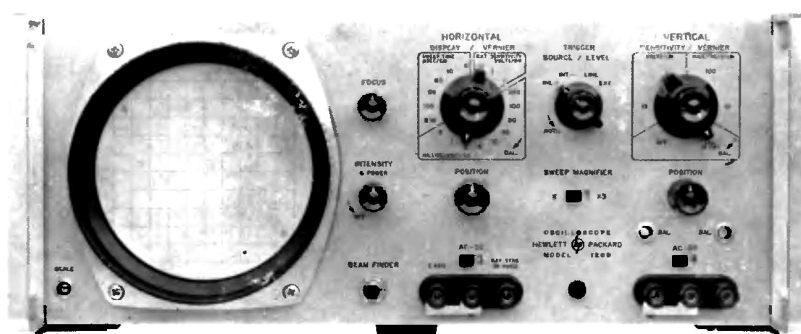


# OPERATING AND SERVICE MANUAL

## OSCILLOSCOPE 120B



HEWLETT  PACKARD

Table 1-1. Specifications

## **SWEEP**

### **Sweep Range:**

One  $\mu\text{sec}/\text{cm}$  to at least 0.5 sec/cm. Fifteen calibrated sweeps accurate to within  $\pm 5\%$ , in a 1, 2, 5, 10... sequence, from 5  $\mu\text{sec}/\text{cm}$  to 200 millisecc/cm. Vernier control permits continuous adjustment of sweep time between calibrated steps, and extends the 200 millisecc/cm to at least 0.5 sec/cm.

### **Sweep Expand:**

X5 sweep expansion may be used on all ranges and expands fastest sweep to 1  $\mu\text{sec}/\text{cm}$ . Expanded sweep accuracy is  $\pm 10\%$ .

### **Automatic Synchronization:**

Internal: from signals 50 cps to 450 kc with approximately 0.5-cm or more vertical deflection; and from line voltage.

External: from signal 50 cps to 450 kc, 1.5 v peak-to-peak.

### **Trigger Point:**

Zero-crossing negative slope of external sync signals; or zero-crossing positive or negative slope of vertical deflection signals. Front-panel control overrides automatic and permits the trigger point to be set between -7 to +7 volts. Turning control fully counterclockwise restores automatic operation.

## **VERTICAL AMPLIFIER**

### **Bandwidth:**

DC coupled: dc to 450 kc. AC coupled: 2 cps to 450 kc. Bandwidth is at least 450 kc regardless of sensitivity setting.

### **Sensitivity:**

10 millivolts/cm to 100 volts/cm. Four calibrated steps with attenuator accuracy of  $\pm 3\%$ , 10 mv/cm, 100 mv/cm, 1 v/cm, and 10 v/cm. Vernier permits continuous adjustment of sensitivity between steps, and extends 10 v/cm step to at least 100 v/cm.

### **Internal Calibrator:**

Calibrating signal automatically connected to vertical amplifier for standardizing of gain, accuracy  $\pm 2\%$ .

### **Input Impedance:**

1 megohm, shunted by approximately 50 pf.

### **Balanced Input:**

On 10 mv/cm range only; input impedance is 2 megohms shunted by approximately 25 pf.

### **Common-Mode Rejection:**

Rejection at least 40 db. Common mode signal must not exceed  $\pm 3$  volts peak.

### **Phase Shift:**

Vertical and horizontal amplifiers have same phase characteristics within  $\pm 2^\circ$  to 100 kc when verniers are in CAL.

## **HORIZONTAL AMPLIFIER**

### **Bandwidth:**

DC coupled: dc to 300 kc. AC coupled: 2 cps to 300 kc. Bandwidth is at least 300 kc regardless of attenuator setting.

### **Sensitivity:**

0.1 volt/cm to 100 volts/cm. Three calibrated steps, accurate within  $\pm 5\%$ , 0.1 v/cm, 1 v/cm, and 10 v/cm. Vernier permits continuous adjustment of sensitivity between steps and extends 10 v/cm step to at least 100 v/cm.

### **Input Impedance:**

1 megohm nominal, shunted by approximately 100 pf.

### **Phase Shift:**

Horizontal and vertical amplifiers have same phase characteristics within  $\pm 2^\circ$  to 100 kc when verniers are in CAL.

## **GENERAL**

### **Cathode Ray Tube:**

P31 phosphor, mono-accelerator with internal graticule normally supplied; 2700-volt accelerating potential. Face plate eliminates glare and reduces hazard of implosion. P2, P7, and P11 phosphors also available.

### **Internal Graticule:**

10 cm x 10 cm marked in cm squares. Major horizontal and vertical axes have 2-mm subdivisions. Eliminates parallax error.

### **Intensity Modulation:**

Terminals on front panel. Plus 20 volt pulse required to blank trace of normal intensity.

### **Dimensions:**

16-3/4 in. wide, 7-1/2 in. high, 18-3/8 in. deep, overall; hardware furnished for quick conversion to 7 in. x 19 in. rack mount.

### **Weight:**

Net: 32 lbs; shipping 45 lbs.

### **Power:**

115 or 230 volts  $\pm 10\%$ , 50 to 1000 cps, approximately 95 watts.

### **Options:**

- 05. External graticule crt with P31 phosphor.
- 06. Rear terminals in parallel with front.
- 10. Provision for single sweep operation.
- 13. Special front panel for rack mounting only.

## SECTION II INSTALLATION

### 2-1. INCOMING INSPECTION.

2-2. **MECHANICAL INSPECTION.** Unpack and inspect the Model 120B in the presence of the carrier. Be careful when unpacking the instrument, for all electron tubes including the cathode ray tube remain installed during shipment. Save all packing materials until inspection is complete. These materials may be required for reshipment in the event shipping damage is discovered.

2-3. Inspect the instrument for signs of possible damage in shipment such as scratched panel, broken knobs, etc. If possible, energize the equipment and check it operationally (see paragraph 2-5).

2-4. If there are any indications of damage, file a claim with the carrier. Refer to the Hewlett-Packard Warranty sheet at the front of this manual.

2-5. **PERFORMANCE CHECK.** Paragraph 5-52 contains performance check procedures for verifying operation within listed specifications. The performance check is recommended for inclusion in receiving quality-control inspection. The following procedure is offered, however, as a means to check basic operation.

2-6. **INITIAL TURN ON.** Energize the 120B as follows:

- Turn INTENSITY control to OFF and plug in power cable.
- Set SWEEP MAGNIFIER switch to X1 position.
- Set HORIZONTAL DISPLAY switch to 0.5 MIL-ISECONDS/CM position.
- Center HORIZONTAL POSITION and VERTICAL POSITION controls.
- Turn 120B on and allow two minutes warmup.
- Set TRIGGER LEVEL to AUTO.
- Rotate INTENSITY clockwise until trace appears. If crt remains blank, press BEAM FINDER and re-adjust position controls as necessary.
- Adjust FOCUS for thin, well-defined trace, and adjust HORIZONTAL POSITION to place left end of sweep on left-end graticule line.

### 2-7. POWER REQUIREMENTS.

2-8. The Model 120B requires a power source of 115 or 230 volts  $\pm 10\%$ , single phase, 50 to 1000 cps, which can deliver approximately 95 watts. The oscilloscope is normally shipped from the factory wired for use with a 115-volts power source. To convert the instrument for use with a 230-volt source, change the dual primary windings of transformer T302 from a parallel combination to a series combination. Figure 2-1 illustrates the connection for 115- and 230-volt operation. At the time of the change, replace the 1.6-ampere slow-blow line fuse with 0.8-ampere slow-blow fuse.

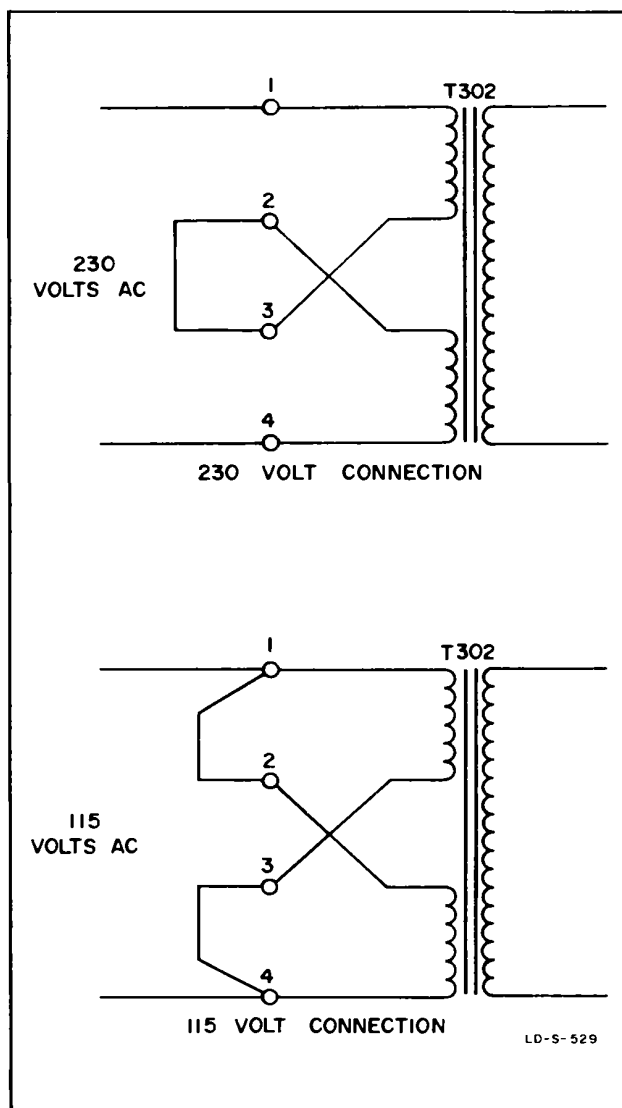


Figure 2-1. Primary-Power Connections

2-9. For the protection of operating personnel, the National Electrical Manufacturers' Assn (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground pin. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green pigtail on the adapter to ground.

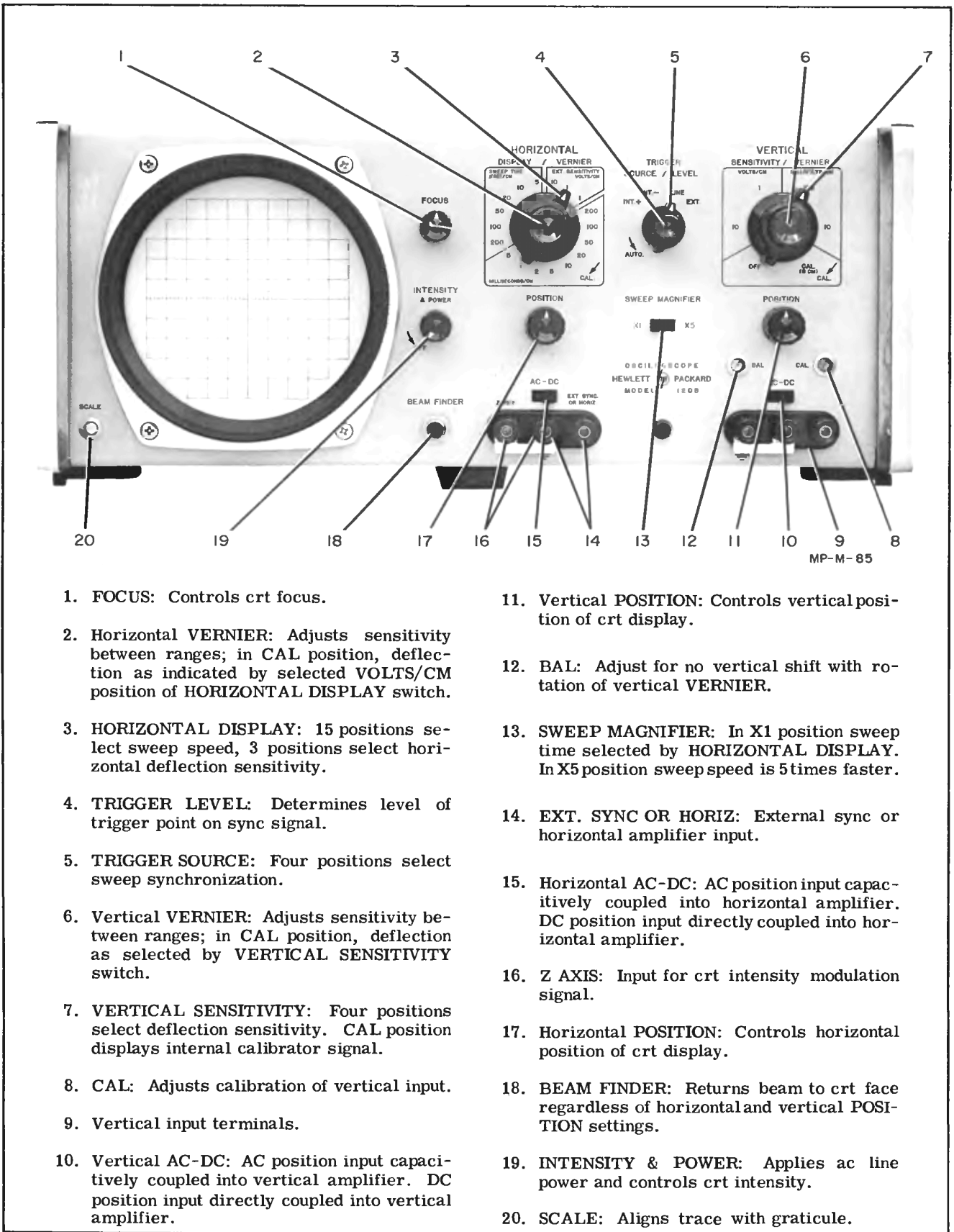
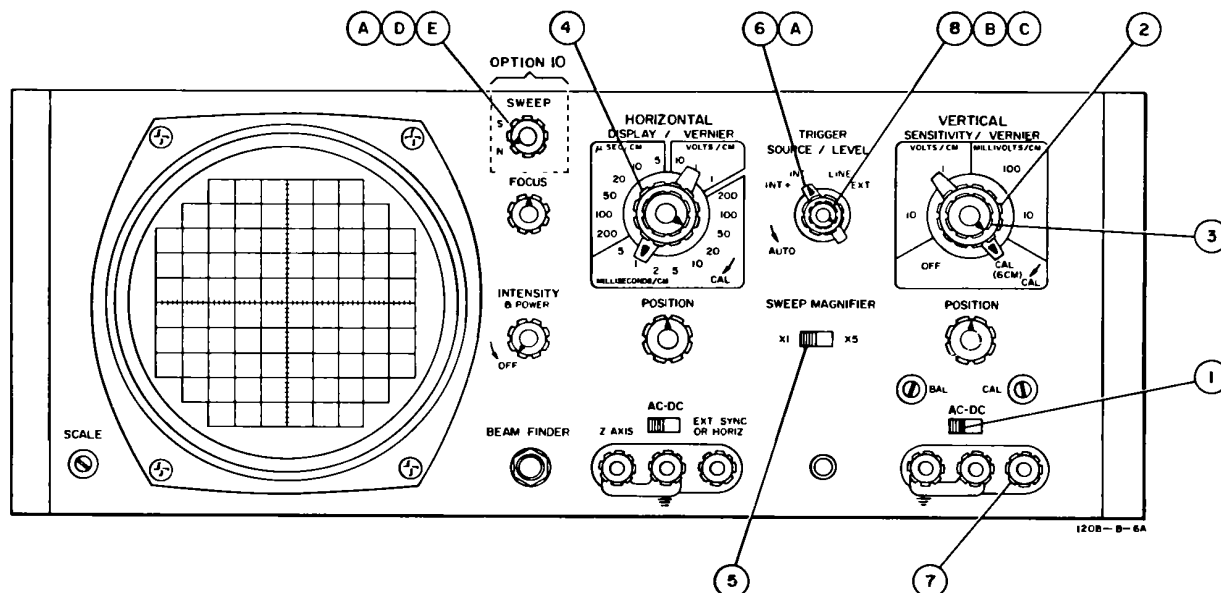


Figure 3-1. Model 120B Oscilloscope, Front View

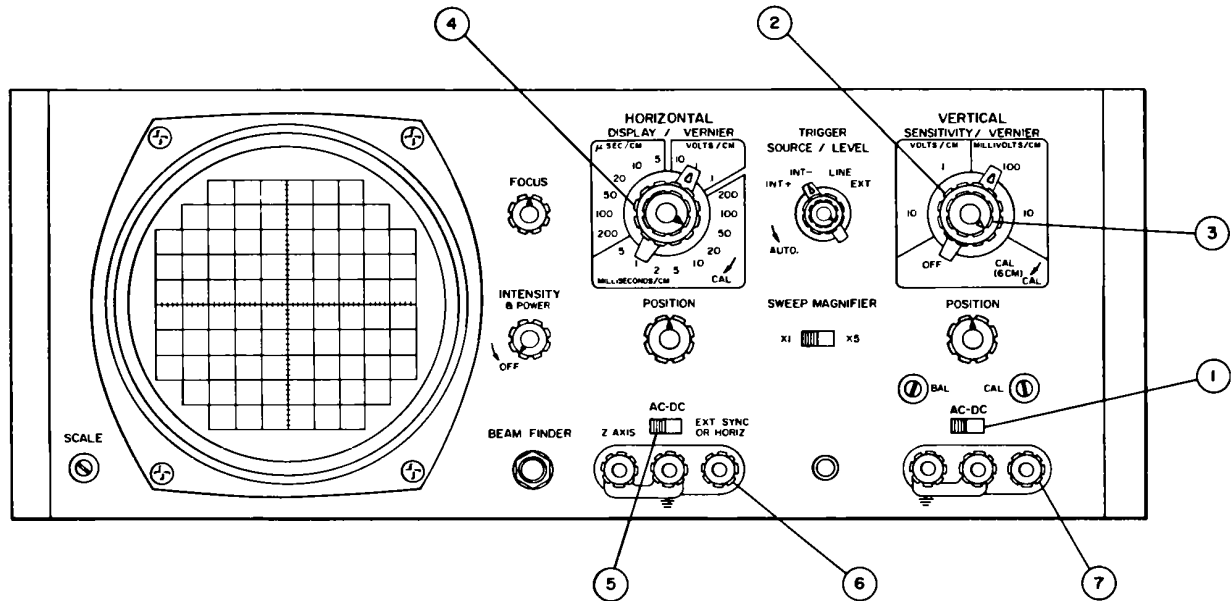
**INTERNAL HORIZONTAL SWEEP:**

1. Set vertical AC-DC to desired type of input coupling.
2. Set VERTICAL SENSITIVITY to desired vertical sensitivity.
3. Set vertical VERNIER to CAL for calibrated sensitivity.
4. Set HORIZONTAL DISPLAY to desired horizontal sweep time. Set VERNIER to CAL for calibrated sweep time.
5. Set SWEEP MAGNIFIER to X1 or X5, as desired.
6. Set TRIGGER SOURCE to desired type of horizontal sweep synchronization. If external sync is selected, connect sync signal to EXT. SYNC.
7. Apply vertical input signal to vertical input terminals.
8. Adjust TRIGGER LEVEL for desired synchronization.

**SINGLE SWEEP (OPTION 10):**

- A. Set SWEEP switch to normal (N), TRIGGER SOURCE switch to EXT, and remove any external trigger source.
- B. Adjust TRIGGER LEVEL control fully clockwise. Minimum trigger sensitivity is obtained with the control in this position.
- C. To increase trigger sensitivity, rotate TRIGGER LEVEL control counterclockwise. Maximum sensitivity will be obtained just prior to the point where the oscilloscope sweeps intermittently.
- D. Set SWEEP switch to single (S). The instrument is now in the "armed" state and will sweep once when triggered.
- E. To rearm the sweep circuit, set SWEEP switch from S to N and then back to S. External triggering should not be applied during this operation to prevent the single sweep from occurring immediately when the switch is returned to the S position.

Figure 3-2. Operation Using Internal Horizontal Sweep or Single Sweep



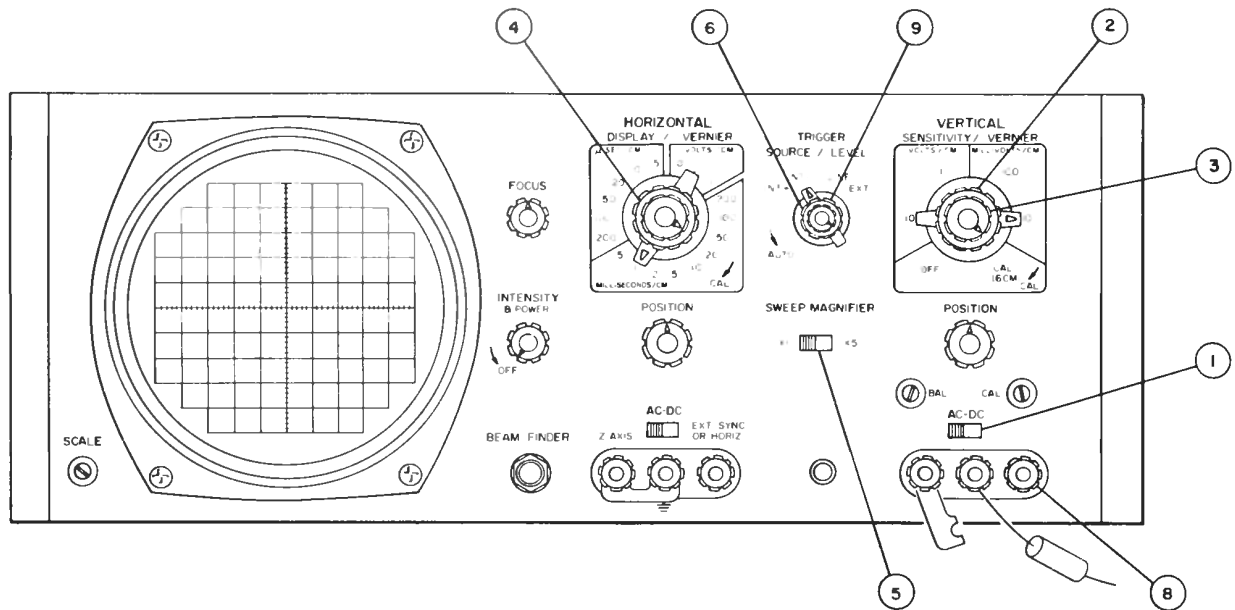
LD-M-491

1. Set vertical AC-DC to desired type of input coupling.
2. Set VERTICAL SENSITIVITY to desired vertical sensitivity.
3. Set vertical VERNIER to CAL for calibrated sensitivity.
4. Set HORIZONTAL DISPLAY to desired VOLTS/CM. Set VERNIER to CAL for calibrated sensitivity.
5. Set horizontal AC-DC to desired type of coupling.
6. Apply external horizontal sweep to horizontal input terminals.
7. Apply vertical input signal to vertical input terminals.

Note

Relative phase shift of horizontal and vertical amplifiers is the same  $\pm 2^\circ$  to 100 kc only when both VERNIER controls are set to CAL.

Figure 3-3. Operation Using External Horizontal Input



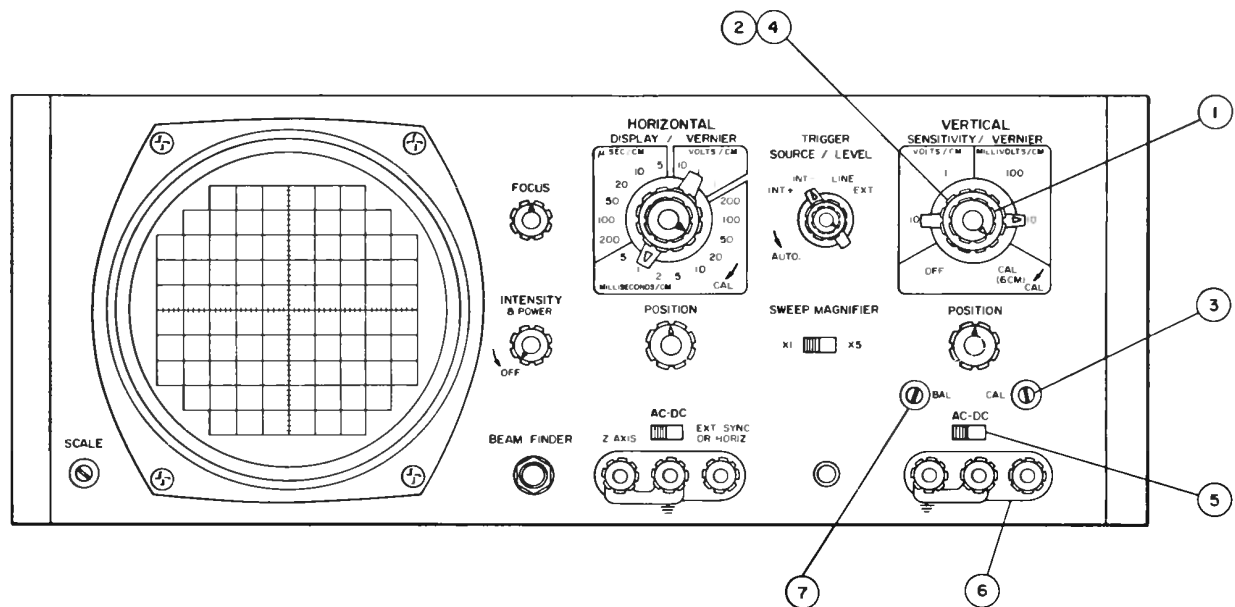
11. M-692

1. Set vertical AC-DC to desired type of input coupling.
2. Set VERTICAL SENSITIVITY to 10 MILLI-VOLTS/CM. (Input not balanced in any other position of VERTICAL SENSITIVITY switch.)
3. Set vertical VERNIER to CAL for calibrated sensitivity.
4. Set HORIZONTAL DISPLAY to desired horizontal sweep speed.
5. Set SWEEP MAGNIFIER to X1 or X5, as desired.
6. Set TRIGGER SOURCE to desired type of horizontal sweep synchronization.
7. Remove grounding strap from vertical input terminals.
8. Connect vertical signal to vertical input terminals; if ac coupling is desired, connect 0.1-uf 600-volt capacitor in series with center vertical input terminal.
9. Adjust TRIGGER LEVEL for desired synchronization.

**Note**

The common-mode input signal voltage, either positive or negative, must not exceed 3 volts minus the peak amplitude of the differential input signal.

Figure 3-4. Operation Using Balanced Vertical Input



LD-M 490

#### CALIBRATION ADJUSTMENTS:

1. Set vertical VERNIER to CAL.
2. Set VERTICAL SENSITIVITY to CAL.
3. Adjust CAL for exactly 6 cm of vertical deflection.

#### BALANCE ADJUSTMENTS:

4. Set VERTICAL SENSITIVITY to 10 MILLI-VOLTS/CM.
5. Set vertical AC-DC to DC.
6. Short vertical input terminals.
7. While rotating vertical VERNIER back and forth, adjust BAL for no shift of spot.

Figure 3-5. Vertical Deflection Calibration and Balance Adjustment

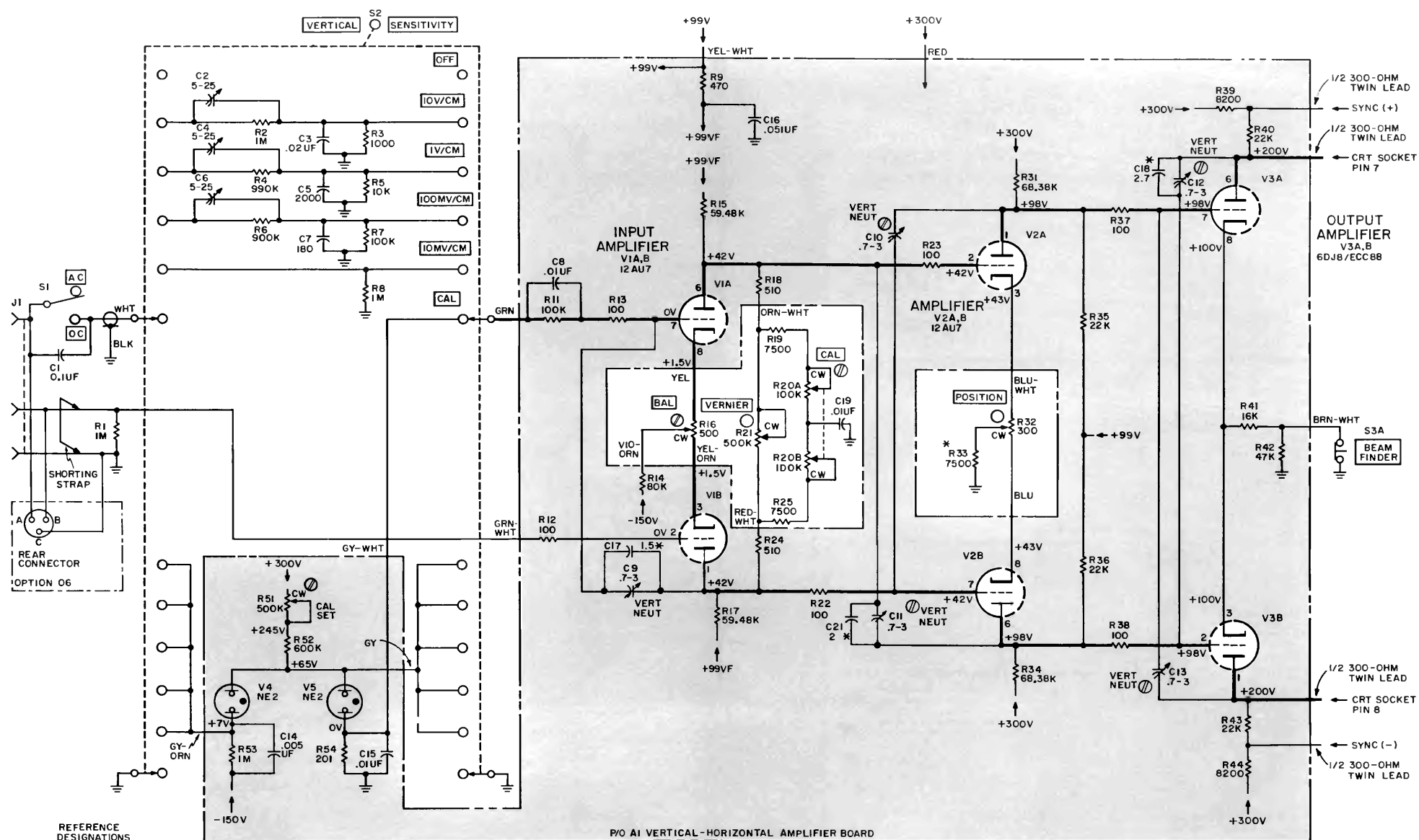


Figure 5-6. Vertical Amplifier

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Section V  
Figure 5-7

Model 120B

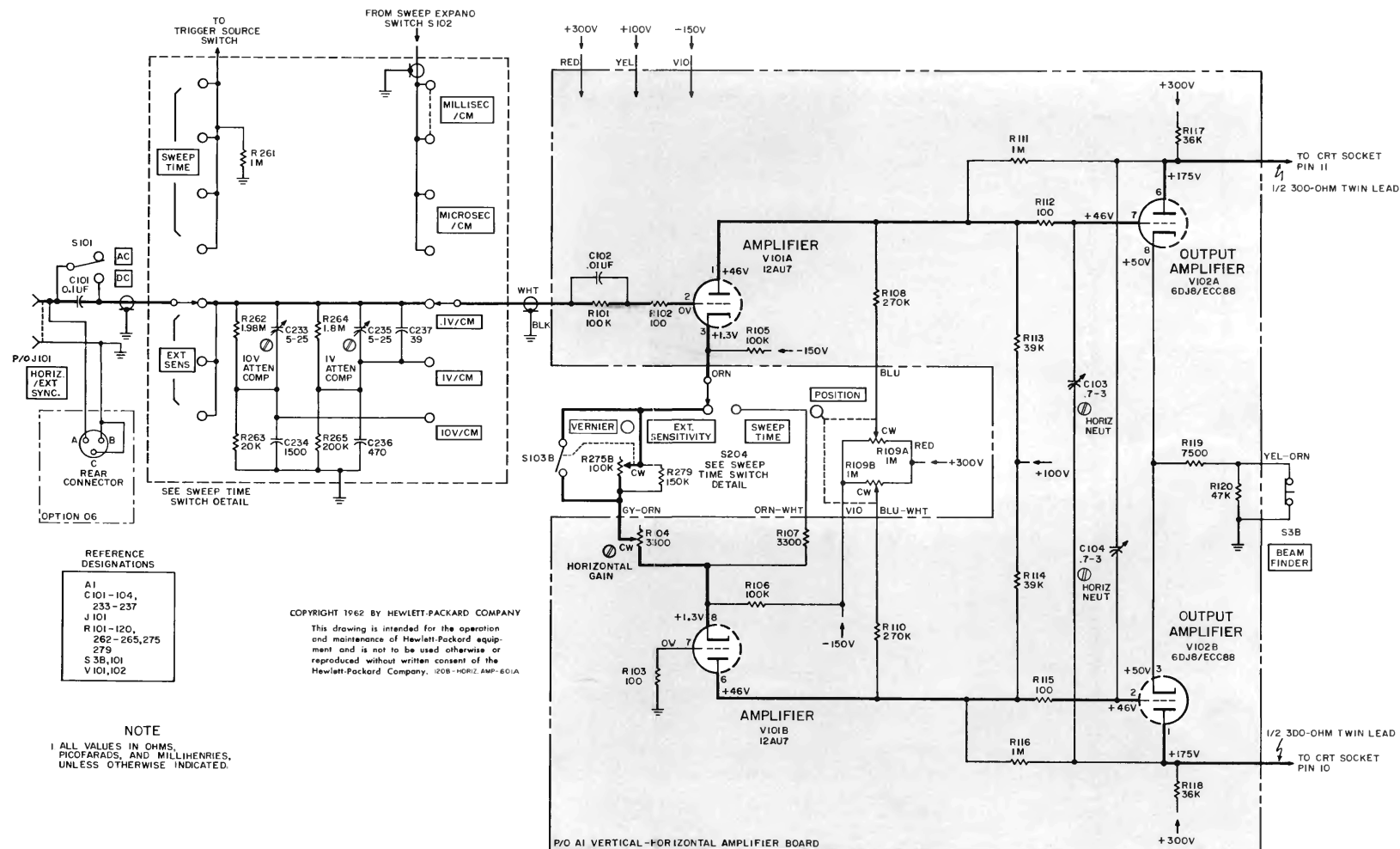
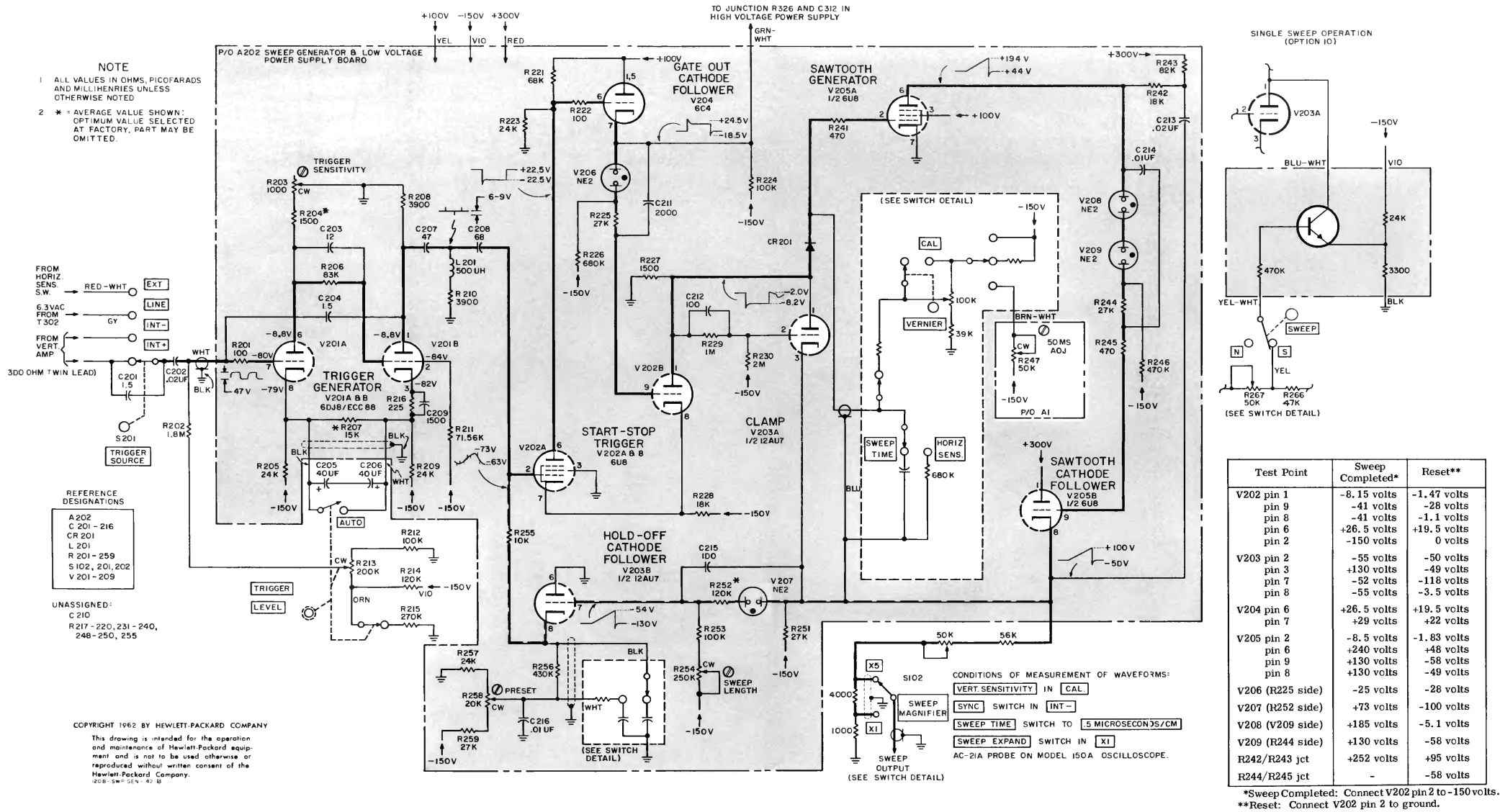


Figure 5-7. Horizontal Amplifier



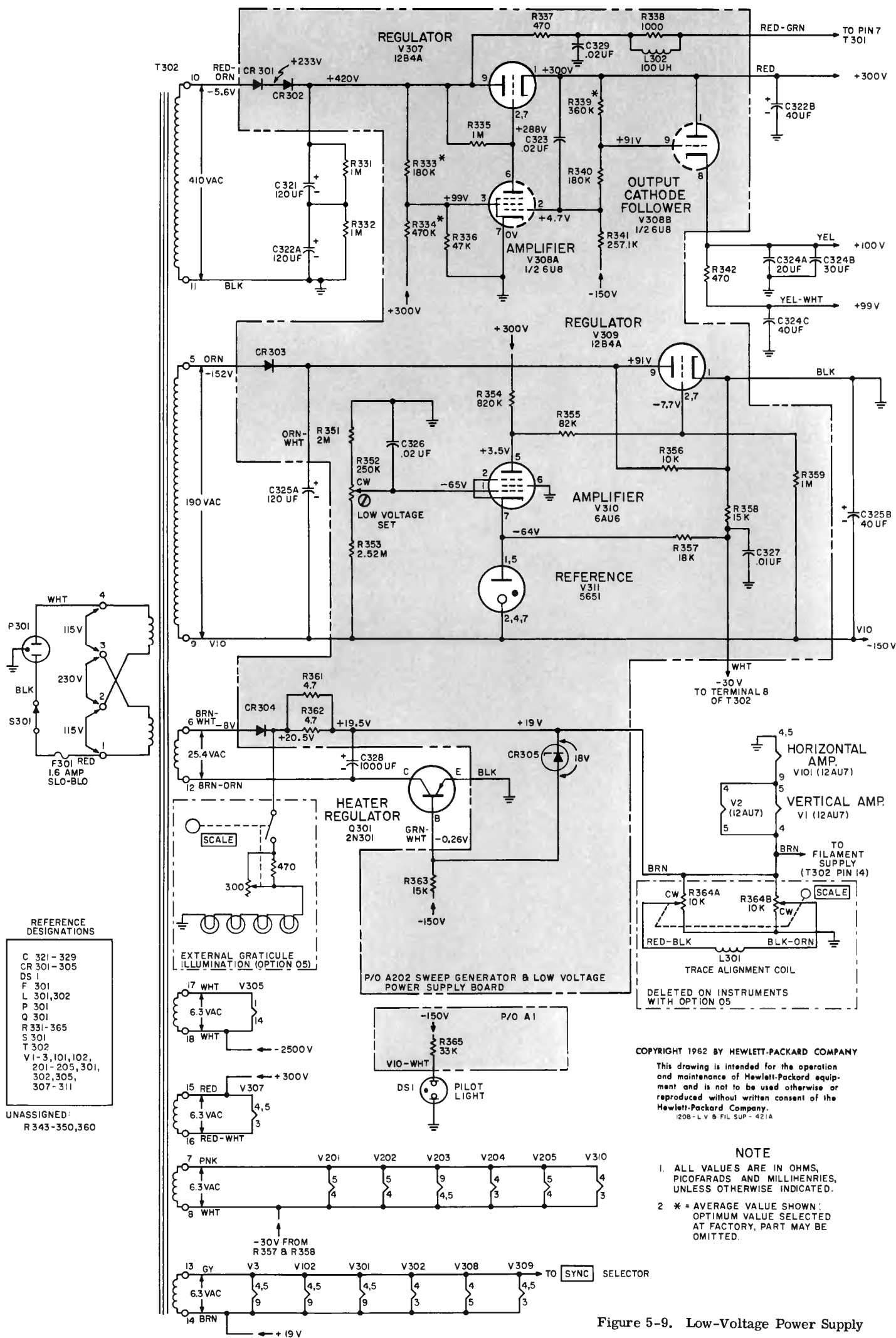
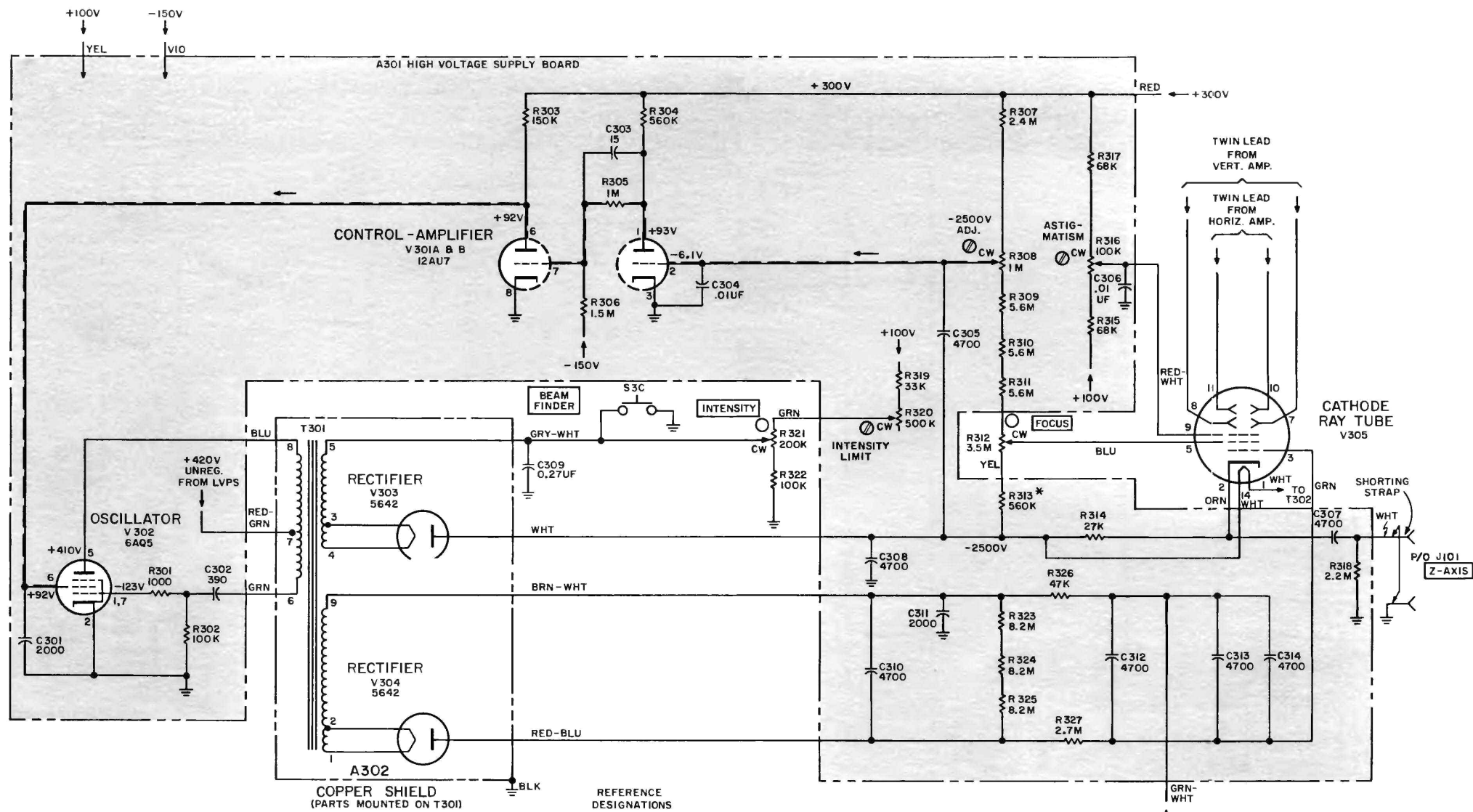


Figure 5-9. Low-Voltage Power Supply



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120B-H V.P.S.-242B

Figure 5-10. High-Voltage Power Supply

