OPERATING INSTRUCTIONS

TYPE 1558-A

OCTAVE BAND NOISE ANALYZER

GENERAL RADIO COMPANY

B

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TYPE 1558-A

OCTAVE BAND NOISE ANALYZER

Form 1558-0100-B
October, 1963

ANALYZER SERIAL NO. ____________
MICROPHONE SERIAL NO. ____________
MICROPHONE SENSITIVITY ____________ db re 1v/μbar

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

TABLE OF CONTENTS

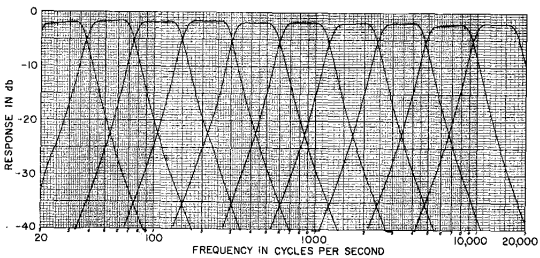
SPECIFICATIONS

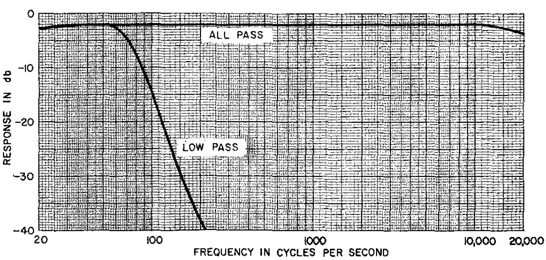
Bands: (See Figures below)

LOWER CUTOFF FREQUENCY (cps)	UPPER CUTOFF FREQUENCY (cps)	CENTER FREQUENCY (cps)*
18.75	37.5	26.5
37.5	75	53
75	150	106
150	300	212
300	600	424
600	1200	848
1200	2400	1696
2400	4800	3392
4800	9600	6784
9600	19,200	13,570
LOW PASS	75	
ALL PASS		

* Geometric mean

Filter Characteristics, signal applied at INPUT (SLM) terminals: For bands from 37.5 to 9600 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 37.5 to 9600 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





Typical response characteristics of GR Type 1558-A Octave Band Noise Analyzer. Characteristics measured at OUTPUT jack with signal applied at INPUT (SLM) terminals.

(Top) Octave-band characteristics.

(Bottom) Low-pass and all-pass characteristics.

least 50 db at one-fourth the lower nominal cutoff frequency and at four times the upper nominal cutoff frequency. The 75-cycle low-pass filter has at least 30 db attenuation at 200 cps and at least 50 db attenuation at 400 cps.

Sound-Level Range: 44 to 150 db above 2×10^{-4} μbar in any band when the Type 1560-P4 PZT Microphone Assembly is used.

Inputs: Impedance at MIKE terminals is approximately 50 pf in parallel with 50 MΩ. It is intended for use with high-impedance transducers such as the Type 1560-P4 PZT Microphone Assembly.

Impedance at INPUT (SLM) terminals is approximately 100 kΩ. 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/μbar. With this calibration, the absolute accuracy for ALL PASS levels is ensured within 1 db, over a wide range of atmospheric conditions.

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 CAP-11 Power Cord, Type 1560-P76 Cable Assembly, Type Z2CAM-20 Carrying Strap.

Accessories Available: Type 1560-P4 PZT 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 horizontal Adaptor Set, to convert for relay-rack mounting.

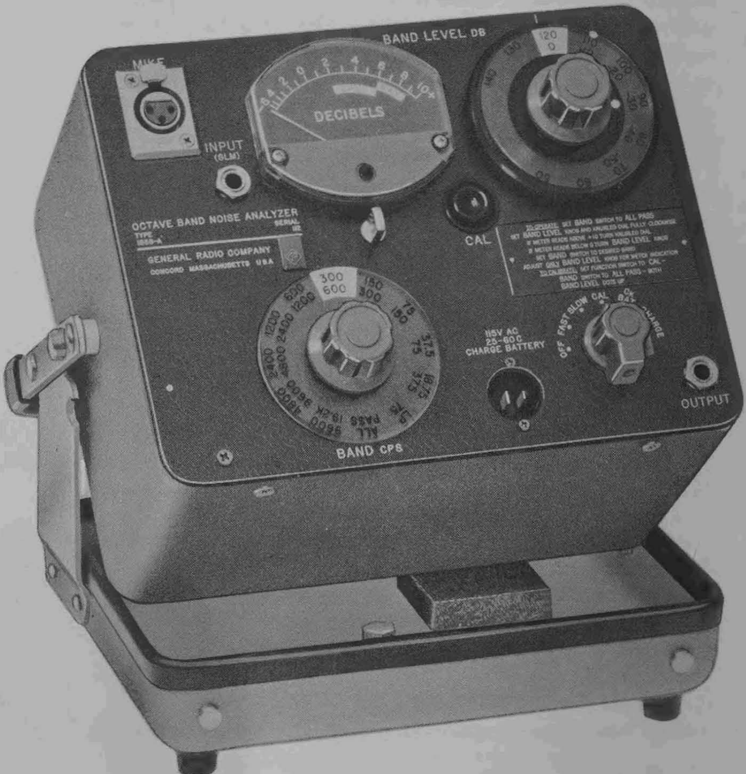
Dimensions: Flip-tilt case, width 10¼, height 9¼, depth 7¼ inches (260 by 235 by 185 mm), including handle.

Net Weight: 8¾ pounds (4 kg).

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

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

Figure 1-1. Views of the Type 1558-A Octave Band Noise Analyzer. (Above, left) in relay-rack adaptor; (above, right) case closed; (right) with microphone attached; (below) panel view.



SECTION 1

INTRODUCTION

1.1 PURPOSE.

The Type 1558-A 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. It is designed to meet the requirements of the American Standard Specification for an Octave Band Filter Set for the Analysis of Noise and Other Sounds, ASA Z24.10-1953.

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-P4 PZT 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} μbar. The analyzer can be used with a Type 1551 Sound-Level Meter for measurements at levels as low as 10 db.

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	Thumbset control	Adjusts gain.
MIKE	Three-terminal Cannon Type XLR locking socket	High-impedance input.
INPUT (SLM)	Phone jack	Low-impedance (100 kΩ) input (maximum input 3 volts).
OUTPUT	Phone jack	Supplies 1 volt open circuit for full-scale meter indication (6000 ohms output impedance).
CHARGE BATTERY, 115 V AC 25 - 60 C	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-P4 PZT 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-A Octave Band Noise Analyzer:

1 - Type CAP-11 Power Cord,
1 - Type 1570-P76 Cable Assembly,
1 - Type Z2CAM-20 Carrying Strap.

1.6 RELAY-RACK MOUNTING.

The Type 0480-9752 Adapter 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-P4 PZT MICROPHONE ASSEMBLY.

The Type 1560-P4 PZT Microphone Assembly, recommended for use with the Type 1558-A Octave Band Noise Analyzer, consists of a piezo-electric ceramic microphone connected to a short length of flexible conduit, which in turn mounts on a swivel base. A connector on the base mates with the three-terminal input connector (MIKE) on the panel of the analyzer.

The microphone is identical to that supplied with the Type 1551-C Sound-Level Meter. Several features make it an excellent choice for use with sound-measuring equipment:

1. The frequency characteristic (Figure 1-2) is carefully controlled in manufacture to give a flat response to sounds of random incidence from 20 cps to 8 kc.

2. It is rugged, dependable, and can withstand wide climatic changes (from -30 to 200 degrees F and from 0 to 100% relative humidity).

3. The temperature coefficient of sensitivity is low, with minimal change in output voltage from 0 to 200 F.

4. It has a low temperature coefficient of internal impedance. Thus a cable correction is not affected by the temperature at the microphone.

The nominal internal impedance of the microphone is 475 pf.

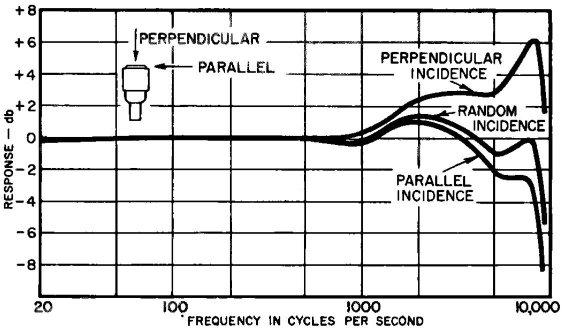


Figure 1-2. Response of the Type 1560-P4 PZT Microphone Assembly.

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 unity-gain amplifier with a high input impedance, a weighting network, and a second attenuator and amplifier.

An elementary schematic diagram is given in Figure 2-1.

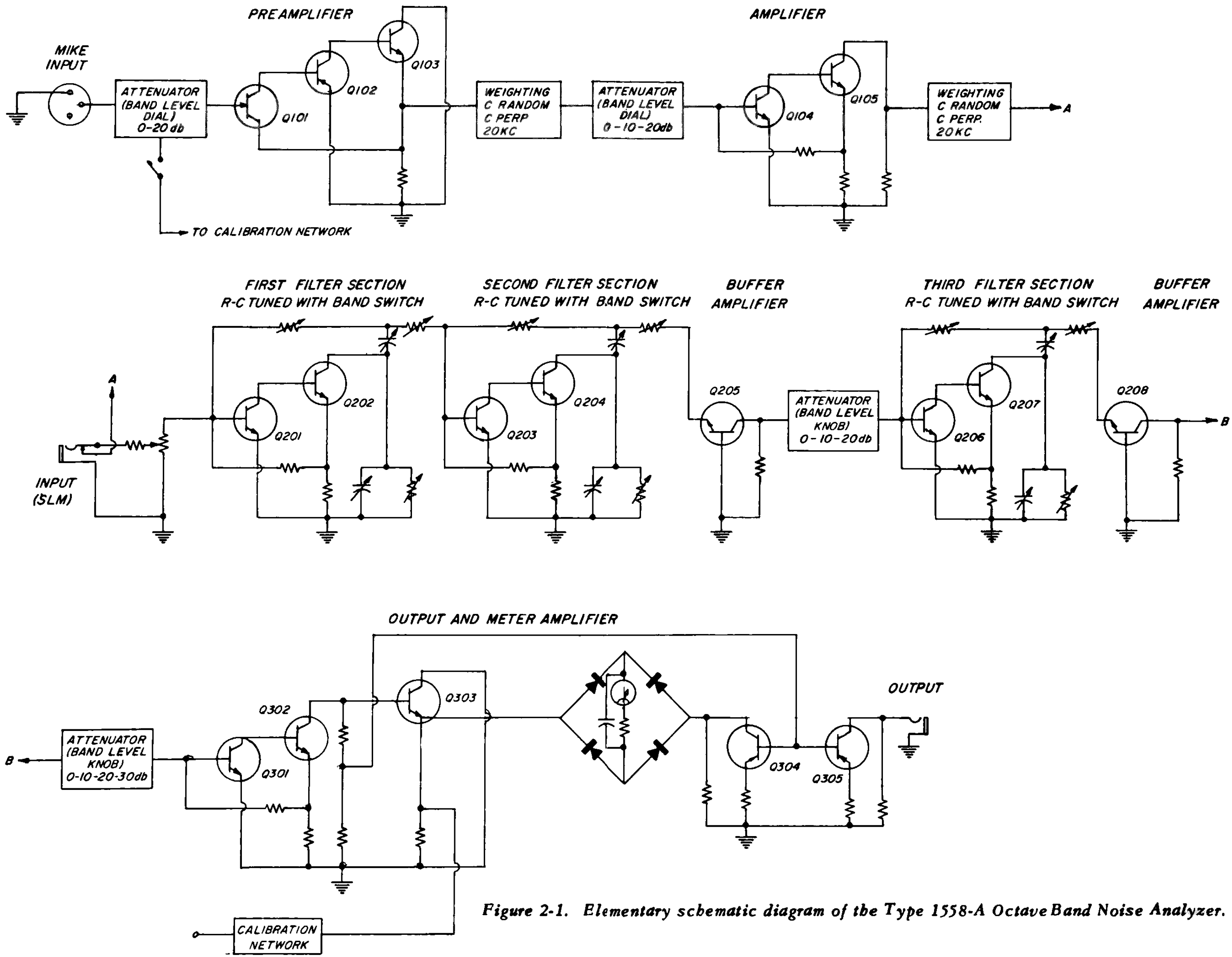


Figure 2-1. Elementary schematic diagram of the Type 1558-A Octave Band Noise Analyzer.

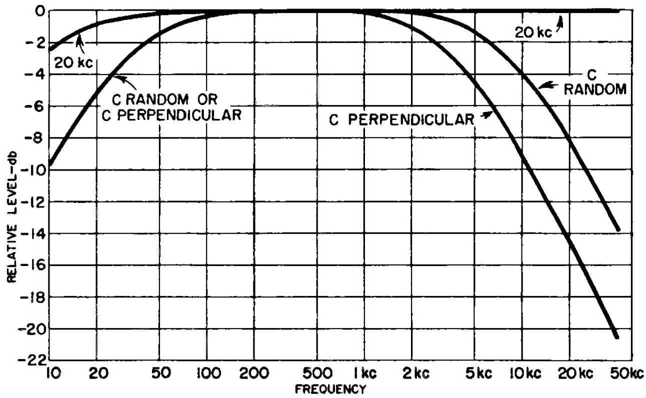


Figure 2-2. Frequency response of preamplifier.

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. Figure 2-2 shows the frequency response of the preamplifier; Figure 2-3 gives the combined response of the preamplifier and the Type 1560-P4 PZT Microphone Assembly.

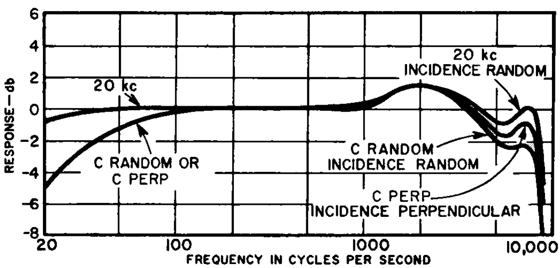
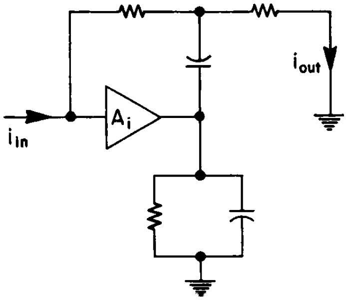


Figure 2-3. Combined response of Type 1560-P4 PZT Microphone Assembly and preamplifier in cascade.

2.2 FILTER CIRCUIT.

A block diagram of a single filter section is shown in Figure 2-4. 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 2-4. 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.

A normalized, magnitude-frequency characteristic is shown in Figure 2-5.

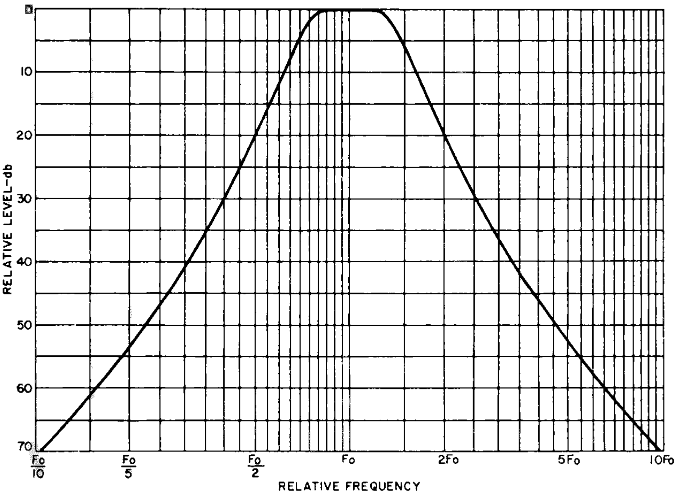


Figure 2-5. Normalized magnitude-frequency characteristic of one-octave filter.

2.3 OUTPUT CIRCUIT.

The output circuit includes a 30-db step attenuator, an amplifier, and a meter circuit. An isolating stage 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.[1] The conduction angle for sinusoidal excitation is chosen to give a close approximation to rms for many types of signals.

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 850 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.

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

SECTION **3**

OPERATING PROCEDURE

3.1 OPENING AND TILTING THE CABINET.

The directions for opening the Type 1558-A 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-P4 PZT 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 3.7).

3.2.2 WEIGHTING. The internal weighting switch is set to the 20 KC position in the GR laboratory. For C weighting, remove the instrument from its case and set switch S103 (on the etched board, at the left of the instrument) to the desired position. Refer to paragraph 3.5. Always turn the panel function switch to OFF before removing the instrument from the cabinet, to prevent damage to the resistors.

3.3 OPERATION WITH TYPE 1560-P4 PZT 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.

a. Set the BAND CPS switch to ALL PASS.

b. Set the white dots on both BAND LEVEL DB controls (the large knurled dial and the small gray knob) to the red reference line.

c. 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.

a. 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°.

b. Turn both BAND LEVEL DB controls clockwise (knob and dial).

c. Set the BAND CPS switch to ALL PASS.

d. Set the function switch for the desired meter response (FAST or SLOW).

e. 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} μbar, is the algebraic sum of the meter reading and the outer-scale BAND LEVEL DB indication.

f. Set the BAND CPS switch to any desired band 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 preamplifier and introduce errors. *Always* measure the ALL PASS level before analyzing. *Never* readjust the knurled dial after selecting an octave band. 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-A 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 1552-B 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.

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-P4 PZT 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.

3.6 OPERATION WITH SOUND-LEVEL METER.

For band levels below 44 db (re 2×10^{-4} μbar) a sound-level meter, such as the GR Type 1551-C, must 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.

b. Set the BAND CPS switch to ALL PASS.

c. Connect the output of the sound-level meter to the INPUT (SLM) jack on the analyzer, using the Type 1560-P76 Shielded Cable Assembly (supplied). Calibrate the sound-level meter by the means appropriate to that particular model, or use a GR Type 1552-B 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 either 20 KC or C, 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} μbar is the algebraic sum of the readings of 1) the attenuator of the sound-level meter, 2) the inner (orange) scale of the BAND LEVEL DB dial on the analyzer, and 3) the meter reading of the analyzer.

3.7 CHARGING THE BATTERY.

3.7.1 115-VOLT LINE. The analyzer is powered by two nickel-cadmium batteries that provide 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 115 V AC, 25-60 C, CHARGE BATTERY. Set the function switch to CHARGE. To charge the battery requires approximately 14 hours.

3.7.2 230-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 Type CAP-11 Power Cord (supplied). Use the 115-volt CHARGE BATTERY terminals on the front panel. Set the function switch at CHARGE and allow 14 hours to charge the battery fully.

The disconnected lead must be replaced before the battery can be recharged from a 115-volt line.

3.8 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.

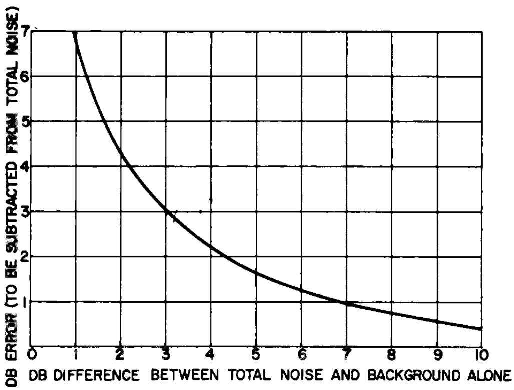


Figure 3-1. Effect of background noise on measurements.

3.9 TYPE 1560-P73 EXTENSION CABLE.

The Type 1560-P73 25-foot Extension Cable can be used to permit operation of a Type 1560-P3 or -P4 Microphone at some distance from the analyzer. The cable loss is approximately 7 db. For greater accuracy, this insertion loss should be more precisely determined by means of a Type 1552-B Sound-Level Calibrator.

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 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.

[1] R. 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.

3.11 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-P4 PZT Microphone Assembly approximates the random incidence response. The directivity characteristic of the Type 1560-P4 PZT 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).

3.12 CARRYING STRAP.

The Type Z2CAM-20 Carrying Strap (supplied) is used to support the instrument so that the operator's hands are free to manipulate the controls. Connect the strap to the eyebolt located on the front panel, below the meter. Use the aluminum slide ring to adjust the strap to a convenient length.

3.13 USE AS A SOUND-LEVEL METER.

The Type 1558-A Octave Band Noise Analyzer can be used to measure C-weighted sound level. Except for the exclusion of A- and B-weighting networks, it meets all requirements of the American Standard Specification for General-Purpose Sound-Level Meters, ASA S1.4-1961.

To measure C-weighted sound level, set the internal weighting switch to C. Then proceed as in paragraph 3.3.2, steps a through e.

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-A Octave Band Noise Analyzer can be used to drive the GR Type 1521-A Graphic Level Recorder, to obtain a permanent record of the sound measurement.

SECTION **4**

SERVICE AND MAINTENANCE

4.1 GENERAL.

We warrant that each new instrument 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, district 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 attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions, please write or phone 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 district 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, turn the panel function switch to OFF and 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 1 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 knurled dial -- fully counterclockwise

Function switch -- FAST

BAND CPS switch -- ALL PASS

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

4.4 MICROPHONE SENSITIVITY ADJUSTMENT.

The internal sensitivity control (R126) is shown in Figure 4-1. It is adjusted in the GR laboratory to match the sensitivity of the Type 1560-P4 PZT 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-P4 PZT 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 475-pf capacitor (the equivalent impedance of the Type 1560-P4 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, and at 400 or 1000 cps for ALL PASS. Apply 1 volt through a shielded, 475-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.

TABLE 1 - Transistor Voltages.

TRANSISTOR (Type)	TERMINAL	DC VOLTS TO GROUND
Q101 (TR-32/Crystalonics C620-A)	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
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

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

TABLE 1 (Cont)

TRANSISTOR (Type)	TERMINAL	DC VOLTS TO GROUND
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
18.75 - 37.5	68	68	68	68	67	64	54	44	34	24
37.5 - 75.0	68	68	68	68	67	64	54	44	34	24
75 - 150	68	68	68	68	67	66	60	50	41	31
150 - 300	68	68	68	68	68	66	61	52	43	33
300 - 600	68	68	68	68	68	67	62	54	44	34
600 - 1200	68	68	68	68	68	67	62	54	44	34
1200 - 2400	68	68	68	68	68	66	61	52	42	32
2400 - 4800	67	67	67	67	67	65	59	49	39	29
4800 - 9600	67	67	67	67	67	64	57	47	37	27
9600 - 19,200	66	66	66	66	66	63	54	44	35	25
LP - 75	67	67	67	67	66	60	50	39	29	19
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/μbar)	TYPE 1558-A 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

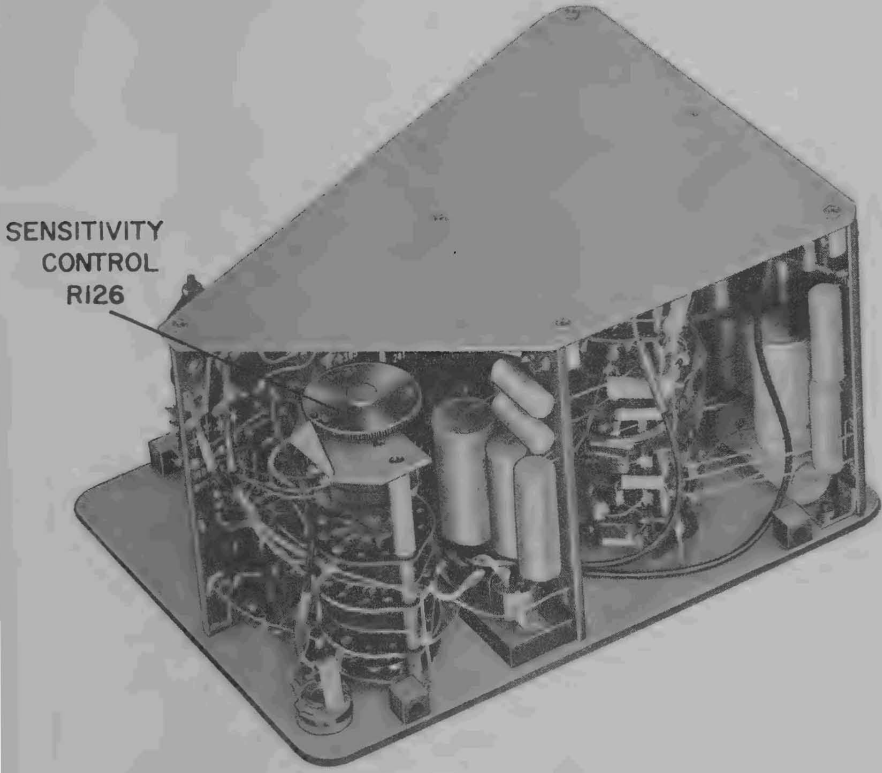


Figure 4-1. Internal sensitivity control is preset in the laboratory.

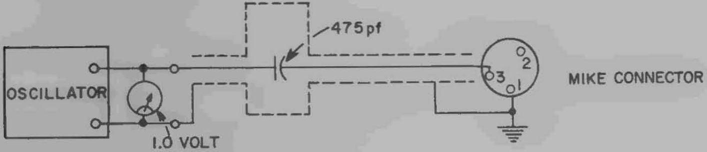


Figure 4-2. Circuit for calibration of gain of analyzer.

Figure 4-3. Preamplifier and first filter section etched board.

Figure 4-4. Second filter section and output amplifier etched board.

Figure 4-5. Third filter section etched board.

PARTS LIST

RESISTORS

R101	75 k	± 5%	1/2 w	REC-20BF(753B)
R102	100 k	± 5%	1/2 w	REC-20BF(104B)
R103	5.1 M	± 5%	1/2 w	REC-20BF(515B)
R104	100 M	± 5%	1/4 w	REC-9BF(107B)
R105	110 k	± 5%	1/2 w	REC-20BF(114B)
R106	100 k	±20%		POSC-22(104D)
R107	15 k	± 5%	1/2 w	REC-20BF(153B)
R108	100 k	± 5%	1/2 w	REC-20BF(104B)
R109	10 k	± 5%	1/2 w	REC-20BF(103B)
R110	300 k	± 5%	1/2 w	REC-20BF(304B)
R111	20.5 k	± 1%	1/8 w	REF-60(2052A)
R112	20.5 k	± 1%	1/8 w	REF-60(2052A)
R113	30.1 k	± 1%	1/8 w	REF-60(3012A)
R114	14.0 k	± 1%	1/8 w	REF-60(143A)
R115	14.0 k	± 1%	1/8 w	REF-60(143A)
A116	18 k	± 5%	1/2 w	REC-20BF(183B)
R117	33 k	± 5%	1/2 w	REC-20BF(333B)
R118	10 k	± 5%	1/2 w	REC-20BF(103B)
R119	7.5 k	± 5%	1/2 w	REC-20BF(752B)
R120	2.7 k	± 5%	1/2 w	REC-20BF(272B)
R121	430	± 5%	1/2 w	REC-20BF(431B)
R122	300 k	± 5%	1/2 w	REC-20BF(304B)
R123	11 k	± 5%	1/2 w	REC-20BF(113B)
R124	100 k	± 5%	1/2 w	REC-20BF(104B)
R125	1.3 k	± 5%	1/2 w	REC-20BF(132B)
R126	10 k	±10%		POSC-18(103C)
R127	10 k	± 5%	1/2 w	REC-20BF(103B)
R128	5.62 M	± 1%		REF-70(5624A)
R129				1558-1110
R201	8.87 k	± 1%	1/8 w	REF-60(8871A)
R202	6.19 k	± 0.25%	1/8 w	ZREPR-6S(6191BB)
R203	3.09 k	± 0.25%	1/8 w	ZREPR-6S(3091BB)
R204	4.53 k	± 0.25%	1/8 w	ZREPR-6S(4531BB)
R205	33 k	± 5%	1/2 w	REC-20BF(333B)
R206	6.19 k	± 0.25%	1/8 w	ZREPR-6S(6191BB)
R207	52.3 k	± 1%	1/8 w	REF-60(5232A)
R208	8.66 k	± 1%	1/8 w	REF-60(8661A)
R209	9.65 k	± 0.25%	1/8 w	ZREPR-6S(9651BB)
R210	7.5 k	± 5%	1/2 w	REC-20BF(752B)
R211	1 k	±20%		POSC-22(102D)
R212	3 k	± 5%	1/2 w	REC-20BF(302B)

PARTS LIST (Cont)

RESISTORS (Cont)

R213	8.66 k	± 1%	1/8 w	REF-60(8661A)
R214	3.01 k	± 1%	1/8 w	REF-60(3011A)
R215	3.25 k	± 1%	1/8 w	REF-60(8251A)
R216	18.2 k	± 1%	1/8 w	REF-60(1822A)
R217	8.87 k	± 1%	1/8 w	REF-60(8871A)
R218	6.19 k	± 0.25%	1/8 w	ZREPR-6S(6191BB)
R219	3.09 k	± 0.25%	1/8 w	ZREPR-6S(3091BB)
R220	4.53 k	± 0.25%	1/8 w	ZREPR-6S(4531BB)
R221	52.3 k	± 1%	1/8 w	REF-60(5232A)
R222	33 k	± 5%	1/2 w	REC-20BF(333B)
R223	6.19 k	± 0.25%	1/8 w	ZREPR-6S(6191BB)
R224	8.66 k	± 1%	1/8 w	REF-60(8661A)
R225	9.65 k	± 0.25%	1/8 w	ZREPR-6S(9651BB)
R226	11 k	± 1%	1/8 w	REF-60(113A)
R227	62 k	± 5%	1/2 w	REC-20BF(623B)
R228	7.5 k	± 5%	1/2 w	REC-20BF(752B)
R229	1 k	±20%		POSC-22(102D)
R230	3 k	± 5%	1/2 w	REC-20BF(302B)
R231	8.66 k	± 1%	1/8 w	REF-60(8661A)
R232	3.01 k	± 1%	1/8 w	REF-60(3011A)
R233	8.25 k	± 1%	1/8 w	REF-60(8251A)
R234	18.2 k	± 1%	1/8 w	REF-60(1822A)
R235	1.5 k	± 5%	1/2 w	REF-20BF(152B)
R236	5.1 k	± 5%	1/2 w	REC-20BF(512B)
R237	5.36 k	± 1%	1/8 w	REF-60(5361A)
R238	14.3 k	± 1%	1/8 w	REF-60(1432A)
R239	3.09 k	± 0.25%	1/8 w	ZREPR-6S(3091BB)
R240	6.19 k	± 0.25	1/8 w	ZREPR-6S(6191BB)
R241	750	± 1%	1/8 w	REF-60(751A)
R242	3.16 k	± 1%	1/8 w	REF-60(3161A)
R243	110 k	± 5%	1/2 w	REC-20BF(114B)
R244	21.5 k	± 1%	1/8 w	REF-60(2152A)
R245	3.16 k	± 1%	1/8 w	REF-60(3161A)
R246	29.4 k	±0.25% 100	1/8 w	REF-6(2942BB)
R247	8.2 k	± 5%	1/2 w	REC-20BF(822B)
R248	3.40 k	± 0.25%	1/8 w	ZREPR-6S(342BB)
R249	33 k	± 5%	1/2 w	REC-20BF(333B)
R250	6.19 k	± 0.25%	1/8 w	ZREPR-6S(6191BB)
R251	10.5 k	± 1%	1/8 w	REF-60(1052A)
R252	1 k	±20%		POSC-22(102D)

PARTS LIST (Cont)

RESISTORS (Cont)

R253	2.4 k	± 5%	1/2 w	REC-20BF(242B)
R254	665	± 1%	1/8 w	REF-60(6650A)
R255	13 k	± 5%	1/2 w	REC-20BF(133B)
R256	300	± 5%	1/2 w	REC-20BF(301B)
R257	1 k	±20%		POSC-22(102D)
R258	124	± 1%	1/8 w	REF-60(124A)
R259	2.10 k	± 1%	1/8 w	REF-60(212A)
R260	1.5 k	± 5%	1/2 w	REC-20BF(152B)
R261	5.1 k	± 5%	1/2 w	REC-20BF(512B)
R262	62 k	± 5%	1/2 w	REC-20BF(623B)
R263	11 k	± 1%	1/8 w	REF-60(113A)
R264	110 k	± 5%	1/2 w	REC-20BF(114B)
R265	22.1 k	± 1%	1/8 w	REF-60(2212A)
R301	22 k	± 5%	1/2 w	REC-20BF(223B)
R302	30 k	± 5%	1/2 w	REC-20BF(303B)
R303	27 k	± 5%	1/2 w	REC-20BF(273B)
R304	5.1 k	± 5%	1/2 w	REC-20BF(512B)
R305	2 k	± 5%	1/2 w	REC-20BF(202B)
R306	8.2 k	± 5%	1/2 w	REC-20BF(822B)
R307	270	± 5%	1/2 w	REC-20BF(271B)
R308	8.2	± 5%	1/2 w	REC-20BF(822B)
R309	6.2 k	± 5%	1/2 w	REC-20BF(622B)
R310	300 k	± 5%	1/2 w	REC-20BF(304B)
R311	2 k	± 5%	1/2 w	REC-20BF(202B)
R312	11 k	± 5%	1/2 w	REC-20BF(113B)
R313	680	± 5%	1/2 w	REC-20BF(681B)
R314	6.2 k	± 5%	1/2 w	REC-20BF(622B)
R315	6.2 k	± 5%	1/2 w	REC-20BF(622B)
R316	820	± 5%	1/2 w	REC-20BF(821B)
R317	1 M	± 5%	1/2 w	REC-20BF(105B)
R318	20 k	± 1%	1/8 w	REF-60(203A)
R319	147 k	± 1%	1/8 w	REF-60(1583A)
R320	47.5 k	± 1%	1/8 w	REF-60(4752A)
R321	25 k	±20%		POSC-22(253D)
R322				0971-4220
R323	3.01 k	± 1%	1/8 w	REF-60(3011A)
R324	100 k	± 1%	1/8 w	REF-60(104A)
R325	100 k	± 1%	1/8 w	REF-60(104A)
R501	1 k	± 5%	1/2 w	REC-20BF(102B)
R502	6.2 k	± 5%	1/2 w	REC-20BF(622B)
R503	68 k	± 5%	1/2 w	REC-20BF(683B)

PARTS LIST (Cont)

RESISTORS (Cont)

R504	3 k	± 5%	1/2 w	REC-20BF(302B)
R505	36 k	± 5%	1/2 w	REC-20BF(363B)
R506	3 k	± 5%	1/2 w	REC-20BF(302B)
R507	36 k	± 5%	1/2 w	REC-20BF(363B)
R508	1.2 k	± 5%	5 w	REPO-43(122B)
R509	910	± 5%	5 w	REPO-43(911B)
R510	36.5 k	± 1%	1/8 w	REF-60(2373A)

CAPACITORS

C101				1558-1100
C102	51.1 pf	± 2%	500 dcwv	COM-15E(0511A1)
C103	464 pf	± 2%	300 dcwv	COM-15E(4640A1)
C104	.0013 µf	± 5%	200 dcwv	COP-24(132B)
C105	.0030 µf	± 5%	200 dcwv	COP-24(302B)
C106	.01 µf	±10%	100 dcwv	COW-17(103C)
C107	5 µf		5 dcwv	COE-57
C109	180 pf	±10%	500 dcwv	COM-22B(181C)
C110	40 µf		6 dcwv	COE-54
C111	.36 µf	± 5%	100 dcwv	COP-24(364B)
C112	.18 µf	± 5%	100 dcwv	COP-24(184B)
C113	40 µf		6 dcwv	COE-54
C114	10 µf		25 dcwv	COE-56
C115	40 µf		6 dcwv	COE-54
C116	100 µf		15 dcwv	COE-46
C117	0.47 µf	±10%	100 dcwv	COW-17(474C)
C201	.0814 µf	± 1%	100 dcwv	COP-24(8142A)
C202	.0205 µf	± 1%	100 dcwv	COP-24(203A)
C203	0.326 µf	± 1%	100 dcwv	COP-24(3263A)
C204	.00510 µf	± 1%	200 dcwv	COP-24(4881A)
C205	1.30 µf	± 1%	100 dcwv	COP-24(135A)
C206	.0814 µf	± 1%	100 dcwv	COP-24(8142A)
C207	0.326 µf	± 1%	100 dcwv	COP-24(3263A)
C208	1.30 µf	± 1%	100 dcwv	COP-24(135A)
C209	.0200 µf	± 1%	100 dcwv	COP-24(203A)
C210	.00488 µf	± 1%	200 dcwv	COP-24(4881A)
C211	5 µf		15 dcwv	COE-57
C212	60 µf		25 dcwv	COE-47
C213	40 µf		6 dcwv	COE-54
C214	100 µf		15 dcwv	COE-46
C215	0.442 µf	± 1%	100 dcwv	COP-24(4423A)
C216	0.442 µf	± 1%	100 dcwv	COP-24(4423A)

PARTS LIST (Cont)

CAPACITORS (Cont)

C217	.0451 µf	± 1%	100 dcwv	COP-24(4512A)
C218	.0113 µf	± 1%	100 dcwv	COP-24(1112A)
C219	0.180 µf	± 1%	100 dcwv	COP-24(184A)
C220	0.722 µf	± 1%	100 dcwv	COP-24(7223A)
C221	.00280 µf	± 1%	200 dcwv	COP-24(2711A)
C222	.0451 µf	± 1%	100 dcwv	COP-24(4512A)
C223	0.180 µf	± 1%	100 dcwv	COP-24(184A)
C224	0.722 µf	± 1%	100 dcwv	COP-24(7223A)
C225	.0111 µf	± 1%	100 dcwv	COP-24(1112A)
C226	.00270 µf	± 1%	200 dcwv	COP-24(2711A)
C227	5 µf		15 dcwv	COE-57
C228	60 µf		25 dcwv	COE-47
C229	100 µf		15 dcwv	COE-46
C230	0.442 µf	± 1%	100 dcwv	COP-24(4423A)
C231	0.442 µf	± 1%	100 dcwv	COP-24(4423A)
C232	10 µf		25 dcwv	COE-56
C233	10 µf		25 dcwv	COE-56
C234	.00380 µf	± 1%	200 dcwv	COP-24(3651A)
C235	.0153 µf	± 1%	100 dcwv	COP-24(154A)
C236	.0970 µf	± 1%	100 dcwv	COP-24(974A)
C237	.0242 µf	± 1%	100 dcwv	COP-24(2422A)
C238	.0606 µf	± 1%	100 dcwv	COP-24(6062A)
C239	.00365 µf	± 1%	200 dcwv	COP-24(3651A)
C240	.0150 µf	± 1%	100 dcwv	COP-24(153A)
C241	.0606 µf	± 1%	100 dcwv	COP-24(6062A)
C242	.242 µf	± 1%	100 dcwv	COP-24(2423A)
C243	0.970 µf	± 1%	100 dcwv	COP-24(974A)
C244	2.19 µf	± 1%	100 dcwv	COP-24(2214A)
C245	600 µf		3 dcwv	COE-62
C246	10 µf		25 dcwv	COE-56
C247	40 µf		6 dcwv	COE-54
C248	100 µf		15 dcwv	COE-46
C249	10 µf		25 dcwv	COE-56
C250	10 µf		25 dcwv	COE-56
C252	100 pf	± 5%	500 dcwv	COM-15D(101B)
C301	40 µf		6 dcwv	COE-54
C302	100 µf		15 dcwv	COE-46
C303	200 µf		6 dcwv	COE-44
C304	10 µf	±20%	20 dcwv	COE-61(106D)
C305	1.5 µf	±20%	20 dcwv	COE-60(155D)
C306	60 µf		25 dcwv	COE-47
C307	10 µf	±20%	20 dcwv	COE-61(106D)
C308	10 µf	±20%	20 dcwv	COE-61(106D)

PARTS LIST (Cont)

CAPACITORS (Cont)

C309	.00160 µf	± 5%	200 dcwv	COP-24(162B)
C310	.00160 µf	± 5%	200 dcwv	COP-24(162B)
C311	100 µf	±10%	500 dcwv	COM-22B(101C)
C501	100 µf		25 dcwv	COE-35
C502	100 µf		25 dcwv	COE-35
C503	100 µf		25 dcwv	COE-35
C504	100 µf		25 dcwv	COE-35

DIODES

CR301	2RED-1003/1N34A(S)	CR305	2RE-1001/1N3253
CR302	2RED-1003/1N34A(S)	CR306	2RE-1001/1N3253
CR303	2RED-1003/1N34A(S)	CR501	2RE-1003/1N3255
CR304	2RED-1003/1N34A(S)		

TRANSISTORS

Q101	TR-32/C620A	Q207	TR-31/2N445A*
Q102	TR-23/2N520A*	Q208	TR-31/2N445A*
Q103	TR-31/2N445A*	Q301	TR-31/2N445A*
Q104	TR-31/2N445A*	Q302	TR-31/2N445A*
Q105	TR-31/2N445A*	Q303	TR-31/2N445A*
Q201	TR-31/2N445A*	Q304	TR-10/2N1374
Q202	TR-31/2N445A*	Q305	TR-10/2N1374
Q203	TR-31/2N445A*	Q501	TR-31/2N445A*
Q204	TR-31/2N445A*	Q502	TR-31/2N445A*
Q205	TR-31/2N445A*	Q503	TR-31/2N445A*
Q206	TR-31/2N445A*		

SWITCHES

S101	SWRW-247	S201	SWRW-249
S102	SWRW-250	S202	SWRW-247
S103	SWRW-248		

MISCELLANEOUS

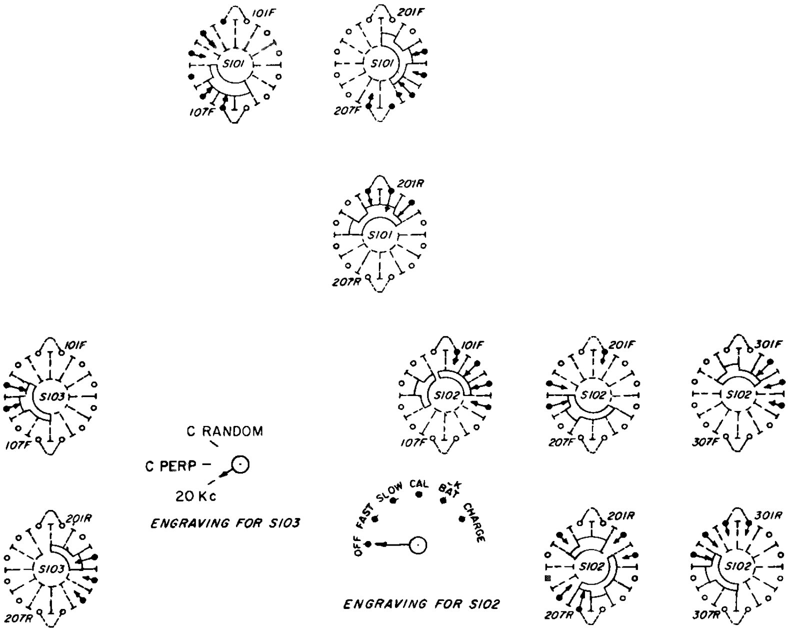
Battery	B501	2BA-1000	Jack	J301	CDSJ-820
Battery	B502	2BA-1000	Plug	PL501	CDMP-1264-2
Meter	M301	MEDS-105	Socket	SO101	CDMS-35
Jack	J101	CDSJ-10			

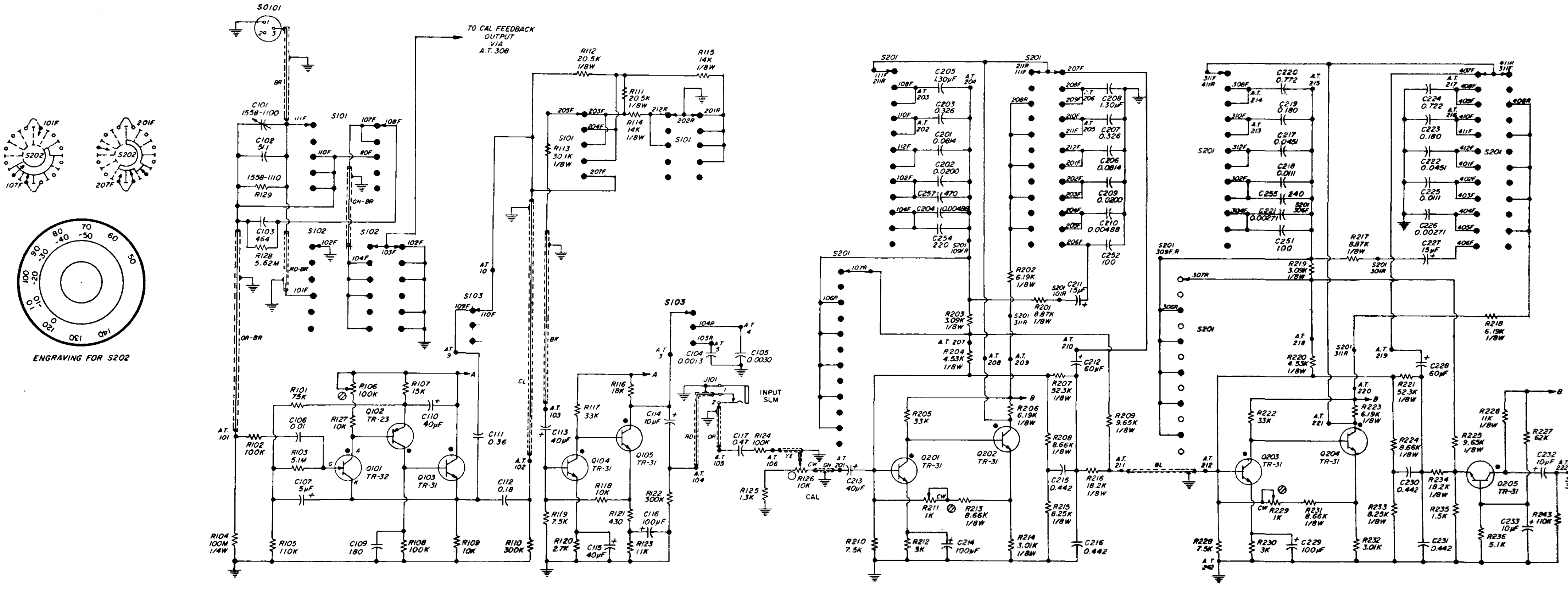
*Selected for H_{fe} between 80 and 125.

NOTES FOR PARTS LIST

When ordering replacement parts, please specify the instrument type number as well as the part numbers of the items required.

All resistances are in ohms, unless otherwise indicated by k (kilohms) or M (megohms).





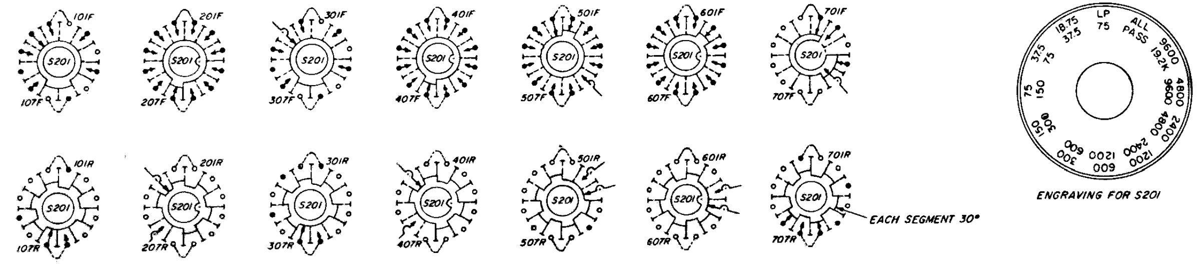


Figure 4-6. Schematic diagram for Type 1558-A Octave Band Noise Analyzer (see Figure 4-7).

NOTES:

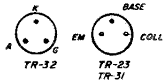
POSITION OF ALL SWITCHES SHOWN COUNTERCLOCKWISE

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

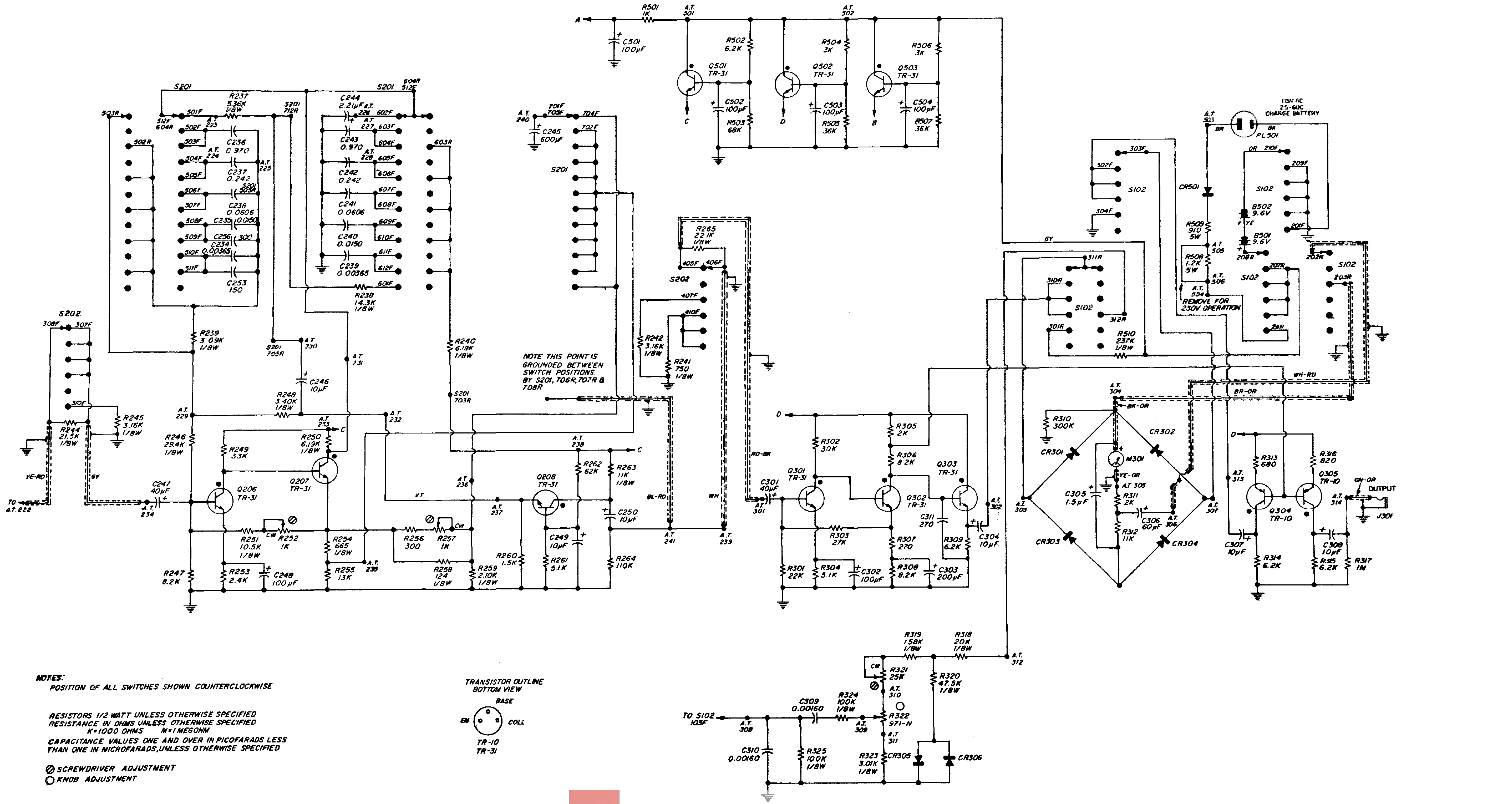
⊘ SCREWDRIVER ADJUSTMENT

○ KNOB ADJUSTMENT

TRANSISTOR OUTLINE BOTTOM VIEW



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.



NOTES:
POSITION OF ALL SWITCHES SHOWN COUNTERCLOCKWISE

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-A Octave Band Noise Analyzer (see Figure 4-6).

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