



Q-50 Noise Dosimeter

Operators Manual



TABLE OF CONTENTS

1. INTRODUCTION TO THE Q-50	2
1.1 Installing the Battery	2
1.2 Keypad Functions	3
1.3 Initial Turn On and Check	4
1.4 RESET - Erasing Stored Data	6
1.5 Calibration	6
1.6 Changing Measurement Parameters	8
1.7 Overload Detection	9
1.8 Security Mode	9
2. GENERAL SOUND MEASUREMENT PRACTICES	9
2.1 Microphone Positioning	9
2.2 Accuracy of Readings	11
2.3 Microphone Windscreen	11
2.4 Background Noise	12
3. TECHNICAL INFORMATION	12
3.1 Principles of Operation	12
3.2 Microphone Characteristics	13
3.3 Weighting Characteristic	14
3.4 Tone Burst Response	14
4. SPECIFICATIONS	15
5. ACCESSORIES	16
6. TROUBLESHOOTING	16
APPENDIX	17
Definitions	17
Typical Setups	18
Acoustical Formulas	19
QUEST SERVICE AND WARRANTY POLICY	20

1. INTRODUCTION TO THE Q-50

The Quest Model Q-50 noise dosimeter is an easy to use general purpose instrument designed for industrial noise monitoring. Both exponential averaged and time integrated measurements may be made, with the result displayed or stored in internal non-volatile memory for future reference. All measurements are performed with the A frequency weighting and either Fast or Slow response time may be selected. The Q-50 delivers Type 2 accuracy for general field survey work.

A large LCD display provides a dynamic readout of data during a study, or of the final results of the study. Meter operation is controlled from a simple four button keypad.

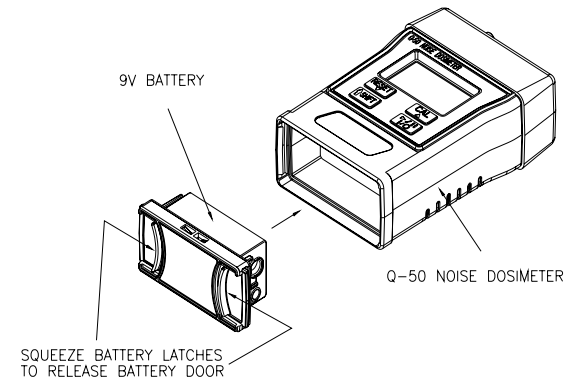
The Q-50 may be clipped on a belt or worn in a shirt pocket. The small microphone is simply clipped to the shirt near the ear. The Q-50 is housed in a tough, molded case to protect against physical abuse. The case has internal shielding to protect the instrument from external electrical interference, such as that from motors or portable radios.

1.1 Installing the Battery



The Q-50 is powered by a single 9-volt battery which snaps into a removable battery holder. The **BAT** indicator in the display lights when there is less than 8 hours of battery life remaining.



To replace the battery:



- 1.) Insert the thumb and forefinger into the end of the battery holder and slide the locking tabs toward each other. Gently pull the battery holder out of the instrument.
- 2.) Remove the old battery and install a new one, noting the proper polarity. Polarity is indicated on the inside of the battery holder.
- 3.) Insert the battery holder into the Q-50 until the locking tabs snap into place. Turn the Q-50 ON and check that the **BAT** indicator is not showing.




1.2 Keypad Functions


 Pressing this key turns the meter on. Pressing and holding this key will cause the display to read " OFF5 " and count down for five seconds until " OFF0 " is displayed. Releasing the key will turn the meter off. Pressing this key while holding  begins a study and lights the RUN indicator. Pressing these two keys again ends the study and lights the PAUSE indicator.

 The down arrow is used to select specific measurements within each of the function displays. This key is also used for setting measurement parameters. Holding  while pressing and holding this key for five

 The up arrow is used to select specific measurements within each of the function displays. This key is also used for setting measurement parameters. Holding  while pressing this key will start the Q-50's calibration routine, which adjusts the instrument's sensitivity to match the SPL present at the microphone.

 The shift key is held while pressing another key to select the second function (shown in red type) of the other three keys.

1.3 Initial Turn On and Check

Before taking measurements with the Q-50, there is a series of quick checks that should be performed. Turn the unit on by pressing . The display will show the software revision, **rx.x**, followed by a brief display of each measurement parameter setting. These parameters are:



Response Time or averaging time constant, either Fast or Slow. For example, Response time is displayed as **rs:S** for a SLOW time constant.

Threshold Sound Pressure Level (SPL). Sounds below this SPL are not included in the calculations. Threshold is displayed as **th:80** for an 80dB threshold level.

Exchange Rate, or doubling rate for noise exposure. Exchange Rate is displayed as **Er:5** for a 5dB exchange rate.

Criterion SPL. The SPL at which 8 hours of constant sound results in a 100% noise dose. This is displayed as **CL:90** for a 90dB criterion level.

Calibration SPL. The SPL reading expected from the Q-50 when connected to the sound source used to calibrate the Q-50. A display of **114.0** along with the **CAL** indicator shows that a 114.0dB calibrator is to be used.

After a brief pause, a measurement display will appear along with a measurement indicator. Check for the **BAT** indicator in the display. If it indicates a low battery condition, replace the battery. Press the  and  keys to select the various measurement displays. The measurements are:

Sound Pressure Level (**SPL**) in dB. This is always the current SPL, updated each second.











Maximum SPL (**MAX**) during the study, if any.

Average Level (**LAVG** or **LEQ**) during the study. **LAVG** indicates that

Run Time (**RT**) duration of the study. Run time is displayed as **xx:xx** (minutes:seconds) and **xx:hr** (hours) in two displays.

Sound Exposure (**EXP**) during the study in Pascal-squared hours, or Pa²H. Sound Exposure is only calculated if the Exchange Rate is set to 3dB.

Noise Dose (**DOSE**) accumulated during the study, in percent.

To perform an Acoustic Study, press both  and . Allow the unit to run for a short period of time. Press the  and  keys to review the various measurement displays. Press both  and  again to end the study. The  and  keys may now be used to review the results. Pressing  and  again will resume the study. The Q-50 accumulates sound as one study as long as it is in RUN. Resetting the instrument clears the memory in order to begin a new study.

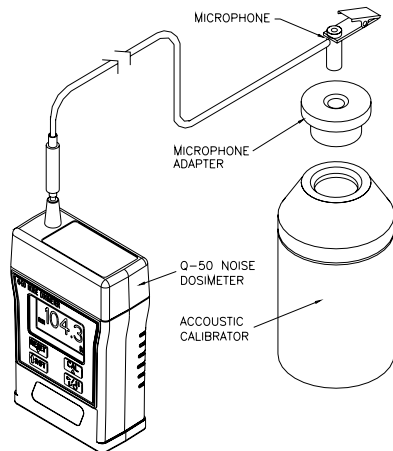
1.4 RESET - Erasing Stored Data

To erase the data in memory, the Q-50 must be in the PAUSE mode. Press and hold the shift and RESET key for five seconds. The display will count down from " rES5 " to " rES1 ". After five seconds the data memory will be cleared.

1.5 Calibration

Although the Q-50 will maintain accurate calibration over a long period of time, the calibration should be checked before each use. To check the calibration of the Q-50, perform the following procedure using a Quest calibrator.

1. Check that the **BAT** indicator is not on, indicating a weak battery.
2. Turn the calibrator ON. If optional, set the frequency to 1 kHz. Note the SPL of the calibrator. Make sure that the calibrator output is within the measuring range of the Q-50 (70 - 140dBA)
3. Insert the microphone fully into the microphone adapter ring.
4. Slowly place the calibrator onto the adapter/microphone.
5. Press **LEVELS**. Use the Δ or ∇ keys to set the Q-50 to read SPL. The display should read the proper level within 0.5dB.



NOTE: Most calibrators are affected by changes in altitude and barometric pressure. The rated SPL is set at standard barometric pressure at sea level (760 mm Hg). Consult your calibrator manual for correction factors.

NOTE: The Q-50 measures A weighted SPL and should be calibrated at a frequency of 1kHz, as the A weighting filter does not change the level of the signal at this frequency. If a calibrator of another frequency is used, the signal gain of the A weighting filter at that frequency must be taken into account. For example, at 250Hz the A weighting filter reduces the signal by 8.6dB. If a calibrator that produces an SPL of 114.0dB at 250Hz is used, the calibration level of the dosimeter must be set to 105.4dB. ($114 - 8.6 = 105.4$)

Performing a Calibration

By performing a calibration, the Q-50 will adjust its sensitivity to match the output of a known sound source such as an acoustic calibrator. If there is data in memory, the unit must be RESET prior to performing a calibration. (Refer to page ??) To perform a calibration, the Q-50 must not be in RUN mode.

Connect the microphone to the calibrator as directed in the previous section. Press both **↑SHIFT** and **CAL** keys to begin the calibration routine. The **CAL** indicator in the display will flash on and off for a short period of time and return to the data display. If the calibration fails, " FAIL " will appear briefly in the display.

1.6 Changing Measurement Parameters

When the Q-50 is first turned on, each of the measurement parameters is briefly displayed. These parameters may be changed during this display by simultaneously pressing **↑SHIFT** and **I/O** to freeze the display. The Q-50 must first have its data memory RESET before changing any of these parameters.

RESET the Q-50 by pressing and holding both **↑SHIFT** and **RESET** for five seconds while the display counts down from " RES5 " to " RES1 ". This erases any data in memory. Turn the Q-50 off by pressing and holding the I/O key for five seconds while the display counts down from " OFF5 " to " OFF1 ".

Press the I/O key to turn the Q-50 back on. At the desired display simultaneously press **↑SHIFT** and **I/O**. The display should stop and the colon should flash on and off. Use the Δ or ∇ keys to change the setting of the

th Threshold Level; Set level in dB, 00 (off) or 75 to 90
Er Exchange Rate; Set to 3 or 5 decibels
CL Criterion Level; Set level in decibels, 75 to 90
CAL Calibration SPL; Set level in decibels, 90.0 to 130.0

When the desired value is set, press the SHIFT key to proceed on to the next display.

1.7 Overload Detection

While viewing SPL, the overload indicator (OL) is displayed whenever the incoming signal is too large for the Q-50's circuitry. If an OL condition occurs while in the RUN mode, the OL indicator will light and remain on for the duration of the study.

Run time is limited to a maximum of 145 hours and 38 minutes. When this time is reached, the Q50 will automatically PAUSE and briefly display " FULL ".

1.8 Security Mode

The Q-50 may be locked into RUN mode to prevent tampering. While in RUN, simultaneously press I/O and Δ. The keypad has now been disabled and the display will read " SEC ". To unlock the keypad, press I/O and Δ again.

2. GENERAL SOUND MEASUREMENT PRACTICES

Before taking measurements with the Q-50 there is a series of quick checks that should be performed. After switching the unit ON, check for the LOBAT indicator in the display. Replace the battery if needed.

Although the Q-50 will maintain accurate calibration over a long period of time, the calibration should be checked and the calibration routine run, if necessary, before each use.

When performing integrating measurements, press the RUN/PAUSE key, making sure " RUN " is indicated in the display. It is always a good idea to document all measurement conditions and meter settings for possible future needs.

2.1 Microphone Positioning

The dosimeter measures sound most accurately without the presence of sound reflecting or absorbing objects. Any near-by object or surface (including the operator) will act as a reflector or absorber of sound. To minimize these errors, use the dosimeter as follows:

When taking Personal Noise Dosimeter Measurements:

Connect the Microphone to the shirt at the shoulder. (See Figure 7) Keep it high on the shoulder and away from the neck if possible.

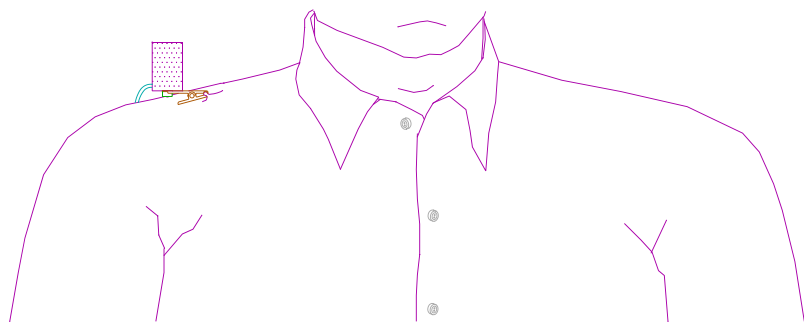


Figure 5. Placement of Microphone When Used as a Personal Monitor.

Install a Windscreen on the microphone. It holds the microphone in an upright position and keeps the microphone from brushing against clothing, which can produce high noise levels into the microphone.

2.2 Accuracy of Readings

For maximum accuracy, it is important to use the dosimeter correctly and to understand its limitations. It will correctly integrate all sound levels within the range of the instrument.

A few items related to accuracy are as follows:

The values (such as Leq) are computed to a precision of 0.1 dB. However, the absolute accuracy of the reading is not 0.1 dB, but is accurate to the stated overall accuracy of the instrument.

The 0.1 dB resolution is useful in determining the minimum sample time required to get an accurate short term measurement.

If, for example, the Leq is increasing 0.3 dB every second, then a longer sample time is required.

If the Leq is remaining stable from second to second within a few tenths of a dB, then the sample time is long enough.

2.3 Microphone Windscreen

It is recommended that a windscreen be used at all times. The Q-50 uses the WS-5 Windscreen. Using a windscreen will improve the accuracy by minimizing the effect of the following:

Wind blowing across the microphone can produce higher than normal sound level readings. The windscreen blocks wind from direct contact with the microphone, producing less unwanted noise.

Clothing brushing against the microphone can produce higher than normal sound level readings. The windscreen helps position the microphone so that clothing cannot brush against it as easily.

Dirt entering the microphone, in time, can damage the microphone, changing the microphone's frequency characteristics. The windscreen catches and collects this dirt before it enters the microphone.

Simply insert the microphone into the windscreen and gently pull it over the Velcro strip.

2.4 Background Noise

Background noise can cause considerable error in measurement when its level is close to that of the noise source of interest. When it is not possible to eliminate or reduce the background noise, use the curve shown in Figure 4 to correct for the effect of the background noise on the measurement.

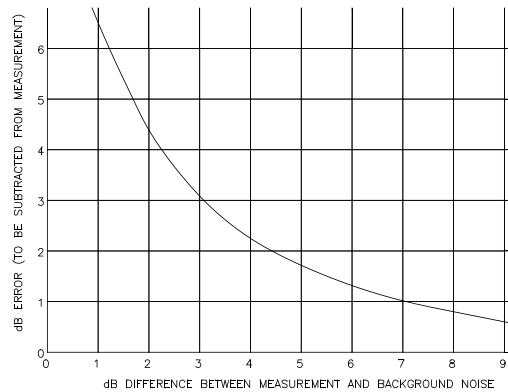


Figure 4 Effect of Background on Measurement

The effect of the "Noise Floor" on low level readings can cause inaccurate data. In a "Perfectly Quiet" room, the electrical noise floor of the Q-50 is approximately 50 dBA, well below the measuring range. Measured SPLs must always be at least 5 dB above the background noise to be valid. The Q-50 will not display SPLs below 70.0dB.

3. TECHNICAL INFORMATION

3.1 Principles of Operation

The Q-50 dosimeter uses low power state-of-the-art circuitry. The dosimeter is very stable and reliable over a wide range of environmental conditions. The low power circuitry gives the dosimeter a long battery life. When the battery is changed, all data and dosimeter setup information is

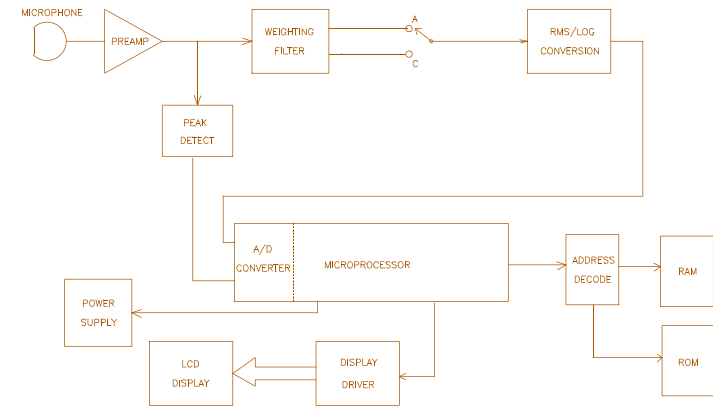


Figure 7. Block Diagram of the Q-200

3.2 Microphone Characteristics

The Q-50 uses an 8mm omnidirectional ceramic microphone. It is buffered by a high impedance FET input stage. (See Figure 6.)

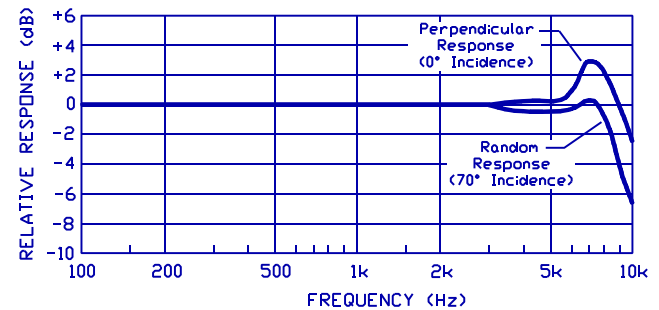


Figure 8. Q-300 Microphone Frequency Response.

3.3 Weighting Characteristic

The Q-50 uses the A frequency weighting characteristic (Figure 7). A weighting has a response similar to the human ear at low SPLs.

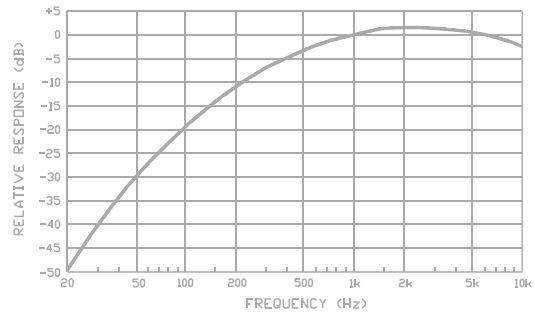


Figure 7. Weighting Characteristics

3.4 Tone Burst Response

Figure 8 shows the Q-50's tone burst response to sinewave inputs of varied burst duration. The available time constants are:

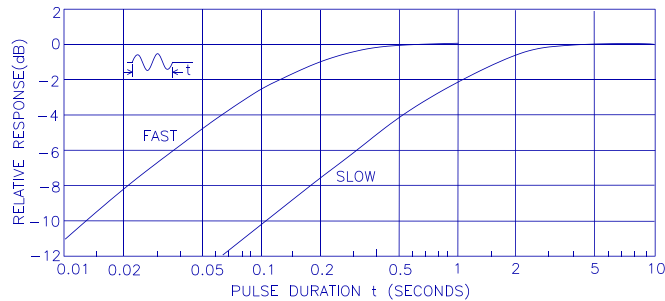


Figure 8. Q-50 Pulse Response

4. SPECIFICATIONS

Standards:	ANSI S1.25 - 1991, ANSI S1.4 - 1983: Type 2 IEC 651 - 1979, IEC 804 - 1985: Type 2 IEC 1252 - 1993
Measuring Range:	70-140dB Maximum level is for sinusoidal signals. A signal with a 10dB crest factor will be measured accurately if its RMS level is 10dB below the maximum level for the range.
Detector:	True RMS, 63dB Pulse Range
Microphone:	8mm Shoulder-Mount, Type 2.
Battery:	Single 9-volt alkaline typically provides 80 hours of operation
Integration Time:	145 hours and 38 minutes maximum.
Temperature:	-10° to +50°C operating; -20° to +60°C storage (battery removed)
Humidity:	0 to 95% non-condensing
Electromagnetic Field Effects:	Negligible below 50 Oerstedes at 50 to 60 Hz. Tested for RF susceptibility with <1dB error at field strengths to 10 V/m over the frequency range of 10 MHz to 500 MHz.
Size:	5.5 x 2.8 x 1.4 inches (140 x 70 x 40 mm)
Weight:	8oz. (255 grams) including microphone cable strain relief

Note: Specifications subject to change.

5. ACCESSORIES

- 58-452 WS-5 Windscreens, package of 10.
- 58-852 Earloops to hold microphone at the ear, package of 10.
- 56-830 Clothing Clips, package of 5, for microphone cable.
- 56-981 QC-10 Calibrator; 114dB at 1000 Hz Output
- 56-982 QC-20 Calibrator; Selectable 94dB or 114dB at 250 Hz or 1000 Hz Output
- 56-989 Calibrator Adapter, 8 mm to 1 inch coupler. Fits QC-10 and QC-20.
- 58-839 Calibrator Adapter, 8 mm to 1 1/8 inch coupler. Fits older Quest Calibrators models CA-12, CA-15, CA-22 and CA-32.

6. TROUBLESHOOTING

Blank display when the **ON/OFF** key is pressed:

Replace the battery with a known fresh battery.

Unit does not calibrate:

Check for BAT indicator. Battery must check OK.

Check the Calibrator; Listen for a tone from its output.

Reset the dosimeter and try again.

Return for service.

APPENDIX

Acoustical Definitions

All definitions are in reference to the Q-50 dosimeter.

CL: Criterion Level

The constant sound level in dB that, if applied for 8 hours, would accumulate a DOSE of 100%. (Used in Dose measurements.)

DOSE: Dose

A percentage of the maximum allowable noise that a worker can be exposed to per day. This is a computation that is based on the following variables: Criterion Level (CL), Threshold Level (TH), and Exchange Rate (ER).

ER: Exchange Rate

The number of decibels that a sound must change to either halve or double the rate of dose accumulation.
(3 and 5dB exchange rates are common.)

EXP: Exposure

A method of measuring noise exposure, in Pascal Squared Hours. Pa²H is a linear unit rather than a percentage.

1 Pascal is equal to 94 dB. 94 dB for 1 Hour equals 1 Pa²H.

Examples of the 94 dB/time relationship:

94 dB for 1 Hour = 1.00 Pa²H
94 dB for 8 Hours = 8.00 Pa²H

The accumulation of Pa²H will double (or halve) for every 3 dB of change from 94 dB as follows:

97 dB for 1 Hour = 2.00 Pa²H
94 dB for 1 Hour = 1.00 Pa²H
91 dB for 1 Hour = .50 Pa²H
88 dB for 1 Hours = .25 Pa²H
85 dB for 1 Hours = .125 Pa²H

1 Pa²H is typically the maximum allowable Exposure.

85 dB for 8 Hours = 1 Pa²H

FAST: Fast Response

A Measurement Time Constant, or averaging time, of 125 milliseconds.

LAVG: Average Level

The average sound level, in decibels, for the measurement period based on a 5dB Exchange Rate (ER). If the Exchange Rate (ER) is 3 dB, then LAVG becomes LEQ.

LEQ: Equivalent Continuous Sound Level

The average sound level for the measurement period based on a 3 dB Exchange Rate (ER) and no threshold.

If the Exchange Rate is 5dB, then LEQ becomes LAVG.

MAX: Maximum Level

The highest sound pressure level, in decibels, that occurs during a given time period.

SLOW: Slow Response

A Measurement Time Constant, or averaging time, of 1 second. When Slow is used, SPL will not track a quickly fluctuating noise source, but will produce an averaged reading.

SPL: Sound Pressure Level

A quantity in decibels equal to the sound pressure divided by 20 uPa (0.00002 N/m²), times 20. The word "Level" indicates that the sound pressure is a certain level above the reference level. The SPL is displayed each second as the maximum value (Slow or Fast Response) for the previous 1 second period.

TL: Threshold Level

A preset level in decibels below which sound is not accumulated or averaged into LAVG or Dose.

Typical Setups

OSHA NOISE COMPLIANCE

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

OSHA HEARING CONSERVATION

Threshold = 80dB Exchange Rate = 5dB
Weighting = A Response = Slow

IEC NOISE MONITORING

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

Acoustical Formulas

The Q-50 uses the following formulas to calculate the accumulated data:

$$Dose = \frac{100}{TC} \left[\int_0^{RTIME} 2^{(LS-CL)/ER} dt \right]$$

$$L_{EQ} = 3.01 \left[LOG_2 \int_0^{RTIME} 2^{LS/3.01} dt - LOG_2 (RTIME) \right]$$

$$L_{AVG} = ER \left[LOG_2 \int_0^{RTIME} 2^{LS/ER} dt - LOG_2 (RTIME) \right]$$

$$Pa^2H = \left[2^{(L_{EQ}-94)/3.01} \right] \frac{RTIME}{3600}$$

Where:

- LS = Sound Level in dB with the selected Time Constant (Slow or Fast). Its value is entered only if the Sound Level is greater than the Threshold Level. Otherwise, it is entered as minus infinity.
- TC = Criterion Time of 28800 seconds, or 8 hours.
- RTIME = Run Time in seconds.
- ER = Exchange Rate in dB. (Selectable 3 or 5 dB)
- CL = Criterion Level in dB. (Selectable 75 to 90 dB)
- TS = Total Samples. The total number of samples during the Run Time.

For definitions of the following, See APPENDIX, Acoustical Definitions:

DOSE	CL	LAVG
ER	LEQ	Pa ² H (Exposure)

QUEST SERVICE AND WARRANTY POLICY

Service Policy

The Quest product you have purchased is one of the finest acoustic instruments available. It is backed by our full one year warranty which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at 1(800)245-0779 (USA) or Fax (262)567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 1060 Corporate Center Dr., Oconomowoc, WI 53066 U.S.A..

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 8 AM to 5 PM (Central Standard Time) Monday through Friday.

Warranty

Quest Technologies warrants our instruments to be free from defects in materials and workmanship for one year under normal conditions of use and service. For U.S.A. customers we will replace or repair (our option) defective instruments at no charge, excluding batteries, abuse, misuse, alterations, physical damage, or instruments previously repaired by other than Quest Technologies. Microphones, sensors, printers and chart recorders may have shorter warranty periods. This warranty states our total obligation in place of any other warranties expressed or implied. Our warranty does not include any liability or obligation directly resulting from any defective instrument or product or any associated damages, injuries, or property loss, including loss of use or measurement data.

For warranty outside the U.S.A., a minimum of one year warranty applies to the same limitation and exceptions as above with service provided or arranged through the authorized Quest sales agent or our Quest European Service Laboratory. Foreign purchasers should contact the local