# HEWLETT-PACKARD MODEL 400C VACUUM TUBE VOLTMETER
# DESCRIPTION

CONTENTS



## 1. GENERAL

1.01 This section is reissued to include information previously shown in Issue 1 of the addendum. It describes the Hewlett-Packard Model 400C Vacuum Tube Voltmeter. The information contained in this section is obtained from an instruction pamphlet issued by the manufacturer and is reproduced herein with the permission of the Hewlett-Packard Company.

1.02 This voltmeter is used in connection with tests on the Type N carrier telephone system and may be used for other types of testing when it meets the testing requirements as to frequency and voltage range, accuracy, etc.

1.03 The Model 400C vacuum tube voltmeter is portable and is operated on nominal 115 volt a-c supply. It is designed to cover a frequency range from 20 cycles to two megacycles per second. The instrument has a wide voltage range. In addition to its voltage scale, it has a db scale based on a zero reference of one milliwatt in 600 ohms, that is, 0 dbm. Output terminals are provided so that the amplifier can be used independently and provides approximately 50 db maximum gain for numerous applications requiring an amplifier with wide frequency response.

1.04 The information given in this section applies to vacuum tube voltmeters having serial numbers 1128 and above. Voltmeters with other serial numbers may differ in some respects but the general features covered herein should apply.

## 2. DESCRIPTION

### (A) Equipment Features

2.01 The face view of the vacuum tube voltmeter is shown in Fig. 1. The apparatus assembly is housed in a metal box, the approximate overall dimensions of which are 8 inches wide, 9-1/2 inches high and 10-3/4 inches deep. It weighs approximately 13-1/2 pounds.


Fig. 1 - Face View of Model 400C Vacuum Tube Voltmeter

2.02 The apparatus assembly may be removed from the cabinet by unscrewing four screws. Two of these screws are located on the back of the cabinet and the others are located, one on the right side and one on the left side of the cabinet. The screws on the front panel should not be removed when removing the assembly from the cabinet.

2.03 The toggle switch ON at the right of the panel controls the power supply to the apparatus. When the switch is in the ON position the red indicator below the switch will glow.

2.04 The rotary switch located below the meter connects the proper multiplier resistors into the circuit for the desired voltage range. The position of the switch indicates the meter scale and the full scale voltage of the range in use. The switch position also indicates the DB value associated with the DB or lower meter scale.

2.05 The two binding posts, located in the lower left corner of the front panel are connected to the input circuit of the voltmeter. The lower binding post is connected to the chassis.

2.06 The two binding posts to the right of the meter are the output terminals of the amplifier for use when the amplifier is to be operated independent of the indicating part of the voltmeter. The lower binding post is connected to the chassis.

2.07 The fuse holder, located on the back of the chassis, contains a 1.5 ampere cartridge fuse. The fuse may be replaced by unscrewing the fuse holder cap and inserting a new fuse of the same rating.

2.08 The power cable consists of three conductors. Two of these conductors carry power to the apparatus while the third conductor (green in color) is connected to the 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 desired to have a grounded chassis.

2.09 The power supply rating is as follows:

Voltage - 105 to 125 volts a-c.

Frequency - 50 to 60 cycles.

Wattage - 45 watts.

(B) Circuit Description

2.10 The circuit of the vacuum tube voltmeter includes an input voltage divider, a stabilized amplifier, a rectifier and meter circuit and a power supply. The detailed circuit is shown on Fig. 2 attached.

2.11 The input voltage divider consists of a compensated resistance divider feeding into a cathode follower with a tapped wire-wound resistor in its cathode circuit. This resistor serves as the multiplier on all of the ranges, although on the higher ranges the input voltage is divided by a factor of one thousand before being applied to the grid of the cathode follower.

2.12 The input circuit is followed by the amplifier including tubes V2, V3, V4 and V5. This amplifier has a uniform response over the wide range from 20 cycles to 2 megacycles per second. This wide response is achieved through the use of a novel circuit arrangement wherein the tubes are effectively operated as triodes with a high load impedance at low frequencies and as pentodes with a low load impedance at high frequencies. This effect is obtained by the use of special value screen grid by-pass capacitors and a split plate load resistor. At low frequencies the by-passing of the screen grids is not effective so that the tubes operate as triodes with a load impedance consisting of a 5600-ohm and an 8200-ohm resistor in series. At high frequencies, however, the by-passing of the screen is effective so that the tubes operate as pentodes with a load impedance consisting only of the 5600-ohm resistor. In addition the cathode resistors of the tubes are not by-passed at low frequencies so that cathode degeneration is obtained. This system gives a uniform response which is further stabilized by the use of a negative feed-back loop extending over the complete four-tube amplifier. This feed-back loop has been carefully designed so that oscillation of the amplifier should not occur under normal operating conditions.

2.13 The amplifier feeds a full-wave rectifier circuit with a meter connected to indicate the output level of the amplifier. The meter is calibrated in the rms value of a sine wave. The meter circuit is returned to ground through the cathode circuit of the first tube of the amplifier, constituting the over-all negative feed-back loop previously described.

2.14 The power supply includes a conventional full-wave rectifier and a degenerative type voltage regulator to maintain the plate voltage supply constant over a wide range of

line voltage changes. In addition, extensive filtering is used throughout the circuit to prevent feed-back through common power supply impedances.

## 3. PERFORMANCE

3.01 The full-scale voltage range is from .001 to 300 volts in twelve ranges as indicated by the designation of the range switch as shown on Fig. 1. The db range for the 0 db point on the meter is from -60 to +50 db in twelve ranges as indicated on Fig. 1.

3.02 The frequency range is 20 cycles to 2 megacycles per second and the accuracy is as follows:

(a) ± 3 per cent. of full-scale reading on all ranges from 20 cycles to 100 kc.

(b) ± 5 per cent. of full-scale reading on all ranges from 100 kc to 2 megacycles.

3.03 The meter calibration is as follows:

(a) Meter calibrated to rms value of a sine wave.

(b) Linear voltage scales 0-1 volt and 0-3 volts.

(c) Voltage ranges related by 10 db steps.

(d) Db scale calibration -12 to +2 db.

(e) Zero level - 1 milliwatt in 600 ohms - 0 dbm.

3.04 The input impedance is equivalent to 10 megohms shunted by 15 mmf for the 1 volt to 300 volt range. For the range .001 volt to 0.3 volt, the input impedance is equivalent to 10 megohms shunted by 24 mmf.

3.05 The amplifier circuit rating is as follows:

(1) Maximum open circuit output voltage - 0.5 volts.

(2) Open circuit internal output impedance - 1000 ohms.

(3) Maximum gain (.001 volt range) - 50 db.

3.06 The meter should not be damaged by occasional overloads of 100 times normal.

## 4. OPERATING PROCEDURE

### (A) General Considerations

4.01 The 400C vacuum tube voltmeter should be ready for use when received, provided the tubes are firmly seated in their sockets and the set has not received damage in transit. See Paragraph 2.02 for removing the apparatus from the cabinet for inspection.

4.02 The meter pointer may not indicate zero before power is turned on. After power is turned on, the meter pointer may show an indication of as much as two scale divisions, principally on the one volt range. These effects are normal and do not impair the accuracy of the set.

4.03 The following caution should be observed with respect to the maximum applied voltage.

Caution: The maximum voltage applied to the input terminals must not exceed 425 volts d-c or 425 a-c peak volts. Higher voltages will break down the capacitors in the input system of the test set.

4.04 On the lowest three ranges of the voltmeter, the high input impedance coupled with the gain of the amplifier may cause the meter needle to be forced against the right-hand stop of the meter when the input is not shielded. This condition is normal and is caused by stray voltages in the vicinity of the voltmeter.

4.05 If measurements are being made on a high impedance source, pick-up can affect the meter reading owing to the high impedance of both the source and voltmeter itself. Shielded leads will reduce pick-up although they will cause an increase in the capacity shunted across the source to be measured with possible consequent circuit loading.

4.06 Preliminary Procedure.

(1) Connect the power cord to the 115 volt a-c supply and turn the toggle switch to ON position.

(2) Allow about five minutes for the test set to reach a stable operating condition before making tests.

(B) Voltage Measurements

4.07 Procedure.

(1) Set the range switch to the desired voltage range and connect the input terminals at the lower left of the panel to the voltage source to be measured.

(2) With the toggle switch operated to ON position (Paragraph 4.06) read the meter on the proper scale as indicated below.

| Switch Position Full Scale Volts | Read on Scale 0-1 | 0-3 |
|---|---|---|
| .001 | X | |
| .003 | | X |
| .01 | X | |
| .03 | | X |
| .1 | X | |
| .3 | | X |
| 1. | X | |
| 3. | | X |
| 10. | X | |
| 30. | | X |
| 100. | X | |
| 300. | | X |

C) Db Measurements

.08 Procedure.

(1) Set the range switch to the desired db range and connect the input terminals at the lower left of the panel to the terminals to be measured. The measurement will be in dbm only when made across 600 ohms resistance.

(2) With the toggle switch operated to ON position (Paragraph 4.06) read the meter on the db scale. The value shown by the range switch position should be added algebraically to the meter reading. A minus reading on the meter indicates that the measured level is lower than the value indicated by the switch and likewise a plus meter reading indicates a higher value. For example assume a switch position of -30 db and a meter reading of +1, the corrected value is -29 db.

(3) The difference between two voltages measured in db will indicate transmission gain or loss directly, provided each measurement is made across the same value of impedance.

(D) Independent Use of Amplifier

4.09 The amplifier portion of the voltmeter may be used as an independent amplifying device under certain conditions. The amplifier is between the voltmeter input terminals at the lower left of the panel and the output terminals at the right of the meter. The range switch serves as a stepped gain control.

4.10 Procedure.

(1) Set the range switch to the .001 volt position and operate the toggle switch to ON position (Paragraph 4.06).

(2) Connect the input terminals to the voltage source to be amplified and the output terminals to the device to be supplied by the amplifier. To obtain optimum amplifier gain and minimum distortion, the load impedance across the output of the amplifier should be at least 10,000 ohms.

(3) Under the above conditions of Items (1) and (2), one millivolt is the maximum voltage which can be applied to the amplifier. The maximum voltage obtainable at the output terminals is .3 volt.

(4) Higher voltages than one millivolt can be applied to the input of the amplifier provided the range switch is set for a full-scale voltage equal to or greater than the applied voltage. The gain of the amplifier goes down by 10 db for each step that the range switch is advanced toward the high voltage end. At the .3 volt position, the amplifier has unity gain and at higher voltage range switch positions the gain is less than unity.

5. MAINTENANCE

(A) Filament Voltage Adjustment

5.01 The filament voltage of tubes V1, V2 and V3 should be measured periodically as the service experience with the voltmeter may indicate to be necessary.

5.02 Procedure.

(1) Measure the voltage of terminals 3 and 4 of the V3 tube socket. Also measure the a-c line voltage supply.

(2) Adjust the variable resistor R35 so that the filament voltage is 6.3 volts when the line voltage is 115 volts.

(3) Resistor R36 may be removed from the circuit if the range of R35 is not sufficient which may be the case after the V3 tube has aged due to prolonged usage.

(B) Tube Replacement

5.03 The electron tubes may be tested in the KS-5727-L1 Hickok Tube Tester or equivalent in accordance with the information covering the test set, for example, 100-630-101.

5.04 When replacing tubes V1 and V2, select tubes which have low residual noise and microphonics. Type 6AK5 tubes with $G_m$ of 4200 to 5500 micromhos should give the best performance in the amplifier. Tubes with an excessively high $G_m$ may cause the amplifier to oscillate, while those with too low $G_m$ will cause poor voltage and frequency response and reduce the gain of the amplifier.

(C) Meter Zero Adjustment

5.05 Since adequate testing apparatus is not generally available for checking the tracking of the meter, the zero indication adjustment screw on the meter should not be changed. See Paragraph 4.02 for zero indication.

5.06 If suitable testing apparatus is available for checking the tracking of the meter by a comparison with that of another reliable voltmeter, the adjustment of the meter zero indication is given in Paragraph 5.07. The calibration error at 1 milliwatt may be determined as given below but the zero should not be adjusted unless the tracking can be checked.

(1) Use any 600-ohm thermocouple set such as the 2A Thermo-Milliammeter or equivalent. If the 30A Transmission Measuring Set is used the 135:600-ohm impedance matching transformer must be used and allowance made for the coil loss. If a 600-ohm thermocouple set is not available to calibrate the output of the 1000-cycle milliwatt supply, the output may be assumed to be 0 dbm. However, the accuracy of the calibration of the 400C voltmeter will be impaired due to any deviation of the milliwatt supply from 0 dbm output.

(2) Calibrate the 600-ohm thermocouple set. Measure the output of the milliwatt supply and note the error from 0 dbm.

(3) Connect the 400C vacuum tube voltmeter in parallel with the 600-ohm thermocouple set to the 1000-cycle milliwatt supply and observe the voltmeter reading. The difference between the thermocouple reading in (2) and the voltmeter reading is the calibration error of the 400C voltmeter at the 1000-cycle 0 dbm point.

Caution: Be sure that the voltmeter is not grounded.

(4) If a 600-ohm thermocouple set is not available, connect the 400C voltmeter, with a 600-ohm resistance across its terminals, to the 1000-cycle milliwatt supply. See Caution under (3) above. The difference between the voltmeter reading and 0 dbm is the calibration error of the 400C voltmeter at the 1000-cycle 0 dbm point assuming that the output of the milliwatt supply is 0 dbm.

5.07 Procedure.

(1) Set the range switch to 300 volts and short-circuit the input terminals.

(2) Note the meter indication with no a-c power supply to the voltmeter.

(3) Operate the toggle switch to ON position and when set has reached stable operation, note meter indication.

(4) Set the meter pointer by means of the zero adjustment screw to that point between the indications of Items (2) and (3) where the most accurate meter scale tracking is obtained by checking with a reliable voltmeter in a comparison circuit.

(D) Replacement Parts

5.08 A list of replaceable parts is given in Table I attached. The circuit references relate to the various resistors, capacitors, tubes, etc., as they appear on Fig. 2 attached. The Hewlett-Packard Company stock number as well as the manufacturer's designation is given. The abbreviation "vdcw" used in the table in connection with capacitors refers to "voltage d-c working."

TABLE I

REPLACEABLE PARTS

| Circuit Ref. | Description | Hewlett-Packard Stock No. | Mfr. & Mfrs. Designation |
|---|---|---|---|
| C1 | Capacitor: fixed, paper, .01 mf; 600 vdcw | 16-11 | Aerovox Type P688 |
| C2 | Capacitor: fixed, mica, 5000 mmf; ± 10% 300 vdcw | 14-14 | Micamold Type W |
| C3 | Capacitor: variable, ceramic, 2.5 - 9.5 mmf; 500 vdcw | 13-7 | Erie Resis. Corp. TS2A-NP0 |
| C4 | Capacitor: fixed, 1.5 mmf; 500 vdcw | 15-38 | Stackpole Carbon Co. GA-3 |
| C5 | Capacitor: fixed, paper, .2 mf; 200 vdcw | 16-36 | Sprague Elect. Co. #68P |
| C6 abcd | Capacitor: fixed, electrolytic, 20,20,20,20 mf; 450 vdcw | 18-42 | PR Mallory FPQ-444 |
| C7 | Capacitor: fixed, mica, 1000 mmf; ± 10% 500 vdcw | 14-11 | Micamold Type W |
| C8 | Capacitor: fixed, mica, 400 mmf; ± 10% 500 vdcw | 14-400 | Micamold Type OXM |
| C9 | Capacitor: fixed, mica, 50 mmf; ± 10% 500 vdcw | 14-50 | Micamold Type OXM |
| C10 | Capacitor: fixed, paper, .22 mf; 400 vdcw | 16-48 | Aerovox Type P488 |
| C11 | Capacitor: fixed, mica, 1000 mmf; ± 10% 500 vdcw | 14-11 | Micamold Type W |
| C12 | Capacitor: fixed, mica, 400 mmf; ± 10% 500 vdcw | 14-400 | Micamold Type OXM |
| C13 | Capacitor: fixed, electrolytic, 50 mf; 50 vdcw | 18-50 | PR Mallory TC-39 |
| C14 | Capacitor: fixed, paper, .22 mf; 400 vdcw | 16-48 | Aerovox #P488 |
| C15 | Capacitor: fixed, mica, 1000 mmf; 500 vdcw | 14-11 | Micamold Type W |
| C16 | Capacitor: fixed, mica, 400 mmf; ± 10% 500 vdcw | 14-400 | Micamold Type OXM |
| C17 | Capacitor: fixed, paper, 1 mf; 400 vdcw | 16-44 | Sprague #88P1054 |
| C18 | Capacitor: fixed, paper, .22 mf; 400 vdcw | 16-48 | Aerovox #P488 |
| C19 | Capacitor: fixed, mica, 1000 mmf; ± 10% 500 vdcw | 14-11 | Micamold Type W |
| C20 | Capacitor: fixed, mica, 1000 mmf; ± 10% 500 vdcw | 14-11 | Micamold Type W |
| C21 | Capacitor: fixed, paper, .2 mf; 200 vdcw | 16-36 | Sprague #68P |
| C22 | Capacitor: fixed, electrolytic, 2000 mf; 15 vdcw | 18-3 | PR Mallory WP 041 |
| C23 | Capacitor: fixed, paper, .05 mf; ± 10% 600 vdcw | 16-15 | Aerovox Type P688 |
| C24 ab | Capacitor: fixed, electrolytic, 10,10,10 mf; 450 vdcw | 18-31 | PR Mallory FPT-389 |
| C25 | Capacitor: fixed, electrolytic, 20 mf; 450 vdcw | 18-20 | PR Mallory FPS-144 |

TABLE I (Cont'd)

REPLACEABLE PARTS

| Circuit Ref. | Description | Hewlett-Packard Stock No. | Mfr. & Mfrs. Designation |
|---|---|---|---|
| R1 | Resistor: fixed, composition, 10.31 megohms; ± 1% 1W | 31-10.31M | Wilkor Resis Co. Type CP1 |
| R2 | Resistor: fixed, composition, 10,310 ohms; ± 1% 1W | 31-10.31K | Wilkor Type CP1 |
| R3 | Resistor: fixed, composition, 15,000 ohms; ± 10% 1/2W | 23-15K | AB EB 1531 |
| R4,R5,R6 R7,R8,R9 | Part of Range Switch Assembly: Replacement resistors only | 4C-71 | Hewlett-Packard |
| R10 | Resistor: fixed, composition, 560K ohms; ± 10% 1W | 24-560K | Allen-Bradley Co.(AB) GB 5641 |
| R11 | Resistor: fixed, composition, 100 ohms; ± 10% 1W | 24-100 | AB GB 1011 |
| R12 | Resistor: fixed, composition, 10,000 ohms; ± 10% 1W | 24-10K | AB GB 1031 |
| R13 | Resistor: fixed, composition, 8200 ohms; ± 10% 2W | 25-8200 | AB HB 8221 |
| R14 | Resistor: fixed, composition, 5600 ohms; ± 5% 1W | 24-85 | AB GB 5625 |
| R15 abc | Resistor: fixed, wirewound, 8300, 8 ohms; | 4C-26 | Hewlett-Packard |
| R16 | Resistor: fixed, composition, 560,000 ohms; ± 10% 1W | 24-560K | AB GB 5641 |
| R17 | Resistor: fixed, composition, 100 ohms; ± 10% 1W | 24-100 | AB GB 1011 |
| R18 | Resistor: fixed, composition, 4700 ohms; ± 10% 2W | 25-4700 | AB HB 4721 |
| R19 | Resistor: fixed, composition, 8200 ohms; ± 10% 2W | 25-8200 | AB HB 8221 |
| R20 | Resistor: fixed, composition, 5600 ohms; ± 5% 1W | 24-85 | AB GB 5625 |
| R21 | Resistor: fixed, composition, 180 ohms; ± 10% 1W | 24-180 | AB GB 1811 |
| R22 | Resistor: fixed, composition, 180 ohms; ± 10% 1W | 24-180 | AB GB 1811 |
| R23 | Resistor: fixed, composition, 560K ohms; ± 10% 1W | 24-560K | AB GB 5641 |
| R24 | Resistor: fixed, composition, 2200 ohms; ± 10% 2W | 25-2200 | AB HB 2221 |
| R25 | Resistor: fixed, composition, 100 ohms; ± 10% 1W | 24-100 | AB GB 1011 |
| R26 | Resistor: fixed, composition, 8200 ohms; ± 10% 2W | 25-8200 | AB HB 8221 |
| R27 | Resistor: fixed, composition, 5600 ohms; ± 5% 1W | 24-85 | AB GB 5625 |
| R28 | Resistor: fixed, composition, 560K ohms; ± 10% 1W | 24-560K | AB GB 5641 |
| R29 | Resistor: fixed, composition, 150 ohms; ± 10% 1W | 24-150 | AB GB 1511 |
| R30 | Resistor: fixed, composition, 12,000 ohms; ± 10% 2W | 25-12K | AB HB 1231 |

TABLE I (Cont'd)

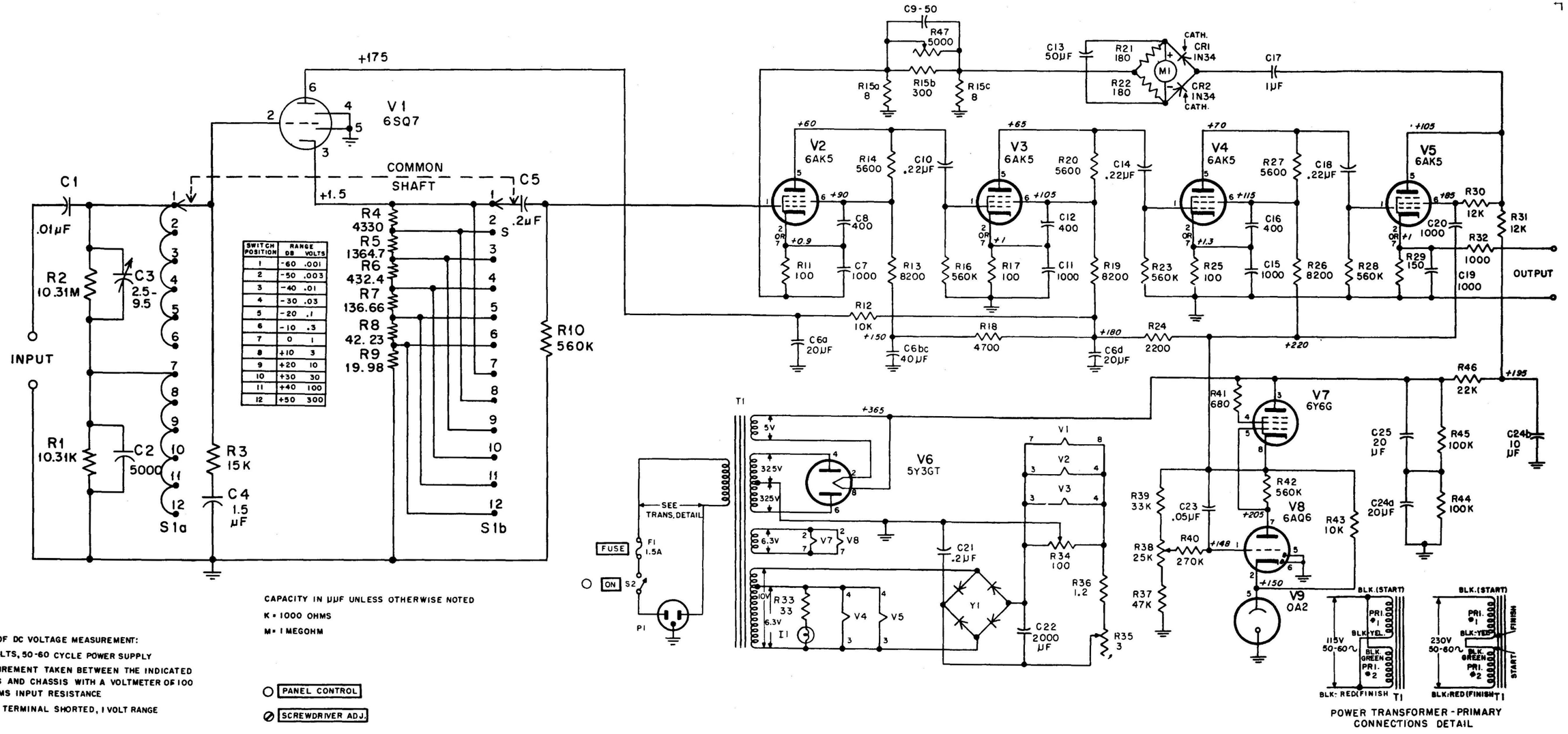
REPLACEABLE PARTS

| Circuit Ref. | Description | Hewlett-Packard Stock No. | Mfr. & Mfrs. Designation |
|---|---|---|---|
| R31 | Resistor: fixed, composition, 12,000 ohms; ± 10% 2W | 25-12K | AB HB 1231 |
| R32 | Resistor: fixed, composition, 1000 ohms; ± 10% 1W | 24-1000 | AB GB 1021 |
| R33 | Resistor: fixed, composition, 33 ohms; ± 10% 1W | 24-33 | AB GB 3301 |
| R34 | Resistor: variable, wirewound, 100 ohms; linear taper | 210-4 | Centralab 21-010-354 |
| R35 | Resistor: variable, wirewound, 3 ohms; linear taper | 210-3 | PR Mallory M3PX |
| R36 | Resistor: fixed, wirewound, 1.2 ohms | 26-21 | Clarostat Type FYG |
| R37 | Resistor: fixed, composition, 47,000 ohms; ± 10% 1W | 24-47K | AB GB 4731 |
| R38 | Resistor: variable, composition, 25,000 ohms; linear taper | 210-11 | Centralab BA1-010-1990 |
| R39 | Resistor: fixed, composition, 33,000 ohms; ± 10% 1W | 24-33K | AB GB 3331 |
| R40 | Resistor: fixed, composition, 270,000 ohms; ± 10% 1W | 24-270K | AB GB 2741 |
| R41 | Resistor: fixed, composition, 680 ohms; ± 10% 1/2W | 23-680 | AB EB 6811 |
| R42 | Resistor: fixed, composition, 560K ohms; ± 10% 1W | 24-560K | AB GB 5641 |
| R43 | Resistor: fixed, composition, 10,000 ohms; ± 10% 2W | 25-10K | AB HB 1031 |
| R44 | Resistor: fixed, composition, 100,000 ohms; ± 10% 1W | 24-100K | AB GB 1041 |
| R45 | Resistor: fixed, composition, 100,000 ohms; ± 10% 1W | 24-100K | AB GB 1041 |
| R46 | Resistor: fixed, composition, 22,000 ohms; ± 10% 2W | 25-22K | AB HB 2231 |
| R47 | Resistor: variable, composition, 5000 ohms; linear taper | 210-7 | Centralab 21-010-357 |
| CR1,CR2 | Crystal rectifier: 1N34 | 212-34 | Sylvania 1N34 |
| F1 | Fuse: 1.5A; 3 AG | 211-8 | Littelfuse #312002 |
| | Fuseholder: | 312-8 | Littlefuse #342001 |
| L1 | Lamp: | 211-47 | GE Supply #47 |
| | Binding Post: | 312-3 | Hewlett-Packard |
| M1 | Meter: | 112-6 | Hewlett-Packard |
| S1 ab, R4-R9 | Range Switch Assembly: | 4C-19W | " |
| S2 | Switch: Toggle, SPST | 310-11 | Arrow-Hart & Hegeman 20994-HW |
| T1 | Transformer: Power | 910-67 | Hewlett-Packard |
| | Power Cable: | 812-56 | " |
| Y1 | Rectifier: | 212-26 | Fansteel BD0-29K |

TABLE I (Cont'd)

REPLACEABLE PARTS

| Circuit Ref. | Description | Hewlett-Packard Stock No. | Mfr. & Mfrs. Designation |
|---|---|---|---|
| V1 | Tube: 6SQ7 | 212-6SQ7 | Any tube with RMA standard characteristics |
| V2 | Tube: 6AK5 | 212-6AK5 | " |
| V3 | Tube: 6AK5 | 212-6AK5 | " |
| V4 | Tube: 6AK5 | 212-6AK5 | " |
| V5 | Tube: 6AK5 | 212-6AK5 | " |
| V6 | Tube: 5Y3GT | 212-5Y3GT | " |
| V7 | Tube: 6Y6G | 212-6Y6G | " |
| V8 | Tube: 6AQ6 | 212-6AQ6 | " |
| V9 | Tube: 0A2 | 212-0A2 | " |




CAPACITY IN μμF UNLESS OTHERWISE NOTED

K = 1000 OHMS

M = 1 MEGOHM

○ PANEL CONTROL

⊘ SCREWDRIVER ADJ.

⏚ CHASSIS

NOTES:
CONDITIONS OF DC VOLTAGE MEASUREMENT:

1. 115 VOLTS, 50-60 CYCLE POWER SUPPLY
2. MEASUREMENT TAKEN BETWEEN THE INDICATED POINTS AND CHASSIS WITH A VOLTMETER OF 100 MEGOHMS INPUT RESISTANCE
3. INPUT TERMINAL SHORTED, 1 VOLT RANGE

Fig. 2 - Circuit Schematic - 4,000 Vacuum Tube Voltmeter