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MODELS 1900/2900 SOUND LEVEL METER
WITH THE OB-100/OB-300

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1. INTRODUCTION TO THE MODELS 1900/2900

The Quest Models 1900 and 2900 are advanced sound level meters which perform a wide variety of acoustical measurements. Both exponential averaged and time integrated measurements may be made, with the capability of either internal or external data logging. The output of an independently weighted peak detector may also be displayed or logged. Applications include laboratory, industrial, community and audiometric measurement and analysis.

The models 1900 and 2900 provide a numerical readout of measurements as well as a moving bar graph indication. The results of individual sound studies may be stored in internal memory for future reference. Meter operation is controlled from either the membrane keypad or through the communications port. AC and DC output jacks are provided for connecting to external devices such as audio recorders, chart recorders, oscilloscopes, etc. Data may be sent to a parallel printer by using a special interface cable. The meters are housed in a tough injection molded plastic case with internal shielding to protect against external electrical interference, such as that from motors or portable radios.

The Model 1900 delivers Type 1 accuracy for critical measurements, while the model 2900 is a Type 2 instrument for general field survey work. The model 2900 uses a 0.52 inch electret microphone, while the 1900 accommodates a variety of microphones to meet even the most unconventional applications. As both meters are operationally identical, this manual will refer only to the model 1900 except where appropriate.

Options include expanded logging memory and a second RMS detector to allow simultaneous measurement of C-A frequency weighted LEQ or LAVG.

Plug in the Model OB-300 combination 1/3 - 1/1 Octave Filter Set and create a 1/3 or 1/1 octave band analyzer covering 33 bands from 12.5 Hz to 20 kHz. The addition of the Model OB-100 Octave Filter Set will create an octave band analyzer covering 10 bands from 31.5 Hz to 16 kHz.

If sound measurements need to be made from a distance, simply remove the microphone/pre-amplifier and insert either an ICM-10 (10 foot) or an ICM-50 (50 foot) extension cable. Distances of up to 100 feet can be accommodated by adding two ICM-50 extension cables in series.

With the microphone and preamplifier removed, the meter can accept other input devices such as the Quest Model VI-90 Vibration Integrator. The VA-508C Vibration Assembly, combined with the Models 1900 or 2900, provides a quick and precise method of measuring and analyzing many types of industrial vibration.

1.1 Assembling the Meter

The microphone and preamplifier must be assembled prior to making any measurements.

Microphone Handling and Storage

The microphones used with the model 1900 will provide years of reliable use, but certain precautions should be followed with regard to handling and storage.

1. Never remove the microphone grid. This will expose the diaphragm, making it susceptible to physical damage. When removing a microphone from the preamplifier be careful not to unscrew only the grid.
2. Never touch the diaphragm.
3. Electret (prepolarized) microphones should never be stored at high temperatures, as long term degradation of the polarization charge may occur. This results in a decrease in microphone sensitivity.
4. An electret microphone should be stored in its protective box when not in use for long periods of time.

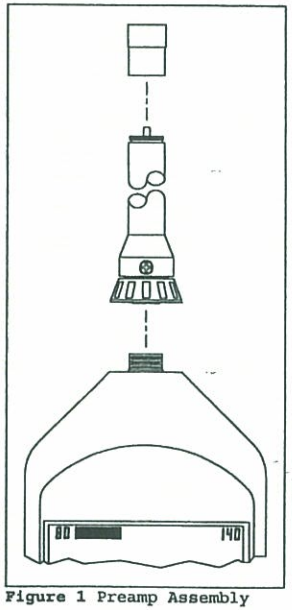

Figure 1 Preamp Assembly

To attach the microphone to the preamplifier, screw the microphone onto the threaded end of the preamplifier. Attach the preamplifier to the meter by placing the connector ends together and rotating the preamplifier until it drops onto the meter. Finger tighten the black locking ring by screwing it onto the meter.

MODEL 1900 ONLY:Microphone Polarization Voltage - 200VDC

Check that the microphone polarization voltage switch is set properly. This switch is located inside the battery compartment on the rear of the meter. To locate this switch, remove the battery door with a phillips head screwdriver and pull the 9 volt batteries out of the compartment. Electret, or prepolarized microphones such as the QE4146 or QE224 should be operated with the 200 Volt microphone polarization voltage turned OFF. Condenser microphones must be operated with the 200 Volts turned ON.

CAUTION: Be careful not to turn on the 200 volt polarization switch if a prepolarized (electret) microphone is attached. The microphone may be damaged.

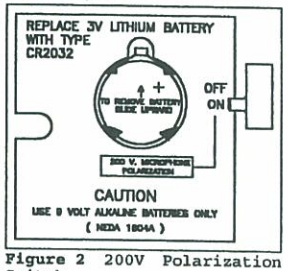

Figure 2 200V Polarization Switch

1.2 Initial Turn On and Check

Before taking measurements with the Model 1900, there is a series of quick checks that should be performed. Turn the unit on by pressing the ON/OFF key. The display will indicate that a brief warmup is taking place. Check for the BAT indicator in the display. If it indicates a low battery condition, replace the batteries.

A measurement display such as SPL or LEQ will appear in the display. Pressing the FUNCTION key will select a different display. Press FUNCTION to review the possible measurements. When you have done this, set the display to read SPL. The meter is now displaying current Sound Pressure Level. Press the A/C/LIN key to change the frequency weighting. Press the FAST/SLOW/PEAK/IMPULSE key to change the response time of the reading.

To perform an Acoustic Study, press RUN/PAUSE. Allow the meter to run for a while and press RUN/PAUSE again to end the study. The FUNCTION key may now be used to review the results.

Although the Model 1900 will maintain accurate calibration over a long period of time, the calibration should be checked and the meter slightly adjusted, if necessary, before each use. To check the calibration of the Model 1900, perform the following procedure using a Quest Calibrator.

1. Turn the Calibrator ON. If optional, set the frequency to 1 kHz. Note the SPL of the calibrator.

3. Insert the microphone fully into the calibrator adapter ring, if required for the size microphone in use.

4. Slowly place the Calibrator onto the adapter/microphone.

5. Using the FUNCTION key, set the Model 1900 to read SPL and set the weighting, response and range as appropriate. Note: SPL must be one of the display options enabled in the Setup Menu.

6. Use a screwdriver to adjust the calibration control, located through the small hole on the left side of the meter, until the display matches the calibration level.

Storing the Calibration Value

The model 1900 can store the time, date and SPL of a calibration, which will be included in the printout and in downloaded data for each study. Enter the PARA Setup Menu and go to CAL by pressing the following keys:

SETUP,
▲ or ▼ to " PARA ",
ENTER,
▲ or ▼ to " CAL "

The meter will display current SPL. Perform a calibration as directed in the previous section. Range and weighting keys will be operational, but the response time will be set to FAST. When the reading on the display is correct, press ENTER to store. The display will briefly read " CAL_{OK} " and return to the "PARA" menu display. The calibration SPL, time and date are now stored. Press SETUP to return to the measurement displays, such as SPL.

2. ABOUT THE METER

2.1 The Display

The LCD display provides the user with the selected measurement and the current measurement parameters. The measurement range, as well as instrument status such as low battery (BAT), RUN (▸), PAUSE (▮▮), and OVERLOAD (OL) is also displayed. The numeric display normally updates every second, while the bargraph provides a continuous indication of the sound level.

The bar indicator portion of the display always indicates the current SPL (Sound Pressure Level). The range of the bar indicator is the same as that of the instrument and is indicated by the numbers on either side of the bargraph. Each segment of the bargraph represents 2 dB.

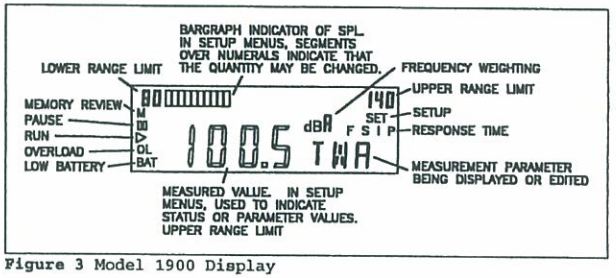

Figure 3 Model 1900 Display

2.2 Keypad Functions

ON OFF

Press this key to turn the meter on. After a warmup period of several seconds, the meter is ready to use. Pressing and holding this key for five seconds until " OFF_{OFF} " is displayed, and then releasing, will turn the meter off.

Momentarily pressing this key turns the LCD backlight on for several seconds. Pressing and holding for 3 seconds will turn the backlight on until the switch is again pressed to turn it off.

Note: Leaving the backlight on for extended periods will reduce battery life.

RUN PAUSE

Press this key to begin a study, which automatically increments the memory location counter by 1. The number of the location appears on the display briefly after pressing RUN. Pressing RUN/PAUSE again ends the study and stores the data in that memory location.

RANGE

Press the ▲ or ▼ to increase or decrease the 60dB measuring range in 10dB steps. Pressing this key while in RUN ends the current study and begins a new study. When this happens, the memory location will momentarily appear on the screen so that the operator may make note of his time and location for that study. (Key locked out while in Session mode and RUN.)

While inside the SETUP menus, the RANGE key may be used as UP and DOWN arrows for incrementing or decrementing numeric values.

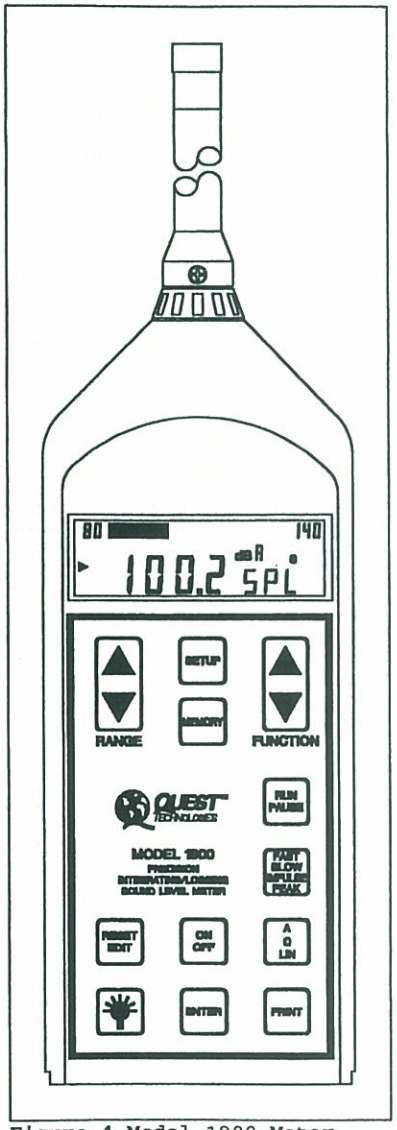

Figure 4 Model 1900 Meter

FAST SLOW IMPULSE PEAK

Press this key to select the time averaging from the four choices of FAST, SLOW, IMPULSE or PEAK. A display annunciator indicates the response by displaying " F ", " S ", " I " or " P ". Pressing this key while in RUN mode will end the current study and begin a new study. (Key locked out while in Session mode and RUN.) Refer to section 6.8 for details on time averaging.

A C LIN

Press this key to cycle the frequency weighting through the choices of A, C or Linear. The choice is shown by a letter following 'dB' in the display (A, C or L). Pressing this key while in RUN mode will end the current study and begin a new study. (Key is locked out while in Session mode and RUN.)

FUNCTION

Press FUNCTION ▲ or ▼ to select any of the following displays that have been selected via the SETUP key:

SPL, LEQ (LAVG), TWA, LMAX, LMIN, LN1, LN2, LN3, LN4, LDN, CNEL, % OL time, exposure in Pa2S or Pa2H, LPK, SEL, elapsed TIME (min/sec), elapsed TIME (hour/min), LLOG (LAVG or LEQ last logged - this value updates every logging interval), BATT, or TAKM. If the C-A option is installed, C-A Leq or Lavg may also be displayed. Refer to section 3.1, Measured Quantities.

While in RUN mode, the display shows the current value for the study. While in PAUSE mode the final value for the previous study is displayed. SPL will always show the current 1 second MAX according to the response selected (F/S/I/P). While in PAUSE, if selecting quantities such as LMAX, LEQ, etc. after the meter has been RESET (had it's memory cleared) the display will show "----". FUNCTION is also used while in the setup mode as an up/down arrow key for selecting menus or parameters.

SETUP

While in PAUSE mode, press SETUP to access one of five Setup Menus which allow the user to define the operation of the meter. There are many quantities that may be displayed, logged or printed, and most users will not be interested in all of them. SETUP allows the user to select only the items of interest, for example SPL, LAV and L10, excluding all others. The five menus are:

COMM	Communications Parameters
PARA	Measurement Parameters
PRNT	Data to be Printed
LOG	Data to be Logged
DISP	Data to be Displayed

Refer to section 3.3 for details on meter SETUP.

MEMORY

This key is used to group studies stored in memory into a File for printout, and to review individual studies stored in memory. While in PAUSE, press MEMORY to display " FILE ". Press ENTER to group the previously stored

studies into a File . Pressing FUNCTION ▲ or ▼ causes " XX_{LOC} " to be displayed, where XX is the number of the last study (as in memory LOCation #XX). Press ENTER to display a measured quantity such as LAV. The FUNCTION key may be used to display other quantities (LMAX, SEL, etc.). Press ENTER again to return to the " XX_{LOC} " display. The function key may be used to increment or decrement memory locations. If incrementing past the last location the display will read " 1 LOC ", or the first study. If 10,000 or more studies have been performed, the display will read " $XXXX_{xLOC}$ ". Press MEMORY again to exit study review. (Refer to section 3.2 for more details)

Pressing MEMORY while in RUN briefly displays the number of the current memory location (study number and session number).

PRINT — Press this key while in PAUSE to print all studies in memory to a parallel printer or computer. Press this key while in Memory Review to print only the study currently under review. To interrupt a printout, press again.

ENTER — The ENTER key is used in SETUP to enter or exit any of the five setup menus. When changing a numeric value in the PARA menu, it will store that value and turn off the bar graph segments above that parameter.

RESET EDIT — This key has two functions. While in SETUP, it is used to turn on or off display, logging or print choices, or to cycle through certain parameter selections (3>4>5>6>3...dB exchange rate for example). When not in setup (i.e. in PAUSE), pressing and holding RESET/EDIT will clear the internal memory.

2.3 Output Jacks

DC - The Sound Pressure Level (SPL) over the 60 dB range selected is linearly represented by a 0 to 1 volt DC output. Zero volts is equal to the bottom of the range and 1 volt is equal to full scale. This output is provided for connecting to a 0 to 1 volt input data acquisition system or chart recorder. See section 4.4 "Chart Recording" for details.

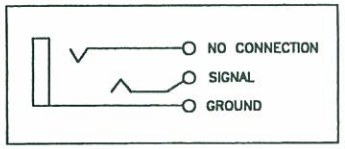

Figure 5. Output Jack Connections

AC - This jack provides an amplified, weighted AC signal. Full scale output (SPL) equals 3.16VAC.

COMM - The COMM jack is used for direct connection to an RS-232 compatible device such as a personal computer via the supplied cable. An optional Parallel Interface Module is used to connect to a parallel printer.

3. OPERATING PROCEDURE

Pressing the ON/OFF key will turn the meter on. The initial display is " 1900_{128K} " where 128k bytes is the amount of memory installed. The next display, " $X.X_{REV}$ " shows the revision of the installed firmware. A 5 second warmup will follow, and the display will read " 5_{WMUP} " counting down to " 1_{WMUP} ". If the logging memory has been filled, the display will read " $FULL_{MEM}$ " for those 5 seconds. If this occurs, reset the unit before performing any studies.

3.1 Measured Quantities

The FUNCTION switch steps through the following possible measurements performed by the model 1900. This list may be shortened as desired via the DISP Setup Menu. Refer to section 3.3 "Setup Menus" for details.

SPL - Sound Pressure Level will be displayed, with the selected weighting and response characteristics. The value displayed is the maximum SPL during the previous second. (SPL is also always shown in the display bar indicator.)

LEQ - The average integrated sound level accumulated while in the RUN mode is shown in the numeric display. LEQ indicates that a 3dB exchange rate was used for the measurements.

LAVG - The same type of measurement as LEQ, except that a 4, 5 or 6dB exchange rate was used. The display will be correct for the exchange rate selected.

TWA - Time Weighted Average. The average level accumulated during a study, but calculated with an eight hour integration time.

LMAX - The Maximum SPL obtained while in the RUN mode is shown in the numeric display. With PEAK response selected, this functions as a Peak Hold.

LMIN - The Minimum Sound Pressure Level obtained while in the RUN mode is shown in the numeric display.

LN - The SPL exceeded for N% of the time during a study. Four user selectable values are calculated. The default values are L5, L10, L50 and L90. The values may be changed in the PARA Setup Menu.

LDN - Day/Night Sound Level. The average sound pressure over a 24 hour study, with additional factors for time of day. Sound pressures between the hours of 10 pm and 7 am are increased by 10dB prior to being averaged. A 3dB exchange rate should be used and is generally assumed. If an exchange rate other than 3dB is selected via the Setup Menu, LDN will not be calculated and " $----_{LDN}$ " will be displayed.

CNEL - Community Noise Exposure Level. The average sound pressure over a 24 hour study, with additional factors for time of day. Sound pressures between the hours of 7 pm and 10 pm are increased by 5dB prior to being averaged. Sound pressures between the hours of 10 pm and 7 am are increased by 10dB prior to being averaged. A 3dB exchange rate should be used and is generally assumed. If an exchange rate other than 3dB is selected via the Setup Menu, CNEL will not be calculated and the display will show " $----_{CNEL}$ ".

%OL - Percentage of time during the study that an overload (OL) condition occurred. Overload indicates that the signal has exceeded the measuring range.

PA2S - PA2H Sound Exposure in Pascal-squared seconds or Pascal -squared hours, switching from Pa2S to Pa2H at 3600 Pa2S. The display will show " $----_{PA2}$ " if the exchange rate is not 3dB.

SEL - The Sound Exposure Level is the constant sound level which, if lasting for one second, would deliver the same amount of acoustical energy as that accumulated over the entire study.

RTMS or RTHM - The total RUN time will be displayed. Time may be displayed in MIN:SEC and HRS:MIN. The MIN:SEC display for a study that lasts over one hour will wrap around to 00:00. The HRS:MIN display will count to 99:59 and then wrap around to 00:00 but the actual time will be stored in memory.

LPK - The Peak Level. The output of a second peak detector may be viewed as LPK or logged. The frequency weighting is independent of the main RMS detector and may be set in the PARA setup menu as 2PK. The selection of whether or not to log peaks is made in the LOG Setup Menu. The weighting selection (A, C or LIN) is made in the PARA Setup Menu. While viewing LPK the weighting of the second peak detector is displayed, and the Weighting and Response keys are disabled.

LLOG - The LEQ (or LAVG) last logged during a study. Data is logged at a user defined interval. This feature may be used to display a timed LEQ for the previous logging interval. This display updates at the end of each logging interval. The display will show " $----_{LLOG}$ " if LEQ is not being logged.

TAKM The time integration of individual Taktmaximal values. Taktmaximal is the maximum level (L_{MAX}) encountered over either a 3 or 5 second interval. 3 or 5 second Taktmaximal is selected in the PARA Setup Menu. Individual Taktmaximal (L_{MAX}) values may be logged by setting the logging interval to 3 or 5 seconds in the LOG Setup Menu. Taktmaximal measurements are required by some countries' noise regulations. A Taktmaximal measurement calculates a higher average level for highly impulsive sounds than does a LEQ measurement. TAKM is affected by the Exchange Rate and should be run with an Exchange Rate of 3dB.

BATT Displays the voltage of the weaker of the two 9 volt batteries to give an indication of remaining life. The low battery indication (BAT) on the display occurs at approximately 6.8 volts.

LC-A An optional second RMS detector may be used to provide a simultaneous C-A weighted LEQ or LAVG of the measured sound. Refer to section 3.6 "C-A Option".

Acoustic Study Options

An acoustic **Study** is a set of measurements performed over a user defined period of time, referred to as the **Run Time.** The study begins at the **Start Time** and ends at the **Stop Time.** Each study is stored in a consecutively numbered **Memory Location** which is displayed briefly at the beginning of each study. Consecutive studies may be grouped into a **File.** When printing data, each File will have its own individual header, which makes it easier to locate related groups of data in the printout. Alternately, place the meter in **Session Mode** to create a cummulative summary of the data from consecutive studies with identical measuring parameters.

Up to five quantities may be logged at user defined time intervals. Final summary data for all measured quantities is also stored for each study.

The study may be initiated and ended in several ways (refer to Figure 6):

Manual Study - Press RUN/PAUSE to begin a study, causing the RUN indicator to light. " X_{LOC} " will be displayed briefly, where X is the number of the current memory location. Press RUN/PAUSE again to end the study, causing the PAUSE indicator to light.

NOTE: During a study, pressing a key to change a parameter such as weighting, range or response time will stop the current study and, after a brief settling time, begin a new study.

Manual Timed Study - Press RUN/PAUSE to begin a study. If a Programmed Run Time duration has been set and enabled in the Parameter (PARA) setup menu, the study will run for this time duration and automatically stop. The study may be interrupted by pressing the PAUSE key.

Auto Timed Study - An Auto ON time and date must be set and enabled in the setup menu and the meter must be turned OFF. When the internal clock/calendar reaches this time and date, the meter will turn on and begin a study. The duration of the study will be that of the Programmed Run Time stored via the setup menu. At the end of the study, the unit will PAUSE and turn itself OFF. The study may be interrupted by depressing the PAUSE key.

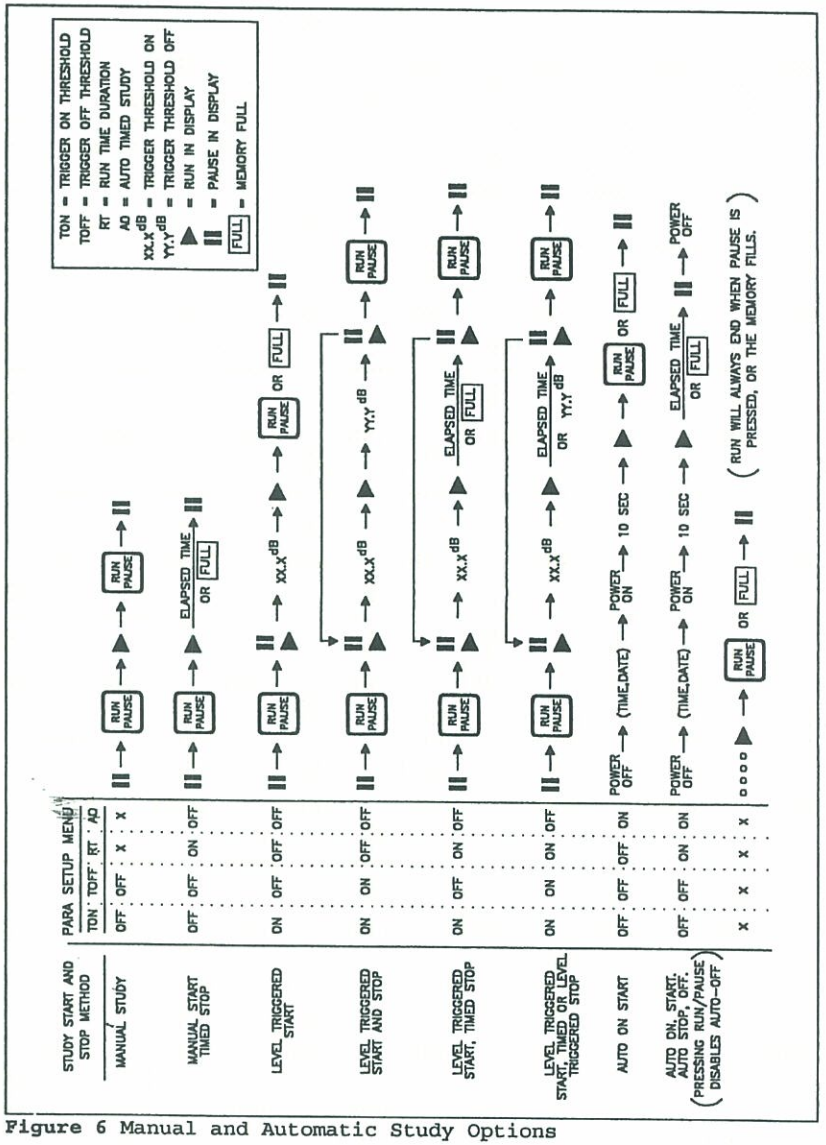

Figure 6 Manual and Automatic Study Options

Threshold Triggered Study - A Trigger Threshold ON level in dB must be set and enabled in the setup menu. While in PAUSE mode, press RUN to arm the meter. If the SPL reaches the desired level a study will begin. The study will end in one of three ways. If a Trigger Threshold OFF level in dB is set, the study will end when the SPL falls to this level. (Note: This level cannot be greater than the Trigger Threshold ON level.) If a Programmed Run Time duration is enabled, the study will last for the specified length of time unless the OFF level is reached. If the SPL is still above the ON level a new study will begin. The study may be interrupted by pressing PAUSE.

NOTE: Both Threshold Triggered and Auto Timed studies may not be enabled simultaneously. While in the Setup Menu, one may not be enabled without first disabling the other.

Filter Controlled Study - Each time the filter band on the optional bandpass filters (OB-100 or OB-300) is changed, either manually or automatically, the current study is ended and, after a brief settling time, a new study will begin.

NOTE: For long term unattended measurements where the possibility of power interruption exists, it is recommended that the meter be set up to run shorter term consecutive studies, such as one hour threshold-triggered studies with a Trigger Threshold ON level sufficiently low to always retrigger at the end of the hour. If power is interrupted during a RUN, all data for that study will be lost. The data from previous studies will be retained.

File Creation (Grouping Studies)

It may be desirable to separate a group of studies into a File. For example, if several studies were performed at a single site using various weightings, response times or filters, you might wish to separate the printout of these studies from that of a similar group of studies performed at a different site. Grouping consecutive studies into a File accomplishes this. A File is created after performing the last study to be grouped, and prior to beginning the first study of the next group.

To create a File, press MEMORY while in Pause mode. " FILE " will appear in the display. Press ENTER. This will group all studies performed since the last File was created into a new File. When printing data, each File will have a Header section to separate it from the previous File. Refer to Figure 7.

File creation is not available if the meter is set to run in session mode. Refer to the next section.

Session Mode (Combined Studies)

To obtain a cumulative measurement of consecutive studies (which must have identical measurement parameters), enable Session mode in the Parameters Setup Menu. (The meter must first have its memory cleared by performing a RESET.) A Session consists of individual studies stored in their memory locations with the addition of an overall summary of all of those studies. Any number of consecutive studies may be grouped into a Session. For example Session 1 might consist of studies 1 through 5, session 2 might consist of studies 6 through 9 and session 3 might consist of studies 10 through 31.

Pressing RUN after performing a RESET begins Session 1 and Study 1 (memory location 1). A session is closed in one of four ways:

1) Press MEMORY , then RESET
2) Change a measurement parameter such as weighting or exchange rate while in PAUSE (Weighting, Response and Range keys are locked out while in RUN only in Session mode)
3) Change the state of an optional bandpass filter. This may be done in either RUN or PAUSE.
4) Turn the meter off. This session cannot be reopened.

After closing a session, the next time RUN is pressed will begin the next session and study. Measurements for individual studies cannot be viewed while measuring Session mode. The displayed data is for the overall session. Individual studies can be viewed by reviewing data in memory. (Refer to section 3.2)

Viewing Measured Results

While performing a study (unit is in RUN mode) the FUNCTION key may be used to view the various measurements as they are occurring. Only measurements selected via the DISP Setup Menu will be available for viewing. If the meter is in Session mode, the value displayed will be the overall summary for the entire session. The displayed value will be updated each second, except for LLOG which is updated each logging interval as selected in the Setup menu. Pressing the MEMORY key during a study will briefly display " XX_{LOC} ", where XX is the current memory location. If the meter is in Session mode, pressing MEMORY will briefly display " XX_{SESS} "" followed by " XX_{LOC} "" to indicate the current session and memory location.

While the unit is in PAUSE mode, the FUNCTION key may be used to view the results of the previous study, or the results of the current session if the meter is in Session mode. The exceptions to this are SPL, which always shows the current SPL updated once per second, and LLOG, the value of which is not displayed. Again, only measurements selected via the Setup Menu will be available for viewing.

While in PAUSE mode, any change to range, weighting or response will make the data from the previous study or session available only by reviewing its memory location. Turning on the optional bandpass filter or changing its frequency will also cause this to happen.

3.2 Reviewing Memory Locations

The results of all currently stored studies are available by pressing the MEMORY key. The memory review process is slightly different depending upon whether or not Session mode was used to create the data in memory.

If Session mode was not enabled, pressing MEMORY will cause " FILE " to appear in the display (refer to File Creation). Press the FUNCTION ▲ or ▼ key. This will display the memory location of the last study performed. For example " 19_{LOC} " would indicate that the last study was the 19th study stored in memory. The ▲ or ▼ keys are used to select other memory locations. Pressing ▼ would select " 18_{LOC} ", but pressing ▲ would wrap around to the first study and select " 1_{LOC} ". Refer to Figure 7.

If Session mode is enabled, pressing MEMORY will display " XX_{SESS} ", which is the last session completed (a currently open session cannot be viewed in memory). The FUNCTION arrow keys select the desired session. The RANGE arrow keys select either individual memory locations of studies within that session or the overall session data.

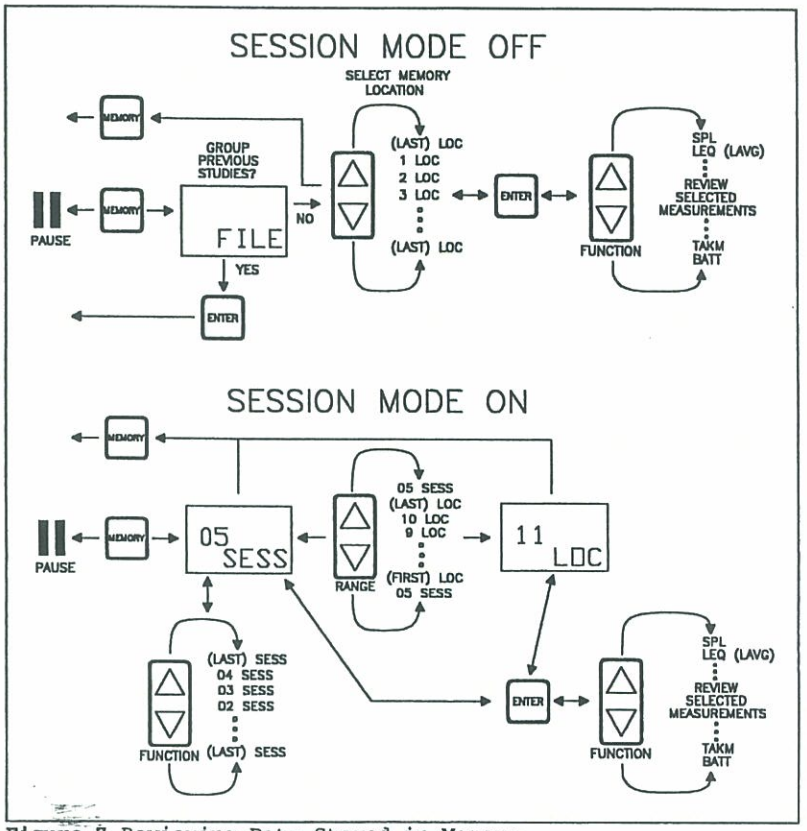

Figure 7 Reviewing Data Stored in Memory

Once the memory location of the desired study is selected, press ENTER to view the measurement results. The measurement parameters such as range , weighting and response will be shown in the display and the " M " indicator will be lit. If an optional bandpass filter was used during the study, the frequency will be briefly displayed. Use the FUNCTION key to select the measurements of interest. Only measurements currently selected via the Setup menu will be available for viewing, but these can be changed at any time by going back to the Setup menu. Pressing ENTER will return to the memory location or session number display. Pressing MEMORY returns to Pause mode.

The data in the memory location being reviewed may be printed using the PRINT key. Refer to section 4.4, "Printing Data". Data logged during a study may be viewed by printing the Time History portion of the printout.

Memory Capacity

The number of studies (memory locations) that can be created is limited by the amount of memory. The amount of data that is logged, if any, during a study will also fill the available memory. Logging data every second will fill memory faster than logging every minute. Session mode will also use more memory due to the extra summary information that must be stored. If the memory fills during a study, the unit will PAUSE and display " FULL ".

In addition to the problem of filling the memory, the total amount of energy accumulated during a study can cause the unit to overflow, causing calculation errors. This is dependent upon the range setting and how high the SPLs are during the study. This can be determined from the value of SEL at various exchange rates as follows:

Exchange Rate	Maximum SEL Without Overflow
3 dB	150 dB + Range
4 dB	200 dB + Range
5 dB	250 dB + Range
6 dB	301 dB + Range

For example, with an exchange rate of 3dB on the 60 - 120 dB range, the maximum SEL without overflow would be 150 dB + 60 dB = 210dB.

The following chart shows approximate time available versus logging rate and number of items logged for the standard 128Kbyte memory.

Maximum number of studies with no data logged: 796 for 128k memory.

Logging Rate	Number of items logged				
	1	2	3	4	5
1 second	21 hr	10.5 hr	7 hr	5 hr	4 hr
3 seconds	2.6 dy	1.3 dy	21 hr	15 hr	12.5 hr
5 seconds	4.4 dy	2.2 dy	1.4 dy	1.1 dy	21 hr
10 seconds	8.7 dy	4.4 dy	2.8 dy	2.2 dy	1.7 dy
15 seconds	13.3 dy	6.5 dy	4.4 dy	3.3 dy	2.6 dy
30 seconds	26 dy	13.2 dy	8.7 dy	6.6 dy	5.3 dy
1 minute	53 dy	26 dy	17.6 dy	13.3 dy	10.5 dy
3 minutes	159 dy	79 dy	53 dy	39 dy	31 dy
5 minutes	265 dy	132 dy	88 dy	66 dy	53 dy
10 minutes	1.3 yr	265 dy	176 dy	132 dy	106 dy
15 minutes	2.2 yr	1 yr	265 dy	198 dy	159 dy
30 minutes	4.3 yr	2.2 yr	1.3 yr	1 yr	318 dy
1 hour	8.6 yr	4.3 yr	2.9 yr	2.2 yr	1.7 yr
2 hours	17 yr	8.6 yr	5.7 yr	4.3 yr	3.4 yr
4 hours	34 yr	17 yr	11.6 yr	8.6 yr	6.9 yr
8 hours	69 yr	34 yr	23 yr	17 yr	13.9 yr
24 hours	209 yr	104 yr	69 yr	52 yr	41 yr

If the 512K memory option is installed, the above times would increase by a factor of 4.

The total number of logged items (LEQ, LMAX, LPK, L10 or L90) possible can be calculated by the following formula:

# of logged items = 2/3 [M - (144 x # of studies) -
(3072 x # of studies with stats logged)]

where M = 114687 w/ 128k memory or 507903 w/ 512k memory. The total run time is calcuated by multiplying the number of logged items by the logging rate divided by the number of items logged.

Erasing Stored Data

To erase the data in the memory locations, the meter must be in the Pause mode. Press and hold the RESET/EDIT key for five seconds. The display will read " 5_{RST} " , count down from 5 to 1, and " $----_{RST}$ " will be displayed. The memory is now cleared and the next study will be stored in memory location 1.

3.3 Setup Menus

The operation of the model 1900 may be customized through the Setup menus. While in PAUSE mode, pressing the SETUP key lights the SET annunciator in the display and allows access to the various menus. Pressing the FUNCTION ▲ or ▼ keys selects from among the five Setup menus. Once the desired menu is displayed, pressing the ENTER key enters that menu and displays the first item that may be modified. Refer to figures 8 - 11. The five menus are:

DISP - Displayed Data, or the measurements that may be viewed by pressing FUNCTION while in RUN or PAUSE.

LOG - Logged Data and Logging parameters, or which measurements are logged, where the data is stored and how often the data is stored.

PRNT - Printout format, or printout data presentation.

PARA - Measurement Parameters, or variables affecting the way a measurement is performed. These include thresholds, percentage values for LN, peak detector weighting, etc. as well as clock/calendar setting and calibration value storage.

COMM - Communications parameters for using the COMM port.

The key sequence to exit a Setup Menu is the reverse of the one used to enter the menu.

DISP Setup Menu (Displayed data) Refer to Figure 8

Press SETUP and the FUNCTION ▲ or ▼ keys until "DISP" is displayed. Pressing ENTER gets you into the Display Setup Menu and will, for example, display " on_{SPL} ". You may now choose whether or not SPL will be among the active displays by pressing RESET/EDIT, which toggles between " on_{SPL} " and " oFF_{SPL} ". Pressing FUNCTION ▼ cycles to the next selection, " on_{LAV} " which may be turned on or off with the RESET/EDIT key. The displayed quantities that are selected in this manner are:

SPL (Sound Pressure Level), LEQ or LAVG (Equivalent Level), TWA (Time Weighted Average), LMAX (Maximun Level), LMIN (Minimum Level), LN1, LN2, LN3, LN4 (% Exceedance Levels), LDN (Day Night Level) , CNEL (Community Noise Exposure Level), %OL (Percent Overload Time), PA2S or Pa2H (Exposure), LPK (Peak Level) , SEL (Sound Exposure Level), RTMS (Run Time MIN:SEC), RTHM (Run Time HR:MIN), LLOG (Last LEQ Logged), BATT (Battery Voltage), TAKM (Taktmaximal) and/or LEQ (LAVG) C-A if the C-A option is installed. (TAKM and LC-A cannot both be enabled.)

Press ENTER to exit the DISP Setup Menu, displaying "DISP". The FUNCTION ▲ or ▼ keys may now be used to select another Setup menu.

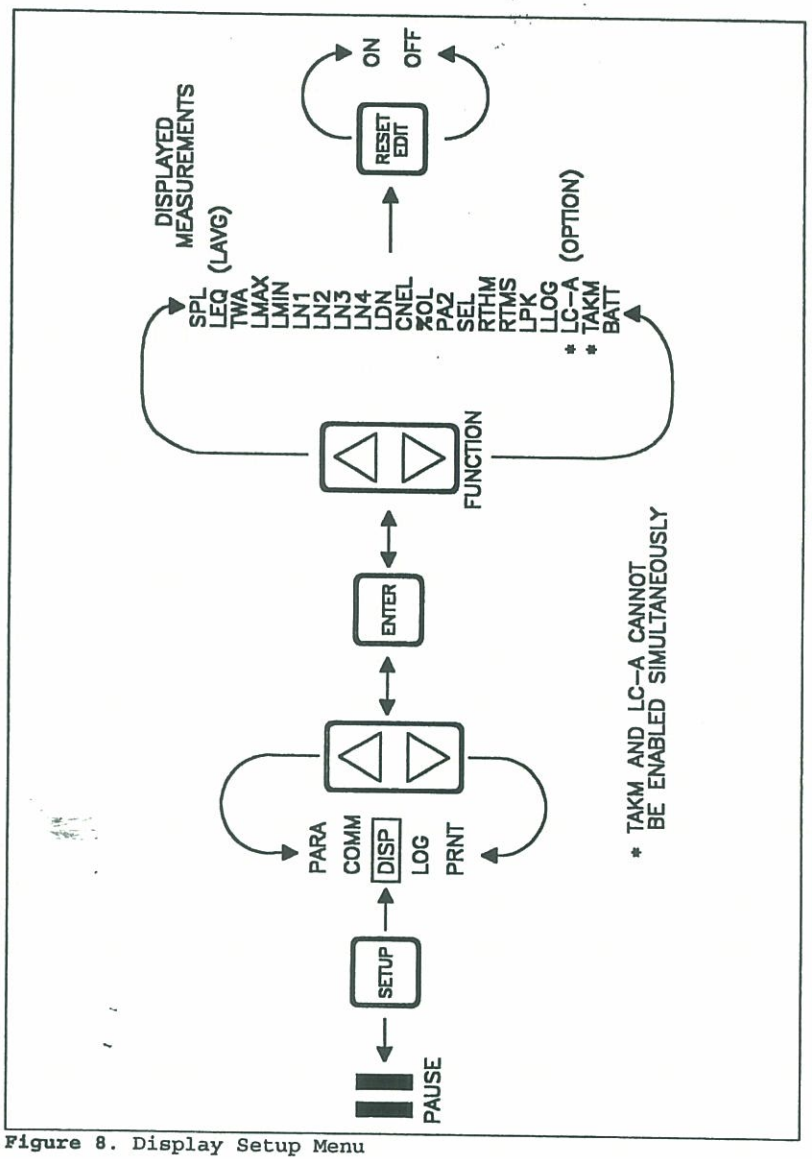

Figure 8. Display Setup Menu

LOG Setup Menu (Data to be logged) Refer to Figure 9

After pressing SETUP, the ▲ or ▼ keys may be pressed until "LOG" is displayed. Pressing ENTER gets you into the Logging Setup Menu and will, for example, display " on_{LEQ} ". You may now choose whether or not LEQ will be among the data that will be periodically logged. Press RESET/EDIT to toggle between " on_{LEQ} " and " oFF_{LEQ} ". Pressing FUNCTION cycles to the next selection, " on_{LPEAK} ", which is turned on or off in the same way. The measured quantities available for logging are:

LAV(or LEQ), Peak, LMAX, L10, L90.

Note that the Peak value that is logged has independently selectable weighting from that of the main measurement. This is set in the PARA Setup Menu.

In addition, whether or not to log to internal memory, whether or not to log to the COMM port, and the time interval (logging rate) may be selected. Saving statistics tables (STAT on or off) for each study may also be selected. The statistics tables provide useful information when downloaded to the optional PC support software, but are not available to the user directly from the meter.

At each of the five measured quantities, press RESET/EDIT to turn that quantity on or off. Do the same for STAT.

To select the destination for logged data, depress FUNCTION to display " on_{COMM} " or " on_{MEM} " which sends logged data to the COMM jack or internal memory respectively. Use the RESET/EDIT key to turn these options on or off.

To select the **logging interval**, press EDIT/RESET which will light the bargraph over the time interval shown on the display. Use the UP or DOWN arrow key to select the desired time interval. The choices are:

1, 3, 5, 10, 15 or 30 seconds
1, 3, 5, 10, 15 or 30 minutes
1, 2, 4, 8 or 24 hours

When the desired interval is displayed, press ENTER to store your selection.

Press ENTER again to exit the LOG Setup menu.

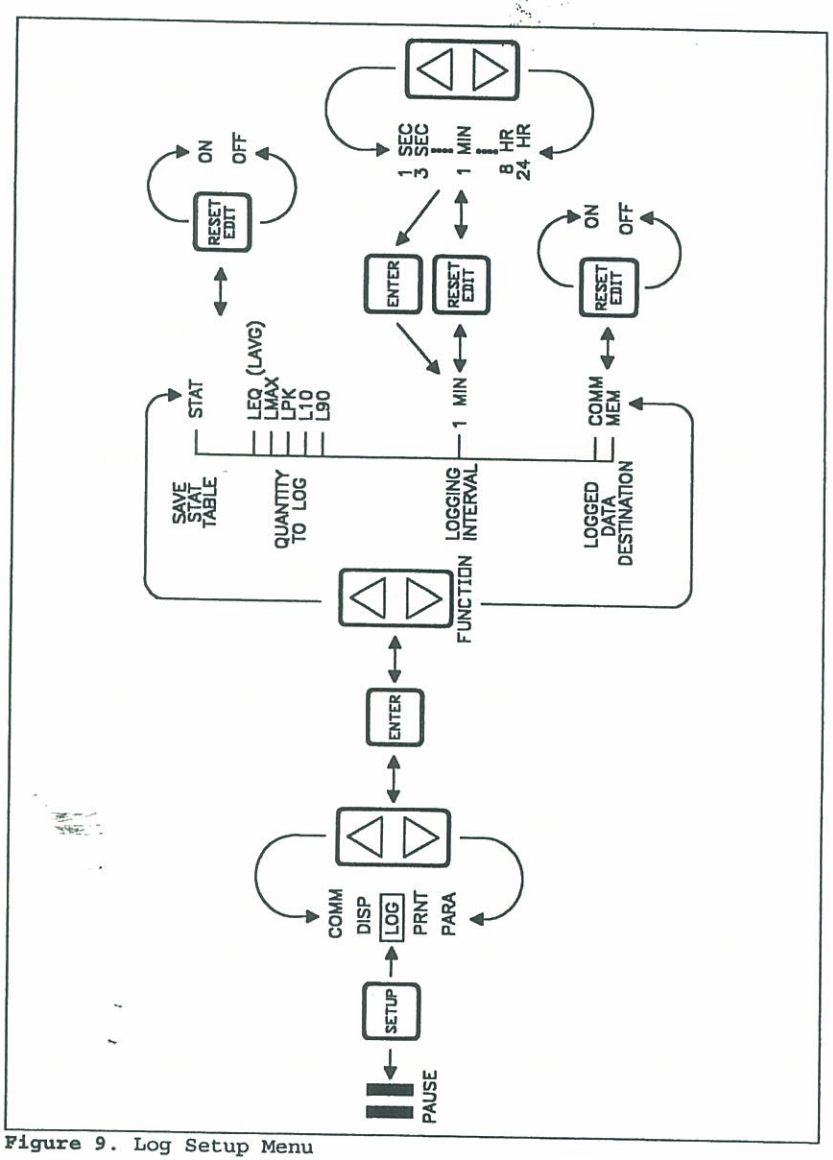

Figure 9. Log Setup Menu

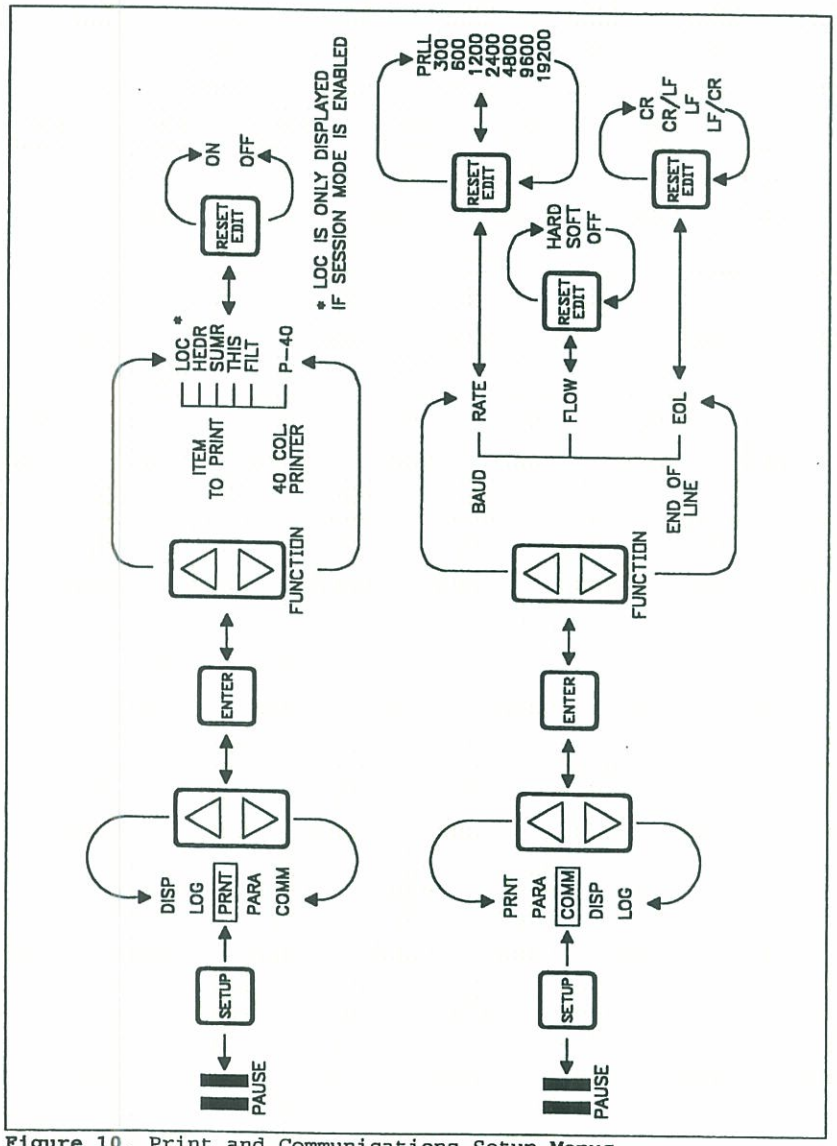

Figure 10. Print and Communications Setup Menus

PRNT Setup Menu (Data to be printed) Refer to Figure 10

After pressing SETUP, the ▲ or ▼ arrow keys may be pressed until PRNT is displayed. The data presentation for the printout may be selected in the Print setup menu. Pressing ENTER gets you into the menu and will, for example, display " on_{HDR} ". You may now choose whether or not the header is included in the printout. Pressing EDIT/RESET toggles between " on_{HDR} " and " oFF_{HDR} ". Pressing FUNCTION cycles to the next selection, " on_{SUMR} ", which is turned on or off in the same way. The printout options are:

HEDR - Header, on or off

SUMR - Summary of all measurements, on or off

THIS - Numeric Time History, on or off

FILT - Filter Data Grouping, on or off. Data collected using an optional bandpass filter may be grouped under a common header (ON) or printed as an individual study (OFF).

P-40 - Compressed print mode. This will fit the printout onto a small 40 column printer.

LOC - Print individual memory locations along with session data (Session mode only)

A sample printout is shown in Section 4.4, "Printing Data".

COMM Setup Menu (Communications parameters) Refer to Figure 10

While in SETUP, press the FUNCTION key to display "COMM". Press ENTER to access the Communications Setup Menu where the following selections involving data communications are made:

BAUD - Baud Rate. Choice of 300, 600, 1200, 2400, 4800, 9600, 19200 baud or parallel printer output (PRLL).

FLOW - Flow control or handshaking. Select HARDware, SOFTware or OFF. This is important for transfers of large amounts of data to prevent lost data.

EOL - End of Line Characters. Choice of :
- Cr (carriage return)
- CrLF (carriage return and line feed)
- LF (line feed)
- LFCr (line feed and carriage return)

Cycle through these parameters by pressing the ▲ and ▼ keys. Press the RESET/EDIT key to change the values. Pressing ENTER returns to the "COMM" display. Refer to section 4, Communications, for more information.

PARA Setup Menu (Measurement parameters) Refer to Figure 11

After pressing SETUP, the ▲ or ▼ keys may be pressed until PARA is displayed. Pressing ENTER gets you into the Measurement Parameter setup menu, where the following parameters may be set:

ER - Exchange Rate selection of 3, 4, 5 or 6dB. Changing this parameter from 3dB changes LEQ to LAVG for all displays.

TH - Threshold level for averaging (set dB level from 0 to 180, or turn off). If the threshold is enabled, the meter will not integrate SPL below the threshold.

LNX - Four selectable exceedance (LN) values (X = 1 through 4). For each LNX, set N from 1 to 99 in 1% increments.

Ton - Threshold Trigger ON level (set dB level from 0 to 180 or turn off). Sets Threshold triggered study initiation level.

ToFF - Threshold Trigger OFF level (set dB level < or = Threshold Trigger ON level). Sets Threshold triggered study termination level (this is overridden if Programmed Run Time Duration is enabled).

RTHM or RTMS - Programmed Run Time Duration in Hours/Minutes or Minutes/Seconds (set hours/minutes/seconds, or turn off). Sets study length for manual, threshold, or Auto-On initiated study. 99 hour, 59 minute 59 second maximum. Setting to 00:00:00 will default to OFF.

AOMD, AOHM or AOMS - Auto-On Time in Month/Day, Hours/Minutes or Minutes/Seconds (Set Month, Day, Time, or turn off). Sets time to automatically turn on unit and begin study. 24 hour military time format is used for Hours/Minutes.

YEAR, MODY or HRMN - Clock/Calendar (Set year, month/day, hours/minutes). 24 hour military time format is used.

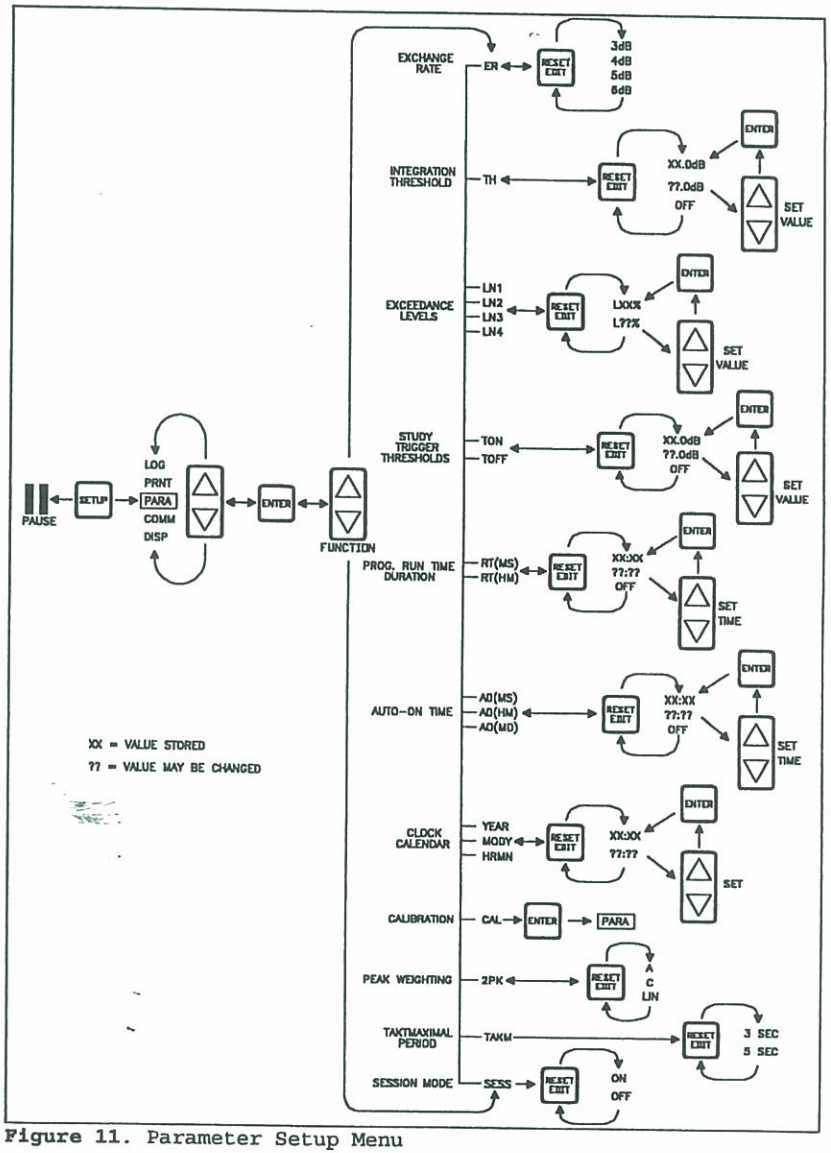

Figure 11. Parameter Setup Menu

- Calibration Value. Stores calibration value for SPL and peak detector. SPL calibration value and time and date of calibration will appear on the printout. The instrument's range settings may be adjusted to compensate for microphones that differ in sensitivity from the standard mics. Refer to section 5.1 "Calibration" for details.

2PK - Select Weighting of Second Peak Detector (A, C, LIN) used for LPK display or for logging data.

TAKM - 3 or 5 second L_{MAX} for Taktmaximal measurements.

SESS - Session mode ON or OFF. ON combines consecutive studies into a cumulative summary. See section 3.2 for details. If there is data in memory, this cannot be changed without first resetting the unit.

The user cycles through these parameters by pressing the ▲ and ▼ keys. Pressing the EDIT/RESET key allows the user to change the values or enable/disable the parameter. When setting numeric values the bargraph sections above the quantity to be changed will be lit. The ▲ and ▼ keys are used to change numeric values. Pressing ENTER stores the value. Pressing ENTER again returns to the "PARA" display.

Typical Setups

OSHA NOISE COMPLIANCE

Threshold = 90dB
Weighting = A
Exchange Rate = 5dB
Response = Slow

OSHA HEARING CONSERVATION

Same as above except with Threshold = 80dB

DEPARTMENT OF DEFENSE NOISE COMPLIANCE

Threshold = 80dB
Weighting = A
Exchange Rate = 4dB
Response = Slow

IEC NOISE MONITORING

Threshold = OFF
Weighting = A
Exchange Rate = 3dB
Response = Slow

TAKTMAXIMAL

Weighting = A
Response = Fast
TAKM = 3 or 5 Seconds as desired, with Logging Interval set to 3 or 5 seconds to log TAFts as LMAX values if LMAX is enabled in LOG Setup Menu

3.4 Overload Detection

While viewing SPL the overload indicator (OL) is displayed whenever the incoming signal saturates (overloads) the circuitry. If the OL indicator is on, increase the RANGE until the OL condition is removed. If an OL condition occurs while in the RUN mode, the OL indicator will light and remain on for the duration of the study.

The percentage overload time is a display option that may be enabled via the DISP setup menu and then selected using the FUNCTION key. The overload time will also be printed on the hard copy printout. While reviewing a study stored in memory, the OL indicator will remain on if an overload occurred during that study. Percentage overload time may be useful in determining the validity of a study during which overload occurred. A small percentage indicates that the data is fairly accurate, while a larger percentage indicates that significant errors occurred.

An overload will also be indicated while logging to the serial port or printing a time history of a study. For each logging interval that contained an overload condition, OL will print at the end of that line of data.

3.5 Battery Replacement

The BAT indicator in the display means that one or both 9V batteries is weak and should be replaced. Make sure the meter is turned off when replacing the batteries. Use a phillips head screwdriver to remove the battery cover on the rear of the unit. Remove the old batteries and replace with fresh alkaline batteries.

A lithium coin cell (type CR2032) is accessible through the battery compartment. This battery maintains the data memory, clock/calendar and setup information when the meter is turned off. A dead lithium cell will cause the meter to lose information stored in the setup menus, the serial number and any data. As long as the meter is turned on, this information will not be lost. If the meter is to be turned off while changing the lithium cell, retrieve any data stored in the meter and make note of setup parameters as these will be erased. Refer to figure 2.

1. Remove the 9 volt batteries from the battery compartment. Using a fingernail or other thin non-metallic object, push the bottom edge of the battery toward the top (microphone end) of the meter until it comes out of the holder.

2. Insert the new lithium cell, edge first and **+ side up**, into the top of the holder. Press the bottom edge of the battery toward the top of the meter until it snaps into the holder.