

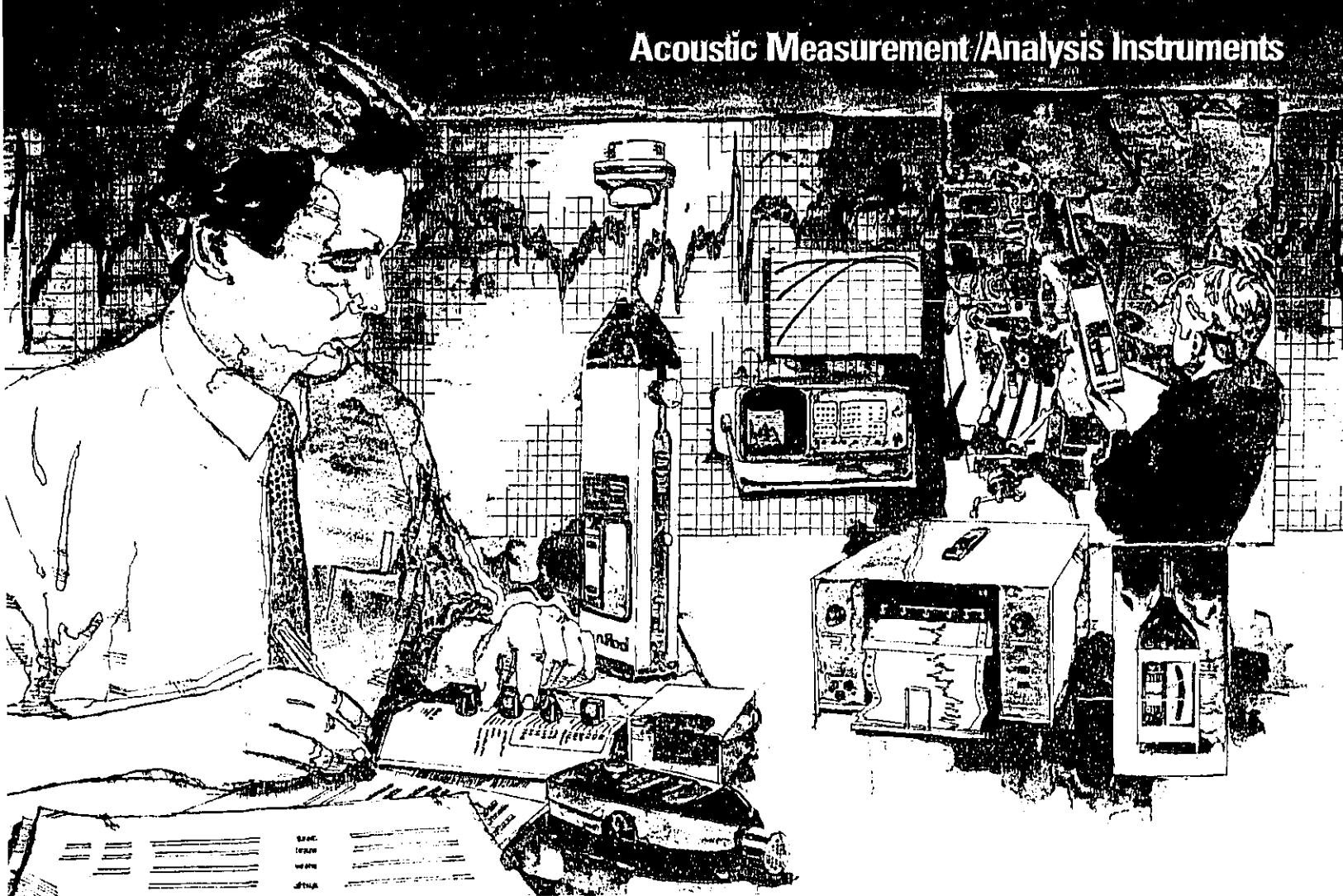


GenRad

A-96-01
II-A-809

NOISE CONTROL STARTS HERE.

Acoustic Measurement/Analysis Instruments



A LOOK AT GENRAD

Founded in 1915 as the General Radio Company, GenRad has earned a strong reputation for product innovation, quality, and reliability in the test and measurement industry.

GenRad pioneered the acoustic measurement instrumentation described in this catalog, bringing the first commercial sound-level meter to market more than 50 years ago. We've been improving them ever since.

Today, you'll find GenRad at the forefront of acoustic measurement, with versatile and reliable meters, analyzers, calibrators, microphones, and accessories.

We're charting new directions in other test technologies as well, including

- stroboscopes...
- manual bridges and standards...
- microprocessor-based automatic bridges...
- computer-aided engineering and yield-management software...
- semiconductor and printed-circuit board test systems...
- structural and field service test systems, and more.

For more information about GenRad products not covered in this catalog, please call your local GenRad sales representative.

A LOOK AT OUR PRODUCTS

Excessive noise can be more than a nuisance.

It can be dangerous for your employees; it can be hazardous to the environment; and it can have a detrimental impact on the profitability of your business.

An effective noise-control program starts with GenRad acoustic/measurement analysis products. Whether you have industrial, product, or community noise applications, there are GenRad instruments to meet your needs.

This catalog will help you identify, order, and put those instruments to work in your noise-control program as quickly as possible. The material provided includes complete specifications on all acoustic instruments, warranty and ordering information, and recommended applications for our broad range of equipment. Catalog sections are divided according to product groups. Our handy applications charts will help you quickly pinpoint the GenRad model best suited to your needs.

Quality and Reliability

Each GenRad instrument is backed by a tradition of quality, accuracy, and innovation spanning more than half a century. All equipment meets applicable American and international performance standards for general- and special-purpose applications.

GenRad sound-level meters and noise dosimeters measure the magnitude of noise levels and help determine if they are annoying or dangerous. GenRad noise analyzers help identify process, product, and environmental noise by giving information on the frequency components of noise so noise reduction measures can be taken. And GenRad calibrators and audiometer calibration systems—along with mikes, preamps, and accessories—help you configure a system precisely meeting your requirements.

Let GenRad acoustic instruments work for you to isolate and correct your sound-level problems so they're never more than a nuisance. This is where noise control begins.

TABLE OF CONTENTS

Warranty and Ordering Information	3
Sound-Level Meters	4
Noise Dosimeters	18
Calibrators	23
Analyzers and Recorders	32
Microphones and Preamplifiers	38
Accessories for Acoustic Instruments	45
Random-Noise Generators and Audio Test Meters	47
Product Index	54
National Stock Numbers	54

APPLICATIONS INFORMATION

Whether you need hearing conservation, product noise reduction, or community noise measurements, GenRad has engineered sound-measuring equipment for your specific needs.

Use these handy applications **Hearing Conservation**

charts to quickly choose the products best suited to your applications.

And feel free to call 1-800-343-4470 (in Massachusetts, 1-617-369-4400 ext. 3138) with any questions you may have about the capabilities of specific GenRad products.

	page
Sound-Level Meters	
1988 Precision Integrating Sound-Level Meter and Analyzer	5
1982 Precision Sound-Level Meter and Analyzer	8
1981-B Precision Sound-Level Meter	10
1565-B Sound-Level Meter	13
Sound-Level Measurement Set (Industrial Noise)	15
1565-D Sound-Level Meter	13
Sound-Level Measurement Set (Community Noise)	16
Noise Dosimeters	
1954 Noise Dosimeter	19
Calibrators	
1986 Omnical Sound-Level Calibrator	24
1987 Minical Sound-Level Calibrator	25
1562-A Sound-Level Calibrator	27
1565 Audiometer Calibration Set	28
1560-9619 Audiometer Calibration Accessory Set	29

Product Noise Reduction

	page
Sound-Level Meters	
1988 Precision Integrating Sound-Level Meter and Analyzer	5
1982 Precision Sound-Level Meter and Analyzer	8
Vibration Measuring Instruments	
1933 Vibration Integrator System	12
Sound and Vibration Analyzers	
1995 Integrating Real-Time Analyzer	33
Recorders	
1985 DC Recorder	36
Calibrators	
1986 Omnical Sound-Level Calibrator	24
1987 Minical Sound-Level Calibrator	25
1557-A Vibration Calibrator	31

Community Noise Measurements

	page
Sound-Level Meters	
1988 Precision Integrating Sound-Level Meter and Analyzer	5
1982 Precision Sound-Level Meter and Analyzer	8
1981-B Precision Sound-Level Meter	10
1565-D Sound-Level Meter	13
Calibrators	
1986 Omnical Sound-Level Calibrator	24
1987 Minical Sound-Level Calibrator	25
1562-A Sound-Level Calibrator	27
Analyzers	
1995 Integrating Real Time Analyzer	33

WARRANTY & ORDERING INFORMATION

Order Your GenRad Instruments Today.

How to Order

To order by telephone dial our toll free number:

Acoustics:
1-800-343-4470
In Massachusetts:
1-617-369-4400, Ext. 3138
9:30 a.m. to 5:30 p.m.
Eastern Standard Time

When ordering your GenRad equipment by mail use the following address:

GenRad, Inc.
Instrument Sales Group
300 Baker Avenue
Concord, MA 01742

When placing orders, please list:

1. Quantity of each item
2. Order Number of each item
3. Complete Description of each item
4. Shipping Address
5. Billing Address
6. Purchase Order Number

Confirming Orders

To avoid duplication of a telephone order, please write "Confirming Order" clearly on the order form.

Terms and Conditions of Sale

The determination of prices, the terms and conditions of sale, and the final acceptance of orders are made at the GenRad office in Concord, MA. We will be pleased to furnish quotations either by mail or by telephone.

Terms are net 30 days, if credit has been arranged. Shipments will be made C.O.D. unless payment is received before the ship date.

Minimum Billing

Minimum Billing is \$50.00.

Prices

Prices of all instruments and products described in this catalog appear in a separate price list. Call our toll free number 1-800-343-4470 for price quotes and copies of price lists.

All prices are FOB, Concord, MA. Prices given in the price list are subject to change without notice. GenRad price quotations remain in effect for 30 days.

Shipping Information

Unless specific instructions accompany your order, we will use our judgment as to the most appropriate method of shipment. Your GenRad products can be shipped by either air or surface transportation. For fast delivery at a reasonable premium over other means, we recommend air shipment. Please submit specific requests with your original order.

Return of Items

You must obtain authorization from our Service Department before returning items for any reason. Please call our Service Department in Concord, Massachusetts at (617) 369-4400 to request a Return Material Tag, which includes shipping instructions.

Please state the type and serial number of the instrument, date of purchase, and reason for return:

Service Policy

GenRad Service Department representatives will assist you in all matters relating to product maintenance, such as calibration, repair, and replacement parts.

The GenRad Service Department is located at:

GenRad, Inc.
Service Dept., Dock 4
300 Baker Avenue
Concord, MA 01742
Telephone: 617-369-4400

GenRad Warranty

GenRad warrants that this product is free from defects in material and workmanship and when properly used, will perform in accordance with GenRad's applicable published specifications.

If within one (1) year after original shipment it is found not to meet this standard, it will be repaired, or at the option of GenRad, replaced at no charge when returned to our GenRad service facility. Changes in the product not approved by GenRad shall void this warranty.

GenRad shall not be liable for any indirect, special, or consequential damages, even if notice has been given of the possibility of such damages.

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

SOUND-LEVEL METERS

The sound-level meter—the basic instrument of sound measurement—reads sound levels at its microphone in terms of a standard reference pressure ($20 \mu\text{Pa}$). The instrument consists of a microphone, amplifier, weighting networks, detector, and indicating meter. The networks provide the three common sound-level meter responses, A, B, and C.

Today, sound-level meters are used to help control sound in environments from industrial facilities to urban streets, and in products from computer systems to household appliances.

That's why GenRad offers a choice of five high-performance meters, varying in size, dynamic range, and analysis capabilities. Together, all GenRad meters meet or exceed both U.S. and international standards for Types 1 (Precision), 2 (General Purpose), and 3 (Survey).

Small, lightweight, and easy-to-use, GenRad meters can be handheld, mounted on a tripod, or used on a bench or table. Sound-level readings can be easily taken with the microphone in vertical or horizontal positions. And all meters have outputs for accessories and peripheral equipment such as analyzers, recorders, oscilloscopes, and earphones.

1988 PRECISION INTEGRATING SOUND-LEVEL METER & ANALYZER

Integrates Sound Levels Easily and Automatically

- Automatically performs all integration for cumulative sound-level measurements like L_{eq} and SEL
- Conventional measurements as well as peak and impulse readings and octave bands
- Lightweight (3 pounds) for easy handling and use, with choice of power supplies for flexibility
- 5 dB exchange rate available for OSHA measurements



Basically, an integrating sound-level meter lets you capture and add up the contributions of noise sources by averaging their levels over periods of time.

With conventional meters, these measurements often require costly, time-consuming manual steps. With the GenRad 1988 Precision Integrating Sound-Level Meter and Analyzer, you can integrate and average noise levels over extended periods of time—automatically, precisely, and with the versatility to address product noise, community noise, and industrial noise.

Designed for both integrating and conventional noise measurements, the 1988 provides exacting measurements for L_{eq} (equivalent continuous level) and SEL (sound exposure level) integrating parameters.

The instrument contains A, B, C weighting networks as well as flat (no weighting) networks. It incorporates 10 octave band filters and uses a single attenuator, eliminating the confusion of a two-attenuator system. And the 1988 provides direct readings for levels ranging from 30 dB to 140 dB (150-dB peak).

Easy, Accurate Readings

With the 1988, most tasks involve simple, pushbutton operations. Integration periods can be pre-set to run anywhere from 1 second to 24 hours, so in many cases the 1988 can be left unattended.

Meter readings can be easily viewed during operation on the digital LED display (resolution of 0.1 dB), or the 1988's analog meter.

The 1988's peak detector is fast, for measuring impact- or impulse-type noise. With a 50 microsecond rise time, the detector ensures reading the true peak of the signal up to 140 dB. (An accessory microphone attenuator extends this range to 150 dB.) An impulse detector which meets IEC 651 is also built in.

A significant feature of the 1988 lets you capture and hold the peak or rms reading on the digital display without inhibiting successive readings on the analog meter. This lets you take ambient level readings immediately after the impact occurs—without losing the peak reading.

Also, in this mode you don't have to wait for the peak detector to decay before reading a lower peak—a press of the capture button resets the long decay time of the detector, allowing you to read a lower peak immediately following the previous measurement.

Flexible Power Supplies

The 1988 can operate from an internal battery pack, from a conventional power line, from an extended life battery/charger unit that permits up to 24 hours continuous operation, or from a 12-volt car battery using an auto-power cable.

For noise measurements where a remote microphone location is required, GenRad provides accessories including a calibrator, carrying case, tripod, and extension cable.

For hard-copy printouts, the 1988 can be easily attached to a printer.

Continued on the next page.

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1988 SOUND-LEVEL METER & ANALYZER (Cont'd)

SPECIFICATIONS

INTEGRATION CHARACTERISTICS:

The 1988 measures and displays sound-pressure level (SPL or $L_{p,m}$) or sound-exposure level (SEL) integrated over selectable times ranging from 1 sec to 24 hr. Integration can be timed manually or automatically. Two time ranges are available: 1 sec to 600 sec in 1-sec steps and 10 min to 24 hr in 1-min steps. A PAUSE feature permits exclusion of events not wanted in the integrated result. Short-time standard FAST and SLOW sound levels over range of more than 70 dB are included in integrated result. Long-time integrated sound-pressure levels ($L_{p,m}$) ranging from 25 to 150 dB and sound-exposure levels (SEL) ranging from 25 to 190 dB are displayed. The maximum detected level (Fast, Slow, or Impulse) during integration period can be displayed at any time.

STANDARDS: Meets the following (use 1987 or 1986 Sound-Level Calibrator):

ANSI Standard Specifications for Sound-Level Meters S1.4-1971, Type 1 (Precision).

IEC Standard 651-1979, Sound-Level Meters (Type 1).

ANSI Standard Specifications for Octave, Half-Octave, and Third-Octave Band Filter Sets S1.11-1966, Type E, Class II.

IEC Recommendation Publication 225-1966, Octave, Half-Octave, and Third-Octave Band Filters for the Analysis of Sound and Vibration.

REFERENCE CONDITIONS: Reference conditions as required by IEC Standard 651-1979 are as follows:

Reference Direction of Incidence:

1988-9700 - random

1988-9710 - perpendicular to plane of diaphragm

Reference Sound Pressure Level: 94 dB
Reference Range: 100 dB full scale
Reference Frequency: 1 KHz

LEVEL RANGE (PREAMPLIFIER GAIN SET TO x 1): 30 to 130 dB re 20 μ Pa* (140 dB pk). May be extended to 140 dB rms (150 dB pk) using 10-dB microphone attenuator (1962-3210) supplied. Typical minimum measurable level, 32 dBA, lower in octave bands. Noise floor at least 5 dB below minimum measurable levels.

FREQUENCY WEIGHTING AND FILTERS: A, B, and C weighting per reference standards. Flat response from 5 Hz to 20 KHz. Response is down -3 dB \pm 3 dB at 5 Hz and 20 KHz relative to 1-KHz level (electrical only, microphone not included). Ten octave-band filters ranging from 31.5 Hz to 16 KHz (center frequencies).

DETECTOR CHARACTERISTICS: Detector Response: Fast, Slow, Impulse (per IEC 651) and absolute peak (>50- μ sec detector rise time) switch selectable. Precise rms detection for signals with crest factors up to 20 dB at 120 dB, \pm 10 dB at 130 dB). Crest-factor capacity increases below full scale.

DETECTION OF OVERLOAD AND UNDERLOAD: Signal peaks monitored at 2 critical points to provide positive indication of peak overload on panel LED. If, during integration, upper limit of detector range is exceeded for more than 0.1% of integration period, overload warning on digital display indicates that result may be in error. If integrated level is less than lower limit corresponding to 5 dB below bottom scale on panel meter, underload warning is given on digital display.

DISPLAY: ANALOG: 3-in. panel meter graduated in 1-dB increments; four ranges: 30-80 dB, 50-100 dB, 70-120 dB, and 90-140 dB; displays continuous level (i.e., Fast, Slow, Impulse, and Peak). DIGITAL: Display is 4-digit LED type with 0.1-dB resolution for level display; can display continuous level, maximum level, integrated sound level ($L_{p,m}$), or sound-exposure level (SEL); display is updated once per second when integrating, 7 times per second in continuous mode.

FILTERS: Octave-band filters have attenuation of 3.5 ± 1 dB at nominal cutoff frequency, more than 18-dB attenuation at $\frac{1}{2}$ and 2 x center frequency, and more than 70-dB ultimate attenuation.

MICROPHONE AND PREAMPLIFIER: TYPE: $\frac{1}{2}$ -in. Electro-Condenser Microphone with Flat response to random (-9700) or perpendicular (-9710) incidence; response curve supplied. MOUNTING: Detachable preamplifier (1560-3410) that plugs into nose of instrument or can be removed with 10-ft cable (1933-0220) supplied or 60-ft cable (1933-9601) available. Preamplifier has selectable x 1 or x 10 gain, normally set for x 1. INPUT IMPEDANCE: Approximately 2 G Ω in parallel with <6 pF. Switchable 200-V polarizing supply allows use with air-condenser microphones.

OUTPUTS: AC OUTPUT: 0.4 V rms nominal, behind 5 k Ω , corresponding to full-scale deflection; any load permissible. DC OUTPUT: 3 V nominal, behind 30 k Ω , corresponding to full-scale meter deflection. Output is linear in dB at 60 mV/dB over 70-dB range (50-dB panel-meter display range plus 20-dB crest-factor allowance). Any

load permissible. OUTPUT TO PRINTER: RS232C with TTL-logic levels (0-5 V), 25-pin-connector optional printer cable available for use with most TTL-compatible printers. Serial output rate at EIA standard 110 baud. Dwell time of 4 sec permits use with buffered-input printers. Elapsed integration time, selected integration level ($L_{p,m}$ or SEL) and maximum level during each integration period are printed.

CALIBRATION: FACTORY: Calibrated and fully tested to all specifications. Sensitivity measured in free field by comparison with laboratory-standard microphone that has calibration traceable to U.S. National Bureau of Standards. FIELD: GenRad 1987 or 1986 Sound-Level Calibrators are available for field calibration.

ENVIRONMENT: TEMPERATURE: -10 to +50°C operating, -40 to +60°C storage with batteries removed, +15°C during battery charging. HUMIDITY: 0-95% RH operating. MAGNETIC FIELD: 1-oersted (80 A/m) 60-Hz field causes 50-dB, C-weighted indication and negligible A-weighted indication, when meter is oriented for maximum sensitivity to field. Equivalent A-weighted response to 1-oersted 400-Hz field is approximately 55 dBA with meter oriented for maximum sensitivity to field. VIBRATION: When sound-level meter, with attached microphone, is vibrated at acceleration of 1 m/sec² (0.1/G) in direction perpendicular to plane of microphone diaphragm, the indicated flat-weighted level does not exceed 80 dB in frequency range from 20 Hz to 1 KHz. Reference instrument that is not being vibrated indicates maximum level of 65 dB.

SUPPLIED: Battery pack assembly; power pack and charger, microphone extension cable (10 ft); 10-dB microphone attenuator; calibration screwdriver; wrist strap; miniature phone plug (2); carrying pouch; microphone windscreen; power cable; support; instruction manual.

AVAILABLE: Carrying case (includes space for calibrator, cable, tripod, miscellaneous accessories); battery pack assembly; microphone extension cables (10 ft, 60 ft); calibrators, 1986 and 1987; dummy microphones, 22 and 35 pF with BNC female input; tripod - will mount either 1982 or preamplifier; windscreen (package of 4); adaptor cables for connection to outputs, all 3 ft (0.9 m) long; 1560-9619 Audiometer Calibration Accessory Set; Vibration Integrator System; weatherproof enclosure adaptor; extended-life battery and charger set; printer cable; auto power cable.

POWER: May be operated from any of the following 4 sources of power. 1) 100-125 or 200-250 V line with power pack supplied. 2) Supplied AA-size rechargeable battery pack provides at least 2-hr continuous operation. Battery pack is recharged in about 4 hr from power pack. 3) Three AA-size alkaline (non-rechargeable) batteries in place of rechargeable AA battery pack. 4) Remote 12-V battery or any remote battery of sufficient capacity and voltage in range from 3.3 to 14 V. Cable and plug for connection are supplied.

MECHANICAL: 1988-9700, 1988-9710 DIMENSIONS (W x H x D): 3.9 x 20.2 x 2.3 in. (99 x 513 x 59 mm), WEIGHT: 3 lb. (1.36 kg) net, 11 lb. (5.0 kg) shipping.

1988-9610, EXTENDED LIFE BATTERY AND CHARGER SET.

An optional rechargeable battery, charger, and battery cable provide greater than 24-hour operation of the 1988-9700 or 1988-9710 instruments at locations remote from AC sources.

12.6 V, 5 aH rechargeable battery in simulated leather case, plus shoulder strap.

MECHANICAL: DIMENSIONS (W x H x D): 3.50 x 7.88 x 4.12 in. (89 x 202 x 105 mm), WEIGHT: 6.13 lb. (2.77 kg).

ELECTRICAL CONNECTION: Universal automotive cigar-lighter socket provided on one end of carrying case. Socket accepts cigar-lighter plug for charging the battery, or an adaptor cable for supplying power to the instrument.

PROTECTION: 5 ampere, type 3AG, normal blow fuse provided in in-line fuseholder mounted within carrying case.

AC CHARGER: 12.6 V, 520 mA charger to charge the 12.6 V Battery Pack. Comes in plastic case and is switchable from 120 VAC to 220 VAC 50/60 Hz.

CHARGING TIMES:

120 V	220 V
104 V 24 hrs	198 V 24 hrs
127 V 8 hrs	242 V 8 hrs

MECHANICAL: DIMENSIONS (W x H x D): 2.4 x 5.1 x 2.2 in. (61 x 130 x 56 mm), WEIGHT: 1.06 lb. (0.48 kg).

ELECTRICAL CONNECTIONS: INPUT: IEC Universal socket. OUTPUT: 6-ft (1.8-m) cord with automotive cigar-lighter plug.

CABLE: Retractable cable with cigar-lighter plug at one end. Provides connection between 1988 and 12.6 V Battery Pack. Cable is extended from coiled length of approximately 1 ft (0.3 m) to 4 ft (1.2 m).

* In the international system of units (SI) the unit of pressure is the pascal (Pa; 1 Pa = 1 N/m² = 10 dynes/cm² = 10⁻² mbar. REF: "The International System of Units (SI)," U.S. Dept. of Commerce, National Bureau of Standards, NBS Special Publication 3320, SD Cat. No. C13.10:3302, U.S. GPO, Washington, D.C. 20402.
† 10 dB higher when 10-dB microphone attenuator is used.



ORDERING INFORMATION

Description	Order No.
Precision Integrating Sound-Level Meter and Analyzer (with random-incidence microphone)*	1988-9700
Precision Integrating Sound-Level Meter and Analyzer (with perpendicular-incidence response microphone)**	1988-9710
Accessories	Order No.
Printer Cable	1988-9605
Weatherproof Enclosure Adaptor	1988-9600
Extended Life Battery and Charger Set	1988-9610
Auto Power Cable	1988-9606
Carrying Case (1988, 2986, tripod, etc.)	1982-9630
1988 Omnidirectional Sound-Level Calibrator	1986-9706
1987 Minimal Sound-Level Calibrator	1987-9700
Dummy Microphone	1982-9820
Tripod	1560-9590
Windscreen (package of 4 for 1 in. microphone)	1560-9521
Windscreen (package of 4 for 1/2 in. microphone)	1560-9522
Microphone Extension Cable (10 ft)	1933-9600
Microphone Extension Cable (60 ft)	1933-9601
Vibration Integration System	1933-9810
1 in. Ceramic Microphone	1971-9601
1 in. Electret Condenser Microphones (random-incidence response)	1961-9610
1 in. Electret Condenser Microphones (perpendicular-incidence response)	1961-9611
OSHA Conversion Kit (5 dB)	1988-9002

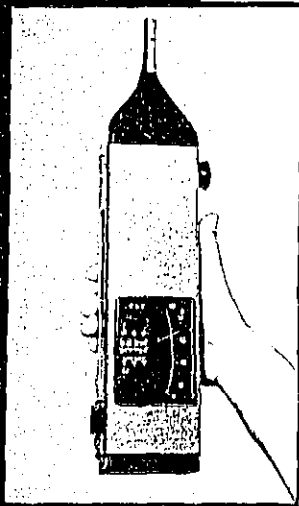
* Conforms to ANSI S1.4 1971 Type 1 and IEC 661
** Conforms to IEC 651

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1982 PRECISION SOUND-LEVEL METER & ANALYZER

Meets Your Requirements for Quality Sound Measurements

- Versatile, all-purpose instrument for the widest range of noise measurements: precision sound-level meter, peak and impulse noise meter, and octave-band analyzer
- Ideal for OSHA measurements
- Digital and analog displays for error-free readings
- Lightweight (3 pounds) and compact for easy handling and use



Versatility and ease-of-use. That's what GenRad designed into the 1982.

Now you can use a single instrument, without plug-in filters or costly accessories, to make A, B, or C weighted sound-level measurements from 30 dB to 140 dB...octave-band analyses in 10 bands from 31.5 Hz to 16 KHz...and peak or impulse noise measurements.

The 1982 conforms to ANSI Type 1 and IEC sound-level meter standard 651.

In addition, it uses a single attenuator, allowing you to set the range desired, switch on the instrument, and read the measured level from either the digital or analog display. This eliminates the confusion of a two-attenuator system.

Easy, Accurate Readings

Meter readings can be easily viewed during operation on the digital LED display (resolution of 0.1 dB), or the 1982's analog meter.

The 1982's peak detector is fast, for measuring impact- or impulse-type noise. With a 50 microsecond

rise time, the detector ensures reading the true peak of the signal up to 140 dB. (An accessory microphone attenuator extends this range to 150 dB.) An impulse detector which meets IEC 651 is also built in.

A significant feature of the 1982 lets you capture and hold the peak or rms reading on the digital display without inhibiting successive readings on the analog meter. This lets you take ambient level readings immediately after the impact occurs—without losing the peak reading.

Also, in this mode you don't have to wait for the peak detector to decay before reading a lower peak—a press of the capture button resets the long decay time of the detector, allowing you to read a lower peak immediately following the previous measurement.

The 1982 weighs a mere 3 pounds. For noise measurements where a remote microphone location is required, GenRad provides accessories including a calibrator, carrying case, tripod, extension cable, battery pack assembly, and dummy microphones.

SPECIFICATIONS

STANDARDS: Meets the following (use 1986 or 1987 Sound-Level Calibrator):

ANSI Standard Specifications for Sound-Level Meters S1.4-1971, Type 1 (Precision).

IEC Sound Level Meter Standard 651, Type 1.

ANSI Standard Specifications for Octave, Half-Octave, and Third-Octave Band Filter Sets S1.11-1966, Type O, Class II.

IEC Recommendation Publication 225-1966, Octave, Half-Octave, and Third-Octave Band Filters for the Analysis of Sound and Vibrations.

LEVEL RANGE: 30-130 dB re 20 μ Pa rms (140-dB PEAK). May be extended to 140-dB rms (150-dB PEAK) using 10-dB microphone attenuator (1962-3200) supplied. Typical minimum measurable level, 34 dBA; lower in octave bands. Noise floor at least 5 dB below minimum measurable levels.

FREQUENCY RESPONSE: A, B, and C weighting; 10 octave-band filters ranging in center frequency from 31.5 Hz to 16 KHz; a FLAT response (+ 0.5, -3 dB from 10 Hz to 20KHz).

DETECTOR CHARACTERISTICS: DETECTOR RESPONSE*: Fast, Slow, Impulse (per IEC 651), and Absolute Peak (<50 μ s rise time), switch selected. Precise rms detection for signals with crest factors as high as 20 dB to 120dB** (10 dB at 130 dB). OVERLOAD: Signal peaks monitored at two critical points to provide positive panel lamp warning of overload.

DISPLAY: ANALOG: Meter with 3-in. scale marked in 1-dB increments, four ranges; 30-80 dB, 50-100 dB, 70-120 dB, 90-140 dB. DIGITAL: 4-digit LED display with 0.1-dB resolution. Direct reading on all ranges. DIGITAL DISPLAY MODES: OFF for minimum battery drain; CONTINUOUS, like meter except present reading can be "captured" by pushbutton; MAXIMUM, automatically holds highest level in measurement interval, until reset by pushbutton.

MICROPHONE: TYPE: 1/2-in. Electret-Condenser Microphone with flat random (-9700) or perpendicular (-9710) incidence response. MOUNTING: Mounted with detachable preamplifier (1981-4000) that plugs into nose of instrument, or may be removed with 10-foot cable (1933-0220) supplied or 60-foot cable (1933-9601) available. INPUT IMPEDANCE: Approximately 2 G Ω / <3 pF.

OUTPUTS: AC OUTPUT: 0.4 V rms nominal behind 5k Ω corresponding to full-scale deflection, any load permissible. DC OUTPUT: 3V behind 30k Ω corresponding to full-scale meter deflection. Output is linear in dB at 60 mv/dB over 70-dB range (50-dB display range plus 20-dB crest-factor allowance). Any load permissible.

CALIBRATION: FACTORY: Fully tested and calibrated to all specifications; acoustical response and sensitivity are measured in a free field by comparison with a

*U.S. PATENT NO. 3,681,618
**10 dB HIGHER WHEN 10-dB MICROPHONE ATTENUATOR IS USED.

Western Electric Type 640AA Laboratory Standard Microphone whose calibration is traceable to the U.S. National Bureau of Standards. FIELD: GenRad 1986 or 1987 Sound-Level Calibrators are available for making an overall pressure calibration.

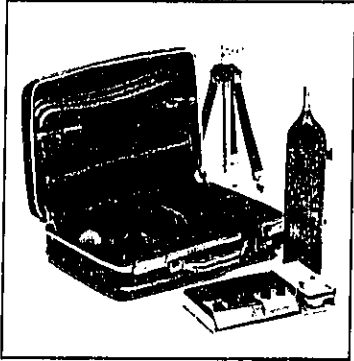
ENVIRONMENT: TEMPERATURE: -10 to +50° C operating, -40 to +60° C storage with batteries removed, 15 to 50° C during battery charging. HUMIDITY: 0-90% RH operating.

SUPPLIED: Battery pack assembly; battery charger; microphone extension cable (10-foot); 10-dB microphone attenuator; calibration screwdriver; wriststrap; miniature phone plug(2); instruction manual; microphone windscreen.

AVAILABLE: Carrying Case (includes space for calibrator, cable, tripod, misc. access.); battery pack assembly; microphone extension cables (10- and 60-foot); calibrators, 1986 and 1987; dummy microphones, 22 and 35 pF with BNC female input; tripod - will mount either 1982 or preamplifier; windscreen (package of 4); adaptor cables for connection to outputs, all 3 feet (0.9 mm) long; 1560-9619 Audiometer Calibration Accessory Kit.

POWER: Removable battery pack containing 3 AA-size nickel-cadmium rechargeable cells with charger interlock. Battery life between charges 3 to 4.5 hours depending on digital display usage. Battery charger supplied operates on 115/220 volts AC 50-60 Hz; full recharge accomplished in about 4 hours. Three AA-size alkaline cells (not rechargeable) may be used in place of the battery pack.

MECHANICAL: DIMENSIONS: (wxhxd): 3.9x16.8x2.3 in. (99x425x59mm). WEIGHT: 3 lb. (1.36 kg) net; 6 lb. (2.8 kg) shipping.



ORDERING INFORMATION

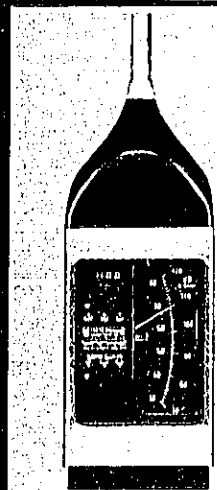
Description	Order No.
1982 Precision Sound-Level Meter and Analyzer (supplied with 1/2-in. flat random-incidence response electret condenser microphone)*	1982-9700
1982 Precision Sound-Level Meter and Analyzer (supplied with 1/2-in. flat perpendicular-incidence response electret condenser microphone)**	1982-9710
Sound-Analysis System - 1982 Precision Sound-Level Meter and Analyzer (with 1/2-in. flat random-incidence response microphone). This system includes accessories supplied as noted in Specifications, plus: 1562-A Calibrator, 1560-9590 Tripod, 1982-9630 Carrying Case, and 1933-9601 60-foot Cable	1982-9720
Sound-Analysis System - 1982 Precision Sound-Level Meter and Analyzer (with 1/2-in. flat perpendicular-incidence response microphone). This system includes all of the accessories of the above described system. Note: the difference between these systems is in the microphones supplied.	1982-9730
Accessories	Order No.
1986 Omnical Sound-Level Calibrator	1986-9700
1987 Minical Sound-Level Calibrator	1987-9700
1560-9619 Audiometer Calibration Accessory Kit	1560-9619
Microphone Extension Cable (10 ft)	1933-0000
Microphone Extension Cable (60 ft)	1933-0601
1933 Vibration Integration System	1933-9610
Dummy Microphone	1982-9620
Rechargeable Battery Pack	1981-2050
Carrying Case (for 1982, calibrator, tripod)	1982-9630
Tripod	1560-9590
Windscreen (package of 4)	1560-0522
*Conforms to ANSI S1.4 Type 1 and IEC 651 **Conforms to IEC 651	

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138 9

1981-B PRECISION SOUND-LEVEL METER & ANALYZER

Simplifies Noise Measurements for All Levels of Expertise

- Digital display captures and holds maximum sound level for accurate readings
- Digital and analog displays for error-free readings
- Digital display can be "frozen" for instant measurement of specific events
- 50-dB analog meter scale has 1-dB linear calibration



The 1981-B is a precision, Type S1A sound-level meter specially designed for quick, easy precision measurements of community, environmental, and industrial noise. Two displays—digital and analog—simplify data collection and make the 1981-B easy to use for all levels of expertise.

The meter spans 30 dBA to 120 dBA in two switch-selectable 50-dB ranges. To address a range of applications, its digital display has three operating modes: Continuous, Capture, and Maximum Hold.

In the *Continuous* mode, the digital display tracks the analog meter so that the user can read either display depending on the application or need.

The *Capture* mode lets you capture and hold a digital reading by simply pushing a button. This is especially useful when you want to instantly measure and capture the sound level of a single event.

The *Maximum Hold* mode lets you automatically update and hold the digital display at the maximum A-weighted sound level during a measurement period. This eliminates meter watching and possible misinterpretation of "approximate" needle positions.

Vehicle passby measurements are especially easy using Maximum Hold. You can measure and hold the maximum level during the passby, while simultaneously watching the analog meter rise and fall to verify that an accurate reading has been made.

Two Models Available

To meet both American and international standards, the 1981-B is available in two versions. The first (supplied with a GenRad flat random-incidence response, electret-condenser microphone) conforms to IEC 651, Type 1. When used with a GenRad 1986, 1987, or 1562 calibrator, it conforms to ANSI S1.4-1984 Type S1A.

The second version (supplied with a flat perpendicular-incidence response microphone) conforms to IEC 651 and is designed for countries where ISO recommendations apply.

The 1981-B's removable microphone and preamplifier can be used for remote-site measurements. Accessories available include additional extension cables, tripod, calibrator, carrying case, windscreens, and rechargeable battery pack.

SPECIFICATIONS

STANDARDS: Instruments with a GenRad 1/2-in. flat *random-incidence* response Electret-Condenser Microphone conform to IEC 651 and, when used with a GenRad Sound-Level Calibrator, to ANSI S1.4-1971 Type S1A.

Instruments with a GenRad 1/2-in. flat *perpendicular-incidence* response Electret-Condenser Microphone conform to IEC 651.

MEASUREMENT RANGE AND RESPONSE CHARACTERISTICS: SOUND LEVEL RANGE: 30 to 120 dBA in two 50-dB switch-selectable ranges; 0-dB reference is 20 μ Pa. FREQUENCY RESPONSE: "A" weighting. DETECTOR* CHARACTERISTICS: Rms response. Crest-factor capacity, X5 at full scale. DYNAMICS: Fast and slow, switch selected.

DISPLAYS: ANALOG: Meter 3-in. scale, 30 to 80 and 70 to 120 dBA; increments 1 db. DIGITAL READOUT: 4-digit with decimal point, "LED," 7-segment numerals; increments 0.1 dB. DIGITAL-DISPLAY MODES: OFF, for minimum battery drain; CONTINUOUS, like meter except present reading can be "captured" by pushbutton; MAXIMUM, automatically holds highest level in measurement interval, until reset by pushbutton.

MICROPHONE AND TERMINALS: MICROPHONE: GenRad 1/2-in. electret-condenser, 2 response types (see description). MICROPHONE CONNECTOR: Input impedance approx. 1 G Ω , parallel 5 pF. AC OUTPUT: Weighted, 500 mV nominal full

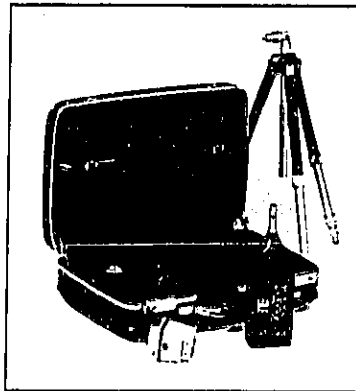
scale, behind 5 k Ω . DC OUTPUT: Approx. 10 mV/dB, linear, 500 mV nominal full scale, behind 100 k Ω . Both outputs are short-circuit-proof; both receive subminiature phone plugs (0.097 in., 2.5 mm dia.). INPUT: 1/2-in. electret-condenser microphone with flat response (random or perpendicular incidence); mounted with detachable preamplifier (1933-4000) that plugs into nose of instrument, or may be removed with accessory 10- or 60-ft cable.

CALIBRATION: FACTORY: The sound-level meter with microphone is fully tested and calibrated to all specifications; acoustical response and sensitivity are measured in a free field by comparison with a Western Electric 640AA Laboratory Standard Microphone whose calibration is traceable to the U.S. National Bureau of Standards. FIELD: GenRad 1986 or 1987 Sound-Level Calibrators are available for making an overall pressure calibration.

ENVIRONMENT: TEMPERATURE: -10 to +50° C operating, 15 to 50° C battery charging, -25 to +60° C storage with battery pack supplied. HUMIDITY: 0 to 90% RH, operating and storage.

SUPPLIED: Wrist strap, battery pack, battery charger, screwdriver for calibration adjustment, miniature phone-plug connectors, windscreen, instruction manual.

AVAILABLE: Calibrators, rechargeable battery pack, spare, microphone extension cables, tripod, carrying case (includes space for accessories), microphone windscreen (package of 4), tripod.



POWER: Removable battery pack containing 3 AA-size nickel-cadmium rechargeable cells with charger interlock. Battery life between recharges, 5 to 10 hours depending on digital display usage. Battery charger (supplied) for 115/220 Vac 50-60 Hz operation; full recharge accomplished in about 4 hours. Instrument may be operated continuously from AC power by using charger; in this case battery pack is trickle-charged. Three AA-size primary

cells (not rechargeable) may be used in place of the battery pack.

MECHANICAL: DIMENSIONS (wxhxd): 3.4 x 11 x 2.3 in. (87 x 292 x 59 mm). WEIGHT: 30 oz (0.8 kg) net, 5.5 lb. (2.5 kg) shipping.

ORDERING INFORMATION

Description	Order No.
1981-B Precision Sound-Level Meter With 1/2-in. electret condenser microphone (random incidence)*	1981-9750
With 1/2-in. electret condenser microphone (perpendicular incidence)**	1981-9751
Accessories	Order No.
1986 Omnidirectional Sound-Level Meter	1986-9700
1987 Minical Sound-Level Meter	1987-9700
Carrying Case (for 1981-B, calibrator, tripod)	1982-9030
Microphone Extension Cable (10 ft)	1933-9000
Microphone Extension Cable (60 ft)	1933-9001
Rechargeable Battery Pack (spare)	1981-2050
Tripod	1500-9590
Windscreen (package of 4)	1500-9522
*Conforms to ANSI S1.3 1971 Type S1A and IEC 651	
**Conforms to IEC 651	

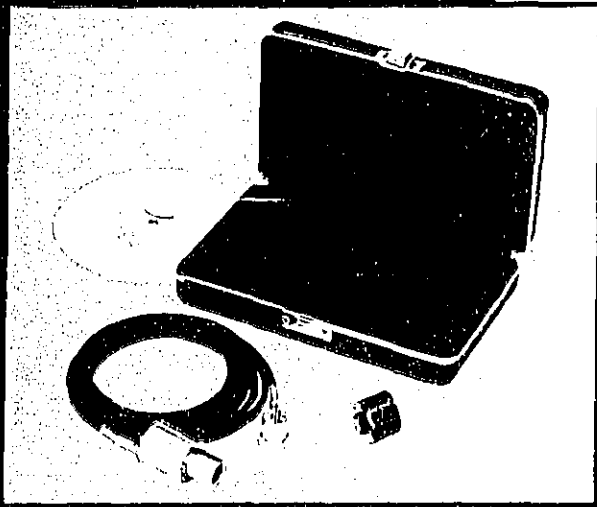
*U.S. PATENT 3,001,618.

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138 

1933-9610 VIBRATION INTEGRATOR SYSTEM

Adds Vibration Measurement Capabilities to the 1981, 1982, 1988 and 1995

- Vibration measurements for increasing the versatility of your GenRad acoustic instruments
- Direct readouts in dB re standard references for acceleration, velocity, and displacement
- Easy-to-use slide rule gives metric and English vibration units



Together with most GenRad meters, the 1933-9610 Vibration Integrator System provides vibration measurements with readouts of acceleration (L_a), velocity (L_v), or displacement (L_d).

The 1933-9610 consists of a vibration pickup (accelerometer) with a magnetic clamp and keeper, a vibration integrator (that mounts

on the preamplifier in place of a microphone), an eight-foot cable connecting the pickup to the integrator, a storage case, and a slide rule.

The special, easy-to-use slide rule permits simple readout directly in vibration units—precluding the need for special conversion tables or complex dB calculations.

SPECIFICATIONS

MEASUREMENT RANGE: ACCELERATION: L_a in dB re 10^{-6} m/s²; (octave) 30 to 140 dB (3.16×10^{-4} to 100 m/s²), (flat) 46 to 140 dB (2×10^{-4} to 100 m/s²). VELOCITY: L_v in dB re 10^{-8} m/s; (octave) 60 to 150 dB (1×10^{-5} to 0.316 m/s), (flat) 76 to 150 dB (6.31×10^{-5} to 0.316 m/s). DISPLACEMENT: L_d in dB re 10^{-7} m; (octave) 50 to 150 dB (3.16×10^{-7} to 3.16×10^{-2} m), (flat) 66 to 150 dB (2×10^{-7} to 3.16×10^{-2} m).

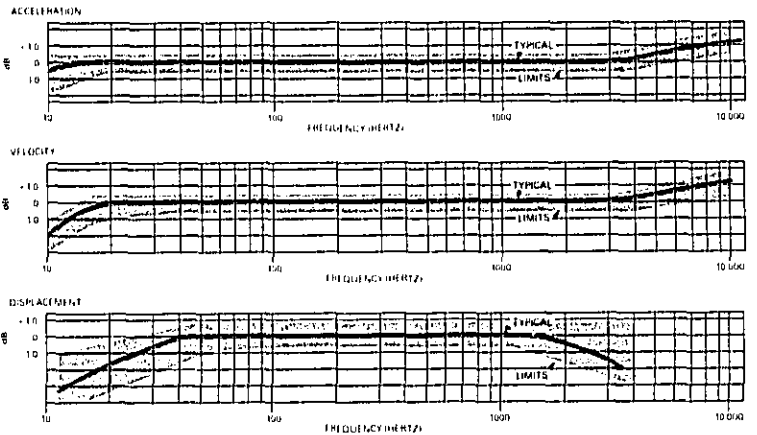
SYSTEM ENVIRONMENT: TEMPERATURE: -10 to $+50^\circ$ C operating; -40 to $+70^\circ$ C storage. HUMIDITY: 0-95% RH operating (45° C). VIBRATION: Withstand 0.030 in. pk-pk vibration 10 to 55 Hz.

TRANSDUCER ENVIRONMENT: (Endevco Model 2217E) VIBRATION: $+1,000$ pk g, sinusoidal, any direction. TEMPERATURE: -54 to $+177^\circ$ C. HUMIDITY: All welded hermetic seal.

MECHANICAL: (System in storage case). DIMENSIONS (wxhxd): $7.562 \times 2.000 \times 4.625$ in. ($190 \times 51 \times 117$ mm). WEIGHT: 1.5 lb. (0.7 kg) net, 3 lb. (1.35 kg) shipping.

ORDERING INFORMATION

Description	Order No.
1933-9610 Vibration Integrator System (Also see 1560 Vibration Pickup System.)	1933-9610



1565-B & 1565-D SOUND-LEVEL METERS

Each Packs High Performance into a Compact, Easy-to-Use Meter

1565-B METER

- Full-featured meter with range of 40 dB to 140 dB
- Lightweight and compact enough to fit in your pocket
- Meets all ANSI Type 2 general-purpose requirements
- Approved by MSHA

1565-D METER

- Full-featured meter with range of 30 dB to 130 dB
- Lightweight and compact enough to fit in your pocket
- Meets ANSI and IEC Type 2 general-purpose requirements
- FET and IC design for performance and reliability



GenRad 1565-B Sound-Level
Meter

Now you can get high performance sound-level measurements in pocket-sized meters that are light, compact, and easy to use.

Using rugged, ceramic microphones, the GenRad 1565-B and 1565-D sound-level meters conform to both American and international standards; meet all ANSI requirements for Type 2 general-purpose sound-level meters (the 1565-D also meets IEC Type 2 requirements); meet all criteria necessary for OSHA provisions; and can operate in severe environments for as long as 50 hours on self-

contained, 9-volt batteries.

Output jacks allow you to use both meters with headphones or recorders. There are no line cords to bother with or microphone cords to trip over. And one-hand operation makes it easy—just aim and read.

Meter Ranges

The 1565-D is ideal for community noise measurements, providing a range of 30 dB to 130 dB.

The 1565-B provides a range from 40 dB to 140 dB for higher sound levels.

Continued on the next page.

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1565-B & 1565-D SOUND-LEVEL METERS (Cont'd)

SPECIFICATIONS 1565-B

SOUND LEVEL: 40 to 140 dB re 20 μ Pa.

WEIGHTING: A, B, and C. Conforms to ANSI S1.4-1971 Type 2 and IEC 651.

METER: Rms response with fast and slow speeds.

INPUT: MICROPHONE: Lead-zirconate-titanate ceramic. A 1560-P96 Adaptor converts input to 3-pin male A3 connector; for correct weighting, source impedance must be 380 pF \pm 5%. **INPUT IMPEDANCE:** 13 M Ω // 15pF.

OUTPUT: \geq 1.2 V rms behind 620 Ω with meter at full scale; will drive oscilloscopes or low-impedance headphone. **HARMONIC DISTORTION:** \leq 0.5% (0.1% typical) from 32 Hz to 8 KHz, C-weighted with meter at full scale.

CALIBRATION: Can be acoustically calibrated at 125, 250, 500, 1,000, 2,000, and 4,000 Hz with 1986 Sound-Level Calibrator and 1562-A Calibrator; and at 1,000 Hz with the 1987 Calibrator.

ENVIRONMENT: TEMPERATURE: -10 to +5 $^{\circ}$ C operating; -40 to +60 $^{\circ}$ C storage, with batteries removed. Coefficient of sensitivity \approx +0.02 dB/ $^{\circ}$ C at 6 dB below full-scale meter reading. **HUMIDITY:** 90% RH. **MAGNETIC FIELD:** 1-Oersted (80 A/m) 50- or 60-Hz field causes \approx 45 dB C-weighted indication when meter is oriented to maximum sensitivity to field.

SUPPLIED: Carrying pouch, miniature phone plug to connect to output, screwdriver for calibration adjust, windscreen, batteries.

POWER: Two 9-V batteries (Burgess 2U6 or equal) supplied, provide \approx 50-h operation.

MECHANICAL: Shielded plastic case. **DIMENSIONS (wxhxd):** 3.63 x 6.5 x 2.09 in. (92 x 165 x 53 mm); **WEIGHT:** 1 lb. (0.5 kg) net, 3 lb. (1.4 kg) shipping.

SPECIFICATIONS 1565-D

SOUND LEVEL: 30 to 130 dB re 20 μ Pa.

WEIGHTING: A, B, and C. Conforms to ANSI S1.4-1971, IEC Sound-Level Meter Standard 651, Type 2.

METER: Rms response with fast and slow speeds.

INPUT: MICROPHONE: Lead-zirconate-titanate ceramic. A 1560-P96 Adaptor converts input to 3-pin male A3 connector; for correct weighting, source impedance must be 380 pF \pm 5%. **INPUT IMPEDANCE:** \approx 13 M Ω // 15pF.

OUTPUT: \geq 1.2 V rms behind 6.2 K Ω with meter at full scale; will drive oscilloscopes or low-impedance headphone. **HARMONIC DISTORTION:** \leq 0.5% (0.1% typical) from 32 Hz to 8 KHz, C-weighted with meter at full scale.

CALIBRATION: Can be acoustically calibrated at 125, 250, 500, 1,000, 2,000, and 4,000 Hz with the GenRad 1986 Sound-Level Calibrator and 1562-A Calibrator; and at 1,000 Hz with the 1987 Calibrator.

ENVIRONMENT: TEMPERATURE: -10 to +50 $^{\circ}$ C operating; -40 to +60 $^{\circ}$ C storage, with batteries removed. Coefficient of sensitivity \approx +0.02 dB/ $^{\circ}$ C at 6 dB below full-scale meter reading. **HUMIDITY:** 90% RH. **MAGNETIC FIELD:** 1-Oersted (80 A/m) 50- or 60-Hz field causes \approx 45 dB C-weighted indication when meter is oriented to maximum sensitivity to field.

SUPPLIED: Carrying pouch, miniature phone plug to connect to output, screwdriver for calibration adjust, batteries.

POWER: Two 9-V batteries (Burgess 2U6 or equal) supplied, provide \approx 50-h operation.

MECHANICAL: Shielded plastic case. **DIMENSIONS (wxhxd):** 3.63 x 6.5 x 2.09 in. (92 x 165 x 53 mm); **WEIGHT:** 1 lb. (0.5 kg) net, 3 lb. (1.4 kg) shipping.

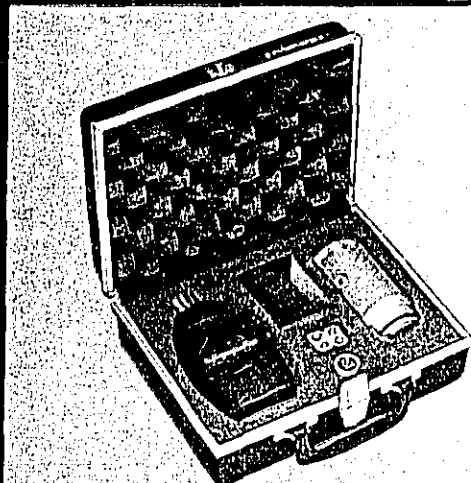
ORDERING INFORMATION

Description	Order No.
1565-B Sound-Level Meter	1565-9702
1565-D Sound-Level Meter	1565-9704
Accessories	Order No.
Windscreens reduce wind noise and protect against contaminants, pack of 4	1560-9521
Battery, spare (2 required)	8410-3200

SOUND-LEVEL MEASUREMENT SET (INDUSTRIAL NOISE)

Offers a Portable, Cost-Effective Set for Fast, Accurate Measurements

- Includes 1565-B Meter that meets ANSI Type 2 standards
- Calibrates right-on-the-spot
- Single carrying case for convenience
- Approved by MSHA



The GenRad sound-level measurement set gives you a convenient combination of sound-level measurement and calibration capabilities...fast, accurate noise measurements and calibrations in a portable set that's easily carried and easy to use.

Two versions of the set are available. Both contain the 1565-B sound-level meter meeting ANSI Type 2 standards (see page 13).

Each contains a different calibrator. The 1562-A Sound-Level Calibrator provides five frequencies, letting you test frequency response as well as calibrate. The 1987 Sound-Level Calibrator tests at 1,000 Hz, for sound-level calibration only.

Battery-powered means portability and convenience. With the set, you can quickly calibrate your meter on-the-spot.

SPECIFICATIONS

1565-9902 SOUND-LEVEL MEASUREMENT SET: 1565-B Sound-Level Meter, 1562-A Sound-Level Calibrator, carrying case, batteries, screwdriver for calibration adjust, miniature phone plug that connects to sound-level-meter output.

1565-9912 SOUND-LEVEL MEASUREMENT SET: 1565-B Sound-Level Meter, 1987 Sound-Level Calibrator, carrying case, batteries, screwdriver for calibration adjust, miniature phone plug that connects to sound-level-meter output.

MECHANICAL (any set): **DIMENSIONS** (wxhxd): 11.25 x 4.25 x 10 in. (286 x 108 x 254 mm). **WEIGHT:** 4.5 lb. (2.1 kg) net, 12 lb. (6 kg) shipping.

For all other specifications, refer to the individual descriptions of the instruments in these sets.

ORDERING INFORMATION

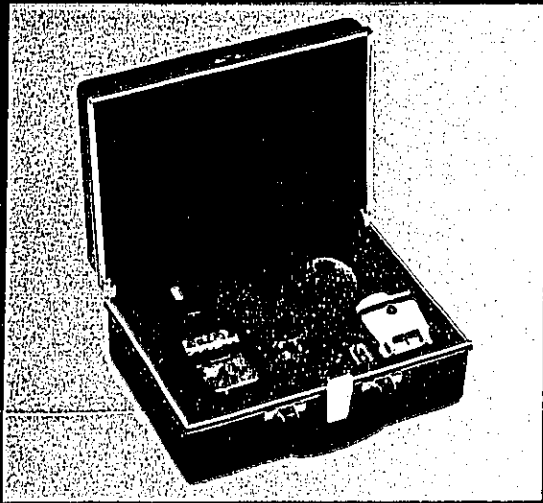
Description	Order No.
1565-9902 Sound-Level Measurement Set	1565-9902
1565-9912 Sound-Level Measurement Set	1565-9912
Accessories	Order No.
Carrying Case, for 1565-9902 or 1565-9912	1565-9600

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

SOUND-LEVEL MEASUREMENT SET (COMMUNITY NOISE)

Provides an Ideal, Self-Contained Set for Measuring Community Noise

- Includes 1565-D Meter that meets ANSI and IEC Type 2 standards
- Calibrates right-on-the-spot
- Battery powered for portability
- Single carrying case for convenience



Ideal for community noise measurements, the GenRad 1565-9910 sound-level measurement set gives you fast, accurate noise measurements and calibrations in a portable set that's easily carried and easy to use.

The set contains the 1565-D sound-level meter, which meets ANSI Type 2 standards and makes

measurements from 30 dB to 130 dB (see page 13).

Battery-powered means portability and convenience. With the 1987 Sound-Level Calibrator (tests at 1,000 Hz), you can quickly calibrate your meter on the spot.

SPECIFICATIONS

1565-9910 SOUND-LEVEL MEASUREMENT SET: Consists of 1565-D Sound-Level Meter, 1987 Sound-Level Calibrator, windscreen, carrying case, batteries, screwdriver for calibration adjust, and miniature phone plug that connects to sound-level-meter output.

MECHANICAL: DIMENSIONS (wxhxd): 11.25 x 4.25 x 10 in. (286 x 108 x 254 mm).
WEIGHT: 4.5 lb. (2.1 kg) net, 12 lb. (6 kg) shipping.

ORDERING INFORMATION

Description	Order No.
1565-9910 Sound-Level Measurement Set	1565-9910
Accessories	Order No.
Carrying Case, for 1565-D and 1987	1565-9600

1560 VIBRATION PICKUPS

Allow Measurements of Solid-Borne Vibrations

- Accessories for increasing the versatility of GenRad sound-level meters and analyzers
- Available in 2 frequency ranges

For measuring solid-borne vibrations with your GenRad sound-level meters, GenRad vibration pickups can be used in place of microphones.

Each vibration pickup system consists of an inertia-operated, ceramic vibration pickup and a connection cable. The pickup generates a voltage proportional to the acceleration of the vibrating body.

Type 1560-P52 uses a lead-zirconate-titanate pickup. A cable, probe, and probe tips are provided.

Type 1560-P53 uses a piezoelectric type accelerometer to make measurements at higher frequencies than the P52. A cable and a small holding magnet are included.

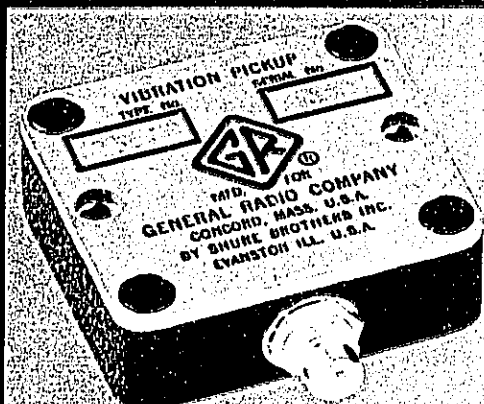
SPECIFICATIONS

Pickup Characteristics		
Pickup Type Number	1560-P52	1560-P53
Sensitivity (mV/g, nominal)	70	70
Temp Coeff of Sens (dB/°C)	< -0.01	< 0.02
Resonant Frequency (Hz)	3,200	27,000
Capacitance (pF)	10,000	350
Temperature Range (°C)	-18 to 100	-54 to 177
Relative Humidity Range (%)	0 to 100	0 to 100
Cable Length (ft)	5 (1.55 m)	8 (2.5 m)
Dimensions (in.)	1 ^{1/2} x1 ^{1/2} x1 ^{1/2}	1 ^{1/2} x1 ^{1/2} x0.7
(mm)	42x37x15	15.5x18
Net Weight (oz)	1.6 (45 grams)	1.1 (31 grams)

1 g = acceleration of gravity.
 *Upper limit of displacement and velocity measurements depends upon frequency and is determined by the maximum acceleration possible before nonlinearity occurs (100 g for 1560-P11B, 1,000 g for 1560-P13).
 **Maximum reading of instrument.

ORDERING INFORMATION

Description	Order No.
1560-P52	1560-9652
1560-P53	1560-9653



GenRad 1560-P52 Vibration Pickup and 1560-P53 Vibration Pickup

TO ORDER CALL TOLL FREE 1-800-343-4470,
 IN MASSACHUSETTS 1-617-369-4400 ext. 3138

NOISE DOSIMETERS

Measuring individual noise levels can be difficult because as your employees go about their daily routines, their proximity to a noise source varies—and the noise itself may vary. In other words, most noise is not continuous.

Using sound-level meters to measure and compute precise cumulative noise exposures—for example, the exposure of an employee to noise over an 8-hour workday—can be time-consuming and costly.

With GenRad noise dosimeters, those computations are made automatically, quickly, and accurately—helping you determine risks to employees and keep your business in compliance with OSHA.

The GenRad dosimeter is small and light enough to be worn without hindering normal movement. The monitor can be clipped on a waist band, and the microphone is easily positioned at the ear, on a shirt collar, or wherever you desire.

The dosimeter is a special purpose sound-level meter including an integrator and a digital memory. The result is a readout on a digital display as a percent of the limits initially set.

The GenRad dosimeter provides a separate readout with a built-in acoustic calibrator to facilitate calibration before and after measurements are taken.

1954 NOISE DOSIMETER MONITOR & INDICATOR

Gives You Fast, Accurate Noise Dose Readings

1954 NOISE-EXPOSURE MONITOR

- Meets ANSI S1.25-1978 standards and portions of IEC sound-level meter standard 651
- Remote microphones for versatility
- Adjustable threshold and criterion levels
- Lightweight and battery-powered for portability

1954 INDICATOR

- Supports any number of monitors
- Built-in calibrator for fast, easy monitor checks
- Readout available only to authorized persons
- Battery-powered for portability

The 1954 Noise Dosimeter is designed to automatically monitor and compute personal noise dose levels (of work-area noise) based on OSHA and other established standards.

Measurements with the 1954 Noise-Exposure Monitor and 1954 Indicator are easy. Turned on at the start of the monitoring period, the dosimeter can be left on without any operator intervention. At the end of the period, the monitor is simply plugged into the indicator and the computed noise dose is read on a digital display.

Since the OSHA maximum allowable noise level is 115 dBA, the 1954 is designed to indicate if 115 dBA was exceeded during the measurement. This is shown by an indicator lamp that lights up during readout of the noise dose.

Fast Calibration

Calibration takes only seconds with the built-in calibrator—and is as easy as calibrating a sound-level meter. The 1954 can be continuously adjusted during the calibration period.

You're also safeguarded against obsolescence or costly "downtime." Re-adjusting the exchange rate, criterion level, threshold level, or maximum allowable level requires only a screwdriver. That eliminates the need to send the unit to the factory.

And if you need the 1954 for community-noise applications, an additional monitor lets you make L_{eq} measurements.

SPECIFICATIONS

NOISE-EXPOSURE MONITOR: (5-dB Exchange Rate) 1954-9710

The 1954-9710 Noise-Exposure Monitor integrates the noise in conformance with OSHA Regulations (80-dB Threshold, 5-dB Exchange rate). The integrated level is stored in a low-power MOS-type counter which is permanently connected to the battery. The Monitor can be converted in the field by changing plug-in jumpers to provide an 80, 85, or 90 dB threshold and an exchange rate of either 3 or 5 dB.

Sound Level dBA	Exposure (hours per day)
90	8
95	4
100	2
105	1
110	0.5
115	0.25

Sound level is interpolated between the above points. The integrator cuts off sharply below 80 dBA.

Continued on the next page.

NOISE LEVEL EXPOSURE: Maximum permissible exposure of 100% in accordance with OSHA is accumulated for the following combinations: (Range control set to 80-130).

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1954 NOISE DOSIMETER (Cont'd)

LEVEL RANGES: Selectable by switch on top of Monitor.

Sound-Level Range (dB)	Threshold Level (dBA)	Peak Level W/D Overload (dB)	Allowable Level Exceeded Indication (dBA)
80-130	80	143	115
60-110	60	123	95
40-90	40	103	75

WEIGHTING: "A" in accordance with ANSI Standard S1.25-1978 and IEC Sound-Level Meter Standard 651.

ACCURACY: At 116.5 dB, 1KHz, 23° C, 760 mm Hg; $\pm 7\%$ of indicated reading (± 0.5 dB). Temperature coefficient of sensitivity typically $+ 0.03$ dB/° C. Unit calibrated for a reading at the mid-point of the allowable calibration range using the built-in calibrator.

LINEARITY: Within selected sound-level range: ± 1 dB (measured at 1 KHz with reference to a level of 35 dB above threshold).

STANDARDS: Satisfies ANSI S1.25-1978 for Personal Noise Dosimeters and applicable sections of IEC 651 for sound-level meters.

DETECTOR*: True rms response with SLOW dynamic characteristics in accordance with ANSI S1.25-1978 and IEC 651. Crest-factor capacity at 115 dB is greater than 25 dB.

ALLOWABLE LEVEL EXCEEDED: If on the 80-130 dB sound-level range, 115-dB sound level is exceeded, this information is stored in the monitor unit and read out on the indicator. On the 60-110 dB and 40-90 dB ranges, an indication is given if level during monitoring period ever exceeds 90 and 75 dB respectively.

MICROPHONE: Ceramic type. Remote from monitor (32 in. extension cable).

ENVIRONMENT: TEMPERATURE: -10 to +50° C operating, -40 to +60° C storage with batteries removed. **HUMIDITY:** 0 to 90% RH at 40° C.

Factory Mutual Systems has approved the intrinsic safety of the GenRad 1954-9710 Noise Dosimeter for use in the following locations:

- Class I and Class II, Division I
 - Group C Hazardous Atmosphere (gas)
 - Group D Hazardous Atmosphere (gas)
 - Group E Hazardous Atmosphere (metal dust)
 - Group F Hazardous Atmosphere (coal dust)
 - Group G Hazardous Atmosphere (grain dust)
- Class III, Division I
 - Hazardous Atmosphere (textile fibers)

*U.S. PATENT NUMBER 368,168

EFFECT OF MAGNETIC FIELD: On the 80-130 dB range, the monitor will accumulate equivalent to a level less than 80 dB when placed in a magnetic field of 100 oersteds at 50 or 60 Hz, or less than 40 dB in a 6-oersted magnetic field at 50 or 60 Hz on any range.

SUPPLIED: Three earloops, one windscreens set (contains 2 windscreens assemblies), one 9-V alkaline battery, three battery sleeves, shoulder microphone holder.

AVAILABLE: 1954-9610 Windscreens Set (contains 4 windscreens assemblies), 1954-9630 Microphone Assembly (includes 32-inch cable and plug), 8410-3400 9-V alkaline battery, Mallory Type MN 1604 or equivalent, 1954-9660 Shoulder Microphone Holder-5 pack.

POWER: One 9-V alkaline battery supplied, provides 40 hours of typical operation. MOS-counter and latch-storing data are permanently connected to the battery and can store accumulated noise dose and maximum level exceeded data for three months (monitor alone), one month with monitor plugged into indicator.

MECHANICAL: Shielded microphone and metal case. **DIMENSIONS (wxhxd):** 2.5 x 6.0 x 1.2 in. (63 x 153 x 31 mm). **WEIGHT:** 10.3 oz. (0.29 kg) net.

NOISE-EXPOSURE MONITOR (3-dB Exchange Rate) 1954-9730

Specifications same as 1954-9710 except those below. The 1954-9730 Noise-Exposure Monitor integrates noise in accordance with ISO 1999 (August 1975). The integrated level is stored in a low-power, MOS-type counter which is permanently connected to the battery. The monitor can be converted in the field by changing plug-in jumpers to provide an 80, 85, or 90 dB threshold and an exchange rate of 3 or 5 dB.

NOISE LEVEL EXPOSURE: The noise exposure index number displayed doubles when exposed time is doubled or when exposure level is increased by 3 dB. A level change of 3 dB can be traded for a factor of two in time. The monitor operates linearly over a dynamic range of 60 dB above the threshold level selected. This 60-dB range includes an allowance of 13 dB for signal crest factor. Exposure index numbers from 00.00 to 9,999 are stored for display on the indicator.

LEVEL RANGES: Selectable by switch on top of Monitor.

Sound-Level Range (dB)	Threshold Level (dBA)	Peak Level W/D Overload (dB)	Allowable Level Exceeded Indication (dBA)
80-130	80	143	130
60-110	60	123	110
40-90	40	103	90

WEIGHTING: "A" in accordance with ANSI Standard S1.25-1978 and IEC 651 for Type 2 Sound-Level Meters.

ACCURACY: At 116.5 dB, 1 KHz, 23° C, 760 mm Hg atmospheric pressure $\pm 11\%$ of indicated reading ($\approx \pm 0.5$ dB). Temperature coefficient of sensitivity typically $+0.03$ dB/° C. (Unit calibrated for a reading at the midpoint of the allowable calibration range using the built-in calibrator.)

STANDARDS: Satisfies ANSI S1.25-1978 for Personal Noise Dosimeters ISO 1999 (1975), and applicable portions of IEC Sound-Level Meter Standard 651 for Type 2 Sound-Level Meters.

DETECTOR*: True rms response with SLOW dynamic characteristics in accordance with IEC 651 and ANSI Standard S1.25-1978. Crest-factor capacity at high end of range is 13 dB.

ALLOWABLE LEVEL EXCEEDED: If the upper limit of the selected range is exceeded (i.e., 130, 110, or 90 dB), this information is stored in the monitor unit and read out on the indicator.

*U.S. PATENT NUMBER 308,168

NOISE-EXPOSURE MONITOR (4-dB Exchange Rate) 1954-9780

Specifications same as 1954-9710 except those below.

The 1954-9780 Noise-Exposure Monitor integrates noise in accordance with AFR 161-35. The integrated level is stored in a low-power, MOS-type counter which is permanently connected to the battery. The monitor can be converted in the field by changing plug-in jumpers to provide an 80, 85, or 90 dB threshold and an exchange rate of either 3, 4, or 5 dB.

NOISE LEVEL EXPOSURE: The percentage exposure displayed doubles when exposed time is doubled or when exposure level is increased by 4 dB. A level change of 4 dB can be traded for a factor of two in time. Percentage exposure numbers from 00.00 to 9,999 are stored for display on the indicator.

LEVEL RANGES: Selectable by switch on top of Monitor.

Sound Level Range (dB)	Threshold Level (dBA)	Peak Level W/O Overload (dB)	Allowable Level Exceeded Indication (dBA)
80-130	80	137	115
60-110	60	117	95
40-90	40	97	75

ACCURACY: At 116.5 dB, 1 KHz, 23° C, 760 mm Hg atmospheric pressure; $\pm 9\%$ of indicated reading ($\approx \pm 0.5$ dB). Temperature coefficient of sensitivity typically $+0.03$ dB/° C. (Unit calibrated for a reading at the midpoint of the allowable calibration range using the built-in calibrator.)

STANDARDS: Satisfies ANSI S1.25-1978 for Personal Noise Dosimeters, ISO 1999 (1975) and applicable portions of IEC Sound-Level Meter Standard 651 for Sound-Level Meters.

DETECTOR*: True rms response with SLOW dynamic characteristics in accordance with IEC 651 and ANSI Standard S1.25-1978.

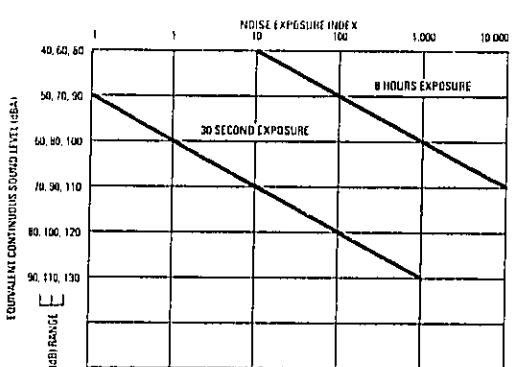
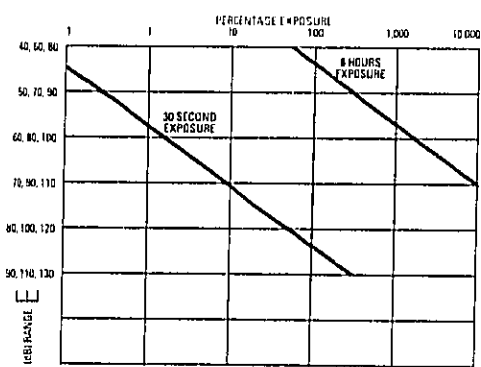
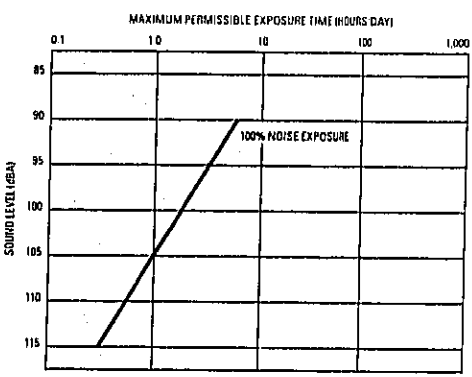
ALLOWABLE LEVEL EXCEEDED: If, on the 80-130 sound-level range, 115-dB sound level is exceeded, this information is stored in the monitor unit and read out on the indicator. On the 60-110 dB and 40-90 dB ranges, an indication is given if the level (during the monitoring period) exceeds 90 and 75 dB respectively.

INDICATOR 1954-9720

The 1954-9720 Indicator converts the information stored in the 1954 Noise-Exposure Monitor and displays it as a four digit number. This number has different designations depending on the monitor in use. The indicator is also used to calibrate and reset the monitor as well as check the monitor battery.

READOUT: The display will indicate either percentage exposure or index number and have a range of either 0.000 to 999.9 or 00.00 to 9,999. The indication and display range are dependent on the monitor in use (see 1954 Noise-Exposure Monitor Specifications).

Continued on the next page.



TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1954 NOISE DOSIMETER (Cont'd)

ALLOWABLE LEVEL EXCEEDED: When the DISPLAY button is depressed, a light indicates if the specified ALLOWABLE LEVEL for the monitor in use (see 1954 Noise-Exposure Monitor Specifications), was exceeded during the monitoring period.

The allowable level exceeded circuit in the monitor is reset when the RESET button is depressed.

CALIBRATION: A sound-level calibrator is included in the indicator. The calibrator tests all circuits in the monitor including the integrator. The calibration signal is applied as a steady tone. The calibration cycle will repeat automatically every 0.9 sec. by resetting the monitor, allowing calibration adjustment in a matter of seconds.

The calibrator operates at a frequency of 1,000 Hz with an output level of 116.5 ± 0.5 dB re 20 μ Pa. Temperature coefficient is ± 0.02 dB/ $^{\circ}$ C. Atmospheric pressure correction chart supplied.

BATTERY CHECK: The monitor battery voltage is checked by lighting an LED on the indicator if it is above the minimum operating voltage. Additionally, all eights are activated on the readout to (1) check the readout digits and (2) apply a heavier than normal load to the battery.

30-SECOND SAMPLE OPERATION

MODE: This mode is initiated by depressing and holding the RESET button. The display automatically indicates exposure when 30 (28.8 actual) seconds have lapsed. This number multiplied by 1,000 predicts the 8-hour exposure.

ENVIRONMENT: TEMPERATURE: -10 to +50 $^{\circ}$ C operating, -40 to +60 $^{\circ}$ C storage. **HUMIDITY:** 0-90% RH at 40 $^{\circ}$ C.

SUPPLIED: An accessory slide rule allows "equivalent continuous sound level" to be computed by entering the measurement period and the percentage or index number displayed.

Jeweler's screwdriver is supplied for calibration, activation of monitor controls, and access to battery compartment. Microphone extension assembly supports microphone on indicator when L_{eq} measurements are being made.

AVAILABLE: 1954-9600 Carrying Case includes space for one indicator, ten monitors, microphone extension assembly, ten batteries, and miscellaneous small accessories.

POWER: Supplied by battery in monitor.

MECHANICAL: DIMENSIONS (wxhxd): 3.31 x 14.5 x 2.39 in. (84 x 386 x 61 mm). **WEIGHT:** 2.7 lb. (1.25 kg).



ORDERING INFORMATION

Description	Order No.
1954 Noise-Exposure Monitor, 5-dB exchange rate meets U.S.A. OSHA requirements	1954-9710
1954 Noise-Exposure Monitor, 3-dB exchange rate, meets ISO recommendations and IEC standards	1954-9730
1954 Noise-Exposure Monitor, 4-dB exchange rate, meets USAF 101-35 requirements	1954-9780
1954 Indicator, one indicator and at least one monitor comprise a complete dosimeter. Only one indicator is required for any number of monitors.	1954-9720
Accessories	Order No.
1954-9785 Personal Noise Dosimeter, contains 5 each 1954-9780, one 1954-9720, and one 1954-9600 (meets USAF requirements)	1954-9785
1954 Carrying Case, holds up to 10 monitors and one indicator	1954-9600
1954 Windscreen Set, contains 4 windscreen assemblies	1954-9610
1954 Microphone Assembly, includes 32-in. cable and connector, used on -9710, -9780 monitors	1954-9030
1954 Microphone Assembly, includes 32-in. cable and connector, used on -9730 monitor	1954-9640
Spare Battery, only one required to power both monitor and indicator	8410-3400

CALIBRATORS

Routine, precise calibration of sound measurement instruments is essential to the success of any noise control program. GenRad recommends calibration before and after each day's measurements – and comprehensive calibration on an annual basis.

You can choose from three different GenRad sound-level calibrators according to your acoustic calibration needs. We also offer two audiometer calibration systems for calibrating audiometers.

GenRad sound-level calibrators consist of a small, stabilized transducer in an enclosure that fits over the sound-level microphone. The chamber is designed so that the acoustic coupling between loudspeaker and microphone is fixed and can be readily repeated.

Calibrators can have a single frequency (usually 1,000 Hz) to check level response – or up to five or six frequencies to check both level and frequency responses. This flexibility allows checks of indicator linearity and ranging errors.

For added versatility, we offer a calibrator with a special tone-burst capability that allows you to check dynamic characteristics and rms accuracy.

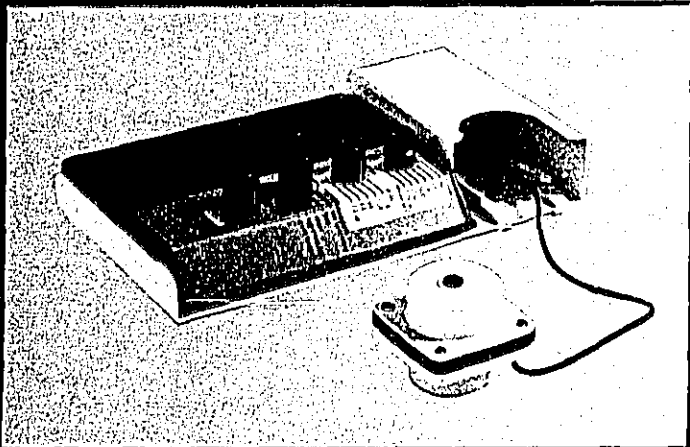
For audiometer calibration, you can use a GenRad sound-level meter, sound-level calibrator and a special earphone coupler. The coupler mates the audiometer earphone to a sound-level meter, forming a fixed acoustic chamber for proper calibration.

GenRad also provides a vibration calibrator. This is a single-frequency calibrator for checking the overall operation of a vibration-measuring system.

1986 OMNICAL SOUND-LEVEL CALIBRATOR

Tests Virtually Any Acoustic Instrument or System

- Tests nearly all the basic characteristics as specified by IEC and ANSI standards
- Multi-level and multi-frequency outputs for flexibility and high performance
- Repeated tone bursts for checking rms accuracy and crest-factor capability
- The only portable, battery-powered calibrator in its class



A wide variety of sound-level calibration needs can be handled with the 1986 Omnicall Sound-Level Calibrator—our most versatile, top-of-the-line calibrator.

With its supplied (and optional) microphone cavity adaptors, the 1986 can be used with a wide variety of acoustic instruments for the testing of the basic characteristics specified by IEC and ANSI standards.

The 1986 includes tones at six different frequencies from 125 Hz to 4,000 Hz in octave steps. Sound-pressure levels range from 74 dB to 114 dB in 10 dB ranges. This allows a sensitivity check of an acoustic instrument near the specific frequency and level at each measurement being made.

The frequency response of a sound-measuring system, weighting network, or filter may also be checked.

With the 1986, the two sources of linearity error in a sound-measuring instrument are easily checked: the measuring instrument's indicator display and its level-range control.

And there's more. Fast detector response and slow detector response can be tested by the 1986 to required standards; and rms

accuracy and crest-factor capabilities are tested using repeated tone bursts with a high crest factor.

The 1986's transducer is resiliently mounted to protect against damage from the accidental bumps and drops that often occur in field calibration situations. The entire assembly, except for the test cavity, is enclosed in a molded plastic case that is tightly sealed against dust and moisture.

Accommodates Many Microphones

The 1986 can accommodate GenRad 1-inch microphones, the WE 640AA, and the Tokyo Riko MR 103. With the adaptor provided, the calibrator can be used on GenRad 1/2-inch microphones.

Adaptors are available for Bruel & Kjaer 1-inch, 1/2-inch, and 1/4-inch microphones; Shure Brothers 1 1/8-inch microphone; and the 3/8-inch microphone on the GenRad 1954 Noise Dosimeter.

SPECIFICATIONS

OUTPUT SOUND-PRESSURE LEVELS: 74, 84, 94, 104, or 114 dB re 20 μ Pa.

NOMINAL OUTPUT FREQUENCIES: 125, 250, 500, 1,000, 2,000 or 4,000 Hz.

ACTUAL OUTPUT FREQUENCIES: Preferred per ANSI S1.6-1960 and ISO R266: 125.9, 251.2, 501.2, 1,000, 1,995 or 3,981 Hz \pm 3%.

REFERENCE CONDITIONS: TEMPERATURE: 20° C (68° F). ATMOSPHERIC PRESSURE: 1,013 mbart (760 mm of Hg) (30 in. of Hg). RELATIVE HUMIDITY: 65%. MICROPHONE EFFECTIVE VOLUME: 0.5 cm³ (0.03 in.³) (nominal for GenRad 1961 Electret-Condenser Microphone*).

ACCURACY OF SOUND-PRESSURE LEVEL: Under stated reference environmental conditions, at 114-dB SPL and at all frequencies except 4,000 Hz: \pm 0.25 dB for cavity alone or when used with any adaptor (except 1 $\frac{1}{8}$ -in. adaptor: \pm 0.5 dB at 1,000 Hz only); at 114-dB SPL and 4,000 Hz: \pm 0.5 dB. At output levels other than 114-dB SPL, tolerance is increased by \pm 0.1 dB.

TEMPERATURE COEFFICIENT OF SOUND-PRESSURE LEVEL: Less than \pm 0.02 dB/° C (\pm 0.01 dB/° F for all frequencies except 4,000 Hz).

TONE-BURST SIGNALS: Test signals provided as prescribed by ANSI S1.4-1971; IEC Sound-Level Meter Standard 651. In tone-burst modes, output can be either continuous (SET FAST/SLOW or SET CREST FACTOR) or a series of bursts (FAST,

SLOW or CREST FACTOR), as selected. Level is uncalibrated and continuously adjustable. In FAST or SLOW, peak amplitude of tone-burst is identical to that of continuous signal. In CREST FACTOR, rms value of tone-burst sequence is identical to that of continuous signal. FAST: Repeated tone bursts at 1,000 Hz, 200-ms duration every 2 s, for measuring sound-level-meter FAST rise response; amplitude is continuously variable from 72 dB to 118 dB re 20 μ Pa; background level is 20 dB below burst level. SLOW: Repeated tone bursts at 1,000 Hz, 500-ms duration every 10 s, for measuring sound-level meter SLOW rise response; amplitude is continuously variable from 72 to 118 dB re 20 μ Pa; background level is 20 dB below burst level. CREST FACTOR: Repeated tone bursts at 2,000 Hz, 5.5-ms duration, 40-Hz repetition rate, crest factor X3, for measuring rms detector-indicator accuracy and amplifier crest-factor capacity; rms amplitude is continuously variable from 75 to 111 dB re 20 μ Pa.

VARIABLE SOUND-PRESSURE-LEVEL CONTROL: Enabled only in tone-burst modes. Provides 11 dB of adjustment.

ELECTRICAL OUTPUT: Output provided from nominal 600- Ω shuntable source. Voltage proportional to sound pressure; 230-mV-rms nominal output corresponding to 114-dB SPL.

DISTORTION: Less than 1% THD acoustic or electrical.

BATTERY TEST: Internal circuitry checks condition of battery continuously. Automatic instrument shutdown when battery voltage falls below acceptable range.

MICROPHONE COUPLING: Transducer cavity accommodates following 1-in. microphones: GenRad 1961 electret condenser*, GenRad 1971 ceramic, Western Electric 640AA and Tokyo Riko MR 103.

ENVIRONMENT: TEMPERATURE: -10 to +50° C (+14 to +122° F), operating; -40 to +70° C (-40 to +140° F), storage with battery removed. HUMIDITY: 0 to 90% RH, operating.

ACCESSORIES SUPPLIED: Coupler-adaptor to accommodate GenRad 1962 $\frac{1}{2}$ -in. electret-condenser microphone* and GenRad 1983 Sound-Level Meter microphone; 3 spare desiccant kits; battery; instruction manual.

ACCESSORIES AVAILABLE: Adaptor set that includes coupler-adaptor for $\frac{3}{8}$ -in. GenRad 1954 Noise Dosimeter microphone; coupler-adaptors and "O" ring for 1-in., $\frac{1}{2}$ -in. and $\frac{1}{4}$ -in. B&K microphones, and coupler-adaptor for $\frac{1}{8}$ -in. Shure Brother microphone. Carrying case.

POWER: Powered by 9-V alkaline battery, Mallory MN 1604 or Eveready 522 recommended. Battery provides at least 8-h continuous operation.

MECHANICAL: DIMENSIONS (wxhxd): approximately 280 x 67 x 165 mm (11 x 2 $\frac{5}{8}$ x 6 $\frac{1}{2}$ in.). WEIGHT: Approximately 1 kg (2.2 lb.).

ORDERING INFORMATION

Description	Order No.
1986 Omnidirectional Sound-Level Calibrator	1986-9700
Accessories	Order No.
Carrying Case	1906-9600
Calibrator Adaptor Set, adapts 1986 to: 3 $\frac{1}{8}$ -in. microphone on GenRad 1954 Noise Dosimeter, B&K 1-, $\frac{1}{2}$ -, $\frac{1}{4}$ -in., and Shure Brothers 1 $\frac{1}{8}$ -in. microphones.	1987-9600
Battery, spare (1 required)	8410-3400

In the international system of units (SI) the unit of pressure is the pascal (Pa), 1 Pa = 1 N/m² = 10 dynes/cm² = 10⁻² mbar REF: "The International System of Units (SI)," U.S. Dept. of Commerce, National Bureau of Standards, NBS Special Publication 330, SD Cat. No. C13.10:330.2, U.S. GPO, Wash., D.C. 20402.

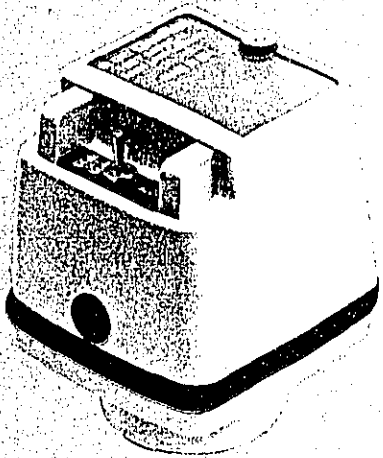
*U.S. PATENT 4,070,741

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138 **25**

1987 MINICAL SOUND-LEVEL CALIBRATOR

Brings One-Step, Economical Calibration to the Field

- Produces frequency of 1,000 Hz at levels of 94 dB or 114 dB
- Compatible with wide range of microphones for versatility
- Approved by MSHA



The 1987 Minical Sound-Level Calibrator is ideal for quick, daily calibration checks of sound-level meters and other acoustic instruments in the field.

The cost-effective 1987 produces a single frequency of 1,000 Hz at sound-pressure levels of either 94 dB or 114 dB. It incorporates the same design features as the 1986

Omnical Sound-Level Meter; it is built with the same durability and resistance to moisture, dust, and mechanical shock; and it accommodates the same wide variety of microphones as the 1986.

The 1987 is a cost-effective solution for easily determining acoustic instrument sensitivity before and after sound-level measurements.

SPECIFICATIONS

OUTPUT SOUND-PRESSURE LEVELS: 114 dB or 94 dB to 20 μ Pa at under reference conditions.

OUTPUT FREQUENCY: 1,000 Hz \pm 3%.

REFERENCE CONDITIONS: TEMPERATURE: 20° C (68° F), ATMOSPHERIC PRESSURE: 1,013 mbar (760 mm of Hg) (30 in. of Hg), RELATIVE HUMIDITY: 65%, MICROPHONE EFFECTIVE VOLUME: 0.5 cm³ (0.03 in.³) (nominal for GenRad 1961 Electret-Condenser Microphone*).

ACCURACY OF SOUND-PRESSURE LEVEL: Under stated reference environmental conditions, \pm 0.25 dB for cavity alone, or cavity when used with any adaptor (except 1 1/8-in. adaptor: \pm 0.5 dB).

TEMPERATURE COEFFICIENT OF SOUND-PRESSURE LEVEL: Less than \pm 0.02 dB/° C (\pm 0.01 dB/° F).

BATTERY TEST: Internal circuitry checks condition of battery continuously. Calibrator will not operate at all if battery voltage falls below acceptable range.

MICROPHONE COUPLING: Transducer cavity accommodates following 1-in. microphones: GenRad 1961 electret-condenser,* GenRad 1971 ceramic, Western Electric 640AA and Tokyo Riko MR103.

ENVIRONMENT: TEMPERATURE: -10 to +50° C (+14 to +122° F), operating; -40 to +70° C (-40 to +140° F), storage with battery removed. HUMIDITY: 0 to 90% RH, operating.

ACCESSORIES SUPPLIED: Coupler-adaptor to accommodate GenRad 1962 1/2-in. electret-condenser microphone; carrying pouch; 3 spare desiccant kits; battery; instruction manual.

ACCESSORIES AVAILABLE: Adaptor set that includes coupler-adaptor for 3/8-in. GenRad 1964 Noise Dosimeter microphone; coupler-adaptors and "O" ring for 1-in., 1/2-in. and 1/4-in. B & K microphones, and coupler-adaptor for 1 1/8-in. Shure Brothers microphone.

POWER: Powered by 9-V alkaline battery, Mallory MN 1604 or Eveready 522 recommended. Battery provides at least 20-h continuous operation.

MECHANICAL; DIMENSIONS (wxhxd): Approximately 63 x 63 x 89 mm (2 1/2 x 2 1/2 x 3 1/2 in.). **WEIGHT:** Approximately 270 gm (9.5 oz.).

For the international system of units (SI), the unit of pressure is the pascal (Pa): 1 Pa = 1 N/m² = 10 dynes/cm² = 10⁻² mbar. REF: "The International System of Units (SI)," U.S. Dept. of Commerce, National Bureau of Standards, NBS Special Publication 330-50 Cat. No. C 13-10-330-2, U.S. GPO Wash., D.C. 20402 *U.S. PATENT 4,070,741

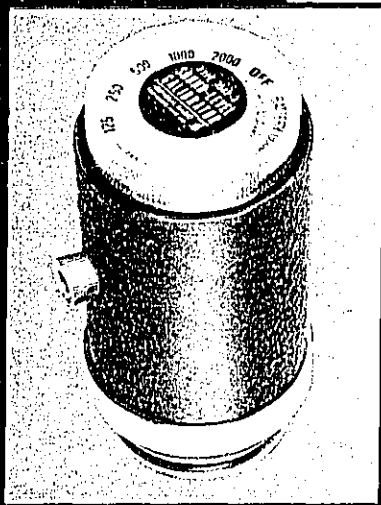
ORDERING INFORMATION

Description	Order No.
1987 Minical Sound-Level Calibrator	1982-0700
Accessories	Order No.
Calibrator Adaptor Set, adapts 1987 to: 3/8-in. microphone on GenRad 1964 Noise Dosimeter, B & K 1-, 1/2-, 1/4-in. and Shure Brothers 1 1/8-in. microphones.	1987-9600
Battery, spare (1 required)	8410-3400

1562-A SOUND-LEVEL CALIBRATOR

Provides a Handful of Precision

- Five frequencies from 125 Hz to 2,000 Hz for versatility
- Accuracy at plus-or-minus 0.3 dB at 500 Hz
- Versatility to fit a variety of microphones
- Approved by MSHA



The 1562-A Sound-Level Calibrator fits in the palm of your hand and is battery-operated—ideal for on-site measurements of GenRad meters and analyzers.

With a single “fumble-free” control, the easy-to-use 1562-A provides five ANSI-preferred frequencies from 125 Hz to 2,000 Hz.

SPECIFICATIONS

ACOUSTIC OUTPUT: FREQUENCIES: 125, 250, 500, 1,000, and 2,000 Hz; $\pm 3\%$. SOUND-PRESSURE LEVEL: 114 dB re 20 μ Pa; accuracy at 23° C and 760 mm Hg is, for WE 640AA or equivalent microphone, ± 0.3 dB at 500 Hz and ± 0.5 dB at other frequencies; and, for other microphones, ± 0.5 dB at 500 Hz and ± 0.7 dB at other frequencies.

ELECTRICAL OUTPUT: 1 V $\pm 20\%$ behind 6 k Ω , flat $\pm 2\%$ with $<0.5\%$ distortion; available at phone jack.

ENVIRONMENT: TEMPERATURE: 0 to 50° C operating. Temperature coefficient of sound-pressure level is 0 to -0.012 dB/° C; correction chart supplied. HUMIDITY: 0 to 100% RH.

SUPPLIED: Carrying case, adaptors for $\frac{1}{2}$ - and 1-in. microphones (fits $1\frac{1}{4}$ -in. microphones without adaptor), battery.

POWER: Battery operated (9 V, Burgess PM6 or equal); 120 h use.

MECHANICAL: DIMENSIONS: 5 in. (127 mm) long x 2.25 in. (57 mm) dia. WEIGHT: 1 lb. (0.5 kg) net, 4 lb. (1.9 kg) shipping.

Calibrations are made quickly and easily for all GenRad $1\frac{1}{4}$ -inch, 1-inch, $\frac{1}{2}$ -inch, and other similar microphones.

An electrical signal output is provided for tests on instruments without microphones, and a rugged carrying case protects the calibrator when not in use.

ORDERING INFORMATION

Description	Order No.
1562-A Sound-Level Calibrator	1562-9701
Accessories	Order No.
Battery, spare (1 required)	8410-3000

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1565 AUDIOMETER CALIBRATION SET

Includes Everything You Need for Audiometer Calibration

- Sound-level meter for fast, accurate measurements
- Sound-level calibrator to maintain accuracy
- Earphone coupler for interface between mike and headset



Audiometers can be easily checked with the GenRad 1565 Audiometer Calibration Set. Entirely self-contained, the set gives you everything you need for measurement and calibrations—without squeezing your budget.

The 1565 set includes a GenRad 1565-B Sound-Level Meter, a 1987 Minical Sound-Level Calibrator, a 1560-P83B Earphone Coupler, batteries, a calibration chart, instructions,

and a rugged carrying case.

The 1560-P83B earphone coupler, which provides an interface between the microphone and headset, fits GenRad 1-inch microphones and Type L standard laboratory microphones such as the WE 640AA. The set can be used for calibrating the Telephonics TDH-39 and TDH-49 earphones with the cushions (MX-41/AR) left in place.

SPECIFICATIONS

1565 AUDIOMETER CALIBRATION SET

SUPPLIED: 1565-B Sound-Level Meter, 1987 Sound-Level Calibrator, earphone coupler, spare batteries, storage case.

MECHANICAL: DIMENSIONS (wxhxd): 11.25 x 4.25 x 10 in. (286 x 108 x 254 mm). **WEIGHT:** 5 lb. (2.3 kg) net, 12 lb. (6 kg) shipping.

EARPHONE COUPLER

1560-P83B: GenRad 9A (modified version of NBS type 9-A). **VOLUME:** 5.630 cm³ including volume added by microphone. **AXIAL HOLDING FORCE:** 450 grams nominal.

FREQUENCY: 125 Hz to 8 KHz audiometric frequencies; response is equal to that obtained with NBS 9-A coupler within 1 dB to 4 KHz and 1.5 dB to 8 KHz when it is used with TDH-39 or TDH-49 earphones in MX-41/AR earcushion.

MECHANICAL: 1560-P83B: DIMENSIONS: Coupler, 2.94 in. dia x 1.25 in. high (75x32 mm); overall (wxhxd), 2.94 x 3.5 x 3.5 in. (75 x 90 x 90 mm). **WEIGHT:** 0.5 lb. (0.3 kg) net, 2 lb. (1 kg) shipping.

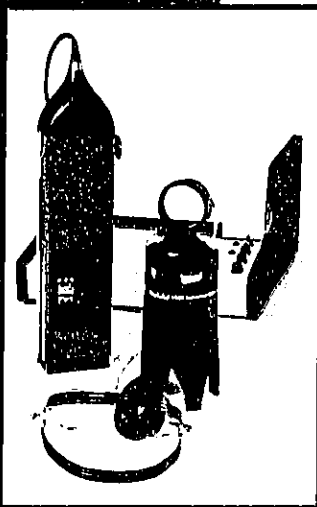
ORDERING INFORMATION

Description	Order No.
1565 Audiometer Calibration Set	1565-9911
1560-P83B Earphone Coupler, GenRad type 9A	1560-9685
Accessories	
Battery, spare for 1565-B (2 required)	8410-3200
Battery, spare for 1987 (1 required)	8410-3400

1560-9619 AUDIOMETER CALIBRATION ACCESSORY SET

Puts Factory-Level Accuracy in the Field

- Field calibration of audiometers with accuracy per OSHA and ANSI standards—comparable to factory calibration
- Stable, bench-mounted base for safe, reliable use of microphone and coupler
- Precision, 1-inch electret-condenser microphone ensures accurate measurements
- Includes all necessary calibration data



When used with the GenRad 1982 and 1988 Sound-Level Meters and Analyzers, the 1560-9619 Audiometer Calibration Accessory Set lets you calibrate audiometers to sound-pressure level values specified in ANSI S3.6 1969 or other standards requiring the NBS Type 9-A coupler. That represents factory-level calibration in the field.

When used with the 1982 or 1988, the set contains everything you need for fast, accurate calibrations: a GenRad 1560-P83B Earphone Coupler (meeting NBS Type 9-A requirements), 1-inch GenRad electret-condenser microphone, an adaptor (1-inch to 1/2-inch thread), stand assembly, calibration chart, and instructions. With an optional GenRad calibrator—such as the 1986 or 1987—you can use the set to make an independent acoustical check of the measuring system.

levels from 125 Hz to 8,000 Hz. Data are given for an audiometer setting of 70 dB HL for the TDH-39 earphones, and for audiometer settings of both 70 dB HL and 90 dB HL for the TDH-49 and TDH-50 headphones.

Readings are given for the flat and A-weighted scales on the 1982 and 1988 sound-level meters.

Also included are pressure-response corrections for the microphone in the 1560-P83B coupler, at octave-band frequencies from 125 Hz to 8,000 Hz.

The sturdy, cast metal stand uses a polyethylene-foam base to protect the system from shock and vibration during measurement. With the stand, you don't have to mount the earphone coupler directly on the sound-level meter, which eliminates the risk of the meter accidentally falling over.

Continued on the next page.

Detailed Calibration Data

The calibration chart in the set documents octave-band, sound-pressure

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1560-9619 CALIBRATION SET (Cont'd)

SPECIFICATIONS

FREQUENCY RANGE: 125 Hz to 8 KHz.

ACCURACY: The electret microphone response in a 1560-P83B Type 9-A coupler is calibrated to be equal to the response of a type L microphone in an NBS 9-A coupler when used to calibrate TDH-39, TDH-49 and TDH-50 earphones mounted in a MX41/AR ear cushion. **MICROPHONE/COUPLER CALIBRATION:** (Factory), ± 0.2 dB - 125 Hz to 4 KHz; ± 0.3 dB - 6 KHz to 8 KHz. System accuracy when used with 1988-9700 or 1982-9700 and the microphone supplied with the 1560-9619 and calibrated with the 1986 or 1987 Acoustic Calibrator is within 1 dB at audiometric test frequencies 125 Hz to 4 KHz; 1.5 dB at audiometric test frequencies 6 KHz and 8 KHz.

EARPHONE COUPLER: The GenRad 1560-P83B 9-A type coupler fulfills the volume requirements for the NBS 9-A coupler specified in ANSI S3.7 1973 when used with the GenRad 1961-9610 1-in. electret condenser microphone. **VOLUME:** 5,630 cm³ \pm 0,030 cm³ including volume added by microphone. **AXIAL HOLD FORCE:** 450 grams nominal.

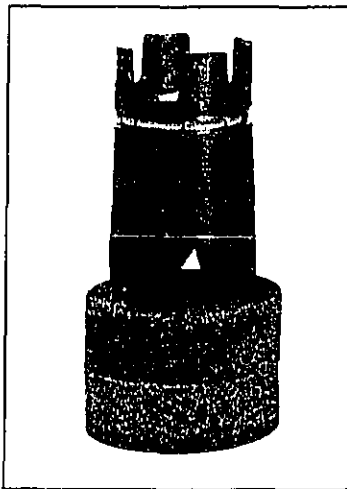
MICROPHONE: GenRad 1961-9610 1-in. electret-condenser microphone, random-incidence response with pressure-response corrections given for audiometer test frequencies.

ENVIRONMENTAL: (1961-1910 1-in. microphone only). **TEMPERATURE:** - 20 to + 55°C and 90% RH operating.

SUPPLIED: (1560-9619): 1560-9685 Earphone Coupler, 1961-9610 Microphone, 1560-9618 Audiometer Calibration Stand Assembly, Calibration Chart, Instruction Sheet, adaptor.

AVAILABLE: 1560-9618 Audiometer Calibration Stand Assembly, supplied as part of the 1560-9619, is also available separately. This offers the present user of the 1933-9716 Audiometer Calibration System a stable, bench-mounted stand for the earphone coupler and microphone.

MECHANICAL: DIMENSIONS: 1560-9618 Stand Assembly, 10 in. high x 3.87 in. dia (254 x 98 mm). **WEIGHT:** 2.4 lb. (1.1 kg.) net, 6 lb. (2.3 kg.) shipping.



GenRad Audiometer Stand Assembly

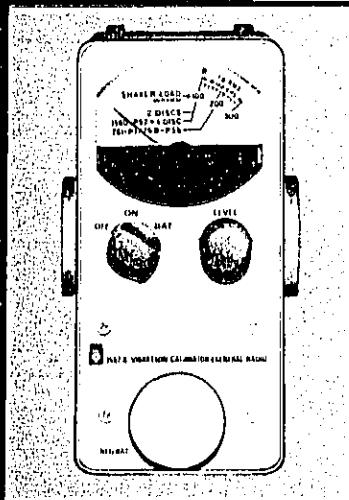
ORDERING INFORMATION

Description	Order No.
Audiometer Calibration Accessory Set	1560-9619
Audiometer Calibration Stand Assembly	1560-9618

1557-A VIBRATION CALIBRATOR

Provides Easy Calibration of Vibration Pickups

- On-the-spot calibration generating 1 g at 100 Hz
- Calibrates any pickup with total mass of 300 grams or less
- Battery-operated for portability



When you need on-the-spot calibration of vibration-measuring systems immediately before and after measurements, you can turn to the GenRad 1557-A Vibration Calibrator.

The calibrator provides a single-frequency (100 Hz), single-level (1 g) check on GenRad vibration pickups and any other pickup whose total mass is 300 grams or less.

The small, battery-powered unit consists of a transistorized electro-mechanical oscillator and a cylindrical

cal shaker. Operation is simple. A pickup is attached to the shaker; the user adjusts the level control until the meter indicates the mass of the pickup; and the pickup is automatically subjected to an acceleration of 1 g at 100 Hz.

The acceleration output appears at two pillbox-shaped, 50-gram disks mounted on an internal cylinder projecting through the sides of the instrument.

SPECIFICATIONS

OUTPUT: ACCELERATION: 1 g rms \pm 10%. 1 g = 386 in./s² (9.81 m/s²). VELOCITY: 0.614 in./s (15.6 mm/s) rms. DISPLACEMENT: 0.000978 in. (0.0248 mm) rms; 0.00277 in. (0.0704 mm) pk-pk. FREQUENCY: 100 Hz \pm 1% for 50-gram load; 100 Hz \pm 0, - 2% for 300-gram load.

POWER: Battery operated (Eveready 724 or equivalent dry cell).

SUPPLIED: Leather carrying case.

MECHANICAL: Aluminum case. DIMENSIONS (wxhxd): 4 x 8 x 4 in. (105 x 205 x 105 mm). WEIGHT: 3.25 lb. (1.5 kg.), net; 5.25 lb. (2.4 kg.) shipping.

ORDERING INFORMATION

Description	Order No.
1557-A Vibration Calibrator (with dry battery)	1557-9702
Accessories	Order No.
Replacement Dry Cell, 1 req'd	8410-1050

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

ANALYZERS & RECORDERS

Analyzers are designed to help you correct unwanted noise and vibration by isolating the discrete frequencies that are contributing most to the overall noise.

This, in turn, helps you pinpoint the source of the problem.

Generally, an analyzer is an instrument with one or more filters that are fixed or tunable. A serial analyzer enables measurements of the frequency spectrum a "piece at a time." A real-time analyzer enables measurements of the whole frequency spectrum continuously.

An octave-band analyzer—for acoustic measurements—measures the audible frequency range in ten bands. The center frequencies of the preferred octave bands are 31.5, 63, 125, 250, 500, 1,000, 2,000, 4,000, 8,000, and 16,000 Hz. The actual nominal frequency range of any of these bands is 2-to-1. For example, the effective group of frequencies being measured in the 1,000-Hz octave band would be from 707 to 1,414 Hz. All other frequencies would be excluded from the measurement.

For more detailed analysis of the distribution of sound energy as a function of frequency, still narrower bands are used. The next popular division is a split of the octave into three parts. This type of analysis is accomplished with a $1/3$ -octave-band analyzer. The effective frequencies being measured in the 1,000-Hz band of a $1/3$ -octave-band analyzer would be from about 891 to 1,122 Hz.

Graphic Recorder

The GenRad graphic recorder helps you keep a permanent record of your results for future reference or analysis. When used with an analyzer or other instruments, the GenRad recorder can plot the amplitude of sound-pressure and vibration levels versus time.

1995 INTEGRATING REAL-TIME ANALYZER

Combines Microprocessor-Based Performance with Portability

- Bandwidth of 25 Hz to 20 KHz...2.5 Hz to 20 KHz...or 10 Hz to 80 KHz
- One-third and full-octave real-time analysis with integration times from 1/8 second to 24 hours
- Built-in display scope features bar-graph display or numerical listings for fast, easy readings
- Battery-powered for portability

The 1995 Integrating Real-Time Analyzer combines microprocessor-based technology and portability for performance to meet your most demanding applications.

The 1995 satisfies a broad range of noise measurement requirements in real time, on the spot, without the need to make tape recordings for analysis later on in the laboratory.

Battery-powered, the 1995 is a one-third and full-octave analyzer. It also operates as an integrating analyzer or integrating sound-level meter to display A-weighted sound level, Flat response, or any selected band level as a function of time.

The 1995's spectrum comparison capability (optional) allows for fast, easy GO/NO GO testing. And spectrum storage is held in internal memory powered by a separate battery, so spectrums can be stored for

recall and comparison with new data.

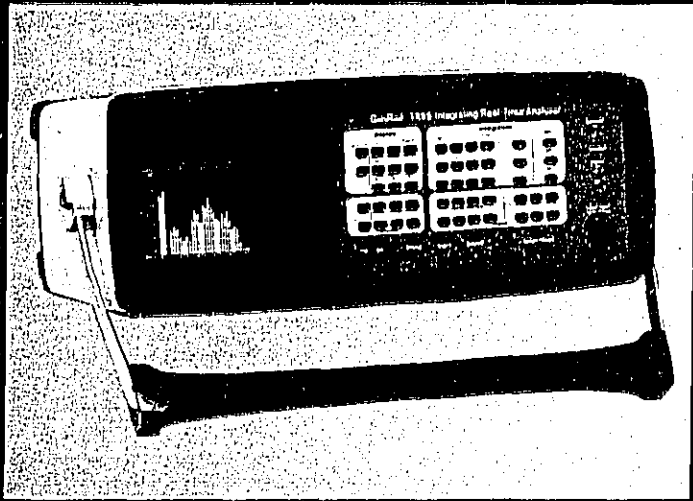
Measurements can range from 25 Hz to 20 KHz...2.5 Hz to 20 KHz... or 10 Hz to 80 KHz.

A Range of Applications

With a 50-dB display range and integration times from 1/8 second to 24 hours, the 1995 is an excellent instrument for many applications:

- factory/machinery noise reduction
- product-noise rating and reduction
- sound-power measurements per EPA standards
- machine-tool measurements per NMTBA
- aircraft-noise and automobile-passby measurements
- community-noise measurements (L_{max})

Continued on the next page.



TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1995 INTEGRATING REAL-TIME ANALYZER (Cont'd)

SPECIFICATIONS

STANDARDS: FILTERS: One-third-octave filters in accordance with: ANSI Standard Specification for Octave, Half-Octave and Third-Octave-Band Filter Sets S1.11 1966, Type E, Class III; IEC Recommendation Publication 225-1966, Octave, Half-Octave and Third-Octave-Band Filters for the Analysis of Sound and Vibration; DIN 45 652, 1964 Third-Octave-Band Filters for Electroacoustical Measurements. A-weighting characteristics and Fast and Slow responses in accordance with: ANSI Standard Specification for Sound-Level Meters S1.4-1971, Type 1; IEC Sound-Level Meter Standard 651 Type 1, DIN 45 633/1, 1970, Precision Sound-Level Meters General Requirements.

PREAMPLIFIER INPUT: MICROPHONES AND ACCELEROMETERS: Preamplifier has 0.460x60 thread for direct connection to 1/2-in. electret-condenser or air-condenser microphone and various adaptors for use with other microphones and accelerometers. Switchable polarizing voltage for use with air-condenser microphones is provided. **ELECTRICAL SIGNALS:** BNC to the amplifier thread adaptor is available.

Level Range for Direct Reading in dB re 20 μ Pa

Nominal Microphone Sensitivity dB re 1 V/Pa	Microphone Sensitivity Range dB re 1 V/Pa	Level Range* For Direct Reading dB re 20 μ Pa	Corresponding Voltage Range
30	26 to 36	120 to 20	63 V to 63 μ V
40	36 to 46	130 to 20	63 V to 63 μ V
50	46 to 56	140 to 20	63 V to 63 μ V
60	56 to 66	140 to 20	2 V to 63 μ V

*Lower level may be limited due to noise depending on the capacitance of the microphone used, its exact sensitivity, and the particular pass-band or weighting. Units apply with preamplifier set to X1 gain. Lower limit may be extended by setting the preamplifier to X10 gain.

Typical sensitivity of GenRad 1971 Ceramic and 1962 Electret-Condenser Microphones is 40 dB re 1 V/Pa. Equivalent A weighted noise for 1971 Ceramic Microphone: 21 dB; for 1962 Electret-Condenser Microphone: 27 dB. One-third octave band levels are typically less than 10 dB for bands from 25 Hz to 20 KHz with 1971 Microphone. One-third octave band levels decrease with increasing frequency for 1962 Microphones, ranging from typically 30 dB at 25 Hz to 12 dB at 20 KHz.

IMPEDANCE: Approximately 2 G Ω in parallel with less than 6 pF. **CALIBRATION ADJUSTMENT:** Rear-panel screwdriver adjustment with 10-dB total range. **MAXIMUM INPUT:** For linear operation +5 V peak.

TAPE INPUT (REAR PANEL); CONNECTOR: Tape input connector; BNC. **SENSITIVITY:** Nominally 1 V rms full scale. Independent of full-scale range selected and continuously adjustable from 0.316 V to 3.16 V rms full scale. **IMPEDANCE:** 100 k Ω , ac coupled. **MAXIMUM INPUT:** For linear operation, a peak signal 20 dB above full-scale settling; +32 V peak without damage. Maximum dc input, \pm 30 V without damage.

OVERLOAD INDICATION: Indication of overload on display when peak input voltage exceeds linear range (non-latching).

FILTERS: FREQUENCY RANGE: 1995-9700 and 1995-9720: 25 Hz-to-20 KHz one-third-octave center frequencies (standard bands 14 to 43), or 31.5 Hz to 16 KHz, one-octave-band center frequencies (bands 15 to 42); 1995-9730: 2.5 Hz-to-20 KHz (bands 4 to 43) one-third octave or 4 Hz-to-16 KHz octave-band center frequencies (bands 6 to 42); 1995-9008: 10 Hz-to-80 KHz one-third-octave center frequencies (standard bands 10 to 49) 16 Hz-to-63 KHz one-octave-band center frequencies (bands 12-48). **BANDWIDTH:** Bandwidths of one-third octave or one octave (octaves derived by summing 1/3 octaves). Either result may be displayed at completion of analysis. **CHARACTERISTICS:** One-third-octave filters have nominal 6-pole Butterworth response.

WEIGHTING: A.

PREWEIGHTING: Flat or A ahead of filters.

AC OUTPUT: Flat output unfiltered provides 0.5 V rms nominal at full scale, output provided from 5 k Ω shortable source.

VIDEO OUTPUT: Composite video; negative sync; 1 V p-p into 75 Ω . 8-MHz picture element rate.

DETECTOR AND INTEGRATOR: DETECTOR RESPONSE: True Square Law (rms). **SOUND-PRESSURE LEVEL:** Sound-pressure level with either integration or exponential averaging as selected by operator. **SOUND-EXPOSURE LEVEL:** Sound-exposure level (time reference one second) selected by operator. **INTEGRATION TIMES:** 1/8, 1/4, 1/2, 1, 2, 4, 8, 9, 10, 15, 24 seconds, minutes or hours selectable by operator in linear modes; 1/8, 1/4, 1/2, 1, 2, 4, 8, 9, 10, 15, 24 seconds or minutes selectable by operator in exponential mode. In exponential mode, time constants of 1/8 second and 1 second correspond to FAST and SLOW sound-level meter responses, respectively. **DYNAMIC RANGE:** Dynamic range, including 10 dB allowance for crest factor above full scale, is 63 dB. Linearity error less than \pm 0.75 dB for sine wave inputs ranging from +7 dB to -40 dB re full scale and less than +1 dB for inputs ranging from -40 to -50 dB re full scale. Resolution is 0.25 dB. **CREST FACTOR:** At least 10 dB at full scale. **OVERLOAD INDICATION:** Indication of overload on display when the integrated level in any band exceeds full scale (non-latching).

DISPLAY: TYPE: 5-in. raster-scan display with tube face recessed to permit viewing in bright ambient light. **POWER:** Controlled by front-panel switch. Display may be turned off to conserve battery power without affecting performance of instrument. **RANGE:** 50 dB displayed. Full-scale sensitivity selectable from 70 to 140 dB re 20 μ Pa in 10-dB steps. **LEVEL-VS-FREQUENCY:** Bar graph display of one-third octave or one octave band levels plus A-weighted and flat-response levels. A

second result, previously stored, may be displayed as a line graph, superimposed on the bar graph, for comparison. Status information and one band level (selected by "cursor") displayed alphanumerically. **LEVEL-VS-TIME:** Bar graph of up to 32 sequential integration results plus status information and one integration result (selected by "cursor") displayed alphanumerically. **NUMERICAL RESULT:** All band numbers, levels, and standard deviations (except for octaves) are listed numerically along with status information. In level-vs-time mode, all integration periods and corresponding levels and standard deviations (except for octaves) are displayed. **CURSOR:** A cursor operates in the graphical mode to display the band number, level, and standard deviation of any one selected band. The bar corresponding to the selected band is intensified for identification (standard deviation not available on 1995-9008). **STORAGE:** A displayed result may be stored and then recalled and displayed alone or superimposed on a "real time" result. A composite one-third-octave spectrum developed from one-third-octave band-level maximums in a series of integrations is stored and may be displayed alone or superimposed on a "real time" or stored spectrum. **DATA REDUCTION:** In the REDUCED DATA mode, A-weighted and flat-response sound levels and Speech Interference Level are displayed.

CALIBRATION: A built-in noise source permits an overall check on all channels. Overall system calibration, including accessory preamplifier, microphone, or accelerometer, can be performed using any acoustic or vibration calibrator.

BASIC INPUT/OUTPUT INTERFACE TO

ACCESSORIES: VIDEO OUTPUT: A composite video output signal permits use of large external monitors for display. **START-STOP-PAUSE:** A TTL compatible input allows remote control of panel START, STOP, and PAUSE functions.

OPTIONAL INTERFACE TO ACCESSORIES: X-Y RECORDER: An optional output interface in the 1995-9720 and -9730 supplies a 1-V full-scale signal for an X-Y plotter or level recorder. Recorder calibration voltages of 1-V full scale for both axes are available. LEVEL RECORDER: Synchronizing and pan lift circuits permit use of GenRad 1523 recorders. IEEE 488 INTERFACE: Optional output interface supplies digital data in IEEE 488 format, permitting use of data printers, computers, calculators, and other accessories compatible with the standard.

ENVIRONMENT: OPERATING TEMPERATURE RANGE: 0 to 50°C. STORAGE TEMPERATURE RANGE: -40 to +70°C with power supply; -40 to +60°C with batteries. HUMIDITY: Operating, up to 90% RH at 40°C.

POWER SUPPLY: LINE POWER SUPPLY: 1995-3040 plugs into rear-panel recess. Can be removed and replaced with optional rechargeable battery pack plug-in. Power consumption from line is 40 W maximum. Operates from 90 to 125 V or 180 to 250 V, 50 to 60 Hz. Used either to power the instrument or to recharge the batteries. BATTERY POWER SUPPLY: Optional rechargeable battery plug-in 1995-3030 provides at least one hour of operation with display on, at least two hours with display off. Battery is charged from power supply to 80% of full capacity in approximately eight hours. BATTERY VOLTAGE INDICATION: Low battery voltage is indicated on the display.

ACCESSORIES SUPPLIED: Rear-panel mating connector with unterminated 5-foot cable, 2 each; front-panel cable connector lock; preamplifier; 10-foot preamplifier cable.

ACCESSORIES AVAILABLE: Rechargeable battery pack and accessories; camera adaptor set; carrying case.

MECHANICAL: OVERALL DIMENSIONS (not including handle): (wxhxd): 17 x 7 x 17.5 in. (432 x 178 x 444 mm). WEIGHT (including removable ac power supply): 1995-9700, 41 lb. (18.6 kg.); 1995-9720, 42 lb. (19.0 kg.); 1995-9730, 43.5 lb. (19.7 kg.); 1995-9008, 43.5 lb. (19.7 kg.).

ORDERING INFORMATION

Description	Order No.
1995 Integrating Real-Time Analyzer (25 Hz to 20 KHz)	1995-9700
1995 Integrating Real-Time Analyzer (25 Hz to 20 KHz) with output interface	1995-9720
1995 Integrating Real-Time Analyzer (2.5 Hz to 20 KHz) with output interface	1995-9730
1995 Integrating Real-Time Analyzer (10 Hz to 80 KHz) with output interface ¹	1995-9008
Accessories	Order No.
Rechargeable Battery Pack and Accessories	1995-9000
Camera Adaptor Set (includes hood, bracket, and close-up lens)	1995-9001
Carrying Case (for accessories): provides space for calibrator, 60-ft cable, battery pack, tripod, microphones, and preamplifiers	1995-9002
¹ Covers 10 Hz-80 KHz in two ranges, 10 Hz-8 KHz or 100 Hz-80 KHz. Either range may be displayed on scope. Data from entire 10 Hz-80 KHz range is always available at IEEE 488 interface after measurement.	

1985 DC RECORDER

Records Your Results in Permanent Hard Copy

- 50-dB recording range for compatibility with GenRad equipment
- Provides convenient chart speeds from 2 cm/hour to 60 cm/minute
- Meets ANSI and IEC Type 1 response requirements
- Built-in rechargeable battery for portability

Compatible with the GenRad 1981 and 1982 Sound-Level Meters—as well as the GenRad 1988 Integrating Sound-Level Meter—the 1985 DC Recorder puts the “finishing touches” on complete GenRad sound measurement/recording systems.

The DC recorder produces permanent hard-copy plots of noise-level-vs.-time without the usual complicated calibration procedures that can cause recording errors.

When used with a GenRad Type 1 instrument, the recorder's pen response is fast enough to meet ANSI and IEC Type 1 requirements for fast and slow meter response.

To ensure compatibility, the recorder always plots a 50-dB range for GenRad 1981, 1982, and 1988 sound-level meters, regardless of attenuator setting. These settings ensure that the 1985's full scale automatically coincides with a GenRad meter's full scale setting.

Chart paper comes in 20-meter lengths, fan-folded. Chart speeds range from 2 cm/hour to 60 cm/minute.

An internal rechargeable battery gives you 8 hours of continuous use. The 1985 can also be used as a stand-alone recorder with other equipment.

SPECIFICATIONS

RECORDER TYPE: Portable, battery-powered, single-channel, strip-chart recorder with multiple speeds and with ranges matched to GenRad sound-level meters. Provides a direct reading, 50-dB dynamic range permanent recording of sound-level meter output data.

STANDARDS: When used with the GenRad 1933, 1981, 1982, or 1988 Precision Sound-Level Meters or with the GenRad 1945 Community Noise Analyzer, the recording system meets the fast and slow meter-response requirements of ANSI S1.4-1971 Type 1, IEC Sound-Level Meter Standard 651, Type 1.

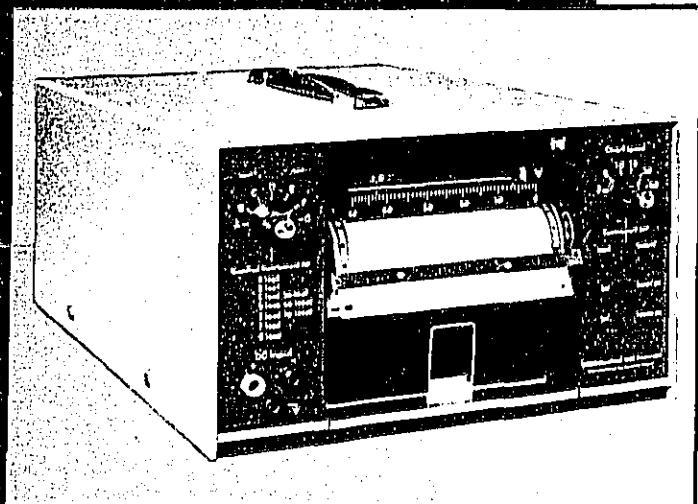
When used with the GenRad 1983, the recording system meets the fast and slow meter response requirements of ANSI S1.4-1971 Type 2, IEC Sound-Level Meter Standard 651, Type 2.

RECORDING SYSTEM: METHOD OF WRITING: Cable-driven disposable cartridge with integral marking tip and ink supply. **STEP RESPONSE TIME:** 500 ms from bottom scale to full scale—corresponding to a 50-dB step. Response time is proportional to step size. **OVER-**

SHOOT: 1.25% (0.6 dB) typical; 2% (1 dB) maximum. **PEN LIFTER:** Manual front-panel lever. **CHART PAPER:** Z-fold, rectilinear with 10 cm active span corresponding to 50-dB dynamic range (1-dB graduations). Chart has 5-cm folds and is 20 m long. **SCALEPLATE:** Removable 50-0 uniform, right-hand zero.

MEASURING SYSTEM: SOURCE IMPEDANCE: Up to 100 k Ω maximum. **INPUT IMPEDANCE:** Potentiometric on all spans. **INPUT SENSITIVITIES:** Seven switch-selectable spans are provided. Front-panel switch selects span for specific GenRad instrument as follows:

GenRad	
Model No.	Span
(baseline to full scale)	
1983	0 to +250 mV dc
1981	0 to +500 mV dc
1945	
(30-80 dB range)	-1.2 to -3.2 V dc
1945	
(50-100 dB range)	-2.0 to -4.0 V dc
1945	
(70-120 dB range)	-2.8 to -4.8 V dc
1982	0 to +3.0 V dc
1933	0 to +5.0 V dc
1988	0 to +3.0 V dc
1995	0 to +1.0 V dc



COMMON MODE POTENTIAL: ± 150 V dc maximum. **COMMON MODE REJECTION:** 120 dB at 100 V dc. **MAXIMUM SAFE OVERLOAD:** Input protected up to ± 100 V dc. **MEASUREMENT ACCURACY:** $\pm 0.5\%$ (0.25 dB) of span with maximum offset drift of $30 \mu\text{V}/^\circ\text{C}$ (0.005 dB/ $^\circ\text{C}$ worst case with GenRad model 1983). **DEADBAND:** $\pm 0.3\%$ (0.15 dB) of chart span maximum. Included in measurement accuracy. **CONTROLS:** Zero and Span adjustments are provided on the front panel. Each allows for $\pm 10\%$ of full-scale adjustment. **SIGNAL INPUT CONNECTIONS:** (+), (-), and ground (\equiv) banana jacks provided on the front panel.

CHART DRIVE SYSTEM: FEED RATES: 2, 5, 10, 15, 30, and 60 cm/hour and cm/minute. **CHART SPEED ACCURACY:** $\pm 1\%$ at $23^\circ\text{C} \pm 10^\circ\text{C}$; $\pm 2\%$ at 0°C to 50°C . **CONTROLS:** Six-position feed-rate selector, Hour/Minute and chart ON/OFF switches provided on the front panel. **TRANSPORT FEATURES:** Front loading, dual-ended sprocket drive, slide-out chart accumulator, thumbwheel advance and chart tear-off bar.

ENVIRONMENT: TEMPERATURE: 0 to 50°C operating and storage. HUMIDITY: 0 to 90% RH. Due to size changes in chart paper, the recorder should be calibrated at the operating humidity.

SUPPLIED: Chart paper, 1 pack, 20m; 1 pen; rechargeable battery; battery charger; cable (15 feet); screwdriver.

AVAILABLE: Chart paper, 6 packs, 20 m each; replacement pens, pack of 6; replacement battery; carrying case.

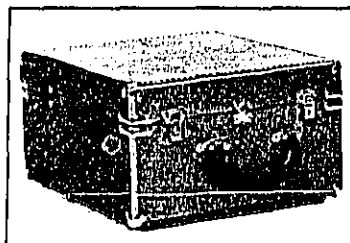
POWER REQUIREMENTS: The instrument may be powered from any one of three configurations:

INTERNAL DC SOURCE: 12-volt, 4.5 AH, rechargeable gelled lead-acid battery. Approximately 8-hour operation with full charge (not stalled). The stalled condition exists when the instrument is off scale in either direction. Current drain with the instrument stalled is approximately doubled. **BATTERY CONDITION INDICATOR:** Continuous reading meter provided on the front panel. **POWER DRAIN:** Approximately 6 VA (not stalled); 10 VA maximum. Fuse protection is provided. **BATTERY CHARGER:** AC adaptor supplied. Output is approximately 12 V dc at 500 mA. Plugs into ac line and rear panel jack. Instrument is inoperative during charge period. Maximum charge time is 16 to 24 hours. Fuse protection is provided. **BATTERY LIFE:** Approximately 200 charge/discharge cycles.

EXTERNAL DC SOURCE: Requires nominal 12 V dc supply (10.5 V dc at 15.0 V dc). Source connects to rear panel jack. Fuse protection is provided. **POWER DRAIN:** Approximately 6 VA (not stalled); 10 VA maximum.

EXTERNAL AC SOURCE: Battery charger supplied for ac operation from $115\text{V} \pm 10\%$ or $230\text{V} \pm 10\%$, 50 or 60 Hz. Plugs into ac line and rear panel jack. **POWER DRAIN:** Approximately 12 VA (not stalled). **POWER CONTROLS:** Three-position mode switch is provided on the rear panel to select internal, external, or charging power functions. Power ON/OFF switch is provided on the front. **CIRCUIT PROTECTION:** Two replaceable fuses are provided on the rear panel for internal and external sources.

MECHANICAL: DIMENSIONS: (wxhxd): 9.75 x 6.13 x 14.63 in. (248 x 156 x 372 mm). WEIGHT: Approximately 14 lb. (6.4 kg) with battery, net.



The 1985 comes with an optional carrying case.

ORDERING INFORMATION

Description	Order No.
1985 DC Recorder	1985-0700
Accessories	Order No.
Chart Paper, 20 m, pack of 6	1985-9800
Pens, pack of 6	1985-9901
Battery, replacement	1985-0402
Carrying Case	1985-9903

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138

MICROPHONES & PREAMPLIFIERS

With reliability and proven performance, GenRad microphones will help you get the most from your measurement capabilities.

To maintain high accuracy between calibrations, we have designed structural stability and reliability into our entire line of microphones. This helps ensure that conditions normally encountered in making sound measurements will not have a detrimental effect on the GenRad microphone or its calibration.

GenRad ceramic microphones use a piezoelectric ceramic (lead-titanate, lead-zirconate) as the voltage-generating element. A diaphragm fastened to the ceramic transfers the sound-pressure variations into a corresponding force that bends the ceramic element, producing voltage.

The GenRad electret-condenser microphone features a permanently charged diaphragm that doesn't require a polarizing voltage. This microphone gives you all the benefits of conventional air-condenser microphones—high sensitivity, flat frequency response, and wide dynamic range—and more.

The electret-condenser microphone's output capacitance is higher than that of the air-condenser microphone, and it does not become noisy in a humid environment, since no free electrostatic charge exists at the diaphragm's surface.

Preamplifiers

GenRad preamplifiers are available to amplify the output from GenRad microphones and vibration pickups. Our preamplifiers provide step-down impedance so "driving" long cables won't result in signal loss.

They can also be used to increase the sensitivity and input impedance of GenRad amplifiers, analyzers, or other equipment.

1961 & 1962 ELECTRET- CONDENSER MICROPHONES

Both Offer High Performance at an Affordable Price

- 1-inch and 1/2-inch models for laboratory-quality performance
- Permanently polarized diaphragm that eliminates the need for a polarizing-voltage power supply

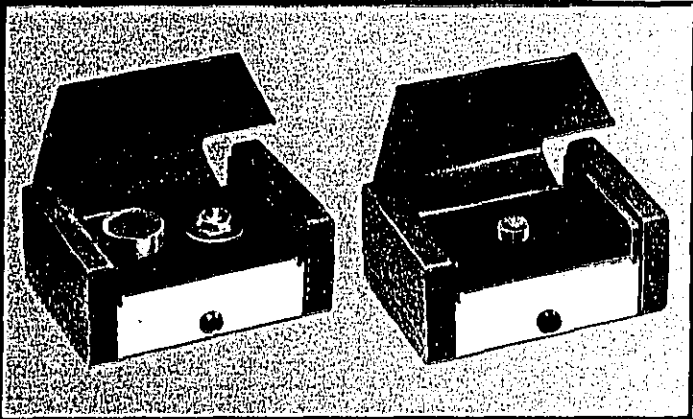
The GenRad 1961 (1-inch) and 1962 (1/2-inch) electret-condenser microphones provide laboratory-quality performance at a modest price.

The permanently polarized solid dielectric diaphragm means high reliability. Permanent polarization eliminates the need for a polarizing-voltage power supply.

Uniform high-frequency performance in both flat random- and flat-perpendicular-incidence models – in a variety of sizes – means a wide range of applications.

And since polarization voltage is not required, these microphones can be used with inexpensive preamplifiers such as the GenRad 1972-9600 Preamplifier.

Continued on the next page.



GenRad 1961 and 1962 Electret-Condenser Microphones

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1961 & 1962 MICROPHONES (Cont'd)

SPECIFICATIONS

1961 1-IN. ELECTRET-CONDENSER MICROPHONES

FREQUENCY: Curves show typical response and guaranteed limits; individual response curve supplied with each microphone. Below 20 Hz, the microphone is typically flat ± 1 dB down to 15 Hz relative to 1-KHz level. Microphone is essentially omni-directional.

SENSITIVITY LEVEL: NOMINAL: 38 dB re 1 V/Pa (-58 dB re 1 V/ μ bar). **TEMPERATURE COEFFICIENT:** $< \pm 0.010$ dB/ $^{\circ}$ C typically from -20 to $+55^{\circ}$ C at 1 KHz. **MAXIMUM SOUND-PRESSURE LEVEL:** 160 dB re 20 μ Pa absolute max.

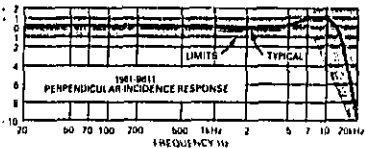
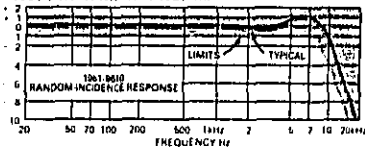
IMPEDANCE: NOMINAL: 63 pF at 23 $^{\circ}$ C and 1 KHz.

ENVIRONMENT: -40 to $+60^{\circ}$ C and 0 to 99% RH operating; 1-year exposure in an environment of $+55^{\circ}$ C and 90% RH causes negligible sensitivity change.

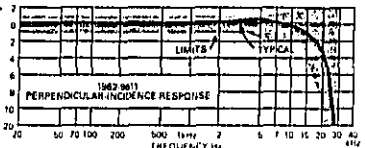
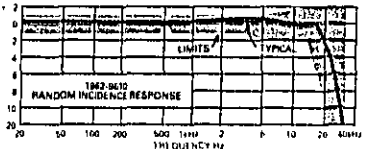
MECHANICAL: TERMINALS: Coaxial, with 0.907-60 thread, adapted to 0.460-60 (thread per in.).

DIMENSIONS: 0.936 \pm 0.001 in. dia. x 0.670 in. long (1.060 in. long with adaptor) (23.77 \pm 0.025 x 17 mm). **WEIGHT:** 1 oz. (28 g) net, 1 lb. (450 g) shipping.

1961 1-INCH MICROPHONES



1962 1/2-INCH MICROPHONES



1962 1/2-IN. ELECTRET-CONDENSER MICROPHONES

FREQUENCY: Curves show typical response and guaranteed limits; individual response curve supplied with each microphone. Below 20 Hz, the microphone is typically flat ± 1 dB down to 15 Hz relative to 1-KHz level. Microphone is essentially omni-directional.

SENSITIVITY LEVEL: NOMINAL: -40 dB re 1 V/Pa (-60 dB re 1 V/ μ bar). **TEMPERATURE COEFFICIENT:** $+0.010$ dB/ $^{\circ}$ C at 1 KHz. **MAXIMUM SOUND-PRESSURE LEVEL:** 170 dB re 20 μ Pa absolute max.

IMPEDANCE: NOMINAL: 25 pF at 23 $^{\circ}$ C and 1 KHz.

ENVIRONMENT: -40 to $+60^{\circ}$ C and 0 to 99% RH operating; 1-year exposure in an environment of $+55^{\circ}$ C and 90% RH causes negligible sensitivity change.

MECHANICAL: TERMINALS: Coaxial, with 0.460-60 thread.

DIMENSIONS: 0.500 \pm 0.001 in. dia x 0.615 in. long (12.70 \pm 0.0254 x 15.62 mm). **WEIGHT:** 0.25 oz. (7 g) net, 1 lb. (450 g) shipping.

ORDERING INFORMATION

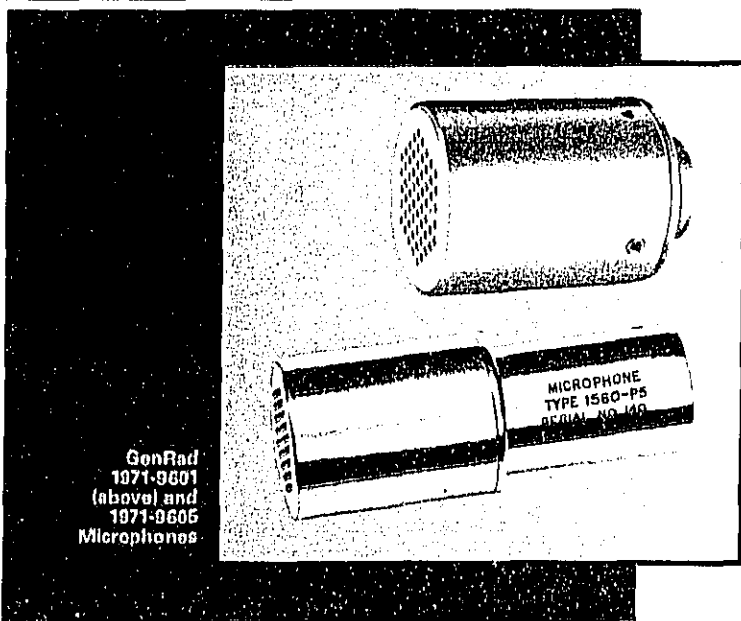
Description	Order No.
1961 Electret-Condenser Microphones Flat random-incidence response, 1-in. Flat perpendicular-incidence response, 1-in.	1961-9610 1961-9611
1962 Electret-Condenser Microphones Flat random-incidence response, 1/2-in. Flat perpendicular-incidence response, 1/2-in.	1962-9610 1962-9611

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1971-9605 & 1971-9601 CERAMIC MICROPHONES

Both Give You Multi-Purpose, Economical Performance

- Operates over wide temperature range (-40°C to $+60^{\circ}\text{C}$)
- Immune to changes in humidity



GenRad provides two separate 1-inch ceramic microphones. Both versions use the same microphone cartridge but each has a different base for connection to different sound-level meters.

Both operate in a wide temperature range for versatility— from -40°C to $+60^{\circ}\text{C}$. And both are immune to changes in humidity.

The GenRad 1971-9605 Microphone comes with an adaptor base

that plugs into a female three-terminal connector. It mates directly with the 1560-P73 extension cable and can be mounted on a tripod when the microphone is remote from the instrument and no preamplifier is used.

The GenRad 1971-9601 Microphone features an adaptor for mounting directly on 1560-P42 or 1972-9600 preamplifiers.

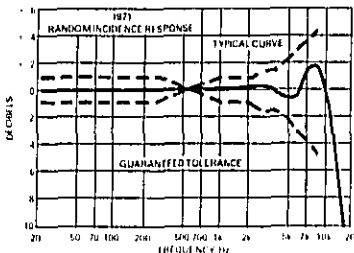
SPECIFICATIONS

FREQUENCY: Curve shows typical random response and guaranteed limits; individual response curve supplied with each microphone. Below 20 Hz, the microphone is typically flat ± 1 dB down to 5 Hz re the 500-Hz level. Time constant of pressure-equalizing leak is typically 0.08 s with a corresponding 3-dB rolloff at 2 Hz.

SENSITIVITY LEVEL: NOMINAL: -40 dB re 1 V/N/m^2 (-60 dB re $1 \text{ V}/\mu\text{bar}$); MINIMUM: -42 dB re 1 V/N/m^2 (-62 dB re $1 \text{ V}/\mu\text{bar}$). **TEMPERATURE COEFFICIENT:** -0.01 dB/ $^{\circ}\text{C}$. **KEY SOUND-PRESSURE LEVELS:** -1% distortion at 150 dB; at -184 and $+174$ dB peak, microphone may fail.

IMPEDANCE: $385 \text{ pF} \pm 15\%$ at 23°C . **TEMPERATURE COEFFICIENT OF Z:** $2.2 \text{ pF}/^{\circ}\text{C}$ from 0 to 50°C .

ENVIRONMENT: TEMPERATURE: -40 to $+60^{\circ}\text{C}$ operating. HUMIDITY: 0 to 100% RH operating.



MECHANICAL: TERMINALS: 1971-9601, Coaxial with 0.460-60 thread for mounting on 1560-P42 or 1972-9600 preamplifiers. Center terminal is signal, outer terminal (shell) is ground. 0.460-60 threaded adaptor may be removed for mounting on 1560-P40 preamplifier. 1971-9605, Microphone cartridge fitted with 3-terminal audio connector. **DIMENSIONS:** Cartridge only, 1.13 in. (29 mm) long, 0.936 ± 0.002 in. (23.7 mm $\pm 50 \mu\text{m}$) dia; assembly, 1971-9601, 1.44 in. (36.5 mm) long; 1971-9605, 2.31 in. (59 mm) long. **WEIGHT:** 1971-9601, 1.5 oz. (41 g) net, 1 lb. (0.5 kg) shipping; 1971-9605, 2 oz. (56.6 g) net, 1 lb. (0.5 kg) shipping.

Typical performance of the 1971 Microphones with the 1560-P42 and 1972-9600 Preamplifiers (Unity Gain "System")

Frequency Range	Sensitivity re 1 V/N/m^2	Dynamic Range* re $20 \mu\text{N/m}^2$
5 Hz to 12.5 kHz	40 dB	27 to 145 dB

*A weighted noise level for maximum allowable signal without clipping.

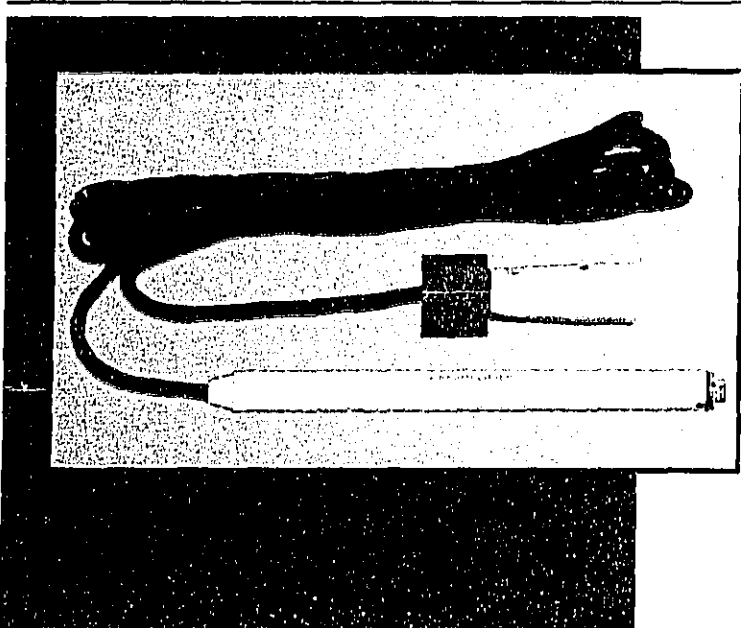
ORDERING INFORMATION

Description	Order No.
1971 1-in. Ceramic Microphone With adaptor to mike connector	1971-9605
With adaptor to preamplifier	1971-9601

1560-P42 PREAMPLIFIER

Delivers High-Input Impedance/ Low Noise for a Variety of Acoustic Equipment

- High-Input impedance, low-noise preamplifier for amplifying the output of capacitive sources
- Built-in 200 volt polarizing voltage
- Provides voltage gain choice of 1 or 10 (0 dB or 20 dB)



With high-input impedance and low noise, the GenRad 1560-P42 Preamplifier is well suited for amplifying the output of capacitive sources, including all GenRad electret-condenser microphones, air-condenser microphones, ceramic microphones, and vibration pickups.

The preamplifier is ideal with GenRad sound-level meters and analyzers when you want to "drive" very long cables at high levels (between the microphone and the instrument) without losing signal integrity.

The preamplifier is also an effective probe amplifier for various other electrical signals.

And you can use the 1560-P42 for increasing the sensitivity and input impedance of analyzers, recorders, amplifiers, null detectors, counters, frequency meters, voltmeters, and oscilloscopes.

Output from the preamplifier is through a removable three-wire shielded cable. DC supply voltage is applied from one of the wires to ground.

SPECIFICATIONS

GAIN: 1:1 or 10:1 (20 dB) \pm 0.3 dB at 25°C, slide-switch controlled; \pm 0.3-dB gain change, from that at 25°C, from -30 to +65°C.

FREQUENCY RESPONSE: (at 1-V rms open-circuit output behind 600 Ω , -30 to +55°C):

3Hz	5Hz	20Hz	100KHz	300KHz	100KHz
1.1 gain	-3dB	+1dB	+0.25dB	-1.0dB	-1.0dB
10.1 gain	-3dB	+15dB	+0.3dB	-2.0dB	-2.0dB

IMPEDANCE: INPUT: \approx 2 G in parallel with \approx 6 pF; driven shield reduces input-capacitance loading for condenser microphones. OUTPUT: \approx 15 Ω in series with 3.3 μ F.

OUTPUT: SIGNAL: Up to 11 V pk-pk to 10 KHz into open circuit with 15-V supply, decreasing to 2 V pk-pk for 1:1 gain and 1 V pk-pk for 10:1 gain at 100 KHz. Up to 10-mA rms output with 1560-P62 Power Supply. **POLARIZING VOLTAGE:** +200 V \pm 5% behind \approx 1.2 G Ω dc source resistance; on-off slide-switch controlled; temperature coefficient \approx 0.1%/°C; frequency \approx 50 KHz.

NOISE: \approx 3.5- μ V equivalent input with 390-pF source capacitance, C-weighted, 10-KHz effective bandwidth.

DISTORTION: \approx 0.25% harmonic distortion at 1 KHz with 1-V rms into open circuit load; \approx 1% at 10 KHz with 1-V rms output into 0.1 μ F (equivalent to 2,000 ft. of cable).

INSERT TERMINALS: Accepts insert calibration signal. Insert resistance 10 Ω \pm 20%. Nominal loss between connector and microphone terminals \approx 0.5 dB. Maximum insert voltage 1 V rms.

CONNECTORS: INPUT CONNECTOR: 0.460-60 thread for direct connection to 1/2-in. microphones and adaptors. OUTPUT (SIGNAL) CONNECTOR: (male) 4-pin shielded GenRad Type 1933-0410. Mates with 1560-2370 10-foot cable with Switchcraft Type A3 3-terminal microphone connector on opposite end.

POWER: +15 to +25 Vdc, 1 to 2 mA idling (200 V off) or 3 to 5 mA idling (200 V on). Available directly from 1523, 1558, 1568, 1564, 1909, 1911, 1913, 1921, or 1925 Analyzers, 1525 Recorder, 1561 Sound-Level Meter, 1934 Noise-Exposure Meter, 1566 Multichannel Amplifier, or from 1560-P62 power supply when preamplifier is to be used with 1565 or 1551 Sound-Level Meter, 1553 Vibration Meter, and 1910 Analyzer.

MECHANICAL: DIMENSIONS (less cable): 6.75 in. (170 mm) long x 0.5 (13 mm) dia. WEIGHT (with cable): 1 lb. (0.5 kg) net, 3 lb. (1.4 kg) shipping.

ORDERING INFORMATION

Description	Order No.
1560-P42 Preamplifier	1560-9642

1972-9600 PREAMPLIFIER/ADAPTOR

Amplifies Your Signals at a Modest Price

- Provides high-input impedance
- Drives long cables up to 100 feet

The GenRad 1972-9600 Preamp/Adaptor provides the high-input impedance required by electret-condenser and ceramic microphones; unity voltage gain; and the capability to drive cables up to 100 feet in length.

The amplifier requires a 9- to 25-volt DC power supply, or normal connection to the GenRad 1560-P62 Power Supply (or most any GenRad acoustic instrument).

It has the same input connector as the GenRad 1560-P42 Preamp/Adaptor, and can be driven from the same kind of transducer—with the exception of transducers that require polarization voltage.

The 1972-9600 does not provide polarization voltage for air-condenser microphones.

SPECIFICATIONS

GAIN: 0 dB, ± 0 -0.25 dB, at 1 KHz.

FREQUENCY RESPONSE: ± 1 dB, 5 Hz to 100 KHz; ± 3 dB, 3 Hz to 500 KHz (at 0.1 V rms output into an open circuit, driven from 600- Ω source).

INPUT IMPEDANCE: 3 pF in parallel with 1 G Ω , at low audio frequencies.

OUTPUT IMPEDANCE: Less than 20 Ω in series with 6.8 μ F.

OUTPUT: MAXIMUM VOLTAGE AVAILABLE: ± 10 V pk-pk, open circuit, at frequencies ± 100 KHz, with ± 15 -V supply. CURRENT (available): ± 1 mA, pk, with ± 15 -V supply.

NOISE: ± 2.5 μ V equivalent input noise voltage, with 390 pF source capacitance, C weighted.

DISTORTION: 0.1% total harmonic distortion for frequencies ± 100 KHz, at 1 V rms output level, open circuit, ± 15 -V supply.

TERMINALS: INPUT: Coaxial, with 0.460 x 60 thread for direct connection to most microphones (see block diagram). OUTPUT: Switchcraft type A3M microphone connector, mates with 3-wire extension cable 1560-9666.

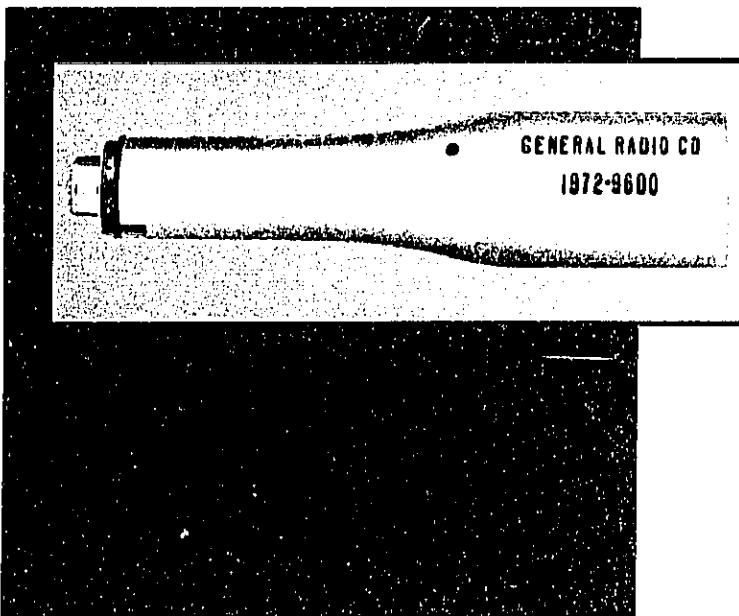
POWER: 9 to 25 V (1 mA at 9 V). Available for most GenRad analyzers or 1560-P62 power supply. (See list with 1560-P42.)

MECHANICAL: DIMENSIONS: 0.75 in. dia. x 3.44 in. long (19 x 87 mm). WEIGHT: 3 oz. (85 g) net.

ORDERING INFORMATION

Description	Order No.
1972 Preamp/Adaptor	1972-9600

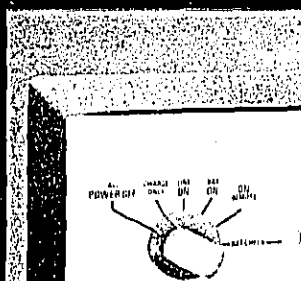
TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138



1560-P62 POWER SUPPLY

Provides Power for Preamplifiers

- A reliable power source for preamplifiers
- Single control panel for easy use



If your preamplifier needs a power source, use the reliable, easy-to-use GenRad 1560-P62 Power Supply.

The unit is ideal for use with GenRad 1560-P40, -P42, or 1972-9600 preamplifiers when they are used

with instruments that don't include power sources, such as some sound-level meters and analyzers.

The power supply's rechargeable batteries are easily removed by a slide-out clip.

SPECIFICATIONS

INPUT: 100 to 125 or 200 to 250 V, 50 to 60 Hz.

OUTPUT: 18 to 21 V dc, 15 mA max; automatic limiting protects supply and prevents deep battery discharge. **BATTERIES:** Two rechargeable Ni-Cd batteries provide up to 225 mA-hours operation at room temperature between charges. **RIPPLE:** <5 mV rms in CHARGE-OPERATE mode. **CHARGE TIME:** 14 to 16 h for completely discharged battery, constant 22-mA battery-charging current. Rear-panel slide switch selects internal or external battery.

INTERFACE: **INPUT** (from preamp): Power to, and signal from, preamplifier. Use Switchcraft type A3M microphone connector. **OUTPUT** (to analyzer): Signal from preamplifier and remote power control. Use Switchcraft type A3F microphone connector. **ADDITIONAL OUTPUT:** Miniature phone jack for connection to 1933 sound-level meter/analyzer and patch cable fitted with miniature phone plugs (listing follows).

SUPPLIED: Cable to connect to 1561, 1561, 1564, etc; and cable to connect to 1561 charging terminals.

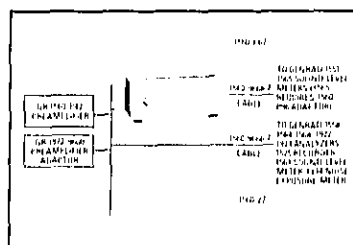
REMOTE OPERATION: With line voltage not connected, preamplifier can be set to Operate-Only mode by signal of ± 15 to 25 V at 300 μ A.

ENVIRONMENTAL: TEMPERATURE: -15 to +50°C operating.

MECHANICAL: Convertible Bench cabinet. **DIMENSIONS** (wxhxd): 8.5x3.84x5.5 in. (216x98x140 mm). **WEIGHT:** 3 lb. (1.4 kg) net, 5 lb. (2.3 kg) shipping.

ORDERING INFORMATION

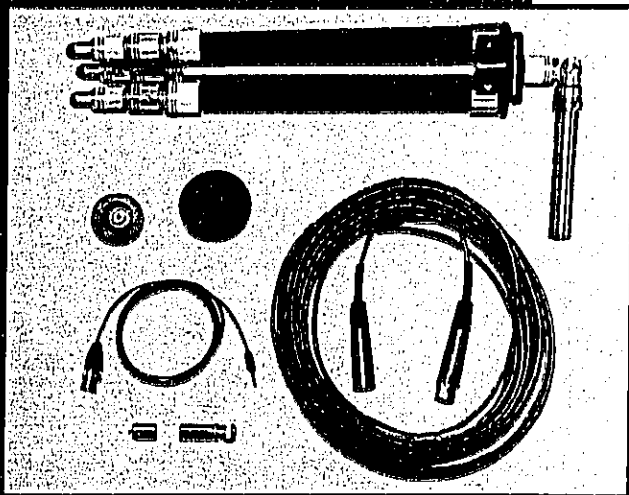
Description	Order No.
1560-P62 Power Supply, Bench Model	1560-9575



ACCESSORIES FOR ACOUSTIC INSTRUMENTS

Accessories for Enhancing Your GenRad Equipment

- Microphone Windscreens to reduce ambient wind effects
- Tripod to ensure repeatable measurements
- Extension Cables for versatility
- Preampifier Accessories



Clockwise, from top: Tripod, Extension Cable, Dummy Mike, Mike Attenuator, Patch Cable, Clamp, and Windscreen

A number of GenRad acoustic accessories are available to help you quickly and cost-effectively implement—and improve—your noise-monitoring program.

Microphone Windscreens. Made of reticulated polyurethane foam for convenient cleaning, the windscreens easily attaches to any 1-inch or 1/2-inch microphone to reduce ambient wind noise and protect the instrument from oily, misty, or dusty environments. It does not appreciably alter the sensitivity or frequency response of the microphone.

Tripod. Adaptable to all GenRad sound-level meters and stroboscopes, the tripod provides a sturdy foundation for making accurate measurements. One-inch and 1/2-inch sleeves for the tripod accept both GenRad preamplifiers.

Extension Cables. GenRad cables are shielded three-wire-plus-ground cables that terminate in Switchcraft Type A3 three-terminal connectors (male and female), for use between preamplifier output and analyzers. The cable mates directly with input/output connectors of the GenRad 1560-P62 Power Supply and most GenRad acoustic instruments. A wire is provided to carry power from an analyzer, for example, to the preamplifier.

A four-wire extension cable is also available for GenRad 1981, 1982, 1988, and 1995 Sound-Level Meters and Analyzers.

Patch Cable. This cable is for general use. Net weight is approximately 2 ounces.

Miniature Phone-Plug Adapting Cables (phone plug at one end and a double in-line banana plug at the other). Using these cables lets you connect outputs of sound-level meters to analyzers or chart recorders, enhancing the versatility of your equipment.

Microphone Attenuators. GenRad attenuators attenuate the output of the GenRad 1962 1/2-inch electret-condenser microphone by either 10 dB or 20 dB to allow operation at high levels.

Dummy Microphones. These microphones are used to simulate the GenRad 1962 1/2-inch electret-condenser microphone to determine instrument noise floor. A BNC input connector is also provided to connect a signal source—simulating a signal sound. A BNC shorting plug is supplied.

The 1560-P35 Permanent-Magnet Clamp. The clamp firmly holds a vibration pickup to any ferrous metal surface.

Continued on the next page.

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

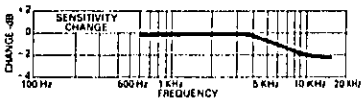
ACCESSORIES FOR ACOUSTIC INSTRUMENTS (Cont'd)

SPECIFICATIONS

WINDSCREENS

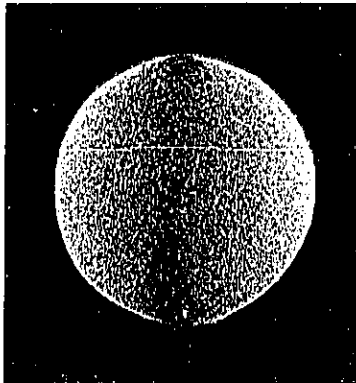
Wind-Noise Reduction: 20 dB in winds ≤ 30 mph.

Microphone Sensitivity Loss: 0 dB to 3 KHz, ≈ 0.5 dB to 5 KHz, ≈ 2 dB to 12 KHz; see curve.

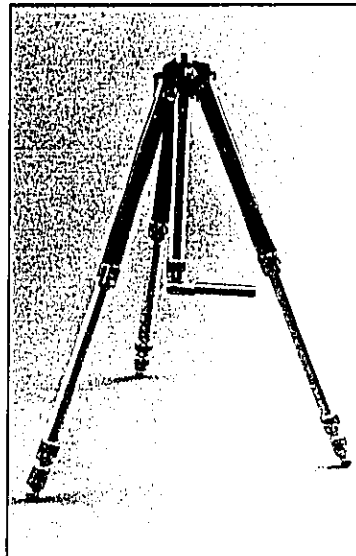


EXTENSION CABLES

Net Weight: -P72E 13 oz (369 g); -F, 2.3 lb. (1.1 kg).



Microphone Windscreen



Tripod

ORDERING INFORMATION

Description	Order No.
Microphone Windscreens 4 each per pack	
For 1-in. microphones	1500-9521
For 1/2-in. microphones	1500-9522
Tripod	1500-9590
Preamplifier Cable 1500-P72E Extension, Cable, 25 ft.	1500-0068
Extension Cables 4-wire, for extending the 1933, 1981, 1982 and 1988 Preamplifier from the instrument case.	
Microphone Extension Cable, 10 ft.	1933-9000
Microphone Extension Cable, 60 ft.	1933-9001
Miniature Phone-Plug Patch Cord 1500-P79, with BNC Plug, 3 ft.	1500-9679
1500-P77, with Double Banana Plug, 3 ft.	1500-9677
Preamplifier Accessories	
Microphone Attenuator, 10 dB	1902-3200
Microphone Attenuator, 20 dB	1902-9000/4
Dummy Microphone, 22 pF (used in place of 1902-9610, -9611)	1902-9620
1500-P35 Permanent Magnet Clamp	1500-9635

RANDOM-NOISE GENERATORS & AUDIO TEST METERS

Random-Noise Generators

Well-defined random noise is a remarkably useful test signal that has, for many measurements, properties that are far more useful than those of a single-frequency signal. Its wide spectrum sometimes permits one test with random noise to replace a series of single-frequency tests.

Noise is called random if its instantaneous amplitude—at any future instant—is unpredictable. Random noise is specified by its amplitude distribution and by its spectrum.

In general-purpose noise generators, the design objective is random noise that is Gaussian and has a uniform spectrum level over the specified frequency range.

GenRad has designed three random-noise generators fitting a wide range of applications.

Choose the model that's right for you in audio-frequency range, noise spectrum, and output levels.

Audio Test Meter

The measurement of output power is fundamental to the evaluation of many audio systems and components. That's why we've engineered the GenRad 1840-A Output Power Meter.

The meter provides a matching load impedance to the device under test—such as an amplifier or preamplifier—in order to accurately measure the device's output power.

1381 & 1382 RANDOM-NOISE GENERATORS

Companion Instruments Generating Truly Random Noise

1381 GENERATOR

- Generates noise from 2 Hz to as high as 2 KHz, 5 KHz, or 50 KHz, Gaussian distribution
- 3 volt rms output
- Adjustable amplitude clipping

1382 GENERATOR

- Generates noise from 20 Hz to 50 KHz, Gaussian distribution
- White, pink, or ANSI spectra for wide range of needs
- 3 volt rms output, balanced, unbalanced, or floating

Choose either the 1381 or the 1382 Random-Noise Generator. Either way, you're choosing a reliable instrument that provides truly random noise from a semiconductor source.

Both instruments ensure a symmetrical, Gaussian amplitude distribution.

Output levels can be adjusted from below 3 millivolts to 3 volts rms, behind a 600 Ω source impedance.

And both units are small (3½ inches high, in half-rack-width cabinets) – perfect for bench use. They can be mounted side-by-side in a single relay rack.

Either of these noise generators can be used for simulation of noise in signal paths, test-signal sources, or demonstration of statistical and correlation principles.

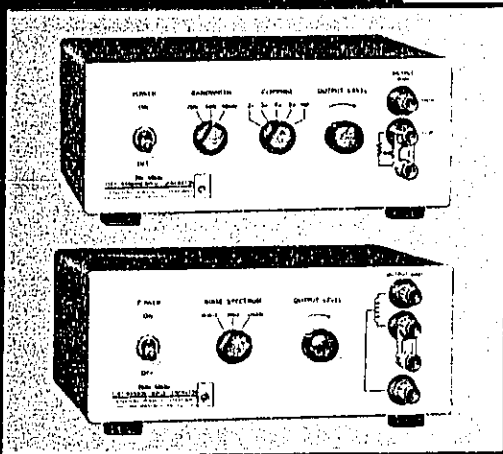
Each model offers different features to match different applications.

Lowest Frequency

The 1381 generates noise that is flat down to 2 Hz. It's designed for random-vibration tests and general use in the audio and subaudio range. The upper-frequency limit (at -3 dB) can be switched to 2 KHz, 5 KHz, or 50 KHz. The output signal can be clipped symmetrically at 2, 3, 4, or 5 times the rms amplitude.

Pink or White Noise

The 1382 generates noise in the 20-Hz to 50-Hz band and is intended for electrical, acoustical, and psychoacoustical tests. Three spectra are provided – white (flat), pink (-3 dB per octave), and ANSI (see specifications). The output can be taken balanced or unbalanced, floating or grounded.



GenRad 1381 (above) and 1382 Random-Noise Generators

SPECIFICATIONS

SPECTRUM OF 1381: SHAPES: Flat (constant energy per hertz of bandwidth) ± 1 dB from 2 Hz to half of cutoff. **CUTOFF FREQUENCY** (down 3 dB); 2, 5, or 50 KHz, selected by switch. **SPECTRAL DENSITY**, at 3-V output level and for 1-Hz bandwidth: 64, 40 and 13 mV, approx, respectively for upper cutoff frequencies of 2, 5, and 50 KHz. **SLOPE** of amplitude vs frequency above upper cut-off: 12 dB/octave. See graph.

SPECTRUM OF 1382: Choice of 3 shapes. **WHITE NOISE** (flat spectrum, constant energy per hertz bandwidth): ± 1 dB, 20 Hz to 25 KHz, with 3-dB points at approx 10 Hz and 50 KHz; **PINK NOISE** (constant energy per octave bandwidth): ± 1 dB, 20 Hz to 20 KHz; or **ANSI NOISE**, as specified in ANSI* Standard S1.4-1961. See graph.

WAVEFORM:

Voltage	Gaussian Probability-Density Function	Amplitude Density Distribution of 1381-1382
0	0.0796	0.0796 \pm 0.005
1	0.0484	0.0484 \pm 0.005
2	0.0138	0.0138 \pm 0.003
3	0.00098	0.00098 \pm 0.0002
4	0.000274	0.000274 \pm 0.00002

These data measured in "windows" of 0.2 σ , centered on the indicated values of voltage; σ is the standard deviation of rms value of the noise voltage.

CLIPPING: The output of the 1381 can be clipped internally to remove the occasional wide extremes of amplitude. Clipping, if desired, is adjustable to approx 2, 3, 4, or 5 σ . Such clipping has negligible effect on the spectrum or the rms amplitude.

OUTPUT: VOLTAGE: >3 V rms max, open-circuit, for any bandwidth. **CONTROL:** Continuous adjustment from that level down approx 60 dB. **IMPEDANCE:** 600 Ω . Can be shorted without causing distortion. 1381 output is unbalanced; 1382 output is floating, can be connected balanced or unbal-

anced. **TERMINALS:** 1381 output at front-panel binding posts and rear-panel BNC connector; 1382 output at front-panel binding posts and rear-panel BNC connector; 1382 output at front-panel binding posts and rear-panel jacks for double plugs.

SUPPLIED: Power cord, rack-mounting hardware with rack models.

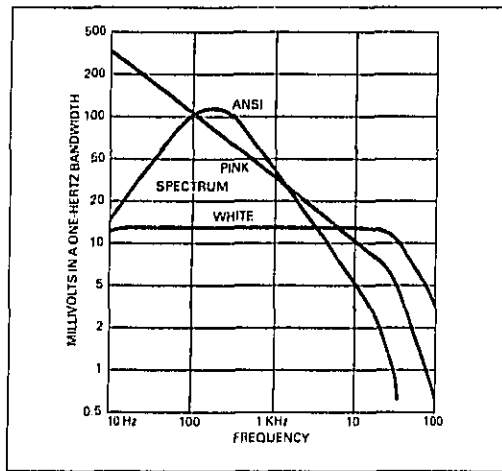
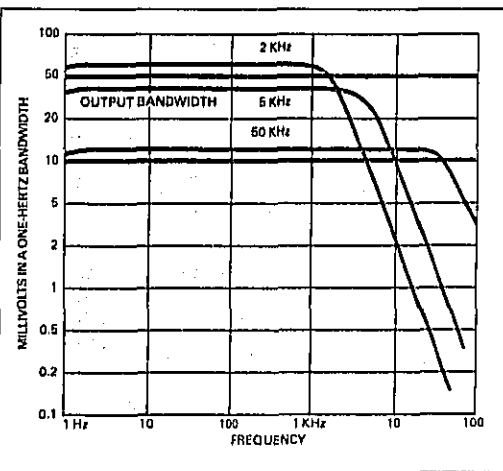
POWER: 100 to 125 or 200 to 250 V, 50 to 400 Hz, 6 W.

MECHANICAL: Convertible bench cabinet. **DIMENSIONS** (w \times h \times d): Bench, 8.5 x 3.87 x 9.87 in. (216 x 98 x 250 mm); rack, 19 x 3.5 x 9 in. (483 x 89 x 229 mm). **WEIGHT:** 7 lb. (3.2 kg) net, 10 lb. (4.6 kg) shipping.

ORDERING INFORMATION

Description	Order No.
Random-Noise Generator	
1381 (2 Hz to 50 KHz), Bench	1381-9700
1381 (2 Hz to 50 KHz), Rack	1381-9701
1382 (20 Hz to 50 KHz), Bench	1382-9700
1382 (20 Hz to 50 KHz), Rack	1382-9701

*Formerly ASA and USASI



1381 Random-Noise Generator

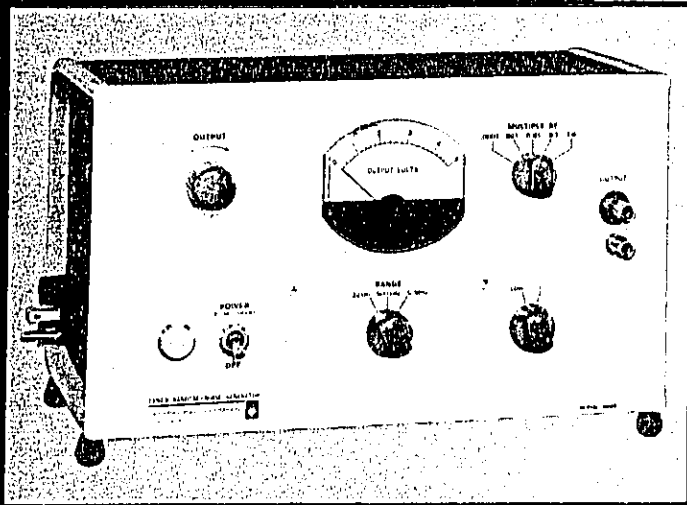
1382 Random-Noise Generator

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138

1390-B RANDOM- NOISE GENERATOR

Generates Wide-Band Noise of Uniform Spectrum Level

- Frequency range from 5 Hz to 5 MHz
- Adjustable output level of 30 microvolts to 3 volts
- ± 1 dB audio-spectrum-level uniformity



The 1390-B Random-Noise Generator generates wide-band noise of uniform spectrum level for a variety of useful applications.

The noise output is generated by a gas discharge tube that is amplified and shaped with low-pass filters to provide wide spectral ranges. Upper cutoff frequencies are 20 KHz, 500 KHz and 5 MHz.

The output level is metered and adjustable by a continuous attenuator followed by a four-step attenuator of 20 dB per step, from fewer than 30 microvolts to 3 volts.

With the 1390-B, you can drive the device-under-test (DUT) and then analyze output with any one of several GenRad analyzers. And since the 1390-B makes the DUT handle a wide spectrum simultaneously—in contrast to the typical swept-single-frequency method—it gives you a significant advantage when measuring nonlinear devices.

Versatile Functions

The 1390-B can be used as a broadband signal source for a wide range of applications:

- frequency response
- intermodulation and cross-talk tests
- simulation of telephone-line noise
- setting transmission levels in communications circuits

The instrument can be used for acoustic measurements including:

- reverberation
- room acoustics
- acoustical properties of materials
- frequency response
- sound attenuation of walls, floors, ducts, etc.

And when used with an amplifier, the 1390-B can drive loudspeakers (for structural fatigue tests) and vibration shake-tables.

SPECIFICATIONS

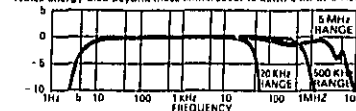
FREQUENCY RANGE: 5 Hz to 5 MHz.

OUTPUT: VOLTAGE: Max open-circuit is at least 3 V for 20-KHz range, 2 V for 500-KHz range, and 1 V for 5-MHz range. **IMPEDANCE:** Source impedance for max output is approx 900 Ω . Output is taken from a 2,500- Ω potentiometer. Source impedance for attenuated output is 200 Ω . One output terminal is grounded.

SPECTRUM: See spectrum-level curves and following table. Note: Spectrum level is shown with constant-Hz bandwidth analysis, "white" noise being ideally flat. (Pink noise would slope down at 10 dB per decade.)

Range	Typical Spectrum Level (with 1-V rms output)	Spectrum Level Uniformity*
20 KHz	0 mV for 1-Hz band	within \pm 1 dB, 20 Hz to 20 KHz
500 KHz	1.2 mV for 1-Hz band	within \pm 3 dB, 20 Hz to 500 KHz
5 MHz	0.6 mV for 1-Hz band	within \pm 3 dB, 20 Hz to 500 KHz within \pm 4 dB, 500 KHz to 5 MHz

*Noise energy also beyond these limits. Level is down 3 dB at 5 Hz.



Typical spectrum-level characteristics.

WAVEFORM: Noise source has good normal, or Gaussian, distribution of amplitudes for ranges of the frequency spectrum that are narrow compared with the band selected. Over wide ranges the distribution is less symmetrical because of dissymmetry introduced by the gas tube. Some clipping occurs on the 500-KHz and 5-MHz ranges.

VOLTMETER: Rectifier-type averaging meter measures output. It is calibrated to read rms value of noise.

ATTENUATOR: Multiplying factors of 1.0, 0.1, 0.01, 0.001, and 0.0001. Accurate to \pm 3% to 100 KHz, within \pm 10% to 5 MHz.

AVAILABLE: Rack-adaptor set (19x7 in.); 139D-P2 Pink-Noise Filter.

POWER: 105 to 125 or 210 to 250 V, 50 to 400 Hz, 50 W.

MECHANICAL: Convertible bench cabinet. **DIMENSIONS (wxhxd):** Bench, 12.75 x 7.5 x 9.75 in. (324 x 191 x 248 mm). **WEIGHT:** 12 lb. (5.5 kg) net, 16 lb. (7.5 kg) shipping.

ORDERING INFORMATION

Description	Order No.
1390-B Random-Noise-Generator	
115-V Model	1390-9702
230-V Model	1390-9703

TO ORDER CALL TOLL FREE 1-800-343-4470, IN MASSACHUSETTS 1-617-369-4400 ext. 3138 51

1390-P2 PINK- NOISE FILTER

Allows Conversion of White Noise to Pink

- Converts white noise to pink noise for flat response on constant percentage bandwidth analyzer

When white noise is used for frequency-response measurements in conjunction with constant-percentage-bandwidth analyzers such as the GenRad 1982, 1988, or 1985 Analyzer ...there can be a problem.

The problem is that the amplitude-frequency characteristic of a flat system can appear to slope upward with increasing frequency at a rate of 3 dB per octave, due to the constantly increasing bandwidth

(in hertz) of the analyzer.

The GenRad solution is the 1390-P2 Pink-Noise Filter.

The pink-noise filter converts the audio-frequency output of the GenRad 1390-B Random-Noise Generator from white noise to pink noise.

The pink noise has constant energy per octave—flattening the response curves made with constant-percentage-bandwidth analyzers.

SPECIFICATIONS

FREQUENCY RESPONSE: Sloping -3 dB per octave from 20 Hz to 20 KHz, -6 dB per octave above 20 KHz. Output voltage is approx -5 dB with respect to the input voltage at 20 Hz and -35 dB at 20 KHz. It lies within 1 dB of the straight line connecting these two points on a graph of output in decibels vs log frequency.

MAX. INPUT VOLTAGE: 15 V rms.

TERMINALS: Input terminals are recessed banana pins on $\frac{3}{4}$ -in. spacing at rear of unit. Output terminals are jacktop binding posts with $\frac{1}{4}$ -in. spacing.

OVERALL OUTPUT LEVEL: When the filter is used with the random-noise generator set for the 20-KHz range, the output voltage of the filter is approx 30 dB below its input, and the voltage level in each one-third-octave band is approx 17 dB below that. Thus, when the output meter of the generator indicates 3 V, the output of the filter is approx 0.1 V, and the level in each one-third-octave band is approx 15 mV.

MECHANICAL: Plug-in unit housing. DIMENSIONS (w x h x d): 1.38 x 5 x 2.87 in. (35 x 127 x 73 mm). WEIGHT: 6 oz. (0.2 kg) net, 4 lb. (1.9 kg) shipping.

INPUT IMPEDANCE: The filter should be driven from a source whose impedance is 1k Ω or less. Input impedance is variable from 6.5k Ω + load resistance at zero frequency to 6.7k Ω at high frequencies.

OUTPUT IMPEDANCE: The filter should not be operated into a load of less than 20k Ω . Internal output impedance is variable from 6.5k Ω + source resistance at low frequencies to approx 200 Ω at high frequencies.

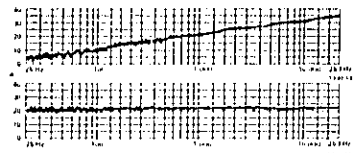
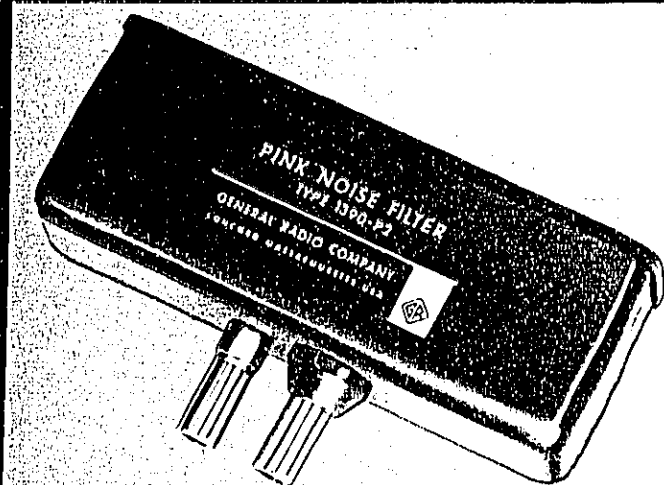


Figure 1: Frequency response of the 1390-P2 Pink-Noise Filter. The curve lies within 1 dB of the straight line connecting these two points on a graph of output in decibels vs log frequency.

ORDERING INFORMATION

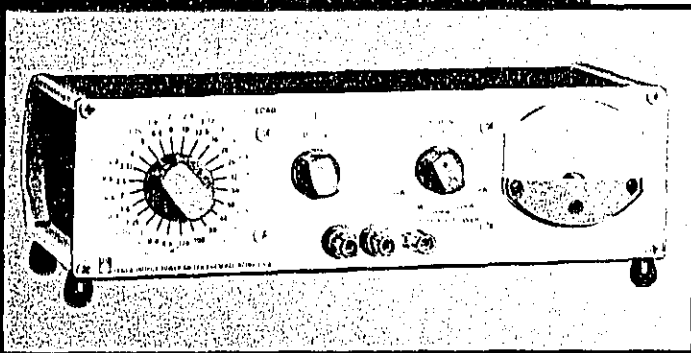
Description	Order No.
1390-P2 Pink-Noise Filter	1390-9602



1840-A OUTPUT POWER METER

Accurately Measures Wide Range of Audio Frequency Power

- 20 Hz to 20 KHz, 0.1 mW to 20 W power range for variety of applications
- A total of 48 different primary impedances
- Easily extended maximum power ratings
- 0.6 Ω to 32 k Ω input impedance



The 1840-A Output Power Meter accurately measures audio-frequency power into any desired magnitude of load impedance.

- It's ideal for measuring:
- power output of oscillators, amplifiers, preamplifiers, transformers, transducers, and low-frequency lines,
 - output impedance, by adjustment of this load to yield maximum power indication, and
 - frequency-response characteristics of amplifiers, transformers, and other audio-frequency devices.

This instrument is basically a multi-tapped audio-frequency transformer with a fixed secondary load. The 1840-A's two front-panel switches connect eight identical primary windings and six secondary taps in various combinations providing a total of 48 different primary impedances.

And you can extend the maximum power rating for any given impedance by using a simple T-network attenuator. Design data for the attenuator is supplied.

SPECIFICATIONS

POWER: 0.1 mW to 20 W, 40 Hz to 20 KHz. Below 40 Hz, max rating is reduced by up to 50% (at 25 Hz), depending on impedance selected. See curve. Auxiliary dB scale reads from -15 to +43 dB re 1 mW.

IMPEDANCE: 0.6 Ω to 32 k Ω in two ranges; yielding 48 individual impedances spaced approximately $\sqrt{2}$ apart.

POWER ACCURACY:

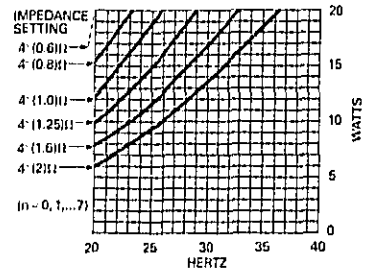
- At 1 KHz, ± 0.3 dB;
- 50 Hz to 5 KHz, ± 0.5 dB;
- 30 Hz to 10 KHz, ± 1 dB;
- at 20 Hz, -1.5 dB max, -1 dB avg;
- at 20 KHz, -5 dB max, ± 1.5 dB avg.

IMPEDANCE ACCURACY (AT FULL-SCALE VOLTAGE):

- At 1 KHz, $\pm 6\%$ max, -0.5% avg;
- 70 Hz to 2.5 KHz, $\pm 7\%$;
- 2.5 KHz to 5 KHz, for $Z < 10$ k Ω , $\pm 7\%$;
- at 20 Hz, -15% max, -8% avg;
- at 20 KHz, $\pm 50\%$ max, $\pm 12\%$ avg.

WAVEFORM ERROR: Meter will indicate true rms with as much as 20% second and third harmonics present in the input signal.

MECHANICAL: Convertible bench cabinet. DIMENSIONS (wxhxd): 12 x 4 x 8 in. (305 x 102 x 203 mm). WEIGHT: 11 lb. (5 kg) net, 17 lb. (8 kg) shipping. Rack-adaptor panel height, 3.5 in. (89 mm).



Power rating vs impedance setting and frequency. All 48 impedance settings are represented, as n = 0, 1, 2, ..., 7.

ORDERING INFORMATION

Description	Order No.
1840-A Output Power Meter	1840-9701

TO ORDER CALL TOLL FREE 1-800-343-4470,
IN MASSACHUSETTS 1-617-369-4400 ext. 3138

INDEX

SOUND LEVEL METERS

1988 Precision Integrating Sound-Level Meter and Analyzer	5
1982 Precision Sound-Level Meter and Analyzer	8
1981-B Precision Sound-Level Meter and Analyzer	10
1933-9610 Vibration Integrator System	12
1565-B Sound-Level Meter	13
1565-D Sound-Level Meter	13
1565 Sound-Level Measurement Set (Industrial Noise)	15
1565 Sound-Level Measurement Set (Community Noise)	16
1560 Vibration Pickups	17

NOISE DOSIMETERS

1954 Noise Dosimeter	19
----------------------------	----

CALIBRATORS

1986 Omnicol Sound-Level Calibrator	24
1987 Minical Sound-Level Calibrator	26
1562-A Sound-Level Calibrator ..	27
1565 Audiometer Calibration Set ..	28
1560-9619 Audiometer Calibration Accessory Set	29
1557-A Vibration Calibrator	31

ANALYZERS AND RECORDERS

1995 Integrating Real-Time Analyzer	33
1985 DC Recorder	36

MICROPHONES AND PREAMPLIFIERS

1961 and 1962 Electret-Condenser Microphones	39
1971-9605 and 1971-9601 Ceramic Microphones	41
1560-P42 Preamplifier	42
1972-9600 Preamplifier/Adaptor ..	43
1560-P62 Power Supply	44

ACCESSORIES FOR ACOUSTIC INSTRUMENTS

Microphone Windscreens	45
Tripod	45
Extension Cables	45
Miniature Phone-Plug Adapting Cables	45
Microphone Attenuators	45
Dummy Microphones	45
1560-P35 Permanent-Magnet Clamp	45

RANDOM-NOISE GENERATORS AND AUDIO TEST METERS

1381 and 1382 Random-Noise Generators	48
1390-B Random-Noise Generator ..	50
1390-P2 Pink-Noise Filter	52
1840-A Output Power Meter	53

NATIONAL STOCK NUMBERS

1381-9700	6625-00-140-8381	1560-9666	5995-01-024-6588
1381-9701	6625-00-574-6078	1560-9695	5995-00-169-6873
1382-9700	6625-00-190-1299	1562-9701	6625-00-401-5364
1382-9701	6625-00-214-9865	1562-9701	6625-00-438-0625
1390-9702	6625-00-799-8999	1565-9702	6625-00-003-9714
1390-9702	6625-00-942-4260	1565-9702	6625-01-012-9225
1390-9702	6625-00-992-0813	1565-9902	6625-00-001-4452
1390-9702	6625-01-003-7464	1840-9701	6625-00-895-1512
1390-9703	6625-00-799-8999	1840-9701	6625-00-937-6156
1560-9521	5965-01-022-3484	1954-9640	5695-01-040-6844
1560-9522	5965-01-022-3483	1954-9710	6625-01-041-0293
1560-9653	6625-01-007-6686	1954-9720	6625-01-043-8294