HEWLETT-PACKARD

MODEL 206A

AUDIO SIGNAL GENERATOR

OPERATING AND SERVICING MANUAL

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FOR

MODEL 206A

AUDIO SIGNAL
GENERATOR

----NOTICE----

The Operating and Servicing Manual for the Hewlett-Packard Model 206A is temporarily out of print. To speed shipment of your instrument we are supplying the attached operating instructions. We will send the complete manual to you as soon as it becomes available.

The Hewlett-Packard Company

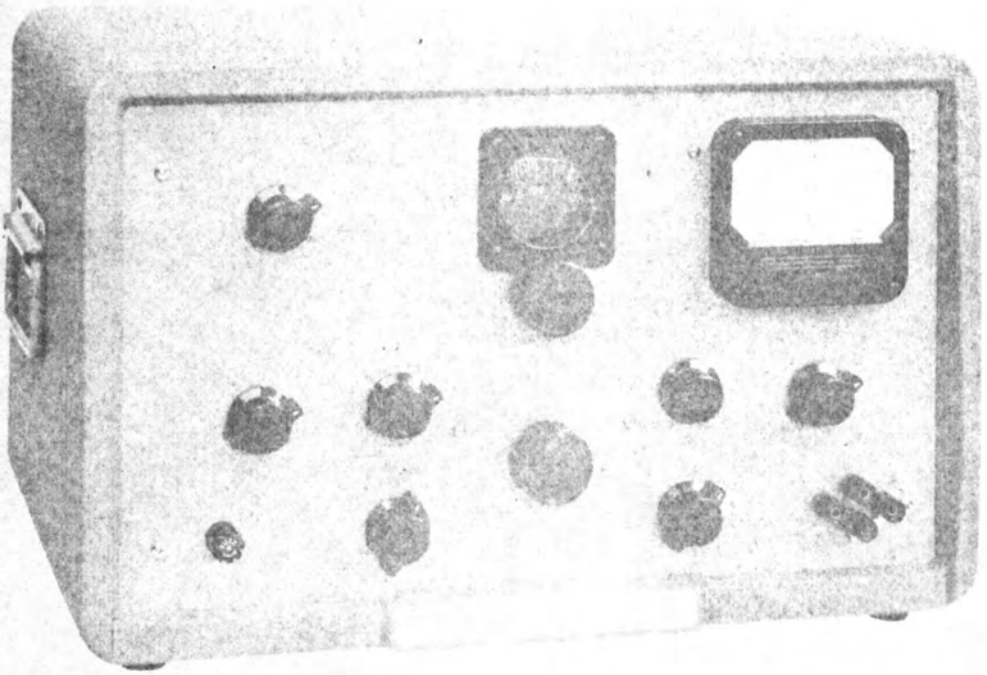
OPERATING AND SERVICING MANUAL

FOR

MODEL 206A

LOW DISTORTION AUDIO SIGNAL GENERATOR

Serial 1223 and Above



HEWLETT-PACKARD COMPANY
275 PAGE MILL ROAD, PALO ALTO, CALIFORNIA U. S. A.

206A002-2

TABLE OF SPECIFICATIONS

FOR

MODEL 206A LOW DISTORTION AUDIO SIGNAL GENERATOR

FREQUENCY RANGE:	20 to 20,000 cycles/sec., in 3 ranges.
FREQUENCY DIAL CALIBRATION:	20 to 200
RANGES:	X1 20 to 200 cycles/sec. X10 200 to 2,000 cycles/sec. X100 2,000 to 20,000 cycles/sec.
FREQUENCY RESPONSE:	Beyond the output meter, better than .2 db at all levels, 30 to 15,000 cycles/sec. (reference: 1 kc).
FREQUENCY STABILITY:	±2% including warmup drift.
POWER OUTPUT:	31.6 milliwatts (+15 db above 1 mw) into 50, 150, or 600 ohms; approximately 10 volts open circuit.
DISTORTION:	Less than .1% at frequencies above 50 cycles/sec., less than .25% at frequencies from 20 to 50 cycles/sec.
HUM AND NOISE LEVEL:	At least 70 db below the output signal, or more than 100 db below zero level, whichever is the larger.
OUTPUT IMPEDANCE:	50, 150, or 600 ohms, balanced or unbalanced. Selector switch provided. Center-tap connection available for balanced-to-ground operation.
OUTPUT METER:	Calibrated to read directly in volts (0 to 4.5 volts) across 600 ohms and in dbm (-5 to +15 dbm) (reference: 1 mw into 600 ohms).
OUTPUT ATTENUATOR:	A three-section attenuator provides a range of 111 db in .1 db steps 110 db in 1 db steps 100 db in 10 db steps
POWER SUPPLY RATING:	Voltage - 115/230 volts ±10% Frequency - 50 - 1,000 cps Wattage - 145 watts
DIMENSIONS:	Cabinet Model - 20-1/2" wide x 12-1/2" high x 14-3/4" deep Rack Model - 19" wide x 10-1/2" high x 13-3/4" deep Depth behind panel - 13-1/2".
WEIGHT:	Cabinet Model - approximately 56 pounds Rack Model - approximately 49 pounds.

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MODEL 206A

LOW DISTORTION AUDIO SIGNAL GENERATOR

SECTION I

GENERAL DESCRIPTION

1-1 GENERAL

The Model 206A Low Distortion Audio Signal Generator provides a precise source of continuously variable audio-frequency voltage suitable for use in making accurate gain or frequency response measurements of high-quality audio circuits. Any desired frequency within a range of 20 to 20,000 cycles/second is made available by an extremely low-distortion resistance-capacity oscillator within the instrument. A voltmeter, calibrated both in volts and dbm, is provided to measure the output of the oscillator output amplifier. Following the voltmeter is an attenuator which permits the output level to be reduced in .1 db steps to a maximum of 111 db. A line-matching transformer and associated switch permits the signal generator output to be coupled to a balanced line of 50, 150, or 600 ohms. An unbalanced 600-ohm output which bypasses the line-matching transformer also is provided.

The Model 206A is suitable for FM transmitter maintenance, studio amplifier and console testing, as a low-distortion signal source for bridge measurements, as a transmission-measuring set, and for any application requiring a low-distortion, accurately-known audio test signal.

CAUTION

VOLTAGES WHICH ARE DANGEROUS TO LIFE ARE PRESENT WITHIN THIS INSTRUMENT.

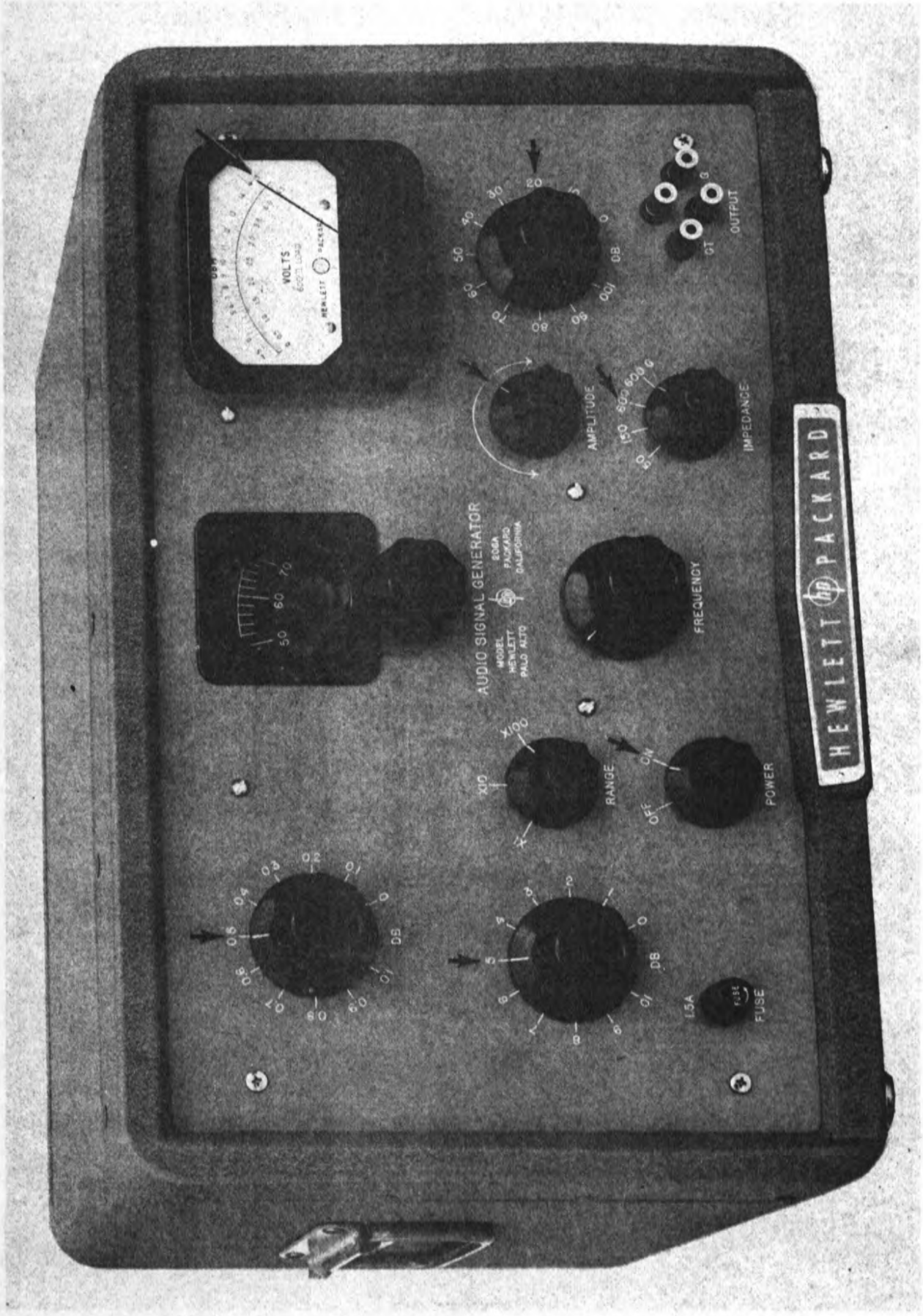


Fig. 2. Model 206A Control Panel Dial Settings for Generator Output of .23 Volts Across 600 Ohms

SECTION II

OPERATING INSTRUCTIONS

2-1 INSPECTION

This instrument was thoroughly tested and inspected before being shipped from the factory. After the instrument is unpacked, it should be carefully checked for any damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" section on the last page of this instruction book.

2-2 CONTROLS AND TERMINALS

FUSE

The fuseholder, located on the control panel, contains a cartridge fuse of the Slo-Blo type. For 115-volt operation, a 1.6-ampere fuse is used, and for 230-volt operation, an .8-ampere fuse of the same type is used. Characteristics of the Slo-Blo fuse used in the Model 206A are given in the Table of Replaceable Parts.

POWER

This rotary switch controls the power supplied to the instrument from the power line. Illumination of the tuning dial window provides indication that the power switch is turned on.

IMPEDANCE

The setting of this four-position rotary switch indicates the impedance at the output binding posts. In three positions (50, 150, and 600) the switch connects windings of the impedance-matching transformer to the OUTPUT binding posts for balanced 50-ohm, 150-ohm, or 600-ohm operation. In the fourth position, 600G, the switch bypasses the impedance-matching transformer and arranges the output circuit for 600-ohm unbalanced operation.

CT OUTPUT G

The Model 206A binding posts will accept either a banana plug or wire. The terminals are so arranged that any double banana plug with 3/4 inch spacing may be used to connect to any pair of adjacent terminals.

An additional set of binding posts, identical in type and arrangement with those on the control panel, is provided at the rear of the instrument. This set of four terminals is connected in parallel with the binding posts on the control panel.

CT - This binding post is the impedance-matching transformer center-tap terminal.

OUTPUT - These two binding posts are the output terminals for the Model 206A Signal Generator.

G - This binding post is connected to the chassis. By patching to terminal G any of the binding posts may be connected to the chassis.

RANGE

This rotary switch controls the magnitude of the resistance in the frequency-determining circuits. The position of the RANGE switch indicates the multiplying factor for the tuning dial indication.

FREQUENCY

This knob is the fine control for adjusting the capacity in the frequency-determining circuits of the Model 206A.

The coarse control for the frequency-determining capacity adjustment is directly connected to the tuning dial and capacitor drive mechanism. The coarse control is the knob immediately below the tuning dial.

The tuning dial is calibrated in cycles per second for the lowest range, and its indication multiplied by the factor indicated by the RANGE switch will give the actual output frequency of the oscillator.

AMPLITUDE

This knob varies the setting of the variable resistor which controls the level of the input to the output amplifier. The voltage level of the amplifier output is indicated by the meter on the control panel.

0-1 DB, 0-10 DB, 0-100 DB

These three dials are the controls for the three-section attenuator, which is inserted in the output path between the output meter and the line-matching transformer. The attenuation in db inserted in the circuit is equal to the sum of the three control knob settings, and the reading of the output meter minus the inserted attenuation is the level of the signal at the generator OUTPUT binding posts. The attenuator provides a means for reducing the output voltage, in .1 db steps, to a maximum of 111 db below the level indicated by the meter.

POWER CABLE

The three-conductor power cable is terminated in a polarized three-prong male connector recommended by the National Electrical Manufacturers' Association. The third contact is an offset round pin, added to a standard two-blade a-c plug, which grounds the instrument chassis when used with the appropriate receptacle. To use this NEMA plug in a standard two-contact outlet, it is recommended that instead of breaking off the ground terminal, a 2-prong to 3-prong adapter be used. The ground connection emerges from the adapter as a short lead which should be connected to ground for the protection of operating personnel.

2-3 OPERATION

The procedure for operating the Model 206A Low Distortion Audio Signal Generator is as follows.

1. General

With the instrument plugged into a power source of specified voltage and frequency, and the power switch at ON allow a warm-up period of a few minutes. Specified accuracy of ±2% will be obtained after a few minutes warmup. For maximum accuracy, however, allow a 20-30 minute warmup.

NOTE

If a 230-volt power source is used, check (1) that power transformer T1 is strapped for 230-volt operation (strapping options are shown on the schematic diagram), and (2) that fuse F1 is an .8-ampere Slo-Blo fuse.

2. Selecting Frequency

The desired output frequencies are obtained by the combined use of the FREQUENCY controls and the RANGE switch. The frequencies from 20 cps to 20,000 cps are covered in three ranges as follows:

X1	Range: 20 cps to 200 cps
X10	Range: 200 cps to 2,000 cps
X100	Range: 2,000 cps to 20,000 cps

The FREQUENCY tuning dial is calibrated in cycles per second for the lowest or X1 range. The higher ranges multiply the calibration of the tuning dial by the indicated factors of 10 or 100. For example, to select a frequency of 400 cps, set the tuning dial to 40 and the RANGE switch to X10. A frequency of 10,000 cps is selected by setting the tuning dial to 100 and the RANGE switch to X100.

3. Connecting the Load

Connect the load to the OUTPUT binding posts. If the impedance of the load is 50, 150, or 600 ohms, the instrument can be set (see par. 5 below) to match the load impedance.

4. Setting the Output Voltage Level

To keep hum at a satisfactory level below that of the output voltage, the output from the amplifier should be maintained at a relatively high level and then reduced to the desired level by means of the attenuator.

In following the procedure for setting the output voltage level, it is important to understand the position of the meter in the output circuit and also the calibration of the meter. The meter is across the output of the output amplifier, ahead of the attenuator, but is so calibrated that when the attenuator is set for zero attenuation and the instrument is working into a matched resistive load, the level of the signal at the OUTPUT binding posts may be read on the meter in dbm. To convert the dbm reading to volts, quick-reference graphs have been provided at the back of this manual. (When working into a matched 600-ohm load with the attenuator at zero attenuation, the voltage at the OUTPUT binding posts may be read directly on the meter.)

The following procedure should be used for setting the output voltage level:

a. Set the level of the output amplifier. Use the output meter reading as an indication of the amplifier output, and adjust the level by means of the AMPLITUDE control (on the con-

trol panel). Unless the noise level in the output signal is non-critical, the output amplifier always should be adjusted for a meter indication of +15 dbm.

b. Determine the level in dbm for the output voltage desired. The quick-reference graphs referred to above are arranged to show the relationship between db referred to 1 milliwatt into a matched load and the voltage across a corresponding matched load. To determine the level in dbm for an output voltage of .23 volts into 600 ohms, for example, refer to the graph and find the level in dbm for .23 volts into 600 ohms. The level will be found to be -10.5 dbm.

c. Compute the amount of attenuation required to bring the output down to the desired level. With the output from the amplifier at +15 dbm, attenuation of 25.5 db will be required to bring the output to -10.5 dbm at the OUTPUT binding posts (+15 dbm minus 25.5 db equals -10.5 dbm).

d. Set the attenuator for the loss required. The loss inserted by the attenuator is the sum of the settings of the dials. Using as an example the condition described above where a loss of 25.5 db is required, all three dials will be set for loss (20 db + 5 db + .5 db equals 25.5 db). Control panel dial positions for setting the generator output for .23 volts across 600 ohms are indicated in Fig. 1.

NOTE

A method for determing the voltage across a non-matching load is described below in paragraph 5. Setting Output Impedance.

5. Setting Output Impedance

The output impedance of the generator is determined by the setting of the IMPEDANCE switch. For balanced 50-, 150-, or 600-ohm operation, set the IMPEDANCE switch to 50, 150, or 600. For balanced-to-ground operation, patch binding post CT to binding post G.

For 50- or 150-ohm unbalanced operation, set the IMPEDANCE switch to the 50 or 150 position, and connect the lower OUTPUT binding post to ground at terminal G.

For 600-ohm unbalanced operation, set the IMPEDANCE switch to 600G. At the 600G position, the IMPEDANCE switch connects the lower OUTPUT binding post to the G binding post. (In the 600G position, the matching transformer is bypassed, and an advantage in distortion and frequency-response characteristics is obtained.)

The calibration of the voltmeter and attenuator is correct only when the instrument is working into a matched resistive load. The VOLTS calibration of the meter is correct only when working into a 600 ohm load; the DBM calibration is correct when working into a 50-, 150-, or 600-ohm load provided the IMPEDANCE switch is in the position which matches the output impedance to the load.

If it is desired to work the generator into resistive loads other than 50, 150, or 500 ohms, the following method may be used to compute the voltage across the external load.

a. With the RANGE switch and FREQUENCY controls set for the desired output frequency, set the IMPEDANCE switch for the impedance nearest that of the load into which the generator will be working.

b. Choose the output level in dbm and add 15 (the reading of the output meter) to it. Set the attenuator dials for the sum.

c. Refer to the voltage graph, and obtain the voltage across the generator output impedance at the chosen output level. (The generator output impedance is the setting of the IMPEDANCE switch; the output level is +15 dbm minus the setting of the attenuator dials.) For example, if the IMPEDANCE switch is set for 150 and the output level is -10 dbm (attenuator dials set for 25 db), the graph shows the voltage across the generator output impedance to be .125 volt.

d. Multiply by two the voltage across the generator output impedance to obtain the open circuit voltage.

e. The voltage across the external resistive load may now be calculated, using the following formula:

$$E_L = \frac{E_{oc}}{R_L + R_o} R_L$$

Where E_L is the voltage across the external resistive load

E_{oc} is the open circuit voltage

R_L is the external resistive load

R_o is the output impedance of the generator

For example, assume the output meter indicates + 15 dbm, the attenuator dials are set for 25 db, the external resistive load is 250 ohms, and the generator IMPEDANCE switch is set at 150.

A. To obtain the open circuit voltage of the generator:

1. The reading of the output meter minus the attenuator setting gives an output level of -10 dbm (+15 dbm minus 25 db).

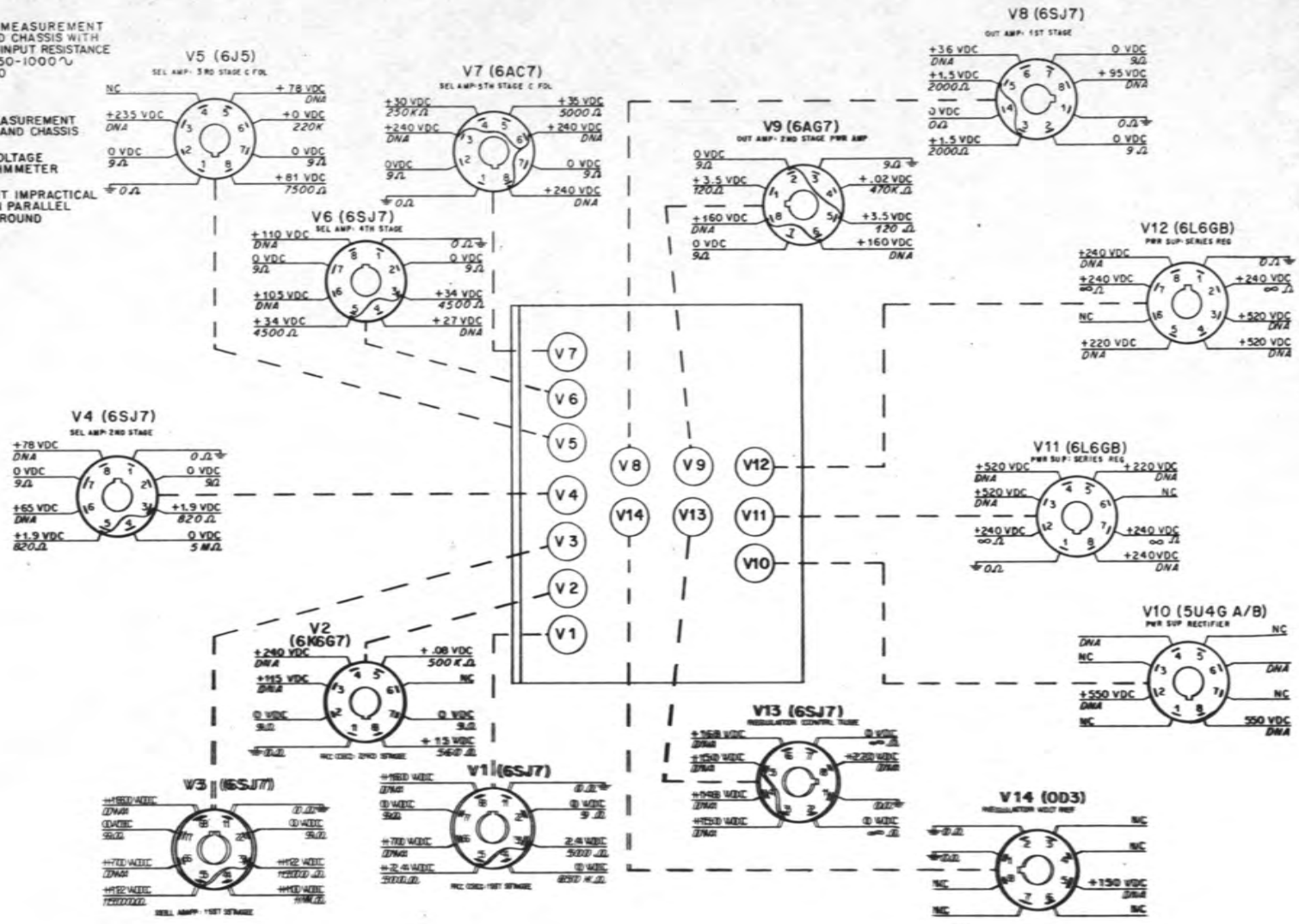
2. The voltage at -10 dbm across the generator output impedance (150 ohms) is .125 volts. Twice .125 volt is .25 volt, the open circuit voltage.

B. Applying the formula:

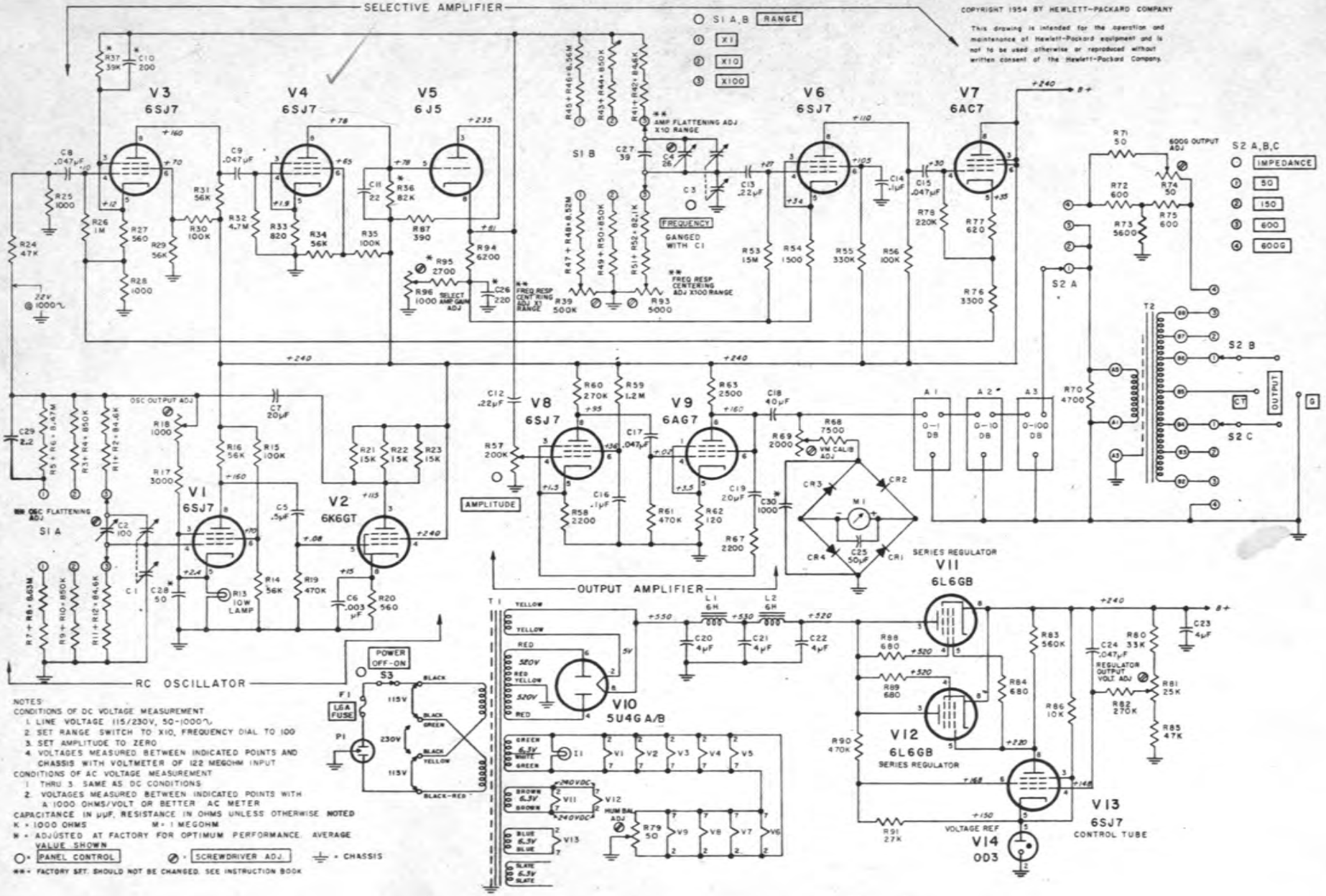
$$E_L = \frac{.25}{250 + 150} \times 250, \text{ or } .156 \text{ volt}$$

CAUTION

When using low output levels of -40 dbm or below (attenuator set for 55 db or more), do not use the 600G position of the IMPEDANCE switch if the accuracy of calibration of the output attenuator is important. If it is desired to have a 600-ohm single-ended output at a low level, use the 600 position of the IMPEDANCE switch, and connect the lower OUTPUT binding post to ground via the G binding post.



Voltage and Resistance Diagram



NOTES:
CONDITIONS OF DC VOLTAGE MEASUREMENT
1. LINE VOLTAGE 115/230V, 50-1000~
2. SET RANGE SWITCH TO X10, FREQUENCY DIAL TO 100
3. SET AMPLITUDE TO ZERO
4. VOLTAGES MEASURED BETWEEN INDICATED POINTS AND CHASSIS WITH VOLTMETER OF 122 MEGOHM INPUT
CONDITIONS OF AC VOLTAGE MEASUREMENT
1. THRU 3. SAME AS DC CONDITIONS
2. VOLTAGES MEASURED BETWEEN INDICATED POINTS WITH A 1000 OHMS/VOLT OR BETTER AC METER
CAPACITANCE IN μμF, RESISTANCE IN OHMS UNLESS OTHERWISE NOTED
K = 1000 OHMS M = 1 MEGOHM
* = ADJUSTED AT FACTORY FOR OPTIMUM PERFORMANCE. AVERAGE VALUE SHOWN
○ = PANEL CONTROL ⊘ = SCREWDRIVER ADJ. ⏚ = CHASSIS
** = FACTORY SET. SHOULD NOT BE CHANGED. SEE INSTRUCTION BOOK

hp MODEL 206A
AUDIO SIGNAL GENERATOR
SERIAL 1223 & ABOVE