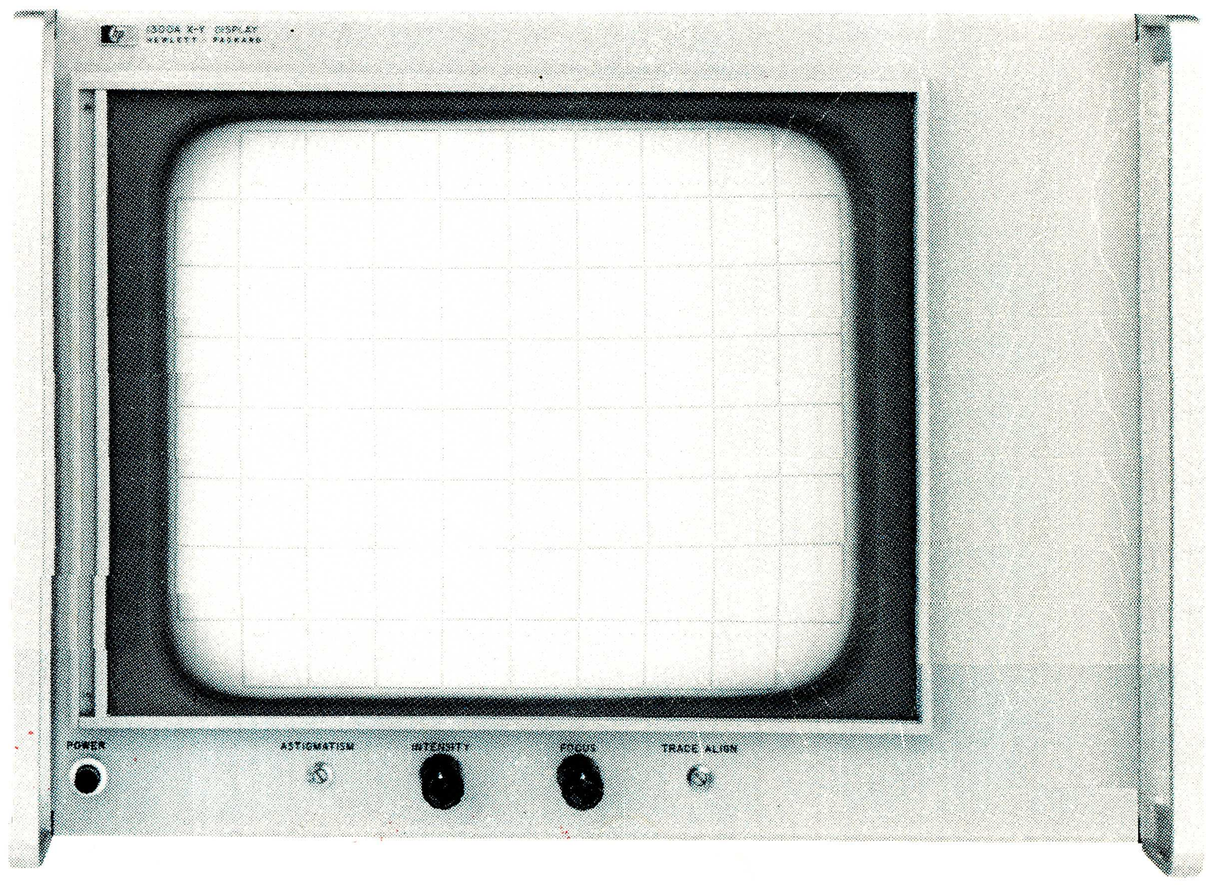
OPERATING AND SERVICE MANUAL

X-Y DISPLAY

1300A



HEWLETT hp PACKARD

MANUAL CHANGES

MODEL 1300A

X-Y DISPLAY

Manual Serials Prefixed: 733-

Manual Printed: AUG 1967

Make all changes in this manual according to the Errata below. Also check the following table for your instrument serial prefix (3 digits) and/or serial number (8 digits) and make any listed change(s) in the manual:

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
751-	1		

ERRATA

Page 2-1, Paragraph 2-6,
Line 1 should read: "The Model 1300A X-Y Display . . . "
Page 3-2, Figure 3-2,
Add 16: INT-EXT. Switch grounds CHOP BLANK input when not in use.
Draw a line to INT-EXT on the figure and label it "16".
Page 3-6, Figure 3-6,
Change 1 in figure to 2; add a line to CHOP BLANK connector and label it "4".
Page 4-2, Paragraph 4-16,
Line 1 should read: "Figure 8-15 . . . "
Table 6-2, CHASSIS PARTS,
R15: Change to hp Part No. 0687-5631; R: fxd comp 56k ohms 10% 1/2w. (Preferred replacement.)
V1: Change to hp Part No. 5083-1752; V: CRT, P31 phosphor.
Add hp Part No. 5083-1722 - P2 phosphor.
Add hp Part No. 5083-1732 - P7 phosphor (amber filter required).
Add hp Part No. 5083-1742 - P11 phosphor.
Add: W1; hp Part No. 8120-0078; Power cord.
Table 6-2, ASSEMBLIES WITH MOUNTED COMPONENTS,
A1Q1, Q2, Q7, Q8: Change to hp Part No. 5080-0472; Q: si fet n-channel matched pair (preferred replacement).
A3Q4: Change to hp Part No. 1854-0215; Q: si npn 2N3904.
A3Q5: Change to hp Part No. 1853-0036; Q: si pnp 2N3906.
A3Q7: Change to hp Part No. 1853-0037; Q: si pnp.
A3Q8: Change to hp Part No. 1854-0056; Q: si npn 2N3119.
A3Q9 and A3Q10: Change to hp Part No. 1853-0015; Q: si pnp 2N3640.
A3R18: Change to hp Part No. 0698-0085; R: fxd metflm 2610 ohms 1% 1/8w.
△ A5CR1/A5CR2: Change to hp Part No. 1901-0341. (Preferred replacement.)
Page 8-11/8-12,
On A2A1: Change legend near collector of Q1 to read: to collector of A2A1Q2.
On A2A1: Change legend near collector of Q2 to read: from collector of A2A1Q1.
Page 8-17, Figure 8-15,
△ A3R14: Change voltage supply to +100 V.
A3R18: Change value to 2610.
Page 8-19, Figure 8-18,
Change location of R19 to be between R13A and ground.

CHANGE 1

Table 6-2, ASSEMBLIES WITH MOUNTED COMPONENTS,
A5: Add R11; hp Part No. 0683-2055; R: fxd comp 2 megohms 5% 1/4w.
Page 8-19, Figure 8-18,
Add R11, 2M*, between A5R9 and R11, FOCUS control. Choose value of A5R11 to ensure that spot can be focused at mid-range of R11.

27 March 1968

Supplement A for
01300-90901

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

MODEL 1300A
X-Y DISPLAY

SERIALS PREFIXED: 818-

See Section I For Instruments
With Other Serial Prefixes.

For Instruments With Option(s),
See Section VII

776-6400

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1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U. S. A.

02608-2

PRINTED: JUN 1968

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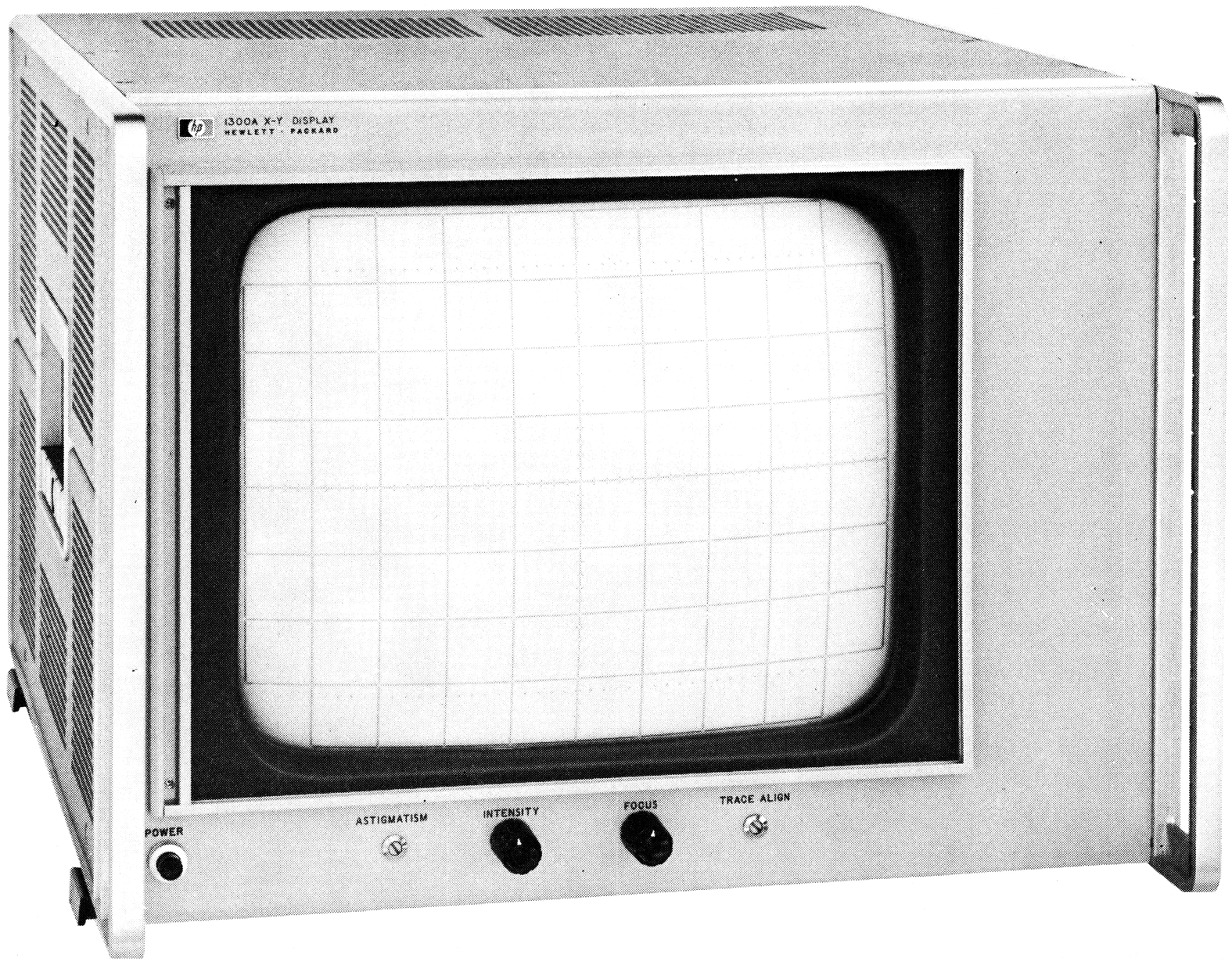


Figure 1-1. Model 1300A X-Y Display

Table 1-1. Specifications

X-Y AMPLIFIERS:

DEFLECTION FACTOR (sensitivity): 0.1 v/inch; vernier provides 2.5: 1 reduction.

DRIFT: < 0.1 inch/hr after 1/2-hr warm-up; < 0.2 inch/8 hr.

BANDWIDTH: dc coupled, dc to 20 MHz; ac coupled 2 Hz to 20 MHz (8-inch reference at 50 kHz).

RISE TIME: < 20 ns (10% to 90% points).

SETTLING TIME: < 200 ns to within a trace width of final value.

REPEATABILITY: Less than 0.15% error for re-addressing a point from any direction — source impedance < 4 kΩ.

INPUT RC: 1 megohm shunted by approximately 20 pf.

INPUT: Single ended; BNC connector, maximum input ± 500 v (dc + peak ac).

LINEARITY: Over 8 x 10-inch screen ± 1% of full screen; any inch with respect to any other inch, within 10%.

PHASE SHIFT: 0.1° to 50 kHz, up to 100-inch signal; 1° to 1 MHz, up to 10-inch signal.

Z AMPLIFIER:

ANALOG INPUT: DC to 20 MHz bandwidth over the 0 to 1 V range; +1 V gives full blanking, -1V gives full instensity; vernier gives 2.5:1 reduction, balance allows intensity reference level adjustment of ±1 V, Maximum input ±500 V (dc + peak ac).

RISE TIME: < 20 ns (10% to 90% points).

SWEEP BLANK INPUT: Digital dc blanking with < 1KΩ and -0.7V to +5V; unblanking with 20KΩ and 0 V to -5 V. Repetition rates to 1 MHz.

CHOP BLANK INPUT: AC coupled blanking, +50V blanks CRT. Input grounded when not in use.

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Hewlett-Packard Model 1300A X-Y Display is a wide-band, large-screen oscilloscope. The X and Y axis amplifiers may be either ac or dc coupled with a bandwidth up to 20 MHz. Deflection sensitivity of the X and Y amplifiers is 0.1 volt/inch which may be reduced to 0.25 volts/inch by means of the GAIN (vernier) controls. The settling time of the Model 1300A is less than 200 nsec. Measured with an eight-inch step input, the settling time is defined as the time required for the spot to settle within one trace width of its final position. A 20 MHz bandwidth Z-axis amplifier gives full trace intensity with -1 volt input from "full blanking" and complete blanking is obtained with +1 volt input from "full intensity". The blanking level may be increased to +2.5 volts by means of the Z GAIN (vernier) control.

1-3. CATHODE RAY TUBE.

1-4. The Model 1300A uses an aluminized, P31 phosphor CRT with an 8 x 10 inch internal graticule which is divided into 1 inch squares with 0.2 inch subdivisions on the major axes. Other phosphors available are P2, P4, P7 and P11. The standard light green face plate filter is changed to an amber filter when the P7 phosphor is used and to a gray filter when P4 phosphor is used. A coating of fiberglas cloth which is painted with aquadag surrounds the CRT from the face plate to a point just before the neck. This coating provides implosion protection for operating and maintenance personnel.

1-5. WARRANTY.

1-6. The Model 1300A is certified and warranted as stated on the inside, front cover of this manual. The CRT is warranted separately; the CRT warranty statement and failure report are found at the back of this manual. If the CRT should fail within the warranty period, return the CRT and the completed form as instructed on the CRT Warranty in back of manual.

1-7. MANUAL CHANGES.

1-8. The information in this manual applies directly to the Model 1300A instruments with serial prefix 818-. The serial prefix is the first three digits of the eight-digit serial number (000-00000) used to identify

Table 1-1. Specifications (cont'd)

CALIBRATOR:
0.5 v ± 2%, line frequency square wave.

CRT:

ACCELERATING POTENTIAL: 20 kV.

WRITING RATE: > 20 inches/μs.

SPOT SIZE: Less than 30 mils throughout 8 x 10-inch screen at 100 ft.-lamberts light output; nominally 20 mils at center screen (shrinking raster).

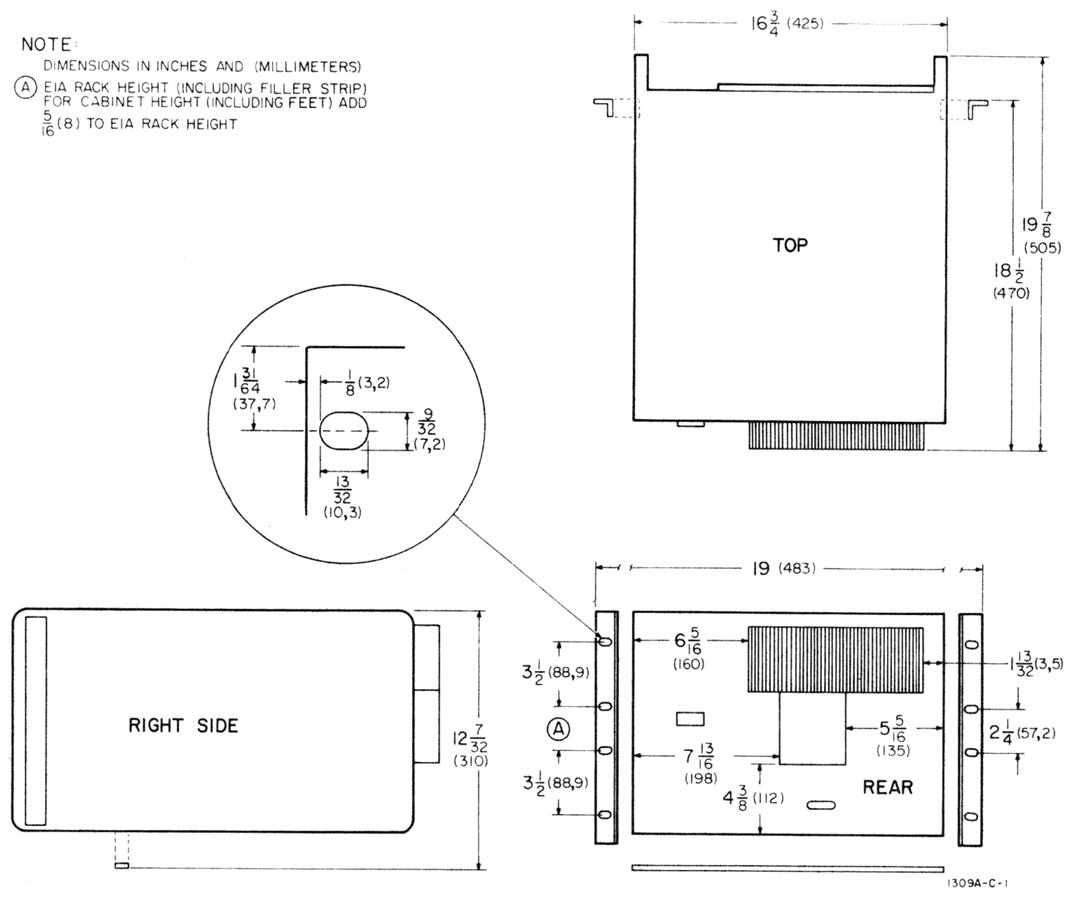
PHOSPHOR AND GRATICULE: Aluminized P31 phosphor with 1-inch grid and 0.2-inch subdivisions on major axes. P2, P4, P7, P11 and other phosphors available; other graticules available on special order. Amber face plate filter supplied with P7 phosphor instead of standard blue-green.

CONTROLS:

X-Y-Z inputs, ac-dc input switches, calibrator, X-Y gain verniers and position, Z axis vernier and balance on rear panel. Intensity, astigmatism, trace align, and focus on front panel.

GENERAL:

SIZE: 12 1/4 in. high, 16 3/4 in. wide, 19 7/8 in. deep, 18 1/2 in. behind front panel (310 x 425 x 470 mm). Rack mount hardware supplied.



WEIGHT: Net, 47 pounds (21,4 kg). Shipping, 64 pounds (29,1 kg).

POWER: 175 watts at 115-230 V; 47-440 Hz.

all hp instruments. Another manual, hp Part Number 01300-90901 provides information for instruments with Serial Prefixes below 751- and 733-. Technical corrections to this manual, due to errors in print, are called Errata and are included in the Manual Changes sheet supplied with this manual. Refer to Section VII for any options and information to bring this manual into agreement with instruments which have serial prefix number lower than the one given above. For information pertaining to change sheets, or other information, contact your nearest hp Sales/Service Office. The Sales/Service Offices are listed at the back of the manual.

1-9. ACCESSORIES.

1-10. All Model 1300A's are shipped with a rack mounting kit and hardware. Two special low reflection CRT filters are available at additional cost. These filters are Model 10181A, light green, and Model 10182A, amber.

1-11. SCOPE OF MANUAL.

1-12. This manual provides complete operating and maintenance instructions for the Model 1300A. For information on other hp instruments, refer to the Operating and Service Manual for that particular instrument.

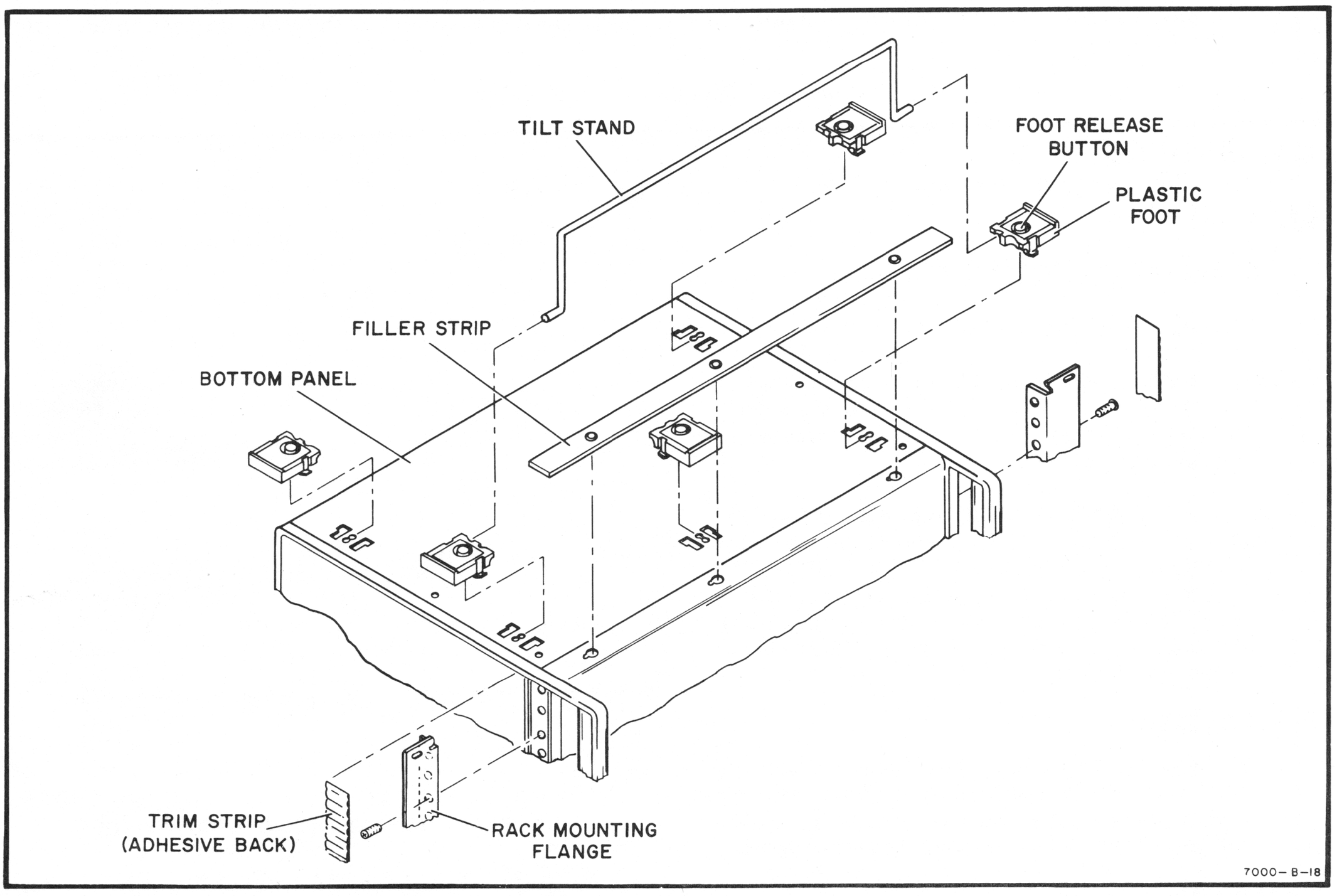


Figure 2-1. Rack Mounting Procedure.

should be repackaged with the following materials: (1) a double walled carton (refer to Table 2-1 for test strength required); (2) heavy paper or sheets of cardboard to protect all instrument surfaces; use a non-abrasive material such as polyurethane or a cushioned paper such as Kimpak around all projecting parts; (3) at least 4 inches of tightly packed, industry approved, shock absorbing material, such as extra firm polyurethane foam; (4) heavy duty shipping tape to secure outside of carton.

Table 2-1. Shipping Carton Test Strengths

Gross Weight (lbs)	Carton Test Strength (lbs)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION.

2-2. MECHANICAL CHECK. If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors, and dents or scratches on the panel surface. If damage is evident, see Paragraph 2-15 for recommended claim procedure. If the shipping carton is not damaged, check the cushioning material and note any signs of severe stress and rough handling in transit. If the instrument appears to be undamaged, perform the electrical check. Retain the packaging material for possible future use.

2-3. ELECTRICAL CHECK. Check the electrical performance of the Model 1300A as soon as possible after receipt. Paragraph 5-5 contains performance check procedures which will verify the instrument operation within the specifications listed in Table 1-1. Initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to Paragraph 2-15 for the recommended claim procedure.

2-4. PREPARATION FOR USE.

2-5. POWER REQUIREMENTS.

2-6. The Model 1300A X-Y Display requires a power source of either 115 or 230 v ac ± 10%, single phase, 50-1000 Hz. A rear panel switch allows selection of the line voltage to be used.

CAUTION

Be sure to set the rear panel switch for the line voltage to be used. The power supplies may be damaged if the switch is set to the wrong position.

2-7. 230 VOLT OPERATION. If the instrument is to be operated from a 230 volt source, set the rear panel slide switch to the 230 v position. The line fuse, F1, must be changed to a 1.5 amp, slow-blow fuse (supplied) for 230 volt operation. The line fuse is accessible from the back panel.

2-8. THREE CONDUCTOR POWER CABLE. For the protection of operating personnel the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. The Model 1300A is equipped with a detachable, three-conductor power cable which, when plugged into an appropriate receptacle will ground the instrument. The offset (round) pin on the power cable connector is the ground pin. To preserve the protection feature when operating the Model 1300A from a two contact outlet, use a three-conductor to two-conductor adapter and connect the green lead on the adapter to ground at the power outlet.

2-9. INSTRUMENT MOUNTING.

2-10. MODULAR CABINET. The Model 1300A is shipped from the factory as a bench instrument with tilt-stand, feet, and plastic trim in place. The top, bottom and side panel covers can be removed for complete accessibility to all components and adjustments.

2-11. RACK MOUNTING. A kit for converting the modular cabinet to a rack mount is supplied with each Model 1300A. Instructions for making the conversion are given below. Refer to Figure 2-1 for aid in identifying parts.

a. Detach tilt stand by pressing away from front feet. Remove all plastic feet by depressing metal button and sliding feet free.

b. Aluminum trim strips (behind each front handle) on sides of instrument have an adhesive back. Use a thin blade tool to remove them.

c. Attach the rack mounting flange, using screws provided in kit, in each space where trim strip was adhered; larger notch of flange should be positioned at instrument bottom.

d. If the Model 1300A is to be placed in a rack above or below another hp instrument, attach the filler strip provided with the kit between front panels of the instruments.

2-12. INSTRUMENT COOLING.

2-13. The Model 1300A makes use of convection cooling to maintain reasonable operating temperatures within the instrument. When operating the instrument choose a location which will provide at least two inches of clearance around the top, the rear and both sides.

2-14. CLAIMS.

2-15. If physical damage is found or if the instrument does not operate within specifications when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office immediately. The Sales/Service Office will arrange for the repair or replacement of the instrument without waiting for a claim to be settled with the carrier. The warranty statement for all Hewlett-Packard products is on the inside front cover of this manual (note different CRT warranty as explained in Paragraph 1-6). Contact the nearest Sales/Service Office for information about warranty claims.

2-16. REPACKAGING FOR SHIPMENT.

2-17. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag to it showing owner, and owner's address; instrument model number, date of purchase, and 8 digit serial number; and a description of service required. The original shipping carton and packaging materials, except for the accordion-pleated pads, should be used for reshipment. If they are not available or reusable, the instrument

should be repackaged with the following materials: (1) a double walled carton (refer to Table 2-1 for test strength required); (2) heavy paper or sheets of cardboard to protect all instrument surfaces; use a non-abrasive material such as polyurethane or a cushioned paper such as Kimpak around all projecting parts; (3) at least 4 inches of tightly packed, industry approved, shock absorbing material, such as extra firm polyurethane foam; (4) heavy duty shipping tape to secure outside of carton.

Table 2-1. Shipping Carton Test Strengths

Gross Weight (lbs)	Carton Test Strength (lbs)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. The Model 1300A is an X-Y-Z Display with full 20 MHz capability on all axes. It has no attenuators or sweep generating circuits. All signals must be derived externally and connected to the Model 1300A for display. All input connectors and controls are located on the rear panel.

3-3. Figures 3-1 and 3-2 identify all front and rear panel controls respectively. These controls are keyed by numbers to the list beneath the figures.

3-4. INSTRUMENT OPERATION.

3-5. Refer to Figures 3-3 through 3-6 for specific operating instructions. These operations should be performed at least once by the operator/technician for familiarization purposes.

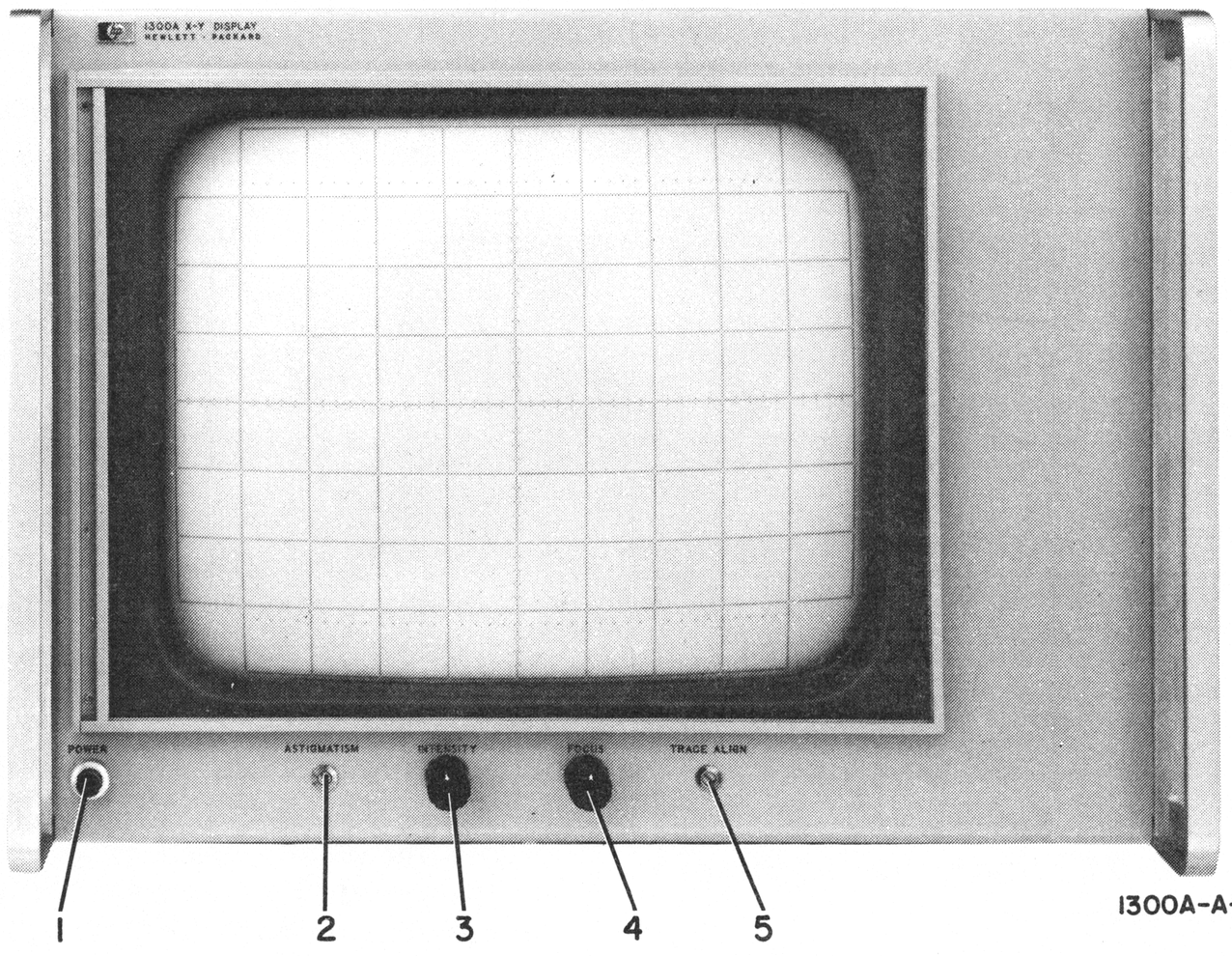
3-6. TYPICAL APPLICATIONS.

3-7. The Model 1300A may be used to provide a visual display of the solutions of problems solved by analog computer. These solutions may be presented as a plot of the problem and the results of changes in the parameters of the problem may be viewed immediately.

3-8. The Model 1300A may also be used to display alpha-numeric data.

3-9. Figures 3-7 through 3-10 give other applications with representative equipment connections for each application.

3-10. Figure 3-11 is a plot of the intensity response of the Model 1300A to an analog signal at the Z-Axis input. The curve defines the response of the CRT in foot lamberts per volt of input. The range of intensities between full off to full intensity may be referred to as "gray scales." The input level required for a specified trace intensity may be determined from the curve of Figure 3-11. Circuits for electronically defining the 4 or 8 level gray scales are available for the Model 1300A on special order (see Paragraph 7-9).



1. POWER. A push button switch with indicator which turns the Model 1300A on.

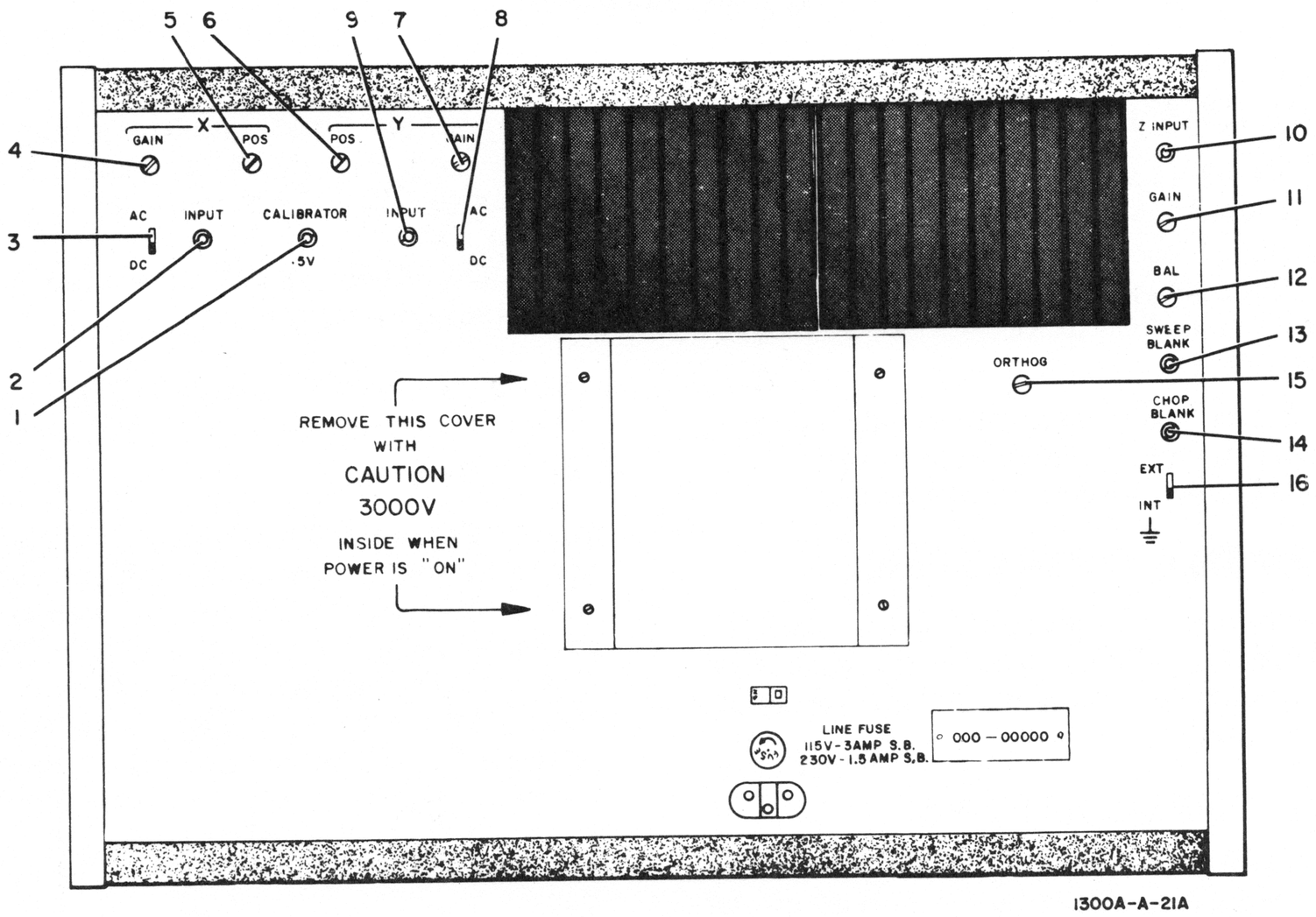
2. ASTIGMATISM. A screwdriver control which adjusts the roundness of the spot.

3. INTENSITY. Adjusts the brightness of the display.

4. FOCUS. Focuses the trace; works in conjunction with the ASTIGMATISM control to provide the best display on the CRT.

5. TRACE ALIGN. A screwdriver control which aligns traces about the Z-Axis so that vertical and horizontal traces are parallel to vertical and horizontal graticule lines. Works with ORTHOG control which aligns vertical trace perpendicular to horizontal trace.

Figure 3-1. Front Panel Controls



1. CALIBRATOR. 0.5 v pk-pk square wave output; used to calibrate X and Y amplifier gains.

2. X-INPUT. BNC input connector for the X deflection amplifier.

3. X-COUPLING. Selects either ac or dc coupling to the X amplifier.

4. X-GAIN. Screwdriver adjustment for varying the gain of the X amplifier. Gives 2.5:1 range of adjustment (from 0.1 v/inch to 0.25 v/inch).

5. X-POS. Screwdriver adjustment for positioning the trace horizontally.

6. Y-POS. Screwdriver adjustment for positioning the trace vertically.

7. Y-GAIN. Screwdriver adjustment for varying the gain of the Y amplifier. Gives 2.5:1 adjustment (from 0.1 v/inch to 0.25 v/inch.

8. Y-COUPLING. Switch selects ac or dc coupling to the Y amplifier.

9. Y-INPUT. BNC connector for connecting signals to the Y amplifier input.

10. Z-INPUT. BNC connector for connecting signals to the Z amplifier input.

11. Z-GAIN. Screwdriver adjustment for varying the gain of the Z amplifier. Adjusts the gain over a 2.5:1 range.

12. Z-BAL. Screwdriver adjustment for balancing dc offset of input signal.

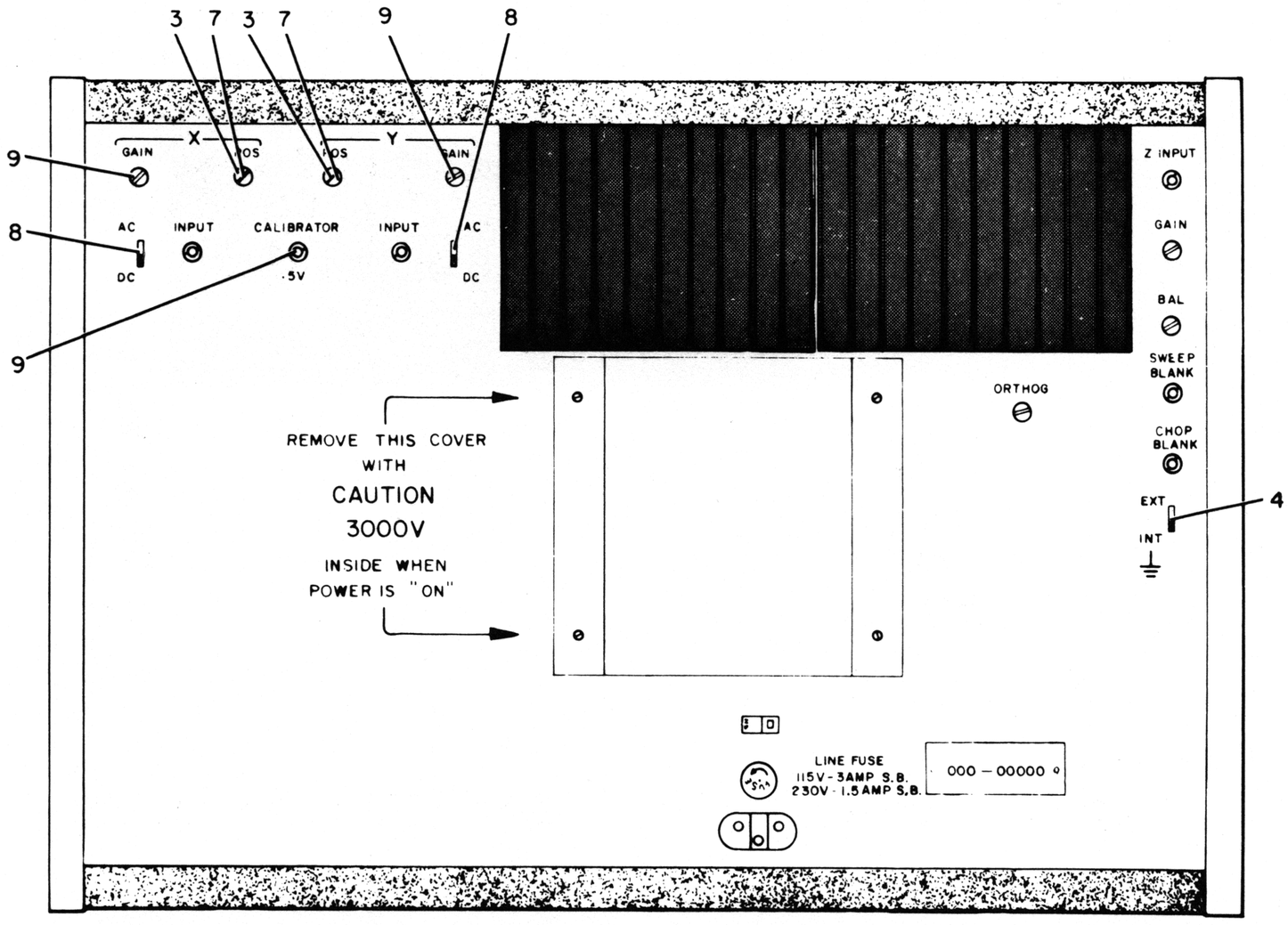
13. SWEEP BLANK. BNC connector for connecting blanking signals to the Z-amplifier. Positive voltage or low impedance to ground causes blanking.

14. CHOP BLANK. BNC connector for connecting chopped blanking signals directly to the cathode of the CRT. +50 v produces blanking. Signal is ac coupled. Connector is grounded when not in use by the INT-EXT switch.

15. ORTHOG. Screwdriver adjustment for adjusting the perpendicularity of the X and Y traces. Operates in conjunction with TRACE ALIGN adjustment on the front panel.

16. INT-EXT. Switch grounds Chop Blank INPUT when not in use.

Figure 3-2. Rear Panel Connectors and Controls



1300A-A-22

Steps 1 thru 6 are for initial set-up.
Steps 7 thru 10 are to adjust the Model 1300A for normal operation.

1. Set FOCUS fully ccw.

2. Set INTENSITY to approximately 10 o'clock.

3. Adjust X and Y POS controls to center of range.

4. Make certain that the INT-EXT switch (below the CHOP BLANK input) is set to the INT position.

5. Turn on Model 1300A.

6. As soon as spot appears, adjust INTENSITY and FOCUS controls for normal viewing.

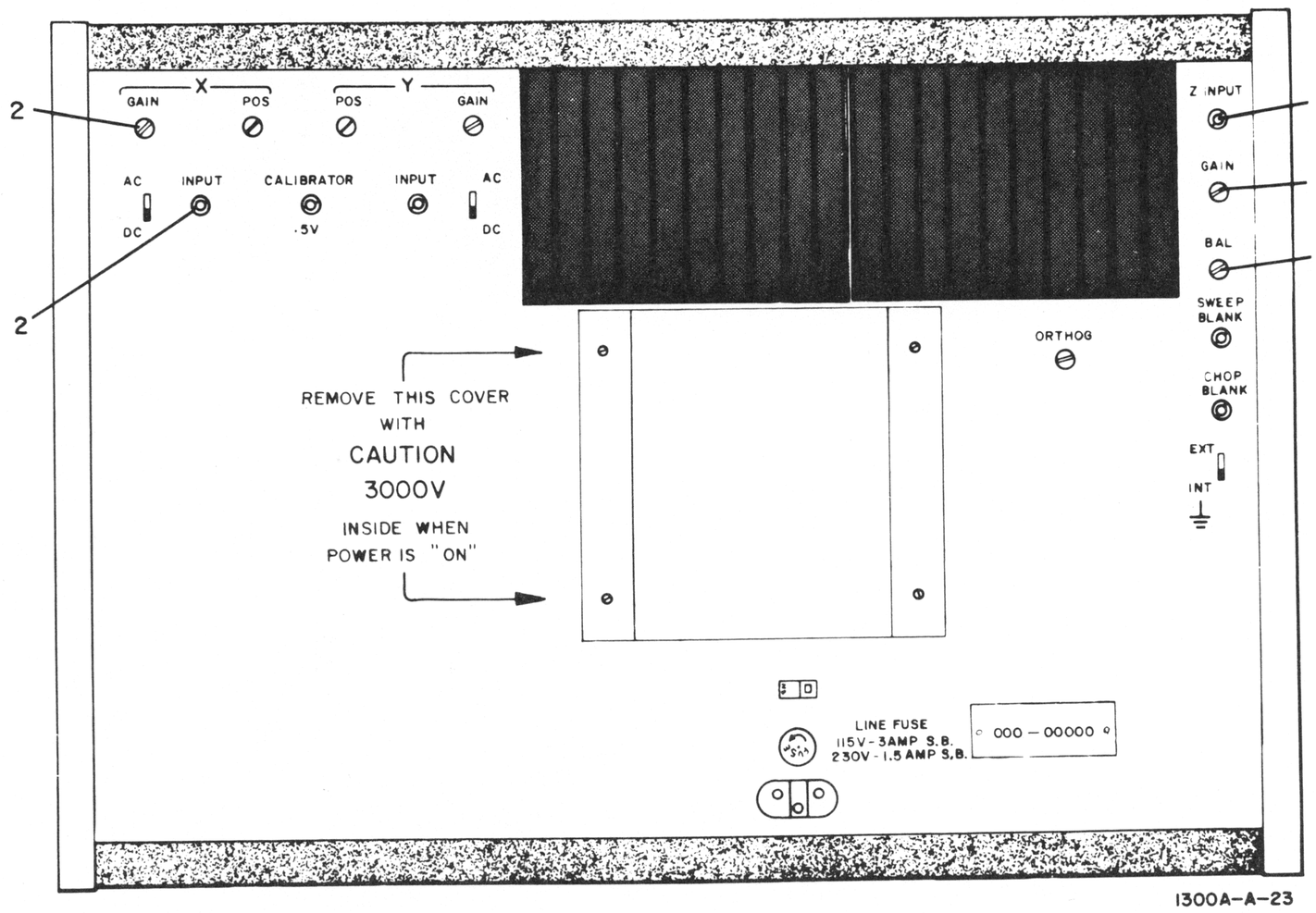
7. Adjust X and Y POS controls to position spot to the desired place on the CRT.

8. Set X and Y input coupling to DC if direct coupling is desired, or to AC if unwanted dc levels are present.

9. Apply 0.5 v CAL output to X or Y INPUT. Adjust X or Y GAIN to obtain desired sensitivity, 5 in. deflection for 0.1 volt/in. (maximum sensitivity), or 2 in. deflection for 0.25 volt/in. (minimum sensitivity).

10. Remove 0.5 v CAL from X or Y INPUT and apply signals to be displayed.

Figure 3-3. Normal Operation



1. Obtain and position spot as outlined under Figure 3-3 Normal Operation, steps 1 through 7.

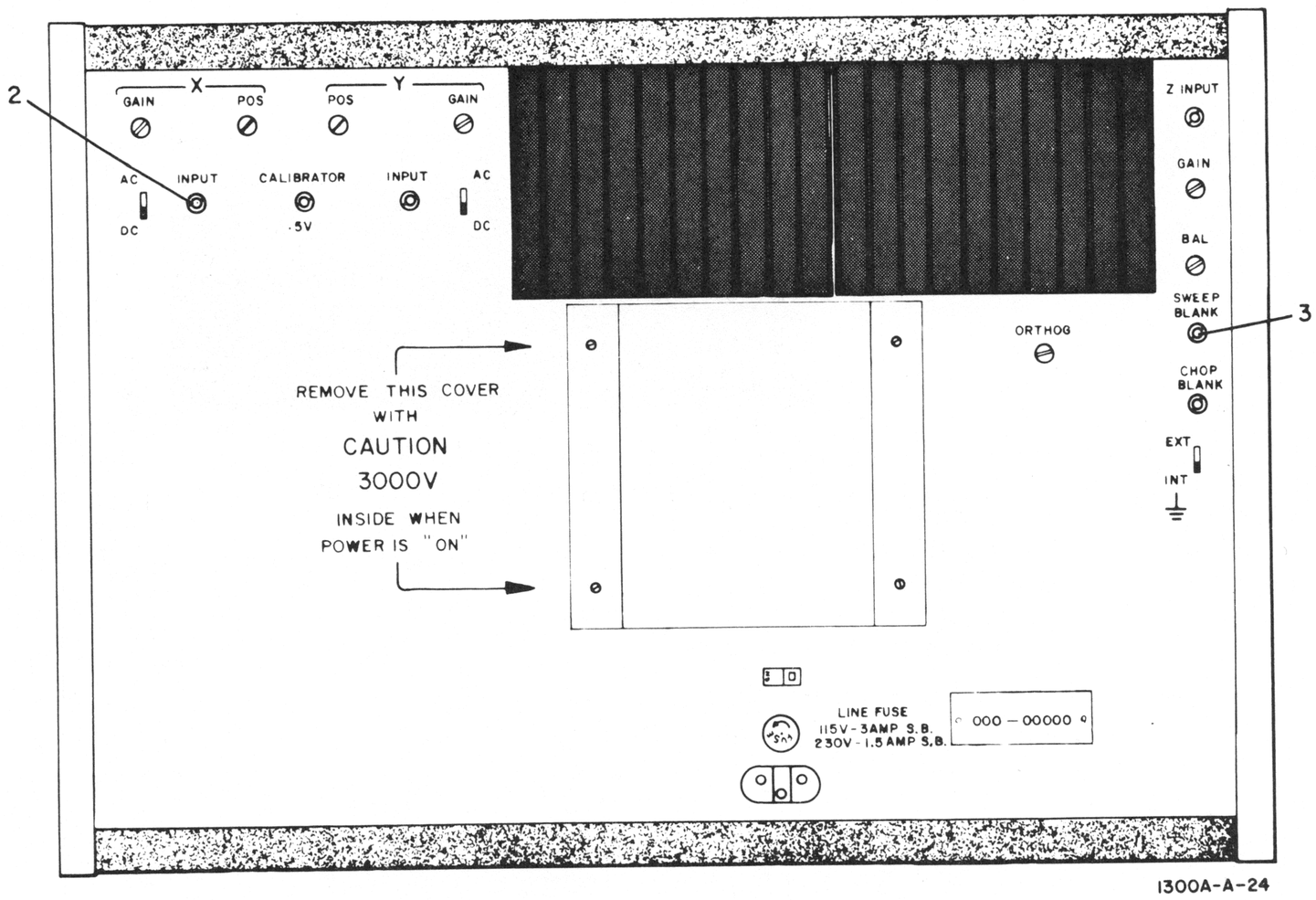
2. Apply a signal to the X INPUT, adjust X GAIN to obtain required deflection.

3. Apply the Z-axis signal to the Z INPUT.

4. Adjust Z GAIN for correct intensification/blanking.

5. If the Z-axis signal has a positive or negative dc level, adjustment of the Z BAL control will compensate for the dc level of the signal over a range of ± 1 v.

Figure 3-4. Z-Axis Operation



1. Obtain and position a display as outlined under Figure 3-3, Normal Operation.

2. Connect a 1 v pk-pk signal from the output of the horizontal signal generator to the X-INPUT on the Model 1300A.

3. Connect a signal which goes from a negative level to ground to the SWEEP BLANK input on the Model 1300A.

4. Adjust the timing and duration of the blanking signal to the horizontal signal to give the desired blanking as viewed on the CRT of the Model 1300A.

5. If a sweep blanking signal is not readily available, the circuit shown below may be used to blank the display using a negative input signal.

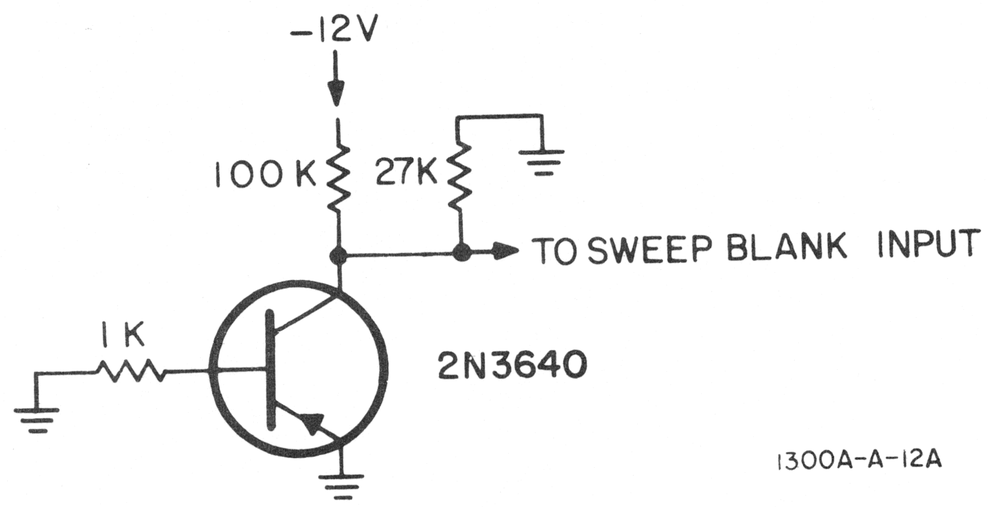
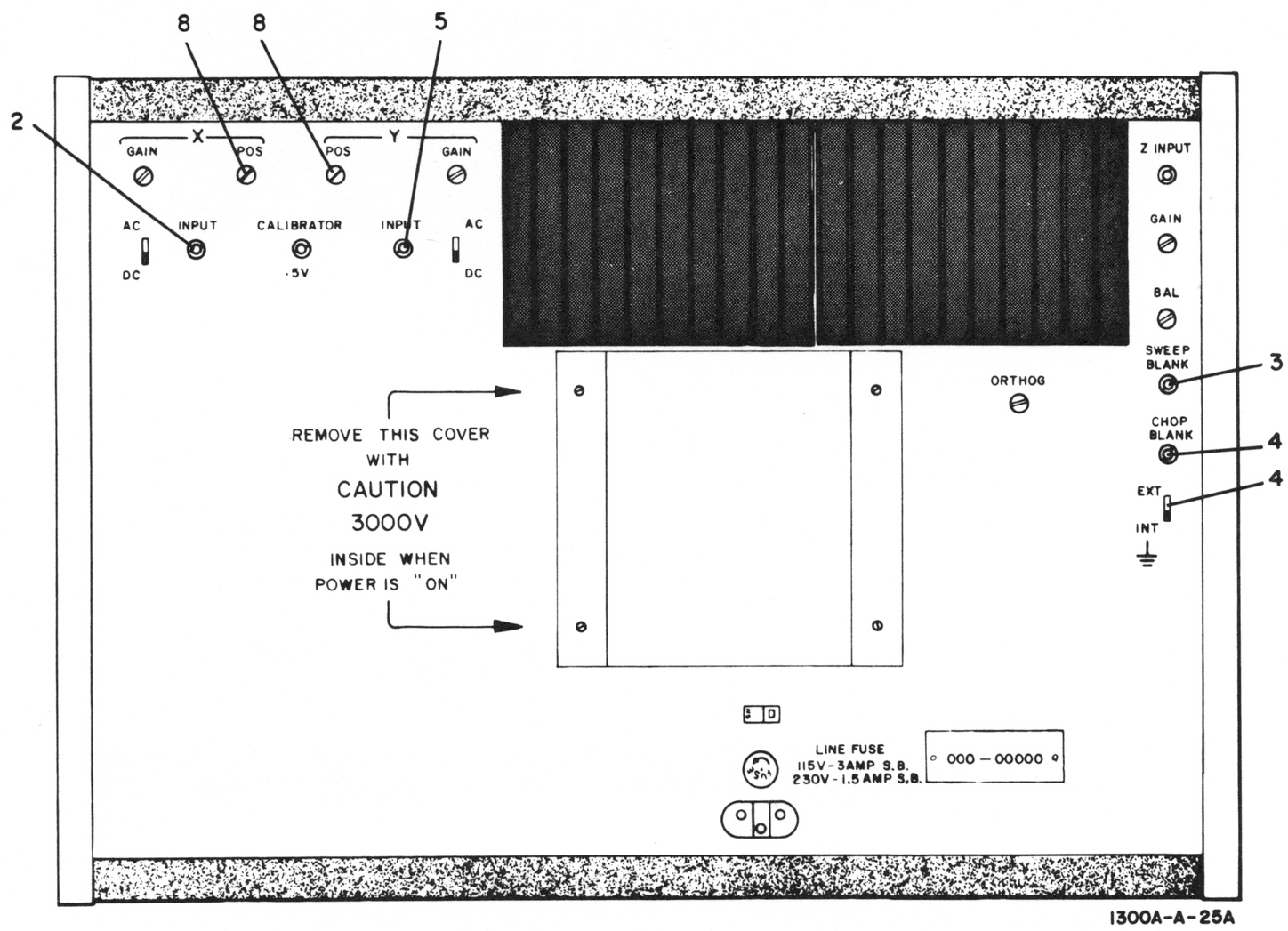


Figure 3-5. Sweep Blanking Operation



1. Obtain and position a display as outlined under Figure 3-3 Normal Operation.

2. Connect a 1 v pk-pk signal from the horizontal signal generator to the X-INPUT.

3. Connect a SWEEP BLANK signal as described on the preceding page.

4. Set the INT-EXT switch (on the back panel) to EXT, connect a +50 v pk blanking signal from the electronic switch to the CHOP BLANK INPUT.

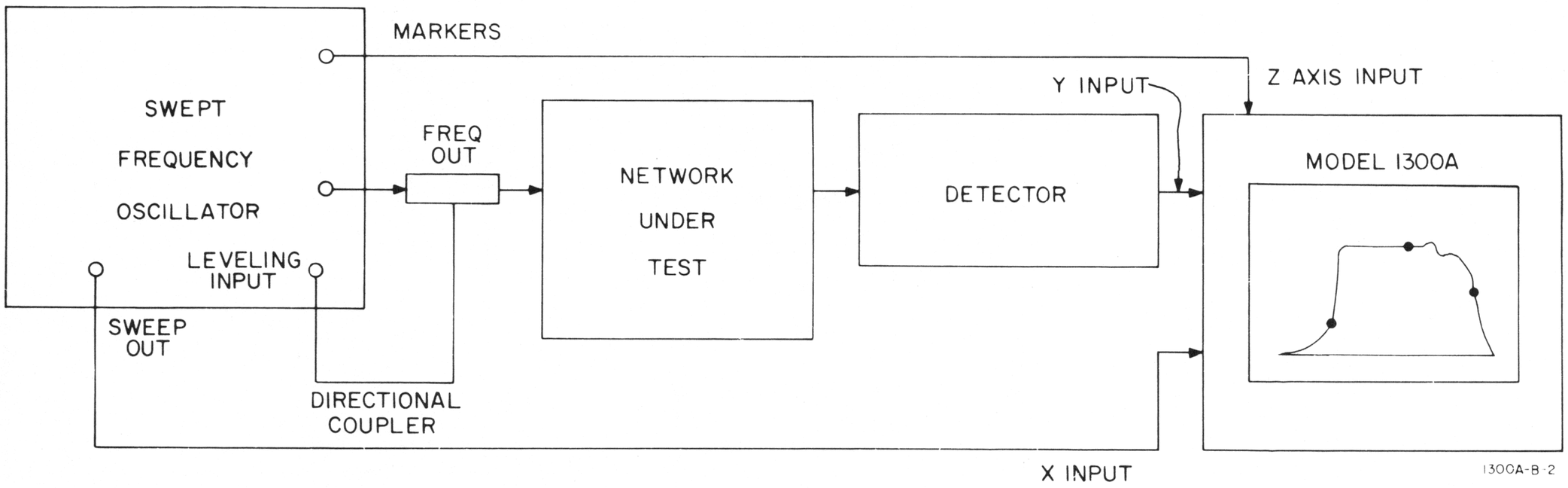
5. Connect the output of the electronic switch to the Y-INPUT.

6. Adjust the electronic switch to obtain the desired separation of the two traces.

7. Connect the signals to be displayed to the input of the electronic switch. Readjust the trace separation if necessary.

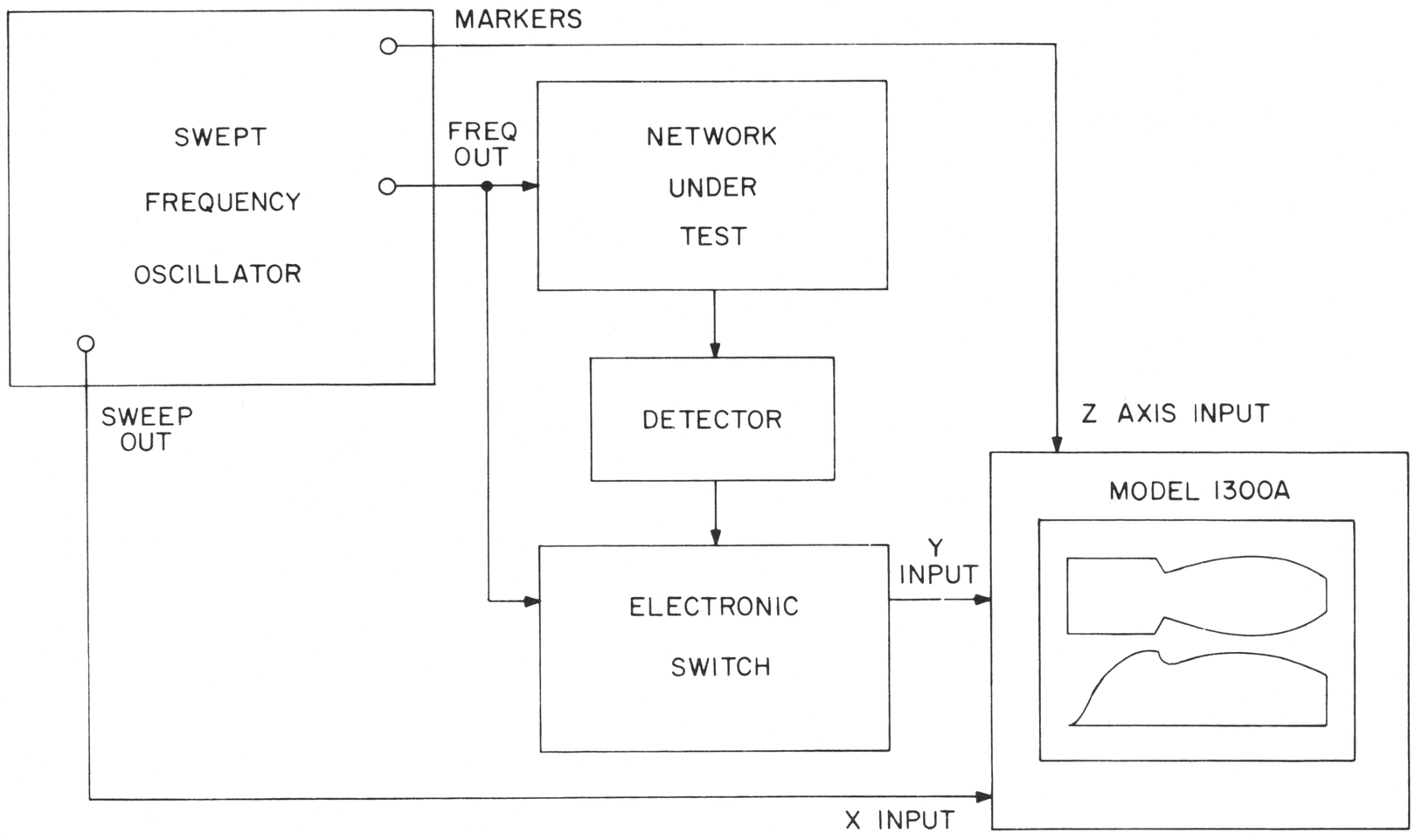
8. The whole display may be centered by adjusting the X and Y POS controls.

Figure 3-6. Chopped Blanking Operation



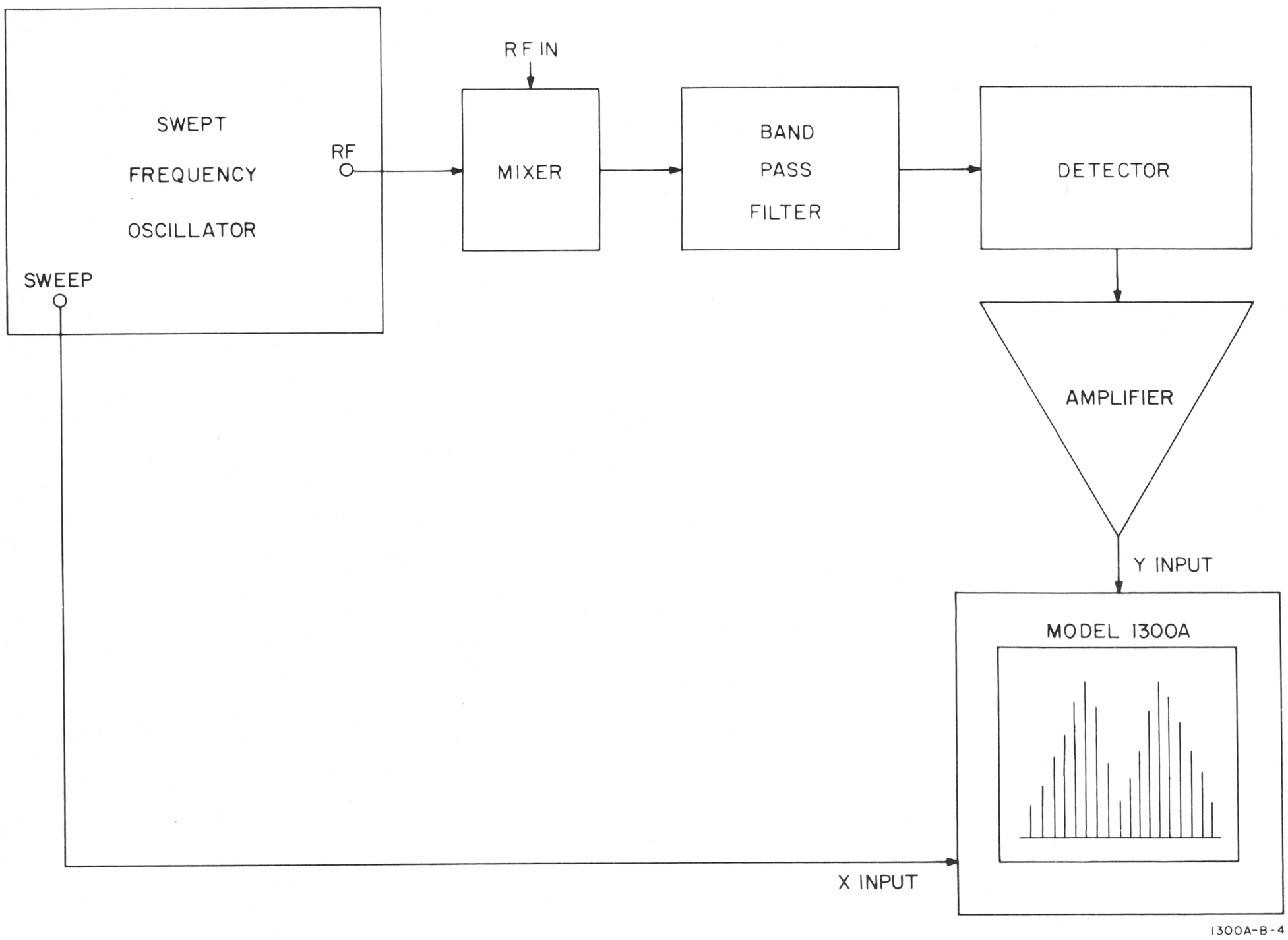
Because the display is large and easily read, the Model 1300A is ideal for examining the response characteristics of filters and amplifiers. The Swept Frequency Oscillator should have a leveled output. The Model 1300A will respond directly to frequencies up to 20 MHz. For measurement of frequencies above 20 MHz a Square Law Detector may be inserted between the Network under test and the Model 1300A. To obtain the display shown in the figure a gated output is required.

Figure 3-7. Frequency Response Measurements



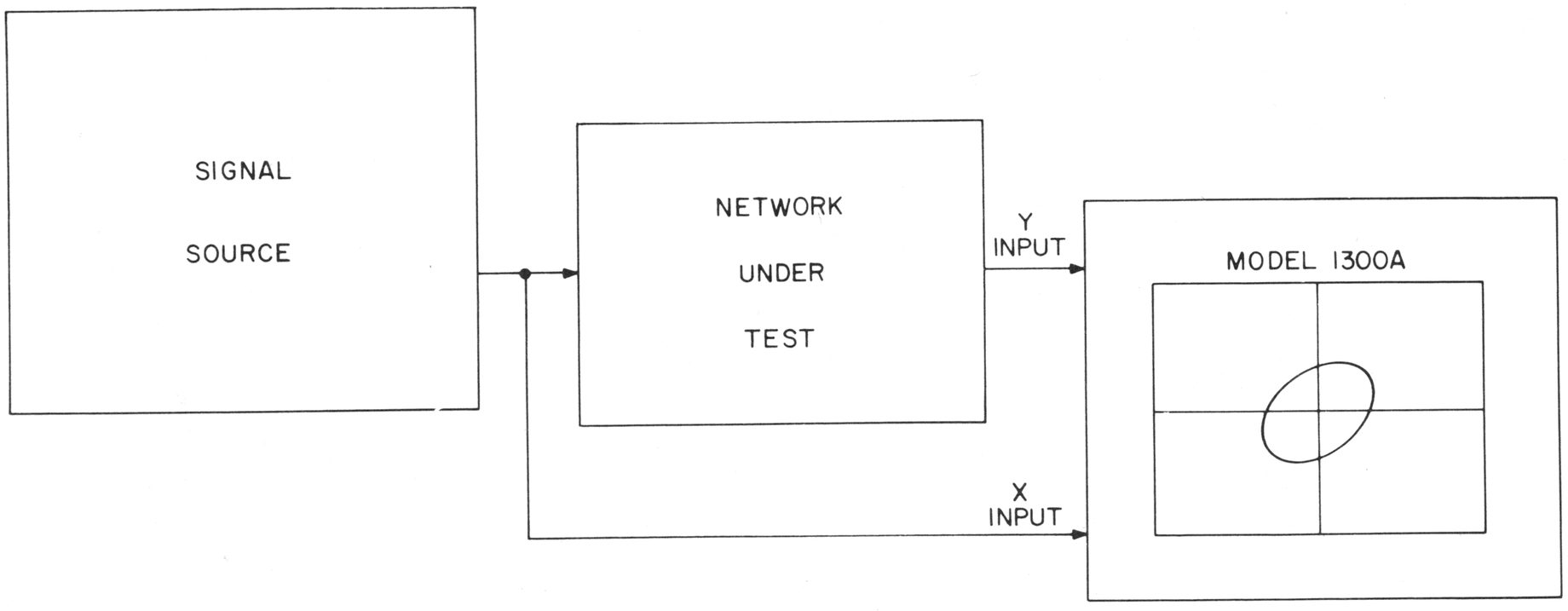
If a Swept Frequency Oscillator with a leveled output and a Square Law Detector are not available, the setup shown here will provide useful information. At the lower limit of the frequency range, the amplitude of the input signal is set by means of the Swept Frequency Oscillator, the gain of the electronic switch, and the Y-GAIN setting on the Model 1300A. As the frequency increases, any dips in amplitude or response of the three systems will be observed as a reduction in amplitude of the input signal's envelope and a corresponding dip in the detected output of the network under test.

Figure 3-8. Unleveled Frequency Response Measurements



A spectrum analyzer can be useful for bench testing of signal sources and RF components. A quickly constructed spectrum analyzer may be assembled from the components shown. The band pass filter may be an electronic type which will eliminate the requirement that the amplifier make up the insertion loss of the filter and the crystal detector. If the filter's bandwidth is adjustable, narrow to wide-band operation may be achieved. The Swept Frequency Oscillator should have a leveled output and the crystal detector should be operated in the square-law region.

Figure 3-9. Spectrum Analysis



Phase shift measurements require the least amount of equipment, but are difficult to make quantitatively. HP Application Note 29 gives methods for calculating phase shift. Figure 3-10 shows the required equipment connections. Low internal phase shift in the Model 1300A (0.1° for a 100 inch signal up to 50 kHz, 1° for a signal up to 1 MHz) makes it unnecessary to consider test equipment phase shift in these calculations.

Figure 3-10. Phase Shift Measurements

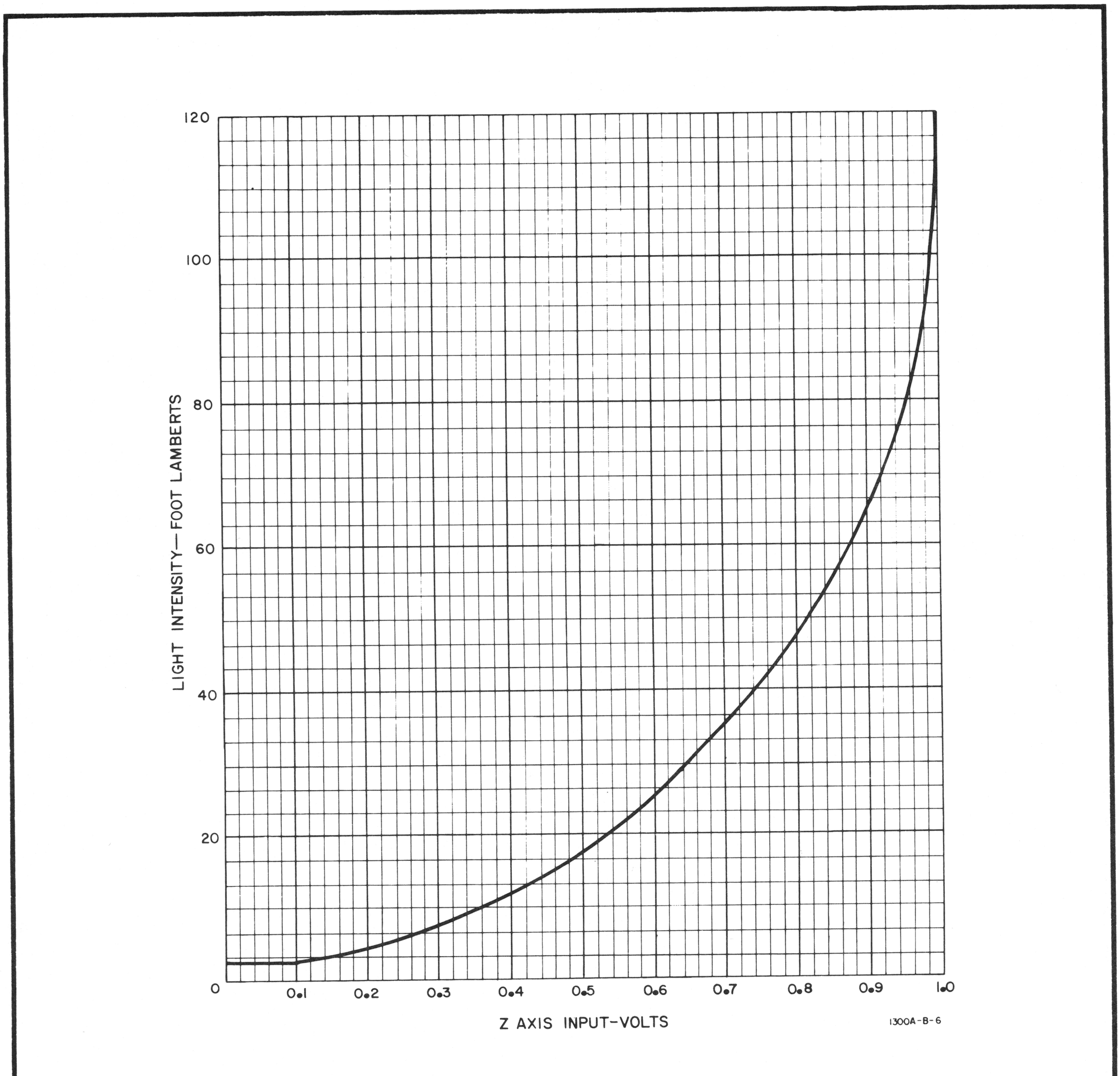


Figure 3-11. Light Output vs Input Voltage

NOTES

SECTION IV
PRINCIPLES OF OPERATION

4-1. GENERAL.

4-2. The Model 1300A X-Y Display is a wide-band large screen oscilloscope consisting of low and high voltage power supplies, a calibrator, a Z-Axis amplifier and X and Y deflection amplifiers. The X, Y, and Z amplifiers have full 20 MHz bandwidth capabilities. All amplifiers have single-ended inputs; all inputs are applied to connections on the rear panel. In addition to the three display inputs, two control inputs are also available; they are sweep blanking and chopped blanking. Refer to the Over-All Block Diagram, Figure 8-5, for the following functional description.

Note

Reference designations for components in the Model 1300A are assigned according to the Unit Numbering Method recommended by the American Standard Y32. 16- 1965. A detailed explanation of this Method is included in Section VIII, Paragraph 8-4 of this manual.

4-3. FUNCTIONAL DESCRIPTION.

4-4. DEFLECTION SYSTEM. A single-ended signal applied to the X or Y INPUTS will pass through the Impedance Converter without amplification. From the Impedance Converter the signal goes to the X or Y Deflection Amplifiers where it is amplified and converted into a differential signal. From the Deflection Amplifiers the signal is applied directly to the CRT.

4-5. Z-AXIS AMPLIFIER. The Z-Axis Amplifier adds the signal currents from three sources to provide a variable reference for the CRT grid supply. These sources are: 1) the INTENSITY control 2) the Z-Axis input signal, and 3) the output of the Sweep Blanking Schmitt Trigger. The Z-Axis amplifier varies the bias on the CRT in response to the sum of the input signals.

4-6. HIGH VOLTAGE POWER SUPPLY. The High Voltage Power Supply generates +17 kv, -3kv and -2950 v for the CRT. The -2950 v supply is sensed by a 30:1 divider and the resultant voltage is referenced to +100 v. Deviations from zero volts at the input are amplified and applied to the oscillator. The 3 kv grid supply "floats" with respect to the -2950 v cathode supply. The Quadrupler rectifies and quadruples the voltage at its input and develops +17 kv for the post accelerator of the CRT. One voltage for the CRT is not generated in the High Voltage Power Supply. This voltage (46.4 v) is applied to the accelerator electrode in the CRT.

4-7. LOW VOLTAGE POWER SUPPLY. The low voltage power supplies are series regulated power supplies. The reference voltage for the -100 v power supply is the +100 v supply instead of a breakdown diode or glow tube. The +15 v and -15 v supplies are referenced to the -100 v power supply. Only the positive and negative 100 v outputs are adjustable.

4-8. CALIBRATOR. The calibrator amplifies 6 vac from the power transformer and applies the amplified signal to a transistor switch. The switch connects ground to the center of a precision voltage divider on alternate half cycles of the input waveform. The output is a positive going 0.5 v pk-pk square wave of line frequency, referenced to ground. The rise time of the square wave is typically less than 1 μsec. The calibrator output impedance is approximately 1 k ohm.

4-9. CIRCUIT DESCRIPTION.

4-10. DEFLECTION SYSTEM.

4-11. The vertical and horizontal deflection systems are exactly alike; therefore, only the horizontal deflection system is described in the next paragraphs. Refer to Figures 8-7 and 8-11 for this description. The vertical deflection system schematics are Figures 8-12 and 8-13. The horizontal deflection system is divided into two sub-systems: the X-Axis Impedance Converter and the X-Axis Deflection Amplifier.

4-12. X-AXIS IMPEDANCE CONVERTER. Refer to Figure 8-7 for the schematic diagram of the Impedance Converter. The over-all purpose of the Impedance Converter is to reduce the input impedance to a value low enough to drive the Deflection Amplifier at the required bandwidth. The input signal is applied to the gate of the input Source Follower. The output of the Source Follower is coupled through an Emitter Follower, A1Q3, to the Output Emitter Follower. The diodes on the input prevent excessively large input signals from damaging the Source Follower. The X-POS control, R1, adjusts the voltage level to the input of Source Follower, A1Q2. The output of A1Q2 changes current through the next two stages (A1Q4, A1Q6) and thereby provides positioning current to the input of the Deflection Amplifier. The X-GAIN control, R2, is part of a differential voltage divider consisting of A1R8, R2, A1R9 and A1R18. The GAIN control gives a minimum to maximum gain ratio of nearly 3:1. In order to prevent trace drift, the input Source Followers are mechanically coupled together by means of a metal heat equalizer. The cases of the Input Source Followers are connected to ground through a fourth lead from the header of each unit. Grounding the cases reduces noise pick-up at the input.

4-13. DEFLECTION AMPLIFIER. Refer to Figure 8-11 for a schematic of the Horizontal Deflection Amplifier. The output signal from the Impedance Converter is applied to the bases of the input Emitter Followers. The output from these Emitter Followers is dc coupled to the first Differential Amplifier, A2A1Q3 and A2A1Q4. The positioning current from Output Emitter Follower, A1Q6, establishes a voltage level at the base of A2A1Q4 through Emitter Follower,

A2A1Q2. The signals at the collectors of A2A1Q3/Q4 are the amplified difference between the incoming signal at the base of A2A1Q3 and the level on the base of A2A1Q4. The difference signals are direct coupled through Emitter Followers A2A1Q5/Q6 to the diode antisaturation networks at the input to the Output Cascode Amplifier. Should a signal large enough to saturate the Output Amplifiers be supplied to the antisaturation networks, both diodes will conduct, maintaining the base to collector junction of the input amplifiers reverse - biased by approximately 7 v (the difference between the forward drop of the standard diodes and the 8 v drop across the breakdown diodes). The output amplifiers in the Output Cascode Amplifier are prevented from saturating by the diode in series with their bias supply. As the signal on the emitters of these amplifiers drives them toward saturation a point is reached where the diodes in the base circuits begin to cut off due to the increased base current requirements of the amplifiers. If the diodes become completely turned off, the base-to-collector junctions will remain reverse - biased by the drop across A2A2R1/R4. The dividers consisting of A2A2R1/R4, A2A1R16/30, and A2A1CR2/CR4 form negative feedback loops which serve to limit dissipation in the Output Amplifier at high signal levels. The HF Adjusts are peaking adjustments which vary the gain of the differential amplifiers at high frequencies by lowering the impedance common to both emitters in each amplifier, increasing the amplitude of differential signals above the desired frequency limits.

4-14. Z-AXIS AMPLIFIER.

4-15. The Z-Axis Amplifier is, essentially, a three input operational amplifier which varies the reference level of the CRT grid supply with respect to the CRT cathode supply reference (ground).

4-16. Figure 8-15 is the schematic diagram of the Z-Axis Amplifier. The Z-Axis Amplifier sums the signal currents from three sources and develops an output level which sets the bias on the CRT and thus controls the intensity of the display. The current sources are: 1) the Z-input signal current through A3Q3, 2) the current through the INTENSITY control, and 3) the current from the Blanking Schmitt Trigger.

4-17. INTENSITY CONTROL. The INTENSITY control establishes the reference bias level on the CRT by setting the current level through the Summing Amplifier. Increasing the intensity of the display by means of the INTENSITY control will increase the conduction of the Summing Amplifier.

4-18. Z-AXIS INPUT. The signal applied to the Z-AXIS INPUT is direct coupled to a Source Follower. The output of this Source Follower drives one side of a differential amplifier. The Z-BAL control, R8, provides a fixed voltage to the base of A3Q3. The fixed base voltage sets the emitter voltage of A3Q3. Normally this voltage is set so that no difference in voltage exists across the GAIN control, R7. Any signals on the input to the Source Follower will increase or decrease the voltage across the GAIN control and thereby vary the current through A3Q3. This current will then add to or subtract from the current through the Summing Amplifier.

4-19. SWEEP BLANKING. A positive input to the SWEEP BLANK input will switch the Blanking Schmitt Trigger. When switched, the Schmitt Trigger will decrease the current through the Summing Amplifier and thereby cut off the CRT. The Schmitt Trigger consists of A3Q9 and A3Q10. The hysteresis band of this circuit is approximately 1 v. Initially, A3Q9 is conducting heavily and is in saturation. Base current to A3Q9 is supplied by A3R37 through A3CR8. A positive going input to the SWEEP BLANK input will begin to turn A3CR8 off and decrease the base drive to A3Q9. Any reduction in base drive will tend to bring A3Q9 out of saturation and increase the voltage drop from collector to emitter. When the collector to emitter voltage becomes large enough to start turning on A3Q10 the increased current through A3R41 will initiate a regenerative action which ends with A3Q9 cut off and A3Q10 in saturation. The saturated impedance of A3Q10 is so low that all of the current from A3Q3 and the INTENSITY control is shunted away from the Summing Amplifier, cutting it off and blanking the CRT.

4-20. SUMMING AMPLIFIER. The Summing Amplifier adds the three input currents and the feedback current and provides an output signal which is coupled through Emitter Followers to the Complementary Output Amplifiers. The Output Amplifiers amplify the input signals to a voltage level to control the CRT trace intensity. A positive-going level will increase the conduction of the CRT and brighten the display.

4-21. HIGH VOLTAGE POWER SUPPLY.

4-22. The High Voltage Power Supply consists of three assemblies: the High Voltage Regulator A4, the High Voltage Rectifier A5, and the Quadrupler A8. This system generates all of the voltages for operating the CRT except one which is discussed with the low voltage power supplies.

4-23. HIGH VOLTAGE REGULATOR. The High Voltage Oscillator circuit (see Figure 8-18) produces a sine wave signal of approximately 20 kHz which is used to drive the high voltage transformer A5T1, which generates the voltage levels required to operate the CRT. When the signal on the base of HV Oscillator A4Q4 goes positive, it drives the collector negative. This negative signal is coupled back to the base by the mutual inductance of A5T1's primary windings. The sine wave developed is stepped up through the transformer, rectified and filtered. Some of this output is fed back to the base of A4Q4. This feedback voltage controls the amplitude of the oscillator signal and therefore controls the output voltage of the supply. The voltage from pin 10 of A5T1 is rectified by A5CR1 and filtered by A5R3 and A5C2 through A5C6. It is then coupled through an RC Network, A5C11 and A5R8, to the gate of A4Q1. Any variation in the feedback voltage level is amplified by A4Q2/A4Q3 and applied to the base of A4Q4 to re-establish the proper output voltage of -2950 v.

4-24. The RC Network and A4R1 and A4R2 in series form a 30:1 voltage divider. Returning the low end of the divider to +100 v sets the output at a level close to ground. If the -2950 v goes positive by 30 volts, the input to A4Q1 will go positive by 1 volt. The 1 volt

change is direct-coupled to A4Q2 and will cause A4Q2 to conduct more heavily. A4Q2 and A4Q3 are direct-coupled; therefore, an increase in conduction of A4Q2 will result in an increase in conduction of A4Q3. The same is true for A4Q3 and A4Q4. When A4Q4 conducts more heavily the transformer, A5T1, couples more energy into the secondary. Thus more voltage of opposite polarity is produced and the system returns to a balanced state. A4R8 and A4C2 are a high frequency roll-off network which reduces the gain of A4Q2 above approximately 100 Hz. Diode A4CR3 at the emitter of amplifier A4Q2, insures the start-up of the High Voltage Oscillator, A4Q4, by preventing Amplifier A4Q2 from saturating immediately after application of power. Saturation of A4Q2 will cut off A4Q3 and A4Q4. During the time just after power is applied to the Model 1300A, no high voltage is available at the output of the supply. Thus, no feedback voltage is produced, and the regulator will attempt to correct the situation by applying a very high amplitude error signal to the base of A4Q2. The high amplitude error signal will cause the first regulator amplifier to conduct very heavily. Without A4CR3 the amplifier would go into saturation because the voltage at the collector will go negative enough to forward-bias the base to collector junction of the transistor. The forward-biased base to collector junction will force the collector to follow the positively increasing error signal at the base, cutting A4Q3 off. A4CR3 prevents saturation by limiting the positive signal at the base of A4Q2 to approximately +2 v which cannot saturate the transistor.

4-25. CRT POST-ACCELERATOR VOLTAGE. The CRT post-accelerator voltage is developed in the High Voltage Power Supply. The sine wave signal produced by High Voltage Oscillator, A4Q4, is stepped up by the high voltage transformer which produces a peak-to-peak voltage of approximately 5 kv between pins 8 and 6. This signal is then applied to a high voltage rectifer assembly, A8, which is a quadrupler circuit. The Quadrupler assembly rectifies the input voltage and multiplies it to approximately +17 kvdc to drive the CRT post-accelerator (anode).

4-26. CRT CATHODE VOLTAGE. AC for the CRT cathode supply is obtained from pins 10 and 6 of high voltage transformer A5T1. The transformer signal is rectified by A5CR1 and filtered by A5C2 through A5C6. A portion of the high voltage is returned to the high voltage oscillator amplifiers, A4Q1/A4Q3, through the feedback circuitry A5C11/A5R8 to provide a regulated cathode voltage of -2950 volts dc. FOCUS control, R11 is part of a resistive voltage divider connected to the -2950 v supply. The divider consists of A5R9, A5R11, and R11. A separate divider is necessary to eliminate variations on the cathode supply when adjusting the focus setting.

4-27. CRT GRID VOLTAGE. The CRT grid voltage is developed by the voltage divider string across pins 5 and 11 of the high voltage transformer. The ac voltage from pin 11 is rectified by A5CR2 and filtered by A5C7 before being applied to the divider. The Intensity Limit control, A5R5, adjusts the current through the divider and therefore the voltage drop across A5R7. The common side of the grid supply is at a level determined by the output level of the Z-Axis Amplifier.

4-28. CHOPPED BLANKING. Chopped blanking is used where it is desired to display two low frequency signals simultaneously with the same time reference. The CHOP BLANK input is an ac-coupled input which is connected to the cathode of the CRT. A +50 v signal at the CHOP BLANK input will blank the CRT. In normal operation this connector is grounded by S5 (INT-EXT) to prevent noise from modulating the CRT display.

4-29. LOW VOLTAGE POWER SUPPLY.

4-30. The Low Voltage Power Supplies provide regulated +100 v, -100 v, +15 v and -15 v for operation of the various circuits in the Model 1300A and +46.4 v for the CRT. The supply consists of two assemblies: A6, the Low Voltage Rectifier and Fuse Board; and A7, the Low Voltage Regulator and Calibrator Board.

4-31. +100 v SUPPLY. See Figure 8-21 for this explanation. Power transformer T1 steps up the line voltage to approximately 150 v at pins 3 and 4. This 150 vac is rectified by a full-wave bridge, A6CR1 through A6CR4. The rectified ac is filtered by C3. C9, across pins 3 and 4 of T1, is a noise-suppression filter. The unregulated dc is coupled to the regulator through a 3/4 amp fuse which provides protection in the event of a short circuit. A portion of the output voltage is compared to a reference level by Differential Sensor Amplifiers A7Q3 and A7Q4. The voltage used for comparison is determined by the adjustment of A7R14, the +100 v adj. The reference level is set by a glow tube, A7VR1, at approximately +82 v. If the output voltage varies, an error signal is produced and the amplified signal is applied to the driver A7Q5. A positive change of 1 v in the output voltage will result in a positive change of 0.8 v at the base of A7Q3. This will produce a negative change at the collector of A7Q3. The negative change at the collector of A7Q3 will reduce the conduction of A7Q5 and Q1; the output voltage will decrease until the voltages at the bases of A7Q3 and A7Q4 are equal. A7R6 and A7VR2 form a regulated +106 v supply which is necessary to provide the required bias voltage at the base of A7Q5. A7R12 and A7C2 provide higher gain for ac variations on the +100 v line by shunting the ac signal around the upper half of the divider network. R16 gives the Series Regulator, Q1, current-limiting protection in the event of a short circuit to ground at the output. A network consisting of A7R10 and A7C1 provides gain reduction at higher frequencies for the supply feedback loop. A7VR1 protects A7Q5 from turn-on transients or line transients above the allowable operating line voltage. A7R16 and A7VR3 form a 46.4 v regulated supply for the accelerator electrode in the CRT.

4-32. -100 v SUPPLY. The -100 v supply operates in exactly the same manner as the +100 v supply. The difference between the two supplies is the method used to provide a reference voltage for the Differential Sensor Amplifier. Although both the reference and the sensor voltage will change with a variation in the -100v, a greater percentage of voltage variation will be felt by A7Q1 and therefore an error signal is developed at the collector of A7Q10.

4-33. POSITIVE AND NEGATIVE 15 v SUPPLIES. The line voltage is stepped down by T1 to approx.

28 vac at pins 2 and 13, and 5 and 10. The 28 vac is rectified by a full wave bridge for each supply and filtered before being regulated. Deviations are sensed by amplifiers A7Q6 and A7Q8 for the +15 v and -15 v supplies respectively. These variations are amplified and inverted and applied to the driver transistors which in turn cause the series regulators to reduce the variation on the outputs. The reference for the error amplifiers is provided by a resistor divider returned to -100 v. There is no adjustment for either of these supplies and accuracy is dependent upon the -100 v output and the relative ratio of the resistors in the divider to one another.

SECTION V
PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section provides the performance check (Paragraph 5-5) and the adjustment procedure (Paragraph 5-17) for the Model 1300A. Troubleshooting information, schematic diagrams, and component identification are in Section VIII.

5-3. TEST EQUIPMENT.

5-4. Test equipment required for maintaining and checking the performance of the Model 1300A is listed in Table 5-1. Test equipment having characteristics similar to those listed in the table may be used for the performance check and adjustments.

5-5. PERFORMANCE CHECK.

5-6. The performance check verifies whether or not the Model 1300A is operating within the specifications as stated in Table 1-1. This check may be used as part of an incoming quality control inspection, as a periodic operational check, or after repair and/or adjustments have been made. Recently calibrated test equipment should be used when performing the check.

5-7. A Performance Check Record form is included in this manual on Page 5-2a/5-2b. As the initial performance check is accomplished, the actual readings should be entered on the form. The form should then be removed from the manual and filed in a safe place so that readings taken at a later date can be compared with the original readings.

5-8. The performance check must be done in the sequence given below. Do not attempt to start the procedure in mid-sequence, as succeeding steps are dependent upon control settings and results of previous steps.

5-9. PRELIMINARY SET-UP.

5-10. Apply power to the Model 1300A and all test equipment. Allow at least fifteen minutes for warm-up.

5-11. X AND Y-AMPLIFIER SENSITIVITY AND VERNIER RANGE.

a. Apply 0.5 V CALIBRATOR output to X-INPUT.

b. Adjust X-GAIN fully cw; trace on CRT should be at least 5 inches in length.

c. Adjust X-GAIN fully ccw; trace should be less than 2 inches in length.

d. Adjust X-GAIN for 5 inches deflection and disconnect 0.5 V CALIBRATOR.

e. Repeat steps a through d interchanging X and Y INPUT and controls.

5-12. X AND Y AMPLIFIER BANDWIDTH.

a. Connect the output of the Constant Amplitude Signal Generator to the X-INPUT.

b. Adjust the Generator frequency to 50 KHz and amplitude to obtain 8 inches of deflection.

c. Increase the frequency of the Generator to 20 MHz (keep the generator output constant); deflection should be at least 5.7 inches.

d. Repeat steps a through c interchanging X and Y INPUTS.

5-13. X AND Y PHASE SHIFT.

a. Connect the output of the Constant Amplitude Generator to the X-INPUT.

b. Set the Generator frequency to 50 KHz and amplitude to 0.5 v pk-pk.

c. Adjust the X-GAIN for 5 inches of deflection.

d. Repeat steps a through c interchanging the X and Y INPUTS.

e. Connect the output of the Constant Amplitude Signal Generator to the X and Y INPUTS.

f. Center display with X and Y POS controls; increase Generator amplitude to 10 v.

g. The diagonal traces should cross the center line within 0.1 inch of each other.

h. Increase the frequency of the Generator to 1 MHz and decrease the amplitude to 1 v pk-pk.

i. The diagonal traces should cross the center line within 0.1 inches of each other.

j. Disconnect the Generator from the X and Y-INPUTS.

5-14. Z-AXIS AMPLIFIER RANGE.

a. Connect the Voltmeter Calibrator Output to the Z-INPUT.

b. With the INTENSITY fully ccw adjust the Voltmeter Calibrator to -1 v dc; the CRT should be unblanked.

c. Turn FOCUS fully ccw and INTENSITY fully cw.

d. Set the Voltmeter Calibrator to +1 v dc; CRT should be blanked.

e. Disconnect the Voltmeter Calibrator.

f. Return INTENSITY to 12 o'clock.

5-15. CHOPPED BLANKING.

a. Adjust SYMMETRY control on Square Wave Generator so the positive cycle is as narrow as possible.

b. Connect the 600 ohm output of the Square Wave Generator to the CHOP BLANK input and the input of the Monitor Oscilloscope; connect the 75 ohm output to the X-INPUT.

c. Adjust the Generator 75 ohm attenuator to produce 4 to 5 inches of deflection.

Table 5-1. Required Test Equipment

Recommended Type	Instrument Model	Required Characteristics	Check	Paragraph
PERFORMANCE CHECK				
Constant Amplitude Signal Generator	Tektronix type 191 or 190 B	50 KHz to 20 MHz at 10 v pk-pk	Bandwidth	5-12
			Phase Shift	5-13
Voltmeter Calibrator	hp 738 BR	0.1 v to 300 v; dc and ac (rms and pk-pk, 400 Hz)	Z-Axis Range	5-14
			Calibrator	5-16
Square Wave Generator	hp 211A	500 Hz; 5 and > 50 v output into 0.5 Megohm	Chopped Blanking	5-15
Monitor Oscilloscope	hp 180A w/1801A and 1821A or 1820A	DC to 50 MHz Bandwidth; 0.2 μsec/cm to 5 Msec Sweep output	Calibrator	5-16
ADJUSTMENT				
DC Voltmeter	hp 414A	15 vdc to 100 vdc ± 1%; Resolution -0.1 v	Low Voltage Power Supplies	5-23
DC VTVM	hp 410B	30.0 v dc ± 3%	HVPS	5-25
Voltage Divider	hp 11044A	100:1 divider probe ± 1% accuracy; for 410B	HVPS	5-25
Constant Amplitude Signal Generator	Tektronix type 191 or 190B	50 KHz to 20 MHz @ 10 v pk-pk	Geometry	5-29
10:1 Probe	hp 10002C	10:1 attenuator. 10 Meg shunted by 20 pf; attenuation accuracy ± 2%	Geometry	5-29
			Trace Align	5-31
			Deflection Amplifier Pulse Response	5-35
Monitor Oscilloscope	hp 180A w/1801A and 1821A or 1820A	DC to 50 MHz Bandwidth; 0.2 μsec to 5 msec sweep speed Sweep output	Geometry	5-29
			Trace Align	5-31
			Deflection Amp Pulse Response	5-35
			Z-Axis Pulse Response	5-37
Square Wave Generator	hp 211A	500 Hz 5 v and > 50 v amplitude into 0.5 Megohm	Input Bias Compensation	5-33
Pulse Generator	hp 222A	Output > 0.5 v; rise time < 5 ns; frequency 400 KHz	Deflection Amplifier Pulse Response	5-35
			Z-Axis Pulse Response	5-37
50Ω Termination	hp 10100A	50Ω ± 1Ω	Deflection Amp Pulse Response	5-35
			Z-Axis pulse Response	5-37
50:1 Probe	hp 10002A	50:1 attenuation; 50 Meg shunted by 2.5 pf; division accuracy 3%	Z-Axis Pulse Response	5-37

CUT ALONG DOTTED LINE

1300A PERFORMANCE TEST RECORD

Instrument Serial Number _____

PAR.	STEP	CHECK	MIN	READING	MAX
5-11	b	X Amp Sensitivity and Vernier Range	5 inches	_____	2 inches
	c				
	e	Y Sensitivity and Vernier Range	5 inches	_____	2 inches
5-12	c	X Amplifier bandwidth	5.7 inches	_____	
	d	Y Amplifier bandwidth	5.7 inches	_____	
5-13	g	50 KHz phase shift		_____	0.1 inches
	i	1 MHz phase shift		_____	0.1 inches
5-14	b	Z-Axis blanking	CRT is completely blanked	_____	
	e	Z-BAL range; high	CRT is blanked	_____	
	h	Z-BAL range; low	CRT is blanked	_____	
5-15	e	Chopped blanking		_____	50 v pk-pk
5-16	d	Calibrator Amplitude	4.9 cm	_____	5.1 cm

d. Increase the 600 ohm amplitude until the bright dot at the left end of the display is extinguished.

Note
The 75Ω and 600Ω outputs are 180° out of phase.

e. The amplitude of the waveform on the Monitor Oscilloscope should be +15 v or less.

5-16. CALIBRATOR.

a. Connect the output of the Voltmeter Calibrator to the input of the Monitor Oscilloscope.

b. Set the Voltmeter Calibrator to 400 Hz 0.5 v pk-pk square wave out; obtain 5 cm of deflection on the Monitor Oscilloscope. Disconnect the Voltmeter Calibrator.

c. Connect 0.5 V CALIBRATOR output to Monitor Oscilloscope input. Adjust the sweep speed to obtain a good display of the Calibrator waveform.

d. Calibrator waveform should be 5 cm ± 1 mm in amplitude.

5-17. ADJUSTMENTS.

5-18. Procedures for adjusting the Model 1300A are given in Paragraphs 5-20 through 5-35. The required test equipment is listed in Table 5-1 and at the beginning of the individual adjustment procedures. Test equipment with similar characteristics may be substituted if necessary. Figures 8-2 through 8-4 show the location of adjustments in the Model 1300A.

5-19. After making the adjustments or repairs, recheck the Model 1300A by completing the performance checks, Paragraphs 5-9 to 5-16.

5-20. PRELIMINARY SET-UP.

5-21. Set the controls on the Model 1300A as follows:

a. INTENSITY. . . . . 10 o'clock

b. X and Y GAIN . . . . . max cw

c. X and Y POS . . . . . To center spot

d. Z BAL . . . . . Centered

5-22. Turn on the Model 1300A and all test equipment. Allow fifteen minutes for warm-up.

5-23. LOW VOLTAGE POWER SUPPLIES.

5-24. The DC Voltmeter is required for this check.

a. Connect the Voltmeter ground lead to the chassis; measure the voltages at the Test Points on Regulator Board, A7.

b. Adjust the components in the order given in Table 5-2 to obtain the voltage shown.

Table 5-2. Low Voltage Adjustments

Voltage	Adjust
+100 v	A7R14
-100 v	A7R39

c. Check the Positive and Negative 15 volt supplies to determine that they are within 2% of nominal value, i. e. ± 15 v ± 0.3 v.

5-25. HIGH VOLTAGE POWER SUPPLY.

5-26. The VTVM and 100:1 Divider probe are required for this check.

WARNING

Voltages measured in the High Voltage Power Supply are dangerous to life.

a. Connect the 100:1 Divider Probe to the dc probe of the VTVM.

b. Set VTVM to -3 v DC range.

c. Set Voltmeter Calibrator to -300 v DC output and touch output with divider tip.

d. Set the VTVM gain to give a reading of -3 v on the VTVM.

e. Set VTVM to -30 vdc range, and measure the voltage at the HV Test Point on A5.

f. Adjust A4R1 for -29.5 v on the VTVM.

g. Remove the Divider Probe from the VTVM and recalibrate the VTVM if necessary.

5-27. INTENSITY LIMIT.

5-28. No equipment is required for this adjustment.

a. Set the INTENSITY to 9 o'clock.

b. Adjust A5R5 to just extinguish a focused spot.

5-29. GEOMETRY.

5-30. The Constant Amplitude Signal Generator, the Monitor Oscilloscope and the 10:1 Divider Probe are required for this adjustment.

a. Connect the output of the Constant Amplitude Generator to the Y-INPUT of the Model 1300A.

b. Connect the BNC end of the 10:1 Divider Probe to the X-INPUT of the Model 1300A and the Probe tip to the SWEEP OUT on the Monitor Oscilloscope.

c. Adjust the X-GAIN and the Signal Generator to obtain the largest square, solid pattern possible without the pattern going outside the graticule edge lines.

d. Adjust A4R13 to obtain the squarest display with the least distortion at the vertical and horizontal edges.

e. Disconnect the Constant Amplitude Generator.

5-31. TRACE ALIGN.

5-32. The Monitor Oscilloscope and the 10:1 Divider Probe are required for this adjustment.

a. Connect the BNC end of the 10:1 Probe to the X-INPUT on the Model 1300A. Connect the Probe tip to the SWEEP OUT on the Monitor Oscilloscope.

b. Adjust the TRACE ALIGN to bring the trace parallel to the horizontal axis of the CRT.

c. Disconnect the BNC end of the Probe and reconnect it to the Y-INPUT on the Model 1300A.

d. Adjust the ORTHOG control, located on the back panel, to align the trace parallel to the vertical axis.

e. Repeat steps a through d until no further adjustments are required.

f. Remove Probe from the X-INPUT.

5-33. INPUT BIAS COMPENSATION.

5-34. The Square Wave Generator is required for this adjustment.

a. Connect the 600Ω output of the Square Wave Generator to the Y-INPUT.

b. Adjust the X and Y POS controls to center the trace horizontally and set the zero reference (upper dot) at the vertical center.

c. While varying the symmetry of the Square Wave Generator, adjust A2A1R78, Input Bias Comp, until the zero reference dot does not shift.

d. Apply signal to X-INPUT, and center trace vertically. Repeat steps b and c, adjusting A2A1R77, Input Bias Comp. Zero reference is at the horizontal center.

5-35. DEFLECTION AMPLIFIER PULSE RESPONSE.

5-36. The Monitor Oscilloscope, 10:1 Divider Probe, the Pulse Generator, and 50 ohm feed through termination are required for these adjustments.

a. Connect the BNC end of the 10:1 Divider Probe to the X-INPUT of the Model 1300A and the Probe tip to the SWEEP output of the Monitor Oscilloscope.

b. Connect the pulse output of the Pulse Generator to the Y-INPUT through the 50 ohm feed through termination; connect the Trigger Output of the Pulse Generator to the EXT TRIG input of the Monitor Oscilloscope.

c. Set the Pulse Generator to provide a positive 2 μsec pulse of 0.5 v amplitude at a frequency of 400 KHz.

d. Adjust the sweep time of the Monitor Oscilloscope to display two or three pulses across the CRT; adjust triggering to stabilize the display on the CRT.

e. Adjust A2A1C14, 1st High Frequency Adjust, A2A1C17, 2nd High Frequency Adjust, and A2A1C12, 3rd High Frequency Adjust, to obtain the squarest pulse display without overshoot.

f. Repeat steps a through d, interchanging the X and Y-INPUT connections.

g. Adjust A2A1C3, 1st High Frequency Adjust, A2A1C6, 2nd High Frequency Adjust, and A2A1C1, 3rd High Frequency Adjust, to obtain the squarest pulse display without overshoot.

h. Disconnect all cables from the Model 1300A.

5-37. Z-AXIS AMPLIFER PULSE RESPONSE.

5-38. The Pulse Generator, 50 ohm feedthrough Termination, 50:1 Probe and Monitor Oscilloscope are required for this adjustment.

a. Connect the output of the Pulse Generator to the Z-AXIS INPUT through the 50 ohm feedthrough termination. Connect the trigger output of the Pulse Generator to the EXT TRIG input of the Monitor Oscilloscope.

b. Connect the 50:1 Probe to the testpoint on the Z-Axis Amplifier board (see Figure 8-3) and the Vertical input of the Monitor Oscilloscope.

c. Set the Pulse Generator to provide a negative 2 μsec pulse at 0.3 v amplitude and 400 KHz repetition rate.

d. Adjust the sweep time of the Monitor Oscilloscope to display one whole pulse on the Monitor; adjust the trigger level to obtain a stable display.

e. Defocus spot. Adjust the Pulse Generator amplitude to obtain a 30 v output on the Monitor Oscilloscope. Adjust the INTENSITY so that the pulse is not limited on the positive or negative excursion (approximately 10 o'clock setting of the INTENSITY control).

f. Adjust A3C8, 1st High Frequency Adjust, A3C7, 2nd High Frequency Adjust, and A3C6, 3rd High Frequency Adjust, to obtain a pulse with approximately 2% overshoot from fastest peaking adjustment.

g. Check the risetime of the pulse. It should be faster than 18 ns, and slower than 15 nsec.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information necessary for ordering replacement parts. Table 6-2 is divided into two classifications of parts: chassis mounted (see Paragraph 6-3); and assemblies with mounted components (see Paragraph 6-5). The following information is provided for each item:

a. hp Part Number.

b. Total quantity (TQ) used in the instrument; given only first time a part number is listed.

c. Description of part; see Table 6-1 for the list of reference designators and abbreviations used.

6-3. CHASSIS MOUNTED.

6-4. Chassis mounted components are listed according to reference designations in alpha-numerical sequence. Reference designations for chassis mounted components are complete as shown in the table. Miscellaneous chassis-related parts are listed following those parts with reference designations.

6-5. ASSEMBLIES WITH COMPONENTS.

6-6. Assemblies, sub-assemblies, and components mounted on assemblies or sub-assemblies are listed following the chassis parts. Components on an assembly are listed in "partial reference designation" sequence following the heading for each assembly. To complete the designation for components on assemblies, prefix with the assembly reference designation. For example, R27 listed under Assembly A3 should be referred to as A3R27. For additional information on this Unit Numbering Method, refer to Section VIII of this manual. Miscellaneous assembly-related parts are listed following those parts with reference designations on that specific assembly.

6-7. ORDERING INFORMATION.

6-8. To order replacement part(s), direct the order or inquiry to the nearest Hewlet-Packard Sales/Service Office (see list at back of this manual) and provide the following information.

a. hp Part Number of item(s).

b. Model number and eight-digit serial number of instrument.

c. Quantity of part(s) desired.

6-9. To order a part not listed or identifiable in the table, provide the following information:

a. Model number and eight-digit serial number of instrument.

b. Part description, including function and location.

Note

Upon request, information will be supplied to allow ordering of applicable parts from a manufacturer other than Hewlett-Packard. Contact the hp Sales/Service Office for details.

Table 6-1. Reference Designators And Abbreviations

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	M	= meter	TB	= terminal board
B	= motor	FL	= filter	MP	= mechanical part	TP	= test point
C	= capacitor	H	= hardware	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
CP	= coupling	IC	= integrated circuit	Q	= transistor		
CR	= diode	J	= jack	R	= resistor	VR	= voltage regulator (diode)
DL	= delay line	K	= relay	RT	= thermistor	W	= cable
DS	= device signaling (lamp)	L	= inductor	S	= switch	X	= socket
E	= misc. electronic part	LS	= speaker	T	= transformer	Y	= crystal

ABBREVIATIONS

amp	= amperes	gl	= glass	mtg	= mounting	rf	= radio frequency
ampl	= amplifier	grd	= ground(ed)	my	= mylar		
						s-b	= slow-blow
		h	= henries	n	= nano (10^{-9})	Se	= selenium
bp	= bandpass	Hg	= mercury	n/c	= normally closed	sect	= section(s)
		hr	= hour(s)	ne	= neon	semicon	= semiconductor
car	= carbon	hp	= Hewlett-Packard	n/o	= normally open	Si	= silicon
ccw	= counterclockwise			npo	= negative positive zero	sil	= silver
cer	= ceramic	if.	= intermediate freq.		(zero temperature	sl	= slide
coef	= coefficient	impg	= impregnated		coefficient)	spl	= special
com	= common	incd	= incandescent	nsr	= not separately		
comp	= composition	incl	= include(s)		replaceable	Ta	= tantalum
conn	= connector	ins	= insulation(ed)			td	= time delay
crt	= cathode-ray tube	int	= internal	obd	= order by description	tgl	= toggle
cw	= clockwise			ox	= oxide	Ti	= titanium
		k	= kilo (10^{3})			tol	= tolerance
depc	= deposited carbon			pc	= printed circuit	trim	= trimmer
		lin	= linear taper	pf	= picofarads = 10^{-12} farads		
elect	= electrolytic	log	= logarithmic taper				
encap	= encapsulated	lpf	= low pass filter	piv	= peak inverse voltage	μ	= micro (10^{-6})
ext	= external			p/o	= part of		
		m	= milli (10^{-3})	porc	= porcelain	var	= variable
f	= farads	meg	= mega (10^{6})	pos	= position(s)	vdcw	= dc working volts
fet	= field effect transistor	metflm	= metal film	pot	= potentiometer		
		met ox	= metal oxide	pk-pk	= peak-to-peak	w	= watts
fxd	= fixed	mfr	= manufacturer			w/	= with
		minat	= miniature			w/o	= without
Ge	= germanium	mom	= momentary	rect	= rectifier	ww	= wirewound

Table 6-2. Replaceable Parts

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
				CHASSIS PARTS		
A1	01300-66506		1	A: Horizontal and Vertical Impedance Converters		
A2	01300-65801		1	A: Horizontal and Vertical Deflection Amplifiers		
A3	01300-66505		1	A: Z-Axis Amplifier		
A4	01300-66501		1	A: High Voltage Regulator		
A5	01300-66502		1	A: High Voltage Power Supply		
A6	01300-66509		1	A: Low Voltage Fuse and Rectifier Board		
A7	01300-66510		1	A: Low Voltage Regulator and Calibrator Board		
C1	0170-0022		2	C: fxd my 0.1uf ± 20% 600vdcw		
C2	0170-0022			C: fxd my 0.1uf ± 20% 600vdcw		
C3	0180-0046		2	C: fxd elect 600uf -10 +75% 200vdcw		
C4	0180-0129		2	C: fxd elect 975uf -10 +50% 40vdcw		
C5	0180-0129			C: fxd elect 975uf -10 +50% 40vdcw		
C6	0180-0046			C: fxd elect 600uf -10 +75% 200vdcw		
C7	0180-0011		2	C: fxd elect 20uf -10 +100% 450vdcw		
C8	0180-0011			C: fxd elect 20uf -10 +100% 450vdcw		
C9	0150-0070		2	C: fxd cer 0.02 uf ±20% 500vdcw		
DS1	2140-0244		1	DS: Neon A1H (p/o S3)		
F1	2110-0029		1	F: 3 amps slow blow 125vdc		
J1	1250-0001		5	J: BNC, bulkhead mount		
J2	1250-0001			J: BNC, bulkhead mount		
J3	1250-0001			J: BNC, bulkhead mount		
J4	1250-0001			J: BNC, bulkhead mount		
J5	1250-0001			J: BNC, bulkhead mount		
J6	1251-0202		1	J: banana jack		
L1	5060-0435		1	L: trace alignment coil		
L2	5060-0442		1	L: orthogonality alignment coil		
Q1	1854-0063		4	Q: si npn 2N3055		
Q2	1854-0063			Q: si npn 2N3055		
Q3	1854-0063			Q: si npn 2N3055		
Q4	1854-0063			Q: si npn 2N3055		
R1	2100-0013		2	R: var comp lin 50k ohms 20% 1/3w		
R2	2100-1815		2	R: var comp 10 clog 10k ohms 20% 1/4w		
R3	0815-0007		2	R: fxd ww 300 ohms 5% 10w		
R4	2100-0013			R: var comp lin 50k ohms 20% 1/3w		
R5	2100-1815			R: var comp 10 clog 10k ohms 20% 1/4w		
R6	0815-0007			R: fxd ww 300 ohms 5% 10w		
R7	2100-0078		1	R: var comp 500 ohms 30% lin . 3w		
R8	2100-1439		1	R: var comp 1000 ohms 20% lin . 3w		
R9	2100-0024		1	R: var comp 1000 ohms 10% lin 2w		
R10	0757-0465		3	R: fxd metflm 100k ohms 1% 1/8w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
R11	2100-1627		1	R: var comp 5 megohms 20% lin 1/2w		
R12	2100-0445		2	R: var comp 2000 ohms dual 30% lin 1/2w		
R13	2100-0445			R: var comp 2000 ohms dual 30% lin 1/2w		
R14	2100-0063		1	R: var comp 100k ohms 20% lin 1/3w		
R15	0687-5631		1	R: fxd comp 56k ohms 10% 1/2w		
R16	0813-0040		2	R: fxd ww 20 ohms 5% 5w		
R17	0813-0040			R: fxd ww 20 ohms 5% 5w		
R18	0687-5611		2	R: fxd comp 560 ohms 10% 1/2w		
R19	0687-5611			R: fxd comp 560 ohms 10% 1/2w		
S1	3101-6070		3	S: slide spdt		
S2	3101-6070			S: slide spdt		
S3	3101-0100		1	S: push button spdt (power)		
S4	3101-6070			S: slide spdt		
T1	9100-1118		1	T: power transformer		
V1	5083-1752		1	V: crt P31 phosphor		
	5083-1722			V: crt P2 phosphor		
	5083-1732			V: crt P7 phosphor (amber filter required)		
	5083-1442			V: crt P11 phosphor		
W1	8120-0078		1	W: power cord		
XV1	1200-0037		1	XV: socket crt		
				MISCELLANEOUS		
	0370-0084		2	Knob: black		
	1200-0043		4	Insulator: transistor		
	1400-0084		1	Holder: fuse		
	1490-0030		1	Stand: tilt		
	5000-0055		2	Plate: fluted aluminum		
	5000-0751		2	Cover: side		
	5060-0743		1	Cover: top		
	5060-0752		1	Cover: bottom		
	5060-0763		2	Handle		
	5060-0765		2	Retainer: handle		
	5060-0767		5	Foot assy		
	01300-01201		1	Bracket: capacitor (4)		
	01300-01202		1	Bracket: capacitor (2)		
	01300-01203		1	Bracket: transformer		
	01300-60201		1	Panel: front		
	01300-60202		1	Panel: rear		
	01300-01205		1	Bracket: crt mounting left		
	01300-01206		1	Bracket: crt mounting right		
	01300-01208		1	Strap: ground		
	01300-02701		1	Filter: crt light green		
	01300-04101		1	Cover: crt rear panel		
	01300-22201		1	Bezel: filter		
	01300-61104		2	Heat sink assy		
	01300-60601		1	Shield: crt		
	01300-60602		1	Shield: magnetic		
	01300-61201		2	T-bolt strap		
	01400-00461		1	Latch strap assy		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
				ASSEMBLIES WITH MOUNTED COMPONENTS		
A1	01300-66506			A: Horizontal and Vertical Impedance Converters		
C1	0150-0024		2	C: fxd cer 0.02 μf -20 +80% 600vdcw		
C2	0160-0161		5	C: fxd my 0.01 μf 10% 200vdcw		
C3	0180-0376		8	C: fxd ta elect 0.47 μf 10% 35vdcw		
C4	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C5	0180-0116		4	C: fxd ta elect 6.8 μf 10% 35vdcw		
C6	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C7	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C8	0180-0116			C: fxd ta elect 6.8 μf 10% 35vdcw		
C9	0150-0024			C: fxd cer 0.02 μf -20 +80% 600vdcw		
C10	0160-0161			C: fxd my 0.01 μf 10% 200vdcw		
C11	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C12	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C13	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
C14	0180-0376			C: fxd ta elect 0.47 μf 10% 35vdcw		
CR1 thru CR4	1901-0376		6	CR: si		
Q1	5080-0472		4	Q: si FET n-channel matched pair		
Q2	5080-0472			Q: si FET n-channel matched pair		
Q3 thru Q6	1854-0092		12	Q: si npn 2N3563		
Q7	5080-0472			Q: si FET n-channel matched pair		
Q8	5080-0472			Q: si FET n-channel matched pair		
Q9 thru Q12	1854-0092			Q: si npn 2N3563		
R1	0757-0344		3	R: fxd metflm 1 megohm 1% 1/4w		
R2	0757-0475		3	R: fxd metflm 274k ohms 1% 1/8w		
R3	0757-0394		14	R: fxd metflm 51.1 ohms 1% 1/8w		
R4	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R5	0757-0436		5	R: fxd metflm 4320 ohms 1% 1/8w		
R6	0757-0388		44	R: fxd metflm 30.1 ohms 1% 1/8w		
R7	0757-0736		4	R: fxd metflm 1500 ohms 1% 1/4w		
R8	0757-0282		5	R: fxd metflm 221 ohms 1% 1/8w		
R9	0757-0284		3	R: fxd metflm 150 ohms 1% 1/8w		
R10	0757-0338		4	R: fxd metflm 1000 ohms 1% 1/4w		
R11	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R12	0757-0462		3	R: fxd metflm 75k ohms 1% 1/8w		
R13	0757-0442		4	R: fxd metflm 10k ohms 1% 1/8w		
R14	0757-0401		17	R: fxd metflm 100 ohms 1% 1/8w		
R15	0757-0436			R: fxd metflm 4320 ohms 1% 1/8w		
R16	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R17	0757-0736			R: fxd metflm 1500 ohms 1% 1/4w		
R18	0757-0282			R: fxd metflm 221 ohms 1% 1/8w		
R19	0757-0338			R: fxd metflm 1000 ohms 1% 1/4w		
R20	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
A1 (Cont'd)						
R21 thru R23	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R24	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R25	0757-0276		2	R: fxd metflm 61.9 ohms 1% 1/8w		
R26	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R27	0757-0344			R: fxd metflm 1 megohm 1% 1/4w		
R28	0757-0475			R: fxd metflm 274k ohms 1% 1/8w		
R29	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R30	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R31	0757-0436			R: fxd metflm 4320 ohms 1% 1/8w		
R32	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R33	0757-0736			R: fxd metflm 1500 ohms 1% 1/4w		
R34	0757-0282			R: fxd metflm 221 ohms 1% 1/8w		
R35	0757-0284			R: fxd metflm 150 ohms 1% 1/8w		
R36	0757-0338			R: fxd metflm 1000 ohms 1% 1/4w		
R37	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R38	0757-0462			R: fxd metflm 75k ohms 1% 1/8w		
R39	0757-0442			R: fxd metflm 10k ohms 1% 1/8w		
R40	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R41	0757-0436			R: fxd metflm 4320 ohms 1% 1/8w		
R42	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R43	0757-0736			R: fxd metflm 1500 ohms 1% 1/4w		
R44	0757-0282			R: fxd metflm 221 ohms 1% 1/8w		
R45	0757-0338			R: fxd metflm 1000 ohms 1% 1/4w		
R46	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R47	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R48	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R49	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R50	0757-0276			R: fxd metflm 61.9 ohms 1% 1/8w		
				MISCELLANEOUS		
	01801-22301		2	Heat equalizer		
A2	01300-65801			A: Deflection amplifier assy		
A2A1	01300-66503		1	A: horiz and vert amplifier board assy		
A2A2	01300-66508		1	A: horiz output load assy		
A2A3	01300-66507		1	A: vert output load assy		
Q1 thru Q8	1854-0056		9	Q: si npn 2N3119		
XQ1 thru XQ8	1200-0153		8	XQ: transistor socket		
				MISCELLANEOUS		
	0340-0152		8	Insulator: BeO		
	5000-0234		8	Spring: transistor		
	01300-01101		2	Heat sink		
A2A1						
C1	0121-0046		6	C: var cer 9-35 pf 500vdcw		
C2	0160-2198		4	C: fxd mica 20 pf 5% 300vdcw		
C3	0121-0046			C: var cer 9-35 pf 500vdcw		
C4	0160-2198			C: fxd cer 20 pf 5% 500vdcw		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.	RS	TQ	Description (See Table 6-1.)	Mfr	Mfr Part No.
A2A1 (Cont'd)						
C5	0160-2261		1	C: fxd cer 15 pf 5% 500vdcw		
C6	0121-0046			C: var cer 9-35 pf 500vdcw		
C7	0170-0040		15	C: fxd my 0.047 μf 10% 200vdcw		
C8	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C9	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C10	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C11	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C12	0121-0046			C: var cer 9-35 pf 500vdcw		
C13	0160-2198			C: fxd mica 20 pf 5% 300vdcw		
C14	0121-0046			C: var cer 9-35 pf 500vdcw		
C15	0160-2198			C: fxd mica 20 pf 5% 300vdcw		
C16	0160-2257		1	C: fxd cer 10 pf 5% 500vdcw		
C17	0121-0046			C: var cer 9-35 pf 500vdcw		
C18	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C19	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C20	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C21	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C22	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
CR1	1901-0050		5	CR: si		
CR2	1901-0040		15	CR: si		
CR3	1901-0050			CR: si		
CR4	1901-0040			CR: si		
CR5	1901-0050			CR: si		
CR6	1901-0040			CR: si		
CR7	1901-0050			CR: si		
CR8	1901-0040			CR: si		
Q1	1854-0092			Q: si npn 2N3563		
Q2	1854-0092			Q: si npn 2N3563		
Q3	1853-0036		8	Q: si pnp 2N3906		
Q4	1853-0036			Q: si pnp 2N3906		
Q5	1854-0053		4	Q: si npn 2N2218		
Q6	1854-0053			Q: si npn 2N2218		
Q7	1854-0092			Q: si npn 2N3563		
Q8	1854-0092			Q: si npn 2N3563		
Q9	1853-0036			Q: si pnp 2N3906		
Q10	1853-0036			Q: si pnp 2N3906		
Q11	1854-0053			Q: si npn 2N2218		
Q12	1854-0053			Q: si npn 2N2218		
R1	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R2	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R3	0757-0339		4	R: fxd metflm 3010 ohms 1% 1/4w		
R4	0757-0821		4	R: fxd metflm 1210 ohms 1% 1/2w		
R5	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R6	0757-0404		2	R: fxd metflm 130 ohms 1% 1/8w		
R7	0757-0731		4	R: fxd metflm 825 ohms 1% 1/4w		
R8	0761-0016		4	R: fxd met ox 7500 ohms 5% 1w		
R9	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R10	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R11	0767-0016		4	R: fxd met ox 3000 ohms 5% 3w		
R12	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R13	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R14	0773-0001		8	R: fxd met ox 1500 ohms 5% 5w		
R15	0773-0001			R: fxd met ox 1500 ohms 5% 5w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.	RS	TQ	Description (See Table 6-1.)	Mfr	Mfr Part No.
A2A1 (Cont'd)						
R16	0757-0438		6	R: fxd metflm 5110 ohms 1% 1/8w		
R17	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R18	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R19	0757-0339			R: fxd metflm 3010 ohms 1% 1/4w		
R20	0757-0731			R: fxd metflm 825 ohms 1% 1/4w		
R21	0757-0821			R: fxd metflm 1210 ohms 1% 1/2w		
R22	0761-0016			R: fxd met ox 7500 ohms 5% 1w		
R23	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R24	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R25	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R26	0767-0016			R: fxd met ox 3000 ohms 5% 3w		
R27	0757-0715		2	R: fxd metflm 150 ohms 1% 1/4w		
R28	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R29	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R30	0757-0438			R: fxd metflm 5110 ohms 1% 1/8w		
R31 thru R36	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R37	0757-0416		2	R: fxd metflm 511 ohms 1% 1/8w		
R38	0699-0001		2	R: fxd comp 2.7 ohms 10% 1/2w		
R39	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R40	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R41	0757-0339			R: fxd metflm 3010 ohms 1% 1/4w		
R42	0757-0821			R: fxd metflm 1210 ohms 1% 1/2w		
R43	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R44	0757-0404			R: fxd metflm 130 ohms 1% 1/8w		
R45	0757-0731			R: fxd metflm 825 ohms 1% 1/4w		
R46	0761-0016			R: fxd met ox 7500 ohms 5% 1w		
R47	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R48	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R49	0767-0016			R: fxd met ox 3000 ohms 5% 3w		
R50	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R51	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R52	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R53	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R54	0757-0438			R: fxd metflm 5110 ohms 1% 1/8w		
R55	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R56	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R57	0757-0339			R: fxd metflm 3010 ohms 1% 1/4w		
R58	0757-0731			R: fxd metflm 825 ohms 1% 1/4w		
R59	0757-0821			R: fxd metflm 1210 ohms 1% 1/2w		
R60	0761-0016			R: fxd met ox 7500 ohms 5% 1w		
R61	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R62	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R63	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R64	0767-0016			R: fxd met ox 3000 ohms 5% 3w		
R65	0757-0715			R: fxd metflm 150 ohms 1% 1/4w		
R66	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R67	0773-0001			R: fxd met ox 1500 ohms 5% 5w		
R68	0757-0438			R: fxd metflm 5110 ohms 1% 1/8w		
R69 thru R74	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R75	0757-0416			R: fxd metflm 511 ohms 1% 1/8w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.	RS	TQ	Description (See Table 6-1.)	Mfr	Mfr Part No.
A2A1 (Cont'd)						
R76	0699-0001			R: fxd comp 2.7 ohms 10% 1/2w		
R77	2100-1772		2	R: var ww lin 500 ohms 10% 1/2w		
R78	2100-1772			R: var ww lin 500 ohms 10% 1/2w		
VR1 thru VR4	1902-3139		4	VR: breakdown 8.25 v, 5%, 400 mw		
A2A2	01300-66508			A: horiz output load assy		
C1	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
R1	0757-0836		4	R: fxd metflm 7500 ohms 1% 1/2w		
R2	0776-0002		8	R: fxd met ox 1750 ohms 5% 7w		
R3	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
R4	0757-0836			R: fxd metflm 7500 ohms 1% 1/2w		
R5	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
R6	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
A2A3	01300-66507			A: vert output load assy		
C1	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
R1	0757-0836			R: fxd metflm 7500 ohms 1% 1/2w		
R2	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
R3	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
R4	0757-0836			R: fxd metflm 7500 ohms 1% 1/2w		
R5	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
R6	0776-0002			R: fxd met ox 1750 ohms 5% 7w		
A3	01300-66505			A: Z-Axis Amplifier		
C1	0160-0153		1	C: fxd my 0.001 μf 10% 200vdcw		
C2	0180-0116			C: fxd elect ta 6.8 μf 10% 35vdcw		
C3	0180-0116			C: fxd elect ta 6.8 μf 10% 35vdcw		
C4	0160-0161			C: fxd my 0.01 μf 10% 200vdcw		
C5	0160-0161			C: fxd my 0.01 μf 10% 200vdcw		
C6	0132-0003		2	C: var trimmer 0.7-3 pf		
C7	0121-0168		1	C: var teflon 0.2-1.5 pf 600vdcw		
C8	0132-0003			C: var trimmer 0.7-3 pf		
C9	0160-0161			C: fxd my 0.01 μf 10% 200vdcw		
C10	0160-0380		1	C: fxd my 0.22 μf 10% 200vdcw		
C11	0160-0151		1	C: fxd cer 4700 pf -20 +80% 4kvdcw		
C12	0170-0066		2	C: fxd my 0.027 μf 10% 200vdcw		
C13	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C14	0170-0066			C: fxd my 0.027 μf 10% 200vdcw		
C15	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C16	0180-0089		2	C: fxd elect 10 μf -10 +100% 150vdcw		
CR1	1901-0376			CR: si		
CR2	1901-0376			CR: si		
CR3	1901-0040			CR: si		
CR4	1901-0040			CR: si		
CR5	1901-0050			CR: si		
CR6	1901-0045		2	CR: si		
CR7	1901-0045			CR: si		
CR8	1901-0040			CR: si		
CR9	1901-0040			CR: si		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
A3 (Cont'd)						
Q1	1855-0022		1	Q: si FET n-channel		
Q2	1853-0036			Q: si pnp 2N3906		
Q3	1853-0036			Q: si pnp 2N3906		
Q4	1854-0215		3	Q: si npn 2N3904		
Q5	1853-0036			Q: si pnp 2N3906		
Q6	1854-0215			Q: si npn 2N3904		
Q7	1853-0037		1	Q: si pnp		
Q8	1854-0056			Q: si npn 2N3119		
Q9	1853-0015		2	Q: si pnp 2N3640		
Q10	1853-0015			Q: si npn 2N3640		
R1	0757-0344			R: fxd metflm 1 megohm 1% 1/4w		
R2	0757-0475			R: fxd metflm 274k ohms 1% 1/8w		
R3	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R4	0757-0394			R: fxd metflm 51.1 ohms 1% 1/8w		
R5	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R6	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R7	0757-0415		2	R: fxd metflm 475 ohms 1% 1/8w		
R8	0757-0060		2	R: fxd metflm 24.3k ohms 1% 1/2w		
R9	0757-0415			R: fxd metflm 475 ohms 1% 1/8w		
R10	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R11	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R12	0761-0006		3	R: fxd met ox 10k ohms 5% 1w		
R13	0757-0284			R: fxd metflm 150 ohms 1% 1/8w		
R14	0761-0006			R: fxd met ox 10k ohms 5% 1w		
R15	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R16	0761-0006			R: fxd met ox 10k ohms 5% 1w		
R17	0757-0274		1	R: fxd metflm 1210 ohms 1% 1/8w		
R18	0698-0085		1	R: fxd metflm 2610 ohms 1% 1/8w		
R19	0757-0741		1	R: fxd metflm 2430 ohms 1% 1/4w		
R20	0757-0438			R: fxd metflm 5110 ohms 1% 1/8w		
R21	0757-0283		1	R: fxd metflm 2000 ohms 1% 1/8w		
R22	0757-0438			R: fxd metflm 5110 ohms 1% 1/8w		
R23	0757-0456		1	R: fxd metflm 43.2k ohms 1% 1/8w		
R24	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R25	0757-0828		1	R: fxd metflm 3010 ohms 1% 1/2w		
R26	0761-0015		2	R: fxd met ox 1500 ohms 5% 1w		
R27	0761-0015			R: fxd met ox 1500 ohms 5% 1w		
R28	0757-0734		1	R: fxd metflm 1210 ohms 1% 1/4w		
R29	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R30	0687-6801		1	R: fxd comp 68 ohms 10% 1/2w		
R31	0757-0871		1	R: fxd metflm 1.21 megohms 1% 1/2w		
R32	0757-0746		1	R: fxd metflm 4750 ohms 1% 1/4w		
R33	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R34	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
R35	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R36	0757-0346		1	R: fxd metflm 10 ohms 1% 1/8w		
R37	0757-0458		1	R: fxd metflm 51.1k ohms 1% 1/8w		
R38	0757-0433		2	R: fxd metflm 3320 ohms 1% 1/8w		
R39	0757-0273		2	R: fxd metflm 3010 ohms 1% 1/8w		
R40	0757-0407		2	R: fxd metflm 200 ohms 1% 1/8w		
R41	0757-0407			R: fxd metflm 200 ohms 1% 1/8w		
R42	0757-0280		1	R: fxd metflm 1000 ohms 1% 1/8w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
A3 (Cont'd)						
VR1	1902-0041		1	VR: breakdown 5.11 v 5% 400 mw		
VR2	1902-0064		1	VR: breakdown 7.5 v 5% 400 mw		
VR3	1902-0341		2	VR: breakdown 30.1 v 5% 1w		
VR4	1902-0341			VR: breakdown 30.1 v 5% 1w		
				MISCELLANEOUS		
	1205-0061		2	Heat sink		
A4	01300-66501			A: High Voltage Regulator		
C1	0160-0168		4	C: fxd my 0.1 μf 10% 200vdcw		
C2	0180-0291		1	C: fxd elect ta 1 μf 10% 35vdcw		
C3	0180-0058		3	C: fxd elect 50 μf -10 +100% 25vdcw		
C4	0180-0195		1	C: fxd elect ta 0.33 μf 20% 35vdcw		
C5	0170-0064		1	C: fxd my 0.47 μf 10% 100vdcw		
C6	0170-0040			C: fxd my 0.047 μf 10% 200vdcw		
C7	0180-0049		1	C: fxd alum. elect 20 μf -10 +100% 50vdcw		
C8	0180-0089			C: fxd elect 10 μf -10 +100% 150vdcw		
CR1	1901-0040			CR: si		
CR2	1901-0040			CR: si		
CR3	1901-0040			CR: si		
F1	2110-0033		5	F: 3/4 amp 250vdc		
Q1	1855-0057		1	Q: si FET n-channel		
Q2	1854-0071		8	Q: si npn		
Q3	1853-0036			Q: si pnp 2N3906		
Q4	1854-0072		1	Q: si npn 2N3054		
R1	2100-0426		1	R: var comp 250k ohms 30% lin 1/4w		
R2	0757-0138		1	R: fxd metflm 909k ohms 1% 1/2w		
R3	0757-0442			R: fxd metflm 10k ohms 1% 1/8w		
R4	0757-0442			R: fxd metflm 10k ohms 1% 1/8w		
R5	0757-0465			R: fxd metflm 100k ohms 1% 1/8w		
R6	0757-0465			R: fxd metflm 100k ohms 1% 1/8w		
R7	0757-0044		1	R: fxd metflm 33.2k ohms 1% 1/2w		
R8	0757-0430		1	R: fxd metflm 2210 ohms 1% 1/8w		
R9	0757-0385		2	R: fxd metflm 22.1 ohms 1% 1/8w		
R10	0757-0282			R: fxd metflm 221 ohms 1% 1/8w		
R11	0757-0463		2	R: fxd metflm 82.5k ohms 1% 1/8w		
R12	0687-1001		1	R: fxd comp 10 ohms 10% 1/2w		
R13	2100-0836		1	R: var comp 100k ohms 20% lin 1/4w		
R14	0757-0395		1	R: fxd metflm 56.2 ohms 1% 1/8w		
R15	0757-0385			R: fxd metflm 22.1 ohms 1% 1/8w		
R16	0757-0401			R: fxd metflm 100 ohms 1% 1/8w		
VR1	1902-3203		1	VR: breakdown 14.7 v 5% 400 mw		
				MISCELLANEOUS		
	2110-0269		12	Fuseholder		
	01300-61103		1	Heat sink assy		
A5	01300-66502			A: High Voltage Rectifier		
A1	01300-61101			A: High Voltage Quadrupler		
C1 thru C10	0160-3007		10	C: fxd cer 4700 pf 20% 4k vdcw		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
A5 (Cont'd)						
C11	0160-2403		1	C: fxd cer disc 1500 pf 20% 5k vdcw		
CR1	1901-0341		2	CR: si		
CR2	1901-0341			CR: si		
R1	0757-0427		1	R: fxd metflm 1500 ohms 1% 1/8w		
R2	0757-0847		1	R: fxd metflm 27.4k ohms 1% 1/2w		
R3	0757-0833		1	R: fxd metflm 5110 ohms 1% 1/2w		
R4	0757-0367		1	R: fxd metflm 100k ohms 1% 1/2w		
R5	2100-0981		1	R: var comp 1 megohm 20% lin 1/4w		
R6	0757-0156		1	R: fxd metflm 1.5 megohms 1% 1/2w		
R7	0836-0005		1	R: fxd car. film 33 megohms 10% 1w		
R8	0698-6239		1	R: fxd car. film 30 megohms 2% 1w		
R9	0698-6277		1	R: fxd car. film 8 megohms 10% 1w		
R10	0698-6278		1	R: fxd car. film 18 megohms 10% 1w		
R11*	0683-2055		1	R: fxd comp 2 megohms 5% 1/4w (choose value so that spot is focused at mid range of focus pot, R11)		
T1	01300-61102		1	T: High Voltage Transformer		
A6	01300-66509			A: Low Voltage Fuse and Rectifier Board		
C1	0150-0070		1	C: fxd cer 0.02 μf 20% 500vdcw		
CR1 thru CR4	1901-0029		8	CR: si		
CR5 thru CR12	1901-0026		10	CR: si		
CR13 thru CR16	1901-0029			CR: si		
F1 thru F4	2110-0033			F: 3/4 amp 250vdc		
R1	0687-1041		2	R: fxd comp 100k ohms 10% 1/2w		
R2	0687-5631		6	R: fxd comp 56k ohms 10% 1/2w		
R3	0687-5631			R: fxd comp 56k ohms 10% 1/2w		
R4	0687-1041			R: fxd comp 100k ohms 10% 1/2w		
				MISCELLANEOUS		
	2110-0269			Holder: fuse		
A7	01300-66504			A: Low Voltage Regulator and Calibrator Board		
C1 thru C3	0160-0168			C: fxd my 0.1 μf 10% 200vdcw		
C4	0180-0058			C: fxd elect 50 μf -10 +75% 25vdcw		
C5	0160-0168			C: fxd my 0.1 μf 10% 200vdcw		
C6	0180-0058			C: fxd elect 50 μf -10 +75% 25vdcw		
C7	0160-0168			C: fxd my 0.1 μf 10% 200vdcw		
C8	0180-0100		1	C: fxd ta elect 4.7 μf 10% 35vdcw		
CR1	1901-0040			CR: si		
CR2	1901-0040			CR: si		
CR3	1901-0026			CR: si		
CR4	1901-0040			CR: si		
CR5	1901-0040			CR: si		
CR6	1901-0026			CR: si		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.		TQ	Description (See Table 6-1.)		
A7 (Cont'd)						
CR7 thru CR12	1901-0040		6	CR: si		
Q1	1854-0071			Q: si npn		
Q2	1854-0215			Q: si npn 2N3904		
Q3	1854-0071			Q: si npn		
Q4	1854-0071			Q: si npn		
Q5	1854-0022		4	Q: si npn		
Q6	1854-0071			Q: si npn		
Q7	1854-0022			Q: si npn		
Q8	1854-0071			Q: si npn		
Q9	1854-0022			Q: si npn		
Q10	1854-0071			Q: si npn		
Q11	1854-0071			Q: si npn		
Q12	1854-0022			Q: si npn		
R1	0687-1031		1	R: fxd comp 10k ohms 10% 1/4w		
R2	0687-5621		2	R: fxd comp 5600 ohms 10% 1/4w		
R3	0698-4023		1	R: fxd metflm 130.4k ohms 1/2% 1/8w		
R4	0757-0461		2	R: fxd metflm 68.1k ohms 1% 1/8w		
R5	0698-3358		1	R: fxd metflm 1000 ohms 1/2% 1/8w		
R6	0698-3640		1	R: fxd met ox 1800 ohms 5% 2w		
R7	0684-1021		3	R: fxd comp 1000 ohms 10% 1/4w		
R8	0687-5631			R: fxd comp 56k ohms 10% 1/2w		
R9	0684-5621			R: fxd comp 5600 ohms 10% 1/4w		
R10	0757-0399		2	R: fxd metflm 82.5 ohms 1% 1/8w		
R11	0757-0433			R: fxd metflm 3320 ohms 1% 1/8w		
R12	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R13	0757-0436			R: fxd metflm 4320 ohms 1% 1/8w		
R14	2100-1774		2	R: var ww 2000 ohms 10% lin 1/2w		
R15	0757-0761		2	R: fxd metflm 22.1k ohms 1% 1/4w		
R16	0684-2731		1	R: fxd comp 27k ohms 10% 1/4w		
R17	0687-5631			R: fxd comp 56k ohms 10% 1/2w		
R18	0757-0764		2	R: fxd metflm 33.2k ohms 1% 1/4w		
R19	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R20	0757-0461			R: fxd metflm 68.1k ohms 1% 1/8w		
R21	0757-0477		1	R: fxd metflm 332k ohms 1% 1/8w		
R22	0757-0435		1	R: fxd metflm 3920 ohms 1% 1/8w		
R23	0757-0060			R: fxd metflm 24.3k ohms 1% 1/2w		
R24	0687-5631			R: fxd comp 56k ohms 10% 1/2w		
R25	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R26	0757-0462			R: fxd metflm 75k ohms 1% 1/8w		
R27	0757-0480		1	R: fxd metflm 432k ohms 1% 1/8w		
R28	0757-0273		1	R: fxd metflm 3010 ohms 1% 1/8w		
R29	0757-0844		1	R: fxd metflm 16.2k ohms 1% 1/2w		
R30	0684-1021		2	R: fxd comp 1000 ohms 10% 1/4w		
R31	0687-5631			R: fxd comp 56k ohms 10% 1/2w		
R32	0757-0399			R: fxd metflm 82.5 ohms 1% 1/8w		
R33	0757-0848		1	R: fxd metflm 30.1k ohms 1% 1/2w		
R34	0757-0463			R: fxd metflm 82.5k ohms 1% 1/8w		
R35	0757-0190		1	R: fxd metflm 20k ohms 1% 1/2w		
R36	0757-0764			R: fxd metflm 33.2k ohms 1% 1/4w		
R37	0757-0388			R: fxd metflm 30.1 ohms 1% 1/8w		
R38	0757-0437		1	R: fxd metflm 4750 ohms 1% 1/8w		
R39	2100-1774			R: var ww 2000 ohms 10% lin 1/2w		
R40	0757-0761			R: fxd metflm 22.1k ohms 1% 1/4w		
R41	0684-1021			R: comp 1000 ohms 10% 1/4w		

Table 6-2. Replaceable Parts (Cont'd)

Ref Desig	hp Part No.	RS	TQ	Description (See Table 6-1.)	Mfr	Mfr Part No.
A7 (Cont'd)						
VR1	1902-3357		2	VR: breakdown 56.2 v 5% 400 mw		
VR2	1902-0034		1	VR: breakdown 5.76 v 10% 400 mw		
VR3	1940-0013		1	VR: electron tube 82 v reference		
VR4	1902-3333		1	VR: breakdown 46.4 v 5% 400 mw		
VR5	1902-3357			VR: breakdown 56.2 v 5% 400 mw		

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. MANUAL CHANGES.

7-2. This manual applies directly to the standard Model 1300A having serial prefix 818-. The following paragraphs provide instructions for adapting this manual to cover older or newer instruments. Refer to the separate "Manual Changes" sheet supplied with this manual for Errata.

7-3. OLDER INSTRUMENTS.

7-4. Another Manual, hp Part Number 01300-90901, provides the information covering Model 1300A instruments with serial prefixes 751- and 733-. This manual may be obtained from your nearest Hewlett-Packard Sales/Service Office.

7-5. NEW INSTRUMENTS.

7-6. As changes are made in the Model 1300A, newer instruments may have serial prefixes higher than 818-. The manual for these new instruments will have a "Manual Changes" sheet supplied which will contain all necessary up-dating information. If the serial prefix of your instrument is higher than the one listed at the front of this manual and no "Manual Changes" sheet was supplied with the manual, contact your nearest Hewlett-Packard Sales/Service Office.

7-7. OPTIONS.

7-8. Options for an hp instrument are standard modifications installed at the factory.

OPTION 14

Option 14 includes a CRT which does not have an internal graticule.

7-9. SPECIAL INSTRUMENTS.

7-10. Special instruments are instruments which have been modified to meet special customer specifications. An insert sheet is supplied with every instrument so modified which explains the modification. The sheet provides pertinent data and instructions for operating, adjusting and maintaining the modified instrument. Some specials now available are: front panel controls; X and/or Y input attenuators; high gain differential preamplifiers for either or both channels; and a four-level or eight-level Gray Scale input.

Table 8-1. Schematic Diagram Notes

Refer to MIL-STD-15-1A for schematic symbols not listed in this table.

= Etched circuit board

= Front panel marking

= Rear panel marking

= Front panel control

= Screwdriver adjustment

P/O = Part of

CW = Clockwise end of variable resistor

N.C. = No connection

= Waveform test point (with number)

= Common electrical point (with letter) not necessarily ground

= Single pin connector on board

= Pin of a plug-in board (with letter or number)

= Main signal path

= Primary feedback path

= Secondary feedback path

* = Optimum value selected at factory, average value shown; part may have been omitted.

= Module outline

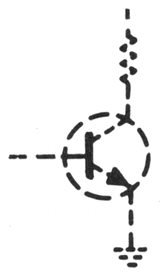
= Assembly outline

= Field effect transistor (N-channel)

= Breakdown diode

= Tunnel diode

= Step recovery diode



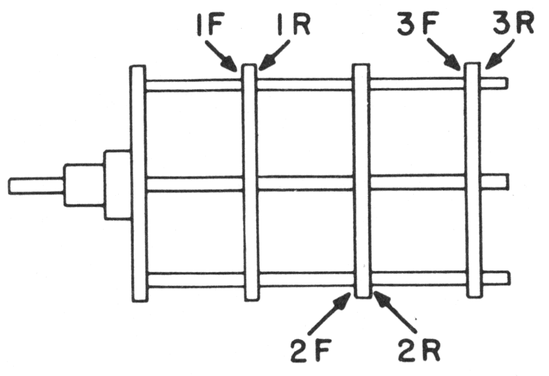
= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

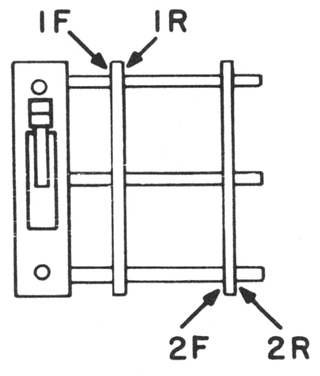
Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries

Wire colors are given by numbers in parentheses using the resistor color code [(925) is wht-red-grn].

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

Switch wafers are identified as follows:





SECTION VIII
SCHEMATICS AND TROUBLESHOOTING

8-1. SCHEMATIC DIAGRAMS.

8-2. LAYOUT.

8-3. The schematic diagrams are in this section of the manual. They are drawn to show the electronic function of the circuitry and the circuits shown on one schematic may include all or part of several different assemblies. Chassis parts and assemblies are identified in Figures 8-2 thru 8-4. Component identification diagrams, conditions for dc voltage and waveform measurements are placed adjacent to each schematic. Table 8-1 provides general schematic notes related to symbols and conventions used on the schematic.

8-4. REFERENCE DESIGNATIONS.

8-5. The unit system of reference designations, used in this manual, is in accordance with the provisions of the American Standard Electrical and Electronics Reference Designations, dated August 1965, published by American Standards Association, Inc. Minor variations, due to design and manufacturing practices not specifically covered by the standard, may be noted. A brief explanation is presented here for those unfamiliar with the unit designation system.

8-6. Each electrical component is identified by a class letter and a number. This letter-number combination is the basic designation for each component. Components which are separately replaceable and are part of an assembly or sub-assembly have, in addition to the basic designation, a prefix designation which identifies the assembly or sub-assembly on which the basic component is physically located. Components not physically located on an assembly or sub-assembly have only the basic reference designation.

8-7. Figure 8-1 is used as an example. The base reference designation R1 appears five times in the figure, however, each R1 is identified by a unique designation formed in combination with assembly and sub-assembly designations. Consider the R1 on sub-assembly A1 of sub-assembly A2 of assembly A5 of a complex instrument. The complete and unique designation of that resistor is A5A2A1R1. No other resistor in the complete instrument will have this identical complete reference designation. Similarly, the R1 on sub-assembly A2 of assembly A5 of the complete instrument has the complete designation A5A2R1. Now, consider the R1 between sub-assemblies A1 and A2. The complete designation for this R1 is A5R1. The R1 connected between assembly A5 and the complete instrument has the complete designation R1 with no prefix, since it is not part of any assembly. This system applies to all classes of components, C, CR, Q, etc.

8-8. In general, the numerical designation of assemblies is based on the physical location of the assemblies in the complete instrument. Assemblies are numbered from 1, consecutively. If an assembly number is assigned and later deleted, this number is not reused and is then shown in the replaceable parts table as "deleted". Schematics also list deleted reference designations.

Sub-assemblies which are part of an assembly are numbered consecutively from 1, and have the complete designation consisting of the assembly designation prefixed to the sub-assembly designation.

8-9. Section VI, Replaceable Parts, contains the information necessary to locate a specific part in Table 6-2. The information is obtained either from the schematic diagram on which the part is shown, or the component identification diagram for the assembly on which the component is physically located.

8-10. TROUBLESHOOTING.

8-11. The first and most important prerequisite to systematic troubleshooting is an understanding of how the instrument is designed to operate. This information is helpful in recognizing a malfunction, as well as interpreting the malfunction in terms of a probable cause. Section IV, Principles of Operation contains circuit descriptions intended to satisfy this information requirement.

8-12. Table 8-2 will aid in quick troubleshooting of the Model 1300A. No attempt is made to troubleshoot concurrent troubles. Should more than one trouble be present, use the most evident symptoms for troubleshooting with the table. The purpose of Table 8-2 is to isolate the problem to one general area only.

8-13. If any of these checks (or any checks devised by the operator) fail to produce the correct response, the trouble will have been isolated to one specific circuit. Normal troubleshooting techniques (voltages and waveforms) will then determine the malfunctioning component.

8-14. ASSEMBLY REMOVAL AND REPLACEMENT.

8-15. LOW VOLTAGE BOARDS.

8-16. All components on the low voltage circuit boards, A6 and A7, may be removed and replaced from the component side of the boards. If it is necessary to remove these assemblies, remove all clip-wires and the four retaining screws and lift the assembly away from the instrument. To replace the assemblies, reverse the removal procedure. The component identification diagrams, Figures 8-19 and 8-20, indicate the color of the wire for each clip-on pin.

8-17. DEFLECTION AMPLIFIER LOAD ASSEMBLIES.

8-18. The Deflection Amplifier Load Assemblies A2A1A2 and A2A1A3, are mounted on the Deflection Amplifier board A2A1. Figure 8-8 shows the two sub-assemblies which go together to make up these assemblies. To remove these assemblies proceed as follows:

a. Remove all of the clip-on leads attached to the circuit board. Figure 8-8 indicates the correct color to pin connections for reassembly.

b. Remove the two screws securing the circuit board to the heat sink.

c. Remove the four transistors from the heat sink.

CAUTION

Two of the four transistors have the collector lead cut-off. These are the output transistors and must not be substituted for the driver transistors which have all three leads intact. The output transistors go nearest the edge of A2A1. The white inserts are beryllium oxide; see Paragraph 8-29.

d. Remove the four screws securing the heat sink to the Deflection Amplifier Board, A2A1.

e. Before replacing the Load Assemblies spread a light coating of silcone grease on the beryllium oxide heat sinks.

f. To replace the load assemblies, reverse the above procedure.

8-19. HIGH VOLTAGE RECTIFIER.

8-20. The High Voltage Rectifier Assembly, A5A1, is a potted assembly and replacement of individual components is not recommended. To remove this assembly, proceed as follows:

WARNING

The post accelerator lead may hold a high voltage charge. Use a screwdriver and carefully lift the insulator cap. Ground the screwdriver and the post accelerator lead as the lead is loosened and disconnected from the CRT.

a. Ground the post accelerator at the connection to the CRT.

b. Remove the HV lead from the CRT; ground the lead again after removal from the CRT.

c. Unsolder the red lead from the HV transformer, A5T1.

d. Remove C5 from its mounting clip. (See Figure 8-2.)

e. Remove the three screws which mount the assembly to the chassis.

f. To replace the HV Rectifier Assembly, reverse the above procedure.

8-21. CIRCUIT BOARDS.

8-22. All components on the circuit boards may be removed and replaced without removing the circuit board from the chassis. Some components on the Deflection Amplifier Board, A2A1 will require the removal of the Load Assemblies before they can be replaced. If it becomes necessary to remove a circuit board, remove the clip-on wires and the four retaining screws. Refer to the appropriate component identification figure for the correct wire color to pin connections.

8-23. CRT REMOVAL AND REPLACEMENT.

WARNING

To prevent personal injury, always wear a face mask or goggles, and gloves when handling the CRT. Handle the CRT carefully.

8-24. Since the CRT in the Model 1300A is a large screen tube, it is awkward and heavy; and therefore difficult to remove. Also, the CRT is removed through the TOP of the instrument and not the front as in many models. Figure 8-2 gives the top view of the Model 1300A. Use this figure to locate the various parts called out in Paragraph 8-25.

8-25. To remove the CRT proceed as follows:

a) Remove the top and both side covers.

b) Remove the two (2) nuts holding the CRT brackets to the CRT strap.

c) Remove the CRT brackets by removing the screws fastening them to the side castings.

d) Remove the CRT socket cover from the rear panel.

e) Short the post accelerator connection to ground and disconnect the post accelerator lead from the CRT.

f) Remove the wires from the neck pins and unsolder the four wires running into the CRT shield (which connect to the Trace Align and Orthogonality coils) at the end connecting to the circuitry in the scope.

g) Gently pry the CRT socket loose; remove the socket.

h) Loosen the CRT strap by loosening the nuts at the left and right corners of the CRT.

i) Move the tube and magnetic shield toward the rear a distance sufficient to allow the large end to be rotated upward out of the cabinet.

j) Loosen the clamp at the base and slide the magnetic shield off of the neck of the CRT being careful that the neck pins do not catch the alignment coils inside the magnetic shield.

k) To replace the CRT, reverse the above procedure. Use care to locate shield securely against neck of CRT and to square CRT graticule markings with respect to front panel bezel. The mounting strap on top of the CRT at the front should have the thicker end to the the rear of the CRT. Be sure to remove old RTV from post accelerator connection and replace it with fresh RTV.

8-26. SERVICING ETCHED CIRCUIT BOARDS.

8-27. The Model 1300A has circuit boards of the plated-through type. Components can be removed by applying heat from either side. When removing a multiple lead component, move the soldering iron tip from lead to lead and lift it from the board. Excess solder can be removed by applying heat and rotating a wooden toothpick in the hole. Hewlett-Packard Service Note M-20D contains additional information on the repair of circuit boards; important considerations are as follows:

a. Do not apply excessive heat.

b. Apply heat to component leads and remove component with a straight pull away from board.

c. Do not force replacement component leads into the holes.

d. Etched circuit, lifted from the board, may be cemented back with acetate-base cement.

8-28. HANDLING BERYLLIUM OXIDE.

8-29. Four heat sinks used on the Deflection Amplifier Load Assemblies A2A1A2 and A2A1A3 are made of beryllium oxide. Beryllium oxide is poisonous and may be harmful if inhaled (in powder or dust form). The heat sinks, in solid form, are completely safe to handle.

WARNING

Do not file, scrape or otherwise alter the shape of the beryllium oxide heat sinks. Inhalation of beryllium oxide particles may be harmful.

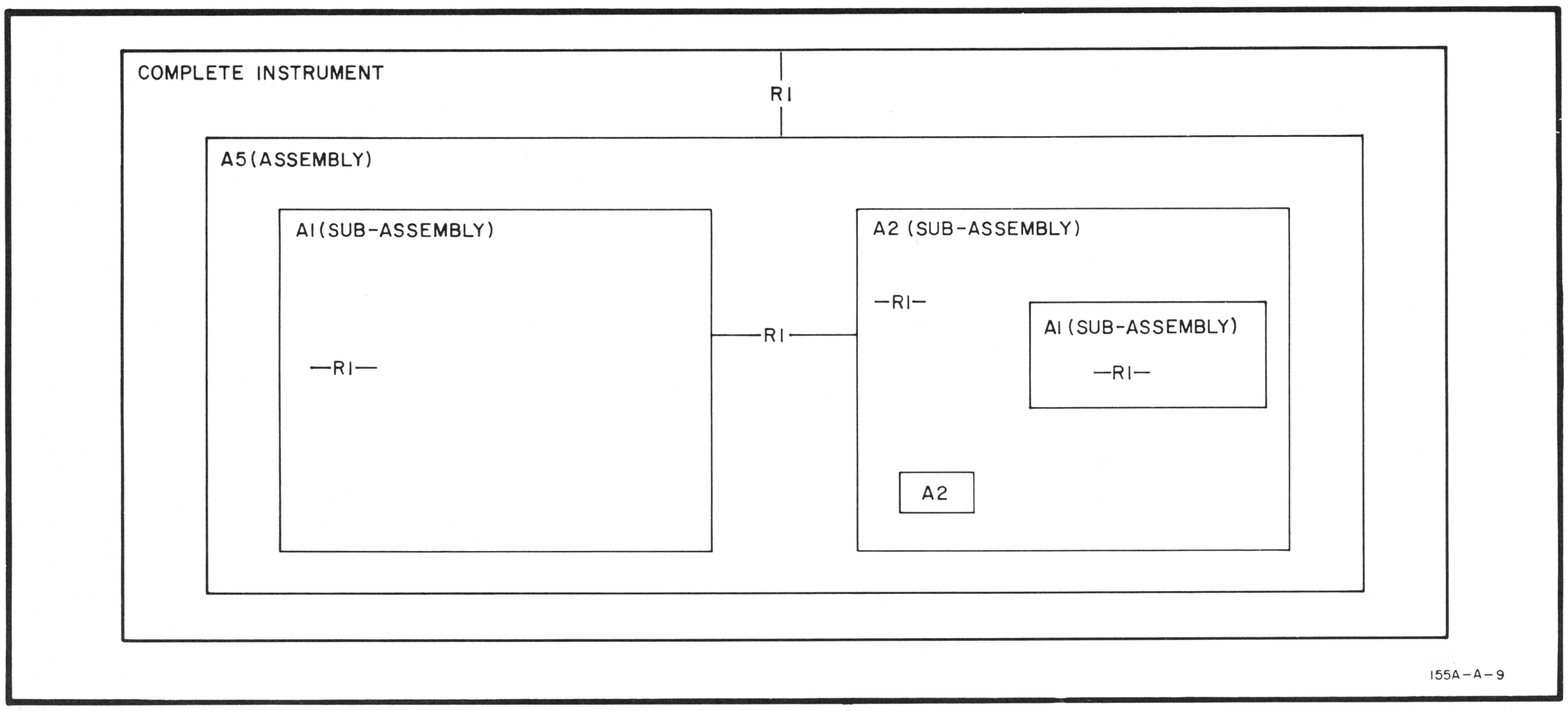


Figure 8-1. Unit System for Reference Designations

Table 8-2. Troubleshooting

SYMPTOM	CHECKS	RESULTS	POSSIBLE AREA
No spot	Check fuse in hv Supply	Fuse is blown	A4Q4
			HV Power supply has possible shorts
Spot too bright	Adjust Z-BAL fully ccw	No spot	Z-AMP Inoperative
		Dim spot	Intensity Limit set wrong
	short SWEEP BLANK input to ground	No effect	Intensity Limit
		Blanks	Z-AXIS Complementary Output Amplifier
			Z-AXIS Input Circuit
			Z-AXIS unbalanced
No deflection	Interchange output cables on A1	X deflects	X portion of A1, Y portion of A2A1
		Y deflects	Y portion of A1, X portion of A2A1
		Neither deflects	A1 or A2A1
Spot is off screen	Remove output wires from A1	Spot returns	A1
		Spot does not return	A2A1

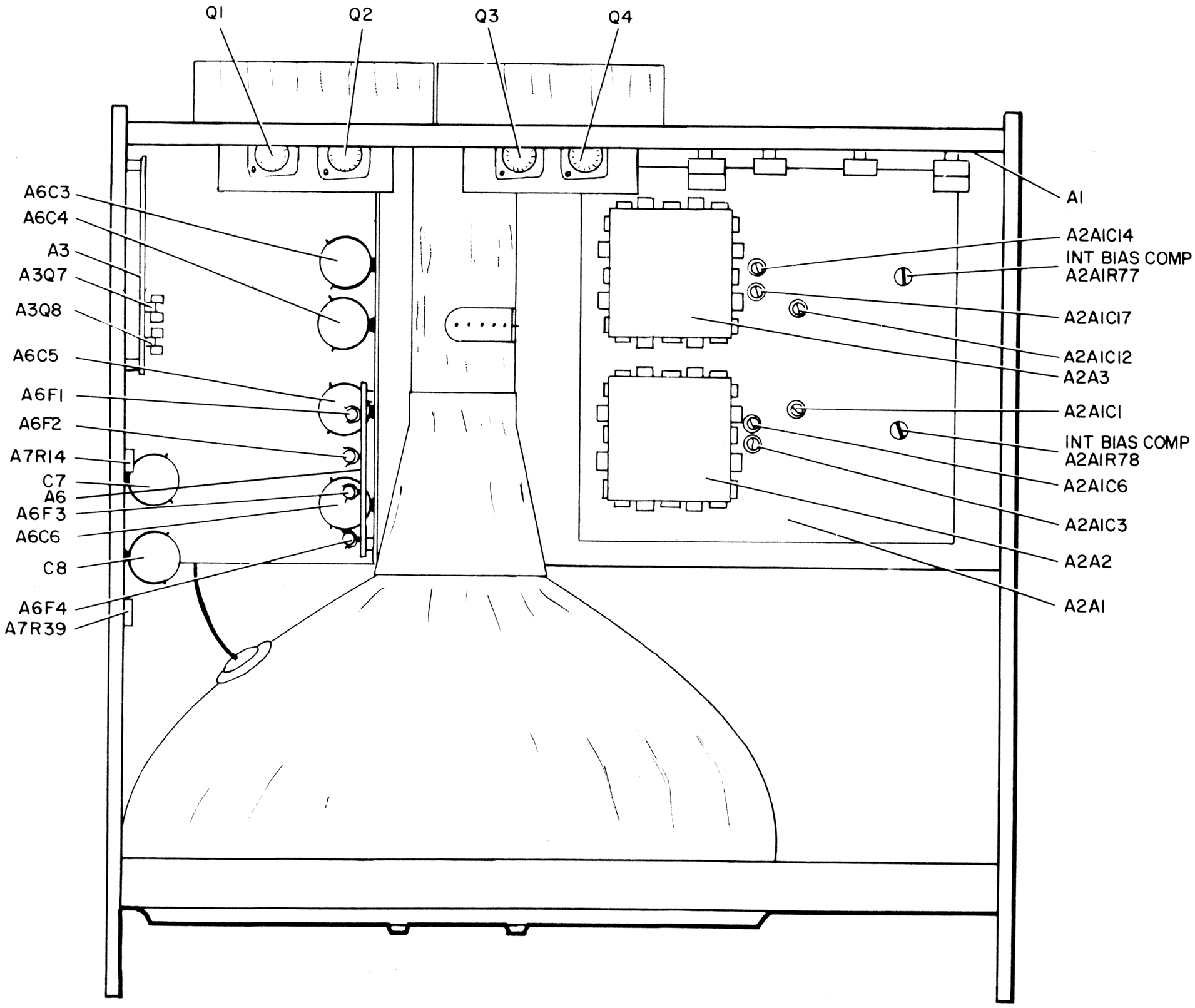


Figure 8-2. Assembly and Adjustment Location, Top View

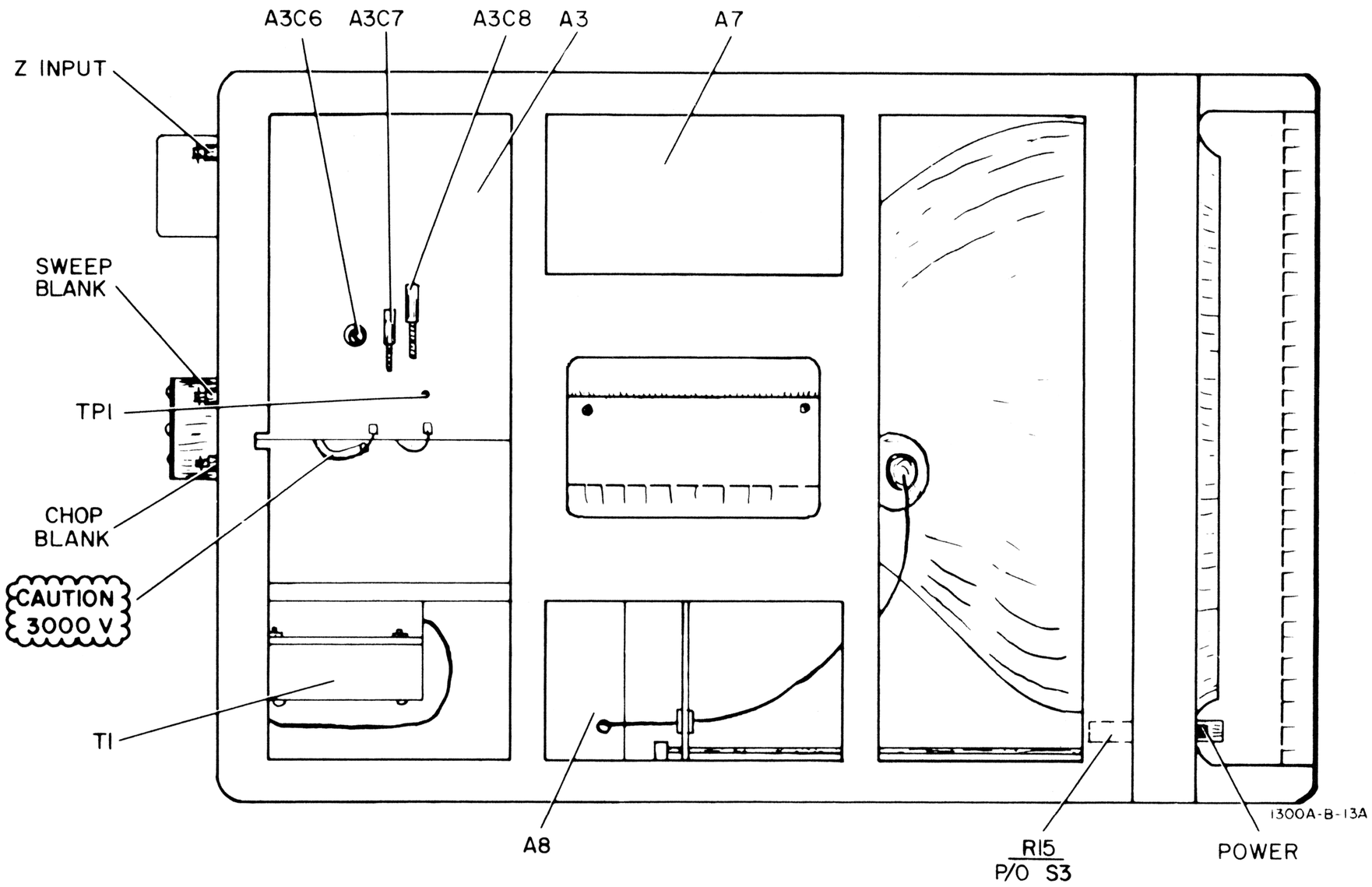


Figure 8-3. Assembly and Adjustment Locations, Left Side View

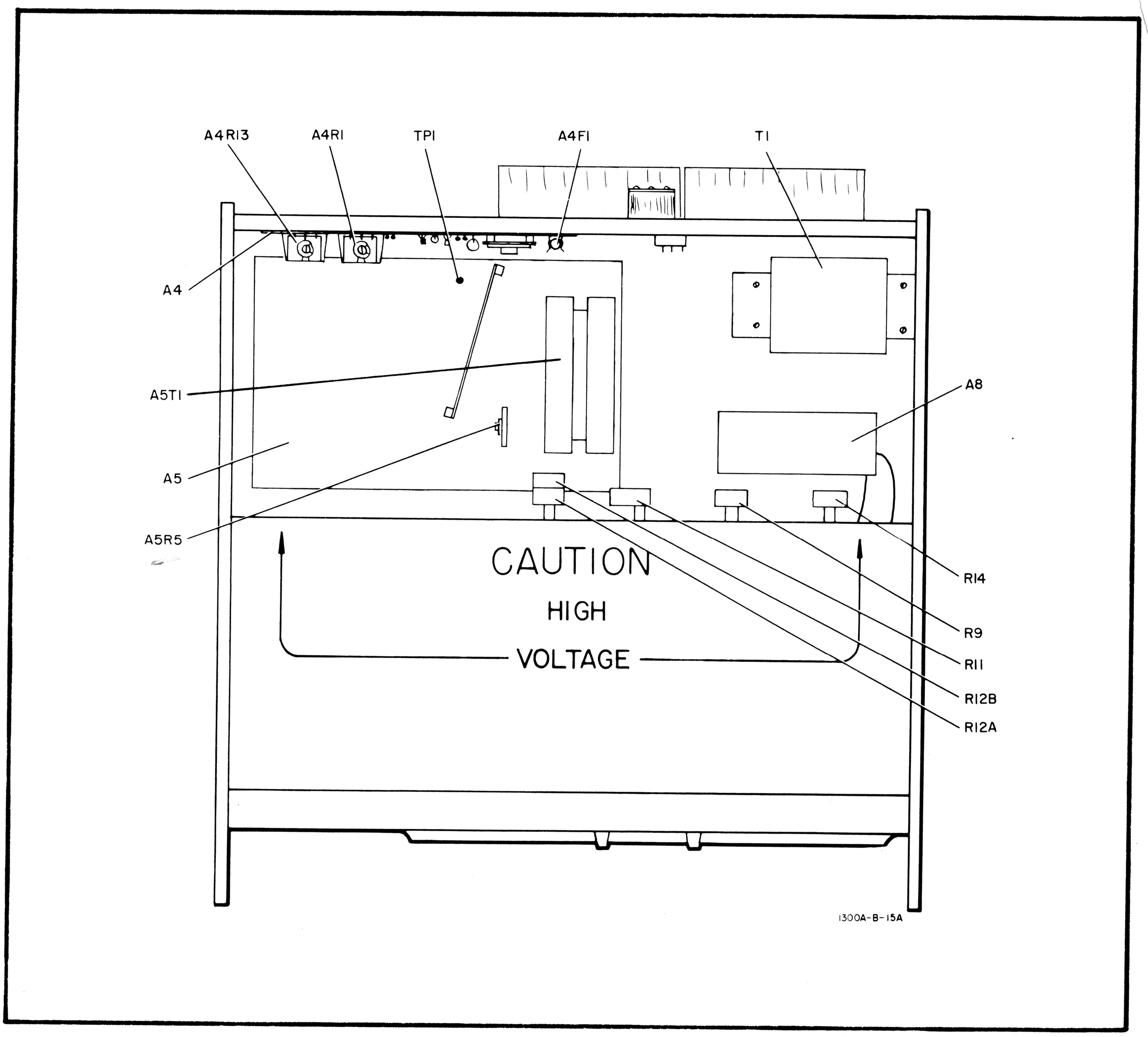


Figure 8-4. Assembly and Adjustment Location, Bottom View

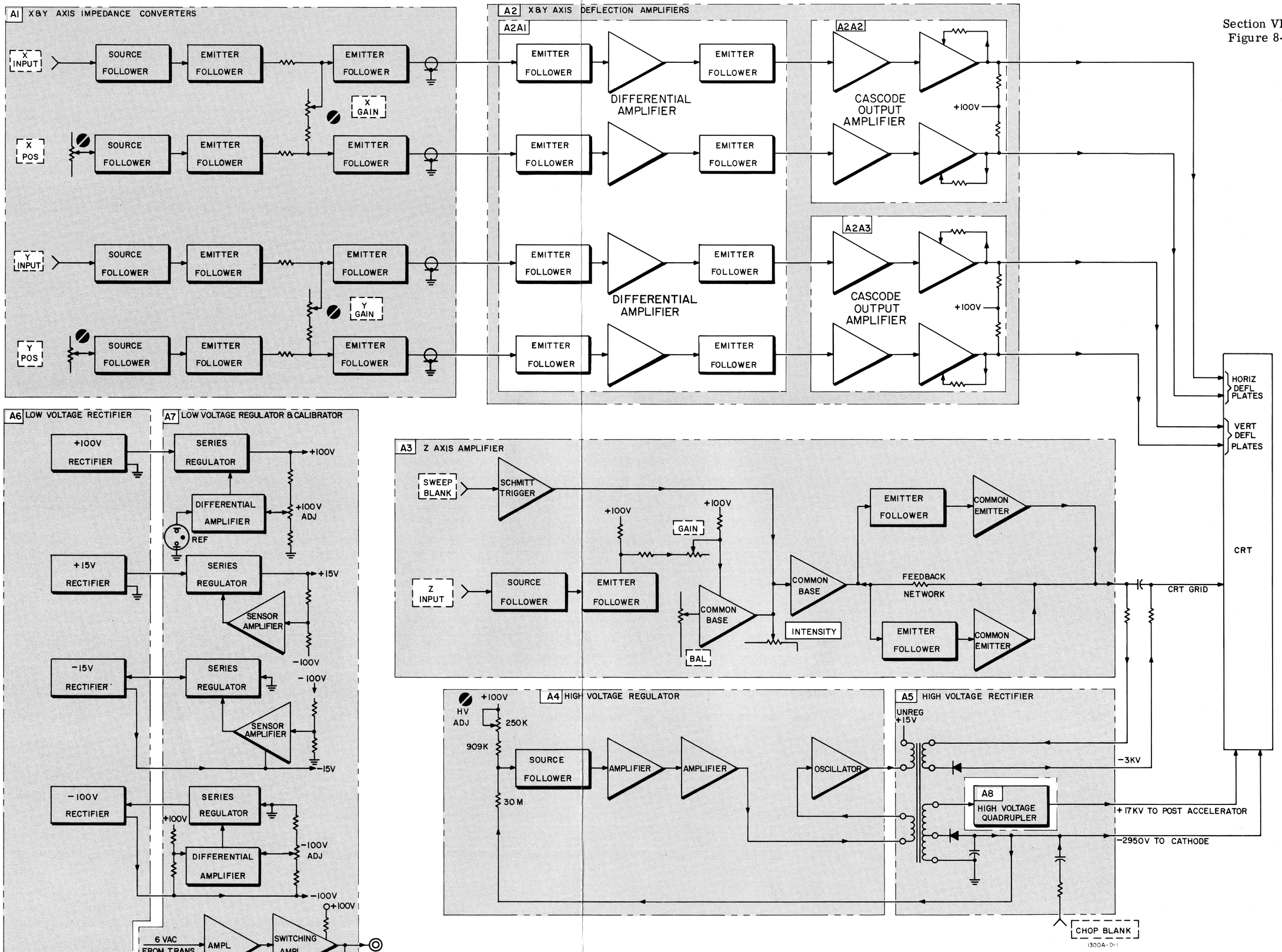
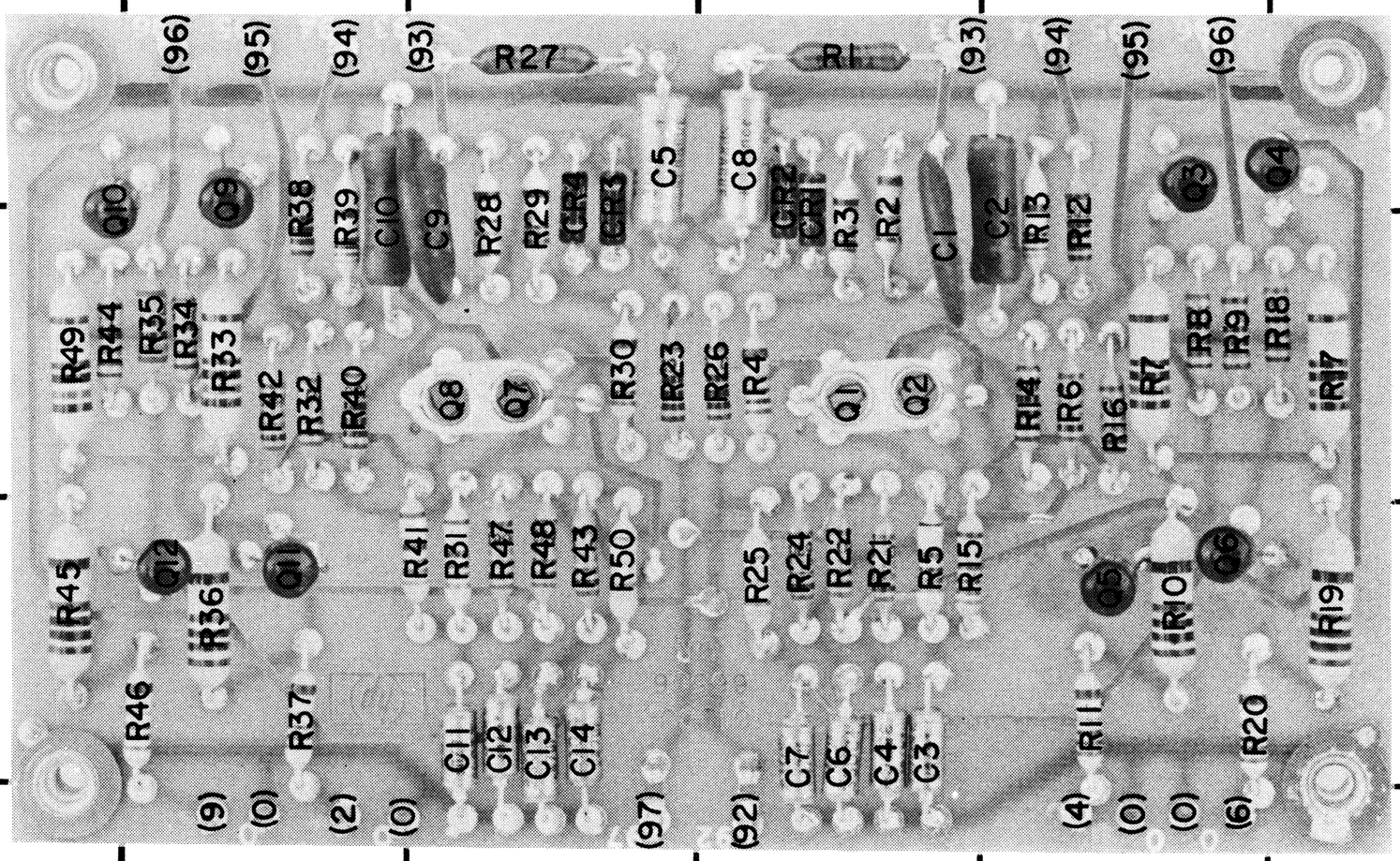


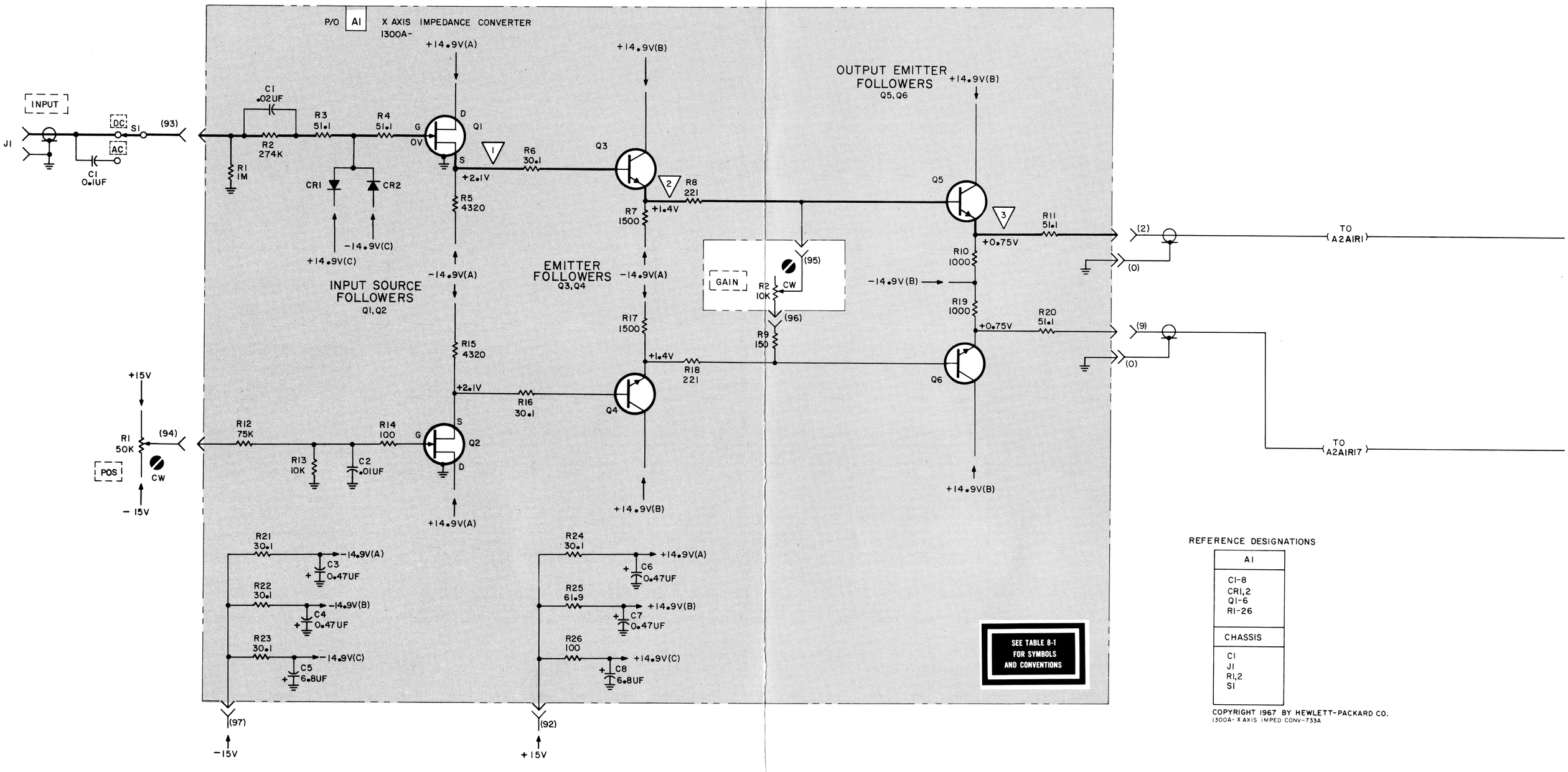
Figure 8-5. Over-all Block Diagram



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	C11	C-4	Q3	E-2	R1	D-2	R11	E-4	R21	D-4	R31	C-4	R41	C-4
C2	E-3	C12	C-4	Q4	F-2	R2	D-3	R12	E-3	R22	D-4	R32	B-3	R42	B-3
C3	D-4	C13	C-4	Q5	E-4	R3	D-3	R13	E-3	R23	C-3	R33	B-3	R43	C-4
C4	D-4	C14	C-4	Q6	E-4	R4	D-3	R14	E-3	R24	D-4	R34	B-3	R44	A-3
C5	C-2	CR1	D-2	Q7	C-3	R5	D-4	R15	D-4	R25	D-4	R35	B-3	R45	A-4
C6	D-4	CR2	D-2	Q8	C-3	R6	E-3	R16	E-3	R26	D-3	R36	B-4	R46	B-4
C7	D-4	CR3	C-2	Q9	B-2	R7	E-3	R17	F-3	R27	C-2	R37	B-4	R47	C-4
C8	D-2	CR4	C-2	Q10	A-2	R8	E-3	R18	F-3	R28	C-3	R38	B-2	R48	C-4
C9	C-3	Q1	D-3	Q11	B-4	R9	E-3	R19	F-4	R29	C-3	R39	B-2	R49	A-3
C10	B-3	Q2	D-3	Q12	B-4	R10	E-4	R20	E-4	R30	C-3	R40	B-3	R50	C-4

1300A-A-19

Figure 8-6. Impedance Converter Component Identification, A1



REFERENCE DESIGNATIONS

A1
C1-8 CR1,2 Q1-6 R1-26
CHASSIS
C1 J1 R1,2 S1

SEE TABLE 8-1 FOR SYMBOLS AND CONVENTIONS

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1300A- X AXIS IMPED CONV-733A

Figure 8-7. X-Axis Impedance Converter Schematic

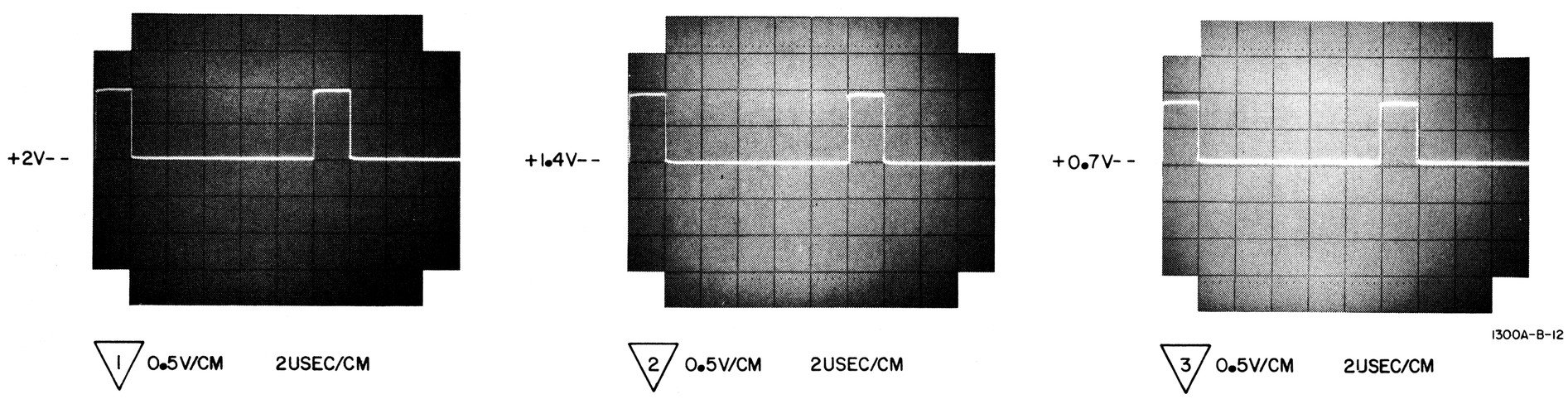
DC VOLTAGE MEASUREMENT CONDITIONS

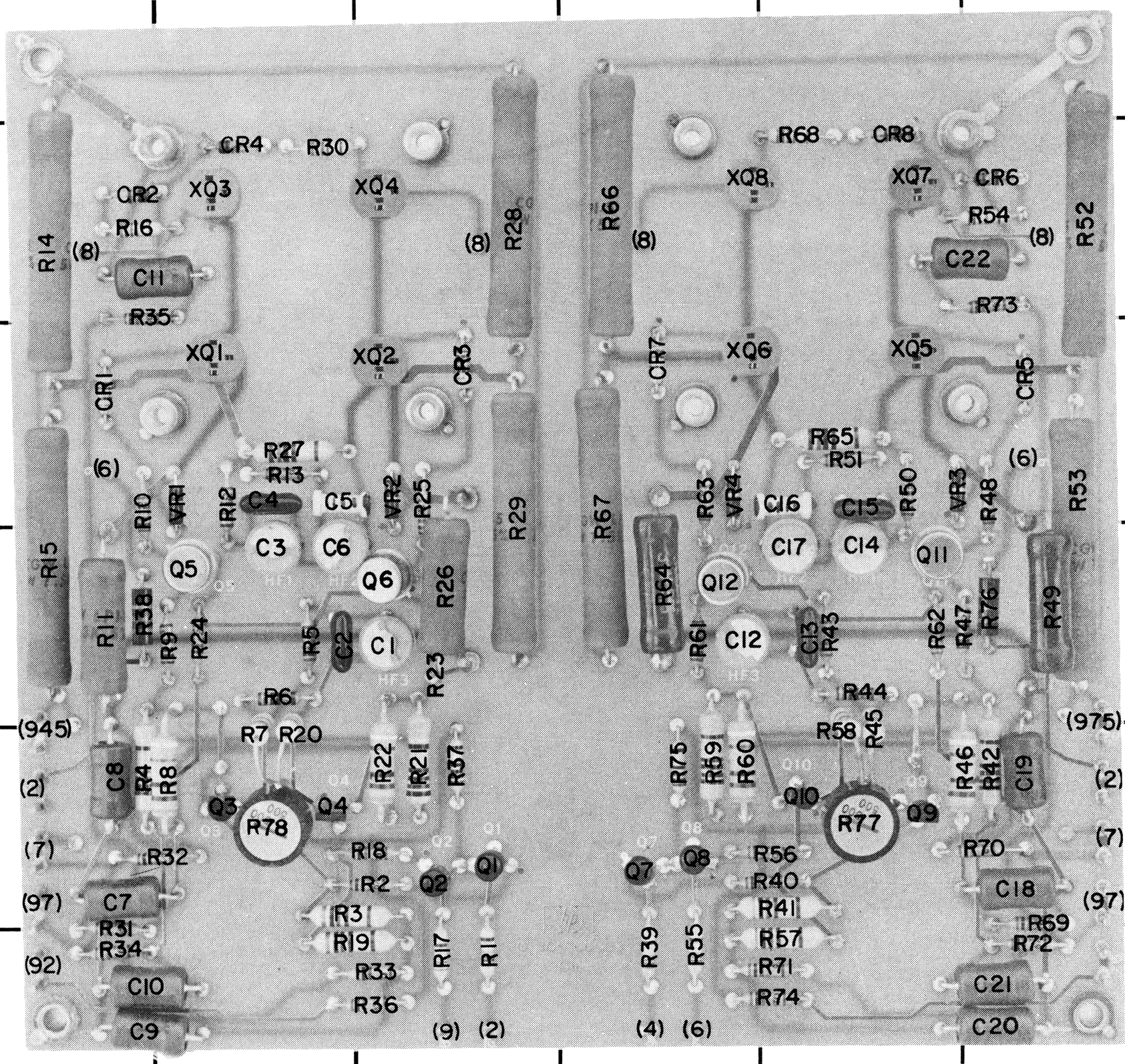
1. X and Y POS . . . . . to center spot
2. X and Y GAIN . . . . . fully cw
3. No signal into X or Y INPUTS
4. INTENSITY, FOCUS, ASTIGMATISM . . . . . for normal viewing

WAVEFORM MEASUREMENT CONDITIONS

1. X and Y POS . . . . . to center spot
2. X and Y GAIN . . . . . fully cw
3. Positive 2 μsec 1 v pulse into INPUT
4. INTENSITY, FOCUS, ASTIGMATISM . . . . . for normal viewing

Measurement Conditions apply to Impedance Converters and Deflection Amplifiers.

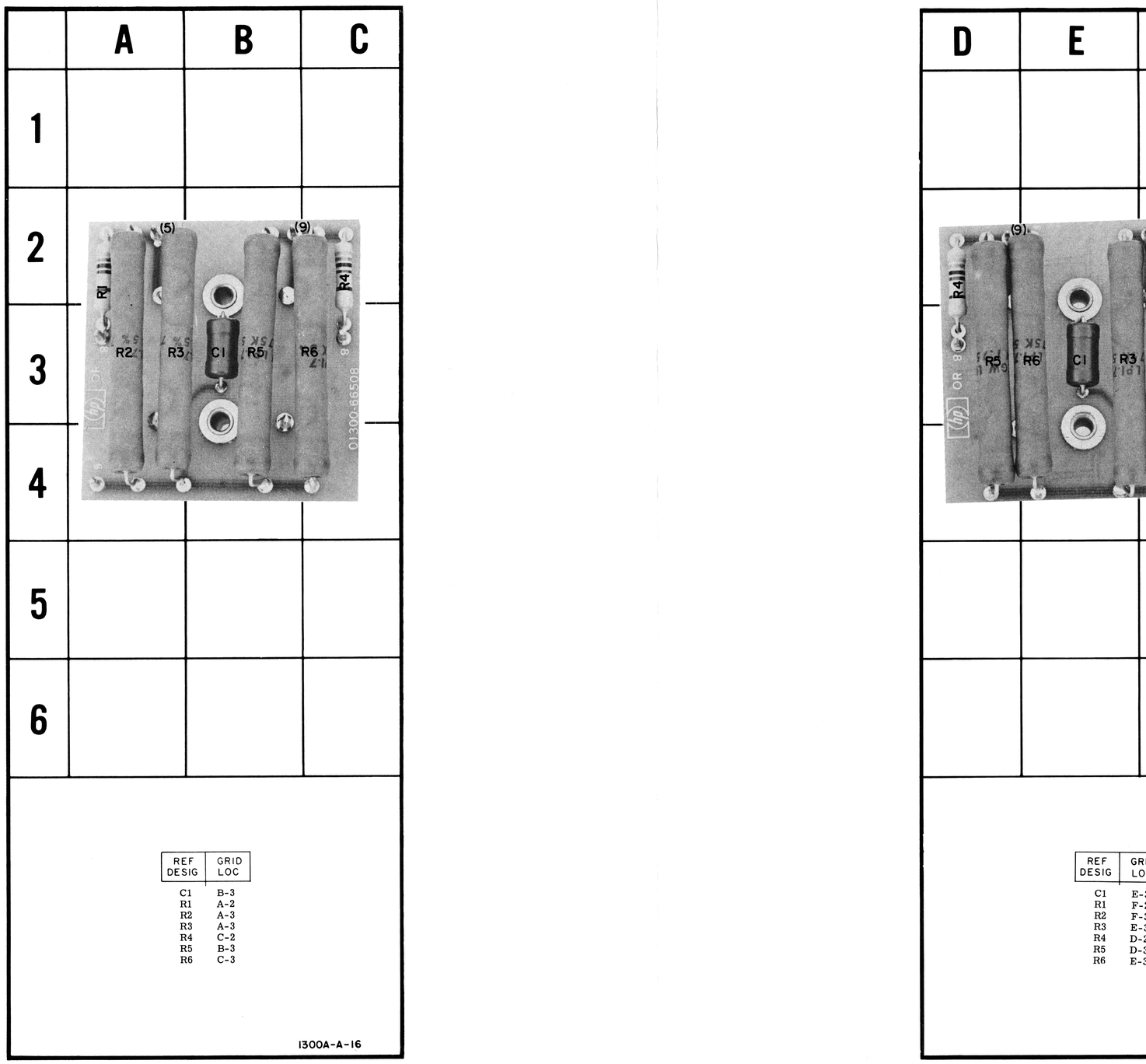




REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	C18	F-5	Q5	B-4	R10	A-3	R27	B-3	R43	E-4	R59	D-5	R75	D-5
C2	B-4	C19	F-5	Q6	C-4	R11	A-4	R28	C-2	R44	E-4	R60	D-4	R76	F-4
C3	B-4	C20	F-6	Q7	D-5	R12	B-3	R29	C-3	R45	E-5	R61	D-4	R77	E-5
C4	B-3	C21	F-6	Q8	D-5	R13	B-3	R30	B-2	R46	E-5	R62	E-4	R78	B-5
C5	B-3	C22	E-2	Q9	E-5	R14	A-2	R31	A-6	R47	E-4	R63	D-3	VR1	B-3
C6	B-4	CR1	A-3	Q10	E-5	R15	A-4	R32	A-4	R48	F-3	R64	D-5	VR2	C-3
C7	A-5	CR2	A-2	Q11	E-4	R16	A-2	R33	C-6	R49	F-4	R65	E-2	VR3	E-3
C8	A-5	CR3	C-3	Q12	D-4	R17	C-6	R34	A-6	R50	E-3	R66	D-2	VR4	D-3
C9	A-6	CR4	B-2	R1	C-6	R18	C-5	R35	A-2	R51	E-3	R67	D-3	XQ1	B-3
C10	A-3	CR5	F-3	R2	C-5	R19	B-6	R36	C-6	R52	F-2	R68	E-2	XQ2	C-3
C11	A-4	CR6	F-2	R3	B-5	R20	B-5	R37	C-5	R53	F-3	R69	F-6	XQ3	B-2
C12	D-4	CR7	D-3	R4	A-5	R21	C-5	R38	A-4	R54	F-2	R70	F-5	XQ4	C-2
C13	E-4	CR8	E-2	R5	B-4	R22	C-5	R39	D-6	R55	D-6	R71	E-6	XQ5	E-3
C14	E-4	Q1	C-5	R6	B-4	R23	C-4	R40	E-5	R56	E-5	R72	F-6	XQ6	D-3
C15	E-3	Q2	C-5	R7	B-5	R24	B-4	R41	E-5	R57	E-6	R73	F-2	XQ7	E-2
C16	E-3	Q3	B-5	R8	B-5	R25	C-3	R42	F-5	R58	E-5	R74	E-6	XQ8	D-2
C17	E-4	Q4	B-5	R9	B-4	R26	C-4								

1300A-A-18A

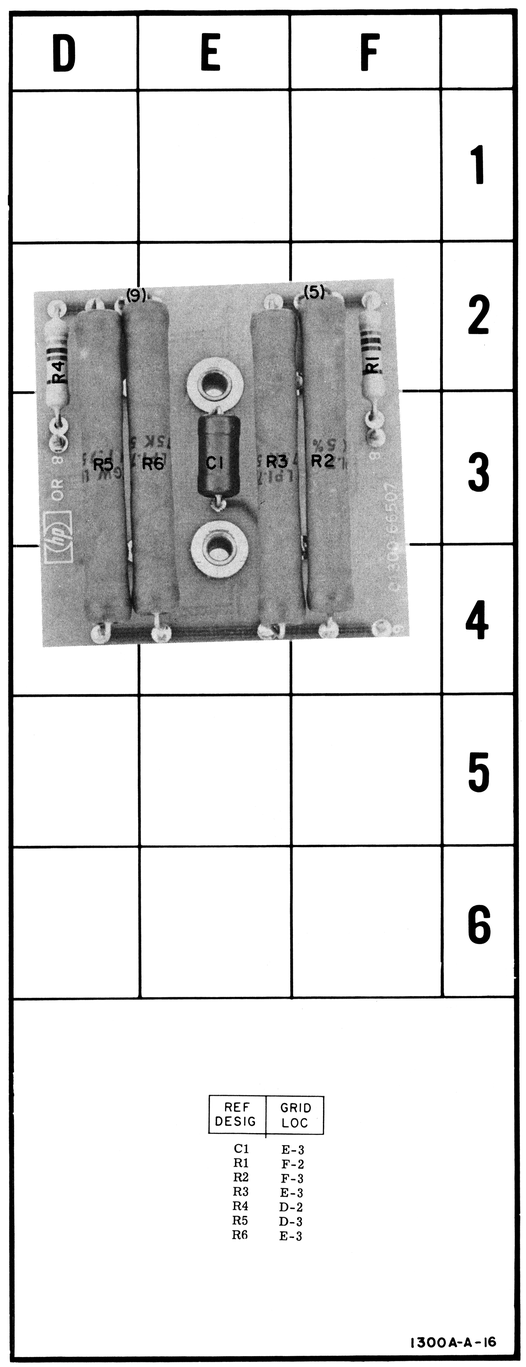
Figure 8-10. Deflection Amplifier Component Identification, A2A1



REF DESIG	GRID LOC
C1	B-3
R1	A-2
R2	A-3
R3	A-3
R4	C-2
R5	B-3
R6	C-3

1300A-A-16

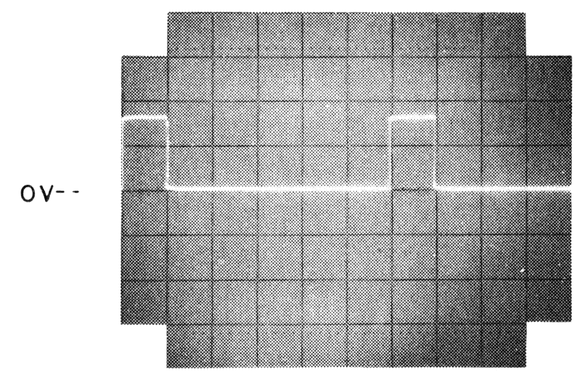
Figure 8-8. Horizontal Load Assembly Component Identification, A2A2



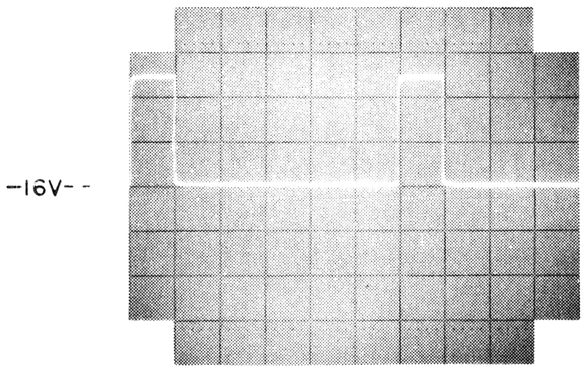
REF DESIG	GRID LOC
C1	E-3
R1	F-2
R2	F-3
R3	E-3
R4	D-2
R5	D-3
R6	E-3

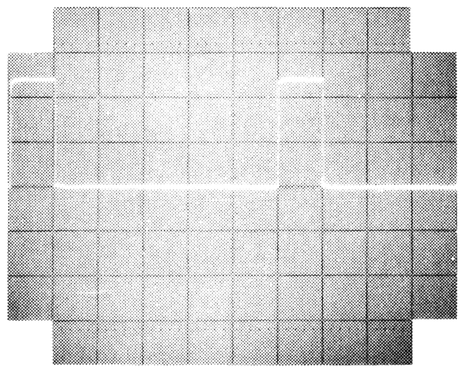
1300A-A-16

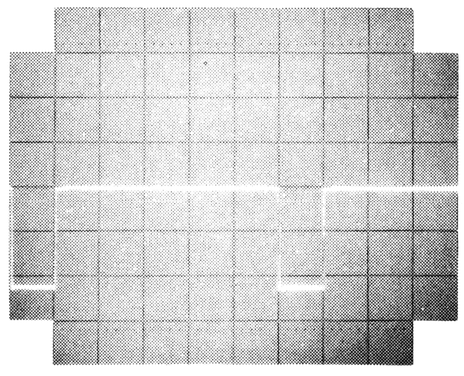
Figure 8-9. Vertical Load Component Identification, A2A3

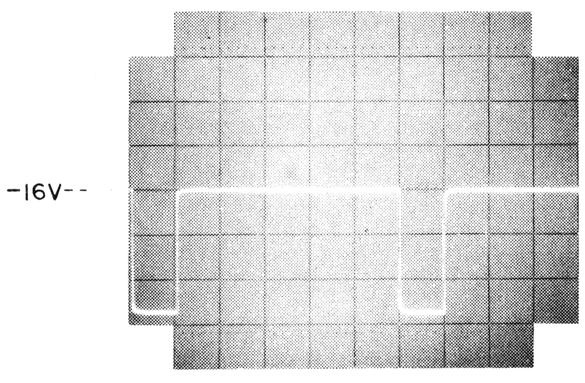


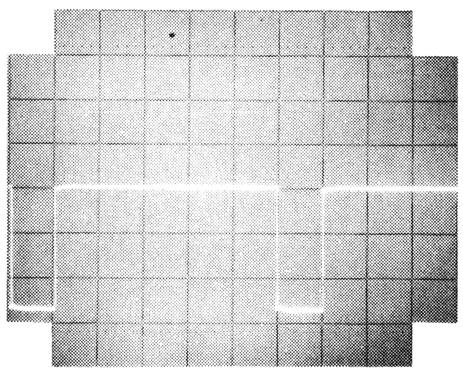
For VOLTAGE AND WAVEFORM MEASUREMENT CONDITIONS, see Page 8-9

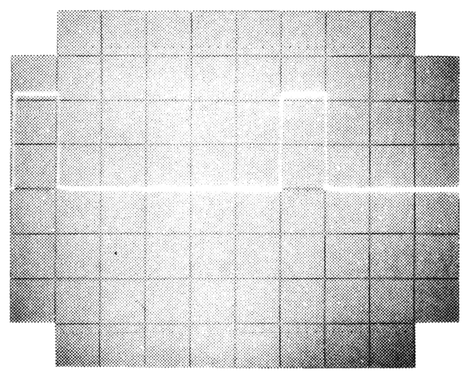


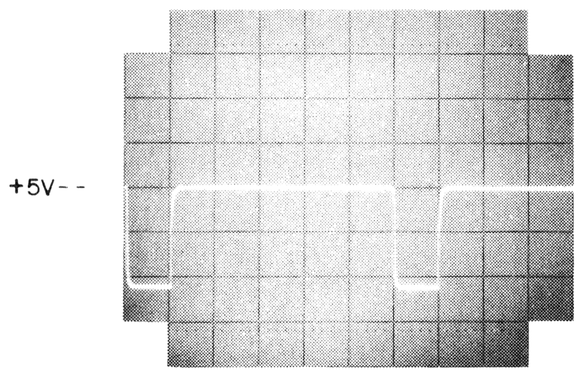


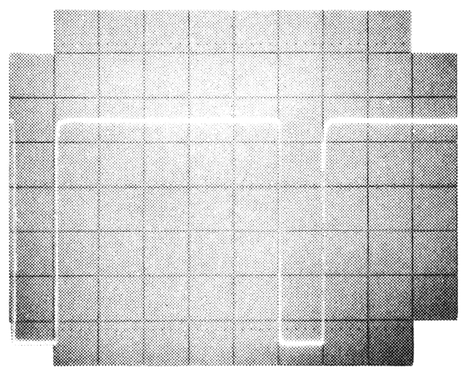


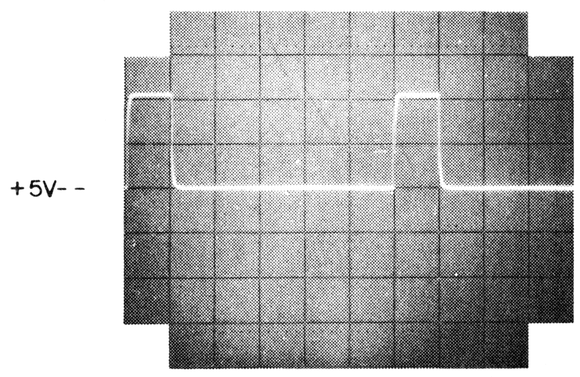


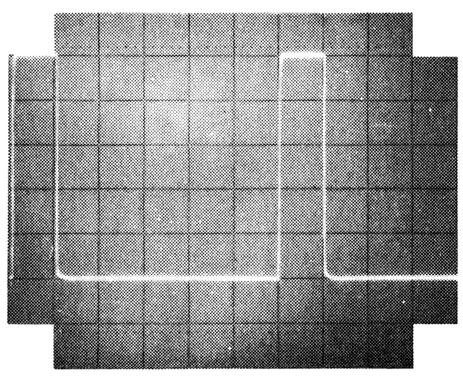




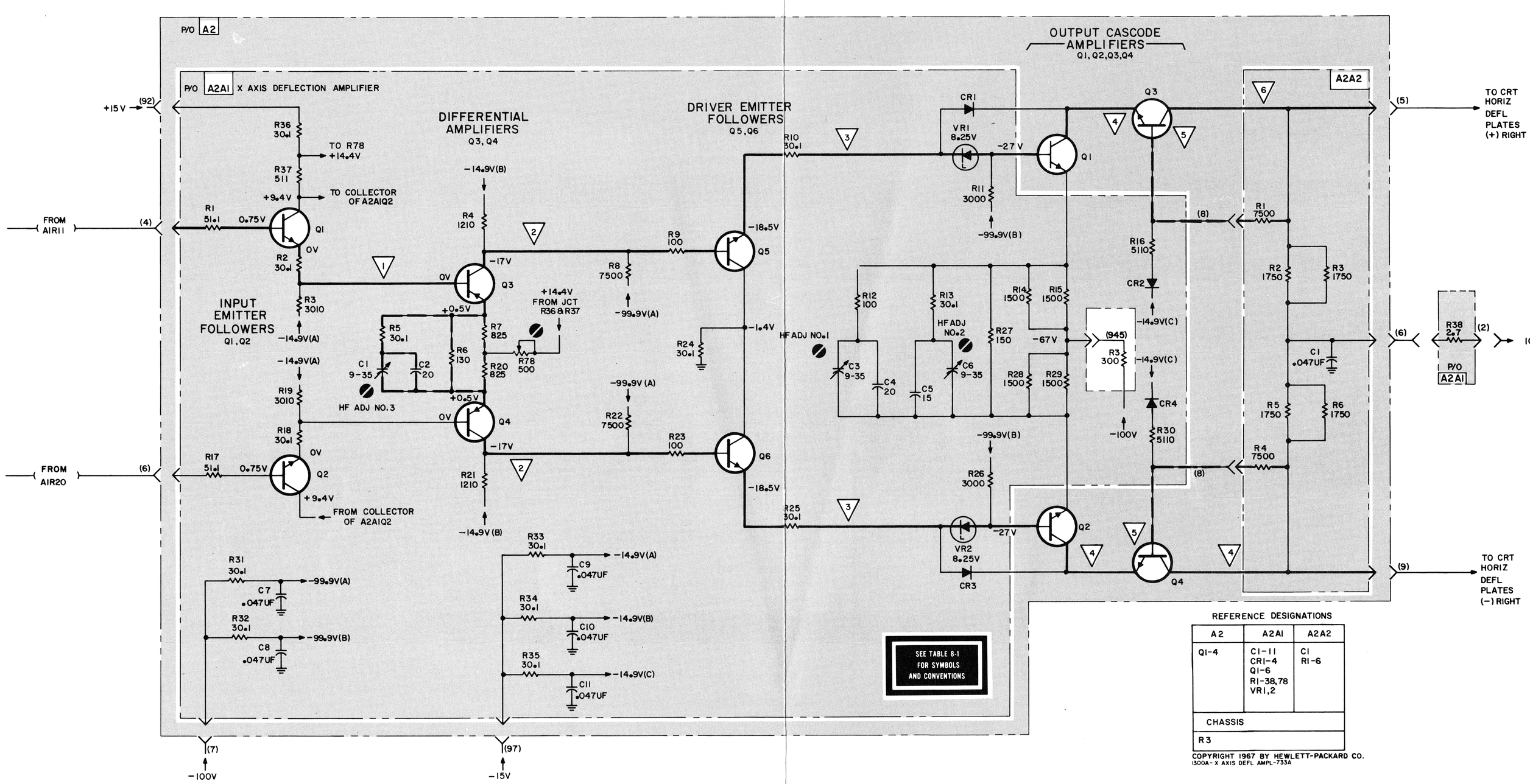








1300A-C-1A



REFERENCE DESIGNATIONS

A2	A2A1	A2A2
Q1-4	C1-11 CR1-4 Q1-6 R1-38,78 VR1,2	C1 R1-6
CHASSIS		
R3		

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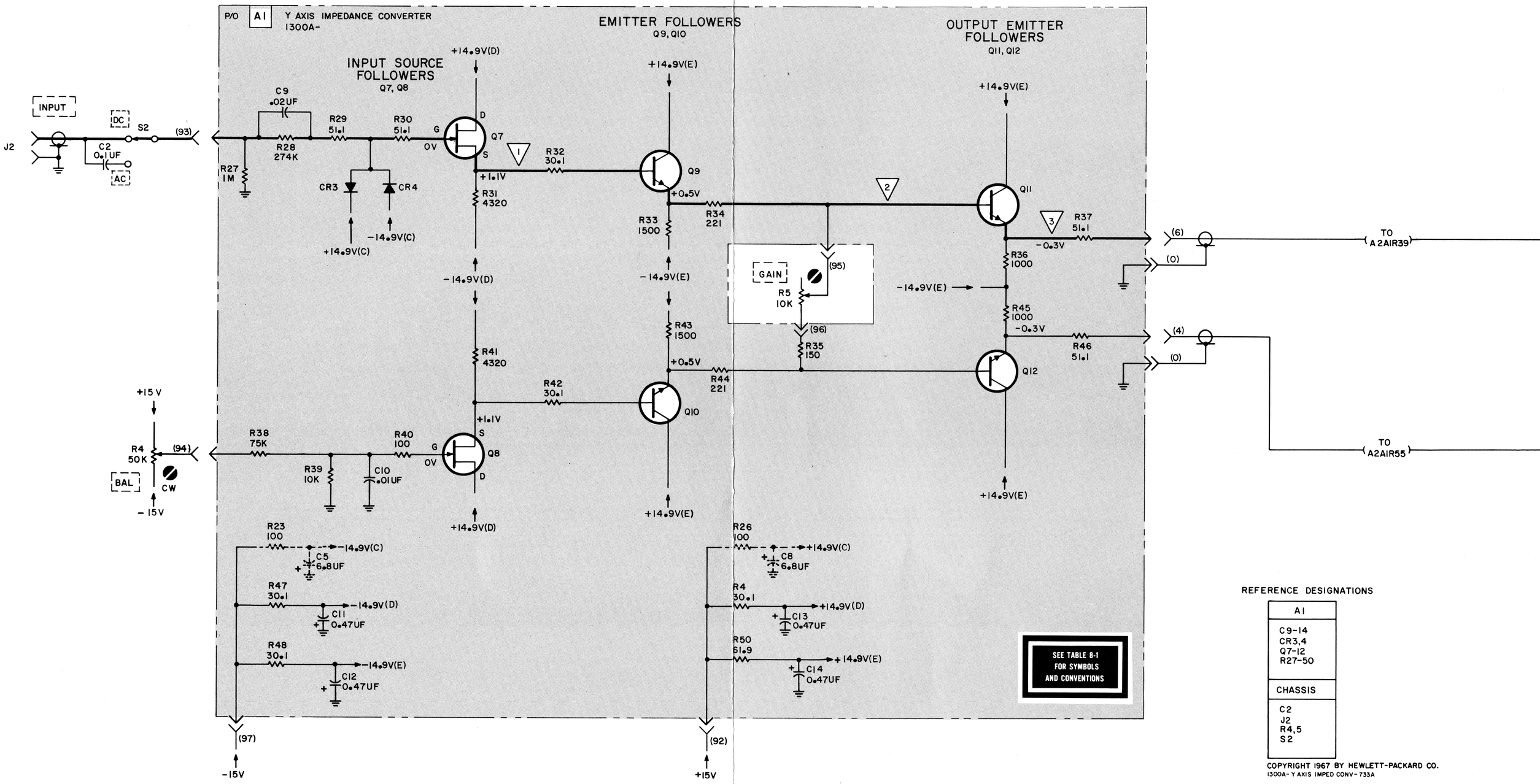
1300A-X AXIS DEFL AMPL-733A

Figure 8-11. X-Axis Deflection Amplifier Schematic



REFERENCE DESIGNATIONS

A1
C9-14 CR3,4 Q7-12 R27-50
CHASSIS
C2 J2 R4,5 S2

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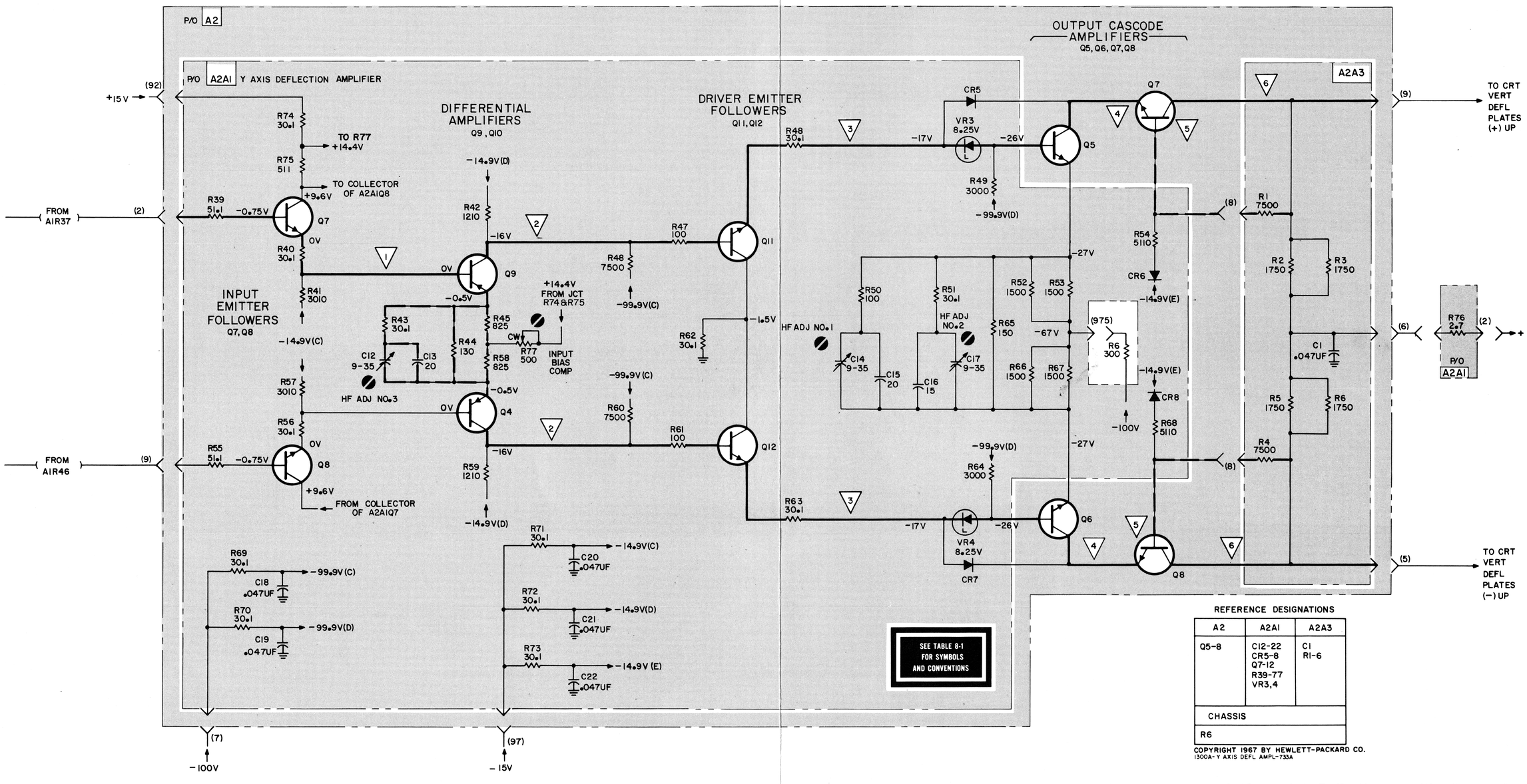
1300A-Y AXIS IMPED CONV-733A

Figure 8-12. Y-Axis Impedance Converter Schematic



REFERENCE DESIGNATIONS

A2	A2A1	A2A3
Q5-8	C12-22 CR5-8 Q7-12 R39-77 VR3,4	C1 R1-6
CHASSIS		
R6		

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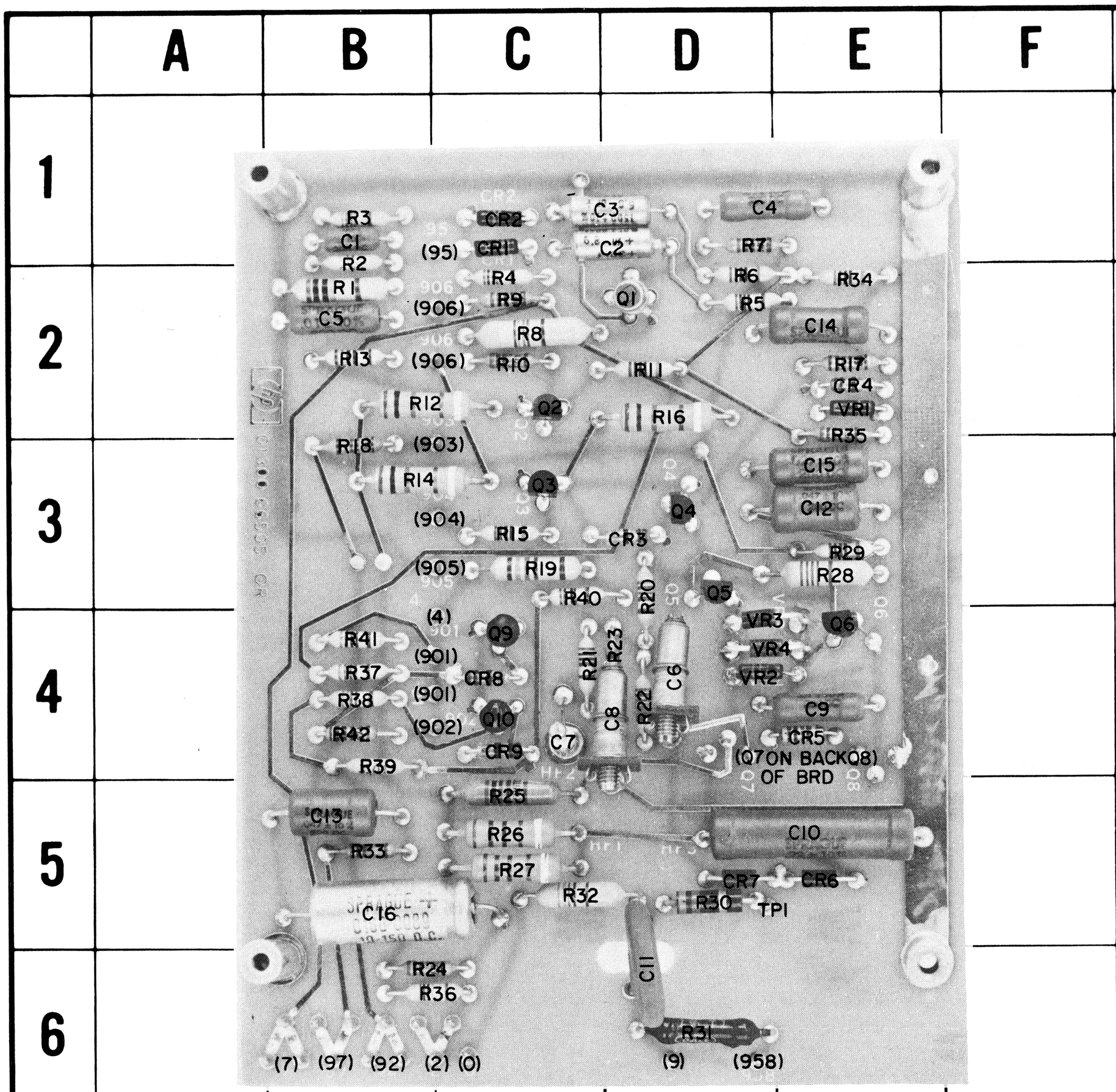
1300A-Y AXIS DEFL AMPL-733A

Figure 8-13. Y-Axis Deflection Amplifier Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-1	C12	E-3	CR7	D-5	Q8	E-4	R8	C-2	R18	B-3	R28	E-3	R38	B-4
C2	D-1	C13	B-5	CR8	C-4	Q9	E-4	R9	C-2	R19	C-3	R29	E-3	R39	B-4
C3	C-1	C14	E-2	CR9	C-4	Q10	C-4	R10	C-2	R20	D-3	R30	D-5	R40	C-3
C4	D-1	C15	E-3	Q1	D-2	R1	B-2	R11	D-2	R21	C-4	R31	D-6	R41	B-4
C5	B-2	C16	B-5	Q2	C-2	R2	B-1	R12	B-2	R22	D-4	R32	C-5	R42	B-4
C6	D-4	CR1	C-1	Q3	C-3	R3	B-1	R13	B-2	R23	D-4	R33	B-5	TP1	D-5
C7	C-4	CR2	C-1	Q4	D-3	R4	C-2	R14	B-3	R24	B-6	R34	E-2	VR1	E-2
C8	D-4	CR3	D-3	Q5	D-3	R5	D-2	R15	C-3	R25	C-4	R35	E-2	VR2	D-4
C9	E-4	CR4	E-2	Q6	E-4	R6	D-2	R16	D-2	R26	C-4	R36	B-6	VR3	D-4
C10	E-5	CR5	E-4	Q7	D-4	R7	D-1	R17	E-2	R27	C-4	R37	B-4	VR4	D-4
C11	D-6	CR6	E-5												

1300A-A-20A

Figure 8-14. Z-Axis Amplifier Component Identification, A3

DC VOLTAGE MEASUREMENT CONDITIONS

1. INTENSITY · · · · · · · · · · · · · · · · 12 o'clock
2. Z-GAIN · fully cw
3. Z-BAL for zero difference between A3Q2/A3Q3 emitters.
4. No signal into Z-INPUT

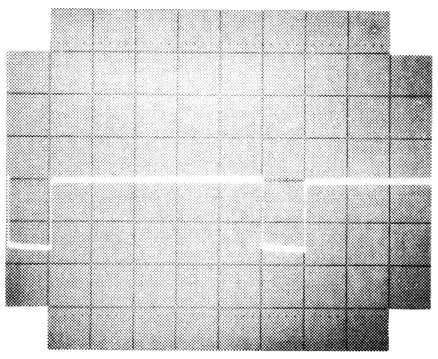
Special conditions for Blanking Schmitt Trigger:

1. All voltages in parenthesis are taken with SWEEP BLANK Input grounded.

WAVEFORM MEASUREMENT CONDITIONS

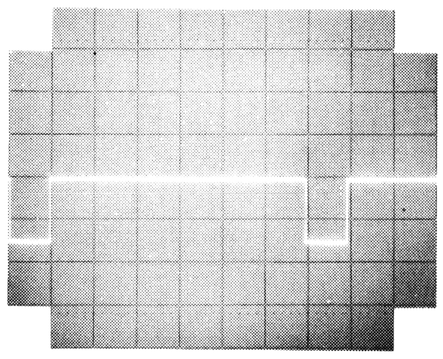
1. Negative 1v, 2 μsec pulse input.
2. Z-GAIN set for 20 volt output pulse at TPI.
3. Z-BAL set for 0V DC across R7, Z-GAIN.
4. INTENSITY set for no clipping on positive or negative excursion.
5. 50:1 attenuator Probe

+1.75V- -



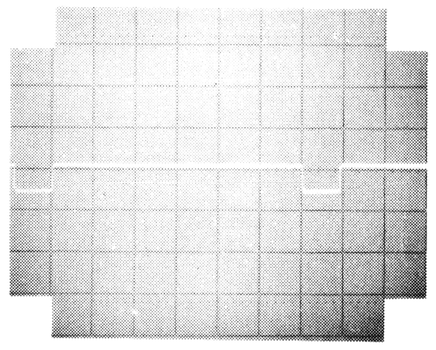
1 0.5V/CM 2USEC/CM

+1.5V- -



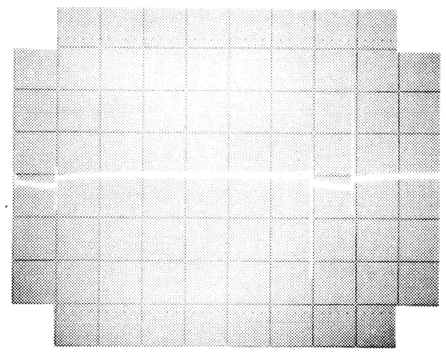
2 0.5V/CM 2USEC/CM

-6.5V- -



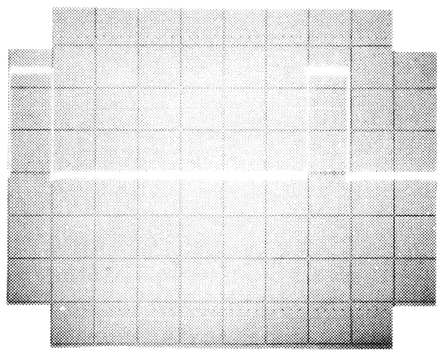
3 50mv/CM 2USEC/CM

+0.8V- -



4 50mv/CM 2USEC/CM

0V- -



5 5V/CM 2USEC/CM

1300A-B-14A

A3 Z AXIS AMPLIFIER 1300A-

SWEEP BLANK

J4 (902)

(901)

Z INPUT

J3 (95)

V (97)

BLANKING SCHMITT TRIGGER Q9,Q10

INPUT SOURCE FOLLOWER Q1

DIFFERENTIAL CURRENT AMPLIFIER Q2,Q3

COMMON BASE SUMMING AMPLIFIER Q4

DRIVER EMITTER FOLLOWERS Q5, Q6

COMPLEMENTARY OUTPUT AMPLIFIER Q7, Q8

TO JCT OF A5R6 & A5R7 (958)

TO CRT GRID PIN 3 (9)

TO JCT OF A5T1 & A5C9 (0)

INTENSITY (4)

(2)

(7)

(92)

SEE TABLE 8-1 FOR SYMBOLS AND CONVENTIONS

REFERENCE DESIGNATIONS

A3
C1-16 CR1-9 Q1-10 R1-42 TP1 VR1-4
CHASSIS
J3,4 R7-9

*BALANCE CONTROL EQUALIZES STARRED VOLTAGES BETWEEN +1V AND +2V WITH GAIN CONTROL FULLY CW.

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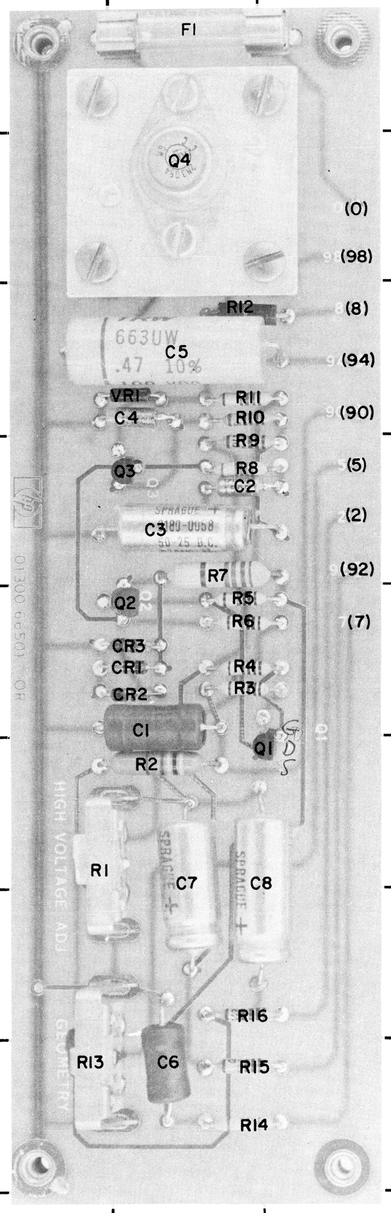
1300A-Z AXIS AMPLIFIER-818

Figure 8-15. Z-Axis Amplifier Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	R2	B-6
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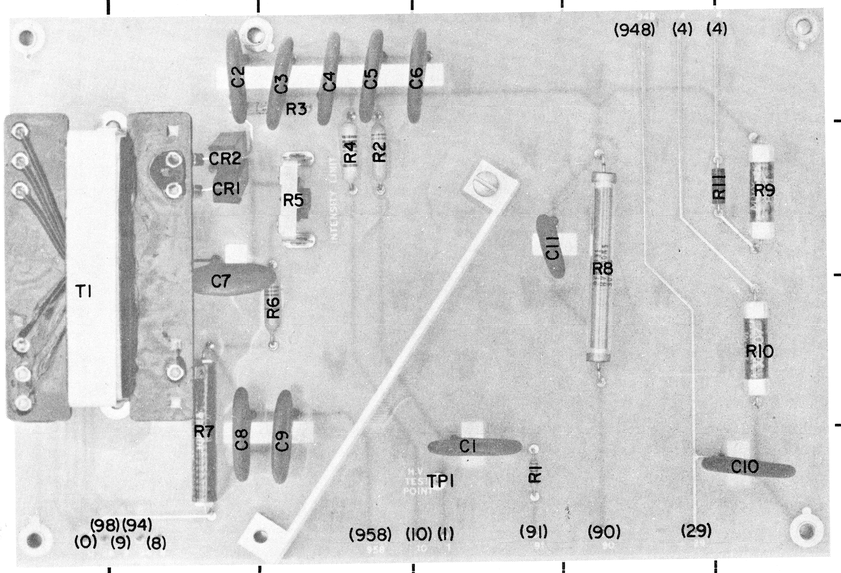
C3	B-4	R4	B-5
C4	B-3	R5	B-5
C5	B-3	R6	B-5
C6	B-8	R7	B-4
C7	B-6	R8	B-4
C8	C-6	R9	B-4
CR1	B-5	R10	B-3
CR2	B-5	R11	B-3
CR3	B-5	R12	B-3
F1	B-1	R13	A-8
Q1	C-6	R14	B-8
Q2	B-5	R15	B-8
Q3	B-4	R16	B-7
Q4	B-2	VR1	B-3
R1	A-6		

1300A-A-13

Figure 8-16. High Voltage Regulator Component Identification, A4



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
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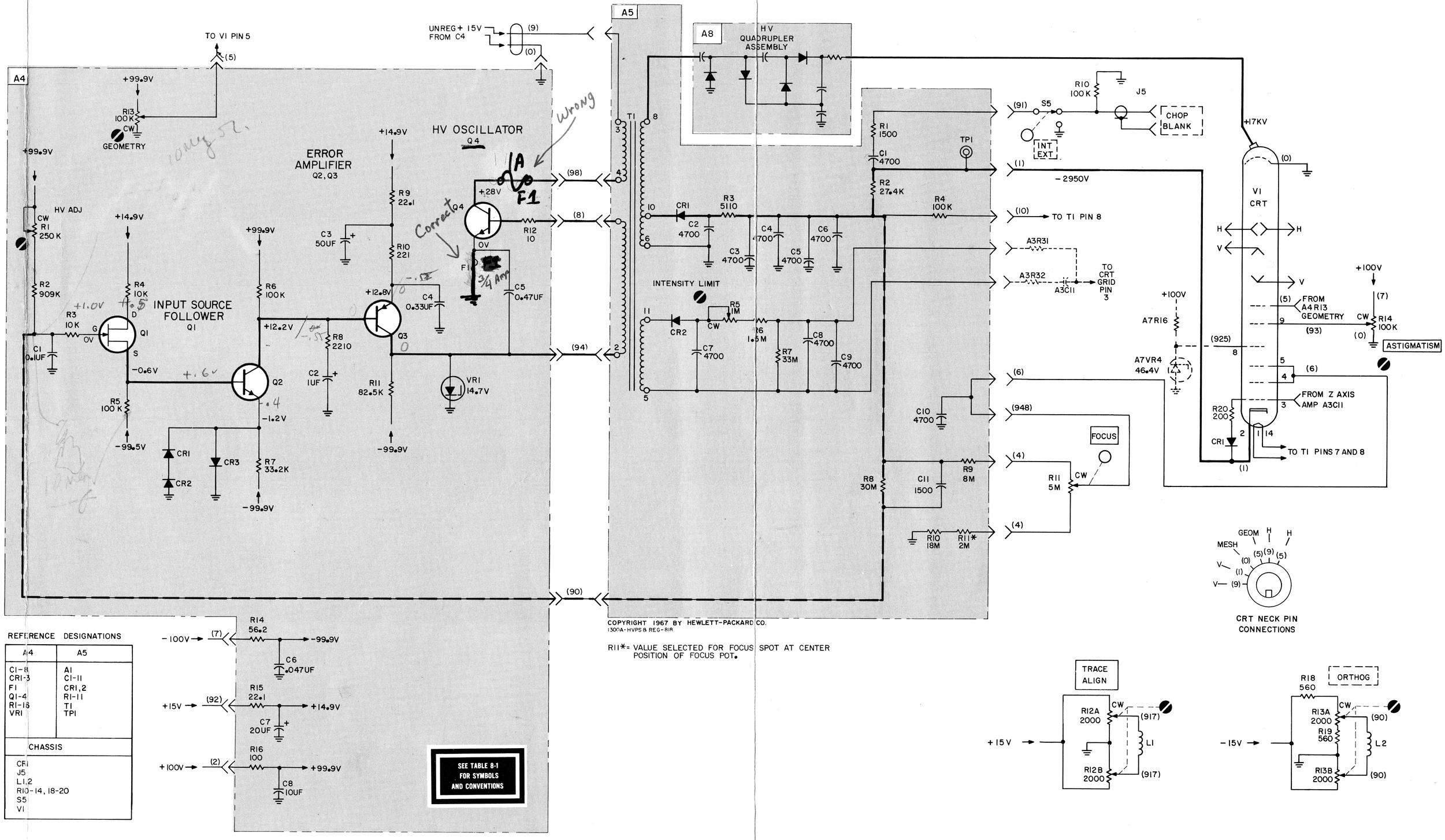
C2	B-2	C9	C-5	R3	C-2	R9	F-3
C3	C-2	C10	F-5	R4	C-3	R10	F-4
C4	C-2	C11	D-3	R5	C-3	R11	F-3
C5	C-2	CR1	B-3	R6	C-4	T1	A-4
C6	D-2	CR2	B-3	R7	B-5	TP1	D-5
C7	B-4	R1	D-5				

1300A-A-17A

Figure 8-17. High Voltage Rectifier Component Identification, A5

DC VOLTAGE MEASUREMENT CONDITIONS

1. Model 1300A . . . . . Set for normal viewing
2. No INPUT to any axis



REFERENCE DESIGNATIONS

A4	A5
C1-8 CR1-3 F1 Q1-4 R1-15 VR1	A1 C1-11 CR1,2 R1-11 T1 TP1
CHASSIS	
CR1 J5 L1,2 R10-14, 18-20 S5 V1	

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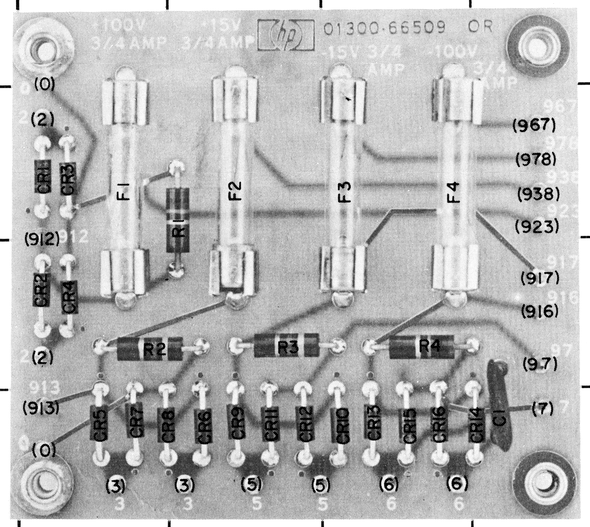
1300A-HVPS & REG-8IR

R11* = VALUE SELECTED FOR FOCUS SPOT AT CENTER POSITION OF FOCUS POT.

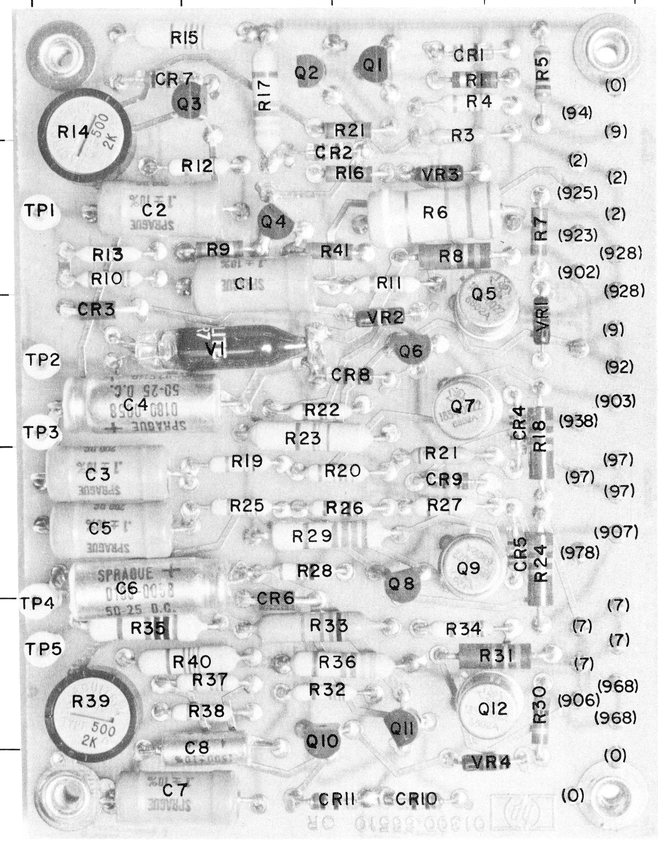
Figure 8-18. High Voltage Power Supply Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-5	CR9	C-5	F1	B-3
CR1	B-3	CR10	D-5	F2	C-3
CR2	B-4	CR11	C-5	F3	D-3
CR3	B-3	CR12	C-5	F4	D-3
CR4	B-4	CR13	D-5	R1	C-3
CR5	B-5	CR14	D-5	R2	B-4
CR6	C-5	CR15	D-5	R3	C-4
CR7	B-5	CR16	D-5	R4	D-4
CR8	B-5				

1300A-A-14

Figure 8-19. Low Voltage Rectifier and Fuse Board Component Identification, A6



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-2	CR7	B-1	Q10	C-5	R12	C-2	R26	D-4	R40	B-5
C2	B-2	CR8	D-3	Q11	D-5	R13	B-2	R27	D-4	TP1	B-2
C3	B-4	CR9	D-4	Q12	E-5	R14	B-1	R28	C-4	TP2	B-3
C4	B-3	CR10	D-6	R1	D-1	R15	B-1	R29	C-4	TP3	B-3
C5	B-4	CR11	C-6	R2	D-1	R16	D-2	R30	E-5	TP4	B-5
C6	B-4	Q1	D-1	R3	D-1	R17	C-1	R31	E-5	TP5	B-5
C7	B-6	Q2	C-1	R4	D-1	R18	E-2	R32	C-5	V1	C-3
C8	B-6	Q3	C-1	R5	E-1	R19	C-4	R33	C-5	VR1	E-3
CR1	D-1	Q4	C-2	R6	D-2	R20	D-4	R34	D-5	VR2	D-3
CR2	C-2	Q5	D-3	R7	E-2	R21	D-4	R35	B-5	VR3	D-2
CR3	B-3	Q6	D-3	R8	D-2	R22	C-3	R36	C-5	VR4	D-6
CR4	E-3	Q7	D-3	R9	C-2	R23	C-3	R37	C-5		
CR5	E-4	Q8	D-4	R10	B-2	R24	E-4	R38	C-5		
CR6	C-5	Q9	D-4	R11	D-2	R25	C-4	R39	B-5		

1309A-A-10A

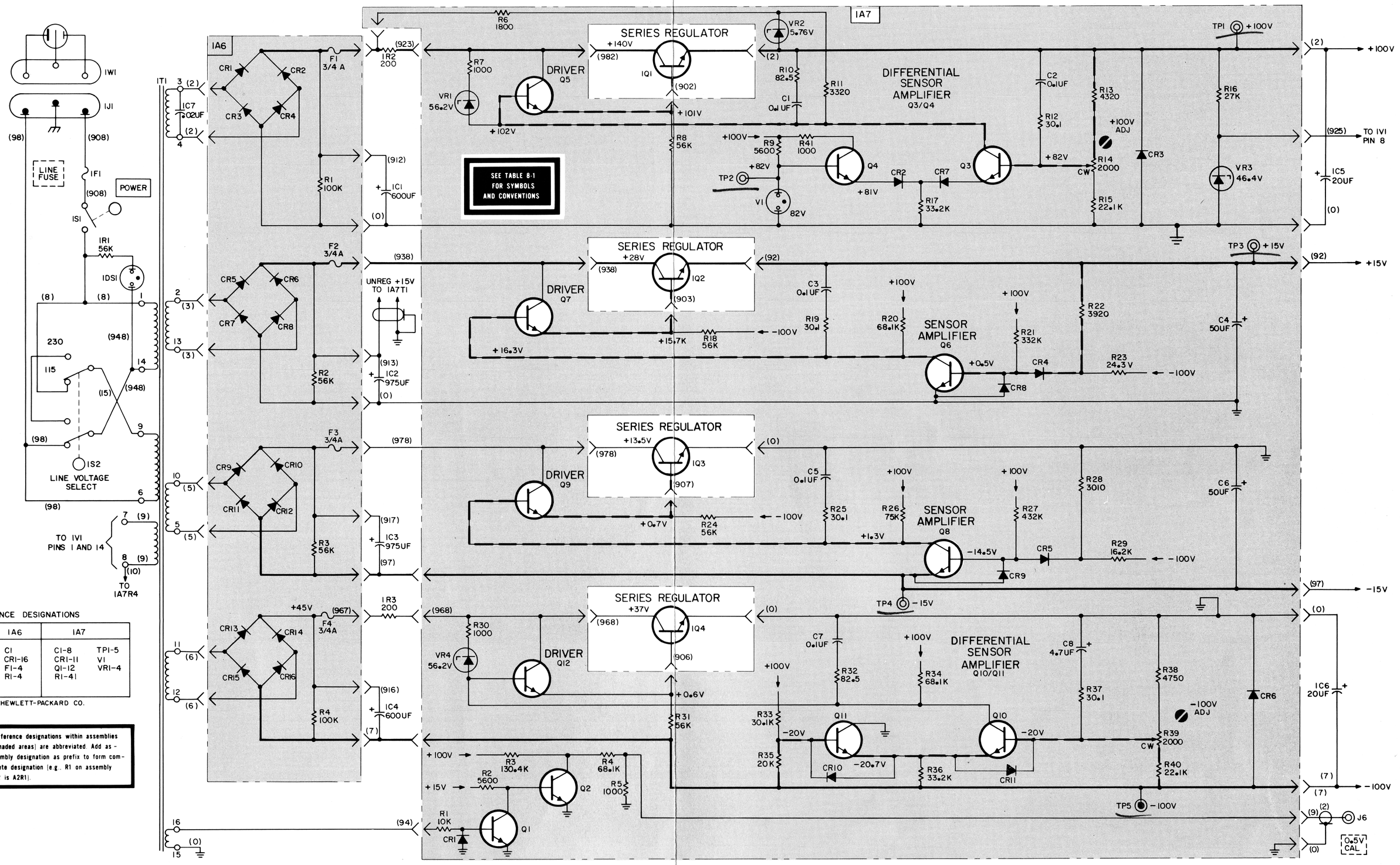
Figure 8-20. Low Voltage Regulator and Calibrator Component Identification, A7

DC VOLTAGE MEASUREMENT CONDITIONS

1. Model 1300A . . . . . set for normal viewing

NOTE

There is no way to conveniently measure dc in the calibrator. Use an Oscilloscope to determine if the Calibrator is operating properly.



REFERENCE DESIGNATIONS

1		1A6		1A7	
C1-7	R1-3	C1		C1-8	TP1-5
DS1	S1,2	CR1-16		CR1-11	V1
F1	T1	F1-4		Q1-12	VR1-4
J1,6	W1	R1-4		R1-41	
Q1-4					

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1300A-LVPS-818

Reference designations within assemblies (shaded areas) are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

Figure 8-21. Low Voltage Power Supply Schematic

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CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

ADDRESS _____

1. HP instrument MODEL NO. _____

2. HP instrument SERIAL NO. _____

3. CRT SERIAL NO. _____

4. Please describe the failure and, if possible, show the trouble on the appropriate CRT face below.

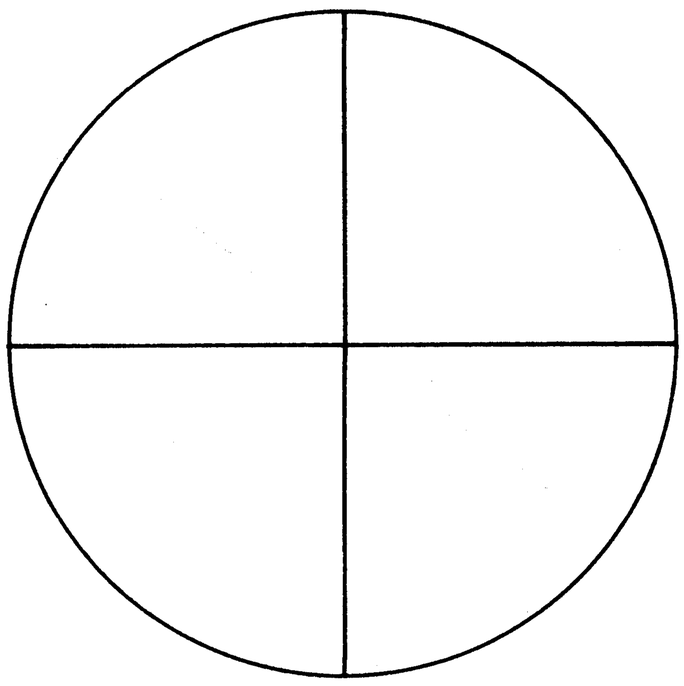
_____

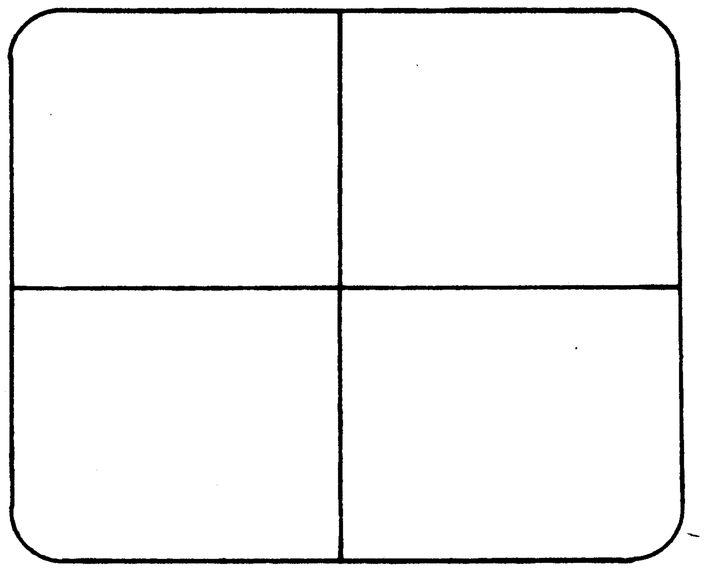
_____

_____

_____

_____





5. Warranty claimed ? Yes _____ No _____

6. HP Sales/Service Office _____ Repair Order No. _____

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The cathode-ray tube (CRT) supplied in your Hewlett-Packard Oscilloscope and replacement CRT's purchased from hp are warranted by the Hewlett-Packard Company against electrical failure for a period of one year from the date of sale. Broken tubes and tubes with phosphor or mesh burns are not included under this warranty. If the CRT is broken when received, a claim should be made with the responsible carrier.

Your nearest Hewlett-Packard Sales/Service Office (listed at rear of instrument manual) maintains a stock of replacement tubes and will assist in processing the warranty claim.

We would like to evaluate every defective CRT. This engineering evaluation helps us to provide a better product for you. Please fill out the CRT Failure Report on the reverse side of this sheet and return it with the defective CRT to:

Hewlett-Packard Company
1900 Garden of the Gods Road
Colorado Springs, Colorado 80907

Attention: CRT QA

To avoid damage to the tube while in shipment, please follow the shipping instructions below; warranty credit is not allowed on broken tubes.

SHIPPING INSTRUCTIONS

It is preferable that the defective CRT be returned in the replacement CRT carton. If the carton or packaging material is not available, pack the CRT according to the instructions below:

1. Carefully wrap the tube in 1/4 inch thick cotton batting or other soft padding material.

2. Wrap the above in heavy kraft paper.

3. Pack wrapped tube in a rigid container which is at least 4 inches larger than the tube in each dimension.

4. Surround the tube with at least 4 inches of packed excelsior or similar shock absorbing material; be sure the packing is tight all around the tube.

Thank you,

CRT Department

02537-4

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