

INSTRUCTION AND OPERATING MANUAL

FOR

MODEL 201B

AUDIO OSCILLATOR

Serial 768 and Above

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

INSTRUCTIONS

MODEL 201B

AUDIO OSCILLATOR

Specifications

Frequency Rating --

Frequency Range - 20 to 20,000 cycles/sec.

Frequency Dial Calibration - 20 to 200

Range -

x1 20 - 200 cycles/sec.

x10 200 - 2000 cycles/sec.

x100 2000 - 20,000 cycles/sec.

Calibration Accuracy - $\pm 2\%$ ($\pm 1\%$ with standardization)

Frequency Response - ± 1 db 20 to 20,000 cycles/sec. Reference:
1000 cycles/sec., 42.5 volts, 600 ohms resistive load.

Frequency Stability - $\pm 2\%$ under normal temperature conditions,
including initial warm-up. Line voltage variations from 105 to
125 volts will cause a negligible change in frequency.

Power Output Rating --

Power Output - 3 watts into rated load (42.5 volts across a 600 ohm load)

Distortion -

Watts Output	% Distortion	Frequency Range
3	1	50 to 20,000 cycles/sec.
1	1/2	50 to 20,000 cycles/sec.
1	1	20 to 20,000 cycles/sec.

Hum - Less than .1% of rated output. Less than .1% at any signal below
3 watts when attenuator is used.

Load Impedance - 600 ohms, resistive

Approximated Internal Impedance - 75 ohms below 5000 cycles/sec.

at zero setting of attenuator. 600 ohms over entire frequency range
with the attenuator set at 10 db or more.

Power Supply Rating --

Voltage - 115 volts

Frequency - 50/60 cycles

Wattage - 105 watts

Overall Dimensions --

Cabinet Model - 18-3/4" wide x 8-5/8" high x 11-3/4" deep
Rack Model - 19" wide x 8-3/4" high x 11-3/4" deep
Panel - 19" wide x 8-3/4" high
Depth behind panel - 10-1/2"

Weight --

Cabinet Model - 29 pounds
Rack Model - 29 pounds

Operating Instructions

Inspection --

This instrument has been thoroughly tested and inspected before being shipped and is ready for use when received.

After the instrument is unpacked, the instrument should be carefully inspected for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" page at the back of this instruction book.

Controls and Terminals --

OFF-ON - This rotary switch, which is located in the lower left corner of the control panel, controls the power supplied to the instrument from the power line.

FREQ. RANGE - This rotary switch inserts various values of resistance in the frequency determining circuit of the oscillator. The position of this switch indicates the multiplying factor for the frequency dial calibration.

Frequency Dial - This dial, located in the middle of the control panel, is calibrated directly in cycles per second for the lowest frequency range of the oscillator. The dial and tuning capacitor are driven by the knob just below the dial escutcheon.

AMPLITUDE - This variable resistor controls the amplitude of the oscillator voltage admitted to the amplifier and therefore the output voltage of the instrument. This control is calibrated from "0" to "100" in arbitrary units.

ATTENUATION - The "T" pad type attenuator is used to reduce the output of the oscillator to any desired level without changing the ratio between the hum voltage and sine wave voltage. The attenuator is continuously variable with the calibration marks every five and ten db from 0 to 40 db.

FUSE - The fuseholder, located on the back of the chassis, contains a 1.5 ampere cartridge fuse. The fuse may be replaced by unscrewing the fuseholder cap and inserting a new fuse. For 230V operation use a .75 ampere fuse.

Power Cable - The power cable consists of three conductors. Two of these conductors carry power to the instrument while the third conductor (green wire) is connected to the instrument chassis. The third wire projects from the cable near the plug end of the cable and may be connected to a ground when it is desirable to have a grounded chassis.

Output Terminals - The two binding posts, in the lower right corner of the control panel, are the output terminals for the oscillator. The binding post marked "G" is connected to the chassis of the instrument as well as to the output transformer.

Operation --

The procedure for operating the Model 201B Audio Oscillator is as follows:

1. Connect the instrument power cable to a 115V power line and the output terminals to the equipment being tested.

2. Turn the power switch to ON and allow about five minutes (thirty minutes or more for extreme accuracy) for the instrument to reach operating temperature. Set the FREQ. RANGE control and the frequency dial so that their indications when multiplied together, equal the desired frequency. For example: RANGE control set at "x100" times the frequency dial setting of "20" = 2000 cycles/sec.

3. Set the ATTENUATOR control to zero and the AMPLITUDE control for the desired output voltage. After the output voltage has been set with the AMPLITUDE control, the ATTENUATOR control may be used to reduce the output voltage to any desired value.

The Model 201B should be operated with its rated load for best results. The attenuator is calibrated for a 600 ohms load. The oscillator may be operated with loads other than 600 ohms without damage to the instrument. Any load of less than 600 ohms will cause an increase in distortion while loads of greater than 600 ohms will result in less power output.

To avoid excessive hum voltages at low output levels, the AMPLITUDE control should be set so that the oscillator delivers rated output with zero attenuation. Then the ATTENUATOR control is set so that the desired output level is obtained.

Circuit Description

The circuit of the Model 201B consists of an oscillator section, an amplifier section, and a regulated power supply.

The oscillator section includes V1 and V2, and is basically a two-stage resistance-coupled amplifier over which both positive and negative feedback are applied. The positive feedback network is a frequency-selective resistance-capacitance combination which is used to control the frequency of oscillation. Negative feedback is used to stabilize the operation of the circuit. The magnitude of the negative feedback is determined by a resistance network which contains a non-linear element in the form of a 3-watt incandescent lamp. This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the proper operating point for the system.

The amplifier section is a conventional audio power amplifier with a push-pull output stage. Negative feedback is used in this circuit to minimize distortion and to provide a uniform frequency response over the entire range of the instrument. The amplifier output transformer feeds a 600-ohm T-pad attenuator, which has a range from zero to infinity; practically, however, the attenuator is usable to 40 db.

The power supply includes a conventional full-wave rectifier and a voltage-regulating circuit.

Maintenance

Cover and Bottom Plate Removal --

The cover is removed by unscrewing the eight screws which fasten the cover to the top and back of the instrument.

The bottom plate is removed by unscrewing the four screws, one in each corner of the bottom plate, which fasten the plate to the chassis.

Tube Replacement --

When replacing any of the tubes except the power rectifier, it is desirable to measure the distortion in the output if maximum performance of the instrument is desired, because a poor tube can cause excessive distortion without seemingly affecting the operation.

Distortion --

Excessive distortion in the output voltage of the oscillator may be caused by leaking coupling capacitor, defective tubes, or open by-pass capacitors.

Frequency Standardization --

The frequency calibration of one or all ranges may be checked against a frequency standard by means of an oscilloscope. The procedure is as follows:

1. Allow the oscillator to warm up for 30 minutes. Connect the oscillator output to the vertical plates of an oscilloscope and the frequency standard to the horizontal plates.

2. Set the frequency dial and adjust the oscillator frequency adjustments as shown in the following table.

<u>Range</u>	<u>Frequency Dial Setting</u>	<u>Adjustment Control</u>
x1	100	R7
x10	100	R8 See Figure 2
x100	100	R9

The proper Lissajous figure on the oscilloscope will indicate when the oscillator is adjusted to the same frequency as the standard. The variable resistors for frequency adjustment have shafts slotted to fit a screwdriver. These adjustments are reached through access holes in the bottom plate. The range adjusted by each control is stamped next to the variable resistor.

Lubrication of Tuning Capacitor Drive Assembly --

The tuning capacitor drive assembly should be oiled once a month if the instrument is in constant use, otherwise once every six months.

The vernier drive shaft bearing should have one drop of oil put on each end of the bearing.

The idler pulley should have a drop of oil and the spring loaded take-up pulley should have a drop of oil at each end of the pulley.

A satisfactory lubricant for the tuning capacitor drive is Lubriplate #2, manufactured by the Fiske Brothers Refining Co., Newark, New Jersey.

Power Transformer Primary Connections --

The Model 201B power transformer is connected for 115 volts operation when the instrument leaves the factory. Refer to the "Trans. Detail" on the schematic diagram for the correct connections for 230 volt operation.

Voltage Regulator Circuit Adjustment --

When a tube (V6, V7 or V8) has been replaced in the voltage regulator circuit, the direct current voltage between the junction of R32, R35 and the chassis should be measured. If this voltage is not 240 volts, variable resistor R33 should be adjusted to bring the regulated voltage back to 240 volts. The regulated voltage should also be checked to see that it remains at 240 volts when the power supply voltage is varied from 105 to 125 volts. If the regulated voltage does not hold constant, replacement of one or all of the tubes in the voltage regulator circuit will usually be the remedy.

Hum Balance Adjustment R37 --

This variable resistor is used to minimize the beat between the oscillator and the power supply frequency. This variable resistor, which is located as shown in Fig. 2, is adjusted for minimum beat between the oscillator and power supply frequency. The oscillator should be tuned to the power supply frequency.

Output Stage Distortion Adjustment R42 --

This variable resistor, which is located as shown in Fig. 2, is adjusted for minimum distortion at 30 cycles/sec. When either or both of the output tubes (V4, V5) are replaced, this adjustment should be checked.

Replacement of Lamp R10 --

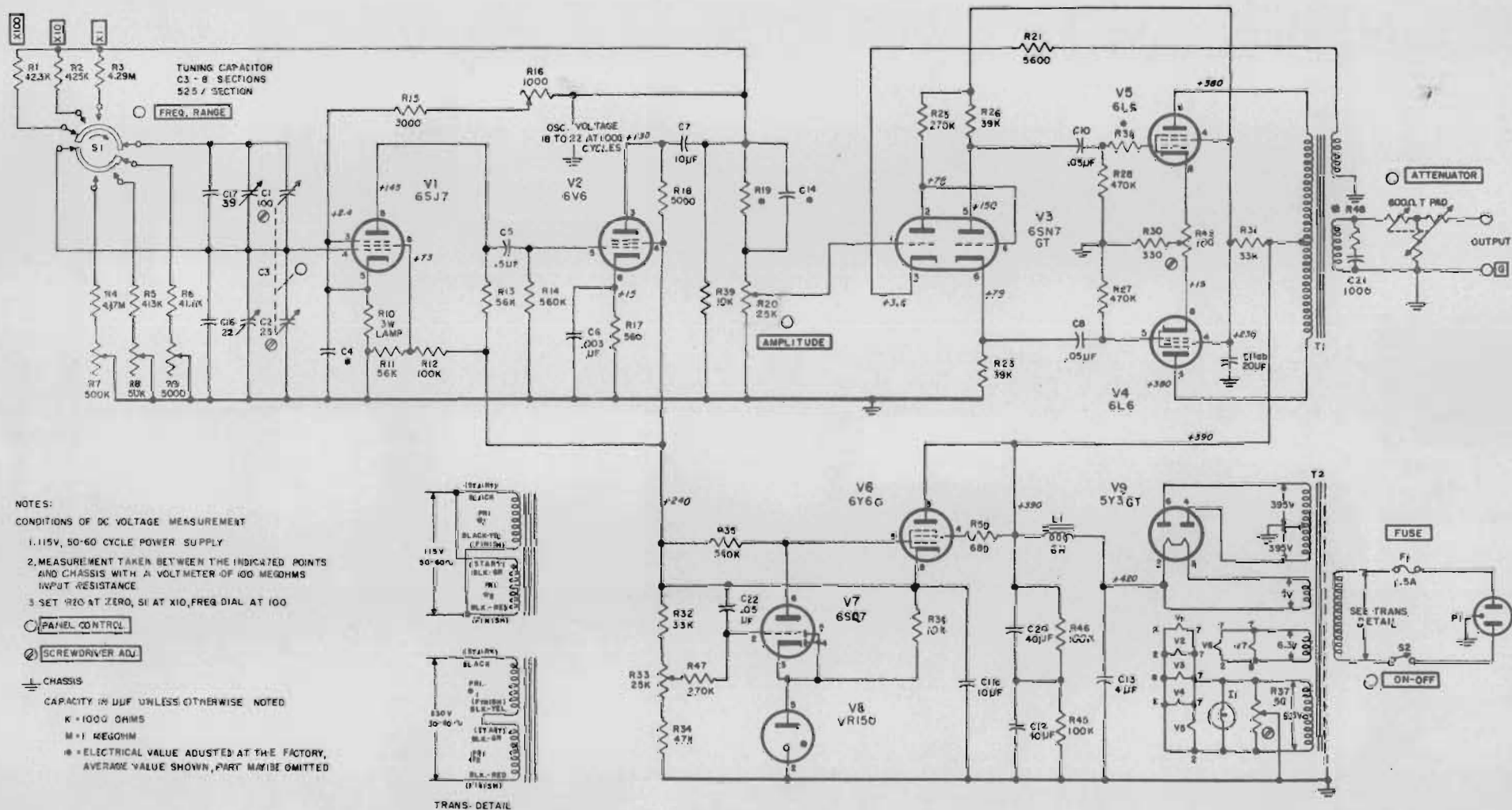
The 3-watt lamp R10 is operated at a very low level and should have an almost infinite life. Therefore, the lamp should not be changed indiscriminately. However, should the lamp require changing, it is necessary to check the ac voltage from the junction of R16 and C7 to the chassis with the new lamp in the circuit. As measured with a high-impedance ac vacuum tube voltmeter, this voltage should be within the range of approximately 18-22 volts when the Model 201B is tuned to 1000 cps. If the voltage is not within this range, it may be corrected by adjusting R16.

If the voltage cannot be brought within the range from 18-22 volts by means of R16, the new lamp should be rejected in favor of another.

Trouble Shooting -

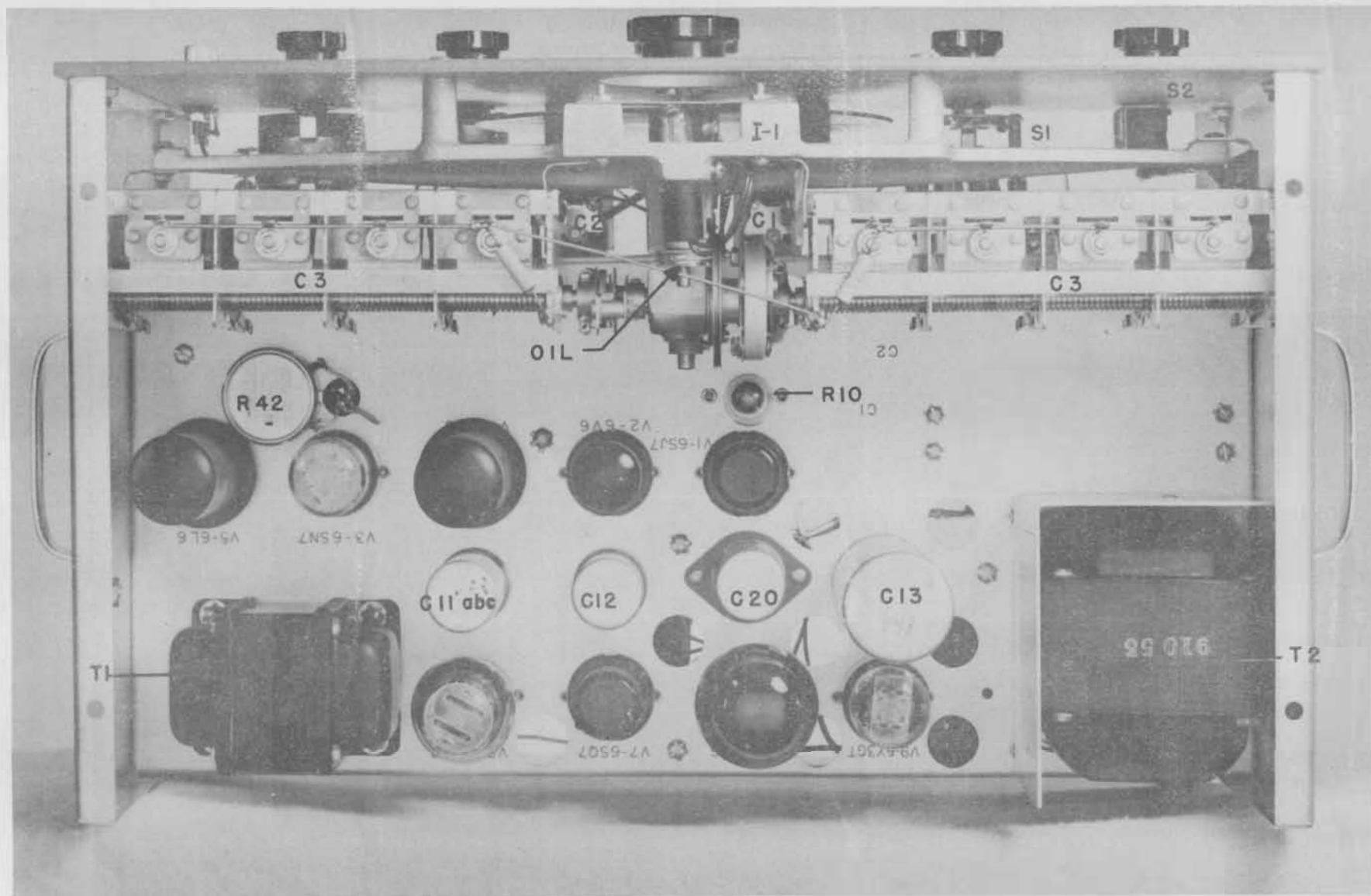
The following is a listing of possible symptoms, causes and remedies.

<u>Symptoms</u>	<u>Causes</u>	<u>Remedies</u>
Instrument inoperative (Indicator lamp won't light, no audio output)	Blown fuse	Clear short circuit and replace fuse
Instrument inoperative (Indicator lamp lights, no audio output)	Defective tube Check the 5Y3GT tube first	Replace tube (See "Tube Replacement" in Maintenance section)
	Short circuit in DC power circuit capa- citor (C12, C13, C20 or C11 abc)	Replace capacitor
Intermittent Output	Capacitors C5, C7, C8 or C10 inter- mittently open	Replace capacitor

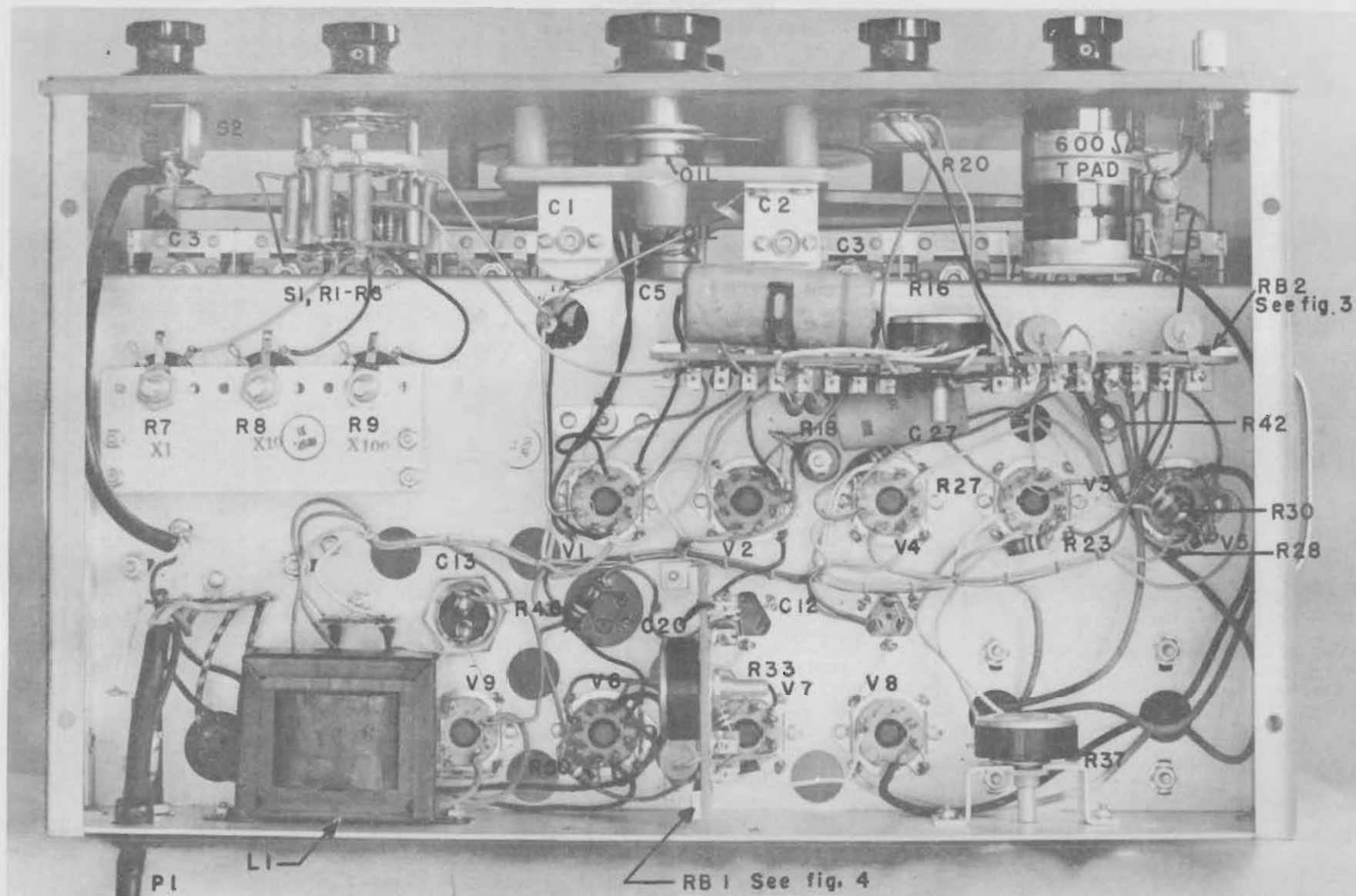


NOTES:
 CONDITIONS OF DC VOLTAGE MEASUREMENT
 1. 115V, 50-60 CYCLE POWER SUPPLY
 2. MEASUREMENT TAKEN BETWEEN THE INDICATED POINTS AND CHASSIS WITH A VOLT-METER OF 100 MEGOHMS INPUT RESISTANCE
 3. SET R20 AT ZERO, S1 AT X10, FREQ DIAL AT 100
 PANEL CONTROL
 SCREWDRIVER ADJ.
 CHASSIS
 CAPACITY IN DUF UNLESS OTHERWISE NOTED
 K = 1000 OHMS
 M = 1 MEGOHM
 * = ELECTRICAL VALUE ADJUSTED AT THE FACTORY, AVERAGE VALUE SHOWN, PART MAY BE OMITTED

SCHEMATIC DIAGRAM OF MODEL 201B
 SERIAL 618 TO



Model 201B Top View
Cover Removed



Model 201B Bottom View
Bottom Plate Removed

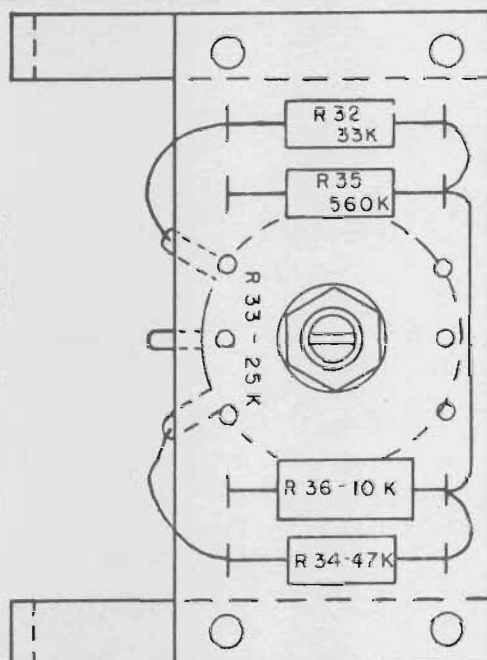


FIGURE 4

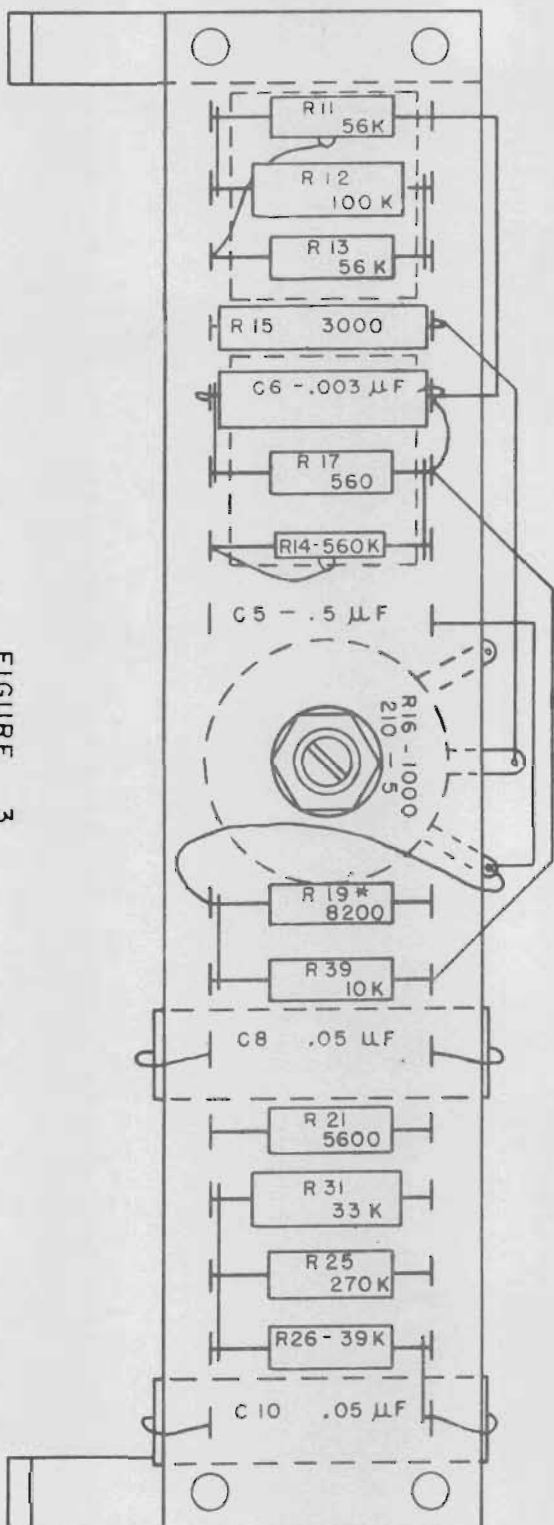


FIGURE 3

INSTRUCTIONS FOR RECTIFIER TUBE REPLACEMENT

These instructions apply to any Hewlett-Packard instrument in which a 5V4 tube is mounted in the power rectifier tube socket. When it is necessary to replace the rectifier tube, a 5Y3GT tube may be used as a replacement if the following instructions are followed.

INSTRUMENTS WITH DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube without any circuit changes. After the 5Y3GT tube has been installed, the regulated voltage should be measured to see if it agrees with the voltage shown on the schematic wiring diagram in the instruction book. If the regulated voltage is incorrect, it may be corrected by following the instructions in the instruction book.

INSTRUMENTS WITHOUT DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube providing the resistor, in series with the DC output of the rectifier, is removed. This resistor does not appear in the schematic wiring diagram in the instruction book. The following instruments use a 500 ohms series resistor: Models 200C, 200D, 202D, 210A, 300BCD, and the 400A.

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
R1-R6	Part of Range Switch Assembly		
R7	Resistor: variable, composition, 500,000 ohms, linear taper	210-20	G 33-010-255
R8	Resistor: variable, composition, 50,000 ohms, linear taper	210-18	G 33-010-176
R9	Resistor: variable, composition, 5000 ohms, linear taper	210-15	G 33-010-256
R10	Lamp: 3W	211-4	O
R11	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$, 1 W	24-56K	B GB 5631
R12	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$, 2 W	25-100K	B HB 1041
R13	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$, 1 W	24-56K	B GB 5631
R14	Resistor: fixed, composition, 560 ohms, $\pm 10\%$, 1/2 W	23-560	B EB 5611
R15	Resistor: fixed, wirewound, 3000 ohms, $\pm 10\%$, 1 W	26-3000	R Type BW
R16	Resistor: variable, wirewound, 1000 ohms, linear taper	210-5	G 21-010-355
R17	Resistor: fixed, composition, 560 ohms, $\pm 10\%$, 1/2 W	23-560	B EB 5611
R18	Resistor: fixed, wirewound, 5000 ohms, $\pm 10\%$, 20 W	27-3	S Type 2R
R19	Resistor: Factory Adjustment		
R20	Resistor: variable, composition, 25,000 ohms, linear taper	210-54	B JU 2531
R21	Resistor: fixed, composition, 5600 ohms, $\pm 10\%$, 1 W	24-5600	B GB 5621

*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
R22	This circuit reference not assigned		
R23	Resistor: fixed, composition, 39,000 ohms, $\pm 5\%$, 1 W	24-76	B GB 3935
R24	This circuit reference not assigned		
R25	Resistor: fixed, composition, 270,000 ohms, $\pm 10\%$, 1 W	24-270K	B GB 2741
R26	Resistor: fixed, composition, 39,000 ohms, $\pm 5\%$, 1 W	24-76	B GB 3935
R27	Resistor: fixed, composition, 470,000 ohms, $\pm 10\%$, 1 W	24-470K	B GB 4741
R28	Resistor: fixed, composition, 470,000 ohms, $\pm 10\%$, 1 W	24-470K	B GB 4741
R29	This circuit reference not assigned		
R30	Resistor: fixed, composition, 330 ohms, $\pm 10\%$, 2 W	25-330	B HB 3311
R31	Resistor: fixed, composition, 33,000 ohms, $\pm 10\%$, 2 W	25-33K	B HB 3331
R32	Resistor: fixed, composition, 33,000 ohms, $\pm 10\%$, 1 W	24-33K	B GB 3331
R33	Resistor: variable, composition, 25,000 ohms, linear taper	210-11	G BAI-010-1990
R34	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$, 1 W	24-47K	B GB 4731
R35	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$, 1 W	24-560K	B GB 5641
R36	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$, 2 W	25-10K	B HB 1031
R37	Resistor: variable, wirewound, 50 ohms, linear taper	210-2	G 21-010-067
R38	Resistor: factory adjustment		

*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
R39	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$, 1 W	24-10K	B GB 1031
R40, R41	This circuit reference not assigned		
R42	Resistor: variable, wirewound, 100 ohms, linear taper	210-4	G 21-010-354
R43, R44	These circuit reference not assigned		
R45	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$, 1 W	24-100K	B GB 1041
R46	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$, 1 W	24-100K	B GB 1041
R47	Resistor: fixed, composition, 270,000 ohms, $\pm 10\%$, 1 W	24-270K	B GB 2741
R48	Resistor: Factory adjustment		
R49	This circuit reference not assigned		
R50	Resistor: fixed, composition, 630 ohms, $\pm 10\%$, 1 W	24-680	B GB 6811
	Attenuator: 600 ohms, T pad	210-1	I, PTCM-1739
C1	Capacitor: variable, air, 100 μf	12-11	AA, A-103L
C2	Capacitor: variable, air, 25 μf	12-10	AA, 0-25L
C3	Capacitor: Part of Tuning Capacitor and Drive Assembly		
C4	Capacitor: Factory Adjustment		
C5	Capacitor: fixed, paper, .5 μf , -10% +20%, 600 vdcw	16-5	A Type 684
C6	Capacitor: fixed, paper, .003 μf , -25% +50%, 600 vdcw	16-23	A Type 684
C7	Capacitor: fixed, electrolytic, 10 μf , 450 vdcw	18-10	X WB 72

*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
C8	Capacitor: fixed, paper .05 μ f, -10%, +30%, 600 vdcw	16-15	A Type P688
C9	This circuit reference not assigned		
C10	Capacitor: fixed, paper, .05 μ f, -10%, +30%, 600 vdcw	16-15	A Type P688
C11 abc	Capacitor: fixed, electrolytic, 10, 10, 10 μ f, 450 vdcw	18-31	X FPT-389
C12	Capacitor: fixed, electrolytic, 40 μ f, 450 vdcw	18-40	X FPS-146
C13	Capacitor: fixed, paper 4 μ f, \pm 10%, 600 vdcw	17-10	J TLA6040
C14	Capacitor: Factory adjustment		
C15	This circuit reference not assigned		
C16	Capacitor: fixed, silver mica, 22 μ f, \pm 5%, 500 vdcw	15-2	K CI-2
C17	Capacitor: fixed, silver mica, 39 μ f, \pm 5%, 500 vdcw	15-4	K CI-3
C18, C19	This circuit reference not assigned		
C20	Capacitor: fixed, electrolytic, 40 μ f, 450 vdcw	18-40	X FPS-146
C21	Capacitor: fixed, paper, 1000 μ f, -20%, +80%, 600 vdcw	16-21	A Type 684
C22	Capacitor: fixed, paper, .05 μ f, -10%, +30%, 600 vdcw	16-15	A Type P688
F1	Fuse: 1.5A, 3 AG	211-15	E, MDL 1.6
	Binding Post:	312-3	HP
	Fuseholder:	312-8	T, 342001
I1	Lamp:	211-47	O, #47

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*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
	Lampholder: for 3 watt lamp	38-39	HP
L1	Reactor: 6 H @ 125 MA, 240 ohms	911-12	HP
S1, R1-R6	Range Switch Assembly:	2B-19W	HP
S2	Switch: rotary	310-1	D. 81715
	Panel Plate:	2B-43	HP
T1	Transformer: Output	912-6	HP
T2	Transformer: Power	910-55	HP
	Power Cable:	812-56	HP
	Knob: 1-5/8" diam.	37-12	HP
	Knob: 1-1/2" diam.	37-11	HP
	Knob: 2" diam.	37-13	HP
	Tuning Capacitor and Drive Assembly:	I-100	HP
	Escutcheon:	G-99A	HP
V1	Tube: 6SJ7	212-6SJ7	ZZ
V2	Tube: 6V6	212-6V6	ZZ
V3	Tube: 6SN7GT	212-6SN7GT	ZZ
V4	Tube: 6L6	212-6L6	ZZ
V5	Tube: 6L6	212-6L6	ZZ
V6	Tube: 6Y6G	212-6Y6G	ZZ
V7	Tube: 6SQ7	212-6SQ7	ZZ
V8	Tube: VR150	212-VR150	ZZ
V9	Tube: 5Y3GT	212-5Y3GT	ZZ

*See "List of Manufacturers Code Letters For Replaceable Parts Table."

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

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.