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INSTRUCTION AND OPERATING MANUAL

FOR

MODEL 205AH

AUDIO SIGNAL GENERATOR

Serial 223 and Above

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

AUDIO SIGNAL GENERATOR

MODEL 205-AH

ELECTRICAL SPECIFICATIONS

1. Frequency Range ..... Two bands..... 1 KC to 10 KC  
10 KC to 100 KC  
Calibration of Main Dial..... Variation..... 1 to 10 KC  
Accuracy..... 2%
2. Maximum Power Output ..... 5 watts into matched load.
3. Distortion.... Less than 1% distortion at 1 watt into matched load.  
Approximately 3% distortion at 5 watts into matched load.
4. Output Impedances ..... 50, 200, 500, 5000 ohms.  
(center tapped, ungrounded)
5. Frequency Response .....  $\pm 1$  db from 10 KC reference.
6. Frequency Stability.  $\pm 10\%$  line voltage changes cause no more than  
 $\pm \frac{1}{2}\%$  variation after  $\frac{1}{2}$  hour warmup period.
7. Hum Level ..... At least 65 db below output voltage, or 65 db  
below 1 MW at 500 ohms, whichever is greater.
8. Output Attenuation...Range.....0 to 110 db in 1 db steps.  
Accuracy  $\pm \frac{1}{4}$  db in first 80 db;  
 $\pm 3$  db in last 30 db.
9. Output Meter Calibration ..... Volts : Decibels.  
Volts (500 ohms output impedance) .... 60 V, full scale.  
Decibels (0 db-1 MW into 500 ohm load) ... $\pm 20$  to  $\pm 37$  db.
10. Power Supply ..... 110 to 120 V, 60 cycles, 140 watts.
11. Fuse Rating .....  $1\frac{1}{2}$  amperes.

## MECHANICAL SPECIFICATIONS

Cabinet Model: Overall Dimensions, 22-19/32 x 13-3/16 x 11-5/8 in. max.  
Panel Size.....19 x 10½ in.  
Panel Finish..... Grey Wrinkle Enamel.  
Cabinet Finish..... Light Oak.

Relay Rack Model: Panel Size....., 19 x 10½ in.  
Dust Cover 17-3/16 x 12-1/8 x 10-3/16 in. max.  
Finish..... Grey Wrinkle Enamel.

## CIRCUIT DESCRIPTION

The Model 205-AH Audio Signal Generator consists of a Hewlett-Packard resistance-tuned oscillator in combination with an output meter, an attenuator, and an impedance-matching system.

The oscillator section consists of a resistance-coupled amplifier with positive feedback through a frequency-selective resistor-capacitor combination, and negative feedback through a non-linear resistance which acts as an automatic amplitude control. A 6J7 and a 6F6 are used as oscillator tubes. A regulated power supply is used as a dc power source for the oscillator section, to increase the frequency stability.

In the power amplifier a 6J7 amplifier tube and a 6J5 phase inverter tube are used to drive two triode-connected 6L6G output tubes. The tertiary winding on the output transformer is used for negative feedback. This amplifier operates into a 500 ohm line. The output meter measures the output voltage of the 5 watt power amplifier across the 500 ohm circuit. This meter is a diode circuit and is of the average reading type, calibrated to read the r.m.s. value of the sine wave.

Following the output meter are two bridged-T attenuators, one having 100 db of attenuation in 10 db steps, and one having 10 db of attenuation in 1 db steps. The 500 ohm circuit then feeds a line-matching transformer. This transformer has output impedances of 50, 200, 500, and 5000 ohms, all center tapped. These are selected by the impedance switch on the front panel near the output terminals.

It is necessary that the attenuators be correctly loaded for the metering and attenuation systems to operate properly. In cases where the generator is working into a matched load, the operation will be correct. Where the generator is operating into a high impedance, the load built into the instrument should be used. This load is a 500 ohm resistance, which can be switched across the 500 ohm transformer winding by a switch on the front panel.

## O P E R A T I O N

This instrument has been carefully tested and adjusted at the factory and should need no further adjustment. The power switch may be turned on and if the instrument is operating properly, a voltage of at least 50 volts at 500 ohms output impedance will be obtained over the frequency range 1 to 100 KC.

The volume control on the front panel is used to set the output voltage level on the output meter to the desired value.

The output frequency is selected by the main dial behind the front of the panel. This dial is calibrated in kilocycles per second for the lowest frequency range.

The frequency range switch below and to the left of this dial indicates the proper multiplying factor to be used on the main dial calibration.

If the output meter is held at a fixed setting the voltage at the output terminals will be constant over most of the frequency range.

The output meter has been set to read the voltage at the 500 ohm output terminals with the system loaded. The voltage at the output terminals is reduced by the attenuator setting, or changed by the impedance level used. When the attenuators are set at zero, the following multiplying factors apply to the meter reading:

<u>Impedance</u>	<u>Meter Multiplying Factor</u>
500 ohms .....	1.0
5000 ohms .....	3.16
200 ohms .....	.632
50 ohms .....	.316

The attenuators are located on the right-hand side of the panel. A table of output voltage ratios for various attenuator settings follows. Note that the attenuators must be properly loaded at the output of the instrument for this table to apply.

<u>Attenuator Setting</u>	<u>Meter Multiplying Factor</u>
0 .....	1.0
6 .....	.5
10 .....	.316
20 .....	.1
26 .....	.05
30 .....	.0316
40 .....	.01
46 .....	.005
50 .....	.00316
60 .....	.001
66 .....	.0005
70 .....	.000316
80 .....	.0001

Output impedances of 50, 200, 500, and 5000 ohms are provided. These windings are center tapped to provide impedances of 12.5, 50, 125, and 1250 ohms from one side to center tap. The output terminals are brought out to three binding posts. A fourth binding post, connected to ground, is provided for grounding the output system if necessary. The impedance matching switch is located next to the output terminals on the panel. A second table follows, indicating the output voltage correction factor for different output impedances:

<u>Impedance</u>	<u>Output Voltage</u>
50 ohms .....	Subtract 10 db
200 ohms .....	Subtract 4 db
500 ohms .....	No Correction
5000 ohms .....	Add 10 db

### M A I N T E N A N C E

Proper operating voltages are shown on the circuit diagram.

The frequency calibration will ordinarily remain correct without adjustment. Should it be necessary, however, to adjust the tracking of the main frequency selecting dial, an accurate source of frequency must be used for comparison. Set dial to 1 KC, range switch to X1. Note output of oscillator at 1 KC, then set to 10 KC on dial. Adjust oscillator frequency to 10 KC by means of C3 (see circuit diagram) and at the same time adjust the voltage output to be equal to that obtained at 1 KC on the dial, by adjusting the compensating capacitor C1. This requires some maneuvering, as the settings are inter-dependent. Check output at 1 KC again, to make sure it has not changed. If it has, readjust output and frequency at 10 KC to match. If the instrument still does not track properly, the resistors have probably changed value. Return generator to the factory for range switch replacement and recalibration.

The distortion in this instrument should be measured periodically. Poor tubes will cause an increase in the harmonic content of the output, and if this rises above 1% (40 db) at 1 watt output, the tubes should be replaced. Any of the tubes are capable of causing distortion.

Mazda lamp failure: Should it be necessary to change this lamp because of unstable output or failure to oscillate, adjust the output voltage of the oscillator section to approximately 18 volts. Set dial to 1 KC on the X1 frequency range, connect a high impedance voltmeter from the junction of C3 and R17 to ground, and vary the padding resistor R8 on the negative feedback. Add resistance to raise voltage, and vice versa.

The output meter may be checked against an external meter, and if necessary its calibration can be corrected by adjusting R29 or by replacing T7 (6H6).

The distortion of the oscillator section should be 0.3% (50 db) or less at 10 KC.

The fuse is a  $1\frac{1}{2}$  ampere cartridge located on the under side of the chassis, next to the power cord. If fuse fails, the instrument should be carefully checked to ascertain the cause of the overload. Do not replace with a fuse of higher amperage, or short the clips on the fuse block.

In general this instrument should be thoroughly cleaned every six months to remove accumulated dust. At the same time, the mechanical drive should be cleaned and lubricated with a light oil.

## LIST OF COMPONENT PARTS

## MODEL 205AH

C1	100 mmfd	Air padder
C2	530 mmfd ea sec.	4-gang 4-section variable capacitor
C3	25 mmfd	air padder
C4	50 mmfd	500 V mica
C5a	20 mfd)	
C5b	10 mfd)	450 V electrolytic
C6	.1 mfd	600 V paper
C7	.003	600 V paper
C8	This reference not assigned	
C9	.5 mfd	600 V paper
C10	.1 mfd	600 V paper
C11	2000 mmfd	600 V paper
C12	.05 mfd	600 V paper
C13	.05 mfd	600 V paper
C14a	4 mfd	600 V paper
C15	4 mfd	600 V paper
C16	4 mfd	600 V paper
C17	4 mfd	600 V paper
C18	4 mfd	600 V paper
C19	Value selected to circuit at factory	
C20	Value selected to circuit at factory	
S1	Frequency-determining range switch	
S2	AC power switch, SPST	
S3	Impedance matching switch	
S4	Load switch, SPST	
A1	Attenuator, 500 ohm, 0-10 db	
A2	Attenuator, 500 ohms, 0-100 db	
Pilot Lamp	6-8V, .15 amps, Mazda	
Fuse	1½ amps, non-renewable	
T1	Power Transformer	
T2	Output Transformer	
T3	Line-matching Transformer	
L1	Filter choke, 6 h at 125 MA	
L2	Filter choke, 6 h at 125 MA	
M1	Meter, 1 milliamp	

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SER 223 D

205A H



## LIST OF COMPONENT PARTS

## MODEL 205-AH

R1	14.5 K	1 W composition
R2	14.5 K	1 W composition
R3	14.5 K	1 W composition
R4	14.5 K	1 W composition
R5	Lamp	3 W Mazda
R6	56 K	1 W composition
R7	56 K	1 W composition
R8	3 K	1 W wirewound
R9	1000 ohms	1 W wirewound; variable
R10	56 K	1 W composition
R11	220 K	1 W composition
R12	220 Ohms	1 W composition
R13	This reference not assigned	
R14	This reference not assigned	
R15	10 K	1 W composition
R16	5 K	10 W wirewound
R17	25 K	variable carbon
R18	3300 ohms	1 W composition
R19	750 K	1 W composition
R20	56 K	1 W composition
R21	100 K	1 W composition
R22	47 K	1 W composition
R23	1 megohm	1 W composition
R24	4700 ohms	1 W composition
R25	47 K	1 W composition
R26	270 K	1 W composition
R27	270 K	1 W composition
R28	500 ohms	10 W wirewound
R29	27.5 K	1 W wirewound
R30	33 ohms	1 W wirewound
R31	250 ohms	10 W wirewound
R33	560 K	1 W composition
R34	15 K	2 W composition
R35	47 K	1 W composition
R36	25 K	variable carbon
R37	33 K	1 W composition
R38	500 ohms	25 W wirewound
R40	1000 ohms	10 W wirewound
R41	270 ohms	$\frac{1}{2}$ W composition
V1	6J7	
V2	6AG7	
V3	6J7	
V4	6J5	
V5	6L6G	
V6	6L6G	
V7	6H6	
V8	5T4	
V9	6SQ7-GT	
V10	6L6G	
V11	VR150	

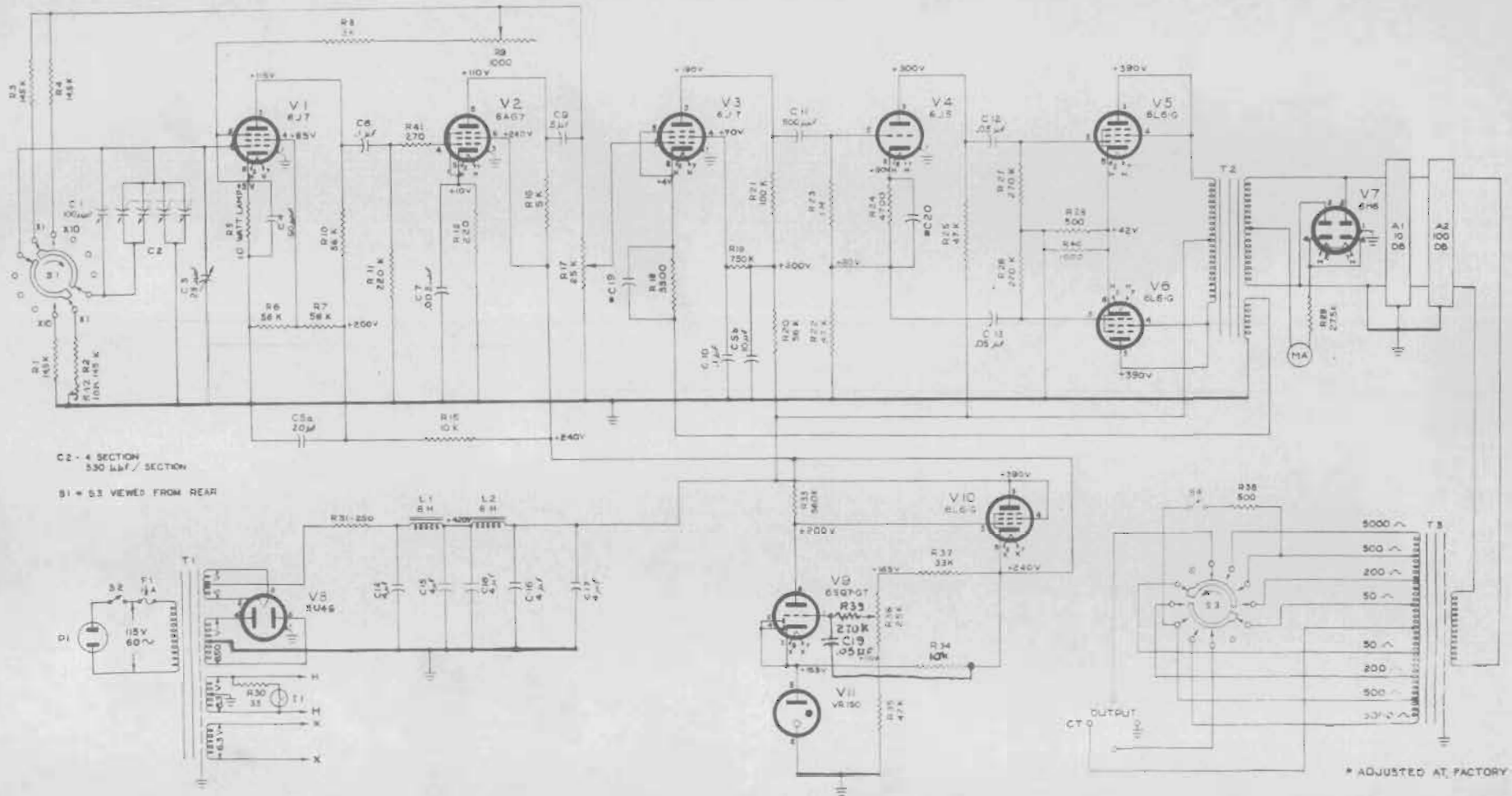
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222

2ER

205AH



SCHEMATIC DIAGRAM OF -hp- MODEL 205AH SIGNAL GENERATOR

## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number, type number and serial number when referring to this instrument for any reason.

## WARRANTY

Hewlett-Packard Company warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof (except tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number, type number and serial number. On receipt of this information, we will give you service instructions or shipping data.
2. On receipt of shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

## SHIPPING

All shipments of Hewlett-Packard instruments should be made via Railway Express. The instruments should be packed in a wooden box and surrounded by two to three inches of excelsior or similar shock-absorbing material.

**DO NOT HESITATE TO CALL ON US**

**HEWLETT-PACKARD COMPANY**

*Laboratory Instruments for Speed and Accuracy*

395 PAGE MILL ROAD

PALO ALTO, CALIF.



LIST OF MANUFACTURERS CODE LETTERS  
FOR REPLACEABLE PARTS TABLE

<u>Code Letter</u>	<u>Manufacturer</u>
A	Aerovox Corp.
B	Allen-Bradley Co.
C	Amperite Co.
D	Arrow, Hart and Hegeman
E	Bussman Manufacturing Co.
F	Carborundum Co.
G	Centralab
H	Cinch Manufacturing Co.
I	Clarostat Manufacturing Co.
J	Cornell Dubilier Electric Co.
K	Electrical Reactance Co.
L	Erie Resistor Corp.
M	Federal Telephone and Radio Corp.
N	General Electric Co.
O	General Electric Supply Corp.
P	Girard-Hopkins
HP	Hewlett-Packard
Q	Industrial Products Co.
R	International Resistance Co.
S	Lectrohm, Inc.
T	Littelfuse, Inc.
U	Maguire Industries, Inc.
V	Micamold Radio Corp.
W	Oak Mfg. Co.
X	P. R. Mallory Co., Inc.
Y	Radio Corp. of America
Z	Sangamo Electric Co.
AA	Sarkes Tarzian
BB	Signal Indicator Co.
CC	Sprague Electric Co.
DD	Stackpole Carbon Co.
EE	Sylvania Electric Products, Inc.
FF	Western Electric Co.
GG	Wilkor Products, Inc.
HH	Amphenol
II	Dial Light Co. of America
JJ	Leecraft Manufacturing Co.
ZZ	Any tube having RMA standard characteristics