOn	– turn on Oscillator
Fn	– turn on filter to 1/1 octave

Examples:

FO43	– 20KHz oscillator
FT30	– 11Hz 1/3 octave filter
F34	– 2.5kHz 1/1 octave filter
F0	– full bandwidth - no osc.

The Highpass filter in the 801 can be turned on and off with the H command.

H or H0	– Highpass off
H1	– Highpass on

Input In n = 1 to 4

The Input select command operates the input selection switch in the 801.

I1	– select Input 112
I2	– select Input 21I3
I3	– select Input 314
I4	– select Input 4

Level <n> n = 0 to 638

The Level of the internal attenuator of the 801 can be programmed with the L command. The attenuator has a range of 0 to 63.75 dB in .25 dB steps. The last digit sent is assumed to be the fractional part rounded to one digit. The permissible fraction digits are 0, 3, 5, and 8 for .00, .25, .50 and .75 respectively. No decimal point needs to be included. Several examples follow:

L000 – attenuation Level of -0.0 dB
L065 – minus 6.5dB
L313 – minus 31.25dB
L638 – minus 63.75dB (max. attn)

Noise Nc c = P or W

The Noise generator in the 801 can produce Pink or White weighted noise. This choice is made with the N command.

NP – select Pink Noise
NW – select White Noise

Program P<n> n = 0 to 2

The Program mode command selects what device the commands following it are intended for. The possibilities are:

P or P0 – Program for LDL 800
P1 – Program for LDL 801
P2 – Program for LDL 802

The program mode defaults to the 800B upon power up and after every carriage return.

Reset/Retrig R

The noise generator can be Reset or Retriggered to provide a repeatable broadband signal.

R – Reset or Retrigger noise

Signal S<n> n = 0 or 1

The S command allows the Signal source of the 801 to be turned on and off.

S or S0 – Signal source off
S1 – Signal source on

Alpha Commands for the 802[1]

Acceleration A

The 802 can be programmed for Acceleration measurements with the A command. See the D and V commands also.

A – Acceleration

Displacement D

The 802 can be programmed for Displacement measurements with the D command. See the A and V commands also.

D – Displacement

[1] The 802 is no longer available.

Highpass H<n> n = 0 to 30

The frequency of the 802's Highpass filter can be selected with the H command. The four possible filter frequencies are:

H or H1	– 1Hz Highpass
H3	– 3Hz Highpass
H10	– 10 Hz Highpass
H30	– 30Hz Highpass

Input <n><c> n = 0 to 8, c = T

Eight input sources are available on the 802. These are selected with the following instructions:

I, I0 or I7	– No input (input grounded)
In	– Input n (n = 1 to 6)
IT or I8	– Test Input

Lowpass L<n> n = 0 to 30

The Lowpass filter frequency in the 802 can be programmed with the L command. The four possible filter frequencies are:

L or L30	– 30KHz Lowpass
L10	– 10KHz Lowpass
L3	– 3KHz Lowpass
L1	– 1KHz Lowpass

Manual S M< n > n = 0 or

The Manual Service Request (MSR) input can be enabled or disabled with the M command.

M or M0 – enable MSR bit M1– disable MSR bit

Program P<n> n = 0 to 2

The Program mode command selects what device the commands following it are intended for. The possibilities are:

P or P0	– Program for LDL 800
P1	– Program for LDL 801
P2	– Program for LDL 802

The program mode defaults to the 800B upon power up and after every carriage return.

Velocity V

The 802 can be programmed for Velocity measurements with the V command. See the A and D commands also.

V – Velocity

Binary Commands

The Binary command mode is almost identical to the HP-IL command procedure. The exact binary codes needed by the 800B system must be sent. Please refer to the HP-IL programming procedure for detailed operation information. There are several additional commands that perform control functions needed by the RS-232 interface itself such as Inquire status or Enable data send that are detailed here. The ^ symbol indicates 'CONTROL' key held down also.

Binary commands for the 800:

Char Code	Function	
^A	01	set to **A**lpha command mode
^B	02	set **B**lock data mode
^C	03	**C**ancel block data mode
^D	04	set to alpha **D**ata mode
^E	05	**E**nable output of data (INA equiv.)
^Hn	08n	set **H**old or delay value n (1 byte)
^I	09	**I**nquire status
^M <CR>	13	Group Execute Trigger (GET or TRIGGER)
^N	14	**N**ormal, back to binary data mode

Binary commands for the discontinued 801 and 802 are the same as when using HP-IL controllers. See their respective operation manuals.

Hints and Precautions

After making a Range change in the 800B, perform a system RESET so that the display LCD reads with the correct range offset.

When communicating via RS-232, the command/data sequence must be anticipated and adhered to in the controller software. For example one possible cause of system lockup is when the controller is waiting for data to be sent while the 800 is waiting for more commands. Data can also be lost if commands are sent before the data has been read out of the buffer. Most commands, excluding those that control the transmitting of data, clear out the storage buffer, The use of hardware handshaking (implement CTS) can also protect input overrun errors in the controller if it cannot accept data as fast as it is being transmitted.

The serial format for communication is 8 data bits with no parity, 2 stop bits and a fixed baud rate of 1200. The data transmitted by the 800-50 can usually be received by a simple INPUT statement with the appropriate number of variables to match the number of SAMPLES programmed.

The bottom line in working with these types of devices is that they are machines built to work in a strict manner. Our challenge when interfacing with them is to understand what is happening at any given moment.

4 Model 800B Specifications

Specifications: Model 800B Sound Level Meter

Amplitude ranges

Five selectable settings with a large overlap area between ranges.

-10-50 dB
10-70 dB
30-90 dB
50-110 dB
80-140 dB

The analyzer is capable of measurement over the entire operating range when used with suitable microphones. 800B-OPT-160 extends the ranges to cover from +10 to 160 dB.

Frequency Response (preamp input)

20 HZ to 20 kHz:	±0.3 dB
1 Hz to 30 kHz:	-3.0 dB

The analyzer frequency response may be limited by the frequency response of the input transducer used. 800B-OPT 65 extends the upper frequency limit to 65 kHz.

Frequency Weighting Filters

A-weight
C-weight
Flat
High Pass
1/3 Octave (800-OPT 30 only)
1/1 Octave (800-OPT 30 only)

The 800-OPT 30 optional internal filter bank provides 44-1/1 Octave and 44-1/3 Octave bandpass filters with center frequencies from 1 Hz to 20 kHz.

Detectors (True RMS and Peak)

Fast
Slow
Impulse
Peak (rise time 20 µsec)
Integrate (3-4-5 dB)

Dynamic range: >70dB

Crest factor: up to 73dB

Max hold can be used with any detector response. Overload indicator triggers if range is exceeded.

Display Characteristics

The 800B has a digital LCD for high resolution measurements and a bar-graph style LED display for viewing signal dynamics over a 60 dB linear range.

AC Output

Output Impedance:	600 ohms
Output Voltage:	1.0 Vac full scale

DC Output

Output Impedance:	5K ohms
Output Voltage:	50 mV/dB
	3.2 V full scale

System Electrical Noise Floor (18 pF dummy load, 1/2 inch cartridge)

A-weight:	typically 24 dBA
C-weight:	typically 30 dBC
LIN-weight:	typically 38 dBL

Microphone (choice of)

Option 10 1/2" random-incidence condenser microphone

Option 15 1" pressure condenser microphone

Option 20 1/2" free-field condenser microphone

Option 25 1/2" high sensitivity free field condenser microphone

Dynamic Range:	typically 24-160 dBA
	noise floor to 3% THD
Sensitivity:	12mV/Pa to 50 mV/Pa
Temp. Coeff:	.01 dB/°C

Temp Range:	-50 to +60°C
Stability:	1dB/300yrs @ 27°C
	<0.5dB/hr @ 150°C
Polarization Voltage:	200Vdc
Response:	microphones individually calibrated (curve supplied)

Power Sources

Internal:	4 alkaline "C" cells
Remote:	battery input range 4-15 Vdc.
Battery Life:	continuous operation with alkaline cells
Manual Operation:	20 hours
Programmable System:	14 hours

International Standards Met

800B SLM

ANSI Standard Specifications for Sound-Level Meters S1.4-, Type 1 (Precision).
IEC Standard 651-1979, Sound-Level Meters, Type 1 Peak.
IEC Standard 804-1984. Integrating-Averaging Sound Level Meter. BS4197-1967, DIN 45633 B1.1 and B1.2

Optional Filters

ANSI Standard Specifications for Octave, Half-Octave, and Third-Octave Band.
Filter Sets S1.11-1966. 1/3 Octave Class III. 1/1 Octave Class II.
BS 2475-1964, DIN 45652 and IEC 225-1966.

Preamplifier (Model 826B)

Input Impedance:	10G ohms//2.0pf
Gain:	0.9

Environmental

Operating Temperature:	-10 to +50°C
Operating Humidity:	0 to 90%
Electrostatic Effects:	negligible

Mechanical

Dimensions:	59 x 96 x 422mm, 2.36 x 3.85 x 17.0in
Weight:	1.6kg (3.5 lb) includes batteries, internal filter bank and computer interface.

2-Year Limited Warranty

Equipment Warranty

Larson•Davis warrants this product to be free from defects in material and workmanship for two years from the date of original purchase.

During the first year warranty period Larson•Davis will repair, or at its option, replace, any defective component(s) without charge for parts or labor if the unit is returned, freight prepaid, to an authorized service center. The product will be returned freight prepaid.

During the second year warranty period there will be no charge for replacement parts provided the product is returned to a Larson•Davis repair facility.

Product defects caused by misuse, accidents or user modification are not covered by this warranty, nor are any other warranties expressed or implied. Larson•Davis is not responsible for consequential damages.