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INSTRUCTION MANUAL



TYPE 1558-BP

OCTAVE BAND
NOISE ANALYZER

B

GENERAL RADIO COMPANY

Printed in USA

INSTRUCTION MANUAL

TYPE 1558-BP

**OCTAVE BAND
NOISE ANALYZER**

Form 1558-0100-B

ID 2435

June, 1968

NOTE: This instrument is equipped with our new snap-on knob for added convenience and safety. Refer to the Service Section for details.

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WEST CONCORD, MASSACHUSETTS, USA**

TABLE OF CONTENTS

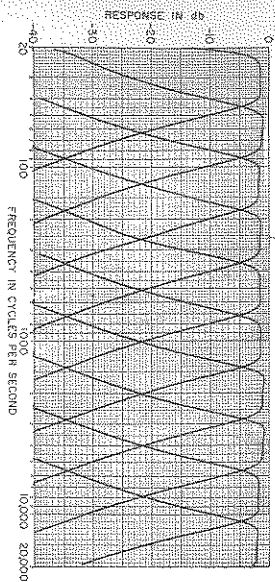
Section 1. INTRODUCTION	1
1.1 Purpose	1
1.2 Description	1
1.3 Controls and Connectors	2
1.4 Carrying Case	2
1.5 Accessories Supplied	3
1.6 Relay-Rack Mounting	3
1.7 Type 1560-P6 Microphone Assembly	3
1.8 Type 1560-P40 Preamplifier	4
Section 2. PRINCIPLES OF OPERATION	5
2.1 Microphone Preamplifier	5
2.2 Filter Circuit	5
2.3 Output Circuit	7
2.4 Calibration Circuit	8
2.5 Charge Circuit	8
Section 3. OPERATING PROCEDURE	8
3.1 Opening and Tilting the Cabinet	8
3.2 Preliminary Checks	8
3.3 Operating with Type 1560-P6 Microphone Assembly	9
3.4 Use of Type 1552-B Sound-Level Calibrator	10
3.5 Preamplifier Weighting	10
3.6 Operation with Sound-Level Meter	10
3.7 Operation with Type 1560-P40 Preamplifier	11
3.8 Charging the Battery	12
3.9 Background Noise	12
3.10 Effect of Presence of Observer and Instrument Case	12
3.11 Preferred Angle of Incidence	13
3.12 Carrying Strap	13
3.13 Use as a Sound-Level Meter	14
3.14 Use of Wide-Range Microphones	14
3.15 Recording	14
Section 4. SERVICE AND MAINTENANCE	15
4.1 General	15
4.2 Removal of Instrument From Case	15
4.3 Transistor Voltages	15
4.4 Microphone Sensitivity Adjustment	15
4.5 Internal Noise	16
4.6 Gain Check	16
PARTS LIST	22
APPENDIX	33

SPECIFICATIONS

Bands:

LOWER CUTOFF FREQUENCY (cps)	UPPER CUTOFF FREQUENCY (cps)	CENTER FREQUENCY* (cps)
22.3	44.6	31.5
44.6	89.2	63
88.4	177	125
177	354	250
354	707	500
707	1414	1000
1414	2828	2000
2828	5656	4000
5656	11,310	8000
11,310	22,620	16,000
ALL PASS		
A-weighted sound level		

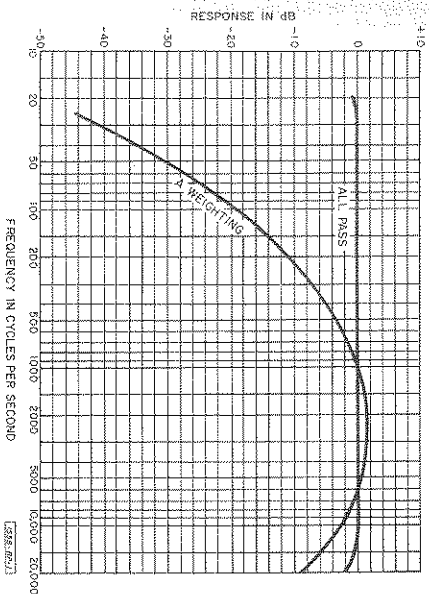
*Geometric mean



Typical response characteristics of GR Type 1558-BP Octave Band Noise Analyzer, Characteristics measured at OUTPUT jack with (SLM) terminals.

(TOP) Octave-band characteristics.

(BOTTOM) All-pass and A-weighting characteristics.



SPECIFICATIONS (cont)

Filter Characteristics, signal applied at INPUT (SLM) terminals: For bands from 63 to 8000 cps, the level at the center frequency is uniform within 1 db. Maximum deviation from ALL PASS level at center frequency in any band is 1 db. For bands from 63 to 8000 cps, the response at the nominal cutoff frequency is 3.5 ± 1 db below the response at the center frequency. For all octave bands, the attenuation is at least 30 db at half the lower nominal cutoff frequency and at twice the upper nominal cutoff frequency; the attenuation is at least 50 db at one-fourth the lower nominal cutoff frequency and at four times the upper nominal cutoff frequency.

Sound-Level Range: 44 to 150 db above 2×10^{-4} μ bar in any band when the Type 1560-P6 Microphone Assembly is used.

Inputs: Impedance at MIKE terminals is approximately 50 pF in parallel with 50 M Ω . It is intended for use with high-impedance transducers such as the Type 1560-P6 Microphone Assembly.

Impedance at INPUT (SLM) terminals is approximately 100 k Ω . Maximum input is 3 volts. This input is intended for connection to the output of a sound-level meter. Low terminal is grounded to the case.

Preamplifier Frequency Characteristics: Two characteristics are included: C weighting, which meets the requirements of the American Standards Association Specification S1.4-1961 (SLM); and 20 kc, an essentially flat response.

Outputs: Open-circuit output is at least 1 volt for full-scale meter deflection. Output impedance is 6000 ohms. Any load can be connected to the OUTPUT terminals.

Meter Response: FAST or SLOW meter response is selected by a panel control. The characteristics of each are as specified by the American Standards Association Specification S1.4-1961 for General Purpose Sound-Level Meters.

Internal Calibration: The gain of the analyzer can be calibrated, by means of a built-in reference, for use with a piezoelectric microphone with sensitivity between -52 and -62 db re 1 v/ μ bar. With this calibration, the absolute accuracy for ALL PASS levels is ensured within 1 db.

Batteries: Two 9.6-volt, rechargeable, nickel-cadmium batteries (Gould, Type 9.6 V/450B) provide 30 hours of operation. To recharge them, the instrument is connected to a 115- (or 230-) volt, 25- to 60-cycle line for 14 hours.

Accessories Supplied: Type 4200-0600 Power Cord, 1560-2101 Cable Assembly, 4170-7060 Carrying Strap.

Accessories Available: Type 1560-P6 Microphone Assembly; Type 1560-P34 Tripod and Extension Cable (including Type 1560-P32 Tripod and Type 1560-P73 25-foot Extension Cable); Type 0480-9752 Adaptor Set, to convert for relay-track mounting; Type 1560-P40 Preamplifier and accessories.

Dimensions: Flip-tilt case, width 10%, height 9%, depth 7% inches (260 by 235 by 185 mm), including handle.

Net Weight: 8 $\frac{1}{2}$ pounds (4 kg).

U. S. Patent Nos. 3,012,197; 2,966,257; D187,740.

General Radio Experimenters reference: Vol 36, No. 10, October 1962.

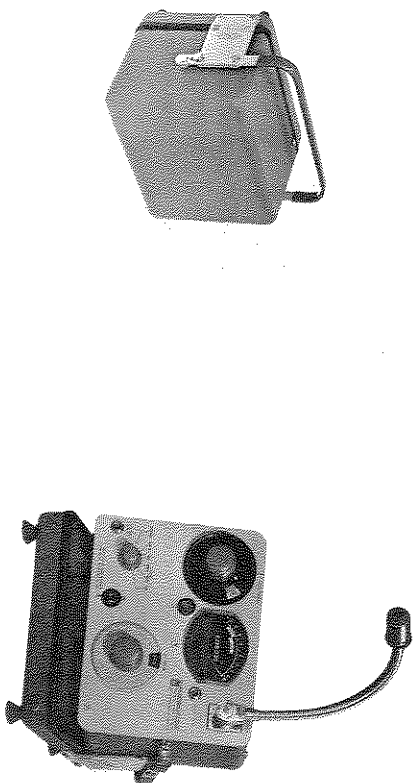


Figure 1-1. Type 1558 Octave
Band Noise Analyzer.

SECTION 1

INTRODUCTION

1.1 PURPOSE.

The Type 1558-BP Octave Band Noise Analyzer (Figure 1-1) is a portable audio-frequency spectrum analyzer, for use in the study of sound or vibration spectra. (For details of the various applications of this analyzer, refer to the General Radio *Handbook of Noise Measurement*.) The noise analyzer can also be used as a filter unit, a selective detector, or an analyzer for voltage spectra.

1.2 DESCRIPTION.

The analyzer consists of a high-impedance microphone preamplifier, a tunable filter with a noise bandwidth of 1 octave, an output amplifier, and a meter. When used with the Type 1560-P6 Microphone Assembly, the analyzer indicates directly the sound pressure level in any of its 12 bands, for levels between 44 and 150 db, re 2×10^{-4} μ bar. The analyzer can be used with a Type 1560-P40 Preamplifier, which extends its sensitivity to 24 db and permits placement of the microphone at the end of a long cable. The analyzer can also be used with the Type 1551-C Sound-Level Meter for still greater sensitivity.



1.3 CONTROLS AND CONNECTORS.

Name	Type	Function
BAND LEVEL DB (gray knob)	6-position rotary switch	Adjusts gain of output amplifier and indicates meter range.
BAND LEVEL DB (knurled dial)	5-position rotary switch	Adjusts input level to filter and indicates meter range.
BAND CPS	12-position rotary switch	Selects band.
None (Function switch)	6-position rotary switch	Turns instrument on and OFF. Selects meter speed and mode of operation (CAL, CK BAT, or CHARGE).
CAL	Thumb-set control	Adjusts gain.
MIKE	Three-terminal Cannon Type XLR locking socket	High-impedance input.
INPUT (SLM)	Phone jack	Low-impedance (100 K Ω) input (maximum input 3 volts).
OUTPUT	Phone jack	Supplies 1 volt open circuit for full-scale meter indication (output impedance is 6000 ohms).
CHARGE BATTERY, 115 VAC 25-60C	Two-terminal male connector	Input connector for line voltage, to charge battery.

1.4 CARRYING CASE.

The analyzer is mounted in a Flip-Tilt case. The captive protective cover serves as a mounting base when the instrument is in use. The friction of the rubber seal serves to keep the instrument at any convenient angle, from horizontal to vertical.

Space is provided in the cover for the Type 1560-P6 Microphone Assembly. The flexible conduit is positioned across the panel, below the BAND CPS switch, while still held in place at the MIKE terminals.

1.5 ACCESSORIES SUPPLIED.

The following accessories are supplied with the Type 1558-BP Octave Band Noise Analyzer:

- 1-Power Cord, P/N 4200-0600
- 1-Cable Assembly, P/N 1560-2101
- 1-Carrying Strap, P/N 4170-7060

1.6 RELAY-RACK MOUNTING.

The Type 0480-9752 Adaptor Set, to convert the analyzer for relay-rack mounting, is available from General Radio. Complete instructions for installation are included with the set.

1.7 TYPE 1560-P6 MICROPHONE ASSEMBLY.

The Type 1560-P6 Microphone Assembly (Figure 1-2) is recommended for use with the Type 1558-BP Octave Band Noise Analyzer. It consists of a piezoelectric, ceramic microphone connected to a short length of flexible conduit, which, in turn, is mounted on a swivel base. A connector on the base mates with the three-terminal input connector (MIKE) on the panel of the analyzer.

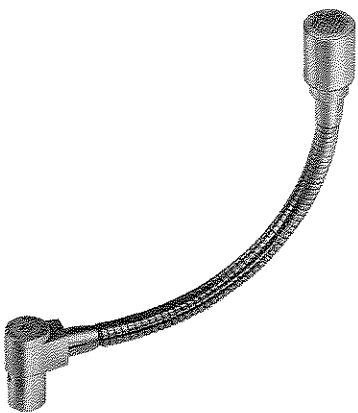


Figure 1-2. Type 1560-P6 Microphone Assembly.

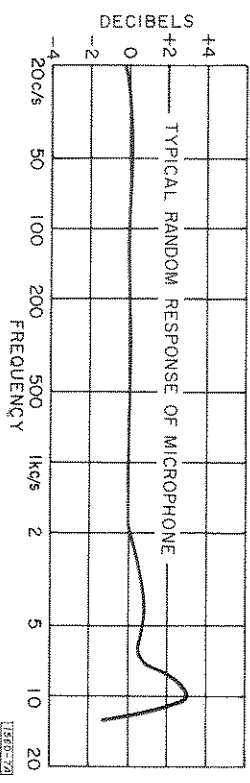


Figure 1-3. Typical random frequency response of Type 1560-P6.



1.8 TYPE 1560-P40 PREAMPLIFIER.

The Type 1560-P40 Preamplifier (Figure 1-4) is a high-input-impedance low-noise preamplifier. It is particularly well suited for amplifying the output of piezoelectric transducers, such as microphones and vibration pickups, and for driving long connecting cables without loss in signal voltage. A switch provides a voltage gain of either 1:1 or 10:1.

The amplifier is housed in a small cylindrical case. The GR Type 1560-P5 Microphone cartridge plugs directly on to the input end of the case. Adaptors are available for connecting the preamplifier to the cartridge of the GR Type 1560-P3 Microphone, to GR874 Connectors, and to 3-terminal microphone connectors. Output from the preamplifier is through a 3-terminal shielded connector. The required dc supply voltage is applied from one of these terminals to ground. This voltage can be obtained directly from the Type 1558-BP Analyzer.

The preamplifier and accessories are available in various combinations (refer to the Appendix).

The Type 1560-P40H Preamplifier and Power Supply Set is self-powered and independent of any external supply.

The Type 1560-P40I Preamplifier and Adaptor Set is dependent for its power on the instrument to which it is connected, so that it should be used with the Type 1558 or 1564 Analyzer.

The Type 1560-P40K Preamplifier and Microphone Set is for use with the Types 1558 and 1564 Analyzers when an acoustical measurement is needed at low levels and the microphone must be mounted at the end of a cable.

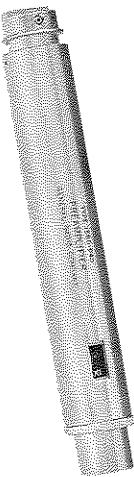


Figure 1-4. Type 1560-P40 Preamplifier.

SECTION 2
PRINCIPLES OF OPERATION

2.1 MICROPHONE PREAMPLIFIER.

The very low-level signals from a high-impedance transducer are amplified by the preamplifier to a level convenient for analysis. The preamplifier consists of an input attenuator, a unit-gain amplifier with a high input impedance, a weighting network, and a second attenuator and amplifier. An elementary schematic diagram is given in Figure 2-2.

The voltage gain of the preamplifier at mid-frequency is 20 db. An internal rotary switch can be set to give either an amplitude-frequency characteristic that is essentially flat from 20 cps to 20 kc, or one that is C weighted. The weighting switch is set in the General Radio Laboratory to the 20 KC position and should normally be used in this position. Figure 2-1 shows the frequency response of the preamplifier.

2.2 FILTER CIRCUIT.

A block diagram of a single filter section is shown in Figure 2-3. The filter circuit consists of three isolated, resonant sections in cascade, with a 20-db step attenuator between the second and third sections. The sections are staggered about the center frequency of the selected band to give a maximally flat (or Butterworth) characteristic. The nominal noise bandwidth is 1 octave.

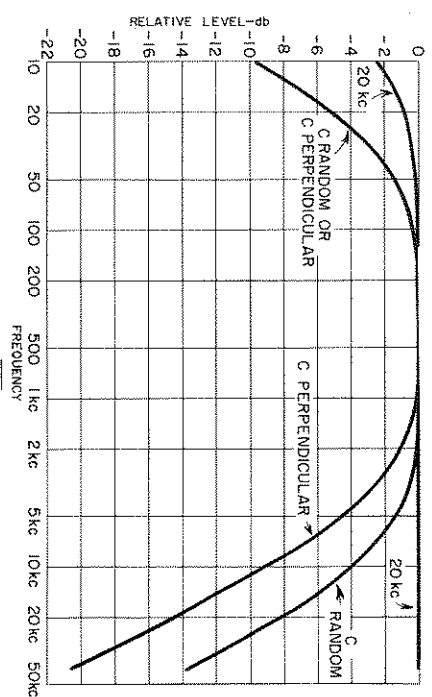


Figure 2-1. Frequency response of preamplifier.

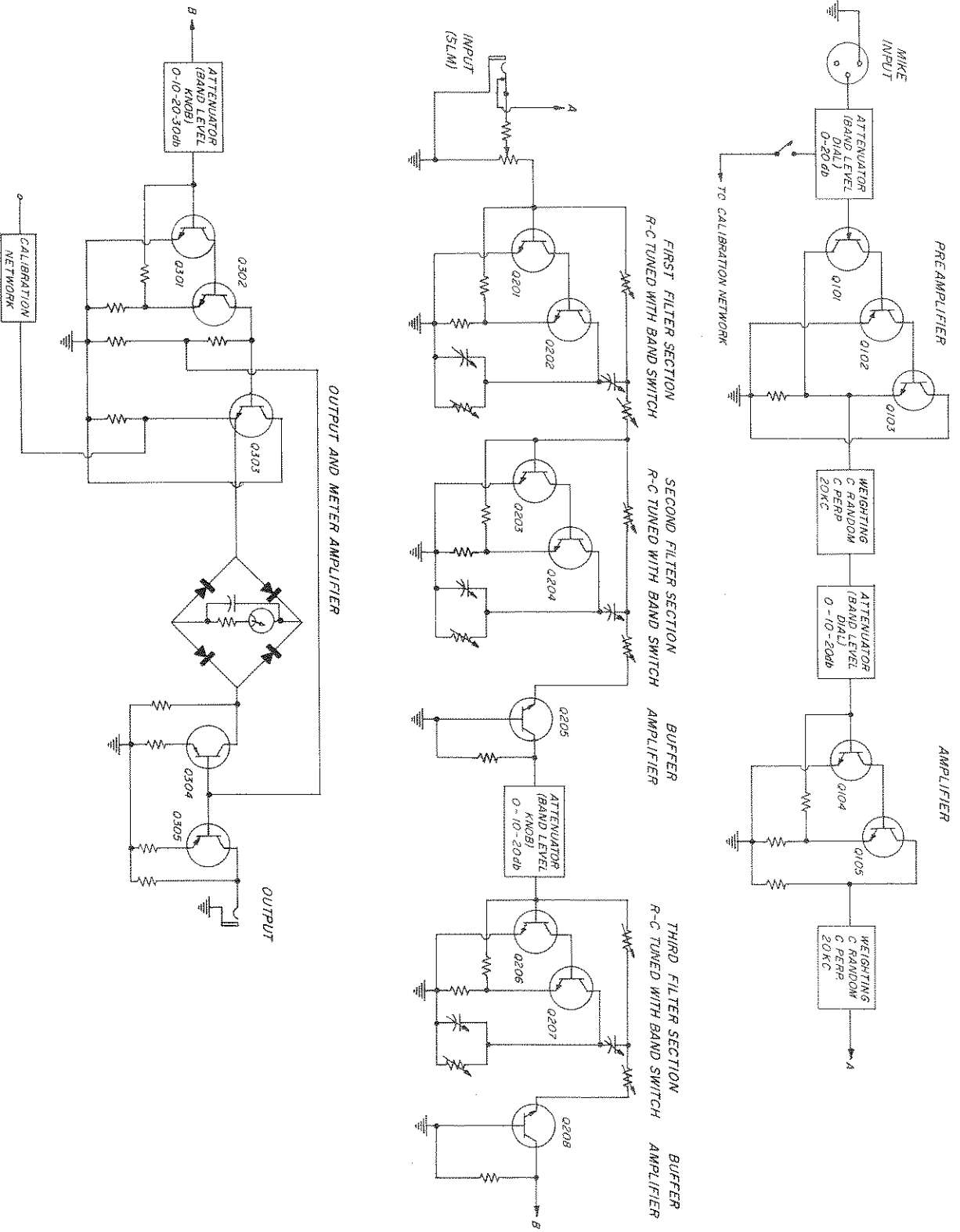


Figure 2-2. Elementary schematic diagram of the Type 1558-BP Octave Band Noise Analyzer.

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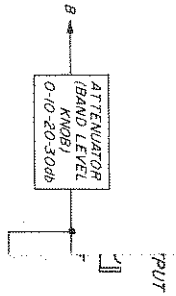
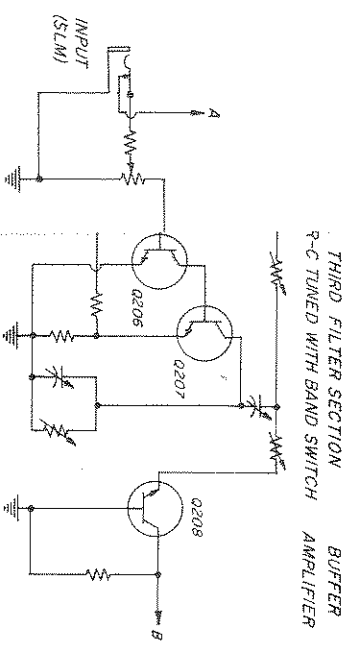
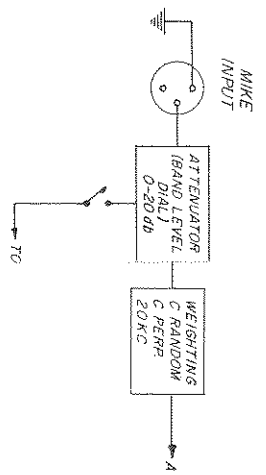


Figure Analyzer.

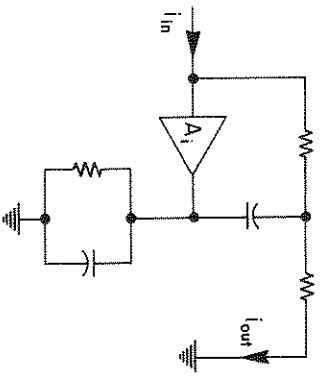


Figure 2-3. Block diagram of a single section of the filter circuit.

Each section of the filter circuit uses a highly stabilized current amplifier and an RC feedback network. To tune the filter, both resistors and capacitors are switched in a manner that allows each set of capacitors to be used for two bands.

Anormalized, magnitude-frequency characteristic is shown in Figure 2-4. This section also contains the RC circuit for an A-weighted sound-level meter characteristic.

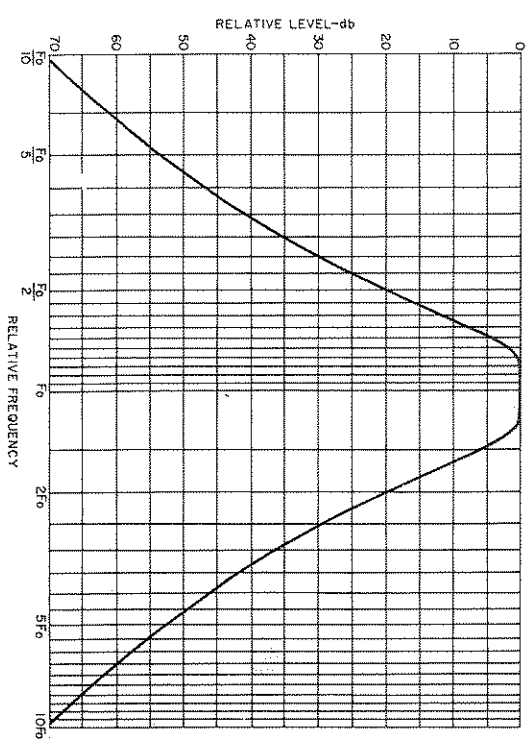


Figure 2-4. Normalized magnitude-frequency characteristic of one-octave filter.

2.3 OUTPUT CIRCUIT.

The output circuit includes a 30-db step attenuator, an amplifier, and a meter circuit. An isolating stage, feeding the OUTPUT jack, ensures that a load will not affect the meter indication.

The meter circuit gives an indication that has come to be known as quasi-rms. I The conduction angle for sinusoidal excitation is chosen to give a close approximation to rms for many types of signals.

I. E. Gross, "Improved Performance Plus a New Look for the Sound-Level Meter", GENERAL RADIO EXPERIMENTER, Vol. 32, No. 17, October, 1958.



2.4 CALIBRATION CIRCUIT.

To calibrate the analyzer, the output is connected to the input through a filter, a limiter, and a calibrated attenuator. When the gain is adjusted to equal the attenuation of this feedback network, the system oscillates at a frequency of 1000 cps. The attenuation of this feedback network is adjusted by means of an internal control that is calibrated in terms of the microphone sensitivity.

2.5 CHARGE CIRCUIT.

The nickel-cadmium battery is constant-current charged through a simple half-wave rectifier and a series resistor that is connected directly to the line. When charging, the battery "floats" on the line; neither side of the line is connected to the case or to any part of the instrument except the charge circuit.

SECTION 3

OPERATING PROCEDURE

3.1 OPENING AND TILTING THE CABINET.

The directions for opening the Type 1558-BP Octave Band Noise Analyzer are given on the handle of the Flip-Tilt case. Once open, the instrument can be tilted to any convenient angle, as shown in Figure 1-1. The angle should be chosen to give the most convenient access to knobs and the best view of the panel control settings and meter indication.

The instrument can be locked fully open by the same slide pins that are used to lock it when it is closed. It can be carried in the open position, with the cover firmly in place.

The flexible conduit on the Type 1560-P6 Microphone Assembly can be positioned across the panel so that it does not interfere with the closing of the case. It can remain connected to the panel MIKE terminals.

3.2 PRELIMINARY CHECKS.

3.2.1 BATTERY. To check the battery, turn the function switch to CK BAT. The meter should read in the region marked BAT. The battery will require charging after about 30 hours of operation (refer to paragraph 3.8).

3.2.2 WEIGHTING. The internal weighting switch, S103, is set to give the preamplifier in the analyzer a flat (20 KC) frequency response and should normally be left in this position. The A-weighting characteristic is correct only when this switch is set to 20 KC.

3.3 OPERATION WITH TYPE 1560-P6 MICROPHONE ASSEMBLY.

3.3.1 CALIBRATION CHECK. Make the following check on the amplifier gain before using the analyzer. This check is valid only when the internal microphone sensitivity control is set to indicate the sensitivity of the microphone being used. Refer to paragraph 4.4.

- Set the BAND CPS switch to ALL PASS.
- Set the white dots on both BAND LEVEL DB controls (the large knurled dial and the small gray knob) to the red reference line.
- Set the function switch to CAL.

The meter should now indicate in the white area marked CAL. If it does not, adjust it by means of the CAL thumbset control on the panel.

3.3.2 OPERATION.

- Place the microphone in the desired position. Detents are provided in the panel connector to hold the gooseneck assembly in place. The connector can be turned through 180°.
- Turn both BAND LEVEL DB controls clockwise (knob and dial).
- Set the BAND CPS switch to ALL PASS.
- Set the function switch for the desired meter response (FAST or SLOW).
- If the meter indicates above +10, turn the BAND LEVEL DB knurled dial until an on-scale meter reading is obtained. If the meter indicates below zero, adjust the BAND LEVEL DB gray knob until a reading in the positive section of the meter scale is obtained. The all-pass level, in db re 2×10^{-4} μ bar, is the algebraic sum of the meter reading and the outer-scale BAND LEVEL DB indication.
- Set the BAND CPS switch to any desired octave band or to A weighting and adjust the BAND LEVEL DB gray knob to obtain an on-scale reading on the meter. The level in the band selected is then the algebraic sum of the meter reading and the outer-scale BAND LEVEL DB indication.

**CAUTION**

Improper use of the **BAND LEVEL DB** controls can overload the pre-amplifier and introduce errors. Always measure the **ALL PASS** level before analyzing. Never readjust the knurled dial after selecting an octave band or **A** weighting. This procedure ensures that the preamplifier is not overloaded and allows the entire potential analyzing range of the instrument to be realized.

3.4 USE OF TYPE 1552-B SOUND-LEVEL CALIBRATOR.

The Type 1558-BP Octave Band Noise Analyzer contains an internal calibrator that checks the electrical circuits only. For a check on the complete system calibration (including the microphone), the Type 1562 Sound-Level Calibrator is recommended. This calibrator includes a closed coupler and a driving loudspeaker that produces a known sound-pressure level at the microphone of the analyzer.

3.5 PREAMPLIFIER WEIGHTING.

The selection of one of three frequency characteristics is made by means of an internal three-position rotary switch, S103 (See Figures 4-3 and 4-6). The three switch positions are labeled 20 KC, C RANDOM, and C PERP. The 20 KC characteristic is the most uniform and should normally be used.

The C weighting characteristics are included because it has been common practice to analyze signals that have passed through a sound-level meter set to C weighting. The C RANDOM position of the switch gives a response for the combination of the preamplifier and the Type 1560-P6 Microphone Assembly that conforms to the requirements of the American Standards Association Specification ASA S1.4-1961 (SLM), for sounds arriving at random incidence. In the C PERP position, compensation is made for the directivity of the microphone, to produce a C response with incidence perpendicular to the plane of the diaphragm. The A weighting indicated by the BAND switch is incorrect when the internal switch is set to either C position.

3.6 OPERATION WITH SOUND-LEVEL METER.

For band levels below 44 db (re 2×10^{-4} μ bar), a sound-level meter, such as the GR Type 1551-C or 1561, can be used ahead of the analyzer. The procedure is as follows:

- a. Set the **BAND LEVEL DB** knurled dial so that the indicating area is under the red reference line. Turn the **BAND LEVEL DB** gray knob fully clockwise.

- c. Connect the output of the sound-level meter to the INPUT (SLM) jack on the analyzer, using the 1560-2101 Shielded Cable Assembly (supplied). Calibrate the sound-level meter by the means appropriate to that particular model, or use a GR Type 1562 Sound-Level Calibrator.

- d. With the calibration signal applied to the sound-level meter, adjust the CAL thumbset control on the panel of the analyzer to give the same meter reading as that of the sound-level meter.

- e. To analyze, set the weighting switch on the sound-level meter to 20 KC and adjust the attenuator on the sound-level meter for a meter reading between 0 and +10 db.

- f. Set the **BAND CPS** switch to the desired band and adjust only the **BAND LEVEL DB** gray knob to obtain an on-scale meter reading on the analyzer. The band level in db re 2×10^{-4} μ bar is the algebraic sum of the readings of 1) the attenuator of the sound-level meter, 2) the inner red scale of the **BAND LEVEL DB** dial on the analyzer, and 3) the meter reading of the analyzer.

3.7 OPERATION WITH TYPE 1560-P40 PREAMPLIFIER.

The Type 1560-P40 Preamplifier can be used with the analyzer to increase the sensitivity to a 24-db sound-pressure level, thus permitting operation at a remote distance from the microphone (refer to paragraph 1.8). Power for the Type 1560-P40 Preamplifier is supplied through terminal No. 2 of the MIKE socket of the analyzer. Plug the Type 1560-P40 Preamplifier and microphone combination directly into the MIKE socket, or make the connection by means of a 2-conductor shielded cable of convenient length. (Cables are supplied with the Type 1560-P40K Preamplifier and Microphone Set; they may also be purchased separately.) Set the gain switch on the Type 1560-P40 Preamplifier to either X1 or X10, as desired. When it has been calibrated, the analyzer is direct reading with this gain switch set to X1. When the switch is set to X10, subtract 20 db from the indication of the analyzer to obtain the actual sound-pressure level.

When the microphone and Type 1560-P40 Preamplifier are used with the Type 1558-BP Analyzer, the effective sensitivity of the microphone is increased. This is because the voltage loss caused by the input-capacitance load of the Type 1560-P40 on the microphone is less than the loss caused by the input-capacitance load of the analyzer. Also, when a cartridge only is used from a Type 1560-P4 or -P6 Microphone Assembly, the loss due to the presence of the flexible arm is avoided. (The sensitivity given for a Type 1560-P6 or -P4 Microphone is for the combination of microphone cartridge and flexible arm.)



To calibrate the analyzer-preamplifier combination, a Type 1562 Sound-Level Calibrator is recommended. However, the electrical calibrator in the Type 1558-BP can be used if the internal sensitivity control, R322, is set properly. If the microphone cartridge is supplied with the Type 1560-P40 Preamplifier or if it is removed from either the Type 1560-P3 or -P5 Microphone and is used on the Type 1560-P40 Preamplifier, set the sensitivity control 1 db higher than the sensitivity specified for the microphone. For example, if the sensitivity of the microphone or cartridge is -61 db, set the internal sensitivity control to -60 db. If the microphone cartridge is removed from a Type 1560-P4 or -P6 Microphone Assembly and is used with the Type 1560-P40 Preamplifier, set the sensitivity control 1.6 db higher than the sensitivity specified.

3.8 CHARGING THE BATTERY.

3.8.1 115-VOLT LINE. The analyzer is powered by a nickel-cadmium battery that provides about 30 hours of operation from full charge. To charge the battery, connect the analyzer to the 115-volt line, using the Type CAP-11 Power Cord (supplied). Terminals for this connection are provided on the front panel and are labeled 115V AC, 25-60 C, CHARGE BATTERY. Set the function switch to CHARGE. To charge the battery requires approximately 16 hours.

3.8.2 230-VOLT LINE. To charge the battery from a 230-volt line, disconnect the lead short-circuiting resistor R508 (see Figures 4-4 and 4-7). Connect the instrument to the 230-volt line, using the 4200-0600 Power Cord (supplied). Use the 115-volt CHARGE BATTERY terminals on the front panel. Set the function switch to CHARGE and allow 16 hours to charge the battery fully.

CAUTION: Continuous or repeated overcharging may seriously reduce the battery life.

3.9 BACKGROUND NOISE.

Whenever possible, sound measurements should be made with negligible background noise. In any band, the background noise level should be at least 10 db below the total measured level for that band. When this is not possible, apply the corrections given in Figure 3-1 for errors due to background noise.

3.10 EFFECT OF PRESENCE OF OBSERVER AND INSTRUMENT CASE.

Except in reverberant fields, the presence of the observer and the instrument case can disturb the sound field and thereby introduce significant

errors.¹ To minimize this effect, adjust the gooseneck assembly so that the microphone is located as far as possible from both the observer and the instrument. The observer should stand with the analyzer in front of him and with the sound source at his side. For greatest accuracy, mount the microphone on a tripod and connect it to the analyzer by means of an extension cable. The observer and the instrument are thus removed from the sound field.

3.11 PREFERRED ANGLE OF INCIDENCE.

For sounds in reverberant fields, the angle of incidence is indeterminate.

In a free field, the response obtained with an angle of incidence of 70° with respect to the axis of the Type 1560-P6 Microphone Assembly approximates random-incidence response. The directivity characteristic of the Type 1560-P6 Microphone Assembly can be used to advantage if the microphone is positioned with its axis directed toward the source. Under this condition, a C-weighted spectrum is presented to the filter when the internal weighting switch (S103) is set to C PERP (see Figure 4-3). Do not use the A-weighting position on the BAND switch with the internal weighting switch in this position.

3.12 CARRYING STRAP

The 4170-7060 Carrying Strap (supplied) is used to support the instrument so that the operator's hands are free to manipulate the controls. Attach the strap to the thimbles at the side of the case.

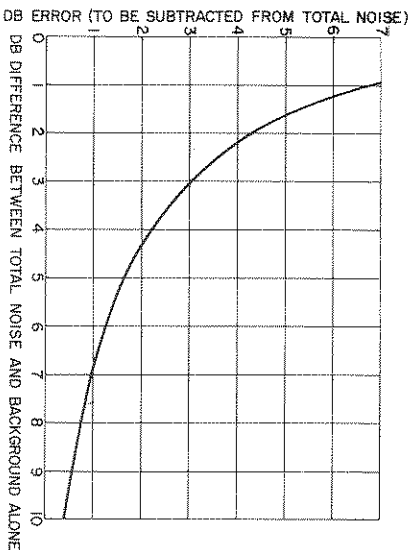


Figure 3-1.
Effect of background
noise on measurements.

¹R. W. Young, "Can Accurate Measurements Be Made With a Sound-Level Meter Held in Hand?" *SOUND*, Vol. 1, No. 1, January-February, 1962, pp. 17-24.



3.13 USE AS A SOUND-LEVEL METER.

The Type 1558-BP Octave Band Noise Analyzer can be used to measure either A- or C-weighted sound levels. Except for the fact that it does not include a B-weighting characteristic, it meets all requirements of the American Standards Specification for General Purpose Sound Level Meters, ASA S1.4-1961.

To measure A-weighted sound level, set the internal weighting switch, S103, to 20 KC (it is set to this position when delivered). Then follow the procedure given in paragraph 3-3, measuring first the ALL PASS (20-kc) level, then the A-weighted level. (Use the A-weighted position as though it were an octave band.)

To measure C-weighted sound level, set the internal weighting switch to C RANDOM and proceed as in paragraph 3.3.1 and steps a through e of paragraph 3.3.2. The indicated level with the BAND switch set to ALL PASS is the C-weighted sound level.

The A-weighting position of the switch gives incorrect results when the internal switch is set to C RANDOM. (It indicates the A-weighted level of the C-weighted spectrum.)

3.14 USE OF WIDE-RANGE MICROPHONES.

The frequency response of the microphone preamplifier is essentially flat from 20 cps to 20 kc when the weighting switch is set at 20 KC. Thus it is possible to use wide-range microphones, such as those included in the GR Types 1551-P1L and -P1H Condenser Microphone Systems.

3.15 RECORDING.

The output from the Type 1558-BP Octave Band Noise Analyzer can be used to drive the GR Type 1521-B Graphic Level Recorder, to plot amplitude versus time in a band.

SECTION 4

SERVICE AND MAINTENANCE

4.1 GENERAL.

We warrant that each new instrument manufactured and sold by us is free from defects in material and workmanship, and that, properly used, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, Sales Engineering Office, or authorized repair agency personnel, will be repaired, or, at our option, replaced without charge, except for tubes or batteries that have given normal service.

The two-year warranty stated above arrests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions, please write or phone our Service Department (see rear cover), giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest Sales Engineering Office, requesting a Returned Material Tag. Use of this tag will ensure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

4.2 REMOVAL OF INSTRUMENT FROM CASE.

To take the instrument out of its Flip-tilt case, remove the four screws near the front panel, two through the top and two through the bottom of the case.

4.3 TRANSISTOR VOLTAGES.

Table I gives the normal voltage from each transistor terminal to ground. Allow a deviation of 10 percent from these figures. Set the panel controls as follows:



- BAND LEVEL DB gray knob - - fully clockwise
- BAND LEVEL DB knurled dial - - fully counterclockwise
- Function switch - - FAST
- BAND CPS switch - - ALL PASS

To measure these voltages, use a high-impedance voltmeter. The battery voltage must be about 21 volts.

4.4 MICROPHONE SENSITIVITY ADJUSTMENT.

The internal sensitivity control (R322) is shown in Figure 4-1. It is adjusted in the GR laboratory to match the sensitivity of the Type 1560-P6 Microphone Assembly that is sent with the analyzer. The procedure for the internal calibration, described in paragraph 3.3.1, is valid only when this control is set to indicate the sensitivity of the microphone being used. If the Type 1560-P6 Microphone Assembly is purchased separately or is replaced, or if another type of piezoelectric microphone is used, this control must be set to the new sensitivity.

4.5 INTERNAL NOISE.

Typical noise levels at the OUTPUT terminals, for various settings of the BAND LEVEL DB and the BAND CPS switches, are given in Table 2. To measure these levels, connect a 425-pf capacitor (the equivalent impedance of the Type 1560-P6 Microphone Assembly) across the MIKE input terminals (see Figure 4-2). The capacitor and connecting leads must be shielded to avoid hum or noise interference.

4.6 GAIN CHECK.

A check on the gain gives a good indication of the serviceability of the analyzer. This check should be made at the center frequency of each band, at 400 or 1000 cps for ALL PASS, and at 1000 cps for A weighting. Apply 1 volt through a shielded, 425-pf capacitor, connected at the MIKE input terminals, as shown in Figure 4-2. Set the internal weighting switch to 20 KC and calibrate the analyzer by the method described in paragraph 3.3.1. Select the desired band and adjust the oscillator to the center frequency of that band. The center frequencies are given in the Specifications. If the instrument is operating properly, the BAND LEVEL DB indication should agree within 1 db with the values in Table 3, except on the lowest and highest bands, where the analyzer will read low by about 1 db.

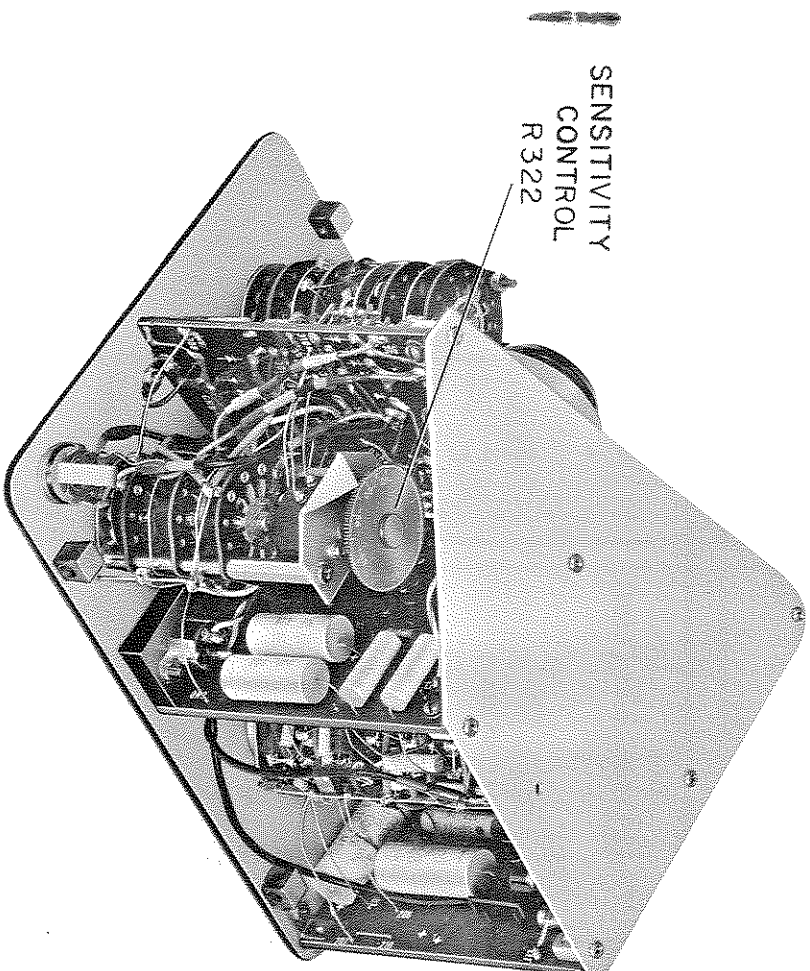


Figure 4-1. Internal sensitivity control is preset in the laboratory.

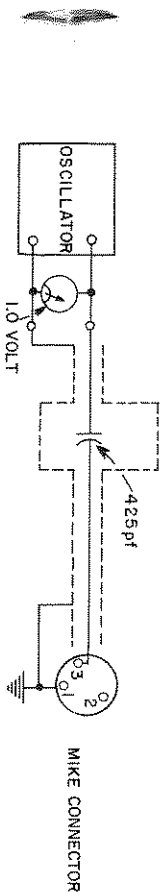


Figure 4-2. Circuit for calibration of gain of analyzer.



TABLE 1
Transistor Voltages

TRANSISTOR (Type)	TERMINAL	DC VOLTS TO GROUND
Q101 (TR-32/Crystalonics C6601)	K	9.4
	G	9.3
	A	15.8
Q102 (TR-23/2N520A)*	E	15.9
	B	15.8
	C	9.5
Q103 (TR-31/2N445A)*	E	9.4
	B	9.5
	C	18.8
Q104 (TR-31/2N445A)*	E	1.2
	B	1.3
	C	3.3
Q105 (TR-31/2N445A)*	E	3.2
	B	3.3
	C	10.2
Q201 (TR-31/2N445A)*	E	1.2
	B	1.3
	C	4.1
Q202 (TR-31/2N445A)*	E	4.0
	B	4.1
	C	8.8
Q203 (TR-31/2N445A)*	E	1.2
	B	1.3
	C	4.1

*Selected for H_{fe} between 80 and 125.

TABLE 1 (Cont)

TRANSISTOR (Type)	TERMINAL	DC VOLTS TO GROUND
Q204 (TR-31/2N445A)*	E	4.0
	B	4.1
	C	8.8
Q205 (TR-31/2N445A)*	E	1.2
	B	1.3
	C	9.2
Q206 (TR-31/2N445A)*	E	1.0
	B	1.1
	C	3.0
Q207 (TR-31/2N445A)*	E	2.9
	B	3.0
	C	8.2
Q208 (TR-31/2N445A)*	E	1.2
	B	1.3
	C	9.4
Q301 (TR-31/2N445A)*	E	2.2
	B	2.3
	C	5.4
Q302 (TR-31/2N445A)*	E	5.3
	B	5.4
	C	11.0
Q303 (TR-31/2N445A)*	E	10.9
	B	11.0
	C	18.8

*Selected for H_{fe} between 80 and 125.



TABLE 1 (Cont)

TRANSISTOR (Type)	TERMINAL	DC VOLTS TO GROUND
Q304 (TR-10/2N1374)	E	17.5
	B	17.4
	C	10.7
Q305 (TR-10/2N1374)	E	17.5
	B	17.4
	C	9.0
Q501 (TR-31/2N445A)*	E	18.8
	B	18.9
	C	21.0
Q502 (TR-31/2N445A)*	E	18.8
	B	18.9
	C	21.0
Q503 (TR-31/2N445A)*	E	18.8
	B	18.9
	C	21.0

*Selected for H_{fe} between 80 and 125.

TABLE 2
Typical internal noise levels in db below output voltage corresponding to full-scale meter deflection.

BAND CPS SWITCH SETTING	BAND LEVEL DB SWITCH SETTING									
	140	130	120	110	100	90	80	70	60	50
31.5	68	68	68	68	67	64	54	44	34	24
63.0	68	68	68	68	67	64	54	44	34	24
125.	68	68	68	68	67	66	60	50	41	31
250.	68	68	68	68	68	66	61	52	43	33
500.	68	68	68	68	68	67	62	54	44	34
1000.	68	68	68	68	68	67	62	54	44	34
2000.	68	68	68	68	68	66	61	52	42	32
4000.	67	67	67	67	67	65	59	49	39	29
8000.	67	67	67	67	67	64	57	47	37	27
16,000.	66	66	66	66	66	63	54	44	35	25
ALL PASS (20 KC)	63	63	63	63	62	56	46	36	26	16

TABLE 3

Band level indications for various microphone sensitivities
with 1 volt applied at MIKE terminals.

MICROPHONE SENSITIVITY (db re 1 volt/ μ bar)	TYPE 1558-BP BAND LEVEL DB INDICATIONS
-62	136
-61	135
-60	134
-59	133
-58	132
-57	131
-56	130
-55	129
-54	128
-53	127
-52	126



4.7 KNOB REMOVAL.

To remove the knob on a front-panel control, either to replace one that has been damaged or to replace the associated control, proceed as follows:

a. Grasp the knob firmly with the fingers, close into the panel (or the indicator dial, if applicable) and pull the knob straight, away from the panel.

CAUTION

Do not pull on the dial to remove a dial/knob assembly. Always remove the knob first.

b. Observe the position of the setscrew in the bushing, with respect to any panel markings (or at the full CCW position of a continuous control).

c. Release the setscrew with an Allen wrench and pull the bushing off the shaft.

d. Remove and retain the black nylon thrust washer, behind the dial/knob assembly, as appropriate.

NOTE

To separate the bushing from the knob, if for any reason they should be combined off the instrument, drive a machine tap a turn or two into the bushing to provide sufficient grip for easy separation.

4.8 KNOB INSTALLATION.

To install a "Snap-on" knob assembly on the control shaft:

a. Place the black nylon thrust washer over the control shaft, if appropriate.

b. Mount the bushing on the shaft, using a small slotted piece of wrapping paper as a shim for adequate panel clearance.

c. Orient the setscrew on the bushing with respect to the panel-marking index and lock the setscrew with an Allen wrench.

NOTE

Make sure that the end of the shaft does not protrude through the bushing or the knob won't seat properly.

d. Place the knob on the bushing with the retention spring opposite the setscrew.

e. Push the knob in until it bottoms and pull it slightly to check that the retention spring is seated in the groove in the bushing.

NOTE

If the retention spring in the knob comes loose, reinstall it in the interior notch with the small slit in the outer wall.

FEDERAL MANUFACTURERS CODE

Table with 3 columns: Code, Manufacturers Name and Address, Code, Manufacturers Name and Address, Code, Manufacturers Name and Address. Lists various manufacturers and their addresses across the United States.

PARTS LIST

Ref. Desc'tion	GR Part No.	PMC	Mfg. Part No.	Fed. Stock No.
BATTERIES				
BS01	8410-0410	24655	8410-0410	5910-448-5527
BS02	8410-0410	24655	8410-0410	5910-952-0467
CAPACITORS				
C101	4910-1101	24655	4910-1101	5910-911-8073
C102	4650-0102	72136	CM15E, 5L1, PF ±2%	
C103	Mica, 51.1 pF ±2%	4650-0102	4650-0102	
C104	Mica, 464 pF ±5%, 300 V	4650-0546	4650-0546	
C105	Plastic, 432 pF ±1%, 200 V	4860-7315	4860-7315	
C106	Plastic, 0.0030 µF ±5%, 200 V	4860-7349	4860-7349	
C107	Wax, 0.01 µF ±10%, 100 V	5010-1600	5010-1600	
C110	Electrolytic, 5 µF ±5%, 100 V	4450-3600	4450-3600	
C111	Electrolytic, 40 µF ±5%, 100 V	4450-3600	4450-3600	
C112	Plastic, 0.36 µF ±5%, 100 V	4860-7986	4860-7986	
C113	Plastic, 0.18 µF ±5%, 100 V	4860-7987	4860-7987	
C114	Electrolytic, 40 µF ±5%, 100 V	4450-3800	4450-3800	
C115	Electrolytic, 40 µF ±5%, 100 V	4450-3800	4450-3800	
C116	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C117	Wax, 0.47 µF ±10%, 100 V	5010-3600	5010-3600	
C201	Plastic, 0.0691 µF ±1%, 100 V	4860-7879	4860-7879	
C202	Plastic, 0.0174 µF ±1%, 100 V	4860-7845	4860-7845	
C203	Plastic, 0.277 µF ±1%, 100 V	4860-7952	4860-7952	
C204	Plastic, 0.00414 µF ±1%, 200 V	4860-7385	4860-7385	
C205	Plastic, 1.09 µF ±1%, 100 V	4860-8010	4860-8010	
C206	Plastic, 0.0691 µF ±1%, 100 V	4860-7879	4860-7879	
C207	Plastic, 0.277 µF ±1%, 100 V	4860-7952	4860-7952	
C208	Plastic, 1.09 µF ±1%, 100 V	4860-8010	4860-8010	
C209	Plastic, 0.0170 µF ±1%, 100 V	4860-7856	4860-7856	
C210	Plastic, 0.00414 µF ±1%, 200 V	4860-7385	4860-7385	
C211	Electrolytic, 5 µF ±5%, 100 V	4450-3900	4450-3900	
C212	Electrolytic, 40 µF ±5%, 100 V	4450-3900	4450-3900	
C213	Electrolytic, 100 µF ±5%, 100 V	4450-3900	4450-3900	
C214	Electrolytic, 100 µF ±5%, 100 V	4450-3900	4450-3900	
C217	Plastic, 0.0383 µF ±1%, 100 V	4860-7857	4860-7857	
C218	Plastic, 0.00967 µF ±1%, 100 V	4860-7896	4860-7896	
C219	Plastic, 0.153 µF ±1%, 100 V	4860-7896	4860-7896	
C220	Plastic, 0.608 µF ±1%, 100 V	4860-7994	4860-7994	
C221	Plastic, 0.00236 µF ±1%, 200 V	4860-7327	4860-7327	
C222	Plastic, 0.0383 µF ±1%, 100 V	4860-7857	4860-7857	
C223	Plastic, 0.153 µF ±1%, 100 V	4860-7896	4860-7896	
C224	Plastic, 0.608 µF ±1%, 100 V	4860-7994	4860-7994	
C225	Plastic, 0.00967 µF ±1%, 100 V	4860-7857	4860-7857	
C226	Plastic, 0.00228 µF ±1%, 200 V	4860-7328	4860-7328	
C227	Electrolytic, 5 µF ±5%, 100 V	4450-3900	4450-3900	
C229	Electrolytic, 100 µF ±5%, 100 V	4450-3900	4450-3900	
C232	Electrolytic, 10 µF ±5%, 100 V	4450-3800	4450-3800	
C233	Electrolytic, 10 µF ±5%, 100 V	4450-3800	4450-3800	
C234	Plastic, 0.00323 µF ±1%, 200 V	4860-7348	4860-7348	
C235	Plastic, 0.0129 µF ±1%, 100 V	4860-7844	4860-7844	
C236	Plastic, 0.816 µF ±1%, 100 V	4860-7996	4860-7996	
C237	Plastic, 0.205 µF ±1%, 100 V	4860-7925	4860-7925	
C238	Plastic, 0.0514 µF ±1%, 100 V	4860-7878	4860-7878	
C239	Plastic, 0.00310 µF ±1%, 200 V	4860-7337	4860-7337	
C240	Plastic, 0.0127 µF ±1%, 100 V	4860-7852	4860-7852	
C241	Plastic, 0.0514 µF ±1%, 100 V	4860-7878	4860-7878	
C242	Plastic, 0.205 µF ±1%, 100 V	4860-7925	4860-7925	
C243	Plastic, 0.816 µF ±1%, 100 V	4860-7996	4860-7996	
C245	Electrolytic, 600 µF ±5%, 100 V	4450-5589	4450-5589	
C246	Electrolytic, 10 µF ±5%, 100 V	4450-3800	4450-3800	
C247	Electrolytic, 40 µF ±5%, 100 V	4450-3800	4450-3800	
C248	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C249	Electrolytic, 10 µF ±5%, 100 V	4450-3800	4450-3800	
C250	Electrolytic, 10 µF ±5%, 100 V	4450-3800	4450-3800	
C252	Mica, 82 pF ±5%, 500 V	4650-0442	4650-0442	
C301	Electrolytic, 40 µF ±5%, 100 V	4450-3800	4450-3800	
C302	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C303	Electrolytic, 200 µF ±5%, 100 V	4450-3800	4450-3800	
C304	Electrolytic, 10 µF ±20%, 20 V	4450-5100	4450-5100	
C305	Electrolytic, 1.5 µF ±20%, 20 V	4450-4400	4450-4400	
C306	Electrolytic, 60 µF ±5%, 25 V	4450-2900	4450-2900	
C307	Electrolytic, 10 µF ±20%, 20 V	4450-5100	4450-5100	
C308	Electrolytic, 10 µF ±20%, 20 V	4450-5100	4450-5100	
C309	Plastic, 0.0013 µF ±5%, 200 V	4860-7315	4860-7315	
C310	Plastic, 0.0013 µF ±5%, 200 V	4860-7315	4860-7315	
C311	Mica, 100 pF ±10%, 500 V	4200-4400	4200-4400	
C301	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C302	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C303	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C304	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C305	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C306	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C307	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C308	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C309	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C310	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C311	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C312	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C313	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C314	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C315	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C316	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C317	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C318	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C319	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C320	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C321	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C322	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C323	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C324	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C325	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C326	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C327	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C328	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C329	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C330	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C331	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C332	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C333	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C334	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C335	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C336	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C337	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	
C338	Electrolytic, 100 µF ±5%, 100 V	4450-3800	4450-3800	

PARTS LIST (cont)

Ref. Desc'tion	GR Part No.	PMC	Mfg. Part No.	Fed. Stock No.
CAPACITORS				
C504	Electrolytic, 100 µF ±5%, 25 V	4450-2300	4450-2300	
C701	Plastic, 0.045 µF ±1%, 100 V	4860-8150	4860-8150	
C702	Plastic, 0.036 µF ±5%, 100 V	4860-7986	4860-7986	
C703	Plastic, 0.0051 µF ±5%, 100 V	4860-7349	4860-7349	
C704	Plastic, 0.30 µF ±5%, 100 V	4860-7972	4860-7972	
DIODES				
CR301	Type 1N34AS	6082-1003	58854 1N34AS(S)	5961-170-4430
CR302	Type 1N34AS	6082-1003	58854 1N34AS(S)	5961-170-4430
CR303	Type 1N34AS	6082-1003	58854 1N34AS(S)	5961-170-4430
CR304	Type 1N34AS	6082-1003	58854 1N34AS(S)	5961-170-4430
CR305	Type 1N3253	6081-1001	79089 1N3253	5961-814-4251
CR306	Type 1N3253	6081-1001	79089 1N3253	5961-814-4251
CR307	Type 1N3253	6082-1016	24446 1N3253	5961-814-4251
CR308	Type 1N3253	6082-1016	24446 1N3253	5961-814-4251
CR309	Type 1N3253	6082-1016	24446 1N3253	5961-814-4251
CR310	Type 1N3253	6082-1016	24446 1N3253	5961-814-4251
CR311	Type 1N3253	6081-1003	79089 1N3253	5961-814-4251
METER				
M301		5730-1050	40931 M301	6625-708-5186
JACKS				
J101		4260-1040	82389 J101	
J301		4260-1030	82389 J101	
PLUG				
PL501		4220-4300	71785 P-302-AB	
RESISTORS				
R101	Composition, 75 kΩ ±5%, 1/2 W	6100-3755	01121 RC20GF753J	5905-279-1867
R102	Composition, 100 kΩ ±5%, 1/2 W	6100-4105	01121 RC20GF104J	5905-279-2616
R103	Composition, 5.1 MΩ ±5%, 1/2 W	6100-5515	01121 RC20GF515J	5905-195-6761
R104	Composition, 100 MΩ ±5%, 1/4 W	6099-7105	75042 B75, 100 MΩ ±5%	
R105	Composition, 110 kΩ ±5%, 1/2 W	6100-4115	01121 RC20GF114J	5905-279-1867
R106	Potentiometer, Composition, 100 kΩ ±20%	6040-1000	01121 FWC, 100 kΩ ±20%	
R107	Composition, 15 kΩ ±5%, 1/2 W	6100-3155	01121 RC20GF15J	5905-958-7949
R108	Composition, 10 kΩ ±5%, 1/2 W	6100-3155	01121 RC20GF10J	5905-195-6761
R109	Composition, 10 kΩ ±5%, 1/2 W	6100-3105	01121 RC20GF10J	5905-185-8510
R110	Composition, 300 kΩ ±5%, 1/2 W	6100-4605	01121 RC20GF304J	5905-185-8510
R111	Film, 20.5 kΩ ±1%, 1/8 W	6100-4205	75042 CE A, 20.5 kΩ ±1%	5905-819-1262
R112	Film, 20.5 kΩ ±1%, 1/8 W	6250-2205	75042 CE A, 20.5 kΩ ±1%	5905-819-1262
R113	Film, 30.1 kΩ ±1%, 1/8 W	6250-2301	75042 CE A, 30.1 kΩ ±1%	5905-819-1262
R114	Film, 14.0 kΩ ±1%, 1/8 W	6250-2140	75042 CE A, 14.0 kΩ ±1%	5905-702-1760
R115	Film, 14.0 kΩ ±1%, 1/8 W	6250-2140	75042 CE A, 14.0 kΩ ±1%	
R116	Composition, 18 kΩ ±5%, 1/2 W	6100-3185	01121 RC20GF18J	5905-279-1867
R117	Composition, 33 kΩ ±5%, 1/2 W	6100-3385	01121 RC20GF33J	5905-171-1998
R118	Composition, 10 kΩ ±5%, 1/2 W	6100-3105	01121 RC20GF10J	5905-185-8510
R119	Composition, 7.5 kΩ ±5%, 1/2 W	6100-3105	01121 RC20GF75J	5905-279-1867
R120	Composition, 2.7 kΩ ±5%, 1/2 W	6100-2735	01121 RC20GF27J	5905-279-1867
R121	Composition, 10 kΩ ±5%, 1/2 W	6100-31		

PARTS LIST (cont)

Ref. Design	Description	GR Part No.	FMC	Mfg. Part No.	Fed. Stock No.
RESISTORS					
R226	Film, 11 K Ω \pm 1% 1/8 W	6250-2110	75042	CEA, 11 K Ω \pm 1%	5905-249-3656
R227	Composition, 62 K Ω \pm 5% 1/2 W	6100-3625	01121	RC20GF6231	5905-249-4195
R228	Composition, 7.5 K Ω \pm 5% 1/2 W	6100-3755	01121	RC20GF7521	5905-249-4195
R229	Potentiometer, 1 K Ω \pm 20% 1/2 W	6040-0400	01121	PWC, 1 K Ω \pm 20%	5905-279-1751
R230	Composition, 3 K Ω \pm 5% 1/2 W	6100-2305	01121	RC20GF3021	5905-755-8130
R231	Film, 8.66 K Ω \pm 1% 1/8 W	6250-1866	75042	CEA, 8.66 K Ω \pm 1%	5905-702-5974
R232	Film, 3.01 K Ω \pm 1% 1/8 W	6250-1301	75042	CEA, 3.01 K Ω \pm 1%	5905-841-7461
R233	Composition, 1.5 K Ω \pm 5% 1/2 W	6100-2155	01121	RC20GF1521	5905-279-2019
R236	Composition, 5.1 K Ω \pm 5% 1/2 W	6100-2515	01121	RC20GF5121	5905-686-9983
R238	Film, 14.3 K Ω \pm 1% 1/8 W	6250-2143	75042	CEA, 14.3 K Ω \pm 1%	
R239	Precision, 3.09 K Ω \pm 0.25% 1/8 W	6690-6256	24655	6690-6256	
R240	Precision, 6.19 K Ω \pm 0.25% 1/8 W	6690-6288	24655	6690-6288	
R241	Precision, 750 Ω \pm 1% 1/8 W	6250-0750	75042	CEA, 750 Ω \pm 1%	5905-676-8776
R242	Film, 3.16 K Ω \pm 1% 1/8 W	6250-1316	75042	CEA, 3.16 K Ω \pm 1%	5905-577-1792
R243	Composition, 110 K Ω \pm 5% 1/2 W	6100-4115	01121	RC20GF1141	5905-279-1867
R244	Film, 21.5 K Ω \pm 1% 1/8 W	6250-2215	75042	CEA, 21.5 K Ω \pm 1%	5905-615-7339
R245	Film, 3.16 K Ω \pm 1% 1/8 W	6250-1316	75042	CEA, 3.16 K Ω \pm 1%	5905-577-1792
R246	Film, 29.4 K Ω \pm 0.25% 1/8 W	6190-7200	01121	M9A-T0, 29.4 K Ω \pm 0.25%	
R247	Composition, 8.2 K Ω \pm 5% 1/2 W	6100-2825	24655	6690-6282	5905-299-1971
R248	Precision, 3.40 K Ω \pm 0.25% 1/8 W	6690-6282	24655	6690-6282	
R249	Composition, 33 K Ω \pm 5% 1/2 W	6100-3335	01121	RC20GR3331	5905-171-1998
R250	Precision, 6.19 K Ω \pm 0.25% 1/8 W	6690-6288	24655	6690-6288	
R251	Film, 10.5 K Ω \pm 1% 1/8 W	6250-2105	75042	CEA, 10.5 K Ω \pm 1%	5905-882-0037
R252	Potentiometer, Composition, 1 K Ω \pm 20%	6040-0400	01121	PWC, 1 K Ω \pm 20%	
R253	Composition, 2.4 K Ω \pm 5% 1/2 W	6100-2245	01121	RC20GF2421	5905-279-1877
R254	Film, 665 Ω \pm 1% 1/8 W	6250-0665	75042	CEA, 665 Ω \pm 1%	
R255	Composition, 13 K Ω \pm 5% 1/2 W	6100-3135	01121	RC20GF1331	5905-279-2669
R256	Composition, 300 Ω \pm 5% 1/2 W	6100-1305	01121	RC20GF3011	5905-279-5481
R257	Potentiometer, Composition, 1 K Ω \pm 20%	6040-0400	01121	PWC, 1 K Ω \pm 20%	
R258	Film, 12.4 Ω \pm 1% 1/8 W	6250-0124	75042	CEA, 12.4 Ω \pm 1%	5905-815-4136
R259	Film, 2.10 K Ω \pm 1% 1/8 W	6250-1210	75042	CEA, 2.10 K Ω \pm 1%	
R260	Composition, 1.5 K Ω \pm 5% 1/2 W	6100-2155	01121	RC20GF1521	5905-841-7461
R261	Composition, 5.1 K Ω \pm 5% 1/2 W	6100-2515	01121	RC20GF5121	5905-279-2019
R262	Composition, 62 K Ω \pm 5% 1/2 W	6100-3625	01121	RC20GR6231	5905-249-3656
R263	Film, 11 K Ω \pm 1% 1/8 W	6250-2110	01121	RC20GF1141	5905-279-1867
R264	Composition, 110 K Ω \pm 5% 1/2 W	6100-4115	75042	CEA, 110 K Ω \pm 5%	5905-702-5974
R265	Film, 22.1 K Ω \pm 1% 1/8 W	6250-2221	01121	RC20GF2231	5905-171-2004
R301	Composition, 22 K Ω \pm 5% 1/2 W	6100-3225	01121	RC20GF2231	5905-192-3978
R302	Composition, 30 K Ω \pm 5% 1/2 W	6100-3305	01121	RC20GF3031	5905-279-3499
R303	Composition, 27 K Ω \pm 5% 1/2 W	6100-3275	01121	RC20GF2731	5905-279-2019
R304	Composition, 5.1 K Ω \pm 5% 1/2 W	6100-2515	01121	RC20GF5121	5905-190-8887
R305	Composition, 2.1 K Ω \pm 5% 1/2 W	6100-2205	01121	RC20GF2021	5905-299-1971
R306	Composition, 8.2 K Ω \pm 5% 1/2 W	6100-2825	01121	RC20GF8221	5905-171-2006
R307	Composition, 260 Ω \pm 5% 1/2 W	6100-1275	01121	RC20GF2711	5905-299-1971
R308	Composition, 8.2 K Ω \pm 5% 1/2 W	6100-2825	01121	RC20GF8221	5905-279-2673
R309	Composition, 6.2 K Ω \pm 5% 1/2 W	6100-2625	01121	RC20GF6221	5905-190-8887
R310	Composition, 300 K Ω \pm 5% 1/2 W	6100-4305	01121	RC20GF3041	5905-185-6859
R311	Composition, 2 K Ω \pm 5% 1/2 W	6100-2205	01121	RC20GF2021	5905-279-2667
R312	Composition, 11 K Ω \pm 5% 1/2 W	6100-3115	01121	RC20GF1131	5905-195-6791
R313	Composition, 680 Ω \pm 5% 1/2 W	6100-1685	01121	RC20GF6811	5905-279-2673
R314	Composition, 6.2 K Ω \pm 5% 1/2 W	6100-2625	01121	RC20GF6221	5905-279-2673
R315	Composition, 6.2 K Ω \pm 5% 1/2 W	6100-2625	01121	RC20GF6221	5905-279-2673
R316	Composition, 820 Ω \pm 5% 1/2 W	6100-1825	01121	RC20GF8211	5905-171-1999
R317	Composition, 1 M Ω \pm 5% 1/2 W	6100-5105	75042	CEA, 20 K Ω \pm 1%	5905-192-0390
R318	Film, 20 K Ω \pm 1% 1/8 W	6250-2200	75042	CEA, 147 K Ω \pm 1%	5905-702-5971
R319	Film, 147 K Ω \pm 1% 1/8 W	6250-3147	75042	CEA, 47.5 K Ω \pm 1%	5905-892-6965
R320	Film, 47.5 K Ω \pm 1% 1/8 W	6250-2475	01121	PWC, 25 K Ω \pm 20%	5905-577-6747
R321	Potentiometer, Composition, 25 K Ω \pm 20%	6040-0800	01121	PWC, 25 K Ω \pm 20%	5905-958-7950
R322	Potentiometer, 10 K Ω	0971-4220	24653	0971-4220	
R323	Film, 3.01 K Ω \pm 1% 1/8 W	6250-1301	75042	CEA, 3.01 K Ω \pm 1%	5905-702-5974
R324	Film, 100 K Ω \pm 1% 1/8 W	6250-3100	75042	CEA, 100 K Ω \pm 1%	5905-577-6743
R325	Film, 100 K Ω \pm 1% 1/8 W	6250-3100	75042	CEA, 100 K Ω \pm 1%	5905-195-6806
R501	Composition, 1 K Ω \pm 5% 1/2 W	6100-2105	01121	RC20GF1021	5905-279-2019
R502	Composition, 6.2 K Ω \pm 5% 1/2 W	6100-2625	01121	RC20GF6221	5905-249-3661
R503	Composition, 68 K Ω \pm 5% 1/2 W	6100-3685	01121	RC20GF6831	5905-249-3661
R504	Composition, 3 K Ω \pm 5% 1/2 W	6100-2305	01121	RC20GF3021	5905-279-1751
R505	Composition, 36 K Ω \pm 5% 1/2 W	6100-3365	01121	RC20GF3631	5905-249-4256
R506	Composition, 3 K Ω \pm 5% 1/2 W	6100-2305	01121	RC20GF3021	5905-279-1751
R507	Composition, 36 K Ω \pm 5% 1/2 W	6100-3365	01121	RC20GF3631	5905-249-4256
R508	Power, 1.2 K Ω \pm 5% 5 W	6660-2125	75042	AS-5, 1.2 K Ω \pm 5%	
R509	Power, 910 Ω \pm 5% 5 W	6660-1915	75042	AS-5, 910 Ω \pm 5%	5905-892-6966
R510	Film, 34.8 K Ω \pm 1% 1/8 W	6250-2348	75042	CEA, 34.8 K Ω \pm 1%	5905-702-5974
R511	Film, 3.01 K Ω \pm 1% 1/8 W	6250-1301	75042	CEA, 3.01 K Ω \pm 1%	5905-815-4136
R701	Composition, 10 K Ω \pm 5%	6100-3105	01121	RC20GF1031	5905-185-8510

PARTS LIST (cont)

Ref. Design	Description	GR Part No.	FMC	Mfg. Part No.	Fed. Stock No.
SWITCHES					
S101		7890-2470	24655	7890-2470	
S102		7890-2500	24655	7890-2500	
S103		7890-2480	24655	7890-2480	
S201		7890-2490	24655	7890-2490	
S202		7890-2470	24655	7890-2470	
SOCKET					
SO101		4230-2850	24655	4230-2850	
TRANSISTORS					
Q101	Type C6601	8210-1032	12498	C6601	
Q102	Type 2N520A	8210-5200	72699	2N520A	
Q103	Type 2N445A	8210-4451	93916	2N445A	
Q105	Type 2N445A	8210-4451	93916	2N445A	
Q201	Type 2N445A	8210-4451	93916	2N445A	
Q208	Type 2N445A	8210-4451	93916	2N445A	
Q301	Type 2N445A	8210-4451	93916	2N445A	
Q303	Type 2N1374	8210-1374	96214	2N1374	
Q304	Type 2N1374	8210-1374	96214	2N1374	
Q501	Type 2N445A	8210-4451	93916	2N445A	
Q503	Type 2N445A	8210-4451	93916	2N445A	

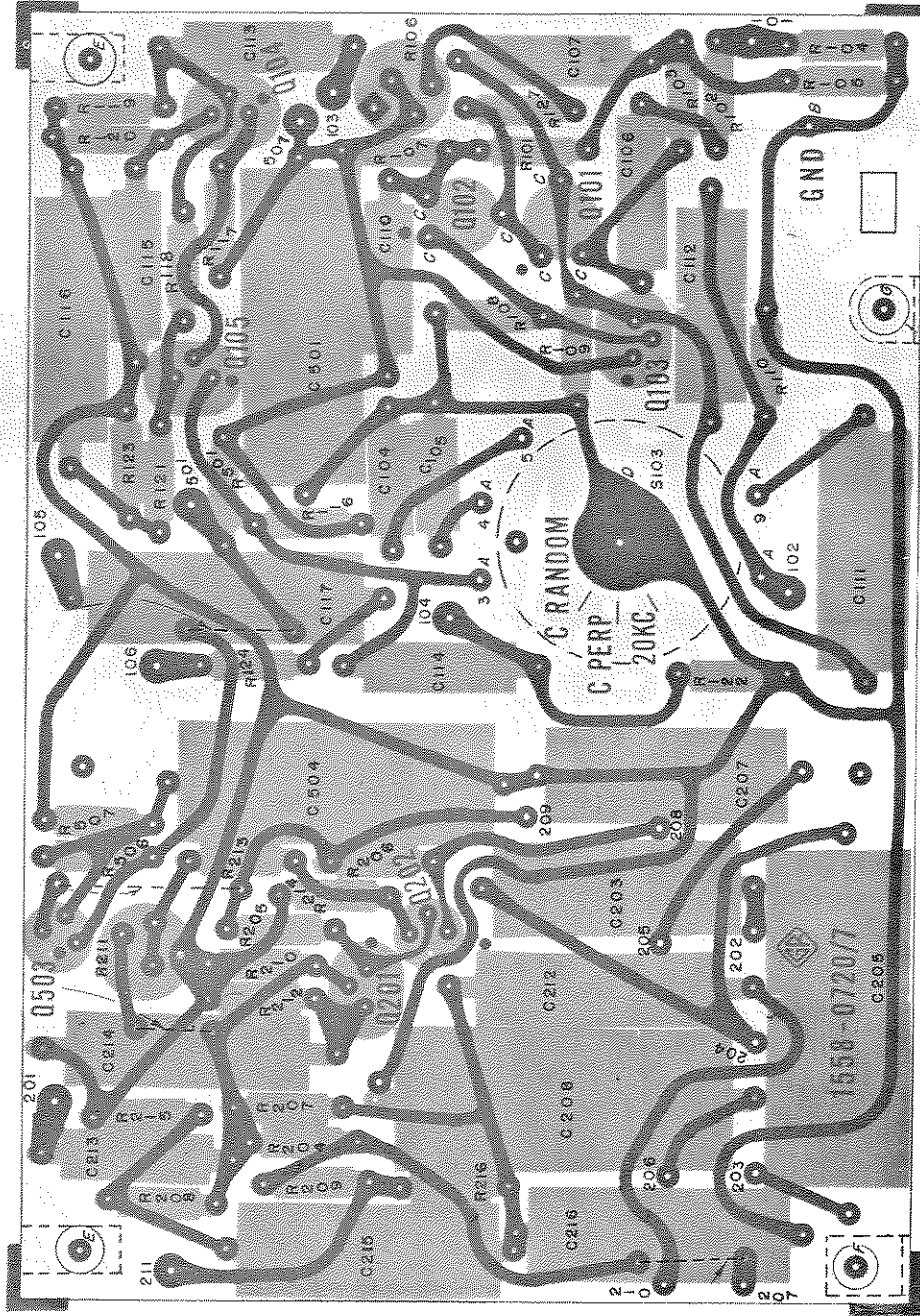


Figure 4-3. Preamplifier and first filter section etched board.
 For Type 1558-BP the following components are omitted:
 C215, C216, R207, R208, R215, R216.
 Complete board is P/N 1558-2723.

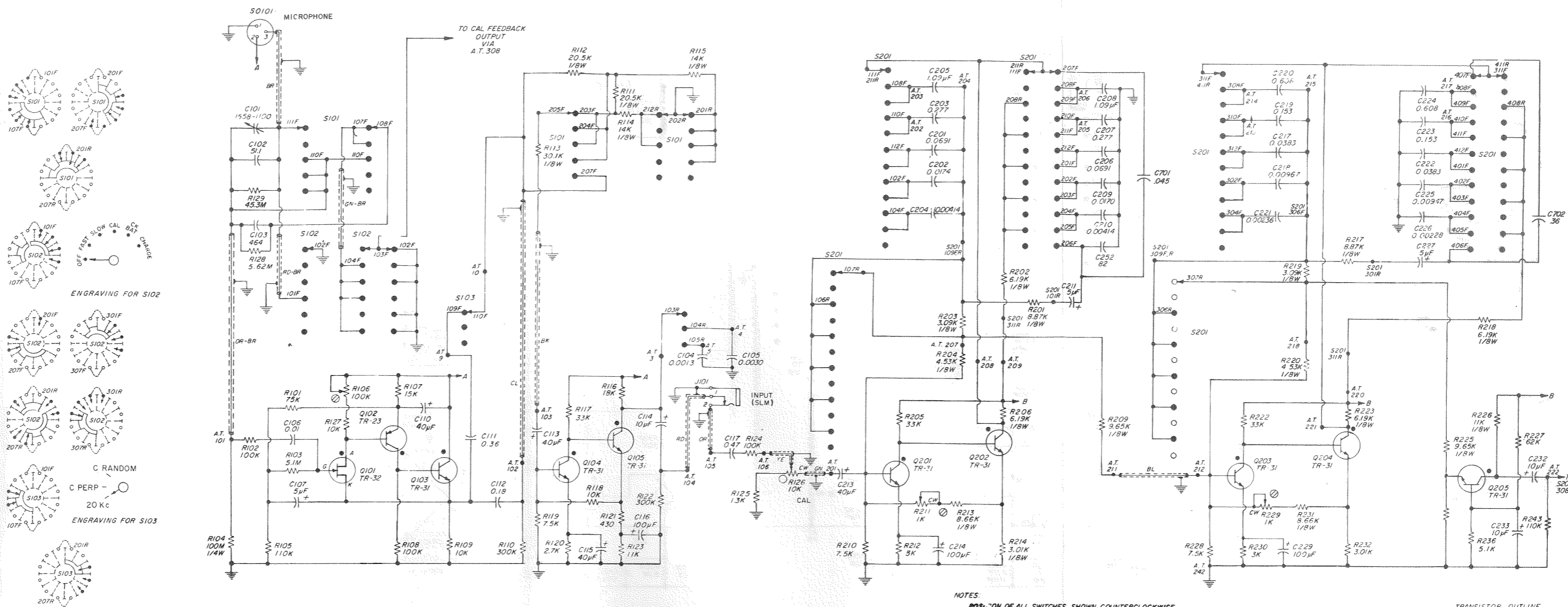
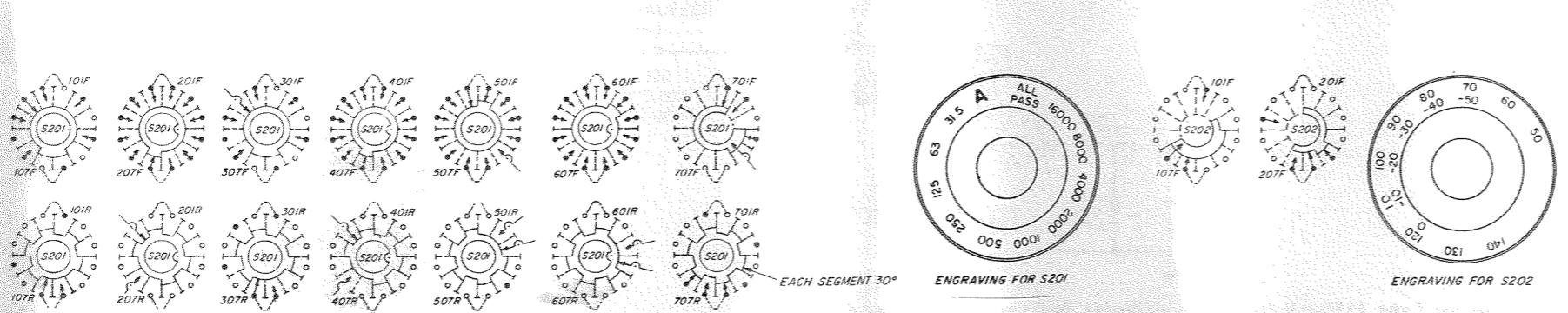
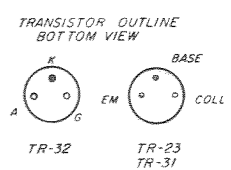


Figure 4-6. Schematic diagram for Type 1558-BP Octave Band Noise Analyzer (see Figure 4-7).

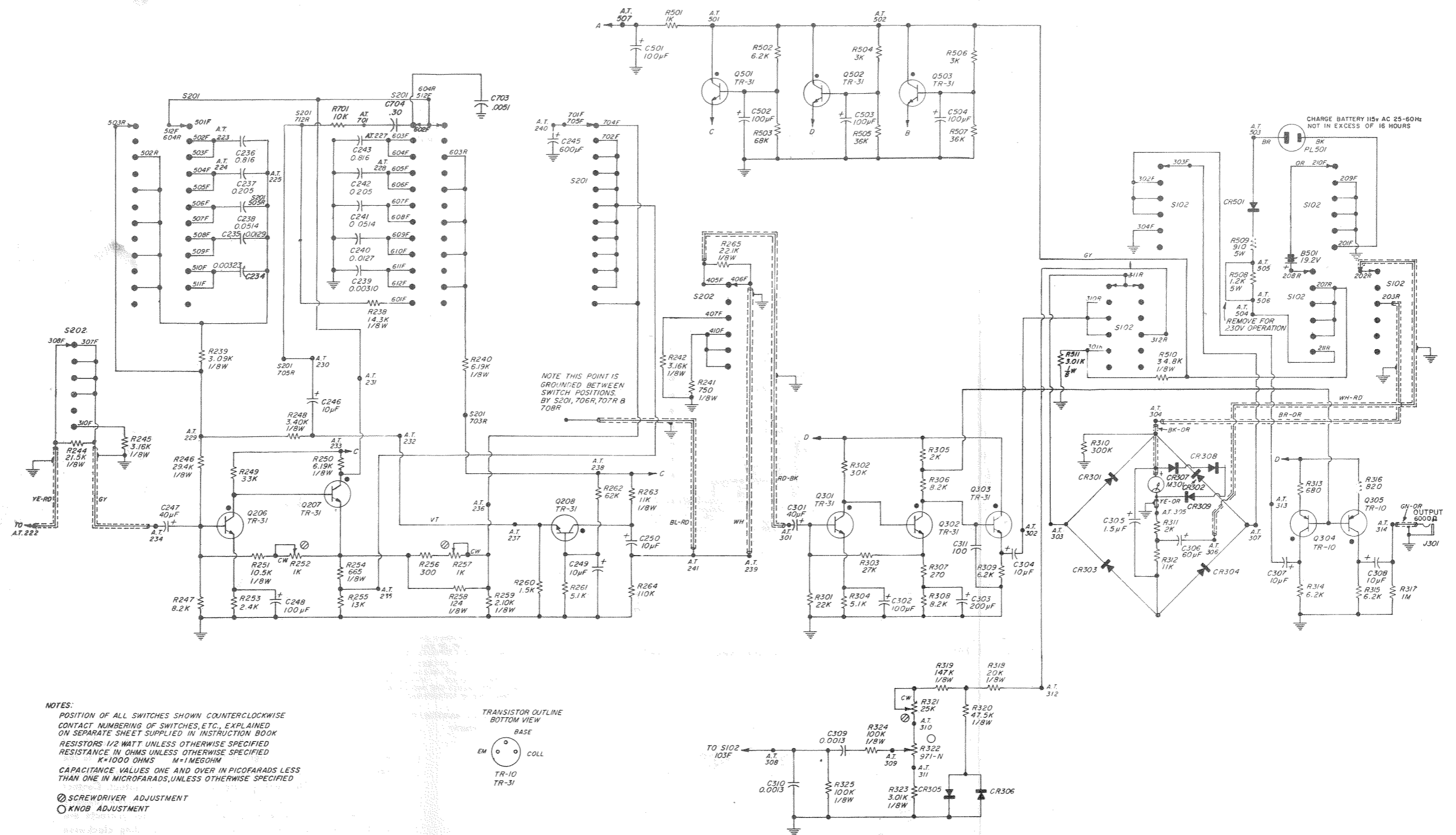


NOTES:
 POSITION OF ALL SWITCHES SHOWN COUNTERCLOCKWISE
 CONTACT NUMBERING OF SWITCHES ETC. EXPLAINED ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK
 RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED
 RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED
 K=1000 OHMS M=1 MEGOHM
 CAPACITANCE VALUES ONE AND OVER IN PICOFARADS
 LESS THAN ONE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED
 ⊕ SCREWDRIVER ADJUSTMENT
 ○ KNOB ADJUSTMENT



Rotary switch sections are shown as viewed from the panel end of the shaft. The first digit of the contact number refers to the section. The section nearest the panel is 1, the next section back is 2, etc. The next two digits refer to the contact. Contact 01 is the first position clockwise from a strut screw (usually the screw above the locating key), and the other contacts are numbered sequentially (02, 03, 04, etc), proceeding clockwise around the section. A suffix F or R indicates that the contact is on the front or rear of the section, respectively.

Resistors etched
 components are
 R234.



NOTES:
 POSITION OF ALL SWITCHES SHOWN COUNTERCLOCKWISE
 CONTACT NUMBERING OF SWITCHES, ETC., EXPLAINED
 ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK
 RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED
 RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED
 K=1000 OHMS M=1 MEGOHM
 CAPACITANCE VALUES ONE AND OVER IN PICOFARADS LESS
 THAN ONE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED

⊗ SCREWDRIVER ADJUSTMENT
 ○ KNOB ADJUSTMENT

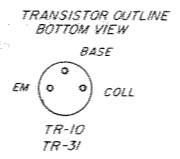


Figure 4-7. Schematic diagram for Type 1558-BP Octave Band Noise Analyzer (see Figure 4-6).

Appendix

VIBRATION MEASUREMENTS WITH THE TYPE 1558 OCTAVE BAND ANALYZER

Any General Radio vibration pickup can be used directly with the 1558 Analyzer. The meter on the analyzer reads in dB. Therefore, if we convert the meter reading to volts (or millivolts), we can obtain the acceleration, since the sensitivity of the pickup is given in volts/g.

To make the conversion, use the calibration procedure of paragraphs 3.2 and 3.3. Set the internal microphone-sensitivity control at -63.2 for the 1560-P52 Pickup and at -63.8 for the 1560-P53 or -P54 Pickup.

70 mV = 107 dB
or 700 mV = 127 dB

The acceleration is given by

$$\text{Acceleration (in g)} = \frac{\text{Meter Reading (converted to volts)}}{\text{Sensitivity of the Pickup (in volts/g)}}$$

The velocity and displacement can then be computed from the acceleration and the frequency.

$$\text{Velocity} = \frac{\text{Acceleration}}{2 \pi f}$$

$$\text{Displacement} = \frac{\text{Acceleration}}{4 \pi^2 f^2}$$

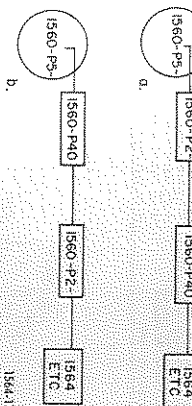
The high-frequency response will be determined by the resonant frequency of the pickup. The useful frequency ranges for the various pickups are given in the accompanying table.

PICKUP TYPE NO.	NOMINAL SENSITIVITY (mV/g)	NOMINAL IMPEDANCE (pF)	RESONANT FREQUENCY (to)	USEFUL FREQUENCY RANGE WITH 1558 ANALYZER (Hz)
1560-P52	70	10,000	3200	20-1100
1560-P53	70	350	27,000	20-10,000
1560-P54	700	700	5000	20-1700

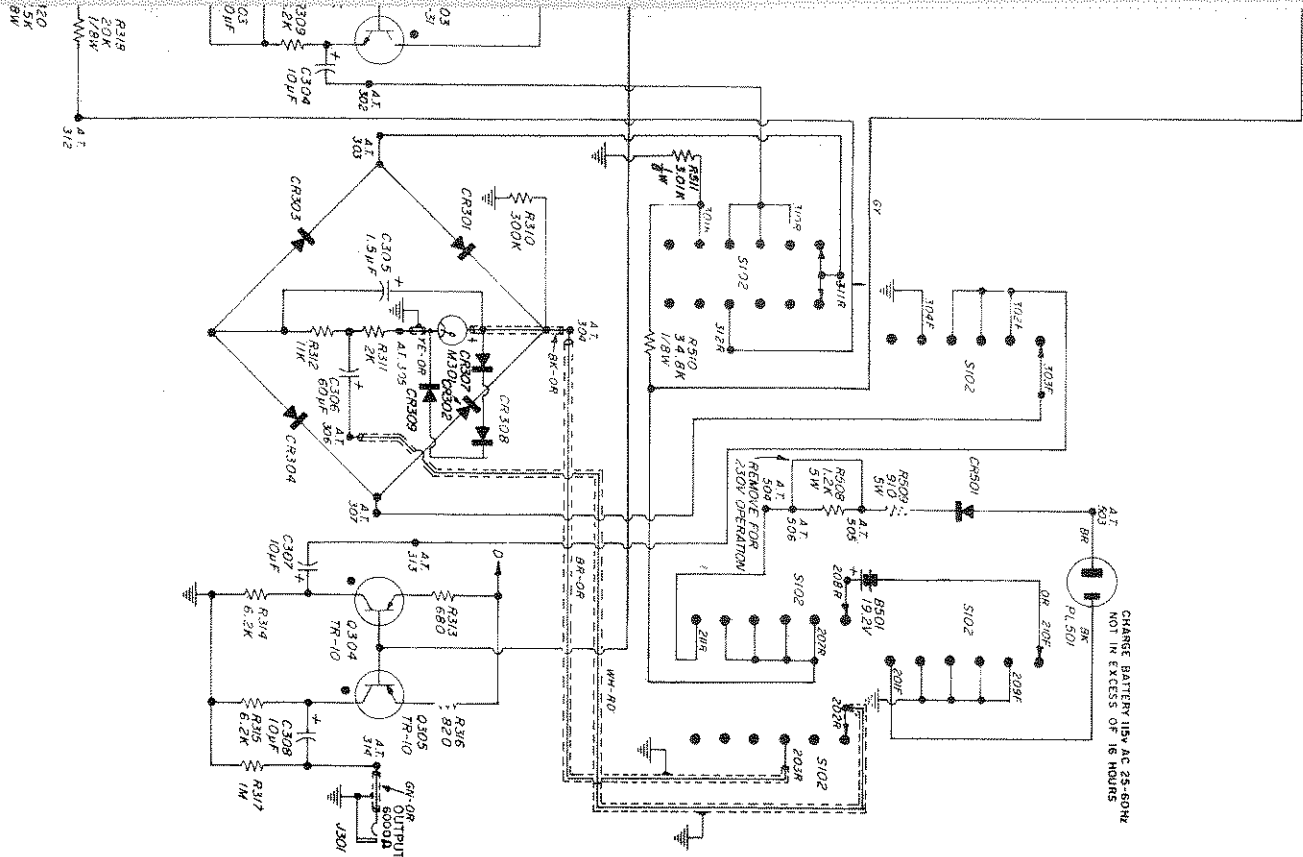
If the 1560-P40 Preamp is used between the pickup and the analyzer, the effective sensitivity can be increased 10 to 1. The low-frequency limit remains at 20 Hz, the low-frequency cutoff of the 1558.

If one wishes to use the control box to determine the velocity and displacement, the low-frequency limit in all cases is 25 Hz. The 1560-P40 Preamp can be used to increase the effective sensitivity, but it will not improve the low-frequency response appreciably, because this is limited by the control box. The connections and modifications necessary for the use of the preamp with the control box are given below.

The 1560-P40 Preamp can be used with the 1560-P2 Control Boxes with no modification if the connections are made as shown in a.



When the control box follows the preamp, as in b, the following modifications must be made: A connection must be provided to supply power for the 1560-P40 Preamp, and the output of the preamp must be made to look like the 1560-P5 pickup.



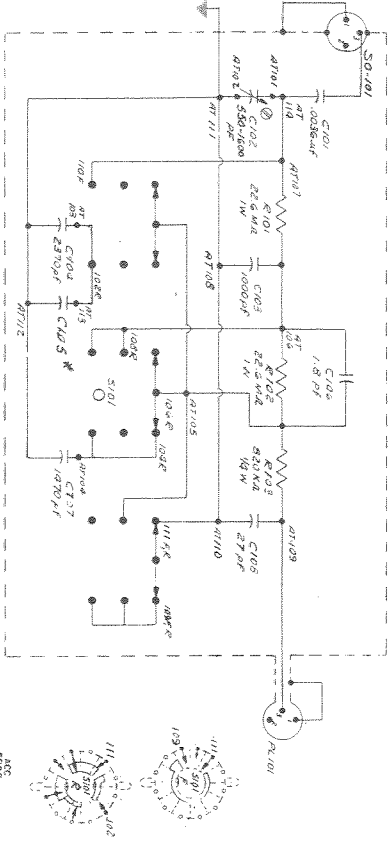
To provide the connection for power to the 1560-P40 preamplifier, replace the 1560-P2 output cable with a similar cable made from 2-wire shielded microphone cable (instead of single-conductor shielded (coax) cable). Use one of the two conductors to replace the single conductor of the original cable and connect the other from pin #2 of the OUTPUT socket of the 1560-P2 Control Box.

To provide the proper source impedance for the 1560-P2 Control Box, connect a capacitor in series with the input lead of the box. This capacitor must be equal to the capacitance of the appropriate vibration pickup plus its cable. Nominal values and the connection points for the three GR Vibration Systems are tabulated below. For best results, the measured value of the pickup capacitance including its connecting cable should be used.

VIB. MEAS. SYSTEM	CONTROL BOX	PICKUP	NOMINAL PICKUP CAP INC. CABLE	IN SERIES WITH C101 CONNECTION
1560-P11B	1560-P21B	1560-P52	.91 μ F	S0-101 #3 - AT 114
1560-P13	1560-P23	1560-P53	525 pF	S0-101 #3 - AT 114
1560-P14	1560-P24	1560-P54	930 pF	S0-101 #3 - AT 114
1560-P11B	1560-P21B	1560-P52	.00265 μ F*	S0-101 #3 - AT 114

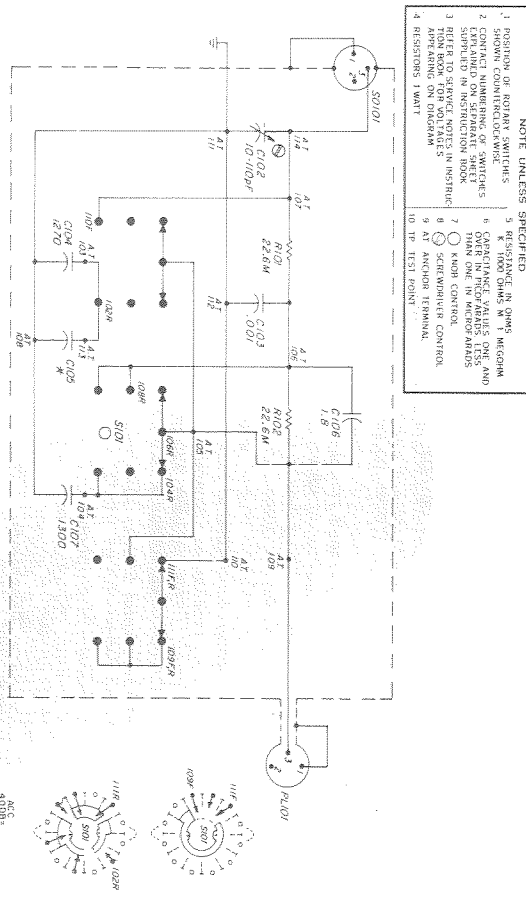
* Series combination of .01 μ F and .0036 μ F so C101 can be replaced with .00265 μ F.

- NOTE UNLESS SPECIFIED
- POSITION OF ROTARY SWITCHES
 - SHOWN CONSIDERATION OF CONTACT NUMBERING OF SWITCHES
 - EXPANDED ON SEPARATE SHEET
 - SUPPLIED IN INSTRUCTION BOOK
 - RIGHT TO SERVICE NOTES IN INSTRUCTION BOOK
 - APPEARING ON DIAGRAM
 - RESISTORS 1 WATT
 - RESISTANCE IN OHMS, MEGOHMS
 - CAPACITANCE VALUES ONE AND OVER IN MICROFARADS, LESS THAN ONE IN MICROFARADS
 - KNOB CONTROL
 - SCREWDRIVER CONTROL
 - AT ANCHOR TERMINAL
 - IN TEST POINT



Schematic diagram for Type 1560-P21B Control Box.

*NOTE: C105 VALUE DETERMINED IN LAB



Schematic diagram for Type 1560-P23 Control Box.

*NOTE: C105 VALUE DETERMINED BY LAB

Schematic diagram for Type 1560-P24 Control Box.

*NOTE: C105 VALUE DETERMINED IN LAB

SPECIFICATIONS FOR TYPE 1560-P6 MICROPHONE ASSEMBLY

(refer to paragraph 1.7)

Frequency Response: Typical response is shown in the accompanying plot. Deviations of individual units from the typical response are approximately ± 0.3 dB from 20 to 1000 c/s and ± 1 dB up to about 7000 c/s. (Figure 1-3).

Sensitivity: -60 dB re 1 V/ μ bar nominal.

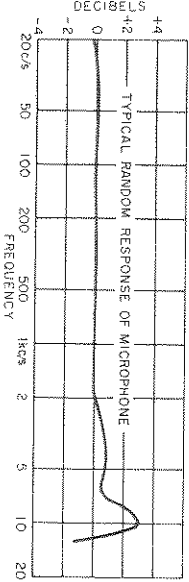
Temperature Coefficient of Sensitivity: Approximately -0.01 dB/ $^{\circ}$ C. **Internal Impedance:** Capacitive; Type 1560-P5, 390 pF at 25 $^{\circ}$ C, nominal; Type 1560-P6, 425 pF at 25 $^{\circ}$ C, nominal. Temperature coefficient of capacitance: 2.2 pF/ $^{\circ}$ C over range of 0 to 50 $^{\circ}$ C.

Environmental Effects: Microphone is not damaged by temperatures from -30 to $+95^{\circ}$ C and relative humidities of 0 to 100%. **Terminals:** Microphones fit 3-terminal microphone cable connector. For hum reduction both microphone terminals may be floated with respect to ground.

Cartridge Dimensions: Diameter 0.936 \pm 0.002 in (23.7 mm), length 1 $\frac{1}{8}$ in (29 mm).

Net Weight: Type 1560-P5, 2 oz (60 g); Type 1560-P6, 8 oz (0.3 kg).

Shipping Weight: Type 1560-P5, 1 lb (0.5 kg); Type 1560-P6, 3 lb (1.4 kg).



SPECIFICATIONS FOR TYPE 1560-P40 PREAMPLIFIER

(refer to paragraph 1.8)

Gain: 1:1 or 10:1 (20 dB) \pm 0.3 dB.

Input Capacitance: 6 pF.

Input Resistance: > 500 M Ω at low audio frequencies.

Output Resistance: 1:1 gain — approx 5 Ω .

10:1 gain — approx 100 Ω .

Noise: ≤ 2.5 μ V equivalent input voltage (400-pF source impedance, C-weighted, 8-ke effective bandwidth).

Frequency Response: ± 0.3 dB from 5 c/s to 500 kc/s.

Harmonic Distortion at Audio Frequencies:

Open circuit, at 1 V, peak-to-peak: $< 0.25\%$.

Capacitor load of 0.01 μ F (equivalent to a cable over 200-ft long): Maximum output (peak-to-peak) at 1% distortion is 5 V for 1 kc/s, 2 V for 10 kc/s.

Accessories Available (in combinations listed below): Power supply, includes two 9.6-volt nickel-cadmium rechargeable batteries, a charging circuit, a battery-check light, and a power cord.

Types 1560-P96, 1560-P97, and 1560-P98 Adaptors for converting the input pin connections to 3-terminal shielded microphone connectors, to the pin sockets necessary for the cartridge of a Type 1560-P3 Microphone, and to a General Radio Type 874 Connector, respectively.

Types 1560-P72 (25-ft) and 1560-P72C (4-ft) cables for supplying power to and transferring the signal from the preamplifier.

Type 1560-P95 Adaptor Cable for connecting the signal from the power supply through a cable to a Type 274 Double Plug.

Type 1560-P99 Adaptor Cable for connection from phone plug to microphone plug.

Power Supply: 15 V to 25 V, 1 mA to 2 mA, dc.

Dimensions: length 6 $\frac{7}{8}$ in, diameter 1.155 by 1 in (175, 30, 26 mm).

Net Weight: 9 oz (0.3 kg).

Shipping Weight: 3 lb (1.4 kg).

TYPE 1560-P40H

PREAMPLIFIER AND POWER SUPPLY SET

Consists of:

- Type 1560-P40 Preamplifier
- Type 1560-P96 Adaptor
- Type 1560-P98 Adaptor
- Type 1560-P95 Adaptor Cable
- Type 1560-P99 Adaptor Cable (4 ft)
- Type 1560-P72C Cable (4 ft)
- Type 874-Q2 Adaptor
- Power Supply

Shipping Weight: 10 lb (4.6 kg).

TYPE 1560-P40J

PREAMPLIFIER AND ADAPTOR SET

Consists of:

- Type 1560-P40 Preamplifier
- Type 1560-P96 Adaptor
- Type 1560-P97 Adaptor
- Type 1560-P98 Adaptor
- Type 1560-P72C Cable (4 ft)

Shipping Weight: 4 lb (1.9 kg).

TYPE 1560-P40K

PREAMPLIFIER AND MICROPHONE SET

Consists of:

- Type 1560-P40 Preamplifier
- Type 1560-P72C Cable (4 ft)
- Type 1560-P72 Cable (25 ft)
- Type 1560-P32 Tripped Microphone Cartridge

Shipping Weight: 14 lb (6.5 kg).

