

Errata

Title & Document Type: 1222A Oscilloscope Operating and Service Manual

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About this Manual

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

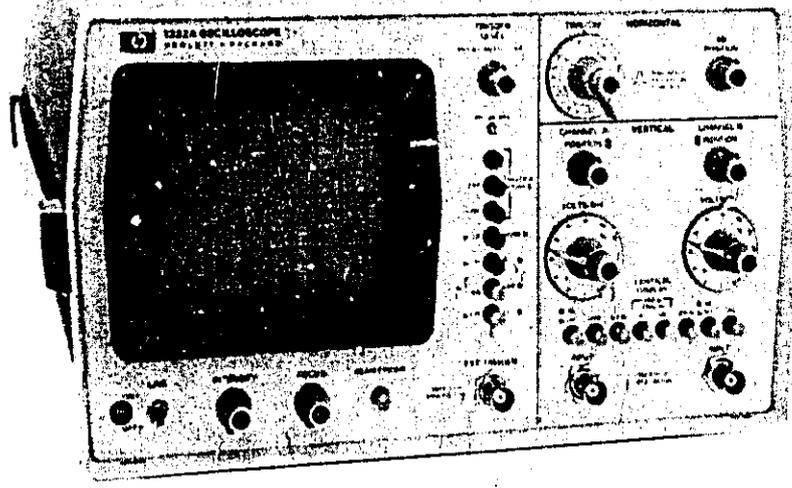


Agilent Technologies

HP 1222A

OPERATING AND SERVICE MANUAL

1222A OSCILLOSCOPE



 **HEWLETT
PACKARD**

HP 1222A

SAFETY

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section 1 and the Safety Summary for general safety considerations applicable to this product.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

The cathode-ray tube (CRT) in the instrument and any replacement CRT purchased from HP are also warranted against electrical failure for a period of one year from the date of shipment from Colorado Springs. **BROKEN TUBES AND TUBES WITH PHOSPHOR OR MESH BURNS, HOWEVER, ARE NOT INCLUDED UNDER THIS WARRANTY.**

For warranty service or repair, this product must be returned to a service facility designated by HP. However, warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within the HP service travel area. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

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 1222A OSCILLOSCOPE

(Including Options: 007, S01, 010, and 117)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2217S.

With changes described in Section VII, this manual also applies to instruments with serial numbers prefixed 1843S through 1845S.

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Manual Part Number 01222-90908
Microfiche Part Number 01222-90808

PRINTED: MAY 1982

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT.

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

Breakage of the Cathode-ray Tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the instrument. Handling of the CRT shall be done only by qualified maintenance personnel using approved safety mask and gloves.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS.

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

**Dangerous voltages, capable of causing death, are present in this instrument.
Use extreme caution when handling, testing, and adjusting.**

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Hewlett-Packard Model 1222A is a general-purpose oscilloscope designed for bench or field service. The 1222A has a bandwidth of 15MHz and a vertical deflection capability of 2mv/div. The 1222A contains a delay line which permits viewing of the entire leading edge of the input signal. In addition, the automatic baseline feature can be inhibited. Also, the signal applied to channel B on the 1222A can be inverted for A-B operation.

1-3. This manual contains installation and operating instructions, as well as maintenance information for the Model 1222A. Instrument specifications and procedures for verifying proper operation are included. Procedures are also included for adjusting the instrument to its performance specifications.

1-4. This section of the manual contains the performance specifications for the 1222A and a list of options available. It also lists the accessories supplied with the instruments. Instrument and manual identification are also included.

1-5. SPECIFICATIONS.

1-6. Table 1-1 is a complete list of 1222A critical specifications that are controlled by tolerances. Table 1-2 contains general information that describes the operating characteristics of the 1222A.

1-7. Any change in the specifications due to manufacturing design, or traceability to the U.S. National Bureau of Standards will be listed on a manual change sheet included with this manual. The manual and manual change sheet supercede all previous information concerning specifications of the Model 1222A.

1-8. ACCESSORIES SUPPLIED.

1-9. The following accessories are supplied with the Model 1222A:

- One ac power cord, HP Part No. 8120-0696.
- One blue light filter, HP Part No. 4114-0521.
- One fuse for 100/120-V operation, HP Part No. 2110-0016 (.6A) or
- One fuse for 220/240-V operation, HP Part No. 2110-0044 (.3A).

1-10. ACCESSORIES AVAILABLE.

1-11. The following accessories are available for the Model 1222A:

- HP Model 10119A - Rack Mounting Kit
- HP Model 10013A - 10:1 Attenuator Probe
- HP Model 10110B - BNC/Banana Plug Adapter
- HP Model 10117A - Front-panel Cover with accessory storage compartment
- HP Model 10116A - Viewing Hood

1-12. OPTIONS.

1-13. The following factory installed options are available for the 1222A:

OPTION S01. Adds one 10:1 voltage divider probe (HP Part No. 10013A) for use with Model 1222A oscilloscope.

OPTION 007. Replaces standard P31 phosphor CRT (V1) with internal graticule P7 phosphor CRT.

OPTION 010. Adds two 10:1 voltage divider probes (HP Model No. 10013A) and one front panel cover (HP Model No. 10117A) to standard Model 1222A oscilloscope.

OPTION 117. Adds front panel cover (HP Model No. 10117A) to standard Model 1222A oscilloscope.

1-14. INSTRUMENT AND MANUAL IDENTIFICATION.

1-15. Instrument identification serial number tag is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and five-digit suffix, separated by a letter designating the country in which the instrument was manufactured. (A = U.S.A.; G = West Germany; J = Japan; S = Singapore; U = United Kingdom.)

1-16. This manual applies to instruments with serial prefix numbers as shown on the title page. If changes have been made in the instrument since this manual was printed, a "Manual Changes" supplement supplied with the manual will define these changes. Be sure to record these changes in your manual. Back-dating information in Section VII adapts this manual

to instruments with serial numbers lower than that shown on the title page. Part numbers for the manual

and the microfiche copy of the manual are also shown on the title page.

Table 1-1. Specifications

<p>VERTICAL AMPLIFIERS</p> <p>BANDWIDTH: ≤ 3 dB down from 50 kHz, 6-division reference signal (from terminated 50-ohm source).</p> <p>DC Coupled: dc to 15 MHz.</p> <p>AC Coupled: ± 2 Hz to 15 MHz.</p> <p>DEFLECTION FACTOR</p> <p>Ranges: 2 mV/div to 10 V/div (12 calibrated positions) in 1, 2, 5 sequence. $\pm 3\%$ attenuator accuracy in calibrated position on 20 mV/div to 10 V/div ranges. $\pm 5\%$ attenuator accuracy in calibrated position on 2 mV/div, 5 mV/div, and 10 mV/div ranges.</p> <p>Vernier: continuously variable between all ranges; extends maximum deflection factor to at least 25 V/div.</p> <p>Maximum Input: ± 350 V (dc + pk ac).</p> <p>Differential (A-B) Common Mode: CMRR at least 30 dB from dc to 1 MHz.</p>	<p>TRIGGERING</p> <p>Internal: approx 10 Hz to 15 MHz on signals causing 1 div or more vertical deflection.</p> <p>External: approx 10 Hz to 15 MHz on signals 0.1 V p-p or more.</p> <p>TV Sync: separator for + or - video; requires 1 div of video signal to trigger; automatic frame (0.5 s/div to 100 μs/div) and line select (50 μs/div to 0.1 μs/div).</p> <p>Level and Slope</p> <p>INTERNAL: at any point on waveform displayed.</p> <p>EXTERNAL: continuously variable for +0.5 V to -0.5 V on either slope of trigger waveform; +5 V to -5 V in +10 position.</p> <p>X-Y OPERATION</p> <p>Bandwidth (X-axis): dc to 1 MHz.</p> <p>Deflection Factor: See Vertical Amplifier - Deflection Factor.</p> <p>X-Y Phase Shift: $\leq 3^\circ$ at 100 kHz.</p>
<p>TIME BASE</p> <p>SWEEP</p> <p>Ranges: 0.1 μs/div to 0.5 s/div (21 ranges) in 1, 2, 5 sequence. $\pm 4\%$ with expander in calibrated position.</p> <p>Expander: expands (continuously) sweeps approximately 10 times. Maximum usable sweep speed with expander is approximately 20 ns/div (0.2 μs/div range).</p>	<p>CATHODE-RAY TUBE AND CONTROLS</p> <p>BEAM FINDER: returns trace to CRT screen regardless of setting of horizontal or vertical controls.</p> <p>INTENSITY MODULATION (Z-AXIS INPUT): +5 V (TTL compatible), 2 Hz to 1 MHz blanks trace of any intensity. Maximum input 7 V rms.</p>

Table 1-2. General Information

<p>VERTICAL AMPLIFIERS</p> <p>MODES OF OPERATION: channel A; channel B; channel B inverted; channels A and B displayed alternately on successive sweeps (0.1 μs/div to 0.5 ms/div); triggering by channel A or external; channel A and B displayed by switching between channels at approx 200 kHz rate with blanking during switching (1 ms/div to 0.5 s/div); alternate and chopped mode of display automatically selected by setting of TIME/DIV control. In addition channel A \pm B.</p>	<p>RISE TIME: approx 23 ns.</p> <p>INPUT RC: approx 1 megohm shunted by approx 30 pF.</p> <p>INPUT COUPLING: selectable; AC, DC, or GND. GND position disconnects signal input and grounds amplifier input.</p> <p>DELAY LINE: allows entire leading edge of pulse to be seen (depending on input signal repetition rate).</p>
	<p>TIME BASE</p> <p>SWP MODE: sweep triggered by internal, external, or line frequency signal. Bright base-</p>

Table 1-2. General Information (Cont'd)

line displayed in absence of input trigger signal with PULL AUTO OFF control not engaged.

X-Y MODE: sweep supplied by external signal.

CATHODE-RAY TUBE AND CONTROLS

TYPE: mono-accelerator, approx 2 kV accelerating potential, P31 phosphor.

GRATICULE: 8- by 10-div internal graticule: 0.2 div subdivisions on major horizontal and vertical axes. 1 div = 1 cm.

INTENSITY MODULATION (Z-AXIS): Input R approx 1000 ohms.

GENERAL

PROBE ADJUST: approx ± 0.5 V, 2 kHz square wave for probe compensation.

POWER: 100, 120, 220, and 240 Vac, $- 10\%$ $+ 10\%$, 48 to 66 Hz, approx 40 VA.

WEIGHT: net, 7.3 kg (16 lb); shipping, 9.5 kg (21 lb).

DIMENSIONS: see outline drawing.

ENVIRONMENT: (oscilloscope operates within specifications over the following ranges.)

Temperature: 0°C to +45°C (operating); -40°C to +75°C (non-operating).

Humidity: at 95% relative humidity to +40°C.

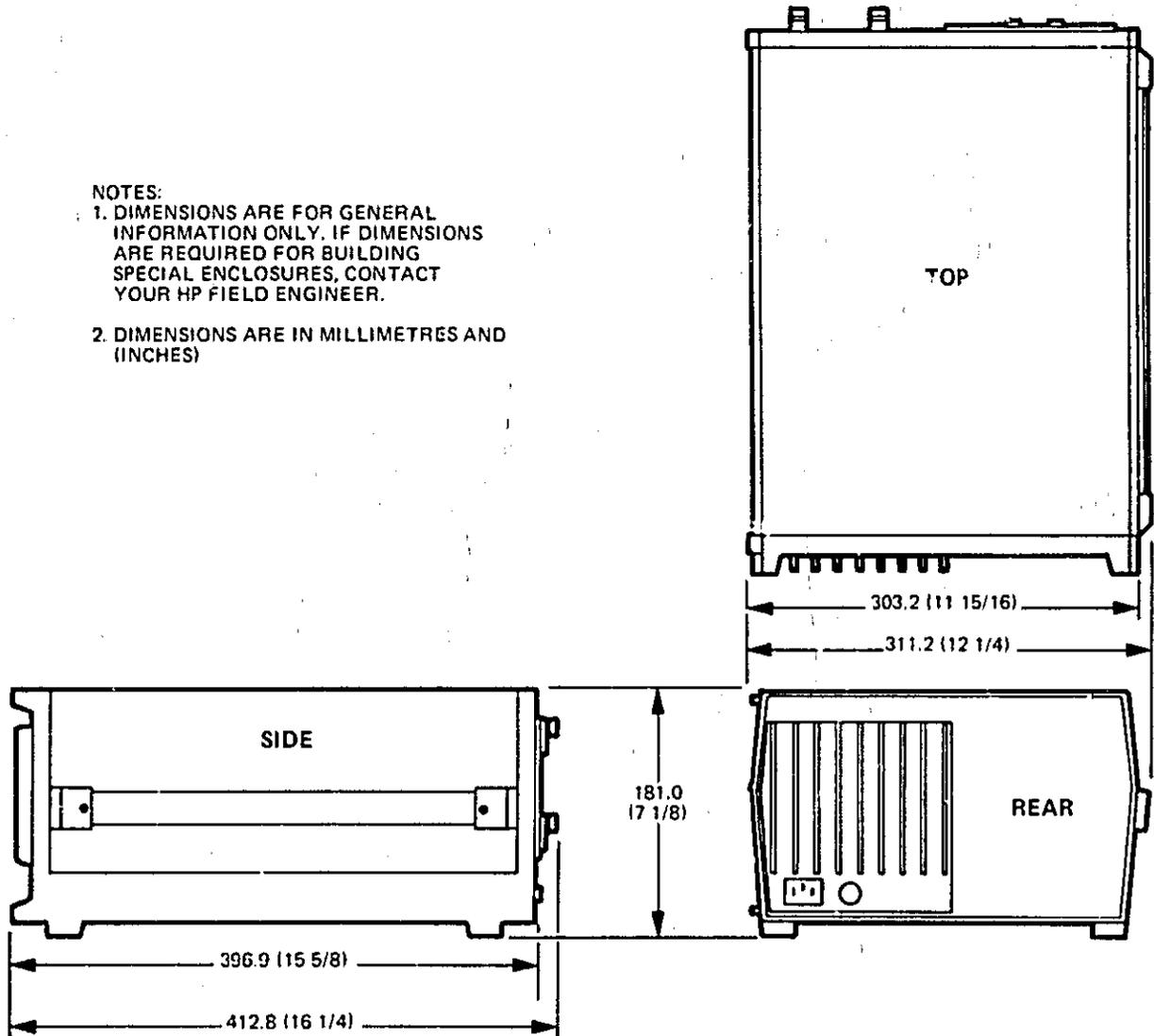
Altitude: to 4600 m (15 000 ft).

Vibration: vibrated in three planes for 15 minutes each with 0.25 mm (0.010 in.) excursion, 10 to 55 Hz.

NOTES:

1. DIMENSIONS ARE FOR GENERAL INFORMATION ONLY. IF DIMENSIONS ARE REQUIRED FOR BUILDING SPECIAL ENCLOSURES, CONTACT YOUR HP FIELD ENGINEER.

2. DIMENSIONS ARE IN MILLIMETRES AND (INCHES)



SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions necessary for installing and interfacing the Model 1222A Oscilloscope. Included are initial inspection procedures, power and grounding requirements, installation instructions, and procedures for repacking the instrument for shipment.

2-3. INITIAL INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of marks or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage incurred in transit. If the instrument was damaged in transit, file a claim with the carrier. Check for supplied accessories (listed in Section I) and test the electrical performance of the instrument using the performance test procedures outlined in Section V. If there is damage or deficiency, see the warranty in the front of this manual.

WARNING

Read the Safety Summary at the front of this manual before installing or operating the instrument.

2-5. POWER CORDS AND RECEPTACLES.

2-6. Figure 2-1 illustrates the standard configuration used for HP power cords. The HP part number directly

HP POWER CABLE PART NUMBERS		
8120 - 1692	8120 - 0696	
 Option 902	 Option 901	
8120 - 1703	8120 - 2296	8120 - 1521
 Option 900	 Option 906	 STD
INPUT POWER RECEPTACLE TYPES		

Figure 2-1. Types of Power Source Receptacles and Applicable Input Power Cable Part Numbers

above each drawing is the part number for an instrument power cord equipped with a connector of that configuration. If the appropriate power cord is not included with the instrument, notify the nearest HP Sales and Service Office and a replacement cord will be provided.

2-7. POWER REQUIREMENTS.

2-8. The Model 1222A can be operated from any ac power source supplying 100 V, 120 V, 220 V, or 240 V (−10% +10%), 48 to 66 Hz (see figure 2-2 for proper switch positions). Power dissipation is approximately 40 watts. Refer to Section III for instrument turn-on procedure.

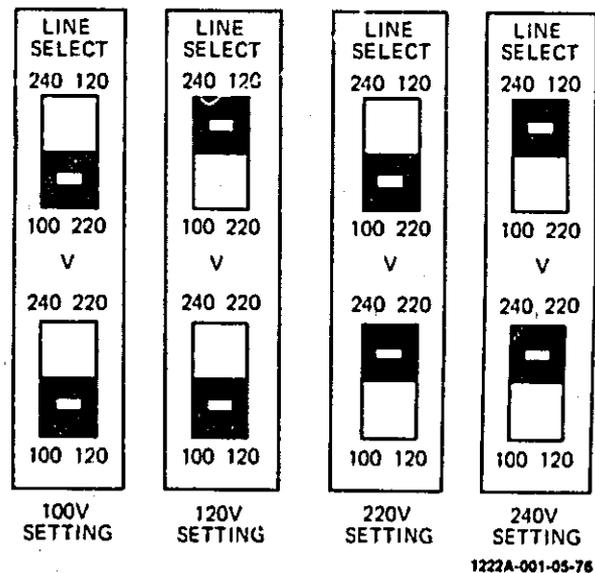


Figure 2-2. AC Input Switch Settings

2-9. REPACKING FOR SHIPMENT.

2-10. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office for service or repair, attach a tag showing owner (with address), complete instrument serial number, and a description of the service required.

2-11. Use the original shipping carton and packing material. If the original packing material is not available, the Hewlett-Packard Sales/Service Office will provide information and recommendations on materials to be used.

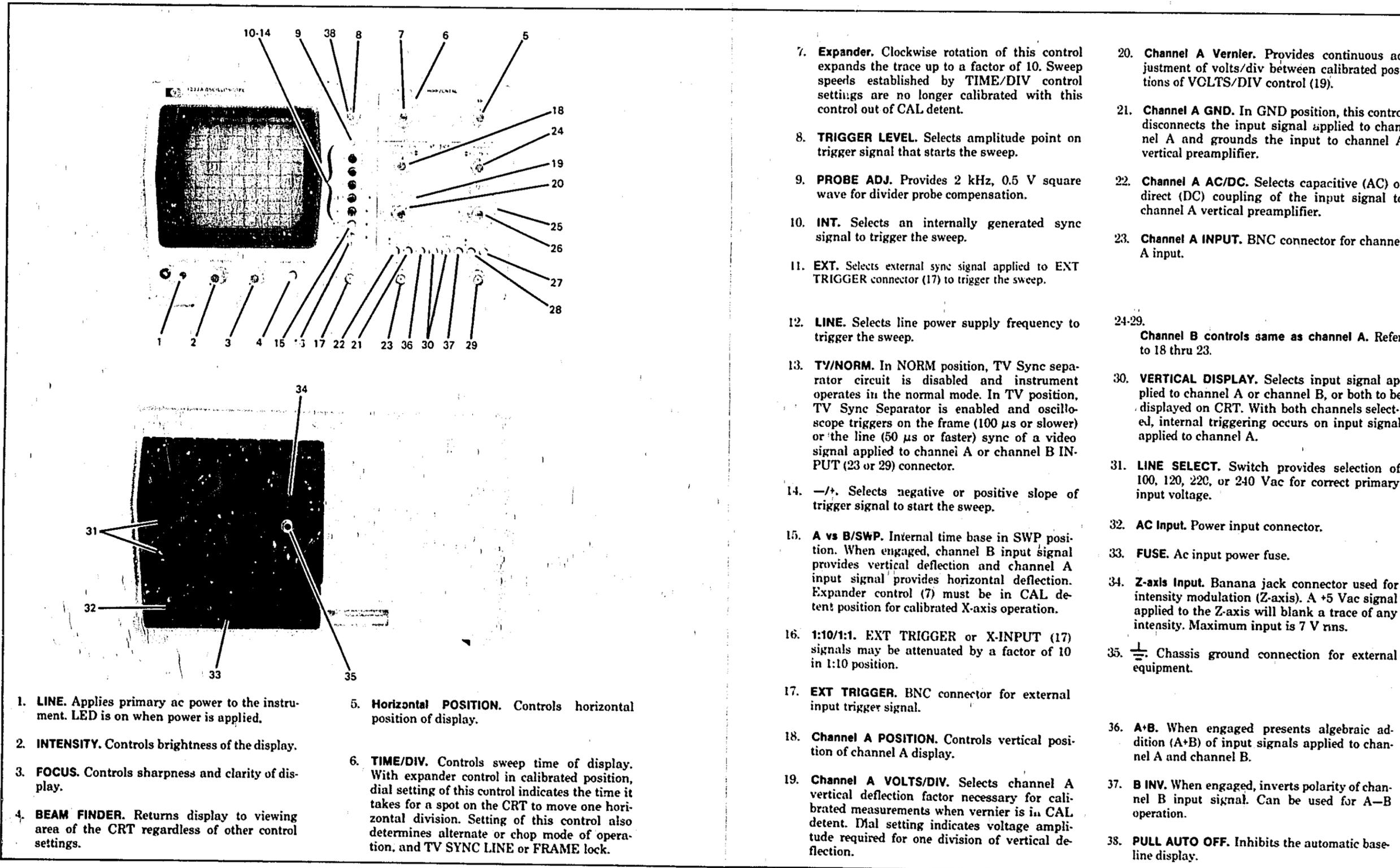


Figure 3-1.
Front- and Rear-panel Features
3-0

7. **Expander.** Clockwise rotation of this control expands the trace up to a factor of 10. Sweep speeds established by TIME/DIV control settings are no longer calibrated with this control out of CAL detent.
8. **TRIGGER LEVEL.** Selects amplitude point on trigger signal that starts the sweep.
9. **PROBE ADJ.** Provides 2 kHz, 0.5 V square wave for divider probe compensation.
10. **INT.** Selects an internally generated sync signal to trigger the sweep.
11. **EXT.** Selects external sync signal applied to EXT TRIGGER connector (17) to trigger the sweep.
12. **LINE.** Selects line power supply frequency to trigger the sweep.
13. **TV/NORM.** In NORM position, TV Sync separator circuit is disabled and instrument operates in the normal mode. In TV position, TV Sync Separator is enabled and oscilloscope triggers on the frame (100 μ s or slower) or the line (50 μ s or faster) sync of a video signal applied to channel A or channel B INPUT (23 or 29) connector.
14. **-/+.** Selects negative or positive slope of trigger signal to start the sweep.
15. **A vs B/SWP.** Internal time base in SWP position. When engaged, channel B input signal provides vertical deflection and channel A input signal provides horizontal deflection. Expander control (7) must be in CAL detent position for calibrated X-axis operation.
16. **1:10/1:1.** EXT TRIGGER or X-INPUT (17) signals may be attenuated by a factor of 10 in 1:10 position.
17. **EXT TRIGGER.** BNC connector for external input trigger signal.
18. **Channel A POSITION.** Controls vertical position of channel A display.
19. **Channel A VOLTS/DIV.** Selects channel A vertical deflection factor necessary for calibrated measurements when vernier is in CAL detent. Dial setting indicates voltage amplitude required for one division of vertical deflection.
20. **Channel A Vernier.** Provides continuous adjustment of volts/div between calibrated positions of VOLTS/DIV control (19).
21. **Channel A GND.** In GND position, this control disconnects the input signal applied to channel A and grounds the input to channel A vertical preamplifier.
22. **Channel A AC/DC.** Selects capacitive (AC) or direct (DC) coupling of the input signal to channel A vertical preamplifier.
23. **Channel A INPUT.** BNC connector for channel A input.
- 24-29. **Channel B controls same as channel A.** Refer to 18 thru 23.
30. **VERTICAL DISPLAY.** Selects input signal applied to channel A or channel B, or both to be displayed on CRT. With both channels selected, internal triggering occurs on input signal applied to channel A.
31. **LINE SELECT.** Switch provides selection of 100, 120, 220, or 240 Vac for correct primary input voltage.
32. **AC Input.** Power input connector.
33. **FUSE.** Ac input power fuse.
34. **Z-axis Input.** Banana jack connector used for intensity modulation (Z-axis). A +5 Vac signal applied to the Z-axis will blank a trace of any intensity. Maximum input is 7 V rms.
35. **Chassis ground connection for external equipment.**

SECTION III OPERATION

3-1. INTRODUCTION.

3-2. This section contains information and instructions necessary for operation of the 1222A Oscilloscope. Included are power and warmup information, functional identification of all controls and connectors, and special applications information.

3-3. INSTRUMENT CAPABILITIES.

3-4. The 1222A Oscilloscope contains dual vertical preamplifiers for dual-channel operation. Each channel offers a choice of ac or dc input coupling. With the dual trace feature, displays can be obtained on either channel A or channel B or on both channels. Simultaneous display of two signals is possible in either chop or alternate mode of display, depending on the TIME/DIV control setting. Slower sweep-speed settings on the TIME/DIV control automatically select the chop mode of display while faster sweep-speed settings automatically select the alternate mode of display. In addition, the 1222A can be operated in an A+B (algebraic addition) mode of display. Signals applied to channel B on the 1222A can be inverted to provide A-B mode of display.

3-5. Twelve calibrated switch settings on each vertical amplifier provide a deflection factor range from 2 mV/div to 10 V/div in 1, 2, 5 sequence. The vertical vernier permit continuous adjustment between calibrated steps and extend the least sensitive deflection factor (10 V/div) to at least 25 V/div.

3-6. Vertical input signals can be displayed by either an internally generated trigger or an external trigger signal. Trigger level and slope are also selectable.

3-7. Horizontal amplifier sweep-speed settings from 0.1 us/div to 0.5 s/div are available in 1,2,5 sequence. Expander control allows continuous adjustment between steps and expands the sweep up to 10 times. Usable maximum sweep speed with the expander is approximately 20 ns/div.

3-8. A bright baseline is always present in the absence of a trigger input signal. A control on the 1222A permits the operator to inhibit the bright baseline if desired (PULL AUTO OFF). A trigger signal of 10 Hz or greater will override the auto function.

3-9. FRONT- AND REAR-PANEL DESCRIPTIONS.

3-10. Front- and rear-panel features are described in figure 3-1. Description numbers match the numbers on the illustration.

3-11. GENERAL OPERATING INSTRUCTIONS.

3-12. Before connecting ac power to the 1220A, make sure the rear-panel line selector switches are set to correspond to the voltage of the available power line, as shown in figure 2-2. If the instrument is to be operated from a 220- or 240-volt ac power source, a 0.3-ampere slow-blow fuse (HP Part No. 2100-0044) is used at the rear panel. A 0.6 ampere slow-blow fuse (HP Part No. 2100-0016) is to be used for a 100- or 120-volt ac power source.

NOTE

In the following paragraphs all control numbers (in parentheses) refer to the numerical assignment in figure 3-1.

3-13. INITIAL TURN-ON PROCEDURES. To prepare the 1222A for operation, perform the following steps:

- a. Set INTENSITY control (2) fully counterclockwise.
- b. Set VERTICAL DISPLAY to channel A (30).
- c. Set vertical vernier (20) for channel A fully clockwise to CAL detent position.
- d. Set channel A input coupling to GND (21).
- e. Set channel A POSITION control (18) to mid-range.
- f. Set horizontal POSITION control (5) to mid-range.
- g. Set TIME/DIV control (6) to 1 mSEC position.
- h. Set sweep expander control (7) fully counterclockwise to CAL detent position.
- i. Set TRIGGER SOURCE to INT (10).
- j. Except for controls indicated in steps a thru i, make sure that all other pushbutton switches are disengaged. (PULL AUTO OFF switch should be pushed in.)

CAUTION

Make sure ac power switches on rear panel of instrument are set for proper ac power input (refer to paragraph 3-12).

k. Set LINE switch (1) to ON and allow 30 minute warm-up period.

CAUTION

A trace or spot of very high intensity (brightness) may burn the phosphor inside the CRT face. To prevent such damage always adjust INTENSITY as low as possible for comfortable viewing.

l. Slowly turn INTENSITY control (2) clockwise until trace is just visible.

m. Set channel A AC/DC input coupling switch (22) to AC position.

n. Release channel A input coupling GND switch (21).

3-14. TRACE ALIGN ADJUSTMENT. The trace align adjustment compensates for external magnetic fields that may affect the alignment of the horizontal trace with respect to the graticule. When the instrument is moved to a new location, trace alignment should be checked and adjusted if necessary. To align the trace, proceed as follows:

a. Accomplish paragraph 3-13.

b. Using channel A vertical POSITION control (18), position trace on center horizontal graticule line.

c. Using non-metallic alignment tool, adjust A3R25 (accessible through hole in side of case) until trace aligns with horizontal graticule.

NOTE

If intensity modulation of trace is apparent, refer to high-voltage power supply adjustment in Section V.

3-15. FOCUS ADJUSTMENT. To adjust the front-panel FOCUS control (3) for the best display, proceed as follows:

a. Accomplish paragraph 3-13.

b. Set INTENSITY control (2) fully counterclockwise.

c. Set A vs B/SWP switch (15) to X-Y position.

d. Slowly turn INTENSITY control (2) clockwise until spot becomes visible on CRT.

e. Using INTENSITY (2) and FOCUS (3) controls, adjust display for smallest, sharpest, spot possible.

f. Set INTENSITY control (2) fully counterclockwise.

g. Set A vs B/SWP switch (15) to SWP position.

3-16. SIGNAL APPLICATION. To apply an external signal, proceed as follows:

a. Accomplish paragraph 3-13.

b. Set channel A VOLTS/DIV control (19) to 10 V/div.

c. Connect sine-wave signal of 10 V amplitude, 1 kHz frequency to channel A INPUT connector (23).

d. Position display on CRT, using horizontal POSITION (5) and channel A POSITION (18) controls.

e. Adjust TRIGGER LEVEL control (8), if necessary, for stable display.

3-17. APPLICATION PROCEDURES.

3-18. PEAK-TO-PEAK VOLTAGE MEASUREMENTS. To measure the peak-to-peak voltage of an input signal, proceed as follows:

a. Accomplish paragraph 3-13.

b. Connect input signal to be measured to channel A INPUT connector (23).

c. Set channel A VOLTS/DIV control (19) for signal display of at least three divisions in amplitude.

d. Set TIME/DIV control (6) so that display contains two or three cycles of input signal.

e. Adjust TRIGGER LEVEL control (8) for stable display.

f. Using channel A POSITION control (18), position negative peaks of input signal on horizontal graticule line near bottom of graticule.

g. Using horizontal POSITION control (5), position one positive peak of input signal on center vertical graticule line.

h. Count number of vertical divisions from most negative to most positive portions of waveform (estimate to nearest tenth of division).

i. Multiply number of divisions noted in step h by channel A VOLTS/DIV control (19) setting for peak-to-peak voltage of input signal.

NOTE

If the input signal is applied through a divider probe, multiply the results obtained in step i by the attenuation factor of the probe.

3-19. DC VOLTAGE MEASUREMENTS. To determine the dc component of an input signal or a dc level point on an input signal, proceed as follows:

- a. Accomplish paragraph 3-13.
- b. Connect input signal to be measured to channel A INPUT connector (23).
- c. With channel A input coupling GND switch (21) engaged, position baseline on convenient horizontal graticule line using channel A POSITION control (18).

NOTE

Reference for positive dc voltages should be below the center horizontal graticule line; reference for negative dc voltages should be above the center horizontal graticule line. Once a particular horizontal graticule line is selected as reference, do not change channel A POSITION control (18).

- d. Set channel A AC/DC input coupling switch (22) to DC position.
- e. Release channel A input coupling GND switch (21).
- f. Set channel A VOLTS/DIV control (19) so that point of input signal to be measured is as far as possible from zero-volt reference line selected in step c.
- g. Using horizontal POSITION control (5), move point on signal to be measured until it rests on center vertical graticule line.
- h. Count number of vertical divisions between zero-volt reference graticule line and point on signal to be measured (estimate to nearest tenth of division).
- i. Multiply number of divisions noted in step h by channel A VOLTS/DIV control (19) setting for dc voltage measurement.

NOTE

If the input signal is applied through a divider probe, multiply the results obtained in step i by the attenuation factor of the probe.

3-20. TIME-INTERVAL MEASUREMENTS. To measure the time interval between two events of interest, proceed as follows:

- a. Accomplish paragraph 3-13.
- b. Connect signal to be measured to channel A INPUT connector (23).
- c. Set TIME/DIV control (6) so that both events of interest are displayed on CRT.
- d. Adjust TRIGGER LEVEL control (8) for stable display.
- e. Using horizontal POSITION control (5), position one measurement point on signal to convenient vertical graticule line.
- f. Using channel A POSITION control (18) position other measurement point on center horizontal graticule line.
- g. Count horizontal divisions between two measurement points (estimate to nearest tenth of division).
- h. Multiply number of divisions noted in step g by TIME/DIV control setting for time interval between two events of interest.

3-21. FREQUENCY CALCULATION. To determine the approximate frequency of an input signal, proceed as follows:

- a. Accomplish paragraph 3-20 using start and ending points of one cycle of input signal as events of interest.
- b. Calculate input signal frequency using the following formula:

$$\frac{1}{\text{time in seconds noted in step a}}$$

3-22. PROBE COMPENSATION. To adjust divider probes having a compensation adjustment, proceed as follows:

- a. Accomplish paragraph 3-13.
- b. Connect divider probe cable to channel A INPUT connector (23).
- c. Connect probe tip to PROBE ADJ terminal (9).

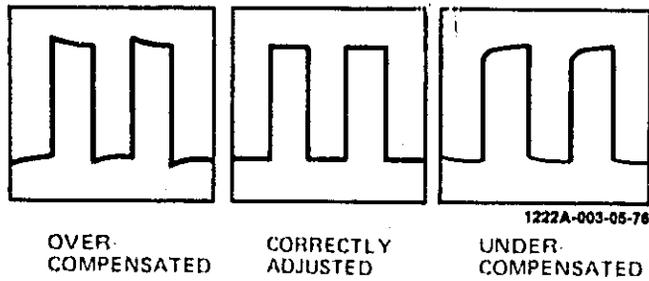


Figure 3-2. Divider Probe Adjustment Display

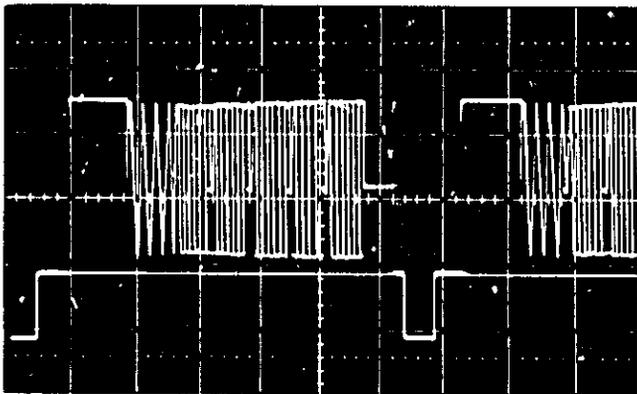
d. Set channel A VOLTS/DIV control (19) for square-wave display having two or three divisions of vertical deflection.

e. Set TIME/DIV control (6) for horizontal display of at least two full square waves.

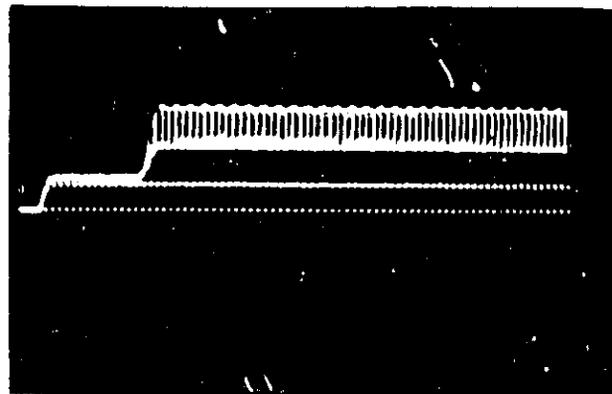
f. Adjust divider probe compensation adjustment for correct display (see figure 3-2).

3-23. TV SIGNALS. To observe a television composite or sync-only signal, proceed as follows:

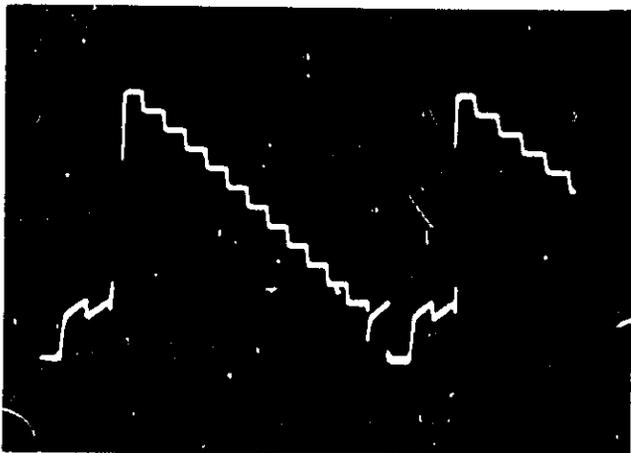
- a. Accomplish paragraph 3-13.
- b. Connect input signal to be measured to channel A INPUT connector (23).
- c. Set TV/NORM control (13) to TV position.
- d. Set channel A VOLTS/DIV control (19) for desired vertical amplitude display.
- e. Set TIME/DIV control (6) for desired horizontal display (typically in range area of TIME/DIV control dial marked FRAME).
- f. If individual lines of picture signal are to be observed, set TIME/DIV control dial to area marked LINE (typically $2 \mu\text{s}/\text{div}$). Oscilloscope will trigger on each line sync pulse. (See figure 3-3 for typical TV waveforms.)



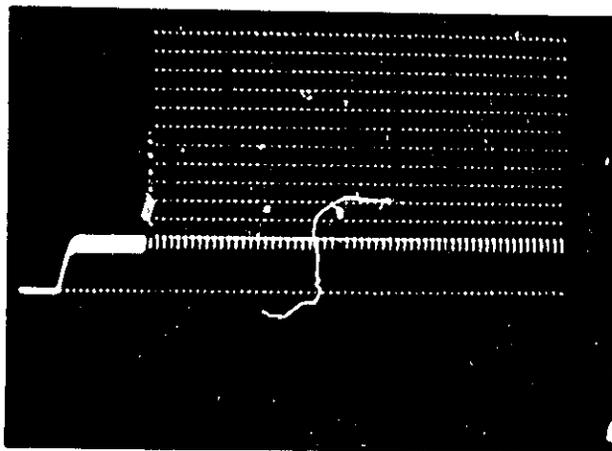
Pattern generator color TV signal, line trigger



Color bar, signal frame trigger 0.5 ms/div



Staircase Signal, line trigger $10 \mu\text{s}/\text{div}$



Color Staircase Signal, frame trigger 0.5 ms/div

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Figure 3-3. Typical TV Waveforms

3-24. TIME DIFFERENCE MEASUREMENTS. To measure the time difference between two events having a common source, for example, propagation delay, proceed as follows:

- a. Accomplish paragraph 3-13 for both channel A and channel B.
- b. Connect one signal of interest to channel A INPUT connector (23).
- c. Connect other signal of interest to channel B INPUT connector (29).

NOTE

Make sure reference signal is connected to channel A since the trigger signal for both channel A and channel B is obtained from channel A.

- d. Set channel A and channel B VOLTS/DIV controls (19/25) for desired vertical amplitude of display.
- e. Set TIME/DIV control so that two events of interest are at least four horizontal divisions apart.
- f. If necessary, adjust TRIGGER LEVEL control (8) for stable display.

NOTE

If stable display is not obtainable, externally trigger the oscilloscope with the common source signal.

- g. Using horizontal POSITION control (5), position first event of interest on convenient vertical graticule line.
- h. Using appropriate vertical POSITION control (18 or 24), position second event of interest on center horizontal graticule line.
- i. Count horizontal divisions between two measurement points (to nearest tenth of division).
- j. Multiply number of divisions noted in step i by TIME/DIV control (6) setting for time difference between events.

3-25. PHASE DIFFERENCE MEASUREMENTS. To measure the phase difference between two signals of the same frequency, proceed as follows:

- a. Accomplish paragraph 3-13 for both channel A and channel B.
- b. Set A vs B/SWP control (15) to AvsB position.
- c. Connect X-signal to channel A INPUT connector (23).

d. Using channel A VOLTS/DIV control (19), POSITION control (18), and vernier control (20), obtain trace of exactly eight horizontal divisions at center horizontal graticule line.

- e. Press channel A input coupling GND switch (21).
- f. Connect Y-signal to channel B INPUT connector (29).

g. Using channel B VOLTS/DIV control (25), POSITION control (24), and vernier control (26), obtain two spots separated vertically by exactly eight divisions on center vertical graticule line.

h. Release channel A input coupling GND switch (21).

i. Compare display to figure 3-4A for approximate phase difference of signals.

j. For actual phase difference, center ellipse at intersection of center vertical and horizontal graticule lines (see figure 3-4B).

k. Measure distances C and D.

l. Substitute measurements of C and D in formula given in figure 3-4B for sine of phase angle.

m. Refer to table of sines to determine phase angle.

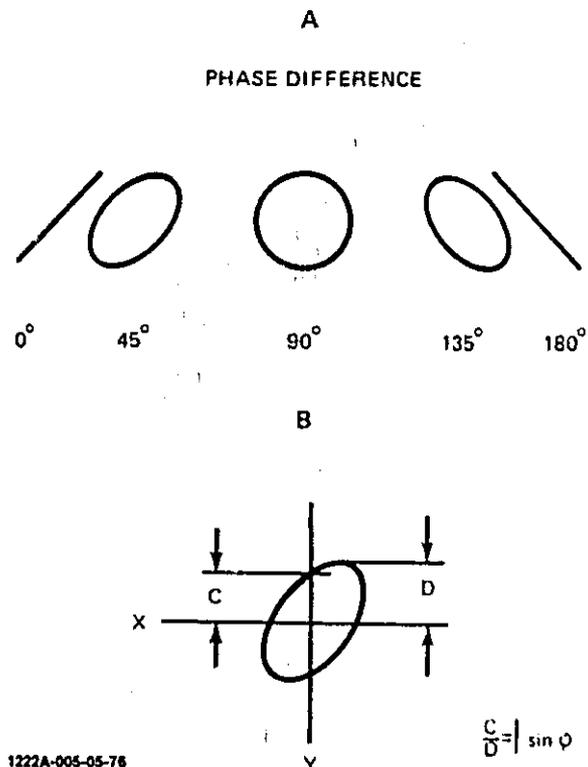


Figure 3-4. X-Y Phase Measurements

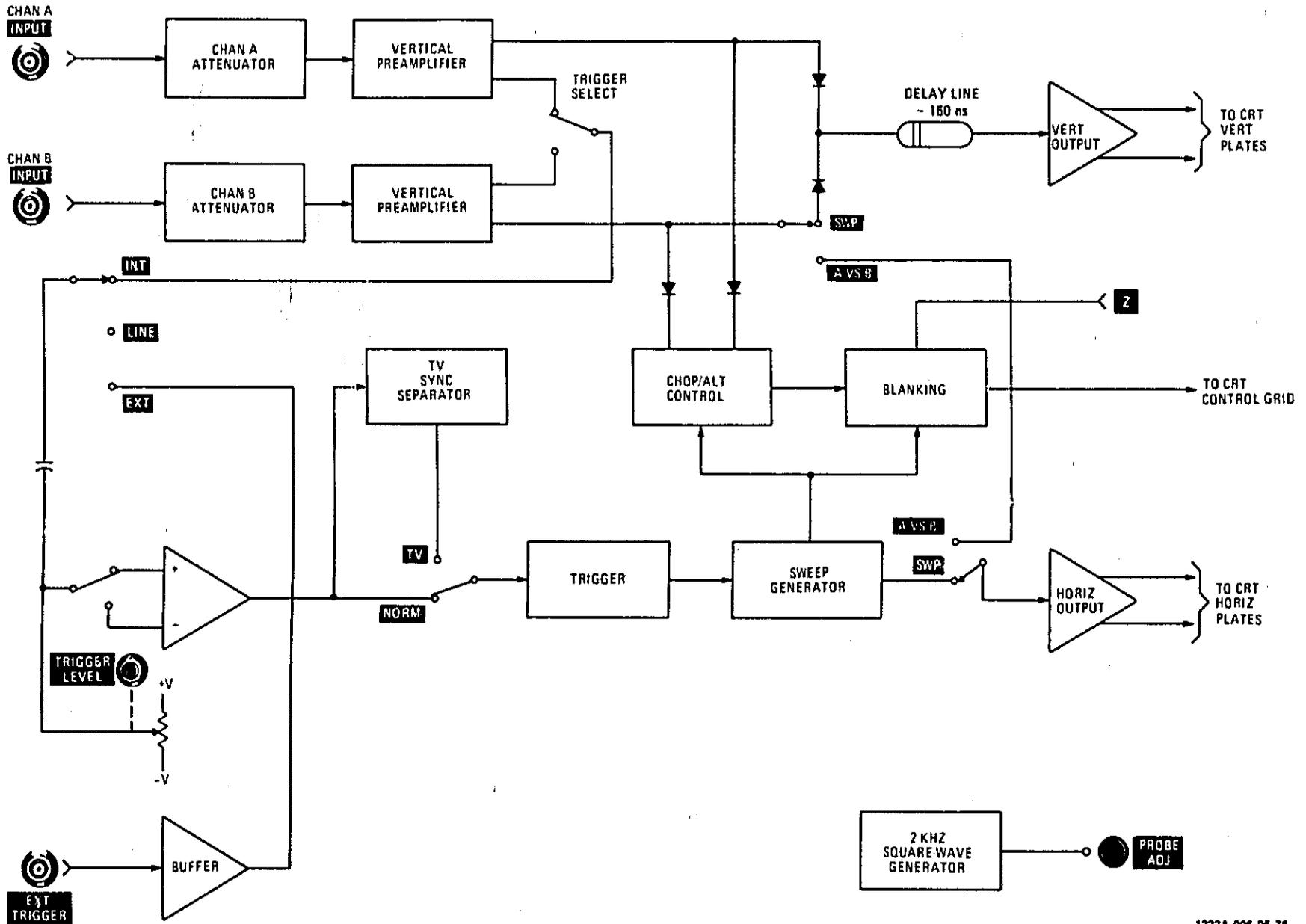


Figure 4-1. Simplified Block Diagram

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SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains descriptions of circuits keyed to a simplified block diagram (figure 4-1) and a detailed theory of operation keyed to a functional block diagram (figure 4-3). Schematics are located in Section VIII of this manual.

4-3. OVERALL DESCRIPTION.

4-4. **ATTENUATORS.** Channel A and channel B attenuators accept the input signals applied to the front-panel INPUT connectors. The input signal can be coupled to the attenuator directly (DC) or capacitively (AC). A GND position is also available for disconnecting the input signal and grounding the attenuator input. The GND feature permits the operator to establish a baseline reference level without disconnecting the input signal from the INPUT connector.

4-5. The input impedance on all ranges is one megohm in parallel with approximately 30 pF. The vertical deflection factor is selected by the VOLTS/DIV switch which divides the input signal by 1, 10, or 100. Division by 1, 2, and 5 is accomplished in the preamplifier.

4-6. **VERTICAL PREAMPLIFIER.** The vertical preamplifier accepts the single-ended signal from the attenuator and converts it to a differential signal. The signal is amplified and a portion of it is used for the sync amplifier while the main path is applied to the vertical output amplifier.

4-7. **DELAY LINE.** The delay line circuitry delays the input signal approximately 160 nanoseconds. This delay allows the sweep to trigger before the vertical signal is applied to the CRT deflection plates.

4-8. **VERTICAL OUTPUT.** The vertical output amplifier converts the single-ended signal from the vertical preamplifier stages to a differential signal. It also provides the drive required by the vertical CRT plates.

4-9. **TRIGGER CIRCUIT.** The trigger switches select the source of the sync signal (INT, LINE, or EXT). The sync signal is ac coupled to the trigger amplifier and offset by the TRIGGER LEVEL control. Selection of trigger slope is also accomplished at the input to the trigger amplifier.

4-10. The signal from the trigger amplifier is applied to the trigger circuit through the TV/NORM switch. When the TV/NORM switch is in the TV position, the sync signal is developed by the TV Sync Separator circuit.

4-11. The trigger circuit develops the trigger signal required to start the sweep generator. The output voltage from the sweep generator increases linearly at a rate proportional to time established by the setting of the TIME/DIV control. The output of the sweep generator is buffered to the horizontal output circuit.

4-12. The horizontal output circuit provides drive to the CRT horizontal deflection plates.

4-13. DETAILED THEORY.

4-14. The following paragraphs provide explanations of the individual circuits in the 1222A. When using this portion of the manual, see figure 4-3 (functional block diagram) and the schematics which are located in Section VIII.

4-15. **LOW-VOLTAGE POWER SUPPLIES.** The low-voltage power supply provides +5 V, +12 V, +95 V, +210 V, and -12 V for operation of the various circuits in the instrument. All supplies are regulated except the +210 V supply. The +210 V supply is an unregulated +115 V which is offset by +95 V at the junction of CR5 and CR6 of bridge rectifier CR5-CR8.

4-16. **+5 V Supply.** The output of the 12 Vac secondary of A4T1 is rectified by bridge rectifier CR1 - CR4 and regulated by U1.

4-17. **+95 V Supply.** The +95 V supply is a fully regulated, current-limiting supply. A sample of the output voltage is applied to pin 4 of U₂ where it is compared with a reference voltage applied to pin 5. The difference between these two voltages cause an error output from pin 9 which is applied to the base of series-regulator transistor Q1. When the output voltage decreases, the error voltage causes Q1 to conduct more and supply more current to the load. When the output voltage increases, the error signal tends to cut off Q1 to reduce the output current and effect a lowering of the output voltage.

4-18. Current limiting is accomplished by R9 and a cut-off transistor in U2. As the current output increases, the voltage drop across R9 increases. Pins 2 and 3 of U2 are the base and emitter connections of the cut-off transistor. When the voltage drop across

R9 is sufficient to cause the transistor to conduct, it removes the error signal from Q1 causing the output current to decrease, thereby reducing the output voltage.

4-19. +12 V Supply. The +12 V supply is also a series-regulated, current-limiting supply that operates in a similar manner to the +95 V supply. The reference voltage with which the output sample is compared is derived from the +95 V supply.

4-20. -12 V Supply. The -12 V supply is also a series-regulated, current-limiting supply. However, the sample of the output voltage is derived from both the +12 V and -12 V outputs, so that the difference between the +12 V and -12 V supplies is always constant. When the current through R23 is sufficient, it turns on Q4 and the transistor drains some of the current from U4 causing the output current to decrease.

4-21. HIGH-VOLTAGE POWER SUPPLY. The voltage from the 1600 V secondary of A1T1 is rectified by A3CR1-A3CR4, filtered by A3C1, regulated by A3Q1, and applied to the intensity network and CRT filament circuit.

4-22. Regulation is accomplished by comparing a portion of the HV output with the +95 V supply and applying the comparison to A3U1. The output of A3U1 controls the emitter-collector resistance of A3Q1 so that the voltage drop across the transistor compensates for high-voltage fluctuations. A zener diode chain (VR1 - VR3) prevents the breakdown potentials of A3Q1 and A3Q6 from being reached.

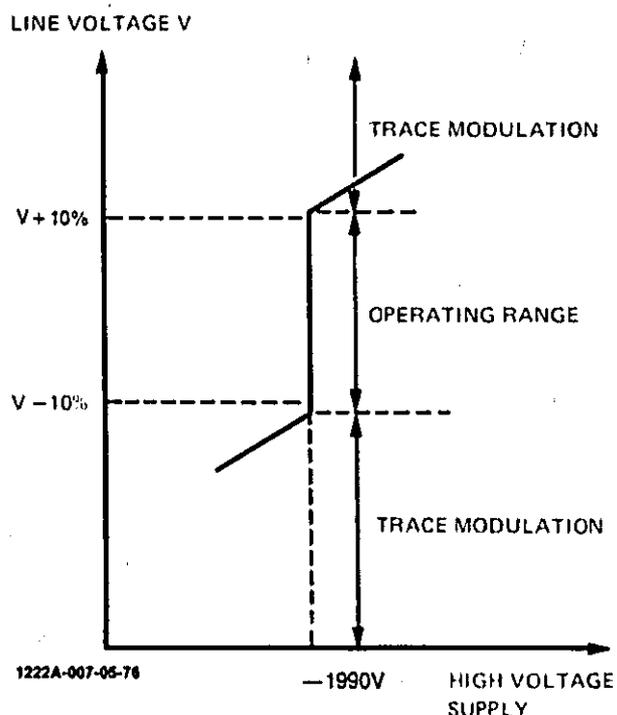


Figure 4-2. HVPS Operating Characteristic

4-23. The operating characteristic of the high-voltage supply is shown in figure 4-2. The horizontal position of the characteristic, and consequently the level of the high-voltage supply, is adjusted by A3R20. The vertical portion of the characteristic is set by A3R3 so that proper regulation occurs in the +10%, -10% range of the selected line voltage. If the line voltage goes outside this range, regulation will cease and ripple will cause visible trace modulation.

NOTE

In areas where the line voltage excursions lie outside one of the regulator limits, A3R3 should be adjusted so that the characteristic brackets these excursions rather than the nominal 100, 120, 220 or 240 volts, +10%—10%.

4-24. VERTICAL SECTION. In the following discussion, circuits which are identical for both channels A and B are discussed for channel A only.

4-25. Attenuators. The input impedance on all ranges of the VOLT/DIV switch is one megohm shunted by a capacitance of approximately 30 pF. The attenuator divides the input signal by 1, 10, or 100. The resistor-divider network for the +10 range consists of R27 and R28. The resistor-divider network for the +100 range consists of R29 and R30.

4-26. Vertical Preamplifier. The preamplifier is a three-stage differential amplifier with switched gain control and input protection. Diodes CR21 and CR22 limit excessive signal swings from the attenuator to approximately ± 4.1 V as established by zener diodes VR2 and VR3. The signal is applied to the first differential amplifier stage (pin 6 of U5) by way of source-follower Q5A and an emitter-follower section of U5 (pin 3).

4-27. In conjunction with the input attenuator, ranging is accomplished by selecting different emitter current paths in the first and third preamplifier stages. In the first stage, this is effected by differential switches Q6 and Q7 which are controlled by the position of the VOLTS/DIV switch. In the 2 mV, 5 mV, and 10 mV positions, the VOLTS/DIV switch connects the voltage from the junction of R24 and R25 to the base of Q7. Transistor Q6 cuts off and Q7 routes the emitter current through R54, R55, and CR23. In the other VOLTS/DIV switch positions, Q6 conducts (Q7 cuts off) and routes the emitter current through R52 and R53. In this instance, the amplification is one tenth of that selected in the three lower ranges of the VOLTS/DIV switch.

4-28. In the last preamplifier stage, gain is controlled in the same manner as the first preamplifier stage by U6. The voltage at the junction of R24 is applied to a particular transistor in U6, depending on the position of the VOLTS/DIV switch. The transistor

that is turned on enables a particular current path which establishes the gain of the output stage of U6.

4-29. Fine control is achieved with vernier A2A3R3 in the second preamplifier stage. Overall gain of the vertical channel is accomplished by R144 (with vernier A2A3R3 in CAL detent position). Balance potentiometers R49, R62, and R64 are adjusted so that the trace does not move when switching from one range to another.

4-30. The channel B signal can be inverted at the input to the second preamplifier stage. The signal is inverted by reversing the input to the differential stage. Balance between the two stages is maintained by balance potentiometer A2A2R17⁶.

4-31. For internal triggering, one output of the preamplifier is buffered to the trigger circuits by common base stage Q13. The other output is buffered to the CHOP/ALT control by common base stage Q15. In this stage the signal is offset by a current derived from vertical position potentiometer R1.

4-32. The CHOP/ALT control (CR35-CR38) is biased by CHOP/ALT flip-flop A1A1U3A. During channel A operation, CR37 conducts causing CR38 to cut-off and block the channel B signal. At the same time, reverse bias is applied to CR35 cutting it off. This enables CR36 to pass the channel A signal to the output amplifier. During channel B operation, the situation is reversed so that only the channel B signal is displayed.

4-33. When both channels are to be displayed in the chopped mode of operation (TIME/DIV switch in 1 ms to 0.5 s range), the CHOP/ALT control switches between channel A and channel B so that both channels are displayed during the same sweep. When both channels are to be displayed in the alternate mode of operation (TIME/DIV switch in 0.5 ms to 0.1 μ s range), the CHOP/ALT control alternately selects channel A on one sweep and channel B on the next.

4-34. Operation in the A+B display mode results in a composite signal, developed by A2A2Q13 and A2A2Q14 being applied to the trigger circuits. In addition, with the A+B switch engaged and the horizontal A vs B/SWP switch in SWP position, A2A2Q17 is enabled causing both CR36 and CR38 to be forward biased. With both diodes conducting, a composite signal (algebraic addition of both channel signals) is applied to the vertical output amplifier.

4-35. **Output Amplifier Input.** The signal from the CHOP/ALT control circuit is applied to delay-line driver assembly A2A1. Input stage A2A1Q1/Q2 differentiates the signal and applies it to delay-line assembly A5. The signal is delayed approximately 160 nanoseconds. The signal from the delay line is applied to the differential amplifier stage of the delay line

driver. Diodes CR1 and CR2 prevent the amplifier from going into saturation when excessive signals are applied or when the vertical position control is at one of its extremes. Two of the transistors in U1 are connected as back-to-back diodes and linearize the logarithmic characteristic of the amplifier at high signal levels.

4-36. The BEAM FINDER switch, when pressed, disconnects R21 from the emitter circuit of the differential input stage. This reduces the overall gain of the output stage, so the trace is always displayed regardless of the vertical POSITION control setting. This does not affect the intensity.

4-37. **Output Amplifier.** The final output is comprised of two identical amplifier stages. Therefore, only one stage is described. Transistors A1A1Q3/Q4 form a cascode amplifier with negative feedback supplied to drive stage A1A1Q1/Q2. Transistors A1A1Q5/Q6, connected in series, comprise a driven current source. The steady-state current level is established by A1A1R22 while extra current for fast transients is supplied by A1A1C10. High-frequency components of the deflection signal are coupled through A1A1C8 to the current source.

4-38. **HORIZONTAL SECTION.** There are two basic modes of operation of the horizontal deflection circuits: X-Y operation and normal sweep operation. In X-Y operation, a signal applied to the channel A INPUT connector is used to provide the reference source for the horizontal axis of the display.

4-39. **X-Input Signal Path.** The signal applied to the channel A INPUT connector is processed as a vertical signal up to the CHOP/ALT control circuit (A2A2CR35/CR36). With the A vs B/SWP switch in A vs B position, the channel A signal is applied through A2A2CR35 to A1A1Q37 where it is conditioned and applied to the horizontal-output amplifier circuit.

4-40. **External Input Buffer.** The external-input buffer is made up of A1A1Q13/14. The source follower (Q13) provides high-input impedance, and emitter follower (Q14) provides low-output impedance for driving the trigger amplifier.

4-41. **Trigger Switches.** The trigger switches select the source of the trigger signal. When EXT switch is pressed, the signal from the external input buffer is applied to the trigger amplifier. When LINE switch is pressed, the switch connects the line frequency signal (from the +5 V secondary winding of A4T1) to the trigger amplifier. When LINE is not selected, the line frequency signal is grounded through R46 so that it cannot be a source of line frequency interference. Similarly when EXT triggering is not selected, the output of the external input buffer is grounded through R45.

4-42. Trigger Amplifier. The trigger signal is ac coupled through C22 to the trigger amplifier which consists of Q15 - Q18, and Q21. At the input to the trigger amplifier, the signal is offset by TRIGGER LEVEL control R4 so that the output signal from the trigger amplifier is shifted relative to the threshold level of input Schmitt trigger U5A. This permits U5A to trigger at various levels of the input signal. The $-/+$ switch S1E selects the slope on which the threshold level is defined. Resistor R51 is a symmetry control that is adjusted so that the dc level of the trigger amplifier output is the same for inverting ($-$) or non-inverting ($+$) operation.

4-43. When TV/NORM switch is in TV position, the trigger signal is taken from Q16 and applied to the TV Sync Separator. Transistor Q21 cuts off to prevent the unprocessed video signal from reaching the trigger circuit.

4-44. TV Sync Separator. The TV Sync Separator separates the Frame and Line Sync pulses of a composite video signal and outputs either Line sync pulses or a Frame signal to the trigger circuit.

4-45. RC network C24 and R61 filter the video portion of the signal to produce a mean dc level. When a sync pulse occurs, it is superimposed on this dc level and turns on Q19 so that only sync pulses reach the sync separator.

4-46. When the TIME/DIV switch is in the range 0.1 μ s/div to 50 μ s/div, flip-flop U3B is held in its preset state and only the Line circuit provides an output. In the Line circuit, Q22, U2B, and R73 are connected as a Schmitt trigger so that the sync pulses are only reshaped. When the TIME/DIV switch is set to sweep speeds of 0.1 ms/div or longer, the ground is removed from the preset input of U3B and the Frame circuit is enabled. This signal is integrated by R65/C25 and applied as a clock input to U3B by way of Schmitt trigger Q20, U2A, and R68.

4-47. Only when Frame sync pulses occur does the integrator output reach a sufficient level to clock U3B. Because U3B divides sync pulses by a factor of two, triggering occurs on alternate Frame sync pulses. When Frame circuit operation is selected, the Line circuit output is always high (+5 V) so that U4A is enabled and inverts the Frame signal from U3B. In the Line mode of operation, U3B is in the preset state and its Q output is high. This enables U4A which inverts the Line sync pulses.

4-48. Trigger Circuit. On the negative transition from either the trigger amplifier or the sync separator, the output of Schmitt trigger U5A (pin 6) goes high. The high is applied directly to an input on NAND gate U6D causing its output to go low since its other input from U1C is still high. However, the output of U6D is low only for the propagation delay time that it takes for the Schmitt trigger output to pass through U1A,

U1B, and U1C. When the output of U1C goes low, the output of U6D again goes high.

4-49. The output of U5A also clocks U7A (through U1A) and U8 (through U1A and U1B). When the Q output of U8 goes high, it enables U2D. When the Q output of U7A goes high, it enables U6C.

4-50. After the propagation delay time of U1A, U1B, and U1C, the output of U6D (pin 11) goes high. The positive transition is inverted by U6C (enabled by U7A) clocking U7B. The Q output of U7B goes high and the \bar{Q} output goes low. The low \bar{Q} output enables the ramp generator and causes the blanking circuits to remove the blanking signal. The high Q output causes a low at the output of U2I (enabled by U8). A low at the output of U2D holds off input Schmitt trigger U5A.

4-51. Ramp Generator. The ramp generator consists of a constant current source (Q24 and associated circuitry) which charges a selected capacitor (C32/C33, C34, C35, or C36). Ramp output voltage increases linearly with time at a rate determined by the value of the selected capacitor and the charging current. The charging circuit is controlled by Q23. When conducting, Q23 functions as a current sink, discharging the selected ramp capacitor and preventing it from recharging. When Q23 is cut off, the current source charges the selected capacitor. Transistor Q23 is turned on or off by the signal generated in the trigger circuit.

4-52. Completion of the ramp signal is detected at the input of cut-off Schmitt trigger U5B. The negative transition of the output of U5B clears U7B. This disables the ramp generator, and the hold-off signal applied to the input Schmitt trigger U5A is removed. To prevent premature triggering, the hold-off circuit keeps U7A and U7B in the clear state (pins 3 and 8 low) until the ramp generator is fully reset. When the holdoff signal is removed, the next trigger signal will restart the sequence.

4-53. Bright-Line Auto Operation. If no trigger signal is received within approximately 500 milliseconds of the last trigger signal, the bright-line auto monostable flip-flop U8 returns to its stable state (Q output low, \bar{Q} output high). When the \bar{Q} output goes high, it presets U7B by way of U6A. The ramp generator is enabled and a sweep occurs, although it is asynchronous. At the end of the sweep, if no new trigger signal has been received, the end of the hold-off signal presets U7B by way of U6A and another sweep is started. Until U8 is set to its quasi-stable state by a new trigger signal, continuous sweeps occur with minimum time between them. In the normal mode of operation (with trigger signals constantly applied), U8 is always in its quasi-stable state since it is a retriggerable monostable flip-flop.

4-54. The front-panel PULL AUTO OFF control is used to disable the bright-line auto circuit. When the PULL AUTO OFF control is pulled, the output from the probe calibrator multivibrator is applied to an input on bright-line auto monostable flip-flop U8. The monostable flip-flop interprets these signals from the probe calibrator multivibrator as trigger signals and remains in its quasi-stable state. In the absence of any trigger signal, no sweep is generated. When the PULL AUTO OFF control is pushed in, the signal from the probe calibrator multivibrator to U8 is grounded through A1A1CR15 (see schematic 9.)

4-55. **Hold-off Circuit.** The hold-off circuit is a monostable circuit that holds off the trigger circuit while the ramp generator capacitor is discharging. The circuit consists of A1A2A1C1-C4, U6B and R86. When the output of cut-off Schmitt trigger U5B goes low, the output of U2C goes high. The loop U2C/U6B retains this status for an interval of time determined by the selected capacitor (A1A2A1C1-C4) and R86. During this interval, U7B is held in a clear state and permits discharge of the ramp capacitor.

4-56. **Sweep Output.** The sweep output circuit Q25/Q26, connected as a Darlington pair, provides high-input impedance, low-output impedance, and high-current gain. The sweep output circuit buffers the ramp generator to the horizontal output amplifier.

4-57. **Horizontal Output Amplifier.** The horizontal output amplifier is very similar to the vertical output amplifier. The differential input stage Q27/Q28 provides gain adjustment and horizontal position control. When the BEAM FINDER switch is pressed, the gain of the amplifier is reduced because +95 V is now applied to the input stage through R101 instead of directly from the switch. This reduction in gain shortens the sweep so that it can be seen on the display regardless of the position control setting. The output stage is made up of two channels which are identical to those described for the vertical output amplifier (paragraph 4-37).

4-58. **Chop Oscillator.** NAND gates U4B and U4C are connected as a free-running multivibrator. The oscillator which runs at approximately 200 kHz is disabled in the single channel display mode and at sweep speeds faster than 1 ms/div. The oscillator is also

disabled between sweeps (by the Q output from U7B through R75).

4-59. **CHOP - ALT Control.** In the chop mode (sweep speeds of 1 ms/div and longer) with dual trace operation, the Chop-Alt control flip-flop U3A is clocked by the output of the chop oscillator by way of U4D. In the alternate mode of operation (sweep speeds of 0.5 ms/div and faster) with dual trace operation, flip-flop U3A is clocked at the end of each sweep by the signal from Schmitt trigger U5B. In single trace mode, the flip-flop is held in either the preset (channel A display) or the clear (channel B display) state.

4-60. **Blanking.** The purpose of the blanking circuit is to suppress the display (trace) during retrace, during switching in chop operation, and to provide a Z-input. Retrace is suppressed by the Q output of U7B through CR6, U4D, and RC network C15/R35 to the blanking amplifier. The connection through CR7 from Schmitt trigger U5B ensures that blanking takes place immediately when the sweep ends.

4-61. In chop operation, the output of U4D provides blanking during switching from one channel to the other.

4-62. Z-input and the output of U4D are fed through similar shaping networks to the blanking amplifier on assembly A3.

4-63. **Blanking Amplifier.** The blanking amplifier A3Q2-Q4 is an inverting amplifier that drives the grid of the CRT through A3C15 to cut off the electron beam during trace return, during chop mode of operation, and under control of the Z-axis input. A3Q2 acts as a static current source at low frequencies and as an active current source at high frequencies. Commutation capacitor A3C14 and decoupling capacitor A3C7 improve the high frequency response. A3Q4 acts as a preamplifier to improve response. A3C15 isolates the amplifier from the high grid voltage. A3Q5 and its associated circuitry ensure that the CRT remains blank until the start of a sweep. This feature is necessary when the brightline auto circuit is inhibited. The probe calibrator signal ensures that a blanking signal is always applied to the CRT in the absence of an unblanking signal from chop-blanking NAND gate A1A1U4D.

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains performance checks and adjustment procedures for the 1222A. The performance checks verify that the instrument meets specifications as listed in table 1-1. Adjustment procedures are provided to help maintain the instrument within specification limits.

5-3. RECOMMENDED TEST EQUIPMENT.

5-4. Equipment required for the performance checks and adjustment procedures is listed in table 5-1. Any equipment that satisfies the required characteristics given in the table may be substituted for the recommended model(s).

5-5. PERFORMANCE CHECK RECORD.

5-6. A performance check record is provided at the end of this section for recording results of the performance checks. This form lists all performance checks and their acceptable limits. The form may be removed and retained as a permanent record of the incoming inspection or routine maintenance performed on the instrument.

NOTE

To ensure your instrument is operating within specifications, a 30-minute warmup period should be allowed after turn-on.

5-7. PERFORMANCE CHECKS.

5-8. These checks are provided to verify instrument performance within the specifications outlined in table 1-1 of this manual. None of these checks require access to the interior of the instrument. If it has been determined, after the performance checks, that the instrument does not meet one or more of its specifications refer to the adjustment procedures.

5-9. **INITIAL CONTROL SETTINGS.** The control settings listed below are to be used for each performance check and adjustment procedure. If a control is to be set to another position, it will be listed in the procedure. After the completion of each performance check or adjustment procedure, set the controls back to the original front-panel settings.

Control	Position
---------	----------

Vertical (channels A and B):

POSITION	centered
VOLTS/DIV	100 mV
Input coupling	AC
Verniers	CAL
VERTICAL DISPLAY	A
B INV	out position

Horizontal:

POSITION	centered
TIME/DIV	0.1 msec
TRIGGER LEVEL	midrange
TRIGGER SOURCE	INT
TV/NORM	NORM
-/+	+
A vs B/SWP	SWP
1:10/1:1	1:1
INTENSITY	visible trace
PULL AUTO OFF	in position

5-10. **DEFLECTION FACTOR.** The ranges are from 2 mV/div to 10 V/div (12 ranges) in 1, 2, 5 sequence. With vernier in calibrated position, the attenuator accuracy is $\pm 3\%$ for 20 mV/div through 10 V/div ranges and $\pm 5\%$ for 2 mV/div, 5 mV/div, and 10 mV/div ranges. Vernier is continuously variable between all ranges and extends maximum deflection factor to at least 25 V/div.

5-11. The deflection factor is checked by applying a voltage-calibrated signal to the input. The displayed signal is compared against the voltage standard.

Equipment Required:

Voltmeter calibrator
 Adapter (HP Part No. 1251-2277)
 44-in. BNC cable

5-12. Perform deflection factor check as follows:

- a. Connect equipment as shown in figure 5-1.
- b. Set channel A and channel B VOLTS/DIV controls to 20 mV position.
- c. Set voltmeter calibrator for 0 volt output.
- d. Using channel A POSITION control, set trace to bottom horizontal graticule line.

Table 5-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	Model		
Voltmeter Calibrator	HP Model 6920B	Voltage: 10 mV to 50 V Accuracy: 0.4%	P
Oscillator	HP Model 204C	Output Voltage: >5 V rms Accuracy: $\pm 3\%$	P
Constant Amplitude Signal Generator	User's Selection	Frequency: 50 kHz to 15 MHz Accuracy: 2%	P
Time-mark Generator	User's Selection	Time-marks: 0.1 μ s to 0.5 s	P
TV Sync Generator	User's Selection	TV line and frame generator	P
Multifunction Digital Voltmeter	HP Model 3465A	Voltage Range: >210 VDC Accuracy: $\pm 0.1\%$	A
Variable Transformer	User's Selection	Voltage Range: 100-250V Rating >50 VA	A
Square-wave Generator	HP Model 8013B	Frequency: 1 kHz and 1 MHz Output Termination: 50 ohms	A
LCR Meter	HP Model 4332A	Range: to 36 pF	A
Adapter (2)	HP Part No. 1251-2277	Twin banana plug to BNC female adapter	P
44-in. BNC Cable (2)	HP Model 10501A	BNC, 44-in cable	P
Cable Assy	HP Model 11000A	Dual banana plug to dual banana plug	P
50-ohm Termination	HP Model 10100C	Termination: 50-ohm	P
9-in. BNC Cable (2)	HP Model 10502A	BNC, 9-in cable	P
BNC Tee	HP Part No. 1250-0781	BNC Tee Adapter	P
Test Leads (2)	HP Model 11002A		P, A
1000:1 Divider Probe	HP Model 34111A	Divider: 1000:1, ≤ 40 kV	A
BNC Barrel Adapter	HP Part No. 1250-0080	BNC female to BNC female	P, A
	HP Model 10110B	Twin banana plug to BNC male adapter	A

Note: P = Performance Check, A = Adjustment Procedure.

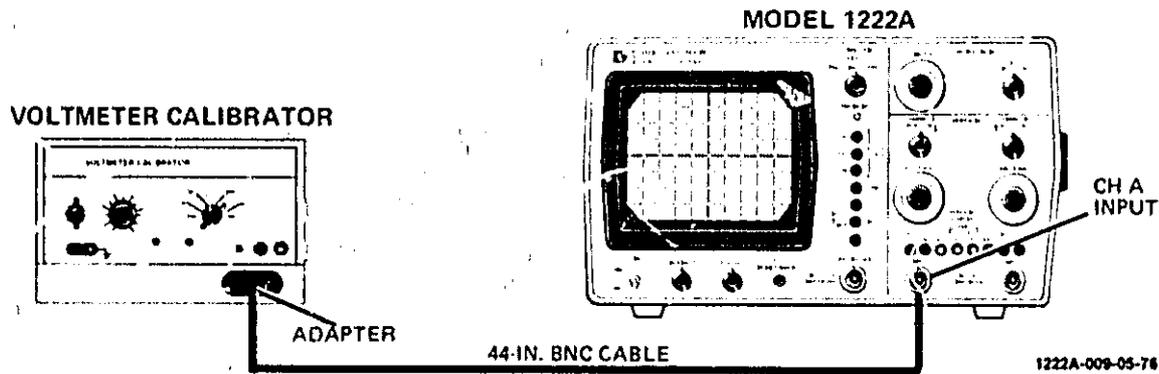


Figure 5-1. Deflection Factor Test Setup

- e. Set voltmeter for +100 mV output.
- f. Note display. Vertical deflection should be 5 divisions $\pm 3\%$.
- g. Observe vertical deflection factors specified in table 5-2.

Table 5-2. Deflection Factor Accuracy

Voltmeter Calibrator Settings (Volts p-p)	VOLTS/DIV Settings	Vertical Display (div)
.01	2 mV	5 $\pm 5\%$ ($\pm .25$)
.03	5 mV	6 $\pm 5\%$ ($\pm .3$)
.05	10 mV	5 $\pm 5\%$ ($\pm .25$)
.1	20 mV	5 $\pm 3\%$ ($\pm .15$)
.3	50 mV	6 $\pm 3\%$ ($\pm .18$)
.5	100 mV	5 $\pm 3\%$ ($\pm .15$)
1	200 mV	5 $\pm 3\%$ ($\pm .15$)
3	500 mV	6 $\pm 3\%$ ($\pm .18$)
5	1 V	5 $\pm 3\%$ ($\pm .15$)
10	2 V	5 $\pm 3\%$ ($\pm .15$)
30	5 V	6 $\pm 3\%$ ($\pm .18$)
50	10 V	5 $\pm 3\%$ ($\pm .15$)

- h. Connect voltmeter calibrator to channel B INPUT connector.
- i. Set VERTICAL DISPLAY control for channel B only operation.
- j. Repeat steps c through g for channel B.
- k. Disconnect test equipment.
- l. Set Model 1222A front-panel controls to initial settings.

5-13. **Z-AXIS BLANKING.** A signal of +5 Vac, 2 Hz to 1 MHz blanks a trace of any intensity.

5-14. A trace of normal intensity is obtained on the CRT. A signal of +5 Vac peak is applied to the Z-input connector on the rear panel and to the EXT TRIGGER connector on the front panel of Model 1222A. The display should be chop-blanked regardless of INTENSITY setting. The chop-blanking effect results from the sine wave input.

Equipment Required:

- Oscillator
- Two adapters (HP Part No. 1251-2277)
- Two 44-in. BNC cables
- 9-in. BNC cable
- BNC tee

5-15. Perform Z-axis blanking check as follows:

- a. Set TIME/DIV control to 1 msec position and select EXT TRIGGER.
- b. Obtain baseline on CRT.
- c. Adjust INTENSITY control for normal viewing level of baseline.
- d. Connect equipment as shown in figure 5-2.
- e. Set oscillator for 10 kHz, 10 V p-p output.
- f. Verify modulated blanking of CRT regardless of INTENSITY setting.
- g. Set INTENSITY control fully counterclockwise.
- h. Disconnect test equipment.
- i. Set Model 1222A front-panel controls to initial settings.

5-16. **BANDWIDTH CHECK.** <3 dB down from 50 kHz, 6-division reference signal (terminated 50-ohm source).

5-17. To check the bandwidth, a constant amplitude signal generator is used to apply a 6-division, 50 kHz reference signal to the input of Model 1222A. The

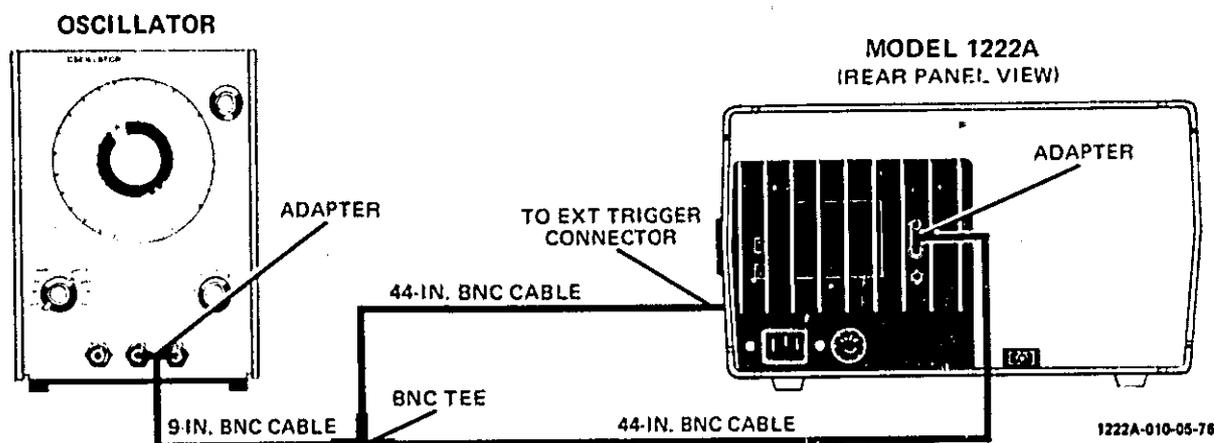


Figure 5-2. Z-axis Blanking Test Setup

constant amplitude signal generator frequency is increased to 15 MHz. Displayed amplitude on the CRT must be equal to or greater than 4.2 divisions.

Equipment Required:

- Constant amplitude signal generator
- 44-in. BNC cable
- 50-ohm termination

5-18. Perform bandwidth check as follows:

- a. Connect equipment as shown in figure 5-3.
- b. Set channel A and channel B input coupling to DC position.
- c. Set channel A and channel B VOLTS/DIV controls to 2 mV position.
- d. Set TIME/DIV control as required.
- e. Adjust constant amplitude signal generator for 50 kHz, 6-division display on CRT.
- f. Increase frequency output of constant amplitude signal generator to 15 MHz.

g. Observe display on CRT. Signal amplitude is equal to or greater than 4.2 divisions.

h. Disconnect input signal from channel A INPUT connector.

i. Connect input signal to channel B INPUT connector.

j. Set VERTICAL DISPLAY to B only.

k. Repeat steps e through g for channel B.

l. Disconnect test equipment.

m. Set Model 1222A front-panel controls to initial settings.

5-19. TRIGGERING CHECK. Internal triggering occurs from approximately 10 Hz to 15 MHz on signals causing one division or more of vertical deflection. Triggering on line frequency is also selectable. External triggering occurs from approximately 10 Hz to 15 MHz on signals 0.1 V p-p or more.

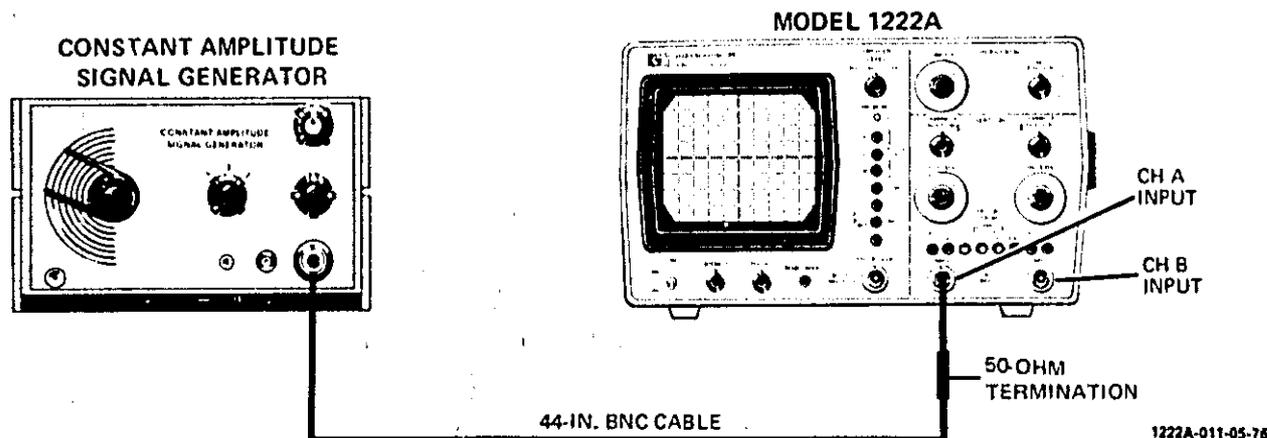


Figure 5-3. Bandwidth Test Setup

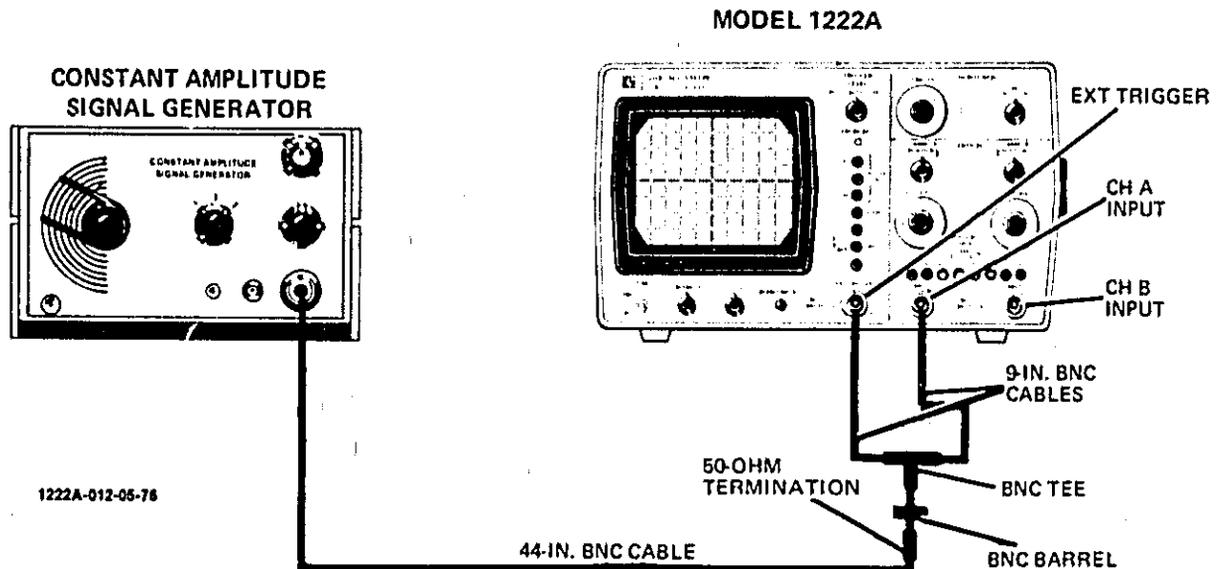


Figure 5-4. HF Triggering Test Setup

5-20. In the internal trigger mode of operation, triggering is checked against certain vertical deflections on the CRT. In the external mode of operation, the input signal amplitude determines trigger requirements.

Equipment Required:

Constant amplitude signal generator
Oscillator
Adapter (HP Part No. 1251-2277)
44-in. BNC cable
Two 9-in. BNC cables
BNC tee
One 50-ohm termination
BNC barrel

5-21. Perform triggering check as follows:

- a. Connect equipment as shown in figure 5-4.
- b. Set channel A and channel B input coupling to DC position.
- c. Set TIME/DIV control as required.
- d. Adjust constant amplitude signal generator for 15 MHz, 1 division amplitude display on CRT.
- e. Adjust TRIGGER LEVEL control for stable display (if necessary). Stable display indicates proper triggering.
- f. Change trigger slope from + to - and back to + position. Display remains stable. (If necessary, adjust TRIGGER LEVEL control for stable display.)
- g. Set TRIGGER SOURCE to EXT position. Display remains stable. (If necessary, adjust TRIGGER LEVEL control for stable display.)

h. Set TRIGGER SOURCE to INT position.

i. Disconnect constant amplitude signal generator from instrument.

j. Connect HP Model 204C Oscillator to Model 1222A as shown in figure 5-5.

k. Set TIME/DIV control as required.

l. Adjust oscillator for 10 Hz, 1 division amplitude display on CRT.

m. Adjust TRIGGER LEVEL control for stable display (if necessary). Stable display indicates proper triggering.

n. Change trigger slope from + to - and back to + position. Display remains stable. (If necessary, adjust TRIGGER LEVEL control for stable display.)

o. Set TRIGGER SOURCE to EXT position. Display remains stable. (If necessary, adjust TRIGGER LEVEL control for stable display.)

p. Set TRIGGER SOURCE to INT position.

q. Set VERTICAL DISPLAY to B only.

r. Repeat steps c through o for channel B.

s. Disconnect test equipment.

t. Set Model 1222A front-panel controls to initial settings.

5-22. **SWEEP TIME ACCURACY.** The ranges are from $0.1 \mu\text{s}/\text{div}$ to $0.5 \text{ s}/\text{div}$ (21 ranges) in 1, 2, 5 sequence. The accuracy is $\pm 4\%$ with sweep expander control in calibrated position.

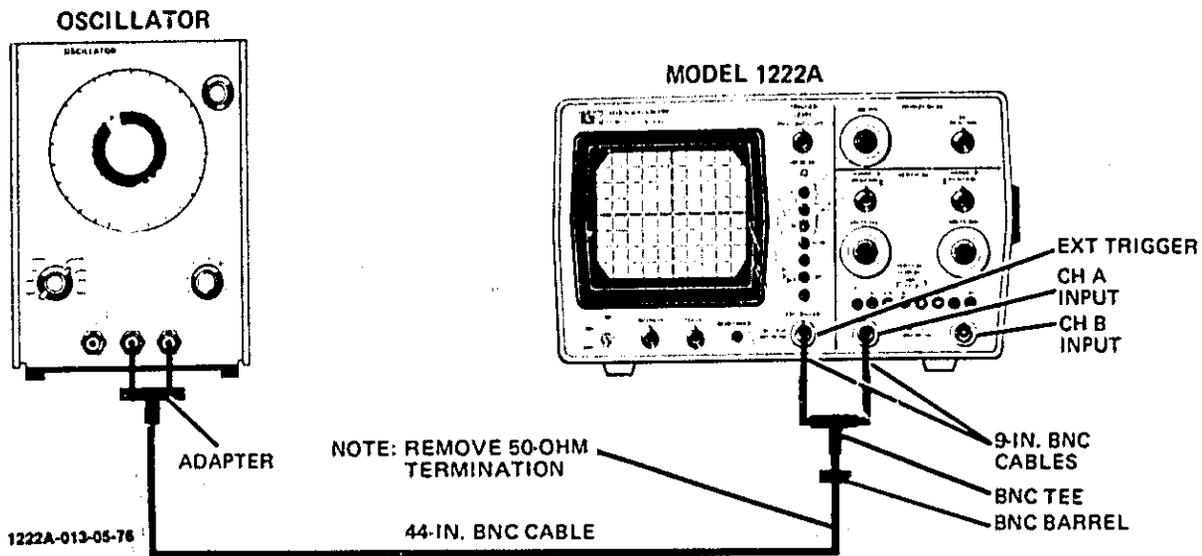


Figure 5-5. LF Triggering Test Setup

5-23. The Model 1222A time base is compared to a time-mark generator to verify accuracy.

Equipment Required:

- Time-mark generator
- 44-in. BNC cable
- 50-ohm termination

5-24. Perform sweep time accuracy check as follows:

- a. Connect equipment as shown in figure 5-6.
- b. Set channel A input coupling to DC position.
- c. Set channel A VOLTS/DIV control as required.
- d. Check sweep time accuracy in accordance with table 5-3.
- e. Disconnect test equipment.
- f. Set Model 1222A front-panel controls to initial settings.

5-25. **TV SYNC CHECK.** The TV Sync Separator requires one division of video signal to trigger sweep. Automatic selection of line and frame display.

5-26. A signal from a TV Sync Generator is used to check the TV Sync Separator triggering circuit in the instrument.

Equipment Required:

- TV sync generator
- 44-in. BNC cable
- Two 9-in. BNC cables
- BNC tee
- BNC barrel

5-27. Perform TV Sync check as follows:

- a. Connect equipment as shown in figure 5-7.
- b. Set channel A input coupling to DC position.
- c. Set channel A VOLTS/DIV control for one major division of display on CRT.

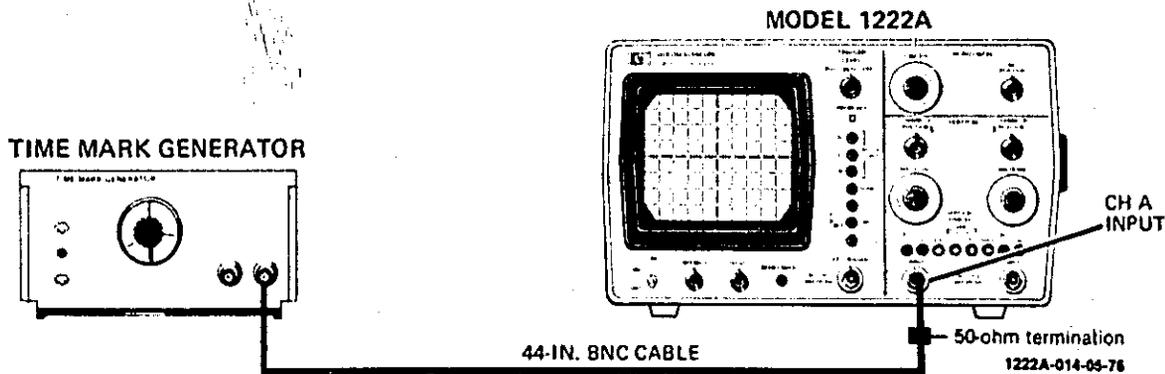


Figure 5-6. Sweep Time Accuracy Test Setup

Table 5-3. Sweep Time Accuracy

Time-mark Generator Setting	TIME/DIV Setting	Time Marks (10 divisions)	Limit ($\pm 4\%$)
.1 μ sec	.1 μ sec	11	± 0.4 div
.2 μ sec	.2 μ sec	11	± 0.4 div
.5 μ sec	.5 μ sec	11	± 0.4 div
1 μ sec	1 μ sec	11	± 0.4 div
2 μ sec	2 μ sec	11	± 0.4 div
5 μ sec	5 μ sec	11	± 0.4 div
10 μ sec	10 μ sec	11	± 0.4 div
20 μ sec	20 μ sec	11	± 0.4 div
50 μ sec	50 μ sec	11	± 0.4 div
.1 msec	.1 msec	11	± 0.4 div
.2 msec	.2 msec	11	± 0.4 div
.5 msec	.5 msec	11	± 0.4 div
1 msec	1 msec	11	± 0.4 div
2 msec	2 msec	11	± 0.4 div
5 msec	5 msec	11	± 0.4 div
10 msec	10 msec	11	± 0.4 div
20 msec	20 msec	11	± 0.4 div
50 msec	50 msec	11	± 0.4 div
.1 sec	.1 sec	11	± 0.4 div
.2 sec	.2 sec	11	± 0.4 div
.5 sec	.5 sec	11	± 0.4 div

- d. Set $-/+$ switch to $-$ position.
 - e. Set TV/NORM switch to TV position.
 - f. Set TV sync generator controls as follows:
 MODE SELECTOR..... DNA
 SYNC ON/OFF..... ON
 - g. Adjust TRIGGER LEVEL control for stable display. Stable display indicates proper triggering (frame).
 - h. Set TIME/DIV control to 20 μ sec position.
 - i. If necessary, adjust TRIGGER LEVEL control for stable display. Stable display indicates proper triggering (line).
 - j. Set TIME/DIV control to 2 msec position.
 - k. Set TRIGGER SOURCE to EXT position.
 - l. Repeat steps g through i for external trigger.
 - m. Disconnect test equipment.
 - n. Set Model 1222A front-panel controls to initial settings.
- 5-28. X-Y PHASE CHECK. The phase shift in X-Y mode of operation is less than 3° to 100 kHz.
- 5-29. A 100 kHz signal is applied to channel A and channel B INPUT connectors. The phase angle is then checked for specifications.

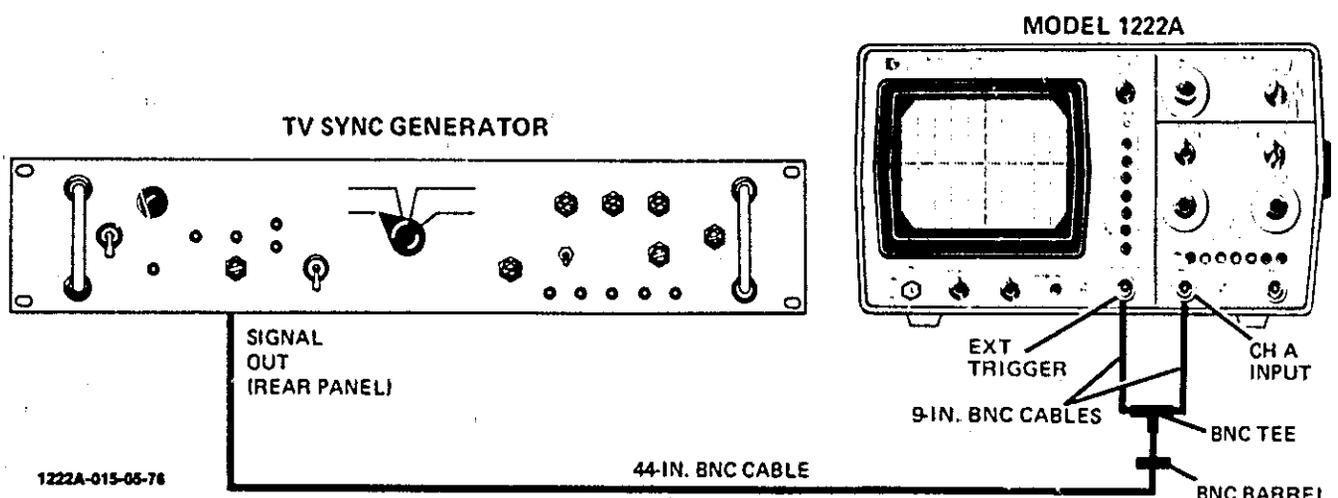


Figure 5-7. TV Sync Test Setup

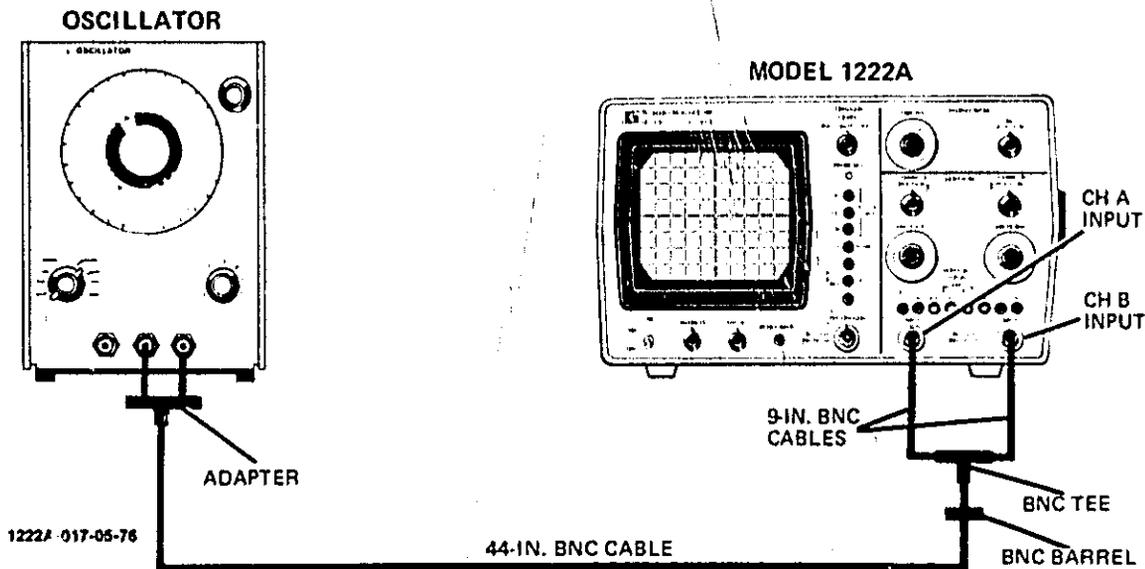


Figure 5-8. X-Y Phase Test Setup

Equipment Required:

- Oscillator
- 44-in. BNC cables
- Two 9-in. BNC cables
- BNC tee
- BNC barrel
- Adapter (HP Part No. 1251-2277)

5-30. Perform X-Y phase measurement check as follows:

- a. Connect equipment as shown in figure 5-8.
- b. Set channel A and channel B input coupling to DC position.
- c. Set channel A and channel B VOLTS/DIV controls to 1 V position.

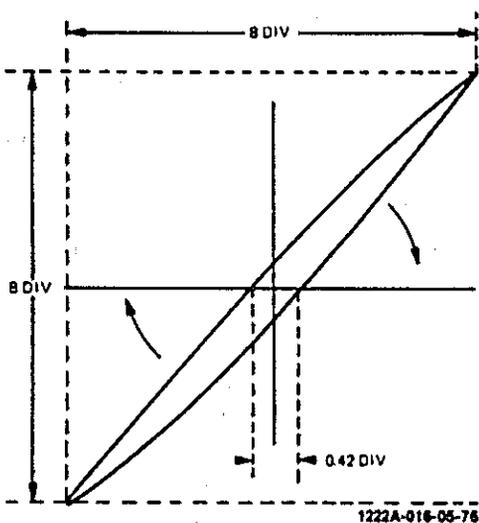


Figure 5-9. X-Y Phase Measurement

- d. Set A vs B/SWP switch to A vs B position.
- e. Set oscillator for 100 kHz output signal.
- f. Adjust oscillator output amplitude for CRT display of eight divisions.
- g. Observe CRT display. Phase angle is equal to or less than 0.42 major division (see figure 5-9).
- h. Disconnect test equipment.
- i. Set Model 1222A front-panel controls to initial settings.

5-31. **COMMON-MODE REJECTION CHECK.** At least 30 dB, dc to 1 MHz.

5-32. Identical signals are applied to both channel A and channel B with channel B set to B INV mode. The displayed signal is the common-mode signal.

Equipment Required:

- Oscillator
- BNC tee
- 44-in. BNC cable
- Two 9-in. BNC cables
- BNC barrel
- Adapter (HP Part No. 1251-2277)

5-33. Perform Model 1222A common-mode rejection check as follows:

- a. Connect equipment as shown in figure 5-10.
- b. Set channel A and channel B input coupling to DC position.

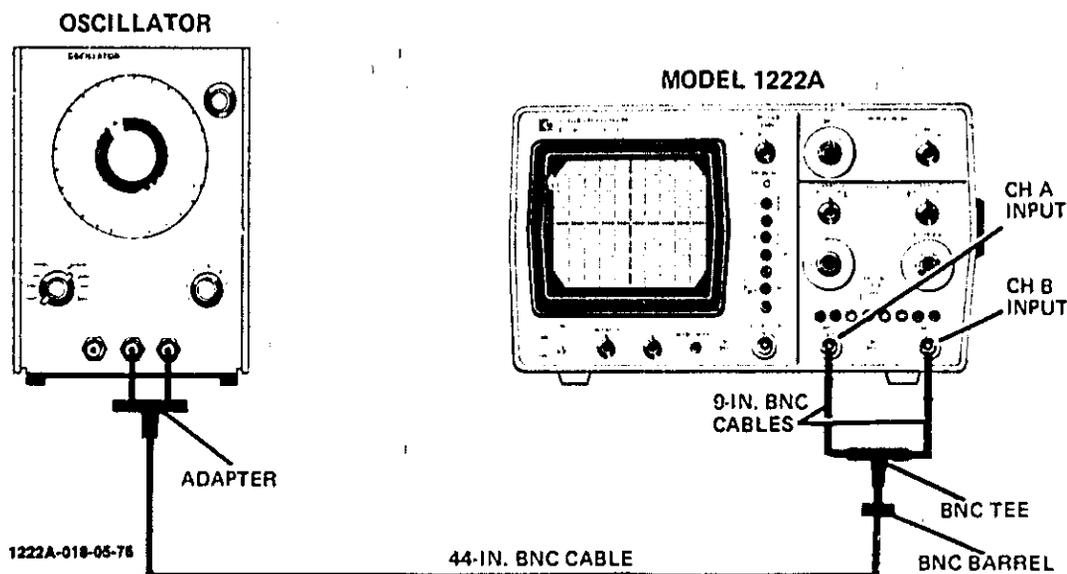


Figure 5-10. Common-mode Rejection Test Setup

- c. Set channel A and channel B VOLTS/DIV controls to 100 mV position.
- d. Set TIME/DIV control to 1 μ sec position.
- e. Set oscillator for 1 MHz, 3-division display.
- f. Press vertical display switch A+B.
- g. Press B INV switch and set channel A and channel B VOLTS/DIV controls to 10 mV position.
- h. Adjust either channel A or channel B vernier (whichever is most effective) to achieve minimum deflection.
- i. Deflection is equal to or less than 0.9 division.
- j. Disconnect test equipment.
- k. Set Model 1222A front-panel controls to initial settings.

5-34. ADJUSTMENT PROCEDURES.

WARNING

Read the Safety Summary at the front of this manual before performing adjustment procedures.

5-35. The following is a complete adjustment procedure for the Model 1222A. These procedures should be performed only if it has been previously established by the performance checks that the instrument is out of adjustment. If the instrument cannot be brought

into specifications by the following adjustments, refer to the troubleshooting hints given in Section VIII. See figure 5-16 for location of board assemblies.

5-36. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT. (See figure 5-11.) The +95-volt supply is an adjustable reference for the +12-volt and +210-volt supplies. It is normally adjusted to produce the greatest accuracy on the +12-volt supply.

Equipment Required:

- Multifunction digital voltmeter
- Test leads

5-37. Perform low-voltage power supply adjustment as follows:

- a. Connect multifunction digital voltmeter between test point A2A2TP4 (+) and ground. Test point is marked +12 V.
- b. Adjust A2A2R13 for an indication on multifunction digital voltmeter of +12 V \pm 0.05 V.
- c. Check other voltages as listed in table 5-4.
- d. Disconnect test equipment.

Table 5-4. Low-voltage Power Supply Outputs

Test Point	Voltage Indication
TP1 (+5)	+5 V \pm 0.25 V
TP2 (+210)	+210 V \pm 20 V
TP3 (+95)	+95 V \pm 2 V
TP5 (-12)	-12 V \pm 0.3 V

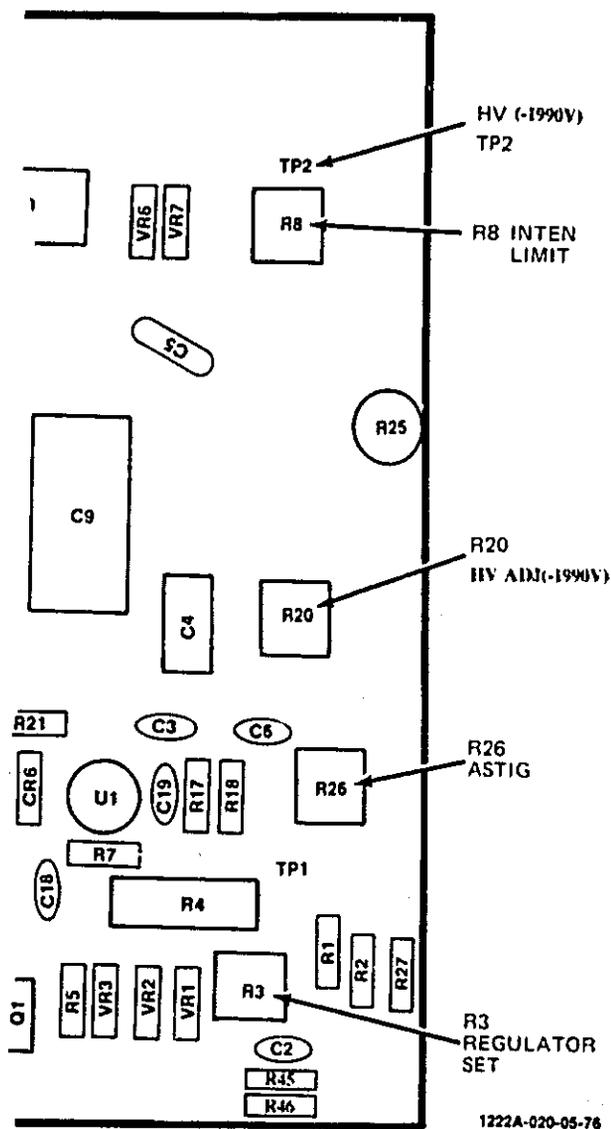


Figure 5-12. High-voltage Power Supply Adjustments

5-38. HIGH-VOLTAGE POWER SUPPLY ADJUSTMENTS. (See figure 5-12.) For this adjustment the line voltage must be within 1% of the nominal voltage set on the LINE SELECT switches.

Equipment Required:

Variable transformer
1000:1 divider probe
Multifunction digital voltmeter

5-39. Perform high-voltage power supply adjustments as follows:

a. Connect variable transformer between ac source and HP Model 1222A power input.

b. Set LINE SELECT switches on rear panel of Model 1222A for 120-V operation (refer to Section II for settings of switches).

c. Set Model 1222A front-panel TIME/DIV control to 5 msec position.

d. Using digital voltmeter as monitor, adjust variable transformer for 108-Vac output.

e. Adjust A3R3 counterclockwise until trace modulation starts. Then adjust A3R3 clockwise about 10° until trace modulation stops.

f. Using digital voltmeter as monitor, adjust variable transformer for 120-Vac output.

g. Connect digital voltmeter through 1000:1 divider probe to A3TP2.

h. Adjust A3R20 for digital voltmeter indication of 1.99 V \pm 5 mV.

i. Using digital voltmeter as monitor, adjust variable transformer for 132-Vac output.

j. Adjust A3R3 clockwise until trace modulation starts. Then adjust A3R3 counterclockwise about 10° until trace modulation stops.

k. Repeat steps d and e if trace modulation is noted on lower ac input level.

l. Disconnect test equipment.

m. Set Model 1222A front-panel controls to initial settings.

5-40. FOCUS AND ASTIGMATISM ADJUSTMENTS. (See figure 5-12.) The trace is adjusted for optimum line definition over the entire screen.

Equipment Required:

Oscillator

5-41. Perform focus and astigmatism adjustments as follows:

a. Connect oscillator output to channel A input.

b. Adjust Model 1222A for two complete cycles of full screen display.

c. Adjust FOCUS control and A3R26 (ASTIGMATISM) for optimum line definition over entire screen. Line width should be nearly equal at top, middle, and bottom of screen.

5-42. INTENSITY LIMIT ADJUSTMENT. (See figure 5-12.) With front-panel INTENSITY control set to 11 o'clock position, the intensity limit is adjusted for just visible spot.

Equipment Required: None.

5-43. Perform intensity limit adjustment as follows:

- a. Set A vs B/SWP switch to A vs B position.
- b. Set INTENSITY control to 11 o'clock position.
- c. Adjust intensity limit adjustment A3R8 until spot is just visible.
- d. Set Model 1222A front-panel controls to initial settings.

5-44. VERTICAL PREAMPLIFIER BALANCE ADJUSTMENTS. (See figure 5-11.) The vertical preamplifier balance adjustments are set to balance the amplifier with the POSITION control.

Equipment Required: None.

5-45. Perform vertical preamplifier balance adjustments as follows:

- a. Set channel A input coupling to GND position.
- b. Set channel A VOLTS/DIV control to 20 mV position.
- c. Using channel A POSITION control, set trace to center horizontal graticule line.
- d. Set channel A VOLTS/DIV control to 2 mV position.
- e. Adjust A2A2R62 to recenter trace.
- f. Repeat steps b through e until trace shift of no greater than one trace width occurs when channel A VOLTS/DIV control is moved from 20 mV to 2 mV position.
- g. Set channel A VOLTS/DIV control to 100 mV position.
- h. Using channel A POSITION control, set trace to center horizontal graticule line.
- i. Set channel A VOLTS/DIV control to 50 mV position.
- j. Adjust A2A2R64 to recenter trace.
- k. Repeat steps g through j until trace shift of no greater than one trace width occurs when channel A VOLTS/DIV control is moved from 100 mV to 50 mV position.
- l. Set channel A VOLTS/DIV control to 100 mV position.
- m. If necessary, use channel A POSITION control to exactly center trace on center horizontal graticule line.

n. Set channel A VOLTS/DIV control to 20 mV position.

o. Adjust A2A2R49 to recenter trace.

p. Repeat steps l through o until trace shift to no greater than one trace width occurs when channel A VOLTS/DIV control is moved for 100 mV to 20 mV position.

q. Repeat steps a through p for channel B using adjustments A2A2R114, A2A2R116, and A2A2R101.

r. Set Model 1222A front-panel controls to initial settings.

5-46. SWEEP LENGTH ADJUSTMENT. (See figure 5-13.) The sweep length is adjusted for 10.5 horizontal divisions.

Equipment Required: None.

5-47. Perform the sweep length adjustment as follows:

- a. Using horizontal POSITION control, position trace so that beginning of trace is aligned with 1st vertical graticule line.
- b. Adjust A1A1R95 for ten divisions of sweep.
- c. Using horizontal POSITION control, move end of sweep exactly one-half division to left.
- d. Adjust A1A1R95 so that end of sweep aligns with 11th vertical graticule line.
- e. Set Model 1222A front-panel controls to initial settings.

5-48. VERTICAL ATTENUATOR COMPENSATION. (See figure 5-14.) The vertical preamplifier is balanced so that the trace does not shift when the attenuators are changed from range to range.

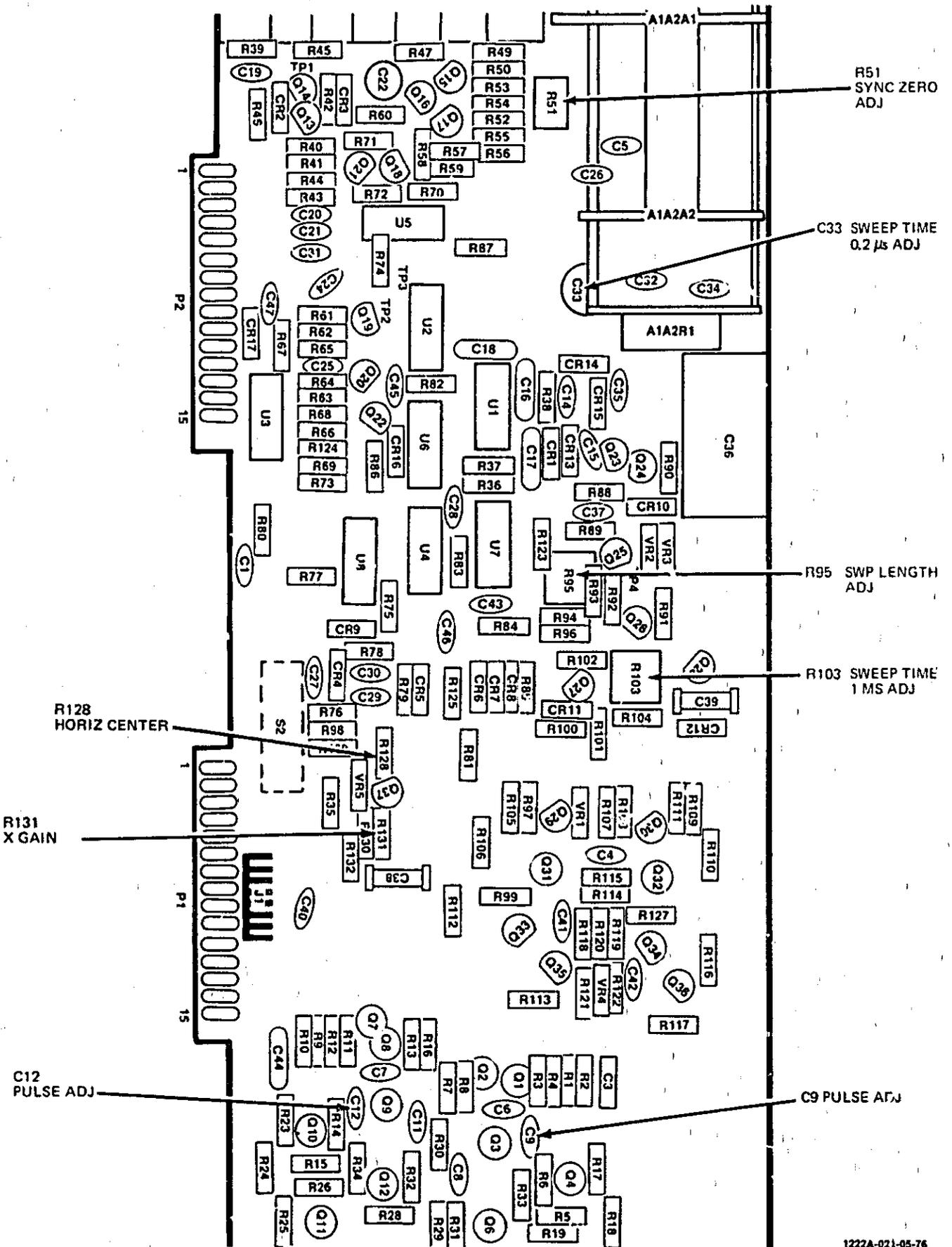
Equipment Required:

Square-wave generator
44-in. BNC cable
Two 9-in. BNC cables
BNC tee
BNC barrel

5-49. Perform attenuator compensation adjustments as follows:

NOTE

The following adjustments are necessary only if repairs have been made to the attenuator assemblies.



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Figure 5-13. Sweep Assembly Adjustment

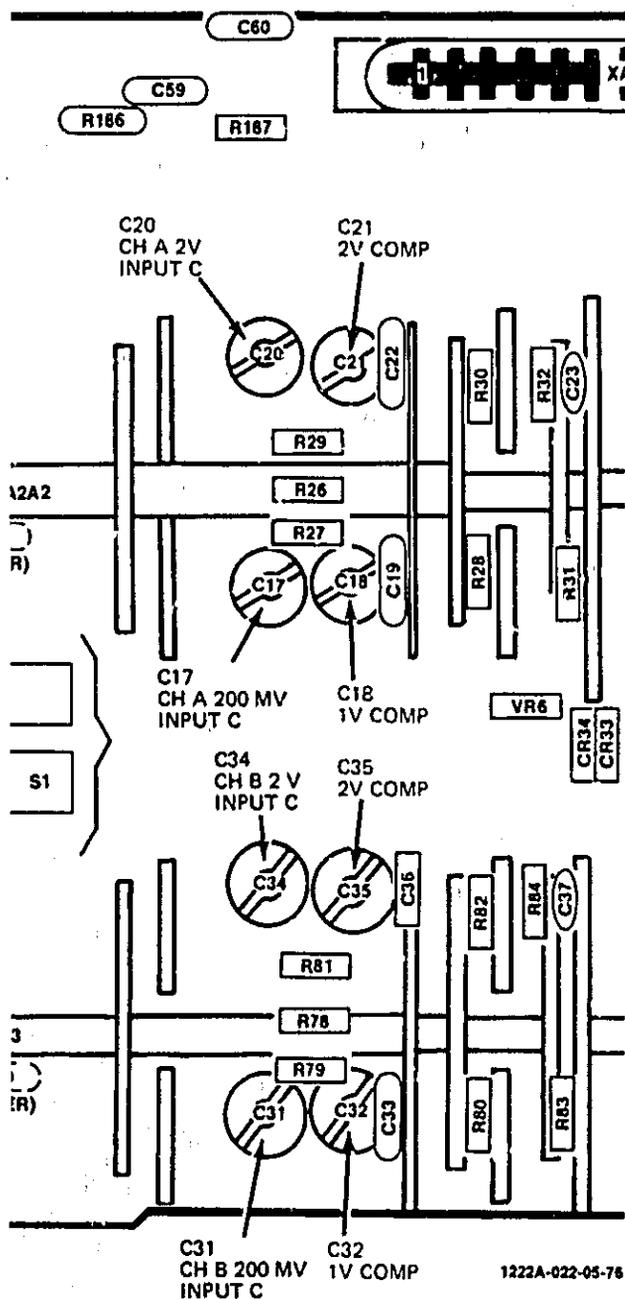


Figure 5-14. Attenuator Compensation Adjustments

- Connect square-wave generator output through 50-ohm termination to channel A and channel B INPUT connectors using BNC tee and BNC barrel.
- Set Model 1222A VERTICAL DISPLAY for A&B operation (both A and B switches engaged).
- Set channel A and channel B input coupling to DC position.
- Set channel A and channel B VOLTS/DIV controls to 1 V position.
- Set TIME/DIV control to 0.2 msec position.

f. Adjust square-wave generator for 1 kHz, 6-division output.

g. Adjust A2A2C18 for best square wave response on channel A.

h. Adjust A2A2C32 for best square wave response on channel B.

i. Set channel A and channel B VOLTS/DIV controls to 2 V position.

j. Adjust square-wave generator for 6-division output.

k. Adjust A2A2C21 for best square wave response for channel A.

l. Adjust A2A2C35 for best square wave response for channel B.

m. Disconnect test equipment.

n. Set Model 1222A front-panel controls to initial settings.

5-50. INPUT CAPACITANCE ADJUSTMENTS. (See figure 5-14.) The input capacitance is adjusted so that the capacitance is the same for all ranges of the VOLTS/DIV control.

Equipment Required:

LCR meter
Adapter (HP Model 10110B)

5-51. Perform input capacitance adjustments as follows:

a. Set channel A and channel B input coupling to DC position.

b. Set channel A and channel B VOLTS/DIV controls to 100 mV position.

c. Connect LCR meter to channel A INPUT connector. Note capacitance reading (30 pF \pm 6 pF).

d. Set channel A VOLTS/DIV control to 200 mV position.

e. Adjust A2A2C17 for same capacitance indication on LCR meter as noted in step c.

f. Set channel A VOLTS/DIV control to 2 V position.

g. Adjust A2A2C30 for same capacitance indication on LCR meter as noted in step c.

h. Disconnect LCR meter from channel A INPUT connector.

i. Connect LCR meter to channel B INPUT connector.

j. Repeat steps c through g for channel B using A2A2C31 and A2A2C34 as adjustments for channel B.

k. Disconnect test equipment.

l. Set Model 1222A front-panel controls to initial settings.

5-52. VERTICAL GAIN ADJUSTMENT. (See figure 5-11.) The gain of vertical preamplifier is calibrated using a 500 mV p-p signal.

Equipment Required:

Voltmeter calibrator
44-in. BNC cable
Adapter (HP Part No. 1251-2277)

5-53. Perform vertical preamplifier gain adjustment as follows:

a. Set Model 1222A channel A input coupling to DC position.

b. Set TIME/DIV control to 1 msec position.

c. Connect output of voltmeter calibrator to channel A INPUT connector.

d. Set voltmeter calibrator for 400-Hz, 500-mV p-p amplitude output.

e. Adjust A2A2R144 for exactly 5 divisions of vertical display.

f. Repeat steps a through e for channel B using A2A2R155 as adjustment.

g. Disconnect test equipment.

h. Set Model 1222A front-panel controls to initial settings.

5-54. SWEEP SPEED ADJUSTMENTS. (See figure 5-13.) The main sweep is calibrated to a known time standard.

Equipment Required:

Time-mark generator
44-in. BNC cable
50-ohm termination

5-55. Perform sweep speed adjustment as follows:

a. Set channel A input coupling to DC position.

b. Set channel A VOLTS/DIV control to 0.5 V position.

c. Set TIME/DIV control to 1 msec position.

d. Connect time-mark generator through 50-ohm termination to channel A INPUT connector.

e. Set time-mark generator for 1 ms output time markers.

f. Adjust A1A1R103 until one marker is on each vertical graticule line.

g. Set time-mark generator for 0.2 μ s output markers.

h. Set TIME/DIV control to 0.2 μ sec position.

i. Adjust A1A1C33 until one marker is on each vertical graticule line.

j. Disconnect test equipment.

k. Set Model 1222A front-panel controls to initial settings.

5-56. PULSE AND BANDWIDTH. (See figure 5-13.) The bandwidth is adjusted for specification limits against a known standard.

Equipment Required:

Constant amplitude signal generator
Square-wave generator
44-in. BNC cable
50-ohm termination

5-57. Perform bandwidth adjustment as follows:

a. Set channel A VOLTS/DIV control to 2 mV position.

b. Set channel A input coupling to DC position.

c. Connect square-wave generator 50-ohm output through 50-ohm termination to channel A INPUT connector.

d. Set square-wave generator for 1 MHz, 6-division output display on CRT.

e. Set TIME/DIV control to 0.1 μ sec position.

f. Adjust pulse response by adjusting trimmer capacitors A1A1C9, A1A1C12, and A2A2C48 (A2A2C49 for channel B) for minimum overshoot and undershoot of displayed pulse.

g. Disconnect test equipment.

h. Connect the equipment as shown in figure 5-3.

i. Adjust constant amplitude signal generator for 50 kHz, 6-division display on CRT.

j. Increase signal output of constant amplitude signal generator to 15 MHz.

k. Amplitude of display must be equal to or greater than 4.2 divisions.

NOTE

If amplitude is low, recheck pulse response.

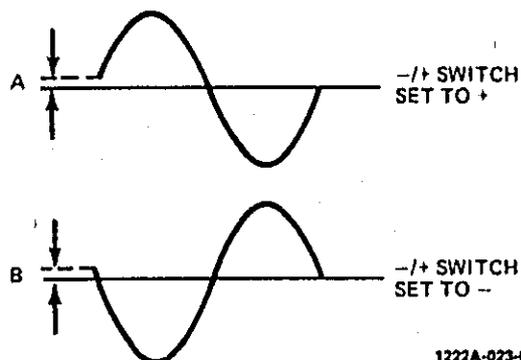
l. Disconnect test equipment.

m. Set Model 1222A front-panel controls to initial settings.

5-58. TRIGGER AMPLIFIER BALANCE ADJUSTMENT. (See figure 5-15.) The + and - trigger slope circuits are balanced to a common signal.

Equipment Required:

Oscillator
44-in. BNC cable



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Figure 5-15. Trigger Balance Adjustment Display

5-59. Perform trigger amplifier balance adjustment as follows:

a. Disconnect W3 cable at A1A1J2 (W3 cable connects TRIGGER LEVEL control to A1A1 assembly).

b. Set TIME/DIV control to 0.1 msec position.

c. Set channel A VOLTS/DIV control to 100 mV position.

d. Connect 600-ohm oscillator output to channel A INPUT connector.

e. Set oscillator for 1 kHz, 600 mV p-p output signal.

f. While switching Model 1222A -/+ switch between + and - positions, adjust A1A1R51 so that both displays start at same point (see figure 5-15).

g. Reconnect W3 cable to A1A1J2.

h. Disconnect test equipment.

i. Set Model 1222A front-panel controls to initial settings.

5-60. X-DEFLECTION ADJUSTMENT. (See figure 5-13.) The instrument is calibrated for external horizontal deflection using a calibrated standard.

Equipment Required:

Oscillator
44-in. BNC cable

5-61. Perform X-deflection adjustment as follows:

a. Set channel A and channel B input coupling to DC position.

b. Set TIME/DIV control to 0.2 msec position.

c. Connect 600-ohm oscillator output to channel A INPUT connector.

d. Adjust oscillator for 1 kHz, 8-division output display.

e. Set A vs B/SWP switch to A vs B position.

f. Adjust A1A1R131 for exactly 8-division deflection over center eight divisions of CRT.

g. Set channel A input coupling to GND position.

h. Set channel A POSITION control to mid-range position.

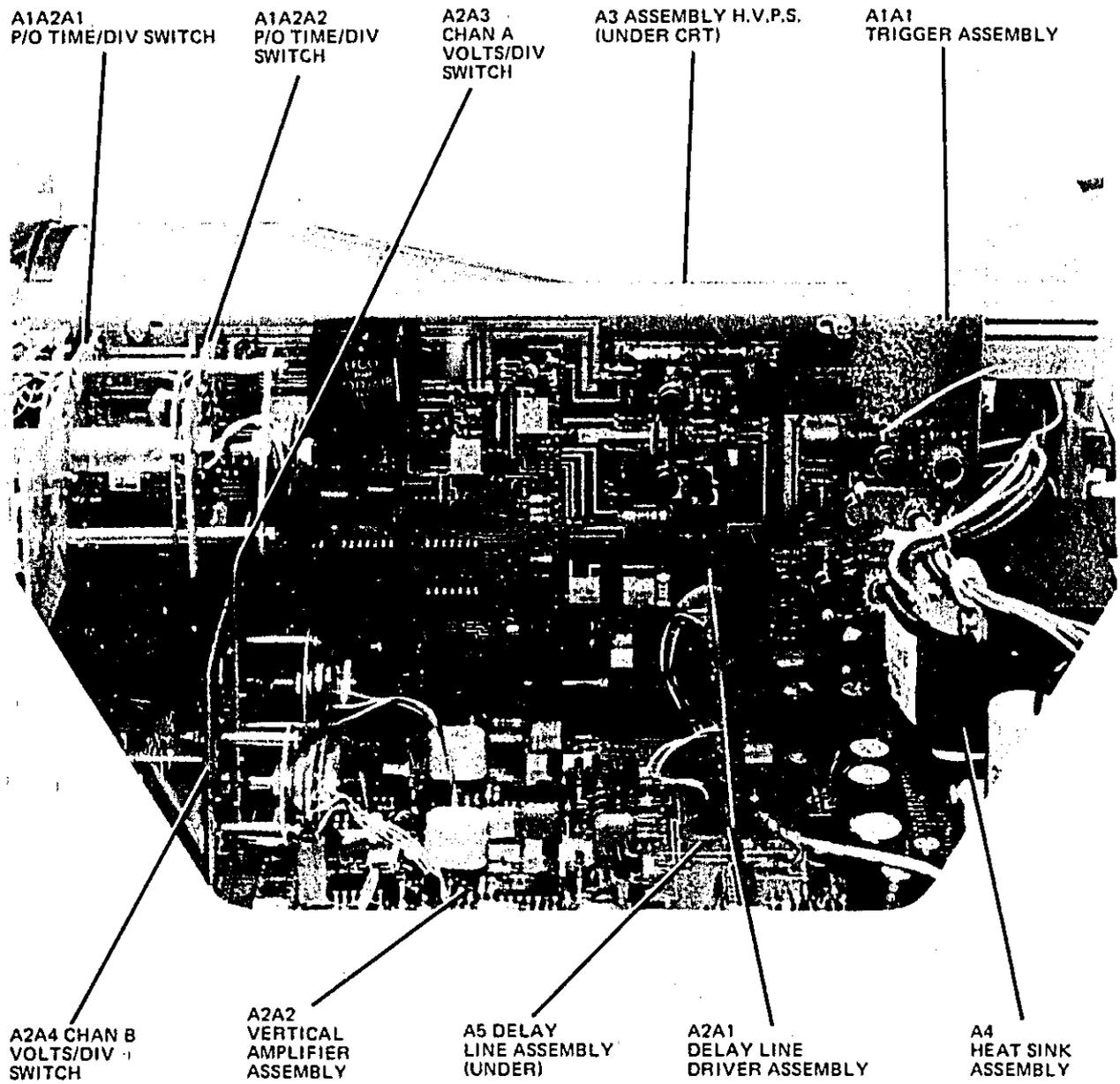
i. Adjust A1A1R128 until spot is centered on graticule line.

j. Set channel A input coupling to DC position.

k. Check step f. If readjustment of A1A1R131 is necessary, repeat steps f through k.

l. Disconnect test equipment.

m. Set Model 1222A front-panel controls to initial settings.



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Figure 5-16. Assembly Locations

**PERFORMANCE CHECK RECORD
MODEL 1222A**

Instrument Serial Number _____

Date _____

Check	Specification	Measured	
		CH A	CH B
<p>DEFLECTION FACTOR</p> <p>2 mV/div 5 mV/div 10 mV/div 20 mV/div 50 mV/div 100 mV/div 200 mV/div 500 mV/div 1 V/div 2 V/div 5 V/div 10 V/div</p>	<p>5 ±5% (±.25) 6 ±5% (±.3) 5 ±5% (±.25) 5 ±3% (±.15) 6 ±3% (±.18) 5 ±3% (±.15) 5 ±3% (±.15) 6 ±3% (±.18) 5 ±3% (±.15) 5 ±3% (±.15) 6 ±3% (±.18) 5 ±3% (±.15)</p>	<p>_____</p>	<p>_____</p>
<p>Z-AXIS BLANKING</p> <p>CRT Blanked</p>	<p>±5 Vac pk Input</p>	<p>_____</p>	<p>_____</p>
<p>BANDWIDTH</p> <p>Channel A Bandwidth Channel B Bandwidth</p>	<p>>4.2 div >4.2 div</p>	<p>_____</p>	<p>_____</p>
<p>TRIGGERING CHECK</p> <p>Internal Triggering (15 MHz) Internal Triggering (10 Hz) External Triggering (15 MHz) External Triggering (10 Hz)</p>	<p>(✓) (✓) (✓) (✓)</p>	<p>_____</p>	<p>_____</p>

SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. The abbreviations used in the parts list are described in table 6-1. Table 6-2 lists the parts in alphanumeric order by reference designation and includes the manufacturer and manufacturer's part number. Table 6-3 contains the list of manufacturers' codes.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts from Hewlett-Packard, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office and supply the following information:

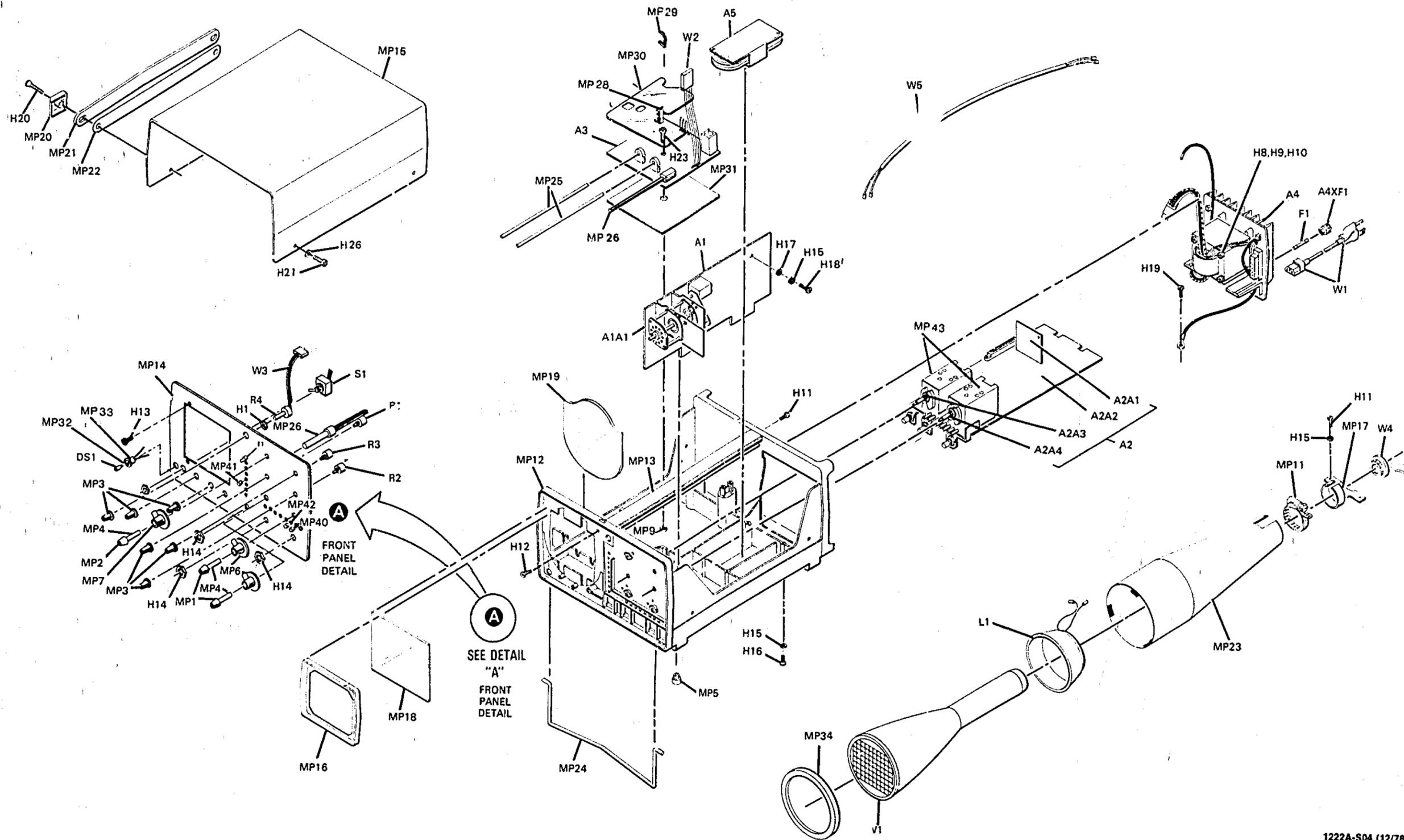
- a. Instrument model and serial number.
- b. HP part number of item(s).
- c. Quantity of part(s) desired.
- d. Reference designation of part(s).

6-5. To order a part not listed in the table, provide the following information:

- a. Instrument model and serial number.
- b. Description of the part, including function and location in the instrument.
- c. Quantity desired.

Table 6-1. Abbreviations for Replaceable Parts List

REFERENCE DESIGNATORS			
<p>A = assembly B = motor BT = battery C = capacitor CP = coupler CR = diode DL = delay line DS = device signaling lamp E = misc electronic part</p>	<p>F = fuse FL = filter IC = integrated circuit J = jack K = relay L = inductor LS = loud speaker M = meter MK = microphone</p>	<p>H = henries HDW = hardware HEX = hexagonal HG = mercury HR = hour(s) HZ = hertz</p>	<p>MP = mechanical part P = plug Q = transistor R = resistor RT = thermistor S = switch T = transformer TB = terminal board TP = test point</p>
<p>A = amperes AFC = automatic frequency control AMPL = amplifier BFO = beat frequency oscillator BE CU = beryllium copper BH = binder head BP = bandpass BRS = brass BWO = backward wave oscillator</p>	<p>IF = intermediate frequency IMPG = impregnated INCD = incandescent INCL = includes INS = insulated INT = internal</p>	<p>K = kilo = 1000</p>	<p>U = integrated circuit V = vacuum tube, neon bulb, photocell, etc VR = voltage regulator W = cable X = socket Y = crystal Z = tuned cavity network</p>
<p>CCW = counter-clockwise CER = ceramic CMO = cabinet mount only COEF = coefficient C/M = common COMP = composition COMPL = complete CONN = connector CP = cadmium plate CRT = cathode-ray tube CW = clockwise</p>	<p>LH = left hand LIN = linear taper LK WASH = lock washer LOG = logarithmic taper LPF = low pass filter</p>	<p>OH = oval head OX = oxide</p>	<p>N/O = normally open NOM = nominal NPO = negative positive zero (zero temperature coefficient) NPN = negative-positive-negative NRFR = not recommended for field replacement NSR = not separately replaceable</p>
<p>DEPC = deposited carbon DR = drive</p>	<p>M = milli = 10⁻³ MEG = meg = 10⁶ MET FLM = metal film MET OX = metallic oxide MFR = manufacturer MHZ = mega hertz MINAT = miniature MOM = momentary MOS = metal oxide substrate MTG = mounting MY = "mylar"</p>	<p>P = peak PC = printed circuit PF = picofarads = 10⁻¹² farads PH BRZ = phosphor bronze PHL = phillips PIV = peak inverse voltage PNP = positive-negative-positive P/O = part of POLY = polystyrene PORC = porcelain POS = position(s) POT = potentiometer PP = peak-to-peak PT = point PWV = peak working voltage</p>	<p>RMO = rack mount only RMS = root-mean square RWV = reverse working voltage S/B = slow-blow SCR = screw SE = selenium SECT = section(s) SEMICON = semiconductor SI = silicon SIL = silver SL = slide SPG = spring SPL = special SST = stainless steel SR = split ring STL = steel</p>
<p>ELECT = electrolytic ENCAP = encapsulated EXT = external</p>	<p>N = nano (10⁻⁹) N/C = normally closed NE = neon NI PL = nickel plate</p>	<p>RECT = rectifier RF = radio frequency RH = round head or right hand</p>	<p>T = tantalum TD = time delay TG = toggle THD = thread TI = titanium TOL = tolerance TRIM = trimmer TWT = traveling wave tube</p>
<p>F = farads FH = flat head FIL H = fillister head FXD = fixed</p>	<p>G = giga (10⁹) GE = germanium GL = glass GRD = grounded</p>	<p>PP = peak-to-peak PT = point PWV = peak working voltage</p>	<p>TA = tantalum TD = time delay TG = toggle THD = thread TI = titanium TOL = tolerance TRIM = trimmer TWT = traveling wave tube</p>
<p>U = micr = 10⁻⁶</p>	<p>VAR = variable VOCW = dc working volts</p>	<p>W/ = with W = watts WIV = working inverse voltage WW = wirewound W/O = without</p>	<p>U = micr = 10⁻⁶ VAR = variable VOCW = dc working volts W/ = with W = watts WIV = working inverse voltage WW = wirewound W/O = without</p>



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Figure 6-1.
Illustrated Parts Breakdown
6-3

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			COMMON HARDWARE (See figures 6-1 and 6-1)		
H1	2190 0033	2	WASHER LK INTL T NO. 5/16 .314 IN ID	78180	1918 02
H2	2950 0007	1	NUT HEX DBL CHAM 5/16-32 THD .004 THK	73734	9001
H3	2190 0084	5	WASHER LK INTL T NO. 1/4 .256 IN ID	78189	1214 05
H4	2350 0072	4	NUT HEX DBL CHAM 1/4-32 THD .062 THK	82389	P-1975
H5	3060 0028	1	WASHER FL MTLN NO. 12 .25 IN ID .438 IN	28480	3060 0028
H6	3060 0389	1	WASHER FL NM NO. 1/4 .26 IN ID .5 IN OD	28480	3060 0389
H7	3060 0386	1	WASHER SHLDR NO. 1/4 .25 IN ID .5 IN OD	72653	6728
H8	3060 0001	4	WASHER FL MTLN NO. 8 .172 IN ID .375 IN OD	73734	1445
H9	2190 0017	4	WASHER LK HLCL NO. 8 .168 IN ID .31 IN OD	28480	2190 0017
H10	2510 0137	3	SCREW MACH 8-32 2.75 IN LG PAN HD	28480	2510 0137
H11	0624 0263	2	SCREW TPG 6-32 .438 IN LG PAN HD	28480	0624 0263
H12	0624 0212	1	SCREW TPG 6-32 .375 IN LG 82 DEG FL HD	28480	0624 0212
H13	0620 0127	2	SCREW MACH 2-56 .188 IN LG PAN HD	28480	0620 0127
H14	2950 0035	3	NUT HEX DBL CHAM 15/32-32 THD .078 THK	28480	0520 0127
H15	2190 0018	6	WASHER LK HLCL NO. 6 .141 IN ID .269 IN OD	28480	2190 0018
H16	2360 0302	2	SCREW MACH 6-32 1.625 IN LG PAN HD	28480	2360 0302
H17	3060 0393	2	WASHER FL MTLN NO. 5 .13 IN ID .313 IN OD	28480	3060 0393
H18	2360 0197	1	SCREW MACH 6-32 .375 IN LG PAN ID	28480	2360 0197
H19	2360 0115	1	SCREW MACH 6-32 .312 IN LG PAN HD	28480	2360 0115
H20	2360 0211	2	SCREW MACH 6-32 .75 IN LG 82 DEG FL HD	28480	2360 0211
H21	2360 0198	2	SCREW MACH 6-32 .438 IN LG 100 DEG FL HD	28480	2360 0198
H23	2200 0145	1	SCREW MACH 4-40 .438 IN LG PAN HD	28480	2200 0145
H26	2190 0915		WASHER LK 100 CTSK EXT NO 6 CHASSIS PARTS	28480	2190 0915
			CHASSIS PARTS		
A1	01-22 66531	1	HORIZONTAL SWEEP ASSEMBLY	28480	01222-66531
A2	01-222 66537	1	VERTICAL AMPLIFIER ASSEMBLY	28480	01222 66537
A3	01222 66532	1	HIGH VOLTAGE POWER SUPPLY	28480	01222 66532
A4	01220 61123	1	HEAT SINK ASSEMBLY	28480	01220-61123
A5	01222 66529	1	DELAY LINE ASSEMBLY	28480	01222-66529
DS1	1990 0524	1	LED VISIBLE YELLOW	28480	1990 0524
E1	0360 1646	1	TERMINAL PROBE ADJUST	28480	0360 1646
L1	01220-67721	1	COIL ASSEMBLY, ALIGN	28480	01220-67721
MP1	0350 0824	2	KNOB CAP DECAL, .375 IN, 5G1	28480	0350 0824
MP2	0350 0975	1	KNOB DECAL SKIRT	28480	0350 0975
MP3	0370 1006	6	KNOB, BASE, PTR, .375 IN, JGK, 5G1	28480	0370 1006
MP4	0370 2512	3	KNOB	28480	0370 2512
MP5	0403 0311	4	RUBBER FEET	28480	0403 0311
MP6	0370-2997	2	KNOB ASSEMBLY, VOLTS/DIV	28480	0370-2997
MP7	0370-2998	1	KNOB ASSEMBLY, TIME/DIV	28480	0370-2998
MP8			NOT ASSIGNED		
MP9	01222 23201	1	COLLAR	28480	01222 23201
MP10			NOT ASSIGNED		
MP11	1400-0537	1	CLAMP, CLIP, .59 DIA, .65 W, .5 L BE CU	28480	1400-0537
MP12	01220-65202	1	HOUSING	28480	01220-65202
MP13	01220-24721	1	EXTRUSION SPACER	28480	01220-24721
MP14	01220-00225	1	PANEL, FRONT	28480	01220-00225
MP15	01220-04121	1	COVER, HOUSING	28480	01220-04121
MP16	01220 42201	1	BEZEL	28480	01220 42201
MP17	01220 42301	1	HOLDER, TUBE	28480	01220 42301
MP18	4-14 0521	1	FILTER, BLUE LIGHT	28480	4-14 0521
MP19	5000 8895	1	PLATE, SAFETY	28480	5000 8895
MP20	01220 44101	2	COVER, HANDLE	28480	01220 44101
MP21	5000 8893	1	HANDLE, SIDE	28480	5000 8893
MP22	5000 8894	2	HANDLE STRAP	28480	5000 8894
MP23	1720 0202	1	SHIELD, CRT	28480	1720 0202
MP24	1460 1406	1	TILT STAND, SST	28480	1460 1406
MP25	01220 43203	2	SHAFT, LONG	28480	01220 43203
MP26	01220 43206	1	SHAFT, BEAM FINDER	28480	01220 43206
MP27			NOT ASSIGNED		
MP28	01220 42303	1	HV HOLDER	28480	01220 42303
MP29	1460-1441	1	SPRING	28480	1460-1441
MP30	01220 44106	1	HV BOARD COVER	28480	01220 44106
MP31	01220 05401	1	INSULATOR	28480	01220 05401
MP32	1400 0547	1	CLIP LED MOUNTING	28480	1400 0547
MP33	1400 0540	1	RETAINER RING-LED CLIP	21848	7212-19-1-A002
MP34	4320 0299	1	RUBBER EXTRUSION	28480	4320 0299
MP40	5040-1126	4	KNOB PUSH BUTTON-GRY	28480	5040-1126
MP41	5040-1127	5	KNOB PUSH BUTTON-GRN	28480	5040-1127
MP42	5040-1128	4	KNOB PUSH BUTTON-BLUE	28480	5040-1128
MP43	01220-00621	2	SHIELD, ATTENUATOR	28480	01220-00621
R1	2100 2488	3	RESISTOR-VAR 10K 20% CC (CH A POSITION)	28480	2100 2488
R2	2100 2488		RESISTOR-VAR 10K 20% CC (CH B POSITION)	28480	2100 2488
R3	2100 2488		RESISTOR-VAR 10K 20% CC (HORIZ POSITION)	28480	2100 2488
R4	2100 3451	1	RESISTOR-VAR 10K 20% CC (TRIGGER LEVEL)	28480	2100 3451
S1	3101-2269	1	SWITCH TGL SUBMIN DPDT NS 2A 250VAC	28480	3101-2269
V1	2090-0708	1	CRT, P31	28480	2090-0708
W1	01220-61626	1	CABLE POWER PWR MODULE	28480	01220-61626
W2	01220-61622	1	CABLE ASSEMBLY, HV INTERCONNECT	28480	01220-61620
W3	01220-61623	1	CABLE ASSEMBLY, POTENTIOMETER	28480	01220-61623
W4	01220-61629	1	CABLE ASSEMBLY, CRT	28480	01220-61629
W5	01220-61628	1	CABLE ASSEMBLY, POWER SWITCH	28480	01220-61628

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
71	0122266531	1	HORIZONTAL SWEEP ASSEMBLY	28487	0122266531
71A1		1	TRIGGER ASSEMBLY, NSR, ORDER A1		
A1A1C1	0160-0174	3	CAPACITOR-FXD .047UF +80-20% 250WVDC CER	28480	0160-0174
A1A1C2	0160-2913	2	CAPACITOR-FXD .05UF +20% 500WVDC CER	28480	0160-2903
A1A1C3	0160-4213	17	CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C4	0160-3233	4	CAPACITOR-FXD .025UF +80-20% 100WVDC CER	28480	0160-3233
A1A1C5	0160-4213	4	CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C6	0160-3451	12	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C8	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C9	0121-0164	2	CAPACITOR VAR: TAPR: P5T4% .2/1.5PF	28480	0121-0164
A1A1C10	0160-2903	2	CAPACITOR-FXD .05UF +20% 500WVDC	28480	0160-2903
A1A1C11	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C12	0121-0164		CAPACITOR VAR: TAPR: P5T4% .2/1.5PF	28480	0121-0164
A1A1C13	0160-2903		CAPACITOR-FXD .05UF +20% 500WVDC CER	28480	0160-2903
A1A1C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C15	0160-2959	16	CAPACITOR-FXD 1000PF +80-20% 100WVDC	28480	0160-2959
A1A1C16	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C17	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C18	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C19	0160-2913	1	CAPACITOR-FXD .01UF +85-20% 100WVDC CER	28480	0160-2913
A1A1C20	0160-3208		CAPACITOR-FXD .025UF +80-20% 100WVDC CER	28480	0160-3208
A1A1C21	0160-3203		CAPACITOR-FXD .025UF +80-20% 100WVDC CER	28480	0160-3203
A1A1C22	0160-0423	3	CAPACITOR-FXD 100UF +50-10% 25VDC AL	28480	0160-0423
A1A1C23	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C24	0160-0374	1	CAPACITOR-FXD: 100UF +10% 20VDC TA-SOLID	56235	15001049020P2
A1A1C25	0160-2959		CAPACITOR-FXD 1000PF +80-20% 100WVDC	28480	0160-2959
A1A1C26	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C27	0180-0229	1	CAPACITOR-FXD 33UF +10% 10VDC TA-SOLID	04200	15003369010B2
A1A1C28	0160-2141	1	CAPACITOR-FXD 680 PF +20% 1000WVDC	28480	0160-2141
A1A1C29	0160-2218	3	CAPACITOR-FXD 1000PF +5% 300WVDC MICA	28480	0160-2218
A1A1C30	0160-2218		CAPACITOR-FXD 1000PF +5% 300WVDC MICA	28480	0160-2218
A1A1C31	0160-0174		CAPACITOR-FXD .047UF +80-20% 250WVDC CER	28480	0160-0174
A1A1C32	0160-0174	1	CAPACITOR-FXD 150PF +5% 300WVDC MICA	72176	0160-0174
A1A1C33	0121-0476	1	CIVIL POLY 5.5-6.5 PF 100VDC	28480	0121-0476
A1A1C34	0160-3039	1	CAPACITOR-FXD 502PF +1% 100VDC MICA	28480	0160-3039
A1A1C35	0160-3255	1	CAPACITOR-FXD .01UF +1% 250WVDC POLYSTY	28480	0160-3255
A1A1C36	0160-0599	1	CAPACITOR-FXD 10UF +2% 63WVDC MET POLYC	28480	0160-0599
A1A1C37	0160-2959		CAPACITOR-FXD 1000PF +80-20% 100WVDC	28480	0160-2959
A1A1C38	0160-2249	1	CAPACITOR-FXD 12PF +5% 500WVDC CER	28480	0160-2249
A1A1C39	0160-2261	1	CAPACITOR-FXD 13PF +5% 500WVDC CER	28480	0160-2261
A1A1C40	0160-2903		CAPACITOR-FXD .05UF +20% 500WVDC CER	28480	0160-2903
A1A1C41	0160-2959		CAPACITOR-FXD 1000PF +80-20% 100WVDC	28480	0160-2959
A1A1C42	0160-2959		CAPACITOR-FXD 1000PF +80-20% 100WVDC	28480	0160-2959
A1A1C43	0160-0174		CAPACITOR-FXD .047UF +80-20% 250WVDC CER	28480	0160-0174
A1A1C44	0160-4213		CAPACITOR-FXD .01UF +20% 50WVDC POLYE	28480	0160-4213
A1A1C45	0160-2204	1	CAPACITOR-FXD 100PF +5% 300WVDC MICA	28480	0160-2204
A1A1C46	0160-0114	1	CAPACITOR-FXD 220PF +5% 300WVDC MICA	28480	0160-0114
A1A1C47	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A1A1C48	1901-0040	25	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C49	1901-0376	5	DIODE-GEN PRP 35V 50MA	28480	1901-0376
A1A1C50	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C51	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C52	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C53	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C54	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C55	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C56	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C57	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C58	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C59	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C60	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C61	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C62	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C63	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C64	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C65	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C66	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1C67	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C68	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C69	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C70	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1A1C71	1251-4853	1	CONNECTOR 16-PIN	28480	1251-4853
A1A1C72	1251-4852	1	CONNECTOR 4-PIN	28480	1251-4852
A1A1C73	1205-0035	6	MULTI-DISSIPATOR SGL TL-572-39 Pkg	28480	1205-0035
A1A1C74	01220-43202	1	COUPLER, SWITCH	28480	01220-43202

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A131	1854-0019	2	TRANSISTOR NPN SI T ₀ -11 P ₀ =300mW	28490	1854-0019
A1A132	1853-0218	2	TRANSISTOR PNP SI T ₀ -14 P ₀ =360mW	28490	1853-0218
A1A133	1854-0637	4	TRANSISTOR NPN 2N2219A SI T ₀ -5 P ₀ =800mW	28490	1854-0637
A1A134	1854-0637		TRANSISTOR NPN 2N2219A SI T ₀ -5 P ₀ =800mW	28490	1854-0637
A1A135	1853-0314	4	TRANSISTOR PNP 2N2905A SI T ₀ -5 P ₀ =600mW	04713	2N2905A
A1A136	1853-0314		TRANSISTOR PNP 2N2905A SI T ₀ -5 P ₀ =600mW	04713	2N2905A
A1A137	1854-0019		TRANSISTOR NPN SI T ₀ -18 P ₀ =360mW	28490	1854-0019
A1A138	1853-0218		TRANSISTOR PNP SI T ₀ -18 P ₀ =360mW	28490	1853-0218
A1A139	1854-0637		TRANSISTOR NPN 2N2219A SI T ₀ -5 P ₀ =800mW	28490	1854-0637
A1A140	1854-0637		TRANSISTOR NPN 2N2219A SI T ₀ -5 P ₀ =800mW	28490	1854-0637
A1A141	1853-0314		TRANSISTOR PNP 2N2905A SI T ₀ -5 P ₀ =600mW	04713	2N2905A
A1A142	1853-0314		TRANSISTOR PNP 2N2905A SI T ₀ -5 P ₀ =600mW	04713	2N2905A
A1A143	1853-0201	1	TRANSISTOR J-FET N-CHAN D-MODE SI	28490	1853-0201
A1A144	1853-0036	14	TRANSISTOR PNP SI P ₀ =310mW FT=250MHZ	28490	1853-0036
A1A145	1854-0071	12	TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A146	1853-0036		TRANSISTOR PNP SI P ₀ =310mW FT=250MHZ	28490	1853-0036
A1A147	1854-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A148	1853-0036		TRANSISTOR PNP SI P ₀ =310mW FT=250MHZ	28490	1853-0036
A1A149	1853-0036		TRANSISTOR PNP SI P ₀ =310mW FT=250MHZ	28490	1853-0036
A1A150	1854-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A151	1854-0236	1	TRANSISTOR NPN SI T ₀ -92 P ₀ =310mW	28490	1854-0236
A1A152	1854-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A153	1854-0005	1	TRANSISTOR NPN 2N708 SI T ₀ -18 P ₀ =360mW	28490	1854-0005
A1A154	1853-0086	1	TRANSISTOR PNP SI P ₀ =310mW FT=40MHZ	28490	1853-0086
A1A155	1854-0392	1	TRANSISTOR NPN SI P ₀ =310mW FT=50MHZ	28490	1854-0392
A1A156	1853-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1853-0071
A1A157	1853-0049	2	TRANSISTOR PNP 2N4917 SI P ₀ =200mW	07263	2N4917
A1A158	1853-0049		TRANSISTOR PNP 2N4917 SI P ₀ =200mW	07263	2N4917
A1A159	1854-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A160	1854-0071		TRANSISTOR NPN SI P ₀ =300mW FT=200MHZ	28490	1854-0071
A1A161	1854-0621	2	TRANSISTOR NPN SI T ₀ -39 P ₀ =800mW	01295	BF258
A1A162	1854-0621		TRANSISTOR NPN SI T ₀ -39 P ₀ =800mW	01295	BF258
A1A163	1853-0038	4	TRANSISTOR PNP SI PD IW FT=100MHZ	28480	1853-0038
A1A164	1853-0038		TRANSISTOR PNP SI PD IW FT=100MHZ	28480	1853-0038
A1A165	1853-0038		TRANSISTOR PNP SI PD IW FT=100MHZ	28480	1853-0038
A1A166	1853-0038		TRANSISTOR PNP SI PD IW FT=100MHZ	28480	1853-0038
A1A167	1854-0215	7	TRANSISTOR NPN SI P ₀ =310mW FT=300MHZ	04713	SPS 2611
A1A168	0757-0494	8	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/B-T0-51R1-F
A1A169	0757-0427	2	RESISTOR 24.3K 1% .125W F TC=0+-100	24546	C4-1/B-T0-2432-F
A1A170	0757-0427	13	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A171	0757-0401	19	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A172	0757-0440	7	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-7501-F
A1A173	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-7501-F
A1A174	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A175	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A176	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A177	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A178	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A179	0757-0394		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/B-T0-51R1-F
A1A180	0757-0491		RESISTOR 24.3K 1% .125W F TC=0+-100	24546	C4-1/B-T0-2432-F
A1A181	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A182	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A183	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1501-F
A1A184	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-7501-F
A1A185	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/B-T0-7501-F
A1A186	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A187	0757-0005	8	RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A188	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A189	0757-0232	6	RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/B-T0-221R-F
A1A190	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A191	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A192	0757-0232		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/B-T0-221R-F
A1A193	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A194	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A195	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A196	0757-0232		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/B-T0-221R-F
A1A197	0758-0005		RESISTOR 4.7K 5% .25W F TC=0+-100	24546	C5-1/A-T0-4701-J
A1A198	0757-0232		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/B-T0-221R-F
A1A199	0698-4467	2	RESISTOR 1.39K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1391-F
A1A200	0753-0019	1	RESISTOR 18K 5% .25W F TC=0+-100	24546	C5-1/A-T0-1802-J
A1A201	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A202	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F
A1A203	0698-3155	2	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/B-T0-4641-F
A1A204	0698-2155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/B-T0-4641-F
A1A205	0757-0276	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/B-T0-1781-F
A1A206	0757-0411	3	RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/B-T0-2431-F
A1A207	0757-0411		RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/B-T0-2431-F
A1A208	0643-5145	1	RESISTOR 510K 5% .25W FC TC=0-100/+500	01121	CP5145
A1A209	0757-0475	1	RESISTOR 274K 1% .125W F TC=0+-100	24546	C4-1/B-T0-2743-F
A1A210	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/B-T0-101-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1R41	0757-0238	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF7C1/2-T0-3322-F
A1A1R42	0757-0431		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A1R43	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A1R44	0757-0233	7	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R45	0757-0419	3	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681-F
A1A1R46	0757-0416	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511-F
A1A1R47	0757-0346	15	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A1R48	0698-3540	1	RESISTOR 15.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1542-F
A1A1R49	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A1A1R50	0698-3150	2	RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A1A1R51	2100-3349	1	RESISTOR-VAR TRMR 100 OHM 10% C SIDE ADJ	73138	T2PR100
A1A1R52	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A1A1R53	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1A1R54	0698-4453	2	RESISTOR 402 1% .125W F TC=0+-100	24546	C4-1/8-T0-402R-F
A1A1R55	0757-0274	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1A1R56	0698-4453		RESISTOR 402 1% .125W F TC=0+-100	24546	C4-1/8-T0-402R-F
A1A1R57	0698-4439	2	RESISTOR 3.24K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3241-F
A1A1R58	0757-0374		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-511-F
A1A1R59	0698-4439		RESISTOR 3.24K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3241-F
A1A1R60	0757-0424	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A1A1R61	0683-1055	2	RESISTOR 1M 5% .25W FC TC=-300/+900	01121	C81055
A1A1R62	0757-0449	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A1A1R63	0757-0448	2	RESISTOR 130K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1301-F
A1A1R64	0698-4476	1	RESISTOR 45.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4532-F
A1A1R65	0757-0449	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1A1R66	0757-0459	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A1A1R67	0757-0280	22	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A1R68	0698-4495	3	RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A1A1R69	0757-0465	15	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A1A1R70	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A1A1R71	0757-0278	1	RESISTOR FXD 316K 1% .125W F	24546	C4-1/8-T0-3161-F
A1A1R72	0757-0431		RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2431-F
A1A1R73	0757-0457	2	RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4752-F
A1A1R74	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A1R75	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511-F
A1A1R76	0757-0457		RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4752-F
A1A1R77	0698-4471	1	RESISTOR 7.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7151-F
A1A1R78	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R79	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R80	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A1R81	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R82	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R83	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A1R84	0757-0410	5	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A1A1R85	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A1A1R86	0757-0420	7	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1A1R87	0757-0290		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1A1R88	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A1R89	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A1R90	0757-0438	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1A1R91	0758-0006	1	RESISTOR 10K 5% .25W F TC=0+-100	24546	C5-1/4-T0-1002-J
A1A1R92	0757-0437	14	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A1A1R93	0757-0453	1	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A1A1R94	0757-0427	1	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A1A1R95	2100-3211	1	RESISTOR-VAR TRMR 1KOHM 10% C TOP ADJ	73138	T2PR1K
A1A1R96	0757-0430	2	RESISTOR 221K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A1A1R97	0698-3225	2	RESISTOR 143K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1431-F
A1A1R98	0698-3530	1	RESISTOR 470 0.5% .125W F TC=0+-100	05524	CMF 55-T1
A1A1R99	0757-0282		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/8-T0-221-F
A1A1R100	0698-4495		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A1A1R101	0757-0464	1	RESISTOR FXD 332K 1% .125W F	24546	C4-1/8-T0-3322-F
A1A1R102	0757-0379	9	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-825-F
A1A1R103	2100-3252	3	RESISTOR-VAR TRMR 5KOHM 10% C TOP ADJ	73138	T2PR5K
A1A1R104	0698-4495		RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A1A1R105	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-825-F
A1A1R106	0757-0044	2	RESISTOR 33.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-3322-F
A1A1R107	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1A1R108	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1A1R109	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-825-F
A1A1R110	0757-0044		RESISTOR 33.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-3322-F
A1A1R111	0698-3225		RESISTOR 1.43K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1431-F
A1A1R112	0761-0028	4	RESISTOR 12K 5% 1W NO TC=0+-200	24546	FP32-1-T00-1202-J
A1A1R113	0761-0028		RESISTOR 12K 5% 1W NO TC=0+-200	24546	FP32-1-T00-1202-J
A1A1R114	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-825-F
A1A1R115	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-825-F

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1R116 A1A1R117 A1A1F118 A1A1R119 A1A1R120	0761-0021 0761-0023 0757-0277 0757-0319 0757-0369	1	RESISTOR 12K 5% 1W MO TC=0+-210 RESISTOR 12K 5% 1W MO TC=0+-210 RESISTOR 82.5 1% .125W F TC=0+-100 RESISTOR 82.5 1% .125W F TC=0+-100 RESISTOR 150K 1% .125W F TC=0+-100	24546 24546 24546 24546 24546	FP32-1-T00-1202-J FP32-1-T00-1202-J CA-1/8-T0-8250-F CA-1/8-T0-8250-F CA-1/8-T0-1500-F
A1A1R121 A1A1R122 A1A1R123 A1A1R124 A1A1R125	0757-0817 0757-0817 0757-0211 0757-0449 0699-3131	6	RESISTOR 511 1% .125W F TC=0+-100 RESISTOR 511 1% .125W F TC=0+-100 RESISTOR 1K 1% .125W F TC=0+-100 RESISTOR 20K 1% .125W F TC=0+-100 RESISTOR 2.87K 1% .125W F TC=0+-100	24546 24546 24546 24546 16299	CA-1/8-T0-511R-F CA-1/8-T0-511R-F CA-1/8-1001-F CA-1/8-T0-2002-F CA-1/8-T0-2871-F
A1A1R126 A1A1P127 A1A1R128 A1A1R129 A1A1R130	0757-0212 2100-2350 0699-3730 0699-3433	1 1 1 1	NOT ASSIGNED RESISTOR 22K 1% .125W F TC=0+-100 RESISTOR-VAR TRMR 200 OHM 10% C SIDE ADJ RESISTOR 715 1% .125W F TC=0+-100 RESISTOR 6.65K 1% .125W F TC=0+-100	24546 71138 16299 16299	CA-1/8-T0-221R-F 72XP200 CA-1/8-T0-715R-F CA-1/8-T0-665R-F
A1A1R131 A1A1R132	2100-3207 0757-0034	1 1	RESISTOR-VAR TRMR 500HM 10% C SIDE ADJ RESISTOR 20K 5% .25W F TC=0+-100	32597 24546	3385X-502 CA-1/8-T0-2032-J
A1A1S1 A1A1S2	3101-0562 3101-1930	1 1	SWITCH: PA -STA OPDT SWITCH	28480 28480	3101-0562 3101-1930
A1A1U1 A1A1U2 A1A1U3 A1A1U4 A1A1U5	1820-0424 1820-0054 1820-1112 1820-0370 1820-0337	1 3 1 1 1	IC SN74L04 N IC SN7400 N IC SN74LS74 N SN74HOON IC SN7413 N	01295 01295 01295 01295 01295	SN74L04N SN7400N SN74LS74N SN74HOON SN7413N
A1A1U6 A1A1U7 A1A1U8	1820-0054 1820-0715 1820-0736	1 1 1	IC SN7400 N IC SN74H106 N IC SN74122 N	01295 01295 01295	SN7400N SN74H106N SN74122N
A1A1V1 A1A1V2 A1A1V3 A1A1V4 A1A1V5	1902-3125 1902-3092 1902-3092 1902-0048 1902-0064	1 2 1 1 1	DIODE ZENER 6.88V 1W 4W MAX PD DIODE ZNR 4.99V 2% DO-7 PD = 4W TC = 012% DIODE ZNR 4.99V 2% DO-7 PD = 4W TC = 012% DIODE ZNR 6.81V 5% DO-7 PD = 0.4W TC = 012% DIODE ZNR 7.5V 5% DO-7 PD = 4W TC = +05%	04713 04713 04713 02037 04713	SZ-10939-138 SZ-10939-96 SZ-10939-86 SZ-30016-134 SZ-10939-146
A1A2	01220-61911	1	SWITCH, POTARY, TIME/DIV	28480	01220-61911
A1A2MP1	01220-00624	1	BRACKET	28480	01220-00624
A1A2R1	2100-3911	1	RESISTOR-VAR 25K 20% C0	23480	2100-3911
A1A2A1	01220-66533	1	SWITCH, P/O TIME/DIV	28480	01220-66533
A1A2A1C1 A1A2A1C2 A1A2A1C3 A1A2A1C4	0160-2218 0160-3594 0160-1745 0160-0227	1 1 1 1	CAPACITOR-FXD 1000PF +-5% 300VDC MICA CAPACITOR-FXD .027UF +-10% 250VDC TCT CAPACITOR-FKDE 1.5UF+-10% 20VDC TA CAPACITOR-FKDE 330PF+-10% 10VDC TA-5-10	28480 44051 56259 56239	0160-2218 06JPM-4770K 1500155X1020A2 1500332X1010A2
A1A2A1R1 A1A2A1R2	0757-0420 0757-0200	1 16	RESISTOR 750 1% .125W F TC=0+-100 RESISTOR 5.62K 1% .125W F TC=0+-100	02273 24546	CEA-993 CA-1/8-T0-5621-F
A1A2A1S1	3130-1635	1	SHAFT AND INDEX ASSY	28480	3130-1635
A1A2A2	01220-66522	1	SWITCH, P/O TIME/DIV	28480	01220-66522
A1A2A2R1 A1A2A2R2 A1A2A2R3 A1A2A2R4 A1A2A2R5	0698-3327 0698-6858 0698-6885 0698-7793 0698-5573	1 1 1 1 1	RESISTOR 3.92K 5% .125W F TC=0+-50 RESISTOR 7.96K 5% .125W F TC=0+-50 RESISTOR 20K 5% .125W F TC=0+-50 RESISTOR 9.9K 25% .125W F TC=0+-50 RESISTOR 50K 5% .125W F TC=0+-50	05524 05524 03888 02985 24546	CMF-55-1, T-1 CMF-55-1, T-1 PME 555 MF4c1/8-T0-9901-C CA-1/8-T0-5002-D
A1A2A2R6 A1A2A2P7 A1A2A2R8	0698-6773 0698-6217 0698-3263	1 1 1	RESISTOR 100K 5% .125W F TC=0+-50 RESISTOR 200K 5% .125W F TC=0+-100 RESISTOR 500K 1% .125W F TC=0+-100	03888 03888 01637	PME 555 PME 555 MFR-1/8, T-1
A2	01222-66537	1	VERTICAL ASSEMBLY	28480	01222-66537
A2A1	01222-66528	1	DELAY LINE DRIVER ASSEMBLY	28480	01222-66528
A2A1C1 A2A1C2 A2A1C3 A2A1C4 A2A1C5 A2A1CR1 A2A1CR2	0140-0919 0160-2307 0160-2307 0160-2940 0160-1704 1901-0535 1901-0535	1 2 1 1 1 1 1	CAPACITOR-FXD 39PF +-5% 300VDC MICA CAPACITOR-FXD 47PF +-5% 300VDC MICA CAPACITOR-FXD 47PF +-5% 300VDC MICA CAPACITOR-FXD 470PF +-5% 300VDC MICA CAPACITOR-FXD electrolytic 47uF +-10% 6VDC DIODE-SCHOTTKY DIODE-SCHOTTKY	72136 28480 28480 28480 16299 8480 28480	DM15F390J0300VVICR 0160-2307 0160-2307 0160-2940 1500476X9006B2 1901-0535 1901-0535
A2A1P1 A2A1P2 A2A1P3	1251-0568 1251-0568	2	NSP, P/O A2A1 CONNECTOR, PCST TYPE CONNECTOR, PCST TYPE	28480 28480	1251-0568 1251-0568

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A101	1853-0035		TRANSISTOR PNP SI PD=310MH FT=250MHZ	28480	1853-0035
A2A102	1853-0036		TRANSISTOR PNP SI PD=310MH FT=250MHZ	28480	1853-0036
A2A103	1853-0036		TRANSISTOR PNP SI PD=310MH FT=250MHZ	28480	1853-0036
A2A104	1853-0036		TRANSISTOR PNP SI PD=310MH FT=250MHZ	28480	1853-0036
A2A1R1	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	CA-1/R-T0-301-F
A2A1R2	0757-0210		RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-1/R-T0-1001-F
A2A1R3	0498-4467		RESISTOR 1.0% 1K 1% .125W F TC=0+-100	24546	CA-1/R-T0-1001-F
A2A1R4	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	CA-1/R-T0-301-F
A2A1R5	0757-0210		RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-1/R-T0-1001-F
A2A1R6	0757-0174	4	RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/R-T0-20R-F
A2A1R7	0698-4405	1	RESISTOR 127 1% .125W F TC=0+-100	16299	CA-1/R-T0-127-F
A2A1R8	0757-0417	1	RESISTOR 562 1% .125W F TC=0+-100	24546	CA-1/R-T0-562R-F
A2A1R9	0757-0173	8	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/R-T0-3011-F
A2A1R10	0698-3224	1	RESISTOR 4.49K 1% .125W F TC=0+-100	16299	CA-1/R-T0-4491-F
A2A1R11	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2871-F
A2A1R12	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2871-F
A2A1R13	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2871-F
A2A1R14	0698-4435	2	RESISTOR 2.49K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2491-F
A2A1R15	0698-4435		RESISTOR 2.49K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2491-F
A2A1R16	0757-0315	2	RESISTOR 42.2 1% .125W F TC=0+-100	24546	CA-1/R-T0-42R2-F
A2A1R17	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	CA-1/R-T0-42R2-F
A2A1R18	0757-0344		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/R-T0-20R-F
A2A1R19	0757-0344		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/R-T0-20R-F
A2A1R20	0757-0344		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/R-T0-20R-F
A2A1R21	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	CA-1/R-T0-2871-F
A2A1R22	0757-0403		RESISTOR-FXD 121 OHM 1% .125W F	24546	CA-1/R-T0-121R-F
A2A1R23	0757-0250	1	RESISTOR-FXD 6190K ±1% .125W F TC=0±100	24546	MF4C1/R-T0-6190-F
A2A1U1	1821-0002	5	IC CA3045	02735	CA3045
A2A1VR1	1702-0126	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.0737	04713	SZ 1C939-14
A2A2		1	VERTICAL AMPLIFIER ASSEMBLY, NSR-ORDER A2		
A2A2C1	0180-0424	3	CAPACITOR FXD 470 UF 25 WVDC	28480	0180-0424
A2A2C2	0180-4213		CAPACITOR-FXD .1UF +-20% 50VDC POLYE	28480	0180-4213
A2A2C3	0180-.475	2	CAPACITOR FXD 4.7 UF 250 WVDC	28480	0180-0425
A2A2C4	0180-0426	2	CAPACITOR FXD 22 UF 250 WVDC	28480	0180-0426
A2A2C5	0180-0425		CAPACITOR FXD 4.7 UF 250 WVDC	28480	0180-0425
A2A2C6	0180-0426		CAPACITOR FXD 22 UF 250 WVDC	28480	0180-0426
A2A2C7	0180-3719	1	CAPACITOR-FXD .068UF +-10% 250VDC MET	28480	0180-3719
A2A2C8	0180-3447	5	CAPACITOR-FXD 470PF +-10% 1000VDC CER	28480	0180-3447
A2A2C9	0180-3451		CAPACITOR-FXD .01UF +-80-20% 100VDC CER	28480	0180-3451
A2A2C10	0180-3451		CAPACITOR-FXD .01UF +-80-20% 100VDC CER	28480	0180-3451
A2A2C11	0180-0424		CAPACITOR FXD 470 UF 25 WVDC	28480	0180-0424
A2A2C12	0180-2141	1	CAPACITOR-FXD 680PF +-20% 1000VDC CER	28480	0180-2141
A2A2C13	0180-0423		CAPACITOR-FXD 100UF +-50-10% 25VDC AL	28480	0180-0423
A2A2C14	0180-0424		CAPACITOR FXD 470 UF 25 WVDC	28480	0180-0424
A2A2C15	0180-0423		CAPACITOR-FXD 100UF +-50-10% 25VDC AL	28480	0180-0423
A2A2C16	0180-3591	2	CAPACITOR-FXD .1UF +-20% 1000VDC MET	28480	0180-3591
A2A2C17	0121-0061	4	CAPACITOR; VAR; TRM; CER; 5.5/13PF	73899	DV11P51A
A2A2C18	0121-0060	4	CAPACITOR; VAR; TRM; CER; 2/8PF	73899	DV11P58A
A2A2C19	0140-0191	2	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15F560J0300VDCR
A2A2C20	0121-0061		CAPACITOR; VAR; TRM; CER; 5.5/13PF	73899	DV11P51A
A2A2C21	0121-0060		CAPACITOR; VAR; TRM; CER; 2/8PF	73899	DV11P58A
A2A2C22	0160-2540		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2540
A2A2C23	0160-3224	2	CAPACITOR-FXD .01UF +-10% 400VDC MET	28480	0160-3224
A2A2C24	0160-3447		CAPACITOR-FXD 470PF +-10% 1000VDC CER	28480	0160-3447
A2A2C25	0160-3447		CAPACITOR-FXD 470PF +-10% 1000VDC CER	28480	0160-3447
A2A2C26	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C27	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C28	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C29	0150-0059	2	CAPACITOR-FXD 3.3PF +-25PF 500VDC CER	28480	0150-0059
A2A2C30	0160-3591		CAPACITOR-FXD .1UF +-20% 1000VDC MET	28480	0160-3591
A2A2C31	0121-0061		CAPACITOR; VAR; TRM; CER; 5.5/13PF	73899	DV11P51A
A2A2C32	0121-0060		CAPACITOR; VAR; TRM; CER; 2/8PF	73899	DV11P58A
A2A2C33	0140-0191		CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15F560J0300VDCR
A2A2C34	0121-0061		CAPACITOR; VAR; TRM; CER; 5.5/13PF	73899	DV11P51A
A2A2C35	0121-0060		CAPACITOR; VAR; TRM; CER; 2/8PF	73899	DV11P58A
A2A2C36	0160-2940		CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0160-2940
A2A2C37	0160-3224		CAPACITOR-FXD .01UF +-10% 400VDC MET	28480	0160-3224
A2A2C38	0160-3447		CAPACITOR-FXD 470PF +-10% 1000VDC CER	28480	0160-3447
A2A2C39	0160-3447		CAPACITOR-FXD 470PF +-10% 1000VDC CER	28480	0160-3447
A2A2C40	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C41	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C42	0160-2959		CAPACITOR-FXD 1000PF +-80-20% 1000VDC	28480	0160-2959
A2A2C43	0150-0059		CAPACITOR-FXD 3.3PF +-25PF 500VDC CER	28480	0150-0059
A2A2C44	0160-4213		CAPACITOR-FXD .1UF +-20% 50VDC POLYE	28480	0160-4213
A2A2C45	0160-3209		CAPACITOR-FXD .025UF +-50-20% 100VDC CER	28480	0160-3209

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number	
A2A2C46	0160-4213	2	CAPACITOR-FXD .1UF +-20% 50WVDC POLYE	28480	0160-4213	
A2A2C47	0160-3208		CAPACITOR-FXD .025UF +-80-20% 100WVDC CER	28480	0160-3208	
A2A2C48	0121-0475		CAPACITOR-VAR 222PF	28480	0121-0475	
A2A2C49	0121-0475		CAPACITOR-VAR 222PF	28480	0121-0475	
A2A2C50	0160-2959		CAPACITOR-FXD 1000PF +-10-20% 100WVDC	28480	0160-2959	
A2A2C51	0160-2959	1	CAPACITOR-FXD 1000PF +-30-20% 1000WVDC	28480	0160-2959	
A2A2C52	0180-0155		CAPACITOR FXD 2.2UF +-20% 20WVDC TA	58289	150D225X0020A2	
A2A2C53	0160-4213		CAPACITOR-FXD .1UF +-20% 50WVDC POLYE	28480	0160-4213	
A2A2C54	0160-3208		CAPACITOR-FXD .025UF +-80-20% 100WVDC CER	28480	0160-3208	
A2A2C55	0160-4213		CAPACITOR-FXD .1UF +-20% 50WVDC POLYE	28480	0160-4213	
A2A2C56	0160-3208	1	CAPACITOR-FXD .025UF +-80-20% 100WVDC CER	28480	0160-3208	
A2A2C57	0160-3431		CAPACITOR-FXD .01UF +-80-20% 100WVDC CER	28480	0160-3431	
A2A2C58	0160-4213		CAPACITOR-FXD .1UF +-20% 50WVDC POLYE	28480	0160-4213	
A2A2C59	0160-4213		CAPACITOR-FXD .1UF +-20% 50WVDC POLYE	28480	0160-4213	
A2A2C60	0140-0202		CAPACITOR-FXD 15PF +-5% 500WVDC MICA	72136	PM15C15J0500WVDC	
A2A2C61	0160-2205	1	CAPACITOR-FXD 120PF +-5% 300WVDC MICA	25480	0160-2205	
A2A2C62	0160-3451		CAPACITOR FXD .01UF +-80-20% 100WVDC CER	28480	0160-3451	
A2A2C63	0160-3451		CAPACITOR FXD .01UF +-80-20% 100WVDC CER	28480	0160-3451	
A2A2CR1	1901-0743		24	DIODE-PWR RECT 400V 750MA	02682	IN4004
A2A2CR2	1901-0743			DIODE-PWR RECT 400V 750MA	02682	IN4004
A2A2CR3	1901-0743	DIODE-PWR RECT 400V 750MA		02682	IN4004	
A2A2CR4	1901-0743	DIODE-PWR RECT 400V 750MA		02682	IN4004	
A2A2CR5	1901-0743	DIODE-PWR RECT 400V 750MA		02682	IN4004	
A2A2CR6	1901-0743	1	DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR7	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR8	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR9	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR10	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR11	1901-0743	1	DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR12	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR13	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR14	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR15	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR16	1901-0743	1	DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR17	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR18	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR19	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR20	1901-0743		DIODE-PWR RECT 400V 750MA	02682	IN4004	
A2A2CR21	1901-0376	6	DIODE-GEN PRP 35V 50MA	28480	1901-0376	
A2A2CR22	1901-0376		DIODE-GEN PRP 35V 50MA	28480	1901-0376	
A2A2CR23	1901-0358		DIODE; MULT; SILICON; DUAL NOT ASSIGNED	04713	MSD6101	
A2A2CR24	1901-0376		DIODE-GEN PRP 35V 50MA	28480	1901-0376	
A2A2CR25	1901-0376		DIODE-GEN PRP 35V 50MA	28480	1901-0376	
A2A2CR26	1901-0376	1	DIODE-GEN PRP 35V 50MA	28480	1901-0376	
A2A2CR27	1901-0358		DIODE; MULT; SILICON; DUAL NOT ASSIGNED	04713	MSD6101	
A2A2CR28	1901-0358		DIODE; MULT; SILICON; DUAL NOT ASSIGNED	04713	MSD6101	
A2A2CR29	1901-0358		DIODE; MULT; SILICON; DUAL	04713	MSD6101	
A2A2CR30	1901-0358		DIODE; MULT; SILICON; DUAL	04713	MSD6101	
A2A2CR31	1901-0358	1	DIODE; MULT; SILICON; DUAL	04713	MSD6101	
A2A2CR32	1901-0358		DIODE; MULT; SILICON; DUAL	04713	MSD6101	
A2A2CR33	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR34	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR35	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR36	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR37	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR38	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR39	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR40	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR41	1901-0040	1	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2CR42	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040	
A2A2J1	1250-0518	3	CONNECTOR:BNC	28480	1250-0518	
A2A2J2	1250-0518		CONNECTOR:BNC	28480	1250-0518	
A2A2J3	1250-0518		CONNECTOR:BNC	28480	1250-0518	
A2A2L1	9140-0114	1	COIL-FXD MOLDED RF CHCKE 10UH 10%	24226	15/102	
A2A2MP1	0340-0530	1	INSULATOR-XSTR	28480	0340-0530	
A2A2MP2	01220-01201		BRACKET, BNC	28480	01220-01201	
A2A2MP3	0340-0473		INSULATOR-XSTR THERMA FILM	28480	0340-0473	
A2A2Q1	1854-0573	1	TRANSISTOR NPN SI PD=30W FT=10MHZ	28480	1854-0573	
A2A2Q2	1854-0402		TRANSISTOR NPN SI PD=30W FT=3MHZ	28480	1854-0402	
A2A2Q3	1854-0402	2	TRANSISTOR NPN SI PD=30W FT=3MHZ	28480	1854-0402	
A2A2Q4	1854-0005		TRANSISTOR NPN SI TO-18 PD=380MW	04713	2N708	
A2A2Q5	1855-0262	2	TRANSISTOR DUAL FET, 51N	28480	1855-0262	

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A206	1854-0071	2	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2A207	1854-0071		TRANSISTOR NPN SI PD=500MW FT=200MHZ	28480	1854-0071
A2A208	5080-1081		TRANSISTOR, MATCHED PAIR	28480	5080-1081
A2A209	1855-0262		TRANSISTOR: DUAL FET, SI N	28480	1855-0262
A2A2010	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2A2011	1854-0071	2	TRANSISTOR, NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2A2012	5080-1081		TRANSISTOR, MATCHED PAIR	28480	5080-1081
A2A2013	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A2A2014	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A2A2015	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A2A2016	1853-0036	2	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A2A2017	1853-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	34713	SPS 3611
A2A2R1	0757-0449	2	RESISTOR 20K 1% .125W F TC=0+-100	24546	CA-1/8-TO-2002-F
A2A2R2	0757-0817		RESISTOR 750 1% 0.5W F TC=0+-100	05524	CMF-65-2
A2A2R3	0761-0069		RESISTOR 5 1K 5% 1W MO TC=0+-200	24546	FP32-1-TOO-5101-J
A2A2R4	0761-0069		RESISTOR 5 1K 5% 1W MO TC=0+-200	24546	FP32-1-TOO-5101-J
A2A2R5	0757-0472		RESISTOR 200K 1% .125W F TC=0+-100	24546	CA-1/8-TO-2003-F
A2A2R6	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1003-F
A2A2R7	0757-0479		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1871-F
A2A2R8	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R9	0757-0364		RESISTOR 20 1% .125W F TC=0+-100	19701	MFAC1/8-TO-20K0-F
A2A2R10	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-3011-F
A2A2R11	0757-0273	2	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/8-TO-3011-F
A2A2R12	0757-0430		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	CA-1/8-TO-2211-F
A2A2R13	2100-0554		RESISTOR-VAR TRMR 500 OHM 10% C TOP ADJ	73138	72PR500
A2A2R14	0757-0461		RESISTOR 48.1K 1% .125W F TC=0+-100	24546	CA-1/8-TO-6812-F
A2A2R15	0699-0077		RESISTOR 93.1K 1% .125W F TC=0+-100	03888	PMF55-1/8-TO-9312-F
A2A2R16	0757-0440	2	RESISTOR 75K 1% .125W F TC=0+-100	24546	CA-1/8-TO-7501-F
A2A2R17	0811-2466		RESISTOR 1.25% .5W PW TC=0+-150	11502	BW 20-1/2-1R2-J
A2A2R18	0698-3518		RESISTOR 732 1% .125W F TC=0+-100	24546	CA-1/8-TO-7321-F
A2A2R19	0757-0438		RESISTOR 5 11K 1% .125W F TC=0+-100	24546	CA-1/8-TO-5111-F
A2A2R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1002-F
A2A2R21	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1002-F
A2A2R22	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TO-201-F
A2A2R23	0811-2466		RESISTOR 1.2 5% .5W PW TC=0+-150	11502	BW20-1/2-1R2-J
A2A2R24	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1501-F
A2A2R25	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1501-F
A2A2R26	0698-3431	2	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PMF55-1/8-TO-23R7-F
A2A2R27	0757-0054		RESISTOR 500K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-9003-F
A2A2R28	0698-5470		RESISTOR 111K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1113-F
A2A2R29	0757-0057		RESISTOR 950K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-9903-F
A2A2R30	0698-2109		RESISTOR 10.1K 1% .125W F TC=0+-100	16299	CA-1/8-TO-1012-F
A2A2R31	0757-0059	2	RESISTOR 1M 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1004-F
A2A2R32	0698-2245		RESISTOR 220K 5% .5W CC TC=0+-82	01121	ER2245
A2A2R33	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	CA-1/8-TO-4751-F
A2A2R34	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	CA-1/8-TO-4751-F
A2A2R35	0757-0431		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TO-101-F
A2A2R36	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CA-1/8-TO-5621-F
A2A2R37	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CA-1/8-TO-5111-F
A2A2R38	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R39	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R40	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	CA-1/8-TO-681R-F
A2A2R41	0757-0449	6	RESISTOR 20K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-2002-F
A2A2R42	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R43	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R44	0699-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	CA-1/8-TO-422R-F
A2A2R45	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R46	0757-0407	7	RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TO-201-F
A2A2R47	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	CA-1/8-TO-422R-F
A2A2R48	0757-0437		RESISTOR 10K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1002-F
A2A2R49	2100-0558		RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	73138	72PR20K
A2A2R50	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-3011-F
A2A2R51	0757-0346	4	RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TJ-10R0-F
A2A2R52	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	CA-1/8-TO-751-F
A2A2R53	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	CA-1/8-TO-751-F
A2A2R54	0698-4384		RESISTOR 54.9 1% .125W F TC=0+-100	16299	CA-1/8-TO-54R9-F
A2A2R55	0698-4384		RESISTOR 54.9 1% .125W F TC=0+-100	16299	CA-1/8-TO-54R9-F
A2A2R56	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TO-10R0-F
A2A2R57	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/8-TO-3011-F
A2A2R58	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CA-1/8-TO-5621-F
A2A2R59	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CA-1/8-TO-5111-F
A2A2R60	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TO-101-F
A2A2R61	0757-0449	2	RESISTOR FXD 20K 1% .125W F TC=0+-100	24546	CA-1/8-TO-20C2-F
A2A2R62	2100-0558		RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	73138	72PR20K
A2A2R63	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TO-10R0-F
A2A2R64	2100-0558		RESISTOR-VAR TRMR 20 K OHM 10% C TOP ADJ	73138	72PR20K
A2A2R65	0757-0454	2	RESISTOR 33.2K 1% .125W F TC=0+-100	24546	CA-1/8-TO-3322-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A2R6c	0757-0230	*	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R67	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A2A2R68	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R69	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422-F
A2A2R70	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A2A2R71	0757-0407	*	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A2A2R72	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R73	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A2A2R74	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R75	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301-F
A2A2R76	0757-0427	*	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A2A2R77	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A2A2R78	0698-3431		RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/3-T0-23R7-F
A2A2R79	0757-0394		RESISTOR 900K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-9003-F
A2A2R80	0698-3470		RESISTOR 111K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1113-F
A2A2R81	0757-0037	*	RESISTOR 990K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-9903-F
A2A2R82	0698-3109		RESISTOR 10.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1012-F
A2A2R83	0757-0059		RESISTOR 1M 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1004-F
A2A2R84	0698-2245		RESISTOR 220K 5% .5W CC TC=0+-100	01121	FP2245
A2A2R85	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A2A2R86	0757-0437	*	RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A2A2R87	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2A2R88	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A2A2R89	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2A2R90	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2A2R91	0757-0465	*	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2A2R92	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A2A2R93	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A2A2R94	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2A2R95	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2A2R96	0698-3447	*	RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422-F
A2A2R97	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2A2R98	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A2A2R99	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422-F
A2A2R100	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2A2R101	2100-0558	*	RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	73138	72PR20K
A2A2R102	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A2A2R103	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R104	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A2A2R105	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A2A2R106	0698-4384	*	RESISTOR 649 1% .125W F TC=0+-100	16299	C4-1/8-T0-54R9-F
A2A2R107	0698-4384		RESISTOR 649 1% .125W F TC=0+-100	16299	C4-1/8-T0-54R9-F
A2A2R108	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R109	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A2A2R110	0757-0230		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A2A2R111	0757-0394	*	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2A2R112	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2A2R113	0757-0449		RESISTOR PAD 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A2A2R114	2100-0558		RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	73138	72PR20K
A2A2R115	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R116	2100-0558	*	RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	73138	72PR20K
A2A2R117	0757-0454		RESISTOR 33.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3322-F
A2A2R118	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R119	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A2A2R120	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R121	0698-3447	*	RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422-F
A2A2R122	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A2A2R123	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A2A2R124	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R125	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A2A2R126	0757-0280	*	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2A2R127	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A2A2R128	0698-4402		RESISTOR 97.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-97R6-F
A2A2R129	0698-4402		RESISTOR 97.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-97R6-F
A2A2R130	0698-3252		RESISTOR 450 1% .125W F TC=0+-50	03888	PME55
A2A2R131	0698-3252	*	RESISTOR 450 1% .125W F TC=0+-50	03888	PME55
A2A2R132	0698-3530		RESISTOR 470 .5% .125W F TC=0+-100	03888	PME55-1/4-T0-470R-0
A2A2R133	0698-3530		RESISTOR 470 .5% .125W F TC=0+-100	03888	PME55-1/4-T0-470R-0
A2A2R134	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R135	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R136	0757-0346	*	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R137	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2A2R138	0698-4402		RESISTOR 97.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-97R6-F
A2A2R139	0698-4402		RESISTOR 97.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-97R6-F
A2A2R140	0698-3252		RESISTOR 450 1% .125W F TC=0+-50	03888	PME55

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A2R141	0698-3252		RESISTOR 450 1% .125W F TC=0+-50	03PFB	PM2554
A2A2R142	0698-3530		RESISTOR 470 .5% .125W J TC=0+-100	03B99	PM2555-1/1-TO-470+-C
A2A2R143	0698-3530		RESISTOR 470 .5% .125W J TC=0+-100	03PFB	PM2555-1/1-TO-470+-C
A2A2R144	2100-2252		RESISTOR-VAR TRMH 5K0HM 10% C TOP ADJ	73138	72P95K
A2A2R145	0757-0240		RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1001-F
A2A2R146	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TJ-201-F
A2A2R147	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TJ-201-F
A2A2R148	0698-3510	4	RESISTOR 453 1% .125W F TC=0+-100	16279	CA-1/8-TJ-453+-F
A2A2R149	0698-3510		RESISTOR 453 1% .125W F TC=0+-100	16279	CA-1/8-TJ-453+-F
A2A2R150	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TJ-101-F
A2A2R151	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TJ-101-F
A2A2R152	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TJ-101-F
A2A2R153	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TJ-101-F
A2A2R154	0757-0240		RESISTOR 1K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1001-F
A2A2R155	2100-3252		RESISTOR-VAR TRMH 5K0HM 10% C TOP ADJ	73138	72P95K
A2A2R156	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TJ-201-F
A2A2R157	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	CA-1/8-TJ-201-F
A2A2R158	0698-3510		RESISTOR 453 1% .125W F TC=0+-100	16279	CA-1/8-TJ-453+-F
A2A2R159	0698-3510		RESISTOR 453 1% .125W F TC=0+-100	16279	CA-1/8-TJ-453+-F
A2A2R160	0757-0434	2	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-3651-F
A2A2R161	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1501-F
A2A2R162	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1501-F
A2A2R163	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1501-F
A2A2R164	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1501-F
A2A2R165	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-3651-F
A2A2R166	0698-3578	2	RESISTOR 4K .5% .125W F TC=0+-100	24546	CA-1/8-TJ-4001-F
A2A2R167	0698-3578		RESISTOR 4K .5% .125W F TC=0+-100	24546	CA-1/8-TJ-4001-F
A2A2R168	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	CA-1/8-TJ-3011-F
A2A2R169	0698-0084	1	RESISTOR 2.15K 1% .125W F TC=0+-100	16279	CA-1/8-TJ-2151-F
A2A2R170	2100-0554		RESISTOR-VAR TRMH 500 OHM 10% C TOP ADJ	73138	72P950
A2A2R171	0757-0439	1	RESISTOR 274 1% .125W F TC=0+-100	24546	CA-1/8-TJ-274+-F
A2A2R172	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1000-F
A2A2R173	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1000-F
A2A2R174	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1000-F
A2A2R175	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	CA-1/8-TJ-1000-F
A2A2R176	2100-1738	1	RESISTOR VAR; TRMH, 10K OHM 10% C	19701	ET50W103
A2A2R177	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	CA-1/8-TO-7502-F
A2A2R178	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	CA-1/8-TO-101-F
A2A2R179	0757-0064		RESISTOR 900K 1% .5W F TC=0+-100	19701	MFC7/2-TO-9003-F
A2A2R180	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	CA-1/8-TO-1003-F
A2A2R181	0698-3530	1	RESISTOR 470 OHM .5% .125W F TC=0+-100	24546	NOC.4.T.O
A2A2S1	3101-2436	1	SWITCH: PB B STA	28430	3101-2436
A2A2U1	1826-0122	1	IC REGULATOR	07263	78P50C
A2A2U2	1820-0439	1	IC REGULATOR	07263	721P
A2A2U3	1920-0196	1	IC REGULATOR	07763	721MC
A2A2U4	1820-0217	1	IC AMPLIFIER	28493	1820-0217
A2A2U5	1821-002	1	IC CA3045	02735	CA 3045
A2A2U6	1821-002		IC CA3045	02735	CA 3045
A2A2U7	1821-002		IC CA3045	02735	CA 3045
A2A2U8	1821-002		IC CA3045	02735	CA 3045
A2A2VR1	1902-0656	1	DIODE-ZNR 20V 5% CO-15PDP-1W	28480	1902-0656
A2A2VR2	1902-3049	5	DIODE-ZNR 3.42V 5% DD-7 PD=4W TC=0+-50K	04713	57-10931-50
A2A2VR3	1902-3048		DIODE-ZNR 3.42V 5% DD-7 PD=4W TC=0+-50K	04713	57-10931-50
A2A2VR4	1902-3047		DIODE-ZNR 3.42V 5% DD-7 PD=4W TC=0+-50K	04713	57-10931-50
A2A2VR5	1902-3048		DIODE-ZNR 3.42V 5% DD-7 PD=4W TC=0+-50K	04713	57-10931-50
A2A2VR6	1902-3048		DIODE-ZNR 3.42V 5% DD-7 PD=4W TC=0+-50K	04713	57-10931-50
A2A2XA1P1	1251-0213	2	CONNECTOR: PC EDGE; 15-CONTS; DIP SOLDER	90939	143-115-07-103
A2A2XA1P2	1251-0213		CONNECTOR: PC EDGE; 15-CONTS; DIP SOLDER	90939	143-115-07-103
A2A	01220-6190	2	SWITCH: POTARY 50MA 6 VOLTS/DIV	28490	01220-6190
A2A3MP2	01220-00621	2	SHIELD (ATTENUATOR COVER)	28480	01220-00621
A2A3MP3	01220-00623	2	BRACKET	28480	01220-00623
A2A3MP4	01220-00622	2	SHIELD (FLAT)	28480	01220-00622
A2A3R1	0757-0386	2	RESISTOR 24.3 1% .125W F TC=0+-100	19721	MFC4/8-TO-24R3-F
A2A3R2	0757-0386	2	RESISTOR 47.5 1% .125W F TC=0+-100	24546	CA-1/8-TO-47R5-F
A2A3R3	2100-3910	2	RESISTOR-VAR 500 OHM 10% C	28450	2100-3910
A2A3S1	01220-6652M	4	BOARD ASSEMBLY, SWITCH	28450	01220-6652M
A2A3S2	01220-6652B	1	BOARD ASSEMBLY, SWITCH	28450	01220-6652B
A2A3S3	01220-6652C	1	BOARD ASSEMBLY, SWITCH	28450	01220-6652C
A2A4	01220-6190		SWITCH: POTARY 50MA 6 VOLTS/DIV	28490	01220-6190
A2A4PP1	3130-0038		COMPLETE SWITCH SST (H-SHAPE)	74134	32276-6
A2A4PP2	01220-00621		SHIELD (ATTENUATOR COVER)	28480	01220-00621
A2A4PP3	01220-00623		BRACKET	28480	01220-00623
A2A4PP4	01220-00622		SHIELD (FLAT)	28480	01220-00622

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A4R1 A2A4R2 A2A4R3	0757-0366 0757-0366 2100-3910		RESISTOR 24.3 1% .125W F TC=0+-100 RESISTOR 47.5 1% .125W F TC=0+-100 RESISTOR-VAR 500 OHM 20% CC	19701 24546 28480	MF401/B-TO-24R3-F CA-1/B-TO-17R5-F 2100-3910
A2A4S1 A2A4S2 A2A4S3	01220-66520 01220-66520 01220-66520		BOARD ASSEMBLY, SWITCH BOARD ASSEMBLY, SWITCH BOARD ASSEMBLY, SWITCH	28480 28480 28480	01220-6A520 01220-6A520 01220-6A520
A3	01222 66632	1	HIGH VOLTAGE POWER SUPPLY	28480	01222 66632
A3C1 A3C2 A3C3 A3C4 A3C5	0160-4280 0160-2902 0160-2959 0160-3670 0160-5380	2 2 2 2	CAPACITOR-FXD .22UF +-20% 4000WVDC MET CAPACITOR-FXD .01UF +-20% 1000WVDC CER CAPACITOR-FXD 1000PF +-50-20% 1000WVDC CAPACITOR-FXD .1uF+-20% 200V CER CAPACITOR-FXD .0047 UF +-80-20% 4000 WVDC	28480 28480 28480 18546 28480	43PC224040 0160-2902 0160-2959 CY30B104M 0160-5380
A3C6 A3C7 A3C8 A3C9 A3C10	0160-3451 0160-3451 0160-3670 0160-4042 0160-3720	2 1	CAPACITOR-FXD .01UF +-80-20% 100WVDC CER CAPACITOR-FXD .01UF +-80-20% 100WVDC CER CAPACITOR-FXD .1UF +-20% 200V CER CAPACITOR-FXD .015UF +-20% 300V CAPACITOR-FXD .1UF +-10% 160WVDC MET	28480 28480 18546 28480 29480	0160-3451 0160-2902 CY30B104M 0160-4042 0160-3720
A3C11 A3C12 A3C13 A3C14 A3C15 A3C16 A3C17 A3C18 A3C19 A3C20 A3CR1 A3CR2 A3CR3 A3CR4 A3CR5	0160-2902 0160-3724 0160-3451 0160-3455 0160-4042 0160-5380 0160-3447 0160-2959 0160-2959 0150-0073 1901-0489 1901-0489 1901-0489 1901-0489 1901-0050	1 1 1 1 1 1 1 1 1 1 4 1 1 1 1 4	CAPACITOR-FXD .01UF +-20% 1000WVDC CER CAPACITOR-FXD .47UF +-10% 40WVDC MET CAPACITOR-FXD .01UF +-80-20% 100WVDC CER CAPACITOR-FXD 470 +-10% 1000WVDC CAPACITOR-FXD .015UF +-20% 3000V CAPACITOR-FXD .0047 UF +-80-20% 4000 WVDC CAPACITOR-FXD 470PF +-10% 1000WVDC CER CAPACITOR-FXD 1000PF +-80-20% 1000 WVDC CAPACITOR-FXD 1000PF +-80-20% 1000WVDC CAPACITOR-FXD 100PF +-10%-1000WVDC CER DIODE-HV RECT 2.5KV 250MA DIODE-HV RECT 2.5KV 250MA DIODE-HV RECT 2.5KV 250MA DIODE-HV RECT 2.5KV 250MA DIODE-SWITCHING 2NS 80V 200MA	28480 28480 28480 28480 28480 28480 28480 28480 28480 09538 04713 04713 04713 04713 28480	0160-2902 0160-3724 0160-3451 0160-3455 0160-4042 0160-5380 0160-3447 1060-2959 1060-2959 83B(1KV)SE 101K SR 2016-4 SR 2016-4 SR 2016-4 SR 2016-4 1901-0050
A3CR6 A3CR7 A3CR8 A3CR9 A3CP10	1901-0050 1901-0050 1901-0040 1901-0518 1901-0050	1	DIODE-SWITCHING 2NS 80V 200MA DIODE-SWITCHING 2NS 80V 200MA DIODE-SWITCHING 2NS 30V 50MA DIODE-SWITCHING 2NS 30V 50MA DIODE-SWITCHING 2NS 80V 200MA	28480 28480 28480 28480 28480	1901-0050 1901-0050 1901-0040 1901-0518 1901-0050
A3CR11 A3CR12 A3CP13 A3CP14 A3CR15	1901-0743 1901-0743 1901-0040 1901-0040 1901-0040		DIODE-PWR RECT 400V 750MA DIODE-PWR RECT 400V 750MA DIODE-SWITCHING 2NS 30V 50MA DIODE-SWITCHING 2NS 30V 50MA DIODE-SWITCHING 2NS 30V 50MA	02682 02682 28480 28480 28480	IN4004 IN4004 1901-0040 1901-0040 1901-0040
A3CR16 A3CP17 A3CR18	1901-0040 1901-0743 1901-0743		DIODE-SWITCHING 2NS 30V 50MA DIODE PWR RECT 400 V 750 MA DIODE PWR RECT 400 V 750 MA	02682 02682 02682	1901-0040 IN4004 IN4004
A3P1	1251-2456	1	CONNECTOR, 9-CONT, MALE, UTILITY	27264	1252-P 1
A3Q1 A3Q2 A3Q3 A3Q4 A3Q5 A3Q6 A3P7 A3P8 A3R9 A3P10	1854-0622 1853-0036 1854-0215 1853-0036 1854-0409 1854-0622 0683-2035 0686-1025 2100-3214 0690-1061 0687-1011	2 3 1 1 3 1 1 1 1 2	TRANSISTOR NPN SI PD=20W TRANSISTOR PNP SI PD=310MW FT=250MHZ TRANSISTOR NPN SI PD=310MW FT=300MHZ TRANSISTOR PNP SI PD=310MW FT=250MHZ TRANSISTOR NPN 2N5210 SI TO=18 PD=310MW TRANSISTOR NPN SI PD=20W RESISTOR-FXD 20 K 5% .25 W CC RESISTOR 1K 5% .5W CC TC=0+647 RESISTOR -VAR TRMR 100KOHM 10% C TOP ADJ RESISTOR 10M 10% .1W CC TC=0+1059 RESISTOR-FXD 100 ohm 10% .5W CC	28480 28480 04713 28480 04713 28480 24546 01121 73138 01121 01121	1854-0622 1853-0036 SP5 3611 1853-0036 2N5210 1854-0622 C5-1/4-TO-4752-F EB1025 72PR100K GJ1061 EB1011
A3R6 A3P7 A3P8 A3R9 A3P10	0757-0280 0757-0416 2100-3214 2100-3606 0698-3455	1 1	RESISTOR 1K 1% .125W F TC=0+-100 RESISTOR 511 1% .125W F TC=0+-100 RESISTOR-VAR TRMR 100KOHM 10% C TOP ADJ RESISTOR VAR CC 22 MEG 20% LIN RESISTOR 261K 1% .125W F TC=0+-100	24546 24546 73138 28480 19701	CA-1/B-TO-1001-F CA-1/B-TO-5110-F 72P1100K 2100-3606 CA-1/B-TO-2613-F
A3P11 A3R12 A3P13 A3R14 A3P15	0683-2265 0684-3941 0698-5033 2100-3606 0757-0476	1 1 1 1 1	RESISTOR 22M 5% .25W FC TC=-900/+1200 RESISTOR FXD 390K 10% .25W RESISTOR 560K 1% .5W F TC=0+-100 RESISTOR VAR CC 4.7 MEG 20% LIN RESISTOR-FXD 301K 1% .125WF	01121 01121 24546 28480 24546	CP2265 CB3941 NA6 2100-3606 CA-1/B-TO-3013F
A3P16 A3P17 A3P18 A3R19 A3P20	0757-0052 0757-0442 0757-0468 0757-0768 2100-0558	4	RESISTOR 500K 1% .5W F TC=0+-100 RESISTOR 10K 1% .125W F TC=0+-100 RESISTOR 130K 1% .125W F TC=0+-100 RESISTOR 47.5K 1% .25W F TC=0+-100 RESISTOR-VAR TRMR 20KOHM 10% C TOP ADJ	19701 24546 24546 24546 73138	MF7C1/2-TO-5003-F CA-1/B-TO-1002-F CA-1/B-TO-1303-F C5-1/4-TO-4752-F 72PR20K
A3P21 A3P22 A3P23 A3P24 A3P25	0698-3452 0757-0052 0757-0052 0757-0052 2100-3274	1	RESISTOR 147K 1% .125W F TC=0+-100 RESISTOR 500K 1% .5W F TC=0+-100 RESISTOR 500K 1% .5W F TC=0+-100 RESISTOR 500K 1% .5W F TC=0+-100 RESISTOR-VAR TRMR 100KOHM 10% C SIDE ADJ	19701 19701 19701 19701 73138	CA-1/B-TO-1473-F MF7C1/2-TO-5003-F MF7C1/2-TO-5003-F MF7C1/2-TO-5003-F 72X10K

See Introduction to this section for ordering information

FORM 5320-1747

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R26	2100 3214		RESISTOR 1% TRMR 100 K OHM 10% C TOP ADJ	73138	72PR100K
A3R27	0687 1011		RESISTOR XD 100 OHM 10% 5W CC	01121	EB 1011
A3R28	0757 0442		RESISTOR 10K 1% .125W F TC-0+-100	24546	C4 1.8 TO 1002 F
A3R29	0757 0407		RESISTOR 20K 1% .125W F TC-0+-100	24546	C4 1.8 TO 201 F
A3R30	0757 0442		RESISTOR 10K 1% .125W F TC-0+-100	24546	C4 1.8 TO 1002 F
A3R31	0757 0384		RESISTOR 20 1% .125W F TC-0+-100	19701	MF4C1.8 TO 20R0 F
A3R32	0757 0403	1	RESISTOR 121 1% .125W F TC-0+-100	24546	C4 1.8 TO 12.1R F
A3R33	0757 0200		RESISTOR 5.62K 1% .125W F TC-0+-100	24546	C4 1.8 TO 5621 F
A3R34	0757 0440		RESISTOR 20K 1% .125W F TC-0+-100	24546	C4 1.8 TO 2002 F
A3R35	0757 0442		RESISTOR 10K 1% .125W F TC-0+-100	24546	C4 1.8 TO 1002 F
A3R36	0757 0384		RESISTOR 20 1% .125W F TC-0+-100	19701	MF4C1.8 TO 20R0 F
A3R37	0686 1015		RESISTOR 100 5% .5W CC TC-0+529	01121	EB 1015
A3R38	0757 0280		RESISTOR 1K 1% .125W F TC-0+-100	24546	C4 1.8 TO 1001 F
A3R39	0757 0280		RESISTOR 1K 1% .125W F TC-0+-100	24546	C4 1.8 TO 1001 F
A3R40	0757 0283		RESISTOR 2K 1% .125W F TC-0+-100	24546	C4 1.8 TO 2001 F
A3R41	0757 0465		RESISTOR 100K 1% .125W F TC = 0+-100	24546	C4 1.8 TO 1003 F
A3R42	0757 0442		RESISTOR 10K 1% .125W F TC = 0+-100	24546	C4 1.8 TO 1002 F
A3R43	0757 0441	1	RESISTOR 8.25K 1% .125W F TC = 0+-100	24546	C4 1.8 TO 8251 F
A3R44	0683 1055		RESISTOR 1M 5% .125W FC TC = 800V+-900	01121	CB 1055
A3R45	0757 0486	2	RESISTOR 750K 1% .125W F TC = 0+-100	05524	CMF 5-1
A3R46	0757 0486		RESISTOR 750 K 1% .125W F TC = 0+-100	05524	CMF 55-1
A3S1	3101 1734	1	SWITCH ASSY	26	J101 1734
A3U1	1826 0043	1	IC LM307H	27	LM307H
A3VR1	1902 0668	3	DIODE ZNR 200V 5% DO 15 PD = 1W TC = +0.88%	02037	SZ 11213-449
A3VR2	1902 0668		DIODE ZNR 200V 5% DO 15 PD = 1W TC = +0.88%	02037	SZ 11213-449
A3VR3	1902 0668		DIODE ZNR 200V 5% DO 15 PD = 1W TC = +0.88%	02037	SZ 11213-449
A3VR4	1902 3290	1	DIODE ZNR 31.6V 5% DO-7PD = 4W TC = +0.74%	04713	SZ 10939-326
A3VR5	1902 3345	1	DIODE ZNR 51.5V 5% DO-7PD = 4W TC = +0.18%	04713	SZ 10939-386
A3VR6	1902 0243	1	DIODE ZNR 30 1V 5% DO 7 PD = 4W TC = +0.75%	04713	SZ 10939 320
A3VR7	1902 3315	1	DIODE ZNR 39 2V 5% DO 7 PD = 4W TC = +0.75%	04713	SZ 10939 354
A4	01220-61123	1	HEAT SINK ASSEMBLY	28480	01220-61123
A4C1	0160-4665	1	LINE FILTER CAPACITOR 2UF 250V	28480	0160-4665
A4F1	2110-0016	1	FUSE 6A 250V SLO-BLO(100-120VAC)	71400	MDL 6/10
A4F1	2110-0044	1	FUSE 3A 250V SLOW-BLO(220-240VAC)	71400	MDL 3/10
A4J1			NOT ASSIGNED		
A4J2			DELETED		
A4J3	1231-0229	1	CONNECTOR BNA JACK SINGLE	83130	2192
A4J4	1251-0463	1	CONNECTOR BNA JACK SINGLE	74970	108-903
A4J5	1251-2495	1	CONNECTOR 9 PIN F UTILITY (ALSO ORDER CRIMP TERMINALS (4) PART NO. 1251-2999) AS REQUIRED)	27264	1292-R-2
AAMP1	1400-0440	1	TIE WRAP	28480	1400 0440
AAP1	1251-2357	1	CONNECTOR AC PWR HP 8 MALE FLANGE	28480	1251-2357
AAS1	3101-1609	1	SWITCH SL 2 DPDT NS SID 3A 1.25 VAC SLDR	84389	11E-1036
AAT1	9100-3476	1	TRANSFORMER POWER (SEPARATE REPLACEMENT NOT RECOMMENDED. NORMALLY ORDER A4 ASSY PART NO 01220-61123)	28480	9100-3476
A4W1	01220 60628	1	CABLE ASSY AC PWR SWITCH	28480	01220 61608
A4XA2	1251 0166	1	CONNECTOR PC EDGE 10 CONT. TWISTED U	90949	143010 CR (1158)
A4XF1	2110 0470	1	FUSE HOLDER BODY	28480	2110 0470
A5	01222 66529	1	DELAY LINE ASSEMBLY	28480	01222 66529
AS0L1	8120 1171	1	DELAY LINE	28480	8120 1171
ASMP1	01222 01201	1	BRACKET	28480	01222 01201
ASR1	0757 0399		RESISTOR 82.5 1% .125W F TC-0+-100	24546	C4 1.8 TO 82R5 F
ASR2	0757 0399		RESISTOR 82.5 1% .125W F TC-0+-100	24546	C4 1.8 TO 82R5 F
ASR3	0698 6324	1	RESISTOR 187 1% .125W F TC-0+-100	24546	C4 1.8 TO 187R F

See Introduction to this section for ordering information

Table 6-3. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
GM051	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
01121	ALLEN BRADLY CO	MILWAUKEE WI	53212
01205	TEXAS INSTR INC SEMICONO CMPNT DIV	DALLAS TX	75231
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03888	PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
11502	TRW INC BOONE DIV	BOONE NC	28607
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
27264	MOLEX PRODUCTS CO	DOWNERS GROVE IL	60515
28480	HEWLETT PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO IL	60618
73899	J F D ELECTRONICS CORP	BROOKLYN NY	11219
74970	JOHNSON F E CO	WASECA MN	56093
75015	LITTLEFUSE INC	DES PLAINES IL	60016
76854	DAK IND INC SW DIV	DRYSTAL LAKE IL	60014
82389	SWITCHCRAFT INC	CHICAGO IL	60630
83330	SMITH HERMAN H INC	BROOKLYN NY	11207
90949	AMPHENOL SALES DIV OF BUNKER RAMO	HAZELWOOD MO	63042
91837	DALE ELECTRONICS INC	COLUMBUS NE	68601

SECTION VII MANUAL CHANGES

7-1. INTRODUCTION.

7-2. This section contains information required to backdate this manual for a specific instrument.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either on the title page or in table 7-1, refer to the enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA corrections.

Table 7-1. Manual Changes

Serial Prefix or number	Make Changes
1843 S Thru 1843S00985	12 Thru 1
1843S00986 Thru 1843S Prefix	12 Thru 3, 1
1845S Thru 1845S00948	12 Thru 2
1845S00949 Thru 1845S02466	12 Thru 3
1845S02467 Thru 1845S03125	12 Thru 4
1845S03126 Thru 1845S03265	12 Thru 5
1845S03266 Thru 1845S03646	12 Thru 6
1845S03647 Thru 1845S05678	12 Thru 7
1845S05679 Thru 1845S05699	12 Thru 8
1845S05700 Thru 1845S06006	12 Thru 9
1845S06007 Thru 1845S06050	12 Thru 10
1845S06051 Thru 1845S06116	12 Thru 11
1845S06117 Thru 1845S06138	12
1845S06139 Thru 1845S Prefix	None

CHANGE 1

Table 6-2

- A4: Change to HP Part No. and Mfr Part No. 01220-61122, HEAT SINK ASSY.
- Delete - A4C1
- Delete - A4 MPI
- S1: Change to HP Part No. and Mfr. Part No. 3101-1732, TOGGLE SWITCH
- W5: Change to HP Part No. and Mfr. Part No. 01220-01624, POWER SWITCH ASSY.

Schematic 1

Delete A4C1 (-2UF) between pin 2 and pin 9 of A4S1

CHANGE 2

Table 6-2

- Delete: A3Q6
- Delete: A3R45 and A3R46
- Change: A3VR1, A3VR2, A3VR3, HP Part No. to 1902-0556, DIODE-ZNR 150V 5%

CHANGE 3

Table 6-2

- Change: A3R45 and A3R46, HP Part No. to 0683-5145 RESISTOR 510K 5% -125W F TC=0±100, Mfr. Code 01121 Mfr. Part No. CB5145

CHANGE 4

Table 6-2

- Change: A1A2AIR1, HP Part No. to 0757-0424, RESISTOR 1100 1% -125W F TC=0±100, Mfr code 24546 Mfr. Part No. C4-1/8-TO-1101-F

CHANGE 5

Table 6-2

- Change: A3C5 and A3C16, HP Part No. to 0160-0151, CAPACITOR-FXD 4700 pF ±20% 4KVDC CER, Mfr. Part No. 0160-0151

CHANGE 6

Table 6-2

- Change: A3C14 HP Part No. to 0160-2959, CAPACITOR-FXD 1000 pF ±10% 1KVDC CER, Mfr. code 28480, Mfr. Part No. 0160-2959.

CHANGE 7

Table 6-2

- Delete: A3C20

CHANGE 8

Table 6-2

- Change: A2A2R36, A2A2R58 and A2A2R88, A2A2R110, HP Part No. to 0698-0085, RESISTOR 2610 1% -125W TC=0±100 Mfr. code 16299, Mfr. Part No. C4-1/8-TO-2611-F

CHANGE 9

Table 6-2

- Change: A2A2R63 and A2A2R115, HP Part No. to 0698-3268 RESISTOR 11.5K 1% -125W F TC=0±10 Mfr. code 16299 Mfr. Part No. C4-1/8-TO-1152-F

CHANGE 10

Table 6-2

- Change: A2A2R60 and A2A2R112, HP Part No. to 0757-0401 RESISTOR 100 1% -125W F TC=0±100 Mfr. code 24546, Mfr Part No. C4-1/8-TO-101-F

CHANGE 11

Table 6-2

Change: A3C20, HP Part No. to 0160-3073,
CAPACITOR-FXD 100pF +100 0% 1KVDC CER,
Mfr. Part No. CG67J102E101PE19-CDH

CHANGE 12

Table 6-2

Delete: HEAT SINK, HP Part No. 1205-0095
on transistors A1A1Q31 and A1A1Q32.

Change: A1A1R121 and A1A1R122 HP Part No.
to 0757-0420, RESISTOR 750 1% -125W F TC=
0±100 Mfr. code 24546 Mfr. Part No. C4-1/8-
To-751-F

Change: A2A2R2 HP Part No. to 0757-0159 RESISTOR
1K 1% -5W F TC=0±100 Mfr. code 24546 Mfr Part
No. MFC 1/2-TO-1RD-F.

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains repair procedures, troubleshooting information, and schematics for the Model 1222A. Nonstandard symbols and conventions used in schematics are defined in table 8-1.

8-3. PREVENTIVE MAINTENANCE.

8-4. **CLEANING.** Painted surfaces can be cleaned with a commercial, spray-type, window cleaner or with a mild soap and water solution. Excess grease can be removed with a degreaser such as M-180 FREON TF DEGREASER produced by Miller-Stevenson Company. Spray away from housing.

8-5. **SWITCH MAINTENANCE.** The pushbutton switches used in this instrument have been designed for long, trouble-free service. If one of these switches becomes defective, replacement rather than repair is recommended.

8-6. Conventional rotary switches are serviced by cleaning the contacts with a degreaser such as M-180 FREON TF DEGREASER. Lubricate contact surfaces with a lubricant comparable to LUBRIPLATE FML produced by Fiske Brothers Refining Company. LUBRIPLATE FML is also available from the Hewlett-Packard Company (HP Part No. 6040-0305). Spray away from housing.

8-7. REMOVAL AND REINSTALLATION.

8-8. The following paragraphs provide procedures for removal and installation of assemblies, sub-assemblies, and components. Special repair instructions for etched circuit boards are provided in paragraph 8-18. Section VI provides a detailed parts list for use in ordering replacement parts.

8-9. **TOP COVER REMOVAL AND REINSTALLATION.** To remove the top cover of the instrument, proceed as follows:

- a. Disconnect ac power cord.
- b. Remove four screws from sides of instrument.
- c. Lift cover from instrument.
- d. Replace one screw in right, front securing lug.

This screw connects interior metalizing of cabinet with internal grounding system.

- e. To reinstall top cover reverse removal procedure.

8-10. **HEAT SINK ASSEMBLY REMOVAL AND REINSTALLATION.** To remove heat sink assembly A4, proceed as follows:

- a. Remove two heat sink screws from bottom of case.
- b. Disconnect grounding wire at vertical assembly A2A2.
- c. Disconnect HV cable connector.
- d. Disconnect front-panel LINE switch connector.
- e. Disconnect Z-input wire at trigger assembly A1A1.
- f. Lift assembly A4 to disengage lugs.
- g. Pull assembly A4 out of rear panel.

NOTE

When reinstalling assembly A4, make sure sheet insulators are in place over power transistors on vertical assembly and that insulator surfaces are coated with a thermal compound, such as, HP Part No 6040-0239.

- h. To reinstall assembly A4, reverse removal procedure.

8-11. **CRT REMOVAL PROCEDURE.** To remove the CRT proceed as follows:

WARNING

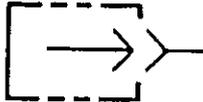
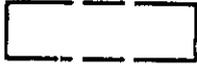
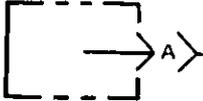
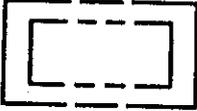
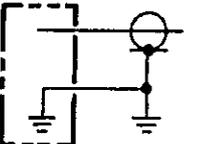
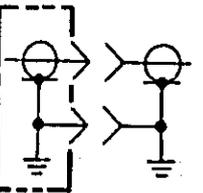
To prevent personal injury, wear a face mask or goggles when handling the CRT. Wear protective gloves and handle the CRT carefully.

- a. Disconnect trace alignment leads from assembly A3.
- b. Disconnect leads from trigger assembly to CRT at trigger assembly A1A1.
- c. Remove CRT collar retaining screws (see figure 6-1 for parts identification).
- d. Lever CRT collar base away from mounting.
- e. Lift CRT base.
- f. Carefully remove CRT socket from CRT base.
- g. Lift CRT away from instrument.
- h. To reinstall CRT, reverse removal procedure.

NOTE

If a new CRT is to be installed, proceed to paragraph 8-12.

Table 8-1. Schematic Notes

REFER TO ANSI Y 32.2 AND Y32.14 FOR SCHEMATIC SYMBOLS NOT LISTED IN THIS TABLE.			
	ETCHED CIRCUIT BOARD		SINGLE-PIN CONNECTOR ON BOARD
	ASSEMBLY		PIN OF A PLUG-IN BOARD (WITH LETTER OR NUMBER)
	ETCHED CIRCUIT BOARD ON ASSEMBLY		COAXIAL CABLE CONNECTED DIRECTLY TO BOARD
	FRONT- AND REAR-PANEL MARKING		COAXIAL CABLE CONNECTED TO SNAP-ON JACK
	MAIN SIGNAL PATH		
	PRIMARY FEEDBACK PATH		
	SECONDARY FEEDBACK PATH		

	FRONT-PANEL CONTROL		BREAKDOWN DIODE (VOLTAGE REGULATOR)	<p>(925) WIRE COLORS ARE GIVEN BY NUMBERS IN PARENTHESIS USING THE RESISTOR COLOR CODE</p> <p>[(925) IS WHT-RED-GRN]</p> <p>0 - BLACK 5 - GREEN 1 - BROWN 6 - BLUE 2 - RED 7 - VIOLET 3 - ORANGE 8 - GRAY 4 - YELLOW 9 - WHITE</p> <p>* OPTIMUM VALUE SELECTED AT FACTORY, TYPICAL VALUE SHOWN; PART MAY HAVE BEEN OMITTED.</p> <p>UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS AND INDUCTANCE IN MICROHENRIES</p>
	TEST POINT (TP WITH NUMBER)		LIGHT EMITTING DIODE (LED)	
	SCREWDRIVER ADJUSTMENT		TUNNEL DIODE	
	WAVEFORM TEST POINT (WITH NUMBER)		FIELD-EFFECT TRANSISTOR (N-TYPE BASE)	
	COMMON ELECTRICAL POINT (WITH LETTER); NOT NECESSARILY GROUND			
	SIGNAL REFERENCE			
	SCHEMATIC REFERENCE			
			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.	

CW	CLOCKWISE END OF VARIABLE RESISTOR	VF (A)	V - VOLTAGE
NC	NO CONNECTION		F - FILTERED
P/O	PART OF		(A) - FILTER SOURCE

8-12. INSTALLING A NEW CRT. To install a new CRT, proceed as follows:

WARNING

To prevent personal injury, wear a face mask or goggles when handling the CRT. Wear protective gloves and handle the CRT carefully.

- a. Accomplish paragraph 8-11 except step h.
- b. Mark orientation of CRT base and CRT collar on CRT shield using pencil.
- c. Loosen circle clip.
- d. Remove CRT collar and circle clip.
- e. Remove rubber ring at face of CRT.
- f. Remove CRT from shield.
- g. Make sure that flat rubber ring is fitted to neck of new CRT near base.
- h. Insert new CRT into shield.
- i. Align CRT base with mark on shield.
- j. Fit rubber ring at face of CRT.
- k. Place CRT and shield face down on smooth surface.
- l. Press down on CRT base for firm fit into rubber ring at face.
- m. Fit CRT collar and circle clip on neck of tube over rubber ring.
- n. Align CRT collar with mark on shield and push toward CRT face so that shield is firmly clamped.

CAUTION

When tightening circle clip, use a torque screwdriver set to 0.11 kg-m (10 in-lb).

- o. Clamp collar, taking care not to overtighten circle clip.
- p. To install new CRT, perform removal procedure (paragraph 8-11) in reverse order.

8-13. REMOVAL AND REINSTALLATION OF CIRCUIT BOARDS. To remove circuit boards from the instrument, proceed as follows:

- a. Accomplish paragraph 8-10.
- b. Disconnect cable from A1A1J1 at trigger assembly.
- c. Disconnect cable from A1A1J2 at trigger assembly.
- d. Remove all front-panel control knobs except channel A and channel B POSITION controls.
- e. Disconnect channel A POSITION control wires from assembly A2A3.
- f. Disconnect channel B POSITION control wires from assembly A2A4.
- g. Remove retaining rings from three front-panel BNC connectors.
- h. Disconnect all wires from rear of trigger assembly.
- i. Remove two screws from top edge of trigger assembly and ease away from rail.

CAUTION

Be careful when removing assemblies to prevent damage to pins on rear of trigger assembly.

- j. Pull circuit boards toward rear of instrument.
- k. When clearance permits, disengage trigger assembly from vertical amplifier assembly.
- l. Remove assemblies from instrument.
- m. To reinstall circuit boards, reverse removal procedure.

8-14. REPLACEMENT OF CIRCUIT BOARDS.

8-15. HORIZONTAL ASSEMBLY A1. Horizontal assembly A1 consists of trigger assembly A1A1 and TIME/DIV switch assembly A1A2. If trigger assembly A1A1 becomes damaged or nonrepairable, replacement of the complete horizontal assembly A1 is recommended. The TIME/DIV switch assembly is made up of assemblies A1A2A1 and A1A2A2, and unsoldering and resoldering of TIME/DIV switch

assembly A1A2 to trigger assembly A1A1 are delicate and time consuming. Therefore, if facilities and trained service personnel are not available, replacement of the complete A1 assembly is recommended.

8-16. VERTICAL ASSEMBLY A2. Vertical assembly A2 consists of delay line driver assembly A2A1, vertical amplifier assembly A2A2, channel A VOLTS/DIV switch A2A3, and channel B VOLTS/DIV switch A2A4. If assembly A2A2 becomes damaged or non-repairable, replacement of the complete vertical assembly A2 is recommended. The unsoldering and resoldering of the delay line driver assembly, channel A VOLTS/DIV switch, and channel B VOLTS/DIV switch are delicate and time consuming. Therefore, if facilities and trained service personnel are not available replacement of the complete A2 assembly is recommended.

8-17. REPAIR OF CIRCUIT BOARDS.

8-18. The following paragraphs provide servicing procedures and special soldering considerations for repairing etched circuit boards.

8-19. SERVICING ETCHED CIRCUIT BOARDS. All the etched circuit boards have plated-through component holes. This allows components to be removed or replaced by unsoldering or soldering from either side of the board. When removing large components such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part

to lift it from the board. HP Service Note M-20E contains additional information for repair of etched circuit boards.

8-20. SEMICONDUCTOR REMOVAL AND REPLACEMENT. Figure 8-1 is included to help identify the leads on the common shapes and sizes of semiconductor devices. When removing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as used for the original part.

8-21. INTEGRATED CIRCUIT REMOVAL AND REPLACEMENT.

CAUTION

Unless an integrated circuit has definitely failed, be careful to prevent damage when removing or replacing it.

8-22. TROUBLESHOOTING.

WARNING

Read the Safety Summary at the front of this manual before troubleshooting the instrument.

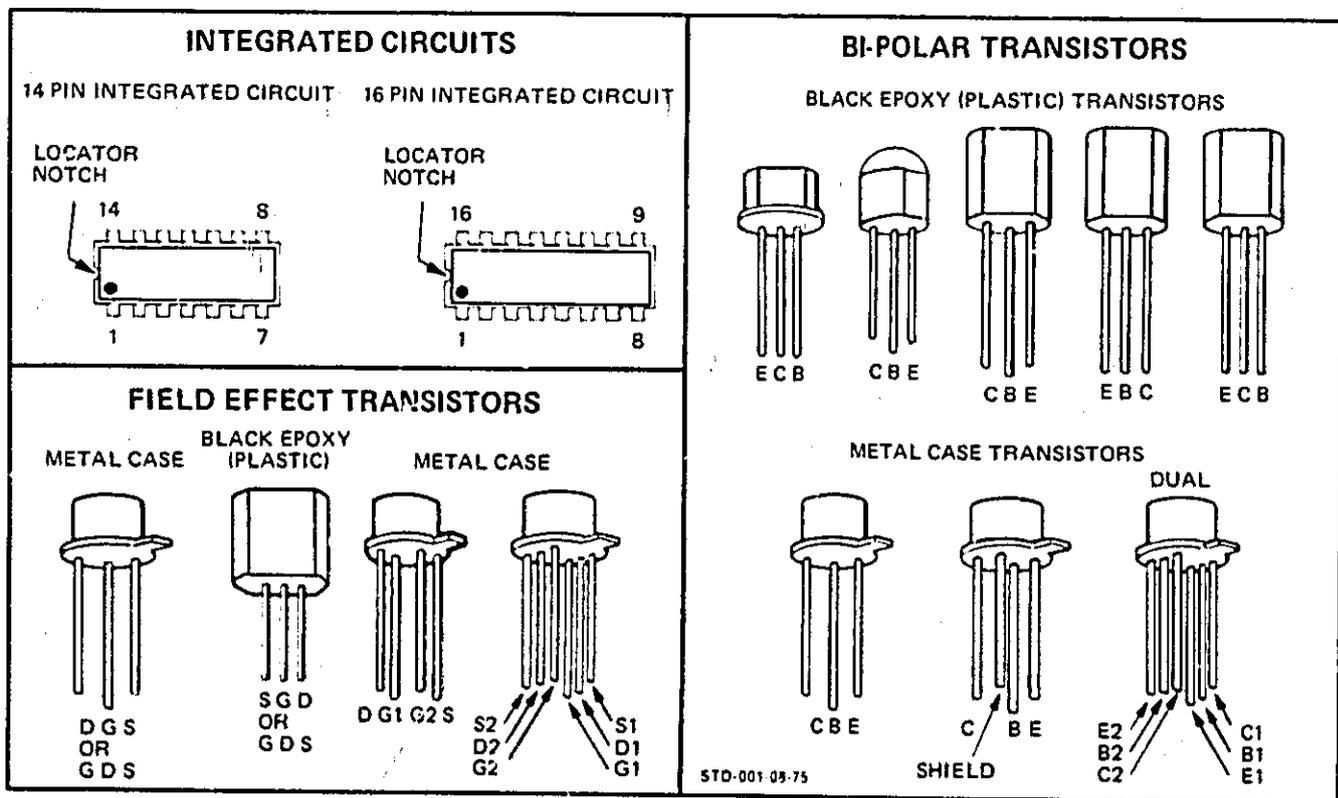


Figure 8-1. Semiconductor Terminal Identification

8-23. Two important prerequisites for successful troubleshooting are understanding how the instrument is designed to operate and correct use of front-panel controls. Improper control settings or circuit connections can cause apparent malfunctions. Read Section III (Operation) for an explanation of controls, connectors, and general operating considerations. Read Section IV (Principles of Operation) for explanation of circuit theory.

8-24. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that may suggest a source of trouble. Verify that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check power supply voltages in the instrument; also check external power sources.

8-25. DC VOLTAGES. On some schematics, dc voltages are indicated for active components (transistors, IC's etc.). Conditions for making these voltage measurements are listed adjacent to the schematics. Since the conditions for making measurements may differ from one circuit to another, always check the specific conditions listed adjacent to the schematic.

8-26. INITIAL TROUBLESHOOTING PROCEDURE. Before troubleshooting the instrument in detail, try to perform the adjustment procedures listed in Section V of this manual. Some apparent malfunctions can be corrected by these adjustments; in addition, the inability to obtain a correct adjustment will often reveal the source of trouble.

8-27. If possible, perform the adjustment procedures in listed sequence since the power supplies should be checked first for any malfunction.

8-28. TROUBLE DIAGNOSIS. By use of front-panel controls, note as many symptoms of the malfunction as possible. From these symptoms, it can usually be determined which section (vertical, horizontal, or power supplies) is malfunctioning. Normally, the vertical and horizontal sections will not malfunction simultaneously, although symptoms may indicate that this has occurred.

8-29. VERTICAL SECTION TROUBLESHOOTING. Although a sweep may not be generated on the CRT, vertical deflection of an input signal on the CRT will normally indicate that the vertical section is functioning properly.

8-30. The sync pulse required for internal triggering is developed in the vertical preamplifier and trigger amplifier located on assembly A1A1. If the instrument does not trigger internally but triggers properly when an external trigger is applied, the vertical preamplifier section should be checked.

8-31. Due to low levels of the signal in the vertical preamplifier, signal tracing becomes difficult. When troubleshooting the preamplifier, check dc bias voltages for best results.

8-32. HORIZONTAL SECTION TROUBLESHOOTING. The horizontal section of the instrument consists of the trigger assembly, TIME/DIV switch, and high voltage power supply. From symptoms derived in paragraph 8-29, check the input and output signals of the suspected circuit(s) until the problem is isolated. Refer to table 8-2 for troubleshooting hints.

NOTE

Table 8-2 is to be used as a guide only. Slight variations in described symptoms may be noted.

Table 8-2. Troubleshooting Hints

1. Initial Conditions:	
a. Disconnect all external inputs except ac power.	FOCUS..... midrange
b. Set ac power switches on rear panel of instrument for proper ac power input.	TIME/DIV 0.2 ms/div
	Sweep Expander CAL
	TRIGGER SOURCE INT
	TRIGGER LEVEL..... 1 o'clock
	All other pushbutton switches..... out position
c. Set front-panel controls as follows:	LINE (AC Power)..... ON
VOLTS/DIV (both channels)... 10 V/div	
VERTICAL DISPLAY A & B	
Input Coupling (both channels) ... GND	
Vertical POSITION (both channels)..... midrange	
Vertical Verniers (both channels)... CAL	
INTENSITY midrange	
	NOTE
	If top cover of the instrument is removed, make sure cover retaining screw is reinserted in right, front securing lug. The screw connects the interior metalizing of cabinet with internal grounding system.

Table 8-2. Troubleshooting Hints (Cont'd)

<p>2. Power Supplies. The power supplies have decoupling components located near the individual circuits that may cause the power supply to current limit, giving the indication of a defective power supply. If the voltage across current sensing resistor A2A2R17 in the +12 V supply or across current sensing resistor A2A2R23 in the -12 V supply exceeds approximately 0.5 V, the supply is most likely in its current-limit state. To isolate the circuit causing the overload, lift one end of each decoupling resistor, such as A2A2R135, while monitoring the current sensing resistor that indicates an overload. When the power supply indicates normal operation, the faulty circuit has been isolated. For the +95 V supply, measure the voltage between pins 2 and 3 of A2A2U2. The voltage should not be greater than 0.5 V (pin 2 more positive than pin 3).</p>	<p>e. +12 V Supply</p> <p>A2A2C10 - C13 A2A2CR13 - CR16 A2A2Q2 A2A2R15 - R19 A2A2U3</p>
<p>3. Symptom Chart. The symptom chart presented in this table is intended to get the service technician to the general area of the trouble but not necessarily to a specific component. A list of the major components associated with the listed trouble areas follows the symptom chart. To use the symptom chart, proceed down the symptom column until the difficulty is noted. Then check the major components associated with the trouble area(s).</p>	<p>f. +5 V Supply</p> <p>A2A2C1, C2 A2A2CR1 - CR4 A2A2U1</p>
<p>4. Trouble-area Components. Check the trouble-area components as listed below: (Parts are listed alphanumerically).</p>	<p>g. -12 V Supply</p> <p>A2A2C14, C15 A2A2CR17 - CR20 A2A2Q3, Q4 A2A2R20 - R23 A2A2U4</p>
<p>a. H.V. Power Supply</p> <p>A3C1 A3CR1 - CR4 A4T1 V1</p>	<p>h. H.V. Regulator</p> <p>A3Q1 A3U1</p>
<p>b. Power Transformer</p> <p>A4T1</p>	<p>i. Horizontal Output Amplifier</p> <p>A1A1Q27 - Q36</p>
<p>c. +210 V Supply</p> <p>A2A2C3, C4 A2A2CR5 - CR8 A2A2R2 A2A2R5</p>	<p>j. Sweep Generator</p> <p>A1A1Q23 - Q26 A1A1U1, U2 A1A1U5 - U8</p>
<p>d. +95 V Supply</p> <p>A2A2C5 - C9 A2A2CR9 - CR12 A2A2Q1 A2A2R3 A2A2R4 A2A2R6 - R14 A2A2U2 A2A2VR1</p>	<p>k. Trigger</p> <p>A1A1Q13 - Q22 A1A1U2 - U4</p>
	<p>l. Vertical Output Amplifier</p> <p>A1A1Q1 - Q12</p>
	<p>m. Vertical Preamplifiers</p> <p>A2A2Q5 - Q12 A2A2Q15 - Q17 A2A1Q1 - Q4 A2A2U5 - U9</p>
	<p>n. Attenuators</p> <p>Channel A: A2A3S1 - S3 Channel B: A2A4S1 - S3</p>

Table 8-2. Troubleshooting Hints (Cont'd)

SYMPTOM	POSSIBLE TROUBLE AREA																			
	POWER TRANS.	+95 V SUPPLY	+12 V SUPPLY	-12 V SUPPLY	+5 V SUPPLY	+210 V SUPPLY	H.V. POWER SUPPLY	H.V. REGULATOR	CRT	HORIZ. OUTPUT AMP	SWEEP GEN.	SWEEP SW. ASSEM	VERT. OUTPUT	VERT. PREAMP	ATTENUATORS	TRIGGER	CHOP OSC.	CHANNEL SW.	BLANKING AMP.	CALIBRATOR
BLOWS FUSE	X	X	X	X	X	X	X	X	X											
NO BEAM (BEAM FIND)	X						X	X	X										X	X
NO SWEEP					X					X	X	X				X				
INTENSITY MODULATION	X	X	X				X													
NO HORIZ. POSIT.										X	X									
NO VERT. POSIT.												X	X							
NO VERT. DEFL.												X	X							
NO TRIGGER					X					X					X					
TRACE SHIFT												X	X							
NO RETRACE BLANK																			X	
NO CHOP/ALT.					X											X	X			
NO PROBE ADJ.					X															X

o. Sweep Switch Assembly

A1A2

p. Chop Oscillator

A1A1U4

q. Channel Switches

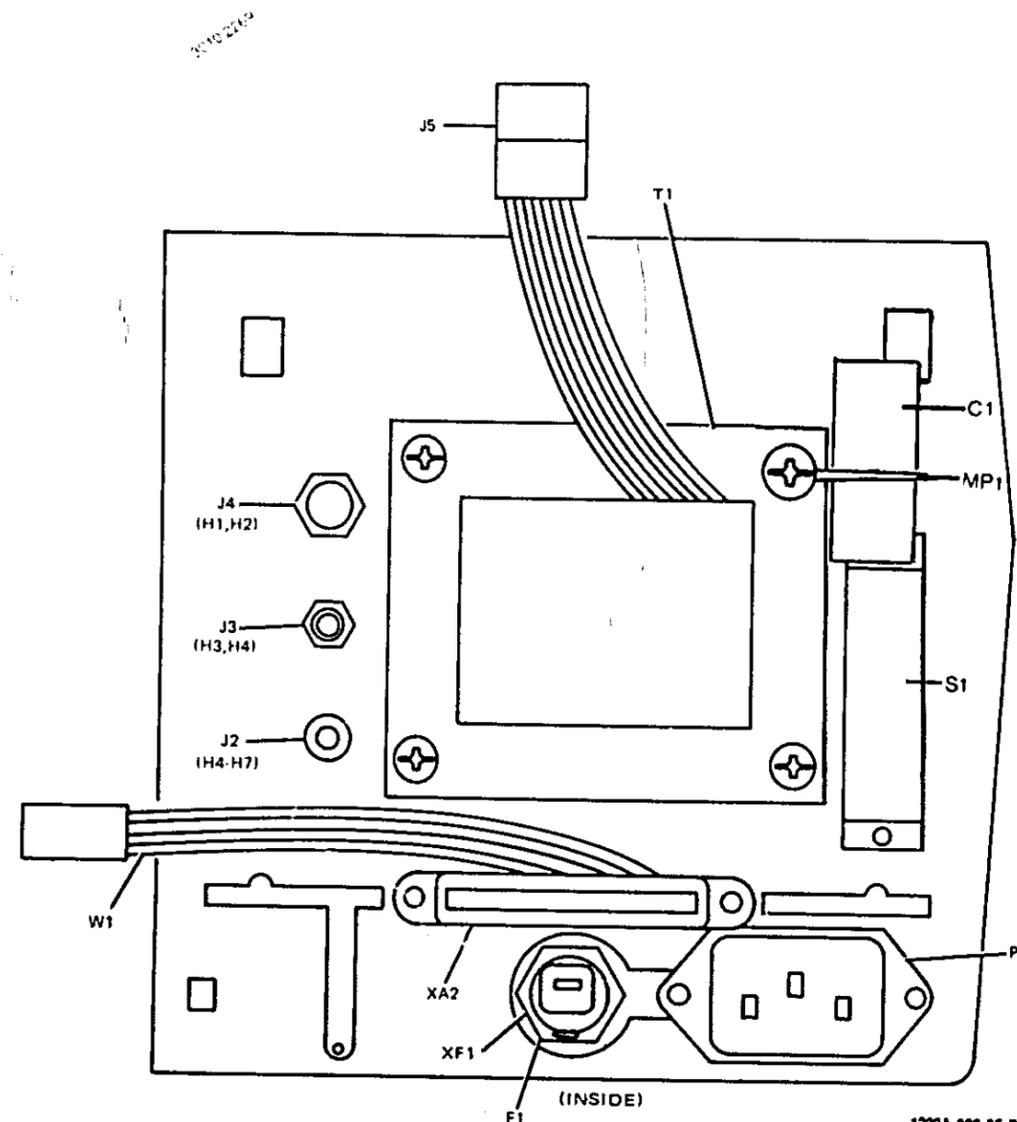
A2A2CR35 - CR40
A1A1U3, U4

r. Blanking Amplifier

A3Q2 - Q5
A3CR14, CR15

s. Calibrator

A1A1U1

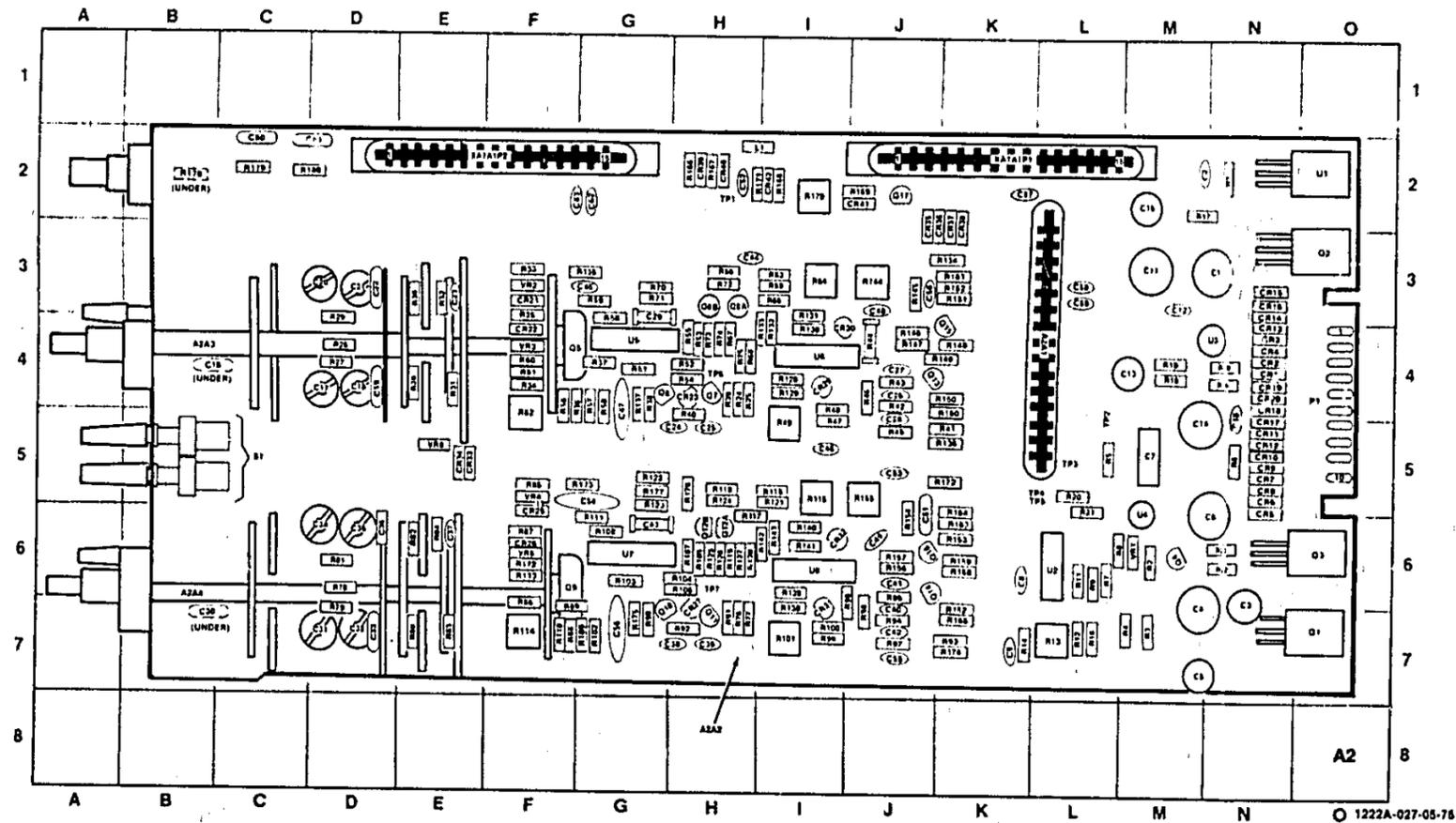


H1-H7 Mounting Hardware
See table 6-1

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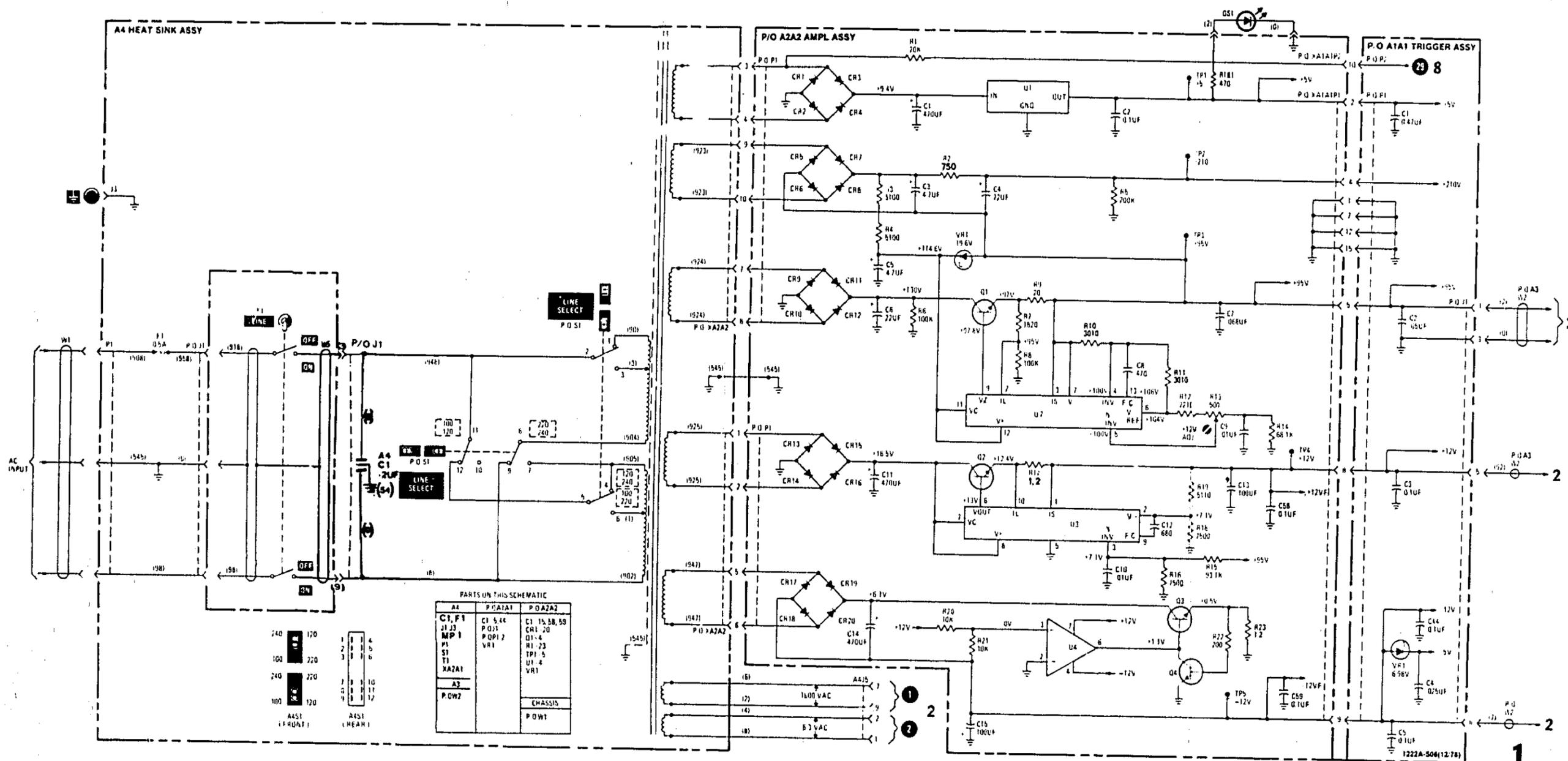
Figure 8-2.
A4 Heat Sink Assembly, Component Locations
8-7

A2A2



REF DESIG	GRID LOC												
C1	N-3	C48	J-3	CR34	E-5	R20	L-5	R67	H-4	R114	F-7	R161	K-3
C2	M-2	C49	J-6	CR35	J-2	R21	L-5	R68	H-3	R115	I-5	R162	K-3
C3	N-6	C50	J-3	CR36	J-2	R22	N-6	R69	I-3	R116	I-5	R163	K-6
C4	M-6	C51	J-6	CR37	K-2	R23	N-6	R70	G-3	R117	H-6	R164	K-6
C5	M-7	C52	H-2	CR38	K-2	R24	H-4	R71	G-3	R118	H-5	R165	K-7
C6	N-5	C53	J-5	CR39	H-2	R25	H-4	R72	H-3	R119	H-6	R166	H-2
C7	M-5	C54	G-5	CR40	H-2	R26	D-4	R73	H-4	R120	H-6	R167	H-2
C8	K-6	C55	J-5	CR41	I-2	R27	D-4	R74	H-4	R121	I-6	R168	I-2
C9	K-7	C56	G-7	CR42	I-2	R28	E-4	R75	H-4	R122	G-5	R169	J-2
C10	N-4	C57	K-2	L1	H-2	R29	D-4	R76	H-3	R123	G-5	R170	I-2
C11	M-3	C58	L-3	P1	O-4	R30	E-3	R77	H-7	R124	H-5	R171	H-2
C12	M-3	C59	L-3	Q1	O-7	R31	E-4	R78	D-6	R125	H-6	R172	K-6
C13	M-4	C60	C-2	Q2	D-3	R32	E-3	R79	D-7	R126	H-6	R173	G-5
C14	M-5	C61	D-2	Q3	O-6	R33	F-3	R80	E-7	R127	H-6	R174	K-7
C15	M-2	C62	G-2	Q4	M-6	R34	F-4	R81	D-6	R128	I-4	R175	G-7
C16	B-2	C63	G-2	Q5	F-4	R35	F-3	R82	E-6	R129	I-4	R176	H-5
C17	D-4	CR1	N-4	Q6	G-4	R36	F-4	R83	E-7	R130	I-4	R177	G-5
C18	D-4	CR2	N-4	Q7	H-4	R37	G-4	R84	E-6	R131	I-3	R178	B-2
C19	D-4	CR3	N-4	Q8A, B	H-3	R38	G-4	R85	F-5	R132	I-4	R179	C-2
C20	D-3	CR4	N-4	Q9	F-6	R39	H-4	R86	F-6	R133	I-4	R180	D-2
C21	D-3	CR5	N-6	Q10	G-7	R40	H-4	R87	F-6	R134	K-3	S1	C-6
C22	D-3	CR6	N-5	Q11	H-7	R41	K-4	R88	F-7	R135	F-3	TP1	H-2
C23	E-3	CR7	N-5	Q12A, B	H-6	R42	J-4	R89	F-6	R136	K-5	TP2	L-4
C24	H-5	CR8	N-5	Q13	J-4	R43	J-4	R90	G-7	R137	G-4	TP3	L-5
C25	H-5	CR9	N-5	Q14	J-6	R44	J-4	R91	H-7	R138	I-7	TP4	L-5
C26	J-4	CR10	N-5	Q15	K-4	R45	J-5	R92	H-7	R139	I-6	TP5	L-5
C27	J-4	CR11	N-5	Q16	J-6	R46	J-4	R93	K-7	R140	I-6	TP6	H-4
C28	J-5	CR12	N-5	Q17	J-2	R47	I-5	R94	J-6	R141	I-6	TP7	H-6
C29	G-3	CR13	N-4	R1	N-2	R48	I-4	R95	J-6	R142	I-6	U1	O-2
C30	B-7	CR14	N-3	R2	M-7	R49	I-5	R96	J-6	R143	I-6	U2	L-6
C31	D-7	CR15	N-3	R3	M-7	R50	G-4	R97	J-7	R144	J-3	U3	N-4
C32	D-7	CR16	N-3	R4	N-5	R51	G-4	R98	J-7	R145	J-3	U4	M-5
C33	D-7	CR17	N-4	R5	L-5	R52	I-4	R99	I-7	R146	J-4	U5	G-4
C34	D-6	CR18	N-4	R6	N-5	R53	H-4	R100	I-7	R147	J-4	U6	I-4
C35	D-6	CR19	N-4	R7	L-6	R54	H-4	R101	I-7	R148	K-4	U7	G-6
C36	D-6	CR20	N-4	R8	L-6	R55	H-4	R102	G-7	R149	K-4	U8	I-6
C37	E-6	CR21	F-3	R9	L-6	R56	G-3	R103	G-6	R150	K-4	VR1	M-6
C38	H-7	CR22	F-4	R10	L-7	R57	G-4	R104	H-6	R151	K-3	VR2	F-3
C39	H-7	CR23	H-4	R11	L-6	R58	F-4	R105	H-6	R152	K-7	VR3	F-4
C40	J-7	CR25	F-6	R12	L-7	R59	G-3	R106	H-6	R153	K-6	VR4	F-5
C41	J-6	CR26	F-6	R13	L-7	R60	F-4	R107	H-6	R154	J-6	VR5	F-6
C42	J-7	CR27	H-7	R14	K-7	R61	F-4	R108	G-6	R155	J-5	VR6	E-5
C43	G-6	CR29	I-4	R15	M-4	R62	F-5	R109	G-7	R156	J-6	XA1P1	K-2
C44	H-3	CR30	I-4	R16	N-4	R63	I-3	R110	F-7	R157	J-6	XA1P2	F-2
C45	F-3	CR31	I-7	R17	M-2	R64	I-3	R111	G-6	R158	K-6	A2A1	L-4
C46	I-5	CR32	I-6	R18	H-4	R65	I-3	R112	F-6	R159	K-6	A2A3	B-4
C47	G-4	CR33	E-5	R19	M-4	R66	H-3	R113	F-6	R160	K-4	A2A4	B-6

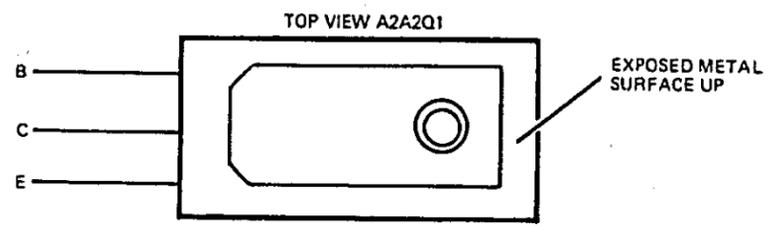
Figure 8-3. A2 Vertical Assembly, Component Locations



PARTS ON THIS SCHEMATIC

AK	P/O A1A1	P/O A2A2
C1, F1	C1 5.44	C1 15, 38, 59
J1, J3	P/O 1	CR1 20
MP 1	P/O 1 2	Q1 4
P1	VR1	R1 23
S1		TP1 5
T1		U1 4
A2A1		VR1
A3		
P.O.W2		CHASSIS
		P.O.W1

INSTALLATION OF A2A2: U1, Q2, Q3



NOTE
POWER TRANSISTOR INSULATORS (A2A1MP1, 3 REQUIRED) MUST BE USED ON A2A1Q1, Q2, AND Q3. INSULATOR IS NOT REQUIRED ON A2A1U1.

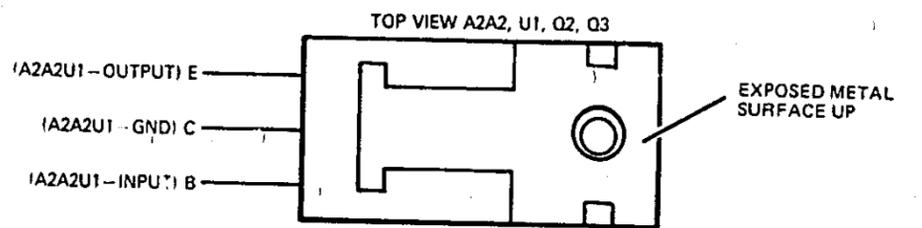
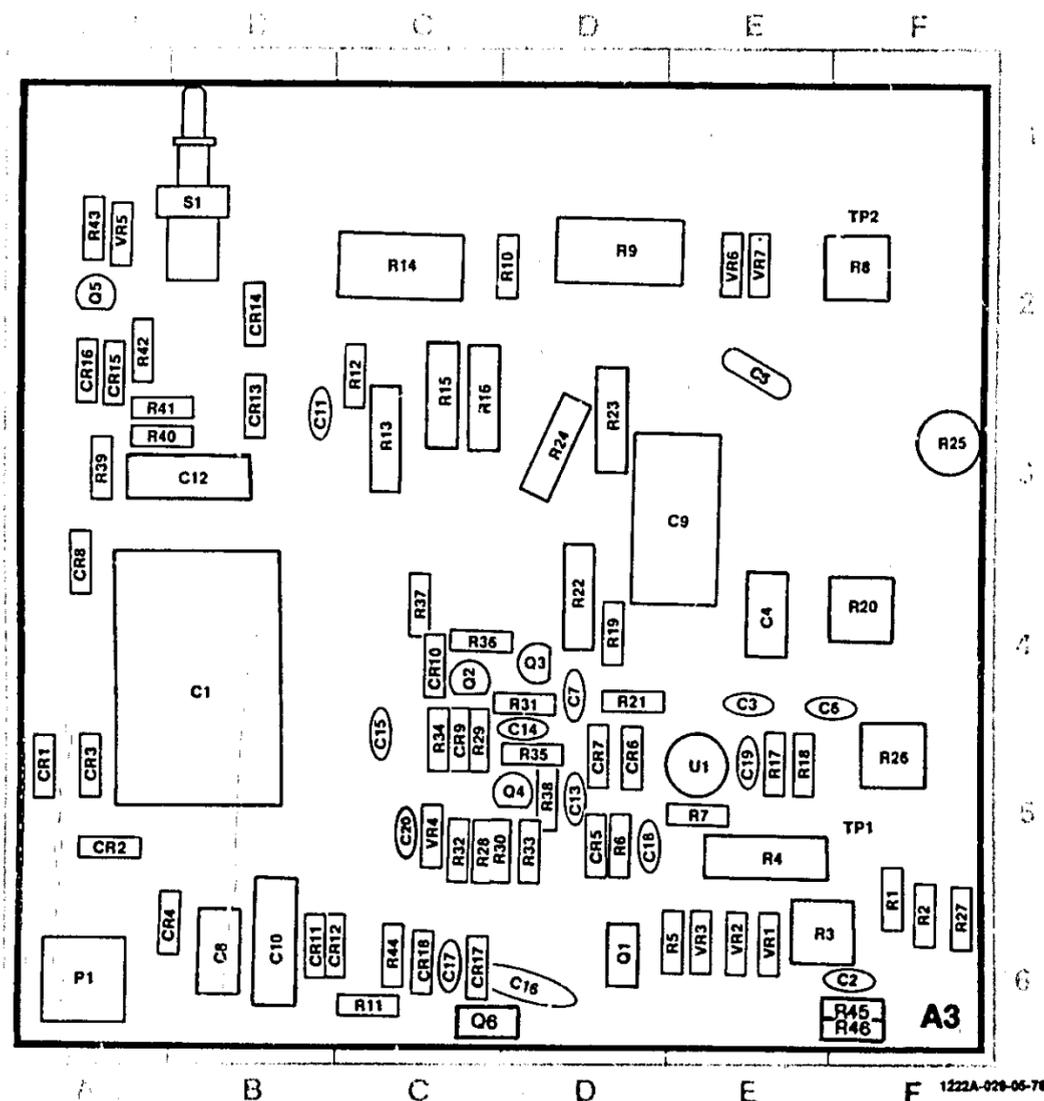


Figure 8-4.
Schematic 1, AC Input and Power Supplies (A4, A2A2)
8-9

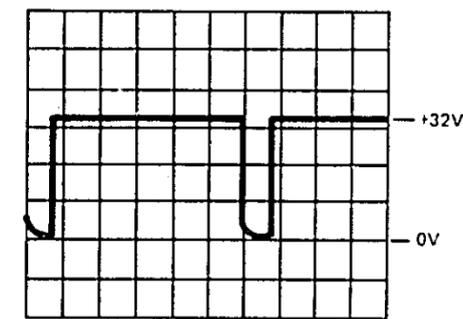


REF DESIG	GRID LOC												
C1	B-4	C17	C-6	CR13	B-3	R4	E-5	R20	F-4	R36	C-4	U1	E-5
C2	F-6	C18	D-5	CR14	B-3	R5	D-6	R21	D-4	R37	C-4	VR1	E-6
C3	F-4	C19	F-5	CR15	A-2	R6	D-6	R22	D-4	R38	D-6	VR2	E-6
C4	F-4	C20	C-5	CR16	A-2	R7	E-6	R23	D-3	R39	A-3	VR3	E-6
C5	E-2	CR1	A-5	CR17	C-6	R8	F-2	R24	D-3	R40	A-3	VR4	C-6
C6	E-4	CR2	A-5	CR18	C-6	R9	D-2	R25	F-5	R41	A-3	VR5	A-2
C7	D-4	CR3	A-5	P1	A-6	R10	D-2	R26	F-6	R42	A-2	VR6	E-2
C8	B-6	CR4	A-6	Q1	D-6	R11	C-6	R27	F-6	R43	A-2	VR7	E-2
C9	E-3	CR5	D-5	Q2	C-4	R12	C-2	R28	C-5	R44	C-6		
C10	B-6	CR6	D-5	Q3	D-4	R13	C-3	R29	C-5	R45	F-6		
C11	B-3	CR7	D-5	Q4	C-5	R14	C-2	R30	C-5	R46	F-6		
C12	A-3	CR8	A-4	Q5	A-2	R15	C-3	R31	D-4	S1	B-1		
C13	D-5	CR9	C-5	Q6	C-4	R16	C-3	R32	C-5	TP1	F-5		
C14	D-5	CR10	C-4	R1	F-6	R17	E-5	R33	C-6	TP2	F-2		
C15	C-5	CR11	B-6	R2	F-6	R18	E-5	R34	C-6				
C16	D-6	CR12	B-6	R3	E-6	R19	D-4	R35	D-5				

Figure 8-5. A3 High-voltage Power Supply Component Locations

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 2

1. Set front-panel controls in accordance with paragraph 5-9, Section V.
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).



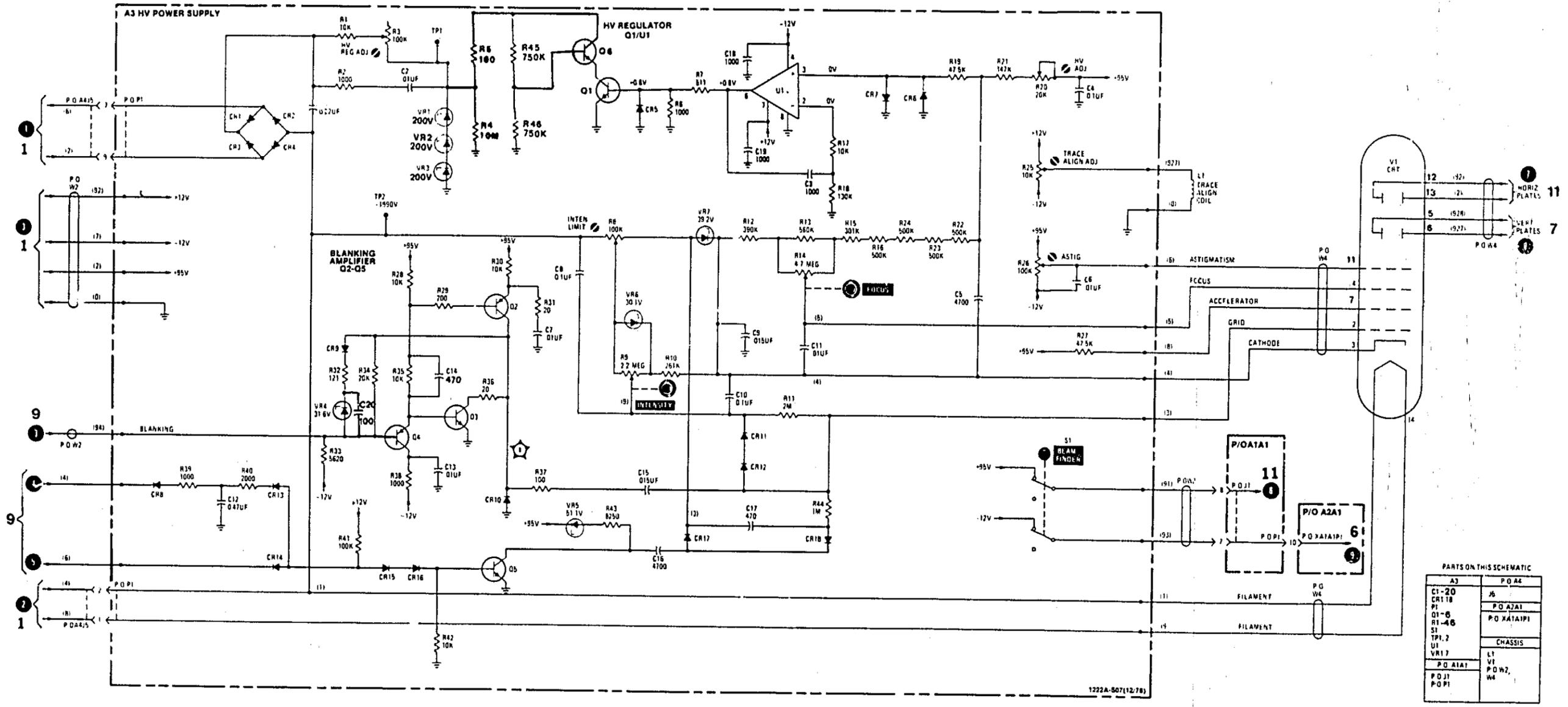
1222A-030-01-05-78
RETRACE BLANKING (SINGLE CHANNEL)

10 V/div
2 μs/div

RETRACE AND CHOP BLANKING (CHOP MODE)

10 V/div
2 ms/div

Figure 8-6. Schematic 2, High-voltage Power Supply (A3) (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC

A3	P.O. A4
C1-20	J5
CR18	P.O. A2A1
Q1-6	P.O. XATA1P1
RT-46	
S1	CHASSIS
TP1, 2	
U1	LT
VR1, 7	V1
P.O. A1A1	P.O. W2,
P.O. J1	W4
P.O. P1	

Figure 8-6. Schematic 2, High-voltage Power Supply (A3) (Sheet 2 of 2) 8-11

**WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 3**

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:
TIME/DIV 0.2 ms/div
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector (to channel B INPUT connector when checking channel B).

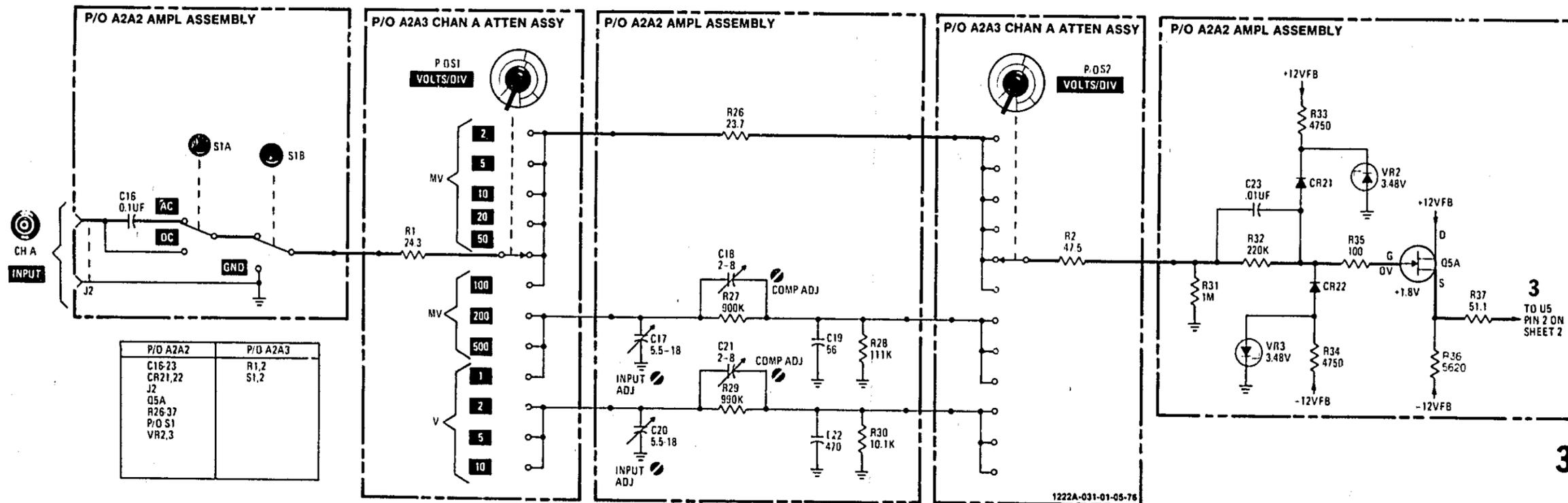
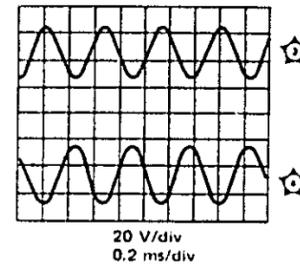
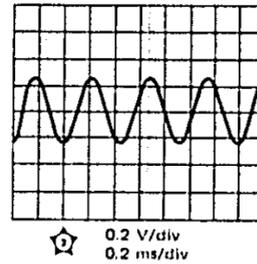
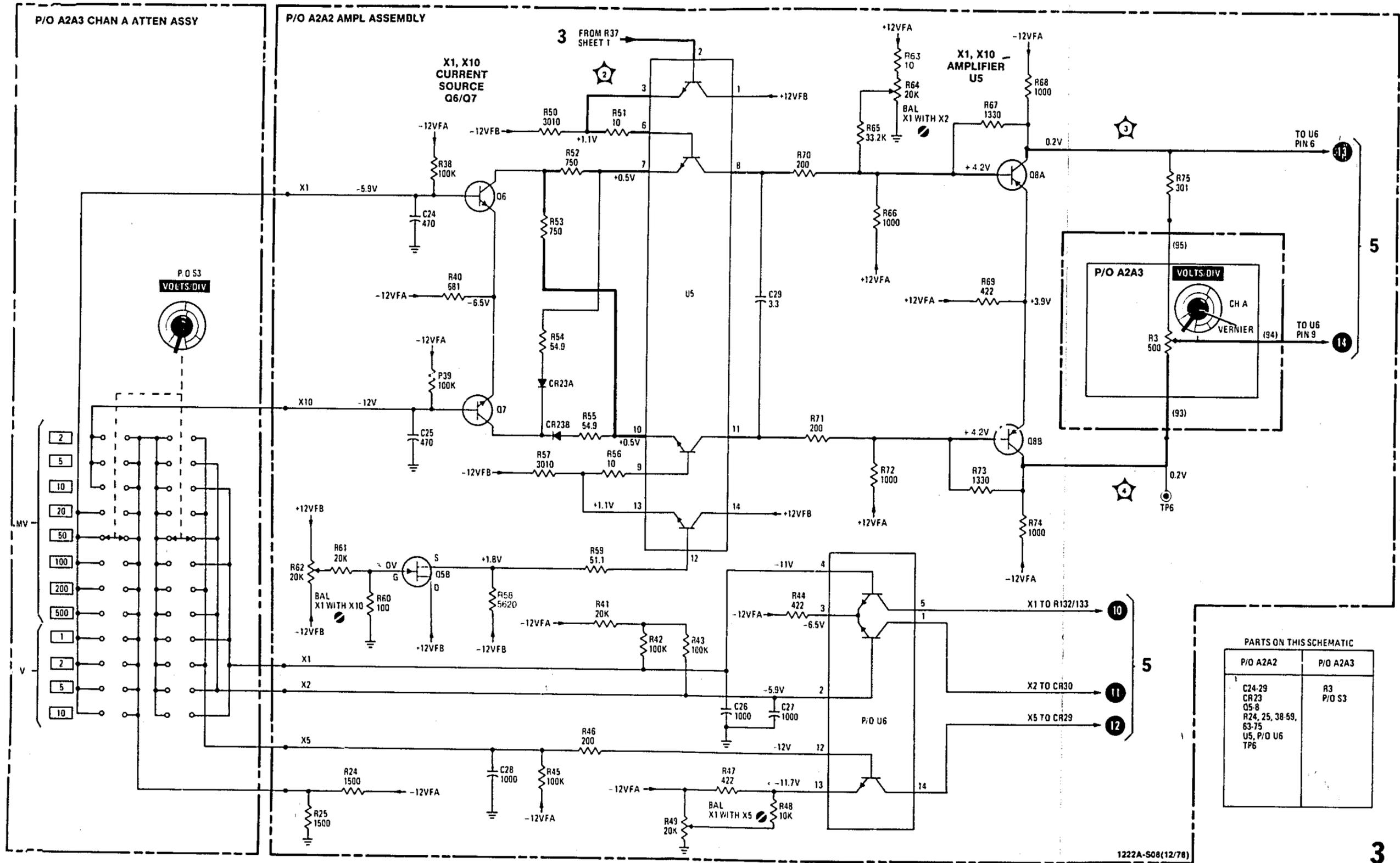


Figure 8-7. Schematic 3, Channel A Attenuator (Sheet 1 of 2)

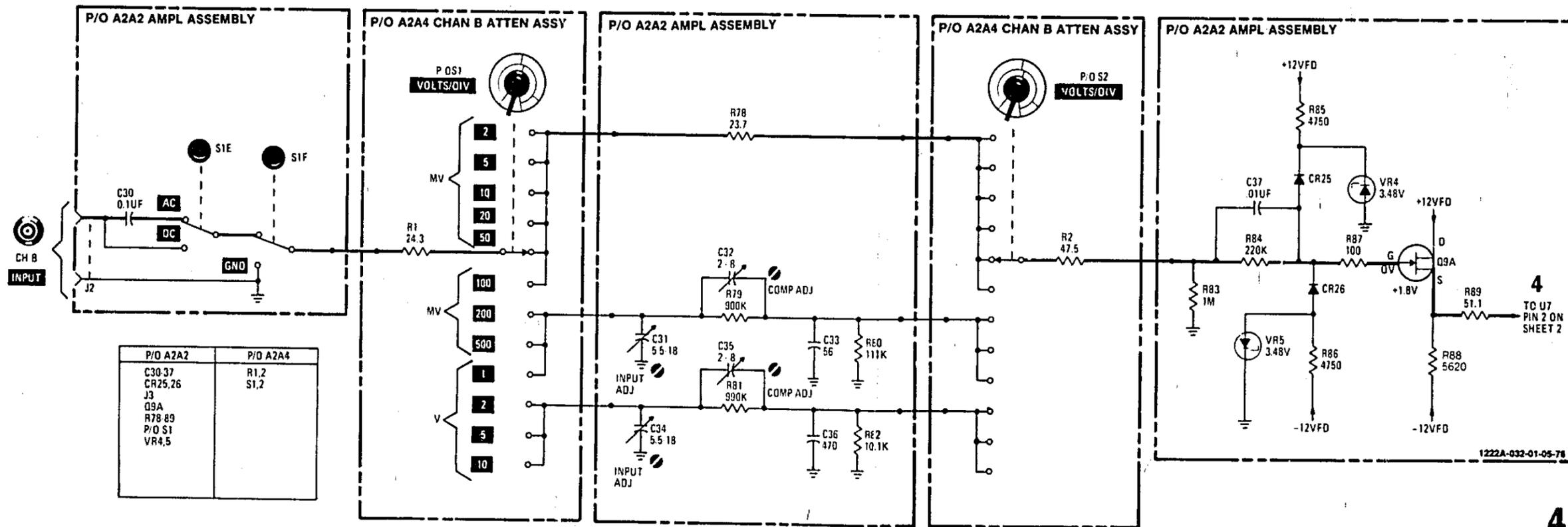
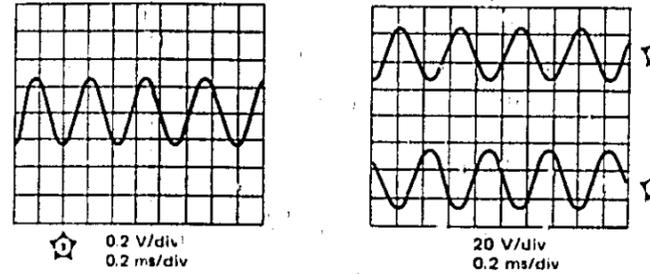


1222A-S08(12/78)

Figure 8-7.
Schematic 3, Channel A Preamp (Sheet 2 of 2)
8-13

**WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 4**

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:
 TIME/DIV 0.2 ms/div
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector (to channel B INPUT connector when checking channel B).



4

Figure 8-8. Schematic 4, Channel B Attenuator (Sheet 1 of 2)

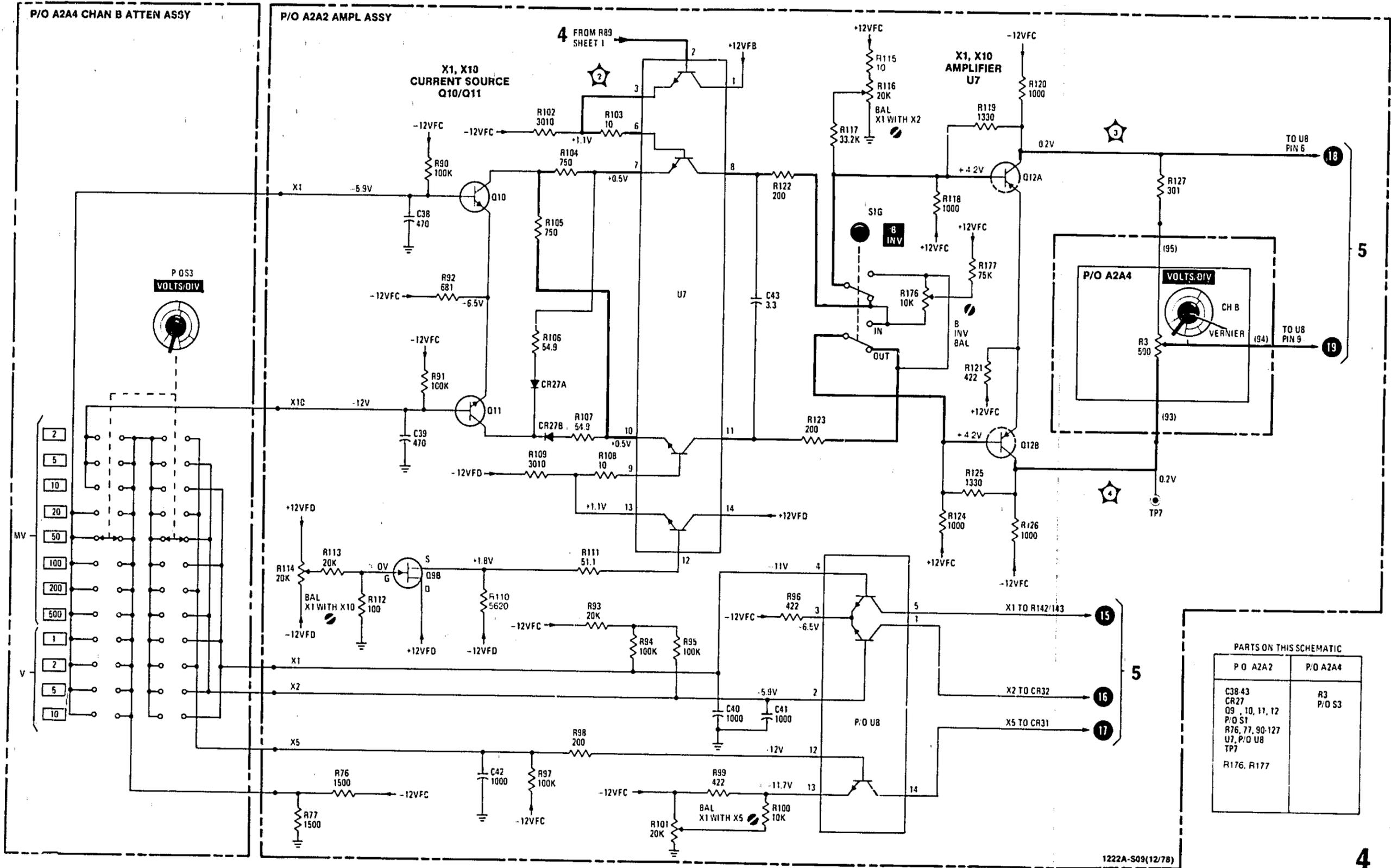


Figure 8-8.
Schematic 4, Channel B Preamplifier (Sheet 2 of 2)
8-15 (8-16 Blank)

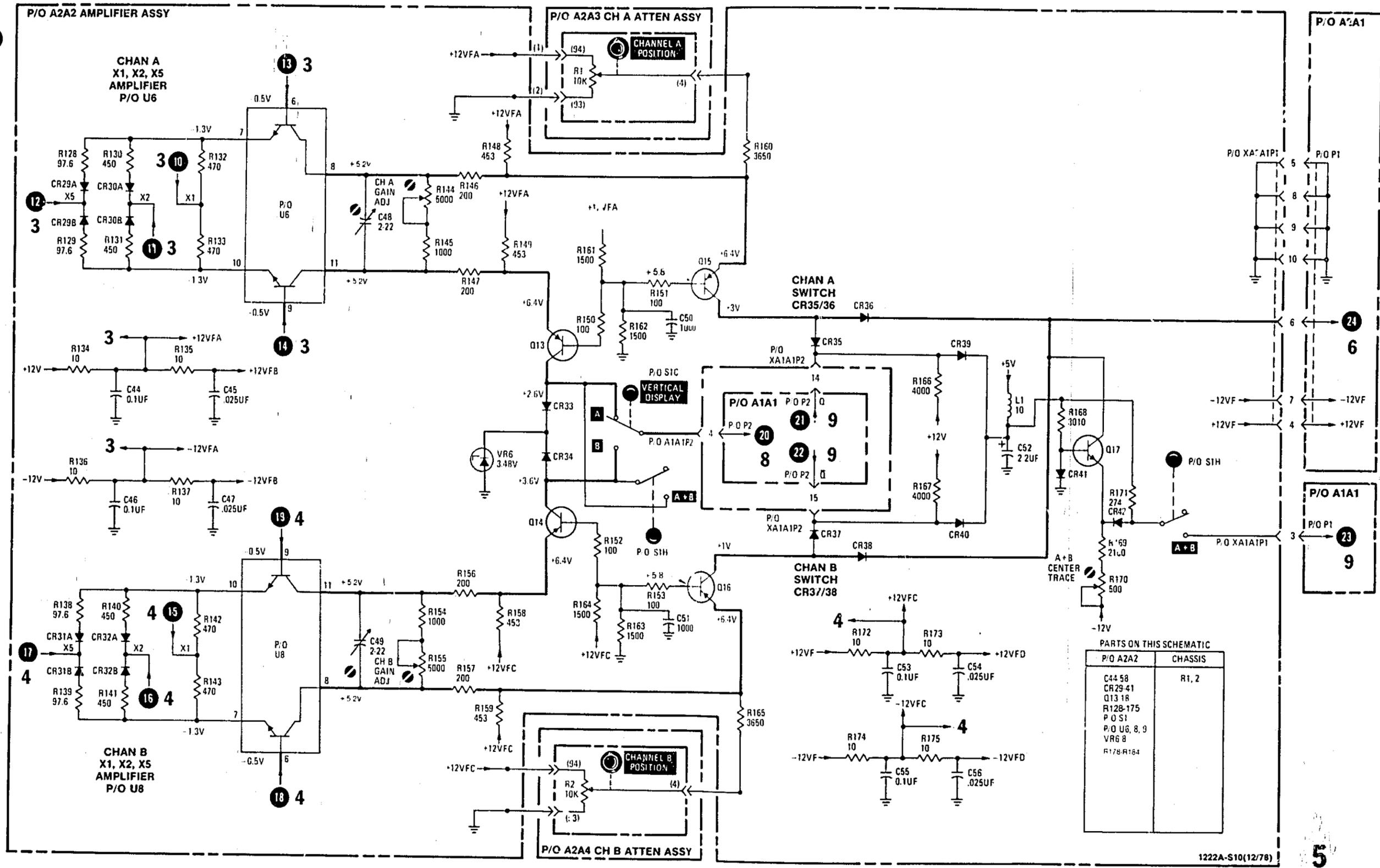
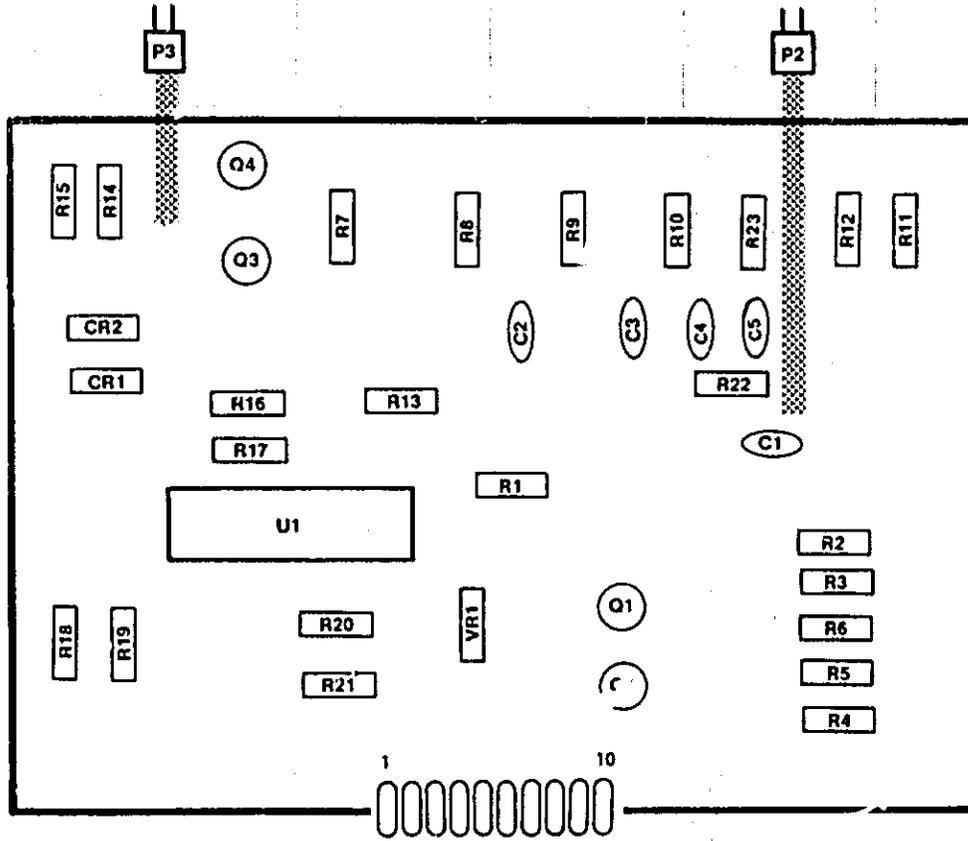


Figure 8-9.
Schematic 5, Vertical Preamplifiers and Channel Switching (A2A2)
8-17



A2 A1

1222A-034-05-76

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-1	Q1	D-4	R7	C-2	R17	B-3
C2	D-3	Q2	D-4	R8	C-2	R18	A-4
C3	D-3	Q3	B-2	R9	D-2	R19	B-4
C4	E-3	Q4	B-2	R10	D-2	R20	C-4
C5	E-3	R1	D-3	R11	F-2	R21	C-4
CR1	B-2	R2	E-4	R12	E-2	R22	E-3
CR2	B-2	R3	E-4	R13	C-3	R23	E-2
P1	C-5	R4	E-5	R14	B-2		
P2	E-1	R5	E-4	R15	A-2	U1	B-4
P3	B-1	R6	E-4	R16	B-3	VR1	C-4

Figure 8-10. A2A1 Delay-line Driver, Component Locations

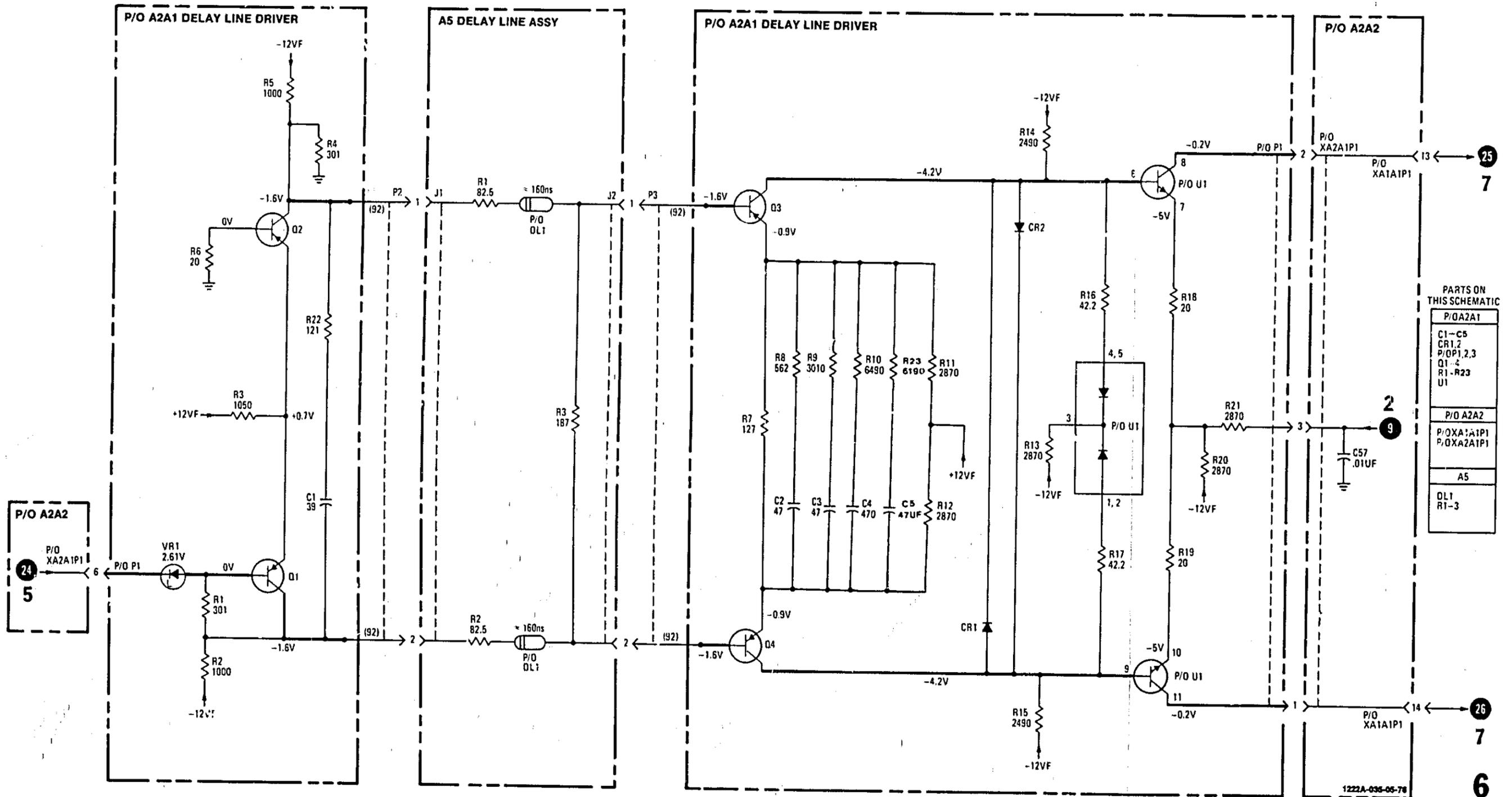
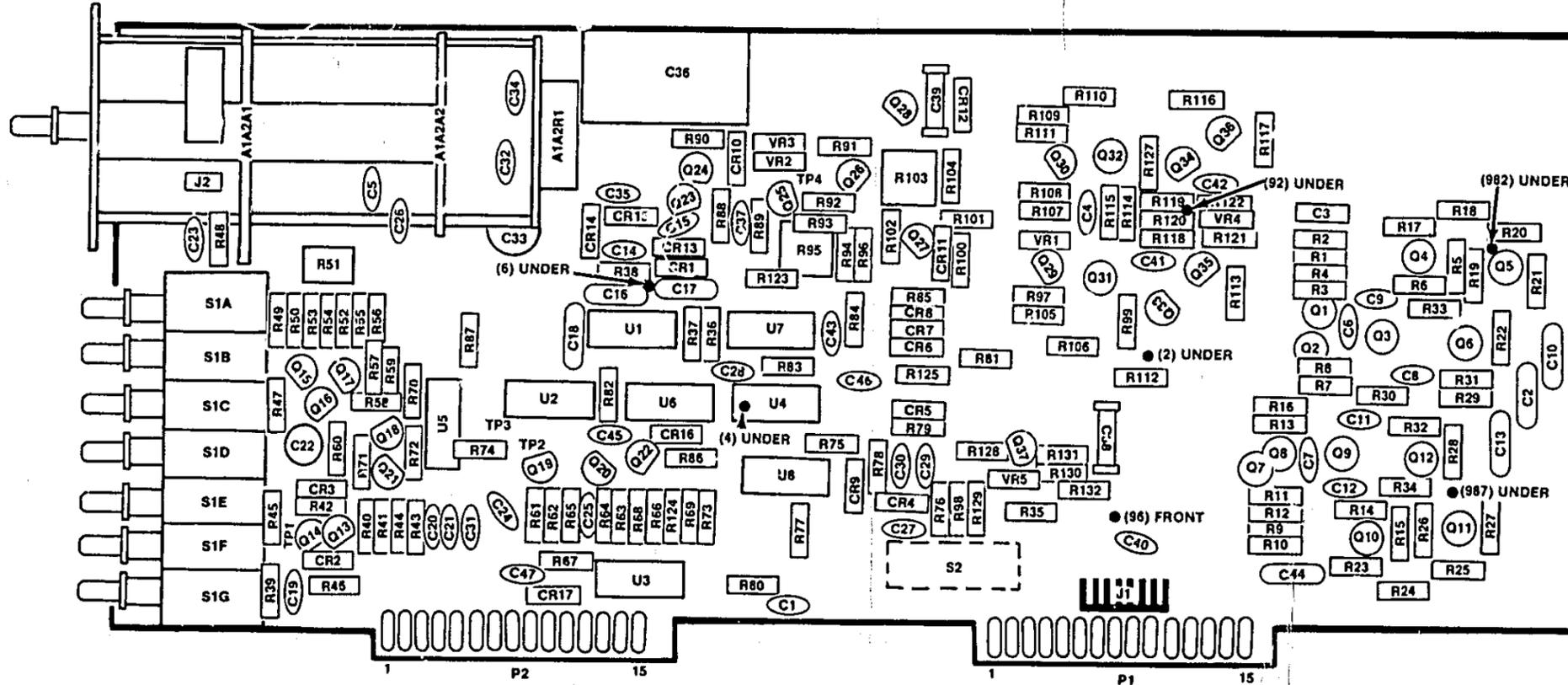


Figure 8-11.
Schematic 6, Delay-line Driver
8-19

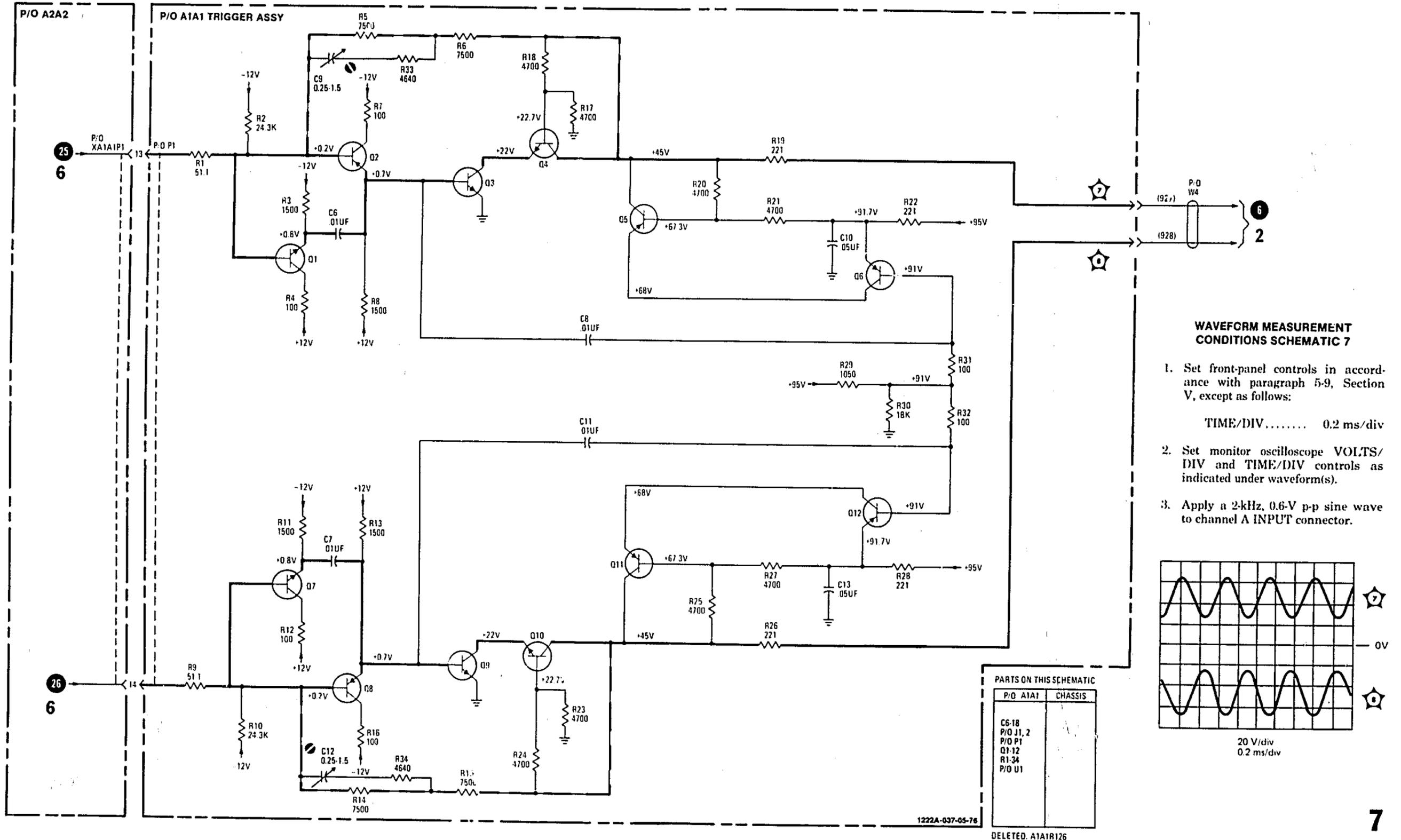


A1A1

REF DESIG	GRID LOC																												
A1	C-2	C15	F-3	C33	E-3	CR4	H-5	Q1	K-3	Q19	F-4	Q36	J-2	R16	J-4	R33	L-3	R50	C-3	R67	E-5	R84	G-3	R101	H-3	R118	J-3	TP1	C-5
A1A2	B-2	C16	F-3	C34	F-3	CR5	H-4	Q2	K-3	Q20	F-4	Q37	I-4	R17	K-3	R34	K-4	R51	D-3	R68	F-5	R85	H-3	R102	H-3	R119	J-2	TP2	E-4
A2	D-2	C17	F-3	C35	F-3	CR6	H-3	Q3	K-3	Q21	D-4	R1	L-2	R18	L-2	R35	L-5	R52	D-3	R69	F-5	R86	F-4	R103	H-2	R120	J-3	TP3	E-4
A2R1	E-2	C18	F-3	C36	F-3	CR7	H-3	Q4	K-3	Q22	F-4	R2	K-3	R19	L-3	R36	F-3	R53	D-3	R70	D-4	R67	E-3	R104	H-2	R121	J-3	TP4	E-4
C2	K-3	C20	D-5	C38	I-4	CR9	G-4	Q5	L-3	Q23	F-2	R3	K-3	R20	L-3	R37	F-3	R54	D-3	R71	D-4	R82	E-3	R105	I-3	R122	J-2	U1	G-2
C3	K-3	C21	F-5	C39	H-2	CR10	G-2	Q6	L-3	Q24	F-2	R4	K-3	R21	L-3	R38	F-3	R55	D-3	R72	D-4	R89	G-3	R106	I-3	R123	G-3	U2	F-3
C4	I-3	C22	D-4	C40	I-5	CR11	H-3	Q7	J-4	Q25	G-2	R5	L-3	R22	L-3	R39	C-5	R56	D-3	R73	F-5	R90	F-2	R107	I-3	R124	F-5	U3	F-4
C5	D-2	C23	C-3	C41	J-3	CR12	H-2	Q8	K-3	Q26	G-2	R6	K-3	R23	K-5	R40	D-5	R57	D-4	R74	E-4	R91	G-2	R108	I-2	R125	H-4	U4	F-5
C6	K-3	C24	F-5	C42	J-3	CR13	F-3	Q9	K-3	Q27	H-3	R7	K-4	R24	K-5	R41	D-5	R58	D-4	R75	G-4	R92	G-3	R109	I-2	R127	J-2	U5	G-4
C7	K-4	C25	D-3	C43	G-2	CR14	F-3	C10	L-5	Q28	H-2	R8	K-4	R25	L-5	R42	D-5	R59	D-4	R76	H-5	R93	G-3	R110	I-2	R128	H-4	U6	D-4
C8	K-4	C26	F-5	C44	K-5	CR15	F-3	C11	L-5	Q29	I-3	R9	J-5	R26	K-5	R43	D-5	R60	D-4	R77	G-5	R94	G-3	R111	I-2	R129	H-5	U7	F-4
C9	K-3	C27	D-3	C45	G-4	CR16	F-3	C12	K-5	Q30	I-2	R10	J-5	R27	L-5	R44	D-5	R61	E-6	R78	I-4	R95	G-3	R112	I-4	R130	I-4	U8	G-3
C10	L-4	C28	G-4	C46	F-4	CR17	E-5	C13	D-5	Q31	I-3	R11	J-4	R28	L-4	R45	C-5	R62	E-6	R79	I-4	R96	G-3	R113	J-3	R131	I-4	VR1	I-3
C11	K-4	C29	H-4	C47	F-5	J1	I-5	Q14	D-5	Q32	I-2	R12	J-5	R29	L-4	R46	D-5	R63	F-5	R80	G-5	R97	G-3	R114	I-3	R132	I-4	VR2	G-2
C12	K-4	C30	H-4	CR1	F-3	J2	C-2	Q15	C-4	Q33	J-3	R13	J-4	R30	K-4	R47	C-4	R64	F-5	R81	H-4	R98	H-5	R115	I-3	S1	C-3	VR3	G-2
C13	L-4	C31	E-5	CR2	D-5	P1	I-6	Q16	D-4	Q34	J-2	R14	K-5	R31	L-4	R48	C-3	R65	E-5	R82	I-4	R99	I-3	R116	J-2	S2	H-5	VR4	J-3
C14	F-3	C32	E-2	CR3	D-4	P2	I-6	Q18	D-4	Q35	J-3	R15	K-5	R32	K-4	R49	C-3	R66	F-5	R83	G-4	R100	H-3	R117	J-2	VR5	I-4		

1222A-511 (12/78)

Figure 8-12. A1A1 Horizontal, Trigger and Vertical Output Component Locations



**WAVEFORM MEASUREMENT
CONDITIONS SCHEMATIC 7**

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:

TIME/DIV..... 0.2 ms/div
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector.

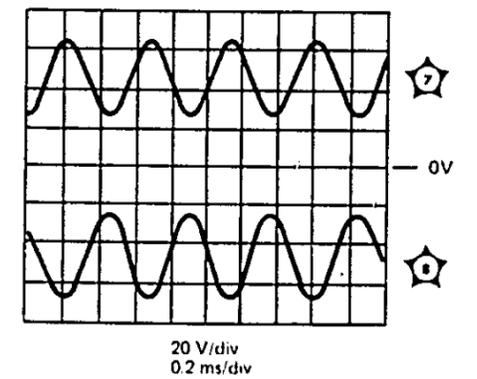
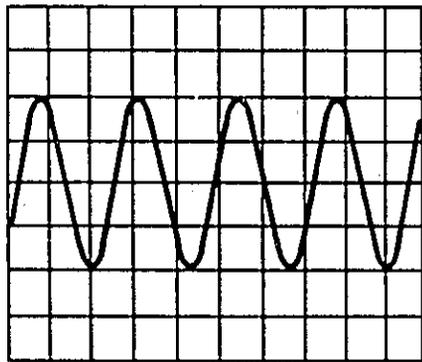


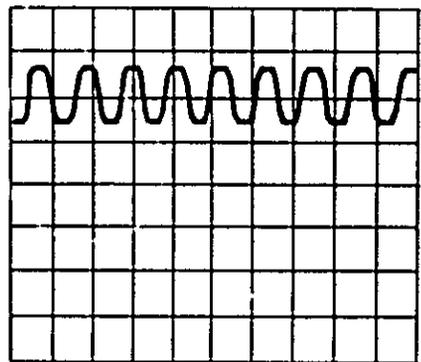
Figure 8-13.
Schematic 7, Vertical Output (A1A1)
8-21

**WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 8**

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:
TIME/DIV 1 ms/div
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V sine wave to channel A INPUT connector.



9 2 V/div
0.2 ms/div



10 2 V/div
2 ms/div

1222A-038-01-05-76

0V

Figure 8-14. Schematic 8, Sync Input (Sheet 1 of 2)

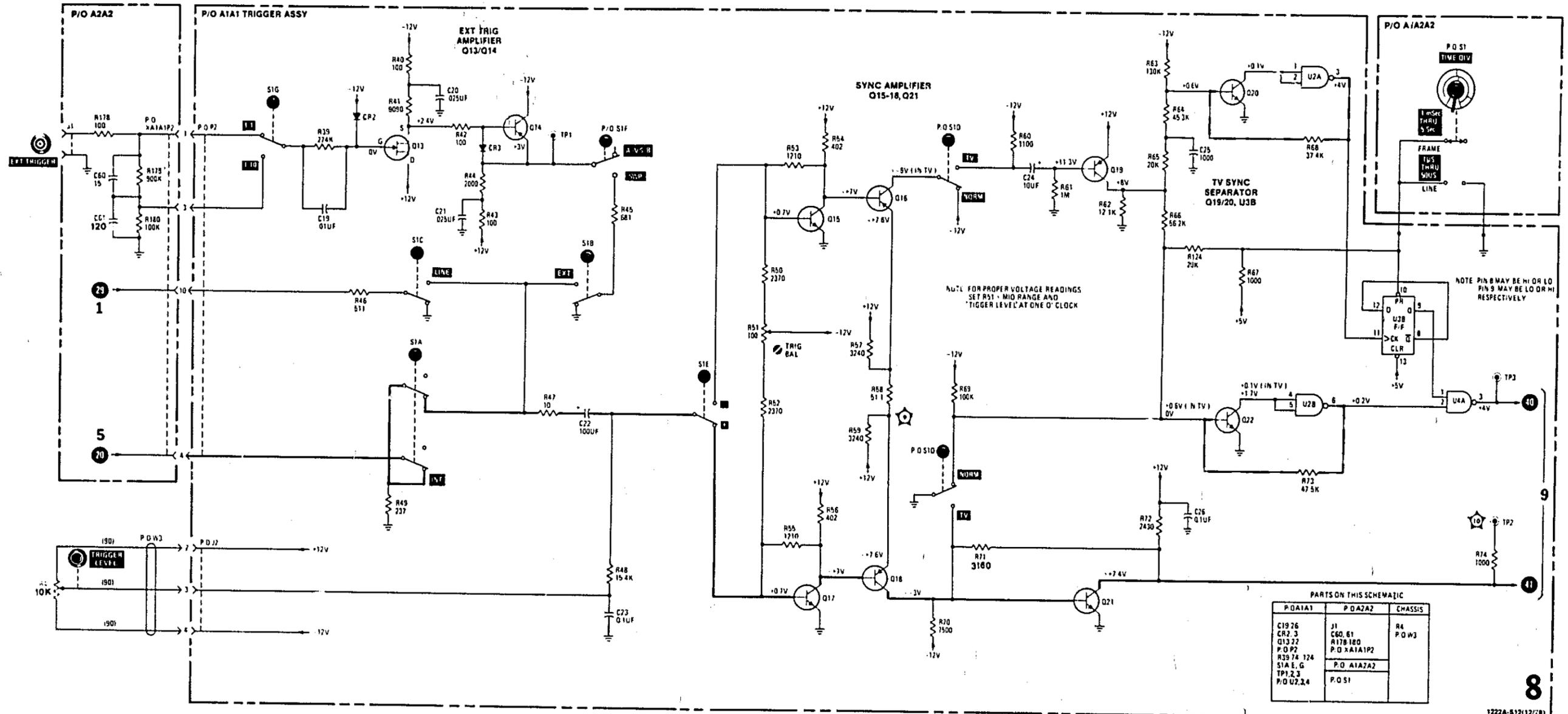
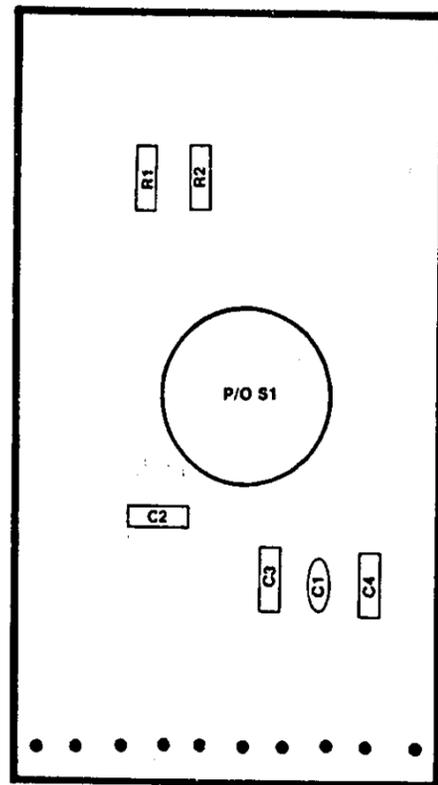


Figure 8-14.
Schematic 8, Sync Input (Sheet 2 of 2)
8-23



A1A2A1

1222A-038-05-78

Figure 8-15. A1A2A1, P/O Time/Div Switch, Component Locations

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC A9

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:

TIME/DIV 1 ms/div

2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).

3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector.

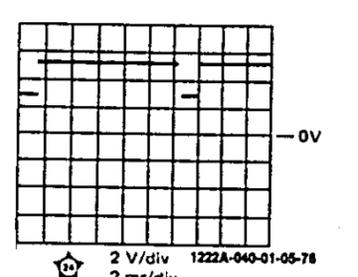
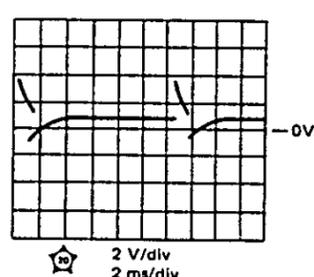
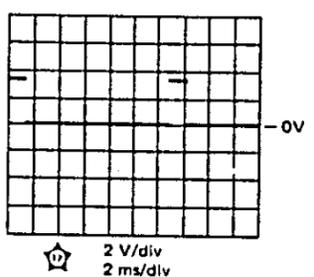
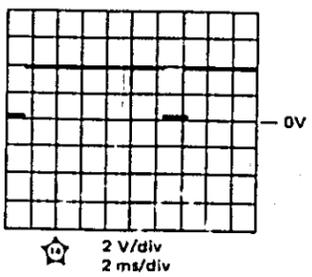
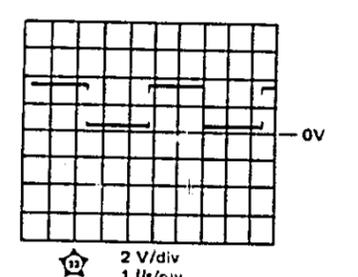
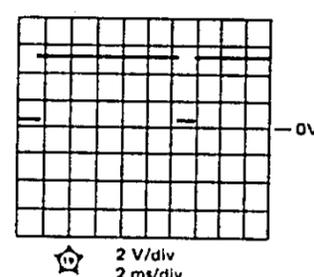
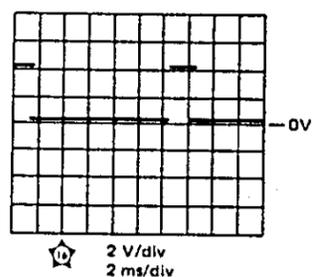
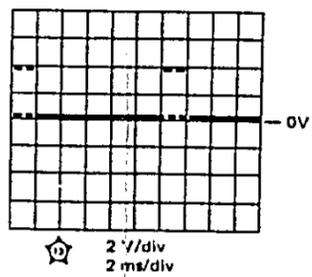
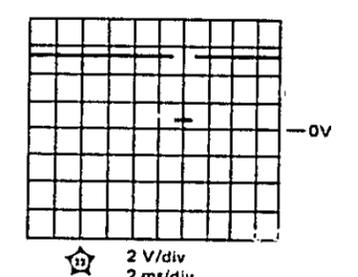
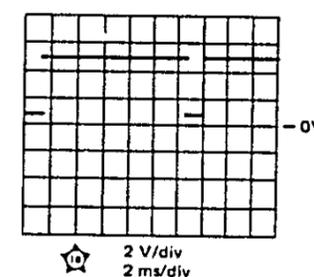
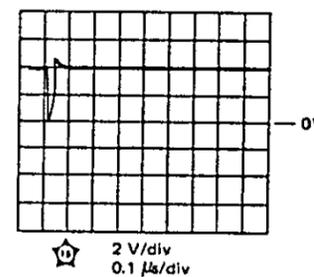
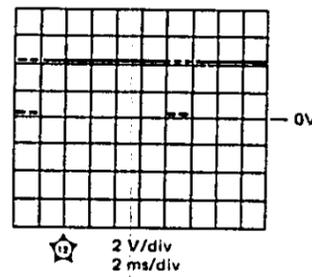
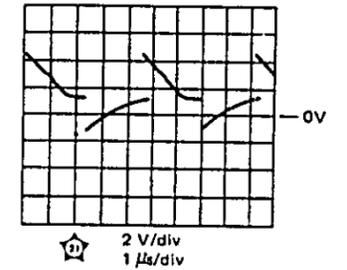
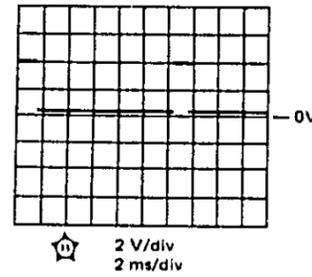


Figure 8-16. Schematic 9, Trigger Generator (Sheet 1 of 2)

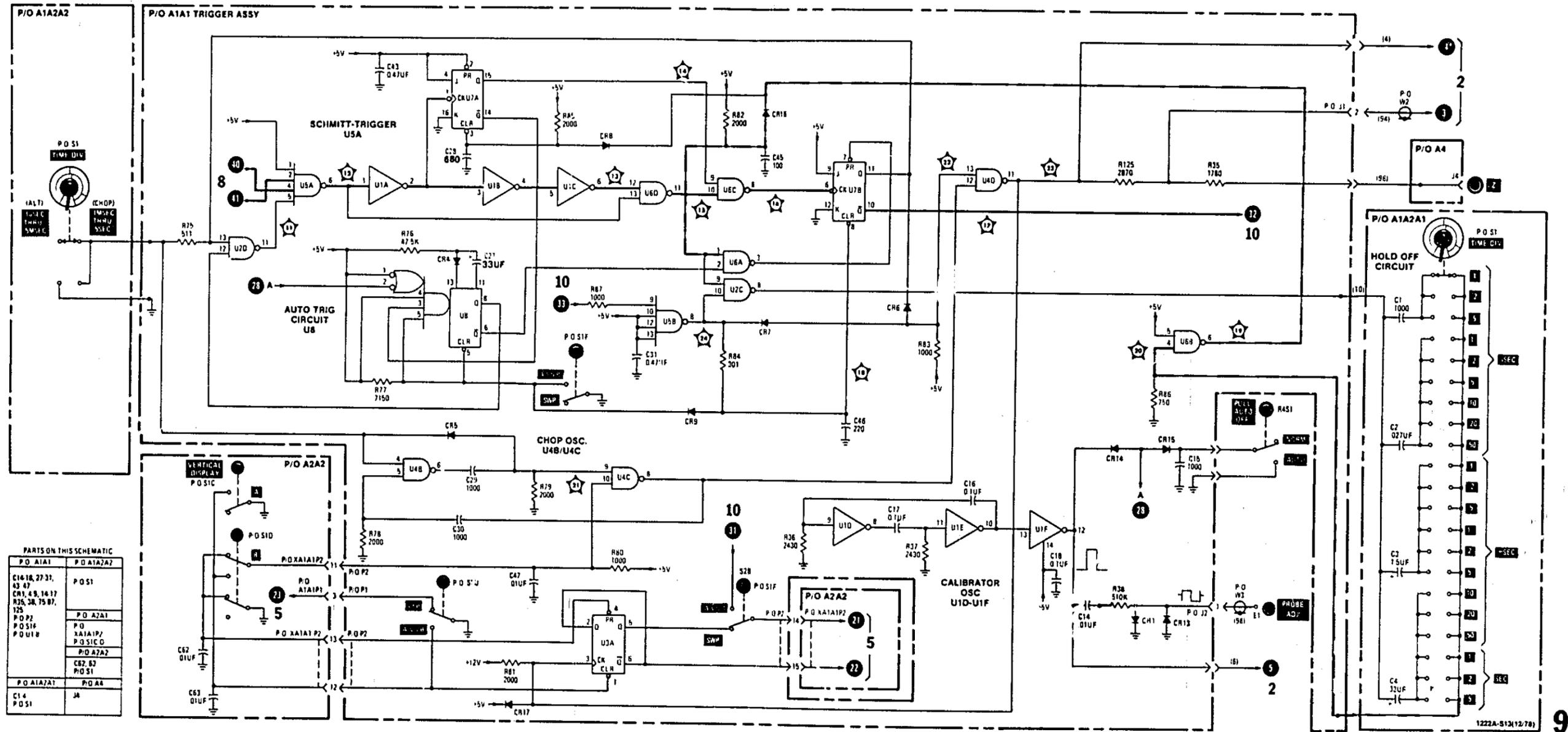
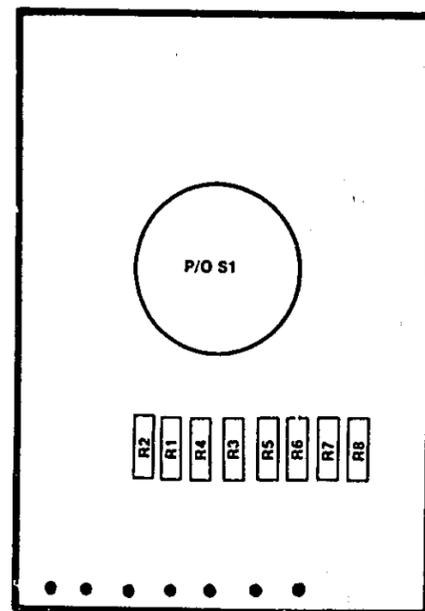


Figure 8-16.
Schematic 9, Trigger Generator (Sheet 2 of 2)
8-25



A1A2A2

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Figure 8-17. A1A2A2, P/O Time/Div Switch, Component Locations

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 10

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:
TIME/DIV 1 ms/div
2. Set monitor oscilloscope VOLTS/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector.

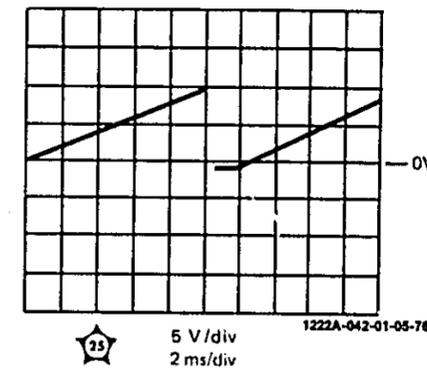
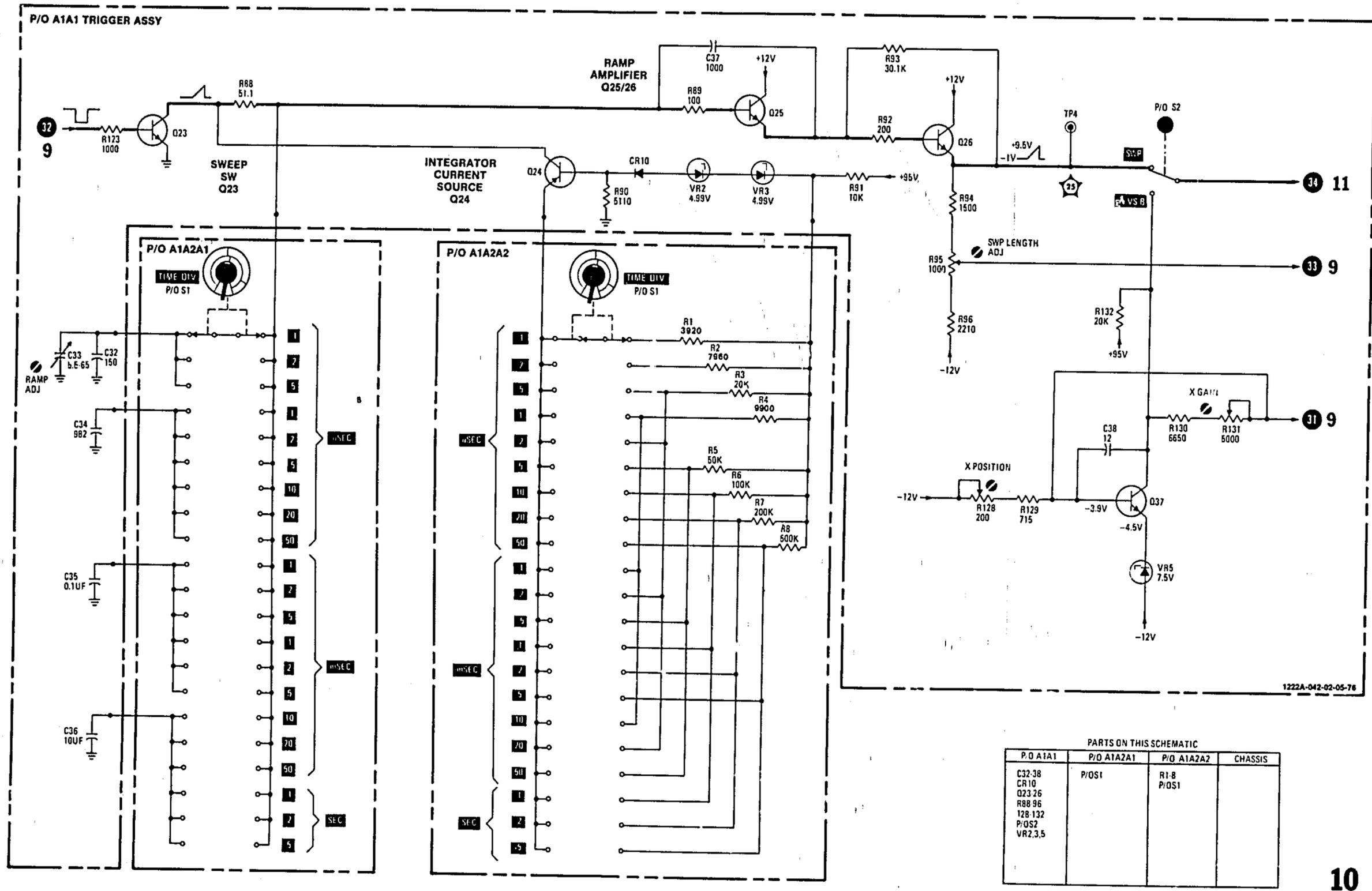


Figure 8-18. Schematic 10, Main Sweep (A1A1) (Sheet 1 of 2)



1222A-042-02-05-76

Figure 8-18.
Schematic 10, Main Sweep (A1A1) (Sheet 2 of 2)
8-27

**WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 11**

1. Set front-panel controls in accordance with paragraph 5-9, Section V, except as follows:

TIME/DIV 1 ms/div

2. Set monitor oscilloscope VOLT/DIV and TIME/DIV controls as indicated under waveform(s).
3. Apply a 2-kHz, 0.6-V p-p sine wave to channel A INPUT connector.

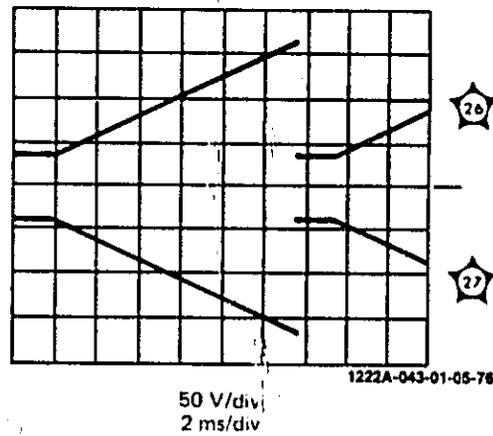
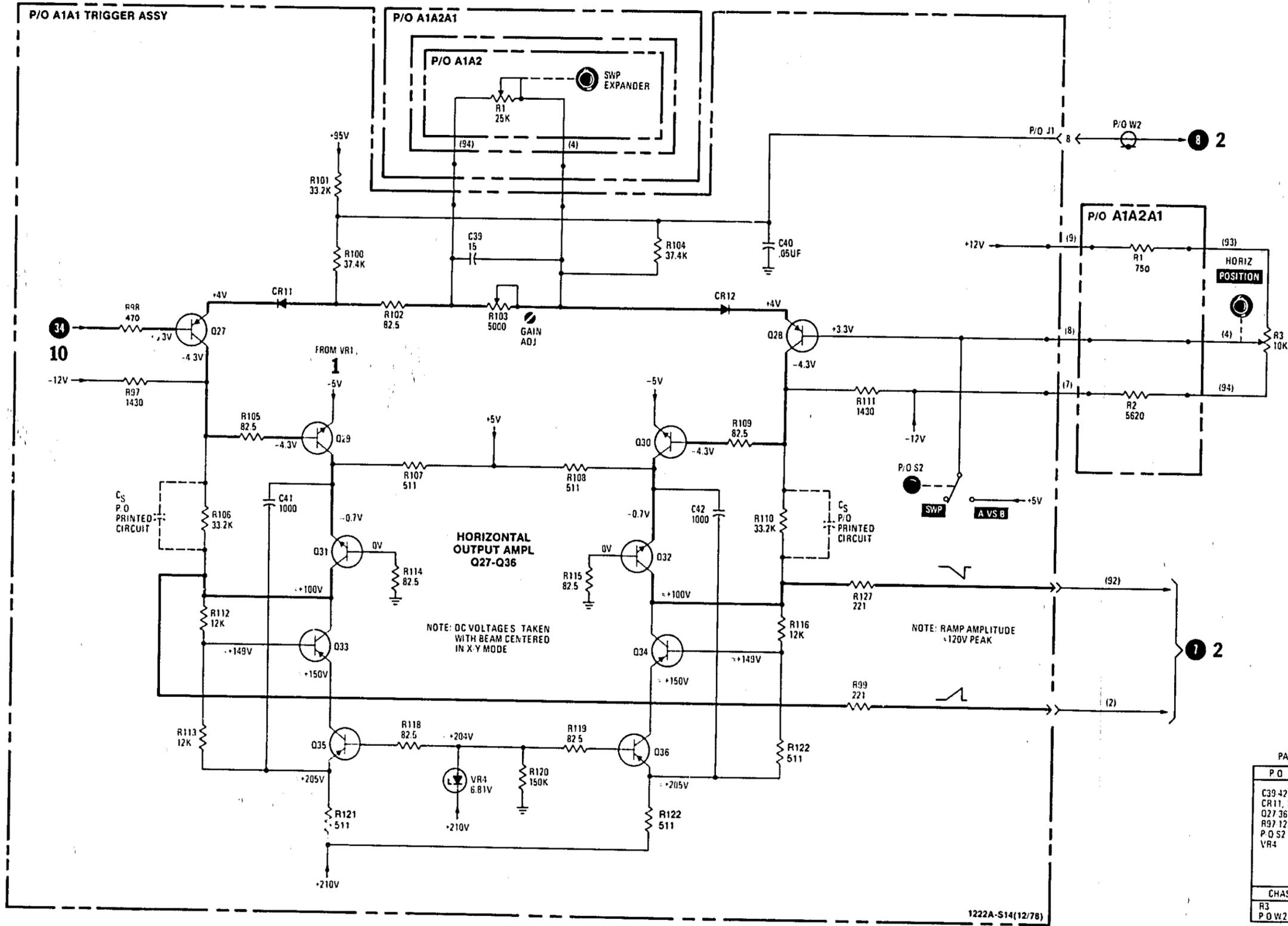


Figure 8-19. Schematic 11, Horizontal Output (A1A1) (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC

P/O A1A1	P/O A1A2
C39-42 CR11, 12 Q27, 36 R97, 122, 127 P/O S2 VR4	R1
	P/O A1A2A1
	R1, 2
CHASSIS	
R3 P/O W2	

Figure 8-19.
Schematic 11, Horizontal Output (A1A1) (Sheet 2 of 2)
8-29