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Concord, Massachusetts 01742

Printed in USA

INSTRUCTION MANUAL

GR 1983-9730
SOUND-LEVEL METER

GenRad

Concord, Massachusetts 01742

INSTRUCTION MANUAL

GR 1983-9730 SOUND-LEVEL METER

(GR 1983-9910 and -9915 SLM Sets)

This instrument is capable of making sound-level measurements required under Part 1910.95 "Occupational Noise Exposure," (Dept. of Labor) of the Code of Federal Regulations, Chap. XVII of Title 29 (36 F.R. 7006).

Certified by California Highway Patrol as meeting ANSI S1.4 Standards.

These instruments carry U.S. Bureau of Mines, Mining Enforcement Safety Administration approval for use in methane-air mixture only. Approval Number 2G-2793.

1983-0150-A
July 1976
ID-6312

CONCORD, MASSACHUSETTS 01742

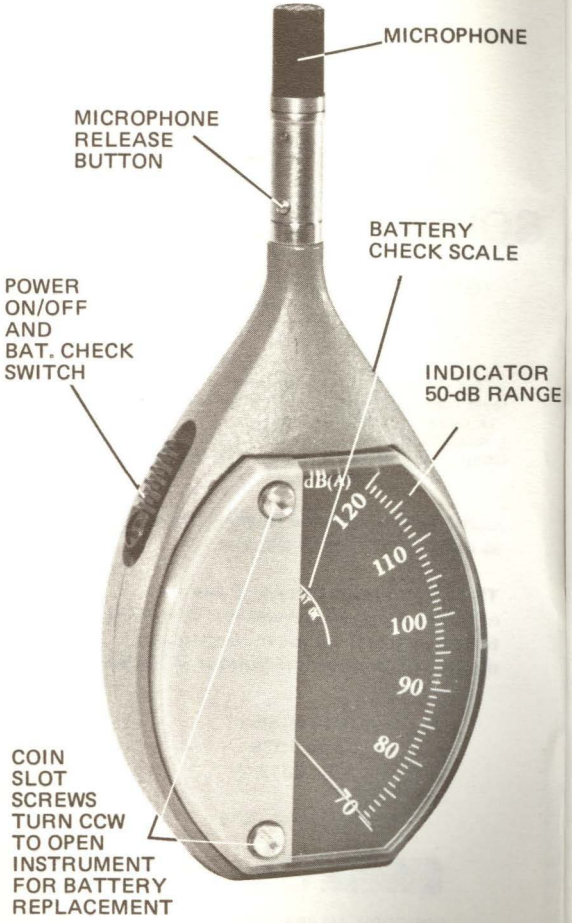


Figure 1-1. Sound-Level Meter Controls and Indicators.

WARRANTY

This product is warranted to be free from defects in material and workmanship and, when properly used, will perform in accordance with specifications. Any GR-manufactured instrument, module or part, found not to meet this standard within a period of one year after original shipment will be repaired or replaced at no charge when returned to a GR service facility.

GR policy is to maintain repair capability for a period of ten years after the original shipment and to make this capability available at the then prevailing schedule of charges for any product returned to a GR service facility. Changes in the product not approved by GR shall void this warranty. GR is not liable for consequential damages.

This warranty is in lieu of all other warranties, expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

The information in this manual is in compliance with Section 1036 of the Exhaust System Certification Law of the California Highway Patrol, effective January 1, 1977, and the GR 1983 has been certified by the California Highway Patrol as meeting ANSI S1.4 Standards for Sound-Level Meters.

1983 CONDENSED OPERATING INSTRUCTIONS

- Remove and retain protective cap on microphone.
- Slide switch toward base of instrument and observe that meter reads above battery line. If it does not, replace battery. (See para. 3.1.)
- Slide switch toward microphone to turn on meter. A slight inward pressure at microphone end of switch locks instrument in ON position. Depressing other end of the switch releases the lock.
- Point the microphone at right angle to the direction of the noise path, keeping your body out of the path. (See Fig. 3-2).
- Periodically calibrate the sound-level meter with a GR 1562 or 1567 Sound-Level Calibrator.

CAUTION

If continuous noise exceeds 115 dB (A) slow, immediate use of protective ear muffs or plugs is indicated.

Battery Installation
See page 9.

SPECIFICATIONS

STANDARDS

Meets the following: ANSI Standard Specification for Sound-Level Meters S1.4-1971, Type S2A; IEC Recommendation Publication 123,1961, Sound Level Meters.

SOUND LEVEL RANGE

Measurement Range: 70 to 120dB re 20 $\mu N/m^2$ (micropascals, μPa).* Input preamplifier including microphone (prior to weighting network) will handle sound pressure levels of at least 145dB at any frequency in the range between 20Hz and 10kHz.

FREQUENCY RESPONSE

A weighting in accordance with above standards.

DETECTOR AND METER CHARACTERISTICS

Meter: Single 70 to 120-dB scale, linear in dB.

Detector Response: Slow, in accordance with above standards. True RMS, with crest-factor capacity of X5 at full scale. (Jumper on etched board allows selection of fast response in accordance with standard.)

MICROPHONE

Ceramic microphone with flat random-incidence response.

D-C OUTPUT

Behind 100 kΩ, 0.25 V at full scale (120 dB). Output can be short circuited without degrading SLM performance.

Specifications (continued)

CALIBRATION

Can be pressure calibrated at 1000 Hz with 1562 or 1567 Sound-Level Calibrator.

POWER

One 9-V battery (Burgess 2U6 or equivalent) produces approximately 60 hours of continuous operation.

SUPPLIED

Battery
Screwdriver
Miniature plug to connect to output
Carrying pouch

ENVIRONMENTAL

Temperature: Operating, −10 to +50° C; −40 to +60° C storage, with batteries removed.

Humidity: Operating, 0 to 95% RH.

Vibration: Complete instrument able to withstand .030 in. peak-to-peak vibration 10 to 55 Hz.

Magnetic Fields. Reads less than 70 dB when placed in a 50 to 60 Hz magnetic field of 25 oersteds.

MECHANICAL DATA: Width: 3.50 in., 88.90 mm, Height: 7.950 in., 201.9 mm, Depth: 1.87 in. 47.50 mm, Net Weight: 12 oz., 0.34 kg.

*Ref: "The International System of Units (SI)", U.S. Dept. of Commerce, National Bureau of Standards, NBS Special Publication 330. SD Cat. No. C 13.10:330/2,U.S. GPO, Wash., D.C., 20402.

U.S. Patent No. 3,681,618

1. **Sound Level Calibrator (Bu Mines Approved)**
2. **Carrying Case**
3. **Remote Cable**
4. **Microphone Windscreen**
5. **Tripod**
6. **SLM – 1983**

GR 1983-9910 SLM Set
(GR 1983-9915 Set same less items 3 and 5)

Section 1
INTRODUCTION

1.1 GENERAL

Sound (or noise) is basically a rapid variation in atmospheric pressure, and a sound-level meter (SLM) is an instrument that measures weighted sound pressure-level. A measurement of sound is accomplished by changing a noise into an electrical signal and displaying it on an indicator in terms of decibels (dB).

The apparent loudness that we attribute to a sound varies not only with the sound pressure but also with the frequency (or pitch) of the sound. How it varies with frequency depends on the sound pressure. This effect is taken into account to some extent for pure tones by "weighting" networks included in the SLM.

The above points are illustrated briefly in other literature available free from GenRad. For a more comprehensive work on noise, our ***Handbook of Noise Measurement*** for $7.50 contains 328 pages of detailed information on how to solve your noise problems.

1.2 PURPOSE

The basic instrument of the General Radio sound-measuring-equipment line is the sound-level meter (SLM). The 1983 (Figure 1-1) is a Type S2A SLM. A Type S2A instrument is a special-purpose SLM, A-weighting only, meeting the requirements of Type 2 as specified by the American National Standards Institute (ANSI) standard specification, S1.4-1971, for sound-level meters. It also meet requirements of IEC (International Electrotechnical Commission) specification R-123 (1961).

The chief use of the 1983 SLM is for noise measurement, to insure compliance with OSHA (Occupational Safety and Health Act of 1970, 84 Stat. 1593). Refer to para 3.9 for a discussion of this law.

Measuring vehicle noise is another application for the 1983 Sound-Level Meter. Refer to para 3.10 and 3-14 for details of the measurement.

1.3 DESCRIPTION

1.3.1 General

The instrument is housed in a high-impact Lexan molded case that is shaped for comfortable hand-held operation and tapered at the microphone end to minimize the effect of case diffraction. It consists of the following elements: a microphone to pick up sound; an A-weighting network to adjust frequency characteristic, an amplifier, a wide-range true-rms detector circuit, a logging circuit to make the meter scale and d-c output linear in dB, and an indicating meter. It covers the sound-level range from 70 to 120 dB (re 20 μPa) on a single range and can be internally set to have either a slow or fast meter characteristic.

The amplifier and detector are capable of handling crest factors up to 13 dB above full scale. Thus, the total dynamic range for sine-waves is 63 dB (d-c output versus sound-pressure-level input), all on one scale.

Figure 1-2 shows a polar plot of the angle-of-incidence responses and Figure 1-3 shows the frequency response as a function of incidence of the SLM.

The microphone used is a lead-zirconate-titanate ceramic microphone that couples into the ½-in. coupling adaptor used with the 1562 or 1567 Sound-Level Calibrators. The following features make it excellent for sound-level measurements:

1. A frequency characteristic carefully controlled to give flat response to sound waves of random incidence at frequencies from 5 Hz to 9 kHz.

2. Rugged, dependable design capable of withstanding wide climate changes (from -40° to $+65^\circ$ C, from 0 to 100% relative humidity), and able to withstand large amounts of vibration and shock (up to 60 g of acceleration).

3. Low temperature coefficient of sensitivity (.01 dB/$^\circ$ C) gives minimal change in output voltage from -10° to $+45^\circ$ C.

4. Unplugs for remote use.

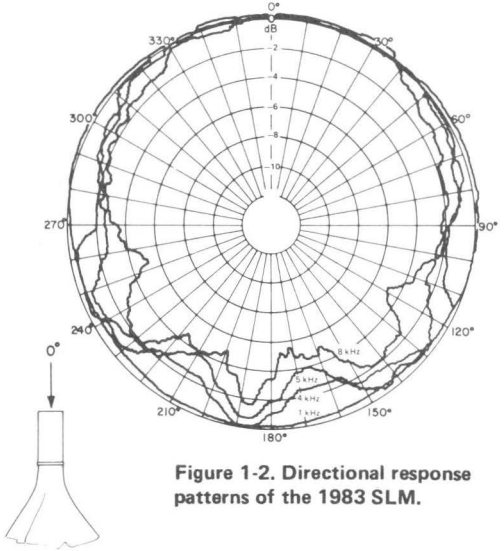


Figure 1-2. Directional response patterns of the 1983 SLM.

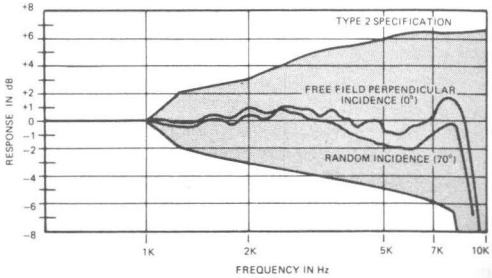


Figure 1-3. Typical frequency response characteristics of the 1983 SLM.

1.4 ACCESSORIES SUPPLIED

The following accessories are supplied:

1. Vinyl carrying pouch – (P/N 1983-0401).
2. Wrist Strap – (P/N 1981-0410)
3. Screwdriver – (P/N 1565-0440).
4. Battery – (Burgess 2U6 or equal)
5. Microplug – Switchcraft type 850-P2
6. Battery sleeves (3) to cover battery
7. Microphone cap – (P/N 1972-7410)
8. Meter response label – (P/N 1983-0430)

The following accessories are supplied with the 1983-9910 Sound-Level Measuring Set* in addition to the above:

1. Sound-Level Calibrator – (P/N 1567-3000)
2. Adaptor 1/2 in. – (P/N 1562-6130)
3. Battery – (Burgess 2U6 or equal)
4. Microphone Windscreen 1/2 in
5. Carrying Case – (P/N 1983-2101)
6. Extension cable – (P/N 1933-0223)
7. Tripod – (P/N 1560-3590)

1.5 ACCESSORIES AVAILABLE

Following are some of the accessories that are available for use with the SLM (consult the GR catalog information for others):

1. Type 1567 or 1562 Sound-Level Calibrator – for accurate field calibration of microphones and sound-measuring instruments. Requires 1/2-in. microphone coupling adaptor, (P/N 1562-6130).
2. Type 1560-9590 Adjustable Tripod.
3. GR microphone windscreens, four per set, (P/N 1560-9522) for reducing the

*1983-9915 Set same less items 6 and 7.

effects of wind noise and protecting the microphone.

4. Carrying Case – (P/N 1983-2101) holds SLM Calibrator 1567 or 1562 and other accessories.

5. Adaptor cables: Type 1560-P77, microplug to 3/4-in.-spaced banana-plug pair (P/N 1560-9677); Type 1560-P78, microplug to standard 1/4-in. phone plug (P/N 1560-9678): Type 1560-P79, microplug to BNC plug (P/N 1560-9679); Type 1560-P80, microplug to standard 1/4-in. phone jack (P/N 1560-9680).

6. Small remote microphone with cable and ear loop for measuring noise on worker or through hearing protectors (P/N 1954-9640).

Section 2
INSTALLATION

2.1 GENERAL

The sound-level meter should be stored in the vinyl pouch (supplied) when not in use.* It can be carried conveniently at waist level by slipping your belt through the loop on the back of the pouch. The protective cap should be in place over the microphone except when the SLM is in actual use.

2.2 OPERATING ENVIRONMENT

The SLM operates over the range of environmental conditions that are normally encountered in industrial applications. It is not recommended that the SLM be stored in a hot place with the battery installed, since the battery life is quickly degraded. The battery has a protective sleeve around it to prevent acid leaking into and damaging the instrument.

CAUTION

Batteries should be removed before storing the SLM for extended periods, to avoid corrosive battery leakage.

2.3 TRIPOD MOUNTING

Any tripod that has a standard 1/4-20 thread will fit the insert on the base of the instrument case. To use the tripod available from General Radio (P/N 1560-9590) the following procedure should be used:

a. Tilt sleeve adaptor (head) to approximately 70° from vertical, i.e., from the axis of the tripod center post.

b. Remove any sleeves or adaptors from the swivel top.

c. Remove each sleeve after loosening its knurled clamping nut ¼ turn.

d. Tighten the smaller clamping nut gently, by hand. (If inadvertently removed, be sure to replace each nut with its split locking ring, oriented so that the beveled edge is down.)

e. Screw instrument onto top stud, approx. 4 turns. Unscrew slightly, if necessary, to orient microphone upwards.

f. Turn the smaller clamping nut snugly against the chassis, to clamp instrument.

*Does not apply to 1983-9910 and 9915.

2.4 MICROPHONE WINDSCREENS.

Microphone windscreens are used to reduce the effects of ambient wind noise. Wind flowing across the surface of the microphone generates low-frequency noise, which can lead to erroneous measurements. The windscreen also protects the microphone from accumulations of vapor and dust in the work environment.

This accessory fits snugly over the microphone. It is made of reticulated polyurethane foam and can be conveniently removed and washed, or replaced, if it becomes soiled.

The windscreens are available in packs of four, P/N 1560-9522, to fit ½-in. microphone.

2.5 OUTPUT CONNECTOR

It may be desirable to plot sound level versus time on a chart recorder. Therefore, a connector at the base of the instrument is available to supply a d-c voltage proportional to meter response. This voltage is even more accurate than the meter reading, accurate to typically ±0.2 dB over the range of 70-120 dB, compared to the 114-dB reference. A Switchcraft type 850-P2 (microplug) connector is supplied with the SLM to complete this end of a patch cord. The other end can be terminated with whatever connector is necessary. (Para. 1.5 refers to standard adaptor cables that are available.) The output voltage is 250 mV behind 100 kΩ source impedance. Refer to para 3.12 for recommended d-c recorders.

Section 3
OPERATING PROCEDURE

3.1 BATTERIES

One 9-V, carbon-zinc, transistor battery (2U6 or equivalent) is supplied and should be checked each time the instrument is used. To check the batteries, slide the power switch down (Figure 1-1). The meter should move to or above the region marked BATTERY OK. If it does not, the batteries must be replaced.

Battery life at 21°C is typically 60 hours. Table 3-1 gives the battery life that can be expected at various temperatures.

Table 3-1

1983 BATTERY LIFE VERSUS TEMPERATURE

Temperature (°F)	(°C)	Life (Hours)
14	−10	34
30	0	45
70	21	60
115	43	60

To ensure an accurate battery check, the test should be made at the temperature at which measurements are to be made.

To replace the battery, first turn the instrument off. Then, using a coin (or screwdriver), unscrew the two large captive screws on the face of the meter. Then pull the meter out of the case, ***being careful not to pull***

hard on the microphone cable. Pull the battery out of the molded plastic holder, pull off the protective sleeve, and disconnect the battery from the clip. Replace with Burgess 2U6, Eveready 216, or equivalent.

If battery acid has leaked into the protective sleeve, discard and replace with new one (three are supplied with the instrument, additional units available thru GR service) (P/N 5451-0100). Mount the sleeve (prevents damage to instrument should battery leak) and put the battery back in the holder as shown in Figure 5-4. With switch in OFF position and the switch on the etched board centered, place the meter back into position in the case and tighten the screws. Again, check the battery before using the instrument.

3.2 CALIBRATION

A quick, reliable sound-pressure level calibration can be performed at 1000 Hz by means of a GR 1567 or 1562 Sound-Level Calibrator. The calibrator, like the SLM, is small, lightweight, and battery operated, making it ideal for field use.

The procedure is as follows:

a. Slide the power switch to the ON position.

b. Turn the calibrator on and, if using the 1562, set the calibrating frequency to 1000 Hz.

c. Place the calibrator, with the Type 1562-6130 Adaptor (1/2 inch) installed, over the microphone of the SLM (as in Figure 3-1).

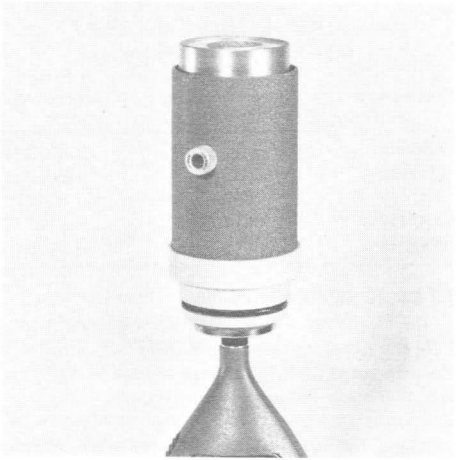


Figure 3-1. Calibrator mounted over SLM microphone.

d. Observe the SLM meter indicator to be 114 ±0.5 dB. If the meter indicator falls outside this range, adjust the CAL control through the tripod mounting hole to obtain a 114-dB indication. (Use the screwdriver supplied – P/N 1565-0440.)

If checking frequencies other than 1000 Hz, using the 1562 Sound-Level Calibrator, remember the A-weighting network will change the CAL point. Table 3-2 shows the correct nominal value with allowable tolerance according to the Type 2 standard.

Table 3-2
CALIBRATION TOLERANCES AT OTHER THAN 1000 Hz

Frequency (Hz)	Nominal Meter Reading (dB)	Allowed Tolerance (dB)
125 Hz	97.8 dB	±1.5 dB
250 Hz	105.4 dB	±1.5 dB
500 Hz	110.8 dB	±1.0 dB
1000 Hz	114.0 dB	±0.5 dB
2000 Hz	115.2 dB	±2.0 dB

3.3 BASIC OPERATION

Check the battery as in para 3.1 above. Slide the power switch to the ON position. (Push forward with the thumb on the front part of the switch, until it detents into position.)

Stand with the instrument in front of you, with the sound coming from the side. Point the microphone in a direction perpendicular to the noise path, keeping your body out of the path (see Figure 3-2).

When using fast meter speed, an average level should be estimated if the meter pointer fluctuates by 3 dB or less. Refer to para 3.5 for converting to SLOW or FAST meter speeds.

It is important to use good technique when measuring sound level. There is no harm done by getting too much information in the field. But if you return with skimpy information, just sound-pressure level, for example, you may have to return for more data. It is a good idea to make up a data form similar to that in Figure 3-3. This provides a reminder for the various checks and data, including a sketch of the site. In an outdoor environment, ground surface and wind can affect the measurement.

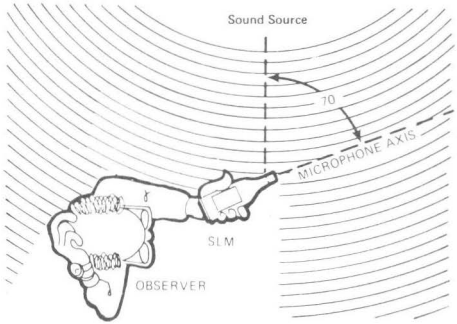


Figure 3-2. Proper positioning of meter with respect to noise source.

When making measurements outdoors, it is important to use a windscreen (P/N 1560-9522). The windscreen has negligible effect on frequency response (refer to Figure 3-4).

To turn the 1983 Sound-Level Meter off, push down on the bottom part of the switch. It will detent off.

3.4 A-WEIGHTING NETWORK

A-weighting is most commonly used for measurement of motor vehicle, applicance, office or plant noise. Except for impact

Plant-Noise Survey Form

DATE 1/2/69
METER # 6547

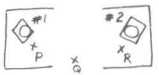
LOCATION: Building 1, Second Floor, Cable Braiding Area
NUMBER OF PERSONNEL EXPOSED: 1
WEARING EAR PROTECTION? ☑ yes ☐ no
OPERATOR: J. R. LaConnor
SIGNED: P. G. Adam

1565 PROCEDURE CHECK LIST
1. REMOVE WHITE CAP.
2. SELECT A WEIGHTING, SLOW METER RESPONSE (OR C WEIGHTING, FAST RESPONSE FOR IMPACT NOISE).
3. TURN ATTENUATOR KNOB TO GET SCALE READING (OR TO 140 dB FULL SCALE FOR IMPACT NOISE).
4. ADD READING TO KNOB SETTING TO GET TOTAL dB.

DIAGRAM (Show measuring location with an X.)

dB(A)

Location	P	Q	R
#1 on	99	95	91.5
#2 on	89.5	92	96.5
Both on	99.5	97	98



Mike 5' 2" off floor

NOTES — Operator goes back and forth between machines
— Set-up time: ~4 min.; Initial run: ~1 min
— 5 minutes at Q, alternate runs
— 25 cables/day-average. Worst case used.
— Both machines not always on during initial part of run

MAXIMUM LEVELS AS MEASURED ON THE SCALE OF THE SOUND LEVEL METER USING A WEIGHTING SLOW METER RESPONSE. USE THE HIGHER LEVEL IF READING IS BETWEEN LEVELS

ORIG. MAX. LEVEL	EXPOSURE TIME (If necessary, note time of day)	TOTAL DURATION IN HOURS PER DAY	PERMISSIBLE HOURS PER DAY	D/P
OVER 115			NONE	
115			¼	
110			½	
105			1	
102			1½	
100	25 times at 1 minute each	.42	2	.21
97	13 times at 5 minutes each	1.08	3	.36
95			4	
92	13 times at 4 minutes each	.87	6	.15
90	12 times at 4 minutes each	.80	8	.10
UNDER 90	coffee break, lunch, cable layout — 4:50 total	4.83	ANY	0
			TOTAL (To comply with regulations, total cannot be more than 1)	.82

IMPACT CHECK: MUST BE UNDER 140 dB PEAK SOUND PRESSURE LEVEL AS MEASURED WITH AN IMPACT NOISE ANALYZER, OR BE UNDER 128 dB AS MEASURED WITH A SOUND LEVEL METER ON C WEIGHTING, FAST RESPONSE, 140 dB FULL SCALE RANGE.

Max — 101 dB(C)

RECOMMENDATIONS: Continue use of ear protection

GENERAL RADIO CONCORD, MASSACHUSETTS 01781 Form No. 7227-A

Figure 3-3. Completed form of a plant-noise survey.

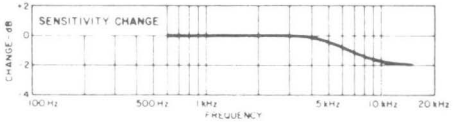


Figure 3-4. Changes in sensitivity caused by use of the microphone windscreen (typical).

noise, Federal Regulations, such as the Occupational Safety and Health Act, require use of the A network (hence, the symbol "dB(A)" for sound-level decibels on the A-scale).* Vehicle and truck noise, under the Noise Control Act of 1972, also require A-weighting.

The frequency response for the A-weighting characteristic is shown in Figure 3-5. The A-weighting characteristic discriminates heavily against low-frequency sound to give an indication closely correlated with subjective estimates of loudness, annoyance and speech interference.

*See *Guidelines To The Department of Labor's Occupational Noise Standards* (Bulletin 334, Revised 1971), copies available from U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C. 20210; American Conference of Governmental Industrial Hygienists "Threshold Limit Values of Physical Agents."

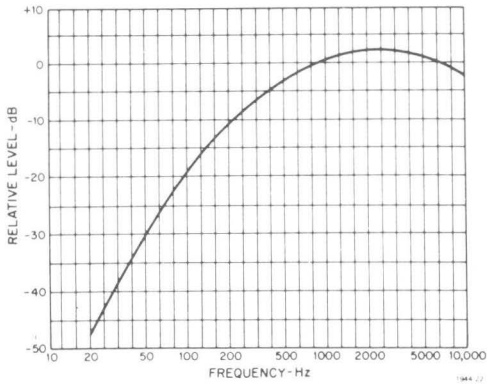


Figure 3-5. A-weighting characteristic showing the deemphasis of low-frequency sound consistent with human noise perception.

3.5 METER RESPONSE

The 1983 Sound-Level Meter has both FAST and SLOW meter response. However, it is meant to be left at one response and labeled. All OSHA measurements require slow response, and some vehicle noise measurements require a fast meter response.

The 1983 is shipped in the SLOW response position and labeled SLOW, as shown in Figure 1-1. In order to change it to the FAST response, proceed as follows:

a. Turn the instrument off.

b. Using a coin or screwdriver, unscrew the two large captive screws on the face of the meter.

c. Pull the meter out of the case, *being careful not to pull hard on the microphone cable.*

d. Remove the jumper from the S position (see Figure 5-6 upper right quadrant) and plug it into the F position.

e. With switch in OFF position and switch on etched board centered, place meter back into position in case and tighten screws.

f. Take the protective backing off the label marked FAST (P/N 1983-0430) and place it into position over the SLOW. This is important, since it lets every operator know what response has been selected.

If in doubt about the response previously selected, turn the instrument on, give the instrument a loud transient, such as whistling directly into the mike, and note the time for the needle to decay 10 dB. It should take about 2 seconds for SLOW and about 0.3 to 0.4 second for FAST.

3.6 OVERLOAD PREVENTION

The amplifier and detector circuit in the 1983 SLM is capable of handling signals linearly more than 10 dB above full-scale meter indication and peaks "on spiked signals" 13 dB above full scale.

The FET input stage, before the A-weighting networks is capable of handling signals up to 145 dB (25 dB above full scale), such as occur when analyzing noise signals with large low-frequency components.

3.7 EFFECT OF THE OPERATOR

When the sound is coming mainly from one direction, the sound-level reading may be somewhat affected by the relative positions of instrument and observer. The SLM should *not* be held between the observer and the source, with the microphone pointed toward the source of the sound, although this seems the most logical manner. This position gives a marked increase in the response at high frequencies. The observer, facing the sound from directly behind the instrument, acts as a reflector to produce errors of several dB in the frequency range above 100 Hz.

A more uniform frequency response is obtained with the meter in front of the observer, but with the sound grazing the microphone (coming from the side, rather than from the front). When out of doors, hold the instrument with the microphone pointing upward, (to avoid interference from reflected high frequencies) and as far from the body as is convenient. Do not point the microphone toward a source of background noise (any source other than the one being measured).

The sound-level meter can be mounted on a tripod (see para 2.3) to reduce further the effects of the observer's presence. His position should be similar to that for hand-held operation; a line between the observer and the instrument should be approximately perpendicular to a line from the instrument to the sound source.

3.8 BACKGROUND NOISE

Measurements should be made with as little background noise as possible. For all weightings the background level should be at least 10 dB below the total measured level. When this cannot be done, apply the corrections given in Figure 3-6.

3.9 OSHA REGULATIONS

The Occupational Safety and Health Act of 1970 (84 Stat. 1593) sets limits for permissible exposure times for the various levels of noise shown in Table 3-3. The noise is measured with a SLM or Noise Dosimeter with "A" weighting and "slow"

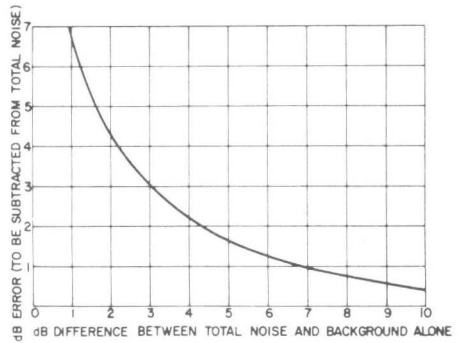


Figure 3-6. Effect of background noise on measurements.

Table 3-3

PERMISSIBLE NOISE EXPOSURES*

Duration per day, hours	Sound level dB (A) Slow-Response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

*Under Part 1910.95 "Occupational Noise Exposure," (Dept. of Labor) of the Code of Federal Regulations, Chap. XVII of Title 29 (39 F.R. 7006). Ref: Federal Register, Vol. 36, No. 105, May 29, 1971.

See also: *Guidelines to the Dept. of Labor's Occupational Noise Standards Bulletin* 334; GPO: 1971 0-484-782 (3).

meter characteristics. The limits in Table 3-3 are taken from Part 1910 of Title 29 of Regulations.

The law defines the percentage (N) of the allowable noise-exposure time where 100% is maximum for a working day. It is given by the following formula:

$$N = 100 \times \frac{A}{8} + \frac{B}{6} + \frac{C}{4} + \frac{D}{3} + \frac{E}{2} + \frac{F}{1.5} + \frac{G}{1} + \frac{H}{0.5} + \frac{I}{0.25}$$

where

A = no. of hours of noise at 90 dB
B = no. of hours of noise at 92 dB
C = no. of hours of noise at 95 dB
D = no. of hours of noise at 97 dB
E = no. of hours of noise at 100 dB
F = no. of hours of noise at 102 dB
G = no. of hours of noise at 105 dB
H = no. of hours of noise at 110 dB
I = no. of hours of noise at 115 dB

This instrument can be used to make measurements in conformance with the Proposed Requirements and Procedures for Occupational Noise Exposure as published in the Federal Register, dated October 24, 1974. This proposal extends the threshold to 85 dB for 16 hours. Cf *Federal Register,* Vol 39, No. 207, pp. 3773 et seq.

If the sound level is fairly constant throughout the day, and the worker does not move around too much, it is fairly easy to calculate the percentage of the allowable noise-exposure time. If the noise level changes or the worker moves, a d-c recorder may be attached to the output of the 1983 SLM. Since the d-c output is linear in dB, an easily readable chart of dB-versus-time results. The percentage N is then calculated using the formula.

The U.S. Department of Health, Education and Welfare has published a criteria document: *Recommendations for an Occupational Exposure Standard for Noise.* This document should be consulted for possible changes to the current regulations.

This is a time-consuming task, and it is more economical to use a noise dosimeter, such as the GR 1954 Noise Dosimeter, for the purpose, since the N is calculated automatically. If the allowable exposure is exceeded, the 1983 SLM is ideal for locating the source of noise. The SLM facilitates these measurements due to its inherent ease of use, since it has only one control, an ON-OFF switch, and a single 50-dB scale.

When measuring noise for OSHA, care must be exercised, as the presence of a worker will affect the measurement result.

The correct procedure is to remove the worker, since body reflections do cause some error. However, this error is small if the worker's head does not block the source of noise. Table 3-4 shows errors for pink noise measured in a reverberant room.

The 1983 can also be used in this way to find the optimum microphone placement for the remote microphone on the 1954 Noise Dosimeter. Measure the noise, with the worker removed as mentioned above. But, place the SLM in the position normally occupied by the worker's ear, then measure the noise at several mike locations, with the operator present, at each ear, top of each shoulder, etc., to find the spot giving a reading closest to the first or ideal measurement.

3.10 VEHICLE REGULATIONS FOR TRUCKS

The Noise Control Act of 1972, Public Law 92-574, 88 Stat. 1234, provides for noise-emission limits for motor carriers

Table 3-4

ERRORS IN RESPONSE TO PINK NOISE CAUSED BY A NEARBY PERSON, MEASURED WITH "A" WEIGHTING

Microphone Location \ Angle	Error-dB(A)				
	0°	90°	180°	270°	Average
Near ear	+0.3	+0.2	−0.3	−0.1	0
Near shoulder	+0.7	+0.5	−0.1	+0.3	+0.4
In shirt pocket	+1.2	+1.0	+0.8	+1.4	+1.1
Near hip	+0.1	−0.4	−0.3	−0.7	−0.4

engaged in interstate commerce. The effective date of the new regulation is October 1, 1974. Its enforcement will be carried out by the Department of Transportation.

The regulation as proposed will apply to motor vehicles operated in interstate commerce and weighing over 10,000 lbs. GVW. The following proposed standards* will apply to total vehicle noise:

1. 90 dB(A) at 50 ft (15 m) in speed limits greater than 35 mph (51 km/h)
2. 86 dB(A) at 50 ft in speed limits equal to or less than 35 mph.
3. 80 dB(A) at 50 ft on level streets in speed limits equal to or less than 35 mph.

*Federal Register, Vol. 38, No. 144, pages 20102-20107.

Table 3-5

ALLOWABLE VEHICLE NOISE LEVEL dB(A)

Test Condition	California 1973	1975	1978	Proposed Federal
Below 35 mph*	86	86	86	86
Above 35 mph	90	90	90	90
New Vehicles above 35 mph	86	83	80	88
Stationary Run-up Test (Accelerate with transmission in neutral)				

*51 km/h

4. 88 dB(A) at 50 ft under stationary run-up test.

More stringent requirements currently in force in California are given in Table 3-5.

The pass-by tests should be measured with the sound-level meter mounted on a tripod using A-weighted FAST. (Refer to para 3.5 for changing meter response.) The SLM should be 50 ft from the center line of the vehicle; see Figures 3-7 and 3-8. A booklet describing procedures for making these measurements is available from Stemco.*

The Bureau of Motor Carrier Safety has also set limits on in-cab sound levels† of 90 dB(A) measured at the driver's seating position. Again, A-weighted FAST is required.

*_Truck Noise Control_, Stemco Manufacturing Co., Inc., Box 1989, Longview, Texas 75601.

†_Federal Register_, Vol. 38, No. 2, pp. 800 and 801, Revised November 8, 1973.

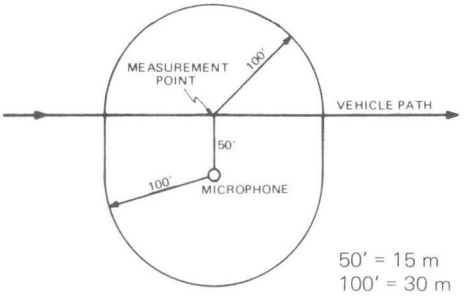


Figure 3-7 Spatial requirements for vehicle pass-by noise measurements.

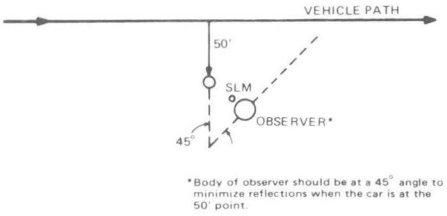


Figure 3-8. Observer and SLM placement for vehicle pass-by measurements.

The procedure for making this measurement is as follows:

1. Park the vehicle in a cleared location 50 ft from any large reflecting surfaces.
2. Close doors, windows and vents and turn off all power accessories.
3. Place the driver in the normal seated position and evacuate all occupants except the driver and the person conducting the test.
4. Place the microphone 6 in. (150 mm) to the right of the driver's right ear as shown in Figure 3-9.
5. With the vehicle in neutral gear, abruptly accelerate (floor-board) the engine from low idle to maximum rated engine speed and stabilize that speed. (NOTE: Caution must be used on engines without a high speed governor.) Return the engine to low idle and repeat this procedure until the two highest sound level readings are within 2 dB of each other.
6. The recorded interior sound level is the average of the two maximum readings.

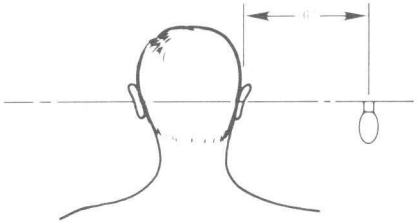


Figure 3-9. Interior vehicle SLM location.

3.11 HEARING-PROTECTOR ATTENUATION

The Recommendations of the OSHA Standards Advisory Committee require that hearing protectors be worn if sound levels exceed the levels shown in Figure 3-10.

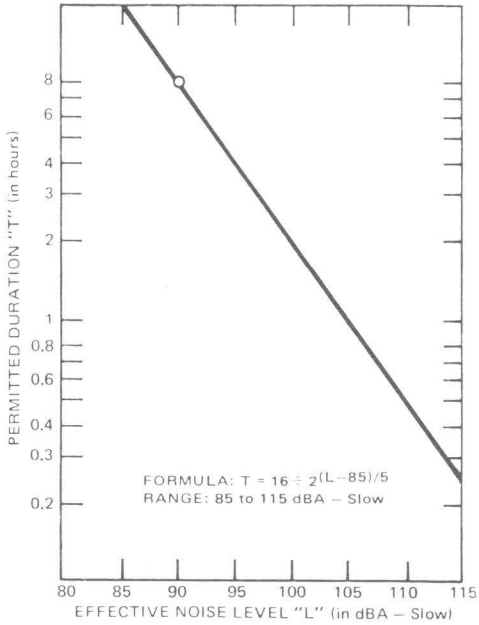


Figure 3-10. Proposed exposure duration vs noise level.

Place the microphone on the ear, using the ear loop.

Measure the SPL with and without the hearing protectors in place. The difference is the noise reduction factor (R).

One can experiment with the placement of the protectors to get the highest (R). Also, one can experiment with different types of protectors. For example, if there is a lot of low-frequency noise, a hearing protector with good low-frequency attenuation, but poor high-frequency attenuation, may give better results than hearing protectors with high attenuation at high frequencies only.

3.12 D-C OUTPUT FOR RECORDING OR CONVERTING TO DIGITAL SAMPLES.

The d-c output jack (see Figure 1-1) provides a means for continuous recording of SPL versus time. At 70 dB the output level is 0 V and, at full scale, it is 250 mV behind 100 kΩ. The d-c output is linear in dB, 5 mV per dB change in level. It is linear within 1.0 dB to 10 dB above full scale and 5 dB below bottom scale. A d-c recorder for use with a sound-level meter should have fast writing speed and a range of chart speeds. The fast writing speed is required for following A-weighted fast or slow transients.

The recorder can be calibrated in SPL as follows:

a. Connect the recorder, using the cable provided or by ordering a cable with correct termination (para 1.5) for the recorder end.

b. With the 1983 SLM off, adjust the 70-dB end, using the zero adjustment on the recorder.

c. Turn the 1983 on and, using a 1562 or 1567 Sound-Level Calibrator, calibrate the 1983 to 114 dB (para 3.2).

d. Still leaving the calibrator on, adjust the recorder sensitivity to get 114 dB (6 divisions below full scale if there are 50 divisions on the paper).

e. Remove the calibrator and the recorder will now follow the meter.

The Simpson 2745 X-Y Recorder is suitable for portable-type measurements outdoors since it is battery operated. The MFE (Mechanics for Electronics) M-12 Recorder is AC (line-operated) and is suitable for OSHA-type measurements indoors.

3.13 PREFERRED ANGLE OF INCIDENCE.

When measurements are made on sounds in reverberant fields, the angle of incidence of sounds reaching the microphone is indeterminant. In this case, there is no preferred angle of incidence between the microphone and the sound source. When measurements are made on a source in a free field, an angle of incidence of 70 degrees between the axis of the microphone and the sound source will approximate random response.

3.14 MUFFLER NOISE MEASUREMENT.

The 1983-9910 Vehicle-Noise Measurement Set permits static muffler-noise measurements. In general, muffler-noise laws specify the meas-

urement of the noise level at the tailpipe of an automobile as follows.

a. Place vehicle in an open area with no sound-reflecting surfaces other than pavement within 10 ft. (3 m).

b. Engine should run at 3000 RPM.

c. Place microphone:

Height: At level of tailpipe but not less than 8-in. (200 mm) off the pavement.

Position: 20-in. (500 mm) ±1-in. (25 mm)) from the outlet of the exhaust at a 45-degree (±10 degrees) angle. If exhaust is under car, the microphone must not be closer to the car body than 8-in. (200 mm).

Orientation: Longitudinal axis of microphone must be parallel to pavement and positioned in accordance with manufacturer's specifications.

d. Remove the tripod from the case.

e. Using a medium-sized screwdriver, remove the screw in the bottom of the vertical mast.

f. Loosen the knurled screw at the top of the tripod and remove the vertical mast.

g. Turn the locknut on the large sleeve cw and slip off the large sleeve.

h. Store the large sleeve in the top of the carrying case.

i. Extend the three legs on the tripod to 27-in. (600 mm). Lock the legs in position and mark the legs with a reference, so that the tripod can be set up easily at a later time.

j. Insert the vertical mast in the tripod upside down, so that the retaining sleeve on the knuckle is between the legs.

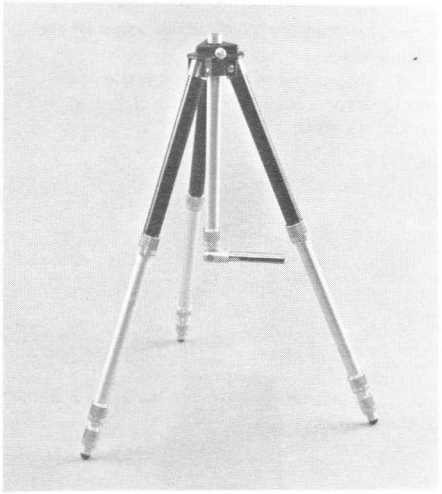


Figure 3-12. Tripod arrangement for muffler measurements.

k. Orient the knuckle so that the sleeve is parallel to the ground, aimed away from the legs (Figure 3-12).

l. Dismount the microphone from the 1983 and install it on one end of the cable.

m. Slip the assembly into the tripod sleeve.

n. Attach the other end of the cable to the 1983 (set to slow response) and turn it on.

o. Mount the 1567 Calibrator on the microphone and check the system acoustic calibration (para 3.2).

p. Pay out enough cable so that the observer, holding the 1983, is well clear of the microphone.

q. Mount the windscreen on the 1983 and look for a muffler noise level not to exceed 95 dBA.

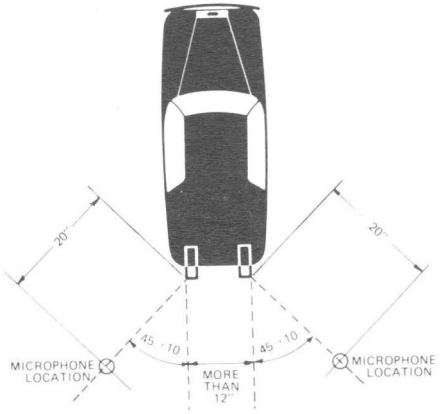


Figure 3-13. Dual extended tailpipes.

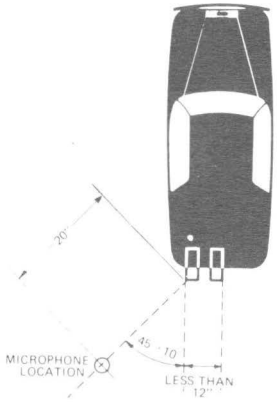


Figure 3-14. Dual extended tailpipes.

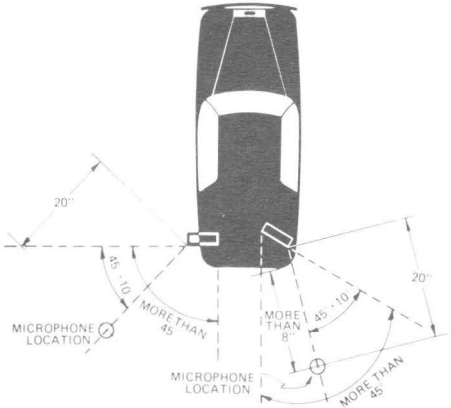


Figure 3-15. Tailpipe under vehicle or extends out at an angle of more than 45 degrees with front to back axis of vehicle.

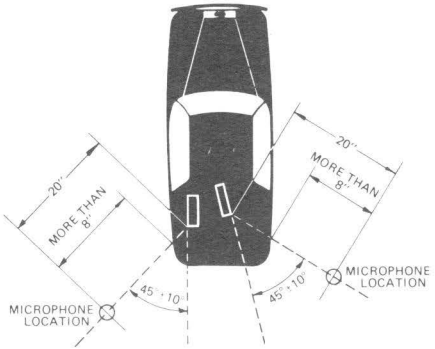


Figure 3.16. Tailpipe under.

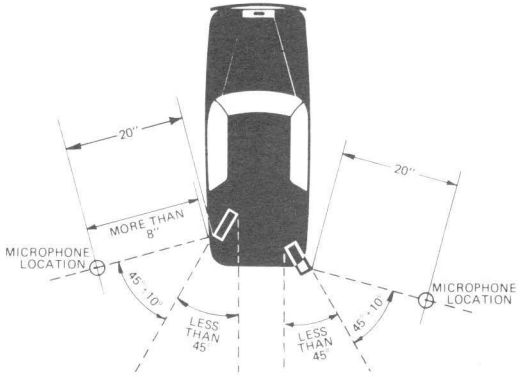


Figure 3-17. Tailpipe under vehicle or extending out at an angle of less than 45 degrees with front to back axis of vehicle.

Section 4
THEORY OF OPERATION

4.1 GENERAL

A block diagram of the sound-level meter is shown in Figure 4-1. The names of circuits and components refer to this diagram and to the schematic diagram for the sound-level meter.

The 1983 active circuitry, two FET's (field-effect transistor) and six IC's (integrated circuits), is contained on a single etched-circuit board with the exception of the microphone

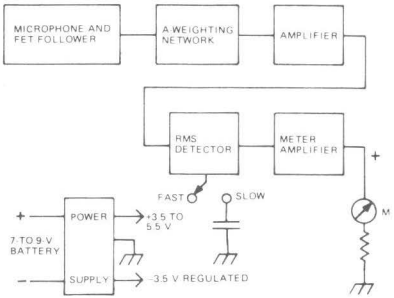


Figure 4-1. Block diagram of the sound level meter.

The law also requires that the hearing protector used by the employee reduce the noise level to within permitted limits. Thus, the noise reduction factor (R) of the hearing protector first has to be determined. The Recommendation describes some complex methods of calculating this noise reduction factor.

It can be measured directly using a small remote microphone assembly (P/N 1954-9640) used on the 1954 Noise Dosimeter.* The microphone fits under the hearing protector as shown in Figure 3-11. The cable coming out of the hearing protector has negligible effect on the noise reduction. This microphone assembly can be unplugged from any GR 1954 Noise Monitor or it can be obtained from the GR Service Department. The plug on this small microphone assembly plugs directly into the internal socket on the 1983 SLM, in place of the microphone on the SLM.

The procedure is as follows:

a. Remove the meter and etched board from the case, as in para 3.1.

b. Unplug the microphone plug on the etched board.

c. Dismount the microphone from the SLM, unscrew the external connector from the case and withdraw the lead and plug.

d. Insert the plug of the 1954 Microphone Assembly through the microphone mount tube and plug it into the socket on the board observing correct polarity. Reinstall the meter in the case and calibrate the microphone using the 1954 indicator.

Figure 3-11. Measurement of noise without hearing protector attenuation. Protector in normal position fits easily over microphone.

NOTE

This calibrator in the Indicator puts out 116.5 dB, so that the CAL adjustment in the 1983 should be adjusted for a 116.5 dB reading on the meter (para 3.2).

* "A Direct Measurement of Daily Noise Dose for Employees Wearing Hearing Protectors", Paper presented at the American Industrial Hygiene Conference, May 16, 1974, by Martin W. Basch, General Radio Company. Write to General Radio Company, Concord, Mass. 01742, for copies of the paper.

buffer. This circuitry consists of an FET follower, an A-weighting network, an amplifier, an rms detector*, a meter amplifier and a regulated power supply.

4.2 CIRCUITRY

The ceramic microphone in the SLM, which includes a built-in FET, drives the A-weighting network, which includes C2, C3, R4 and R5. The output from this network is amplified by U2. A gain control (R11) on the amplifier is used to compensate for sensitivity variations between microphones. The a-c output from the amplifier is fed to an rms detector (U3, U4, U7) whose d-c output voltage is proportional to the log of the rms value of the input voltage.

Following the detector is meter amplifier U5. This stage provides isolation and the necessary gain between the detector and the meter. R23 provides for adjustment of the slope of the detector transfer curve. R27 samples the meter current and provides a d-c output voltage proportional to the meter indication. R35 isolates the dc output jack so that it may be shorted without affecting the instrument reading.

4.3 POWER SUPPLY

The power supply consists of Q3, an FET, providing constant-current drive for zener diode (VR1). The voltage across (VR1) is constant for changes in battery voltage, down to the "replace battery" mark on the meter. U6 is a buffer, yielding −3.5 V regulated and driving ground to split the battery voltage.

*U. S. Patent No. 3,681,618

Section 5
SERVICE AND MAINTENANCE

5.1 GR FIELD SERVICE.

Our warranty (at the front of this manual) attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions, please write or phone the nearest GR service facility (see back page), giving full information of the trouble and of steps taken to remedy it. Describe the instrument by type, serial, and ID numbers.

5.2 INSTRUMENT RETURN.

Before returning an instrument to General Radio for service, please ask our nearest office for a "Returned Material" number. Use of this number in correspondence and on a tag tied to the instrument will ensure proper handling and identification. After the initial warranty period, please avoid unnecessary delay by indicating how payment will be made, i.e., send a purchase-order number or (for transportation charges) request "C.O.D."

For return shipment, please use packaging that is adequate to protect the instrument from damage, i.e., equivalent to the original packaging. Advice may be obtained from any GR office.

5.3 SERVICEABILITY TEST

The procedures outlined below can be used to determine that the 1983 is functioning properly.

5.3.1 Test With Sound-Level Calibrator.

The GR Type 1562 or 1567 Sound-Level Calibrators provide a test signal for making a rapid check of the overall (including the microphone) gain of the instrument. The 1562 provides a test signal at 5 frequencies, ranging from 250 Hz to 2000 Hz. The 1567 provides a test signal frequency at 1 kHz only.

Set the 1983 switch to the battery check position first, to verify that the battery is good. The meter should indicate above the battery mark.

Fit a 1/2-in. coupler-adaptor to the 1562 or 1567 Calibrator, turn the calibrator on (set at 1 kHz) and place it over the 1983 microphone. Set the 1983 to ON. A reading of 114 ± 0.5 dB should be indicated on the 1983 meter. If it does not, adjust the CAL control (screwdriver control, accessible through the tripod mounting hole) for 114.0 dB.

The 1562 can be used to provide a quick check of the A-weighting response. The correct level for each frequency setting is shown in Table 5-1.

5.3.2 Calibration check with Oscillator and Voltmeter.

An electrical test can be made on the instrument, excluding its microphone with an oscillator that covers the frequency range from 20

Table 5-1

FREQUENCY VS dB LEVEL

1562 Freq Hz	1983 Meter Indication
125	97.8±1.5 dB
250	105.4±1.5 dB
500	110.8±1.0 dB
1000	114.0±0.5 dB
2000	115.2±2.0 dB

Hz to 10 kHz, and an accurate a-c voltmeter (to monitor the oscillator output voltage).

An electrical calibration check can be performed by the following procedure:

a. Remove the 1983 meter and etched board from the case (refer to para. 5.4) and disconnect the microphone lead from the connector on the board.

b. Connect the oscillator to the input of the 1983 using a double banana to microphone connector cable (Table 5-2) positive to AT1 and negative to AT3. Adjust the oscillator at 1 kHz for 31.7 mV, as monitored on the voltmeter. (An attenuator such as the GR 1450-TB may be necessary to reduce the oscillator output voltage to obtain the desired level).

c. Set the 1983 to ON (slide toward microphone connector).

d. The correct indication on the meter depends on the sensitivity of the microphone for which the instrument was adjusted. For a microphone of normal sensitivity (−50 dB re 1 V/N/m² * or −70 dB re 1 V/μbar), the 1983

* N/m^2 = Pascal (Pa) in SI units.

should read 114 dB; this corresponds to the 31.7 mV input signal from the oscillator. Unless the actual sensitivity of the microphone is known, it is not possible to calibrate the instrument precisely to the microphone using the above method. This method may be used only as an approximate check of calibration. Minimum and maximum microphone sensitivities normally used on this instrument range between −53 to −47 dB re 1 V/N/m² (−73 to −67 dB re 1 V/μbar); therefore, the 1983 should indicate between 111 and 117 dB. For a precise calibration of the microphone to the instrument, a sound level calibrator such as the GR 1562 or 1567 should be used.

e. The A-weighting response can be checked at individual frequencies by setting the oscillator to the desired test frequency and noting the level of response with respect to the reference of 1 kHz. Refer to Figure 3-5 for the A-weighting response curve.

Para. 5.5.5 (Test and Calibration) details an A-weighting response check.

5.4 INSTRUMENT DISASSEMBLY/ASSEMBLY PROCEDURE.

CAUTION

This instrument should be serviced by skilled service personnel. The procedure outlined below is intended as a guide for skilled service personnel.

5.4.1 Disassembly for Battery Replacement or Electrical Testing.

a. Place the instrument face up and loosen the two screws used to secure the meter to the case.

CAUTION

Pull meter out slowly. It is attached to microphone cable.

b. Grasp the meter and lift straight up from the instrument. The meter, etched board and battery holder will all be intact when removed.

c. The microphone may be disconnected by unplugging the 3-pin connector on the microphone cable from the socket on the etched board.

d. Remove the battery from the holder, if replacement is necessary.

5.4.2 Disassembly for Board and Meter Servicing.

a. In addition to the above disassembly, proceed as follows for a more complete disassembly.

b. Remove the battery holder itself from the meter by removing the screw securing the holder to the meter.

c. Remove screw and washer at edge above meter.

d. Remove the springs, washers and C-clips from each meter screw; this will allow the etched board to be lifted from the back of the meter, thus allowing complete access to the board.

The microphone can be unscrewed from the case (ccw direction) and removed if necessary. The cable and connector attached to the microphone will feed through the hole in the case.

5.4.3 Reassembly.

To reassemble the instrument, reverse the above procedures. When replacing the complete assembly into the case, make sure that the tab on the ON/OFF Switch is in position to mate with the slide button on the case. (Set the button

on the case to OFF, and center the switch on the etched board before mating).

NOTE

The 1983 will operate while completely disassembled, providing the battery and microphone are still connected.

5.5 1983 SLM TEST AND CALIBRATION

5.5.1 General.

The following procedures are intended for an experienced technician to follow in recalibrating and testing the equipment. These procedures should be followed after the instrument has been repaired or when the test of para. 5.3 shows that the instrument may not be working according to specifications. The instrument should be removed from the case and the microphone disconnected before performing the following tests. Refer to para. 5.4 (Instrument Disassembly/Assembly Procedure).

A list of recommended test equipment is given in Table 5-2.

5.5.2 Power-Supply Check.

a. Connection should be made to an external power supply to allow monitoring of the instrument current drain and low and high operating voltages. With the HP 6215 Power Supply output set to zero, connect this supply to the 1983 battery clip (observe proper polarity). Connect a VOM (set for current, 10-mA range) in series with the positive lead for the purpose of monitoring current.

Table 5-2
TEST EQUIPMENT

Instrument	Minimum Requirements	Recommended*
Power Supply	0-10 V, 20 mA	HP 6215
Oscillator	2 Hz – 20 kHz 0-20 V Open Ckt	GR 1310
Counter	Frequency (25 Hz – 10 kHz) Interval (200 – 500 ms)	GR 1191
Decade Attenuator	0.1-dB, 1-dB, 10-dB steps	GR 1450 TB
AC-DC Voltmeter	Range 0-10 V 2% accuracy	2540 DVM (Data Precision)
Distortion Analyzer	100 Hz – 20 kHz 300 μV – 1 V rms full scale	HP 334A
Sound Level Calibrator	1/2-in. acoustic coupler	GR 1562 or 1567
Patch Cord (3)	Double banana-plug (274) to Double banana-plug	GR 274-NP
Patch Cord (1)	BNC-to-BNC	GR 776-C
Adaptor (1)	Banana-plug pair to GR 874	GR 874-Q10
Adaptor (2)	BNC jack to GR 874®	GR 874-QBJA
Adaptor Cable	Double banana-plug (274) to miniature phone plug	GR 1560-P77
Adaptor Cable	Double banana-plug to clip leads	Make up
Resistive Load	600 Ω ± 5%	GR 500-G
Tone-Burst Generator	200-500 ms pulses, continuous	GR 1396-B
Adaptor Cable	Double banana-plug (274) to microphone connector †	Make up
Decade Resistor	0 – 15 kΩ	GR 1433-L
Resistor	600 Ω	600 Ω, 1/4 W
Patch Cord (2)	Single banana-plugs	GR 274-LLR
Oscilloscope	General Purpose	Tektronix 503
Probe	X1	Tektronix P6011
Pulse Generator	200 μs pulses, 500 Hz positive negative	GR 1340

*Or equivalent

†Plastic Prods, Inc., type 162 plug (3 pin).

b. Turn the 1983 switch to ON (slide toward microphone connector) and adjust the 6215A output voltage for 9.0 V dc, as monitored on the 2540 DVM. Nominal supply current should be approximately 3.2 mA.

c. Check the 1983 supply voltage VB– at TP9 (negative side of C14). Voltmeter ground can be connected to the dc output jack mount bracket. This voltage should be between –3.3 and –3.6 V. Check the voltage VB+S at TP10 (positive side of C13); should be between 5.4 and 5.7 V.

d. Set the 1983 switch to BAT position (slide away from microphone connector). The meter should indicate on the high side of the battery mark. This indicates a good battery voltage.

e. Set the 1983 switch back to ON and adjust the 6215A output voltage for 7.0 V dc, as monitored on the 2540 DVM. Nominal supply current should be approximately 3 mA.

f. Again check the 1983 supply VB-at TP9. This voltage should be within –10 mV of the voltage noted in step c., since it is a regulated supply. Check the voltage VB+S at TP10; it should be between +3.4 and +3.7 Vdc.

g. Set the 1983 switch to BAT. The meter should indicate on the low side of the battery mark; this is the minimum battery voltage at which the instrument should be operated.

h. Reset the supply voltage to 9.0 V from the 6215A for the remaining checks, or install a good battery.

5.5.3 Meter Adjustment and Tracking

a. With the power on the 1983 OFF and the meter in a horizontal position, adjust the

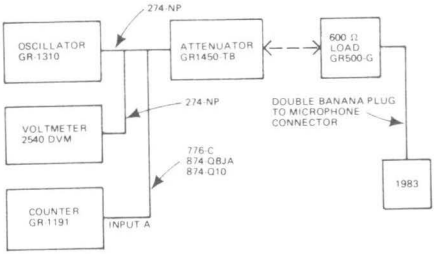


Figure 5-1 Test setup – general.

mechanical meter zero screw for an indication of exactly 70 (adjustment on rear of meter).

b. Arrange the test setup shown in Figure 5-1.

c. Set the controls as follows:

1310
- Frequency Range . . 200 Hz – 2 kHz
- Frequency Dial . . . . 10 (1 kHz)
- Level . . . . Adjust for 1V on DVM

1450
- Attenuation . . . . . 74.0 dB

1983
- ON/OFF . . ON (toward microphone connector)

d. Adjust the microphone sensitivity pot (R11, located adjacent to the d-c output jack) for 70.0 dB on the meter.

e. Set the 1450 to 24.0 dB and adjust R23 (located on the edge of the etched board), for 120.0 dB on the meter.

f. Check the meter tracking in accordance with Table 5-3 by setting the 1450 as indicated.

Table 5-3

METER TRACKING

Set 1450	Meter Reading (dB)
24.0 dB	120.0 (set using R23)
29.0 dB	115.0±0.35 dB
34.0 dB	110.0±0.5 dB
44.0 dB	100.0±0.7 dB
54.0 dB	90.0±0.7 dB
64.0 dB	80.0±0.7 dB
74.0 dB	70.0 (set using R11)

5.5.4 AC Level and Distortion Check

a. Retain the same setup of Figure 5-1 and set the controls as follows:

1310
Frequency Range . . 200 Hz – 2 kHz
Frequency Dial . . . . 10 (1 kHz)
Level . . . Adjust for 1 V on DVM

1450
Attenuation . . . . . 24.0 dB

1983
ON/OFF . . . . . ON

b. Using a 274 (double) to clip-lead cable, connect the 334-A (set to VOLTMETER, 1V RANGE) to TP13 on the 1983 (junction of C7 and R14).

c. The a-c voltage at TP13, as indicated on the 334-A, should be approximately 0.5 V.

d. Set the 1450 to 13 dB (overdrive 1983 by allowable crest factor).

e. Set both the FUNCTION and METER RANGE on the 334-A to SET LEVEL. Adjust the SENSITIVITY for full-scale and measure the distortion to be less than 1%.

5.5.5 A-Weighting Check

a. Retain the same setup of Figure 5-1 and set the controls as indicated in para 5.5.4 step a.

b. Check the A-weighting response in accordance with Table 5-4 by setting the 1310 frequency as indicated and adjusting the 1450 for a meter reading of 70.0 dB in each case. The setting on the 1450 should fall between the limits as shown in the table.

Table 5-4

A-WEIGHTING LIMITS

Set 1310 Frequency	1450 Limits
1 kHz	(Reference, set for 70.0 on meter)
500 Hz	69.8 – 71.8 dB
100 Hz	53.9 – 55.9 dB
25 Hz	29.3 – 32.3 dB
8 kHz	71.4 – 74.4 dB

5.5.6 DC Output Check.

a. Retain the same setup of Figure 5-1 and set the controls as indicated in paragraph 5.5.4 a.

b. Connect the 2540 DVM to the dc output on the 1983 using a 1560-P77 patch cord.

c. The dc output as indicated on the 2540 DVM should read 250 ± 10 mV.

d. Adjust the 1450 slightly such that the dc output reads exactly 250.0 mV.

e. Increase the input to the 1983 (10 dB above full-scale) by decreasing the attenuation from the 1450 by 10 dB (1450 10 dB/STEP set to 1). The d-c output should indicate 300 ± 5 mV.

f. Decrease the input to the 1983 (bottom-scale) by increasing the attenuation from the 1450 (1450 10 dB/STEP set to 7). The d-c output should indicate 0 ± 1 mV. Any variation from the above tolerance would tend to indicate improper adjustment of the meter as detailed in para. 5.5.3, or improper adjustment of the mechanical zero.

5.5.7 Meter Ballistics Test

a. Arrange the test setup shown in Figure 5-2.

NOTE

Connect a 600-Ω resistor in series with the high side of the 1396 SIGNAL OUTPUT to effectively increase the low output impedance. Connect a Decade Resistor (GR 1433-L) between the high side of the 1396 SIGNAL INPUT and the high side of the SIGNAL OUTPUT (connect to attenuator side of the 600-Ω resistor).

b. Set the controls as follows:

1310

Frequency Range	200 Hz – 2 kHz
Frequency Dial	10 (1 kHz)
Level	Adjust for 1V on 2540

1450

Attenuation	10.0 dB

1396

Trigger Level	0
Slope	(–)
Cycle Count	NORMAL
Timing (rear)	INT
Output ON	CONT
Output OFF	1 Sec

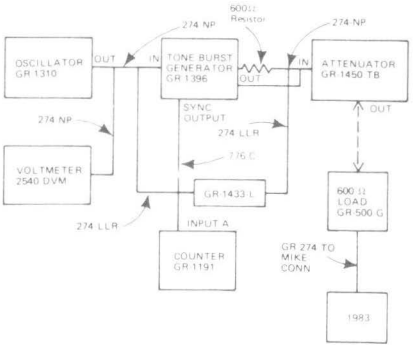


Figure 5-2. Test set-up for meter ballistics check.

1191

Interval	Depressed
Range	.10 μS
Display Time	100 mS
(Input A) AC/DC	DC
(Input A) Polarity & Atten.	1 (+)
(Input B) AC/DC	DC
(Input B) Polarity & Atten..	1 (–)
Separate/Common	COMMON

1983

ON/OFF	ON

Connect the jumper wire on the 1983 to F (fast meter response).

c. The lamp behind CONT on the 1396 OUTPUT ON dial should now be on.

d. Adjust the 1450 attenuator for a reading on the 1983 meter of 116.0 dB.

e. Set the 1396 OUTPUT ON for approximately 0.2 SEC and adjust this dial for a read-

ing of 200 on the 1191. (This sets the time interval of the pulse for 0.2 sec.)

f. Set the 1396 OUTPUT OFF for 10 SEC and adjust the 1433 Decade Resistor for a meter reading of 96.0 dB on the 1983 when the tone burst is off (1433 set for approximately 5 kΩ). This will set the output tone burst from the 1396 for steps of 20 dB amplitude.

g. During the on time of the 200 ms bursts, the meter reading should go to 114.0 ±2.0 dB

h. Set the OUTPUT OFF to 1 SEC and connect the jumper wire on the 1983 to S (slow meter response).

i. Adjust the OUTPUT ON dial for a reading of 500 on the 1191. (This sets the time interval of the pulse for 0.5 sec.).

j. Reset the OUTPUT OFF for 10 SEC. During the on time of 500 ms bursts, the meter reading should go to 112.0 ± 2 dB.

5.5.8 Noise Level Check

a. Disconnect the 1983 from the test setup and reconnect the microphone to the etched board (microphone should be installed on case).

b. Connect the 2540 DVM to the 1983 d-c output, using a 1560-P77 adaptor cable.

c. Place a 1562 or 1567 and 1/2-in. coupler adaptor over the microphone (calibrator turned OFF). The 1983 should be 5 dB or more below bottom scale or greater than −25 mV on the 2540 DVM.

5.5.9. Detector Balance Check

a. Arrange the test setup shown in Figure 5-3, connect to position 1 (+ PULSE) on the 1340.

b. Set the controls as follows:

1340

Pulse Period/Frequency	3.0 x 1 ms
Pulse Duration	2.0 x 100 μs
Pulse Offset (large knob)	0
Pulse Offset (small knob)	0

1450

Attenuation	40.0 dB

1983

ON/OFF	ON

c. Adjust the + pulse amplitude for a 5-V pulse on the scope, using the small knob of the PULSE AMPLITUDE control of the 1340.

d. Adjust the 1450 attenuator such that the 1983 meter indicates 119 dB.

e. Move the 1450 connection to position 2 of Figure 5-3 (– PULSE output of the 1340). Adjust the – pulse amplitude for a 5 V pulse on the scope, using the large knob of the PULSE AMPLITUDE control.

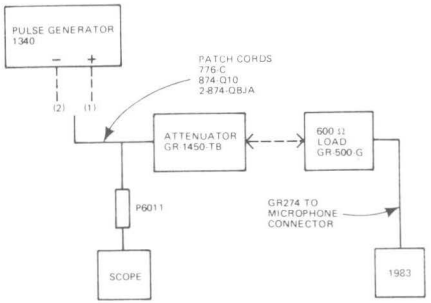


Figure 5-3. Test set-up for detector balance check.

f. The reading on the 1983 meter should be within 1 dB of the previous reading.

g. Adjust the 1450 such that the 1983 meter indicates 71 dB.

h. Move the 1450 connection to position 1 of Figure 5-3 (+ PULSE output of the 1340). The reading on the 1983 meter should be within 1 dB of the reading noted in the previous step.

5.5.10 Final Calibration

a. Final calibration of the microphone to the instrument should be performed using a Type 1562 or 1567 Sound Level Calibrator.

b. With the microphone installed on the instrument, fit a ½-in. coupler-adaptor to the 1562 or 1567, turn it on (set at 1 kHz) and place it over the 1983 microphone.

c. Set the 1983 to ON. If the meter does not read 114 ± 0.5 dB, adjust the CAL control (screwdriver control, accessible through the tripod mounting hole) for 114.0 dB.

5.5.11 Meter Window Care.

The clear acrylic meter window can become susceptible to electrostatic-charge build-up and can be scratched, if improperly cleaned.

It is treated inside and out in manufacturing with a special non-abrasive anti-static solution, Statnul*, which normally should preclude any interference in meter operation caused by electrostatic effects. The problem is evidenced by the inability of the meter movement to return promptly to a zero reading, once it is deenergized. As supplied by General Radio, the meter should return to zero reading within 30 seconds, immediately following the placement of a static charge, as by rubbing the outside surface. This meets the requirements of ANSI standard C39.1-1972.

If static-charge problems occur, possibly as the result of frequent cleaning, the window should be carefully polished with a soft dry cloth, such as cheesecloth or nylon chiffon. Then, a coating of Statnul should be applied with the polishing cloth.

CAUTION

Do not use any kind of solvent. Kleenex or paper towels can scratch the window surface.

If it should be necessary to place limit marks on the meter window, paper-based masking tape is recommended, rather than any kind of marking pen, which could be abrasive or react chemically with the acrylic.

*Available from Mancib Co., Burlington, MA 01803.

5.6 TROUBLE ANALYSIS

5.6.1 General.

If it is desired to repair a defective instrument, waveforms and voltages are shown on the schematic (for a predetermined input signal). These waveforms will help isolate the problem to a part or parts on the board.

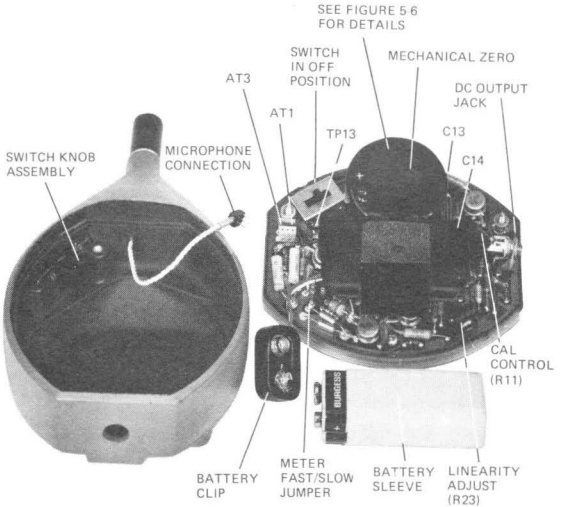


Figure 5-4. Interior view of the SLM.

MECHANICAL PARTS LIST

Fig Ref	Description	GR Part No.
1	Case, molded, asm	1983-1101
2	Slide Button includes:	1983-7100
	spring	1983-8040
	spring	1983-8010
3	Microphone asm	1983-2200
4	Meter assembly	5730-1450
5	Dust cap	1972-7410
6	Snap button 0.359-in.	4160-0250
7	Snap button 0.219-in.	4160-0270
MISCELLANEOUS		
	Battery 2U6	8410-3200
	Battery strap	8160-0120
	Switch asm, S-1 (located on 1983-4700 Board) includes:	
	Cover	1983-8000
	Carrier	1983-7020
	Contacts	1983-8030

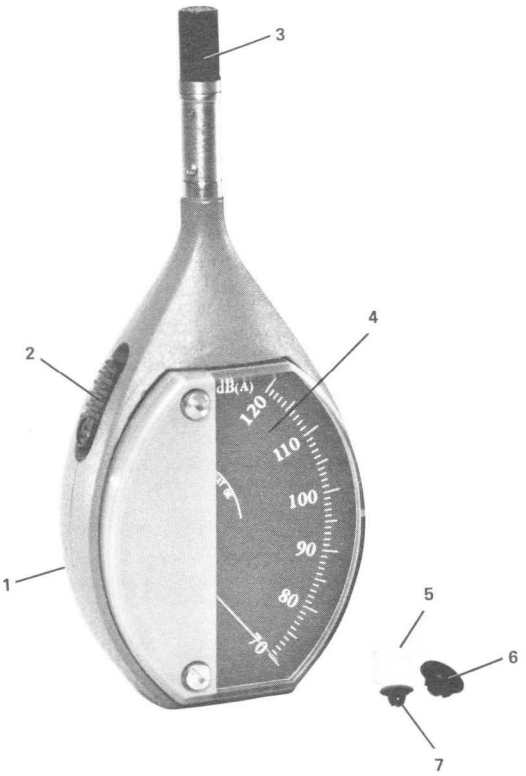


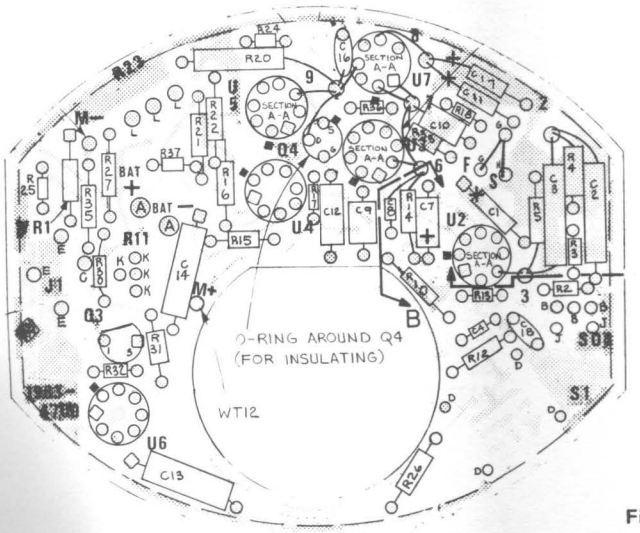
Figure 5-5. Replaceable mechanical parts.

ELECTRICAL PARTS LIST

Ref Des	Description	GR Part No.	Fed Mfg Code	Mfg Part No.
CAPACITORS				
C1	Cap, Tant, 6.8 μF, ±20%, 6V	4450-4800	56289	150D685X0010A2
C2 and				
C3	Cap, Mylar, .00487 μF, ±2%, 100 V	4860-7404	84411	663UW, .00487 uF
C4	Cap. Mica, 665 pF, ±5%, 300 V	4710-0645	81349	CM05, 665 pF ±5%
C7	Cap, Tant, 1.0 uF ±5% 20 V	4450-4302	12954	D Series, 1.0 uF ±5%
C8	Cap, Cer, 150 pF ±5% 100 V	4400-6491	72982	8101, 150 pF ±5%
C9	Cap. Cer. 47 pF, ±5%, 100 V	4400-6487	72982	8101, 47 pF ±5%
C10	Cap. Cer. 0.68 pF ±5% 500 V	4400-0069	95121	QC, 0.68 pF ±5%
C11	Cap, Tant, 6.8 uF ±10% 15 V	4450-6405	56289	162D, 6.8 uF ±10%
C12	Cap, Tant, 1.0 uF ±10% 35 V	4450-4301	56289	150D105X9035A2
C13 and				
C14	Cap, Tant, 33 uF ±20% 10 V	4450-5400	56289	150D336X0010B1
C16	Cap, Cer, .01 uF +80-20% 100 V	4401-3100	72982	805, .01 uF +80-20%
C17	Cap. Tant., 0.47 μF ±10%, 35 V	4450-6430	56289	162D, 0.47 μF ±10%, 35 V
C18	Cap, Cer, 270 pF ±5% 100 V	4400-6494	72982	8101, 270 pF ±5%
CONNECTOR				
J1	Miniature, Jack, Shield	4260-1110	82389	TR2A
DIODES				
VR1	Zener 1N751, ±1%	6083-1102	12498	1N751
INTEGRATED CIRCUITS				
U2	Type MC3476G	1983-0470	24655	1983-0470
U3	Type CA3130T	5432-7000	79089	CA3130T
U4	Type MC3476G	1983-0470	24655	1983-0470
U5 and				
U6	Type μA776	5432-1039	24655	5432-1039
METER				
ME-1		5730-1450	24655	5730-1450
RESISTORS				
R2	Comp., 18 kilohms ±10% 1/8 W	6098-3189	01121	RCR05G183K
R3	Comp., 1.8 kilohms ±10% 1/8 W	6098-2189	01121	RCR05G182K
R4 and				
R5	Film, 115 kilohms ±1% 1/8 W	6250-3115	75042	CEA, 115 kilohms
R10	Film, 2.37 kilohms ±1% 1/8 W	6250-1237	75042	CEA, 2.37 kilohms
R11	Pot. Cermet, 5 kilohms ±20%	6049-0420	80294	3339, 5 kilohms ±20%
R12	Film, 31.6 kilohms ±1% 1/8 W	6250-2316	75042	CEA, 31.6 kilohms
R13	Comp., 220 kilohms ±5% 1/8 W	6098-4225	01121	RCR05G224J
R14	Film, 6.04 kilohms ±1% 1/8 W	6250-1604	75042	CEA, 6.04 kilohms
R15	Film, 14.7 kilohms ±0.5% 1/8 W	6251-2147	75042	CEA, 14.7 kilohms
R16	Film, 29.4 kilohms ±0.5% 1/8 W	6251-2294	75042	CEA, 29.4 kilohms
R17	Comp., 330 kilohms ±10% 1/8 W	6098-4339	01121	RCR05G334K
R18	Comp., 47 kilohms ±10% 1/8 W	6098-3479	01121	RCR05G473K
R20	Film, 15.4 megohms ±1% 1/4 W	6350-5154	75042	CEA, 15.4 megohms
R21	Film, 10 kilohms ±1% 1/8 W	6250-2100	75042	CEA, 10 kilohms

ELECTRICAL PARTS LIST (cont)

Ref Des	Description	GR Part No.	Fed Mfg Code	Mfg Part No.
R22	Film, 45.3 kilohms ±1% 1/8 W	6250-2453	75042	CEA, 45.3 kilohms
R23	Pot. Ceramic, 10 kilohms ±20%	6049-0317	80294	3384S, 10 kilohms
R24	Comp., 1.8 megohms ±10% 1/8 W	6098-5189	01121	RCR05G185K
R25	Comp., 220 kilohms ±10% 1/8 W	6098-4229	01121	RCR05G224K
R26	Film, 4 .32 kilohms ±1% 1/8 W	6250-1432	75042	CEA, 4.32 kilohms
R27	Film, 249 ohms ±1% 1/8 W	6250-0249	75042	CEA, 249 ohms
R30	Comp., 33 kilohms ±5% 1/4 W	6099-3335	01121	RCR07G333J
R31	Comp., 75 kilohms ±5% 1/4 W	6099-3755	01121	RCR07G753J
R32	Comp., 330 kilohms ±10% 1/8 W	6098-4339	01121	RCR05G334K
R33	Comp., 27 megohms ±5% 1/4 W	6099-6275	01121	RCR07G276J
R35	Film, 100 kilohms ±1% 1/8 W	6250-3100	75042	CEA, 100 kilohms
R36	Comp., 1 megohm ±10% 1/8 W	6098-5109	01121	RCR05G105K
R37	Comp., 390 kilohms ±10% 1/8 W	6098-4399	01121	RCR05G394K
SOCKET				
S0-1	Socket	4230-8700	24655	4230-8700
TRANSISTORS				
Q3	Type E501	8215-0100	17856	E501
Q4	Type 2N4339	8210-1152	17856	2N4339



Fig

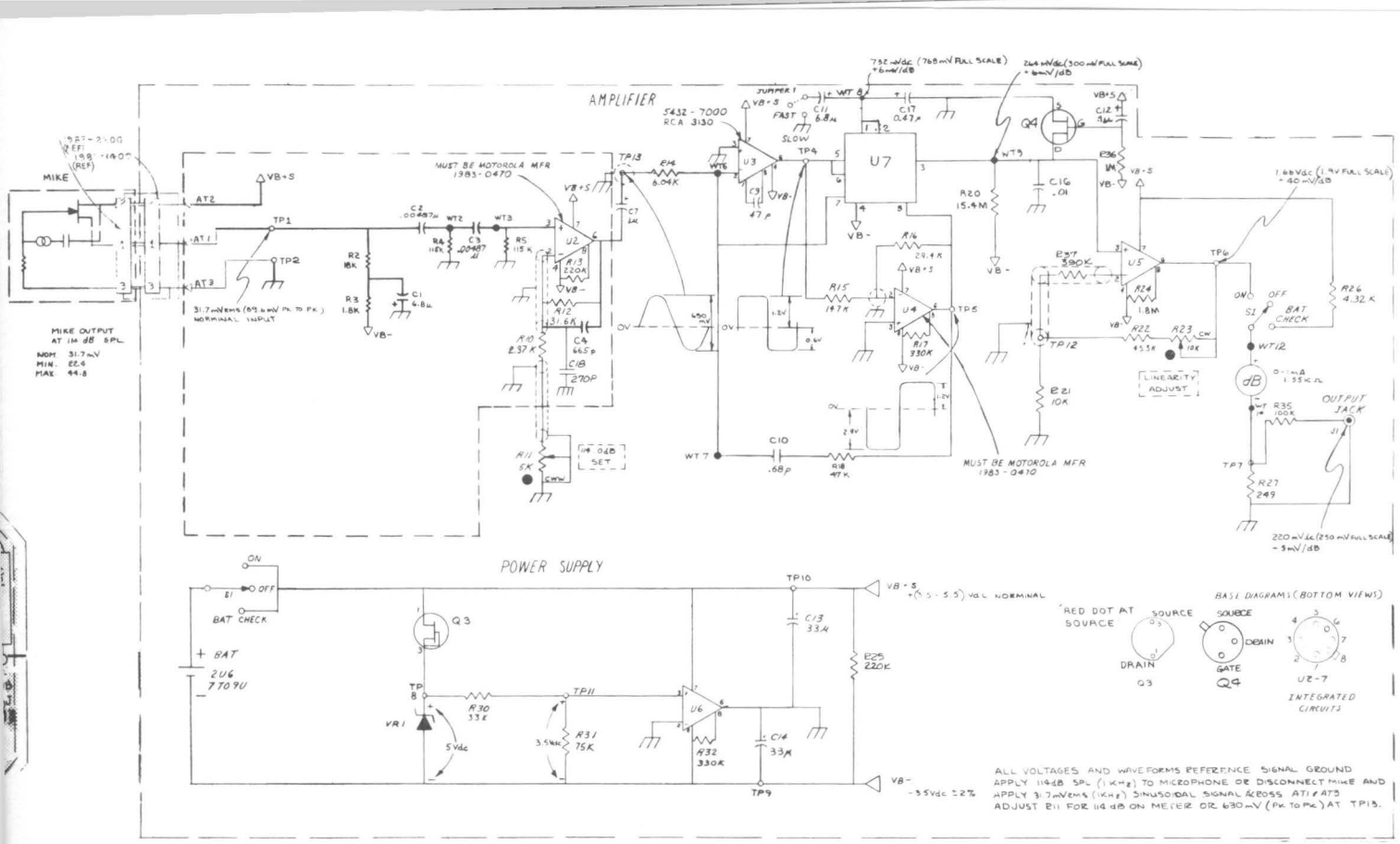


Figure 5-6. Etched circuit board diagram.

Figure 5-7. Schematic diagram for 1983 SLM.

FEDERAL MANUFACTURER'S CODE

From Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) as supplemented through August, 1968.

01121	Allen Bradley Co., Milwaukee, WI 53204
07263	Fairchild Semiconductor, Mountain View, CA 94040
09823	Burgess Battery Co., Freeport, IL 61032
12040	National Semiconductor, Santa Clara, CA 95051
12498	Teledyne, Inc., Cambridge, MA 02140
12954	Dickson Electronics Corp., Scottsdale, AZ 85252
17856	Siliconix, Inc., Sunnyvale, CA 94086
24655	General Radio Co., West Concord, MA 01742
56289	Sprague Electric Co., North Adams, MA 01247
72982	Erie Technological Products, Erie, PA 16512
75042	IRC – Div. of TRW, Burlington, IA 52601
80294	Bourns Laboratories Inc., Riverside, CA 92506
82389	Swithcraft Inc., Chicago, IL 60630
84411	TRW Capacitor, Ogallala, NB 69153
95121	Quality Components Inc., St. Marys, PA 15857