

## Errata

**Title & Document Type:** 1745A Oscilloscope Operating and Service Manual

**Manual Part Number:** 01745-90901

**Revision Date:** September 1982

### About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

### 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.

### Support for Your Product

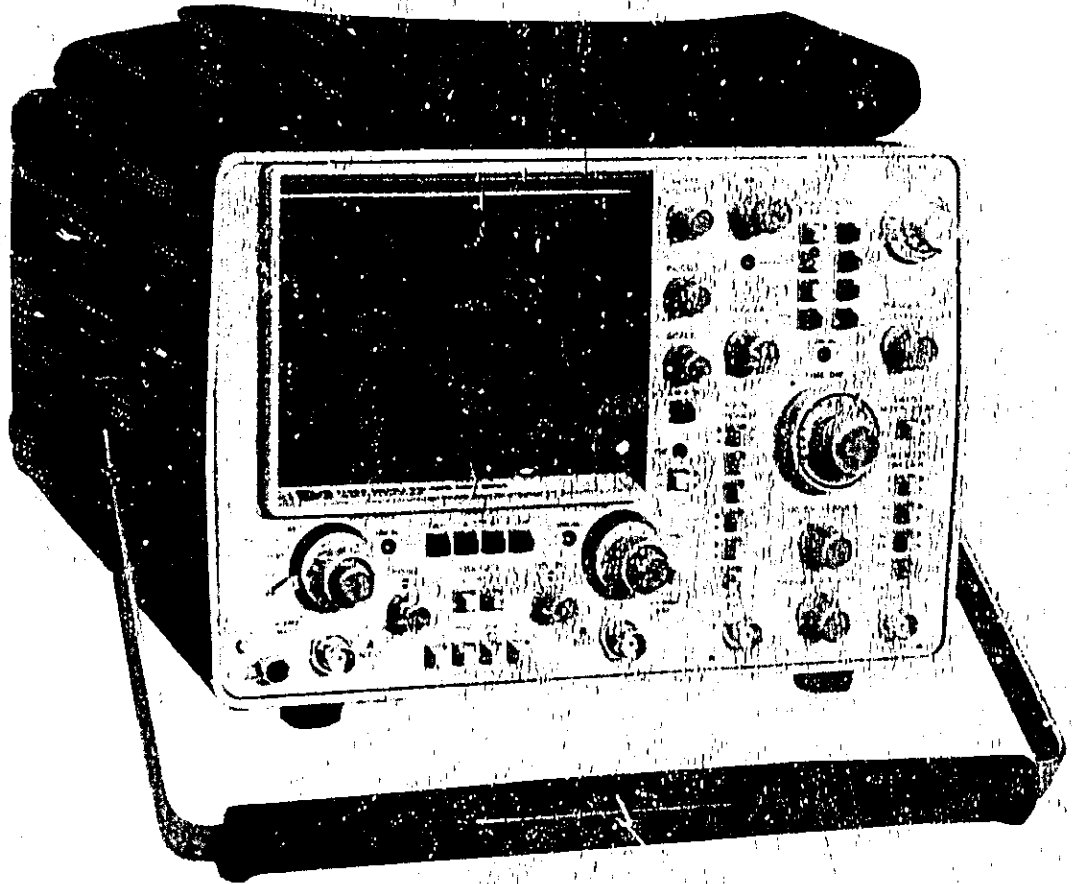
Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

[www.agilent.com](http://www.agilent.com)

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.

OPERATING AND SERVICE MANUAL

# 1745A OSCILLOSCOPE



HEWLETT  
PACKARD

## **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 I 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 1745A OSCILLOSCOPE

### SERIAL NUMBERS

This Manual applies directly to instruments with serial numbers prefixed 2226A.

For additional information about serial numbers, refer to **INSTRUMENTS COVERED BY MANUAL**, in Section I.

© COPYRIGHT HEWLETT-PACKARD COMPANY/COLORADO SPRINGS DIVISION 1982  
1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

ALL RIGHTS RESERVED

Operating and Service Manual Part No. 01745-90901  
Operating and Service Manual Microfiche Part No. 01745-90801

PRINTED: SEPTEMBER 1982

## SAFETY CONSIDERATIONS

**GENERAL** — This is a Safety Class I instrument (provided with terminal for protective earthing).

**OPERATION** — BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage, the correct fuse is installed, and Safety Precautions are taken (see the following warnings). In addition, note the instrument's external markings which are described under "Safety Symbols."

### WARNING

Service instructions are for use by service-trained personnel. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

**BEFORE SWITCHING ON THE INSTRUMENT**, the protective earth terminal of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two conductor outlet is not sufficient protection.

If this instrument is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short circuited fuseholders. To do so could cause a shock or fire hazard.

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.

Do not install substitute parts or perform any unauthorized modification to the instrument.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible, and when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

### SAFETY SYMBOLS



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the product.



Indicates hazardous voltages.



Earth terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

### WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

### CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood or met.

## TABLE OF CONTENTS

| Section                                           | Page | Section                                                | Page |
|---------------------------------------------------|------|--------------------------------------------------------|------|
| <b>I GENERAL INFORMATION</b> .....                | 1-1  | 45. Test Record .....                                  | 4-1  |
| 1-1. Introduction .....                           | 1-1  | 47. Calibration Cycle .....                            | 4-1  |
| 1-5. Specification .....                          | 1-1  | 49. Operation Verification .....                       | 4-1  |
| 1-7. Safety Considerations .....                  | 1-1  | 4-11. Initial Control Settings .....                   | 4-1  |
| 1-9. Instrument Covered by Manuals .....          | 1-1  | 4-13. Performance Test Procedures .....                | 4-1  |
| 1-14. Description .....                           | 1-2  | 4-14. Bandwidth .....                                  | 4-1  |
| 1-17. Options .....                               | 1-2  | 4-17. Common Mode Rejection Ratio<br>(CMRR) .....      | 4-3  |
| 1-19. Accessories Supplied .....                  | 1-2  | 4-19. Triggering (Internal) .....                      | 4-3  |
| 1-22. Recommended Test Equipment .....            | 1-6  | 4-21. Triggering (External) .....                      | 4-4  |
| <b>II INSTALLATION</b> .....                      | 2-1  | 4-23. Sweep Time Accuracy .....                        | 4-5  |
| 2-1. Introduction .....                           | 2-1  | 4-25. Differential Time Accuracy .....                 | 4-5  |
| 2-2. Initial Inspection .....                     | 2-1  | 4-27. Delay Jitter .....                               | 4-5  |
| 2-3. Preparation for Use .....                    | 2-1  | 4-29. Rise Time .....                                  | 4-7  |
| 2-4. Power Requirements .....                     | 2-1  | 4-31. Z-axis Blanking .....                            | 4-7  |
| 2-5. Line Voltage and Fuse<br>Selection .....     | 2-1  | 4-33. Deflection Factor .....                          | 4-7  |
| 2-6. AC Power Cable .....                         | 2-2  | 4-35. Calibrator .....                                 | 4-8  |
| 2-7. Mating Connectors .....                      | 2-3  | <b>V ADJUSTMENTS</b> .....                             | 5-1  |
| 2-8. Operating Environment .....                  | 2-3  | 5-1. Introduction .....                                | 5-1  |
| 2-9. Storage and Environment .....                | 2-3  | 5-3. Safety Requirements .....                         | 5-1  |
| 2-10. Environment .....                           | 2-3  | 5-5. Equipment Required .....                          | 5-1  |
| 2-11. Packaging .....                             | 2-3  | 5-7. Adjustments .....                                 | 5-1  |
| 2-12. Original Packaging .....                    | 2-3  | 5-10. Adjustment Procedure .....                       | 5-3  |
| 2-13. Other Packaging .....                       | 2-3  | 5-13. Low-voltage Power Supply<br>Adjustment .....     | 5-3  |
| <b>III OPERATION</b> .....                        | 3-1  | 5-14. High Voltage Power Supply<br>Adjustment .....    | 5-3  |
| 3-1. Introduction .....                           | 3-1  | 5-15. Intensity Limit Adjustment .....                 | 5-4  |
| 3-3. Panel Features .....                         | 3-1  | 5-16. Astigmatism and Focus<br>Adjustment .....        | 5-4  |
| 3-5. Operator's Checks .....                      | 3-1  | 5-17. Gate Response Adjustment .....                   | 5-4  |
| 3-7. Initial Turn-on Procedure .....              | 3-1  | 5-18. Floodgun Adjustment .....                        | 5-4  |
| 3-8. Trace Alignment .....                        | 3-1  | 5-19. Trace Align and Y-axis Align<br>Adjustment ..... | 5-4  |
| 3-9. Focus and Astigmatism Adjust-<br>ments ..... | 3-1  | 5-20. Calibrator Amplitude<br>Adjustment .....         | 5-4  |
| 3-10. Probe Compensation .....                    | 3-2  | 5-21. Trigger Sensitivity Adjustment .....             | 5-4  |
| 3-11. Vertical Accuracy Check .....               | 3-2  | 5-22. Sync Zero Adjustment .....                       | 5-5  |
| 3-12. Sweep Time Accuracy .....                   | 3-2  | 5-23. Trigger View Balance Adjust-<br>ment .....       | 5-5  |
| 3-13. Operating Instructions .....                | 3-2  | 5-24. Delay Start Adjustment .....                     | 5-5  |
| 3-15. Auto versus Norm .....                      | 3-2  | 5-25. Horizontal Amplifier Gain .....                  | 5-6  |
| 3-16. Sweep after Delay .....                     | 3-2  | 5-26. Preliminary Main Sweep<br>Calibration .....      | 5-6  |
| 3-17. Obtaining Basic Displays .....              | 3-2  | 5-27. X10 Amplifier Balance Adjust-<br>ment .....      | 5-6  |
| 3-18. Normal Sweep Display .....                  | 3-2  | 5-28. Horizontal Linearity Adjust-<br>ment .....       | 5-6  |
| 3-19. Magnified Sweep Display .....               | 3-3  | 5-29. Delayed Sweep Adjustment .....                   | 5-7  |
| 3-20. Delayed Sweep Display .....                 | 3-3  | 5-30. Main Sweep Fine Adjustments .....                | 5-7  |
| 3-21. Mixed Sweep Display .....                   | 3-3  | 5-31. Vertical Amplifier Balance<br>Adjustment .....   | 5-8  |
| 3-22. A vs B Display .....                        | 3-4  | 5-32. Position and Sync Balance<br>Adjustment .....    | 5-8  |
| 3-23. Single Sweep Operation .....                | 3-4  |                                                        |      |
| 3-24. Single Sweep Using<br>Trigger View .....    | 3-4  |                                                        |      |
| <b>IV PERFORMANCE TESTS</b> .....                 | 4-1  |                                                        |      |
| 4-1. Introduction .....                           | 4-1  |                                                        |      |
| 4-3. Equipment Required .....                     | 4-1  |                                                        |      |

**TABLE OF CONTENTS (Cont'd)**

| Section                    | Page                                                          | Section            | Page                                    |
|----------------------------|---------------------------------------------------------------|--------------------|-----------------------------------------|
| 5-33.                      | Input Capacitance and Attenuator Compensation Adjustments ... | VIII SERVICE ..... | 8-1                                     |
|                            | 5-9                                                           | 8-1.               | Introduction .....                      |
| 5-34.                      | Vertical Gain Adjustment .....                                |                    | 8-1                                     |
|                            | 5-9                                                           | 8-3.               | Safety Consideration .....              |
| 5-35.                      | 0.01 Volt/Div Pulse Response Adjustment .....                 |                    | 8-1                                     |
|                            | 5-9                                                           | 8-5.               | Service Sheets .....                    |
| 5-36.                      | 0.5 Volt/Div Pulse Response Adjustment .....                  |                    | 8-1                                     |
|                            | 5-10                                                          | 8-7.               | Schematics .....                        |
| 5-37.                      | X-Y Gain Adjustment .....                                     |                    | 8-1                                     |
|                            | 5-10                                                          | 8-11.              | Component Locations .....               |
| VI REPLACEABLE PARTS ..... | 6-1                                                           | 8-12.              | Theory of Operation .....               |
| 6-1.                       | Introduction .....                                            |                    | 8-1                                     |
|                            | 6-1                                                           | 8-13.              | Reference Designation .....             |
| 6-3.                       | Abbreviations .....                                           |                    | 8-1                                     |
|                            | 6-1                                                           | 8-15.              | Troubleshooting .....                   |
| 6-5.                       | Replaceable Parts List .....                                  |                    | 8-1                                     |
| 6-7.                       | Ordering Information .....                                    |                    | 8-16.                                   |
| 6-10.                      | Direct Mail Order System .....                                |                    | Initial Troubleshooting Procedure ..... |
| VII MANUAL CHANGES .....   | 7-1                                                           |                    | 8-1                                     |
| 7-1.                       | Introduction .....                                            |                    | 8-17.                                   |
|                            | 7-1                                                           |                    | DC Voltages and Waveforms ....          |
|                            |                                                               |                    | 8-18.                                   |
|                            |                                                               |                    | Trouble Diagnosis .....                 |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-19.                                   |
|                            |                                                               |                    | Circuit-level Troubleshooting ....      |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-20.                                   |
|                            |                                                               |                    | Recommended Test Equipment ....         |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-22.                                   |
|                            |                                                               |                    | Repair .....                            |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-23.                                   |
|                            |                                                               |                    | Assembly Removal .....                  |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-24.                                   |
|                            |                                                               |                    | Preventive Maintenance .....            |
|                            |                                                               |                    | 8-2                                     |
|                            |                                                               |                    | 8-30.                                   |
|                            |                                                               |                    | Circuit Boards .....                    |
|                            |                                                               |                    | 8-3                                     |

**LIST OF ILLUSTRATIONS**

| Figure | Title                                         | Page | Figure | Title                                                 | Page |
|--------|-----------------------------------------------|------|--------|-------------------------------------------------------|------|
| 2-1.   | Line Voltage Selection Switch Setting ..      | 2-2  | 4-1.   | Bandwidth Test Setup .....                            | 4-3  |
| 2-2.   | Power Cables and Mains Plug Part Number ..... | 2-2  | 4-2.   | CMRR Test Setup .....                                 | 4-3  |
|        |                                               |      | 4-3.   | External Triggering Test Setup .....                  | 4-4  |
| 3-1.   | Controls and Connectors .....                 | 3-0  | 5-1.   | Adjustment Locations .....                            | 5-15 |
| 3-2.   | Divider Probe Adjustment Display .....        | 3-2  | 6-1.   | Chassis Parts and Board Assembly Identification ..... | 6-3  |
| 3-3.   | Magnified Sweep .....                         | 3-3  | 8-1.   | Overall Block Diagram .....                           | 8-5  |
| 3-4.   | Delayed Sweep .....                           | 3-3  |        |                                                       |      |
| 3-5.   | Mixed Sweep .....                             | 3-4  |        |                                                       |      |

**LIST OF TABLES**

| Table | Title                                       | Page | Table | Title                                         | Page |
|-------|---------------------------------------------|------|-------|-----------------------------------------------|------|
| 1-1.  | Specifications .....                        | 1-3  | 5-5.  | Main Sweep Fine Adjustments .....             | 5-8  |
| 1-2.  | Recommended Test Equipment .....            | 1-6  | 5-6.  | Pulse Response Adjustments .....              | 5-10 |
| 2-1.  | Line Fuse Part Number .....                 | 2-2  | 5-7.  | A3R7 and A3R28 Resistance Values ...          | 5-10 |
|       |                                             |      | 5-8.  | Condensed Adjustment Procedure .....          | 5-11 |
| 4-1.  | Recommended Operation Verification ..       | 4-2  | 6-1.  | Reference Designators and Abbreviations ..... | 6-2  |
| 4-2.  | Main TIME/DIV Accuracy .....                | 4-6  | 6-2.  | Replaceable Parts List .....                  | 6-5  |
| 4-3.  | Delayed TIME/DIV Accuracy .....             | 4-6  | 6-3.  | List of Manufacturer's Codes .....            | 6-25 |
| 4-4.  | Deflection Factor Accuracy .....            | 4-8  | 8-1.  | Schematic Notes .....                         | 8-0  |
| 5-1.  | Adjustable Components .....                 | 5-1  | 8-2.  | Troubleshooting Sequence .....                | 8-2  |
| 5-2.  | Low-voltage Supply Limits .....             | 5-3  | 8-3.  | Assembly to Service Sheet Index .....         | 8-3  |
| 5-3.  | Preliminary Main Sweep Calibration ..       | 5-6  |       |                                               |      |
| 5-4.  | Delayed Sweep Calibration Adjustments ..... | 5-7  |       |                                               |      |

## LIST OF SERVICE SHEETS

| No. | Title                                 | Page | No. | Title                           | Page |
|-----|---------------------------------------|------|-----|---------------------------------|------|
| 1.  | LV Power Supply .....                 | 8-7  | 8.  | Main Sweep Generator .....      | 8-21 |
| 2.  | HV Power Supply .....                 | 8-9  | 9.  | Delayed Trigger Circuitry ..... | 8-23 |
| 3.  | Gate Circuitry .....                  | 8-11 | 10. | Delayed Sweep Generator .....   | 8-25 |
| 4.  | Vertical Preamplifier Circuitry ..... | 8-13 | 11. | Horizontal Output .....         | 8-27 |
| 5.  | Vertical Output .....                 | 8-15 | 12. | Gate Control Circuitry .....    | 8-29 |
| 6.  | Vertical Control Circuit .....        | 8-17 | 13. | Interconnect Assembly .....     | 8-31 |
| 7.  | Main Trigger Circuitry .....          | 8-19 |     |                                 |      |



## SECTION I

### GENERAL INFORMATION

#### 1-1. INTRODUCTION.

1-2. The HP Model 1745A is a dual-channel, 100-MHz, delayed sweep oscilloscope designed for general-purpose bench or field use. The 1745A Operating and Service Manual has eight major sections. The manual contains the following information:

Section I. General Information: describes the instruments documented by this manual. It also provides a basic description of the oscilloscope which includes accessories and specifications.

Section II. Installation: provides information about initial inspection, preparation for use, and storage and shipment.

Section III. Operation: provides detailed operating information for the instrument, including operator's checks and maintenance.

Section IV. Performance Tests: presents the procedures required to check the performance of the instrument against the critical specifications in table 1-1.

Section V. Adjustments: provides instructions for properly adjusting the instrument.

Section VI. Replaceable Parts: provides ordering information for all replaceable parts and assemblies.

Section VII. Manual Changes: contains manual change information necessary to document all serial prefixes listed on the title page of this manual. In addition, this section also contains recommended modifications for earlier instrument configurations.

Section VIII. Service: provides the information required to repair the instrument.

1-3. One copy of the 1745A Operating and Service Manual is supplied with each instrument. Additional copies may be ordered separately through your nearest Hewlett-Packard Sales office. The part number for the complete Operating and Service Manual is listed on the title page of this manual.

1-4. Also listed on the title page is the part number for a microfiche version of the complete Operating and Service Manual. The microfiches are 100×150 mm (4×6 in.) microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of manual pages. The microfiche package also includes the latest Manual Change supplement.

#### 1-5. SPECIFICATIONS.

1-6. Specifications and supplemental characteristics of the 1745A Oscilloscope are listed in table 1-1. This instrument will meet the electrical characteristics listed following complete calibration as given in the Adjustments section of the manual. These electrical characteristics apply over the ambient temperature range of 0 to 55°C except as otherwise noted.

#### 1-7. SAFETY CONSIDERATIONS.

**WARNING**

To prevent personal injury, observe all safety precautions and warnings stated on the instrument and in the manual.

1-8. The 1745A and related documentation must be reviewed for familiarization with safety markings and instructions before operation. Refer to the Safety Considerations page found at the beginning of this manual for a summary of general safety information. Safety precautions for installation, operation, and servicing are found in appropriate locations throughout the Operating and Service Manual. These 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 the manual violates safety standards of design, manufacture, and intended use of this instrument. Hewlett-Packard assumes no liability for failure to comply with these requirements.

#### 1-9. INSTRUMENTS COVERED BY MANUAL.

1-10. Attached to the instrument is a serial number plate. The serial number is in the form: 0000A00000. It is in two parts: the first four digits and the letter are the serial number prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The letter in the prefix designates the country in which the instrument was manufactured. (A=USA; G=Germany; J=Japan; S=Singapore.) The suffix, however, is assigned sequentially and is unique to each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-11. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number

prefix indicates the instrument is different from those described in this manual. Manuals accompanying these newer instruments include a Manual Changes supplement. The supplement contains change instructions for the entire Operating and Service Manual.

1-12. In addition to change information, the supplements may contain information for correcting errors in the manuals. To keep your manuals as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. These supplements are identified with the print date and part number that appears on the title page of this manual. Complimentary copies of these supplements are available from Hewlett-Packard.

1-13. For information concerning a serial number prefix that is not listed on the title page or in the Manual Change supplement, contact your nearest Hewlett-Packard Sales and Service office.

## 1-14. DESCRIPTION.

1-15. The Model 1745A is a dual-channel, 100-MHz, delayed-sweep oscilloscope. The dual-channel dc to 100 MHz vertical deflection system has 12 calibrated deflection factors from 5 mV/div to 20 V/div. A maximum sensitivity of 1 mV/div to 40 MHz is provided on both channels by means of a 5× vertical magnification. Selectable input impedance of either 50 ohms or 1 megohm permits impedance selection that best meets measurement applications.

1-16. The horizontal deflection system has calibrated sweep rates from 2 s/div to 0.05  $\mu$ s/div and delayed sweep rates from 20 ms/div to 0.05  $\mu$ s/div. A 10× magnifier expands all sweeps by a factor of 10 and extends the fastest sweep speed to 5 ns/div. In alternate or chop modes, a trigger-view control will display three signals: channel A, channel B, and the trigger signal. This allows correlation of time between the trigger signal and the channel A and channel B signals. In trigger-view operation, center screen represents the trigger threshold point and allows the operator to see the triggering level location. With the A vs B control, an X-Y mode of operation is possible; channel A input (Y-axis) is plotted versus channel B input (X-axis). The CRT screen has 10 by 10 major divisions on an internal graticule.

## 1-17. OPTIONS.

1-18. Standard options are modifications installed on HP instruments at the factory and are available on request. The following options extend the usefulness of the 1745A:

OPTION 001: Supplies a fixed ac power cord in place of the normal detachable power cord.

OPTION 005: Adds the necessary controls and circuitry to enable the oscilloscope to be triggered internally from a television composite video signal applied to channel A or B. The main time base triggers on a field reference pulse, and the delayed time base triggers on a line reference pulse for displaying selected TV lines.

OPTION 034/035: Adds 3-1/2 digit, five-function, autoranging digital multimeter installed on top of the oscilloscope. The multimeter can also be used for time interval measurements. The option 034 is calibrated for 60-Hz line operation and the option 035 is calibrated for 50-Hz line operation. This option is covered by a separate Operating and Service manual. Installation information may be obtained from the nearest Hewlett-Packard Field Service Office.

OPTION 090: This option omits the two Model 10041A divider probes normally supplied as accessories.

OPTION 091: Replaces two Model 10041A (2 metre) 10:1 divider probes with two Model 10042A (3 metre) 10:1 divider probes.

OPTION 092: Replaces two Model 10041A (2 metre) 10:1 divider probes with two Model 10040A (1 metre) 10:1 divider probes.

OPTION 096: Replaces two Model 10041A (2 metre) 10:1 divider probes with two Model 10006D (1.8 metre) 10:1 divider probes.

OPTION 112: This option adds Model 1112A Inverter Power Supply, a portable power source for the oscilloscope.

OPTION 534/535: Option 534 is a combination of Options 005 and 034. Option 535 is a combination of Options 005 and 035.

OPTION 580: Provides a special bottom cover to meet Canadian Fire Safety Codes.

OPTION 9XX: These options are special cord options. The connector configurations are shown in Section II of this manual.

## 1-19. ACCESSORIES SUPPLIED.

1-20. Included with the instrument are:

- One 2.3 m (7.5 ft) power cord
- One front-panel cover, HP Part No. 5040-0516
- One Accessory Storage Pouch, HP Part No. 1540-0292
- Two 10:1 Divider Probes, HP Model 10041A

1-21. The power cable and line fuse are selected at the factory according to the voltages available in the country of destination. For the part numbers of the available power cords, refer to AC Power Cable paragraph in Section II.

Table 1-1. Specifications

**VERTICAL DISPLAY MODES**

Channel A; channel B; channels A and B displayed alternately on successive sweeps (ALT); channels A and B displayed by switching between channels at an approximate 250 kHz rate with blanking during switching (CHOP); channel A plus channel B (algebraic addition); and trigger view.

**VERTICAL AMPLIFIERS (2)**

Bandwidth and Rise Time at all deflection factors from 0°C to +55°C.

**BANDWIDTH:** 3 dB down from 6 div reference signal.

**DC-Coupled:** dc to 100 MHz in both 50Ω and 1 MΩ input modes.

**AC-Coupled:** approx 10 Hz to 100 MHz.

**BANDWIDTH LIMIT:** limits upper bandwidth to approx 20 MHz.

**RISE TIME:** ≤3.5 ns, measured from 10% to 90% points of a 5 div input step.

**DEFLECTION FACTOR**

**Ranges:** 5 mV/div to 20 V/div (12 calibrated positions) in 1, 2, 5 sequence, accurate within 3%.

**Vernier:** continuously variable between all ranges, extends maximum deflection factor to at least 50 V/div. UNCAL light indicates when vernier is not in the CAL position.

**POLARITY:** channel B may be inverted, front panel pushbutton.

**DELAY LINE:** input signals are delayed sufficiently to view leading edge of input pulse without advanced trigger.

**INPUT COUPLING:** selectable AC or DC, 50Ω (dc), or ground. Ground position disconnects input connector and grounds amplifier input.

**INPUT RC (selectable)**

**AC or DC:** 1 MΩ ±2% shunted by approx 20 pF.

**50 Ohm:** 50Ω ±3%.

**MAXIMUM INPUT**

**AC or DC:** 250 V (dc + peak ac) or 500 V p-p at 1 kHz or less.

**50 Ohm:** 5 V rms.

**A+B OPERATION**

**Amplifier:** bandwidth and deflection factors are uncharged; channel B may be inverted for A-B operation.

**Differential (A-B) Common Mode:** CMR is at least 20 dB from dc to 20 MHz. Common mode signal amplitude equivalent to 8 divisions with one vernier adjusted for optimum rejection.

**VERTICAL MAGNIFICATION (X5)**

**BANDWIDTH:** 3 dB down from 6 div reference signal.

**DC-Coupled:** dc to approx 40 MHz.

**AC-Coupled:** approx 10 Hz to 40 MHz.

**RISE TIME:** ≤9 ns (measured from 10% to 90% points of 5 div input step).

**DEFLECTION FACTOR:** increases sensitivity of the 5 mV and 10 mV/div deflection factor settings by a factor of 5 with a maximum sensitivity of 1 mV on channels A and B.

**TRIGGER SOURCE**

Selectable from channel A, channel B, composite, or line frequency.

**CHANNEL A:** all display modes triggered by channel A signal.

**CHANNEL B:** all display modes triggered by channel B signal.

**COMPOSITE:** all display modes triggered by displayed signal except in Chop, which is triggered from channel A.

**LINE FREQUENCY:** power line frequency.

**TRIGGER VIEW**

Displays internal or external trigger signal. In Alternate or Chop mode, channel A, channel B, and the trigger signals are displayed. In channel A or B mode, Trigger View overrides that channel. Internal trigger signal amplitude approximates vertical signal amplitude. Ext trigger signal deflection factor is approx 100 mV/div or 1 V/div in EXT +10. Trigger point is approx center screen. With identically timed signals to a vertical input and the Ext trigger input, trigger signal delay is ≤3.5 ns.

**HORIZONTAL DISPLAY MODES**

Main, Main Intensified, Mixed, Delayed, Mag X10, and A vs. B.

**MAIN AND DELAYED TIME BASES**

**RANGES**

**Main:** 50 ns/div to 2 s/div (24 ranges) in 1, 2, 5 sequence.

**Delayed:** 50 ns/div to 20 ms/div (18 ranges) in 1, 2, 5 sequence.

**Accuracy:**

| Sweep Time/Div | *Accuracy |     | Temp Range                                       |
|----------------|-----------|-----|--------------------------------------------------|
|                | X1        | X10 |                                                  |
| 50 ns to 20 ms | ±3%       | ±4% | 0°C to +15°C<br>+15°C to +35°C<br>+35°C to +55°C |
|                | ±2%       | ±3% |                                                  |
|                | ±3%       | ±4% |                                                  |

\*Add 1% for 50 ms to 2 s ranges.

**MAIN SWEEP VERNIER:** continuously variable between all ranges, extends slowest sweep to at least 5 s/div. UNCAL light indicates when vernier is not in CAL position.

**MAGNIFIER (X10):** expands all sweeps by a factor of 10, extends fastest sweep to 5 ns/div.

Table 1-1. Specifications (Cont'd)

**CALIBRATED SWEEP DELAY**

**DELAY TIME RANGE:** 0.5 to 10X Main Time/Div settings of 100 ns to 2 s (minimum delay 150 ns).

**DIFFERENTIAL TIME MEASUREMENT ACCURACY:**

| Main Time Base Setting  | *Accuracy (+15°C to +35°C)   |
|-------------------------|------------------------------|
| 100 ns/div to 20 ms/div | ±(0.5% + 0.1% of full scale) |
| 50 ms/div to 2 s/div    | ±(1% + 0.1% of full scale)   |

\*Add 1% for temperatures from 0°C to +15°C and +35°C to +55°C.

**DELAY JITTER:** <0.002% (1 part in 50000) of maximum delay in each step from +15°C to +35°C; <0.005% (1 part in 20000) from 0°C to +15°C and +35°C to +55°C.

**TRIGGERING**

**MAIN SWEEP**

**Normal:** Sweep is triggered by internal or external signal.

**Automatic:** bright baseline displayed in absence of input signal. Triggering is same as Normal above 40 Hz.

**Single:** sweep occurs once with same triggering as Normal; reset pushbutton arms sweep and lights indicator.

**DELAYED SWEEP (SWEEP AFTER DELAY)**

**Auto:** delayed sweep automatically starts at end of delay.

**Trig:** delayed sweep is armed and triggerable at end of delay period.

**INTERNAL:** dc to 25 MHz on signals causing 0.3 divisions or more vertical deflection, increasing to 1 division of vertical deflection at 100 MHz in all display modes (required signal level is increased by 2 when in Chop mode and by 5 when X5 vertical magnifier is used). Line frequency triggering is selectable (main sweep only).

**EXTERNAL:** dc to 50 MHz on signals of 50 mV p-p or more increasing to 100 mV p-p at 100 MHz (required signal level is increased by 2 when in Chop mode).

**EXTERNAL INPUT RC:** approx 1 MΩ shunted by approx 20 pF.

**MAXIMUM EXTERNAL INPUT:** 250 V (dc + peak ac) or 500 V p-p ac at 1 kHz or less.

**LEVEL and SLOPE**

**Internal:** at any point on the positive or negative slope of the displayed waveform.

**External:** continuously variable from +1 V to -1 V on either slope of the trigger signal, +10 V to -10 V in divide by 10 mode (÷10).

**COUPLING:** AC, DC, Main LF REJ, or Main HF REJ.

**AC:** attenuates signals below approx 20 Hz.

**LF Reject (Main Sweep):** attenuates signals below approx 4 kHz.

**HF Reject (Main Sweep):** attenuates signals above approx 4 kHz.

**TRIGGER HOLDOFF (Main Sweep):** increases sweep holdoff time in all ranges.

**CALIBRATED MIXED TIME BASE**

Dual time base in which the main time base drives the first portion of sweep and the delayed time base completes the sweep at the faster delayed sweep. Also operates in single sweep mode. Accuracy, add 2% to main time base accuracy.

**A vs. B OPERATION**

**BANDWIDTH**

**Channel A (Y-axis):** same as channel A.

**Channel B (X-axis):** dc to 5 MHz.

**DEFLECTION FACTOR:** 5 mV/div to 20 V/div (12 calibrated positions) in 1, 2, 5 sequence.

**PHASE DIFFERENCE:** <3°, dc to 100 kHz.

**CATHODE-RAY TUBE AND CONTROLS**

**TYPE:** Hewlett-Packard, 15.6 cm (6.15 in.) rectangular CRT, post accelerator, approx 21 kV accelerating potential, aluminized P31 phosphor.

**GRATICULE:** 10 X 10 div internal, non-parallax graticule with 0.2 subdivision markings on major horizontal and vertical axes and markings for rise time measurements. Internal floodgun graticule illumination.

**BEAM FINDER:** returns trace to CRT screen regardless of setting of horizontal, vertical, or intensity controls.

**Z-AXIS INPUT (INTENSITY MODULATION):** +4 V, ≥50 ns width pulse blanks trace of any intensity, usable to ≤10 MHz for normal intensity. Input R, 1 kΩ ±10%. Maximum input ±20 V (dc + peak ac), ≤1 kHz.

**REAR PANEL CONTROLS:** astigmatism and trace align.

**GENERAL**

**REAR PANEL OUTPUTS:** main and delayed gates, 0.8 V to >2.5 V capable of supplying approx 5 mA.

**AMPLITUDE CALIBRATOR (0°C to +55°C)**

|                |                                           |     |
|----------------|-------------------------------------------|-----|
| Output Voltage | 1 V p-p into ≥1 MΩ<br>0.1 V p-p into 50 Ω | ±1% |
| Rise Time      | ≤0.1 μs                                   |     |
| Frequency      | approx 1.4 kHz                            |     |

Table 1-1. Specifications (Cont'd)

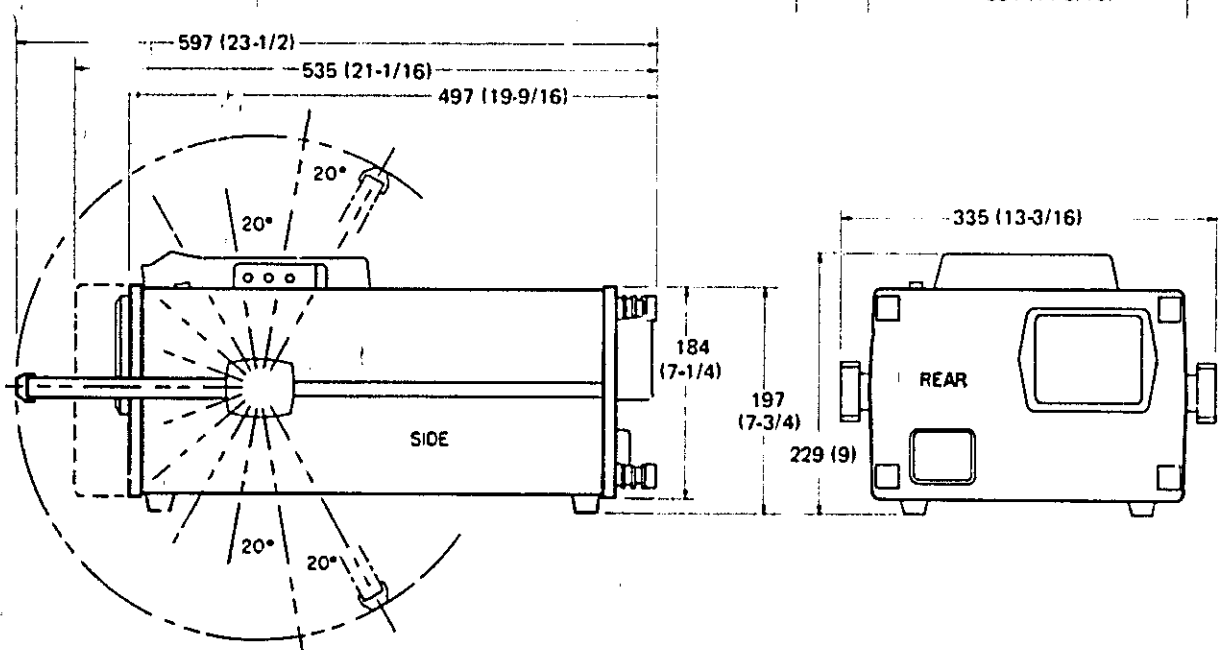
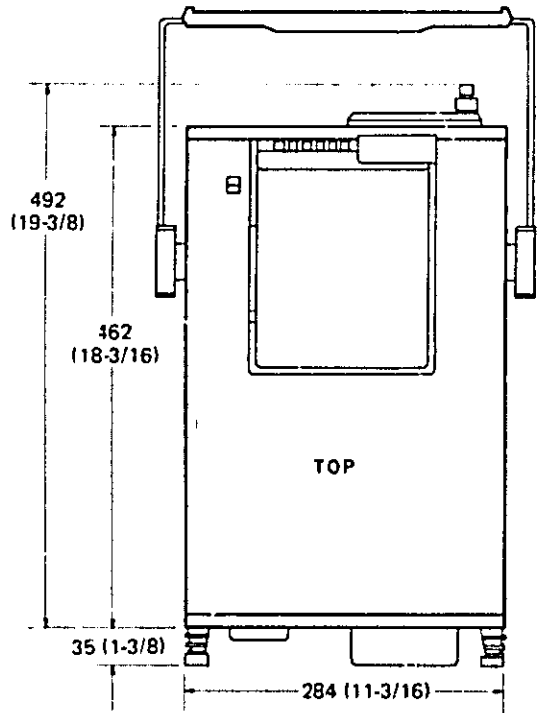
**POWER:** 100, 120, 220, 240 Vac,  $\pm 10\%$ ; 48 to 440 Hz;  
100 VA max.  
**WEIGHT:** net, 13 kg (28.6 lb); shipping, 15.7 kg (34.6 lb).  
**OPERATING ENVIRONMENT**  
**Temperature:** 0°C to +55°C.

**Humidity:** to 95% relative humidity at +40°C.  
**Altitude:** to 4600 m (15 000 ft).  
**Vibration:** vibrated in three planes for 15 min. each  
with 0.254 mm (0.010 in.) excursion, 10 to 55 Hz.  
**DIMENSIONS:** see outline drawing.

**MODEL 1745A WITH  
OPTION 034/035 INSTALLED**

**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).



**1-22. RECOMMENDED TEST EQUIPMENT.**

describes the essential requirements for each piece of test equipment. Other equipment can be substituted if it meets or exceeds these critical specifications.

1-23. Table 1-2 lists equipment required for maintaining the 1745A. The Critical Specifications column

Table 1-2. Recommended Test Equipment

| Instrument                |                                       | Required Characteristics                                                                  | Required For |
|---------------------------|---------------------------------------|-------------------------------------------------------------------------------------------|--------------|
| Type                      | Model                                 |                                                                                           |              |
| Voltage Standard          | Tektronix <sup>1</sup><br>PG506       | Amplitude: 100 V to 25 mV p-p<br>Accuracy: 0.01%                                          | P            |
| VHF Oscillator            | HP Model 3200B                        | Frequency: to 300 MHz<br>Accuracy: $\pm 2\%$                                              | P            |
| Test Oscillator           | HP Model 651B                         | Frequency: 10 MHz                                                                         | A            |
| RF Voltmeter              | HP Model 3406A                        | Voltage: to 3V                                                                            | P            |
| 50-ohm Termination        | HP10100C                              | 50 ohms $\pm 1\%$<br>VSWR $\leq 1.1:1$ ; dc to 300 MHz                                    | P            |
| 50-ohm TEE                | HP Model 11063A                       |                                                                                           | P,A          |
| Time-mark Generator       | Tektronix <sup>1</sup><br>TG 501      | Time marks: 2 ns to 0.5 s                                                                 | P,A          |
| Fast-rise Pulse Generator | Tektronix <sup>2</sup><br>067-0681-01 | Pulse rise time: <400 ps                                                                  | P            |
| Digital Voltmeter         | HP 3465A/B                            | Accuracy: 0.1%<br>Voltage Range: 20 mVdc to 200 Vdc<br>Input Impedance: $\geq 10 M\Omega$ | P,A          |
| High Voltage Probe        | HP Model 34111A                       | Division Ratio: 1000:1                                                                    | A            |
| Probe                     | HP Model 10041A                       | Division Ratio: 10:1                                                                      | A            |
| 50-ohm Power Divider      | HP Model 11549                        | Attenuator: 20 dB                                                                         | P            |
| Test Oscilloscope         | HP Model 1740A                        | 100 MHz, Delayed Sweep Oscilloscope                                                       | A            |
| Capacitance Meter         | HP Model 4332A                        | Range: 20 pf                                                                              | A            |
| Pulse Generator           | HP Model 8013B                        | Trigger Output<br>Frequency: 10 kHz                                                       | A            |

P = Performance Check, A = Adjustment Procedure

<sup>1</sup>Requires Tektronix Model TM 503 Main Frame

<sup>2</sup>Used with Tektronix PG 506

# INSTALLATION

## SECTION II

### INSTALLATION

#### 2-1. INTRODUCTION.

This section provides installation instructions for the Model 1745A Oscilloscope. Also included is information pertinent to initial inspection, preparation for use, storage, and shipment.

#### 2-2. INITIAL INSPECTION.

##### WARNING

To avoid electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers and panels).

Inspect the shipping container for damage. If the shipping container or cushioning is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. Procedures for checking electrical performance are given in the Performance Tests in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard Sales and Service office. If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

#### 2-3. PREPARATION FOR USE.

**2-4. POWER REQUIREMENTS.** The Model 1745A requires a power source of 100, 120, 220, or 240 Vac  $\pm 5\%$  to  $\pm 10\%$ ; 48 to 440-Hz single phase. Power consumption is 100 VA maximum.

##### WARNING

This is a Safety Class I product (provided with a protective earth terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

##### WARNING

If this instrument is to be energized via an autotransformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

#### 2-5. LINE VOLTAGE AND FUSE SELECTION.

##### WARNING

For protection against fire hazard, the line fuse should be replaced with 250 V, slow-blow fuses with the correct current rating.

##### CAUTION

**BEFORE CONNECTING THIS INSTRUMENT TO LINE (Mains) voltage, be sure the line voltage switches are set correctly and that the proper fuse is installed.**

If the line fuse burns out, do not replace it until the cause for the failure has been determined and repaired by a qualified service person only. Replacing this fuse in a damaged instrument can cause additional damage.

The line voltage switch settings and line fuse are selected at the factory according to the line (Mains) voltage available in the country of destination. To operate the instrument from any other power source proceed as follows:

- a. Disconnect power source.
- b. Stand instrument on rear panel legs. Through opening in bottom cover, position LINE voltage select switches for desired Vac input. (Figure 2-1 shows switches set for 120 Vac operation.)
- c. Select and install proper line fuse. Fuse current ratings are printed near the fuse on the instrument rear panel and are listed with HP part numbers in table 2-1.
- d. Reconnect power cord.



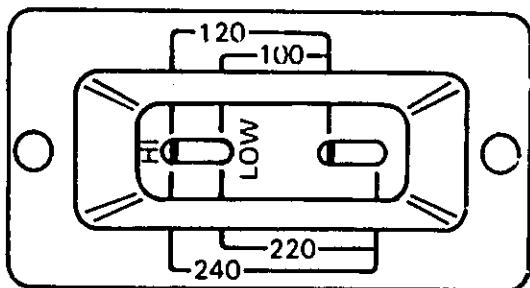


Figure 2-1. Line Voltage Selection Switches

Table 2-1. Line Fuse Part Numbers

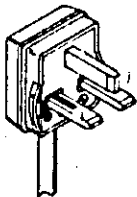
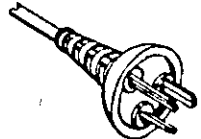
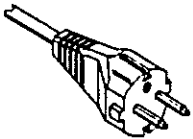
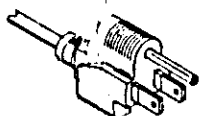
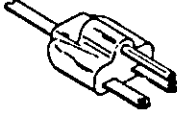
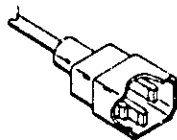
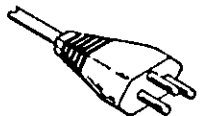
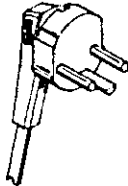
| Line Voltage | Fuse Rating                | HP Part Number |
|--------------|----------------------------|----------------|
| 100/120 Vac  | 250 V, 1 A<br>Slow blow    | 2110-0007      |
| 220/240 Vac  | 250 V, 500 mA<br>Slow blow | 2110-0202      |

2-6. AC POWER CABLE.

**WARNING**

BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the line (Mains) power cord. The Mains plug must be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two conductor outlet does not provide an instrument ground.

This instrument is equipped with a three-wire power cable. When connected to an appropriate power receptacle this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Figure 2-2 shows the part numbers (and associated Option numbers) for the power cable and plug configurations available.

|                                                                                                                                                                                 |                                                                                                                                                                                                  |                                                                                                                                                                                       |                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Option 900</p>  <p>United Kingdom<br/>250 V</p> <p>Plug: BS 1363A<br/>HP 8120-1703</p>    | <p>Option 901</p>  <p>Australia/<br/>New Zealand<br/>250 V</p> <p>Plug: NZSS 198/AS C112<br/>HP 8120-0696</p> | <p>Option 902</p>  <p>European<br/>Continent<br/>250 V</p> <p>Plug: CEE7-VII<br/>HP 8120-1692</p> | <p>Option 903</p>  <p>USA/<br/>Canada<br/>125 V</p> <p>Plug: NEMA 5-15P<br/>HP 8120-1521</p> |
| <p>Option 904</p>  <p>USA/<br/>Canada<br/>250 V</p> <p>Plug: NEMA 6-15P<br/>HP 8120-0698</p> | <p>Option 905</p>  <p>Systems<br/>250 V</p> <p>Plug: CEE 22-VI<br/>HP 8120-2191</p>                           | <p>Option 906</p>  <p>Switzerland</p> <p>Plug: SEV 1011 1959-24507<br/>HP 8120-2296</p>           | <p>Option 912</p>  <p>Denmark<br/>220 V</p> <p>Plug: DHCR 107<br/>HP 8120-2956</p>           |

NOTE: The number listed for the plug is the industry identifier for the plug only. The HP part number specifies a complete power cordset.

Figure 2-2. Power Cable and Mains Plug Part Numbers

**2-7. MATING CONNECTORS.** All connectors used with the Model 1745A are 50-ohm BNC male type connectors.

**2-8. OPERATING ENVIRONMENT.** The operating environment should be within the following limitations:

- Temperature ..... 0° C to +55° C
- Humidity ..... <95% relative at 40° C
- Altitude ..... <4570 metres (15 000 feet)

**2-9. STORAGE AND ENVIRONMENT.**

**2-10. ENVIRONMENT.** The Model 1745A may be stored or shipped in environments within the following limits:

- Temperature ..... -55° C to +75° C
- Humidity ..... <95% relative
- Altitude ..... <15 300 metres (+50 000 feet)

Protect the instrument from conditions which would cause internal condensation.

**2-11. PACKAGING.**

**2-12. ORIGINAL PACKAGING.** Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service

required, return address, model number, and full serial number. Also mark the container FRAGILE to ensure careful handling. In correspondence, refer to the instrument by model number and full serial number.

**2-13. OTHER PACKAGING.** The following general instructions should be used for repackaging with commercially available materials:

a. Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service center, attach tag indicating type of service required, return address, model number, and full serial number.)

b. Use strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.

c. Use a layer of shock-absorbing material 75 to 100 mm (3- to 4-inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside container.

d. Seal shipping container securely.

e. Mark shipping container FRAGILE to ensure careful handling.

f. In any correspondence, refer to instrument by model number and full serial number.

**OPERATION**

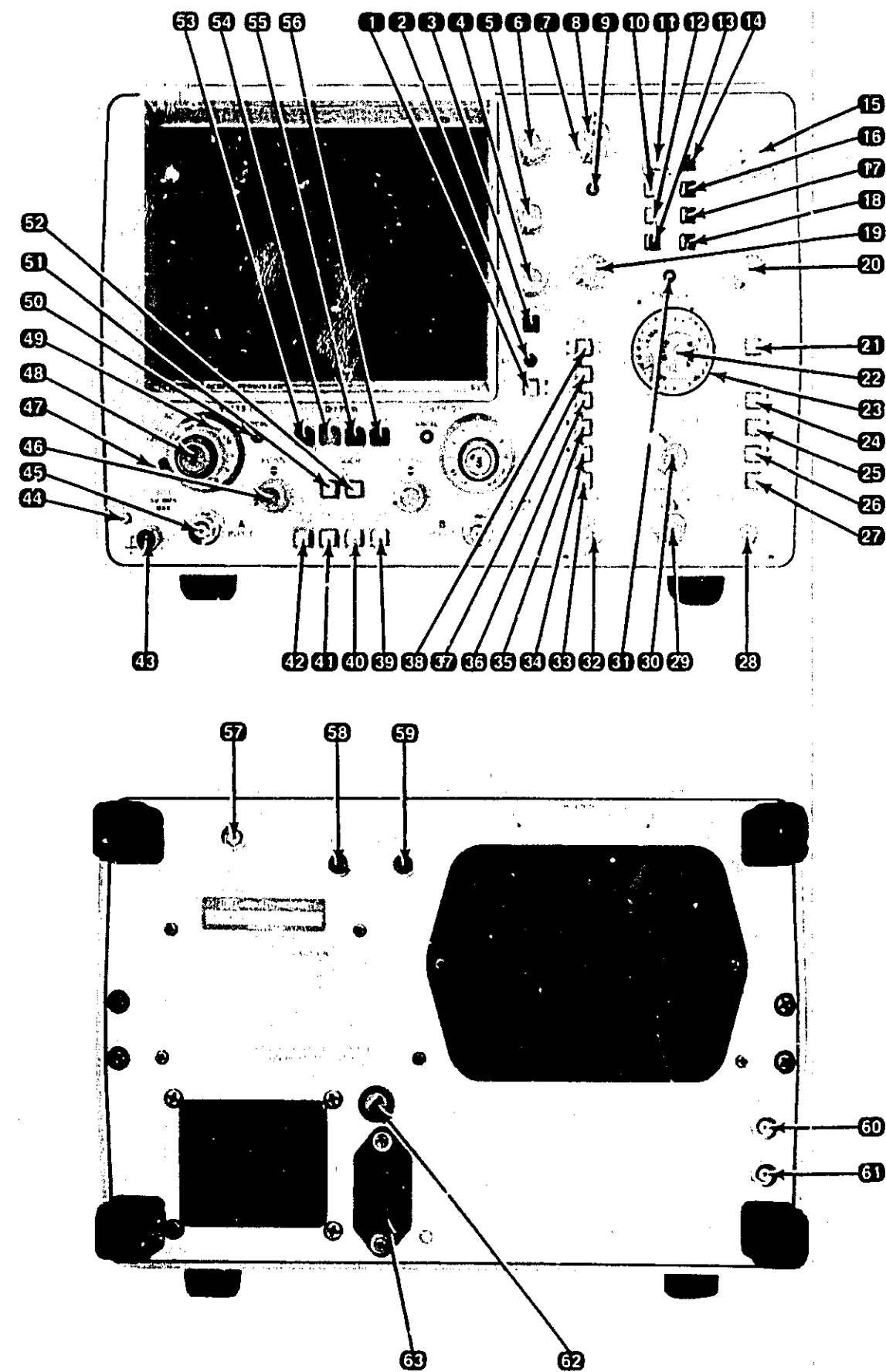


Figure 3-1.  
Controls and Connectors  
3-0

- 1 **LINE.** Switch turns instrument power on and off.
- 2 **LINE INDICATOR.** Indicator lights when instrument power is on.
- 3 **BEAM FIND.** Returns display to viewing area relative to its off-screen position.
- 4 **SCALE ILLUM.** Adjusts CRT background illumination for good contrast between background and the graticule. Useful to illuminate graticule when viewing in dark area, photographing (if camera has no light source), or prefogging film.
- 5 **FOCUS.** Adjusts the writing beam for the sharpest trace. Always keep this display focused to prevent damaging the CRT internally.
- 6 **BEAM INTENSITY.** Controls brightness of the CRT display.
- 7 & 8 **POSITION.** Coarse 7 and FINE 8 adjustments position display horizontally.
- 9 **Reset Lamp.** When lit, indicates trigger circuit is armed. Lamp goes off at end of sweep and remains off until trigger circuit is again armed by pressing RESET 10.
- 10 **RESET.** Momentary pushbutton that arms trigger circuit in single-sweep mode. After RESET 10, sweep can be triggered by internal or external trigger signal or by rotating TRIGGER LEVEL control 19 through zero.
- 11 **AUTO/NORM.** AUTO sweep mode (pushbutton out). Free-running sweep provides bright display in absence of a trigger signal. Trigger signal input (internal or external) or 40 Hz or more overrides AUTO operation and sweep triggering is same as in NORM mode.  
  
NORM sweep mode (pushbutton in) requires internal or external signal to generate sweep and must be used if input frequency is less than 40 Hz.
- 12 **SINGLE.** Sweep occurs once with same triggering as in NORM. After each sweep, trigger circuit must be manually RESET 10.
- 13 **MAG X10.** Magnifies horizontal display 10 times, and expands the fastest sweep time to 5 ns/div.
- 14 **DLY'D.** Selects delayed sweep mode of display.
- 15 **DELAY.** The DELAY control provides a variable delay time from 0.5 to 10X the MAIN TIME/DIV settings of 100 ns to 2 s.
- 16 **MIXED.** Selects main and delayed sweeps for the horizontal display. The first portion of the sweep is at the main sweep rate, and the second portion of the sweep (starting point chosen by DELAY 15) is at the delayed-sweep rate.
- 17 **MAIN.** Selects main sweep of display.
- 18 **A VS B.** Selects an X-Y mode of operation with channel A input (Y-axis) plotted versus channel B input (X-axis). Vertical positioning is adjusted by channel A POSN 46, and horizontal positioning is adjusted by POSITION 7 and FINE 8.
- 19 & 20 **TRIGGER LEVEL.** Selects the voltage level on the input trigger signal where the sweep is triggered. With external trigger signals, the trigger level is continuously variable from +1 V to -1 V on either slope of the input trigger signal; +10 V to -10 V in EXT + 10 27 or 28 mode. With internal trigger signals, the trigger level selects any point on the vertical waveform displayed.
- 21 **SWEEP AFTER DELAY AUTO/TRIG.** Selects the method of starting the delayed-sweep when in main intensified, delayed, or mixed mode operation. In AUTO, delayed sweep starts immediately after the delay interval, which is the product of the DELAY 15 dial setting (div) and the main TIME/DIV 22 setting. In TRIG, the delayed-trigger circuit is armed after the delay interval and delayed sweep must be triggered by either an internal or external trigger signal.
- 22 **Main TIME/DIV.** Inner knob controls main sweep rate. Rate indicated by numbers displayed in knob skirt opening.
- 23 **DLY'D TIME/DIV.** The outer rotating section selects the delayed-sweep rate, which is indicated by the marker on the outer knob. Sweep accuracy is the same as with MAIN TIME/DIV. An interlock is incorporated so the delayed sweep is always faster than the main sweep. When rotated out of the off position in the MAIN mode 17, a portion of the main sweep is intensified indicating the length and delay position of the delayed sweep with respect to the main sweep.
- 24 **∫/∫.** Two position switch that selects slope of event that triggers delayed sweep when in TRIG'D 21 mode.
- 25 **Delayed AC/DC.** Selects delayed sweep trigger coupling.
- 26 **Delayed INT'EXT.** Selects internal or external delayed sweep triggering.
- 27 **Delayed EXT + 10.** Attenuates external trigger signal by factor of 10.
- 28 **Delayed EXT TRIG INPUT.** BNC connector for delayed external trigger signal.
- 29 **TRIGGER HOLDOFF.** Increases time between sweeps and aids triggering on complex displays such as digital words.
- 30 **TIME/DIV VERNIER.** Provides continuous adjustment of main TIME/DIV between calibrated positions, extending slowest sweep to 5 s/div.
- 31 **UNCAL.** Lights when TIME/DIV VERNIER 30 is out of CAL detent position; indicates that sweep is not calibrated.
- 32 **Main EXT TRIG INPUT.** BNC connector for main external trigger signal.
- 33 **Main EXT + 10.** Attenuates external trigger signal by factor of 10.
- 34 **Main INT/EXT.** Selects internal or external main sweep triggering.
- 35 **Main AC/DC.** Selects main sweep trigger coupling.
- 36 **HF REJ.** Attenuates internal or external trigger signals above approx 4 kHz. This is useful to condition low-frequency signals for best synchronization by eliminating unwanted high-frequency signals such as RF.
- 37 **LF REJ.** Attenuates internal or external trigger signal below approx 4 kHz. This is useful to condition high-frequency signals for best synchronization by eliminating unwanted low-frequency signals such as power line interference.
- 38 & 37 **LINE.** Selecting both LF REJ 37 and HF REJ 36 removes all internal and external trigger signals and applies input ac power frequency for triggering.
- 38 **∫/∫.** Two position switch that selects slope of internal or external trigger signal used to start main sweep.
- 39 **CH B INVT.** Inverts polarity of channel B signal. In A+B 53 & 54 mode, pressing CH B INVT 39 results in A minus B display.
- 40 **BW LIMIT.** Reduces bandwidth of channel A and channel B to approx 20 MHz.
- 41 **MAG X5.** Magnifies vertical presentation five times, and increases maximum sensitivity to 1 mV/div. Bandwidth is decreased to 40 MHz. Recommended on 5 mV/div and 10 mV/div ranges only.
- 42 **TRIG VIEW.** Displays the selected internal or external trigger signal at a fixed sensitivity of approximately 100 mV/div or 1 V/div with EXT + 10 33. TRIGGER LEVEL 19 positions the display vertically. Center screen indicates the trigger threshold level with respect to the trigger signal. If ALT 58 or CHOP 59 is selected, three signals are displayed: channel A, the selected trigger signal (at center screen), and channel B.
- 43 **Ground Post  $\frac{1}{2}$ .** Convenient chassis ground connector. Useful to ensure common ground with equipment under test.
- 44 **CAL 1 V.** Provides 1-V peak-to-peak (within 1%) square wave voltage signal recurring at approximate rate of 1.4 kHz (100 mV peak-to-peak when terminated in 50Ω).
- 45 **INPUT.** BNC connector to apply signals to channel A amplifier. Impedance and coupling are selectable by 47.
- 46 **POSN.** Varies vertical position of channel A display.
- 47 **Coupling.** Selects capacitive (AC), direct (DC), or 50-ohm coupling of input signal. GND position disconnects input signal and grounds input to vertical preamplifier.
- 48 **Vernier.** Provides continuous control of deflection factor between calibrated VOLTS/DIV ranges. Vernier range is at least 2.5 to 1.
- 49 **VOLTS/DIV.** Selects vertical deflection factor in 1, 2, 5 sequence from 0.005 V/div to 20 V/div, accurate within 3% with vernier 48 in CAL position.
- 50 **UNCAL.** Lights when vernier control is out of detent position to indicate VOLTS/DIV 49 is uncalibrated.
- 51 **TRIGGER A.** Selects sample of channel A signal as trigger signal when INT/EXT 34 is in INT.
- 52 **TRIGGER B.** When in INT 34, sample of channel B signal is selected as trigger signal.
- 53 & 52 **COMP.** Engaging both trigger A 51 and trigger B 52 selects composite trigger. When display mode is set to channel A, channel B, ALT, or A+B, sweep is triggered by displayed signal. In CHOP, sweep is triggered by channel A signal only.
- 53 **ALT.** Channel A and B signals are displayed alternately on consecutive sweeps.
- 54 **Channel A.** Displays channel A input signal.
- 55 **Channel B.** Displays channel B input signal.
- 53 & 55 **A+B.** Pressing both channel A 53 and channel B 55 displays the algebraic sum of channel A and channel B input signals. If channel B display is inverted (press CH B INVT 39), A minus B display results.
- 56 **CHOP.** Channel A and B signals are displayed simultaneously by switching between channels at 250 kHz rate.
- 57 **Z-AXIS INPUT.** BNC connector for intensity modulation of CRT display. +4-volt, >50-ns width pulse blanks trace of any intensity. Do not apply more than ±20 V (dc + peak ac), <1 kHz.
- 58 **TRACE ALIGN.** Screwdriver adjustment to align horizontal trace with graticule.
- 59 **ASTIGMATISM.** Screwdriver adjustment used in conjunction with FOCUS 5 to achieve clean, sharp spot or trace. Adjustment is easier with stationary spot.
- 60 **MAIN GATE OUTPUT.** Provides rectangular output of approx +2.5 V coincident with main sweep.
- 61 **DLY'D GATE OUTPUT.** Provides rectangular output of approx +2.5 V coincident with delayed sweep.
- 62 **FUSE.** 1A 250 V slow-blow for 100-V or 120-V operation. 0.5A 250 V slow-blow for 220-V or 240-V operation.
- 63 **LINE INPUT.** Connector for ac power cord.

## NOTE

In the following descriptions for controls 45 through 60, only channel A control and connectors are discussed. Channel B controls and connectors are identical in function.

## SECTION III

## OPERATION

## 3-1. INTRODUCTION.

3-2. This operating section explains the function of controls, indicators, and connectors on the 1745A. It describes typical operating modes in a measurement system and includes operator's checks and warmup information.

## 3-3. PANEL FEATURES.

3-4. Front- and rear-panel features are described in figure 3-1. Description numbers match the numbers on the illustration. In addition, description numbers used after control and connector names in the following text are keyed to figure 3-1.

## 3-5. OPERATOR'S CHECKS.

3-6. The checks that follow allow the operator to make quick evaluation of the instrument's main functions prior to use. If trouble is suspected, refer to the service sheets in Section VIII to isolate the problem.

CAUTION

Before connecting power to the 1745A, make sure the low-voltage supply line select switches are set to correspond to the line voltage of the available ac power line. Refer to Section II for proper switch settings.

3-7. INITIAL TURN-ON PROCEDURE. To place the 1745A into operation and avoid CRT damage, accomplish the following steps in the sequence listed:

- a. Set BEAM INTENSITY **6** fully counterclockwise.
- b. Set vertical DISPLAY to ALT **53**.
- c. Set internal TRIGGER to A **51**.
- d. Set vertical verniers **43** for channel A and channel B to CAL detent.
- e. Set CH B INV switch **39** to out position.
- f. Set vertical coupling control **47** for channel A and channel B to GND.
- g. Set vertical POSN controls **46** to midrange.
- h. Set horizontal POSN control **7** to midrange.

- i. Set main TIME/DIV control **22** to 1 mSEC.
- j. Set delayed TIME/DIV control **23** to OFF.
- k. Set TIME/DIV VERNIER **30** to CAL detent.
- l. Set AUTO/NORM switch **11** to AUTO.
- m. Set main INT/EXT trigger switch **33** to INT.
- n. Set LINE switch **1** to ON position and allow 15-minute warmup.
- o. Adjust BEAM INTENSITY **6** for barely visible trace.

3-8. TRACE ALIGNMENT. The trace align adjustment compensates for external magnetic fields that may affect 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 horizontally proceed as follows:

- a. Obtain trace as described in initial turn-on procedure.
- b. Using channel A POSN control **46**, set trace to center horizontal graticule line.
- c. Using nonmetallic alignment tool, adjust TRACE ALIGN **53** (rear panel) for best alignment of trace with horizontal graticule line.

3-9. FOCUS AND ASTIGMATISM ADJUSTMENTS. To adjust focus and astigmatism, proceed as follows:

- a. Obtain trace as described in initial turn-on procedure.
- b. Set BEAM INTENSITY control **6** fully counterclockwise.
- c. Select A vs B **13** horizontal mode of operation.
- d. Adjust BEAM INTENSITY **6** to observe spot.
- e. Position spot near center of CRT using vertical POSN **46** and horizontal POSITION **7** controls.
- f. Adjust FOCUS **5** (front panel) and ASTIGMATISM control **59** (rear panel) for best defined spot.

**3-10. PROBE COMPENSATION.** To adjust a divider probe that has a compensation adjustment, proceed as follows:

- a. Obtain trace as described in initial turn-on procedure.
- b. Connect divider probe to channel A INPUT connector ②.
- c. Connect divider probe tip to CAL 1 V terminal ③.
- d. Set channel A input coupling ④ to DC.
- e. Set channel A VOLTS/DIV control ⑤ for square-wave display with two to three divisions of vertical deflection.
- f. Set main TIME/DIV control ⑥ for horizontal display of at least two full square waves (0.2 mSEC range).
- g. Adjust divider probe compensation for correct display (figure 3-2).

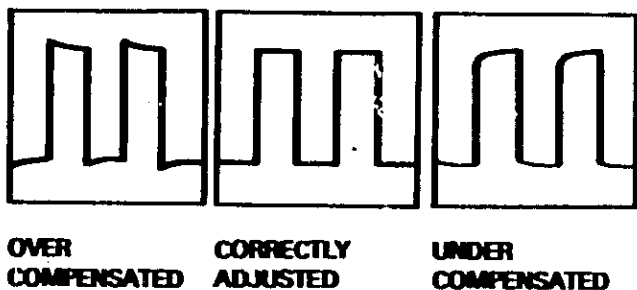


Figure 3-2. Divider Probe Adjustment Display

**3-11. VERTICAL ACCURACY CHECK.** To check vertical accuracy, proceed as follows:

- a. Accomplish initial turn-on procedure.
- b. Connect CAL 1 V ③ output to channel A INPUT connector ② using BNC to banana plug adapter and test lead with alligator clips.
- c. Set channel A VOLTS/DIV control ⑤ to 0.2 V range.
- d. Set main TIME/DIV control ⑥ to 0.2 mSEC range.
- e. Square-wave amplitude of displayed waveform should be five major divisions ( $\pm 4\%$ ).

**3-12. SWEEP TIME ACCURACY.** To check horizontal sweep accuracy, proceed as follows:

- a. Accomplish initial turn-on procedure.

- b. Connect time-mark generator to channel A INPUT connector ②.

- c. Set main TIME/DIV ⑥ to 0.5  $\mu$ SEC position.
- d. Set time-mark generator for 0.5  $\mu$ s markers.
- e. Using horizontal POSITION controls ⑦ and ⑧, set one marker on far left graticule line.
- f. Markers should line up (approximately) with each vertical graticule line across CRT.
- g. Marker on far right-hand side of CRT should be within 0.2 major division of last vertical graticule line.

**3-13. OPERATING INSTRUCTIONS.**

**3-14.** The following procedures provide additional information concerning operation of the instrument.

**3-15. AUTO VERSUS NORM ⑨.** In AUTO operation, there will always be a recurring sweep (baseline trace), except under triggering conditions. A trigger of 40 Hz or higher overrides AUTO operation and a stable presentation is displayed. Adjustment of main TRIGGER LEVEL ⑩ may be necessary for a stable display. If the trigger signal is 40 Hz or less, NORM operation must be used. A trigger signal is always needed in NORM operation to generate a sweep.

**3-16. SWEEP AFTER DELAY ⑪.** In AUTO mode, delayed sweep starts immediately after the delay interval which is the product of the DELAY dial ⑫ setting and the main TIME/DIV ⑥ setting. In TRIG mode, the delayed trigger circuit is armed after the delay interval and delayed sweep must be triggered internally or externally by a trigger signal.

**3-17. OBTAINING BASIC DISPLAYS.** These procedures will aid the operator in becoming more familiar with the instrument. Before performing the procedures, complete the initial turn-on procedure. In addition, set the 1745A front-panel controls as follows:

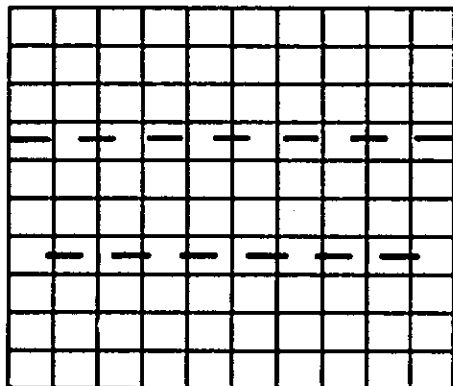
|                    |       |          |
|--------------------|-------|----------|
| Coupling (CH A) ④  | ..... | DC       |
| VOLTS/DIV (Ch A) ⑤ | ..... | 0.02     |
| Main TIME/DIV ⑥    | ..... | 0.5 mSEC |

**3-18. NORMAL SWEEP DISPLAY.**

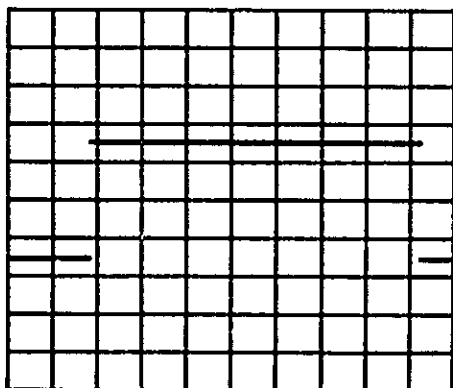
- a. Connect CAL 1 V terminal ③ to channel A INPUT connector ② using 10:1 divider probe supplied.
- b. Adjust channel A POSN ⑦ to align base of square-wave display on second horizontal graticule line from bottom. Adjust main TRIGGER LEVEL ⑩ for stable display.
- c. Observe square-wave display with amplitude of five divisions and approximately seven positive-going pulses.

**3-19. MAGNIFIED SWEEP DISPLAY.**

- a. Obtain normal sweep display.
- b. Adjust horizontal POSITION **7** to place portion of waveform to be magnified on center graticule of CRT (figure 3-3a).
- c. Engage MAG X10 switch **18**.
- d. Adjust fine horizontal POSITION **8** for precise placement of magnified display (figure 3-3b).



a. Normal Display



b. Magnified Display

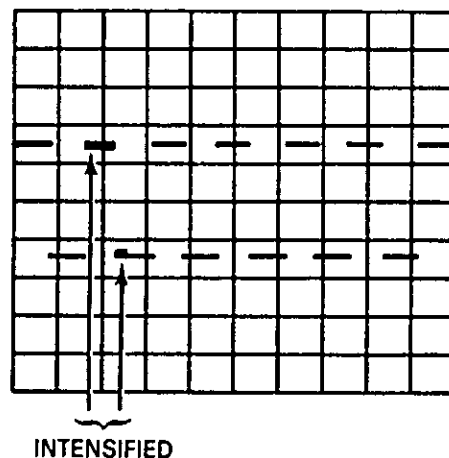
*Figure 3-3. Magnified Sweep*

**3-20. DELAYED SWEEP DISPLAY.**

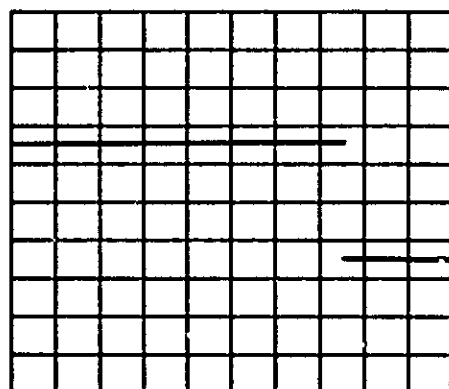
- a. Obtain normal sweep display.
- b. Adjust delayed TIME/DIV **23** for 50  $\mu$ SEC, and observe intensified portion of square wave. Set BEAM INTENSITY **6** control to a comfortable viewing level.
- c. Set SWEEP AFTER DELAY **21** to AUTO and turn DELAY **15** clockwise until intensified portion of trace is over trace area to be investigated (figure 3-4a).

d. Engage DLY'D **14** and note that intensified portion of trace is now displayed across entire CRT (figure 3-4b).

e. DELAY **15** control may be adjusted to view other pulses in the pulse train.



a. Normal Display with Intensified Area

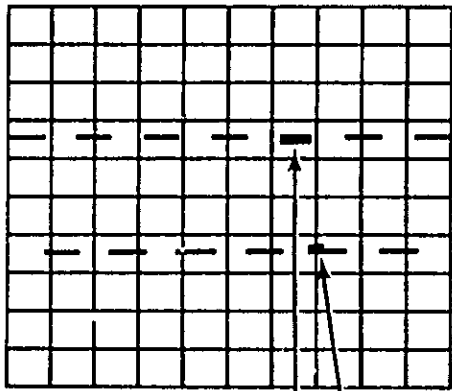


b. Delayed Sweep Display

*Figure 3-4. Delayed Sweep*

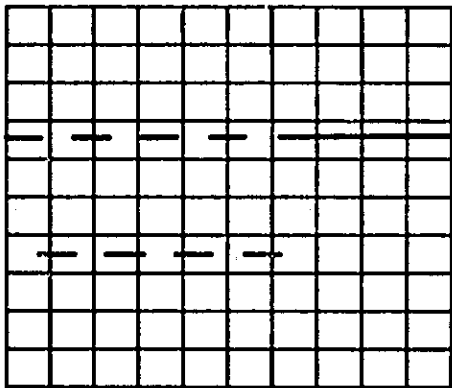
**3-21. MIXED SWEEP DISPLAY.**

- a. Obtain normal sweep display.
- b. Adjust delayed TIME/DIV **23** for 50  $\mu$ SEC and note intensified portion of square wave. Set BEAM INTENSITY **6** to comfortable viewing level.
- c. Turn DELAY **15** clockwise until part of waveform in second half of CRT is intensified (figure 3-5a).
- d. Engage MIXED **19** and observe that first portion of the display is at main TIME/DIV **22** sweep rate and second portion is at delayed TIME/DIV **23** sweep rate (figure 3-5b). The transition point from main sweep to delayed sweep can be varied by adjusting DELAY control **15**.



INTENSIFIED

a. Normal Display with Intensified Area



b. Mixed Sweep Display

Figure 3-5. Mixed Sweep

**3-22. A VS B DISPLAY.**

a. Engage A vs B **13**. BEAM INTENSITY **5** may need to be decreased. Apply vertical (Y-axis) signal to channel A INPUT **45** connector and horizontal (X-axis) signal to channel B INPUT connector. Channel A POSN **46** adjusts vertical positioning; POSITION **7** adjust horizontal positioning. Adjust channel A and B VOLTS/DIV **49** controls as required.

b. If display is not visible, press BEAM FIND **3** and adjust channel A and B VOLT/DIV controls until display is compressed vertically. Center compressed display with POSN **46** and POSITION **7** controls. Release BEAM FIND, and adjust FOCUS **5** for a sharp display.

**3-23. SINGLE SWEEP OPERATION.** Single sweep mode is often used to photograph single occurrence events. To use this mode, proceed as follows:

- a. Select SINGLE **12** sweep mode.
- b. Set AUTO/NORM to NORM **11**.
- c. Set all trigger processing controls to desired settings; for example, INT/EXT **34**, slope **38**, and TRIGGER LEVEL **19**.
- d. Depress RESET **10** pushbutton; the red RESET **9** lamp will light.

**3-24.** The sweep circuitry is now armed; as soon as a trigger signal is received that meets the preset requirements (slope, coupling, level, etc.), the time base will generate one sweep. As soon as the sweep ends, the RESET **9** lamp will extinguish and the time base must be reset again.

**3-25. SINGLE SWEEP USING TRIGGER VIEW.** To use the trigger view feature in single sweep, perform the following steps:

- a. Engage TRIG VIEW **42**. This turns off both vertical channels; however, trigger view circuitry will not be activated until a certain transition occurs at the end of the sweep.
- b. To activate trigger view, press RESET **10** and rotate TRIGGER LEVEL **19** from one extreme to the other or engage AUTO **11** and press RESET, then disengage AUTO.

**3-26.** After one sweep has been manually generated, the necessary transition will have occurred and trigger view mode will operate in a normal manner.



# PERFORMANCE CHECK

## SECTION IV

### PERFORMANCE TESTS

#### 4-1. INTRODUCTION.

4-2. The procedures in this section test the instrument's electrical performance using the specifications in table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument.

#### 4-3. EQUIPMENT REQUIRED.

4-4. A complete list of required test equipment and accessories is given in table 1-3 (Section I). Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s). For best results use recently calibrated test equipment.

#### 4-5. TEST RECORD.

4-6. Results of the performance tests may be tabulated on the Performance Test Record at the end of this section. The record lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspections can be used for comparison during periodic maintenance.

#### 4-7. CALIBRATION CYCLE.

4-8. The 1745A requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked using the following performance test at least every 2000 hours of operation or every six months, whichever comes first.

#### 4-9. OPERATION VERIFICATION.

4-10. To assure that the instrument is performing properly without testing all specifications listed in table 1-1, perform only those procedures indicated in table 4-1. Results may be tabulated on the Operation Verification Record at the end of this section.

#### 4-11. INITIAL CONTROL SETTINGS.

4-12. The control settings listed below must be used for each performance check. Exceptions to these settings

will be noted as they occur. After completing a check, return 1745A controls to the following settings:

| CONTROL                                | SETTING           |
|----------------------------------------|-------------------|
| All Pushbuttons                        |                   |
| (except as noted below) . . . . .      | out position      |
| VOLTS/DIV (Channels A and B) . . . . . | .1                |
| CAL (Channels A and B) . . . . .       | detent (fully cw) |
| Coupling (Channels A and B) . . . . .  | DC                |
| POSN (Channels A and B) . . . . .      | midrange          |
| DISPLAY . . . . .                      | A                 |
| TRIGGER . . . . .                      | A                 |
| FOCUS . . . . .                        | best trace        |
| BEAM INTENSITY . . . . .               | 10 · 11 o'clock   |
| LINE . . . . .                         | ON                |
| POSITION (Horizontal) . . . . .        | midrange          |
| TRIGGER LEVEL                          |                   |
| (Main and Delayed) . . . . .           | 3 o'clock         |
| Sweep Mode . . . . .                   | MAIN              |
| DELAY . . . . .                        | fully ccw         |
| MAIN TIME/DIV . . . . .                | .1 mSEC           |
| DLY'D TIME/DIV . . . . .               | OFF               |
| TIME/DIV VERNIER . . . . .             | CAL               |
| TRIGGER HOLDOFF . . . . .              | MIN               |

#### 4-13. PERFORMANCE TEST PROCEDURES.

4-14. **BANDWIDTH.** 3 dB down from a 6-division reference signal; dc to 100 MHz, dc coupled; and 10 Hz to 100 MHz, ac coupled. In the vertical MAG X5 mode, bandwidth is reduced to 40 MHz.

4-15. A signal generator is used to provide the reference signal. An rf voltmeter is used to monitor the signal level at the input connector to verify that the signal amplitude remains constant.

##### Equipment Required:

|                          |                         |
|--------------------------|-------------------------|
| VHF Oscillator . . . . . | HP Model 3200B          |
| RF Voltmeter . . . . .   | HP Model 3406A w/11063A |

4-16. Perform bandwidth test as follows:

a. Connect signal generator and rf voltmeter as shown in figure 4-1.

b. Set 1745A controls as follows:

|                                     |        |
|-------------------------------------|--------|
| Coupling (both channels) . . . . .  | 50Ω    |
| VOLTS/DIV (both channels) . . . . . | 0.01   |
| MAIN TIME/DIV . . . . .             | 1 μSEC |

Table 4-1. Recommended Operation Verification

| Paragraph No. | Performance Test                   | Alteration                                                                                                                                                                                                              | Remarks                                                                                           |
|---------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 4-14          | BANDWIDTH                          | No change                                                                                                                                                                                                               |                                                                                                   |
| 4-17          | COMMON MODE REJECTION RATIO (CMRR) | Omit test                                                                                                                                                                                                               | CMMR is checked when bandwidth and deflection factors are checked.                                |
| 4-19          | TRIGGERING                         | Omit paragraphs 4-21 and 4-22                                                                                                                                                                                           | An out of specification condition will usually appear on internal triggering check.               |
| 4-23          | SWEEP TIME ACCURACY                | Check following ranges only:<br>Main:<br>0.05 $\mu$ SEC, 0.5 $\mu$ SEC, 10 $\mu$ SEC, 0.1 mSEC, 1 mSEC, 20 mSEC, 50 mSEC, 0.2 SEC<br>Delayed:<br>0.05 $\mu$ SEC, 0.5 $\mu$ SEC, 10 $\mu$ SEC, 0.1 mSEC, 2 mSEC, 20 mSEC | All sweep speed determining components checked in these ranges.                                   |
| 4-25          | DIFFERENTIAL TIME ACCURACY         | No change                                                                                                                                                                                                               |                                                                                                   |
| 4-27          | DELAY JITTER                       | Omit test                                                                                                                                                                                                               | Usually only fails when a hard failure occurs and is repaired at the same time.                   |
| 4-29          | RISE TIME                          | Omit test                                                                                                                                                                                                               | In specification when bandwidth is in specification. Can be computed by<br>$T_r = \frac{.35}{BW}$ |
| 4-31          | Z-AXIS BLANKING                    | Omit test                                                                                                                                                                                                               | Normally in specification when no evidence of blanking failure is present.                        |
| 4-33          | DEFLECTION FACTOR                  | Check following ranges only:<br>0.005 V through 0.5 V/div, both channel A and B                                                                                                                                         | All attenuation and gain ranges are checked on these ranges                                       |
| 4-35          | CALIBRATOR                         | Omit test                                                                                                                                                                                                               | Excellent long term stability, usually only fails consequentially.                                |

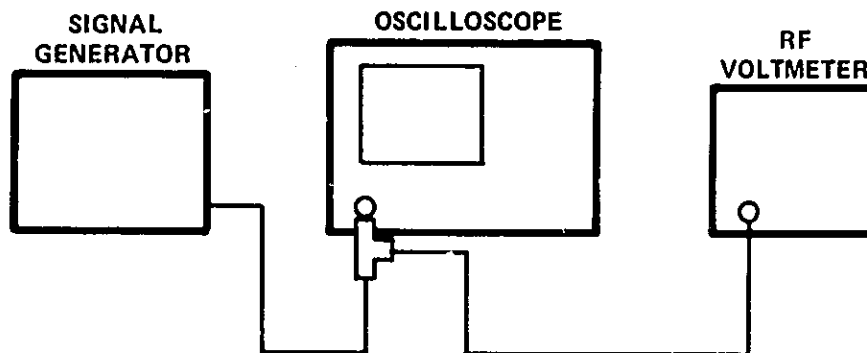


Figure 4-1. Bandwidth Test Setup

- c. Set signal generator frequency for approximately 10 MHz with exactly 6 divisions of vertical deflection on oscilloscope.
- d. Note rf voltmeter indication.
- e. Set signal generator frequency to 100 MrHz.
- f. Adjust signal generator amplitude to obtain same indication as in step d. Amplitude of display should be equal to or greater than 4.25 divisions.
- g. Set 1745A controls as follows:

DISPLAY ..... B  
 TRIGGER ..... B

- h. Connect signal generator to channel B INPUT and repeat steps b through f for channel B.
- i. Disconnect test equipment.

**4-17. COMMON MODE REJECTION RATIO (CMRR).** CMRR is at least 20 dB from dc to 20 MHz. Common mode signal amplitude is equivalent to 8 divisions with one vernier adjusted for optimum rejection. Identical signals are applied to both channels with channel B operated in the inverted mode. The displayed signal is the common mode signal.

**Equipment Required:**

VHF Oscillator ..... HP Model 3200B  
 50-ohm Power Divider ..... HP Model 11549

4-18. Perform CMRR test as follows:

- a. Connect equipment as shown in figure 4-2.
- b. Set 1745A controls as follows:  
 MAIN TIME/DIV ..... 1 μSEC  
 Coupling (both channels) ..... 50Ω

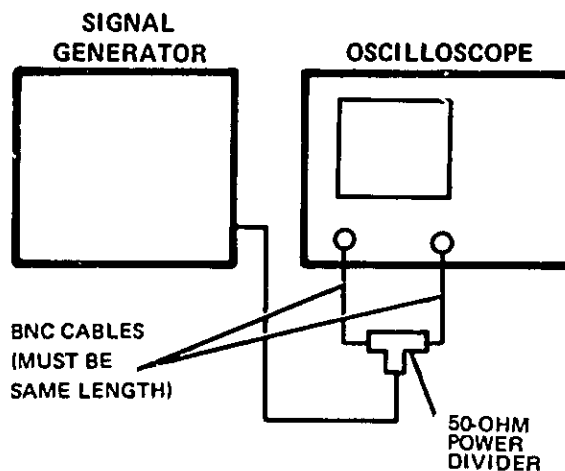


Figure 4-2. CMRR Test Setup

- c. Set signal generator controls to observe 20-MHz signal, 8 divisions in amplitude.
- d. Set 1745A controls as follows:  
 CH B INVT ..... engaged  
 DISPLAY ..... A+B
- e. Adjust either channel vernier (whichever is most effective) to achieve minimum deflection.
- f. Deflection should be less than 0.8 division (20 dB).
- g. Disconnect test equipment.

**4-19. TRIGGERING (INTERNAL).** Main Sweep: dc to 25 MHz on signals causing 0.3 division vertical deflection, increasing to 1 division at 100 MHz. The output of a signal generator is applied to the vertical input to check internal triggering.

**Equipment Required:**

VHF Oscillator ..... HP Model 3200B

4-20. Perform the internal triggering check as follows:

- a. Connect signal generator to channel A INPUT.
- b. Set signal generator controls to obtain 25-MHz signal with 0.3-division amplitude.
- c. Set 1745A controls as follows:  
 Channel A Coupling ..... 50Ω  
 MAIN TIME/DIV ..... .05 μSEC
- d. Adjust main TRIGGER LEVEL to obtain stable display. Stable display confirms proper triggering.
- e. Change signal generator controls to obtain 1-division signal at 100 MHz.
- f. Adjust main TRIGGER LEVEL to obtain stable display. Stable display confirms proper triggering.
- g. Set 1745A controls as follows:  
 MAIN TIME/DIV ..... .1 μSEC  
 DELAYED TIME/DIV ..... .05 μSEC  
 SWEEP AFTER DELAY ..... TRIG'D  
 Sweep Display ..... DLY'D
- h. Set signal generator to obtain 1-division display.
- i. Adjust delayed TRIGGER LEVEL to obtain stable display (slight readjustment of main TRIGGER LEVEL may be required).
- j. Change signal generator output to 0.3 division amplitude at 25 MHz.

k. Adjust delayed TRIGGER LEVEL (and main TRIGGER LEVEL if necessary) to obtain stable display.

l. Disconnect test equipment.

4-21. **TRIGGERING (EXTERNAL).** Main Sweep: dc to 50 MHz on signals of 50 mV p-p or more, increasing to 100 mV p-p at 100 MHz. The output of a signal generator is split, using a power divider, and equal amplitude signals are applied to both channel A and the EXT TRIGGER INPUT connector to check external triggering.

**Equipment Required:**

- VHF Oscillator ..... HP Model 3200B
- RF Voltmeter ..... HP Model 3406A w/11063A
- 50-ohm Feed-through Termination
- 50-ohm Power Divider ..... HP Model 11549

4-22. Perform external triggering test as follows:

- a. Connect equipment as shown in figure 4-3.
- b. Set 1745A controls as follows:  
 Channel A VOLTS/DIV ..... .05  
 Channel A Coupling ..... 50Ω  
 MAIN TIME/DIV ..... .1 μSEC  
 MAG X10 ..... engaged  
 Main INT/EXT ..... EXT
- c. Set signal generator controls to obtain 50-MHz, 50-mV p-p signal. (Indication on RF Voltmeter should be 17.7 mV rms.)
- d. Adjust main TRIGGER LEVEL to obtain stable display.

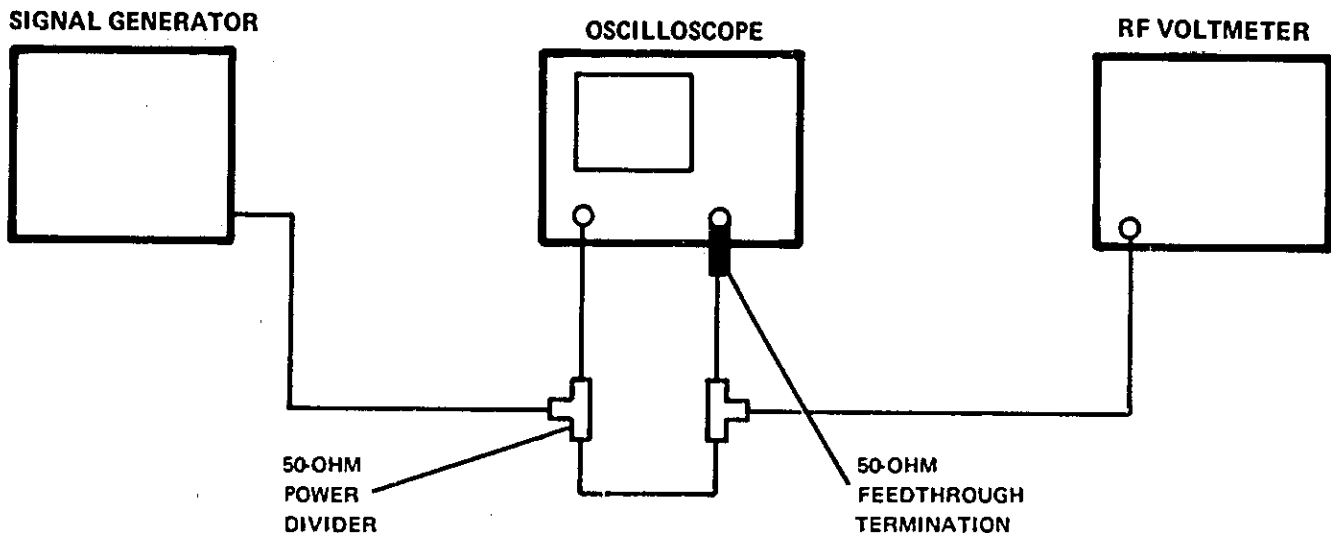


Figure 4-3. External Triggering Test Setup

e. Set signal generator controls to obtain 100-MHz, 100-mV p-p signal. (Indication on RF Voltmeter should be 35.3 mV rms.)

f. Adjust main TRIGGER LEVEL to obtain stable triggering.

g. Set 1745A controls as follows:

Main INT/EXT ..... INT  
 Delayed INT/EXT ..... EXT  
 SWEEP AFTER DELAY ..... TRIG  
 DELAYED TIME/DIV ..... .05 μSEC  
 Sweep Display ..... DLY'D

h. Disconnect signal from main EXT TRIGGER and reconnect to delayed EXT TRIGGER input.

i. Adjust delayed TRIGGER LEVEL to obtain stable display (main TRIGGER LEVEL may also require adjustment).

j. Set signal generator controls to obtain 50-MHz, 50-mV p-p signal. (Indication on RF Voltmeter should be 17.7 mV rms.)

k. Adjust TRIGGER LEVEL(S) as necessary to obtain stable triggering.

l. Set signal generator controls to obtain 100-MHz, 100-mV p-p signal. (Indication on RF Voltmeter should be 35.3 mV rms.)

m. Adjust TRIGGER LEVEL(S) as necessary to obtain stable triggering.

n. Disconnect test equipment.

**4-23. SWEEP TIME ACCURACY.** (+15°C to +35°C) ±2% in unmagnified mode and ±3% in MAG X10 mode. Refer to table 1-1 for other variations in ambient temperatures.

In 50 ms to 2 s ranges, add 1% error.

**Equipment Required:**

Time-mark Generator ..... Tektronix TG501

4-24. Perform sweep time accuracy test as follows:

a. Connect time-mark generator to channel A INPUT.

b. Set time-mark generator and main TIME/DIV controls as shown in table 4-2 and check accuracy as indicated.

c. Set 1745A sweep display to DLY'D.

d. Set main delayed TIME/DIV controls as indicated in table 4-3 and check accuracy.

**4-25. DIFFERENTIAL TIME ACCURACY.** Main time base accuracy: 100 ns/div to 20 ms/div, ± (0.1% of measurement +0.05% of full scale) at ambient temperature of +15°C to +35°C. Refer to table 1-1 for complete specifications. A time mark generator is used in delayed sweep mode to check accuracy.

**Equipment Required:**

Time-mark Generator ..... Tektronix TG501

4-26. Perform differential time accuracy test as follows:

a. Connect time-mark generator to channel A INPUT.

b. Set 1745A controls as follows:

Main TIME/DIV ..... .1 mSEC  
 Delayed TIME/DIV ..... 10 μSEC  
 Channel A Coupling ..... 50Ω

c. Set time-mark generator for 1 mSEC marker.

d. Adjust DELAY dial to intensify second time marker from left.

e. Set sweep display to DLY'D.

f. Adjust DELAY dial to place visible time markers exactly on center vertical graticule line.

g. Record DELAY dial reading \_\_\_\_\_.

h. Set sweep display to MAIN.

i. Adjust DELAY dial to intensity 10th time marker from left.

j. Set sweep display to DLY'D.

k. Adjust DELAY dial to place visible time marker exactly on center vertical graticule line.

l. Record DELAY dial reading \_\_\_\_\_.

m. Subtract DELAY dial reading obtained in step g from reading in step l, difference obtained should be 8 ± 0.05.

n. Disconnect test equipment.

**4-27. DELAY JITTER.** <0.002% (1 part in 50 000) of maximum delay in each step from +15°C to +35°C. Delay jitter is checked by expanding the sweep by 50 000 and visually monitoring the jitter.

**Equipment Required:**

Time-mark Generator ..... Tektronix TG501

Table 4-2. Main TIME/DIV Accuracy

| Main TIME/DIV Setting | Time-mark Generator Settings | Accuracy       |     |
|-----------------------|------------------------------|----------------|-----|
|                       |                              | X1             | X10 |
| .05 μSEC              | 50 nSEC                      | 1 mark/div ±2% | ±3% |
| .1 μSEC               | .1 μSEC                      | 1 mark/div ±2% | ±3% |
| .2 μSEC               | .2 μSEC                      | 1 mark/div ±2% | ±3% |
| .5 μSEC               | .5 μSEC                      | 1 mark/div ±2% | ±3% |
| 1 μSEC                | 1 μSEC                       | 1 mark/div ±2% | ±3% |
| 2 μSEC                | 2 μSEC                       | 1 mark/div ±2% | ±3% |
| 5 μSEC                | 5 μSEC                       | 1 mark/div ±2% | ±3% |
| 10 μSEC               | 10 μSEC                      | 1 mark/div ±2% | ±3% |
| 20 μSEC               | 20 μSEC                      | 1 mark/div ±2% | ±3% |
| 50 μSEC               | 50 μSEC                      | 1 mark/div ±2% | ±3% |
| .1 mSEC               | .1 mSEC                      | 1 mark/div ±2% | ±3% |
| .2 mSEC               | .2 mSEC                      | 1 mark/div ±2% | ±3% |
| .5 mSEC               | .5 mSEC                      | 1 mark/div ±2% | ±3% |
| 1 mSEC                | 1 mSEC                       | 1 mark/div ±2% | ±3% |
| 2 mSEC                | 2 mSEC                       | 1 mark/div ±2% | ±3% |
| 5 mSEC                | 5 mSEC                       | 1 mark/div ±2% | ±3% |
| 10 mSEC               | 10 mSEC                      | 1 mark/div ±2% | ±3% |
| 20 mSEC               | 20 mSEC                      | 1 mark/div ±2% | ±3% |
| 50 mSEC               | 50 mSEC                      | 1 mark/div ±3% | ±4% |
| .1 SEC                | .1 SEC                       | 1 mark/div ±3% | ±4% |
| .2 SEC                | .2 SEC                       | 1 mark/div ±3% | ±4% |
| .5 SEC                | .5 SEC                       | 1 mark/div ±3% | ±4% |
| 1 SEC                 | 1 SEC                        | 1 mark/div ±3% | ±4% |
| 2 SEC                 | 2 SEC                        | 1 mark/div ±3% | ±4% |

Table 4-3. Delayed TIME/DIV Accuracy

| Main TIME/DIV Settings | Delayed TIME/DIV Settings | Time-mark Generator Settings | Accuracy       |                |
|------------------------|---------------------------|------------------------------|----------------|----------------|
|                        |                           |                              | X1             | X10            |
| .1 μSEC                | .05 μSEC                  | 50 nSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| .2 μSEC                | .1 μSEC                   | .1 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| .5 μSEC                | .2 μSEC                   | .2 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 1 μSEC                 | .5 μSEC                   | .5 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 2 μSEC                 | 1 μSEC                    | 1 μSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 5 μSEC                 | 2 μSEC                    | 2 μSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 10 μSEC                | 5 μSEC                    | 5 μSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 20 μSEC                | 10 μSEC                   | 10 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 50 μSEC                | 20 μSEC                   | 20 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| .1 mSEC                | 50 μSEC                   | 50 μSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| .2 mSEC                | .1 mSEC                   | .1 mSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| .5 mSEC                | .2 mSEC                   | .2 mSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 1 mSEC                 | .5 mSEC                   | .5 mSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 2 mSEC                 | 1 mSEC                    | 1 mSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 5 mSEC                 | 2 mSEC                    | 2 mSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 10 mSEC                | 5 mSEC                    | 5 mSEC                       | 1 mark/div ±2% | 1 mark/div ±3% |
| 20 mSEC                | 10 mSEC                   | 10 mSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |
| 50 mSEC                | 20 mSEC                   | 20 mSEC                      | 1 mark/div ±2% | 1 mark/div ±3% |

4-28. Perform delay jitter test as follows:

a. Connect time-mark generator to channel A INPUT (1 mSEC markers).

b. Set 1745A controls as follows:

Main TIME/DIV ..... 1 mSEC  
 Delayed TIME/DIV ..... .2 μSEC  
 Channel A VOLTS/DIV ..... .5  
 Channel A Coupling ..... 50Ω

c. Adjust DELAY dial to position intensified portion of sweep on 11th time marker.

d. Set sweep display to DLY'D, and observe horizontal axis jitter on time marker. Jitter should be less than 1 division (corresponds to 1:50 000).

e. Disconnect test equipment.

4-29. **RISE TIME.** ≤3.5 ns, measured from 10% to 90% points of a 6-division input step, and ≥9 ns in X5 vertical magnification mode. A fast-rise pulse generator is applied to the vertical input; display is then checked to verify the ≤3.5 ns rise time.

Equipment Required:

Fast-rise pulse generator ... Tektronix 067-0681-01

4-30. Perform rise time test as follows:

a. Connect pulse generator to channel A INPUT.

b. Set channel A VOLTS/DIV and pulse generator controls to obtain 6 divisions of vertical deflection.

c. Using channel A POSN control, center 6-division display on CRT.

d. Set 1745A controls as follows:

MAIN TIME/DIV ..... .05 μSEC  
 MAG X10 ..... engaged  
 Channel A Coupling ..... 50Ω

e. Adjust horizontal POSITION as necessary to measure rise time between 10% and 90% points (inner set of dots across CRT face). Rise time should be equal to or less than 3.5 ns.

NOTE

If fast-rise pulse generator has a rise time slower than the recommended 500 ps, the observed rise time will be slower also. To compensate for pulse generator rise time, use the following formula:

$$T_r(\text{observed}) = \sqrt{T_r^2(\text{oscilloscope}) + T_r^2(\text{pulse generator})}$$

$$\text{or}$$

$$T_r(\text{oscilloscope}) = \sqrt{T_r^2(\text{observed}) - T_r^2(\text{pulse generator})}$$

For example, a pulse generator with a 2 ns rise time would cause a properly operating oscilloscope with a rise time of 3.5 ns to display a rise time of 4.03 ns.

$$T_r(\text{observed}) = \sqrt{3.5^2 + 2^2} = 4.03 \text{ ns}$$

f. Depress vertical MAG X5 switch.

g. Reset channel A VOLTS/DIV and pulse generator controls to obtain 8-division display.

h. Center display on CRT. Rise time should be equal to or less than 9 ns.

i. Connect pulse generator to channel B input and repeat step b through h for channel B.

j. Disconnect test equipment.

4-31. **Z-AXIS BLANKING.** +4 V, ≥50-ns wide pulse blanks trace of any intensity, usable to 10 MHz for normal intensity. +4 V signal is applied to the Z-axis input and the CRT is monitored to verify blanking.

Equipment Required:

Voltage ..... Tektronix PG506

4-32. Perform blanking test as follows:

a. Connect dc standard to Z-AXIS INPUT on rear panel.

b. Set dc standard for +4 Vdc.

c. Verify that free-running baseline is blanked, regardless of INTENSITY setting.

d. Disconnect test equipment.

4-33. **DEFLECTION FACTOR.** Accuracy ±3% on all ranges. A dc standard is connected to the vertical inputs and deflection is checked on all ranges.

Equipment Required:

Voltage Standard ..... Tektronix PG506

4-34. Perform deflection factor test as follows:

a. Connect dc standard to channel A INPUT.

b. Set channel A VOLTS/DIV control and dc standard as indicated in table 4-4. Deflection should be 8 divisions ±3% for each checkpoint.



Table 4-4. Deflection Factor Accuracy

| VOLTS/DIV Settings | Dc Standard Settings |
|--------------------|----------------------|
| 20                 | 160 V                |
| 10                 | 80 V                 |
| 5                  | 40 V                 |
| 2                  | 16 V                 |
| 1                  | 8 V                  |
| .5                 | 4 V                  |
| .2                 | 1.6 V                |
| .1                 | .8 V                 |
| .05                | .4 V                 |
| .02                | .16 V                |
| .01                | .08 V                |
| .005               | .04 V                |

c. Change DISPLAY to B and repeat step b for channel B.

d. Disconnect test equipment.

4-35. CALIBRATOR. Amplitude: 1 V p-p into 1 megohm,  $\pm 1.0\%$  0.1 V into 50 ohms with  $< 0.1 \mu s$  rise time.

Calibrator amplitude is checked against a known dc standard. Rise time is measured directly on CRT.

Equipment Required:

Voltage Standard..... Tektronix PG506

4-36. Perform calibrator test as follows:

a. Set channel A VOLTS/DIV to .2.

b. Connect dc standard to channel A INPUT.

c. Set dc standard for +1 V output and carefully note vertical deflection.

d. Disconnect dc standard and connect CAL 1 V output to channel A INPUT using test lead and adapter. Deflection should be within  $\pm 1.0\%$  of that noted in step c.

e. Set channel A VOLTS/DIV to .02 and coupling to 50 ohms. Set MAIN TIME/DIV control to .05  $\mu s$  and measure rise time. Rise time should be less than 0.1  $\mu s$ .

f. Disconnect test equipment.

4-37. This completes the performance checks.

**PERFORMANCE TEST RECORD**  
**HP MODEL 1745A OSCILLOSCOPE**

Tested By \_\_\_\_\_

Date \_\_\_\_\_

| Paragraph No. | Test                                                                                                                                                                                                                                                                                                                                                                           | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Measured                                                                                                                                                                      |                                                                                                                                                                                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4-14          | <b>BANDWIDTH</b><br><br>A 100 MHz<br>B 100 MHz                                                                                                                                                                                                                                                                                                                                 | $\geq 4.25$ div<br>$\geq 4.25$ div                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | _____<br>_____                                                                                                                                                                |                                                                                                                                                                                |
| 4-17          | <b>CMRR</b><br><br>20 dB 20 MHz                                                                                                                                                                                                                                                                                                                                                | $< .8$ div                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | _____                                                                                                                                                                         |                                                                                                                                                                                |
| 4-19          | <b>TRIGGERING</b><br><br>Internal MAIN<br>.3 div 25 MHz<br>1 div 100 MHz<br><br>DLY'D<br>.3 div 25 MHz<br>1 div 100 MHz<br><br>External MAIN<br>50 mV p-p 50 MHz<br>100 mV p-p 100 MHz<br><br>DLY'D<br>50 mV p-p 50 MHz<br>100 mV p-p 100 MHz                                                                                                                                  | stable display<br>stable display<br><br>stable display<br>stable display<br><br>stable display<br>stable display<br><br>stable display<br>stable display                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____                                                                                        |                                                                                                                                                                                |
| 4-23          | <b>SWEEP TIME ACCURACY (at room temperature)</b><br><br>MAIN<br><br>.05 $\mu$ SEC<br>.1 $\mu$ SEC<br>.2 $\mu$ SEC<br>.5 $\mu$ SEC<br>1 $\mu$ SEC<br>2 $\mu$ SEC<br>5 $\mu$ SEC<br>10 $\mu$ SEC<br>20 $\mu$ SEC<br>50 $\mu$ SEC<br>.1 mSEC<br>.2 mSEC<br>.5 mSEC<br>1 mSEC<br>2 mSEC<br>5 mSEC<br>10 mSEC<br>20 mSEC<br>50 mSEC<br>.1 SEC<br>.2 SEC<br>.5 SEC<br>1 SEC<br>2 SEC | $\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10 | X1<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | X10<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ |

**PERFORMANCE TEST RECORD (Cont'd)**  
**HP MODEL 1745A OSCILLOSCOPE**

| Paragraph No. | Test                                                                                                                   | Specification                    | Measured |       |
|---------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|-------|
|               |                                                                                                                        |                                  | X1       | X10   |
| 4-23          | <b>SWEEP TIME ACCURACY (at room Temperature)</b><br><b>DLY'D</b><br><b>(Cont'd)</b>                                    |                                  |          |       |
|               | .05 $\mu$ SEC                                                                                                          | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .1 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .2 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .5 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 1 $\mu$ SEC                                                                                                            | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 2 $\mu$ SEC                                                                                                            | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 5 $\mu$ SEC                                                                                                            | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 10 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 20 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 50 $\mu$ SEC                                                                                                           | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .1 mSEC                                                                                                                | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .2 mSEC                                                                                                                | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | .5 mSEC                                                                                                                | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 1 mSEC                                                                                                                 | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 2 mSEC                                                                                                                 | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
|               | 5 mSEC                                                                                                                 | $\pm 2\%$ , $\pm 3\%$ in X10     | _____    | _____ |
| 10 mSEC       | $\pm 2\%$ , $\pm 3\%$ in X10                                                                                           | _____                            | _____    |       |
| 20 mSEC       | $\pm 2\%$ , $\pm 3\%$ in X10                                                                                           | _____                            | _____    |       |
| 4-25          | <b>DIFFERENTIAL TIME ACCURACY</b><br>Accuracy: $\pm 0.5\%$ of measurement + $0.05\%$ of full scale and accuracy of DMM | $\leq 0.8$ mV                    | _____    | _____ |
| 4-27          | <b>DELAY JITTER</b><br><1:50 000                                                                                       | <1 div                           | _____    | _____ |
| 4-29          | <b>RISE TIME</b><br>Ch A<br>Ch A MAG X5                                                                                | $\leq 3.5$ nSEC<br>$\leq 9$ nSEC | _____    | _____ |
|               | Ch B<br>Ch B MAG X5                                                                                                    | $\leq 3.5$ nSEC<br>$\leq 9$ nSEC | _____    | _____ |
| 4-31          | <b>Z-AXIS BLANKING</b><br>+4 V blanking                                                                                | ✓                                | _____    | _____ |
| 4-33          | <b>DEFLECTION FACTOR</b>                                                                                               | $\pm 3\%$ all ranges             |          |       |
|               |                                                                                                                        | 20 V/div                         | _____    | _____ |
|               |                                                                                                                        | 10 V/div                         | _____    | _____ |
|               |                                                                                                                        | 5 V/div                          | _____    | _____ |
|               |                                                                                                                        | 2 V/div                          | _____    | _____ |
|               |                                                                                                                        | 1 V/div                          | _____    | _____ |
|               |                                                                                                                        | .5 V/div                         | _____    | _____ |
|               |                                                                                                                        | .2 V/div                         | _____    | _____ |
|               |                                                                                                                        | .1 V/div                         | _____    | _____ |
|               |                                                                                                                        | .05 V/div                        | _____    | _____ |
|               |                                                                                                                        | .02 V/div                        | _____    | _____ |
| .01 V/div     | _____                                                                                                                  | _____                            |          |       |
| .005 V/div    | _____                                                                                                                  | _____                            |          |       |
| 4-35          | <b>CALIBRATOR</b><br>Amplitude (1 V)<br>Rise Time (Tr)                                                                 | $\pm 1.0\%$<br>$\leq .1 \mu$ s   | _____    | _____ |

**OPERATION VERIFICATION RECORD  
HP MODEL 1745A OSCILLOSCOPE**

| Paragraph No. | Test                                                                                               | Specification                                                                                                                                                                                                                                                | Meets Specification                                                  |                                                                      |
|---------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
|               |                                                                                                    |                                                                                                                                                                                                                                                              | Yes                                                                  | No                                                                   |
| 4-14          | <b>BANDWIDTH</b><br><br>A 100 MHz<br>B 100 MHz                                                     | $\geq 4.25$ div<br>$\geq 4.25$ div                                                                                                                                                                                                                           | _____<br>_____                                                       | _____<br>_____                                                       |
| 4-19          | <b>TRIGGERING</b><br>Internal MAIN<br><br>.3 div 25 MHz<br>1 div 100 MHz                           | stable display<br>stable display                                                                                                                                                                                                                             | _____<br>_____                                                       | _____<br>_____                                                       |
|               | DLY'D<br><br>1 div 100 MHz<br>.3 div 25 MHz                                                        | stable display<br>stable display                                                                                                                                                                                                                             | _____<br>_____                                                       | _____<br>_____                                                       |
| 4-23          | <b>SWEEP TIME ACCURACY (at room temperature)</b><br><br>MAIN                                       |                                                                                                                                                                                                                                                              | Yes                                                                  | No                                                                   |
|               | .05 $\mu$ SEC<br>.5 $\mu$ SEC<br>10 $\mu$ SEC<br>.1 mSEC<br>1 mSEC<br>20 mSEC<br>50 mSEC<br>.2 SEC | $\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10<br>$\pm 3\%$ , $\pm 4\%$ in X10 | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ |
| 4-23          | DLY'D                                                                                              |                                                                                                                                                                                                                                                              |                                                                      |                                                                      |
|               | .05 $\mu$ SEC<br>.5 $\mu$ SEC<br>10 $\mu$ SEC<br>.1 mSEC<br>2 mSEC<br>20 mSEC                      | $\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10<br>$\pm 2\%$ , $\pm 3\%$ in X10                                                                 | _____<br>_____<br>_____<br>_____<br>_____<br>_____                   | _____<br>_____<br>_____<br>_____<br>_____<br>_____                   |
| 4-25          | <b>DIFFERENTIAL TIME ACCURACY</b><br><br>Dial 8.00                                                 | 8 $\pm 0.05$                                                                                                                                                                                                                                                 | _____<br>_____                                                       | _____<br>_____                                                       |
| 4-33          | <b>DEFLECTION FACTOR</b>                                                                           | $\pm 3\%$ all ranges                                                                                                                                                                                                                                         | CH A                                                                 | CH B                                                                 |
|               |                                                                                                    | .5 V/div<br>.2 V/div<br>.1 V/div<br>.05 V/div<br>.02 V/div<br>.01 V/div<br>.005 V/div                                                                                                                                                                        | Yes No                                                               | Yes No                                                               |
|               |                                                                                                    |                                                                                                                                                                                                                                                              | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____          | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____          |

# ADJUSTMENTS

## SECTION V ADJUSTMENTS

### 5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for making all internal adjustments to return the instrument to peak operating capabilities when repairs have been made.

### 5-3. SAFETY REQUIREMENTS.

5-4. Although this instrument has been designed in accordance with international safety standards, general safety precautions must be observed during all phases of operation, service, and repair of the instrument. Failure to comply with the precautions listed in the Safety Summary at the front of this manual or with specific warnings given throughout this manual could result in serious injury or death. Service and adjustments should be performed only by qualified service personnel.

### 5-5. EQUIPMENT REQUIRED.

5-6. A complete list of required test equipment and special accessories is given in table 1-3 (Section I). Test equipment equivalent to that recommended may be substituted, provided it meets the required characteristics. For best results, use recently calibrated test equipment.

### 5-7. ADJUSTMENTS.

5-8. The adjustment procedures are arranged in a recommended sequence. While most adjustments may be made independently, it is recommended that they be made sequentially as a number of adjustments are directly related to preceding or following adjustments. Refer to table 5-1 for a list of adjustable components and their functions.

*Table 5-1. Adjustable Components*

| Reference Designator | Adjustment Name     | Adjustment Paragraph | Schematic Number | Description                                                   |
|----------------------|---------------------|----------------------|------------------|---------------------------------------------------------------|
| A16R26               | +15 V ADJ           | 5-13                 | 1                | Adjusts +15 Vdc supply to within $\pm 10$ mV.                 |
| A15R113              | CATHODE ADJ         | 5-14                 | 2                | Adjusts cathode voltage to $-2870 \pm 100$ V                  |
| A15R2                | Intensity Limit Adj | 5-15                 | 2                | Minimum setting or BEAM INTENSITY control extinguishes trace. |
| A12R12/<br>A12C11    | Gate Comp Adj       | 5-17                 | 3                | Adjusts for best gate pulse response.                         |
| A16R20               | F G Adj             | 5-18                 | 1                | Adjusts scale illumination uniformity.                        |
| A12R16               | Y-ALIGN             | 5-19                 | 3                | Aligns trace with vertical axis of CRT.                       |
| A3R116               | CALIB Ampl          | 5-20                 | 6                | Adjusts calibrator output for 1 V p-p.                        |
| A7R20                | TRIG SENS (Main)    | 5-21                 | 7                | Sets maximum trigger sensitivity (Main).                      |
| A10R9                | TRIG SENS (Delayed) | 5-21                 | 9                | Sets maximum trigger sensitivity (Delayed).                   |
| A7R41                | SYNC ZERO           | 5-22                 | 7                | Compensate for sync signal AC/DC Coupling.                    |
| A3R86                | TRIG VIEW BAL       | 5-23                 | 4                | Center trigger view display on CRT.                           |
| A7R169               | Delay Start Adj     | 5-24                 | 8                | Sets intensified start point.                                 |
| A7R93                | X1 Cal              | 5-25                 | 11               | Adjust X1 gain of horizontal amplifier.                       |
| A7R117               | X10 Cal             | 5-25                 | 11               | Adjust X10 gain of horizontal amplifier.                      |

Table 5-1. Adjustable Components (Cont'd)

| Reference Designator                              | Adjustment Name                                                       | Adjustment Paragraph | Schematic Number | Description                                                                                     |
|---------------------------------------------------|-----------------------------------------------------------------------|----------------------|------------------|-------------------------------------------------------------------------------------------------|
| A8R43<br>A8R12<br>A8R13<br>A8R14                  | 1 $\mu$ SEC Range<br>0.1 mSEC Range<br>10 mSEC Range<br>50 mSEC Range | 5-26<br>and<br>5-30  | 8                | Main sweep calibration adjustments.                                                             |
| A7R105                                            | Mag Center                                                            | 5-27                 | 11               | Balance display around center screen when magnifier is engaged.                                 |
| A11R10<br>A11R15                                  | LIN 1<br>LIN 2                                                        | 5-28                 | 11               | Adjust for best horizontal linearity.                                                           |
| A9R28<br>A9R10<br>A9R11                           | 0.5 $\mu$ SEC Range<br>5 $\mu$ SEC Range<br>0.5 mSEC Range            | 5-29                 | 10               | Calibrates delayed sweep.                                                                       |
| A3R11<br>A3R31                                    | FET BAL<br>(Channel A)<br>FET BAL<br>(Channel B)                      | 5-31                 | 4                | Input channel balance adjustment to vertical preamplifier. 0 V $\pm$ 0.5 V at A3TP9 and A3TP10. |
| A3R18<br>A3R77                                    | 5 mV BAL<br>(Channel A)<br>5 mV BAL<br>(Channel B)                    | 5-31                 | 4                | Set for minimum trace shift on 0.005, 0.01, 0.02 ranges.                                        |
| A3R19<br>A3R76                                    | 50 mV BAL<br>(Channel A)<br>50 mV BAL<br>(Channel B)                  | 5-31                 | 4                | Set for minimum trace shift between 0.05 ranges.                                                |
| A3R90                                             | POL BAL                                                               | 5-31                 | 4                | Balance Channel B polarity selection.                                                           |
| A3R79                                             | A SYNC BAL                                                            | 5-32                 | 4                | Balances channel A sync signal with channel B sync signal.                                      |
| A3R58<br>A3R32                                    | A POSN<br>B POSN                                                      | 5-32                 | 4                | Compensates for position variations between normal and MAG X5 operation.                        |
| A3C2<br>A3C17                                     | 0.5 V COMP<br>(Ch A)<br>0.5 V COMP<br>(Ch B)                          | 5-33                 | 4                | Adjusts for best input response on 0.5 V range.                                                 |
| A3C4<br>A3C19                                     | 0.5 V INPUT<br>CAP (Ch A)<br>0.5 V INPUT<br>CAP (Ch B)                | 5-33                 | 4                | Adjust input capacitance for 0.5 V range.                                                       |
| A3R49<br>A3R46                                    | A GAIN<br>B GAIN                                                      | 5-34                 | 4                | Equalizes vertical gain of each channel.                                                        |
| A3R65                                             | GAIN                                                                  | 5-34                 | 4                | Adjusts overall gain of vertical preamplifier.                                                  |
| A5R24<br>A5R20<br>A5R19<br>A5R22<br>A5R25<br>A5C3 | HF1<br>HF2<br>HF3<br>HF4<br>HF5<br>HF6                                | 5-35                 | 4                | Vertical output pulse response adjustments.                                                     |
| A3R22                                             | B HF ADJ                                                              | 5-35                 | 4                | Matches Ch B response with Ch A.                                                                |
| A7R97                                             | A vs B CAL                                                            | 5-37                 | 7                | Calibrates Channel A vs Channel B.                                                              |

5-9. In addition to complete adjustment procedures, a condensed adjustment procedure is included (table 5-8) for the convenience of technicians who have sufficient experience with the 1745A. For best results, adjustments should be performed at normal room temperature. An adjustment location photograph (figure 5-2) is provided at the rear of this section.

**5-10. ADJUSTMENT PROCEDURES.**

**WARNING**

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

5-11. Remove top and bottom covers from the instrument. Apply input power and allow thirty minutes for the instrument to warm up.

5-12. The following front-panel control settings are to be used for each adjustment procedure. If a control is to be set to another position, it will be listed in the procedure. After completion of each adjustment procedure, reset controls to their original settings and disconnect test equipment.

| CONTROL                            | SETTING           |
|------------------------------------|-------------------|
| All Pushbuttons                    |                   |
| (except as noted below) .....      | out position      |
| VOLTS/DIV (Channels A and B) ..... | .1                |
| CAL (Channels A and B) ...         | detent (fully cw) |
| Coupling (Channels A and B) .....  | DC                |
| POSN (Channels A and B) .....      | midrange          |
| DISPLAY .....                      | A                 |
| TRIGGER .....                      | A                 |
| FOCUS .....                        | best trace        |
| BEAM INTENSITY .....               | 10 · 11 o'clock   |
| LINE .....                         | ON                |
| POSITION (Horizontal) .....        | midrange          |
| TRIGGER LEVEL                      |                   |
| (Main and Delayed) .....           | 3 o'clock         |
| Sweep Mode .....                   | MAIN              |
| DELAY .....                        | fully ccw         |
| MAIN TIME/DIV .....                | .1 mSEC           |
| DLY'D TIME/DIV .....               | OFF               |
| TIME/DIV VERNIER .....             | CAL               |
| TRIGGER HOLDOFF .....              | MIN               |

**5-13. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT.**

**Equipment Required:**

Digital Multimeter ..... HP Model 3465A

a. Connect DVM between A16TP4 and A16TP3 (ground).

b. Adjust the +15 V ADJ A16R26 for +15 Vdc ±10 mV.

c. Check other dc voltages as indicated in table 5-2. Outputs should remain within ripple specifications at both high- and low-line conditions.

Table 5-2. Low-voltage Supply Limits

| Voltage | Test Point | Limits                       | Ripple |
|---------|------------|------------------------------|--------|
| -15 V   | A16TP1     | ±300 mV                      | <10 mV |
| +5 V    | A16TP2     | ±100 mV                      | <5 mV  |
| +15 V   | A16TP4     | previously set to<br><±10 mV | <10 mV |
| +43 V   | A16TP5     | ±.8 V                        | <5 mV  |
| +120 V  | A16TP6     | ±6 V                         | <20 mV |

**5-14. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT.**

**NOTE**

During routine calibration do not adjust cathode voltage if it reads -2870 ±100 V. Adjustment is usually only necessary after major repair to HVPS assembly or replacement of CRT or HVPS assembly.

**Equipment Required:**

DVM ..... HP Model 3465A  
1000:1 HV Divider Probe ..... HP Model 34111A

**NOTE**

Digital multimeter must have a 10-megohm input impedance to be compatible with the 1000:1 divider probe.

a. Set front-panel BEAM INTENSITY control fully ccw.

**WARNING**

Voltages capable of causing injury or death are present in the high-voltage power supply. Use an insulated adjustment tool and proceed carefully.

b. Connect DVM to +120 V test point A16TP6 and note indication.

c. Connect DVM to +120 V test point A16TP6 through 1000:1 divider probe and note voltage indication.

d. Compute error introduced by 1000:1 divider probe (difference between indications noted in steps b and c divided by step b).



e. Connect DVM through 1000:1 divider probe to cathode (HV) test point A15TP1 through insulated access hole in top of high voltage power supply cover.

f. Adjust CATHODE ADJ (A15R113) for cathode voltage of -2870 V ± error computed in step d.

5-15. INTENSITY LIMIT ADJUSTMENT.

a. Set controls as follows:

DELAYED TIME/DIV ..... 10 μSEC  
BEAM INTENSITY ..... fully ccw

b. Adjust intensity limit control A15R2 until intensified portion of sweep is just extinguished.

5-16. ASTIGMATISM AND FOCUS ADJUSTMENT.

a. Set Model 1745A controls as follows:

MAIN TIME/DIV ..... 1 SEC  
TIME/DIV VERNIER ..... fully ccw  
BEAM INTENSITY ..... barely visible spot

b. While spot moves slowly across screen, adjust FOCUS on front panel and ASTIGMATISM on rear panel for smallest, best-defined spot.

5-17. GATE RESPONSE ADJUSTMENT.

Equipment Required:

Monitor Oscilloscope ..... HP Model 1740A  
10:1 Divider Probe ..... HP Model 10041A

a. Connect monitor oscilloscope through 10:1 divider probe to test point A12TP1.

b. Adjust front-panel BEAM INTENSITY control A12R3 so that peak amplitude of gate signal at A12TP1 is 25 volts.

c. Adjust gate comp adj A12R12 and A12C11 for best square-wave response (overshoot, undershoot, etc., should be less than 3%).

5-18. FLOODGUN ADJUSTMENT.

a. Set SCALE ILLUM fully clockwise.

b. Adjust FG adj A16R20 for maximum brightness with uniform illumination.

c. Verify that CRT remains evenly illuminated as SCALE ILLUM control is turned slowly counterclockwise.

5-19. TRACE ALIGN AND Y-AXIS ALIGN ADJUSTMENT.

Equipment Required:

Test Oscillator ..... HP Model 651B

a. Obtain horizontal baseline.

b. Adjust TRACE ALIGN on rear panel to make horizontal trace exactly parallel with CRT graticule lines.

c. Set display mode to A vs B.

d. Connect test oscillator to channel A INPUT.

e. Adjust test oscillator for approximately 1-kHz sine wave with 8 divisions of vertical deflection.

f. Adjust Y-align A12R16 so that vertical trace is parallel with vertical graticule line.

5-20. CALIBRATOR AMPLITUDE ADJUSTMENT.

Equipment Required:

Digital Voltmeter ..... HP Model 3465A

a. Connect DVM between CAL 1 V OUTPUT and ground.

b. Adjust A3R116, CALIB AMPL, for an indication of 0.500 V ± 5 mV. Since the calibrator signal is a square wave, by adjusting amplitude for 0.5 V average value, peak value of calibrator pulse will be 1 V ± 10 mV.

5-21. TRIGGER SENSITIVITY ADJUSTMENT.

Equipment Required:

Test Oscillator ..... HP Model 651B

a. Set 1745A controls as follows:

VOLTS/DIV (Channel A) ..... .005  
Coupling (Channel A) ..... 50Ω  
MAIN TIME/DIV ..... 10 μSEC  
DELAYED TIME/DIV ..... 2 μSEC  
Main INT/EXT ..... EXT

b. Connect test oscillator to channel A INPUT and main EXT TRIGGER input, using BNC tee. Terminate main EXT TRIGGER input with 50-ohm feedthrough termination.

c. Set test oscillator output for 50-kHz, 15-mV p-p sine wave (3 div).

d. Set main AUTO/NORM to NORM.

e. Set main trig sens A7R20 fully cw.

f. Slowly turn main TRIGGER LEVEL from one extreme to the other. Note that one sweep occurs for each direction of rotation (increase INTENSITY slightly).

g. While turning TRIGGER LEVEL, slowly adjust main trig sens A7R20 ccw until sweep occurs for only one direction of rotation of main TRIGGER LEVEL.

h. Set main AUTO/NORM to AUTO.

i. Increase output amplitude from test oscillator to 20 mV p-p (4 div).

j. Set main AUTO/NORM to NORM.

k. Rotate main TRIGGER LEVEL. Sweep should occur for each direction of rotation and there should be one small area of TRIGGER LEVEL control where stable triggering can be obtained.

l. Change 1745A controls as follows:

|                       |      |
|-----------------------|------|
| Main AUTO/NORM .....  | AUTO |
| Main INT/EXT .....    | INT  |
| Delayed INT/EXT ..... | EXT  |

m. Connect test oscillator to delayed EXT TRIGGER input.

n. Set test oscillator output for 50-kHz, 15 mV p-p sine wave.

o. Set SWEEP AFTER DELAY to TRIG'D.

p. Set horizontal sweep mode to DLY'D.

q. Set delay trig sens A10R9 fully cw.

r. While turning delayed TRIGGER LEVEL from one extreme to the other, adjust A10R9 ccw until sweep occurs for only one direction of rotation or not at all (keep INTENSITY set higher than normal).

s. Set SWEEP AFTER DELAY to AUTO.

t. Increase test oscillator output to 20-mV p-p.

u. Set SWEEP AFTER DELAY to TRIG'D.

v. Turn delayed TRIGGER LEVEL. Sweep should occur for each direction of rotation.

**NOTE**

If sweep does not occur for each direction of rotation, readjust A10R9 slightly cw until sweeps do occur.

w. Disconnect test equipment.

**5-22. SYNC ZERO ADJUSTMENT.**

**Equipment Required:**

Test Oscillator..... HP Model 651B

a. Connect test oscillator to channel A INPUT.

b. Set test oscillator output for 1-kHz sine wave and approximately six divisions of amplitude.

c. Adjust main TRIGGER LEVEL for stable display.

d. Change main trigger coupling between AC and DC and note shift in trigger point.

e. Adjust SYNC ZERO A7R41 until no shift occurs.

f. Disconnect test equipment.

**5-23. TRIGGER VIEW BALANCE ADJUSTMENT.**

**Equipment Required:**

Test Oscillator..... HP Model 651B

a. Set 1745A controls as follows:

|                      |         |
|----------------------|---------|
| TRIGGER VIEW .....   | engaged |
| Main AUTO/NORM ..... | NORM    |
| Main INT/EXT .....   | EXT     |

b. Connect test oscillator to main EXT TRIGGER input.

c. Set test oscillator output for approximately 100-mV p-p, 10-kHz sine wave.

d. Adjust main TRIGGER LEVEL for stable display.

e. Decrease test oscillator amplitude to lowest amplitude where stable triggering can be maintained.

f. Adjust trig view bal A3R86 until trigger view display is centered on middle horizontal graticule line.

**5-24. DELAY START ADJUSTMENT.**

a. Set Model 1745A controls as follows:

|                        |          |
|------------------------|----------|
| MAIN TIME/DIV .....    | .1 mSEC  |
| DELAYED TIME/DIV ..... | .05 μSEC |
| DELAY .....            | .2       |

b. Set horizontal POSITION control so that sweep starts exactly on the far left graticule line.

c. Adjust A7R169, delay start, until intensified marker is 2 mm after sweep start point.

**5-25. HORIZONTAL AMPLIFIER GAIN ADJUSTMENTS.****Equipment Required:**

Time-mark Generator ..... Tektronix TG501

- a. Set Model 1745A controls as follows:

Channel A Coupling ..... 50 $\Omega$   
 Channel A VOLTS/DIV ..... .5  
 DELAYED TIME/DIV ..... .05  $\mu$ SEC  
 DELAY ..... 1.00

- b. Adjust horizontal POSITION control until intensified dot is exactly on second vertical graticule line.

**NOTE**

A slight reduction in intensity may be helpful.

- c. Set DELAY control to 9.00 position.  
 d. Adjust A7R93, X1 gain, until intensified dot is on 10th vertical graticule line from left.

- e. Set DELAY control to 9.00 position.

- f. Repeat steps b through e until intensified dot is on second vertical graticule line when DELAY control is at 1.00 position and is on 10th vertical graticule line from left when DELAY control is at 9.00.

- g. Connect time-mark generator to channel A INPUT connector.

- h. Set time-mark generator for .5  $\mu$ SEC time markers.

- i. Set MAIN TIME/DIV to .5  $\mu$ SEC.

- j. Using horizontal POSITION control, align time markers with vertical graticule lines.

- k. On main sweep assembly, A8, adjust .05 - 2  $\mu$ SEC, A8R43, for exactly one time marker per division.

- l. Set HORIZ DISPLAY control to MAG X10.

- m. Using horizontal POSITION control, align one time marker with first left vertical graticule line.

- n. On horizontal sweep assembly, A7, adjust A7R117, X10 gain, until one time marker coincides with first left vertical graticule line and one time marker coincides with last right vertical graticule line.

**5-26. PRELIMINARY MAIN SWEEP CALIBRATION.****Equipment Required:**

Time-mark Generator ..... Tektronix TG501

- a. Connect time-mark generator to channel A INPUT.

- b. Set main AUTO/NORM to NORM.

- c. Set main TIME/DIV and time-mark generator as indicated in table 5-3. Make adjustments to obtain one marker/division. (Set Adjustments as closely as possible.)

Table 5-3. Preliminary Main Sweep Calibration

| MAIN TIME/DIV Settings | Time-mark Generator Settings | Adjust |
|------------------------|------------------------------|--------|
| 1 $\mu$ SEC            | 1 $\mu$ s                    | A8R43  |
| .1 mSEC                | .1 ms                        | A8R12  |
| 10 mSEC                | 10 ms                        | A8R13  |
| 50 mSEC                | 50 ms                        | A8R14  |

**5-27. X10 AMPLIFIER BALANCE ADJUSTMENT.****Equipment Required:**

Time-mark Generator ..... Tektronix TG501

- a. Set Model 1745A controls as follows:

Coupling (Channel A) ..... 50 $\Omega$   
 VOLTS/DIV (Channel A) ..... .5  
 MAIN TIME/DIV ..... 1  $\mu$ SEC

- b. Connect time-mark generator to channel A INPUT connector.

- c. Set time-mark generator for 5  $\mu$ SEC time markers and observe three time marks.

- d. Using horizontal POSITION control, center middle time marker on CRT screen.

- e. Engage MAG X10 switch and adjust A7R105, mag. center, to center time mark.

**5-28. HORIZONTAL LINEARITY ADJUSTMENTS.****Equipment Required:**

Time-mark Generator ..... Tektronix TG501

- a. Connect time-mark generator to channel A INPUT.

b. Set Model 1745A controls as follows:

Coupling (channel A) ..... 50Ω  
 VOLTS/DIV ..... .2  
 MAIN TIME/DIV ..... .05 μSEC  
 MAG X10..... engaged

c. Set time-mark generator for 10 ns markers.

d. Starting with A11R10 and A11R15, linearity adj. fully CW, adjust for best overall linearity in the center 8 divisions of unmagnified sweep (center 80 divisions of magnified sweep).

**5-29. DELAYED SWEEP ADJUSTMENT.**

**Equipment Required:**

Time mark Generator ..... Tektronix TG501

a. Connect time-mark generator to channel A INPUT.

b. Set 1745A controls as follows:

VOLTS/DIV ..... .5  
 Coupling (Channel A) ..... 50Ω  
 Horizontal Sweep ..... DLY'D  
 SWEEP AFTER DELAY ..... TRIG'D

c. Set time-mark generator, main TIME/DIV and delayed TIME/DIV as indicated in table 5-4. Make

necessary adjustments for one time marker/div, compromising (if necessary) so that all ranges controlled by particular adjustment are in specified tolerance.

**5-30. MAIN SWEEP FINE ADJUSTMENTS.** These adjustments utilize the accuracy of the DELAY dial to calibrate main sweep more accurately than is possible using the visual method (paragraph 5-26). These adjustments must be accomplished if the differential time accuracy specifications is to be met.

**Equipment Required:**

Time mark Generator ..... Tektronix TG501

a. Connect time-mark generator to channel A INPUT connector.

b. Set Model 1745A front-panel controls as follows:

Coupling (Channel A) ..... 50Ω  
 VOLTS/DIV (Channel A) ..... .5  
 MAIN TIME/DIV ..... 5 μSEC  
 DELAYED TIME/DIV ..... .05 μSEC  
 Horiz. Display ..... DLY'D  
 AUTO NORM ..... NORM

c. Set time-mark generator for .5 μs markers.

d. Set DELAY potentiometer to 1.00 position.

*Table 5-4. Delayed Sweep Calibration Adjustments*

| MAIN TIME/DIV Settings | DLY'D TIME/DIV Settings | Time-mark Generator Settings | Adjust | Tolerance |
|------------------------|-------------------------|------------------------------|--------|-----------|
| .1 μSEC                | .05 μSEC                | 50 ns                        | A9R23  | ±2%       |
| .2 μSEC                | .1 μSEC                 | .1 μs                        |        |           |
| .5 μSEC                | .2 μSEC                 | .2 μs                        |        |           |
| 1 μSEC                 | .5 μSEC                 | .5 μs                        |        |           |
| 2 μSEC                 | 1 μSEC                  | 1 μs                         |        |           |
| 5 μSEC                 | 2 μSEC                  | 2 μs                         |        |           |
| 10 μSEC                | 5 μSEC                  | 5 μs                         | A9R10  | ±2%       |
| 20 μSEC                | 10 μSEC                 | 10 μs                        |        |           |
| 50 μSEC                | 20 μSEC                 | 20 μs                        |        |           |
| .1 mSEC                | 50 μSEC                 | 50 μs                        |        |           |
| .2 mSEC                | .1 mSEC                 | .1 mSEC                      |        |           |
| .5 mSEC                | .2 mSEC                 | .2 mSEC                      |        |           |
| 1 mSEC                 | .5 mSEC                 | .5 mSEC                      | A9R11  | ±2%       |
| 2 mSEC                 | 1 mSEC                  | 1 mSEC                       |        |           |
| 5 mSEC                 | 2 mSEC                  | 2 mSEC                       |        |           |
| 10 mSEC                | 5 mSEC                  | 5 mSEC                       |        |           |
| 20 mSEC                | 10 mSEC                 | 10 mSEC                      |        |           |
| 50 mSEC                | 20 mSEC                 | 20 mSEC                      |        |           |

e. Using channel A POSN control, center vertically time-mark display on CRT.

f. Using horizontal POSITION control, set leading edge of time mark to center CRT graticule line.

g. Set DELAY potentiometer to 9.00 position.

h. Adjusting .05-2  $\mu$ SEC, A8R43, set leading edge of time marker to center CRT graticule line.

i. Repeat steps d through h until leading edge of time marker can be set to center CRT graticule line with DELAY dial set at 9.00.

j. This completes step 1 in table 5-5. Complete remaining steps in table by repeating above procedure for each step.

Table 5-5. Main Sweep Fine Adjustments

| Step | Time-mark Generator Setting | MAIN TIME/DIV Setting | DLY'D TIME/DIV Setting | Adjust |
|------|-----------------------------|-----------------------|------------------------|--------|
| 1    | .5 $\mu$ s                  | .5 $\mu$ SEC          | .05 $\mu$ SEC          | A8R43  |
| 2    | 10 $\mu$ s                  | 10 $\mu$ SEC          | 1 $\mu$ SEC            | A8R12  |
| 3    | 1 ms                        | 1 mSEC                | .1 mSEC                | A9R13  |
| 4    | 50 ms                       | 50 mSEC               | 5 mSEC                 | A8R14  |

### 5-31. VERTICAL AMPLIFIER BALANCE ADJUSTMENT.

#### Equipment Required:

Digital Voltmeter ..... HP Model 3465A

- Set channel A and B coupling to GND.
- Connect DVM to A3TP9.
- Adjust channel A FET balance A3R11 for 0 V  $\pm$ 0.5 mV.
- Connect DVM to A3TP10.
- Adjust channel B FET balance A3R31 for 0 V  $\pm$ 0.5 mV.
- Disconnect DVM.
- While changing channel A VOLTS/DIV between .005, .01, and .02, adjust channel A 5-mV balance A3R18 for minimum trace shift between ranges.

h. Rotate channel A VOLTS/DIV between .005 and .05 and adjust channel A 50-mV balance A3R19 for minimum trace shift between ranges.

i. Change DISPLAY to B.

j. Rotate channel B VOLTS/DIV between .005, .01, and .02, and adjust channel B 5-mV balance A3R77 for minimum trace shift between ranges.

k. Rotate channel B VOLTS/DIV between .005, .05 and adjust channel B 50-mV balance A3R76 for minimum trace shift between ranges.

l. While switching CH B INVT selector between its engaged and disengaged position, adjust polarity balance A3R90 until trace shift is minimal. If A3R90 is changed, recheck steps j and k for correct balance. If additional adjustments are made for j and k, recheck adjustment of A3R90 as described above.

### 5-32. POSITION AND SYNC BALANCE ADJUSTMENT.

#### Equipment required:

Test Oscillator ..... HP Model 651B

a. Set 1745A controls as follows:

DISPLAY ..... B  
 POSN (Channel B) ..... 12 o'clock

b. Switch between normal and MAG X5 and adjust channel B POSN A3R32 for minimum trace shift.

c. Set 1745A controls as follows:

DISPLAY ..... ALT  
 TRIGGER ..... COMP  
 VOLTS/DIV (both channels) ..... .01

d. Using test oscillator, apply 10-kHz sine wave to both channel INPUTS using BNC tee and two cables of equal electrical length.

e. Adjust test oscillator for 0.5 division of vertical deflection.

f. Adjust sync A bal A3R79 until both channels trigger properly and are in phase. If A3R79 is changed recheck steps g and h in paragraph 5-31 for correct balance. If additional adjustments are made for g and h, recheck adjustment of A3R79 as described above.

g. Disconnect test oscillator.

h. Set 1745A controls to initial settings.

i. Switch between normal and MAG X5 and adjust channel A POSN A3R58 for minimum trace shift.

j. Disengage MAG X5.

**5-33. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION ADJUSTMENTS.**

**Equipment Required:**

Pulse Generator ..... HP Model 8013B  
 Capacitance Meter ..... HP Model 4332A

- a. Connect pulse generator to channel A INPUT.
- b. Set 1745A controls as follows:
  - Coupling (channel A) ..... 50Ω
  - VOLTS/DIV (channel A) ..... .5
  - MAIN TIME/DIV ..... 20 μSEC
- c. Set pulse generator controls to obtain 3-V peak, 10-kHz square wave.
- d. Adjust .5 volt comp A3C2 with insulated adjusting tool for best square-wave response.
- e. Disconnect pulse generator.
- f. Set 1745A controls as follows:
  - VOLTS/DIV (both channels) ..... .2
  - Coupling (channel A) ..... DC
- g. Connect capacitance meter to channel A INPUT and observe reading (19.5 to 21.5 pF).
- h. Set channel A VOLTS/DIV to .5.
- i. Adjust channel A input cap A3C4 to obtain same reading as noted on .2 range (step g).
- j. Disconnect capacitance meter.
- k. Change DISPLAY to B and repeat steps a through j for channel B adjusting channel B .5 V input comp A3C17 and channel B .5 V cap A3C19.

**5-34. VERTICAL GAIN ADJUSTMENT.**

- a. Connect CAL 1 V output to channel A INPUT using test lead and adapter.
- b. Set 1745A controls and adjustments as follows:
  - VOLTS/DIV (both channels) ..... .2
  - A3R49, channel A gain ..... fully cw
  - A3R46, channel B gain ..... fully cw
- c. Note signal amplitude of channel A.
- d. Change DISPLAY and TRIGGER to B and connect CAL 1 V signal to channel B INPUT.
- e. If channel B amplitude is larger than channel A, turn channel B gain A3R46 ccw until channel gains are

equal. If channel A is larger than channel B, turn channel A gain A3R49 ccw until gains are equal.

- f. Adjust overall gain A3R65 to display exactly 5 divisions vertically.

**5-35. 0.01 VOLT/DIV PULSE RESPONSE ADJUSTMENT.**

**Equipment Required:**

Fast-rise pulse generator ... Tektronix 067-0681-01

- a. Set Model 1745A controls as follows:
  - Coupling (both channels) ..... 50 ohms
  - VOLTS/DIV (both channels) ..... .01
  - TIME/DIV (main) as necessary (see table 5-6)

**NOTE**

Perform the following preset adjustments only if major repair or parts replacement was done to delay line, A5 Vertical Output assembly or CRT.

- b. Preset high frequency adjustments A5R19, A5R20, A5R22, A5R24, and A5R25 to midrange.
- c. Connect fast-rise pulse generator to channel A INPUT and adjust pulse generator amplitude for 5 division display. It may be necessary to use oscilloscope VOLTS/DIV CAL vernier to obtain exactly 5 divisions of display.

- d. Adjust A5C3 for dip in leading edge (slowest response).

- e. While referring to table 5-6, perform high frequency adjustments for best pulse shape and fast risetime. Due to interaction it may be necessary to repeat procedure making small incremental changes.

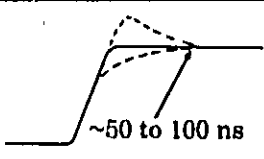
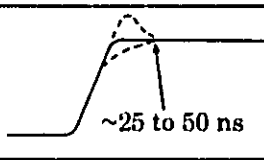
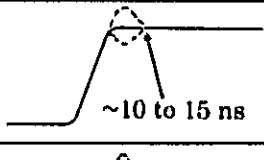
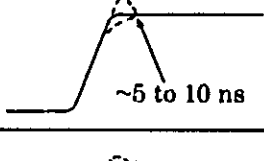
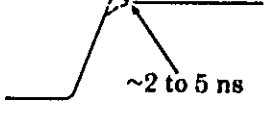
**NOTE**

Optimum adjustment occurs when A5R24 and A5R25 are nearly equal and midrange with minimum ringing ~150 to 200 ns from leading edge. Optimum setting of A5C3 is minimum speed (capacitance) required to make risetime specification on 0.01 VOLT/DIV range. Adding more capacitance than necessary will cause excessive overshoot on 0.2 VOLT/DIV range.

- f. Connect fast-rise pulse generator to channel B INPUT and adjust pulse generator and/or oscilloscope VOLTS/DIV CAL vernier for 5 division display on 0.01 VOLT/DIV range.

- g. Adjust A3R22, channel B HF adj, to make channel B pulse shape match channel A pulse shape as closely as possible.

Table 5-6. Pulse Response Adjustments

| Step | Adjustment                 | Sweep Speed                        | Effect on Pulse                                                                                    |
|------|----------------------------|------------------------------------|----------------------------------------------------------------------------------------------------|
| 1    | A5R22 (HF4)                | .5 $\mu$ SEC                       | <br>~50 to 100 ns |
| 2    | A5R19 (HF3)                | .1 $\mu$ SEC                       | <br>~25 to 50 ns  |
| 3    | A5R20 (HF2)                | .05 $\mu$ SEC                      | <br>~10 to 15 ns  |
| 4    | A5R24 (HF1)<br>A5R25 (HF5) | .05 $\mu$ SEC                      | <br>~5 to 10 ns   |
| 5    | A5C3 (HF6)                 | .05 $\mu$ SEC<br>MAG X10<br>(5 ns) | <br>~2 to 5 ns   |

**NOTE**

Perform bandwidth test (paragraph 4-14) after making pulse response adjustments. If bandwidth is low, increase capacitance of A5C3 slightly until bandwidth is adequate. A5R24 and A5R25 will need to be readjusted for optimum pulse shape without degrading bandwidth.

**5-36. 0.5 VOLT/DIV PULSE RESPONSE ADJUSTMENT.**

**NOTE**

Do not perform this procedure unless major repair of the +100 attenuator (A3 Vertical Preamp) has taken place. If this procedure is necessary due to repair of a channel, it is not necessary to perform on both channels.

a. Ensure pulse response has been adjusted in accordance with paragraph 5-35 for the 0.01 VOLT/DIV range on the repaired channel.

b. Set Model 1745A controls as follows:

Coupling (repaired channel) ..... 50 $\Omega$   
VOLTS/DIV (repaired channel) ..... .01  
TIME/DIV (main) ..... .05  $\mu$ SEC

c. Connect fast-rise pulse generator to repaired channel input and adjust pulse generator amplitude for 5 division display. It may be necessary to use oscilloscope VOLTS/DIV CAL vernier to obtain exactly 5 divisions of display.

d. Observe and note pulse shape and risetime on 0.01 VOLT/DIV range.

e. Change attenuator of repaired channel to 0.5 VOLT/DIV and adjust pulse generator amplitude for exactly 5 divisions of display.

f. Compare 0.5 VOLT/DIV pulse response and risetime with 0.01 VOLT/DIV pulse response and risetime. If pulse response and risetime closely match, no further adjustment is necessary. If the parameters do not match, continue with step g.

g. Note difference of overshoot or undershoot on 0.5 VOLT/DIV range and note the present value of A3R7 (channel A) or A3R28 (channel B). To decrease excessive overshoot, reduce resistance of either A3R7 (channel A) or A3R28 (channel B). To reduce undershoot, increase resistance of either A3R7 or A3R28. Refer to table 5-7 for HP part numbers and resistance values.

Table 5-7. A3R7 and A3R28 Resistance Values

| Resistance (Ohms) | HP Part Number |
|-------------------|----------------|
| 100               | 0698-7710      |
| 121               | 0698-7214      |
| 133               | 0698-7215      |
| 147               | 0698-7216      |
| 162               | 0698-7217      |
| 178               | 0698-7218      |
| 196               | 0698-7219      |
| 215               | 0698-7220      |
| 261               | 0698-7222      |

**5-37. X-Y GAIN ADJUSTMENT.**

**Equipment Required:**

Test Oscillator ..... HP Model 651B

a. Connect test oscillator to both channels using BNC tee.

b. Adjust test oscillator and channel A VOLTS/DIV for exactly 6 divisions of vertical deflection. Test oscillator should be set for low frequency (<1 kHz).

c. Change sweep mode to A vs B.

d. With channel B VOLTS/DIV set to same setting as channel A, adjust A-B cal A7R97 for exactly 6 divisions of horizontal deflection.

Table 5-8. Condensed Adjustment Procedure

| Adjustment                                           | Procedure                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| +15 V Adj A16R26                                     | +15 Vdc $\pm$ 10 mV.                                                                                                                                                                                                                                                                                 |
| CATHODE ADJ A15R113                                  | -2870 $\pm$ 100 V at A15TP1                                                                                                                                                                                                                                                                          |
| Intensity Limit Adj A15R2                            | <ol style="list-style-type: none"> <li>1. Set main sweep to .1 mSEC.</li> <li>2. Set delayed sweep to 10 <math>\mu</math>SEC.</li> <li>3. Adjust so that intensified sweep is just extinguished with BEAM INTENSITY at minimum.</li> </ol>                                                           |
| Gate Comp Adj A12R12 and A12C11                      | <ol style="list-style-type: none"> <li>1. Set BEAM INTENSITY to midrange.</li> <li>2. Adjust for fastest rise time with &lt;3% overshoot. Observe trace and adjust for even intensity, particularly at left edge. Check for less than 1 division of baseline loss at fastest sweep speed.</li> </ol> |
| F.G. Adj A16R20                                      | Adjust for uniform illumination at all settings of SCALE ILLUM.                                                                                                                                                                                                                                      |
| TRACE ALIGN (rear panel) and Y-align (A12R16)        | <ol style="list-style-type: none"> <li>1. Perform TRACE ALIGN first.</li> <li>2. Apply 10-kHz sine wave to channel A while A VS B mode.</li> <li>3. Adjust for perpendicular line.</li> </ol>                                                                                                        |
| Calibrator Amp A3R116                                | Adjust for 1 V peak $\pm$ 10 mV.                                                                                                                                                                                                                                                                     |
| Main Trig Sens Adj A7R20 Delayed Trig Sens Adj A10R9 | Adjust so both main and delayed trigger circuit recognize a 50-kHz, 20 mV sine wave.                                                                                                                                                                                                                 |
| Sync Zero A7R41                                      | <ol style="list-style-type: none"> <li>1. Apply 1-kHz sine wave.</li> <li>2. Adjust for no shift in trigger point while switching time base between AC/DC coupling.</li> </ol>                                                                                                                       |
| Trig View Bal A3R86                                  | <ol style="list-style-type: none"> <li>1. Apply small sine wave to main EXT TRIGGER.</li> <li>2. Select TRIG VIEW mode.</li> <li>3. Adjust to position the triggered display to center screen.</li> </ol>                                                                                            |
| Delay Start Adj. A7R169                              | With MAIN TIME/DIV set to .1 mSEC, DLY'D TIME/DIV set to .05 $\mu$ SEC, and DELAY to .2, set intensified spot 2 mm after sweep start point.                                                                                                                                                          |



Table 5-8. Condensed Adjustment Procedure (Cont'd)

| Adjustment                                                                        | Procedure                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------|--------------|------------------|--------------|-------------|--------------------|---------|-----------|----------------|-------|-----------|
| HORIZ Amp Gain<br>X1 Gain A7R93<br><br>.05 - 2 $\mu$ SEC A8R43<br>X10 Gain A7R117 | <ol style="list-style-type: none"> <li>1. Turn Delayed Sweep to .05 <math>\mu</math>SEC to obtain intensified dot on main sweep.</li> <li>2. Set DELAY to 1.00 and position intensity spot to 2nd graticule line.</li> <li>3. Set DELAY to 9.00. Adjust A7R93 to position bright spot to 10th line.</li> <li>4. Set for 1 marker/div.</li> <li>5. Set for 1 marker/10 div.</li> </ol>                                                                   |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| PRELIMINARY MAIN SWEEP CAL<br><br>A8R43<br>A8R12<br>A8R13<br>A8R14                | <ol style="list-style-type: none"> <li>1. 1 <math>\mu</math>SEC range</li> <li>2. 0.1 mSEC range</li> <li>3. 10 mSEC range</li> <li>4. 50 mSEC range</li> </ol>                                                                                                                                                                                                                                                                                         |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| HORIZ Ampl Balance<br>Mag Center A7R105                                           | <ol style="list-style-type: none"> <li>1. Set so that display at center screen remains at center screen when MAG X10 is used.</li> </ol>                                                                                                                                                                                                                                                                                                                |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| HORIZONTAL LINEARITY<br><br>A11R10<br>A11R15                                      | <ol style="list-style-type: none"> <li>1. Adjust on .05 <math>\mu</math>SEC range, using MAG X10, observing 10-ns markers.</li> </ol>                                                                                                                                                                                                                                                                                                                   |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| Delayed Sweep Calibration<br>A9R28<br>A9R10<br>A9R11                              | <table border="1"> <thead> <tr> <th>Time Marks and Delayed TIME/DIV</th> <th>Adjust</th> <th>Tolerance</th> </tr> </thead> <tbody> <tr> <td>0.05 - 2 <math>\mu</math>s</td> <td>A9R28</td> <td><math>\pm 2\%</math></td> </tr> <tr> <td>5 <math>\mu</math>s - 0.2 ms</td> <td>A9R10</td> <td><math>\pm 2\%</math></td> </tr> <tr> <td>0.5 ms - 20 ms</td> <td>A9R11</td> <td><math>\pm 2\%</math></td> </tr> </tbody> </table>                          | Time Marks and Delayed TIME/DIV | Adjust        | Tolerance    | 0.05 - 2 $\mu$ s | A9R28        | $\pm 2\%$   | 5 $\mu$ s - 0.2 ms | A9R10   | $\pm 2\%$ | 0.5 ms - 20 ms | A9R11 | $\pm 2\%$ |
| Time Marks and Delayed TIME/DIV                                                   | Adjust                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Tolerance                       |               |              |                  |              |             |                    |         |           |                |       |           |
| 0.05 - 2 $\mu$ s                                                                  | A9R28                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $\pm 2\%$                       |               |              |                  |              |             |                    |         |           |                |       |           |
| 5 $\mu$ s - 0.2 ms                                                                | A9R10                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $\pm 2\%$                       |               |              |                  |              |             |                    |         |           |                |       |           |
| 0.5 ms - 20 ms                                                                    | A9R11                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $\pm 2\%$                       |               |              |                  |              |             |                    |         |           |                |       |           |
| MAIN SWEEP FINE ADJ<br><br>A8R43<br>A8R12<br>A8R13<br>A8R14                       | <p>Use DELAY dial at setting of 1.00 and 9.00 to adjust main sweep.</p> <table border="1"> <thead> <tr> <th>Main Sweep and Time Mark</th> <th>Delayed Sweep</th> </tr> </thead> <tbody> <tr> <td>.5 <math>\mu</math>SEC</td> <td>.05 <math>\mu</math>SEC</td> </tr> <tr> <td>10 <math>\mu</math>SEC</td> <td>1 <math>\mu</math>SEC</td> </tr> <tr> <td>1 mSEC</td> <td>.1 mSEC</td> </tr> <tr> <td>50 mSEC</td> <td>5 mSEC</td> </tr> </tbody> </table> | Main Sweep and Time Mark        | Delayed Sweep | .5 $\mu$ SEC | .05 $\mu$ SEC    | 10 $\mu$ SEC | 1 $\mu$ SEC | 1 mSEC             | .1 mSEC | 50 mSEC   | 5 mSEC         |       |           |
| Main Sweep and Time Mark                                                          | Delayed Sweep                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| .5 $\mu$ SEC                                                                      | .05 $\mu$ SEC                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| 10 $\mu$ SEC                                                                      | 1 $\mu$ SEC                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| 1 mSEC                                                                            | .1 mSEC                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |               |              |                  |              |             |                    |         |           |                |       |           |
| 50 mSEC                                                                           | 5 mSEC                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |               |              |                  |              |             |                    |         |           |                |       |           |

Table 5-8. Condensed Adjustment Procedure (Cont'd)

| Adjustment                                                                                                                   | Procedure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Vertical Amplifier Balance</b><br><br>A3R11<br><br>A3R31<br><br>A3R18<br><br>A3R19<br><br>A3R77<br><br>A3R76<br><br>A3R90 | <ol style="list-style-type: none"> <li>1. Connect DVM to A3TP9 and adjust A FET balance for 0 V <math>\pm 5</math> mV.</li> <li>2. Connect DVM to A3TP10 and adjust B FET balance for 0 V <math>\pm 5</math> mV.</li> <li>3. Switch channel A VOLTS/DIV between 0.005 and 0.02 and adjust 5-mV balance for minimum trace shift.</li> <li>4. Switch channel A VOLTS/DIV between 0.005 and 0.05 and adjust 50-mV balance for minimum trace shift.</li> <li>5. Switch channel B VOLTS/DIV between 0.005 and 0.02 and adjust 5-mV balance for minimum trace shift.</li> <li>6. Switch channel B VOLTS/DIV between 0.005 and 0.05 and adjust 50-mV balance for minimum trace shift.</li> <li>7. Engage/disengage CH B INVT and adjust for minimum trace shift. Readjust A3R77 and A3R76 if necessary.</li> </ol> |
| <b>Position and Sync Balance</b><br>A3R32<br><br>A3R79<br><br>A3R58                                                          | <ol style="list-style-type: none"> <li>1. Select B DISPLAY; switch between normal and MAG X5, and adjust channel B POSN for minimum trace shift.</li> <li>2. Apply 10-kHz sine wave to both channels. Select ALT mode and COMPTRIGGER, and adjust sync A balance for stable triggering and minimum phase shift. Readjust A3R18 and A3R19 if necessary.</li> <li>3. Select A DISPLAY; switch between normal and MAG X5, and adjust channel A position for minimum trace shift.</li> </ol>                                                                                                                                                                                                                                                                                                                    |
| <b>Input C and Attenuator Compensation (Channel A)</b><br><br>A3C2<br><br>A3C4                                               | <ol style="list-style-type: none"> <li>1. Apply 10-kHz square wave, and adjust 0.5V comp for best response.</li> <li>2. Adjust 0.5 V input cap to make 0.5 VOLTS/DIV range match reading on 0.2 range (19.5 to 21.5 pF).</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Input C and Attenuator Compensation (Channel B)</b><br><br>A3C17<br><br>A3C19                                             | <ol style="list-style-type: none"> <li>1. Apply 10-kHz square wave, and adjust 0.5V comp for best response.</li> <li>2. Adjust 0.5 V input cap to make 0.5 VOLTS/DIV range match reading on 0.2 range (19.5 to 21.5 pF).</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Table 5-8. Condensed Adjustment Procedure (Cont'd)

| Adjustment                                                                    | Procedure                                                                                                                                                                                        |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gain<br>A3R49<br>A3R49<br>A3R65                                               | 1. Channel A fine gain.<br>2. Channel B fine gain.<br>3. Composite gain.                                                                                                                         |
| Pulse Response<br>A5R22<br>A5R19<br>A5R20<br>A5R24 and A5R25<br>A5C3<br>A3R22 | 1. Long time constant.<br>2. Medium time constant.<br>3. Short time constant.<br>4. Short time constant.<br>5. Very short time constant.<br>6. Adjust to make channel B most resemble channel A. |
| X-Y Gain<br>A7R97                                                             | Adjust for same gain on X-axis as on Y-axis.                                                                                                                                                     |

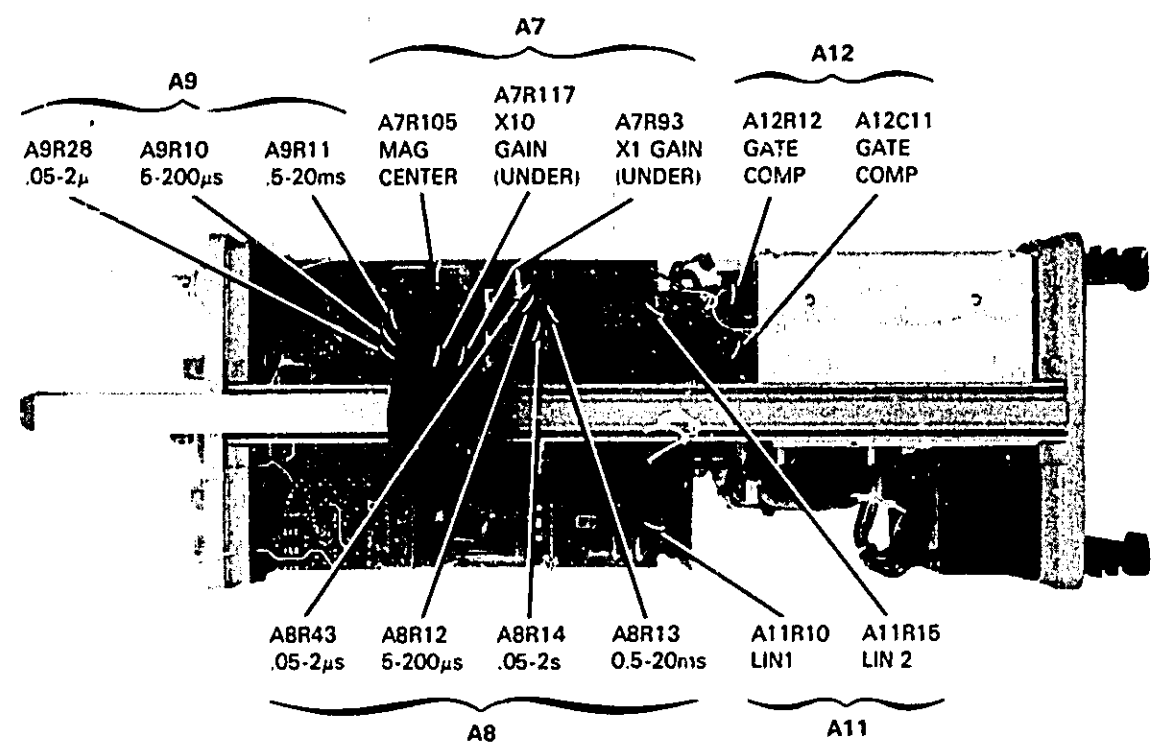
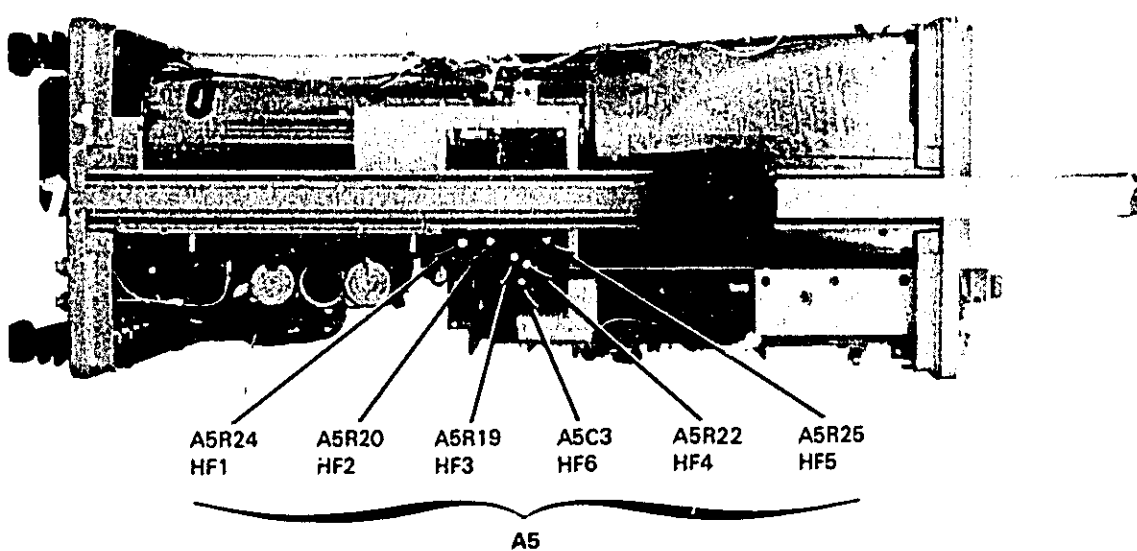
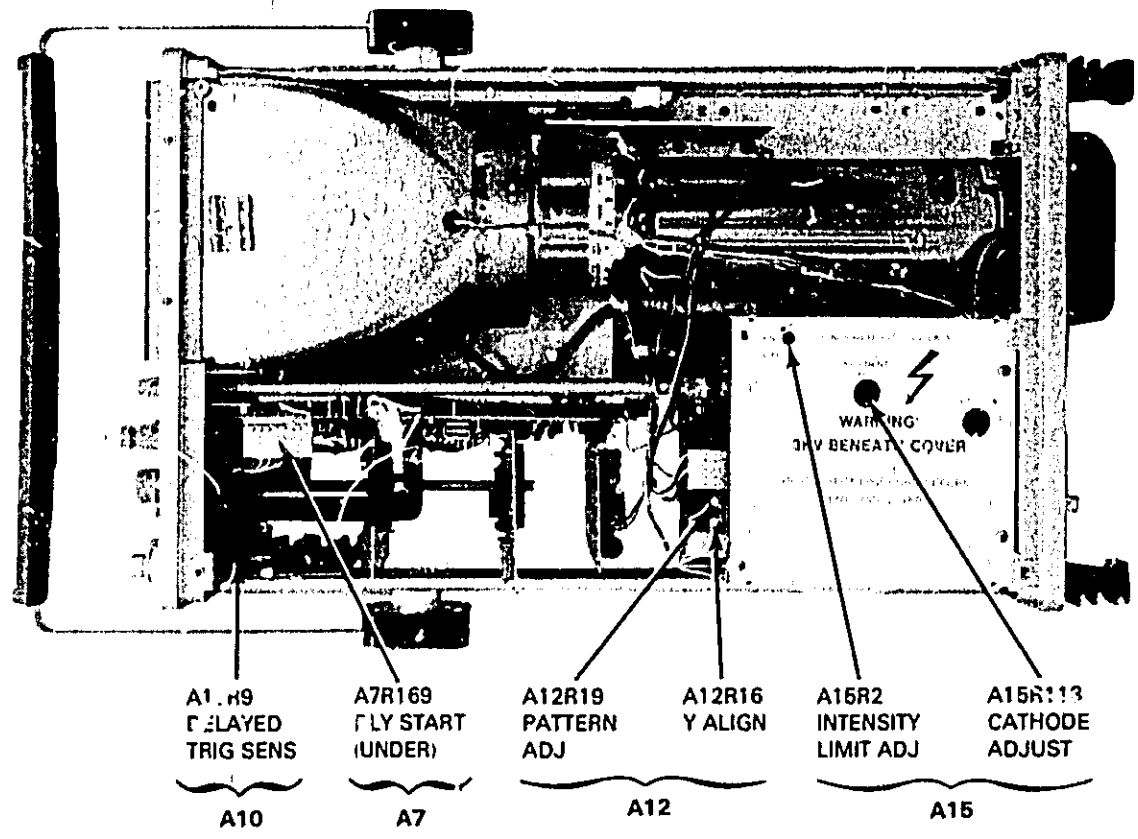
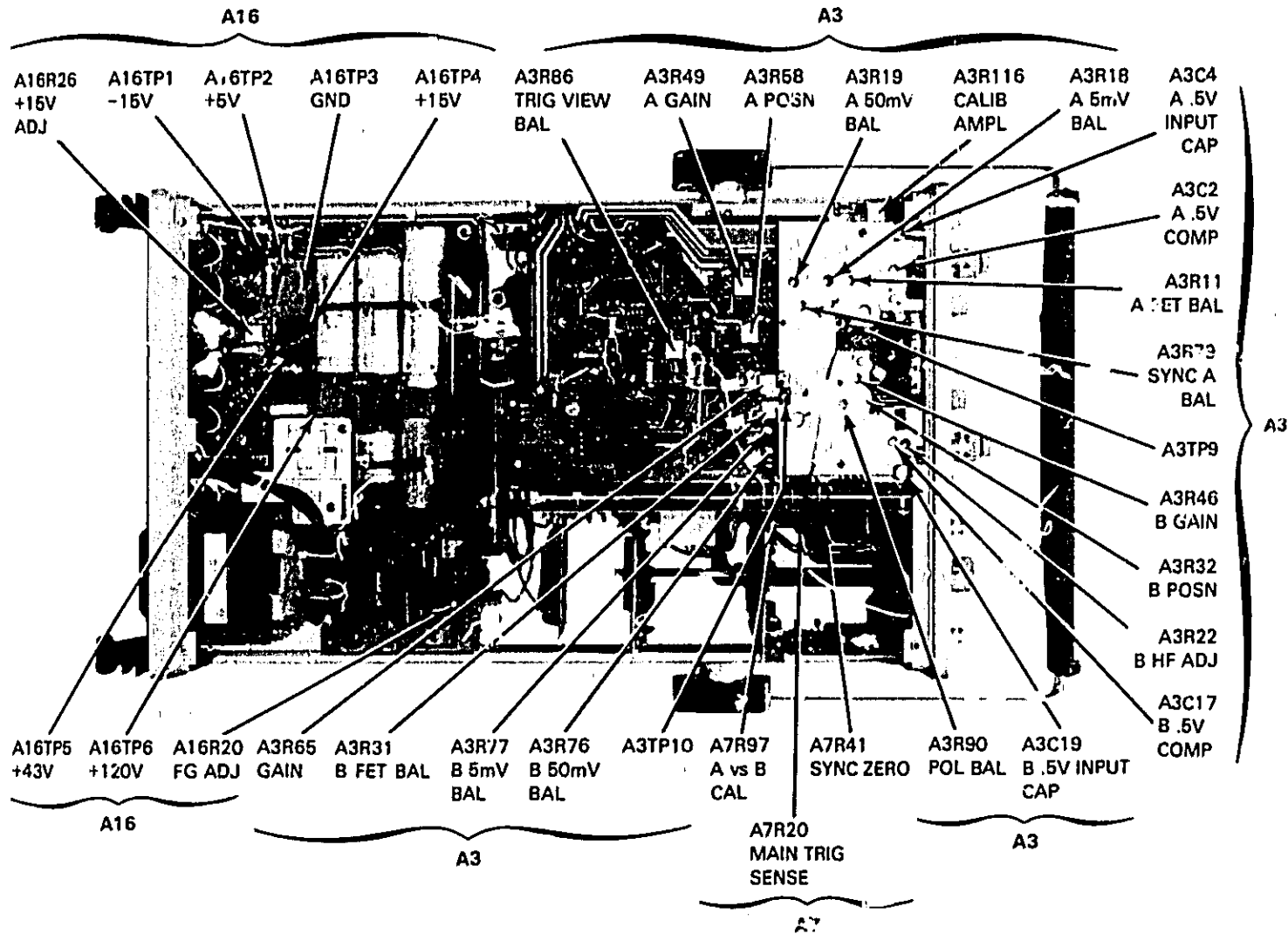


Figure 5-1.  
Adjustment Locations  
5-15/(5-16 blank)

**PARTS**

**LIST**

## SECTION VI

### REPLACEABLE PARTS

#### 6-1. INTRODUCTION.

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts lists. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains the names and addresses that correspond to the manufacture's code numbers. Figure 6-1 shows the illustrated parts breakdown.

#### 6-3. ABBREVIATIONS.

6-4. Table 6-1 lists abbreviations used in the parts lists, the schematics, and throughout this manual. The abbreviations in the parts list are always capital letters. However, in other parts of the manual abbreviations may be used with both lowercase and uppercase letters.

#### 6-5. REPLACEABLE PARTS LIST.

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

- a. Electrical assemblies in alphanumerical order by reference designation.
- b. Chassis-mounted parts in alphanumerical order by reference designation.
- c. Electrical assemblies and their components in alphanumerical order by reference designation.

The information given for each part consists of the following:

- a. Reference designation.
- b. Hewlett-Packard part number.
- c. Part number Check Digit (CD).
- d. Total quantity (QTY) in instrument (or on assembly).

The total quantity is given only once at the first appearance of the part number in the list.

e. Description of part.

f. Typical manufacturer of part in an identifying five-digit code.

#### 6-4. ORDERING INFORMATION.

To order a part listed in the material lists, quote the Hewlett-Packard part number, indicate the quantity desired, and address the order to the nearest Hewlett-Packard Sales/Service Office.

To order a part that is not listed in the material lists, include the instrument model number, instrument serial number, a description of the part (including its function), and the number of parts required. Address the order to the nearest Hewlett-Packard Sales/Service Office.

#### 6-5. DIRECT MAIL ORDER SYSTEM.

Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using this system are:

- a. Direct ordering and shipment from the Hewlett-Packard Parts Center in Mountain View, California.
- b. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local Hewlett-Packard office when the orders require billing and invoicing).
- c. Prepaid transportation (there is a small handling charge for each order).
- d. No invoices.

To provide these advantages, a check or money order must accompany each order.

Mail order forms and specific ordering information is available through your local Hewlett-Packard office. Addresses and phone numbers are located at the back of this manual.

Table 6-1. Reference Designators and Abbreviations

| REFERENCE DESIGNATORS |                                    |           |                                                |           |                                           |
|-----------------------|------------------------------------|-----------|------------------------------------------------|-----------|-------------------------------------------|
| <b>A</b>              | = assembly                         | <b>F</b>  | = fuse                                         | <b>Q</b>  | = transistor, SCR, triode thyristor       |
| <b>B</b>              | = fan, motor                       | <b>FL</b> | = filter                                       | <b>R</b>  | = resistor                                |
| <b>BT</b>             | = battery                          | <b>H</b>  | = hardware                                     | <b>RT</b> | = thermistor                              |
| <b>C</b>              | = capacitor                        | <b>J</b>  | = electrical connector                         | <b>S</b>  | = switch jumper                           |
| <b>CR</b>             | = diode, diode thyristor, varactor | <b>L</b>  | = coil, inductor                               | <b>T</b>  | = transformer                             |
| <b>DL</b>             | = delay line                       | <b>MP</b> | = misc. mechanical part                        | <b>TB</b> | = terminal board                          |
| <b>OS</b>             | = annunciator, lamp, LED           | <b>P</b>  | = electrical connector (movable portion), plug | <b>TP</b> | = test point                              |
| <b>E</b>              | = misc. electrical part            |           |                                                | <b>U</b>  | = integrated circuit, microcircuit        |
|                       |                                    |           |                                                | <b>V</b>  | = electron tube, glow lamp                |
|                       |                                    |           |                                                | <b>VR</b> | = voltage regulator, breakdown diode      |
|                       |                                    |           |                                                | <b>W</b>  | = cable                                   |
|                       |                                    |           |                                                | <b>X</b>  | = socket                                  |
|                       |                                    |           |                                                | <b>Y</b>  | = crystal unit (piezo-electric or quartz) |

| ABBREVIATIONS   |                                           |               |                                                      |                |                                         |
|-----------------|-------------------------------------------|---------------|------------------------------------------------------|----------------|-----------------------------------------|
| <b>A</b>        | = amperes                                 | <b>DWL</b>    | = dowel                                              | <b>MFR</b>     | = manufacturer                          |
| <b>A/D</b>      | = analog-to-digital                       | <b>ECL</b>    | = emitter coupled logic                              | <b>MICPROC</b> | = microprocessor                        |
| <b>AC</b>       | = alternating current                     | <b>ELAS</b>   | = elastomeric                                        | <b>MINTR</b>   | = miniature                             |
| <b>ADJ</b>      | = adjustment                              | <b>EXT</b>    | = external                                           | <b>MISC</b>    | = miscellaneous                         |
| <b>AL</b>       | = aluminum                                | <b>F</b>      | = farad; metal film resistor                         | <b>MLD</b>     | = molded                                |
| <b>AMPL</b>     | = amplifier                               | <b>FC</b>     | = carbon film composition                            | <b>MM</b>      | = millimeter                            |
| <b>ANLG</b>     | = analog                                  | <b>FD</b>     | = feed                                               | <b>MO</b>      | = metal oxide                           |
| <b>ANSI</b>     | = American National Standards Institute   | <b>FEM</b>    | = female                                             | <b>MTG</b>     | = mounting                              |
| <b>ASSY</b>     | = assembly                                | <b>FF</b>     | = flip-flop                                          | <b>MTLC</b>    | = metallic                              |
| <b>ASTIG</b>    | = astigmatism                             | <b>FL</b>     | = flat                                               | <b>MUX</b>     | = multiplexer                           |
| <b>ASYNCHRO</b> | = asynchronous                            | <b>FM</b>     | = foam, from                                         | <b>MW</b>      | = milliwatt                             |
| <b>ATTEN</b>    | = attenuator                              | <b>FR</b>     | = front                                              | <b>N</b>       | = nano (10 <sup>-9</sup> )              |
| <b>AWG</b>      | = American wire gauge                     | <b>FT</b>     | = gain bandwidth product                             | <b>NC</b>      | = no connection                         |
| <b>BAL</b>      | = balance                                 | <b>FW</b>     | = full wave                                          | <b>NMOS</b>    | = n-channel metal-oxide semiconductor   |
| <b>BCD</b>      | = binary-coded decimal                    | <b>FXD</b>    | = fixed                                              | <b>NPN</b>     | = negative-positive-negative            |
| <b>BO</b>       | = board                                   | <b>GEN</b>    | = generator                                          | <b>NPRN</b>    | = neoprene                              |
| <b>BFR</b>      | = buffer                                  | <b>JND</b>    | = grounded                                           | <b>NRFR</b>    | = not recommended for field replacement |
| <b>BIN</b>      | = binary                                  | <b>GP</b>     | = general purpose                                    | <b>NSR</b>     | = not separately replaceable            |
| <b>BRDG</b>     | = bridge                                  | <b>GRAT</b>   | = graticule                                          | <b>NUM</b>     | = numeric                               |
| <b>BSHG</b>     | = bushing                                 | <b>GRV</b>    | = groove                                             | <b>OBD</b>     | = order by description                  |
| <b>BW</b>       | = bandwidth                               | <b>HO</b>     | = henries, high hardware                             | <b>OCTL</b>    | = octal                                 |
| <b>C</b>        | = ceramic, cermet (resistor)              | <b>HDND</b>   | = hardened                                           | <b>OD</b>      | = outside diameter                      |
| <b>CAL</b>      | = calibrate, calibration                  | <b>HG</b>     | = mercury                                            | <b>OP AMP</b>  | = operational amplifier                 |
| <b>CC</b>       | = carbon composition                      | <b>HGT</b>    | = height                                             | <b>OSC</b>     | = oscillator                            |
| <b>CCW</b>      | = counterclockwise                        | <b>HLCL</b>   | = helical                                            | <b>P</b>       | = plastic                               |
| <b>CER</b>      | = ceramic                                 | <b>HORIZ</b>  | = horizontal                                         | <b>P/O</b>     | = part of                               |
| <b>CFM</b>      | = cubic feet/minute                       | <b>HP</b>     | = Hewlett-Packard                                    | <b>PC</b>      | = printed circuit                       |
| <b>CH</b>       | = choke                                   | <b>HP-IB</b>  | = Hewlett-Packard Interface Bus                      | <b>PCB</b>     | = printed circuit board                 |
| <b>CHAM</b>     | = chamfered                               | <b>HR</b>     | = hours                                              | <b>PD</b>      | = power dissipation                     |
| <b>CHAN</b>     | = channel                                 | <b>HV</b>     | = high voltage                                       | <b>PF</b>      | = picofarads                            |
| <b>CHAR</b>     | = character                               | <b>HZ</b>     | = Hertz                                              | <b>PI</b>      | = plug in                               |
| <b>CM</b>       | = centimeter                              | <b>I/O</b>    | = input/output                                       | <b>PL</b>      | = plated                                |
| <b>CMOS</b>     | = complementary metal-oxide semiconductor | <b>IC</b>     | = integrated circuit                                 | <b>PLA</b>     | = programmable logic array              |
| <b>CMR</b>      | = common mode rejection                   | <b>ID</b>     | = inside diameter                                    | <b>PLST</b>    | = plastic                               |
| <b>CNDCT</b>    | = conductor                               | <b>IN</b>     | = inch                                               | <b>PNP</b>     | = positive-negative-positive            |
| <b>CNTR</b>     | = counter                                 | <b>INCL</b>   | = includes                                           | <b>POLYE</b>   | = polyester                             |
| <b>CON</b>      | = connector                               | <b>INCAND</b> | = incandescent                                       | <b>POS</b>     | = positive, position                    |
| <b>CONT</b>     | = contact                                 | <b>INP</b>    | = input                                              | <b>POT</b>     | = potentiometer                         |
| <b>CRT</b>      | = cathode-ray tube                        | <b>INTEN</b>  | = intensity                                          | <b>POZI</b>    | = pozidrive                             |
| <b>CW</b>       | = clockwise                               | <b>INTL</b>   | = internal                                           | <b>PP</b>      | = peak-to-peak                          |
| <b>D</b>        | = diameter                                | <b>INV</b>    | = inverter                                           | <b>PPM</b>     | = parts per million                     |
| <b>D/A</b>      | = digital-to-analog                       | <b>JFET</b>   | = junction field-effect transistor                   | <b>PRCN</b>    | = precision                             |
| <b>DAC</b>      | = digital-to-analog converter             | <b>JKT</b>    | = jacket                                             | <b>PREAMP</b>  | = preamplifier                          |
| <b>DARL</b>     | = darlington                              | <b>K</b>      | = kilo (10 <sup>3</sup> )                            | <b>PRGMBL</b>  | = programmable                          |
| <b>DAT</b>      | = data                                    | <b>L</b>      | = low                                                | <b>PRL</b>     | = parallel                              |
| <b>DBL</b>      | = double                                  | <b>LB</b>     | = pound                                              | <b>PROG</b>    | = programmable                          |
| <b>DBM</b>      | = decibel referenced to 1 mW              | <b>LCH</b>    | = latch                                              | <b>PSTN</b>    | = position                              |
| <b>DC</b>       | = direct current                          | <b>LCL</b>    | = local                                              | <b>PT</b>      | = point                                 |
| <b>DCDR</b>     | = decoder                                 | <b>LED</b>    | = light-emitting diode                               | <b>PW</b>      | = potted wirewound                      |
| <b>DEG</b>      | = degree                                  | <b>LG</b>     | = long                                               | <b>PWR</b>     | = power                                 |
| <b>DEMUX</b>    | = demultiplexer                           | <b>LJ</b>     | = lithium                                            | <b>R-S</b>     | = reset-set                             |
| <b>DET</b>      | = detector                                | <b>LK</b>     | = lock                                               | <b>RAM</b>     | = random-access memory                  |
| <b>DIA</b>      | = diameter                                | <b>LKWR</b>   | = lockwasher                                         | <b>RECT</b>    | = rectifier                             |
| <b>DIP</b>      | = dual in-line package                    | <b>LS</b>     | = low power Schottky                                 | <b>RET</b>     | = retainer                              |
| <b>DIV</b>      | = division                                | <b>LV</b>     | = low voltage                                        | <b>RF</b>      | = radio frequency                       |
| <b>DWA</b>      | = direct memory access                    | <b>M</b>      | = mega (10 <sup>6</sup> ), megohms, meter (distance) | <b>RGLTR</b>   | = regulator                             |
| <b>DPDT</b>     | = double-pole, double-throw               | <b>MACH</b>   | = machine                                            | <b>RGTR</b>    | = register                              |
| <b>DRC</b>      | = DAC refresh controller                  | <b>MAX</b>    | = maximum                                            | <b>RK</b>      | = rack                                  |
| <b>DRVR</b>     | = driver                                  |               |                                                      | <b>RMS</b>     | = root-mean-square                      |
|                 |                                           |               |                                                      | <b>RND</b>     | = round                                 |
|                 |                                           |               |                                                      | <b>ROM</b>     | = read-only memory                      |
|                 |                                           |               |                                                      | <b>RPG</b>     | = rotary pulse generator                |
|                 |                                           |               |                                                      | <b>RX</b>      | = receiver                              |
|                 |                                           |               |                                                      | <b>S</b>       | = Schottky-clamped, seconds (time)      |
|                 |                                           |               |                                                      | <b>SCR</b>     | = screw, silicon controlled rectifier   |
|                 |                                           |               |                                                      | <b>SEC</b>     | = second (time), secondary              |
|                 |                                           |               |                                                      | <b>SEG</b>     | = segment                               |
|                 |                                           |               |                                                      | <b>SEL</b>     | = selector                              |
|                 |                                           |               |                                                      | <b>SGL</b>     | = single                                |
|                 |                                           |               |                                                      | <b>SHF</b>     | = shift                                 |
|                 |                                           |               |                                                      | <b>SI</b>      | = silicon                               |
|                 |                                           |               |                                                      | <b>SIP</b>     | = single in-line package                |
|                 |                                           |               |                                                      | <b>SKT</b>     | = skirt                                 |
|                 |                                           |               |                                                      | <b>SL</b>      | = slide                                 |
|                 |                                           |               |                                                      | <b>SLDR</b>    | = solder                                |
|                 |                                           |               |                                                      | <b>SLT</b>     | = slotted                               |
|                 |                                           |               |                                                      | <b>SOLD</b>    | = solenoid                              |
|                 |                                           |               |                                                      | <b>SPL</b>     | = special                               |
|                 |                                           |               |                                                      | <b>SQ</b>      | = square                                |
|                 |                                           |               |                                                      | <b>SREG</b>    | = shift register                        |
|                 |                                           |               |                                                      | <b>SRO</b>     | = service request                       |
|                 |                                           |               |                                                      | <b>STAT</b>    | = static                                |
|                 |                                           |               |                                                      | <b>STD</b>     | = standard                              |
|                 |                                           |               |                                                      | <b>SYNCHRO</b> | = synchronous                           |
|                 |                                           |               |                                                      | <b>TA</b>      | = tantalum                              |
|                 |                                           |               |                                                      | <b>TBAX</b>    | = tubaxial                              |
|                 |                                           |               |                                                      | <b>TC</b>      | = temperature coefficient               |
|                 |                                           |               |                                                      | <b>TD</b>      | = time delay                            |
|                 |                                           |               |                                                      | <b>THD</b>     | = threaded                              |
|                 |                                           |               |                                                      | <b>THK</b>     | = thick                                 |
|                 |                                           |               |                                                      | <b>THRU</b>    | = through                               |
|                 |                                           |               |                                                      | <b>TP</b>      | = test point                            |
|                 |                                           |               |                                                      | <b>TPG</b>     | = tapping                               |
|                 |                                           |               |                                                      | <b>TPL</b>     | = triple                                |
|                 |                                           |               |                                                      | <b>TRANS</b>   | = transformer                           |
|                 |                                           |               |                                                      | <b>TRIG</b>    | = triggered                             |
|                 |                                           |               |                                                      | <b>TRMR</b>    | = trimmer                               |
|                 |                                           |               |                                                      | <b>TRN</b>     | = turns                                 |
|                 |                                           |               |                                                      | <b>TTL</b>     | = transistor transistor                 |
|                 |                                           |               |                                                      | <b>TX</b>      | = transmitter                           |
|                 |                                           |               |                                                      | <b>U</b>       | = micro (10 <sup>-6</sup> )             |
|                 |                                           |               |                                                      | <b>UL</b>      | = Underwriters Laboratory               |
|                 |                                           |               |                                                      | <b>UNREG</b>   | = unregulated                           |
|                 |                                           |               |                                                      | <b>VA</b>      | = voltampere                            |
|                 |                                           |               |                                                      | <b>VAC</b>     | = volt, ac                              |
|                 |                                           |               |                                                      | <b>VAR</b>     | = variable                              |
|                 |                                           |               |                                                      | <b>VCO</b>     | = voltage controlled oscillator         |
|                 |                                           |               |                                                      | <b>VOC</b>     | = volt, dc                              |
|                 |                                           |               |                                                      | <b>VERT</b>    | = vertical                              |
|                 |                                           |               |                                                      | <b>VF</b>      | = voltage, filtered                     |
|                 |                                           |               |                                                      | <b>VS</b>      | = versus                                |
|                 |                                           |               |                                                      | <b>W</b>       | = watts                                 |
|                 |                                           |               |                                                      | <b>W/</b>      | = with                                  |
|                 |                                           |               |                                                      | <b>W/O</b>     | = without                               |
|                 |                                           |               |                                                      | <b>WW</b>      | = wirewound                             |
|                 |                                           |               |                                                      | <b>XSTR</b>    | = transistor                            |
|                 |                                           |               |                                                      | <b>ZNR</b>     | = zener                                 |
|                 |                                           |               |                                                      | <b>°C</b>      | = degree Celsius                        |
|                 |                                           |               |                                                      | <b>°F</b>      | = degree Fahrenheit                     |
|                 |                                           |               |                                                      | <b>°K</b>      | = degree Kelvin                         |

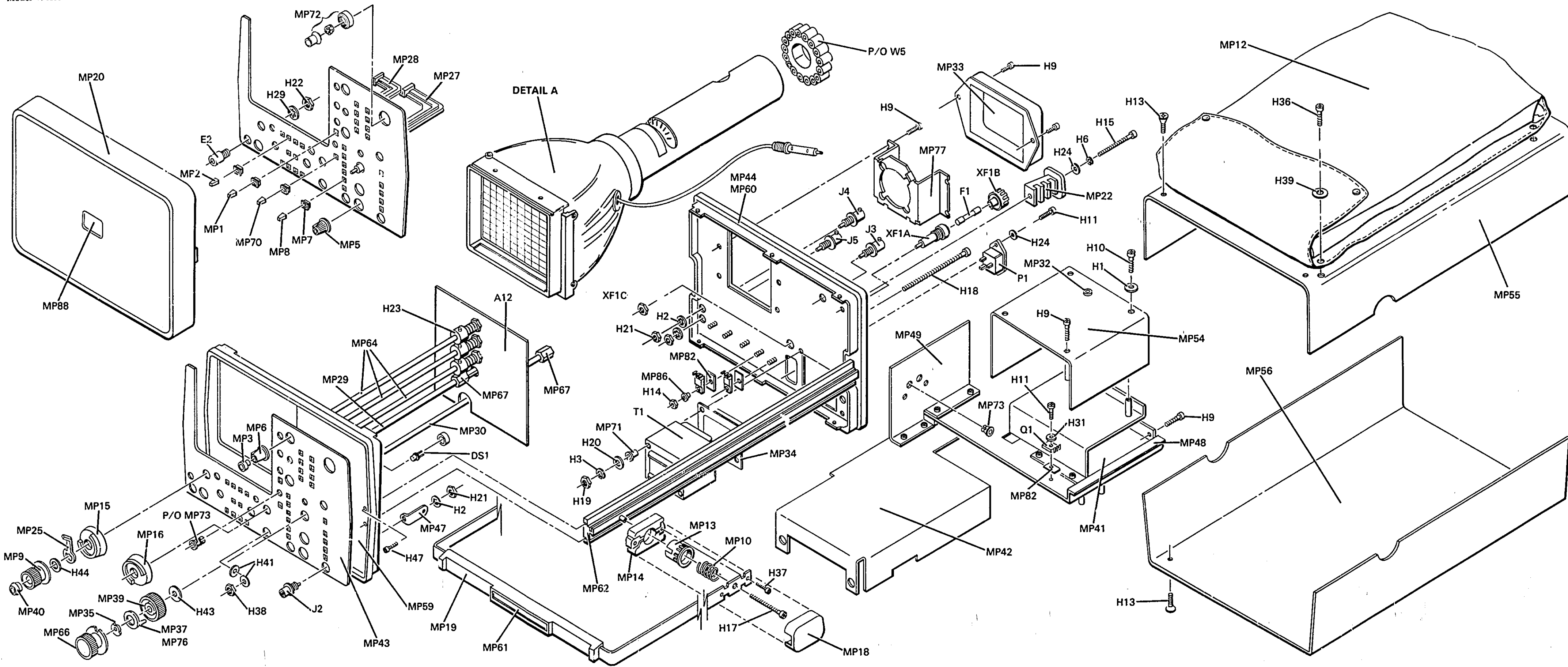
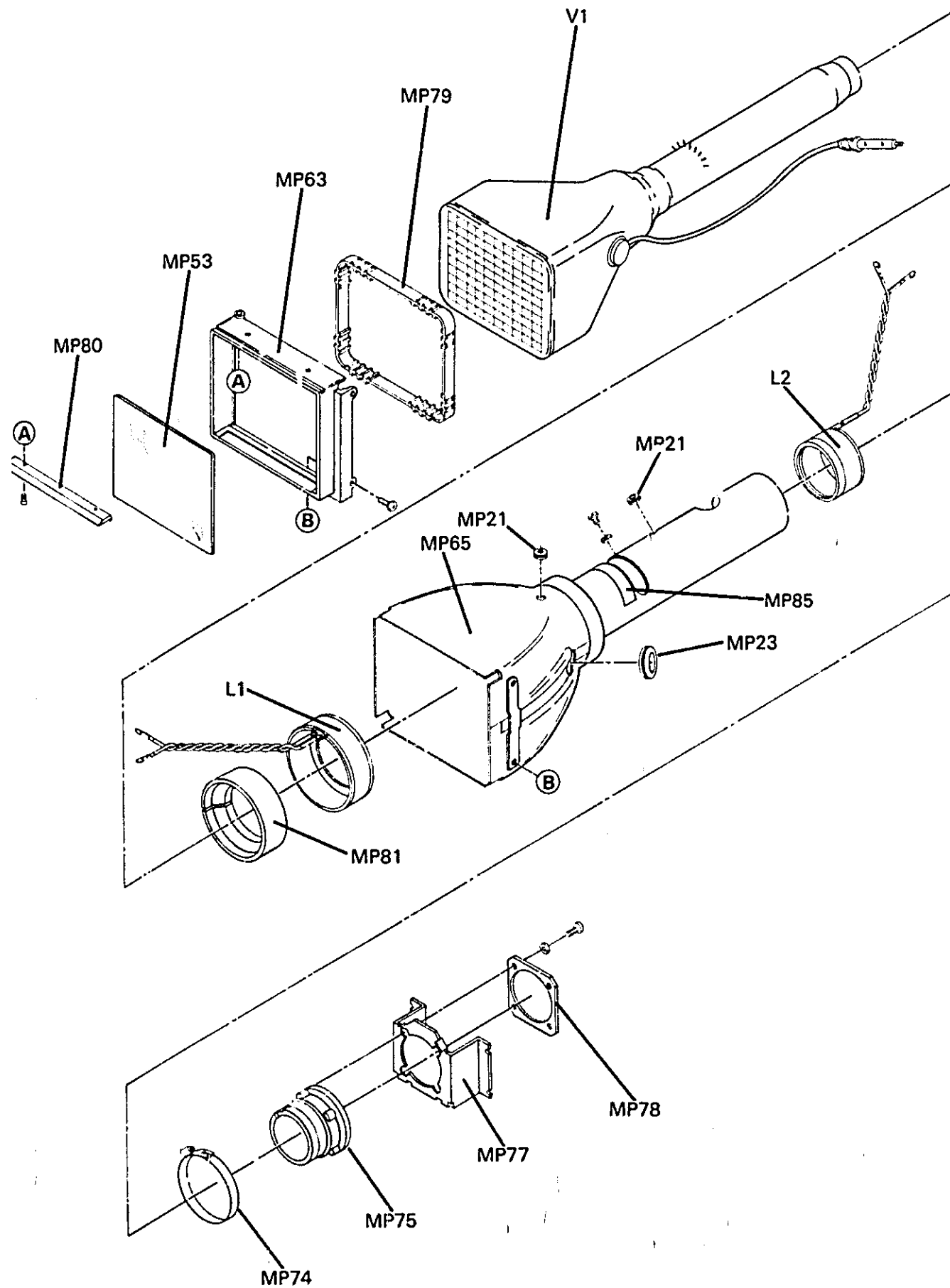


Figure 6-1.  
Chassis Parts and Board Assembly Identification (Sheet 1 of 2)  
6-3





DETAIL A

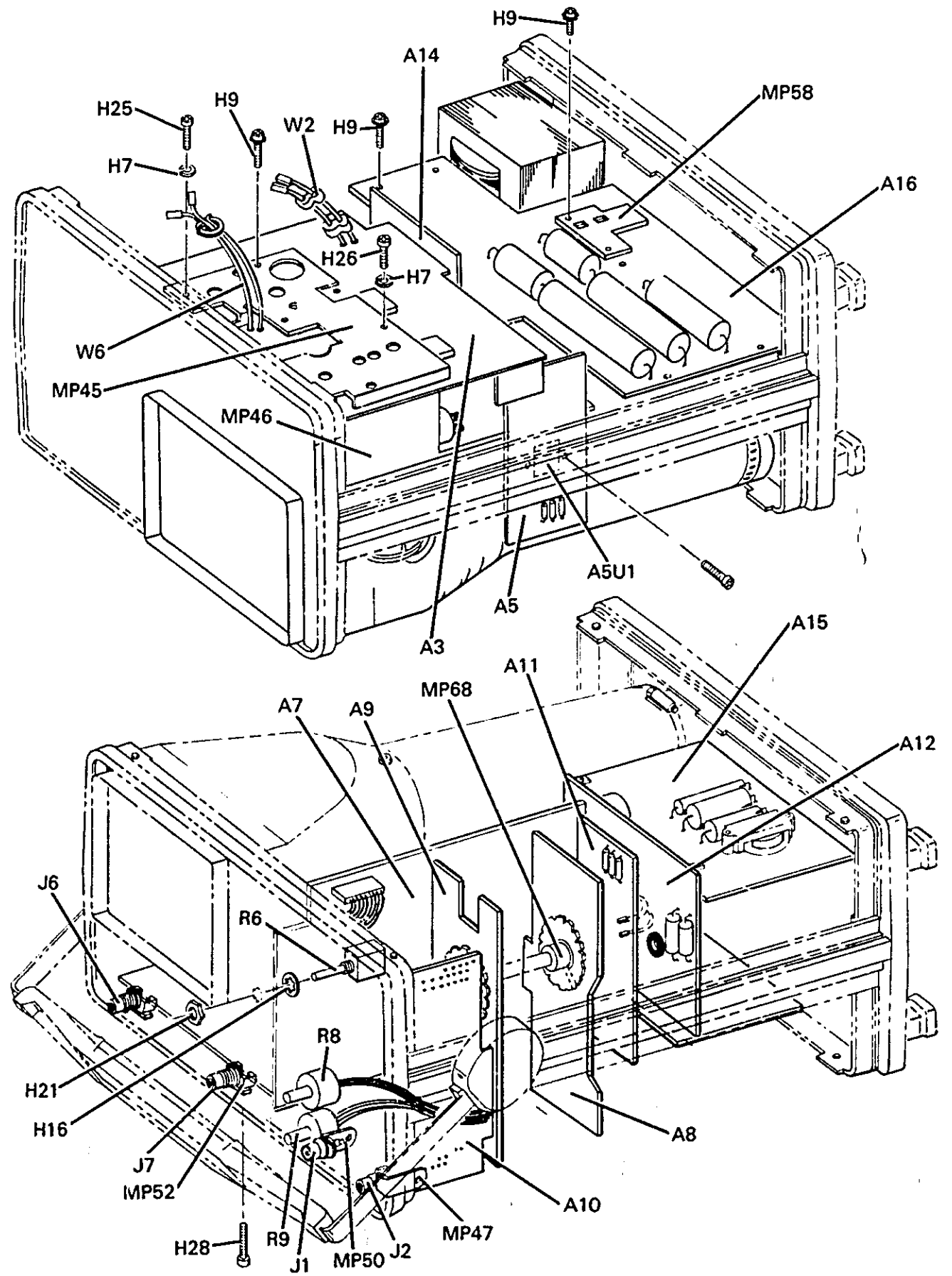


Figure 6-1. Chassis Parts and Board Assembly Identification (Sheet 2 of 2)

Table 6-2. Replaceable Parts

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number      |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|----------------------|
| A1                   | 01740-63401    | 0   | 1   | ATTEN ASSY "A" (LEFT)                   | 28480    | 01740-63401          |
| A2                   | 01740-63402    | 1   | 1   | ATTEN ASSY "B" (RIGHT)                  | 28480    | 01740-63402          |
| A3                   | 01740-66596    | 0   | 1   | BOARD ASSY V PREAMP                     | 28480    | 01740-66596          |
| A4                   | 01740-61611    | 0   | 1   | CABLE ASSEMBLY DELAY LINE               | 28480    | 01740-61611          |
| A5                   | 01745-66503    | 4   | 1   | BOARD ASSY VERT OUTPUT                  | 28480    | 01745-66503          |
| A6                   | 0960-0117      | 6   | 1   | HV MULTIPLIER ASSEMBLY                  | 28480    | 0960-0117            |
| A7                   | 01740-66566    | 4   | 1   | BOARD ASSY HORIZONTAL MOTHER            | 28480    | 01740-66566          |
| A8                   | 01740-66568    | 6   | 1   | BOARD ASSY MAIN SWEEP                   | 28480    | 01740-66568          |
| A9                   | 01740-66566    | 3   | 1   | BOARD ASSY DELAY SWEEP                  | 28480    | 01740-66566          |
| A10                  | 01745-66504    | 6   | 1   | BOARD ASSY DELAY TRIGGER                | 28480    | 01745-66504          |
| A11                  | 01740-66569    | 7   | 1   | BOARD ASSY HORIZONTAL OUTPUT            | 28480    | 01740-66569          |
| A12                  | 01745-66501    | 2   | 1   | BOARD ASSY GATE                         | 28480    | 01745-66501          |
| A13                  | 01740-66564    | 2   | 1   | BOARD ASSY VERT LOGIC                   | 28480    | 01740-66564          |
| A14                  | 01740-66540    | 4   | 1   | BOARD ASSY INTERFACE                    | 28480    | 01740-66540          |
| A15                  | 01745-66502    | 3   | 1   | BOARD ASSY HV POWER                     | 28480    | 01745-66502          |
| A16                  | 01740-66594    | 8   | 1   | BOARD ASSY LV POWER                     | 28480    | 01740-66594          |
| C2                   | 0160-3592      | 1   | 1   | CAPACITOR FXD 2.4PF ± 5PF 200VDC CER    | 28480    | 0160-3592            |
| DS1                  | 1990-0485      | 6   | 1   | LED-VISIBLE (GREEN)                     | 28480    | 5082-4584            |
| DS2                  | 1990-0487      | 7   | 4   | LED-VISIBLE (YELLOW)                    | 28480    | 5082-4584            |
| DS3                  | 1990-0487      | 7   | 7   | LED-VISIBLE (YELLOW)                    | 28480    | 5082-4584            |
| DS4                  | 1990-0487      | 7   | 7   | LED-VISIBLE (YELLOW)                    | 28480    | 5082-4584            |
| DS5                  | 1990-0487      | 7   | 7   | LED-VISIBLE (YELLOW)                    | 28480    | 5082-4584            |
| E1                   | 01740-61203    | 6   | 1   | GROUND STRAP                            | 28480    | 01740-61203          |
| E2                   | 1510-0038      | 8   | 1   | BINDING POST ASSY SGL THD-STUD          | 28480    | 1510-0038            |
| E3                   | 9170-0016      | 8   | 3   | CORE-SHIELDING BEAD                     | 28480    | 917-0016             |
| E4                   | 9170-0016      | 8   | 8   | CORE-SHIELDING BEAD                     | 28480    | 9170-0016            |
| E5                   | 9170-0016      | 8   | 8   | CORE-SHIELDING BEAD                     | 28480    | 9170-0016            |
| F1                   | 2110-0007      | 4   | 2   | FUSE 1A 250V TD 1 25X 25 UL             | 75915    | 313001               |
| F1                   | 2110-0202      | 1   | 2   | FUSE 5A 250V TD 1 25X 25 UL             | 75915    | 313500               |
| H1                   | 2190-0005      | 0   | 9   | WASHER LK EXT T NO 4 115-IN-ID          | 28480    | 2190-0005            |
| H2                   | 2190-0016      | 3   | 10  | WASHER LK INTL T 3/8 IN 377-IN-ID       | 28480    | 2190-0016            |
| H3                   | 2190-0017      | 4   | 4   | WASHER LK HLCL NO 8 168-IN-ID           | 28480    | 2190-0017            |
| H4                   | 2190-0018      | 5   | 2   | WASHER LK HLCL NO 6 141-IN-ID           | 28480    | 2190-0018            |
| H5                   | 2190-0019      | 6   | 7   | WASHER LK HLCL NO 4 115-IN-ID           | 28480    | 2190-0019            |
| H6                   | 2190-0006      | 1   | 4   | WASHER LK HLCL NO 6 141-IN-ID           | 28480    | 2190-0006            |
| H7                   | 2190-0112      | 0   | 6   | WASHER LK HLCL NO 2 088-IN-ID           | 28480    | 2190-0112            |
| H8                   | 2190-0033      | 4   | 1   | WASHER LK INTL T 5/16 IN 314-IN-ID      | 28480    | 2190-0033            |
| H9                   | 2200-0106      | 4   | 39  | SCREW-MACH 4-40 312-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H10                  | 2200-0123      | 6   | 2   | SCREW-MACH 4-40 125-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H11                  | 2200-0143      | 0   | 9   | SCREW-MACH 4-40 375-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H12                  | 2100-0149      | 6   | 3   | SCREW-MACH 4-40 625-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H13                  | 2100-0762      | 9   | 8   | SCREW-MACH 4-40 25-IN-LG TR-HD-POZI     | 00000    | ORDER BY DESCRIPTION |
| H14                  | 2260-0002      | 6   | 10  | NUT-HEX DBL CHAM 4-40-THD 062-IN-THK    | 00000    | ORDER BY DESCRIPTION |
| H15                  | 2260-0207      | 5   | 4   | SCREW-MACH 6-32 875-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H16                  | 2190-0056      | 1   | 1   | WASHER LK INTL T 3/8 IN 42-IN-ID        | 28480    | 2190-0056            |
| H17                  | 2510-0111      | 9   | 2   | SCREW-MACH 8-32 75-IN-LG PAN-HD-POZI    | 00000    | ORDER BY DESCRIPTION |
| H18                  | 2510-0138      | 0   | 4   | SCREW-MACH 8-32 3-IN-LG PAN-HD-POZI     | 00000    | ORDER BY DESCRIPTION |
| H19                  | 2580-0004      | 6   | 1   | NUT-HEX DBL CHAM 8-32-THD 125-IN-THK    | 00000    | ORDER BY DESCRIPTION |
| H20                  | 3060-0071      | 5   | 7   | WASHER FL MTLCL NO 8 169-IN-ID          | 28480    | 3060-0071            |
| H21                  | 2950-0043      | 8   | 16  | NUT-HEX DBL CHAM 3/8-32-THD 094-IN-THK  | 00000    | ORDER BY DESCRIPTION |
| H22                  | 2950-0072      | 3   | 2   | NUT-HEX DBL CHAM 1/4-32-THD 062-IN-THK  | 00000    | ORDER BY DESCRIPTION |
| H23                  | 3030-0198      | 3   | 6   | SCREW-SET 4-40 188-IN-LG SMALL CUP PT   | 00000    | ORDER BY DESCRIPTION |
| H24                  | 3050-0010      | 2   | 15  | WASHER FL MTLCL NO 6 147-IN-ID          | 28480    | 3050-0010            |
| H25                  | 0620-0127      | 6   | 2   | SCREW-MACH 2-56 188-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H26                  | 0620-0136      | 7   | 4   | SCREW-MACH 2-56 625-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H27                  | 0624-0306      | 3   | 8   | SCREW-TPG 2-28 5-IN-LG PAN-HD-POZI STL  | 28480    | 0624-0306            |
| H28                  | 0624-0313      | 2   | 4   | SCREW-TPG 4-20 1-IN-LG PAN-HD-POZI STL  | 28480    | 0624-0313            |
| H29                  | 2190-0084      | 5   | 1   | WASHER LK INTL T 1/4 IN 256-IN-ID       | 28480    | 2190-0084            |
| H30                  | 2190-0555      | 5   | 1   | WASHER LK INTL T 3/8 IN 384-IN-ID       | 28480    | 2190-0555            |
| H31                  | 2190-0910      | 6   | 2   | WASHER LK INTL T NO 4 12-IN-ID          | 28480    | 2190-0910            |
| H32                  | 2200-0092      | 8   | 4   | SCREW-MACH 4-40 125-IN-LG 82 DEG        | 00000    | ORDER BY DESCRIPTION |
| H33                  | 2200-0101      | 0   | 1   | SCREW-MACH 4-40 188-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H34                  | 2200-0117      | 8   | 1   | SCREW-MACH 4-40 875-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H35                  | 2200-0165      | 6   | 2   | SCREW-MACH 4-40 25-IN-LG 82 DEG         | 00000    | ORDER BY DESCRIPTION |
| H36                  | 2360-0117      | 6   | 4   | SCREW-MACH 6-32 375-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H37                  | 2360-0370      | 3   | 4   | SCREW-MACH 6-32 375-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| H38                  | 2950-0035      | 8   | 2   | NUT-HEX DBL CHAM 15/32-32-THD           | 00000    | ORDER BY DESCRIPTION |
| H39                  | 3050-0001      | 1   | 4   | WASHER FL MTLCL NO 6 172-IN-ID          | 28480    | 3050-0001            |
| H40                  | 3050-0106      | 6   | 3   | WASHER FL MTLCL NO 4 125-IN-ID          | 28480    | 3050-0106            |
| H41                  | 3050-0150      | 3   | 4   | WASHER FL MTLCL 7/16 IN 47-IN-ID        | 28480    | 3050-0150            |
| H42                  | 3050-0437      | 7   | 6   | WASHER-SPR CRVD NO 4 128-IN-ID          | 28480    | 3050-0437            |
| H43                  | 3050-0481      | 1   | 1   | WASHER-FL NM NO 12 25-IN-ID 75-IN-OD    | 28480    | 3050-0481            |
| H44                  | 3050-0655      | 1   | 2   | WASHER FL NM NO 6 156-IN-ID 375-IN-OD   | 28480    | 3050-0655            |
| H45                  | 0624-0206      | 2   | 2   | SCREW-TPG 6-32 25-IN-LG PAN-HD-POZI STL | 28480    | 0624-0206            |
| H46                  | 0624-0208      | 4   | 4   | SCREW-TPG 6-32 5-IN-LG PAN-HD-POZI STL  | 28480    | 0624-0208            |
| H47                  | 0624-0279      | 9   | 8   | SCREW-TPG 8-32 75-IN-LG PAN-HD-POZI     | 00000    | ORDER BY DESCRIPTION |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|-----------------|
| J1                   | 1250-0118      | 3   | 5   | CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM | 28480    | 1250-0118       |
| J2                   | 1250-0118      | 3   |     | CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM | 28480    | 1250-0118       |
| J3                   | 1250-0118      | 3   |     | CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM | 28480    | 1250-0118       |
| J4                   | 1250-0118      | 3   |     | CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM | 28480    | 1250-0118       |
| J5                   | 1250-0118      | 3   |     | CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM | 28480    | 1250-0118       |
| J6                   | 1250-0624      | 5   | 2   | CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM | 28480    | 1250-0624       |
| J7                   | 1250-0624      | 5   |     | CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM | 28480    | 1250-0624       |
| L1                   | 01980-65601    | 6   | 1   | COIL ASSY                               | 28480    | 01980-65601     |
| L2                   | 01701-66001    | 5   | 1   | COIL ASSEMBLY-ALIGN                     | 28480    | 01701-66001     |
| MP1                  | 0370-0603      | 4   | 1   | KEY CAP 714 IN SQ 55 IN H FOR           | 28480    | 0370-0603       |
| MP2                  | 0370-0683      | 0   | 10  | PUSHBUTTON 0.230 IN SQ 0.425 IN HGT     | 28480    | 0370-0683       |
| MP3                  | 0370-3042      | 1   | 1   | KNOB-CONC (ROUND)                       | 28480    | 0370-3042       |
| MP4                  | 0370-1005      | 2   | 5   | KNOB-JADE GRAY                          | 28480    | 0370-1005       |
| MP5                  | 0370-1099      | 4   | 4   | KNOB-JADE GRAY                          | 28480    | 0370-1099       |
| MP6                  | 0370-1100      | 8   | 1   | KNOB-JADE GRAY                          | 28480    | 0370-1100       |
| MP7                  | 0370-2626      | 5   | 31  | BEZEL-PUSHBUTTON (GRAY)                 | 28480    | 0370-2626       |
| MP8                  | 0370-0604      | 5   | 16  | PUSHBUTTON 0.230 IN SQ 0.425 IN HGT     | 28480    | 0370-0604       |
| MP9                  | 0370-2783      | 6   | 2   | KNOB-SKIRT 0.750                        | 28480    | 0370-2783       |
| MP10                 | 1460-0604      | 7   | 2   | SPRING-COMPRESSION                      | 28480    | 1460-0604       |
| MP11                 | 01727-01205    | 6   | 1   | CLAMP-H V                               | 28480    | 01727-01205     |
| MP12                 | 1540-0292      | 9   | 1   | CASE-ACCESSORY                          | 28480    | 1540-0292       |
| MP13                 | 5020-8733      | 1   | 2   | GEAR-HUB HANDLE                         | 28480    | 5020-8733       |
| MP14                 | 5020-8788      | 6   | 2   | GEAR-RING HANDLE                        | 28480    | 5020-8788       |
| MP15                 | 5020-8744      | 4   | 1   | SPACER DIAL                             | 28480    | 5020-8744       |
| MP16                 | 5020-8745      | 5   | 1   | SPACER DIAL                             | 28480    | 5020-8745       |
| MP17                 | 5040-0421      | 0   | 1   | INSULATOR-FOCUS POT                     | 28480    | 5040-0421       |
| MP18                 | 5040-0511      | 9   | 2   | CAP-TRIM HANDLE                         | 28480    | 5040-0511       |
| MP19                 | 5041-2625      | 2   | 1   | GRIP-HANDLE                             | 28480    | 5041-2625       |
| MP20                 | 5040-0515      | 4   | 1   | COVER-PANEL                             | 28480    | 5040-0515       |
| MP21                 | 0400-0002      | 2   | 2   | GROMMET-RND .188-IN-ID .312-IN-GRV-OD   | 28480    | 0400-0002       |
| MP22                 | 5040-7829      | 6   | 4   | FOOT-CORD WRAP                          | 28480    | 5040-7829       |
| MP23                 | 0400-0001      | 1   | 1   | GROMMET-RND .582-IN-ID .75-IN-GRV-OD    | 28480    | 0400-0001       |
| MP24                 | 5041-3124      | 8   | 4   | PUSH ROD                                | 28480    | 5041-3124       |
| MP25                 | 5041-3196      | 4   | 2   | COUPLER-LEVER                           | 28480    | 5041-3196       |
| MP27                 | 5040-7706      | 7   | 4   | EXTENDER-PUSHBUTTON                     | 28480    | 5040-7706       |
| MP28                 | 5040-7706      | 8   | 4   | EXTENDER-PUSHBUTTON                     | 28480    | 5040-7706       |
| MP29                 | 5040-7755      | 7   | 1   | EXTENDER-PUSHBUTTON                     | 28480    | 5040-7755       |
| MP30                 | 5040-7756      | 8   | 1   | EXTENDER-PUSHBUTTON                     | 28480    | 5040-7756       |
| MP31                 | 01745-01205    | 7   | 1   | BRACKET-HORIZ BOARD                     | 28480    | 01745-01205     |
| MP32                 | 0400-0010      | 2   | 2   | GROMMET-RND .25-IN-ID .375-IN-GRV-OD    | 28480    | 0400-0010       |
| MP33                 | 01701-04108    | 9   | 1   | COVER-CRT                               | 28480    | 01701-04108     |
| MP34                 | 01710-04103    | 3   | 1   | COVER-TRANSFORMER                       | 28480    | 01710-04103     |
| MP35                 | 01720-22501    | 1   | 1   | RING-ANTIRUN (ROUND)                    | 28480    | 01720-22501     |
| MP36                 | 01720-23705    | 9   | 1   | SHAFT-DELAYED SWEEP                     | 28480    | 01720-23705     |
| MP37                 | 0350-0999      | 9   | 1   | KNOB-DECAL                              | 28480    | 0350-0999       |
| MP38                 | 01720-63703    | 1   | 1   | SHAFT ASSEMBLY-MAIN SWITCH              | 28480    | 01720-63703     |
| MP39                 | 01745-67401    | 3   | 1   | KNOB-SWEEP                              | 28480    | 01745-67401     |
| MP40                 | 0370-3043      | 2   | 2   | KNOB-CONC (ROUND)                       | 28480    | 0370-3043       |
| MP41                 | 01745-00102    | 1   | 1   | DECK-REAR                               | 28480    | 01745-00102     |
| MP42                 | 01745-00101    | 0   | 1   | DECK-FRONT                              | 28480    | 01745-00101     |
| MP43                 | 01745-00201    | 1   | 1   | PANEL-FRONT                             | 28480    | 01745-00201     |
| MP44                 | 01745-00202    | 2   | 1   | PANEL-REAR                              | 28480    | 01745-00202     |
| MP45                 | 01740-00601    | 0   | 1   | SHIELD-PHEAMPL                          | 28480    | 01740-00601     |
| MP46                 | 01745-00601    | 5   | 1   | SHIELD-CAL                              | 28480    | 01745-00601     |
| MP47                 | 01740-01201    | 8   | 1   | BRACKET-DELAY TRIGGER                   | 28480    | 01740-01201     |
| MP48                 | 01740-01202    | 9   | 1   | BRACKET-H V                             | 28480    | 01740-01202     |
| MP49                 | 01745-01201    | 3   | 1   | BRACKET-VERT OUTPUT                     | 28480    | 01745-01201     |
| MP50                 | 01740-01204    | 1   | 1   | BRACKET-HORIZONTAL                      | 28480    | 01740-01204     |
| MP51                 | 01740-01209    | 6   | 1   | BRACKET-HORIZONTAL (TOP)                | 28480    | 01740-01209     |
| MP52                 | 01740-01212    | 1   | 2   | BRACKET-BNC                             | 28480    | 01740-01212     |
| MP53                 | 1000-0649      | 6   | 1   | CONTRAST FILTER                         | 28480    | 1000-0649       |
| MP54                 | 01745-04101    | 8   | 1   | COVER-H V                               | 28480    | 01745-04101     |
| MP55                 | 01740-04102    | 4   | 1   | COVER-TOP                               | 28480    | 01740-04102     |
| MP56                 | 01740-04108    | 0   | 1   | COVER-BOTTOM                            | 28480    | 01740-04108     |
| MP58                 | 01740-04109    | 1   | 1   | COVER-LINE                              | 28480    | 01740-04109     |
| MP59                 | 01745-20601    | 6   | 1   | FRAME-FRONT                             | 28480    | 01745-20601     |
| MP60                 | 01745-20602    | 7   | 1   | FRAME-REAR                              | 28480    | 01745-20602     |
| MP61                 | 7121-3754      | 2   | 1   | LABEL-HANDLE                            | 28480    | 7121-3754       |
| MP62                 | 01740-23701    | 5   | 2   | RAIL-SIDE                               | 28480    | 01740-23701     |
| MP63                 | 5041-3198      | 6   | 1   | BEZEL-CRT                               | 28480    | 5041-3198       |
| MP64                 | 01740-43901    | 3   | 3   | SHAFT-EXTENSION                         | 28480    | 01740-43901     |
| MP65                 | 01745-60601    | 1   | 1   | SHIELD ASSY-SWEEP                       | 28480    | 01745-60601     |
| MP66                 | 01740-67402    | 9   | 1   | KNOB-MAIN SWEEP                         | 28480    | 01740-67402     |
| MP67                 | 01830-23201    | 3   | 2   | COUPLER-SWITCH EXTENSION                | 28480    | 01830-23201     |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                              | Mfr Code | Mfr Part Number      |
|----------------------|----------------|-----|-----|------------------------------------------|----------|----------------------|
| MP66                 | 0610-0641      | 7   | 1   | SHAFT-COLLAR (STL)                       | 28480    | 0610-0641            |
| MP69                 | 1410-0094      | 4   | 2   | PANEL BUSHING- 3/8-32                    | 28480    | 1410-0094            |
| MP70                 | 0370-2862      | 1   | 1   | PUSHBUTTON- CORP WHITE                   | 28480    | 0370-2862            |
| MP71                 | 0390-0006      | 3   | 4   | BUSHING-INSULATOR                        | 28480    | 0390-0006            |
| MP72                 | 1140-0036      | 1   | 1   | DIAL-TURNS COUNT                         | 28480    | 1140-0036            |
| MP73                 | 1400-1213      | 0   | 5   | LED HOLDER                               | 28480    | 1400-1213            |
| MP74                 | 1400-1163      | 9   | 1   | HOSE CLAMP                               | 28480    | 1400-1163            |
| MP75                 | 5041-3145      | 3   | 1   | COLLAR-SUP CRT                           | 28480    | 5041-3145            |
| MP76                 | 5040-5852      | 2   | 1   | CORE-FLOATING                            | 28480    | 5040-5852            |
| MP77                 | 01745-01204    | 5   | 1   | BRACKET-CRT MOUNT                        | 28480    | 01745-01204          |
| MP78                 | 01960-01227    | 8   | 1   | CLAMP RING-CRT MOUNT                     | 28480    | 01960-01227          |
| MP79                 | 5041-3042      | 1   | 1   | SHOCK MOUNT BELT-CRT                     | 28480    | 5041-3042            |
| MP80                 | 5041-3197      | 11  | 3   | RETAINER/FILTER                          | 28480    | 5041-3197            |
| MP81                 | 1520-0231      | 4   | 1   | SHOCK MOUNT                              | 28480    | 1520-0231            |
| MP82                 | 0340-0949      | 8   | 7   | INSULATOR                                | 28480    | 0340-0949            |
| MP83                 | 1400-0017      | 0   | 1   | CLAMP-CABLE 3/12-DIA 375-WD NYL          | 28480    | 1400-0017            |
| MP84                 | 0610-0027      | 4   | 2   | RETAINER-PUSHON                          | 28480    | 0610-0027            |
| MP85                 | 7121-0333      | 7   | 1   | LABEL-CRT                                | 28480    | 7121-0333            |
| MP86                 | 3060-0791      | 6   | 5   | INSULATOR-TRANSISTOR (NYLON)             | 28480    | 3060-0791            |
| MP88                 | 7120-4184      | 2   | 1   | LABEL COVER                              | 28480    | 7120-4184            |
| MP90                 | 1400-0063      | 4   | 1   | CLAMP-CABLE                              | 28480    | 1400-0063            |
| P1                   | 1251-2357      | 8   | 1   | CONNECTOR-AC PWR HP-9 MALE FLG-MTG       | 28480    | 1251-2357            |
| Q1                   | 1854-0433      | 5   | 1   | TRANSISTOR NPN SI PD=90W FT=2MHZ         | 28480    | 1854-0433            |
| Q2                   | 1854-0803      | 3   | 1   | TRANSISTOR NPN SI TO-220AB PD=2W FT=4MHZ | 01295    | TIP75B               |
| Q3                   | 1854-0370      | 9   | 4   | TRANSISTOR NPN 2N5294 SI PD=1 8W         | 3L585    | 2N5294               |
| Q4                   | 1854-0370      | 8   | 1   | TRANSISTOR NPN 2N5294 SI PD=1 8W         | 3L585    | 2N5294               |
| Q5                   | 1854-0370      | 9   | 1   | TRANSISTOR NPN 2N5294 SI PD=1 8W         | 3L585    | 2N5294               |
| Q6                   | 1854-0370      | 8   | 1   | TRANSISTOR NPN 2N5294 SI PD=1 8W         | 3L585    | 2N5294               |
| R3                   | 0683-4706      | 8   | 2   | RESISTOR 47 5% 25W FC TC=-400/+500       | 01121    | CB4706               |
| R3                   | 0684-6801      | 1   | 2   | RESISTOR 68 10% 25W FC TC=-400/+500      | 01121    | CB6801               |
| R4                   | 0683-4706      | 8   | 1   | RESISTOR 47 5% 25W FC TC=-400/+500       | 01121    | CB4706               |
| R4                   | 0684-6801      | 1   | 1   | RESISTOR 68 10% 25W FC TC=-400/+500      | 01121    | CB6801               |
| R5                   | 0683-1506      | 0   | 2   | RESISTOR 15 5% 25W FC TC -400/+500       | 01121    | CB1506               |
| R6                   | 2100-1443      | 3   | 1   | RESISTOR-VAR PREC WW 10-T, IN 50K 3%     | 28480    | 2100-1443            |
| R7                   | 0684-1021      | 7   | 1   | RESISTOR 1K 10% 25W FC TC=-400/+500      | 01121    | CB1021               |
| R8                   | 2100-0657      | 9   | 1   | RESISTOR-VAR W/SW 100K 30% LIN           | 28480    | 2100-0657            |
| R9                   | 2100-3397      | 0   | 1   | RESISTOR-VAR W/SW 200K 20% 10CW 5PST-NC  | 28480    | 2100-3397            |
| R10                  | 0683-1506      | 0   | 1   | RESISTOR 15 5% 25W FC TC=-400/+500       | 01121    | CB1506               |
| R11                  | 2100-3731      | 6   | 1   | RESISTOR-VAR DUAL 20K-20%-CP 20K-20%-CP  | 28480    | 2100-3731            |
| T1                   | 9100-2619      | 4   | 1   | TRANSFORMER                              | 28480    | 9100-2619            |
| V1                   | 5083-5652      | 9   | 1   | CRT-PJ1 ALIGN                            | 28480    | 5083-5652            |
| W1                   | 8120-1521      | 6   | 1   | POWER CORD-7.5 FT                        | 28480    | 8120-1521            |
| W2                   | 01740-61602    | 9   | 1   | CABLE ASSEMBLY-SYNC (TWIN LEAD)          | 28480    | 01740-61602          |
| W3                   | 01740-6162B    | 9   | 1   | CABLE ASSEMBLY-FRONT PANEL               | 28480    | 01740-6162B          |
| W4                   | 01745-61606    | 7   | 1   | CABLE ASSEMBLY-HORIZONTAL                | 28480    | 01745-61606          |
| W5                   | 01745-61601    | 3   | 1   | CABLE ASSEMBLY-GTE/CRT                   | 28480    | 01745-61601          |
| W6                   | 01740-61609    | 6   | 1   | CABLE ASSEMBLY-TRIGGER VIEW              | 28480    | 01740-61609          |
| W7                   | 01740-61629    | 0   | 1   | CABLE ASSEMBLY-HORIZ POS/D               | 28480    | 01740-61629          |
| W8                   | 01745-61603    | 5   | 1   | CABLE ASS. MBLY-SCALE ILL                | 28480    | 01745-61603          |
| W9                   | 01745-61602    | 4   | 1   | CABLE ASSEMBLY-CRT BASE                  | 28480    | 01745-61602          |
| W10                  | 01745-61604    | 6   | 1   | CABLE ASSEMBLY-FOCUS POT                 | 28480    | 01745-61604          |
| W11                  | 01740-61631    | 4   | 5   | CABLE ASSEMBLY-3 CONTACT                 | 28480    | 01740-61631          |
| XF1A                 | 2110-0664      | 8   | 1   | FUSEHOLDER BODY 12A MAX FOR UL           | H9027    | 0311657              |
| XF1B                 | 2110-0665      | 9   | 1   | FUSEHOLDER CAP 12A MAX FOR UL            | 28480    | 2110-0665            |
| XF1C                 | 2110-0669      | 3   | 1   | FUSEHOLDER COMPONENT NUT, THREAD M12.7   | 28480    | 2110-0669            |
| A1                   | 01740-63401    | 0   | 1   | ATTENUATOR ASSEMBLY "A" (LEFT)           | 28480    | 01740-63401          |
| A1H1                 | 2950-0072      | 3   | 1   | NUT-HEX-DBL-CHAM 1/4-32-THD .062-IN-THK  | 00000    | ORDER BY DESCRIPTION |
| A1MP1                | 01740-01205    | 2   | 1   | BRACKET-VERNIER                          | 28480    | 01740-01205          |
| A1MP2                | 5040-0218      | 3   | 1   | COUPLER                                  | 28480    | 5040-0218            |
| A1R1                 | 2100-3551      | 8   | 1   | RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO | 28480    | 2100-3551            |
| A2                   | 01740-63402    | 1   | 1   | ATTENUATOR ASSEMBLY "B" (RIGHT)          | 28480    | 01740-63402          |
| A2H1                 | 2950-0072      | 3   | 1   | NUT-HEX-DBL-CHAM 1/4-32-THD .062-IN-THK  | 00000    | ORDER BY DESCRIPTION |
| A2MP1                | 01740-01205    | 2   | 1   | BRACKET-VERNIER                          | 28480    | 01740-01205          |
| A2MP2                | 5040-0218      | 3   | 1   | COUPLER                                  | 28480    | 5040-0218            |
| A2R1                 | 2100-3551      | 8   | 1   | RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO | 28480    | 2100-3551            |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                            | Mfr Code | Mfr Part Number    |
|----------------------|----------------|-----|-----|----------------------------------------|----------|--------------------|
| A3                   | 01740-66696    | 0   | 1   | V PREAMP BOARD ASSEMBLY                | 28480    | 01740-66696        |
| A3A1                 | 5081-3030      | 9   | 1   | IC-VERTICAL PREAMPLIFIER               | 28480    | 5081-3030          |
| A3C1                 | 0160-4204      | 4   | 2   | CAPACITOR-FXD 033UF ±10% 500VDC CER    | 51642    | 300-500-X7R-333K   |
| A3C2                 | 0121-0060      | 0   | 4   | CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG | 52763    | 304322 2/8PF NPO   |
| A3C3                 | 0150-0021      | 4   | 2   | CAPACITOR-FXD 47PF ±5% 500VDC TI DIOX  | 28480    | 0150-0021          |
| A3C4                 | 0121-0060      | 0   | 0   | CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG | 52763    | 304322 2/8PF NPO   |
| A3C5                 | 0160-2150      | 5   | 1   | CAPACITOR-FXD 33PF ±5% 300VDC MICA     | 28480    | 0160-2150          |
| A3C6                 | 0160-4751      | 6   | 3   | CAPACITOR-FXD 1000PF ±10% 1KVDC CER    | 28480    | 0160-4751          |
| A3C7                 | 0160-3799      | 0   | 1   | CAPACITOR-FXD 18PF ±10% 100VDC CER     | 28480    | 0160-3799          |
| A3C8                 | 0160-2055      | 9   | 21  | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C9                 | 0160-3508      | 9   | 2   | CAPACITOR-FXD 1UF +80-20% 50VDC CER    | 28480    | 0160-3508          |
| A3C10                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C11                | 0160-0648      | 4   | 2   | CAPACITOR-FXD 1UF ±10% 35VDC TA        | 90201    | TDC104K035N5E      |
| A3C12                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C13                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C14                | 0160-4204      | 4   | 0   | CAPACITOR-FXD 033UF ±10% 500VDC CER    | 51642    | 300-500-X7R-333K   |
| A3C15                | 0160-3567      | 4   | 2   | CAPACITOR-FXD 10PF ±5% 100VDC CER 0:30 | 28480    | 0160-3567          |
| A3C16                | 0160-4751      | 6   | 0   | CAPACITOR-FXD 1000PF ±10% 1KVDC CER    | 28480    | 0160-4751          |
| A3C17                | 0121-0060      | 0   | 0   | CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG | 52763    | 304322 2/8PF NPO   |
| A3C18                | 0150-0021      | 4   | 4   | CAPACITOR-FXD 47PF ±5% 500VDC TI DIOX  | 28480    | 0150-0021          |
| A3C19                | 0121-0060      | 0   | 0   | CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG | 52763    | 304322 2/8PF NPO   |
| A3C20                | 0160-2198      | 1   | 1   | CAPACITOR-FXD 20PF ±5% 300VDC MICA     | 28480    | 0160-2198          |
| A3C21                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C22                | 0160-3451      | 1   | 4   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-3451          |
| A3C23                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C24                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C25                | 0160-0648      | 4   | 0   | CAPACITOR-FXD 1UF ±10% 35VDC TA        | 90201    | TDC104K035N5E      |
| A3C26                | 0160-3443      | 1   | 2   | CAPACITOR-FXD 1UF +80-20% 50VDC CER    | 28480    | 0160-3443          |
| A3C27                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C28                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C29                | 0160-0374      | 3   | 2   | CAPACITOR-FXD 10UF ±10% 20VDC TA       | 56289    | 150D106X9020B2     |
| A3C30                | 0160-3443      | 1   | 0   | CAPACITOR-FXD 1UF +80-20% 50VDC CER    | 28480    | 0160-3443          |
| A3C31                | 0160-3567      | 0   | 0   | CAPACITOR-FXD 10PF ±5% 100VDC CER 0:30 | 28480    | 0160-3567          |
| A3C32                | 0160-3470      | 4   | 3   | CAPACITOR-FXD 01UF +80-20% 50VDC CER   | 28480    | 0160-3470          |
| A3C33                | 0160-2255      | 3   | 7   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C34                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C35                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C36                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C37                | 0160-0670      | 9   | 2   | CAPACITOR-FXD 220PF ±20% 100VDC CER    | 20932    | 5024EM100RD221M    |
| A3C38                | 0160-0670      | 9   | 0   | CAPACITOR-FXD 220PF ±20% 100VDC CER    | 20932    | 5024EM100RD221M    |
| A3C39                | 0140-0202      | 2   | 1   | CAPACITOR-FXD 15PF ±5% 500VDC MICA     | 7213F    | DM15C150J0500WV1CR |
| A3C40                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C41                | 0160-3508      | 9   | 0   | CAPACITOR-FXD 1UF +80-20% 50VDC CER    | 28480    | 0160-3508          |
| A3C42                | 0160-0374      | 3   | 0   | CAPACITOR-FXD 10UF ±10% 20VDC TA       | 56289    | 150D106X9020B2     |
| A3C43                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C44                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C45                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C46                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C47                | 0160-2217      | 5   | 1   | CAPACITOR-FXD 910PF ±5% 300VDC MICA    | 28480    | 0160-2217          |
| A3C48                | 0160-0228      | 6   | 3   | CAPACITOR-FXD 22UF ±10% 15VDC TA       | 56289    | 150D226X9015B2     |
| A3C49                | 0160-2207      | 3   | 1   | CAPACITOR-FXD 300PF ±5% 300VDC MICA    | 28480    | 0160-2207          |
| A3C50                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C51                | 0160-0820      | 2   | 4   | CAPACITOR-FXD 05UF +80-20% 25VDC CER   | 28480    | 0160-0820          |
| A3C52                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C53                | 0160-3466      | 8   | 2   | CAPACITOR-FXD 100PF ±10% 1KVDC CER     | 28480    | 0160-3466          |
| A3C54                | 0160-3877      | 5   | 1   | CAPACITOR-FXD 100PF ±20% 20VDC CER     | 28480    | 0160-3877          |
| A3C55                | 0160-3466      | 8   | 0   | CAPACITOR-FXD 100PF ±10% 1KVDC CER     | 28480    | 0160-3466          |
| A3C56                | 0160-0820      | 2   | 0   | CAPACITOR-FXD 05UF +80-20% 25VDC CER   | 28480    | 0160-0820          |
| A3C57                | 0160-0228      | 6   | 0   | CAPACITOR-FXD 22UF ±10% 15VDC TA       | 56289    | 150D226X9015B2     |
| A3C58                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C59                | 0160-0820      | 2   | 0   | CAPACITOR-FXD 05UF +80-20% 25VDC CER   | 28480    | 0160-0820          |
| A3C60                | 0160-0228      | 6   | 0   | CAPACITOR-FXD 22UF ±10% 15VDC TA       | 56289    | 150D226X9015B2     |
| A3C61                | 0160-0820      | 2   | 0   | CAPACITOR-FXD 05UF +80-20% 25VDC CER   | 28480    | 0160-0820          |
| A3C63                | 0160-2255      | 3   | 0   | CAPACITOR-FXD 2 2UF ±20% 20VDC TA      | 28480    | 0160-2255          |
| A3C64                | 0160-3451      | 1   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-3451          |
| A3C65                | 0160-3451      | 1   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-3451          |
| A3C66                | 0160-3451      | 1   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-3451          |
| A3C67                | 0160-4751      | 6   | 0   | CAPACITOR-FXD 1000PF ±10% 1KVDC CER    | 28480    | 0160-4751          |
| A3C68                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C69                | 0160-3470      | 4   | 0   | CAPACITOR-FXD 01UF +80-20% 50VDC CER   | 28480    | 0160-3470          |
| A3C70                | 0160-3470      | 4   | 0   | CAPACITOR-FXD 01UF +80-20% 50VDC CER   | 28480    | 0160-3470          |
| A3C71                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C72                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C73                | 0140-0192      | 9   | 1   | CAPACITOR-FXD 68PF ±5% 300VDC MICA     | 7213F    | DM15E68J0300WV1CR  |
| A3C74                | 0150-0031      | 6   | 1   | CAPACITOR-FXD 2PF ±5% 500VDC TI DIOX   | 28480    | 0150-0031          |
| A3C75                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |
| A3C77                | 0160-2055      | 9   | 0   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055          |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                              | Mfr Code | Mfr Part Number     |
|----------------------|----------------|-----|-----|------------------------------------------|----------|---------------------|
| A3C78                | 0160-2055      | 9   | 2   | CAPACITOR-FXD 01UF +80-20% 100VDC CER    | 28480    | 0160-2055           |
| A3C79                | 0160-3651      | 3   |     | CAPACITOR-FXD 68PF ±10% 200VDC CER       | 28480    | 0160-3651           |
| A3C80                | 0160-3651      | 3   |     | CAPACITOR-FXD 68PF ±10% 200VDC CER       | 28480    | 0160-3651           |
| A3CR1                | 1901-0040      | 1   | 15  | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR4                | 1901-0047      | 8   |     | DIODE-SWITCHING 20V 75MA 10NS            | 28480    | 1901-0047           |
| A3CR5                | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR6                | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR7                | 1901-0047      | 8   |     | DIODE-SWITCHING 20V 75MA 10NS            | 28480    | 1901-0047           |
| A3CR8                | 1901-0047      | 8   |     | DIODE-SWITCHING 20V 75MA 10NS            | 28480    | 1901-0047           |
| A3CR9                | 1901-0047      | 8   |     | DIODE-SWITCHING 20V 75MA 10NS            | 28480    | 1901-0047           |
| A3CR11               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR12               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR13               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR14               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR15               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR16               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR17               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR18               | 1910-0016      | 0   | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1910-0016           |
| A3CR19               | 1901-0040      | 1   |     | DIODE-GE 60V 00MA 1US DO-7               | 28480    | 1910-0016           |
| A3CR20               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR21               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR23               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR25               | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35       | 28480    | 1901-0040           |
| A3CR26               | 1901-0045      | 6   | 2   | DIODE-PA A RECT 100V 750MA DO-29         | 28480    | 1901-0045           |
| A3CR27               | 1901-0045      | 6   |     | DIODE-P/R RECT 100V 750MA DO-29          | 28480    | 1901-0045           |
| A3CR28               | 1906-0042      | 3   | 1   | DIODE-FULL 70V VF DIFF-10MV              | 28480    | 1906-0042           |
| A3CR29               | 1901-0773      | 7   |     | DIODE                                    | 28480    | 1901-0773           |
| A3CR30               | 1901-0773      | 7   |     | DIODE                                    | 28480    | 1901-0773           |
| A3E1                 | 9170-0029      | 3   | 1   | CORE-SHIELDING BEAD                      | 20480    | 9170-0029           |
| A3L1                 | 9100-0670      | 3   | 2   | INDUCTOR-FIXED CORE 47 OHM 1/4 W CARBON  | 28480    | 9100-0670           |
| A3L2                 | 9100-0670      | 3   |     | INDUCTOR-FIXED CORE 47 OHM 1/4 W CARBON  | 28480    | 9100-0670           |
| A3L3                 | 9100-2264      | 5   | 2   | INDUCTOR RF-CH-MLD 6 BUH 10% 105DX 26LG  | 28480    | 9100-2264           |
| A3L4                 | 9100-2264      | 5   |     | INDUCTOR RF-CH-MLD 6 BUH 10% 105DX 26LG  | 28480    | 9100-2264           |
| A3L5                 | 9100-1650      | 1   | 2   | INDUCTOR RF-CH-MLD 680UH 5% 2DX 45LG     | 28480    | 9100-1650           |
| A3L6                 | 9100-1650      | 1   |     | INDUCTOR RF-CH-MLD 680UH 5% 2DX 45LG     | 28480    | 9100-1650           |
| A3MP1                | 01740-00603    | 2   | 2   | SHIELD-RESISTOR                          | 28480    | 01740-00603         |
| A3MP2                | 1205-0037      | 0   |     | HEAT SINK TO-18-CS                       | 28480    | 1205-0037           |
| A3MP3                | 1206-0361      | 3   | 2   | HEAT SINK 5GL TO-5/TO-39-CS              | 13103    | 2226C               |
| A3P2                 | 1251-5346      | 1   | 1   | CONNECTOR 10-PIN M POST TYPE             | 28480    | 1251-5346           |
| A3P3                 | 1251-6149      | 4   |     | CONNECTOR                                | 28480    | 1251-6149           |
| A3P4                 | 1251-6149      | 4   |     | CONNECTOR                                | 28480    | 1251-6149           |
| A3Q1                 | 1853-0380      | 9   | 2   | TRANSISTOR PNP SI TO-92 PD-350MW         | 28480    | 1853-0380           |
| A3Q2                 | 1855-0266      | 4   |     | TRANSISTOR-JFET DUAL N-CHAN D-MODE SI    | 28480    | 1855-0266           |
| A3Q3                 | 1853-0380      | 9   | 2   | TRANSISTOR PNP SI TO-92 PD-350MW         | 28480    | 1853-0380           |
| A3Q4                 | 1855-0266      | 4   |     | TRANSISTOR-JFET DUAL N-CHAN D-MODE SI    | 28480    | 1855-0266           |
| A3Q5                 | 1854-0092      | 2   | 2   | TRANSISTOR NPN SI PD-200MW FT-600MHZ     | 28480    | 1854-0092           |
| A3Q6                 | 1854-0628      | 0   | 2   | TRANSISTOR NPN SI TO-92 PD-625MW         | 04713    | MPS-H17             |
| A3Q7                 | 1854-0628      | 0   |     | TRANSISTOR NPN SI TO-92 PD-625MW         | 04713    | MPS-H17             |
| A3Q8                 | 1854-0215      | 1   | 2   | TRANSISTOR NPN SI PD-350MW FT-300MHZ     | 04713    | 2N3904              |
| A3Q9                 | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD-310MW FT-250MHZ     | 28480    | 1853-0036           |
| A3Q10                | 1854-0092      | 2   | 2   | TRANSISTOR NPN SI PD-200MW FT-600MHZ     | 28480    | 1854-0092           |
| A3Q11                | 1854-0215      | 1   | 1   | TRANSISTOR NPN SI PD-350MW FT-300MHZ     | 04713    | 2N3904              |
| A3Q12                | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD-310MW FT-250MHZ     | 28480    | 1853-0036           |
| A3Q13                | 1855-0367      | 6   | 1   | TRANSISTOR-UJT P ON N                    | 28480    | 1855-0367           |
| A3Q14                | 1854-0071      | 7   |     | TRANSISTOR NPN SI PD-300MW FT-200MHZ     | 28480    | 1854-0071           |
| A3Q15                | 1854-0071      | 7   | 3   | TRANSISTOR NPN SI PD-300MW FT-200MHZ     | 28480    | 1854-0071           |
| A3Q16                | 1853-0015      | 7   | 1   | TRANSISTOR PNP SI PD-200MW FT-600MHZ     | 28480    | 1853-0015           |
| A3Q17                | 1853-0314      | 9   |     | TRANSISTOR PNP 2N2906A SI TO-39 PD-600MW | 04713    | 2N2906A             |
| A3Q18                | 1854-0071      | 7   | 1   | TRANSISTOR NPN SI PD-300MW FT-200MHZ     | 28480    | 1854-0071           |
| A3Q19                | 1854-0786      | 1   |     | TRANSISTOR PNP 2N2540 SI TO-18 PD-600MW  | 04713    | 2N2540              |
| A3Q20                | 1853-0066      | 2   | 1   | TRANSISTOR NPN SI PD-310MW FT-40MHZ      | 27014    | 2N5087              |
| A3Q21                | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD-310MW FT-250MHZ     | 28480    | 1853-0036           |
| A3R1                 | 0698-8648      | 7   | 2   | RESISTOR 50 2% 5W MO TC-0±150            | 28480    | 0698-8648           |
| A3R2                 | 0698-7206      | 1   |     | RESISTOR 56 2 1% 0.5W F TC-0±100         | 24546    | C3-1/8-TO-56R2 F    |
| A3R3                 | 0698-8622      | 7   | 4   | RESISTOR 990K 5% .25W F TC-0±50          | 28480    | 0698-8622           |
| A3R4                 | 0698-3329      | 1   |     | RESISTOR 10K 5% .125W F TC-0±100         | 03888    | PME55-1/8-TO-1002-D |
| A3R5                 | 0698-8622      | 7   |     | RESISTOR 990K 5% .125W F TC-0±50         | 28480    | 0698-8622           |
| A3R6                 | 0675-1011      | 6   | 2   | RESISTOR 100 10% .125W CC TC -270/+540   | 01121    | BB1011              |
| A3R7                 | 0698-7214      | 1   |     | RESISTOR 121 1% 0.5W F TC-0±100          | 24546    | C3-1/8-TO-121R F    |
| A3R7                 | 0698-7215      | 2   | 2   | RESISTOR 133 1% 0.5W F TC-0±100          | 24546    | C3-1/8-TO-133R F    |
| A3R7                 | 0698-7216      | 3   |     | RESISTOR 147 1% 0.5W F TC-0±100          | 24546    | C3-1/8-TO-147R F    |
| A3R7                 | 0698-7217      | 4   | 2   | RESISTOR 162 1% 0.5W F TC-0±100          | 24546    | C3-1/8-TO-162R F    |
| A3R7                 | 0698-7218      | 5   |     | RESISTOR 178 1% 0.5W F TC-0±100          | 24546    | C3-1/8-TO-178R F    |
| A3R7                 | 0698-7219      | 6   | 1   | RESISTOR 196 1% 0.6W F TC-0±100          | 24546    | C3-1/8-TO-196R F    |
| A3R7                 | 0698-7220      | 9   |     | RESISTOR 215 1% 0.6W F TC-0±100          | 24546    | C3-1/8-TO-215R F    |
| A3R7                 | 0698-7222      | 1   | 1   | RESISTOR 261 1% 0.6W F TC-0±100          | 24546    | C3-1/8-TO-261R F    |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number     |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|---------------------|
| A3R7                 | 0698-7710      | 2   | 1   | RESISTOR 100 5% .05W F TC=0±100         | 24546    | C3-1/8-T00-100R J   |
| A3R8                 | 0687-2241      | 1   | 2   | RESISTOR 220K 10% .5W CC TC=0+882       | 01121    | EB2241              |
| A3R9                 | 0757-0401      | 0   | 7   | RESISTOR 100 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-101-F     |
| A3R10                | 0688-3157      | 3   | 4   | RESISTOR 19 6K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-1962-F    |
| A3R11                | 2100-0668      | 1   | 2   | RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN   | 28480    | 2100-0668           |
| A3R12                | 0684-1001      | 3   | 2   | RESISTOR 10 10% .25W FC TC=-400/+500    | 01121    | CB1001              |
| A3R13                | 7683-0476      | 1   | 1   | RESISTOR 4 7 5% .25W FC TC=-400/+500    | 01121    | CB47G5              |
| A3R14                | 0757-0394      | 7   | 4   | RESISTOR 51 1 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-51R1-F    |
| A3R15                | 0688-7926      | 2   | 2   | RESISTOR 470 10% .125W CC TC=-330/+800  | 01121    | BB4711              |
| A3R16                | 0757-0354      | 0   |     | RESISTOR 51 1 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-51R1-F    |
| A3R17                | 0688-3167      | 3   |     | RESISTOR 19 6K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-1962-F    |
| A3R18                | 2100-3531      | 4   | 4   | RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3531           |
| A3R19                | 2100-3531      | 4   | 4   | RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3531           |
| A3R20                | 0688-0082      | 7   | 5   | RESISTOR 464 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-4640-F    |
| A3R20                | 0757-0346      | 2   | 2   | RESISTOR 10 1% .125W F TC=0±100         | 24546    | C4-1/8-T0-10R0-F    |
| A3R20                | 0757-0401      | 0   |     | RESISTOR 100 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-101-F     |
| A3R20                | 0757-0410      | 1   | 2   | RESISTOR 301 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-301R-F    |
| A3R20                | 0757-0413      | 4   | 2   | RESISTOR 392 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-392R-F    |
| A3R20                | 0757-1102      | 0   | 2   | RESISTOR 160 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-161-F     |
| A3R21                | 0688-8648      | 7   |     | RESISTOR 50 2% .5W MO TC=0±150          | 28480    | 0688-8648           |
| A3R22                | 2100-2061      | 3   | 1   | RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN   | 73138    | B2PR200             |
| A3R23                | 0688-8622      | 7   |     | RESISTOR 890K 5% .125W F TC=0±50        | 28480    | 0688-8622           |
| A3R24                | 0688-3329      | 1   |     | RESISTOR 10K 5% .125W F TC=0±100        | 03888    | PME55-1/8-T0-1002-D |
| A3R25                | 0688-8622      | 7   |     | RESISTOR 890K 5% .125W F TC=0±50        | 28480    | 0688-8622           |
| A3R26                | 0687-2241      | 1   |     | RESISTOR 220K 10% .5W CC TC=0+882       | 01121    | EB2241              |
| A3R27                | 0675-1011      | 6   |     | RESISTOR 100 10% .125W CC TC=-270, +540 | 01121    | BB1011              |
| A3R28                | 065J-7216      | 2   | 2   | RESISTOR 133 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-133R-F    |
| A3R28                | 068P-7216      | 3   | 3   | RESISTOR 147 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-147R-F    |
| A3R28                | 0688-7217      | 4   | 4   | RESISTOR 162 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-162R-F    |
| A3R28                | 0688-7218      | 5   |     | RESISTOR 178 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-178R-F    |
| A3R29                | 0757-0401      | 0   |     | RESISTOR 100 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-101-F     |
| A3R30                | 0688-3147      | 3   |     | RESISTOR 19 6K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-1962-F    |
| A3R31                | 2100-0668      | 1   |     | RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN   | 28480    | 2100-0668           |
| A3R32                | 2100-3212      | 8   | 4   | RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3212           |
| A3R33                | 0687-0082      | 7   |     | RESISTOR 464 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-4640-F    |
| A3R34                | 0688-3495      | 2   | 2   | RESISTOR 866 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-866R-F    |
| A3R35                | 0757-0403      | 2   | 2   | RESISTOR 121 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-121R-F    |
| A3R36                | 2100-3433      | 5   | 2   | RESISTOR-VAR CONTROL CP 250 10% LIN     | 01121    | 73U1G040R251U       |
| A3R37                | 0688-0082      | 7   |     | RESISTOR 464 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-4640-F    |
| A3R38                | 0688-4126      | 7   | 2   | RESISTOR 953 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-953R-F    |
| A3R39                | 0684-1001      | 3   |     | RESISTOR 10 10% .25W FC TC=-400/+500    | 01121    | CB10G1              |
| A3R40                | 0757-0394      | 0   |     | RESISTOR 51.1 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-51R1-F    |
| A3R41                | 0757-0284      | 7   | 2   | RESISTOR 150 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-151-F     |
| A3R42                | 0757-0398      | 4   | 2   | RESISTOR 75 1% .125W F TC=0±100         | 24546    | C4-1/8-T0-75R0-F    |
| A3R43                | 0688-7926      | 2   |     | RESISTOR 470 10% .125W CC TC=-330/+800  | 01121    | BB4711              |
| A3R44                | 0684-0271      | 7   | 3   | RESISTOR 2 7 10% .25W FC TC=-400/+500   | 01121    | CB27G1              |
| A3R45                | 0757-0433      | 8   | 7   | RESISTOR 3 32K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3321-F    |
| A3R46                | 2100-0668      | 5   | 3   | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN   | 28480    | 2100-0668           |
| A3R47                | 0757-0394      | 0   |     | RESISTOR 51.1 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-51R1-F    |
| A3R48                | 0688-3157      | 3   |     | RESISTOR 19 6K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-1962-F    |
| A3R49                | 2100-0654      | 5   |     | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN   | 28480    | 2100-0654           |
| A3R50                | 0757-0398      | 4   |     | RESISTOR 75 1% .125W F TC=0±100         | 24546    | C4-1/8-T0-75R0-F    |
| A3R51                | 0757-0284      | 7   | 1   | RESISTOR 150 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-151-F     |
| A3R52                | 0684-0271      | 7   |     | RESISTOR 2 7 10% .25W FC TC=-400/+500   | 01121    | CB27G1              |
| A3R53                | 0757-0433      | 8   |     | RESISTOR 3 32K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3321-F    |
| A3R54                | 0688-7216      | 3   |     | RESISTOR 147 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-147R-F    |
| A3R55                | 0688-7218      | 3   |     | RESISTOR 147 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-147R-F    |
| A3R56                | 0688-4125      | 2   |     | RESISTOR 953 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-953R-F    |
| A3R57                | 0688-3496      | 7   |     | RESISTOR 866 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-866R-F    |
| A3R58                | 2100-3212      | 8   |     | RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3212           |
| A3R58                | 0688-7228      | 7   | 2   | RESISTOR 464 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-464R-F    |
| A3R60                | 0688-7228      | 7   |     | RESISTOR 464 1% .05W F TC=0±100         | 24546    | C3-1/8-T0-464R-F    |
| A3R61                | 2100-3433      | 5   |     | RESISTOR-VAR CONTROL CP 250 10% LIN     | 01121    | 73U1G040R251U       |
| A3R62                | 0757-0403      | 2   |     | RESISTOR 121 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-121R-F    |
| A3R63                | 0757-0411      | 2   | 3   | RESISTOR 332 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-332R-F    |
| A3R64                | 0757-0401      | 0   |     | RESISTOR 100 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-101-F     |
| A3R66                | 2100-0667      | 0   | 2   | RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN    | 28480    | 2100-0667           |
| A3R66                | 0757-0401      | 0   |     | RESISTOR 100 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-101-F     |
| A3R67                | 0688-3455      | 4   | 1   | RESISTOR 261K 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-2613-F    |
| A3R68                | 0684-4721      | 0   | 2   | RESISTOR 4 7K 10% .25W F TC=-400/+700   | 01121    | CB47G1              |
| A3R69                | 0684-1031      | 1   | 9   | RESISTOR 10K 10% .25W FL TC=-400/+700   | 01121    | CB1031              |
| A3R70                | 0757-0462      | 3   | 2   | RESISTOR 75K 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-7502-F    |
| A3R71                | 0684-4721      | 0   |     | RESISTOR 4 7K 10% .25W FC TC=-400/+700  | 01121    | CB47G1              |
| A3R72                | 0688-3161      | 9   | 3   | RESISTOR 38 3K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3832-F    |
| A3R73                | 0684-1031      | 9   |     | RESISTOR 10K 10% .25W FC TC=-400/+700   | 01121    | CB1031              |
| A3R74                | 0757-1022      | 3   | 1   | RESISTOR 1 78K 1% .25W F TC=0±100       | 24546    | C5-1/4-T0-1781-F    |
| A3R75                | 0688-3161      | 9   |     | RESISTOR 38 3K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3832-F    |
| A3R76                | 2100-3531      | 4   |     | RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3531           |
| A3R77                | 2100-3531      | 4   |     | RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN   | 28480    | 2100-3531           |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                           | Mfr Code | Mfr Part Number    |
|----------------------|----------------|-----|-----|---------------------------------------|----------|--------------------|
| A3R76                | 0698-0082      | 7   |     | RESISTOR 464 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-4640-F   |
| A3R78                | 0757-0346      | 2   |     | RESISTOR 10 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1050-F   |
| A3R78                | 0757-0410      | 1   |     | RESISTOR 301 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-301R-F   |
| A3R78                | 0757-0413      | 4   |     | RESISTOR 392 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-392R-F   |
| A3R78                | 0757-1102      | 0   |     | RESISTOR 180 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-181-F    |
| A3R78                | 2100-3212      | 8   |     | RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN | 3480     | 2100-3212          |
| A3R80                | 0757-0290      | 5   | 2   | RESISTOR 6 18K 1% 125W F TC=0:100     | 19701    | MF4C-1/8-TO-6181-F |
| A3R81                | 0757-0417      | 8   | 2   | RESISTOR 662 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-662R-F   |
| A3R82                | 0757-0443      | 0   | 1   | RESISTOR 11K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1102-F   |
| A3R83                | 0698-4037      | 0   | 3   | RESISTOR 464 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-464R-F   |
| A3R84                | 0757-0317      | 7   | 1   | RESISTOR 1 33K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1331-F   |
| A3R85                | 0698-4037      | 0   |     | RESISTOR 464 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-464R-F   |
| A3R86                | 2100-0667      | 0   |     | RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN  | 28480    | 2100-0667          |
| A3R87                | 0757-0433      | 0   |     | RESISTOR 332K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3321-F   |
| A3R88                | 0757-0280      | 3   | 5   | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F   |
| A3R89                | 0757-1094      | 9   |     | RESISTOR 1 47K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1471-F   |
| A3R90                | 2100-3212      | 8   |     | RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN | 28480    | 2100-3212          |
| A3R91                | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R92                | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R93                | 0698-3161      | 9   |     | RESISTOR 38 3K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-3832-F   |
| A3R94                | 0684-3321      | 4   | 4   | RESISTOR 3 3K 10% 25W FC TC=-400/+700 | 01121    | CB3321             |
| A3R95                | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R96                | 0757-1094      | 9   |     | RESISTOR 1 47K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1471-F   |
| A3R97                | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R98                | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R99                | 0698-0082      | 7   |     | RESISTOR 464 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-4640-F   |
| A3R100               | 0757-0478      | 9   | 1   | RESISTOR 301K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3013-F   |
| A3R101               | 0757-0401      | 0   |     | RESISTOR 100 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-101-F    |
| A3R102               | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R103               | 0757-0433      | 8   |     | RESISTOR 332K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3321-F   |
| A3R104               | 0757-0442      | 9   | 4   | RESISTOR 10K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1002-F   |
| A3R105               | 0684-3321      | 4   |     | RESISTOR 33K 10% 25W FC TC=-400/+700  | 01121    | CB3321             |
| A3R106               | 0757-0283      | 6   | 3   | RESISTOR 2K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-2001-F   |
| A3R107               | 0684-3321      | 4   |     | RESISTOR 33K 10% 25W FC TC=-400/+700  | 01121    | CB3321             |
| A3R108               | 0684-1031      | 9   |     | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031             |
| A3R109               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F   |
| A3R110               | 0757-0274      | 5   | 2   | RESISTOR 1 21K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1211-F   |
| A3R111               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F   |
| A3R112               | 0757-0274      | 6   |     | RESISTOR 1 21K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1211-F   |
| A3R113               | 0684-3321      | 4   |     | RESISTOR 33K 10% 25W FC TC=-400/+700  | 01121    | CB3321             |
| A3R114               | 0757-0290      | 5   |     | RESISTOR 6 18K 1% 125W F TC=0:100     | 19701    | MF4C-1/8-TO-6181-F |
| A3R115               | 0757-0283      | 6   |     | RESISTOR 2K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-2001-F   |
| A3R116               | 2100-0654      | 5   |     | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN | 28480    | 2100-0654          |
| A3R117               | 0757-0283      | 6   |     | RESISTOR 2K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-2001-F   |
| A3R118               | 0757-0417      | 8   |     | RESISTOR 662 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-662R-F   |
| A3R119               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F   |
| A3R120               | 0698-3150      | 6   | 2   | RESISTOR 2 37K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2371-F   |
| A3R120               | 0757-0430      | 5   |     | RESISTOR 2 21K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2211-F   |
| A3R121               | 0757-0442      | 9   | 1   | RESISTOR 10K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1002-F   |
| A3R122               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F   |
| A3R123               | 0698-3150      | 6   |     | RESISTOR 2 37K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2371-F   |
| A3R124               | 0757-0442      | 9   |     | RESISTOR 10K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1002-F   |
| A3R125               | 0698-7096      | 7   | 2   | RESISTOR 10 10% 125W CC TC=-120/+400  | 01121    | BB1001             |
| A3R126               | 0698-7229      | 8   | 2   | RESISTOR 511 1% 06W F TC=0:100        | 24546    | C3-1/8-TO-511R-F   |
| A3R127               | 0698-7096      | 7   |     | RESISTOR 10 10% 125W CC TC=-120/+400  | 01121    | BB1001             |
| A3R128               | 0698-7229      | 8   |     | RESISTOR 511 1% 06W F TC=0:100        | 24546    | C3-1/8-TO-511R-F   |
| A3R129               | 0757-0433      | 8   |     | RESISTOR 332K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3321-F   |
| A3R130               | 0757-0442      | 9   |     | RESISTOR 10K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1002-F   |
| A3R131               | 0757-0411      | 2   |     | RESISTOR 332 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-332R-F   |
| A3R132               | 0698-4037      | 0   |     | RESISTOR 464 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-464R-F   |
| A3R133               | 0757-0433      | 8   |     | RESISTOR 332K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3321-F   |
| A3R134               | 0757-1094      | 9   |     | RESISTOR 1 47K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1471-F   |
| A3R135               | 0757-0462      | 3   |     | RESISTOR 75K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-7502-F   |
| A3R136               | 0698-3162      | 0   | 2   | RESISTOR 464K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-4642-F   |
| A3R137               | 0684-0271      | 7   |     | RESISTOR 2 7 10% 25W FC TC=-400/+500  | 01121    | CB27G1             |
| A3R138               | 0698-3162      | 0   |     | RESISTOR 464K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-4642-F   |
| A3R139               | 0757-0416      | 7   | 1   | RESISTOR 511 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-511R-F   |
| A3R140               | 0757-0463      | 2   | 1   | RESISTOR 301K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3012-F   |
| A3R141               | 0757-0411      | 2   |     | RESISTOR 332 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-332R-F   |
| A3R144               | 0757-0440      | 7   | 1   | RESISTOR 75K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-7501-F   |
| A3R145               | 0698-7196      | 8   | 1   | RESISTOR 21 5 1% 06W F TC=0:100       | 24546    | C3-1/8-TO-21R5-F   |
| A3R146               | 0698-7192      | 4   | 1   | RESISTOR 14 7 1% 06W F TC=0:100       | 24546    | C3-1/8-TO-14R7-F   |
| A3R147               | 0757-0433      | 8   |     | RESISTOR 332K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-3321-F   |
| A3R71                | 0837-0035      | 6   | 2   | THERMISTOR DISC 5K-OHM TC=-4.4%/C-DEG | 28480    | 0837-0035          |
| A3R72                | 0837-0035      | 6   |     | THERMISTOR DISC 5K-OHM TC=-4.4%/C-DEG | 28480    | 0837-0035          |
| A3S1                 | 3101-1906      | 5   | 1   | SWITCH-PUSHBUTTON 4 STATIONS          | 28480    | 3101-1906          |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|----------------------|----------------|-----|-----|-------------|----------|-----------------|
|----------------------|----------------|-----|-----|-------------|----------|-----------------|



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

| Reference Designator | HP Part Number | C | D | Qty | Description                             | Mfr Code | Mfr Part Number   |
|----------------------|----------------|---|---|-----|-----------------------------------------|----------|-------------------|
| A3U1                 | 1820-1518      | 8 |   | 1   | IC GATE TTL L NAND QUAD 2 INP           | 27014    | DM74L00N          |
| A3U2                 | 1820-0596      | 0 |   | 2   | IC FF TTL L D-TYPE POS-EDGE TRIG        | 27014    | DM74L74N          |
| A3U3                 | 1820-1198      | 0 |   | 1   | IC GATE TTL LS NAND QUAD 2-INP          | 01295    | SN74LS03N         |
| A3U4                 | 1820-0696      | 0 |   |     | IC FF TTL L D-TYPE POS-EDGE-TRIG        | 27014    | DM74L74N          |
| A3VR1                | 1902-3382      | 9 |   | 1   | DIODE-ZNR 4.64V 5% DO-35 PD-4W          | 25480    | 1902-3082         |
| A3VR2                | 1902-3234      | 1 |   | 1   | DIODE-ZNR 18.8V 5% DO-35 PD-4W          | 28480    | 1902-3234         |
| A3VR3                | 1902-0072      | 1 |   | 1   | DIODE-ZNR 7.87V 2% DO-35 PD-4W          | 28480    | 1902-0072         |
| A3VR4                | 1902-3137      | 5 |   | 1   | DIODE-ZNR 8.06V 2% DO-35 PD-4W          | 28480    | 1902-3137         |
| A3VR5                | 1902-0041      | 4 |   | 1   | DIODE-ZNR 5.11V 5% DO-35 PD-4W          | 28480    | 1902-0041         |
| A3VR6                | 1902-3002      | 3 |   | 1   | DIODE-ZNR 2.37V 5% DO-7 PD-4W TC--074%  | 28480    | 1902-3002         |
| A3W1                 | 01740-61617    | 6 |   | 1   | CABLE ASSEMBLY-COAX                     | 28480    | 01740-61617       |
| A3XU1                | 1200-0638      | 7 |   | 4   | SOCKET-IC 14-CONT DIP DIP-SLDR          | 28480    | 1200-0638         |
| A3XU2                | 1200-0638      | 7 |   |     | SOCKET-IC 14-COFT DIP DIP-SLDR          | 28480    | 1200-0638         |
| A3XU3                | 1200-0638      | 7 |   |     | SOCKET-IC 14-CJNT DIP DIP-SLDR          | 28480    | 1200-0638         |
| A3XU4                | 1200-0638      | 7 |   |     | SOCKET-IC 14-CJNT DIP DIP-SLDR          | 28480    | 1200-0638         |
| A5                   | 01745-66503    | 4 |   | 1   | VERTICAL OUTPUT BOARD ASSEMBLY          | 28480    | 01745-66503       |
| A5C1                 | 0150-0029      | 2 |   | 1   | CAPACITOR-FXD 1PF ±10% 500VDC T1 D10X   | 28480    | 0150-0029         |
| A5C2                 | 0160-2055      | 9 |   | 4   | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2055         |
| A5C3                 | 0121-0489      | 7 |   | 1   | CAPACITOR-V TRMR CER 2.5PF 100V PC-MTG  | 28480    | 0121-0489         |
| A5C3                 | 0160-3567      | 0 |   | 1   | CAPACITOR-FXD 10PF ±5% 100VDC CER 0-30  | 28480    | 0160-3567         |
| A5C4                 | 0160-2055      | 9 |   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2055         |
| A5C5                 | 0160-2055      | 9 |   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2055         |
| A5C6                 | 0160-2255      | 3 |   | 2   | CAPACITOR-FXD 2.2UF ±20% 20VDC TA       | 28480    | 0160-2255         |
| A5C7                 | 0160-2255      | 3 |   |     | CAPACITOR-FXD 2.2UF ±20% 20VDC TA       | 28480    | 0160-2255         |
| A5C8                 | 0160-3650      | 2 |   | 1   | CAPACITOR-FXD 018UF ±10% 50VDC CER      | 28480    | 0160-3650         |
| A5C9                 | 0160-3799      | 0 |   | 2   | CAPACITOR-FXD 18PF ±10% 100VDC CER      | 28480    | 0160-3799         |
| A5C10                | 0160-3569      | 2 |   | 1   | CAPACITOR-FXD 27PF ±5% 100VDC CER 0-30  | 28480    | 0160-3569         |
| A5C10                | 0160-3647      | 7 |   | 1   | CAPACITOR-FXD 22PF ±5% 100VDC CER 0-30  | 28480    | 0160-3647         |
| A5C11                | 0160-3651      | 3 |   | 1   | CAPACITOR-FXD 68PF ±10% 200VDC CER      | 28480    | 0160-3651         |
| A5C12                | 0160-3694      | 4 |   | 1   | CAPACITOR-FXD 330PF ±10% 100VDC CER     | 28480    | 0160-3694         |
| A5C13                | 0180-0269      | 5 |   | 1   | CAPACITOR-FXD 1UF ±50-10% 150VDC AL     | 56289    | 30D105G150BA2     |
| A5C14                | 0160-3799      | 0 |   |     | CAPACITOR-FXD 18PF ±10% 100VDC CER      | 28480    | 0160-3799         |
| A5C15                | 0160-2055      | 9 |   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2055         |
| A5C17                | 0160-3848      | 0 |   | 1   | CAPACITOR-FXD 3.3PF ±5PF 100VDC CER     | 28480    | 0160-3848         |
| A5C18                | 0160-4831      | 3 |   | 2   | CAPACITOR-FXD 4700PF ±10% 100VDC CER    | 28480    | 0160-4831         |
| A5C19                | 0160-4831      | 3 |   |     | CAPACITOR-FXD 4700PF ±10% 100VDC CER    | 28480    | 0160-4831         |
| A5C20                | 0160-5211      | 5 |   | 1   | CAPACITOR-FXD 1UF 250VDC P C            | 28480    | 0160-5211         |
| A5L1                 | 9100-2598      | 8 |   | 2   | INDUCTOR 80NH 6.25% X 26LG Q-35         | 28480    | 9100-2598         |
| A5L2                 | 9100-2257      | 6 |   | 2   | INDUCTOR RF-CH-MLD 820NH 10% 105DX 26LG | 28480    | 9100-2257         |
| A5L3                 | 9100-2257      | 6 |   |     | INDUCTOR RF-CH-MLD 820NH 10% 105DX 26LG | 28480    | 9100-2257         |
| A5L4                 | 9100-2598      | 8 |   |     | INDUCTOR 80NH 6.25% X 26LG Q-35         | 28480    | 9100-2598         |
| A5L5                 | 9100-2249      | 6 |   | 2   | INDUCTOR RF-CH-MLD 150NH 10% 105DX 26LG | 28480    | 9100-2249         |
| A5L6                 | 9100-2249      | 6 |   |     | INDUCTOR RF-CH-MLD 150NH 10% 105DX 26LG | 28480    | 9100-2249         |
| A5L7                 | 9100-2250      | 9 |   | 2   | INDUCTOR RF-CH-MLD 180NH 10% 105DX 26LG | 28480    | 9100-2250         |
| A5L8                 | 9100-2250      | 9 |   |     | INDUCTOR RF-CH-MLD 180NH 10% 105DX 26LG | 28480    | 9100-2250         |
| A5L9                 | 9100-2258      | 7 |   | 1   | INDUCTOR RF-CH-MLD 12UH 10% 105DX 26LG  | 28480    | 9100-2258         |
| A5MP1                | 01740-20506    | 6 |   | 1   | HEAT SINK V OUTPUT                      | 28480    | 01740-20506       |
| A5Q1                 | 1853-0354      | 7 |   | 2   | TRANSISTOR PNP SI TO-92 PD-350MW        | 28480    | 1853-0354         |
| A5Q2                 | 1853-0473      | 1 |   | 2   | TRANSISTOR-HP SPEC PLS P S              | 28480    | 1853-0473         |
| A5Q3                 | 1853-0354      | 7 |   |     | TRANSISTOR PNP SI TO-92 PD-350MW        | 28480    | 1853-0354         |
| A5Q4                 | 1853-0473      | 1 |   |     | TRANSISTOR-HP SPEC PLS P S              | 28480    | 1853-0473         |
| A5R1                 | 0698-4399      | 7 |   | 2   | RESISTOR 88 7 1% 125W F TC-0±100        | 24546    | C4-1/8-T0-88R7-F  |
| A5R2                 | 0757-0734      | 2 |   | 2   | RESISTOR 1.21K 1% 25W F TC-0±100        | 28480    | 0757-0734         |
| A5R3                 | 0757-0719      | 3 |   | 1   | RESISTOR 221 1% 25W F TC-0±100          | 24546    | C5-1/4-T0-221R-F  |
| A5R4                 | 0757-0734      | 2 |   |     | RESISTOR 1.21K 1% 25W F TC-0±100        | 28480    | 0757-0734         |
| A5R5                 | 0698-4399      | 7 |   |     | RESISTOR 88 7 1% 125W F TC-0±100        | 24546    | C4-1/8-T0-88R7-F  |
| A5R6                 | 0698-7096      | 7 |   | 1   | RESISTOR 10 10% 125W CC TC--120/+400    | 01121    | 881001            |
| A5R7                 | 0684-1001      | 5 |   | 1   | RESISTOR 100 10% 25W FC TC--400/+500    | 01121    | CB1011            |
| A5R8                 | 0757-0435      | 0 |   | 2   | RESISTOR 3.92K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-3921-F  |
| A5R9                 | 0698-0083      | 8 |   | 2   | RESISTOR 1.96K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-1961-F  |
| A5R10                | 0684-1001      | 3 |   | 2   | RESISTOR 10 10% 25W FC TC--400/+500     | 01121    | CB1001            |
| A5R11                | 0757-0435      | 0 |   |     | RESISTOR 3.92K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-3921-F  |
| A5R12                | 0684-1001      | 3 |   |     | RESISTOR 10 10% 25W FC TC--400/+500     | 01121    | CB1001            |
| A5R13                | 0698-0083      | 8 |   |     | RESISTOR 1.96K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-1961-F  |
| A5R14                | 0757-0397      | 3 |   | 2   | RESISTOR 68 1 1% 125W F TC-0±100        | 24546    | C4-1/8-T0-68R1-F  |
| A5R15                | 0698-4425      | 0 |   | 2   | RESISTOR 1.54K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-1541-F  |
| A5R16                | 0698-4425      | 0 |   |     | RESISTOR 1.54K 1% 125W F TC-0±100       | 24546    | C4-1/8-T0-1541-F  |
| A5R17                | 0757-0397      | 3 |   |     | RESISTOR 68 1 1% 125W F TC-0±100        | 24546    | C4-1/8-T0-68R1-F  |
| A5R18                | 0757-0289      | 1 |   | 1   | RESISTOR 9.09K 1% 125W F TC-0±100       | 19701    | MFAC1/8-T0-9091-F |
| A5R19                | 2100-2216      | 0 |   | 2   | RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN    | 73138    | 82PR0K            |
| A5R20                | 2100-1788      | 9 |   | 3   | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN   | 73138    | 82PR500           |
| A5R21                | 0757-0400      | 9 |   | 1   | RESISTOR 90.9 1% 125W F TC-0±100        | 24546    | C4-1/8-T0-9091-F  |
| A5R21                | 0757-0401      | 0 |   | 2   | RESISTOR 100 1% 125W F TC-0±100         | 24546    | C4-1/8-T0-101-F   |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                            | Mfr Code | Mfr Part Number    |
|----------------------|----------------|-----|-----|----------------------------------------|----------|--------------------|
| A5R21                | 0757-0401      | 0   |     | RESISTOR 100 1% 125W F TC-0:100        | 24546    | C4 1/8 TO 101 F    |
| A5R22                | 2100-2216      | 0   |     | RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN   | 73138    | 82PR5K             |
| A5R23                | 0698-6435      | 6   | 1   | RESISTOR 2 81K 1% 05W F TC-0:100       | 26480    | 0698 6435          |
| A5R23                | 0698-7245      | 8   | 1   | RESISTOR 2 37K 1% 05W F TC-0:100       | 24546    | C3 1/8 TO 2371-F   |
| A5R23                | 0698-7250      | 5   | 2   | RESISTOR 3 83K 1% 06W F TC-0:100       | 24546    | C3 1/8 TO 3831-F   |
| A5R23                | 0698-7250      | 5   | 2   | RESISTOR 3 33K 1% 05W F TC-0:100       | 24546    | C3 1/8 TO 3831-F   |
| A5R23                | 0698-7252      | 7   | 3   | RESISTOR 4 64K 1% 05W F TC-0:100       | 24546    | C3 1/8 TO 4641 F   |
| A5R23                | 0698-7252      | 7   | 3   | RESISTOR 4 64K 1% 05W F TC-0:100       | 24546    | C3 1/8 TO 4641 F   |
| A5R23                | 0698-7252      | 7   | 3   | RESISTOR 4 64K 1% 05W F TC-0:100       | 24546    | C3 1/8 TO 4641 F   |
| A5R24                | 2100-1788      | 9   |     | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN  | 73138    | 82PR500            |
| A5R25                | 2100-1788      | 9   |     | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN  | 73138    | 82PR500            |
| A5R26                | 0757-0720      | 6   | 1   | RESISTOR 243 1% 25W F TC-0:100         | 24546    | C5 1/4 TO 243R F   |
| A5R27                | 0757-0316      | 6   | 2   | RESISTOR 42 2 1% 125W F TC-0:100       | 24546    | C4 1/8 TO 42R2-F   |
| A5R28                | 0757-0316      | 6   |     | RESISTOR 42 2 1% 125W F TC-0:100       | 24546    | C4 1/8 TO 42R2 F   |
| A5R29                | 0757-0461      | 2   | 2   | RESISTOR 68 1K 1% 125W F TC-0:100      | 24546    | C4 1/8 TO 6812 F   |
| A5R30                | 0757-0461      | 2   | 2   | RESISTOR 68 1K 1% 125W F TC-0:100      | 24546    | C4 1/8 TO 6812 F   |
| A5R31                | 0757-0280      | 3   | 1   | RESISTOR 1K 1% 125W F TC-0:100         | 24546    | C4 1/8 TO 1001-F   |
| A5U1                 | 1NA9 8005      | 1   | 1   | IC-OUTPUT AMPLIFIER                    | 26480    | 1NA9 8005          |
| A5VR1                | 1902-3059      | 0   | 1   | DIODE-ZNR 3 83V 5% DO-35 PD-4W         | 26480    | 1902 3059          |
| A5VR2                | 1902-1392      | 0   | 2   | DIODE-ZNR 30 0V 2% DO-35 PD-4W         | 26480    | 1902 1392          |
| A5VR3                | 1902-17J2      | 0   | 2   | DIODE-ZNR 30 0V 2% DO-35 PD-4W         | 26480    | 1902 1392          |
| A5XA3                | 1251-6137      | 0   | 1   | CONNECTOR                              | 26480    | 1251-6137          |
| A7                   | 01740-66566    | 4   | 1   | HORIZONTAL MOTHERBOARD ASSEMBLY        | 26480    | 01740 66566        |
| A7C1                 | 0160-3569      | 2   | 1   | CAPACITOR-FXD 27PF ±5% 100VDC CER 0:30 | 26480    | 0160-3569          |
| A7C2                 | 0150-2055      | 9   | 26  | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C3                 | 0140-0202      | 2   | 1   | CAPACITOR-FXD 15PF ±5% 500VDC MICA     | 72136    | DM15C150J0500WV1CR |
| A7C4                 | 0150-0070      | 3   | 1   | CAPACITOR-FXD 02UF ±20% 500VDC CER     | 26480    | 0150-0070          |
| A7C5                 | 0140-0196      | 3   | 1   | CAPACITOR-FXD 150PF ±5% 300VDC MICA    | 72136    | DM15F151J0300WV1CR |
| A7C5                 | 0160-3318      | 9   | 1   | CAPACITOR-FXD 047UF ±10% 100VDC CER    | 26480    | 0160 3318          |
| A7C7                 | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160 2055          |
| A7C8                 | 0150-0021      | 4   | 1   | CAPACITOR-FXD 47PF ±5% 500VDC Tl DIOX  | 26480    | 0150 0021          |
| A7C9                 | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C10                | 0140-0193      | 0   | 2   | CAPACITOR-FXD 82PF ±5% 300VDC MICA     | 72136    | DM15E820J0300WV1CR |
| A7C11                | 0160-3443      | 1   | 1   | CAPACITOR-FXD 1UF +80-20% 50VDC CER    | 26480    | 0160-3443          |
| A7C13                | 0160-0195      | 6   | 1   | CAPACITOR-FXD 33UF ±20% 35VDC TA       | 56289    | 1500334X00035A2    |
| A7C14                | 0160-2204      | 0   | 2   | CAPACITOR-FXD 100PF ±5% 300VDC MICA    | 26480    | 0160-2204          |
| A7C15                | 0160-0374      | 3   | 1   | CAPACITOR-FXD 10UF ±10% 20VDC TA       | 56289    | 1500106X902082     |
| A7C16                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C17                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C18                | 0160-0058      | 0   | 1   | CAPACITOR-FXD 50UF +75-10% 25VDC AL    | 56289    | 300506G025CC2      |
| A7C19                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C20                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C20                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C21                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C22                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C23                | 0180-1746      | 5   | 2   | CAPACITOR-FXD 15UF ±10% 20VDC TA       | 56289    | 1500156X902082     |
| A7C24                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C25                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C26                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C27                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C28                | 0180-0106      | 9   | 1   | CAPACITOR-FXD 60UF ±20% 6VDC TA        | 56289    | 1500606X0006B2     |
| A7C29                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C30                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C31                | 0180-0229      | 7   | 1   | CAPACITOR-FXD 33UF ±10% 10VDC TA       | 56289    | 1500336X9010B2     |
| A7C32                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C33                | 0180-1746      | 5   | 2   | CAPACITOR-FXD 15UF ±10% 20VDC TA       | 56289    | 1500156X902082     |
| A7C34                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C35                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C36                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C37                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C38                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C39                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C40                | 0160-2198      | 1   | 2   | CAPACITOR-FXD 20PF ±5% 300VDC MICA     | 26480    | 0160-2198          |
| A7C41                | 0160-2198      | 1   |     | CAPACITOR-FXD 20PF ±5% 300VDC MICA     | 26480    | 0160-2198          |
| A7C42                | 0160-2197      | 0   | 1   | CAPACITOR-FXD 10PF ±5% 300VDC MICA     | 26480    | 0160-2197          |
| A7C44                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C45                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C46                | 0140-0204      | 4   | 1   | CAPACITOR-FXD 47PF ±5% 500VDC MICA     | 72136    | DM15E470J0500WV1CR |
| A7C47                | 0160-2204      | 0   |     | CAPACITOR-FXD 100PF ±5% 300VDC MICA    | 26480    | 0160-2204          |
| A7C48                | 0160-2055      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 26480    | 0160-2055          |
| A7C49                | 0140-0193      | 0   |     | CAPACITOR-FXD 82PF ±5% 300VDC MICA     | 72136    | DM15E820J0300WV1CR |
| A7CR1                | 1901-0376      | 6   | 1   | DIODE-GEN PRP 35V 50MA DO-35           | 26480    | 1901-0376          |
| A7CR2                | 1901-0040      | 1   | 14  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 26480    | 1901-0040          |
| A7CR3                | 1901-0040      | 1   | 14  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 26480    | 1901-0040          |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty                                  | Description                            | Mtr Code                             | Mtr Part Number  |
|----------------------|----------------|-----|--------------------------------------|----------------------------------------|--------------------------------------|------------------|
| A7CR4                | 1901-0040      | 1   | 1                                    | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR5                | 1901-0513      | 3   |                                      | DIODE-DUAL 100V                        | 28480                                | 1901-0513        |
| A7CR6                | 1901-0040      | 1   | 1                                    | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR7                | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR8                | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR9                | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR10               | 1901-0050      | 3   |                                      | DIODE-SWITCHING 80V 200MA 2NS DO-35    | 28480                                | 1901-0050        |
| A7CR11               | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR12               | 1901-0040      | 1   | 2                                    | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR13               | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR15               | 1910-0016      | 0   |                                      | DIODE-GE 60V 60MA 1US DO-7             | 28480                                | 1910-0016        |
| A7CR16               | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR21               | 1901-0040      | 1   | 1                                    | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR22               | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR23               | 1901-0040      | 1   |                                      | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480                                | 1901-0040        |
| A7CR24               | 1910-0016      | 0   |                                      | DIODE-GE 60V 60MA 1US DO-7             | 28480                                | 1910-0016        |
| A7E1                 | 9170-0029      | 3   | 5                                    | CORE-SHIELDING BEAD                    | 28480                                | 9170-0029        |
| A7E2                 | 9170-0029      | 3   |                                      | CORE-SHIELDING BEAD                    | 28480                                | 9170-0029        |
| A7E3                 | 9170-0029      | 3   |                                      | CORE-SHIELDING BEAD                    | 28480                                | 9170-0029        |
| A7E6                 | 9170-0029      | 3   |                                      | CORE-SHIELDING BEAD                    | 28480                                | 9170-0029        |
| A7E7                 | 9170-0029      | 3   |                                      | CORE-SHIELDING BEAD                    | 28480                                | 9170-0029        |
| A7L1                 | 9140-0105      | 3   | 2                                    | INDUCTOR RF-CH-MLD 8 2UH 10%           | 28480                                | 9140-0105        |
| A7L2                 | 9140-0096      | 1   |                                      | INDUCTOR RF-CH-MLD 1UH 10% 166DX 385LG | 28480                                | 9140-0096        |
| A7L3                 | 9100-1813      | 6   |                                      | INDUCTOR RF-CH-MLD 470NH 20%           | 28480                                | 9100-1813        |
| A7L4                 | 9140-0096      | 1   |                                      | INDUCTOR RF-CH-MLD 1UH 10% 166DX 385LG | 28480                                | 9140-0096        |
| A7L5                 | 9140-0106      | 3   |                                      | INDUCTOR RF-CH-MLD 8 2UH 10%           | 28480                                | 9140-0106        |
| A7L6                 | 9140-0096      | 1   | 6                                    | INDUCTOR RF-CH-MLD 1UH 10% 166DX 385LG | 28480                                | 9140-0096        |
| A7L7                 | 9100-1813      | 6   |                                      | INDUCTOR RF-CH-MLD 470NH 20%           | 28480                                | 9100-1813        |
| A7MP1                | 0380-0744      | 5   | 1                                    | SPACER-RND 093-IN LG C9-IN-ID          | 28480                                | 0380-0744        |
| A7P2                 | 1251-6009      | 5   | 1                                    | CONNECTOR 15-PIN M POST TYPE           | 28480                                | 1251-6009        |
| A7P3                 | 1251-6348      | 1   |                                      | CONNECTOR 10-PIN M POST TYPE           | 28480                                | 1251-6348        |
| A7P4                 | 1251-6148      | 3   |                                      | CONNECTOR 8-PIN M POST TYPE            | 28480                                | 1251-6148        |
| A7P5                 | 1251-6012      | 0   |                                      | CONNECTOR 8-PIN M POST TYPE            | 28480                                | 1251-6012        |
| A7Q1                 | 1854-0215      | 1   |                                      | 8                                      | TRANSISTOR NPN SI PD=350MW FT=300MHZ | 04713            |
| A7Q2                 | 1854-0092      | 2   | TRANSISTOR NPN SI PD=200MW FT=600MHZ |                                        | 28480                                | 1854-0092        |
| A7Q3                 | 1854-0092      | 2   | TRANSISTOR NPN SI PD=200MW FT=600MHZ |                                        | 28480                                | 1854-0092        |
| A7Q4                 | 1855-0081      | 1   | TRANSISTOR J-FET N-CHAN D-MODE SI    |                                        | 28780                                | 1855-0081        |
| A7Q5                 | 1854-0092      | 2   | TRANSISTOR NPN SI PD=200MW FT=600MHZ |                                        | 28480                                | 1854-0092        |
| A7Q6                 | 1854-0215      | 1   | 3                                    | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q7                 | 1853-0380      | 9   |                                      | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0380        |
| A7Q8                 | 1853-0380      | 9   |                                      | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0380        |
| A7Q9                 | 1853-0354      | 7   |                                      | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0354        |
| A7Q10                | 1853-0354      | 7   |                                      | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0354        |
| A7Q11                | 1853-0354      | 7   | 7                                    | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0354        |
| A7Q12                | 1853-0380      | 9   |                                      | TRANSISTOR PNP SI TO-92 PD=350MW       | 28480                                | 1853-0380        |
| A7Q13                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q14                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q15                | 1854-0071      | 7   |                                      | TRANSISTOR NPN SI PD=300MW FT=200MHZ   | 28480                                | 1854-0071        |
| A7Q17                | 1854-0071      | 7   | 1                                    | TRANSISTOR NPN SI PD=300MW FT=200MHZ   | 28480                                | 1854-0071        |
| A7Q18                | 1854-0683      | 6   |                                      | TRANSISTOR NPN SI TO-92 PD=310MW       | 04713                                | MPS-A18          |
| A7Q19                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q20                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q21                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q22                | 1853-0015      | 7   | 1                                    | TRANSISTOR PNP SI PD=200MW FT=600MHZ   | 28480                                | 1853-0015        |
| A7Q23                | 1854-0215      | 1   |                                      | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q24                | 1854-0092      | 2   |                                      | TRANSISTOR NPN SI PD=200MW FT=600MHZ   | 28480                                | 1854-0092        |
| A7Q25                | 1854-0092      | 2   |                                      | TRANSISTOR NPN SI PD=200MW FT=600MHZ   | 28480                                | 1854-0092        |
| A7Q26                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q27                | 1854-0215      | 1   | 2                                    | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q28                | 1854-0215      | 1   |                                      | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q29                | 1854-0092      | 2   |                                      | TRANSISTOR NPN SI PD=200MW FT=600MHZ   | 28480                                | 1854-0092        |
| A7Q30                | 1853-0036      | 2   |                                      | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480                                | 1853-0036        |
| A7Q31                | 1854-0215      | 1   |                                      | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q32                | 1854-0215      | 1   | 1                                    | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q33                | 1854-0215      | 1   |                                      | TRANSISTOR NPN SI PD=350MW FT=300MHZ   | 04713                                | 2N3904           |
| A7Q34                | 1854-0092      | 2   |                                      | TRANSISTOR NPN SI PD=200MW FT=600MHZ   | 28480                                | 1854-0092        |
| A7R1                 | 0698-3263      | 2   | 3                                    | RESISTOR 500K 1% .125W F TC=0±100      | 28480                                | 0698-3263        |
| A7R2                 | 0698-3263      | 2   |                                      | RESISTOR 500K 1% .125W F TC=0±100      | 28480                                | 0698-3263        |
| A7R3                 | 0757-0476      | 9   |                                      | RESISTOR 301K 1% .125W F TC=0±100      | 24546                                | C4-1/8-T0-3013-F |
| A7R4                 | 0757-0486      | 1   |                                      | RESISTOR 750K 1% .125W F TC=0±100      | 28480                                | 0757-0486        |
| A7R5                 | 0757-0421      | 4   |                                      | RESISTOR 825 1% .125W F TC=0±100       | 24546                                | C4-1/8-T0-825R-F |
| A7R6                 | 0757-0283      | 6   | 3                                    | RESISTOR 2K 1% .125W F TC=0±100        | 24546                                | C4-1/8-T0-2001-F |
| A7R7                 | 0757-0418      | 9   |                                      | RESISTOR 819 1% .125W F TC=0±100       | 24546                                | C4-1/8-T0-819R-F |
| A7R8                 | 0684-4721      | 0   |                                      | RESISTOR 4.7K 10% .25W FC TC=-400/+700 | 01121                                | CB4721           |
| A7R9                 | 0684-2711      | 4   |                                      | RESISTOR 270 10% .25W FC TC=-400/+800  | 01121                                | CB2711           |
| A7R10                | 0684-1061      | 5   |                                      | RESISTOR 10M 10% .25W FC TC=-900/+1100 | 01121                                | CB1061           |

See introduction to this section for ordering information



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

| Reference Designator | HP Part Number | C D | Qty | Description                           | Mfr Code | Mfr Part Number     |
|----------------------|----------------|-----|-----|---------------------------------------|----------|---------------------|
| A7R88                | 0757-0290      | 5   | 2   | RESISTOR 6 19K 1% 125W F TC=0:100     | 19701    | MF4C1/8-TO-6191-F   |
| A7R89                | 0757-0412      | 3   |     | RESISTOR 365 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-365R-F    |
| A7R90                | 0698-0085      | 0   | 1   | RESISTOR 2 61K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2611-F    |
| A7R91                | 0757-0407      | 6   |     | RESISTOR 200 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-201-F     |
| A7R92                | 0698-3433      | 8   |     | RESISTOR 28 7 1% 125W F TC=0:100      | 03888    | PME55-1/8-TO-28R7-F |
| A7R93                | 2100-3211      | 7   | 1   | RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN  | 28480    | 2100-3211           |
| A7R94                | 0757-0438      | 3   | 2   | RESISTOR 5 11K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-5111-F    |
| A7R95                | 0757-0444      | 1   | 2   | RESISTOR 12 1K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1212-F    |
| A7R96                | 0757-0430      | 5   | 2   | RESISTOR 2 21K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2211-F    |
| A7R98                | 0757-0410      | 1   |     | RESISTOR 301 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-301R-F    |
| A7R99                | 0757-0283      | 6   |     | RESISTOR 2K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-2001-F    |
| A7R100               | 0757-0404      | 3   | 1   | RESISTOR 130 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-131-F     |
| A7R101               | 0757-0418      | 9   |     | RESISTOR 619 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-619R-F    |
| A7R102               | 0698-3446      | 3   |     | RESISTOR 383 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-383R-F    |
| A7R103               | 0698-3155      | 1   | 1   | RESISTOR 4 64K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-4641-F    |
| A7R104               | 0684-3311      | 2   | 2   | RESISTOR 330 10% 25W FC TC=-400/+600  | 01121    | CB3311              |
| A7R105               | 2100-3253      | 7   | 1   | RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN | 28480    | 2100-3253           |
| A7R106               | 0757-0416      | 7   |     | RESISTOR 811 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-611R-F    |
| A7R107               | 0757-0457      | 6   | 1   | RESISTOR 47 6K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-4752-F    |
| A7R108               | 0757-0437      | 2   |     | RESISTOR 4 76K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-4751-F    |
| A7R109               | 0684-1021      | 7   | 5   | RESISTOR 1K 10% 25W FC TC=-400/+600   | 01121    | CB1021              |
| A7R110               | 0684-2221      | 1   |     | RESISTOR 2 2K 10% 25W FC TC=-400/+700 | 01121    | CB2221              |
| A7R111               | 0757-0474      | 7   | 1   | RESISTOR 243K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-2433-F    |
| A7R112               | 0757-0444      | 1   |     | RESISTOR 12 1K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1212-F    |
| A7R113               | 0698-3158      | 4   | 1   | RESISTOR 23 7K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2372-F    |
| A7R114               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F    |
| A7R115               | 0757-0401      | 0   |     | RESISTOR 100 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-101-F     |
| A7R117               | 2100-0568      | 1   | 1   | RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN | 28460    | 2100-0568           |
| A7R118               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R119               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R120               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R121               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R122               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R123               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R124               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R125               | 0684-1021      | 7   |     | RESISTOR 1K 10% 25W FC TC=-400/+600   | 01121    | CB1021              |
| A7R126               | 0684-4711      | 8   |     | RESISTOR 470 10% 25W FC TC=-400/+600  | 01121    | CB4711              |
| A7R127               | 0684-4721      | 0   |     | RESISTOR 4 7K 10% 25W FC TC=-400/+700 | 01121    | CB4721              |
| A7R128               | 0684-1021      | 7   |     | RESISTOR 1K 10% 25W FC TC=-400/+600   | 01121    | CB1021              |
| A7R129               | 0698-3446      | 3   |     | RESISTOR 383 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-383R-F    |
| A7R130               | 0757-0435      | 0   |     | RESISTOR 3 82K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-3921-F    |
| A7R131               | 0698-3446      | 3   |     | RESISTOR 383 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-383R-F    |
| A7R132               | 0698-3446      | 3   |     | RESISTOR 383 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-383R-F    |
| A7R133               | 0757-0434      | 9   |     | RESISTOR 3 65K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-3651-F    |
| A7R134               | 0757-0289      | 2   | 1   | RESISTOR 13 3K 1% 125W F TC=0:100     | 19701    | MF4C1/8-TO-1332-F   |
| A7R135               | 0757-0427      | 0   |     | RESISTOR 1 5K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-1501-F    |
| A7R136               | 0757-0408      | 7   |     | RESISTOR 243 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-243R-F    |
| A7R137               | 0757-0280      | 3   |     | RESISTOR 1K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-1001-F    |
| A7R138               | 0684-4721      | 0   |     | RESISTOR 4 7K 10% 25W FC TC=-400/+700 | 01121    | CB4721              |
| A7R139               | 0684-1021      | 7   |     | RESISTOR 1K 10% 25W FC TC=-400/+600   | 01121    | CB1021              |
| A7R140               | 0757-0438      | 3   |     | RESISTOR 5 11K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-5111-F    |
| A7R141               | 0757-0290      | 5   |     | RESISTOR 6 19K 1% 125W F TC=0:100     | 19701    | MF4C1/8-TO-6191-F   |
| A7R142               | 0684-4721      | 0   |     | RESISTOR 4 7K 10% 25W FC TC=-400/+700 | 01121    | CB4721              |
| A7R143               | 0684-4721      | 0   |     | RESISTOR 4 7K 10% 25W FC TC=-400/+700 | 01121    | CB4721              |
| A7R144               | 0684-4711      | 8   |     | RESISTOR 470 10% 25W FC TC=-400/+600  | 01121    | CB4711              |
| A7R145               | 0757-0416      | 7   |     | RESISTOR 611 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-611R-F    |
| A7R146               | 0757-0430      | 5   |     | RESISTOR 2 21K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-2211-F    |
| A7R147               | 0757-0439      | 4   |     | RESISTOR 6 81K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-6811-F    |
| A7R148               | 0757-0419      | 0   | 1   | RESISTOR 681 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-681R-F    |
| A7R149               | 0684-1021      | 7   |     | RESISTOR 1K 10% 25W FC TC=-400/+600   | 01121    | CB1021              |
| A7R150               | 0757-0391      | 7   | 1   | RESISTOR 39 2 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-39R2-F    |
| A7R151               | 0684-1011      | 5   |     | RESISTOR 100 10% 25W FC TC=-400/+600  | 01121    | CB1011              |
| A7R152               | 0757-0466      | 7   |     | RESISTOR 110K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-1103-F    |
| A7R153               | 0684-4701      | 6   |     | RESISTOR 47 10% 25W FC TC=-400/+500   | 01121    | CB4701              |
| A7R154               | 0684-4711      | 8   |     | RESISTOR 470 10% 25W FC TC=-400/+600  | 01121    | CB4711              |
| A7R155               | 0757-0283      | 6   |     | RESISTOR 2K 1% 125W F TC=0:100        | 24546    | C4-1/8-TO-2001-F    |
| A7R156               | 0684-2701      | 2   |     | RESISTOR 27 10% 25W FC TC=-400/+500   | 01121    | CB2701              |
| A7R157               | 0684-1811      | 3   | 1   | RESISTOR 180 10% 25W FC TC=-400/+600  | 01121    | CB1811              |
| A7R158               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500   | 01121    | CB1001              |
| A7R159               | 0757-0448      | 3   | 1   | RESISTOR 15K 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-1502-F    |
| A7R160               | 0757-0428      | 1   | 1   | RESISTOR 1 62K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-1621-F    |
| A7R161               | 0684-1511      | 0   |     | RESISTOR 150 10% 25W FC TC=-400/+600  | 01121    | CB1511              |
| A7R162               | 0757-0416      | 7   |     | RESISTOR 611 1% 125W F TC=0:100       | 24546    | C4-1/8-TO-611R-F    |
| A7R163               | 0684-1511      | 0   |     | RESISTOR 150 10% 25W FC TC=-400/+600  | 01121    | CB1511              |
| A7R164               | 0684-3311      | 2   |     | RESISTOR 330 10% 25W FC TC=-400/+600  | 01121    | CB3311              |
| A7R165               | 0757-0465      | 6   | 2   | RESISTOR 100K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-1003-F    |
| A7R166               | 0757-0433      | 8   |     | RESISTOR 3 32K 1% 125W F TC=0:100     | 24546    | C4-1/8-TO-3321-F    |
| A7R167               | 0757-0465      | 6   |     | RESISTOR 100K 1% 125W F TC=0:100      | 24546    | C4-1/8-TO-1003-F    |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number    |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|--------------------|
| A7R168               | 0757-0433      | 8   |     | RESISTOR 3 32K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3321-F   |
| A7R169               | 2100-0567      | 0   | 1   | RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN    | 28480    | 2100-0567          |
| A7S1                 | 3101-1906      | 6   | 1   | SWITCH-PUSHBUTTON 4 STATIONS            | 28480    | 3101-1906          |
| A7S2                 | 3101-1908      | 9   | 1   | SWITCH-PUSHBUTTON 6 STATIONS            | 28480    | 3101-1908          |
| A7S3                 | 3101-1907      | 7   | 1   | SWITCH-PUSHBUTTON 4 STATIONS            | 28480    | 3101-1907          |
| A7U1                 | 1826-0069      | 2   | 2   | IC OP AMP GP TO-99 PKG                  | 01295    | LM201AL            |
| A7U2                 | 6081-3019      | 4   | 1   | IC-SEALED PACKAGE                       | 28480    | 6081-3019          |
| A7U3                 | 1826-0069      | 2   |     | IC OP AMP GP TO-99 PKG                  | 01295    | LM201AL            |
| A7U4                 | 1821-0002      | 6   | 1   | TRANSISTOR ARRAY CA3045                 | 31685    | CA3045             |
| A7W1                 | 01740-61605    | 2   | 1   | CABLE ASSEMBLY-GATE DRIVER              | 28480    | 01740-61605        |
| A7XA9                | 1251-6006      | 2   | 1   | CONNECTOR 12-PIN F POST TYPE            | 28480    | 1251-6006          |
| A7XU2                | 1200-0607      | 0   | 1   | SOCKET-IC 16-CONT DIP DIP-SLDR          | 28480    | 1200-060           |
| A7XU4                | 1200-0638      | 7   | 1   | SOCKET-IC 14-CONT DIP DIP-SLDR          | 28480    | 1200-0638          |
| A8                   | 01740-66568    | 6   | 1   | MAIN SWEEP BOARD ASSEMBLY               | 28480    | 01740-66568        |
| A8C1                 | 0160-2065      | 9   | 6   | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8C2                 | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8C3                 | 0180-0197      | 8   | 3   | CAPACITOR-FXD 2 2UF±10% 20VDC TA        | 56289    | 1500225X9020A2     |
| A8C4                 | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8C5                 | 0140-0218      | 0   | 1   | CAPACITOR-FXD 160PF ±2% 300VDC MICA     | 72136    | DM15F161G0300VV1CR |
| A8C1                 | 0160-2204      | 0   | 1   | CAPACITOR-FXD 100PF ±5% 300VDC MICA     | 28480    | 0160-2204          |
| A8C6                 | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8C7                 | 0160-3226      | 8   | 1   | CAPACITOR-FXD 01UF ±10% 400VDC          | 28480    | 0160-3226          |
| A8C10                | 0180-3726      | 3   | 1   | CAPACITOR-FXD 1UF ±10% 40VDC MET-POLYC  | 28480    | 0180-3726          |
| A8C11                | 0180-0481      | 3   | 1   | CAPACITOR-FXD 100UF±10% 20VDC TA        | 56289    | 1080107X9030T2     |
| A8C12                | 0140-0190      | 7   | 1   | CAPACITOR-FXD 39PF ±5% 300VDC MICA      | 72136    | DM15E390J0300VV1CR |
| A8C13                | 0140-0207      | 7   | 1   | CAPACITOR-FXD 330PF ±5% 500VDC MICA     | 72136    | DM15F331J0600VV1CR |
| A8C14                | 0160-0155      | 6   | 1   | CAPACITOR-FXD 3300PF ±10% 200VDC POLYE  | 28480    | 0160-0155          |
| A8C15                | 0160-0194      | 3   | 1   | CAPACITOR-FXD 015UF ±10% 200VDC POLYE   | 28480    | 0160-0194          |
| A8C16                | 0180-2079      | 9   | 1   | CAPACITOR-FXD 39UF±10% 35VDC TA         | 56289    | 1500394X9036A2     |
| A8C17                | 0180-1745      | 4   | 1   | CAPACITOR-FXD 1 5UF±10% 20VDC TA        | 56289    | 1600155X9020A2     |
| A8C18                | 0180-2111      | 0   | 1   | CAPACITOR-FXD 33UF±10% 35VDC TA         | 56289    | 1500336X9036SA     |
| A8C19                | 0180-0197      | 8   |     | CAPACITOR-FXD 2 2UF±10% 20VDC TA        | 56289    | 1500225X9020A2     |
| A8C20                | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8C21                | 0180-0197      | 8   |     | CAPACITOR-FXD 2 2UF±10% 20VDC TA        | 56289    | 1500225X9020A2     |
| A8C22                | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A8CR1                | 1901-0040      | 1   | 4   | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040          |
| A8CR2                | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040          |
| A8CR3                | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040          |
| A8CR4                | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040          |
| A8E1                 | 9170-0029      | 3   | 2   | CORE-SHIELDING BEAD                     | 28480    | 9170-0029          |
| A8E2                 | 9170-0029      | 3   |     | CORE-SHIELDING BEAD                     | 28480    | 9170-0029          |
| A8L1                 | 9140-0105      | 3   | 1   | INDUCTOR RF-CH-MLD 8 2UH 10%            | 28480    | 9140-0105          |
| A8MP1                | 01840-22502    | 7   | 1   | ROLLER-DETENT                           | 28480    | 01840-22502        |
| A8MP2                | 1480-1148      | 6   | 1   | SPRING-TORSION                          | 28480    | 1480-1148          |
| A8Q1                 | 1853-0036      | 2   | 4   | TRANSISTOR PNP SI PD=310MW FT=250MHZ    | 28480    | 1853-0036          |
| A8Q2                 | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD=310MW FT=250MHZ    | 28480    | 1853-0036          |
| A8Q3                 | 1853-0244      | 4   | 1   | TRANSISTOR PNP SI PD=310MW FT=500MHZ    | 04713    | MPS3640            |
| A8Q4                 | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD=310MW FT=250MHZ    | 28480    | 1853-0036          |
| A8Q5                 | 1855-0081      | 1   | 1   | TRANSISTOR J-FET N-CHAN D-MODE SI       | 28480    | 1855-0081          |
| A8Q6                 | 1854-0019      | 3   | 1   | TRANSISTOR NPN SI TO-18 PD=360MW        | 28480    | 1854-0019          |
| A8Q7                 | 1853-0354      | 7   | 1   | TRANSISTOR PNP SI TO-92 PD=350MW        | 28480    | 1853-0354          |
| A8Q8                 | 1853-0036      | 2   |     | TRANSISTOR PNP SI PD=310MW FT=250MHZ    | 28480    | 1853-0036          |
| A8Q9                 | 1854-0071      | 7   | 3   | TRANSISTOR NPN SI PD=300MW FT=200MHZ    | 28480    | 1854-0071          |
| A8Q10                | 1854-0215      | 1   | 1   | TRANSISTOR NPN SI PD=350MW FT=300MHZ    | 04713    | 2N3904             |
| A8Q11                | 1854-0071      | 7   |     | TRANSISTOR NPN SI PD=300MW FT=200MHZ    | 28480    | 1854-0071          |
| A8Q12                | 1854-0071      | 7   |     | TRANSISTOR NPN SI PD=300MW FT=200MHZ    | 28480    | 1854-0071          |
| A8Q13                | 1854-0683      | 6   | 1   | TRANSISTOR NPN SI TO-92 PD=310MW        | 04713    | MPS-A18            |
| A8R1                 | 0684-3901      | 6   | 3   | RESISTOR 39 10% .25W FC TC=-400/+500    | 01121    | CB3901             |
| A8R2                 | 0698-3151      | 7   | 1   | RESISTOR 2 87K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-2871-F   |
| A8R3                 | 0757-0407      | 6   | 1   | RESISTOR 200 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-201-F    |
| A8R4                 | 0684-3901      | 6   |     | RESISTOR 39 10% .25W FC TC=-400/+500    | 01121    | CB3901             |
| A8R5                 | 0757-0411      | 2   | 1   | RESISTOR 332 1% .125W F TC=0±100        | 24546    | C4-1/8-T0-332R-F   |
| A8R6                 | 0684-8201      | 9   | 1   | RESISTOR 82 10% .25W FC TC=-400/+500    | 01121    | CB8201             |
| A8R7                 | 0757-0428      | 1   | 1   | RESISTOR 1 82K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-1821-F   |
| A8R8                 | 0684-1011      | 5   | 3   | RESISTOR 100 10% .25W FC TC=-400/+500   | 01121    | CB1011             |
| A8R9                 | 0684-2251      | 7   | 1   | RESISTOR 2.2K 10% .25W FC TC=-900/+1100 | 01121    | CB2251             |
| A8R12                | 2100-3066      | 8   | 4   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN  | 02111    | 43P502             |
| A8R13                | 2100-3066      | 8   |     | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN  | 02111    | 43P502             |
| A8R14                | 2100-3066      | 8   |     | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN  | 02111    | 43P502             |
| A8R15                | 0757-0434      | 9   | 1   | RESISTOR 3 65K 1% .125W F TC=0±100      | 24546    | C4-1/8-T0-3651-F   |
| A8R16                | 0757-0440      | 7   | 1   | RESISTOR 7 5K 1% .125W F TC=0±100       | 24546    | C4-1/8-T0-7501-F   |
| A8R17                | 0698-6450      | 5   | 1   | RESISTOR 2.6K 1% .125W F TC=0±50        | 28480    | 0698-6450          |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C | D | Qty | Description                            | Mfr Code | Mfr Part Number    |
|----------------------|----------------|---|---|-----|----------------------------------------|----------|--------------------|
| ABR18                | 0698-6449      | 0 |   | 1   | RESISTOR 5K 1% 125W F TC=0±50          | 19701    | MF4C1/8-T2-5001-B  |
| ABR19                | 0698-4157      | 5 |   | 1   | RESISTOR 10K 1% 125W F TC=0±50         | 28480    | 0698-4157          |
| ABR20                | 0698-6942      | 0 |   | 1   | RESISTOR 25K 1% 125W F TC=0±50         | 28480    | 0698-6942          |
| ABR21                | 0698-6450      | 3 |   | 1   | RESISTOR 50K 1% 125W F TC=0±50         | 19701    | MF4C1/8-T2-5002-B  |
| ABR22                | 0698-4158      | 6 |   | 1   | RESISTOR 100K 1% 125W F TC=0±50        | 28480    | 0698-4158          |
| ABR23                | 0684-1021      | 7 |   | 1   | RESISTOR 1K 10% 25W FC TC=-400/+600    | 01121    | CB1021             |
| ABR24                | 0757-0284      | 7 |   | 2   | RESISTOR 150 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-151-F    |
| ABR26                | 0684-1011      | 5 |   | 6   | RESISTOR 100 10% 25W FC TC=-400/+500   | 01121    | CB1011             |
| ABR27                | 0684-1031      | 9 |   | 1   | RESISTOR 10K 10% 25W FC TC=-400/+700   | 01121    | CB1031             |
| ABR28                | 0684-3321      | 4 |   | 1   | RESISTOR 33K 10% 25W FC TC=-400/+700   | 01121    | CB3321             |
| ABR29                | 0684-1011      | 5 |   | 6   | RESISTOR 100 10% 25W FC TC=-400/+500   | 01121    | CB1011             |
| ABR30                | 0757-0284      | 7 |   | 7   | RESISTOR 150 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-151-F    |
| ABR31                | 0757-0416      | 7 |   | 1   | RESISTOR 511 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-511-F    |
| ABR32                | 0757-0273      | 4 |   | 1   | RESISTOR 301K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-3011-F   |
| ABR33                | 0698-3150      | 6 |   | 1   | RESISTOR 237K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-2371-F   |
| ABR34                | 0757-0283      | 6 |   | 1   | RESISTOR 2K 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-2001-F   |
| ABR35                | 0684-3111      | 2 |   | 1   | RESISTOR 330 10% 25W FC TC=-400/+600   | 01121    | CB3311             |
| ABR36                | 0684-3901      | 6 |   | 1   | RESISTOR 39 10% 25W FC TC=-400/+500    | 01121    | CB3901             |
| ABR37                | 0684-6821      | 6 |   | 1   | RESISTOR 68K 10% 25W FC TC=-400/+700   | 01121    | CB6821             |
| ABR38                | 0757-0439      | 4 |   | 1   | RESISTOR 681K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-6811-F   |
| ABR39                | 0757-0420      | 3 |   | 1   | RESISTOR 750 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-751-F    |
| ABR40                | 0757-0464      | 3 |   | 1   | RESISTOR 332K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-3322-F   |
| ABR41                | 0684-0271      | 7 |   | 2   | RESISTOR 27 10% 25W FC TC=-400/+500    | 01121    | CB27G1             |
| ABR42                | 0684-0271      | 7 |   | 7   | RESISTOR 27 10% 25W FC TC=-400/+500    | 01121    | CB27G1             |
| ABR43                | 2100-3066      | 8 |   | 1   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN | 02111    | 43P502             |
| ABS1MP1              | 01740-61901    | 1 |   | 1   | SWITCH ASSEMBLY-ROTARY (MALE)          | 28480    | 01740-61901        |
| ABS1MP2              | 01740-61902    | 2 |   | 1   | SWITCH ASSEMBLY-ROTARY (FEMALE)        | 28480    | 01740-61902        |
| ABS1MP3              | 0510-1101      | 7 |   | 1   | RING-RETAINING                         | 28480    | 0510-1101          |
| ABU1                 | 1828-0086      | 5 |   | 1   | IC OP AMP PRGMBL T0-99 PKG             | 04713    | MC1776CG           |
| ABXA7                | 1251-6136      | 9 |   | 1   | CONNECTOR 10-PIN F POST TYPE           | 28480    | 1251-6136          |
| ABXU1                | 1200-0475      | 0 |   | 8   | CONNECTOR-SGL CONT SKT 017-IN-BSC-SZ   | 28480    | 1200-0475          |
| A9                   | 01740-66666    | 3 |   | 1   | DELAY SWEEP BOARD ASSEMBLY             | 28480    | 01740-66666        |
| ASC1                 | 0160-2250      | 5 |   | 1   | CAPACITOR-FXD 5 1PF ±25PF 500VDC CER   | 28480    | 0160-2250          |
| ASC2                 | 0160-2065      | 9 |   | 5   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2065          |
| ASC3                 | 0160-2065      | 9 |   | 9   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2065          |
| ASC4                 | 0160-2204      | 0 |   | 1   | CAPACITOR-FXD 100PF ±5% 300VDC MICA    | 28480    | 0160-2204          |
| ASC6                 | 0160-2065      | 9 |   | 9   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2065          |
| ASC7                 | 0140-0218      | 0 |   | 1   | CAPACITOR-FXD 180PF ±2% 300VDC MICA    | 72136    | DM15F161G0300WV1CR |
| ASC8                 | 0160-3226      | 8 |   | 1   | CAPACITOR-FXD 01UF ±10% 400VDC         | 28480    | 0160-3226          |
| ASC9                 | 0160-3726      | 3 |   | 1   | CAPACITOR-FXD 1UF ±10% 40VDC MET-POLYC | 28480    | 0160-3726          |
| ASC10                | 0160-2065      | 9 |   | 1   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2065          |
| ASC11                | 0180-0269      | 5 |   | 1   | CAPACITOR-FXD 1UF+50-10% 150VDC AL     | 56289    | 30D106G1508A2      |
| ASC14                | 0160-2065      | 9 |   | 1   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2065          |
| ASC15                | 0180-0197      | 8 |   | 1   | CAPACITOR-FXD 2.2UF±10% 20VDC TA       | 56289    | 150D225X9020A2     |
| ASC11                | 1901-0040      | 1 |   | 2   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040          |
| ASC12                | 1901-0040      | 1 |   | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040          |
| ASL1                 | 9140-0106      | 3 |   | 1   | INDUCTOR RF-CH-MLD 8 2UH 10%           | 28480    | 9140-0106          |
| ASMP1                | 01840-22502    | 7 |   | 1   | ROLLER-DETENT                          | 28480    | 01840-22502        |
| ASMP2                | 1460-1148      | 6 |   | 1   | SPRING-TORSION                         | 28480    | 1460-1148          |
| ASQ1                 | 1853-0036      | 2 |   | 3   | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480    | 1853-0036          |
| ASQ2                 | 1853-0036      | 2 |   | 2   | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480    | 1853-0036          |
| ASQ3                 | 1853-0036      | 2 |   | 2   | TRANSISTOR PNP SI PD=310MW FT=250MHZ   | 28480    | 1853-0036          |
| ASQ4                 | 1853-0244      | 4 |   | 1   | TRANSISTOR PNP SI PD=310MW FT=500MHZ   | 04713    | MPS3640            |
| ASQ5                 | 1854-0683      | 6 |   | 1   | TRANSISTOR NPN SI T0-92 PD=310MW       | 04713    | MPS-A18            |
| ASQ6                 | 1855-0081      | 1 |   | 1   | TRANSISTOR J-FET N-CHAN D-MODE SI      | 28480    | 1855-0081          |
| ASQ7                 | 1854-0019      | 3 |   | 1   | TRANSISTOR NPN SI T0-18 PD=360MW       | 28480    | 1854-0019          |
| ASR1                 | 0684-1021      | 7 |   | 1   | RESISTOR 1K 10% 25W FC TC=-400/+600    | 01121    | CB1021             |
| ASR2                 | 0757-0284      | 7 |   | 2   | RESISTOR 150 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-151-F    |
| ASR3                 | 0757-0834      | 3 |   | 7   | RESISTOR 5 62K 1% 5W F TC=0±100        | 28480    | 0757-0834          |
| ASR4                 | 0684-1011      | 5 |   | 2   | RESISTOR 100 10% 25W FC TC=-400/+500   | 01121    | CB1011             |
| ASR5                 | 0757-0193      | 7 |   | 1   | RESISTOR 3.32K 1% 5W F TC=0±100        | 28480    | 0757-0193          |
| ASR6                 | 0757-0442      | 8 |   | 1   | RESISTOR 10K 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-1002-F   |
| ASR7                 | 0757-0280      | 3 |   | 1   | RESISTOR 1K 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-1001-F   |
| ASR10                | 2100-3066      | 8 |   | 3   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN | 02111    | 43P502             |
| ASR11                | 2100-3066      | 8 |   | 8   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN | 02111    | 43P502             |
| ASR12                | 0757-0433      | 8 |   | 1   | RESISTOR 3.32K 1% 125W F TC=0±100      | 24546    | C4-1/8-T0-3321-F   |
| ASR13                | 0757-0440      | 7 |   | 1   | RESISTOR 75K 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-7501-F   |
| ASR14                | 0698-6450      | 5 |   | 1   | RESISTOR 25K 1% 125W F TC=0±50         | 28480    | 0698-6450          |
| ASR15                | 0698-6449      | 0 |   | 1   | RESISTOR 5K 1% 125W F TC=0±50          | 19701    | MF4C1/8-T2-5001-B  |
| ASR16                | 0698-4157      | 5 |   | 1   | RESISTOR 10K 1% 125W F TC=0±50         | 28480    | 0698-4157          |
| ASR17                | 0698-6942      | 0 |   | 1   | RESISTOR 25K 1% 125W F TC=0±50         | 28480    | 0698-6942          |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C | D  | Qty | Description                            | Mfr Code | Mfr Part Number     |
|----------------------|----------------|---|----|-----|----------------------------------------|----------|---------------------|
| A9R18                | 0698-6450      | 3 | 1  | 1   | RESISTOR 50K 1% 125W F TC -0±100       | 19701    | MF4C1/8-T2 5002-B   |
| A9R19                | 0698-4158      | 8 | 1  | 1   | RESISTOR 100K 1% 125W F TC -0±50       | 28480    | 0698-4158           |
| A9R20                | 0757-0284      | 7 | 1  | 1   | RESISTOR 150 1% 125W F TC -0±100       | 24546    | C4-1/8-TO 151-F     |
| A9R21                | 0683-0475      | 1 | 1  | 1   | RESISTOR 4 7.5% 25W FC TC --400/+500   | 01121    | CB47G5              |
| A9R22                | 0684-1011      | 5 | 1  | 1   | RESISTOR 100 10% 25W FC TC --400/+500  | 01121    | CB1011              |
| A9R23                | 0684-1031      | 9 | 1  | 1   | RESISTOR 10K 10% 25W FC TC --400/+700  | 01121    | CB1031              |
| A9R24                | 0757-0430      | 9 | 1  | 1   | RESISTOR 80 9 1% 125W F TC -0±100      | 24546    | C4-1/8-TO-90R9-F    |
| A9R25                | 0684-1001      | 3 | 1  | 1   | RESISTOR 10 10% 25W FC TC --400/+500   | 01121    | CB1001              |
| A9R27                | 0683-0275      | 9 | 1  | 1   | RESISTOR 2 7.5% 25W FC TC --400/+500   | 01121    | CB27G5              |
| A9R28                | 2100-3066      | 8 | 1  | 1   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN | 02111    | 43P502              |
| A9S1MP1              | 01740-61903    | 3 | 1  | 1   | SWITCH ASSEMBLY-ROTARY (MALE)          | 28480    | 01740-61903         |
| A9S1MP2              | 01740-61904    | 4 | 1  | 1   | SWITCH ASSEMBLY-ROTARY (FEMALE)        | 28480    | 01740-61904         |
| A9S1MP3              | 0610-1101      | 7 | 1  | 1   | RING-RETAINING                         | 28480    | 0610-1101           |
| A9U1                 | 1826-0069      | 2 | 1  | 1   | IC OP AMP GP TO-99 PKG                 | 01295    | LM201AL             |
| A9XA1                | 1251-6105      | 2 | 1  | 1   | CONNECTOR                              | 28480    | 1251-6105           |
| A9XA10               | 1251-3352      | 5 | 1  | 1   | CONNECTOR PC EDGE 12-CONT/ROW 1 ROW    | 28480    | 1251-3352           |
| A9XU1                | 1200-0475      | 0 | 1  | 1   | CONNECTOR SGL CONT SKT 017-IN-BSC-SZ   | 28480    | 1200-0475           |
| A10                  | 01745-66504    | 5 | 1  | 1   | DELAY TRIGGER BOARD ASSEMBLY           | 28480    | 01745-66504         |
| A10C1                | 0150-0070      | 3 | 1  | 1   | CAPACITOR-FXD 02UF ±20% 500VDC CER     | 28480    | 0150-0070           |
| A10C2                | 0160-2204      | 0 | 1  | 1   | CAPACITOR-FXD 100PF ±5% 300VDC MICA    | 28480    | 0160-2204           |
| A10C3                | 0160-2055      | 9 | 5  | 5   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055           |
| A10C4                | 0160-2055      | 0 | 1  | 1   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055           |
| A10C5                | 0140-0197      | 4 | 1  | 1   | CAPACITOR-FXD 180PF ±5% 300VDC MICA    | 72136    | DM15F181J0300WV1CR  |
| A10C7                | 0160-2055      | 9 | 3  | 3   | CAPACITOR-FXD 01UF +80-20% 100VDC CER  | 28480    | 0160-2055           |
| A10C8                | 0180-0197      | 8 | 3  | 3   | CAPACITOR-FXD 2 2UF ±10% 20VDC TA      | 56289    | 1500225X9020A2      |
| A10C9                | 0160-2055      | 9 | 3  | 3   | CAPACITOR-FXD 01UF +60-20% 100VDC CER  | 28480    | 0160-2055           |
| A10C10               | 0180-0197      | 8 | 3  | 3   | CAPACITOR-FXD 2 2UF ±10% 20VDC TA      | 56289    | 1500225X9020A2      |
| A10C11               | 0160-2055      | 9 | 3  | 3   | CAPACITOR-FXD 01UF +60-20% 100VDC CER  | 28480    | 0160-2055           |
| A10C12               | 0180-0197      | 8 | 1  | 1   | CAPACITOR-FXD 2 2UF ±10% 20VDC TA      | 56289    | 1500225X9020A2      |
| A10C13               | 0150-0048      | 5 | 1  | 1   | CAPACITOR-FXD 22PF ±5% 500VDC T1 DIOX  | 28480    | 0150-0048           |
| A10CR1               | 1901-0040      | 1 | 12 | 12  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR2               | 1901-0040      | 1 | 12 | 12  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR3               | 1901-0040      | 1 | 12 | 12  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR4               | 1901-0040      | 1 | 12 | 12  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR5               | 1901-0040      | 1 | 12 | 12  | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR7               | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR8               | 1910-0018      | 0 | 1  | 1   | DIODE-GE 60V 60MA 1US DO-7             | 28480    | 1910-0018           |
| A10CR9               | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR10              | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR11              | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR12              | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR13              | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10CR14              | 1901-0040      | 1 | 1  | 1   | DIODE-SWITCHING 30V 50MA 2NS DO-35     | 28480    | 1901-0040           |
| A10L1                | 9140-0106      | 3 | 1  | 1   | INDUCTOR RF-CH-MLD 8 2UH 10%           | 28480    | 9140-0106           |
| A10MP1               | 0380-0744      | 5 | 10 | 10  | SPACER- C90 093                        | 28480    | 0380-0744           |
| A10Q1                | 1855-0262      | 0 | 1  | 1   | TRANSISTOR JFET DUAL N-CHAN D-MODE SI  | 28480    | 1855-0262           |
| A10Q3                | 1854-0215      | 1 | 2  | 2   | TRANSISTOR NPN SI PD-350MW FT-300MHZ   | 04713    | 2N3904              |
| A10Q4                | 1854-0215      | 1 | 2  | 2   | TRANSISTOR NPN SI PD-350MW FT-300MHZ   | 04713    | 2N3904              |
| A10Q5                | 1854-0092      | 2 | 2  | 2   | TRANSISTOR NPN SI PD-200MW FT-600MHZ   | 28480    | 1854-0092           |
| A10Q6                | 1854-0092      | 2 | 2  | 2   | TRANSISTOR NPN SI PD-200MW FT-600MHZ   | 28480    | 1854-0092           |
| A10Q7                | 1854-0071      | 7 | 2  | 2   | TRANSISTOR NPN SI PD-300MW FT-200MHZ   | 28480    | 1854-0071           |
| A10Q8                | 1853-0036      | 2 | 2  | 2   | TRANSISTOR PNP SI PD-310MW FT-250MHZ   | 28480    | 1853-0036           |
| A10Q9                | 1854-0071      | 7 | 2  | 2   | TRANSISTOR NPN SI PD-300MW FT-200MHZ   | 28480    | 1854-0071           |
| A10Q10               | 1853-0036      | 2 | 2  | 2   | TRANSISTOR PNP SI PD-310MW FT-250MHZ   | 28480    | 1853-0036           |
| A10R1                | 0757-0465      | 5 | 2  | 2   | RESISTOR 100K 1% 125W F TC -0±100      | 24546    | C4-1/8-TO-1003-F    |
| A10R2                | 0757-0488      | 3 | 2  | 2   | RESISTOR 909K 1% 125W F TC -0±100      | 24546    | 0757-0488           |
| A10R3                | 0684-3901      | 5 | 3  | 3   | RESISTOR 39 10% 25W FC TC --400/+500   | 01121    | CB3901              |
| A10R4                | 0684-3901      | 5 | 3  | 3   | RESISTOR 39 10% 25W FC TC --400/+500   | 01121    | CB3901              |
| A10R5                | 0757-0407      | 5 | 2  | 2   | RESISTOR 200 1% 125W F TC -0±100       | 24546    | C4-1/8-TO-201-F     |
| A10R6                | 0757-0419      | 0 | 1  | 1   | RESISTOR 681 1% 125W F TC -0±100       | 24546    | C4-1/8-TO-681R-F    |
| A10R7                | 0757-0407      | 5 | 1  | 1   | RESISTOR 200 1% 125W F TC -0±100       | 24546    | C4-1/8-TO-201-F     |
| A10R8                | 0684-4721      | 0 | 2  | 2   | RESISTOR 4 7K 10% 25W FC TC --400/+700 | 01121    | CB4721              |
| A10R9                | 2100-3351      | 6 | 1  | 1   | RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN | 28480    | 2100-3351           |
| A10R10               | 2100-3434      | 6 | 1  | 1   | RESISTOR-VAR CONTROL CP 50K 10% LIN    | 01121    | 73U4NO48P503U       |
| A10R11               | 0757-0283      | 5 | 1  | 1   | RESISTOR 2K 1% 125W F TC -0±100        | 24546    | C4-1/8-TO-2001-F    |
| A10R13               | 0757-0408      | 7 | 1  | 1   | RESISTOR 243 1% 125W F TC -0±100       | 24546    | C4-1/8-TO-243R-F    |
| A10R14               | 0684-4721      | 0 | 2  | 2   | RESISTOR 4 7K 10% 25W FC TC --400/+700 | 01121    | CB4721              |
| A10R15               | 0757-0427      | 0 | 2  | 2   | RESISTOR 1 5K 1% 125W F TC -0±100      | 24546    | C4-1/8-TO-1501-F    |
| A10R16               | 0698-3433      | 5 | 2  | 2   | RESISTOR 28 7 1% 125W F TC -0±100      | 03888    | PME55-1/8-TO-28R7-F |
| A10R17               | 0698-3433      | 8 | 1  | 1   | RESISTOR 28 7 1% 125W F TC -0±100      | 03888    | PME55-1/8-TO-28R7-F |
| A10R18               | 0698-3152      | 8 | 1  | 1   | RESISTOR 3 48K 1% 125W F TC -0±100     | 24546    | C4-1/8-TO-3481-F    |
| A10R19               | 0757-0438      | 3 | 2  | 2   | RESISTOR 5 11K 1% 125W F TC -0±100     | 24546    | C4-1/8-TO-5111-F    |
| A10R20               | 0684-1531      | 4 | 1  | 1   | RESISTOR 15K 10% 25W FC TC --400/+800  | 01121    | CB1531              |
| A10R21               | 0757-0420      | 3 | 4  | 4   | RESISTOR 750 1% 125W F TC -0±100       | 24546    | C4-1/8-TO-751-F     |

See introduction to this section for ordering information



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

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number    |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|--------------------|
| A10R22               | 0757-0443      | 0   | 2   | RESISTOR 11K 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-1102-F   |
| A10R23               | 0757-0420      | 3   |     | RESISTOR 750 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-751-F    |
| A10R24               | 0757-0438      | 3   |     | RESISTOR 5 11K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-5111-F   |
| A10R25               | 0684-6811      | 3   | 2   | RESISTOR 680 10% 25W FC TC=-400/+600    | 01121    | CB6811             |
| A10R26               | 0684-6811      | 3   |     | RESISTOR 680 10% 25W FC TC=-400/+600    | 01121    | CB6811             |
| A10R27               | 0757-0200      | 7   | 1   | RESISTOR 6 62K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-6621-F   |
| A10R28               | 0757-0420      | 3   |     | RESISTOR 750 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-751-F    |
| A10R29               | 0757-0418      | 9   | 1   | RESISTOR 819 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-819R-F   |
| A10R30               | 0757-0433      | 8   | 1   | RESISTOR 3 32K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-3321-F   |
| A10R31               | 0757-0443      | 0   |     | RESISTOR 11K 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-1102-F   |
| A10R32               | 0757-0420      | 3   |     | RESISTOR 750 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-751-F    |
| A10R33               | 0684-1001      | 3   | 2   | RESISTOR 10 10% 25W FC TC=-400/+500     | 01121    | CB1001             |
| A10R34               | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500     | 01121    | CB1001             |
| A10R35               | 0684-3901      | 6   |     | RESISTOR 39 10% 25W FC TC=-400/+500     | 01121    | CB3901             |
| A10R36               | 0757-0427      | 0   |     | RESISTOR 1 5K 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-1501-F   |
| A10R37               | 0757-0488      | 3   |     | RESISTOR 809K 1% 125W F TC=0±100        | 28480    | 0757-0488          |
| A10R38               | 0757-0465      | 8   |     | RESISTOR 100K 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-1003-F   |
| A10R39               | 0684-1011      | 5   | 2   | RESISTOR 100 10% 25W FC TC=-400/+500    | 01121    | CB1011             |
| A10R40               | 0684-1011      | 5   |     | RESISTOR 100 10% 25W FC TC=-400/+500    | 01121    | CB1011             |
| A10R41               | 0757-0428      | 1   | 1   | RESISTOR 1 62K 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-1621-F   |
| A10S1                | 3101-1904      | 4   | 1   | SWITCH-PUSHBUTTON 6 STATIONS            | 28480    | 3101-1904          |
| A10U1                | 5081-3019      | 4   | 1   | IC-SEALED PACKAGE                       | 28480    | 5081-3019          |
| A10VR1               | 1902-3082      | 9   | 1   | DIODE-ZNR 4.64V 5% DO-35 PD=4W          | 28480    | 1902-3082          |
| A10XU1               | 1200-0607      | 0   | 1   | SOCKET-IC 16-CONT DIP DIP-SLDR          | 28480    | 1200-0607          |
| A11                  | 01740-66569    | 7   | 1   | HORIZONTAL OUTPUT BOARD ASSEMBLY        | 28480    | 01740-66569        |
| A11C1                | 0160-2065      | 9   | 2   | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A11C2                | 0160-2065      | 9   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065          |
| A11C3                | 0160-3665      | 9   | 7   | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C4                | 0160-3502      | 3   | 2   | CAPACITOR-FXD 3PF ±5% 500VDC TI DIOX    | 28480    | 0160-3502          |
| A11C5                | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C6                | 0140-0192      | 9   | 3   | CAPACITOR-FXD 68PF ±5% 300VDC MICA      | 72136    | DM15E680J0300WV1CR |
| A11C7                | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C8                | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C9                | 0140-0192      | 9   |     | CAPACITOR-FXD 68PF ±5% 300VDC MICA      | 72136    | DM15E680J0300WV1CR |
| A11C10               | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C11               | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C12               | 0160-3665      | 9   |     | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480    | 0160-3665          |
| A11C13               | 0160-3502      | 3   |     | CAPACITOR-FXD 3PF ±5% 500VDC TI DIOX    | 28480    | 0160-3502          |
| A11C14               | 0140-0192      | 9   |     | CAPACITOR-FXD 68PF ±5% 300VDC MICA      | 72136    | DM15E680J0300WV1CR |
| A11E1                | 9170-0029      | 3   | 2   | CORE-SHIELDING BEAD                     | 28480    | 9170-0029          |
| A11E2                | 9170-0029      | 3   |     | CORE-SHIELDING BEAD                     | 28480    | 9170-0029          |
| A11MP1               | 1200-0185      | 0   | 1   | HEAT SINK SGL T0-18 TO-39 CS            | 30161    | 32258              |
| A11MP2               | 1200-0185      | 9   | 1   | INSULATOR-XSTR NYLON                    | 28480    | 1200-0185          |
| A11Q1                | 1854-0019      | 3   | 2   | TRANSISTOR NPN SI T0-18 PD=350MW        | 28480    | 1854-0019          |
| A11Q2                | 1853-0354      | 7   | 2   | TRANSISTOR PNP SI T0-92 PD=350MW        | 28480    | 1853-0354          |
| A11Q3                | 1854-0419      | 7   | 1   | TRANSISTOR NPN SI T0-39 PD=1W FT=200MHZ | 28480    | 1854-0419          |
| A11Q4                | 1853-0038      | 4   | 1   | TRANSISTOR PNP SI T0-39 PD=1W FT=100MHZ | 28480    | 1853-0038          |
| A11Q5                | 1853-0354      | 7   |     | TRANSISTOR PNP SI T0-92 PD=350MW        | 28480    | 1853-0354          |
| A11Q6                | 1854-0019      | 3   |     | TRANSISTOR NPN SI T0-18 PD=350MW        | 28480    | 1854-0019          |
| A11Q7                | 1853-0232      | 0   | 1   | TRANSISTOR PNP SI T0-39 PD=1W FT=200MHZ | 28480    | 1853-0232          |
| A11Q8                | 1854-0523      | 4   | 1   | TRANSISTOR NPN SI T0-39 PD=1W FT=150MHZ | 28480    | 1854-0523          |
| A11R1                | 0684-1001      | 3   | 2   | RESISTOR 10 10% 25W FC TC=-400/+500     | 01121    | CB1001             |
| A11R2                | 0684-1011      | 5   | 1   | RESISTOR 100 10% 25W FC TC=-400/+500    | 01121    | CB1011             |
| A11R3                | 0684-1001      | 3   |     | RESISTOR 10 10% 25W FC TC=-400/+500     | 01121    | CB1001             |
| A11R4                | 0757-0645      | 6   | 4   | RESISTOR 18 2K 1% 5W F TC=0±100         | 28480    | 0757-0645          |
| A11R5                | 0684-4721      | 1   | 2   | RESISTOR 4 7K 10% 25W FC TC=-400/+700   | 01121    | CB4721             |
| A11R6                | 0683-0685      | 5   | 2   | RESISTOR 6 8 5% 25W FC TC=-400/+500     | 01121    | CB68G5             |
| A11R7                | 0684-3901      | 6   | 2   | RESISTOR 39 10% 25W FC TC=-400/+500     | 01121    | CB3901             |
| A11R8                | 0683-6835      | 9   | 2   | RESISTOR 68K 5% 25W FC TC=-400/+800     | 01121    | CB6835             |
| A11R9                | 0757-0394      | 0   | 2   | RESISTOR 51.1 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-51R1-F   |
| A11R10               | 2100-3273      | 1   | 2   | RESISTOR-TRMR 2K 10% C SIDE-ADJ 1 RN    | 28480    | 2100-3273          |
| A11R11               | 0757-0768      | 2   | 2   | RESISTOR 47 5K 1% 25W F TC=0±100        | 24546    | C5-1/4-T0-4752-F   |
| A11R12               | 0757-0283      | 6   | 2   | RESISTOR 2K 1% 125W F TC=0±100          | 24546    | C4-1/8-T0-2001-F   |
| A11R13               | 0757-0411      | 2   | 2   | RESISTOR 332 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-332R-F   |
| A11R14               | 0683-6835      | 9   |     | RESISTOR 68K 5% 25W FC TC=-400/+800     | 01121    | CB6835             |
| A11R15               | 2100-3273      | 1   |     | RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN   | 28480    | 2100-3273          |
| A11R16               | 0757-0394      | 0   |     | RESISTOR 51.1 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-51R1-F   |
| A11R17               | 0757-0768      | 2   |     | RESISTOR 47 5K 1% 25W F TC=0±100        | 24546    | C5-1/4-T0-4752-F   |
| A11R18               | 0757-0283      | 6   |     | RESISTOR 2K 1% 125W F TC=0±100          | 24546    | C4-1/8-T0-2001-F   |
| A11R19               | 0757-0411      | 2   |     | RESISTOR 332 1% 125W F TC=0±100         | 24546    | C4-1/8-T0-332R-F   |
| A11R20               | 0683-0685      | 5   |     | RESISTOR 6 8 5% 25W FC TC=-400/+500     | 01121    | CB68G5             |
| A11R21               | 0684-3901      | 6   |     | RESISTOR 39 10% 25W FC TC=-400/+500     | 01121    | CB3901             |
| A11R22               | 0684-4721      | 0   |     | RESISTOR 4 7K 10% 25W FC TC=-400/+700   | 01121    | CB4721             |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty                                   | Description                             | Mfr Code               | Mfr Part Number      |
|----------------------|----------------|-----|---------------------------------------|-----------------------------------------|------------------------|----------------------|
| A11R23               | 0757-0845      | 6   | 1                                     | RESISTOR 18 2K 1% 5W F TC=0±100         | 28480                  | 0757-0845            |
| A11R24               | 0683-1825      | 7   |                                       | RESISTOR 1 8K 5% 25W FC TC=-400/+700    | 01121                  | CB1825               |
| A11R25               | 0757-0845      | 6   |                                       | RESISTOR 18 2K 1% 5W F TC=0±100         | 28480                  | 0757-0845            |
| A11R26               | 0757-0845      | 6   | 1                                     | RESISTOR 18 2K 1% 5W F TC=0±100         | 28480                  | 0757-0845            |
| A11XA7               | 1251-6007      | 3   |                                       | CONNECTOR 15-PIN F POST TYPE            | 28480                  | 1251-6007            |
| A12                  | 01745-66501    | 2   |                                       | GATE BOARD ASSEMBLY                     | 28480                  | 01745-66501          |
| A12C1                | 0180-0230      | 0   | 1                                     | CAPACITOR-FXD 1UF ±20% 50VDC TA         | 56289                  | 1500105X0050A2       |
| A12C2                | 0160-0165      | 8   |                                       | CAPACITOR-FXD 068UF ±10% 200VDC POLYE   | 28480                  | 0160-0165            |
| A12C3                | 0160-3665      | 9   |                                       | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480                  | 0160-3665            |
| A12C4                | 0160-3665      | 9   |                                       | CAPACITOR-FXD 01UF +80-20% 500VDC CER   | 28480                  | 0160-3665            |
| A12C5                | 0160-0165      | 8   |                                       | CAPACITOR-FXD 068UF ±10% 200VDC POLYE   | 28480                  | 0160-0165            |
| A12C6                | 0160-3459      | 9   | 3                                     | CAPACITOR-FXD 02UF ±20% 100VDC CER      | 28480                  | 0160-3459            |
| A12C7                | 0140-0196      | 3   |                                       | CAPACITOR-FXD 150PF ±5% 300VDC MICA     | 72136                  | DM15F151J0300WV1CR   |
| A12C9                | 0160-3459      | 9   |                                       | CAPACITOR-FXD 02UF ±20% 100VDC CER      | 28480                  | 0160-3459            |
| A12C10               | 0160-3459      | 9   |                                       | CAPACITOR-FXD 02UF ±20% 100VDC CER      | 28480                  | 0160-3459            |
| A12C11               | 0121-0474      | 0   |                                       | CAPACITOR-V TRMR PSTN 3-1 SPF 600V      | 28480                  | 0121-0474            |
| A12CR1               | 1901-0040      | 1   | 3                                     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480                  | 1901-0040            |
| A12CR2               | 1901-0040      | 1   |                                       | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480                  | 1901-0040            |
| A12CR3               | 1901-0040      | 1   |                                       | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480                  | 1901-0040            |
| A12H1                | 2200-0103      | 2   | 2                                     | SCREW-MACH 4 40 25-IN-LG PAN-HD-POZI    | 00000                  | ORDER BY DESCRIPTION |
| A12H2                | 2260-0002      | 6   |                                       | NUT-HEX-DBL-CHAM 4-40-THD 062-IN-THK    | 00000                  | ORDER BY DESCRIPTION |
| A12H3                | 2190-0016      | 3   |                                       | WASHER-LK INTL T 3/8 IN 377-IN-ID       | 28480                  | 2190-0016            |
| A12H4                | 2960-0043      | 8   |                                       | NUT-HEX-DBL-CHAM 3/8-32-THD 094-IN-THK  | 00000                  | ORDER BY DESCRIPTION |
| A12MP1               | 1206-0095      | 0   | 2                                     | HEAT SINK SGL TO-5/TO-39-CS             | 30161                  | 3225B                |
| A12MP2               | 01801-01206    | 7   |                                       | BRACKET-ANGLE                           | 28480                  | 01801-01206          |
| A12MP3               | 1200-0185      | 9   |                                       | INSULATOR-XSTR NYLON                    | 28480                  | 1200-0185            |
| A12P1                | 1251-3898      | 4   | 1                                     | CONNECTOR 10-PIN M POST TYPE            | 28480                  | 1251-3898            |
| A12P2                | 1251-6015      | 3   |                                       | CONNECTOR 3-PIN M POST TYPE             | 28480                  | 1251-6015            |
| A12P3                | 1251-6011      | 9   |                                       | CONNECTOR 5-PIN M POST TYPE             | 28480                  | 1251-6011            |
| A12Q1                | 1853-0015      | 7   | 1                                     | TRANSISTOR PNP SI PD=200MW FT=500MHZ    | 28460                  | 1853-0015            |
| A12Q2                | 1853-0232      | 0   |                                       | TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ | 28480                  | 1853-0232            |
| A12Q3                | 1854-0215      | 1   |                                       | TRANSISTOR NPN SI PD=350MW FT=300MHZ    | 04713                  | 2N3904               |
| A12Q4                | 1854-0271      | 9   |                                       | TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ | 28480                  | 1854-0271            |
| A12R1                | 0684-1231      | 1   | 1                                     | RESISTOR 12K 10% 25W FC TC=-400/+800    | 01121                  | CB1231               |
| A12R2                | 0757-0422      | 5   |                                       | RESISTOR 909 1% 125W F TC=0±100         | 24546                  | C4-1/8-TO-909-F      |
| A12R3                | 2100-3423      | 3   |                                       | RESISTOR-VAR CONTROL CCP 10K 20% LIN    | 28480                  | 2100-3423            |
| A12R4                | 0757-0279      | 0   |                                       | RESISTOR 3 16K 1% 125W F TC=0±100       | 24546                  | C4-1/8-TO-3161-F     |
| A12R5                | 0688-3159      | 5   |                                       | RESISTOR 26 1K 1% 125W F TC=0±100       | 24546                  | C4-1/8-TO-2612-F     |
| A12R6                | 0757-0462      | 3   | 1                                     | RESISTOR 75K 1% 125W F TC=0±100         | 24546                  | C4-1/8-TO-7502-F     |
| A12R7                | 0757-0124      | 4   |                                       | RESISTOR 39 2K 1% 125W F TC=0±100       | 28480                  | 0757-0124            |
| A12R8                | 0757-0440      | 7   |                                       | RESISTOR 7 5K 1% 125W F TC=0±100        | 24546                  | C4-1/8-TO-7501-F     |
| A12R9                | 0757-0737      | 5   |                                       | RESISTOR 1 62K 1% 25W F TC=0±100        | 24546                  | C5-1/4-TO-1621-F     |
| A12R10               | 0698-3648      | 5   |                                       | RESISTOR 12K 5% 2W MO TC=0±200          | 27167                  | FP42-2-TOO-1202-J    |
| A12R11               | 0757-0435      | 0   | 1                                     | RESISTOR 3 92K 1% 125W F TC=0±100       | 24546                  | C4-1/8-TO-3921-F     |
| A12R12               | 2100-3273      | 1   |                                       | RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN   | 28480                  | 2100-3273            |
| A12R13               | 0757-0843      | 4   |                                       | RESISTOR 15K 1% 5W F TC=0±100           | 28480                  | 0757-0843            |
| A12R14               | 0687-1211      | 3   |                                       | RESISTOR 120 10% 5W CC TC=0±529         | 01121                  | EB1211               |
| A12R15               | 0684-1021      | 7   |                                       | RESISTOR 1K 10% 25W FC TC=-400/+600     | 01121                  | CB1021               |
| A12R16               | 2100-3353      | 8   | 1                                     | RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN  | 28480                  | 2100-3353            |
| A12R17               | 0684-1021      | 7   |                                       | RESISTOR 1K 10% 25W FC TC=-400/+600     | 01121                  | CB1021               |
| A12R19               | 2100-3355      | 0   |                                       | RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN | 28480                  | 2100-3355            |
| A12R20               | 0684-3331      | 6   |                                       | RESISTOR 33K 10% 25W FC TC=-400/+800    | 01121                  | CB3331               |
| A12R21               | 0684-2211      | 9   |                                       | RESISTOR 220 10% 25W FC TC=-400/+600    | 01121                  | CB2211               |
| A12R22               | 2100-3424      | 4   | 1                                     | RESISTOR-VAR CONTROL CCP 5M 30% LIN     | 28480                  | 2100-3424            |
| A12R23               | 0684-1011      | 5   |                                       | RESISTOR 100 10% 25W FC TC=-400/+500    | 01121                  | CB1011               |
| A12R24               | 0683-0335      | 2   |                                       | RESISTOR 3 3 5% 25W FC TC=-400/+500     | 01121                  | CB3335               |
| A12R25               | 2100-4024      | 2   |                                       | RESISTOR-VAR 1000 CP 10% LIN            | 28480                  | 2100-4024            |
| A12S1                | 3101-1767      | 7   |                                       | 1                                       | SWITCH-PUSHBUTTON DPDT | 28480                |
| A12U1                | 1821-0002      | 5   | TRANSISTOR ARRAY CA3045               |                                         | 3L585                  | CA3045               |
| A12VR1               | 1902-0025      | 4   | DIODE-ZNR 10V 5% DO-35 PD=4W TC=0±06% |                                         | 28480                  | 1902-0025            |
| A12VR2               | 1902-3345      | 7   | DIODE-ZNR 51.1V 5% DO-35 PD=4W        | 28480                                   | 1902-3345              |                      |
| A12XA16              | 1251-6007      | 3   | 1                                     | CONNECTOR 15-PIN F POST TYPE            | 28480                  | 1251-6007            |
| A12XU1               | 1200-0638      | 7   |                                       | SOCKET-IC 14-CONT DIP DIP-SLDR          | 28480                  | 1200-0638            |
| A13                  | 01740-66564    | 2   |                                       | VERTICAL LOGIC BOARD ASSEMBLY           | 28480                  | 01740-66564          |
| A13MP1               | 0380-0744      | 5   | 8                                     | SPACER 080 093                          | 28480                  | 0380-0744            |
| A13R1                | 0757-0282      | 5   |                                       | RESISTOR 221 1% 125W F TC=0±100         | 24546                  | C4-1/8-TO-221R-F     |
| A13R2                | 0757-0282      | 5   |                                       | RESISTOR 221 1% 125W F TC=0±100         | 24546                  | C4-1/8-TO-221R-F     |
| A13S1                | 3101-1908      | 8   | 1                                     | SWITCH-PUSHBUTTON 2 STATIONS            | 28480                  | 3101-1908            |
| A13S2                | 3101-1907      | 7   |                                       | SWITCH-PUSHBUTTON 4 STATIONS            | 28480                  | 3101-1907            |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C D | Qty | Description                             | Mfr Code | Mfr Part Number      |
|----------------------|----------------|-----|-----|-----------------------------------------|----------|----------------------|
| A13XA3               | 1251-6014      | 2   | 2   | CONNECTOR- 8 FEMALE RECEPTACLE          | 28480    | 1251-6014            |
| A13XA3               | 1251-6014      | 2   |     | CONNECTOR- 8 FEMALE RECEPTACLE          | 28480    | 1251-6014            |
| A14                  | 01740-66540    | 4   | 1   | INTERFACE BOARD ASSEMBLY                | 28480    | 01740-66540          |
| A14XA3               | 1251-1632      | 0   | 1   | CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW     | 28480    | 1251-1632            |
| A14XA7               | 1251-1633      | 1   | 1   | CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW     | 28480    | 1251-1633            |
| A14XA16              | 1251-5092      | 4   | 1   | CONNECTOR-POST 15 CONTACT               | 28480    | 1251-5092            |
| A15                  | 01745-66502    | 3   | 1   | HIGH VOLTAGE POWER BOARD ASSEMBLY       | 28480    | 01745-66502          |
| A15A1                | 01740-61101    | 3   | 1   | TRANSFORMER ASSEMBLY- HIGH VOLTAGE      | 28480    | 01740-61101          |
| A15C1                | 0180-1794      | 3   | 1   | CAPACITOR-FXD 22UF±10% 35VDC TA         | 56289    | 1500225X9035R2       |
| A15C2                | 0180-2264      | 2   | 1   | CAPACITOR-FXD 20PF ±5% 500VDC CER 0-30  | 28480    | 0180-2264            |
| A15C3                | 0180-0269      | 5   | 2   | CAPACITOR-FXD 1UF±50-10% 150VDC AL      | 56289    | 300106G150B2A        |
| A15C4                | 0180-0684      | 6   | 2   | CAPACITOR-FXD 1000PF ±20% 4KVDC         | 28480    | 0180-0684            |
| A15C5                | 0180-4061      | 9   | 1   | CAPACITOR-FXD 01UF ±20% 4KVDC           | 28480    | 0180-4061            |
| A15C6                | 0180-0644      | 7   | 1   | CAPACITOR-FXD 022UF ±20% 4KVDC          | 28480    | 0180-0644            |
| A15C7                | 0180-0684      | 5   | 1   | CAPACITOR-FXD 068UF ±20% 4KVDC          | 56289    | 430P683040           |
| A15C8                | 0180-0684      | 6   | 1   | CAPACITOR-FXD 1000PF ±20% 4KVDC         | 28480    | 0180-0684            |
| A15C9                | 0180-4079      | 1   | 1   | CAPACITOR-FXD 1500PF ±20% 4KVDC         | 28480    | 0180-4079            |
| A15C10               | 0180-0197      | 8   | 2   | CAPACITOR-FXD 2 2UF±10% 20VDC TA        | 56289    | 1500225X9020A2       |
| A15C11               | 0180-0197      | 8   |     | CAPACITOR-FXD 2 2UF±10% 20VDC TA        | 56289    | 1500225X9020A2       |
| A15C12               | 0170-0040      | 9   | 1   | CAPACITOR-FXD 047UF ±10% 200VDC POLYE   | 56289    | 292P47392            |
| A15C13               | 0180-3443      | 1   | 1   | CAPACITOR-FXD 1UF ±80-20% 50VDC CER     | 28480    | 0180-3443            |
| A15C14               | 0180-0165      | 8   | 1   | CAPACITOR-FXD 068UF ±10% 200VDC POLYE   | 28480    | 0180-0165            |
| A15C15               | 0180-0269      | 5   | 1   | CAPACITOR-FXD 1UF±50-10% 150VDC AL      | 56289    | 300106G150B2A        |
| A15C16               | 0180-0168      | 1   | 1   | CAPACITOR-FXD 1UF ±10% 200VDC POLYE     | 28480    | 0180-0168            |
| A15C17               | 0180-0230      | 0   | 1   | CAPACITOR-FXD 1UF±20% 50VDC TA          | 56289    | 1500106X0060A2       |
| A15C102              | 0180-2065      | 9   | 1   | CAPACITOR-FXD 01UF ±80-20% 100VDC CER   | 28480    | 0180-2065            |
| A15CR1               | 1901-0873      | 8   | 7   | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR2               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR3               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR4               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR5               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR6               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR7               | 1901-0883      | 8   | 1   | DIODE-HV RECT 10KV BMA 250NS            | 28480    | 1901-0883            |
| A15CR9               | 1901-0873      | 8   |     | DIODE-HV RECT 600V 1A                   | 28480    | 1901-0873            |
| A15CR10              | 1901-0040      | 1   | 3   | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040            |
| A15CR11              | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040            |
| A15CR102             | 1901-0040      | 1   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040            |
| A15E1                | 2110-0269      | 0   | 2   | FUSE-OLDER-CLIP TYPE 250-FUSE           | 28480    | 2110-0269            |
| A15E2                | 2110-0269      | 0   |     | FUSEHOLDER-CLIP TYPE 250-FUSE           | 28480    | 2110-0269            |
| A15F1                | 2110-1007      |     | 1   | FUSE 1A 250V TD 1 25X 25 UL             | 75915    | 313001               |
| A15H1                | 2190-0019      | 8   | 2   | WASHER-LK HLCL NO 4 115-IN-ID           | 28480    | 2190-0019            |
| A15H2                | 2200-0125      | 8   | 2   | SCREW-MACH 4-40 1.5-IN-LG PAN-HD-POZI   | 00000    | ORDER BY DESCRIPTION |
| A15H3                | 2280-0001      | 5   | 2   | N. C-HEX-DBL-CHAM 4-40-THD .094-IN-THK  | 28480    | 2280-0001            |
| A15L1                | 9140-0171      | 3   | 1   | INDUCTOR RF-CH-MLD 40UH 10% 296DX 385LG | 28480    | 9140-0171            |
| A15L2                | 9140-0210      | 1   | 1   | INDUCTOR RF-CH-MLD 100UH 5% 168DX 385LG | 28480    | 9140-0210            |
| A15L3                | 9140-0129      | 1   | 1   | INDUCTOR RF-CH-MLD 220UH 5% 168DX 385LG | 28480    | 9140-0129            |
| A15MP1               | 5040-0402      | 7   | 1   | MOUNT-TRANSFORMER                       | 28480    | 5040-0402            |
| A15MP2               | 5040-0430      | 1   | 1   | MOUNT-TRANSFORMER                       | 28480    | 5040-0430            |
| A15Q1                | 1854-0071      | 7   | 1   | TRANSISTOR NPN SI PD=300MW FT=200MHZ    | 28480    | 1854-0071            |
| A15R1                | 0684-1021      | 7   | 1   | RESISTOR 1K 10% 25W FC TC=-400/+600     | 01121    | CB1021               |
| A15R2                | 2100-3253      | 7   | 1   | RESISTOR-TRMR 50K 10% C TOP-AUJ 1-TRN   | 28480    | 2100-3253            |
| A15R3                | 0687-6841      | 5   | 1   | RESISTOR 680K 10% 1/2W CC TC=0+882      | 01121    | EB6841               |
| A15R4                | 0684-1031      | 9   | 1   | RESISTOR 10K 10% 25W FC TC=-400/+700    | 01121    | CB1031               |
| A15R5                | 0684-2221      | 1   | 3   | RESISTOR 2 2K 10% 25W FC TC=-400/+700   | 01121    | CB2221               |
| A15R6                | 0684-2221      | 1   |     | RESISTOR 2 2K 10% 25W FC TC=-400/+700   | 01121    | CB2221               |
| A15R7                | 0698-4112      | 2   | 1   | RESISTOR 54 9 1% 25W F TC=0±100         | 24544    | CS-1/4-T0-54R9-F     |
| A15R8                | 0684-2221      | 1   |     | RESISTOR 2 2K 10% 25W FC TC=-400/+700   | 01121    | CB2221               |
| A15R9                | 0684-4721      | 0   | 1   | RESISTOR 4 7K 10% 25W FC TC=-400/+700   | 01121    | CB4721               |
| A15R10               | 0683-1065      | 7   | 1   | RESISTOR 10M 5% 25W CC TC=-900/+1100    | 01121    | CB1065               |
| A15R11               | 0687-1531      | 0   | 1   | RESISTOR 15K 10% 5W CC TC=0+765         | 01121    | EB1531               |
| A15R12               | 0687-3301      | 6   | 1   | RESISTOR 33 10% 5W CC TC=0+412          | 01121    | EB3301               |
| A15R13               | 0699-1010      | 5   | 1   | RESISTOR- 30 MEGOHM                     | 28480    | 0699-1010            |
| A15R14               | 0684-1011      | 5   | 2   | RESISTOR 100 10% 25W FC TC=-400/+600    | 01121    | CB1011               |
| A15R15               | 0698-8995      | 7   | 1   | RESISTOR 10M 5% 1W C TC=0±250           | 28480    | 0698-8995            |
| A15R16               | 0699-0169      | 3   | 1   | RESISTOR 16 25M 5% 1W C TC=0±250        | 28480    | 0699-0169            |
| A15R17               | 0687-1011      | 1   | 1   | RESISTOR 100 10% 5W CC TC=0+529         | 01121    | EB1011               |
| A15R18               | 0687-5611      | 6   | 1   | RESISTOR 560 10% 5W CC TC=0+579         | 01121    | EB5611               |
| A15R20               | 0683-2265      | 1   | 1   | RESISTOR 22M 5% 25W FC TC=-800/+1200    | 01121    | CB2265               |
| A15R21               | 0757-0488      | 3   | 3   | RESISTOR 909K 1% 125W F TC=0±100        | 28480    | 0757-0488            |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C | D | Qty | Description                             | Mfr Code | Mfr Part Number      |
|----------------------|----------------|---|---|-----|-----------------------------------------|----------|----------------------|
| A15R23               | 0684-1041      | 1 |   | 2   | RESISTOR 100K 10% 25W FC TC=-400/+800   | 01121    | CB1041               |
| A15R24               | 0684-1041      | 1 |   |     | RESISTOR 100K 10% 25W FC TC=-400/+800   | 01121    | CB1041               |
| A15R25               | 0683-3935      | 4 |   | 1   | RESISTOR 39K 5% 25W FC TC=-400/+800     | 01121    | CB3935               |
| A15R26               | 2100-3355      | 0 |   | 1   | RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN | 28480    | 2100-3355            |
| A15R27               | 2100-3207      | 1 |   | 1   | RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN   | 28480    | 2100-3207            |
| A15R28               | 0684-1011      | 5 |   |     | RESISTOR 100 10% 25W FC TC=-400/+100    | 01121    | CB1011               |
| A15R29               | 0757-0914      | 0 |   | 1   | RESISTOR 390 2% 125W F TC=0±100         | 24546    | CA-1/8-TD-391 G      |
| A15R101              | 0757-0478      | 6 |   | 1   | RESISTOR 95.3K 1% 125W F TC=0±100       | 24546    | CA-1/8-TD-3652 F     |
| A15R102              | 0757-0488      | 3 |   |     | RESISTOR 909K 1% 125W F TC=0±100        | 28480    | 0757-0488            |
| A15R103              | 0757-0438      | 3 |   |     | RESISTOR 909K 1% 125W F TC=0±100        | 28460    | 0757-0488            |
| A15R104              | 0684-6821      | 5 |   | 2   | RESISTOR 6.8K 10% 25W FC TC=-400/+700   | 01121    | CB6821               |
| A15R105              | 0684-6821      | 5 |   |     | RESISTOR 6.8K 10% 25W FC TC=-400/+700   | 01121    | CB6821               |
| A15R106              | 0757-0455      | 4 |   | 2   | RESISTOR 36.5K 1% 125W F TC=0±100       | 24546    | CA-1/8-TD-3652 F     |
| A15R107              | 0757-0455      | 4 |   |     | RESISTOR 36.5K 1% 125W F TC=0±100       | 24546    | CA-1/8-TD-3652 F     |
| A15R110              | 0757-0450      | 9 |   | 1   | RESISTOR 22.1K 1% 125W F TC=0±100       | 24546    | CA-1/8-TD-2212 F     |
| A15R111              | 0698-5470      | 7 |   | 1   | RESISTOR 111K 1% 125W F TC=0±100        | 24546    | CA-1/8-TD-1113 F     |
| A15R112              | 0757-0448      | 5 |   | 1   | RESISTOR 18.2K 1% 125W F TC=0±100       | 24546    | CA-1/8-TD-1822 F     |
| A15R113              | 2100-0658      | 9 |   | 1   | RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN   | 28480    | 2100-0658            |
| A1L1P1               | 1251-0208      | 2 |   | 1   | CONNECTOR 5GL CONT SKT 04-IN-BSC-SZ RND | 28480    | 1251-0208            |
| A15U1                | 1826-0948      | 6 |   | 1   | IC-CA3094                               | 28480    | 1826-0948            |
| A15U2                | 1826-0346      | 0 |   | 1   | IC OP AMP GP DUAL 8-DIP P PKG           | 27014    | LM358N               |
| A15U3                | 1826-0708      | 8 |   | 1   | IC-10V                                  | 28480    | 1826-0708            |
| A15V1                | 2140-0013      | 5 |   | 2   | LAMP GLOW 5AB-A 70/57VDC 300UA T-2-BULB | 06806    | 5AB-A-NE-23A         |
| A15V2                | 2140-0013      | 5 |   |     | LAMP GLOW 5AB-A 70/57VDC 300UA T-2-BULB | 06806    | 5AB-A-NE-23A         |
| A15VR1               | 1902-3345      | 7 |   | 1   | DIODE-ZNR 51 1V 5% DO-35 PD= 4W         | 28480    | 1902-3345            |
| A15XA12              | 1251-6138      | 9 |   | 1   | CONNECTOR                               | 28480    | 1251-6138            |
| A16                  | 01740-66594    | 8 |   | 1   | LOW VOLTAGE POWER BOARD ASSEMBLY        | 28480    | 01740-66594          |
| A16C1                | 0140-0208      | 8 |   | 1   | CAPACITOR-FXD 680PF ±5% 300VDC MICA     | 72136    | DM16F681J0300WV1CH   |
| A16C2                | 0160-0168      | 1 |   | 1   | CAPACITOR-FXD 1UF ±10% 200VDC POLYE     | 28480    | 0160-0168            |
| A16C3                | 0180-1827      | 3 |   | 1   | CAPACITOR-FXD 50UF+50-10% 255VDC AL     | 28480    | 0180-1827            |
| A16C4                | 0180-0089      | 7 |   | 1   | CAPACITOR-FXD 10UF+50-10% 150VDC AL     | 56289    | 30D106F1500D2        |
| A16C5                | 0180-1856      | 0 |   | 1   | CAPACITOR-FXD AL 500UF 75VDC            | 28480    | 0180-1856            |
| A16C6                | 0180-0091      | 1 |   | 1   | CAPACITOR-FXD 10UF+50-10% 100VDC AL     | 56289    | 30D106F1000C2        |
| A16C7                | 0180-2500      | 1 |   | 1   | CAPACITOR-FXD AL 1500UF 16VDC           | 37842    | TT152U016G1C3P       |
| A16C8                | 0180-0583      | 6 |   | 1   | CAPACITOR-FXD 6000UF+75-10% 30VDC AL    | 28480    | 0180-0583            |
| A16C9                | 0180-2211      | 9 |   | 3   | CAPACITOR-FXD 510PF ±5% 300VDC MICA     | 28480    | 0160-2211            |
| A16C10               | 0180-0059      | 1 |   | 2   | CAPACITOR-FXD 10UF+75-10% 25VDC AL      | 56289    | 30D106G0258B2        |
| A16C11               | 0180-0443      | 7 |   | 1   | CAPACITOR-FXD 5300UF+75-10% 15VDC AL    | 28480    | 0180-0443            |
| A16C12               | 0160-2211      | 9 |   |     | CAPACITOR-FXD 510PF ±5% 300VDC MICA     | 28480    | 0160-2211            |
| A16C13               | 0180-0141      | 4 |   | 1   | CAPACITOR-FXD 25UF+75-10% 12VDC AL      | 56289    | 30D256G0128B2        |
| A16C14               | 0180-0576      | 7 |   | 1   | CAPACITOR-FXD 3500UF+75-10% 30VDC AL    | 28480    | 0180-0576            |
| A16C15               | 0160-2211      | 9 |   |     | CAPACITOR-FXD 510PF ±5% 300VDC MICA     | 28480    | 0160-2211            |
| A16C16               | 0180-0069      | 1 |   |     | CAPACITOR-FXD 10UF+75-10% 25VDC AL      | 56289    | 30D106G0258B2        |
| A16C17               | 0180-0039      | 7 |   | 1   | CAPACITOR-FXD 100UF+75-10% 12VDC AL     | 56289    | 30D107G012CC2        |
| A16C18               | 0160-2065      | 9 |   | 2   | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065            |
| A16C19               | 0160-2065      | 9 |   |     | CAPACITOR-FXD 01UF +80-20% 100VDC CER   | 28480    | 0160-2065            |
| A16C20               | 0180-0100      | 3 |   | 1   | CAPACITOR-FXD 4.7UF ±10% 30VDC TA       | 56289    | 1500475X9035B2       |
| A16C21               | 0160-5445      | 7 |   | 1   | CAPACITOR-FILM 0.1UF ±10% 400VDC        | 28480    | 0160-5445            |
| A16C22               | 0160-3670      | 6 |   | 5   | CAPACITOR-FXD 1UF ±20% 200VDC CER       | 28480    | 0160-3670            |
| A16C23               | 0160-3670      | 6 |   |     | CAPACITOR-FXD 1UF ±20% 200VDC CER       | 28480    | 0160-3670            |
| A16C24               | 0160-3670      | 6 |   |     | CAPACITOR-FXD 1UF ±20% 200VDC CER       | 28480    | 0160-3670            |
| A16C25               | 0160-3670      | 6 |   |     | CAPACITOR-FXD 1UF ±20% 200VDC CER       | 28480    | 0160-3670            |
| A16C26               | 0160-3670      | 6 |   |     | CAPACITOR-FXD 1UF ±20% 200VDC CER       | 28480    | 0160-3670            |
| A16CR1               | 1906-0006      | 9 |   | 5   | DIODE-FW BRDG 400V 1A                   | 18546    | VE48                 |
| A16CR2               | 1906-0006      | 9 |   |     | DIODE-FW BRDG 400V 1A                   | 18546    | VE48                 |
| A16CR3               | 1906-0006      | 9 |   |     | DIODE-FW BRDG 400V 1A                   | 18546    | VE48                 |
| A16CR4               | 1906-0048      | 9 |   | 1   | DIODE-FW BRDG 100V 5A                   | 28480    | 1906-0048            |
| A16CR5               | 1906-0006      | 9 |   |     | DIODE-FW BRDG 400V 1A                   | 18546    | VE48                 |
| A16CR6               | 1906-0006      | 9 |   |     | DIODE-FW BRDG 400V 1A                   | 18546    | VE48                 |
| A16CR7               | 1901-0040      | 1 |   | 2   | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040            |
| A16CR8               | 1901-0040      | 1 |   |     | DIODE-SWITCHING 30V 50MA 2NS DO-35      | 28480    | 1901-0040            |
| A16E1                | 0340-0949      | 8 |   | 1   | INSULATOR                               | 28480    | 0340-0949            |
| A16H1                | 0624-0006      | 9 |   | 2   | SCREW-TPG 4-24 25-IN-LG PAN-HD-PHL      | 00000    | ORDER BY DESCRIPTION |
| A16H2                | 2200-0145      | 2 |   | 1   | SCREW-MACH 4-40 438-IN LG PAN-HD-POZ    | 00000    | ORDER BY DESCRIPTION |
| A16H3                | 2190-0199      | 3 |   | 1   | WASHER-FLK NM NO 4 125-IN-ID 312-IN-OD  | 28480    | 2190-0199            |
| A16H4                | 2190-0910      | 6 |   | 1   | WASHER-LK INTL TNG 4 12-IN-ID           | 25380    | 2190-0910            |
| A16H5                | 2260-0003      | 7 |   | 1   | NUT-HEX-PLSTC LKG 4-40-THD 141-IN-T.HK  | 00000    | ORDER BY DESCRIPTION |
| A16MP1               | 1400-0747      | 3 |   | 1   | CABLE TIE 062-4-DIA 19-WD NYL           | 28480    | 1400-0747            |
| A16MP2               | 1400-0249      | 0 |   | 1   | CABLE TIE 062-625-DIA 091-WD NYL        | 06383    | PLT1M-8              |

See introduction to this section for ordering information

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

| Reference Designator | HP Part Number | C<br>D | Qty | Description                           | Mfr Code | Mfr Part Number     |
|----------------------|----------------|--------|-----|---------------------------------------|----------|---------------------|
| A16P1                | 1251-6008      | 4      | 1   | CONNECTOR 12-PIN M POST TYPE          | 28480    | 1251-6008           |
| A16P2                | 1251-6093      | 5      | 1   | CONNECTOR-POST 15 CONTACT             | 28480    | 1251-6093           |
| A16P3                | 1251-6009      | 5      | 1   | CONNECTOR 15-PIN M POST TYPE          | 28480    | 1251-6009           |
| A16P4                | 1251-5346      | 1      | 1   | CONNECTOR 10-PIN M POST TYPE          | 28480    | 1251-5346           |
| A16P5                | 1251-6010      | 8      | 1   | CONNECTOR 3-PIN M POST TYPE           | 28480    | 1251-6010           |
| A16Q1                | 1853-0336      | 5      | 2   | TRANSISTOR PNP SI PD=625MW FT=60MHZ   | 04713    | MPSA92              |
| A16Q2                | 1853-0335      | 5      | 1   | TRANSISTOR PNP SI PD=625MW FT=60MHZ   | 04713    | MPSA92              |
| A16Q3                | 1854-0215      | 1      | 2   | TRANSISTOR NPN SI PD=350MW FT=300MHZ  | 04713    | 2N3904              |
| A16Q4                | 1854-0675      | 6      | 1   | TRANSISTOR NPN SI PD=625MW FT=60MHZ   | 04711    | MPS-A42             |
| A16Q5                | 1853-0090      | 6      | 2   | TRANSISTOR PNP SI PD=300MW FT=30MHZ   | 28480    | 1853-0090           |
| A16Q6                | 1853-0040      | 6      | 1   | TRANSISTOR PNP SI PD=300MW FT=30MHZ   | 28480    | 1853-0080           |
| A16C7                | 1854-0215      | 1      | 1   | TRANSISTOR NPN SI PD=350MW FT=300MHZ  | 04713    | 2N3904              |
| A16C8                | 1854-0358      | 3      | 1   | TRANSISTOR NPN SI PD=310MW FT=60MHZ   | 28480    | 1854-0358           |
| A16Q9                | 1853-0036      | 2      | 2   | TRANSISTOR PNP SI PD=310MW FT=250MHZ  | 28480    | 1853-0036           |
| A16Q10               | 1853-0036      | 2      | 2   | TRANSISTOR PNP SI PD=310MW FT=250MHZ  | 28480    | 1853-0036           |
| A16Q13               | 1854-0472      | 2      | 1   | TRANSISTOR NPN SI DARL PD=500MW       | 04713    | MPS-A14             |
| A16Q14               | 1854-0453      | 5      | 1   | TRANSISTOR NPN SI DARL PD=70W FT=1MHZ | 28480    | 1854-0658           |
| A16R1                | 0757-0434      | 3      | 1   | RESISTOR 33.2K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-3322-F    |
| A16R2                | 0699-0003      | 4      | 1   | RESISTOR 8.2 10% 5W CC TC=0±412       | 01121    | EB92G1              |
| A16R3                | 0684-1241      | 3      | 1   | RESISTOR 120K 10% 25W FC TC=-800/+900 | 01121    | CB1241              |
| A16R4                | 0684-1031      | 8      | 2   | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031              |
| A16R5                | 0698-3455      | 4      | 1   | RESISTOR 281K 1% 12.5W F TC=0±100     | 24546    | C4-1/8-T0-2813-F    |
| A16R6                | 0698-4495      | 7      | 1   | RESISTOR 37.4K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-3742-F    |
| A16R7                | 0684-1021      | 7      | 2   | RESISTOR 1K 10% 25W FC TC=-400/+800   | 01121    | CB1021              |
| A16R8                | 0684-1041      | 1      | 2   | RESISTOR 100K 10% 25W FC TC=-400/+800 | 01121    | CJ1041              |
| A16R9                | 0757-0431      | 6      | 2   | RESISTOR 2.43K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-2431-F    |
| A16R10               | 7811-1668      | 9      | 2   | RESISTOR 1.5 5% 2W PW TC=0±400        | 75042    | BWH2-1R5-J          |
| A16R11               | 0684-1231      | 1      | 1   | RESISTOR 12K 10% 25W FC TC=-400/+700  | 01121    | CB1231              |
| A16R12               | 0684-1031      | 9      | 1   | RESISTOR 10K 10% 25W FC TC=-400/+700  | 01121    | CB1031              |
| A16R13               | 0757-0450      | 9      | 1   | RESISTOR 22.1K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-2212-F    |
| A16R14               | 0698-5437      | 6      | 1   | RESISTOR 12K 1% 125W F TC=0±50        | 28480    | 0698-5437           |
| A16R15               | 0684-1021      | 7      | 1   | RESISTOR 1K 10% 25W FC TC=-400/+800   | 01121    | CB1021              |
| A16R16               | 0684-4731      | 2      | 1   | RESISTOR 47K 10% 25W FC TC=-400/+800  | 01121    | CB4731              |
| A16R20               | 2100-3253      | 7      | 1   | RESISTOR-TRMR 5% 10% C TOP-ADJ 1-TRN  | 28480    | 2100-3253           |
| A16R21               | 0684-8231      | 6      | 1   | RESISTOR 32K 10% 25W FC TC=-400/+800  | 01121    | CB8231              |
| A16R22               | 0687-4721      | 6      | 1   | RESISTOR 4.7K 10% 5W CL TC=0±647      | 01121    | EB4721              |
| A16R23               | 0757-0428      | 1      | 1   | RESISTOR 1.62K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-1621-F    |
| A16R24               | 0811-1668      | 9      | 1   | RESISTOR 1.5 5% 2W PW TC=0±400        | 75042    | BWH2-1R5-J          |
| A16R25               | 0757-0433      | 8      | 1   | RESISTOR 3.32K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-3321-F    |
| A16R26               | 2100-0654      | 5      | 1   | RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN | 28480    | 2100-0654           |
| A16R27               | 0757-1093      | 8      | 1   | RESISTOR 3K 1% 125W F TC=0±100        | 24546    | C4-1/8-T0-3001-F    |
| A16R28               | 0698-3329      | 1      | 1   | RESISTOR 10K 5% 125W F TC=0±100       | 03888    | PMES5-1/8-T0-1002-D |
| A16R29               | 0698-5579      | 7      | 3   | RESISTOR 5K 5% 125W F TC=0±100        | 24546    | C4-1/8-T0-5001-D    |
| A16R30               | 0811-1668      | 7      | 1   | RESISTOR 1.5 5% 2W PW TC=0±400        | 75042    | BWH2-1R5-J          |
| A16R31               | 0684-3321      | 4      | 1   | RESISTOR 3.3K 10% 25W FC TC=-400/+700 | 01121    | CB3321              |
| A16R32               | 0698-5578      | 7      | 1   | RESISTOR 5K 5% 125W F TC=0±100        | 24546    | C4-1/8-T0-5001-D    |
| A16R33               | 0698-5579      | 7      | 1   | RESISTOR 5K 5% 125W F TC=0±100        | 24546    | C4-1/8-T0-5001-D    |
| A16R34               | 0757-0431      | 6      | 1   | RESISTOR 2.43K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-2431-F    |
| A16R35               | 0811-1667      | 8      | 1   | RESISTOR 1.2 5% 2W PW TC=0±400        | 75042    | BWH2-1R2-J          |
| A16R36               | J683-4715      | 0      | 2   | RESISTOR 470 5% 25W FC TC=-400/+800   | 01121    | CB4715              |
| A16R37               | 0684-1011      | 5      | 2   | RESISTOR 100 10% 25W FC TC=-400/+800  | 01121    | CB1011              |
| A16R38               | 0684-471A      | 0      | 1   | RESISTOR 470 5% 25W FC TC=-400/+800   | 01121    | CB4715              |
| A16R39               | 0684-1011      | 5      | 1   | RESISTOR 100 10% 25W FC TC=-400/+800  | J1121    | CB1011              |
| A16R40               | 0684-1041      | 1      | 1   | RESISTOR 100K 10% 25W FC TC=-400/+800 | 01121    | CB1041              |
| A16R44               | 0757-0477      | 0      | 2   | RESISTOR 332K 1% 125W F TC=0±100      | 19701    | MF4C1/8-T0-3323-F   |
| A16R45               | 0757-0477      | 0      | 1   | RESISTOR 332K 1% 125W F TC=0±100      | 19701    | MF4C1/8-T0-3323-F   |
| A16R46               | 0757-0429      | 2      | 1   | RESISTOR 1.82K 1% 125W F TC=0±100     | 24546    | C4-1/8-T0-1821-F    |
| A16R47               | 0757-0406      | 5      | 1   | RESISTOR 182 1% 125W F TC=0±100       | 24546    | C4-1/8-T0-182R-F    |
| A16S1                | 3101-0655      | 9      | 1   | SWITCH-PB D*DT ALTNG 4A 250VAC        | 28480    | 3101-0655           |
| A16S2                | 3101-1914      | 8      | 1   | SWITCH-SL 2-G*DT STD 1 5A 250VAC PC   | 28480    | 3101-1914           |
| A16U1                | 1820-0196      | 6      | 3   | IC 723 V RGLTR TO-100                 | 04713    | MC1723CG            |
| A16U2                | 1820-0196      | 6      | 1   | IC 723 V RGLTR TO-100                 | 04713    | MC1723CG            |
| A.4U3                | 1820-0196      | 6      | 1   | IC 723 V RGLTR TO-100                 | 04713    | MC1723CG            |
| A16VR1               | 1902-3048      | 7      | 1   | DIODE-ZNR 3.48V 5% DO-35 PD=4W        | 28480    | 1902-3048           |
| A16VR2               | 1902-0025      | 4      | 1   | DIODE-ZNR 10V 5% DO-35 PD=4W TC=0%    | 28480    | 1902-0025           |
| A16VR3               | 1902-0049      | 2      | 1   | DIODE-ZNR 6.19V 5% DO-35 PD=4W        | 28480    | 1902-0049           |
|                      |                |        |     | PARTS LIST FOR OPTION C01             |          |                     |
| MP100                | 01720-03201    | 3      | 1   | ADAPTER-POWER CORD                    |          |                     |
| MP101                | 0400-0013      | 5      | 1   | GROMMET-STR ALF STR.                  |          |                     |
| W100                 | 8120-1202      | 0      | 1   | CABLE-POWER 7.5 FT.                   |          |                     |

See Introduction to this section for ordering information

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

| Reference Designator          | HP Part Number | C D | Qty | Description                            | Mfr Code | Mfr Part Number      |
|-------------------------------|----------------|-----|-----|----------------------------------------|----------|----------------------|
| PARTS LIST FOR OPTION 034/035 |                |     |     |                                        |          |                      |
| A200                          | 3476AC         | 3   | 1   | DVM-SCOPE                              | 28480    | 3476AG               |
| E200                          | 8120-2995      | 0   | 1   | TEST LEADS                             | 28480    | 8120-2995            |
| H200                          | 2190-0476      | 9   | 2   | WASHER LK 82 CTSK EXT T NO 4 116 IN ID | 28480    | 2190-0476            |
| H201                          | 2200-0091      | 7   | 2   | SCREW-MACH 4 40 562 IN LG PAN HD POZI  | 00000    | ORDER BY DESCRIPTION |
| H202                          | 2200-0103      | 2   | 2   | SCREW-MACH 4 40 25 IN LG PAN HD POZI   | 00000    | ORDER BY DESCRIPTION |
| MP12                          | 1540-0446      | 5   | 1   | POUCH PLASTIC                          | 28480    | 1540-0446            |
| MP55                          | 01740-04112    | 6   | 1   | COVER-TOP                              | 28480    | 01740-04112          |
| MP200                         | 01710-24705    | 9   | 2   | SPACER                                 | 28480    | 01710-24705          |
| MP201                         | 01742-01202    | 1   | 1   | BRACKET                                | 28480    | 01742-01202          |
| MP202                         | 5040-8302      | 2   | 1   | ADAPTER-3476A                          | 28480    | 5040-8302            |
| T200                          | 9100-3956      | 4   | 1   | TRANSFORMER-POWER                      | 28480    | 9100-3956            |
| W200                          | 01740-61627    | 8   | 1   | CABLE ASSEMBLY-POWER                   | 28480    | 01740-61627          |

Table 6-3. List of Manufacturers' Codes

| Mfr No. | Manufacturer Name                   | Address          | Zip Code |
|---------|-------------------------------------|------------------|----------|
| H9027   | SCHURTER & G H                      | LUZERN SW        |          |
| 00000   | ANY SATISFACTORY SUPPLIER           |                  |          |
| 01121   | ALLEN-BRADLEY CO                    | MILWAUKEE WI     | 53204    |
| 01295   | TEXAS INSTR INC SEMICOND CMPNT DIV  | DALLAS TX        | 75222    |
| 02111   | SPECTROL ELECTRONICS CORP           | CITY OF IND CA   | 91745    |
| 03888   | K O I PYROFILM CORP                 | WHIPPANY NJ      | 07981    |
| 04713   | MOTOROLA SEMICONDUCTOR PRODUCTS     | PHOENIX AZ       | 85008    |
| 06383   | PANDUIT CORP                        | TINLEY PARK IL   | 60477    |
| 08806   | GE CO MINIATURE LAMP PROD DEPT      | CLEVELAND OH     | 44112    |
| 18545   | VARO SEMICONDUCTOR INC              | GARLAND TX       | 75040    |
| 13103   | THERMALLOY CO                       | DALLAS TX        | 75234    |
| 19701   | MEPCO/ELECTRA CORP                  | MINERAL WELLS TX | 76087    |
| 20932   | EMCON DIV ITW                       | SAN DIEGO CA     | 92129    |
| 24546   | CORNING GLASS WORKS (BRADFORD)      | BRADFORD PA      | 16701    |
| 27014   | NATIONAL SEMICONDUCTOR CORP         | SANTA CLARA CA   | 95051    |
| 27167   | CORNING GLASS WORKS (WILMINGTON)    | WILMINGTON NC    | 28401    |
| 28480   | HEWLETT-PACKARD CO CORPORATE HQ     | PALO ALTO CA     | 94304    |
| 31585   | RCS CORP SOLID STATE DIV            | SOMERVILLE NJ    |          |
| 30161   | AAVID ENGINEERING INC               | LACONIA NH       | 03246    |
| 37942   | MALLORY P R AND CO INC              | INDIANAPOLIS IN  | 46206    |
| 61642   | CENTRE ENGINEERING INC              | STATE COLLEGE PA | 16801    |
| 52763   | STETTNER-TRUSH INC                  | CAZENOVIA NY     | 13035    |
| 56289   | SPRAGUE ELECTRIC CO                 | NORTH ADAMS MA   | 01247    |
| 72136   | ELECTRO MOTIVE CORP                 | FLORENCE SC      | 06226    |
| 73136   | BECKMAN INSTRUMENTS INC HELIPOT DIV | FULLERTON CA     | 92634    |
| 75042   | TRW INC PHILADELPHIA DIV            | PHILADELPHIA PA  | 19108    |
| 15915   | LITTELFUSE INC                      | JES PLAINES IL   | 60016    |
| 161201  | MALLORY CAPACITOR CO                | INDIANAPOLIS IN  | 46206    |

See introduction to this section for ordering information

**BACK DATING  
MANUAL  
CHANGES**

**SECTION VII**  
**MANUAL CHANGES**

**7-1. INTRODUCTION.**

7-2. This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does

apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to **INSTRUMENTS COVERED BY MANUAL** in Section I for additional important information about serial number coverage.

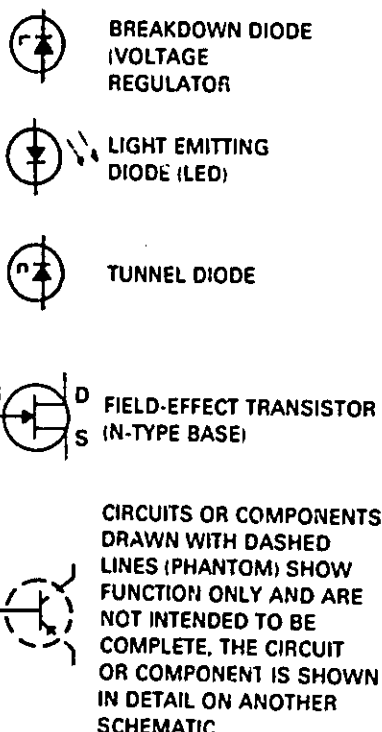
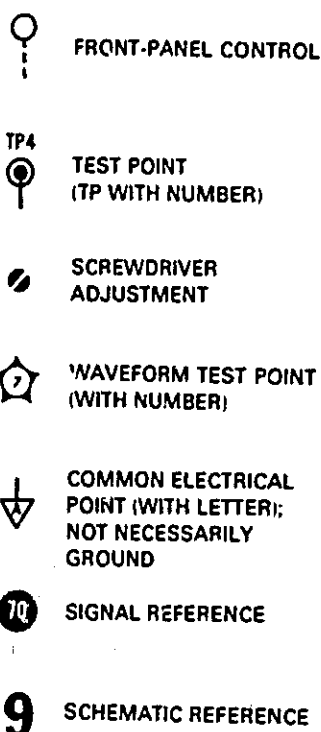
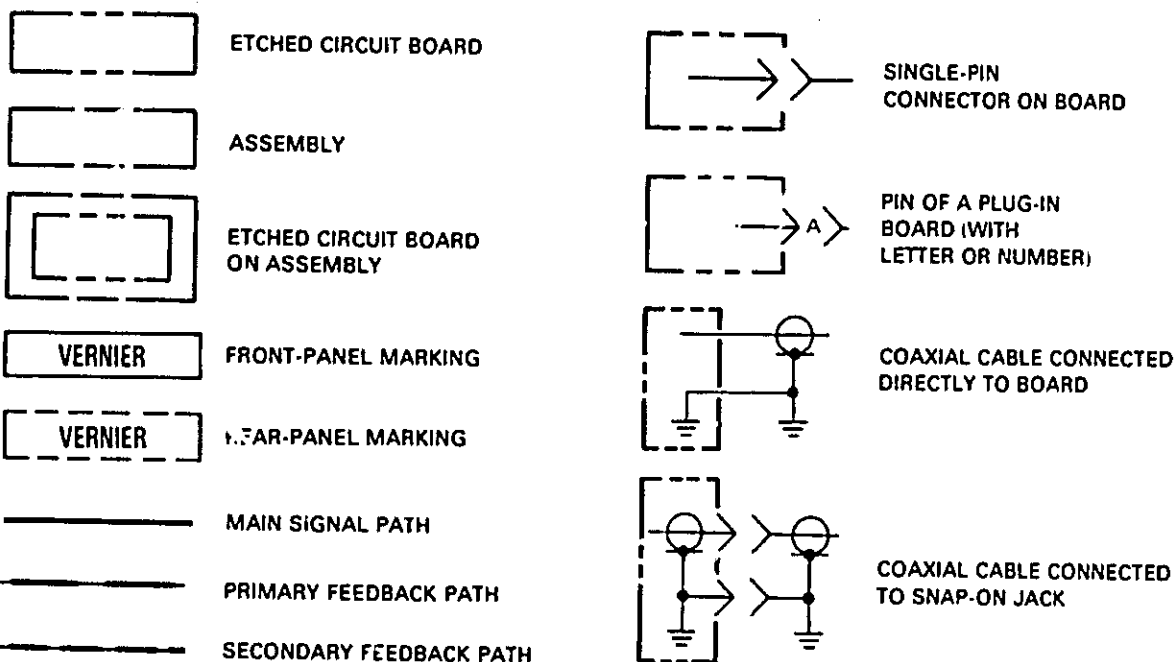


**SERVICE**

**INFORMATION**

Table 8-1. Schematic Notes

REFER TO ANSI Y 32.2 AND Y32.14 FOR SCHEMATIC SYMBOLS NOT LISTED IN THIS TABLE.



(925) WIRE COLORS ARE GIVEN BY NUMBERS IN PARENTHESIS USING THE RESISTOR COLOR CODE (925) IS WHT-RED-GRN)

|            |            |
|------------|------------|
| 0 - BLACK  | 5 - GREEN  |
| 1 - BROWN  | 6 - BLUE   |
| 2 - RED    | 7 - VIOLET |
| 3 - ORANGE | 8 - GRAY   |
| 4 - YELLOW | 9 - WHITE  |

\* OPTIMUM VALUE SELECTED AT FACTORY, TYPICAL VALUE SHOWN; PART MAY HAVE BEEN OMITTED.

UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS AND INDUCTANCE IN MICROHENRIES

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

## SECTION VIII

## SERVICE

**8-1. INTRODUCTION.**

8-2. This section contains schematics, repair and replacement information, component locators, waveform and test conditions.

**8-3. SAFETY CONSIDERATIONS.**

8-4. The following warnings and cautions must be followed for your protection and to avoid damage to the equipment.

**WARNING**

Maintenance described in this section is performed with power supplied to the instrument and with the protective covers removed. Maintenance should be performed only by trained service personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed. Read the Safety Summary at the front of this manual before attempting repair on this instrument.

**8-5. SERVICE SHEETS.**

8-6. The service sheet is a unit of information for a circuit which includes a schematic diagram, component locators, theory of operation, and testing information for the schematic. The service sheet number is a large bold number printed on the lower right-hand corner of each schematic.

8-7. **SCHEMATICS.** Schematics are printed on foldout pages for easy reference to the text and figures in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies. Graphic symbols (table 8-1) used in this manual are based on ANSI Y-32.2-1975, Graphic Symbols for Electrical and Electronics Diagrams.

8-8. The schematics are numbered in sequence with a bold number at the lower right-hand corner of each page. These numbers are used to cross reference signal connections between the schematics. At circuit breaking points, a number in a circle is shown, followed by another number in bold type. The circled number indicates the signal and the bold number indicates the associated schematic that contains the source or destination of the signal. To find the source or

destination of the signal, turn to the indicated schematic and find the circled number.

8-9. A table on each schematic lists all components shown on the schematic by reference designation. Component reference designators that have been deleted from the schematic are listed below the table.

8-10. All components within the bordered areas of the schematic are physically located on circuit board assemblies. Components not physically located on a circuit board assembly are shown in the unbordered areas of the schematic.

8-11. **COMPONENT LOCATIONS.** Locations of components on assemblies and subassemblies are illustrated on line drawings adjacent to the schematics. Since the schematics are drawn to show function, portions of a particular assembly may appear on several different schematics.

8-12. **THEORY OF OPERATION.** Overall theory of operation appears opposite the overall block diagram (figure 8-1). The block diagram briefly describes instrument operation. Each block in the diagram contains the service sheet number(s) where the detailed theory, schematics, and troubleshooting information are presented.

**8-13. REFERENCE DESIGNATIONS.**

8-14. Reference designations used in this manual are based on ANSI Y32.16-1975, Reference Designations for Electrical and Electronics Parts and Equipments. Minor variations from the standard, due to design and manufacturing practices, may be noted.

**8-15. TROUBLESHOOTING.**

8-16. **INITIAL TROUBLESHOOTING PROCEDURE.** Before troubleshooting the 1745A in detail, try to perform the adjustment procedures listed in Section V of this manual. Some apparent malfunctions may be corrected by these adjustments; failure to obtain a correct adjustment will often reveal the source of trouble.

8-17. **DC VOLTAGES AND WAVEFORMS.** DC voltages, waveforms, and conditions for making these measurements are given on or adjacent to the schematics on the service sheets. Since conditions for making these measurements may differ from one circuit to another, always check the specific conditions listed for each schematic.

**8-18. TROUBLE DIAGNOSIS.** Use the front-panel controls and note as many symptoms of the malfunction as possible. From these symptoms you can usually determine which section (vertical, horizontal, low- or high-voltage power supply) is malfunctioning. Even if the problem happens to be in the vertical or horizontal section, it is still good practice to check the low-voltage power supplies, since an out-of-tolerance supply can affect the operation of these circuits. Table 8-2 lists the sequence of checks that should be used when troubleshooting.

**8-19. CIRCUIT-LEVEL TROUBLESHOOTING.** Once a problem has been isolated to a particular assembly or circuit, the text and waveforms on the service sheet that document that circuit should be used to locate the faulty component(s).

**8-20. RECOMMENDED TEST EQUIPMENT.**

**8-21.** Test equipment and accessories required to maintain the 1745A are listed in Section I of this manual. Equipment other than that listed may be used if it meets the listed critical specifications.

**8-22. REPAIR.**

**8-23. ASSEMBLY REMOVAL.** Instructions for removing major assemblies are contained in the Service Sheet instructions for that particular assembly. Refer to table 8-3 for a list of assemblies indexed to Service Sheets.

**8-24. PREVENTIVE MAINTENANCE.**

**8-25. Cleaning.** Painted surfaces can be cleaned with a commercial spray-type window cleaner or with a mild soap and water solution.

**CAUTION**

Avoid chemical cleaning agents that might damage the plastics used in this instrument. Recommended cleaning agents are isopropyl alcohol, kelite (1 part kelite, 20 parts water), or a solution of 1% mild detergent and 99% water.

**8-26** Corroded spots are best removed with soap and water. Stubborn residues can be removed with a fine abrasive. Protect such areas from further corrosion with an application of silicone resin such as GE DRIFILM 88.

**8-27. Switch Maintenance.** The pushbutton switches in this instrument were designed for long, trouble-free service. If one of these switches should become defective, replacement rather than repair is recommended.

**8-28.** Rotary switches can easily be serviced after removal from the instrument. For example, to remove the TIME/DIV switch, the TIME/DIV switch shaft must also be removed. Refer to Service Sheet 8 for TIME/DIV switch shaft removal and appropriate Service Sheet for switch maintenance.

**8-29.** Conventional rotary switches are serviced by cleaning the contacts with a degreaser such as M-180 FREON TF DEGREASER. Contact surfaces should be lubricated with a lubricant comparable to LUBRIPLATE FLM produced by Fiske Brothers Refining Company. LUBRIPLATE FLM is available from Hewlett-Packard (HP Part No. 6040-0305).

*Table 8-2. Troubleshooting Sequence*

| CHECK                          | COMMENT                                                                                                                                                                                         |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. LVPS                        | All other functions rely on LVPS for proper operation.                                                                                                                                          |
| 2. CRT & HVPS                  | All high voltages and CRT must function to obtain a display.                                                                                                                                    |
| 3. GATE AMPLIFIER              | CRT must be unblanked to display signal.                                                                                                                                                        |
| 4. VERTICAL SECTION            | After obtaining a visible beam, begin checking deflection circuitry.                                                                                                                            |
| 5. HORIZONTAL OUTPUT AMPLIFIER | To distinguish between time base and horizontal output amplifier problems, apply signal to channel B (in A VS B mode); if deflection occurs, horizontal output amplifier is operating properly. |
| 6. SWEEP                       | After checking horizontal output amplifier, check ramp generating circuitry (in AUTO mode). When auto sweep is operating properly, check trigger circuit.                                       |

**8-30. CIRCUIT BOARDS.**

**8-31. Board Connections.** Square-pin connectors are identified on circuit boards by color code of connecting wire or by the signal name. Connector pins on plugs and jacks are identified by either a numeral or a letter. The letters G, I, O, and Q have been omitted.

**8-32. Servicing Etched Circuit Boards.** All 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.

*Table 8-3. Assembly to Service Sheet Index*

| ASSY NO. | ASSY NAME                 | THEORY OF OPERATION    | COMPONENT ID     | REMOVAL PROCEDURE | TROUBLE-SHOOTING             | SCHEMATIC              |
|----------|---------------------------|------------------------|------------------|-------------------|------------------------------|------------------------|
| A1       | CHAN A ATTENUATOR         | Service Sheet 4        | NA               | Service Sheet 4   | NA                           | Service Sheet 4        |
| A2       | CHAN B ATTENUATOR         | Service Sheet 4        | NA               | Service Sheet 4   | NA                           | Service Sheet 4        |
| A3       | Vertical Preamplifier     | Service Sheets 4 and 6 | Service Sheet 4  | Service Sheet 4   | Service Sheets 4 and 6       | Service Sheets 4 and 6 |
| A4       | Delay Line                | Service Sheet 4        | NA               | Service Sheet 4   | NA                           | Service Sheet 4        |
| A5       | Vertical Output           | Service Sheet 5        | Service Sheet 5  | Service Sheet 5   | Service Sheet 5              | Service Sheet 5        |
| A6       | High-Voltage Multiplier   | Service Sheet 2        | NA               | Service Sheet 2   | NA                           | Service Sheet 2        |
| A7       | Horizontal Sweep          | Service Sheet 7        | Service Sheet 7  | Service Sheet 7   | Service Sheets 7, 11, and 12 | Service Sheets 10-12   |
| A8       | Main Sweep                | Service Sheet 8        | Service Sheet 8  | Service Sheet 8   | Service Sheet 8              | Service Sheet 8        |
| A9       | Delayed Sweep             | Service Sheet 10       | Service Sheet 10 | Service Sheet 10  | Service Sheet 10             | Service Sheet 10       |
| A10      | Delayed Trigger           | Service Sheet 9        | Service Sheet 9  | Service Sheet 9   | Service Sheet 9              | Service Sheet 9        |
| A11      | Horizontal Output         | Service Sheet 11       | Service Sheet 11 | Service Sheet 11  | Service Sheet 11             | Service Sheet 11       |
| A12      | Gate                      | Service Sheet 3        | Service Sheet 3  | Service Sheet 3   | Service Sheet 3              | Service Sheets 2, 3    |
| A13      | Vertical Control Switch   | NA                     | Service Sheet 6  | Service Sheet 4   | NA                           | Service Sheets 4, 6    |
| A14      | Interface                 | NA                     | NA               | NA                | NA                           | Service Sheet 13       |
| A15      | High-Voltage Power Supply | Service Sheet 2        | Service Sheet 2  | Service Sheet 2   | Service Sheet 2              | Service Sheet 2        |
| A16      | Low-Voltage Power Supply  | Service Sheet 1        | Service Sheet 1  | Service Sheet 1   | Service Sheet 1              | Service Sheet 1        |

## OVERALL BLOCK DIAGRAM

### BASIC PRINCIPLES OF OPERATION

**General.** The following paragraphs contain functional descriptions keyed to a block diagram located on the opposite page. The block diagram is drawn for function and does not show circuit details. Schematics, along with a detailed theory description of each circuit are located on following service sheets. Refer to table 8-3 for an Assembly to Service Sheet Index.

**Vertical Section.** The input attenuators select the type of input coupling (50 $\Omega$ , DC, GND, or AC), and determine the vertical deflection factor (5 mV/div to 20 V/div) as selected by the front-panel VOLTS/DIV switches. Only contact strips and their actuating cams are contained in the attenuator assemblies. The major part of each attenuator is on the preamplifier substrate. The only passive attenuation is an X100 section preceding the discrete, dual-FET impedance converter in each channel. The preamplifier substrate (A3A1) performs the necessary control functions for both channels A and B, including six dc-actuated ranges of attenuation per channel. Along with the X100 section, this configuration provides 12 calibrated levels of vertical sensitivity, ranging from 5 mV/div to 20 V/div. Peripheral circuitry includes control logic for the preamplifier substrate and a trigger-view amplifier that routes trigger signals through the delay line to the output amplifier.

**Delay Line.** The delay line provides approximately 100 nanoseconds delay to the vertical input signal. This allows the horizontal sweep to trigger before the vertical signal reaches the CRT plates.

**Vertical Output Amplifier.** The vertical output amplifier contains pulse-shaping networks and an X5 amplification stage. Its output stage provides drive to the CRT vertical deflection plates.

**Horizontal Section.** The internal sync amplifier provides a synchronization signal for the main and delayed trigger generators. The generators develop trigger signals that start the main and delayed sweeps. The trigger is also applied to an auto circuit that is used in AUTO mode only. Outputs of the generators are controlled by the level of the sync signal applied and the reset signal from the holdoff control circuit. When the reset signal is high, the generator is inoperative; when low, the generator is operational and a trigger signal will be developed if there is an internal or external sync input.

The main and delayed sweep circuits initiate horizontal sweeps from the trigger signal applied to their inputs. Miller integrators produce the horizontal sweep ramps; their slopes are controlled by the TIME/DIV switches. Outputs from the Miller integrators are applied through horizontal display mode switches to the horizontal preamplifier. The horizontal sweep is also compared to a reference voltage by a ramp comparator that drives

the reset circuit. The reset and holdoff circuits control the timing sequence of the sweep ramp.

The holdoff circuit establishes a time interval at the end of the sweep that disables the trigger generator. The trigger generator is armed at the end of holdoff and is ready for the next trigger signal. The duration of holdoff is controlled by the TIME/DIV setting and the TRIGGER HOLDOFF control.

The horizontal preamplifier provides amplification for the sweep ramp. The horizontal POSITION control establishes a reference level for the horizontal sweep. Trace magnification (X10) is also accomplished in this stage. When the BEAM FIND switch is pressed, current in the output stage of the preamplifier is reduced, preventing the horizontal output stage from driving the beam beyond the viewing area of the CRT. The horizontal output stage provides drive to the CRT horizontal deflection plates.

**Gate and HV Power Supply.** The gate amplifier provides the circuitry to control brightness of the CRT display. An intensity control circuit is used for brightening or blanking the CRT when necessary. BEAM FIND, BEAM INTENSITY, and SCALE controls are part of the gate amplifier assembly.

The high-voltage power supply consists of a high-voltage oscillator, a high-voltage transformer, and a rectifying circuit. The high-voltage oscillator produces cathode, grid, and focus voltages for the CRT. A secondary winding on the high-voltage transformer provides voltage for the CRT cathode heater.

The rectified CRT cathode voltage is sampled and fed back to the high-voltage oscillator. Changes in cathode voltage cause the oscillator to change the amplitude of its oscillation. This change corrects the rectified cathode voltage and returns it to the normal operating value. The unrectified cathode voltage in the secondary of the high-voltage transformer is applied to a multiplier assembly where it is increased six times. The multiplier output is connected to the CRT post accelerator.

**Low-Voltage Power Supply.** The low-voltage power supply operates from an ac power source. The ac line is applied to the input power circuit (100-, 120-, 220-, or 240-Vac operation is selectable). The input power circuit contains the ac line protection fuse and applies input ac to a step-down power transformer.

Secondary outputs from the power transformer are applied to rectifiers and voltage regulator circuits which convert input ac power to usable dc outputs of different voltage levels.

### TROUBLESHOOTING

Use this overall block diagram and the troubleshooting sequence outlined in table 8-2 to isolate the trouble to a specific section of the instrument. Next, refer to the service sheets which cover that section, and isolate the trouble to a specific circuit or component.

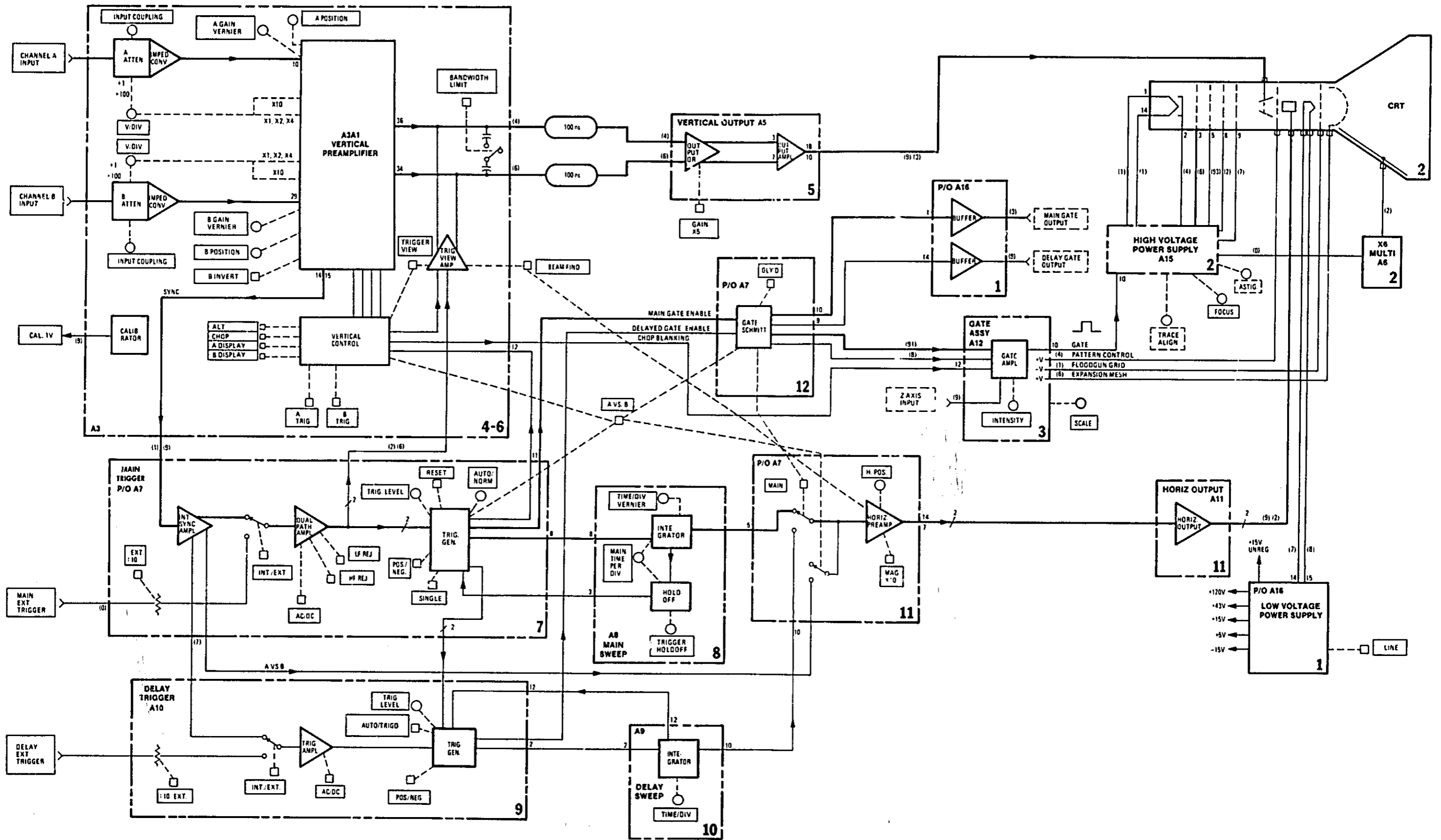


Figure 8-1.  
Overall Block Diagram  
8-5

**SERVICE SHEET 1**

**THEORY OF OPERATION**

**General.** The low-voltage power supply (LVPS) can be operated from a 100-, 120-, 220-, or 240-Vac, 48-Hz to 440 Hz power source. The line voltage is connected to five regulated voltage circuits +5 V, +15 V, +43 V, +120 V, and -15 V. Approximately +22 V is tapped off the +15 V supply (before regulation) for use in the high-voltage oscillator circuit. This voltage is referred to on the schematics as +15 V UNREG. Since the +5 V, +15 V, and -15 V supplies function in the same manner, only the +15 V and +120 V supplies will be discussed.

**+15-volt Supply.** The ac input is applied through transformer T1 to full-wave, diode-bridge rectifier A16CR4. The unregulated rectified voltage (nominally +22 Vdc is applied to voltage regulator A16U1 that employs a built-in thermal shutdown and current-limiting circuits. Operation of the +15 V supply is explained in the following paragraphs.

The output of series regulator Q4 is controlled by the base bias applied from regulator A16U1. IC A16U1 contains a temperature compensation reference circuit and a differential amplifier with a Darlington output. The voltage developed internally by the reference circuit (pin 4 output) is connected to the noninverting input (pin 3) of the differential amplifier through A16R23. The V<sub>REF</sub> voltage is approximately +7 volts with respect to V- pin 5 (ground). The +15 V output (from Q4) is divided by resistor network A16R25-A16R27. The wiper of potentiometer A16R26 is connected to the inverting input (pin 2) of the differential amplifier and is adjusted to compensate for V<sub>REF</sub> variations developed within different ICs. When adjusted, the noninverting and inverting input voltages will always be equal (within a few millivolts) when the regulator is functioning properly. If the output of the +15 V supply raises or lowers for some reason, the inverting input voltage will follow. On the other hand, the reference voltage applied to the noninverting input remains fixed. With different voltages applied to the noninverting and inverting inputs to the amplifier, the output (pin 6) at A16U1 will vary, causing Q4 to increase or decrease its output as necessary to restore the output to +15 volts. The -15 V supply, consisting of A16U3 and Q6, operates identically to the +15 V supply except that the noninverting input to A16U3 (pin 3) is the sum of the +15 V and -15 V outputs (nominally 0 V).

The +5 V supply, consisting of A16U2 and Q5, operates identically to the +15 V supply except that the reference voltage is the +15 V supply and attenuated by A16R28 and A16R29.

**+120-volt and +43-volt Power Supplies.** The +120 V and +43 V power supplies function in the same manner; therefore, only the +120 V supply will be discussed.

The ac input voltage from power transformer T1 is applied to diode-bridge rectifier A16CR1. The dc output from the rectifier is filtered by A16C3. A +15-volt reference is applied through A16R1 to the base of A16Q1 which is part of differential amplifier A16Q1/Q2. The base of A16Q2 is connected to a voltage-divider network across the output circuit. If the output falls below +120 V, the base of A16Q2 becomes less positive and A16Q2 conducts harder. A16Q2 is direct-coupled to Darlington pair A16Q4 and Q2. When the current through A16Q2 increases, conduction through A16Q4 and Q2 will also increase and cause an increase in output voltage. When the output voltage reaches +120 volts, A16Q2 current decreases and equilibrium is attained. Transistor A16Q3 and resistor A16R2 form a current-limiting circuit. As current requirements increase toward the limit of the supply capability, the voltage drop across A16R2 is applied to the base of A16Q3 which conducts, limiting the current drain from the Darlington pair.

The +43 V power supply functions in the same way as the +120 V supply. The Darlington pair consists of A16Q8 and Q3; the current-limiting circuit consists of A16Q7 and A16R10.

**Line Frequency.** The line frequency sync signal is developed in the same secondary winding of power transformer T1 that is used for the +120 V supply. The ac signal is applied through A16R40 to HF REJ switch A7S2B,C on assembly A7 (see Service Sheet 7).

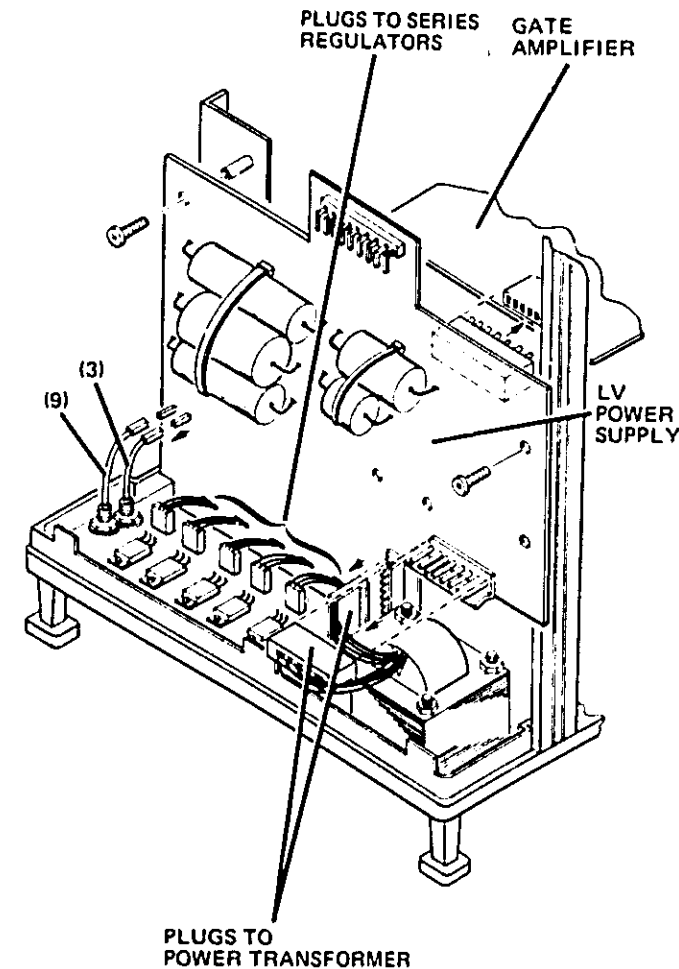
**Floodgun Filament Voltage.** Floodgun filament voltage is developed in a secondary winding of transformer T1, rectified by A16CR3, and filtered by A16C7. The rectified voltage is applied to a time-delay, current-source circuit consisting of two Darlington amplifiers, A16Q11/A16Q12. When the instrument is first turned on, A16Q11 conducts, holding the output of A16Q12 to a minimum value. When A16C20 becomes fully charged (through A16R41), A16Q11 cuts off. The current through A16Q12 is now controlled by front-panel SCALE ILLUM control A12R25 (Service Sheet 4). Zener diode A16VR3 provides a constant voltage across the SCALE ILLUM potentiometer and A16R20 adjusts the floodgun pattern.

**REMOVAL PROCEDURE**

To remove Low-Voltage Power Supply Assembly A16, proceed as follows:

**NOTE**

Removal of A16 is not necessary unless it must be replaced; all work can be performed with A16 in place except for repair or replacement of line selection and on-off switches.



*LV Power Supply Removal*

- Remove Interface Assembly A14.
- Disconnect gate output wires (9) and (3).
- Disconnect two plugs to power transformer.
- Remove line cover MP58 by removing two screws.
- Disconnect ac input leads (98) and (918).
- Disconnect five plugs to series regulators Q2 thru Q6.

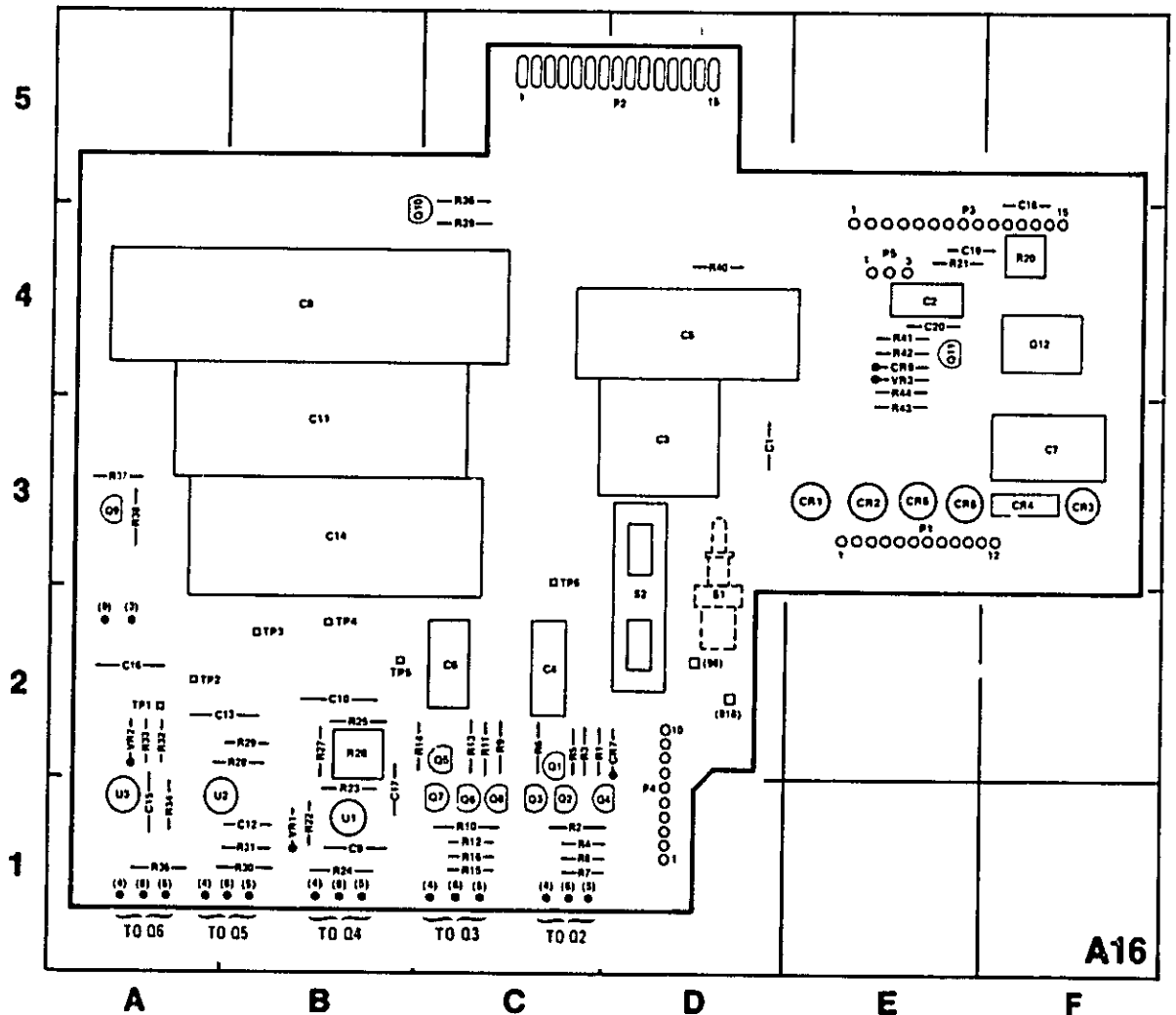
- Remove five screws holding A16 to chassis.
- Disconnect plug to Gate Amplifier Assembly A12.
- Carefully lift and move A16 toward front of instrument. LINE switch shaft will protrude through front panel.
- Unscrew LINE switch shaft and extract it.
- Remove button from shaft; A16 can now be removed.

l. To reinstall A16, reverse procedure, except after A16 is secured in place, screw LINE switch shaft into switch (switch must be in "out" position) until slot is halfway through bezel, then press button onto shaft (see Service Sheet 3).

**TROUBLESHOOTING**

All voltages: +5 V, +43 V, +120 V, -15 V, and the high voltage are referenced to the +15 V supply, so it must be made operational first. Each supply is the current-limiting type, so any excessive loading from the vertical, horizontal, etc., will cause the supply to read low. To quickly check if an external load is causing A16 to current-limit and read low, remove Interface Assembly A14 that connects the power supply to Vertical Pre-amplifier A3 and Horizontal Sweep Assembly A7. If supplies return to normal, then an external heavy load is most likely causing the problem. Assembly A3 can be flexed upward, so A14 (Interface Assembly) can be connected between Assembly A16 and Assembly A7. This will help determine if the problem is on A3 or A7. It is also possible to disconnect Gate Amplifier A12 and HV Power Supply A15, from Power Supply Assembly A16 by disconnecting A15 from the bottom of A16.

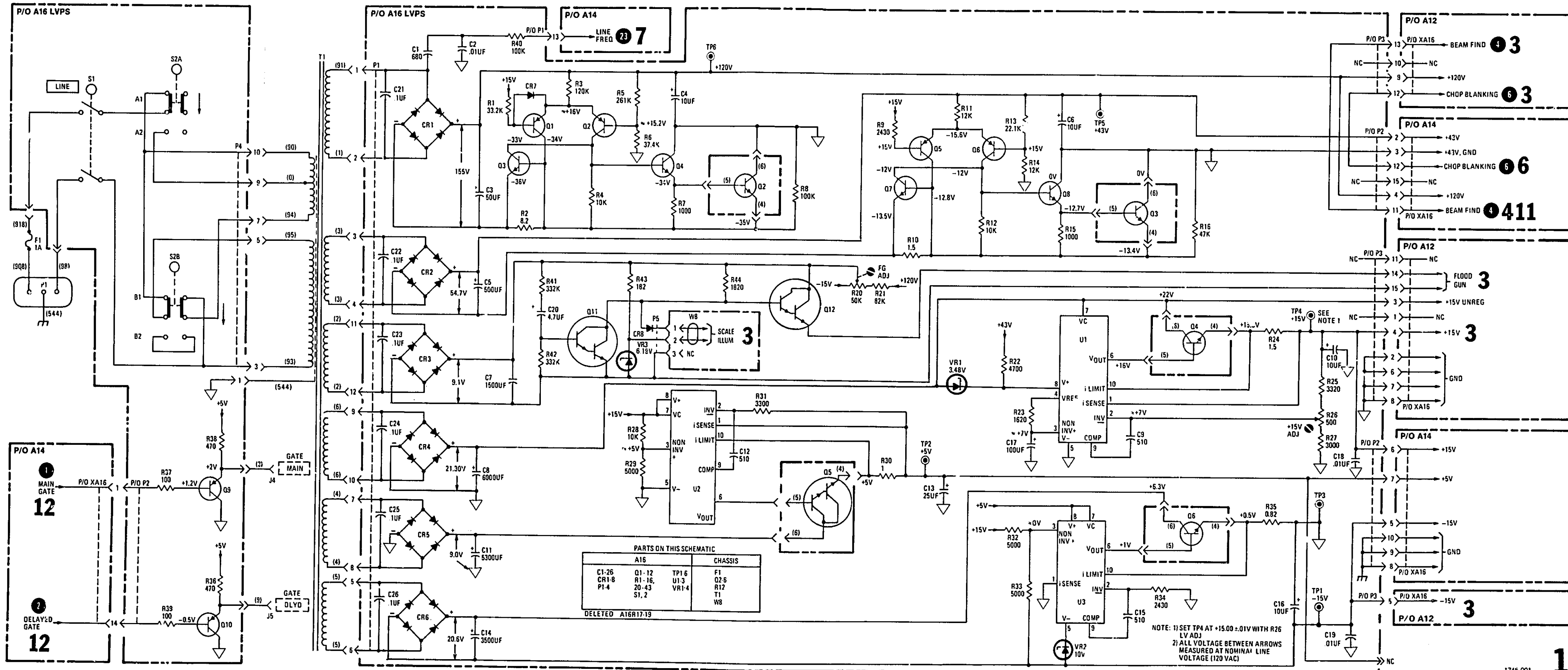
Finally, check for proper dc voltages indicated on the schematic for certain active components. Unless otherwise indicated, all voltages are referenced to chassis ground. All indications are nominal, and 15% variations from those indicated should be considered normal.



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | D-3      | CR1       | E-3      | Q8        | C-1      | R16       | C-1      | R39       | C-4      |
| C2        | E-4      | CR2       | E-3      | Q9        | A-3      | R20       | F-4      | R40       | D-4      |
| C3        | D-3      | CR3       | F-3      | Q10       | B-4      | R21       | E-4      | R41       | E-4      |
| C4        | C-2      | CR4       | F-3      | Q11       | E-4      | R22       | B-1      | R42       | E-4      |
| C5        | D-4      | CR5       | E-3      | Q12       | F-4      | R23       | B-1      | R43       | E-3      |
| C6        | C-2      | CR6       | E-3      | R1        | C-2      | R24       | B-1      | R44       | E-4      |
| C7        | F-3      | CR7       | D-2      | R2        | C-1      | R25       | B-2      | S1        | D-2      |
| C8        | B-4      | CR8       | E-4      | R3        | C-2      | R26       | B-2      | S2        | D-2      |
| C9        | B-1      | P1        | E-3      | R4        | C-1      | R27       | B-2      | TP1       | A-2      |
| C10       | B-2      | P2        | D-5      | R5        | C-2      | R28       | B-2      | TP2       | A-2      |
| C11       | B-3      | P3        | E-4      | R6        | C-2      | R29       | B-2      | TP3       | B-2      |
| C12       | B-1      | P4        | D-1      | R7        | C-1      | R30       | B-1      | TP4       | B-2      |
| C13       | B-2      | P5        | E-4      | R8        | C-1      | R31       | B-1      | TP5       | B-2      |
| C14       | B-3      | Q1        | C-2      | R9        | C-2      | R32       | A-2      | TP6       | C-3      |
| C15       | A-1      | Q2        | C-1      | R10       | C-1      | R33       | A-2      | U1        | B-1      |
| C16       | A-2      | Q3        | C-1      | R11       | C-2      | R34       | A-1      | U2        | A-1      |
| C17       | B-1      | Q4        | C-1      | R12       | C-1      | R35       | A-1      | U3        | A-1      |
| C18       | F-4      | Q5        | C-2      | R13       | C-2      | R36       | C-4      | VR1       | B-1      |
| C19       | E-4      | Q6        | C-1      | R14       | C-2      | R37       | A-3      | VR2       | A-2      |
| C20       | E-4      | Q7        | C-1      | R15       | C-1      | R38       | A-3      | VR3       | E-4      |

*LVPS, A16, Component Identification*





A12.

**NG**

step, discharge high voltage part of wires leads together.

Insert small (0) wire and large (1) wire into assembly A6.

Reverse removal procedure; install small (0) wire and large (1) wire in step k.

Remove covers.

Remove and reinstall 2 longer screws at the rear of HV power supply.

**VG**

Prevent injury or death by disconnecting HV board. Exercise caution performing the following.

**IN**

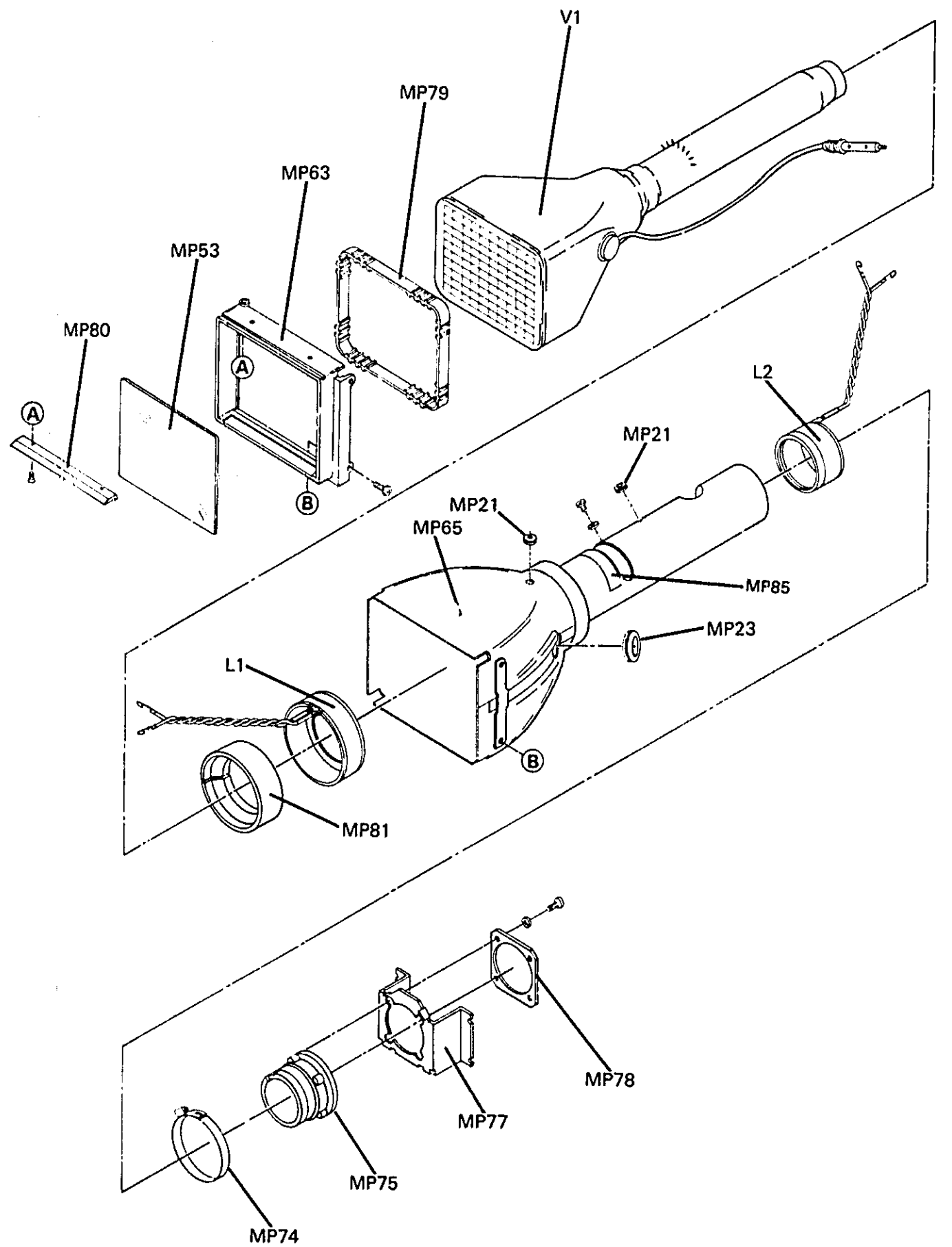
Disconnect filament from static discharge Accelerator lead. Increase intensity do not deviate discharge procedure.

Disconnect accelerator as follows:

Reduce intensity to minimum. Turn maximum.

Elimination is present on

When on, pull HV oscillator lead to disconnect oscillator. Then turn off power and disconnect accelerator output lead at and short CRT end to ensure complete PA discharge.



- e. Disconnect 9 neck pin leads and base socket from CRT.
- f. Disconnect front CRT shield leads (956 and 967) from HVPS board.
- g. Disconnect rear CRT shield leads (0 and 3) from gate board.
- h. Remove shield to deck ground strap screw.
- i. Loosen hose clamp (MP74) (clamp accessible through cut-out in shield).
- j. Remove 4 pan-head and 2 flat-head screws from CRT mounting bracket (MP77).
- k. Slide CRT mount assembly (MP75, MP77 and MP78) rearward until it is completely removed from instrument.

**NOTE**

It may be necessary to loosen 4 screws holding CRT mount clamp ring (MP78) to CRT mounting bracket (MP77) in order for the hose clamp screw to clear the inside of CRT shield.

- l. While supporting rear of CRT and shield, remove 2 flat-head screws holding CRT bezel (MP63) to front casting just above the CRT.
- m. Slide CRT and shield rearward until the CRT bezel clears the front casting.
- n. Lift front of CRT and shield as an assembly up and forward until clear of instrument.
- o. With CRT laying on bench, remove 4 flat-head screws holding CRT bezel to front of CRT shield and remove mount.
- p. While holding CRT faceplate and shield so that CRT does not slip out of shield, position CRT face down on a protected bench surface (soft mat, carpeted, etc.).
- q. Carefully pull the shield upward while providing a slight downward pressure on CRT until shield clears the front CRT positioning strap.
- r. Continue the shield removal being careful not to damage CRT neck pins.
- s. Note the position of the CRT shock mount belt (MP79) before removing so that it can be positioned the same way for installation.
- t. To install CRT reverse steps o through s and check for proper graticule to mount alignment. If the alignment is correct continue installation by reversing

steps a through n. If graticule alignment is not correct note which direction of rotation of the CRT will align graticule.

u. Repeat steps o, p, and q.

v. Rotate front CRT shock mount belt (MP79) in the opposite direction the CRT needs to be rotated a couple of notches and repeat step t.

**TROUBLESHOOTING**

To troubleshoot HV Power Supply Assembly A15, remove the HV cover. Be sure to reinstall the two screws nearest the rear of the instrument. This provides the necessary ground connections for assembly A15.

**WARNING**

Dangerous voltages capable of causing death are present in this instrument. Use extreme care when working on an active high-voltage power supply.

High-voltage oscillator collector and base waveform measurement locations are accessible directly on assembly A15, as well as control-grid and cathode-voltage test points. A high-voltage disable circuit turns off the oscillator if the low-voltage power supplies malfunction. This protects the CRT phosphor from burns.

**CAUTION**

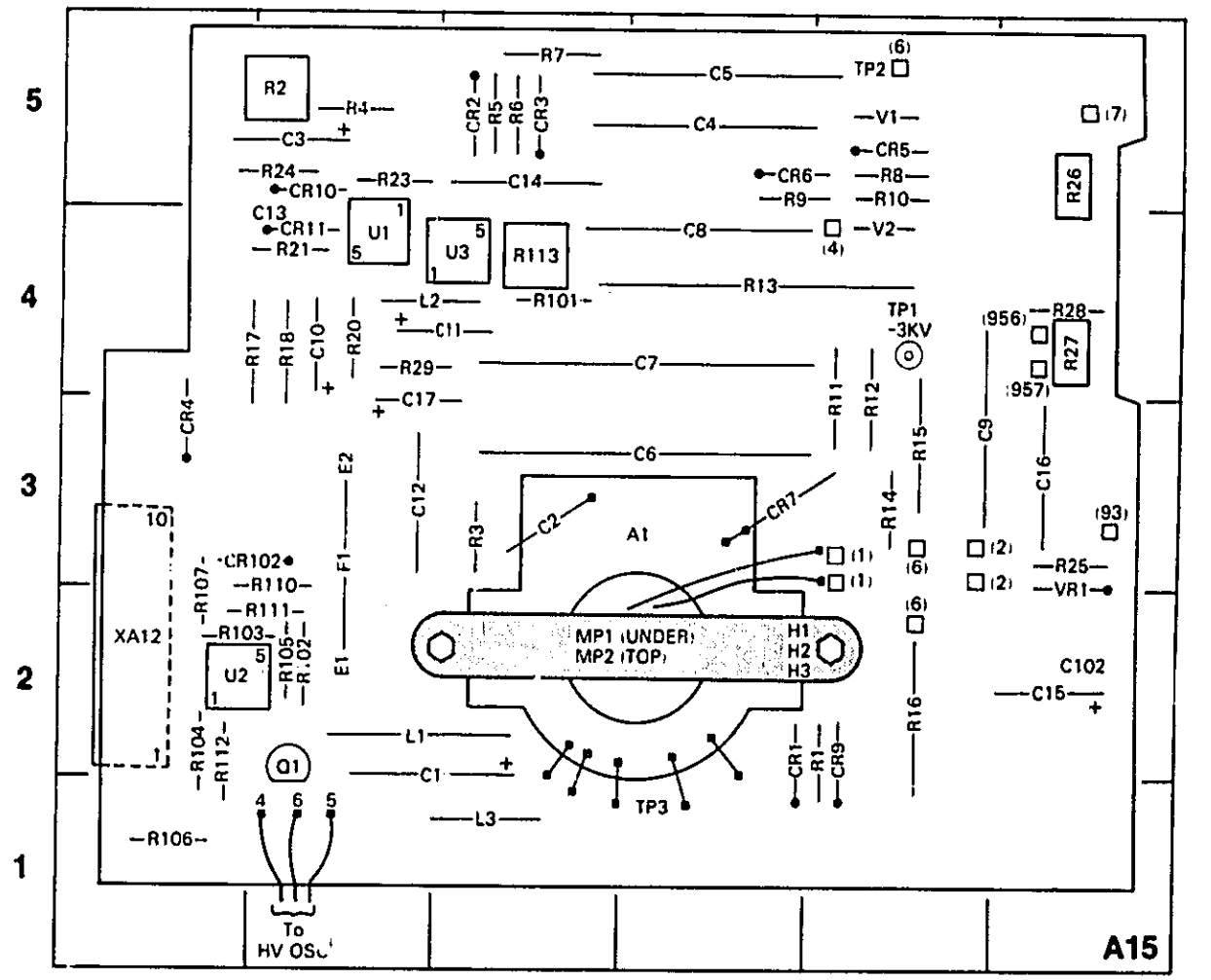
When measuring high voltages, always use a 1000:1 probe with an impedance of 100 MΩ or greater.

If grid and cathode voltages are present on A15, verify that they are also present at the CRT socket; a faulty socket or wire can cause an open circuit.

Common CRT problems consist of open filaments, grid-cathode shorts (uncontrollable beam), and "hollow cathodes," sometimes referred to as "double-peaking." Hollow cathodes can be detected by increasing intensity. As the intensity knob is rotated clockwise, the beam will get brighter, up to a point; beyond this point it will decrease in brilliance and may defocus.

If the high voltage is low, and low voltages are correct, check for a faulty high-voltage transformer, leaky capacitors, or resistors that may have changed in value (typical problem with extremely large resistors - 30 MΩ, etc.).

Faulty high-voltage multipliers usually cause the display to be of low intensity and out of focus. Multipliers can sometimes be checked by measuring the output with a high-voltage probe.



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| A1        | D-3      | C12       | B-3      | CR6       | D-5      | H3        | D-2      | R5        | B-5      | R16       | E-2      | R29       | F-4      | R113      | C-4      |
| C1        | B-1      | C13       | B-4      | CR7       | D-3      | L1        | B-2      | R6        | B-5      | R17       | A-4      | R101      | C-4      | TP1       | E-4      |
| C2        | C-3      | C14       | B-5      | CR9       | E-2      | L2        | B-4      | R7        | C-5      | R18       | B-4      | R102      | B-2      | RP2       | E-5      |
| C3        | B-5      | C15       | F-2      | CR10      | B-5      | L3        | C-1      | R8        | C-5      | R19       | B-4      | R103      | A-2      | TP3       | D-1      |
| C4        | D-5      | C16       | F-3      | CR11      | B-4      | MP1       | C-2      | R9        | D-5      | R21       | B-4      | R104      | A-2      | U1        | B-4      |
| C5        | D-5      | C17       | B-3      | CR102     | B-3      | MP2       | C-2      | R10       | E-5      | R23       | B-5      | R105      | B-2      | U2        | A-2      |
| C6        | D-5      | C102      | F-2      | E1        | B-2      | Q1        | B-2      | R11       | E-3      | R24       | B-5      | R106      | A-1      | U3        | C-4      |
| C7        | D-4      | CR1       | D-2      | E2        | B-3      | R1        | E-2      | R12       | E-3      | R25       | F-3      | R107      | A-2      | V1        | E-5      |
| C8        | D-4      | CR2       | C-5      | F1        | B-3      | R2        | B-5      | R13       | D-4      | R26       | F-5      | R110      | B-2      | V2        | E-4      |
| C9        | E-3      | CR3       | C-5      | H1        | D-2      | R3        | C-3      | R14       | E-3      | R27       | F-4      | R111      | B-2      | VR1       | F-3      |
| C10       | B-4      | CR4       | A-3      | H2        | D-2      | R4        | B-5      | R15       | E-3      | R28       | F-4      | R112      | A-2      | XA12      | A-2      |
| C11       | C-4      | CR5       | E-5      |           |          |           |          |           |          |           |          |           |          |           |          |

HVPS, A15, Component Identification

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 2**

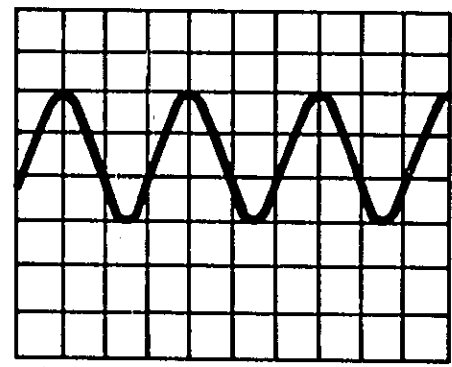
1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variations from those indicated should be considered normal.

**WARNING**

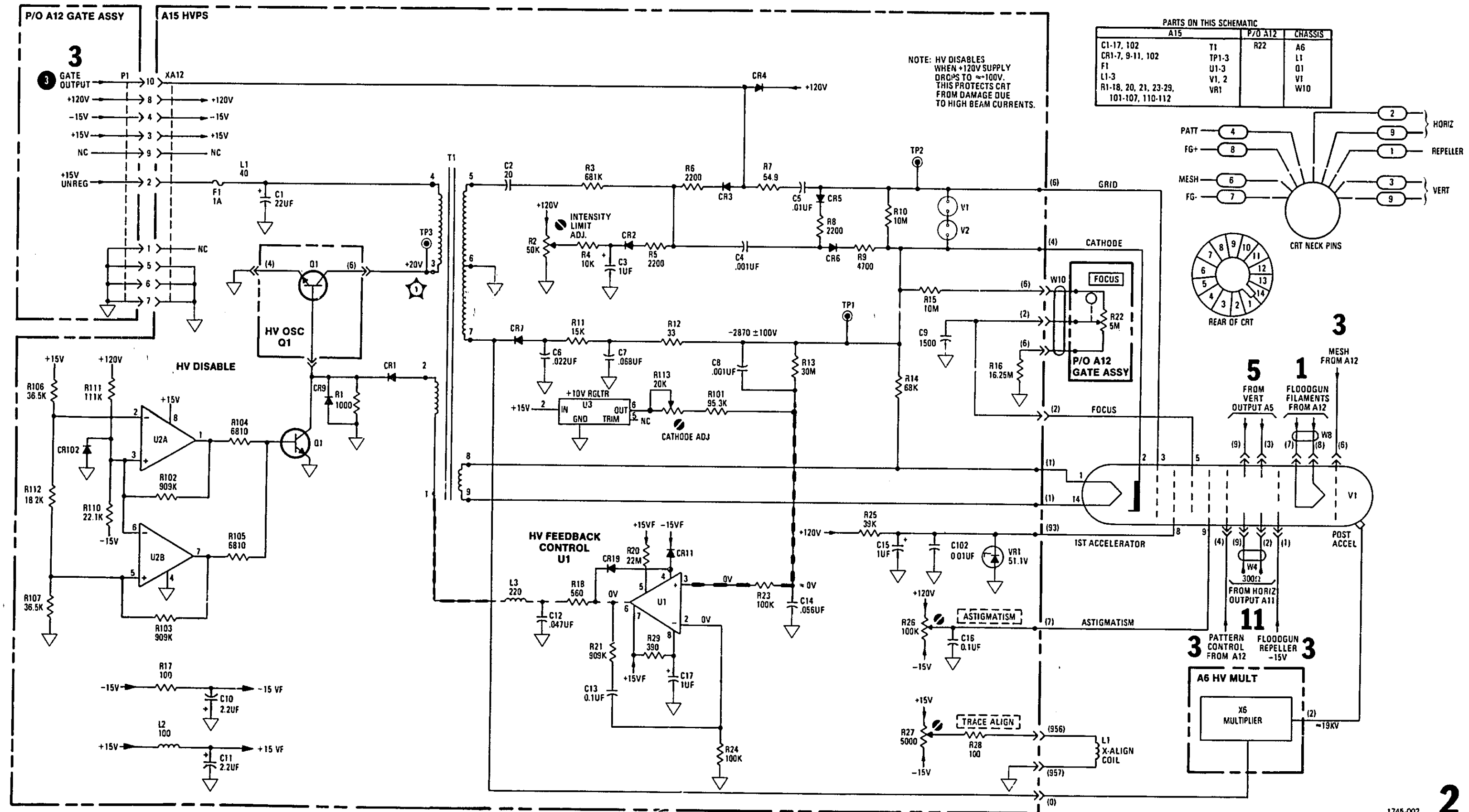
Voltages in the HIGH VOLTAGE area are dangerous to life. Use extreme care in making measurements and observe precautions listed in the SAFETY SUMMARY at the front of this manual.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 2**

1. Set front-panel controls in accordance with initial control settings in Section V.
2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).



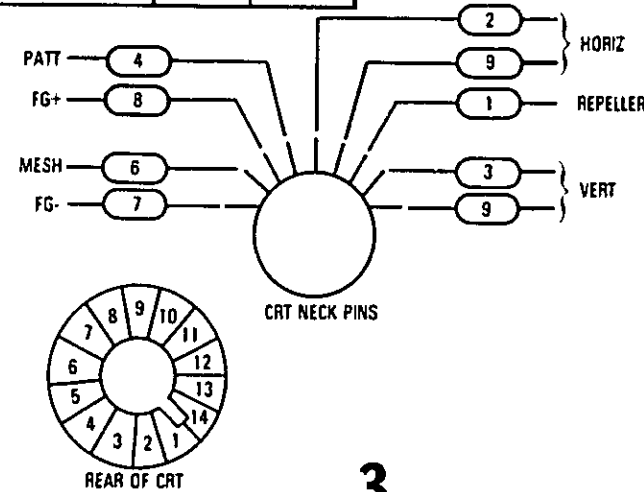
10 V/DIV  
10 μSEC/DIV



NOTE: HV DISABLES WHEN +120V SUPPLY DROPS TO ~100V. THIS PROTECTS CRT FROM DAMAGE DUE TO HIGH BEAM CURRENTS.

PARTS ON THIS SCHEMATIC

| A15                                    | P/O A12 | CHASSIS |
|----------------------------------------|---------|---------|
| C1-17, 102                             | T1      | A6      |
| CR1-7, 9-11, 102                       | TP1-3   | L1      |
| F1                                     | U1-3    | Q1      |
| L1-3                                   | V1, 2   | V1      |
| R1-18, 20, 21, 23-29, 101-107, 110-112 | VR1     | W10     |



**SERVICE SHEET 3**

**THEORY OF OPERATION**

**General.** Gate Assembly A12 controls trace intensity on the CRT; A12U1 sums all functions necessary for intensity control. Inputs to A12U1 are external Z-axis input, main gate, delayed gate, and chop blanking.

**Beam Intensity.** Front-panel BEAM INTENSITY control A12R3 establishes the level of current supplied to current switch A12U1Q1/A12U1Q2. Output of the current switch is applied to a gate amplifier circuit consisting of A12Q1 through A12Q4. Intensity adjustment A15R2 on the high-voltage power supply establishes the minimum cut-off level for the CRT.

**Main Gate.** The main gate signal is applied to the base of A12U1Q1, controlling its operation. When the main gate signal is low, A12U1Q1 turns off and A12U1Q2 conducts, unblanking the CRT. The same sequence occurs for the delayed gate signal which is applied to the base of A12U1Q5. When the delayed gate signal is high, A12U1Q5 conducts, unblanking the CRT.

**Chop Blanking.** Chop blanking is accomplished through A12U1Q3. When CHOP mode of operation is selected, the chop blanking signal, applied to the base of A12U1Q3, turns it on and off. This causes blanking and unblanking of the CRT at the chop blanking repetition rate (~250 kHz).

**Z-axis Input.** A Z-axis signal of +4 V, pulse width >60 nanoseconds, dc to <10 MHz will blank the CRT trace of normal intensity.

**Beam Find.** When BEAM FIND switch A12S1 is engaged, the setting of INTENSITY control A12R3 is added to a fixed voltage and supplied through the gate amplifier to the CRT. This causes intensification of the CRT trace.

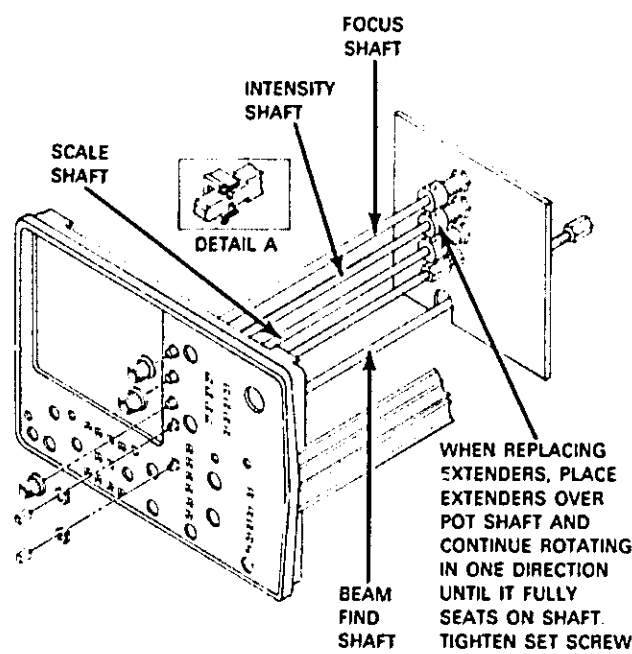
**Output.** The gate amplifier output is a shunt feedback stage consisting of A12Q1 through A12Q4. Transistors A12Q1 and A12Q3 are emitter followers with A12Q1 providing the ac signal path. Network A12R13/A12C11 provides the feedback path.

**REMOVAL PROCEDURE**

To remove Gate Amplifier Assembly A12, proceed as follows:

- a. Remove HVPS cover MP54.

- b. Disconnect wires on component side of A12.
- c. Disconnect two (6) wires and one (2) wire from FOCUS potentiometer on A15 (HVPS).
- d. Disconnect Z-axis wire (9) on rear of A12.
- e. Remove SCALE, FOCUS and BEAM INTENSITY shafts from potentiometer using small hex wrench (Allen 050).
- f. Disconnect A12 from A16 (LVPS).
- g. Disconnect A12 from A15 (HVPS).
- h. Remove BEAM FIND shaft by pushing A12 forward so that button clears front panel and then unscrew shaft.
- i. Remove button from shaft.
- j. Remove A12.
- k. To reinstall A12, reverse removal procedure, except install BEAM FIND shaft and adjust so slot is halfway through bezel after HVPS cover MP54 is secured; then install button.



Gate Amplifier Assembly A12 Removal

**TROUBLESHOOTING**

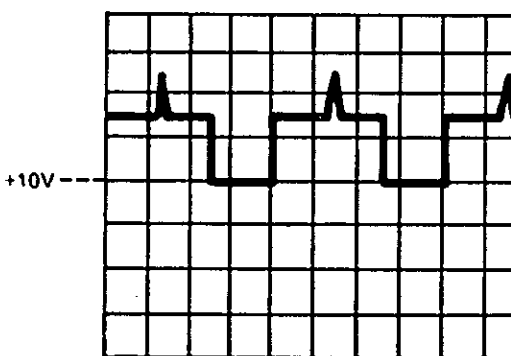
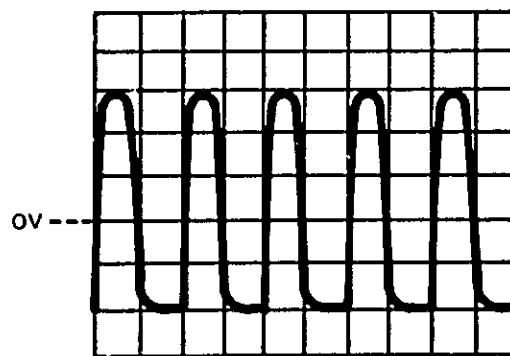
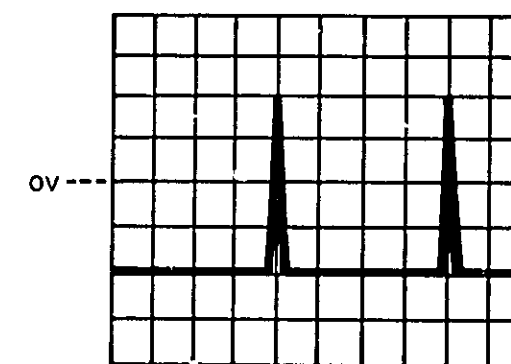
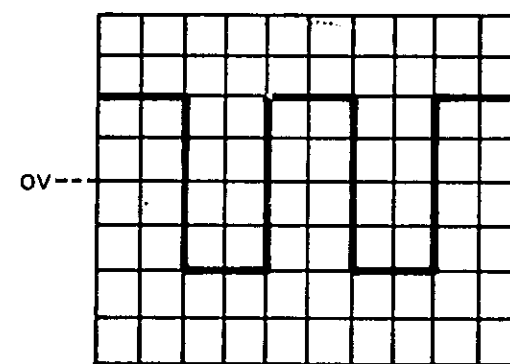
Malfunctions in Gate Amplifier Assembly A12 will usually be transistor failures in the output driver stages.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 3**

1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variations from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 3**

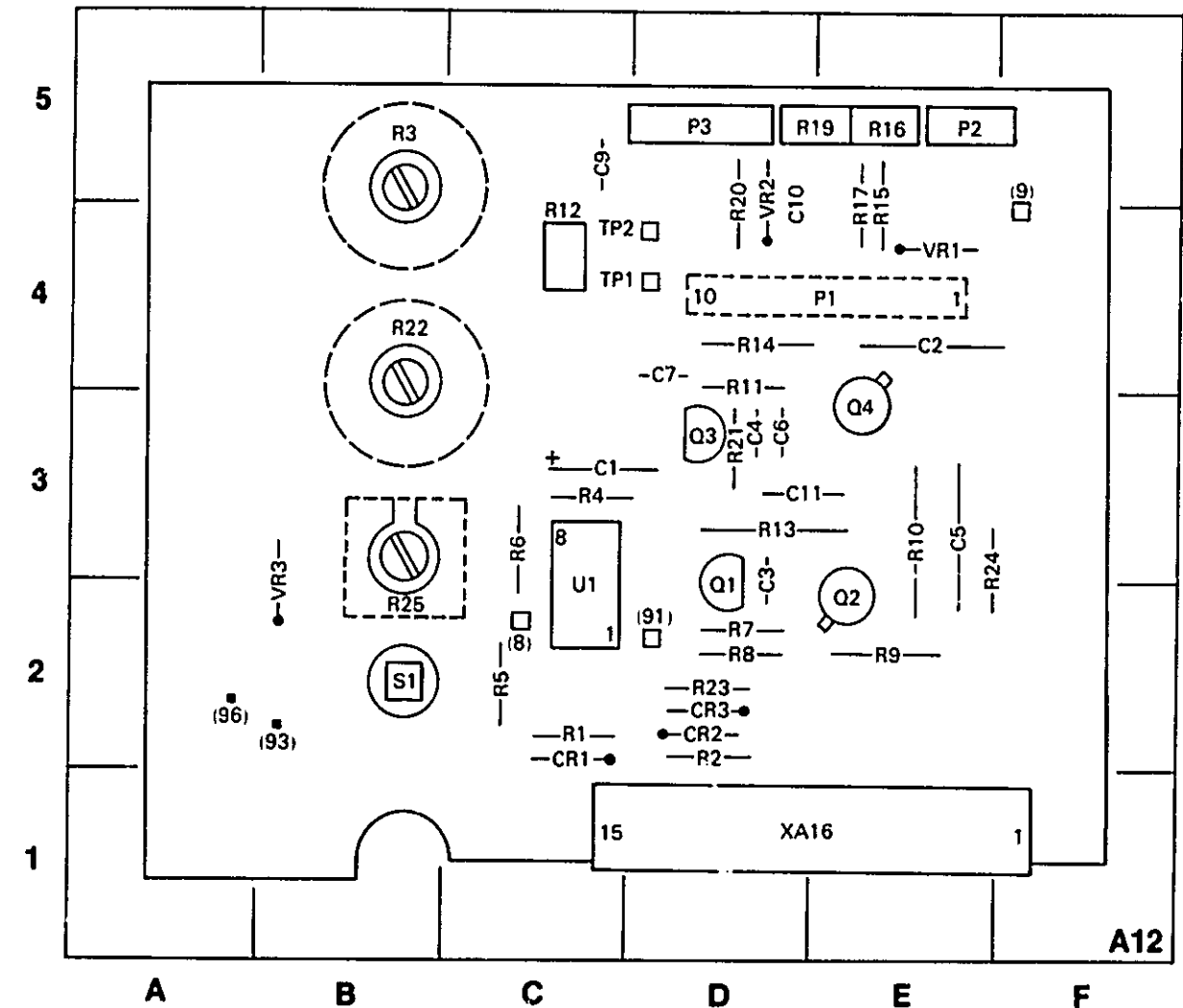
1. Set front-panel controls in accordance with initial control settings in Section V, except as follows:
  - Coupling (channel A) ..... 50Ω
  - TIME/DIV (delayed)..... 1 μSEC
  - STOP ..... 5.00
  - Horiz display ..... MAIN
  - TRIGGER LEVEL (main) ..... stable display
2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V pk) at 5 kHz.



SELECT CHOP MODE

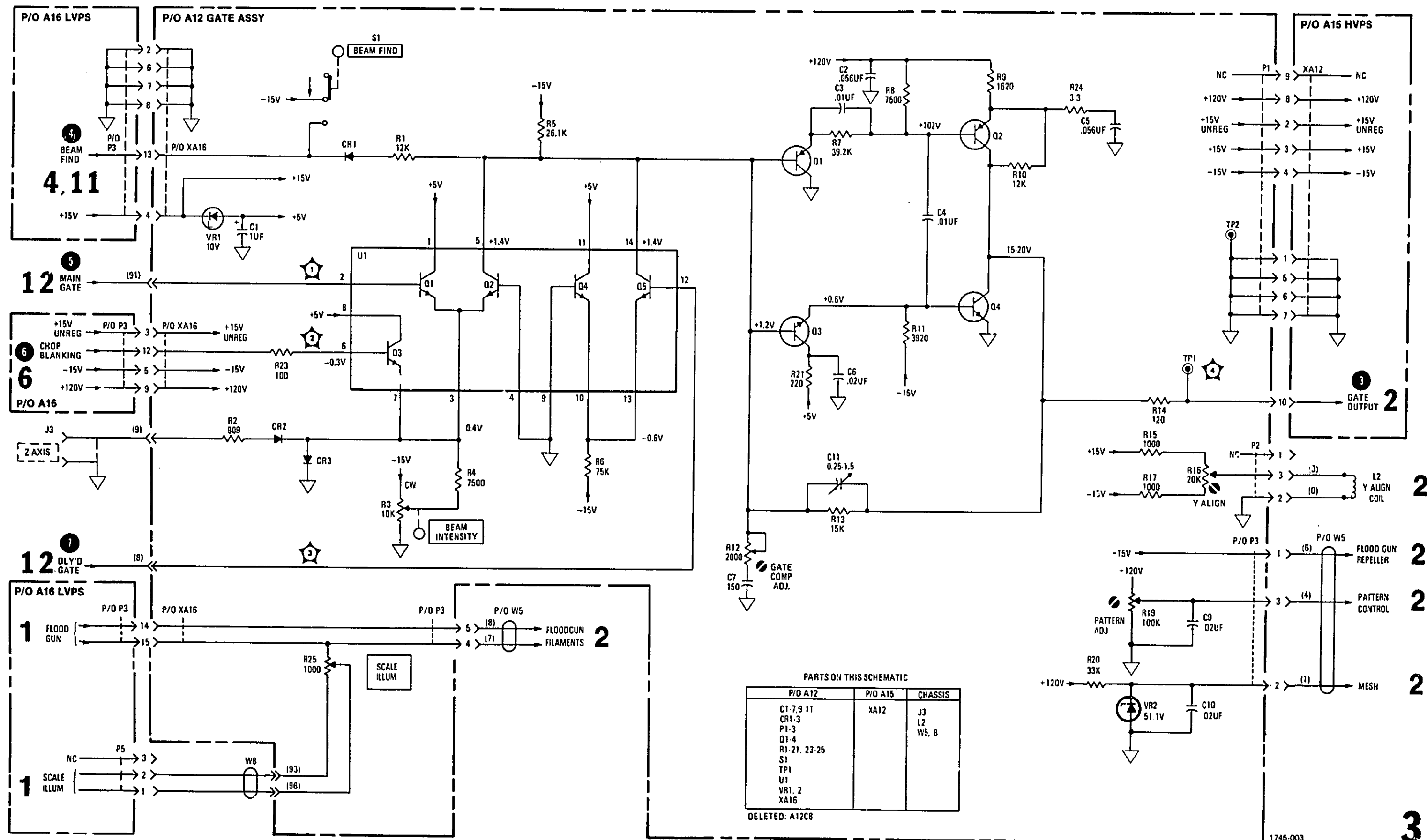
AMPLITUDE VARIES WITH INTENSITY

Waveforms for Service Sheet 3



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | C-3      | P1        | E-4      | R7        | D-2      | R21       | D-3      |
| C2        | E-4      | P2        | E-5      | R8        | D-2      | R22       | B-4      |
| C3        | D-3      | P3        | D-5      | R9        | E-2      | R23       | D-2      |
| C4        | D-3      | Q1        | D-2      | R10       | E-3      | R24       | E-3      |
| C5        | E-3      | Q2        | E-2      | R11       | D-4      | R25       | B-2      |
| C6        | D-3      | Q3        | D-3      | R12       | C-4      | S1        | B-2      |
| C7        | D-4      | Q4        | E-3      | R13       | D-3      | TP1       | C-4      |
| C9        | C-5      | R1        | C-2      | R14       | D-4      | TP2       | C-4      |
| C10       | D-5      | R2        | D-2      | R15       | E-5      | U1        | C-2      |
| C11       | D-3      | R3        | B-5      | R16       | E-5      | VR1       | E-4      |
| CR1       | C-2      | R4        | C-3      | R17       | E-5      | VR2       | D-5      |
| CR2       | D-2      | R5        | C-2      | R19       | D-5      | VR3       | B-2      |
| CR3       | D-2      | R6        | C-3      | R20       | D-5      | X16       | D-1      |

Gate Assembly, A12, Component Identification



## SERVICE SHEET 4

### THEORY OF OPERATION

**General.** In the following explanation, circuits that are identical are explained for channel A only.

**Attenuator Assembly.** Channel A attenuator is a cam-actuated switch assembly. Only contact strips and their actuating cams are contained in the switch assembly. The contacts connect appropriate pads on the preamplifier assembly to complete the coupling and attenuation requirements for the input circuit. Refer to the charts on the schematic which indicate appropriate switch closures for VOLTS/DIV and coupling settings. The VOLTS/DIV switch selects X1 and X100 attenuation circuits in the input circuit, X1 and X10 attenuation circuits in preamplifier substrate A3A1, and X1, X2, or X4 attenuation circuits, also in the substrate assembly.

**Preamplifier Stage.** The channel A input signal is applied to a high-to-low impedance converter stage consisting of dual field-effect transistor (FET) A3Q2, connected in a source follower configuration. The second half of the FET, A3Q2B, provides a current bias for the source of A3Q2A. FET BAL adjustment A3R11 balances the two sections of the FET and ensures that a zero-volt input is applied to channel A input on A3A1 (pin 10). The preamplifier substrate contains 31 thick-film resistors and three monolithic chips: channel A and channel B preamplifiers and a delay-line driver amplifier. These chips perform the conventional control functions of signal polarity, gain vernier, channel switching and sync extraction; in addition, they control six ranges of vertical sensitivity. The gain chip is a four-transistor differential shunt-feedback amplifier that provides a current gain of eight and directly drives the balanced delay line.

The bandwidth limit circuit shunts the delay line input, and, by switching the appropriate capacitance across the line, limits the frequency response to approximately 20 MHz. Trigger view amplifier A3Q6/A3Q7 routes output signals from trigger conditioning circuit A7Q1 (Service Sheet 7), to delay line assembly A4. In channel A or B DISPLAY, trigger view switch A3S1A replaces the main channel display with the triggering waveform. In ALT or CHOP, channel A, channel B, and the trigger signal are displayed.

When BEAM FIND switch A12S1 (Service Sheet 3) is pressed, sufficient current is removed through A3CR4/A3CR5 and A3CR6/A3CR7 to lower sensitivity of the input to the delay line, causing the trace to return to the CRT viewing area.

Channel A and channel B verniers vary the gain of each channel over a range of at least 2.5:1. Channel B vernier interface circuit A3Q21 (Service Sheet 6) allows A2R1 to control channel B gain in both normal and A VS B operations.

**Delay Line.** Output of the Vertical Preamplifier Assembly is applied to Delay Line A4. The delay line has a differential impedance of approximately 180 ohms and provides a time delay of 10<sup>6</sup> nanoseconds. This delay gives sufficient time for the internal sync signal to trigger the horizontal sweep before the input vertical signal is applied to the CRT vertical deflection plates.

### REMOVAL PROCEDURE FOR ASSEMBLIES A3 AND A13.

#### Assembly A3 Removal:

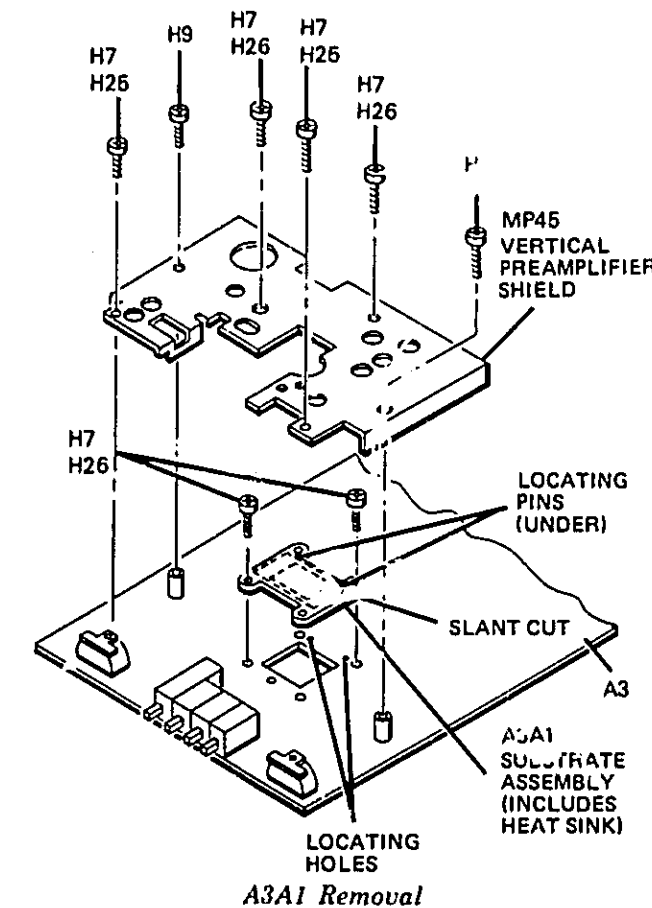
- Disconnect Interface Assembly A14.
- Remove channel A and B POSN vernier, coupling, and VOLTS/DIV knobs.
- Remove nuts and washers from both input BNC connector.
- Disconnect (9) wire from calibrator output.
- Disconnect delay line wires (4), (6), and (0) from rear of Vertical Output Amplifier A5.
- Remove delay line clamp screw from chassis.
- Disconnect twin leads (2, 6) and (1, 9) at Horizontal Sweep Assembly A7.
- Remove channel A attenuator shield by removing three screws.
- Remove screw that connects Horizontal Sweep Assembly A7, shield, and A3 together. This screw is close to point where (1, 9) twin lead attaches to A7.
- Disconnect plug to A5.
- Carefully tilt A3 outward and extract toward rear.
- Disconnect vernier UNCAL light cable (95), (96), and two (0) wires.
- To reinstall A3, reverse removal procedure.

#### Assembly A13 Removal:

- Remove assembly A3 as described above.
- Disconnect wires (4) and (9) from channel A and B vernier potentiometers (total of four wires).
- Disconnect wires (3), (93), (913), (7), and (8) from front of A13.
- Remove screw on component side of A3 that screws into standoff on A13 (near delay line).
- Disconnect two plugs to Vertical Preamplifier Assembly A3.
- To reinstall A13, reverse removal procedure.

#### IC A3A1 Removal:

- Disconnect two leads (2, 6).
- Remove six screws that hold vertical preamplifier shield MP45 to assembly A3, and remove shield.
- Remove two remaining screws that hold IC to A3.
- Lift IC frame and IC off A3.
- To reinstall A3A1, reverse removal procedure, be certain that orientation of location pins is as shown below.



#### TROUBLESHOOTING

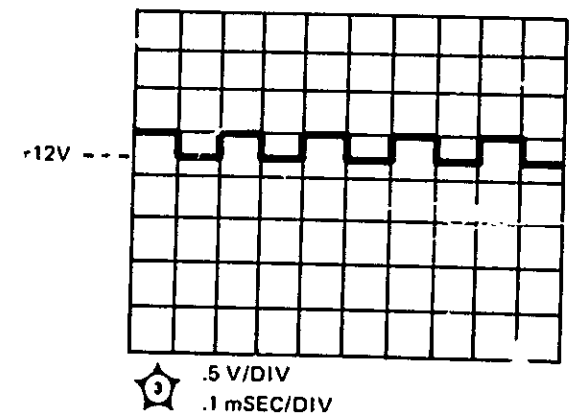
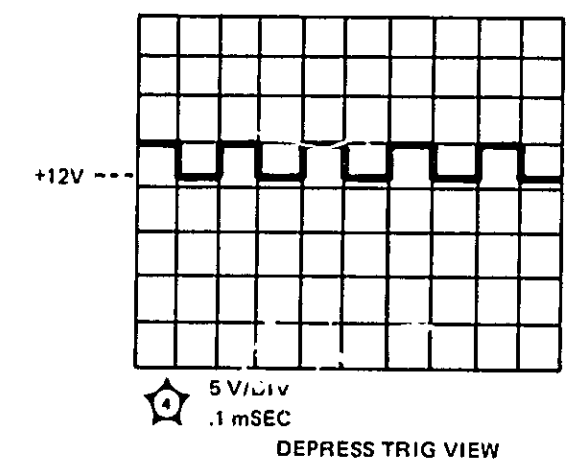
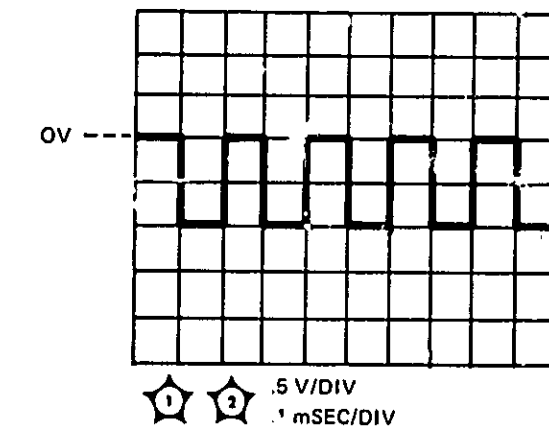
Problems in the vertical amplifier may show up as a variety of symptoms. Low gain problems may be located by applying an input signal and monitoring it through the various stages (refer to waveforms adjacent to schematics). Attenuator problems may be on the attenuator itself or within vertical preamplifier substrate A3A1. Problems can be isolated to either substrate A3A1 or to Vertical Output Assembly A5 by pressing TRIG VIEW on the front panel while applying a known signal to the main EXT TRIGGER input. If it is displayed properly (approximately 100 mV/div), this indicates that assembly A5 is operating properly and the problem is in substrate A3A1. Bandwidth, rise time, or pulse response problems can be caused by dirty CRT neck pins or by a faulty delay line. However, they are most likely caused by defective amplifiers or improper adjustment.

### DC VOLTAGE MEASUREMENT CONDITIONS SERVICE SHEET 4

- Set front-panel controls in accordance with initial control settings in Section V.
- All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

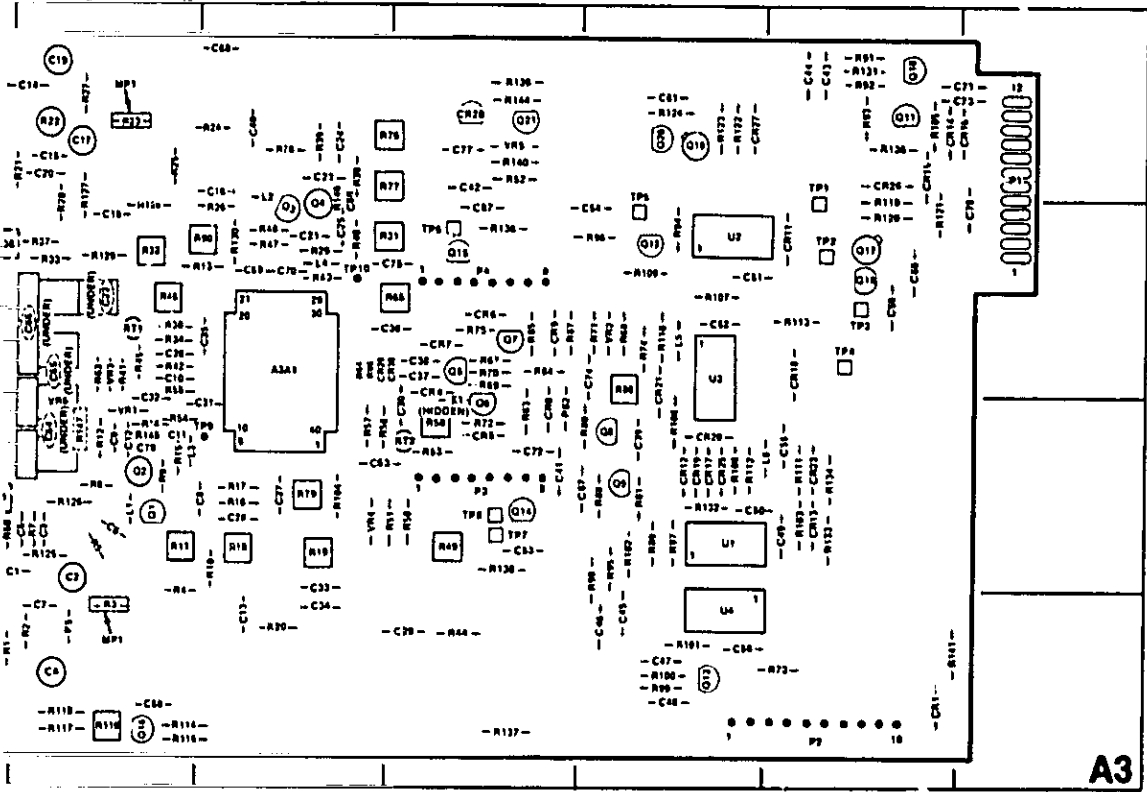
### WAVEFORM MEASUREMENT CONDITIONS SERVICE SHEET 4

- Set front-panel controls in accordance with initial control settings in Section V, except as follows:
  - Coupling (channel A) ..... 50 $\Omega$
  - TRIGGER LEVEL (main) ..... stable display
- Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- Connect Square-wave Generator 50-ohm output to Model 1745A channel A INPUT connector.
- Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



Waveforms for Service Sheet 4

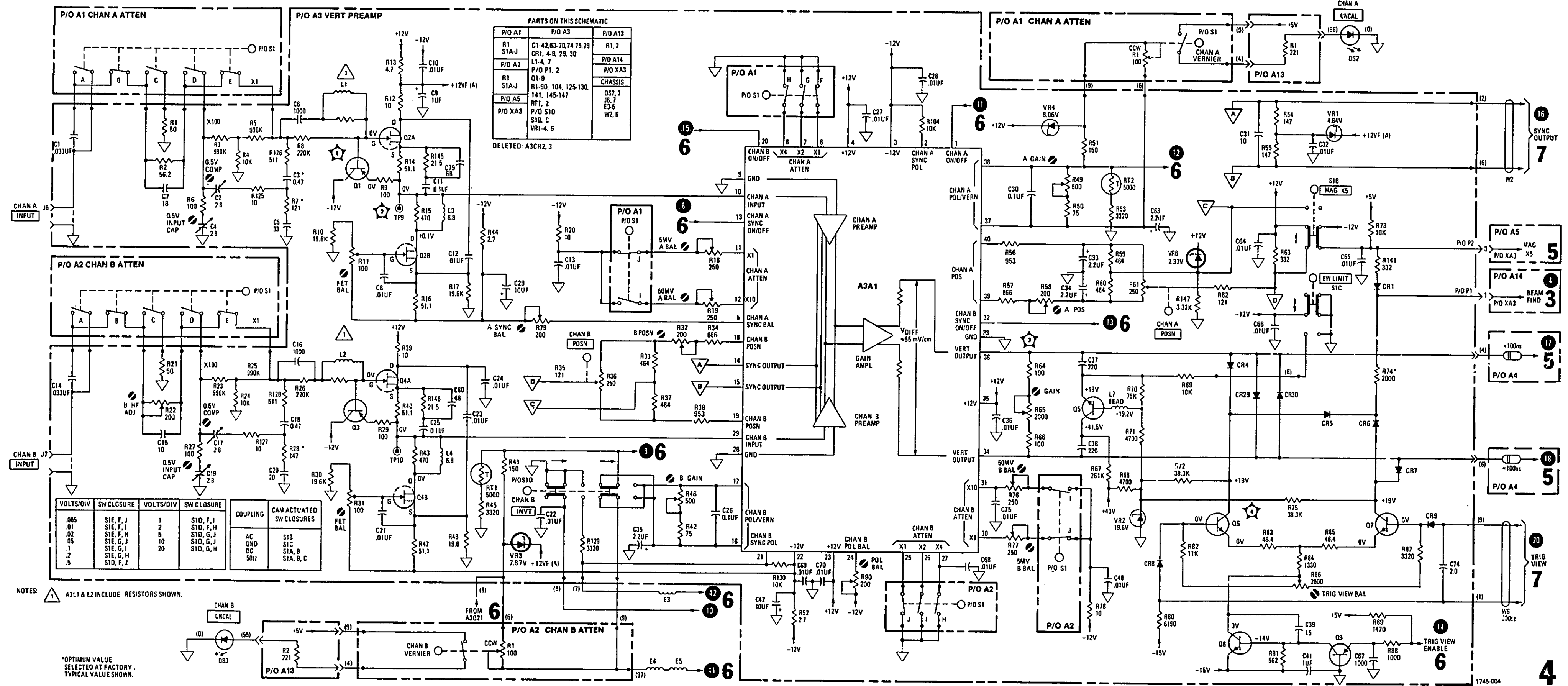
| REF  | DESIG |
|------|-------|
| A3A1 |       |
| C1   |       |
| C2   |       |
| C3   |       |
| C4   |       |
| C5   |       |
| C6   |       |
| C7   |       |
| C8   |       |
| C9   |       |
| C10  |       |
| C11  |       |
| C12  |       |
| C13  |       |
| C14  |       |
| C15  |       |
| C16  |       |
| C17  |       |
| C18  |       |
| C19  |       |
| C20  |       |
| C21  |       |
| C22  |       |
| C23  |       |
| C24  |       |
| C25  |       |
| C26  |       |
| C27  |       |
| C28  |       |
| C29  |       |
| C30  |       |
| C31  |       |
| C32  |       |
| C33  |       |
| C34  |       |
| C35  |       |
| C36  |       |
| C37  |       |
| C38  |       |



A3

| B         |          | C         |          | D         |          | E         |          | F         |          | G         |          |      |     |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|------|-----|
| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |      |     |
| C39       | E-2      | C79       | B-2      | Q2        | B-2      | R19       | C-2      | R57       | C-2      | R95       | E-2      | R133 | F-2 |
| C40       | C-4      | C80       | C-3      | Q3        | C-3      | R20       | C-1      | R58       | D-2      | R96       | E-3      | R134 | F-2 |
| C41       | D-2      | CR1       | F-1      | Q4        | C-3      | R21       | B-4      | R59       | A-2      | R97       | E-2      | R135 | F-4 |
| C42       | D-4      | CR4       | D-2      | Q5        | D-3      | R22       | B-4      | R60       | A-2      | R98       | E-2      | R136 | D-3 |
| C43       | F-4      | CR5       | D-2      | Q6        | D-2      | R23       | B-4      | R61       | A-2      | R99       | E-1      | R137 | D-1 |
| C44       | F-4      | CR6       | D-3      | Q7        | D-3      | R24       | C-4      | R62       | A-2      | R100      | E-1      | R138 | D-2 |
| C45       | E-1      | CR7       | D-3      | Q8        | E-2      | R25       | B-4      | R63       | B-3      | R101      | E-1      | R139 | D-4 |
| C46       | E-1      | CR8       | D-2      | Q9        | E-2      | R26       | C-3      | R64       | C-3      | R102      | E-2      | R140 | D-4 |
| C47       | E-1      | CR9       | D-3      | Q10       | F-4      | R27       | B-4      | R65       | C-3      | R103      | F-2      | R141 | F-1 |
| C48       | E-1      | CR11      | F-3      | Q11       | F-4      | R28       | B-3      | R66       | C-3      | R104      | C-2      | R144 | D-4 |
| C49       | F-2      | CR12      | E-2      | Q12       | E-3      | R29       | C-3      | R67       | D-3      | R105      | F-4      | R145 | B-2 |
| C50       | E-2      | CR13      | F-2      | Q13       | E-1      | R30       | C-4      | R68       | E-3      | R106      | E-2      | R146 | C-3 |
| C51       | E-3      | CR14      | F-4      | Q14       | D-2      | R31       | C-3      | R69       | D-3      | R107      | E-3      | R147 | B-2 |
| C52       | E-3      | CR15      | F-4      | Q15       | D-3      | R32       | B-3      | R70       | D-3      | R108      | E-2      | RT1  | B-3 |
| C53       | D-2      | CR16      | F-4      | Q16       | B-1      | R33       | A-3      | R71       | E-3      | R109      | E-3      | RT2  | D-2 |
| C54       | E-3      | CR17      | E-2      | Q17       | F-3      | R34       | B-3      | R72       | D-2      | R110      | E-3      | S1A  | A-2 |
| C55       | F-2      | CR18      | F-3      | Q18       | F-3      | R35       | A-3      | R73       | F-1      | R111      | F-2      | S1B  | A-2 |
| C56       | E-1      | CR19      | E-2      | Q19       | E-4      | R36       | A-3      | R74       | E-3      | R112      | E-2      | S1C  | A-3 |
| C57       | D-3      | CR20      | E-2      | Q20       | E-4      | R37       | B-3      | R75       | D-3      | R113      | F-3      | S1D  | A-3 |
| C58       | B-1      | CR21      | E-3      | Q21       | D-4      | R38       | B-3      | R76       | C-4      | R114      | B-1      | TP1  | F-4 |
| C59       | F-3      | CR23      | F-2      | R1        | A-1      | R39       | C-4      | R77       | C-4      | R116      | B-1      | TP2  | F-3 |
| C60       | F-3      | CR26      | F-4      | R2        | B-1      | R40       | C-3      | R78       | C-4      | R116      | B-1      | TP3  | F-3 |
| C61       | E-4      | CR27      | E-4      | R3        | B-1      | R41       | B-1      | R79       | C-2      | R117      | B-1      | TP4  | F-3 |
| C63       | C-2      | CR28      | D-4      | R4        | B-1      | R42       | B-3      | R80       | D-2      | R118      | B-1      | TP5  | E-4 |
| C64       | B-2      | CR29      | C-3      | R5        | B-2      | R43       | C-3      | R81       | E-2      | R119      | F-3      | TP6  | D-3 |
| C65       | B-3      | CR30      | C-3      | R6        | B-1      | R44       | D-1      | R82       | D-2      | R120      | F-3      | TP7  | D-2 |
| C66       | B-3      | E1        | D-2      | R7        | B-2      | R45       | B-3      | R83       | D-2      | R121      | F-3      | TP8  | D-2 |
| C67       | D-2      | L1        | B-2      | R8        | B-2      | R46       | B-3      | R84       | D-3      | R122      | E-4      | TP9  | C-2 |
| C68       | C-4      | L2        | C-3      | R9        | B-2      | R47       | C-3      | R85       | D-3      | R123      | E-4      | TP10 | C-3 |
| C69       | C-3      | L3        | B-2      | R10       | C-2      | R48       | C-3      | R86       | E-3      | R124      | E-4      | U1   | E-2 |
| C70       | C-3      | L4        | C-3      | R11       | B-2      | R49       | D-2      | R87       | D-3      | R125      | B-2      | U2   | E-3 |
| C71       | F-4      | L5        | E-3      | P12       | R-2      | R50       | D-2      | R88       | E-2      | R126      | B-2      | U3   | E-3 |
| C72       | D-2      | L6        | E-2      | R13       | C-3      | R51       | C-2      | R89       | E-2      | R127      | B-4      | U4   | E-1 |
| C73       | F-4      | P1        | G-4      | R14       | B-2      | R52       | D-4      | R90       | C-3      | R128      | B-3      | VR1  | B-2 |
| C74       | E-3      | P2        | F-1      | R15       | B-2      | R53       | D-2      | R91       | F-4      | R129      | B-3      | VR2  | E-3 |
| C75       | C-3      | P3        | D-2      | R16       | C-2      | R54       | B-2      | R92       | F-4      | R130      | C-3      | VR3  | B-3 |
| C77       | D-4      | P4        | D-3      | R17       | C-2      | R55       | B-3      | R93       | F-4      | R131      | F-4      | VR4  | C-2 |
| C78       | G-3      | Q1        | B-2      | R18       | C-2      | R56       | C-2      | R94       | E-3      | R132      | E-2      | VR5  | D-4 |
|           |          |           |          |           |          |           |          |           |          |           |          | VR6  | B-2 |

Vertical Preamplifier, A3, Component Identification





**SERVICE SHEET 5**

**THEORY OF OPERATION**

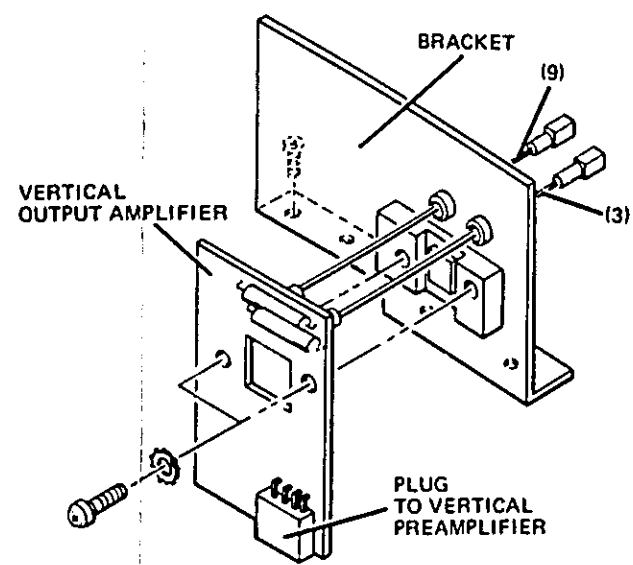
Vertical Output Assembly A5 consists of a vertical amplifier and Output Amplifier Substrate A5A1. Vertical amplifier A5Q1/A5Q3, terminates differential Delay Line Assembly A4 and translates the common-mode bias level to ground for the output amplifier substrate. X5 magnifier A5Q2/A5Q4 increases the vertical gain by a factor of five but limits the bandwidth to approximately 40 MHz. Engaging MAG X5 switch A3S1B turns off A5Q2 and A5Q4 (normally saturated). This increases system gain by a factor of five, and complementary circuitry on the preamplifier simultaneously diminishes position range by the same factor to maintain a consistent position control range.

Substrate A5A1 contains a number of thick-film resistors, one high-frequency monolithic chip, and two discrete transistor chips. It provides drive capability for the CRT vertical deflection plates and has a differential voltage gain in excess of 100. High-frequency adjustments A5R19, A5R20, A5R22, A5R24 control the shape of the pulse response.

**REMOVAL PROCEDURE**

**Assembly A5 Removal:**

- Disconnect delay line wires (4), (9), and (0) from back of A5.



Vertical Output Amplifier Removal

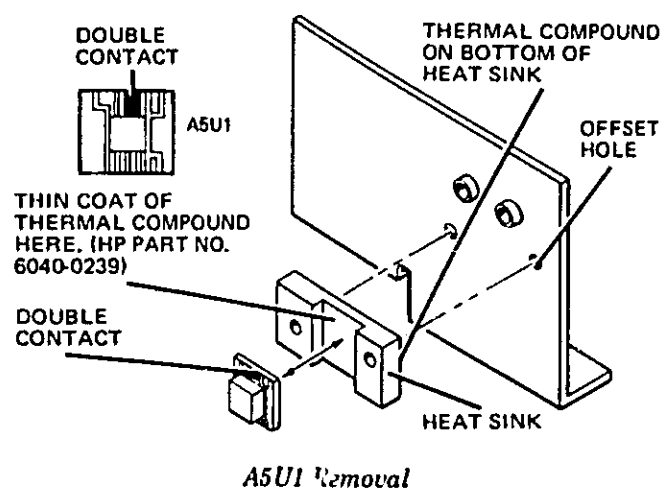
- Disconnect CRT leads (3) and (9).
- Disconnect plug to Vertical Preamplifier Assembly A3 (push down gently on A3).
- Remove four screws holding A5 and bracket to chassis, and remove assembly.
- Remove two screws holding A5 to bracket and heat sink, and remove board.
- To reinstall A5, reverse removal procedure.

**IC A5U1 Removal:**

- Remove Vertical Output Amplifier A5 as described above.
- A5U1 can be removed from heat sink. Heat sink can remain on bracket or be removed.
- To reinstall A5U1, reverse removal procedure, being certain to note orientation of parts as shown below.

**NOTE**

Apply a thin coat of silicone grease (HP P/N 6040-0239) to points indicated.



A5U1 Removal

**TROUBLESHOOTING**

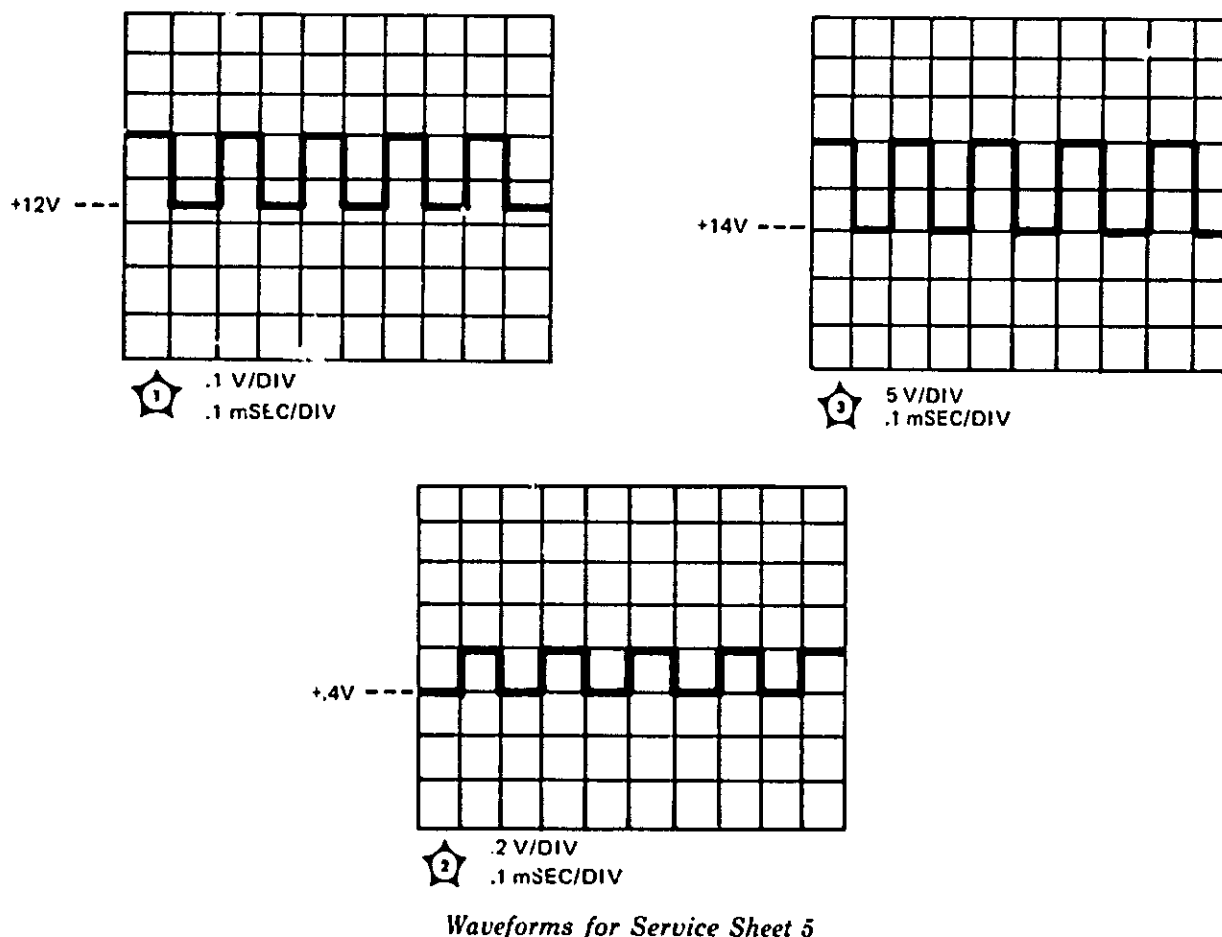
Refer to Service Sheet 4 for vertical section troubleshooting.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 5**

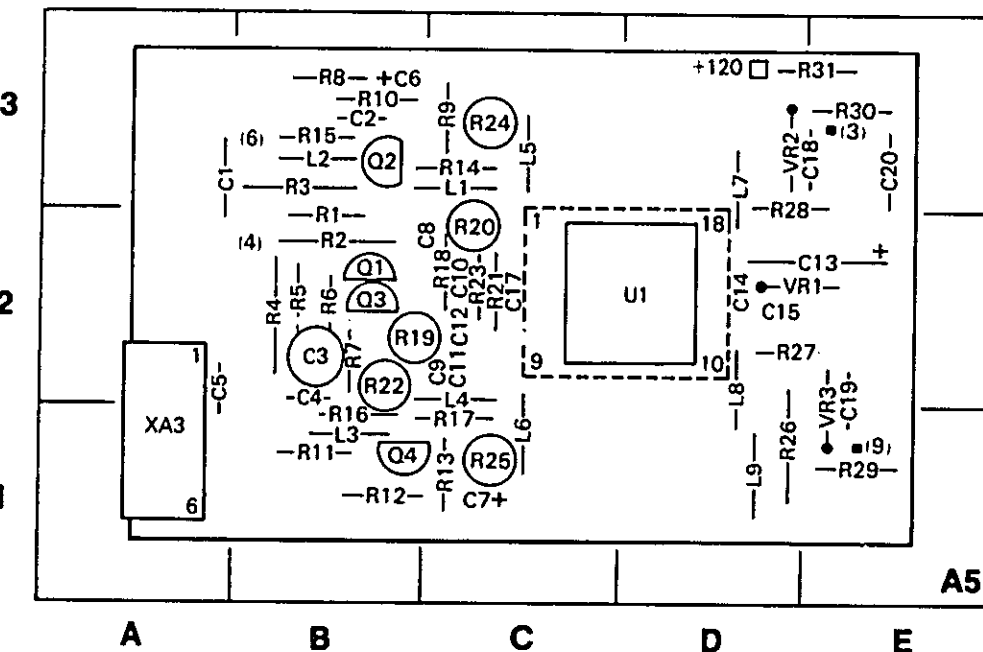
- Set front-panel controls in accordance with initial control settings in Section V.
- All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 5**

- Set front-panel controls in accordance with initial control settings in Section V, except as follows:  
Coupling (channel A) ..... 50Ω
- Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
- Adjust square-wave generator output to 6 divisions of signal amplitude (.6 V) at 5 kHz.

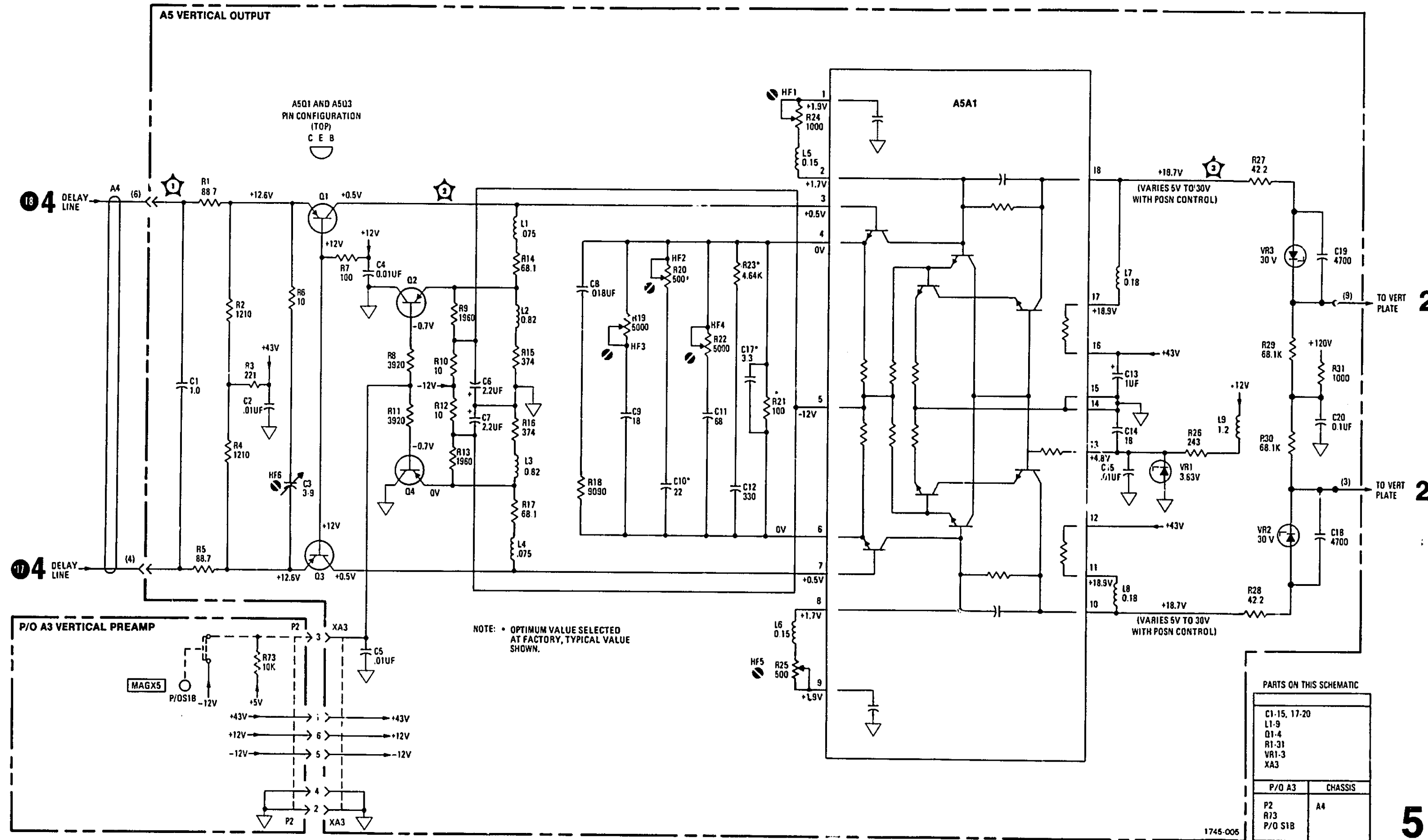


Waveforms for Service Sheet 5



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | A-3      | C19       | E-1      | R3        | B-3      | R20       | C-2      |
| C2        | B-3      | C20       | E-3      | R4        | B-2      | R21       | C-2      |
| C3        | B-2      | L1        | C-3      | R5        | B-2      | R22       | B-2      |
| C4        | B-2      | L2        | B-3      | R6        | B-2      | R23       | C-2      |
| C5        | A-2      | L3        | B-1      | R7        | B-2      | R24       | C-3      |
| C6        | B-3      | L4        | C-2      | R8        | B-3      | R25       | C-1      |
| C7        | C-1      | L5        | C-3      | R9        | B-3      | R26       | D-1      |
| C8        | B-2      | L6        | C-1      | R10       | C-3      | R27       | D-2      |
| C9        | C-2      | L7        | D-3      | R11       | B-1      | R28       | D-3      |
| C10       | C-2      | L8        | D-2      | R12       | B-1      | R29       | E-1      |
| C11       | C-2      | L9        | D-1      | R13       | C-1      | R30       | E-3      |
| C12       | C-2      | Q1        | B-2      | R14       | C-3      | R31       | E-3      |
| C13       | E-2      | Q2        | B-3      | R15       | B-3      | U1        | D-2      |
| C14       | D-2      | Q3        | B-2      | R16       | B-1      | VR1       | D-2      |
| C15       | D-2      | Q4        | B-1      | R17       | C-1      | VR2       | D-3      |
| C17       | C-2      | R1        | B-2      | R18       | C-2      | VR3       | E-1      |
| C18       | E-3      | R2        | B-2      | R19       | B-2      | XA3       | A-1      |

Vertical Output, A5, Component Identification



5

**SERVICE SHEET 6**

**THEORY OF OPERATION**

**General.** Vertical Control Switching Assembly A13 selects the trigger and display modes by controlling the operation of Vertical Pre-amplifier Substrate A3A1.

**Channel A Display.** Engaging DISPLAY A switch A13S2B grounds the preset input (pin 4) on A3U2A, forcing Q output high (pin 5). This state, along with a high Q output (pin 5) from A3U4A, forces NAND gate A3U3C (pin 8) low. A low ( $\leq 2.7$  V) at test point A3TP7 indicates channel A is on; a high ( $\approx 4.7$  V) indicates channel A is off.

**Channel B Display.** Engaging DISPLAY B switch A13S2C grounds the clear input (pin 1) on A3U2A, forcing Q (pin 6) high. This state, along with a high applied to its other input, forces NAND A3U3A (pin 3) low. A low at test point A13TP5 indicates channel B is on; a high indicates channel B is off.

**Channel A+B Display.** To algebraically display channel A and channel B, DISPLAY switches A13S2B and A13S2C are engaged simultaneously; both clear and preset inputs to A3U2A are grounded, forcing both Q and Q outputs high. These states are inverted by A3U3A and A3U3C, enabling both channel A and channel B.

**ALT Mode Display.** With ALT mode display selected, the ALT SIGNAL developed at the end of each horizontal sweep is applied through transistor switch A3Q10 and emitter follower A3Q12 to clock flip-flop A3U2A. As A3U2A is switched by successive sweeps, channel A and B are alternately turned on and off.

**CHOP Mode Display.** In CHOP mode display, channel A and channel B are switched on and off alternately as in ALT mode of operation, except that in CHOP mode, the clock signal applied to A3U2A comes from chop oscillator A3U1B-D, through transistor switch A3Q11 and emitter follower A3Q12. The chop oscillator runs continuously at 500 kHz, resulting in each channel being displayed at a 250-kHz rate.

**Trig View Display.** If channel A or channel B display is selected, engaging TRIG VIEW switch A3S1A forces a low state on the input to NAND gates A3U3A and A3U3C, holding their outputs high, disabling both channel A and channel B. The Q output of A3U4A (pin 6) is forced high by a low input (pin 2). This state switches on transistors A3Q8 and A3Q9, enabling trigger view amplifier A3Q6/A3Q7.

If ALT or CHOP mode is selected, low states are removed from the inputs of A3U3A and A3U3C. A divide-by-three counter, formed by A3U2A, A3U4A, A3U3A, and A3U3C, is clocked by either the chop oscillator signal or the ALT SIGNAL. In this manner, the trigger signal, channel A, and channel B are switched on alternately.

**Channel A Trigger Circuit.** Engaging TRIGGER A sync switch A13S1A grounds the preset input on A3U2B (pin 10), forcing Q high (pin 9). This state is inverted by A3U3D, turning off A3Q14, causing a low on channel A sync enable line. A low at test point A3TP8 indicates sync A is on; a high at A3TP8 indicates sync A is off.

**Channel B Trigger Circuit.** Engaging TRIGGER B sync switch A13S1B applies a ground to the clear input (pin 13) on A3U2B, causing Q (pin 8) to go high. The high is inverted by A3U3E, turning off A3Q15, causing a low on channel B sync enable line. A low at test point A3TP6 indicates sync B is on; a high at A3TP6 indicates sync B is off.

**Composite Trigger Circuit.** When composite triggering is selected, channel A and channel B TRIGGER switches are engaged simultaneously. In A+B mode of display, low states are applied to both the preset and clear inputs on A3U2B causing both Q and Q outputs to go high. This forces the sync enable lines low through A3U3D/A3Q14 and A3U3E/A3Q15. With both channel sync lines enabled, the sweep is triggered by the A+B display. If channel B is inverted, sync B is also inverted. In ALT, engaging channel A and B TRIGGER switches together will remove the preset and clear overrides from A3U2B and allow the flip-flop to be clocked by the ALT SIGNAL generated in the horizontal section. This triggers channel A from the channel A signal and channel B from the channel B signal. If trigger view is also selected, triggering will change to channel A only. This is accomplished by grounding one input on A3U1A (pin 1). In CHOP mode, engaging channel A and B TRIGGER switches selects sync A only as the internal trigger source. Again, pin 1 on A3U1A is grounded.

**REMOVAL PROCEDURE**

To remove either assembly A3 or A13, use the removal procedures given in Service Sheet 4.

**TROUBLESHOOTING**

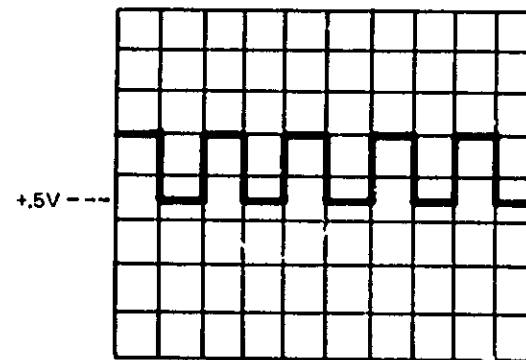
This service sheet contains waveforms and conditions for measuring these waveforms. Use the dc voltage listed on the schematic for active components as a guide in isolating problem areas.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 6**

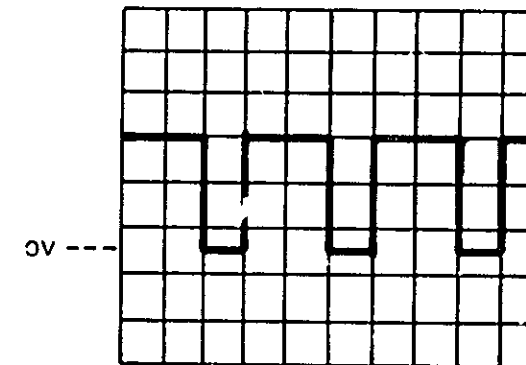
1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 6**

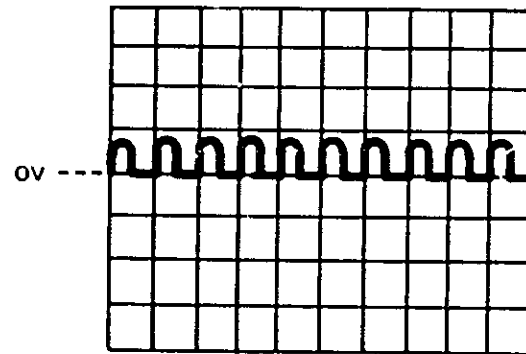
1. Set front-panel controls in accordance with initial control settings in Section V, except as follows:
  - Coupling (channel A) ..... 50 $\Omega$
  - TRIGGER LEVEL (main) ..... stable display
  - DISPLAY ..... ALT
  - TRIG VIEW ..... engaged
2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



1 1 V/DIV  
1 mSEC/DIV

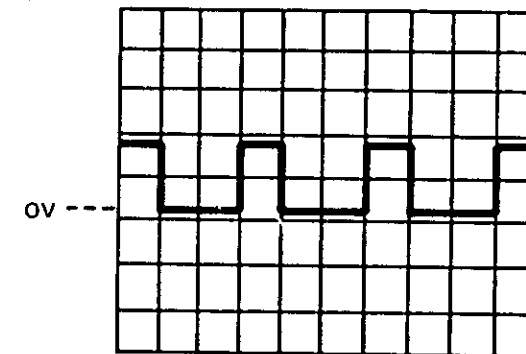


2 2 V/DIV  
2 nSEC/DIV



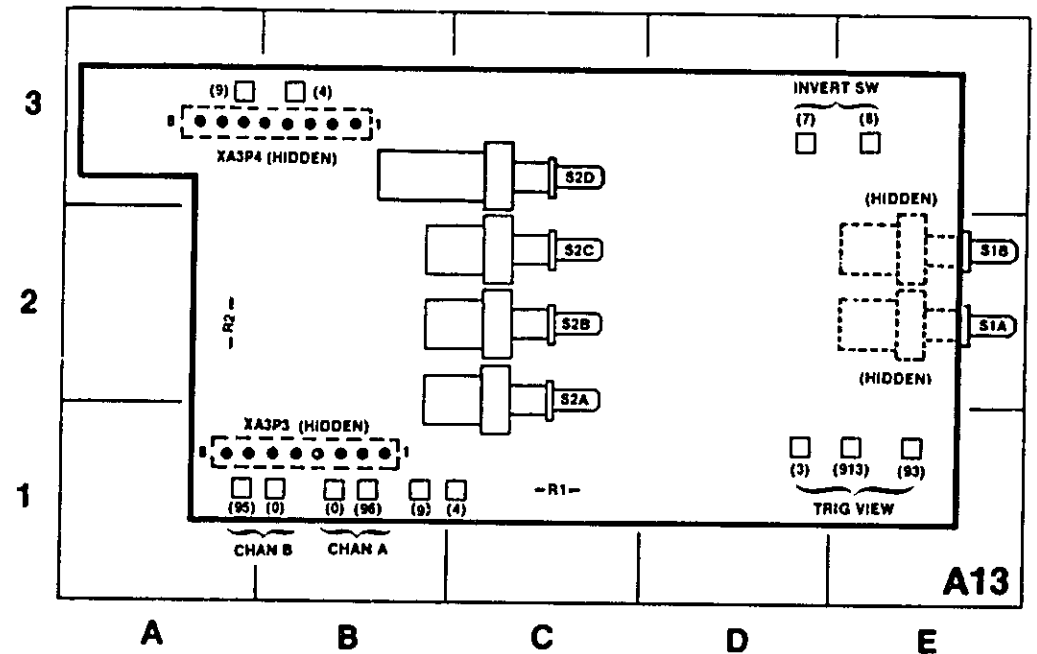
3 5 V/DIV  
2 μSEC/DIV

SELECT CHOP MODE



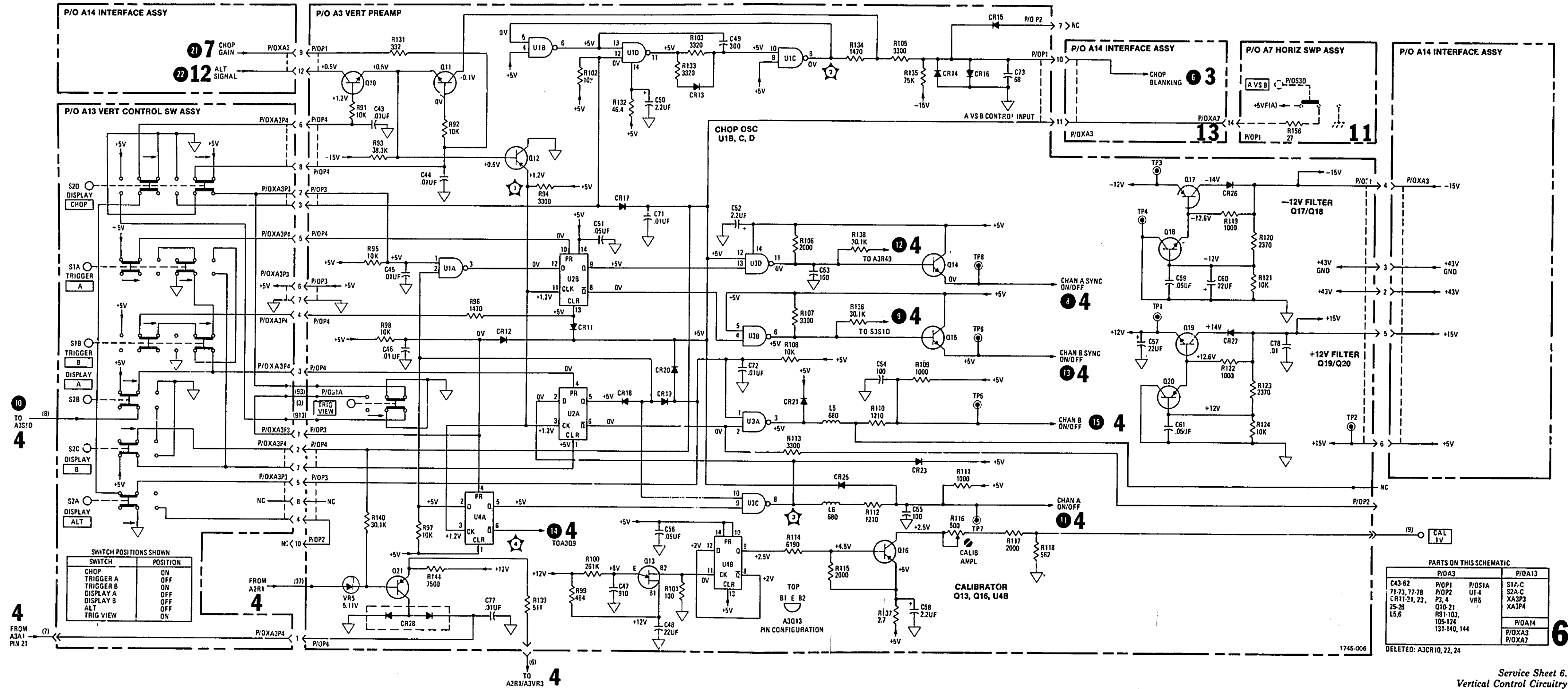
4 2 V/DIV  
2 mSEC/DIV

Waveforms for Service Sheet 6



**NOTE**  
See Service Sheet 4  
for Assembly A3  
Component Identification

Switch Control, A13, Component Identification



**Bright-Line Auto Circuit.** Current switch A7Q13/A7Q14 drives the RESET light and the bright-line auto circuit. The bright-line auto circuit consists of A7Q15 - A7Q18. With the AUTO/NORM switch in NORM position, bias is removed from the emitters of A7Q15 - A7Q17, disabling the bright-line auto circuit. In AUTO mode of operation, A7C13 is discharged by A7Q18 and remains discharged as long as the trigger circuit switches at a rate greater than 45 Hz. With A7C13 discharged, A7Q17 is disabled. When A7C13 becomes charged (no trigger signal), base current to A7Q16 ceases, turning A7Q16 off. When A7Q16 turns off, A7Q17 turns on, turning on A7Q21 which enables the main gate circuit and the main sweep starts. When the sweep reaches +11 volts, the reset Schmitt trigger on A7U2 conducts, forcing pin 6 low. This turns on A7Q14 and A7Q15; A7Q17 and A7Q21 turn off and the sweep resets. At the end of holdoff, A7U2 pin 6 goes high, A7Q15 turns off, A7Q17 turns on and a new sweep is generated.

**Single Mode.** For single sweep operation, SINGLE switch A7S1C is engaged. The SINGLE mode overrides the AUTO mode and also applies a bias signal (+4.7 volts) to pin 5 of A7U2, preventing the input Schmitt of A7U2 from resetting at the end of holdoff. This prevents development of a trigger signal. The input Schmitt does not reset until RESET signal A7S1B is pressed. Pressing A7S1B causes the input at pin 5 of A7U2 to go low momentarily (due to the charging action of A7C14). This allows the input Schmitt to reset.

**Trigger View Signal.** The internal or external sync signal developed in emitter follower A7Q1 is applied to the base of A7Q2 where the trigger-view signal is developed. Transistor A7Q3 is used to translate the position of the TRIGGER LEVEL control for the trigger-view signal.

**REMOVAL PROCEDURE**

To remove assembly A7, proceed as follows:

- a. Remove assemblies A8, A9, and A17 as outlined in Service Sheets 8, 10, and 15.
- b. Remove assembly A11 as outlined in Service Sheet 11.
- c. Unsolder resistor from main EXT TRIGGER BNC connector J1.
- d. Remove two cable connector plugs.
- e. Remove twin leads (3, 6) and (1, 9).
- f. Remove main TRIGGER LEVEL knob and nut from potentiometer.
- g. Remove Interface Assembly A14.

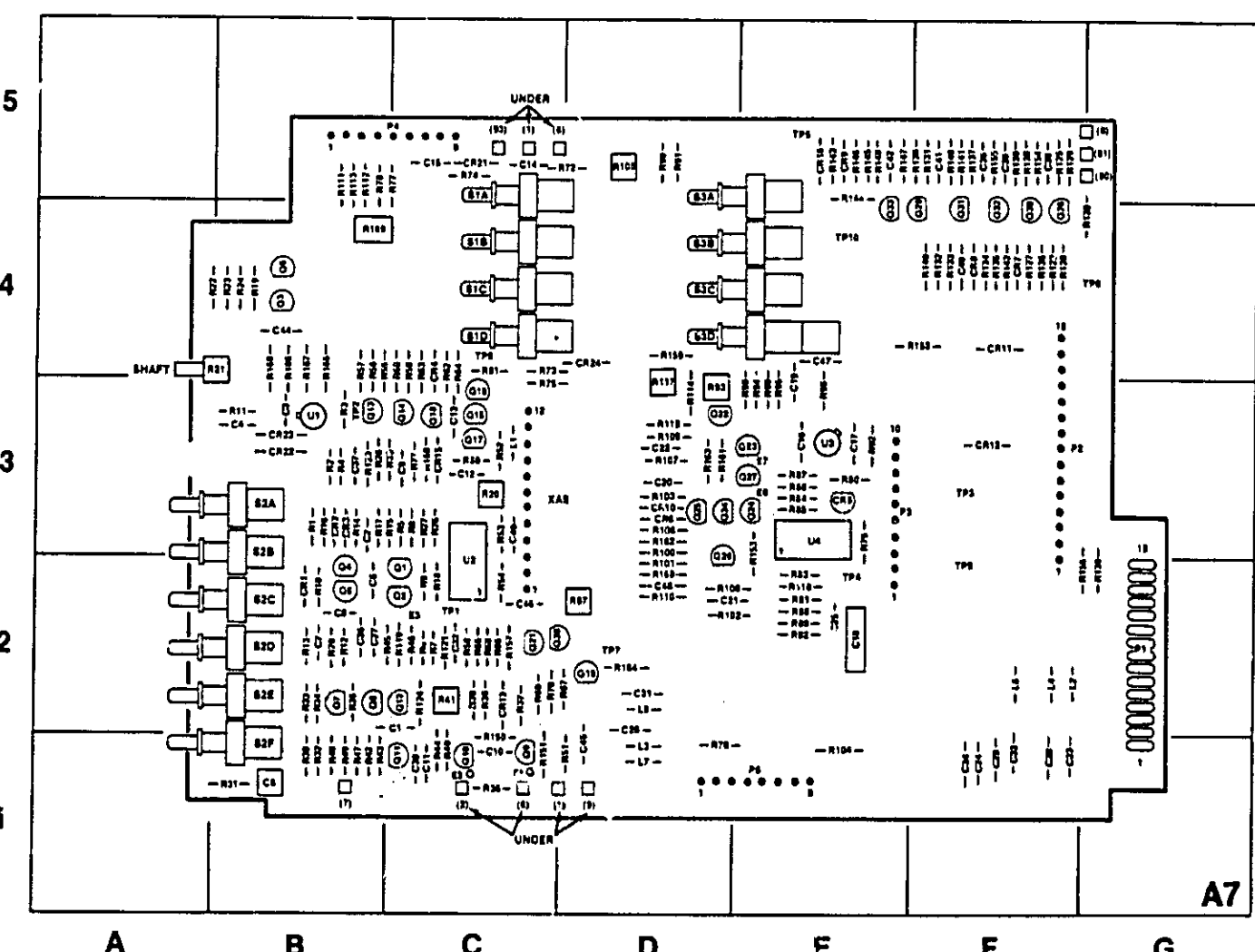
- h. Remove four screws holding A7 to sheet metal.
- i. Remove A7 by pulling it toward rear and tilting away from sheet metal deck. Save lockwasher on trigger level potentiometer for reinstallation.
- j. To reinstall A7, reverse removal procedure, except install four screws (step h) without tightening them until nut on TRIGGER LEVEL potentiometer (step f) is tightened. Lockwasher must be in place on TRIGGER LEVEL potentiometer before inserting in panel.

**TROUBLESHOOTING**

Troubleshooting the time base can be difficult since it is a closed-loop circuit and waveforms may be non-existent in any part of the loop. The following table will help analyze problems under a no-sweep condition. Select main sweep of operation, set main TIME/DIV control to 0.1 ms range, and put all other time base pushbuttons in their out position. This places the time base in the auto-sweep mode. Set INTENSITY control to midrange and set the FOCUS control fully ccw.

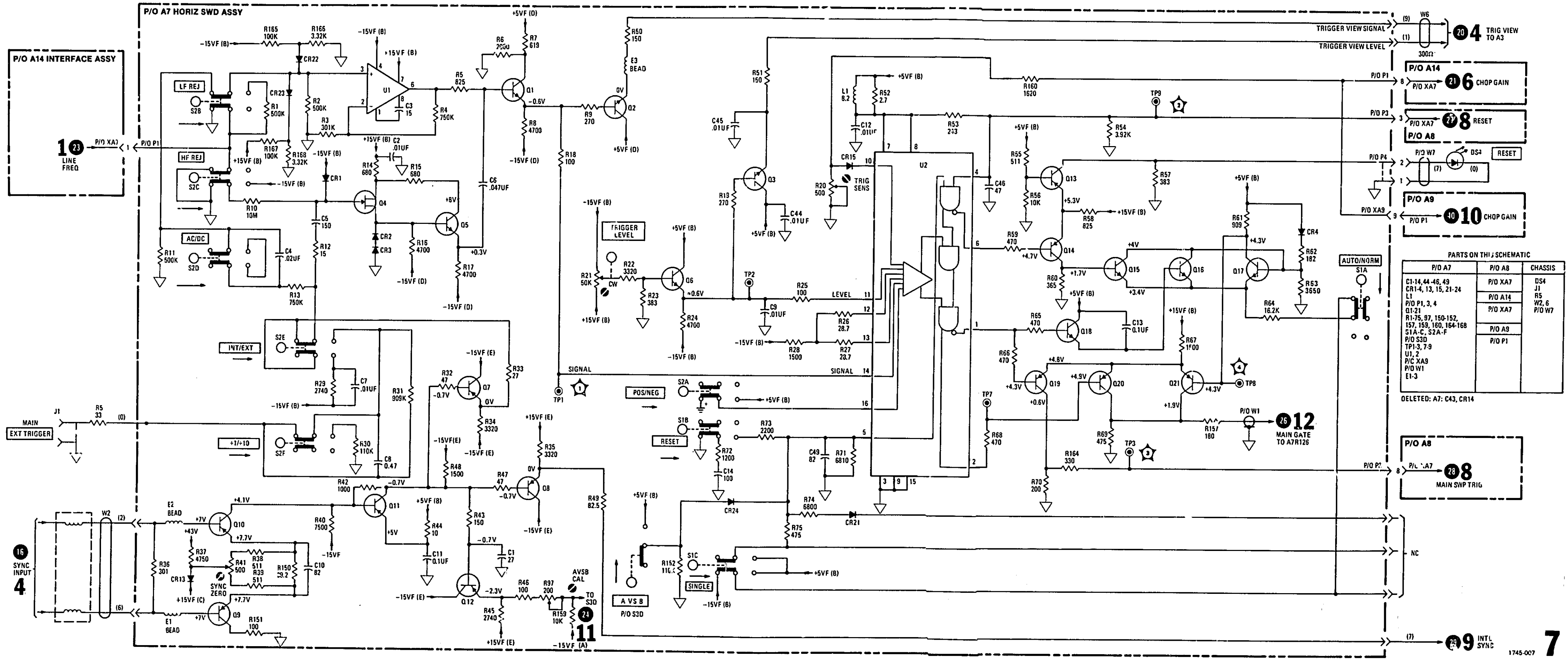
*Time Base Troubleshooting*

| INDICATION                                                          | PROBLEM CAUSE                                                                                                                                          |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Is baseline present?                                                | YES - Check input circuitry (HF/LF amplifiers or sync amplifier).<br>NO - Proceed to next step.                                                        |
| RESET Lamp OFF<br>Beam OFF<br>Beam position left (Using BEAM FIND)  | Check reset/holdoff circuitry.                                                                                                                         |
| RESET Lamp OFF<br>Beam OFF<br>Beam position right (Using BEAM FIND) | Check Miller integrator and associated circuitry.                                                                                                      |
| RESET Lamp OFF<br>Beam ON                                           | With RESET lamp OFF, beam should NEVER be ON. Check gate amplifier circuitry and CRT for grid-cathode short; then return to time base troubleshooting. |
| RESET Lamp ON<br>Beam OFF                                           | With RESET LAMP ON, beam should also be ON. Check gate amplifier and HVPS; then return to time base to repair second problem.                          |
| RESET Lamp ON<br>Beam ON (Left side)                                | Check Miller integrator and associated circuitry.                                                                                                      |
| RESET Lamp ON<br>Beam ON (Right side)                               | Check sweep reset circuitry.                                                                                                                           |



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | C-2      | C39       | F-5      | L5        | D-2      | Q31       | F-4      | R35       | B-2      | R73       | C-4      | R111      | B-5      | R150      | C-1      |
| C2        | B-3      | C40       | F-4      | L6        | F-2      | Q32       | F-4      | R36       | C-1      | R74       | C-5      | R112      | B-5      | R151      | C-1      |
| C3        | B-3      | C41       | F-5      | L7        | D-1      | Q33       | E-4      | R37       | C-2      | R75       | C-3      | R113      | B-5      | R152      | F-4      |
| C4        | B-3      | C42       | E-5      | P1        | G-2      | Q34       | D-3      | R38       | C-2      | R76       | E-1      | R114      | D-3      | R153      | E-3      |
| C5        | B-2      | C44       | B-4      | P2        | F-3      | R1        | B-3      | R39       | C-2      | R77       | B-5      | R115      | D-3      | R154      | F-5      |
| C6        | B-2      | C45       | D-1      | P3        | E-3      | R2        | B-3      | R40       | C-1      | R78       | B-5      | R117      | D-3      | R155      | F-5      |
| C7        | D-2      | C46       | C-2      | P4        | B-5      | R3        | B-3      | R41       | C-2      | R79       | E-3      | R118      | E-2      | R156      | G-2      |
| C8        | E-1      | C47       | E-4      | P5        | E-1      | R4        | B-3      | R42       | B-1      | R80       | E-3      | R119      | C-2      | R157      | C-2      |
| C9        | C-3      | C48       | D-2      | Q1        | C-2      | R5        | C-3      | R43       | B-1      | R81       | E-2      | R120      | G-4      | R158      | D-2      |
| C10       | C-1      | C49       | C-3      | Q2        | C-2      | R6        | C-2      | R44       | C-1      | R82       | E-2      | R121      | C-2      | R159      | D-4      |
| C11       | C-1      | CR1       | B-2      | Q3        | B-4      | R7        | C-2      | R45       | C-2      | R83       | E-2      | R122      | F-4      | R160      | C-3      |
| C12       | C-3      | CR2       | B-3      | Q4        | B-2      | R8        | C-3      | R46       | C-2      | R84       | E-3      | R123      | B-3      | R161      | D-3      |
| C13       | C-3      | CR3       | B-3      | Q5        | B-2      | R9        | C-2      | R47       | B-1      | R85       | E-3      | R124      | C-5      | R162      | D-3      |
| C14       | C-5      | CR4       | C-4      | Q6        | B-4      | R10       | B-2      | R48       | B-1      | R86       | R-3      | R125      | F-5      | R163      | D-3      |
| C15       | C-5      | CR5       | E-3      | Q7        | B-2      | R11       | B-3      | R49       | B-1      | R87       | E-3      | R126      | F-5      | R165      | B-4      |
| C16       | E-3      | CR6       | D-3      | Q8        | B-2      | R12       | B-2      | R50       | C-2      | R88       | E-2      | R127      | F-4      | R166      | B-4      |
| C17       | E-3      | CR7       | F-4      | Q9        | C-1      | R13       | B-2      | R51       | D-1      | R89       | E-2      | R128      | F-4      | R167      | B-4      |
| C18       | E-2      | CR8       | F-4      | Q10       | C-1      | R14       | B-3      | R52       | C-3      | R90       | D-5      | R129      | F-5      | R168      | B-4      |
| C19       | E-3      | CR9       | E-5      | Q11       | C-1      | R15       | C-3      | R53       | C-3      | R91       | D-5      | R130      | F-5      | R169      | B-4      |
| C20       | D-3      | CR10      | D-3      | Q12       | C-2      | R16       | B-3      | R54       | C-2      | R92       | E-3      | R131      | F-5      | S1        | C-4      |
| C21       | D-2      | CR11      | F-4      | Q13       | B-3      | R17       | B-3      | R55       | B-4      | R93       | D-3      | R132      | F-4      | S2        | A-2      |
| C22       | D-3      | CR12      | F-3      | Q14       | D-3      | R18       | C-2      | R56       | B-4      | R94       | E-3      | R133      | F-4      | S3        | E-4      |
| C23       | F-1      | CR13      | C-2      | Q15       | C-3      | R19       | B-4      | R57       | B-4      | R95       | E-3      | R134      | F-4      | TP1       | C-2      |
| C24       | F-1      | CR15      | C-3      | Q16       | C-3      | R20       | C-3      | R58       | C-4      | R96       | E-3      | R135      | F-4      | TP2       | B-3      |
| C25       | E-2      | CR16      | E-5      | Q17       | C-1      | R21       | A-4      | R59       | C-3      | R97       | D-2      | R136      | F-4      | TP3       | F-3      |
| C26       | D-2      | CR21      | C-5      | Q18       | C-3      | R22       | A-4      | R60       | C-4      | R98       | E-3      | R137      | F-5      | TP4       | E-2      |
| C27       | B-2      | CR22      | B-3      | Q19       | D-2      | R23       | B-4      | R61       | C-4      | R99       | E-3      | R138      | F-5      | TP5       | E-5      |
| C28       | F-1      | CR23      | B-3      | Q20       | D-2      | R24       | B-4      | R62       | C-4      | R100      | D-3      | R139      | G-2      | TP6       | G-4      |
| C29       | F-1      | CR24      | D-4      | Q21       | C-2      | R25       | B-3      | R63       | C-4      | R101      | D-2      | R140      | F-5      | TP7       | D-2      |
| C30       | F-5      | E1        | C-1      | Q22       | D-3      | R26       | C-3      | R64       | C-4      | R102      | D-2      | R141      | F-5      | TP8       | C-4      |
| C31       | D-2      | E2        | C-1      | Q23       | E-3      | R27       | C-3      | R65       | C-2      | R103      | D-3      | R142      | F-4      | TP9       | F-2      |
| C32       | C-2      | E3        | C-2      | Q24       | E-3      | R28       | B-3      | R66       | C-2      | R104      | E-1      | R143      | E-5      | TP10      | E-4      |
| C33       | F-1      | E6        | E-3      | Q25       | D-3      | R29       | B-2      | R67       | D-2      | R105      | D-5      | R144      | E-5      | U1        | B-3      |
| C34       | F-1      | E7        | E-3      | Q26       | D-3      | R30       | B-1      | R68       | C-2      | R106      | D-3      | R145      | E-5      | U2        | C-2      |
| C35       | F-5      | L1        | C-3      | Q27       | E-3      | R31       | B-1      | R69       | C-2      | R107      | D-3      | R146      | E-5      | U3        | E-3      |
| C36       | B-2      | L2        | F-2      | Q28       | F-4      | R32       | B-1      | R70       | C-2      | R108      | D-2      | R147      | E-5      | U4        | E-3      |
| C37       | B-3      | L3        | D-1      | Q29       | F-4      | R33       | B-2      | R71       | C-3      | R109      | D-3      | R148      | E-5      | XA9       | C-3      |
| C38       | C-1      | L4        | F-2      | Q30       | F-4      | R34       | B-2      | R72       | C-5      | R110      | D-2      | R149      | F-4      |           |          |

*Horizontal Sweep, A7, Component Identification*



PARTS ON THIS SCHEMATIC

| P/O A7                                        | P/O A8  | CHASSIS |
|-----------------------------------------------|---------|---------|
| C1-14, 44-46, 49                              | P/O XA7 | DS4     |
| CR1-4, 13, 15, 21-24                          | P/O A14 | J1      |
| L1                                            | P/O XA7 | R5      |
| P/O P1, 3, 4                                  | P/O A7  | W2, 6   |
| Q1-21                                         | P/O A9  | P/O W7  |
| R1-75, 97, 150-152,<br>157, 159, 160, 164-168 | P/O P1  |         |
| S1A-C, S2A-F                                  |         |         |
| P/O S3D                                       |         |         |
| TP1-3, 7-9                                    |         |         |
| U1, 2                                         |         |         |
| P/C XA9                                       |         |         |
| P/O W1                                        |         |         |
| E1-3                                          |         |         |

DELETED: A7: C43, CR14

**SERVICE**

**INFORMATION**

**SERVICE SHEET 8**

**THEORY OF OPERATION**

The main sweep integrator consists of current source A8Q13, source follower A8Q5, common-emitter stage A8Q6, and an integrating capacitor between the gate of A8Q5 and the collector of A8Q6. In the reset condition, current from A8Q13 is drained through A8Q3, and the main sweep output remains at approximately +1 V.

When the main sweep enable signal goes low, A8Q1 conducts, turning off A8Q2 and A8Q3. Current from A8Q13 is now applied through the selected integrating capacitor, A8C9 - A8C11, producing a linear ramp (main sweep) at the collector of A8Q6. (For the fastest sweep speeds, .05 - 2 μSEC, A8C6 is the integrating capacitor.) The main sweep is also applied to an emitter follower circuit consisting of A8Q8 - A8Q10. When the main sweep reaches an amplitude of +11 volts, the emitter of A8Q10 is approximately +5 volts, arming A7U2 and shutting off A8Q1. With A8Q1 off, current flows through A8Q3, discharging the selected integrating capacitor. When the voltage level at the base of A8Q4 falls to the voltage level applied to the base of A8Q2, both A8Q2 and A8Q4 are conducting and the sum of the currents at the gate of A8Q5 is zero. This is the reset condition of the ramp.

The output of constant-current source A8Q13 is controlled by operational amplifier A8U1. Different reference voltages are developed for different ranges on TIME/DIV switch A8S1. When different ranges are selected, values of the ramp capacitor, integrating resistor, and reference voltage are changed. This changes the slope of the ramp for different sweep speeds. The slope can be varied for any sweep speed by TIME/DIV VERNIER R8.

The emitter of A8Q9 drives one of the six holdoff capacitors (A8C13 through A8C18) depending on the position of the TIME/DIV switch. At the end of the sweep, the holdoff capacitor is discharged through A8R40 and TRIGGER HOLDOFF potentiometer R9. When voltage at the base of A8Q11 decays to +0.7 volt, A8Q12 turns on and the reset line to A7U2 (pin 4) goes low, resetting A7U2 and arming it for another sync signal.

**REMOVAL PROCEDURE**

Remove assembly A8 as follows:

- a. Loosen hex screws on three TIME/DIV shaft collars.

- b. Set main TIME/DIV control to 1 μSEC position.
- c. Set delayed TIME/DIV control to OFF position.
- d. Remove TIME/DIV shaft by pulling through front panel of instrument.
- e. Remove mounting screw and standoff that hold assemblies A8 and A17 together.
- f. Unsolder bare wire between A8 and A17 at assembly A8.
- g. Remove A8 by pulling from connector on A7.
- h. To replace A8, reverse removal procedure.

**TIME/DIV SWITCH MAINTENANCE**

To service the TIME/DIV rotor switch on assembly A8, proceed as follows:

- a. Remove assembly A8 as described in this service sheet.
- b. After removing A8, note orientation of slot in rotor section of TIME/DIV switch.
- c. Remove metal retainer ring from rotor switch and separate two sections.
- d. Check contact area on etched circuit board. If contact area shows excessive wear, replace circuit board.
- e. Check contact on both rotor sections. If contacts show excessive wear, replace rotor section.
- f. Clean and lubricate contacts on circuit board and rotors as described in Preventive Maintenance at the front of this section.
- g. Place rotor sections on circuit board and re-install retainer ring.
- h. Position slotted portion of open rotor section as noted in step b.
- i. Reinstall assembly in instrument.
- j. Reinstall TIME/DIV shaft and knob assembly.

**TROUBLESHOOTING**

If trouble is isolated to Main Sweep Assembly A8, use waveforms and dc voltages indicated on the schematic to isolate the problem to a particular stage or component.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 8**

- 1. Set front-panel controls in accordance with initial control settings in Section V, except as follows:

Main TRIGGER LEVEL..... fully cw  
 AUTO/NORM..... NORM  
 SINGLE..... engaged  
 RESET light should be off

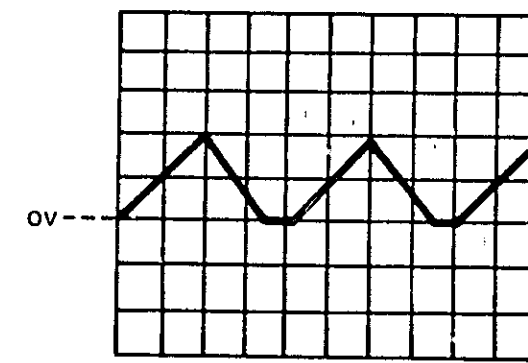
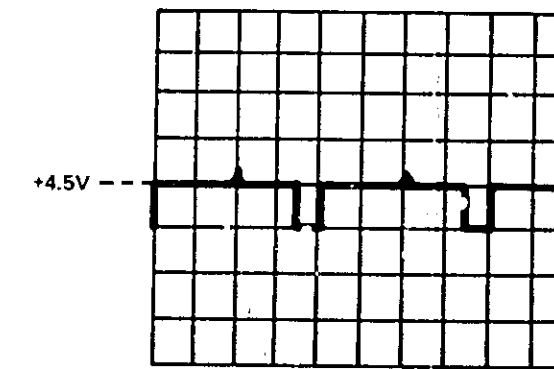
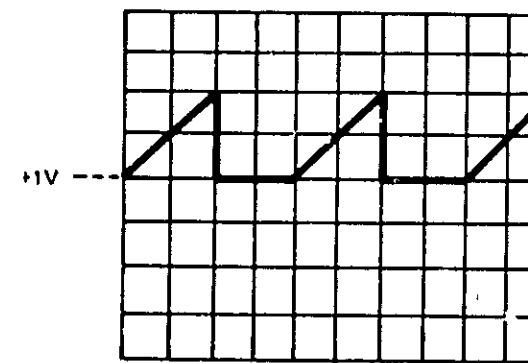
- 2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 8**

- 1. Set front-panel controls in accordance with initial control settings in Section V, except as follows:

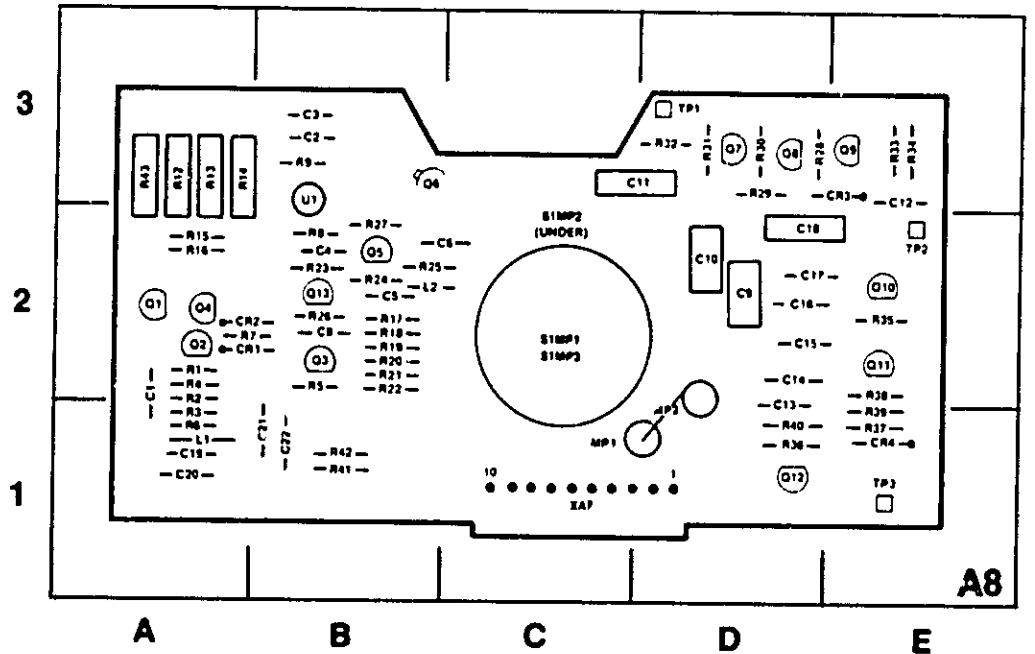
Coupling (channel A)..... 50Ω  
 TRIGGER LEVEL (main)..... stable display

- 2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- 3. Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
- 4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



NOTE: WAVEFORMS ARE TIME RELATED

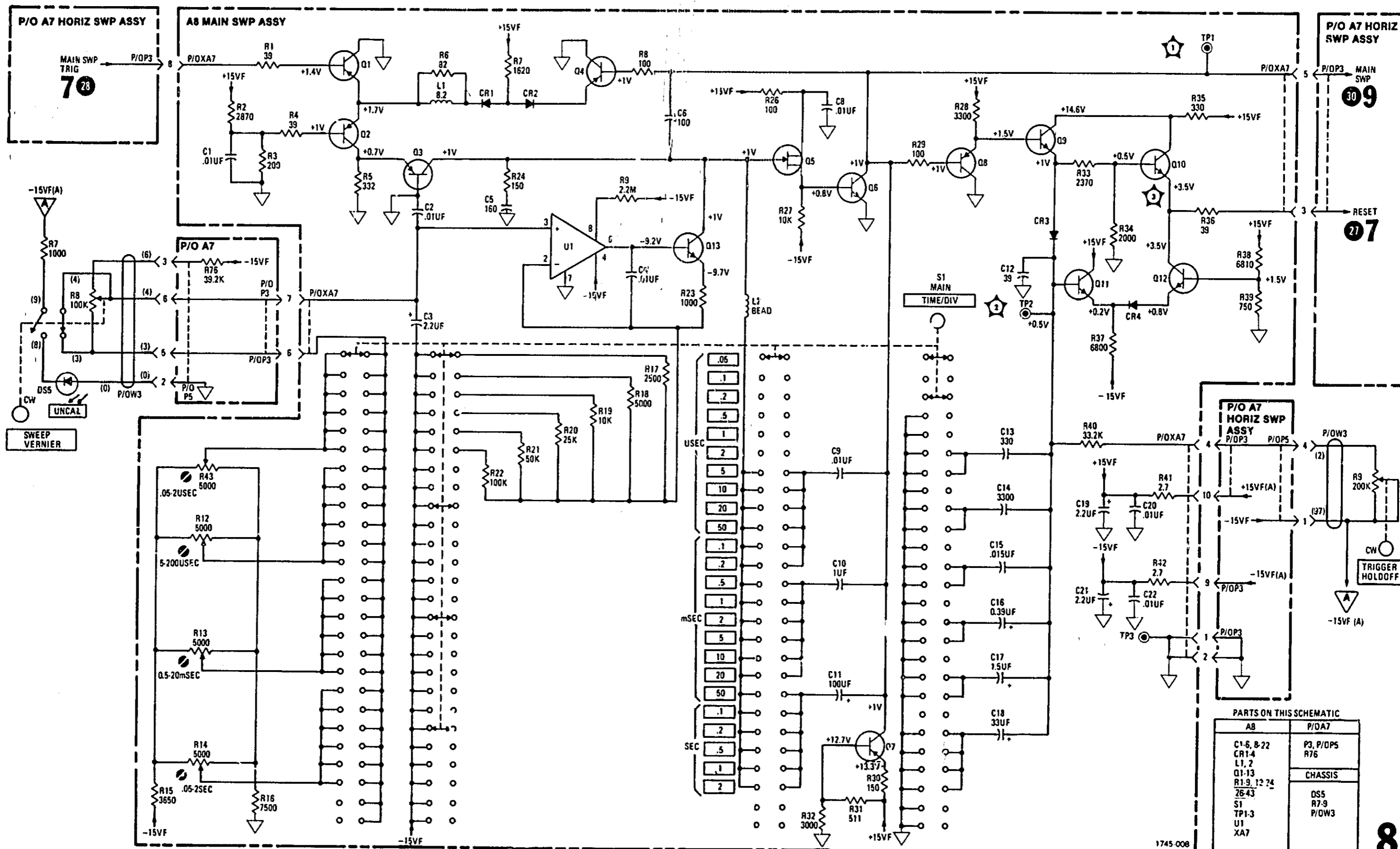
Waveforms for Service Sheet 8



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | A-2      | C20       | A-1      | Q10       | E-2      | R17       | B-2      | R36       | D-1      |
| C2        | B-3      | C21       | B-1      | Q11       | E-2      | R18       | B-2      | P37       | E-1      |
| C3        | B-3      | C22       | B-1      | Q12       | D-1      | R19       | B-2      | F38       | E-2      |
| C4        | B-2      | C11       | B-2      | Q13       | B-2      | R20       | B-2      | R39       | E-1      |
| C5        | B-2      | CR2       | B-2      | R1        | A-2      | R21       | B-2      | R40       | D-1      |
| C6        | C-2      | CR3       | E-3      | R2        | A-2      | R22       | B-2      | R41       | B-1      |
| C8        | B-2      | CR4       | E-1      | R3        | A-1      | R23       | B-2      | R42       | B-1      |
| C9        | D-2      | E1        | B-2      | R4        | A-2      | R24       | B-2      | R43       | A-3      |
| C10       | D-2      | L1        | A-1      | R5        | B-2      | R26       | B-2      | S1MP1     | C-2      |
| C11       | C-3      | Q1        | A-2      | R6        | A-1      | R27       | B-2      | S1MP2     | C-2      |
| C12       | E-3      | Q2        | A-2      | R7        | B-2      | R28       | D-3      | S1MP3     | C-1      |
| C13       | D-2      | Q3        | B-2      | R8        | B-2      | R29       | D-3      | S1MP4     | D-1      |
| C14       | D-2      | Q4        | A-2      | R9        | B-3      | R30       | D-3      | TP1       | D-3      |
| C15       | D-2      | Q5        | B-2      | R12       | A-3      | R31       | D-3      | TP2       | E-2      |
| C16       | D-2      | Q6        | B-3      | R13       | A-3      | R32       | D-3      | TP3       | E-1      |
| C17       | D-2      | Q7        | D-3      | R14       | A-3      | R33       | E-3      | U1        | B-3      |
| C18       | D-2      | Q8        | D-3      | R15       | A-2      | R34       | E-3      | XA7       | C-1      |
| C19       | A-1      | Q9        | E-3      | R16       | A-2      | R35       | E-2      |           |          |

Main Sweep, A8, Component Identification





PARTS ON THIS SCHEMATIC

| A8          | P/OA7     |
|-------------|-----------|
| C1-6, 8-22  | P3, P/OPS |
| CR1-4       | R76       |
| L1, 2       | CHASSIS   |
| Q1-13       |           |
| R1-9, 12-24 |           |
| 26-43       | DS5       |
| S1          | R7-9      |
| TP1-3       | P/OW3     |
| U1          |           |
| XA7         |           |

DELETED: A8, C7, C23, R10, R11, R25

8

**SERVICE SHEET 9**

**THEORY OF OPERATION**

**Arming Circuit.** The positive-going ramp of the main sweep is applied to pin 9 of delay comparator A7U4, which controls arming of the delayed sweep. DELAY potentiometer R6 establishes a reference voltage that is applied to buffer amplifier A7U3. The output of A7U3 drives pin 6 of A7U4. When the main sweep ramp voltage slightly exceeds the level established by R6, the comparator changes states. Its output arms the delayed-trigger circuit. When the delayed sweep switch is in the off position, A7U4 is inhibited at pin 13 and no delayed sweep can be generated.

**Delayed Trigger.** Delayed trigger operation is similar to main trigger operation. The DLYD SYNC input to integrated circuit A10U1 is applied through an impedance converter consisting of FET matched pair A10Q1A/A10Q1B and emitter follower A10Q3. The delayed sweep is started by a negative-going pulse at the collector of A10Q10. With SWEEP AFTER DELAY switch A10S1D in AUTO, the delayed sweep starts as soon as A10U1 is armed (at pin 5) by the transition developed from the DLY COMP signal. With A10S1D in TRIGD position, the transition applied to A10U1, and a delayed trigger will be formed if a DLYD sync pulse occurs during the main sweep time. TRIGGER LEVEL control A10R10 establishes the trigger level threshold in TRIGD mode of operation.

**REMOVAL PROCEDURE**

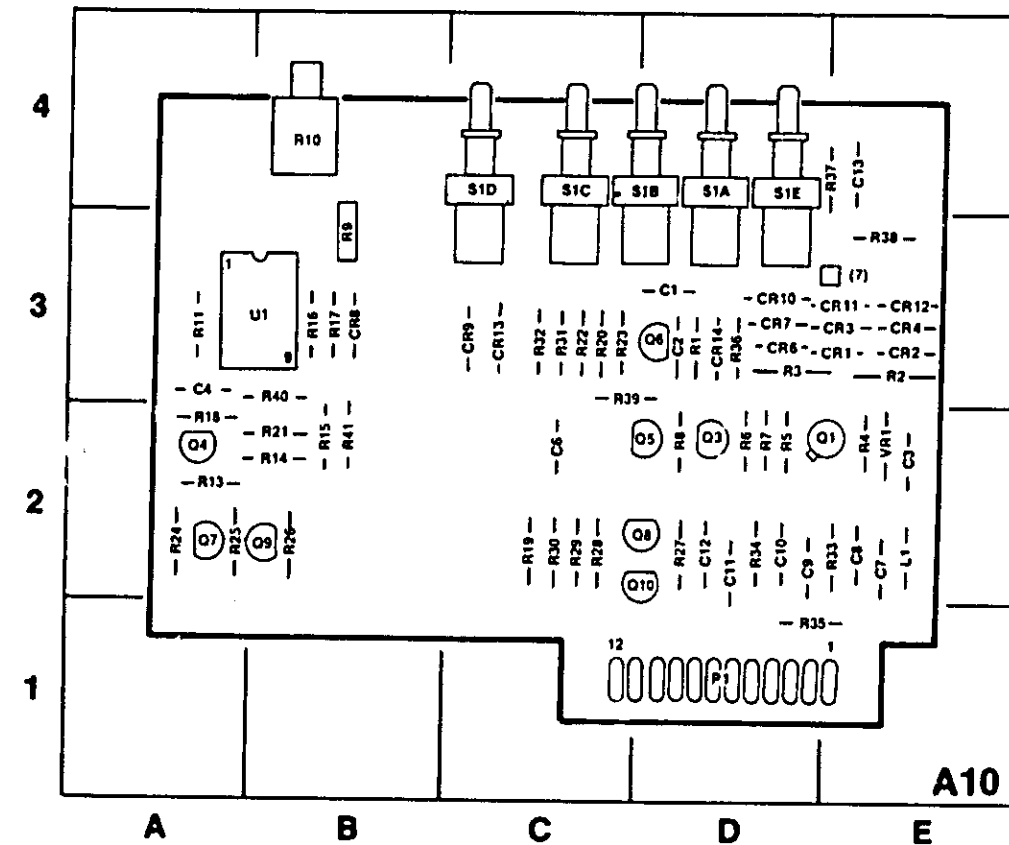
To remove assembly A10, proceed as follows:

- a. Remove assembly A9 (see Service Sheet 10).
- b. Unsolder resistor from delayed EXT TRIGGER BNC connector.
- c. Remove delayed TRIGGER LEVEL knob and nut underneath.
- d. Remove screw from corner of A10 (next to delayed EXT TRIGGER BNC connector).
- e. Gently pull A10 to rear and remove from instrument. Save lockwasher on TRIGGER LEVEL potentiometer before inserting in front panel.

**TROUBLESHOOTING**

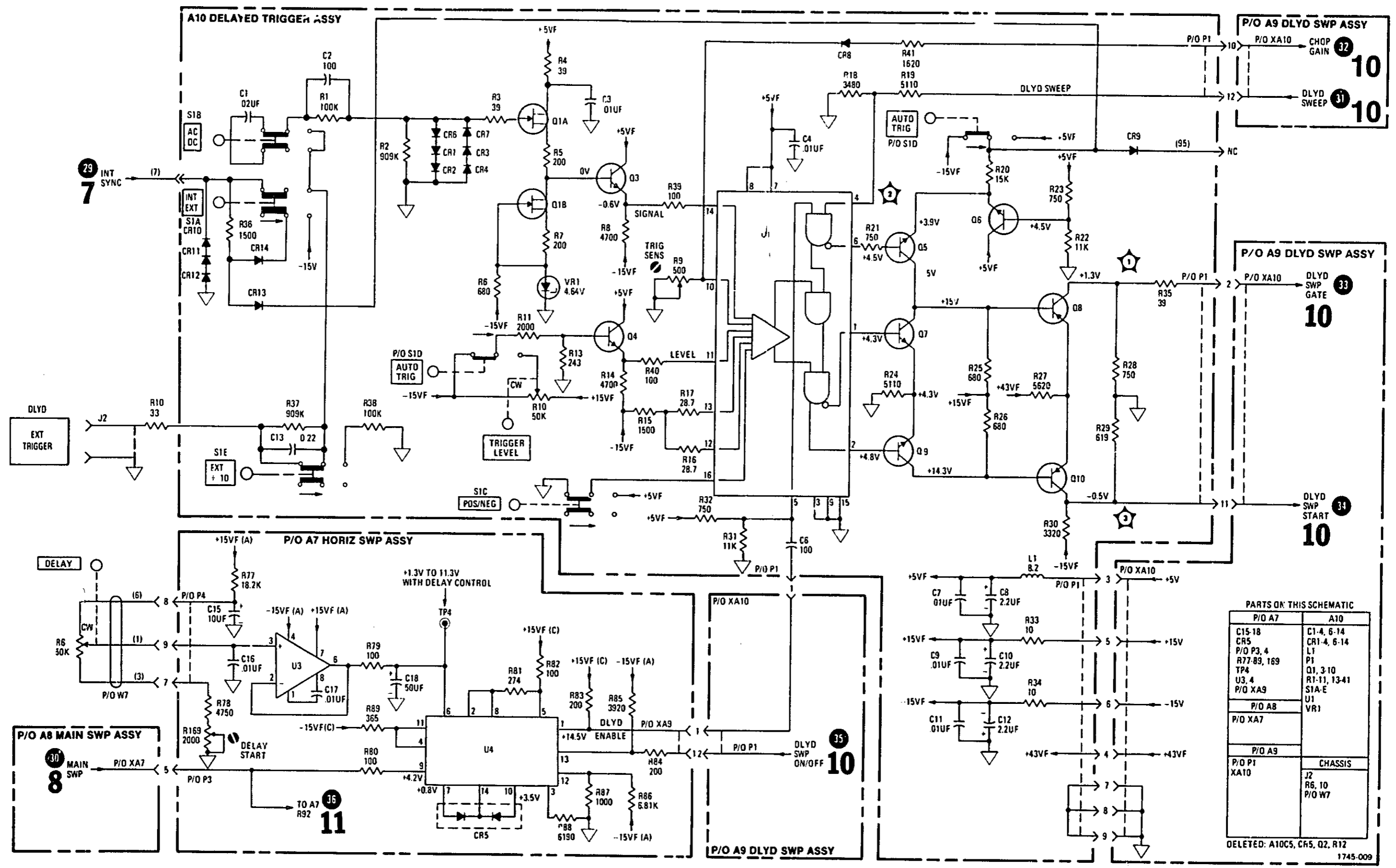
The delayed trigger assembly should cause little trouble in the operation of the instrument. If trouble is suspected, check the following inputs:

- a. MAIN TRIG signal.
- b. DLY COMP signal.
- c. DLYD SYNC signal.
- d. DLY'D SWP.



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | D-3      | CR1       | E-3      | CR14      | D-3      | R4        | E-2      | R16       | B-3      | R27       | D-2      | R38       | E-3      |
| C2        | D-3      | CR2       | E-3      | Q3        | D-2      | R5        | D-2      | R17       | B-3      | R28       | C-2      | R39       | C-3      |
| C3        | E-2      | CR3       | E-3      | Q4        | A-2      | R6        | D-2      | R18       | A-2      | R29       | C-2      | R40       | B-3      |
| C4        | A-3      | CR4       | E-3      | Q5        | D-2      | R7        | D-2      | R19       | A-2      | R30       | C-2      | R41       | B-2      |
| C6        | C-2      | CR6       | D-3      | Q6        | D-3      | R8        | D-2      | R20       | C-3      | R31       | C-3      | S1A       | D-4      |
| C7        | E-2      | CR7       | D-3      | Q7        | A-2      | R9        | B-3      | R21       | B-2      | R32       | C-3      | S1B       | D-4      |
| C8        | E-2      | CR8       | B-3      | Q8        | D-2      | R10       | B-4      | R22       | C-3      | R33       | E-2      | S1C       | C-4      |
| C9        | D-2      | CR9       | C-3      | Q9        | B-2      | R11       | A-3      | R23       | C-3      | R34       | D-2      | S1D       | C-4      |
| C10       | D-2      | CR10      | D-3      | Q10       | D-2      | R13       | A-2      | R24       | A-2      | R35       | D-1      | S1E       | D-4      |
| C11       | D-2      | CR11      | E-3      | R1        | D-3      | R14       | B-2      | R25       | A-2      | R36       | D-3      | U1        | B-3      |
| C12       | D-2      | CR12      | E-3      | R2        | E-3      | R15       | B-2      | R26       | B-2      | R37       | E-4      | VR1       | E-2      |
| C13       | E-4      | CR13      | C-3      | R3        | D-3      |           |          |           |          |           |          |           |          |

*Delayed Trigger, A10, Component Identification*



**PARTS ON THIS SCHEMATIC**

| P/O A7      | A10          |
|-------------|--------------|
| C15-18      | C1-4, 6-14   |
| CR5         | CR1-4, 6-14  |
| P/O P3, 4   | L1           |
| R77-89, 169 | P1           |
| TP4         | Q1, 3-10     |
| U3, 4       | R1-11, 13-41 |
| P/O XA9     | S1A-E        |
|             | U1           |
| P/O A8      | VR1          |
| P/O XA7     |              |
| P/O A9      |              |
| P/O P1      | CHASSIS      |
| XA10        | J2           |
|             | R6, 10       |
|             | P/O W7       |

DELETED: A10C5, CR5, Q2, R12  
1745-009

**SERVICE SHEET 10**

**THEORY OF OPERATION**

The operation of delayed sweep is similar to that of the main sweep (Service Sheet 8). Output of the delayed integrator (A9TP1) parallels the main sweep ramp until the delayed sweep enable signal applied to the base of A9Q3 goes low. At this point, the delayed integrator ramps up at a slope determined by the selected integrating capacitor and selected current source resistor.

**REMOVAL PROCEDURE**

Remove assembly A9 as follows:

- Loosen hex screws on three TIME/DIV shaft collars.
- Set main TIME/DIV control to 1 μSEC position.
- Set delayed TIME/DIV control to OFF position.
- Remove TIME/DIV shaft by pulling through front panel of instrument.
- Remove A9 by gently rocking assembly toward rear of instrument to disconnect it from two connectors.
- To replace, reverse removal procedure.

**TIME/DIV SWITCH MAINTENANCE**

To service the TIME/DIV rotor switch on A9 proceed as follows:

- Remove assembly A9 as described above.
- After removing A9, note orientation of slot in rotor section of TIME/DIV switch.
- Remove metal retainer ring from rotor switch and separate two sections.
- Check contact area on circuit board. If contact area shows excessive wear, replace circuit board.
- Check contact on both rotor sections. If contacts show excessive wear, replace rotor section.
- Clean and lubricate contacts on circuit board and rotors as described in Preventive Maintenance at the front of this section.
- Place rotor sections on circuit board and re-install retainer ring.
- Position slotted portion of open rotor sections as noted in step b.
- Reinstall assembly A9 in instrument.
- Reinstall TIME/DIV shaft and knob assembly.

**TROUBLESHOOTING**

If trouble is isolated to Delayed Sweep Assembly A9, use the waveform and dc voltages indicated on the schematic to isolate the problem to a particular stage or component.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 10**

- Set front-panel controls in accordance with initial control settings in Section V, except as follows:

DLY'D TIME/DIV ..... 50 μSEC  
 AUTO/NORM ..... NORM  
 SINGLE ..... engaged  
 Both TRIGGER LEVELS ..... fully cw  
 RESET light should be off

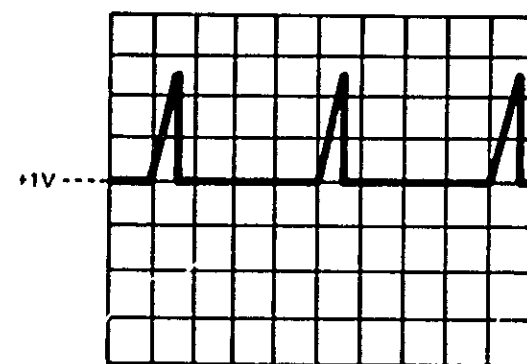
- All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 10**

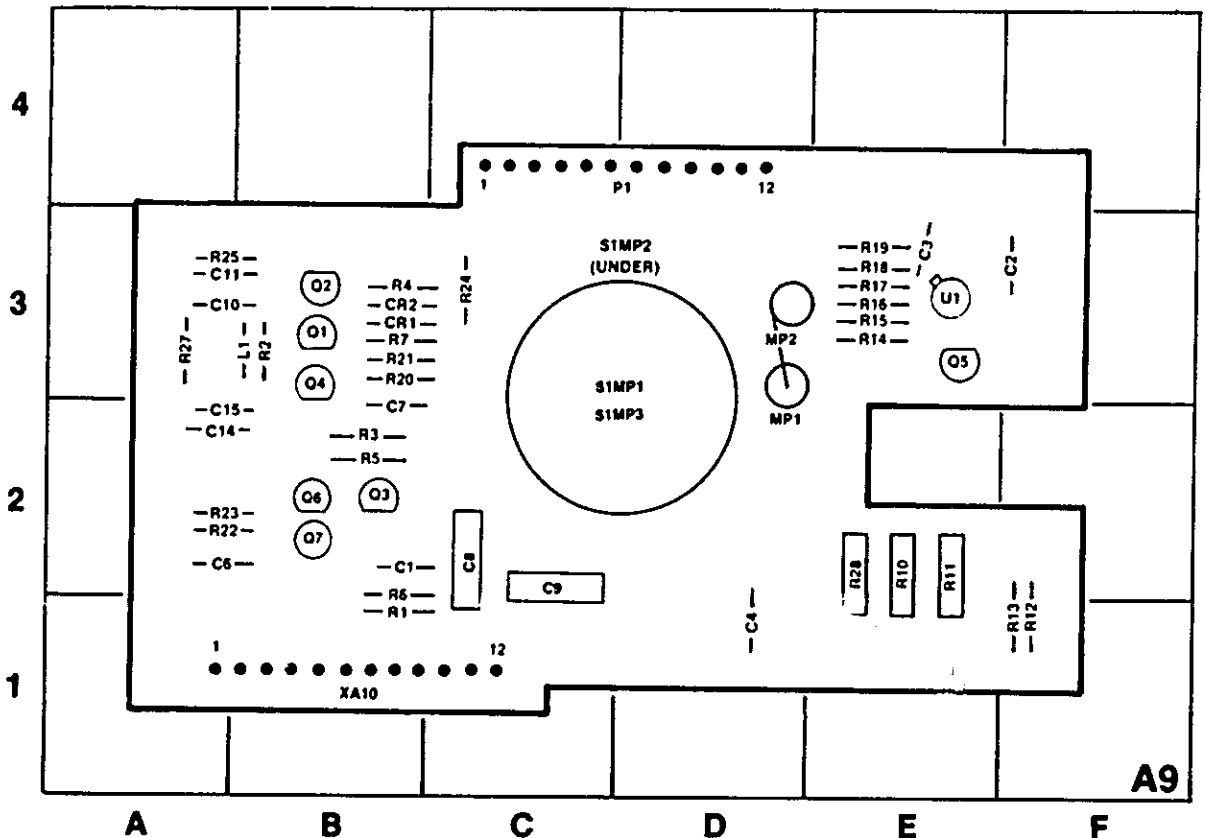
- Set front-panel controls in accordance with initial control settings in Section V, except as follows:

Coupling (channel A) ..... 50Ω  
 DLY'D TIME DIV ..... 10 μSEC  
 START ..... midrange  
 Horiz display ..... MAIN  
 TRIGGER LEVEL (main) ..... stable display

- Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
- Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

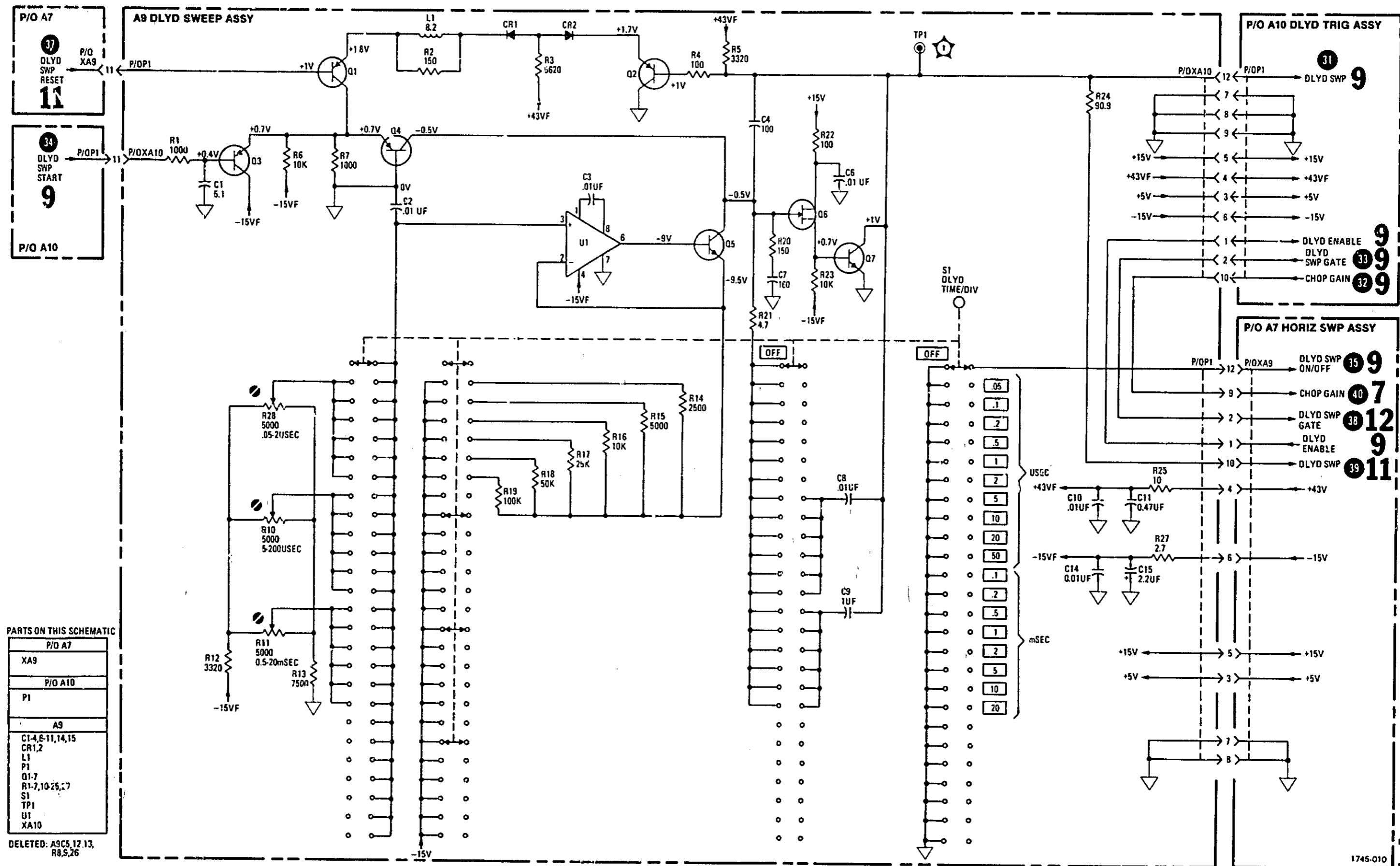


5 V/DIV  
 .5 mSEC/DIV  
 Waveforms for Service Sheet 10



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | B-2      | C15       | A-2      | Q7        | B-2      | R13       | F-1      | R24       | C-3      |
| C2        | F-3      | CR1       | B-3      | R1        | B-1      | R14       | E-3      | R25       | A-3      |
| C3        | E-3      | CR2       | B-3      | R2        | B-3      | R15       | E-3      | R27       | A-3      |
| C4        | D-1      | L1        | B-3      | R3        | B-2      | R16       | E-3      | R28       | A-2      |
| C6        | A-2      | P1        | C-4      | R4        | B-3      | R17       | E-3      | S1MP1     | D-2      |
| C7        | B-2      | Q1        | B-3      | R5        | B-2      | R18       | E-3      | S1MP2     | D-3      |
| C8        | C-2      | Q2        | B-3      | R6        | B-2      | R19       | E-3      | S1MP3     | D-2      |
| C9        | C-2      | Q3        | B-2      | R7        | B-3      | R20       | B-3      | U1        | E-3      |
| C10       | A-3      | Q4        | B-3      | R10       | E-2      | R21       | B-3      | XA10      | B-1      |
| C11       | A-3      | Q5        | E-3      | R11       | E-2      | R22       | A-2      | MP1       | D-3      |
| C14       | A-2      | Q6        | B-2      | R12       | F-1      | R23       | A-2      | MP2       | D-3      |

Delayed Sweep, A9, Component Identification



**PARTS ON THIS SCHEMATIC**

|                    |
|--------------------|
| <b>P/O A7</b>      |
| XA9                |
| <b>P/O A10</b>     |
| P1                 |
| <b>A9</b>          |
| C1-4, 6-11, 14, 15 |
| CR1, 2             |
| L1                 |
| P1                 |
| Q1-7               |
| R1-7, 10, 26, 27   |
| S1                 |
| TP1                |
| U1                 |
| XA10               |

DELETED: A9C5, 12, 13, R8, S, 26

**SERVICE SHEET 11**

**THEORY OF OPERATION**

**Mixed Sweep.** MIXED sweep switch A7S3B performs two functions. When engaged, A7S3B applies the main sweep ramp as the reset reference to the delayed sweep integrator circuit. A7S3B also routes the delayed sweep ramp to the horizontal preamplifier.

**Main Sweep.** MAIN sweep switch A7S3C routes the main sweep ramp to the horizontal preamplifier.

**A VS B Control.** The A VS B switch A7S3D performs several functions. It sends a control signal to the vertical preamplifier which is used to select channel A vertical display and channel B sync. It biases the gate Schmitt to turn the gate on and forces the main trigger circuit to the single-shot mode. It also connects the sync amplifier output to the horizontal preamplifier.

**Horizontal Preamplifier.** The horizontal preamplifier converts the single-ended sweep (main or delayed) or A VS B signal to a differential signal suitable for driving the horizontal output amplifier. The preamplifier provides sweep gain adjustment (X1), sweep magnification adjustment (X10), horizontal position, horizontal beam finding control, and X10 magnification centering.

Transistor A7Q22 is a shunt feedback stage that level shifts the sweep ramp and drives differential amplifier A7Q23/A7Q27. Transistor A7Q26 provides temperature compensation for A7Q22. Horizontal POSITION control R11 drives A7Q26. MAG CENTER control A7R105 also drives A7Q26 when MAG X10 switch A7S10 is engaged. Transistors A7Q24, A7Q25 and A7Q34 are current sources, A7Q24 acts as a collector load for A7Q22. A7Q25 and A7Q34 are emitter loads for A7Q23 and A7Q27. The X1 gain is calibrated by A7R93. MAG X10 control is calibrated by A7R117.

When BEAM FIND switch A12S1 is pressed, voltage at the bases of A7Q25 and A7Q34 is lowered. This decreases the amount of current available to the output amplifier and prevents it from driving the trace off screen.

**Horizontal Output.** Amplifier A11 is a differential shunt feedback amplifier. Current required by A7Q23 is supplied through A11R4. This determines the voltage that drives one horizontal deflection plate through A11R7. Current required by A7Q27 is supplied through A11R23. Transistors A11Q1, A11Q2, A11Q5, and A11Q6 are emitter followers that provide a high impedance for each side of the amplifier. High-speed linearity is controlled by a lag network at the input to each side of the amplifier. Resistor A11R10 controls one side, while A11R15 controls the other. Each side of the output amplifier can swing from approximately +8 volts to +110 volts.

**REMOVAL PROCEDURE**

Assembly A7 Removal: (see Service Sheet 7).

Assembly A11 Removal:

To remove assembly A11, proceed as follows:

- Disconnect (2) and (9) wires from A11.
- Remove A11 from connector by first pulling top of A11 away from assembly A7 and then pulling bottom of A11.
- To reinstall, reverse removal procedure.

**TROUBLESHOOTING**

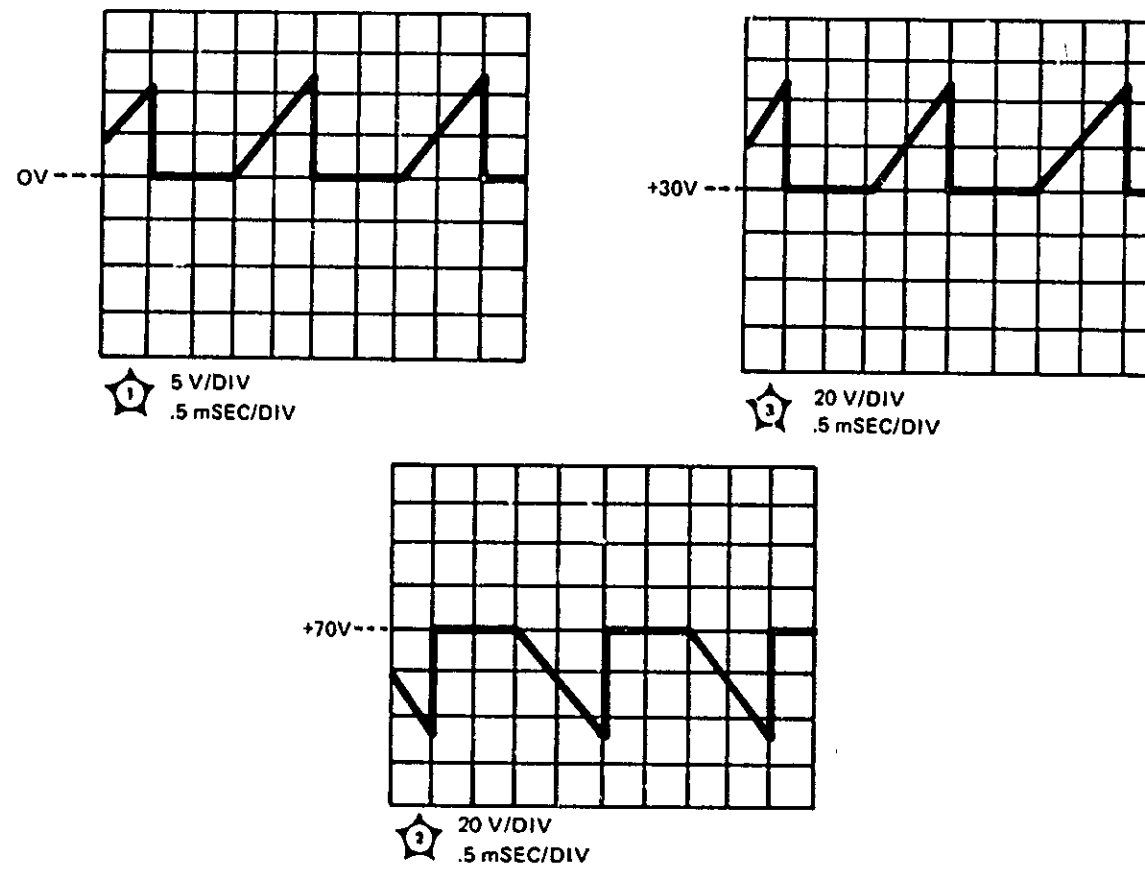
If no horizontal deflection can be obtained under normal sweep conditions, the problem may be either in the time base or in Horizontal Output Assembly A11. To quickly determine which is at fault, put the oscilloscope in the A VS B mode and connect a 1-kHz sine wave to the channel B input. If horizontal deflection is present, the horizontal amplifier (and sync amplifier) are operating properly, and the problem is in the time base. If no horizontal deflection occurs, assembly A11 is probably defective.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 11**

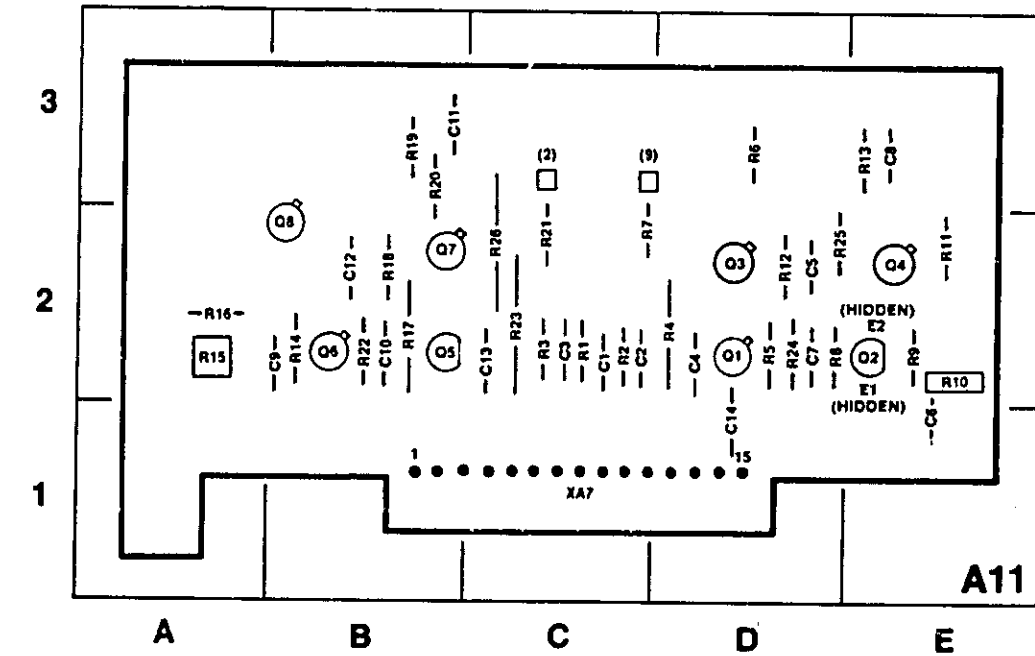
- Set front-panel controls in accordance with initial control settings in Section V, except as follows:
  - Sweep mode ..... A vs B
  - Spot centered on CRT.
  - BEAM INTENSITY ..... barely visible spot
- All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 11**

- Set front-panel controls in accordance with initial control settings Section V, except as follows:
  - Coupling (channel A) ..... 50Ω
  - TRIGGER LEVEL (main) ..... stable display
- Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
- Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

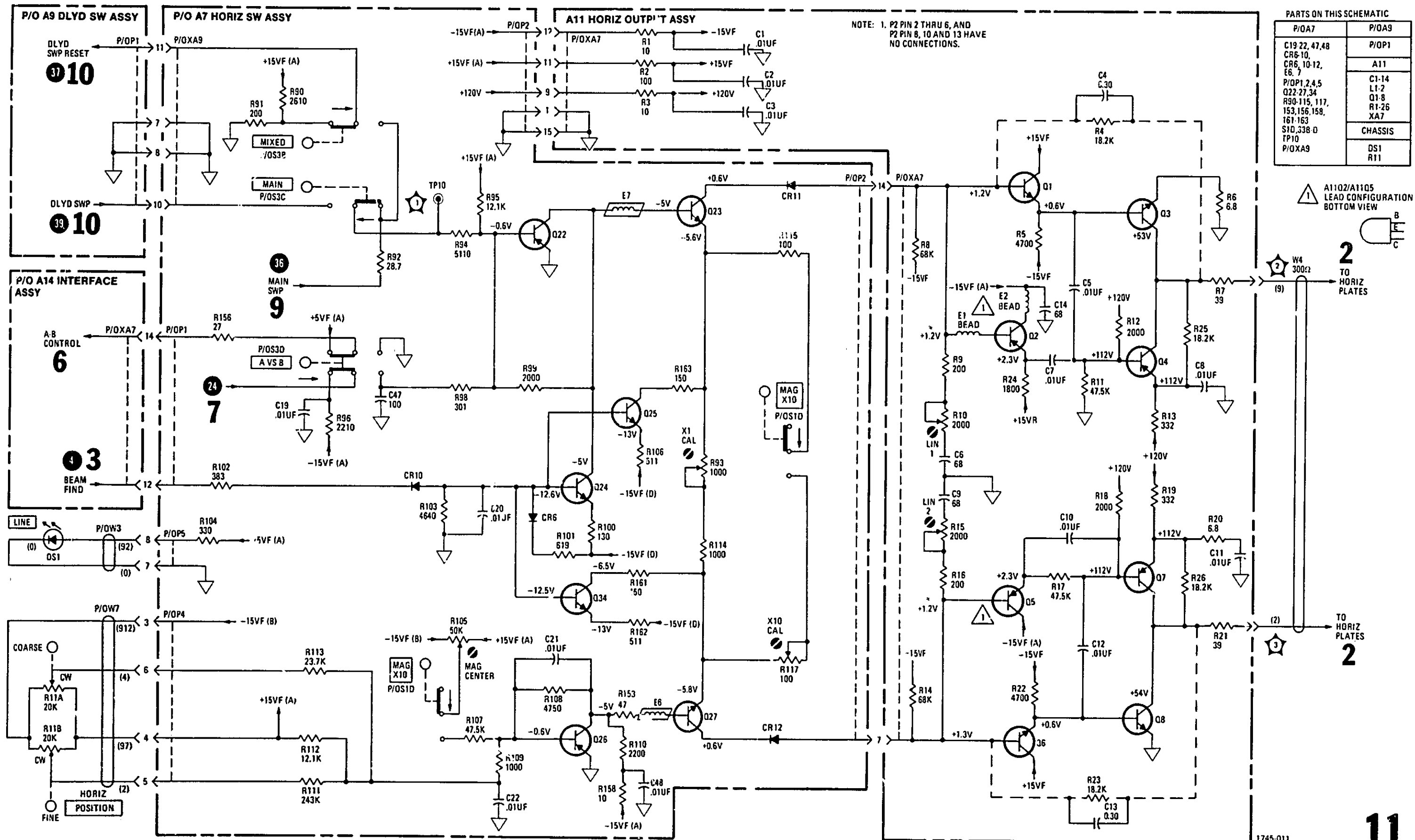


Waveforms for Service Sheet 11



| REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC | REF DESIG | GRID LOC |
|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| C1        | C-2      | C14       | D-1      | R3        | C-2      | R16       | A-2      |
| C2        | C-2      | E1        | E-2      | R4        | D-2      | R17       | B-2      |
| C3        | C-2      | E2        | E-2      | R5        | D-2      | R18       | B-2      |
| C4        | D-2      | Q1        | D-2      | R6        | D-2      | R19       | B-3      |
| C5        | D-2      | Q2        | E-2      | R7        | C-2      | R20       | B-3      |
| C6        | E-1      | Q3        | D-2      | R8        | D-2      | R21       | C-2      |
| C7        | D-2      | Q4        | E-2      | R9        | E-2      | R22       | B-2      |
| C8        | E-3      | Q5        | B-2      | R10       | E-2      | R23       | C-2      |
| C9        | B-2      | Q6        | B-2      | R11       | E-2      | R24       | D-2      |
| C10       | B-2      | Q7        | B-2      | R12       | D-2      | R25       | D-2      |
| C11       | B-3      | Q8        | B-2      | R13       | E-3      | R26       | C-2      |
| C12       | B-2      | R1        | C-2      | R14       | B-2      | XA7       | C-1      |
| C13       | C-2      | R2        | C-2      | R15       | A-2      |           |          |

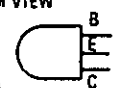
Horizontal Output, A11, Component Identification



**PARTS ON THIS SCHEMATIC**

| P/OA7                                 | P/OA9   |
|---------------------------------------|---------|
| C19-22, 47, 48                        | P/OP1   |
| CR6-10                                | A11     |
| CR6, 10-12, E6, 7                     | C1-14   |
| P/OP1, 2, 4, 5                        | L1-2    |
| Q22-27, 34                            | Q1-8    |
| R90-115, 117, 153, 156, 158, 161, 163 | R1-26   |
| S1D, 338-D                            | XA7     |
| TP10                                  | CHASSIS |
| P/OXA9                                | DS1     |
|                                       | R11     |

A11Q2/A11Q5 LEAD CONFIGURATION BOTTOM VIEW



TO HORIZ PLATES

TO HORIZ PLATES

1745-011

## SERVICE SHEET 12

### THEORY OF OPERATION

The gate Schmitt circuit, A7Q28 - A7Q32, provides Gate Amplifier Assembly A12 with main and delayed gate signals. The Schmitt circuit is controlled by horizontal mode switch A7S3. It is set by the first positive control pulse and resets on the first negative control pulse. In main sweep operation, the gate follows the main sweep. In mixed operation, the gate is started by the main sweep and terminated by the end of the delayed sweep. The gate Schmitt also furnishes the main and delayed

gate outputs to rear panel BNC connectors for external use (Service Sheet 1).

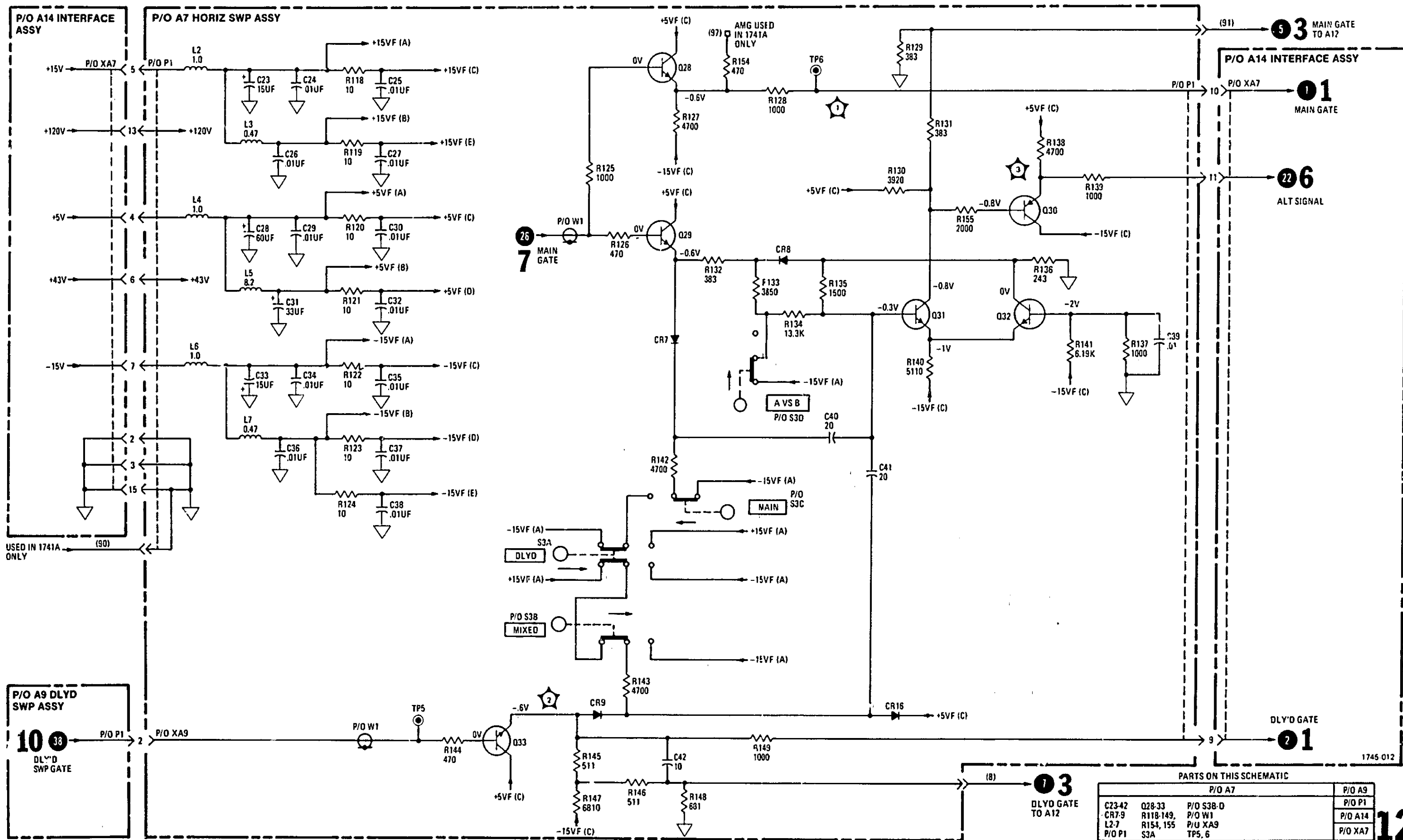
### REMOVAL PROCEDURE

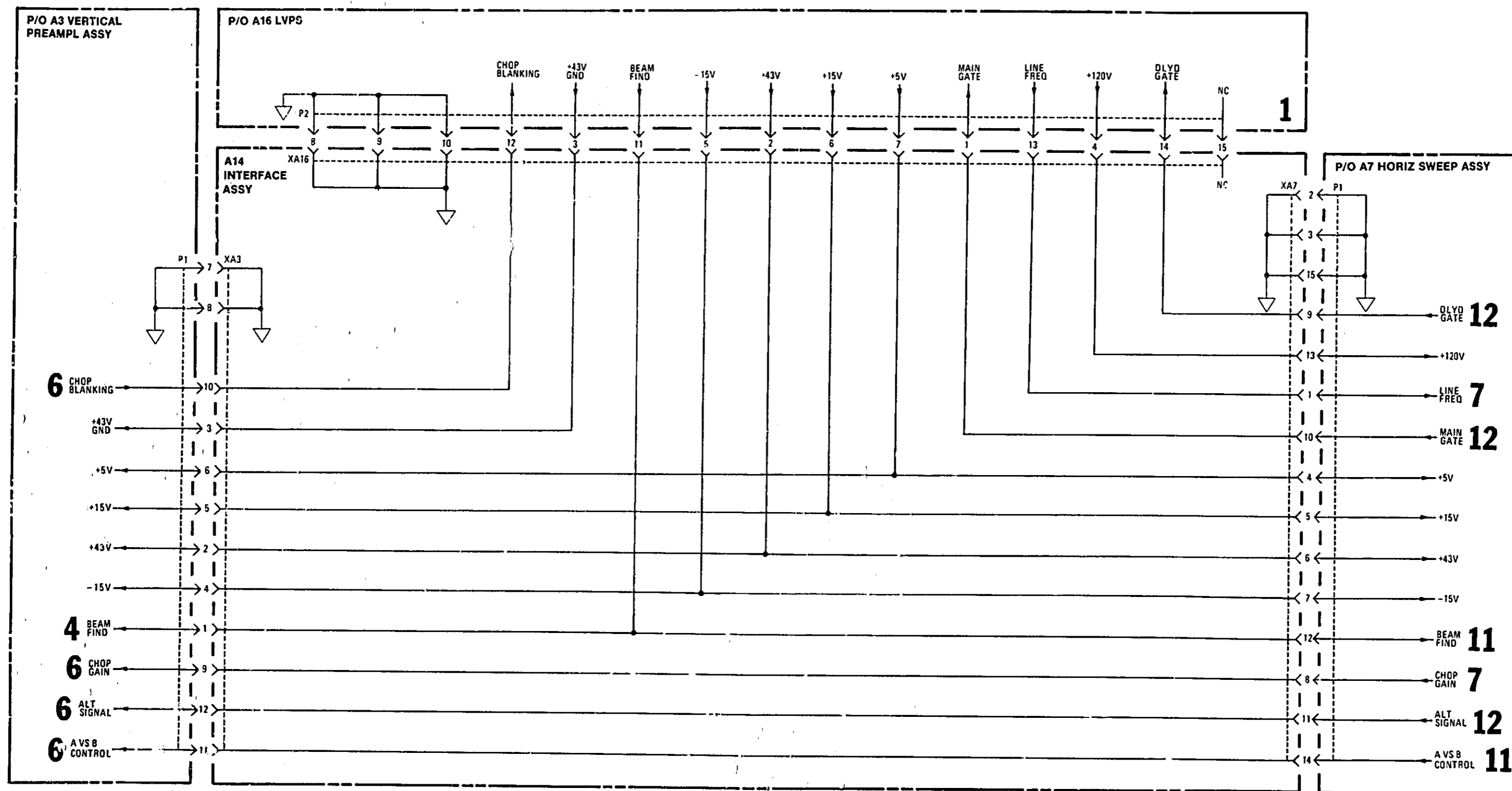
To remove assembly A7 see Service Sheet 7.

### TROUBLESHOOTING

Troubleshooting the gate Schmitt circuit should present few problems to the technician. If input signals are present, follow signals through the individual circuits.







PARTS ON THIS SCHEMATIC

| P/O A3 | P/O A7 | A14                | P/O A16 |
|--------|--------|--------------------|---------|
| P1     | P1     | XA3<br>XA7<br>XA16 | P2      |

1745-013

13

# **MANUAL CHANGES**

---

---

# MANUAL CHANGES

## MANUAL IDENTIFICATION

Model Number: 1745A

Date Printed: SEPTEMBER 1982

Part Number: 01745-90901

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections.

Make all appropriate serial number related changes indicated in the tables below.

| Serial Prefix or Number | Make Manual Changes |
|-------------------------|---------------------|
| 2248A                   | 1                   |
| 2301A                   | 1,2                 |
| 2307A                   | 1, 2, 3             |
| 2309A                   | 1, 2, 3, 4          |
| 2523A                   | 1,2,3,4             |
|                         |                     |

| Serial Prefix or Number | Make Manual Changes |
|-------------------------|---------------------|
|                         |                     |
|                         |                     |
|                         |                     |
|                         |                     |
|                         |                     |
|                         |                     |

▲ NEW ITEM

### ERRATA

Page 5-4, Adjustment Procedures.  
Add test 5-19A.

### 5-19A. PATTERN ADJUSTMENT.

Equipment Required:

Test Oscillator ..... HP Model 651B

- a. Set Model 1745A TRIGGER LEVEL (main) control fully clockwise.
- b. Connect 100-kHz sine wave to channel A and adjust test oscillator output for 10-division vertical display.
- c. Adjust PATTERN ADJ (A12R19) to obtain best raster display (minimum pincushioning or barreling).

Page 6-9, Table 6-2. Replaceable Parts.

Change: A3CR29 and A3CR30 to HP and Mfr Part No. 1901-0979, DIODE-SM SIG SCHOTTKY, CD5.

### NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

6 September 1985

Page 1 of 4



Printed in U.S.A.

**ERRATA (Cont'd)**

Page 6-21, Table 6-2. Replaceable Parts.

Delete: A12R15 and A12R17.

Page 8-8, Service Sheet 2.

Change last sentence of first paragraph of High-Voltage Rectifier theory of operation to read:  
 CRT cathode voltage will vary between -2770 V and -2970 V, depending on component tolerances of  
 A15R13 and A15R101; it is not adjustable.

Page 8-9, Service Sheet 2.

Change: A15R14 to 100 ohms.

Page 8-11, Service Sheet 3.

Delete A12R15 and A12R17. Reconnect +15V to top of A12R16 and -15V to bottom of A12R16.

Page 8-18, Service Sheet 7.

Change step a of removal procedure to read:

- a. Remove assemblies A8 and A9 as outlined in Service Sheets 8 and 10.

Page 8-28A, Service Sheet 12.

Add Page 8-28A as shown in this Manual Change Sheet.

**CHANGE 1**

Page 6-5, Table 6-2. Replaceable Parts.

Change: A15 HP and Mfr Part No. to 01745-66506, CD7.

Page 6-22, Table 6-2. Replaceable Parts.

Change: A15 HP and Mfr Part No. to 01745-66506, CD7.

Change: A15C3 to HP and Mfr Part No. 0160-0168, CAPACITOR-FXD .1UF ±10% 200VDC POYLE, CD1.  
 Delete: A15R4.

Page 6-23, Table 6-2. Replaceable Parts.

Add: A15VR2, HP and Mfr Part No. 1902-0025, DIODE-ZNR 10V 5% DO-35 PD=0.4W T. ±.06%, CD4,  
 Mfr Code 28480.

Page 8-9, Service Sheet 2.

Change: A15C3 to 0.1UF.

Change: A15R4 to A15VR2, 10V. Cathode Points toward A15CR2 cathode.

**CHANGE 2**

Page 6-5, Table 6-2. Replaceable Parts.

Change: A4 HP and Mfr Part No. to 01740-61633, CD6.

**CHANGE 3**

Page 6-5, Table 6-2. Replaceable Parts.

Change: A8, HP and Mfr Part No. to 01740-66593, CD7.

Change: A9, HP and Mfr Part No. to 01740-66592, CD6.

Page 6-17, Table 6-2. Replaceable Parts.

Change: A8, HP and Mfr Part No. to 01740-66593, CD7.

Page 6-18, Table 6-2. Replaceable Parts.

Change: A9, HP and Mfr Part No. to 01740-66592, CD6.

Page 6-19, Table 6-2. Replaceable Parts.

Change: A9R5 to HP and Mfr Part No. 0761-0011, RESISTOR 3.3K 5% 1W MO TC=0±200, Mfr Code 28480,  
 CD7.

Change: A9U1 to HP Part No. 1826-0311, IC OP AMP GP 8-DIP-P PKG, Mfr Code 04713, Mfr Part No.  
 MLM201AP1, CD9.

Delete: A9XU1.

Page 8-25, Schematic 10.

Change: A9R5 to 3300 ohms.

**▲ CHANGE 4**

Page 6-6, Table 6-2, Replaceable Parts.

Change: MP03 to HP and Mfr Part No. 5041-5214, CD1.

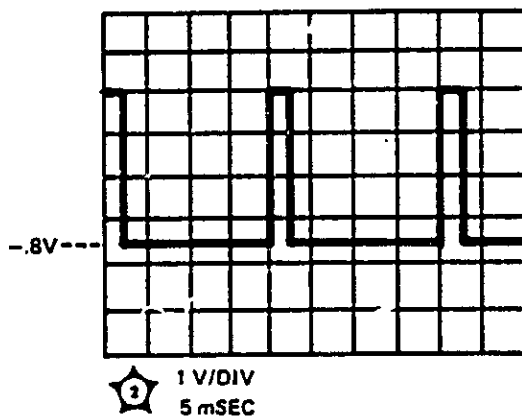
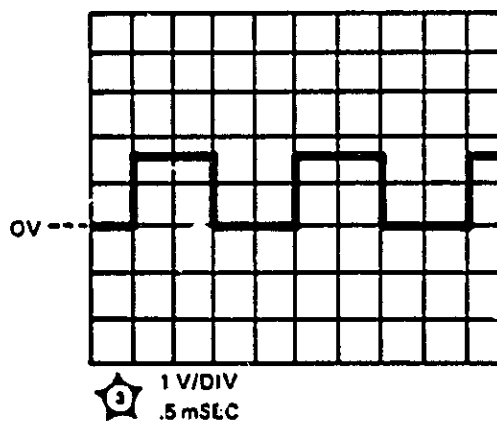
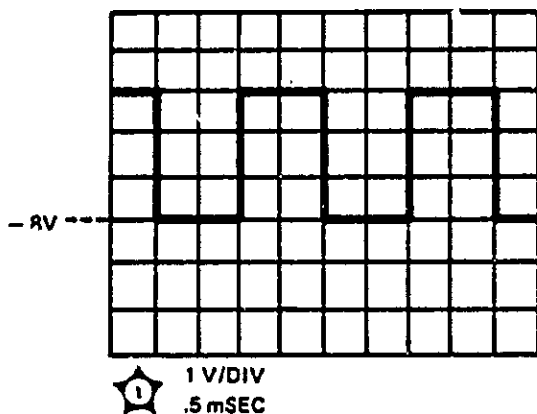
Change: MP05 to HP and Mfr Part No. 01745-60602, CD2.

**DC VOLTAGE MEASUREMENT CONDITIONS  
SERVICE SHEET 12**

- Set front-panel controls in accordance with initial control settings in Section V, except as follows:  
 Sweep mode ..... A vs B  
 BEAM INTENSITY ..... barely visible spot  
 Spot centered on CRT.
- All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

**WAVEFORM MEASUREMENT CONDITIONS  
SERVICE SHEET 12**

- Set front-panel controls in accordance with initial control settings in Section V, except as follows:  
 Coupling (channel A) ..... 50Ω  
 TRIGGER LEVEL (main) ..... stable display
- Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
- Connect square-wave generator 50-ohm output to Model 1745A channel A INPUT connector.
- Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



*Waveforms for Service Sheet 12*