

db-2200

Sound Level Meter

Operator's Manual



Thank you for choosing Metrosonics to meet your sound measuring needs. The Metrosonics db-2200 sound level meter is a light weight easy-to-use type 2 instrument. It is our goal to make your decision to purchase a Metrosonics brand product the right one, and to provide support for any questions or concerns that might arise.

The purpose of this manual is to provide the user with all the necessary information to operate the db-2200 sound level meter. The entire manual should be read to fully understand the many features this instrument offers.

This manual is not all inclusive and cannot cover all unique situations. In addition no warranties are contained in this manual except as described under the warranty policy section.

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1. Introduction

The Metrosonics Brand model db-2200 is an Impulse and Integrating sound level meter for measuring frequency weighted and time averaged SPL, weighted or unweighted peaks or frequency weighted LEQ. Applications include laboratory, industrial, community, military and audiometric measurement or analysis.

The model db-2200 is an easy-to-use hand held meter with an LCD display that provides a numerical readout. It is housed in an R.F. shielded injection molded case. The meter is operated with simple slide switches. An output jack on the bottom of the meter is provided for connecting to peripheral devices such as chart recorders, oscilloscopes, audio recorders, etc.

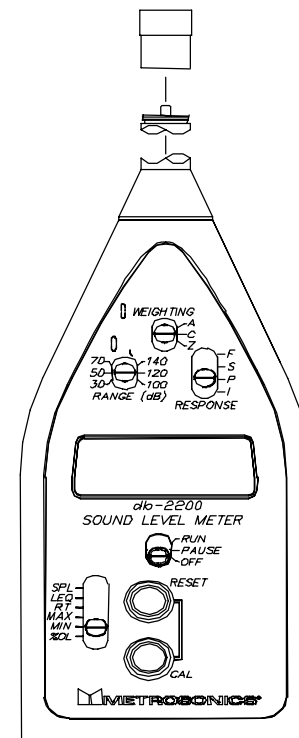


Figure 1. Model db-2200

2. General Overview

The Display:

The LCD display provides a numeric readout in 0.1dB increments along with a LOBAT (Low Battery) indicator. The LOBAT indicator will turn on when the voltage of the battery is too low to allow an accurate reading.

A plus sign '+' will appear on the left side of the display if signal peaks cause an overload condition in the electronics. If the signal falls below the measuring range, 'UR' (Under Range) will be displayed.

Meter Controls:

OFF/PAUSE/RUN Switch

OFF – In this position the power is removed from the instrument.

PAUSE – In SPL mode the meter continuously displays sound pressure level. In other modes the meter will display currently logged RUN time or '---' if no RUN time has been accumulated. The meter display is automatically updated at a rate of once a second.

RUN – Causes the meter to begin calculating the frequency weighted equivalent continuous SPL. All SPL measurements are integrated into a single number representing the SPL for the entire measurement period. This measurement will continue until the meter is placed into the pause mode or reset. Maximum RUN time is 100 Hours, or as long as the battery lasts.

SPL/LEQ/RT/MAX/MIN/%OL Display Mode Switch

This six-position switch determines the display mode of the meter as follows:

SPL – In the SPL mode the numeric display provides a reading of the sound pressure level measured during the previous second.

LEQ – In the LEQ mode, the display indicates the integrated, or average level for the RUN period. If no RUN time has been accumulated, the display shows dashes.

RT – In the RT mode the display shows the elapsed time of the current or last RUN. The RT mode consists of two or three displays. The first is RUN time seconds ':XX'. The second is RUN TIME hours/minutes 'XX:XX'. Pressing the CAL button while in the RT mode toggles the meter between these two displays. If the RUN time exceeds 20 hours, a third display shows up to 99 'h:XX'. If no RUN time has been accumulated the display shows dashes.

MAX – In the MAX mode the display holds the highest reading encountered during the RUN period. If no RUN time has been accumulated the display shows dashes.

MIN – In the MIN mode the display holds the lowest reading encountered during the RUN period. If no RUN time has been accumulated the display shows dashes.

%OL – In the %OL mode the display shows the time that the circuitry has been overloaded as a percent of RUN time. If no RUN time has been accumulated the display shows dashes.

FAST/SLOW/PEAK/IMP Response Switch

The Response Switch controls the rate at which the meter responds to changing input levels. Most sound measurements are done with the Response Switch set to SLOW (S). The FAST (F) response is usually used when measuring short duration noises such as moving vehicles. PEAK (P) is useful when measuring the absolute peak of the sound pressure wave. IMPULSE (I) is used for measuring transient noise or sounds of short very short duration.

The Response Switch characteristics are as follows:

- FAST (F) – 125 millisecond time constant. (See Fig 8)
Decay Rate = 34.7dB/Sec
- SLOW (S) – 1 second time constant. (See Fig. 9)
Decay Rate = 4.35dB/Sec.
- PEAK (P) – 50 microsecond time constant.
- IMPULSE (I) – 35 millisecond time constant. (See Fig 10)
Decay Rate = 2.9dB/Sec.

A/C/Z Weighting Switch

The A/C/Z switch sets the frequency response of the unit.

Range (dB) Switch

The displayed range of the model dB-2200 is 70dB and is switchable between the following ranges: 30-100dB, 50-120dB and 70-140dB. After switching ranges allow several seconds to allow the meter electronics to stabilize. If a range change is necessary during an LEQ study, it is a good practice to first set the meter to LEQ PAUSE, change the range and then set the meter to RUN. This will avoid integrating any handling or switching noise into the LEQ measurement.

RESET Button

This button is used primarily to clear the instrument's data memory. When pressed, the instrument will display a countdown starting at '02'. If the button is pressed and held, the instrument will count down until dashes are displayed ('---'). At this point the data memory is clear.

This button also has a secondary function, which is to act as an up-arrow button during setup. (More on this in the operation section.)

CAL Button

This button has three functions:

- 1) It initiates a calibration.
- 2) It toggles between RUN TIME displays.
- 3) It acts as a down arrow during setup.

(More on this in the operation section)

Output Jack

The model dB-2200 provides an output jack on the bottom of the meter for measuring the weighted AC signals before the rms/log detector and the DC output of that detector. Both signals are real time so calculated values such as LEQ are not available here. This jack may be connected to any load without affecting the operation of the meter. Connection to low impedance loads will require correction as the nominal output impedance of the outputs is 1Kohm. Low impedance loads will also shorten battery life.

The output jack takes a 3.5mm stereo plug. See fig. 2

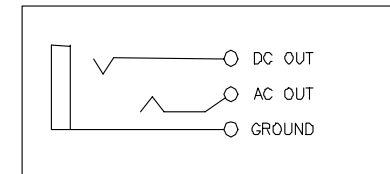


Figure 2. Output Jack Connections

DC Output Function

The SPL or PEAK level over the range selected is linearly represented by the DC output. The output changes 16.7mV/dB or 1V/60dB. This output is provided for connecting a 0 to 1 volt span data recorder. (See section labeled Data Recording, Page 11)

AC Output Function

This jack provides the amplified, frequency weighted AC signal at the input of the RMS detector.

3. Meter Integrity

Power On and Battery Checks

Set the OFF/PAUSE/RUN switch to either the PAUSE or RUN position as desired. Other than at initial turn on, if the LOBAT indicator is displayed, the user must replace the battery. A 9 Volt alkaline battery is recommended for best overall performance.

Battery Replacement

Slide the battery door, (located on the bottom of the unit), to the left to open the battery compartment. Refer to the sticker inside the compartment for proper battery orientation.

Rechargeable Batteries

NiMH type rechargeable 9V batteries, such as the Radio Shack® 23-526 (8.4V, 150mAh), and an appropriate charger may be used with the db-2200. It should be noted however, that the fact that these batteries when fully charged only put out about 8.4VDC will significantly shorten battery life. A Radio Shack 23-526 will only operate for about 8hrs before recharging will be required. At the appearance of the LOBAT indicator, these batteries must be recharged.

Nicad (Nickel-cadmium) batteries are NOT recommended.

Setup

There may be times when it is necessary to change the exchange rate or calibration level that is stored in the meter. Both of these items are accessible during the power up sequence.

Changing The Exchange Rate

Turn on the meter and observe the display. When 'Er3' or 'Er5' appears on the display, press both the CAL and RESET button simultaneously until dashes are displayed. At this point pressing either the CAL or RESET button will toggle the exchange rate between 'Er3' and 'Er5'. When the desired exchange rate is displayed, store the selection by pressing both the CAL and RESET buttons simultaneously. This completes the exchange rate selection.

Changing the Calibration Level

Turn on the meter and observe the display. When the calibration level is displayed, press and hold the RESET and CAL buttons simultaneously until dashes appear. To edit the calibration level, use the RESET key to increase the value and use the CAL key to decrease the value. Edit the value to match your calibrator's output. When the desired calibration level is displayed, press and hold the RESET and CAL buttons until dashes appear on the display. This stores the instrument's new calibration level in memory and will not need to be changed again, unless an alternate calibrator is used.

Calibration

It is recommended that the instrument be calibrated before each use. The model db-2200 may be calibrated in any range with a measurement capability greater than your calibrator's output. There is no warm up period required, but for maximum calibration accuracy the calibration should be performed at the temperature of the environment where the study will take place.

To calibrate the instrument, perform the following procedure:

- 1) Turn on the db-2200 and verify that the LOBAT indicator is not on. Replace the battery if necessary.
- 2) Verify that the calibration level stored in the instrument matches the calibrator's output level. If it does not refer to the section titled "Changing the Calibration Level" above.
- 3) Turn the calibrator on and if optional, set the frequency to 1KHz.
- 4) Carefully place the proper sized calibrator adaptor onto the microphone and the calibrator onto the adapter using downward pressure and a slight twisting motion until the calibrator and adaptor are fully seated.
- 5) Set the db-2200 to SPL, PAUSE, SLOW or FAST and A or C weighting. Set the measuring range so that the calibration level falls within it.
- 6) If the db-2200 has data in it's memory, it must be cleared

before calibration is possible. To do this press and hold the reset button. For more details see the section labeled “Reset Button” on page 4.

- 7) Press and hold the CAL button until ‘CAL’ appears in the display. Release the button. Three dashes will appear and then disappear one at a time as the meter calibrates. Upon completion of the calibration, a final message of ‘PAS’ or ‘BAD’ will appear on the display. If ‘Bad’ review steps one through five.

Calibration Check

It is a good idea to verify calibration after use. To do so, perform the first five steps of the calibration procedure listed above. Verify that the displayed level is within 0.5dB of the calibrator’s stated output. If out of tolerance, repeat the above listed calibration procedure.

Switch Settings to Select Measurement

Set Switches To:	To Measure	Display
SPL, A, C or Z, RUN or PAUSE, RESPONSE of interest	SPL	1 Second Update
LEQ, A, C or Z, RUN, RESPONSE of FAST, SLOW or IMPULSE	LEQ	Holds LEQ until RESET or Meter SETTING is changed
MAX, A, C or Z, RUN, RESPONSE of Interest	MAX HOLD	Holds MAX until RESET or Meter SETTING is changed
MIN, A, C or Z, RUN, RESPONSE of FAST, SLOW or IMPULSE	MIN HOLD	Holds MIN until RESET or Meter SETTING is changed

During an LEQ RUN, weighting, response and range switch settings can not be changed. If these switches values are changed, the LEQ measurement will stop, reset and start again.

4. Operation

Before taking any measurements, there is a series of quick checks that should be performed. After turning the unit on, check for a LOBAT indication on the display and replace the battery if required. (See Battery Replacement, Page 6)

Although the model db-2200 will maintain accurate calibration over a long period of time, the calibration of the instrument should be checked prior to each use. It is also a good practice to verify the calibration upon completion of each study.

Set the RESPONSE, WEIGHTING and RANGE(dB) switches as needed. Hold, set or tripod mount the meter in the desired location. If a MAX, MIN or LEQ measurement is required, be sure to reset the meter before taking the measurements. It is a good practice to document all measurement conditions and meter settings for possible future reference.

Meter/Microphone Placement

Whenever possible, the meter should be tripod-mounted in a relatively open area to minimize reflections from the body or other large reflective structures. Avoid placement against a wall or in a corner. A threaded bushing on the back will accept a standard ¼ -20 tripod fitting.

The microphone cartridge used on the model db-2200 is a free-field microphone. Point it directly at the noise source (0 degrees).

Background Noise

Background noise can cause considerable error in measurement when its level is close to that of the particular sound source of interest. When it is not possible to eliminate or reduce the background noise, use the curve shown in figure 3 to correct for the effect of the background noise on the measurement.

For example, if the background noise is 45dB and the sound of interest measures 51dB, the difference between measurement and background noise is 6dB. From Fig 3, for a difference of 6dB, 1.3dB should be subtracted from the measurement. The correct measurement therefore is 51dB – 1.3dB or 49.7dB.

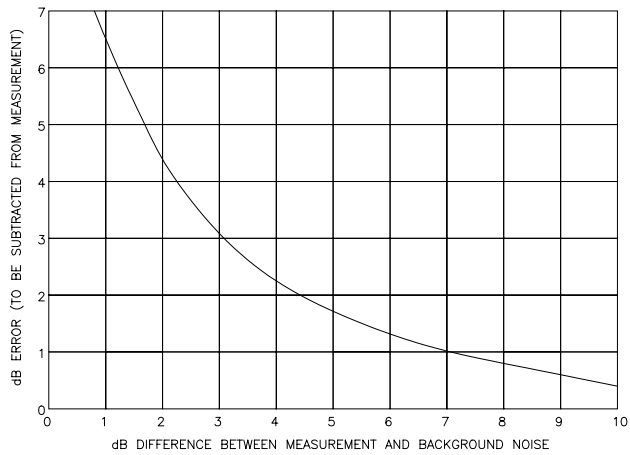


Figure 3. Effects of Background Noise

Wind Screen Effects

To prevent measurement errors caused by wind blowing across the microphone, the use of a windscreen is recommended. The windscreen will reduce wind effects and will also help to protect the microphone under dusty, oily or humid conditions. Acoustic attenuation effects of the windscreen (WS-7) are shown in figure 4.

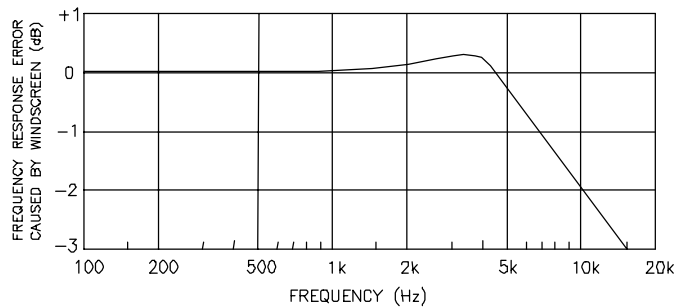


Figure 4. Effects of Wind Screen

Data Recording

The model db-2200 has a DC output that is linearly related to the decibel reading on the LCD display by 16.7mV/dB (1V/60dB).

This output, capable of driving up to 100 feet of shielded or twisted pair cable, is intended for use with a chart recorder or data acquisition device that has a high input impedance. The DC output impedance is 1000 ohms. Recorder input resistance may cause loading of this output, which should be taken into account. Multiplication factors for the above numbers are given in the table below for various recorder input impedances.

Input Impedance of Recorder	Multiply DC Voltage By:
10 KOhm	1.100
20 KOhm	1.050
50 KOhm	1.020
100 KOhm	1.010

5. Technical Information

Principles of Operation

The model db-2200 uses low noise, low power analog and digital integrated circuitry to ensure long battery life, maximum stability and superior reliability over a wide range of environmental conditions. Figure 5 is block diagram of the model db-2200 internal circuit operations.

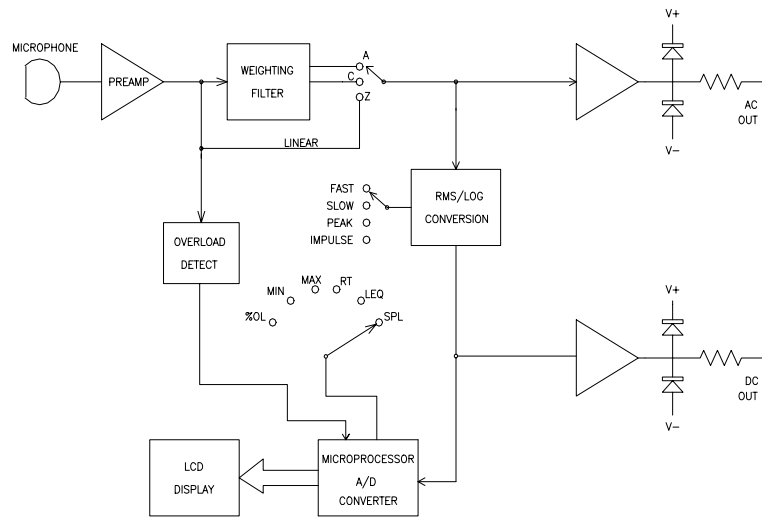


Figure 5. db-2200 Block Diagram

Microphone

The model db-2200 is designed to accept a pre-polarized (electret) Type 2 microphone, P/N 056-316 (QE7052). The Capacitance of this microphone is 15pF. The microphone screws directly onto the fixed microphone extension of the meter case. A typical response curve for the Type 2 microphone is shown in figure 6.

Caution! When installing or removing the microphone, do not unscrew the protective grid. Do not touch the metal foil microphone diaphragm under this grid or permanent damage could result!

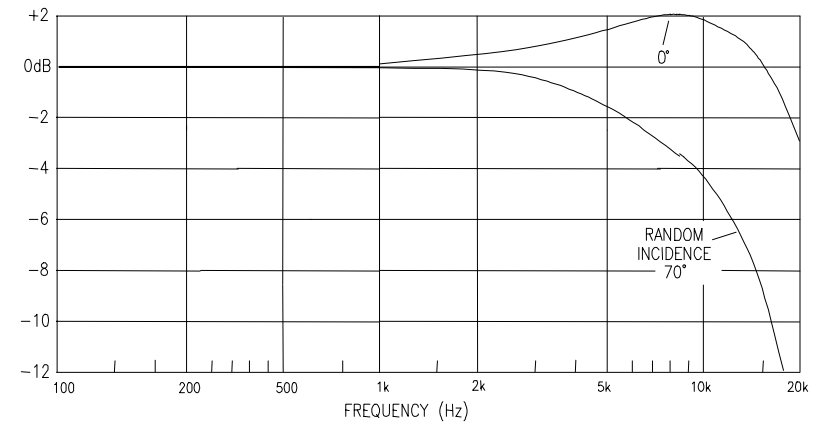


Figure 6. Typical Type 2 Microphone Response

Weighting Characteristics

The weighting characteristics (frequency response) for A, C and Z are shown in figure 7. The “A” weighting response emulates the response of the human ear and is used for most industrial and community noise measurements. Generally, “C” weighting is used for measuring noise reduction in hearing protectors and for other scientific purposes. “Z” is a linear response from 5Hz to 20kHz.

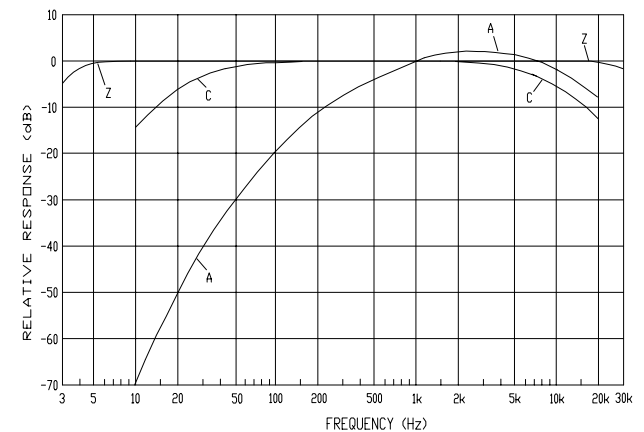


Figure 7. A, C and Z weighting

Tone Burst Response

Figures 8, 9 and 10 show how the meter responds to a sine wave input of varied pulse duration for each response setting.

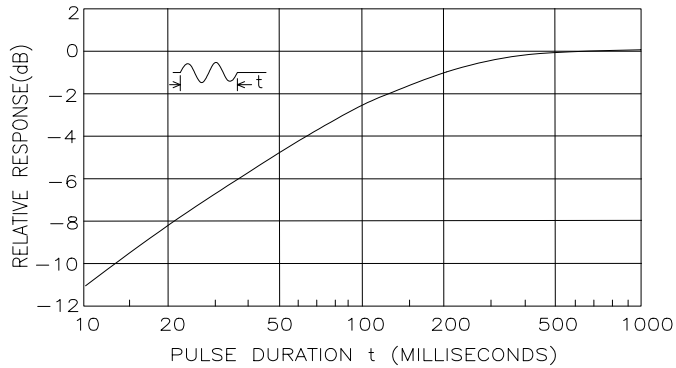


Figure 8. Fast Response

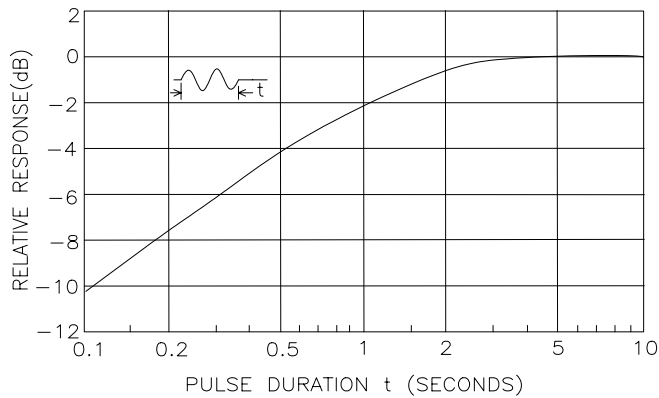


Figure 9. Slow Response

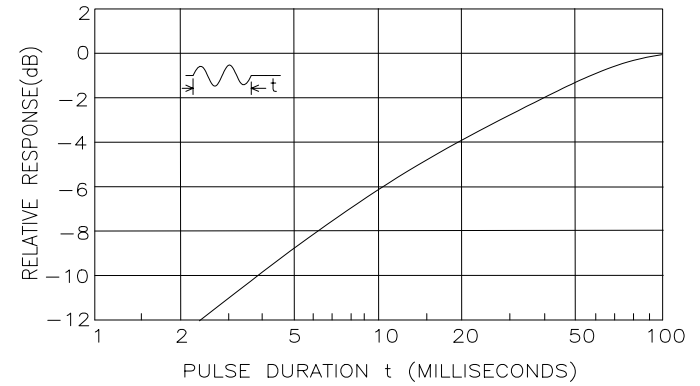


Figure 10. Impulse Response

Nominal decay times for each time response setting are as follows:

- FAST – 34.7 dB per second
- SLOW – 4.35 dB per Second
- IMPULSE – 2.9 db per second

PEAK measurements have a rise time constant of 50 μ S. The displayed value is the highest peak occurring prior to a reset. Resets occur every second in PAUSE. When the meter is in RUN a manual reset is required.

6 Specifications

Standards:	Model db-2200: Type 2 ANSI S1.43-1997, ANSI s1.4-1983 (R1997) IEC 651-1979, IEC 804-1985
Display:	3 ½ Digit Liquid Crystal Display. Level display indicates to 0.1 dB resolution. An enunciator is included for battery check.
Modes of Operation:	Measures sound pressure level (SPL) maximum level (MAX), minimum level (MIN), and equivalent continuous sound pressure level (LEQ).
Range:	30 to 140 dBA SPL, 43 to 143 dBA PEAK 40 to 140 dBC SPL, 43 to 143 dBC PEAK 40 to 140 dBZ SPL, 43 to 143 dBZ PEAK
Pulse Range:	63 dB
Electrical Noise Floor:	26 dBA typ., 30dBC typ., 35 dBC typ.
Frequency Weighting Networks:	A, C and Z
Meter Response:	Fast, Slow and Impulse or Peak (50µS Rise Time Constant).
Microphone:	Removable 0.52 Inch (13.5mm) prepolarized condenser (electret) microphone. Model db-2200 – Type 2 accuracy P/N: 056-317 QE 7052
AC Output:	Approximately 0-1 Volt AC RMS 1 Kohm output impedance, 3.5mm stereo jack.
DC Output:	Approximately 0-1 Volt DC Each 0.167V change equals 10dB (1V/60dB) 1 Kohm output impedance, 3.5 mm stereo jack
Detector:	True RMS

Integration Time:	Signal Dependent – approximately 2.5 hours at a constant 140dB SPL. Time will double with each 3dB decrease in average SPL, until limited by battery life.
Overload Indication:	a '+' sign in the display indicates overload during LEQ measurement.
Accuracy:	Within 0.5 dB at 23°C ; Within 1.0 dB over the temperature range of -10°C to +50°C.
Level Range Accuracy:	+/- 0.7dB from 31.5 – 8000 Hz
Temperature Range:	Operation: -10°C to +50°C
Storage (less batteries):	-20°C to + 60°C
Operating Humidity:	0 to 95% relative humidity, non-condensing.
Effect of Electromagnetic Fields:	Negligible.
Effects Of Electrostatic Fields:	Negligible
Battery:	One 9 Volt alkaline battery ANSI/NEDA Type 1604A or IEC: Type 6LR61 Typical: Energizer 522 (Quest 058-176)
Battery Life:	9 Volt alkaline, approximately 25 hours 9 Volt NICAD, approximately 8 hours
Size:	2.8 x 7.6 x 1.3 inches (including mic)
Weight:	10.3 oz. (293 g.) including battery

7 Accessories

56-990	Calibrator adaptor for 0.50-inch diameter microphone for Metrosonics Brand QC-10M Calibrator.
59-344	WS-7 Windscreen for 0.50 inch microphone.
59-045	Large Tripod
59-046	Small Tripod
59-703	Input Adaptor – Female BNC jack to ½ microphone thread, with 18pF of capacitance. Allows direct electrical signal input to the meter.

Quest Service Policy

Congratulations! You have purchased one of the finest instruments available, manufactured by one of the most respected names in safety & industrial hygiene instrumentation. Your instrument is backed by a limited warranty that seeks complete customer satisfaction. Should your instrument require service for any reason, you can expect prompt and courteous attention.

You must obtain a return authorization prior to shipment. We reserve the right to refuse any shipments forwarded without prior authorization.

The following information will expedite the service process and is required when obtaining return authorization:

1. **Model and serial number of each instrument.**
2. **Description of work required and symptoms of any failures for each instrument.**
3. **VISA, MasterCard or American Express credit card -- or -- company purchase order number (non-warranty service only).**
4. **Billing and/or return shipping addresses.**

Use one of the methods below to obtain return authorization, service pricing and shipping instructions.

International Customers

Contact your local, factory-authorized distributor from whom the product was purchased. To obtain the name of the local factory-authorized distributor, contact us via email at service@quest-technologies.com, via telephone at +(1)-262-567-9157 or via fax at +(1) 262-567-4047.

U.S.A Customers Only

- **Go to the service section of our web site at www.quest-technologies.com.**
- **Contact us via email at service@quest-technologies.com**
- **Contact us at (800) 245-0779. Office hours are 8:00 AM to 5:00 PM U.S. Central Time.**

Warranty Policy

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 subject 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 Quest authorized sales agent for details.



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