Errata

Title & Document Type: **1742A Oscilloscope Operating and Service Manual**

Manual Part Number: **01742-90903**

Revision Date: **July 1978**

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:

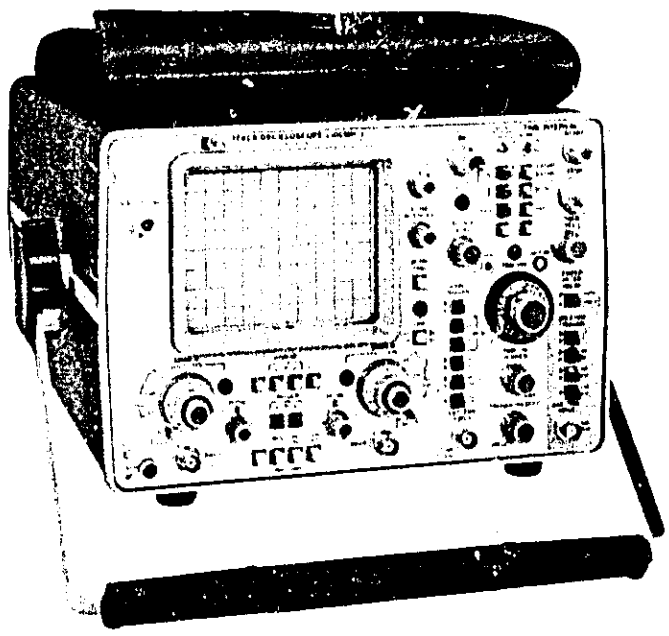
www.agilent.com

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

Agilent Technologies

OPERATING AND SERVICE MANUAL

1742A
OSCILLOSCOPE



HEWLETT hp PACKARD

HP 1742A

CERTIFICATION

Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company 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 AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment. 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. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the preventive maintenance procedures in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

Service contracts or 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 1742A OSCILLOSCOPE

(Including Option 001, 090, 101, 102, 580, 900, 901, 902, and 906)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed **1807A.**

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

Manual Part No. 01742-90903
Microfiche Part No. 01742-90803
Operator's Guide Part No. 01742-90901

PRINTED: JULY 1978

SAFETY SUMMARY

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

GROUND THE INSTRUMENT.

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

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

KEEP AWAY FROM LIVE CIRCUITS.

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

DO NOT SERVICE OR ADJUST ALONE.

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

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

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

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

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

DANGEROUS PROCEDURE WARNINGS.

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

WARNING

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

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont'd)

LIST OF TABLES

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the HP Model 1742A Oscilloscope. A separate Operators Guide is also supplied with the 1742A. It should be kept with the instrument for use by the operator.

1-3. Listed on the title page of this manual is a microfiche part number. This number can be used to order 4- x 6-inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement.

1-4. SPECIFICATIONS.

1-5. Instrument specifications are listed in table 1-1. These specifications are the performance standard or limits against which the instrument is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

1-6. INSTRUMENTS COVERED BY MANUAL.

1-7. Attached to the instrument is a serial number tag. The serial number is in the form: 0000A00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-8. 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. The manual for this newer instrument is accompanied by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-9. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-10. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-11. DESCRIPTION.

1-12. The Hewlett-Packard Model 1742A is a dual-channel, 100-MHz, delayed-sweep oscilloscope designed for general-purpose bench or field use. The dual-channel dc to 109 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 5X vertical magnification. Selectable input impedance of either 50 ohms or 1 megohm permits impedance selection that best meets measurement applications.

1-13. The 1742A provides the two marker time-interval measurement feature in addition to the traditional delayed sweep mode. When using the two marker ΔTIME mode of operation, the time interval is scaled and the output (as a voltage) is applied to rear-panel connectors for readout on an external 3-1/2-digit voltmeter. With Option 034, the time-interval voltage is internally connected and displayed by a DMM that is built into the top cover of the oscilloscope.

1-14. The horizontal deflection system has calibrated sweep rates from 2 s/div to 0.05 s/div and delayed-sweep rates from 20 ms/div to 0.05 μs/div. A 10X magnifier expands all sweeps by a factor of 10 and extends the fastest sweep 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. When using trigger view in the alternate mode along with the ΔTIME sweep mode, the time interval start marker appears on the trigger waveform and the stop marker appears on the channel A and channel B waveforms. This allows correlation of time between the trigger signal and the channel A and 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 8- by 10-cm major divisions on an internal graticule.

1-15. OPTIONS.

1-16. Standard options are modifications installed on HP instruments at the factory and are available on request. The following options extend the usefulness of the 1742A:

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

OPTION 034: Provides a built-in Digital Multimeter that can be used for time interval measurements or as a separate multimeter. 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: Deletes the two Model 10041A divider probes normally supplied. You may specify other probes listed that are more suitable to your requirements.

OPTION 101: Single pushbutton interface option for operation with the HP Model 1607A Logic State Analyzer. The A vs B mode of operation is deleted.

OPTION 102: Option 102 is the Option 101 with an additional adapter plate (HP Part No. 5061-1213) for attaching the 1742A and the 1607A instruments together as a single unit.

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

OPTION 900: Power cord for use in Great Britain and Singapore. 2.3 m (7.5 ft), removable, 240 V max, 3-conductor 90° IEC.

OPTION 901: Power cord for use in Australia and New Zealand. 2.3 m (7.5 ft), removable, 240 V max, 3-conductor IEC.

OPTION 902: Power cord for use in East and West Europe. 2.3 m (7.5 ft), removable, 240 V max, 3-conductor 90° IEC.

OPTION 906: Power cord for use in Switzerland only. 2.0 m (6.5 ft), removable, 240 V max, 3-conductor 90° CEE22/V.

1-17. ACCESSORIES SUPPLIED.

1-18. The following accessories are supplied with the 1742A:

One Blue Light Filter, HP Part No. 01740-02701
One Front-panel Cover, HP Part No. 5040-0516
One Vinyl Storage Pouch, HP Part No. 1540-0292
One 7.5-ft Power Cord, HP Part No. 8120-1521
Two 10:1 Divider Probes, HP Model 10041A, approx 2 m (6.6 ft) long.
One 0.5A slow-blow Fuse for 220/240 V operation (HP Part No. 2110-0202)

1-19. EQUIPMENT AVAILABLE.

1-20. The following items are available for use with the 1742A:

Model 1001A, 1002A, and 1114A - Testmobiles
Model 1120A - 500 MHz Active Probe
Model 1125A - Impedance Converter Probe
Model 10002A - 50:1 Divider Probe, approx 1.5 m (5 ft) long
Model 10020A - Resistive Divider Probe Kit
Model 10021A - 1:1 Divider Probe, approx 1 m (3.3 ft) long
Model 10040A - 10:1 Divider Probe, approx 1 m (3.3 ft) long
Model 10042A - 10:1 Divider Probe, approx 3 m (9.8 ft) long
Model 10140A - Collapsible Viewing Hood
Model 10491B - Rack Mount Adapter
Model 10173A - RFI Filter and Contrast Screen
HP Part No. 01742-69501 - Kit for installing Option 034 (DMM)

1-21. RECOMMENDED TEST EQUIPMENT.

1-22. Equipment required to test and maintain the 1742A is listed in table 1-3. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-1. Specifications

VERTICAL DEFLECTION (Two Channels)

RISE TIME: 3.5 ns (measured from 10% to 90% points of 6-division input step).
BANDWIDTH: dc to 100 MHz. (Measured 3-dB down from 8-div reference.) Bandwidth may be limited to approximately 20 MHz by BW LIMIT switch.
Lower 3-dB Limit, ac Coupling: 10 Hz (1 Hz with 10:1 probe).
DEFLECTION FACTOR
Ranges: 5 mV/div to 20 V/div in 12 calibrated positions (1, 2, 5 sequence, accurate within 3%). With vernier uncalibrated, continuously variable between ranges and to at least 50 V/div on 20 V/div range.
INPUT RC (SELECTABLE)
AC and DC: 1 megohm ± 2%, shunted by approx 20 pF.
50 Ohm: 50 ohms ± 3%.
MAXIMUM INPUT VOLTAGE
AC and DC: 250 V (dc + peak ac) or 500 V p-p ac at 1 kHz or less.
50 Ohm: 5 Vrms.

Table 1-1. Specifications (Cont'd)

A+B OPERATION

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

VERTICAL MAGNIFICATION (X5)

Bandwidth: 3 dB down from 8-division reference signal.

Dc-coupled: dc to 40 MHz (ac-coupled: 10 Hz to 40 MHz).

Rise Time: 9 ns (measured from 10% to 90% points of 8-division input step).

Deflection Factor: increases sensitivity of each deflection factor setting by a factor of five with a maximum sensitivity of 1 mV on channels A and B. (Recommended only for use on .005 V and .01 V ranges.)

MAIN AND DELAYED SWEEPS

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/ Division	*Accuracy X1	*Accuracy X10	Temperature Range
50 ns to 20 ms	±3% ±2% ±3%	±4% ±3% ±4%	0°C to 15°C 15°C to 35°C 35°C to 55°C
*50 ms to 2 s add 1%			

Sweep Vernier (Main Only): continuously variable between all ranges; extends slowest sweep to at least 5 s/div. Front panel UNCAL light indicates when vernier is not in CAL position.

X10 Magnifier: expands all sweeps by a factor of 10 and extends fastest sweep to 5 ns/div.

CALIBRATED SWEEP DELAY

DELAY TIME RANGE: 0.5 to 10 X MAIN TIME/DIV setting; 100 ns to 2 s (minimum delay 150 ns).

DIFFERENTIAL TIME MEASUREMENT ACCURACY (Over first 10 cm of sweep)

Main Time Base Setting	Option 034	**External DVM	DIAL
*100 ns/div to 20 ns/div 50 ms/div to 2 s/div	±(.5 + .05% of full scale) ±(1 + .1% of full scale)	±(.5 + .05% of full scale) ±(1 + .1% of full scale)	±(.5 + .1% of full scale) ±(1 + .1% of full scale)

*On 100 ns/div range, specification applies after 1 cm of sweep. On all other ranges, specification applies after first 8 mm of sweep.

**Plus accuracy of the external DVM.

Delay Jitter: ± 0.002% (1 part in 50 000) of maximum delay in each step from +15°C to +35°C; ± 0.005% (1 part in 20 000) from 0°C to +15°C and +35°C to +55°C.

TIME INTERVAL (ΔTIME MODE)

TIME INTERVAL OUTPUT VOLTAGE: varies from 50 V to 100 mV full scale. Full scale output voltage can be determined by multiplying the number on the TIME/DIV dial by 10 V (e.g., 0.05 s, 0.05 ms, or 0.05 μs per division gives 0.5 V output full scale).

ACCURACY: measurement accuracy is the Time Interval Accuracy plus the external DMM accuracy.

TRIGGERING

INTERNAL: dc to 25 MHz on signals causing 0.3 division or more vertical deflection, increasing to 1 division of vertical deflection at 100 MHz in all display modes. Increase signal level by 2 when in CHOP and by 5 when MAG X5 is used.

EXTERNAL: dc to 50 MHz on signals of 50 mV p-p or more increasing to 100 mV p-p at 100 MHz. Increase signal level by 2 when in CHOP.

LEVEL AND SLOPE

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

External: continuously variable through ± 1.0 V on either slope of the trigger signal; ± 10 V in ÷ 10.

MAXIMUM INPUT VOLTAGE

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

TRIGGER VIEW

Displays the internal or external trigger signal. In alternate or chop mode (dual channel) channel A, channel B, and the trigger signal are displayed. In channel A or B mode (single channel), trigger view overrides that channel and displays the trigger signal. Displayed amplitude of the internal trigger signal is approximately the same as the on-screen vertical signal. Deflection factor of the external trigger signal is 100 mV/div or 1 V/div in EXT mode. Trigger point of the main sweep is approximately at the point that the displayed trigger signal crosses center screen. With identically timed signals applied to a vertical channel and the external trigger input, the trigger signal is delayed by 2.5 ns ± 1 ns.

Table 1-1. Specifications (Cont'd)

A VS B OPERATION

BANDWIDTH

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

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

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

PHASED DIFFERENCE BETWEEN CHANNELS: < 3° dc to 100 kHz.

CATHODE-RAY TUBE AND CONTROLS

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

GENERAL

CALIBRATOR

Type: approx 1.4-kHz square wave, < 0.1 μs rise time.

Voltage: 1 V p-p into ≥ 1 megohm; 0.1 V p-p into 50 ohms.

Accuracy: ± 1%.

REAR-PANEL OUTPUTS: main and delayed gates, 0 V to ≥ +2.5 V; Δ Time out.

Table 1-2. General Characteristics

VERTICAL DEFLECTION (Two Channels)

DISPLAY MODES: channel A; channel B (Normal or Invert); Alternate; chopped (approx 250 kHz rate); A+B; and Trigger View.

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

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

HORIZONTAL DEFLECTION

DISPLAY MODES: MAIN, DELAYED, A START/B START, MAG X10, and A vs B.

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 45 Hz.

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

DELAYED SWEEP

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

Trigd: delayed sweep is armed and can be triggered at end of delay period from selected sources. (Note: the Δt DMM readout is invalid in this mode of operation.)

TRIGGER SOURCE

Selectable from channel A, channel B, composite, or line frequency (composite triggering on displayed signal except in chop; in chop, channel A is trigger source).

External Input RC: approx 1 megohm shunted by approx 20 pF.

Coupling: AC, DC, LF REJ, or HF REJ.

AC: attenuates signals below approx 20 Hz.

LF REJ: (main sweep only) attenuates signals below approx 4 kHz.

HF REJ: (main sweep only) attenuates signals above approx 4 kHz.

TRIGGER HOLDOFF: (main sweep only) increases sweep holdoff time in all ranges.

MAIN INTENSIFIED

DELAYED SWEEP: intensifies that part of main time base to be expanded to full screen in delayed time base mode. Stop control adjusts position of intensified portion of sweep.

TIME MODE: intensifies two parts of main time base to be expanded to full screen in delayed time base mode. START control positions first intensified portion of the sweep; STOP control positions second intensified portion of the sweep.

TIME INTERVAL (Δ TIME MODE)

FUNCTION: measures time interval between two events on channel A (channel A display); between two events on channel B (channel B display); or between two events starting from an event on either channel A or B and ending with an event on either channel A or B (alternate display).

CATHODE-RAY TUBE AND CONTROLS

TYPE: post accelerator, approx 15 kV accelerating potential; aluminized P31 phosphor.

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

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

REAR-PANEL CONTROLS: astigmatism and trace align.

GENERAL

POWER: 100, 120, 220, 240 Vac, + 10%, 48 to 440 Hz, 100 VA maximum.

WEIGHT: (with accessories) net, 13 kg (28.6 lb); shipping, 15.7 kg (34.6 lb).

DIMENSIONS: see outline drawing (with Option 034 installed).

OPERATING ENVIRONMENT

Temperature: 0°C to +55°C.

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

Altitude: to 4600 m (15 000 ft).

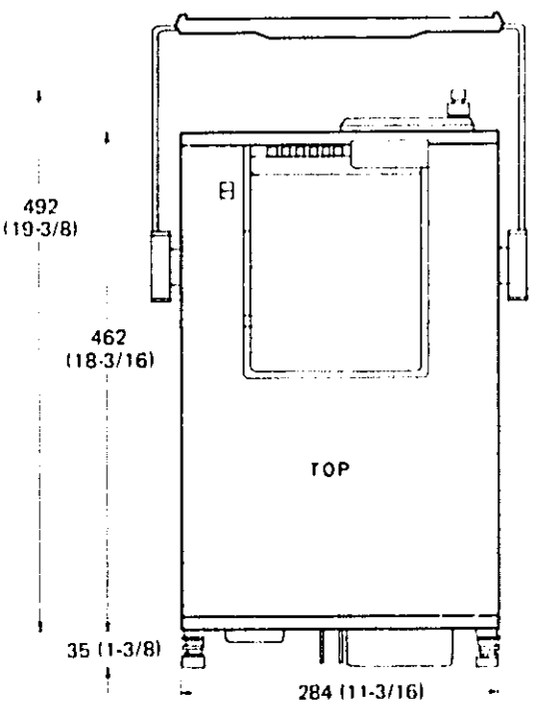
Vibration: vibrated in three planes for 15 minutes each with 0.254 mm (0.010 in.) excursion 10 to 55 Hz.

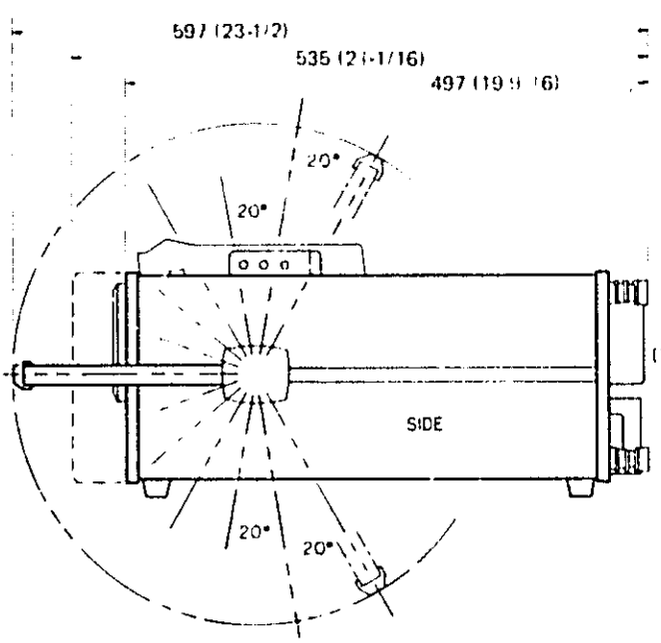
Table 1-2. General Characteristics (Cont'd)

MODEL 1742A WITH OPTION 034 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)





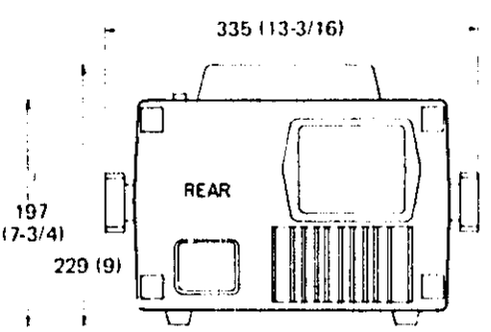


Table 1-3. Recommended Test Equipment

Instrument Type	Recommended Model	Required Characteristics	Required For
Digital Voltmeter	HP Model 3465A	Accuracy: 0.1%	A
Oscilloscope	HP Model 1740A	Bandwidth: 100 MHz 10:1 divider probe	A
Function Generator	HP Model 3310A	1 kHz to 500 kHz, 3 V p-p, Sine and Square Wave	A
Signal Generator	HP Model 3200B	100 MHz, 80 mV p-p	P, A
Time-mark Generator	HP Model 226A	Time Marks 2 s to 5 ns	P, A
Capacitance Meter	HP Model 4332A	20 pF range	A
Fast-rise Pulse Generator		Rise Time: less than 500 ps 50-ohm output Variable amplitude Overshoot less than 3%	P, A
DC Standard	HP Model 740B	40 mV to 160 V Accuracy: 0.1%	P, A
RF Voltmeter	HP Model 3406A with 11063A 50-ohm Tee	Broad-band response to 1 GHz, Voltage to 1 V.	P
Power Divider	General Radio Model 874-TPD	50 ohms at all connections, 6 dB	P, A

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides installation instructions for the Model 1742A Oscilloscope. It also includes information about initial inspection and damage claims, preparation for using the 1742A, and repacking for shipment information.

2-3. INITIAL INSPECTION.

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Contents of the shipment should be as listed in the "Accessories Supplied" paragraph in Section I. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the oscilloscope does not pass the Performance Tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. The HP office will arrange for repair or replacement at HP option without waiting for claim settlement.

2-5. PREPARATION FOR USE.

WARNING

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

2-6. POWER REQUIREMENTS. The 1742A requires a power source of 100, 120, 220 or 240 Vac, ±10%, 48 to 440 Hz single phase. Power consumption is 100 VA (maximum).

CAUTION

Instrument damage may result if the line voltage selection switch is not correctly set for the proper input power source.

2-7. LINE VOLTAGE SELECTION. The instrument is normally set at the factory for 120-V operation. To operate the instrument from any other ac power source, proceed as follows:

a. Disconnect ac input power cord from instrument.

b. Stand instrument on rear panel legs.

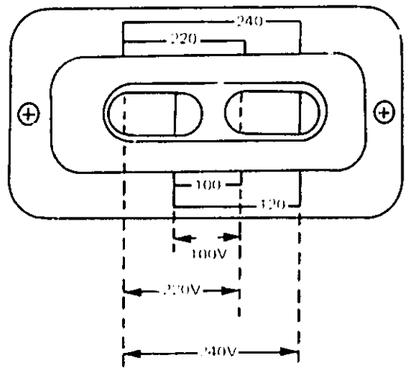


Figure 2-1. Line Voltage Selection Switch Settings

c. Through opening in bottom cover, set Line Voltage Selection Switches to proper position for input power source. Figure 2-1 shows switches set for 120 V operation.

d. For 220 V - 240 V input sources, replace rear panel fuse F1 with 0.5 A slow-blow fuse (HP Part No. 2110-0202) supplied with instrument.

e. Connect 1742A power cable to input power source.

2-8. POWER CABLE. This instrument is equipped with a three-wire power cable. When connected to an appropriate ac 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 lists the part-numbers (and associated Option Numbers) for the power cables and plug configurations available.

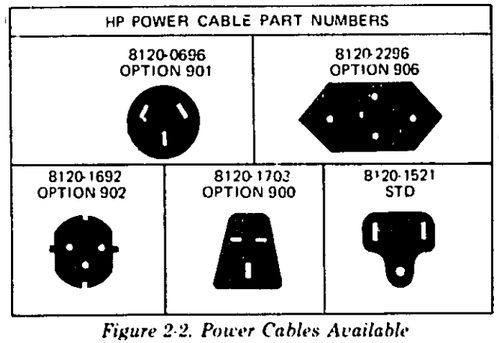
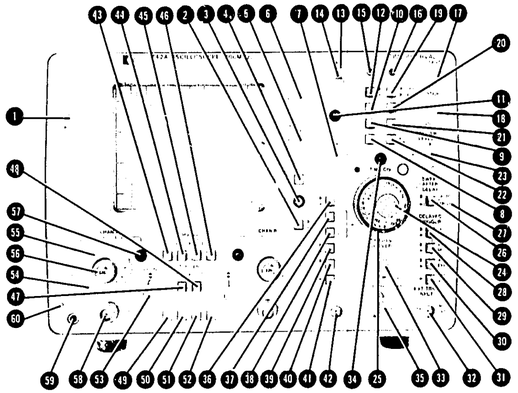


Figure 2-2. Power Cables Available

2-9. REPACKING FOR SHIPMENT.

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

2-11. Use the original shipping carton and packing material. If the original packing material is not available, the Hewlett-Packard office will provide information and recommendations on materials to use



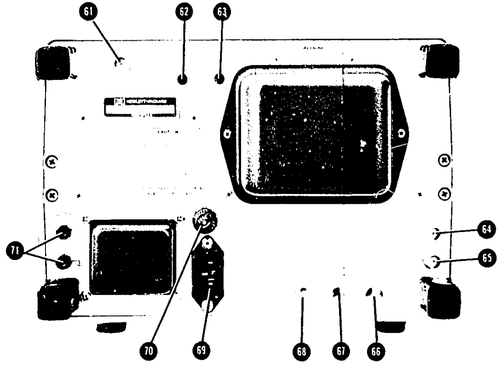


Figure 3-1.
Controls and Connectors
3-0

1 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.

2 LINE. Switch turns instrument power on and off.

3 LINE INDICATOR. Indicator lights when instrument power is on.

4 BEAM FIND. Returns display to viewing area relative to its off-screen position.

5 BEAM INTENSITY. Controls brightness of the CRT display.

6 FOCUS. Adjusts writing beam for sharpest trace. Always keep display focused to prevent damaging the CRT.

7 Main TRIGGER LEVEL. Selects amplitude point on trigger signal that starts main sweep.

8 MAG X10. Magnifies horizontal display 10 times, and expands the fastest sweep time to 5 ns/div.

9 SINGLE. Sweep occurs once with same triggering as in NORM. After each sweep, trigger circuit must be manually RESET (16).

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 (7) through zero.

11 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).

12 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) of 45 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 45 Hz.

13 & 14 POSITION. Coarse (13) and FINE (14) adjustments position display horizontally.

15 SIGNAL OVERLAY (ΔT=0). Screwdriver adjustment to overlap traces with STOP control (18) or DMM (Option 034) at zero.

16 ΔTIME ON/OFF. In OFF position, switch turns off second delayed sweep marker, providing conventional delayed sweep operation.

17 START. Selects delay time between start of main sweep and start of time interval measurement (positions first marker).

18 STOP. Selects end point of time interval measurement (positions second marker).

19 A START/B START. A START position sets first delayed sweep marker on channel A and second delayed sweep marker on channel B. This allows time interval measurement from reference point on channel A to ending point on channel B. B START position sets first delayed sweep marker on channel B and second delayed sweep marker on channel A. This allows time interval measurement from reference point on channel B to ending point on channel A.

20 DLYD. Selects delayed sweep mode of display.

21 MAIN. Selects main sweep of display.

22 A vs B. Selects X-Y mode of operation with channel A input (Y-axis) plotted versus channel B input (X-axis).
OPTION 101 deletes A vs B function and adds logic state display. When Model 1742A is connected to HP Model 1607A Logic State Analyzer, pressing STATE DSPL (22) displays 16-word table of 16-bit words. See Applications Section of Operators Guide for details.

23 Delayed TRIGGER LEVEL. Selects amplitude point of trigger signal that starts delayed sweep.

24 Main TIME/DIV. Inner knob controls main sweep rate. Rate indicated by numbers displayed in knob skirt opening.

25 Delayed TIME/DIV. Outer rotating section selects delayed-sweep rate. Rate indicated by marker on outer knob. An interlock is incorporated so delayed sweep is always faster than main sweep. When rotated out of OFF position in MAIN mode of operation, portion of main sweep is intensified, indicating STOP (18) position of delayed sweep with respect to main sweep.

26 & 27 AUTO/TRIG'D. In AUTO (26), delayed sweep starts immediately after delay interval which is product of either START (17) or STOP (18) setting and main TIME/DIV (24) setting. In TRIG'D (27), delayed-trigger circuit is armed after delay interval and delayed sweep must be triggered internally or externally by trigger signal. (NOTE: the Δt DMM readout (option 034) is invalid in the TRIG'D mode of operation.)

28 ⎍/⎍. Two position switch that selects slope of event that triggers delayed sweep when in TRIG'D (27) mode.

29 Delayed AC/DC. Selects delayed sweep trigger coupling

30 Delayed INT/EXT. Selects internal or external delayed sweep triggering.

31 Delayed EXT ÷ 10. Attenuates external trigger signal by factor of 10.

32 Delayed EXT TRIG INPUT. BNC connector for delayed external trigger signal.

33 TIME/DIV VERNIER. Provides continuous adjustment of main TIME/DIV between calibrated positions, extending slowest sweep to 5 s/div.

34 UNCAL. Lights when TIME/DIV VERNIER (33) is out of CAL detent position; indicates that sweep is not calibrated.

35 TRIGGER HOLDOFF. Increases time between sweeps and aids triggering on complex displays such as digital words.

36 ⎍/⎍. Two position switch that selects slope of internal or external trigger signal used to start main sweep.

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 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.
LINE. Selecting both LF REJ (37) and HF REJ (38) removes all internal and external trigger signals and applies input ac power frequency for triggering.

39 Main AC/DC. Selects main sweep trigger coupling.

40 Main INT/EXT. Selects internal or external main sweep triggering.

41 Main EXT ÷ 10. Attenuates external trigger signal by factor of 10.

42 Main EXT TRIG INPUT. BNC connector for main external trigger signal.

43 ALT. Channel A and B signals are displayed alternately on consecutive sweeps.

44 Channel A. Displays channel A input signal.

45 Channel B. Displays channel B input signal.
A+B. Pressing both channel A (44) and channel B (45) displays the algebraic sum of channel A and channel B input signals. If channel B display is inverted (press CH B INVT (52)), A minus B display results.

46 CHOP. Channel A and B signals are displayed simultaneously by switching between channels at 250 kHz rate.

47 TRIGGER A. Selects sample of channel A signal as trigger signal when INT/EXT (48) is in INT.

48 TRIGGER B. When in INT (48), sample of channel B signal is selected as trigger signal.
COMP. Engaging both trigger A (47) and trigger B (48) 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.

49 TRIG VIEW. Displays main sweep trigger signal. A fixed sensitivity of approx 100 mV/div or 1 V/div with EXT ÷ 10 (41) can be selected in external trigger. TRIGGER LEVEL (7) positions display vertically. Center screen indicates trigger threshold level with respect to trigger signal. If ALT (43) or CHOP (46) is selected, three signals are displayed: channel A, selected trigger signal (at center screen), and channel B. If external trigger signal is selected, you can correlate time between trigger signal and channel A and channel B signals. If you select a single channel, trigger view overrides that channel to display selected trigger signal.

50 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.

51 BW LIMIT. Reduces bandwidth of channel A and channel B to approx 20 MHz.

52 CH B INVT. Inverts polarity of channel B signal. In A+B (44 & 45) mode, pressing CH B INVT (52) results in A minus B display.

NOTE

In the following descriptions for controls (53) through (58), only channel A control and connectors are discussed. Channel B controls and connectors are indentical in function.

53 POSN. Varies vertical position of channel A display.

54 Coupling. Selects capacitive (AC), direct (DC), or 50-ohm coupling of input signal. GND position disconnects input signal and grounds input to vertical preamplifier.

55 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 (56) in CAL position.

56 Vernier. Provides continuous control of deflection factor between calibrated VOLTS/DIV ranges. Vernier range is at least 2.5 to 1.

57 UNCAL. Lights when vernier control is out of detent position to indicate VOLTS/DIV (55) is uncalibrated.

58 INPUT. BNC connector to apply signals to channel A amplifier. Impedance and coupling are selectable by (54).

59 GROUND POST ⏚. Convenient chassis ground connector. Useful to ensure common ground with equipment under test.

60 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).

61 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).

62 TRACE ALIGN. Screwdriver adjustment to align horizontal trace with graticule.

63 ASTIGMATISM. Screwdriver adjustment used in conjunction with FOCUS (6) to achieve clean, sharp spot or trace. Adjustment is easier with stationary spot.

64 MAIN GATE OUTPUT. Provides rectangular output of approx +2.5 V coincident with main sweep.

65 D' Y'D GATE OUTPUT. Provides rectangular output of approx +2.5 V coincident with delayed sweep.

65 - 68 1607A INPUTS - Option 101 only

66 Z-AXIS. Intensity input from HP Model 1607A.

67 VERT. Y-axis input from HP Model 1607A.

68 HORIZ. X-axis input from HP Model 1607A.

69 LINE INPUT. Connector for ac power cord.

70 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.

71 Δ TIME OUT. Banana jack connectors for time interval measurement. Voltage output and position of main TIME/DIV control (24) indicates time interval in s, ms, or μs.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This operating section explains the function of controls, indicators, and connectors on the 1742A. 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 1742A, 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 1742A into operation and avoid CRT damage, accomplish the following steps in the sequence listed:

a. Set BEAM INTENSITY ⑤ fully counterclockwise.

b. Set vertical DISPLAY to ALT ㊸.

c. Set internal TRIGGER to A ㊼.

d. Set vertical verniers ㊺ for channel A and channel B to CAL detent.

e. Set CH B INV switch ㊷ to out position.

f. Set vertical coupling control ㊾ for channel A and channel B to GND.

g. Set vertical POSN controls ㊾ to midrange.

h. Set horizontal POSN control ㊶ to midrange.

i. Set main TIME/DIV control ㉑ to 1 mSEC/div.

j. Set delayed TIME/DIV control ㉓ to OFF.

k. Set TIME/DIV VERNIER ㉑ to CAL detent.

l. Set AUTO/NORM switch ⑫ to AUTO.

m. Set main INT/EXT trigger switch ㊵ to INT.

n. Set LINE switch ② to ON position and allow 15-minute warmup.

o. Adjust BEAM INTENSITY ⑤ 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 ㊾, set trace to center horizontal graticule line.

c. Using nonmetallic alignment tool, adjust TRACE ALIGN ㊷ (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 ⑤ fully counterclockwise.

c. Select A vs B ㉒ horizontal mode of operation.

d. Adjust BEAM INTENSITY ⑤ to observe spot.

e. Position spot near center of CRT using vertical POSN ㊾ and horizontal POSITION ㉓ controls.

f. Adjust FOCUS ⑥ (front panel) and ASTIGMATISM control ㊶ (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 (38).

c. Connect divider probe tip to CAL 1 V terminal (60).

d. Set channel A input coupling (34) to DC.

e. Set channel A VOLTS/DIV control (35) for square-wave display with two to three divisions of vertical deflection.

f. Set main TIME/DIV control (24) for horizontal display of at least two full square waves (0.2 mSEC range).

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

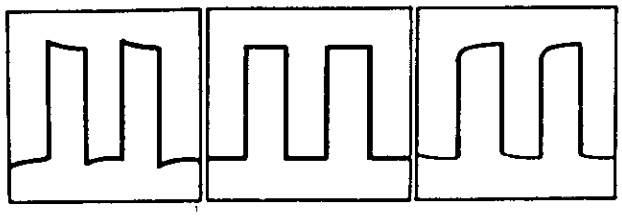


Figure 3-2. Divider Probe Adjustment Display

3-11. DISPLAY/READOUT ZERO ADJUSTMENT. Perform this adjustment before taking Δ t time-interval measurements. The adjustment calibrates the 0.00 setting of the time interval STOP dial (10) or the 0.000 indication of the LED display on the digital multimeter (if used). To accomplish this adjustment, proceed as follows:

a. Apply input signal to channel A or channel B INPUT connector (38).

b. Select channel A (41) or channel B (45) vertical DISPLAY.

c. Select channel A (47) or channel B (48) internal TRIGGER.

d. Adjust appropriate VOLT/DIV control (35) and vernier (36) for full five-division vertical display of signal.

e. Select main TIME/DIV (24) range that displays at least one full cycle of signal.

f. Set delayed TIME/DIV (25) to sweep speed approximately five times faster than main TIME/DIV (24) sweep speed.

g. Set Δ TIME ON/OFF switch (16) to ON position.

h. Adjust time interval START (17) to place first intensified marker on point of interest on displayed trace.

i. Set time interval STOP (10) dial to 0.00. If using Option 034 digital multimeter or external multimeter, readjust time interval STOP (18) to obtain indication as close as possible to 0.000 on DMM.

j. Engaged DLY'D switch (20). With an indication of 0.000 on DMM or 0.00 on time interval STOP (10) dial, the two displayed segments should be perfectly overlapped.

k. If segments are not overlapped, adjust front-panel SIGNAL OVERLAY (ΔT=0) (15) to overlay two signal segments displayed.

NOTE

If using only one signal channel, this completes the adjustment. If using two signal channels, connect probe from second channel to same signal source applied to first channel (same signal applied to both channels simultaneously), and continue on with the adjustment.

l. Select ALT (43) display and internal triggering (47) or (48).

m. Set time-interval mode (19) to A START or B START, as desired.

n. Engage MAG X10 switch (1).

o. With indication of 0.000 on multimeter or 0.00 on time-interval STOP (10) dial, two segments displayed should be overlapped. If not, adjust SIGNAL OVERLAY (ΔT=0) (15) to overlay two signal segments displayed.

3-12. VERTICAL ACCURACY CHECK. To check vertical accuracy, proceed as follows:

a. Accomplish initial turn-on procedure.

b. Connect CAL 1 V (60) output to channel A INPUT connector (38) using BNC to banana plug adapter and test lead with alligator clips.

c. Set channel A VOLTS/DIV control (35) to 0.2 V/DIV range.

d. Set main TIME/DIV control (24) to 0.2 mSEC range.

e. Square-wave amplitude of displayed waveform should be five major divisions (±4%).

3-13. 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 (31).

c. Set main TIME/DIV (24) to 0.5 μSEC position.

d. Set time-mark generator for 0.5 μs markers.

e. Using horizontal POSITION controls (13) and (14), 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.

3-14. OPERATING INSTRUCTIONS.

3-15. The following procedures provide additional information concerning operation of the instrument.

3-16. AUTO VERSUS NORM (12). In AUTO operation, there will always be a recurring sweep (baseline trace), except under triggering conditions. A trigger of 45 Hz or higher overrides AUTO operation and a stable presentation is displayed. Adjustment of main TRIGGER LEVEL (7) may be necessary for a stable display. If the trigger signal is 45 Hz or less, NORM operation must be used. A trigger signal is always needed in NORM operation to generate a sweep.

3-17. SWEEP AFTER DELAY (25) (27). In AUTO (26) mode, delayed sweep starts immediately after the delay interval which is the product of either the START (17) or STOP (18) setting and the main TIME/DIV (24) setting. In TRIG'D (27) mode, the delayed trigger circuit is armed after the delay interval and delayed sweep must be triggered internally or externally by a trigger signal.

NOTE

When the SWEEP AFTER DELAY is in TRIG'D mode of operation, the time interval feature (ΔTIME) is disabled. Output from ΔTIME OUT connectors (or DMM on Option 034) will indicate the position of the STOP control (18), not the time interval being displayed.

3-18. 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 1742A front-panel controls as follows:

Coupling (Ch A) (34)	DC
VOLTS/DIV (Ch A) (33)	.02
Main TIME/DIV (24)	.5 mSEC
START (17)	fully ccw
STOP (18)	fully ccw
ΔTIME ON/OFF (16)	OFF

3-19. NORMAL SWEEP DISPLAY.

a. Connect CAL 1 V terminal (30) to channel A INPUT connector (33) using 10:1 divider probe supplied.

b. Adjust channel A POSN (31) to align base of square-wave display on second horizontal graticule line from bottom. Adjust main TRIGGER LEVEL (7) for stable display.

c. Observe square-wave display with amplitude of five divisions and approximately seven positive-going pulses.

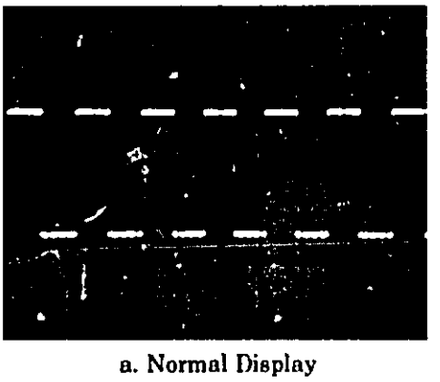
3-20. MAGNIFIED SWEEP DISPLAY.

a. Obtain normal sweep display.

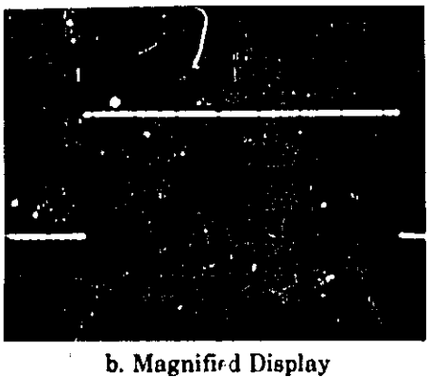
b. Adjust horizontal POSITION (13) to place portion of waveform to be magnified on center graticule of CRT (figure 3-3a).

c. Engage MAG X10 switch (1).

d. Adjust fine horizontal POSITION (14) for precise placement of magnified display (figure 3-3b).



a. Normal Display



b. Magnified Display

Figure 3-3. Magnified Sweep

3-21. DELAYED SWEEP DISPLAY.

a. Obtain normal sweep display.

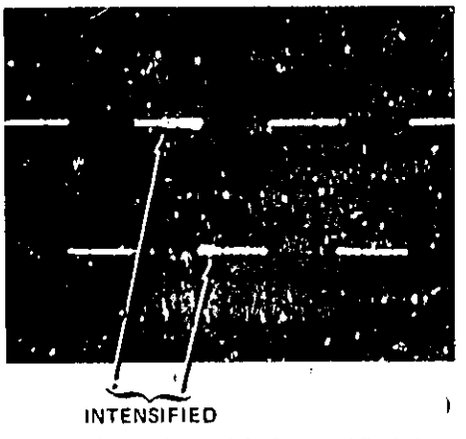
b. Set delayed TIME/DIV (25) to 20 μ SEC.

c. Observe intensified portion of square-wave display.

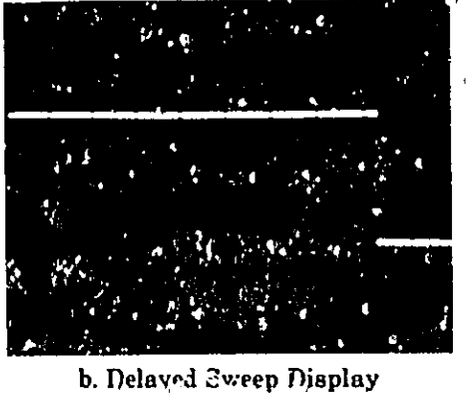
d. Adjust BEAM INTENSITY (5) for comfortable viewing level.

e. Adjust time interval STOP (18) until intensified portion of trace is over display segment under investigation (figure 3-4a).

f. Enguged DLY'D switch (20) and note intensified portion of trace is now displayed across entire CRT (figure 3-4b).



a. Normal Display with Intensified Area



b. Delayed Sweep Display

Figure 3-4. Delayed Sweep

g. Adjust time interval STOP (18) to observe other pulses in pulse train.

3-22. A VS B DISPLAY.

a. Apply vertical (Y-axis) signal to channel A INPUT connector (30).

b. Apply horizontal (X-axis) signal to channel B INPUT connector (30).

c. Engage A vs B switch (22).

d. Adjust channel A and channel B VOLT/DIV controls (35) for desired vertical and horizontal scale factor.

NOTE

Channel A POSN (33) will adjust vertical position of the display. Horizontal POSITION controls (13) and (14) will adjust horizontal position of the display.

e. If display is not visible, engage BEAM FIND switch (4) to locate display. Make necessary adjustments to return display to center of CRT.

3-23. TIME-INTERVAL MEASUREMENT. The 1742A provides for the use of a DMM (digital multimeter) to simplify time-interval measurements. A built-in digital multimeter, Hewlett-Packard Option 034, is available for this instrument. It indicates exact time intervals between the start and stop makers directly in seconds, milliseconds, or microseconds.

3-24. The operator can connect any DMM of his choice to the ΔTIME OUT connectors (11) on the rear panel of the 1742A. To preserve accuracy of the 1742A, use a 3 1/2-digit multimeter for digital readout of time intervals.

3-25. To measure the time interval between two points of interest on a serial-type waveform, proceed as follows:

a. Accomplish display/readout zero adjustment (paragraph 3-11).

b. If Option 034 not installed, connect DMM to ΔTIME OUT (11) banana jack connectors on rear panel of 1742A.

c. Connect input signal to channel A INPUT connector (30).

d. Select channel A (16) DISPLAY and channel A (17) TRIGGER.

e. Set channel A VOLTS/DIV switch (35) for appropriate range.

f. Set main TIME/DIV control (24) and delayed TIME/DIV control (25) for desired display.

NOTE

Use TIME/DIV ranges that separate, as far as possible, the two points of interest being measured.

g. Set Δ TIME ON/OFF switch (10) to ON position.

h. Using time interval START ⑰, position first intensified spot to starting point of interval being measured.

i. Using time interval STOP ⑱, position second intensified spot to end point of interval being measured.

j. Engage DLY'D switch ⑳.

k. Using time interval STOP control ⑱, superimpose two waveforms observed.

l. Note voltage output as indicated on DMM.

m. Note whether main TIME/DIV ㉑ is in SEC, mSEC, or μSEC range. Time interval measured is then the voltage (step l) in s, ms, or μs.

NOTE

For complete information concerning time-interval measurement applications refer to the Operators Guide supplied with this instrument.

3-26. USE OF OPTION 034 DMM.

3-27. TIME-INTERVAL MEASUREMENTS. To use the Option 034 Digital Multimeter for time interval measurements, certain multimeter switches must be set properly. The meter POWER switch must be ON and the VOLTS pushbutton must be engaged (output analog voltage from 1742A is dc).

3-28. The two-position switch built into the instrument's top cover must be in the forward position to obtain time-interval measurements of displayed waveforms. With the switch in the rear position, the analog dc voltage is disconnected from the meter and the connections at the side of the multimeter are enabled for normal multimeter measurements.

3-29. AVERAGE AND RMS VOLTAGE MEASUREMENTS. The Option 034 DMM is an average-responding meter calibrated in rms. To measure rms voltage using the DMM, proceed as follows:

a. Set two-position switch on 1742A top cover to rear position.

b. Set DMM controls as follows:

POWER ..... ON
DC/AC (⎓ ~) ..... ~ (IN)
VOLTS (V) ..... (IN)
AUTO HOLD ..... AUTO (OUT)
AMPS (A) ..... (OUT)
kΩ ..... (OUT)

CAUTION

Do not connect DMM leads to any voltage greater than 707 V rms.

c. Connect test leads from VΩ (HI) and COM (LOW) on DMM to signal under test. DMM will automatically select best meter range and display rms voltage.

d. To measure average voltage, set multimeter DC/AC control to DC (out position).

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. A simpler operational test is included in the Operators Guide supplied with 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 Check 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 1742A 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.

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 1742A 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
START	fully ccw
STOP	fully ccw
ΔTIME	OFF
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 an 8-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.

Table 4-1. Recommended Test Abridgements

Paragraph No.	Performance Test	Alteration	Remarks
4-23	Sweep Time Accuracy	None	Check accuracy from .05 μ SEC thru 2 SEC
4-25	Differential Time Accuracy	None	Check accuracy of time interval indication of ±0.5% of measurement +0.5% of full scale + accuracy of DVM.
4-33	Deflection Factor	None	Check deflection factor on .005 V/div through 20 V/div ranges

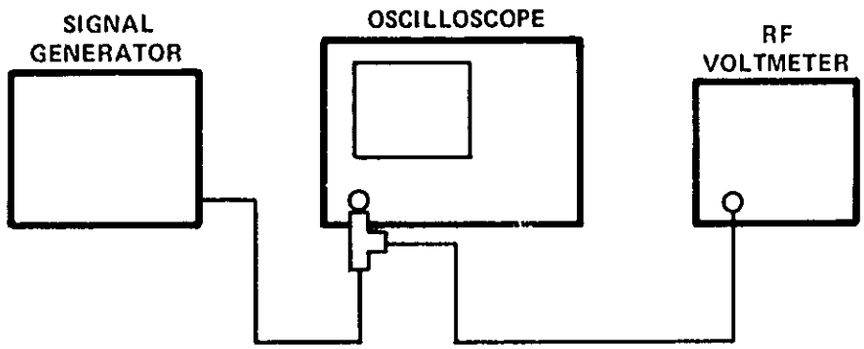


Figure 4-1. Bandwidth Test Setup

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:

Signal Generator ..... 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 1742A controls as follows:

Coupling (both channels) 50Ω
VOLTS/DIV (both channels) 0.01
MAIN TIME/DIV ..... 1 μ SEC

c. Set signal generator frequency for approximately 10 MHz with exactly 8 divisions of vertical deflection on oscilloscope.

d. Note rf voltmeter indication.

e. Set signal generator frequency to 100 MHz.

f. Adjust signal generator amplitude to obtain same indication as in step d. Amplitude of display should be equal to or greater than 5.65 divisions.

g. Set 1742A 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 cm 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:

Signal Generator ..... HP Model 3200A
50-ohm Power Divider ..... Model 874-TPD

4-18. Perform CMRR test as follows:

a. Connect equipment as shown in figure 4-2.

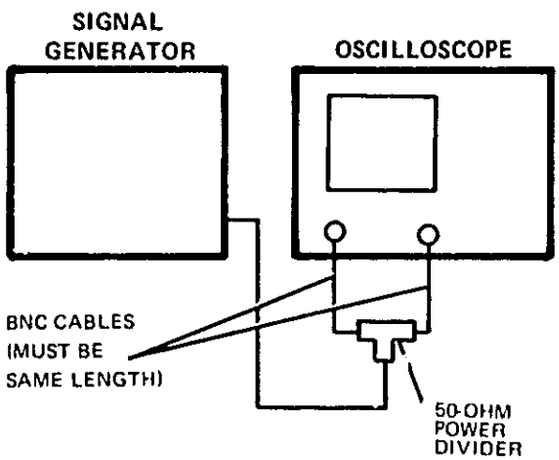


Figure 4-2. CMRR Test Setup

b. Set 1742A controls as follows:

MAIN TIME/DIV ..... 1 μ SEC
Coupling (both channels) 50Ω

c. Set signal generator controls to observe 20-MHz signal, 8 divisions in amplitude.

d. Set 1742A 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.

Equipment Required:

Signal Generator ..... 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 1742A controls as follows:

Channel A Coupling 50Ω
MAIN TIME/DIV ..... .05 μ SEC

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 1742A controls as follows:

MAIN TIME/DIV ..... .1 μ SEC
DELAYED TIME/DIV ..... .05 μ SEC
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:

Signal Generator ..... HP Model 3200B
RF Voltmeter ..... HP Model 3406A w/11063A
50-ohm Feed-through Termination
50-ohm Power Divider ..... Model 874-TPD

4-22. Perform external triggering test as follows:

a. Connect equipment as shown in figure 4-3.

b. Set 1742A controls as follows:

Channel A VOLTS/DIV 05
Channel A Coupling 50Ω
MAIN TIME/DIV ..... .1 μ SEC
MAG X10 ..... engaged
Main INT/EXT ..... EXT

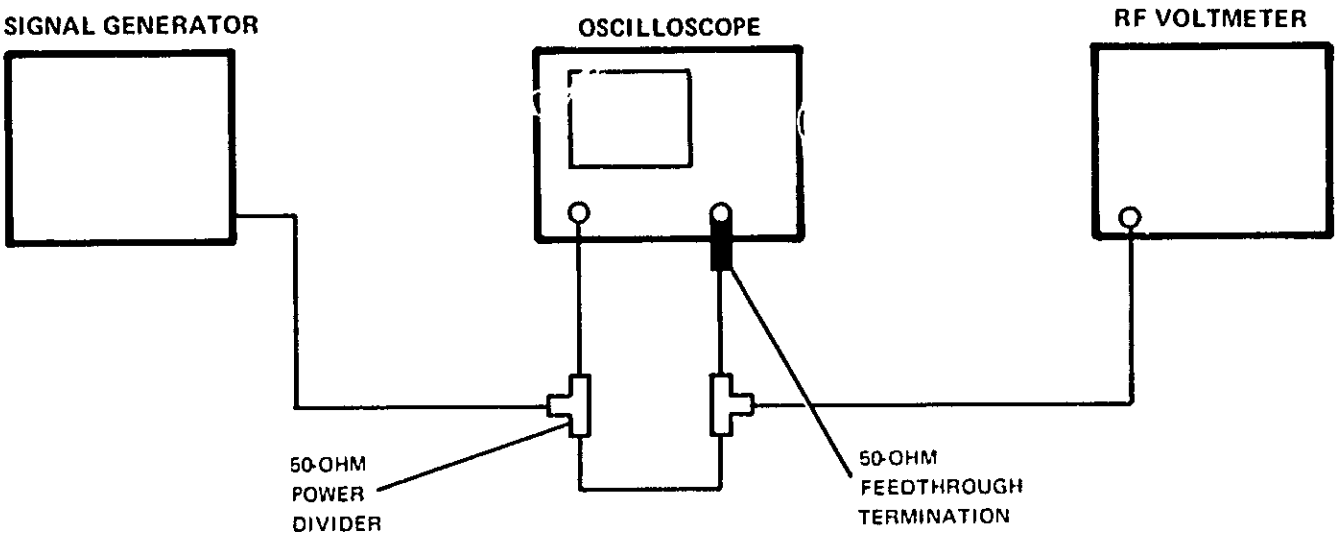


Figure 4-3. External Triggering Test Setup

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.

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

f. Adjust main TRIGGER LEVEL to obtain stable triggering.

g. Set 1742A controls as follows:

Main INT/EXT	INT
Delayed INT/EXT	EXT
SWEEP AFTER DELAY	TRIG
DELAYED TIME/DIV	.05 μ SEC
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 necessry 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..... HP Model 226A

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 1742A sweep display to DLY'D.

d. Set main and 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, ± 0.5% 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..... HP Model 226A
Digital Voltmeter..... HP Model 3465A

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

a. Connect time-mark generator TIME MARK OUTPUT connector to 1742A channel A INPUT connector.

b. Connect time-mark generator TRIGGER OUTPUT connector to 1742A main EXT TRIG INPUT connector.

c. Set 1742A controls as follows:

MAIN TIME/DIV	.1 μ SEC
DELAYED TIME/DIV	.05 μ SEC
VOLTS/DIV (channel A)	as required
MAIN INT/EXT	EXT
ΔTIME	ON

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

e. Adjust horizontal POSITION control to start display on far left vertical graticule line.

f. Connect DVM to Δ TIME OUT connectors on rear panel of 1742A.

g. Adjust START control to position start of intensified portion of sweep on fourth vertical graticule line.

h. Adjust time interval STOP control for DVM indication of 0.010.

i. Set HORIZ DISPLAY to DLY'D.

j. Set horizontal magnifier to MAG X10.

k. Adjust time interval STOP control to superimpose exactly two displayed markers.

l. Note DVM indication.

m. Slowly rotate time interval START control clockwise. Verify that every cycle is superimposed. If

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 mard/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/duv ±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%

cycle is not superimposed, vary time interval STOP control until display is superimposed and note DVM indications for each change of time interval STOP control.

n. Continue step m until time interval START control is fully clockwise. All voltage deviations from indication noted in step l should be equal to or less than 0.0008 (0.8 mV). This corresponds to an 80 picosecond time interval.

o. 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..... HP Model 226A

4-28. Perform delay jitter test as follows:

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

b. Set 1742A controls as follows:

MAIN TIME/DIV..... 1 mSEC
DELAYED TIME/DIV..... .2 μSEC
Channel A VOLTS/DIV..... .5
Channel A Coupling 50Ω

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

d. Set sweep mode to delayed sweep (DLY'D).

e. Increase INTENSITY control, as required, and adjust STOP control to 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

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 1742A 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 the 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:

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

DC Standard..... HP Model 740B

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:

DC Standard ..... HP Model 740B

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 indicatd 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, ±1.0%; 0.1 V into 50 ohms with <0.1 μs rise time. Calibrator amplitude is checked against a known dc standard. Rise time is measured directly on CRT.

Equipment Required

DC Standard ..... HP Model 740B

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 ±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 μ SEC and measure rise time. Rise time should be less than 0.1 μs.

f. Disconnect test equipment.

4-37. This completes the performance checks.

PERFORMANCE TEST RECORD
MODEL 1742A

Test	Specification	Measured
BANDWIDTH		
A 100 MHz	≥ 5.65 div	_____
B 100 MHz	≥ 5.65 div	_____
CMRR		
20 dB 20 MHz	<.8 div	_____
TRIGGERING		
Internal MAIN		
.3 div 25 MHz	stable display	_____
1 div 100 MHz	stable display	_____
DLY'D		
.3 div 25 MHz	stable display	_____
1 div 100 MHz	stable display	_____
External MAIN		
50 mV p-p 50 MHz	stable display	_____
100 mV p-p 100 MHz	stable display	_____
DLY'D		
50 mV p-p 50 MHz	stable display	_____
100 mV p-p 100 MHz	stable display	_____
Sweep Time Accuracy (at room temperature)		X1 X10
MAIN .05 µSEC	±2%, ±3% in X10	_____ _____
.1 µSEC	±2%, ±3% in X10	_____ _____
.2 µSEC	±2%, ±3% in X10	_____ _____
.5 µSEC	±2%, ±3% in X10	_____ _____
1 µSEC	±2%, ±3% in X10	_____ _____
2 µSEC	±2%, ±3% in X10	_____ _____
5 µSEC	±2%, ±3% in X10	_____ _____
10 µSEC	±2%, ±3% in X10	_____ _____
20 µSEC	±2%, ±3% in X10	_____ _____
50 µSEC	±2%, ±3% in X10	_____ _____
.1 mSEC	±2%, ±3% in X10	_____ _____
.2 mSEC	±2%, ±3% in X10	_____ _____
.5 mSEC	±2%, ±3% in X10	_____ _____
1 mSEC	±2%, ±3% in X10	_____ _____
2 mSEC	±2%, ±3% in X10	_____ _____
5 mSEC	±2%, ±3% in X10	_____ _____
10 mSEC	±2%, ±3% in X10	_____ _____
20 mSEC	±2%, ±3% in X10	_____ _____
50 mSEC	±3%, ±4% in X10	_____ _____
.1 SEC	±3%, ±4% in X10	_____ _____
.2 SEC	±3%, ±4% in X10	_____ _____
.5 SEC	±3%, ±4% in X10	_____ _____
1 SEC	±3%, ±4% in X10	_____ _____
2 SEC	±3%, ±4% in X10	_____ _____

PERFORMANCE TEST RECORD (Cont'd)
MODEL 1742A

Test	Specification	Measured
Sweep Time Accuracy (at room Temperature) (Cont'd)		X1 X10
DLY'D .05 µSEC	±2%, ±3% in X10	_____ _____
.1 µSEC	±2%, ±3% in X10	_____ _____
.2 µSEC	±2%, ±3% in X10	_____ _____
.5 µSEC	±2%, ±3% in X10	_____ _____
1 µSEC	±2%, ±3% in X10	_____ _____
2 µSEC	±2%, ±3% in X10	_____ _____
5 µSEC	±2%, ±3% in X10	_____ _____
10 µSEC	±2%, ±3% in X10	_____ _____
20 µSEC	±2%, ±3% in X10	_____ _____
50 µSEC	±2%, ±3% in X10	_____ _____
.1 mSEC	±2%, ±3% in X10	_____ _____
.2 mSEC	±2%, ±3% in X10	_____ _____
.5 mSEC	±2%, ±3% in X10	_____ _____
1 mSEC	±2%, ±3% in X10	_____ _____
2 mSEC	±2% ±3% in X10	_____ _____
5 mSEC	±2%, ±3% in X10	_____ _____
10 mSEC	±2%, ±3% in X10	_____ _____
20 mSEC	±2%, ±3% in X10	_____ _____
DIFFERENTIAL TIME ACCURACY Accuracy: ±0.5% of measurement +0.05% of full scale and accuracy of DMM	≤ 0.8 mV	_____
DELAY JITTER <1:50 000	< 1 div	_____
RISE TIME		
Ch A	<3.5 nSEC	_____
Ch A MAG X5	<9 nSEC	_____
Ch B	<3.5 nSEC	_____
Ch B MAG X5	<9 nSEC	_____
Z-AXIS BLANKING +4 V blanking	√	_____
DEFLECTION FACTOR	±3% all ranges	CH A CH B
	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	_____ _____
CALIBRATOR		
Amplitude (1 V)	±1.0%	_____
Rise Time (T_r)	≤ .1 µs	_____

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	2	Adjusts +15 Vdc supply to within ±10 mV.
A15R2	Intensity Limit Adj	5-14	3	Minimum setting or INTENSITY control extinguishes trace.
A12R12/ A12C11	Gate Comp Adj	5-16	4	Adjusts for best gate pulse response.
A16R20	F G Adj	5-17	2	Adjusts scale illumination uniformity.
A12R16	Y-ALIGN	5-18	4	Aligns trace with vertical axis of CRT.
A3R116	CALIB Ampl	5-20	7	Adjusts calibrator output for 1 V p-p.
A7R20	TRIG SENS (Main)	5-21	8	Sets maximum trigger sensitivity (Main).
A10R9	TRIG SENS (Delayed)	5-21	10	Sets maximum trigger sensitivity (Delayed).
A7R41	SYNC ZERO	5-22	8	Compensate for sync signal AC/DC Coupling.
A3R86	TRIG VIEW BAL	5-23	5	Center trigger view display on CRT.
A7R93	X1 Cal	5-24	12	Adjust X1 gain of horizontal amplifier.
A8R43 A8R12 A8R13 A8R14	1 µSEC Range .1 mSEC Range 10 mSEC Range 50 mSEC Range	5-25 and 5-30	9	Main sweep calibration adjustments.
A7R117	X10 Cal	5-26	12	Adjust X10 gain of horizontal amplifier.

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

Reference Designator	Adjustment Name	Adjustment Paragraph	Schematic Number	Description
A7R105	Mag Center	5-26	12	Balance display around center screen when magnifier is engaged.
A11R10 A11R15	LIN 1 LIN 2	5-27	12	Adjust for best horizontal linearity.
A17R30 A17R35	Δ=0 CNTR Gain Equal	5-28	16	Balances inputs from START, STOP, Δ=0 controls.
A17R39	VM CAL DVM ZERO	5-28	16	Balances STOP control with system DVM.
A9R28 A9R10 A9R11	.5 μSEC Range 5 μSEC Range .5 mSEC Range	5-29	11	Calibrates delayed sweep.
A3R11 A3R31	FET BAL (Channel A) FET BAL (Channel B)	5-31	5	Input channel balance adjustment to vertical preamplifier. 0 V ±0.5 V at A3TP9 and A3T10.
A3R18 A3R77	5 mV BAL (Channel A) 5 mV BAL (Channel B)	5-31	5	Set for minimum trace shift on .005, .01, .02 ranges.
A3R19 A3R76	50 mV BAL (Channel A) 50 mV BAL (Channel B)	5-31	5	Set for minimum trace shift between .05 ranges.
A3R90	POL BAL	5-31	5	Balance Channel B polarity selection.
A3R79	A SYNC BAL	5-32	5	Balances channel A sync signal with channel B sync signal.
A3R58 A3R32	A POSN B POSN	5-32	5	Compensates for position variations between normal and MAG X5 operation.
A3C2 A3C17	0.5 V COMP (Ch A) 0.5 V COMP (Ch B)	5-33	5	Adjusts for best input response on .5 V range.
A3C4 A3C19	0.5 V INPUT CAP (Ch A) 0.5 V INPUT CAP (Ch B)	5-33	5	Adjust input capacitance for 0.5 V range.
A3R49 A3R46	A GAIN B GAIN	5-34	5	Equalizes vertical gain of each channel.
A3R65	GAIN	5-34	5	Adjusts overall gain of vertical preamplifier.
A5R24 A5R20 A5R19 A5R22	HF1 HF2 HF3 HF4	5-35	5	Vertical output pulse response adjustments.
A3R22	B HF ADJ	5-35	5	Matches Ch B response with Ch A.
A7R97	A vs B CAL	5-36	8	Calibrates Channel A vs Channel B.

5-9. In addition to complete adjustment procedures, a condensed adjustment procedure is included (table 5-6) for the convenience of technicians who have sufficient experience with the 1742A. 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
INTENSITY..... 10 - 11 o'clock
LINE..... ON
POSITION (Horizontal)..... midrange
TRIGGER LEVEL
(Main and Delayed)..... 3 o'clock
Sweep Mode ..... MAIN
START..... fully ccw
STOP ..... fully ccw
ΔTIME..... OFF
MAIN TIME/DIV ..... .1 mSEC
DELAYED TIME/DIV ..... OFF
TIME/DIV VERNIER..... CAL
TRIGGER HOLDOFF ..... MIN

5-13. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT.

Equipment Required:

Digital Voltmeter..... HP Model 3465A

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

b. Adjust +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 <±10 mV	<10 mV
+43 V	A16TP5	±.8 V	< 5 mV
+120 V	A16TP6	±6 V	<20 mV

5-14. INTENSITY LIMIT ADJUSTMENT.

a. Set controls as follows:

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

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

5-15. ASTIGMATISM AND FOCUS ADJUSTMENT.

a. Set Model 1742A controls as follows:

MAIN TIME/DIV..... 1 SEC
TIME/DIV VERNIER ..... fully ccw
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.

5-16. GATE RESPONSE ADJUSTMENT.

Equipment Required:

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

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

b. Adjust front-panel 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%).

5-17. FLOODGUN ADJUSTMENT.

a. Set SCALE ILLUM fully clockwise.

b. Adjust F G adj A16R20 for maximum brightness with uniform illumination.

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

5-18. TRACE ALIGN AND Y-AXIS ALIGN ADJUSTMENT. (For Option 101 instruments, omit this paragraph and proceed to paragraph 5-19. Option 101 has the Logic Analyzer Interface instead of A vs B.)

Equipment Required:

Function Generator ..... HP Model 3310A

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 function generator to channel A INPUT.

e. Adjust function generator 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.

5-19. TRACE ALIGN AND Y-AXIS ALIGN ADJUSTMENTS. (Option 101 Instruments only.)

Equipment Required:

Function Generator ..... HP Model 3310A

a. Obtain horizontal baseline.

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

c. Set main TIME/DIV to 1 mSEC.

d. Connect function generator to channel A INPUT.

e. Adjust function generator for approximately 500-kHz sine wave with 8 divisions of vertical deflection.

f. With horizontal POSITION, place left side of raster at center screen.

g. Adjust Y-align A12R16 until left side of raster is parallel to vertical graticule lines.

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:

Function Generator ..... HP Model 3310A

a. Set 1742A controls as follows:

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

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

c. Set function generator 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 rotaion (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 function generator 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 1742A controls as follows:

Main AUTO/NORM	AUTO
Main INT/EXT	INT
Delayed INT/EXT	EXT

m. Connect function generator to delayed EXT TRIGGER input.

n. Set function generator 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 function genera or 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:

Function Generator ..... HP Model 3310A

a. Connect function generator to channel A INPUT.

b. Set function generator ouput 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:

Function Generator ..... HP Model 3310A

a. Set 1742A controls as follows:

TRIGGER VIEW	engaged
Main AUTO/NORM	NORM
Main INT/EXT	EXT

b. Connect function generator to main EXT TRIGGER input.

c. Set function generator output for approximately 100-mV p-p, 10-kHz sine wave.

d. Adjust main TRIGGER LEVEL for stable display.

e. Decrease function generator 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. HORIZONTAL AMPLIFIER GAIN.

Equipment Required:

None

a. Set 1742A controls as follows:

Coupling (Channel A)	50Ω
VOLTS/DIV (Channel A)	.5
MAIN TIME/DIV	1 μSEC
DELAYED TIME/DIV	.05 μSEC
ΔTIME	ON

b. Adjust X1 gain A7R93 for sweep baseline of 10 cm in length. (Use horizontal POSITION control to position baseline while making this adjustment.)

c. Using START control, position beginning of first intensified trace at 0.5 horizontal division graticule mark.

d. Using STOP control position end of second intensified trace at 9.5 horizontal division graticule mark.

e. Readjust A7R93 until start of first delayed trace and stop of second delayed trace are at 0- and 10-division points respectively.

5-25. PRELIMINARY MAIN SWEEP CALIBRATION.

Equipment Required:

Time-mark Generator ..... HP Model 226A

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 μSEC	1 μs	A8R43
.1 mSEC	.1 ms	A8R12
10 mSEC	10 ms	A8R13
50 mSEC	50 ms	A8R14

5-26. X10 GAIN AND BALANCE ADJUSTMENTS.

Equipment Required:

Time-mark Generator ..... HP Mode 226A

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

b. Set main TIME/DIV to 1 μSEC position.

c. Set time-mark generator for 1 μs markers

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

e. Engage horizontal sweep MAG X10 pushbutton.

f. Using horizontal POSITION control, align one time marker with first vertical graticule line.

g. Adjust X10 Cal A7R117 until on 1 arker coincides with first vertical graticule line a' d one marker coincides with last vertical graticule lin

h. Disengage horizontal sweep MAG X10 pushbutton.

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

j. Using horizontal POSITION control, center middle time-marker.

k. Engage horizontal sweep MAG X10 pushbutton.

l. Adjust Mag Center A7R105 to re-center time marker.

5-27. HORIZONTAL LINEARITY ADJUSTMENT.

Equipment Required:

Time-mark Generator ..... HP Model 226A

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

b. Set 1742A 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 linearity adj A11R10 and A11R15 fully cw, adjust for best overall linearity in center 8 divisions of unmagnified sweep (center 80 divisions of magnified sweep).

5-28. TIME INTERVAL DECODER ANALOG ADJUSTMENTS.

Equipment Required:

Time-mark Generator ..... HP Model 226A
Digital Voltmeter ..... HP Model 3465A

a. Connect DVM to 1742A ΔTIME OUT connectors (rear panel).

b. Set 1742A controls as follows:

MAIN TIME/DIV ..... .5 μSEC
DELAYED TIME/DIV ..... .1 μSEC
ΔTIME ..... ON
SIGNAL OVERLAY (ΔT=0) ..... midrange

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

d. Set time-mark generator for 0.5 μs time markers.

e. Adjust START control to position intensified spot on second time mark from left.

f. Set horizontal sweep mode to DLY'D.

g. Set START control as required to observe second time mark (superimposed).

h. Adjust A17R30 to exactly superimpose time mark observed in step g.

i. Set START control to observe tenth time marker.

NOTE

Do not adjust time interval STOP control.

j. Adjust A17R35 to superimpose exactly two time markers observed.

k. Repeat steps e through j until no interaction occurs.

l. With STOP control set to 0.00 (±1 dial line width), adjust A17R42 for DVM indication of 0.000 ±0.005.

m. Set STOP control to 10.00 (±1 dial line width).

n. Adjust A17R39 for DVM indication of 5.000 V ±.005.

5-29. DELAYED SWEEP ADJUSTMENT.

Equipment Required:

Time-mark Generator..... HP Model 226

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

b. Set 1742A controls as follows:

VOLTS/DIV (Channel A) 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 CALIBRATION ADJUSTMENTS.

Equipment Required:

Time-mark Generator..... HP Model 226A

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

b. Set 1742A controls as follows:

MAIN TIME/DIV..... 1 μSEC
DELAYED TIME/DIV ..... .1 μSEC
SWEEP AFTER DELAY ..... AUTO
ΔTIME..... ON

c. Set time-mark generator for 1 μs markers.

d. Adjust START control to position first intensified trace at second time marker.

e. Adjust STOP control for dial setting of 8.00.

f. Engage horizontal sweep DLY'D pushbutton.

g. Adjust A8R43 so that two time markers overlap.

h. Set 1742A controls as follows:

MAIN TIME/DIV..... 10 μSEC
DELAYED TIME/DIV ..... 1 μSEC
Main AUTO/NORM ..... NORM
HORIZONTAL SWEEP ..... MAIN
ΔTIME..... ON

i. Set time-mark generator for 10 μs markers.

j. Adjust START control to position first intensified trace to second time marker.

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	A9R28	±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		

k. Adjust STOP control for dial setting of 8.00.

l. Engage horizontal sweep DLY'D pushbutton.

m. Adjust A8R12 so that two time markers overlap.

n. Repeat steps h through l for two remaining adjustments using control settings indicated in table 5-5.

o. Disconnect test equipment.

Table 5-5. Main Sweep Fine Adjustments

MAIN TIME/DIV	DELAYED TIME/DIV	Time Markers	STOP CONTROL DIAL SETTING	Adjustment
1 mSEC	.1 mSEC	1 ms	8.00	A8R13
50 mSEC	5 mSEC	50 ms	8.00	A8R14

5-31. VERTICAL AMPLIFIER BALANCE ADJUSTMENT.

Equipment Required:

Digital Voltmeter..... HP Model 3465A

a. Set channel A and B coupling to GND.

b. Connect DVM to A3TP9.

c. Adjust channel A FET balance A3R11 for 0 V ±0.5 mV.

d. Connect DVM to A3TP10.

e. Adjust channel B FET balance A3R31 for 0 V ±0.5 mV.

f. Disconnect DVM.

g. 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 and .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:

Function Generator ..... HP Model 3310A

a. Set 1742A controls s 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 1742A controls as follows:

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

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

e. Adjust function generator 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 function generator.

h. Set 1742A 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:

Function Generator ..... HP Model 3310A
Capacitance Meter ..... HP Model 4332A

a. Connect function generator to channel A INPUT.

b. Set 1742A controls as follows:

Coupling (channel A)..... 50Ω
VOLTS/DIV (channel A)..... .5
MAIN TIME/DIV..... 20 μSEC

c. Set function 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 function generator.

f. Set 1742A 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 1742A 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. PULSE RESPONSE ADJUSTMENT.

Equipment Required:

Fast-rise Pulse Generator... HP Model 1105A

a. Connect fast-rise pulse generator to channel A INPUT.

b. Set 1742A controls as follows:

Coupling (both channels)	50Ω
MAIN TIME/DIV	.05 μSEC

NOTE

Make the following preset adjustments only if major repairs have been made to the vertical output amplifier A5.

A5R19	fully ccw
A5R20	fully ccw
A5R22	fully ccw
A5R24	fully ccw

c. Set channel A VOLTS/DIV and pulse generator controls as necessary to obtain 6 division display. If possible, make adjustments on .01 VOLTS/DIV range.

d. Adjust HF No. 1 A5R24 cw to partially smooth front edge perturbation. Adjust HF No. 2 A5R20 cw to speed up front edge (see figure 5-1).

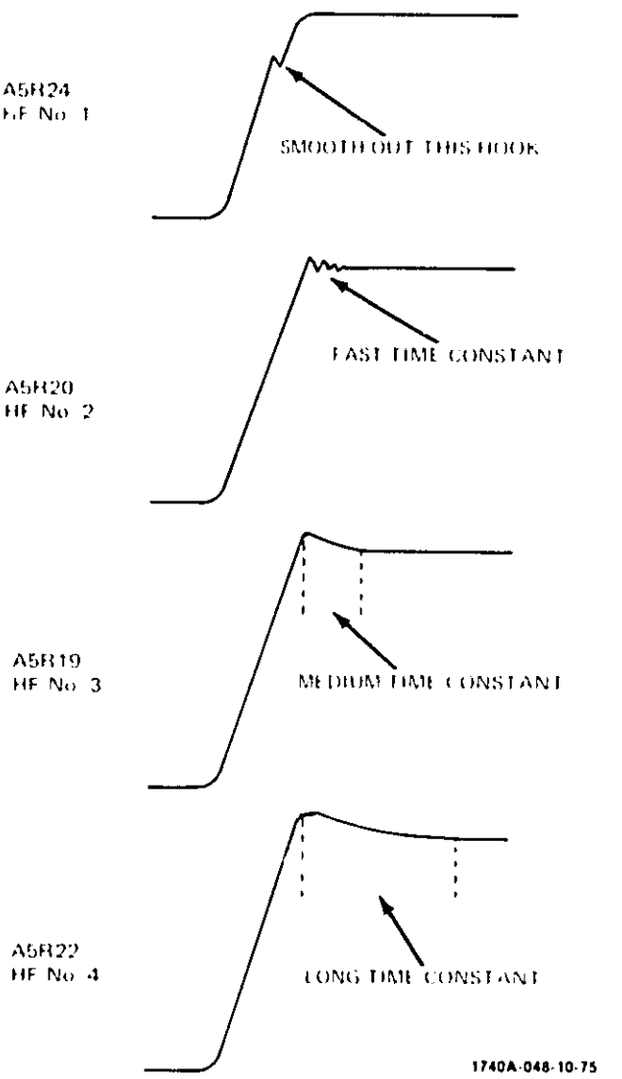


Figure 5-1. Pulse Response Adjustments

e. Alternately adjust A5R24 and A5R20 to set leading edge of pulse for fast, square response, keeping in mind slower time constants have not been adjusted yet.

f. Adjust HF No. 3 A5R19 for flattest pulse top (medium time constant).

g. Adjust HF No. 4 A5R22 for flattest pulse top (long time constant).

h. Check adjustment again since some interaction occurs (steps d through g).

i. Change DISPLAY to B.

j. Connect pulse generator to channel B INPUT.

k. Adjust channel B HF adj A3R22 to make channel B display as similar as possible to channel A display.

l. Disconnect test equipment.

NOTE

Check bandwidth (Section IV, pargraph 4-14) after making response adjustments. If bandwidth is low or marginal, adjust HF No. 1 A5R24 slightly cw to speed up response; then adjust HF No. 2 A5R20 slightly cw to optimize pulse response again.

5-36. X-Y GAIN ADJUSTMENT. (Not applicable on Option 101 Instruments.)

Equipment Required:

Function Generator ..... HP Model 3310A

a. Connect function generator to both channels, using BNC tee.

b. Adjust function generator and channel A VOLTS/DIV for exactly 6 divisions of vertical deflection. Function generator 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 5-6. Condensed Ajustment Procedure

Adjustment	Prccedure
+15 V Adj A16R26	+15 Vdc ±10 mV.
Intensity Limit Adj A15R2	1. Set main sweep to .1 mSec. 2. Set delayed sweep to 10 μSEC. 3. Adjust so that intensified sweep is just extinguished with BEAM INTENSITY at minimum.
Gate Comp Adj A12R12 and A12C11	1. Set BEAM INTENSITY to midrange. 2. Adjust for fastest rise time with <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.
F.G. Adj A16R20	Adjust for uniform illumination at all settings of SCALE ILLUM.
TRACE ALIGN (rear panel) and Y-align (A12R16)	1. Perform TRACE ALIGN first. 2. Apply 10-kHz sine wave to channel A while in A VS B mode. 3. Adjust for perpendicular line.
Calibrator Amp A3R116	Adjust for 1 V peak ±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.

Table 5-6. Condensed Adjustment Procedure (Cont'd)

Adjustment	Procedure
Sync Zero A7R41	1. Apply 1-kHz sine wave. 2. Adjust for no shift in trigger point while switching time base between AC/DC coupling.
Trig View Bal A3R86	1. Apply small sine wave to main EXT TRIGGER. 2. Select TRIG VIEW mode. 3. Adjust to position the triggered display to center screen.
Horizontal Ampl Gain A7R93	1. Adjust for full 10-div baseline. 2. Trigger externally. 3. Position 1st intensified trace at 0.5 and 2nd intensified trace at 9.5 horiz div marks using START and STOP controls respectively. 4. Adjust A7R93 so 1st delayed trace starts at 0 division and 2nd delayed trace ends at 10th division points.
PRELIMINARY MAIN SWEEP CAL A8R43 A8R12 A8R13 A8R14	1. 1 μSEC range 2. .1 mSEC range 3. 10 mSEC range 4. 50 mSEC range
X10 Cal A7R117	1. Apply 1 μs time marks. 2. Set main TIME/DIV for 1 marker/div. 3. Engage MAG X0. 4. Adjust for 1 marker/10 div.
Mag Center A7R105	1. Set main TIME/DIV for 1 μSEC and time-mark generator for 5 μs markers. 2. Center middle time marker. 3. Engage MAG X10. 4. Adjust to re-center marker.
HORIZONTAL LINEARITY A11R10 A11R15	1. Adjust on .05 μSEC range, using MAG X10, observing 10-ns markers

Table 5-6. Condensed Adjustment Procedure (Cont'd)

<table>
<tr><th>Adjustment</th><th>Procedure</th></tr>
<tr><td>TIME INTERVAL ADJUSTMENTS

ΔT=0 CNTR, A17R30 Gain Equal, A17R35 DVM Zero, A17R42 VM CAL, A17R39</td><td>1. Connect DVM to ΔTIME OUT connectors.
2. Set SIGNAL OVERLAY (ΔT=0) to midrange.
3. Apply 0.5 μs time markers.
4. Adjust START control to position intensified spot to second time-mark.
5. Set horizontal sweep to DLY'D.
6. Adjust A17R30 to supermpose time marks exactly.
7. Set START control to tenth time marker.
8. Adjust A17R35 to superimpose time marks exactly.
9. Set STOP control exactly on 0.00.
10. Adjust A17R42 for DVM indication of 0.000 ± 0.005.
11. Set STOP control to exactly 10.00.
12 Adjust A17R39 for DVM indication of +5.000V ± .005.</td></tr>
<tr><td>Delayed Sweep Calibration
A9R28
A9R10
A9R11</td><td><table><tr><th>Time Marks and Delayed TIME/DIV</th><th>Adjust</th><th>Tolerance</th></tr><tr><td>.05 - 2 μs</td><td>A9R28</td><td>±2%</td></tr><tr><td>5 μs - .2 ms</td><td>A9R10</td><td>±2%</td></tr><tr><td>.5 ms - 20 ms</td><td>A9R11</td><td>±2%</td></tr></table></td></tr>
<tr><td>Fine Adjustments

Main Sweep

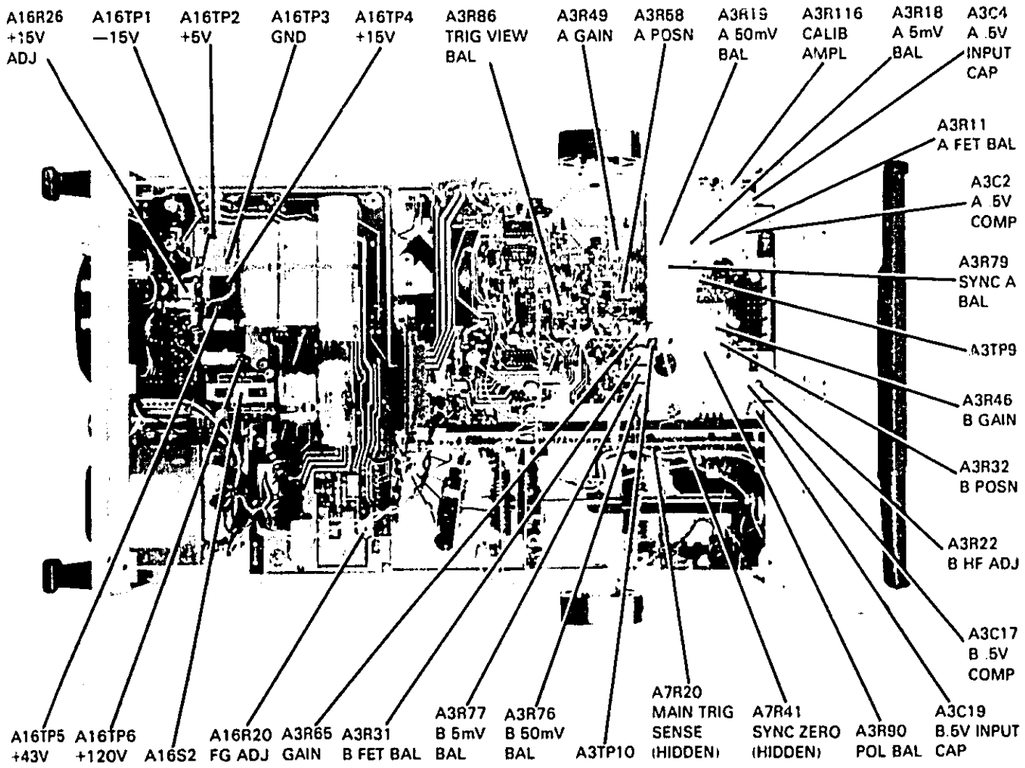
A8R43
A8R12
A8R13
A8R14</td><td>1. Use time markers and TIME/DIV settings as indicated below.
2. Set START control so 1st intensified trace coincides with 2nd marker.
3. Set STOP control as indicated.
4. Adjust for marker overlap.
<table><tr><th>Time Marks and Main TIME/DIV</th><th>DLYD TIME/DIV</th><th>STOP DIAL SETTING</th><th>ADJUST</th></tr><tr><td>1 μSEC</td><td>.1 μSEC</td><td>8.00</td><td>A8R43</td></tr><tr><td>10 μSEC</td><td>1 μSEC</td><td>8.00</td><td>A8R12</td></tr><tr><td>1 mSEC</td><td>.1 mSEC</td><td>8.00</td><td>A8R13</td></tr><tr><td>50 mSEC</td><td>5 mSEC</td><td>8.00</td><td>A8R14</td></tr></table></td></tr>
</table>

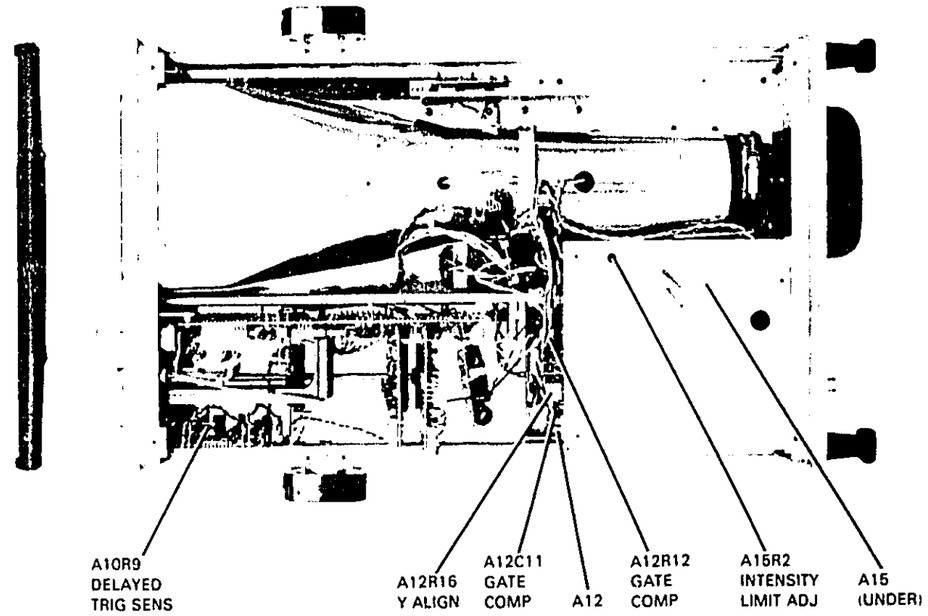
Table 5-6. Condensed Adjustment Procedure (Cont'd)

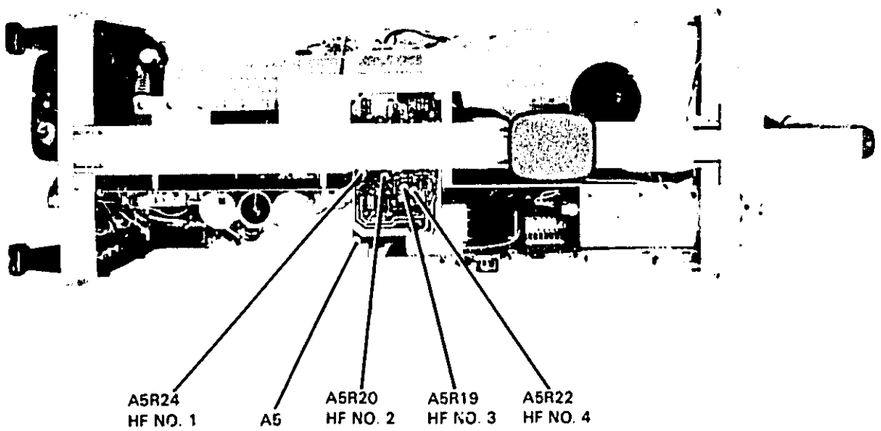
Adjustment	Procedure
Vertical Amplifier Balance	
A3R11	1. Connect DVM to A3TP9 and adjust A FET balance for 0 V ±5 mV.
A3R31	2. Connect DVM to A3TP10 and adjust B FET balance for 0 V ±5 mV.
A3R18	3 Switch channel A VOLTS/DIV between .005 and .02 and adjust 5-mV balance for minimum trace shift.
A3R19	4. Switch channel A VOLTS/DIV between .005 and .05 and adjust 50-mV balance for minimum trace shift.
A3R77	5. Switch channel B VOLTS/DIV between .005 and .02 and adjust 5-mV balance for minimum trace shift.
A3R76	6. Switch channel B VOLTS/DIV between .005 and .05, and adjust 50-mV balance for minimum trace shift.
A3R90	7. Engage/disengage CH B INVT and adjust for minimum trace shift. Readjust A3R77 and A3R76 if necessary.
Position and Sync Balance	
A3R32	1. Select B DISPLAY; switch between normal and MAG X5, and adjust channel B POSN for minimum trace shift.
A3R79	2. Apply 10-kHz sine wave to both channels. Select ALT mode and COMP TRIGGER, and adjust sync A balance for stable triggering and minimum phase shift. Readjust A3R18 and A3R19 if necessary.
A3R58	3. Select A DISPLAY; switch between normal and MAG X5, and adjust channel A position for minimum trace shift.
Input C and Attenuator Compensation (Channel A)	
A3C2	1. Apply 10-kHz square wave, and adjust .5V comp for best response.
A3C4	2. Adjust .5V input cap to make .5 VOLTS/DIV range match reading on .2 range (19.5 to 21.5 pF).
Input C and Attenuator Compensation (Channel B)	
A3C17	1. Apply 10-kHz square wave, and adjust .5 V comp for best response.
A3C19	2. Adjust .5 V input cap to make .5 VOLTS/DIV range match reading on .2 range (19.5 to 21.5 pF).

Table 5-6. Condensed Adjustment Procedure (Cont'd)

Adjustment	Procedure
Gain	
A3R49	1. Channel A fine gain.
A3R49	2. Channel B fine gain
A3R65	3. Composite gain.
Pulse Response	
A5R24	1. Short time constant.
A5R20	2. Short time constant.
A5R19	3. Medium time constant.
A5R22	4. Long time constant.
A3R22	5. Adjust to make channel B most resemble channel A
X-Y Gain (Not applicable to Option 101)	
A7R97	Adjust for same gain on X-axis as on Y-axis.







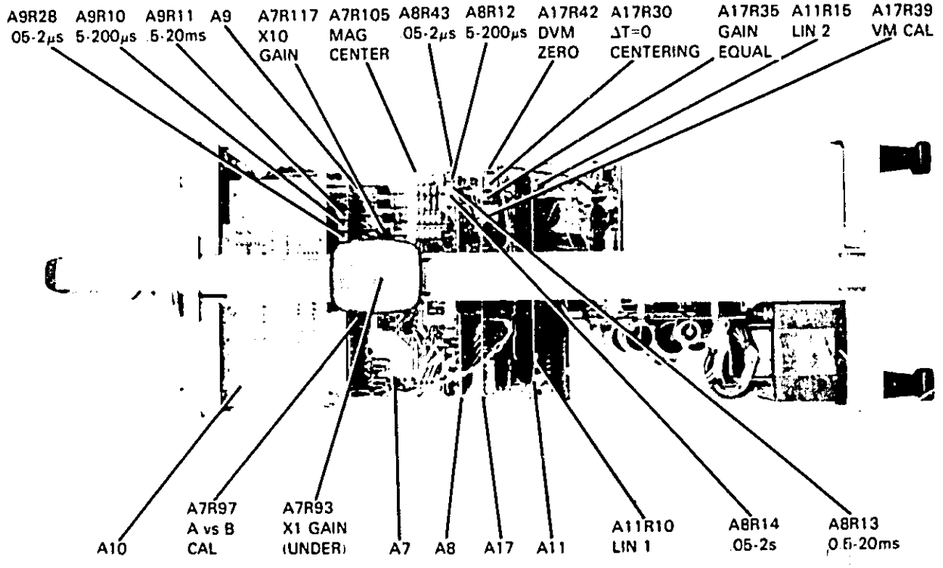


Figure 5-2.
Adjustment Locations

Table 6-1. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

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

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open	RMO	= rack mount only
AFC	= automatic frequency control	HDW	= hardware	NOM	= nominal	RMS	= root mean square
AMPL	= amplifier	HEX	= hexagonal	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
		HG	= mercury				
BFO	= beat frequency oscillator	HR	= hour(s)				
BE CU	= beryllium copper	HZ	= hertz	NPN	= negative-positive-negative	S-B	= slow-blow
BH	= binder head					SCR	= screw
BP	= bandpass			NRFR	= not recommended for field replacement	SE	= selenium
BRS	= brass	IF	= intermediate freq			SECT	= sectional
BWO	= backward wave oscillator	IMPG	= impregnated	NSR	= not separately replaceable	SEMICON	= semiconductor
		INCD	= incandescent			SI	= silicon
CCW	= counter-clockwise	INCL	= include(s)			SIL	= silver
CER	= ceramic	INS	= insulation(ed)	OBD	= order by description	SL	= slide
CMO	= cabinet mount only	INT	= internal	OH	= oval head	SPG	= spring
COEF	= coefficient			OX	= oxide	SPL	= special
COM	= common	K	= kilo = 1000			SST	= stainless steel
COMP	= composition					SR	= split ring
COMPL	= complete	LH	= left hand	P	= peak	STL	= steel
CONN	= connector	LIN	= linear taper	PC	= printed circuit		
CP	= cadmium plate	LK WASH	= lock washer	PF	= picofarads = 10^{-12} farads	TA	= tantalum
CRT	= cathode-ray tube	LOG	= logarithmic taper			TD	= time delay
CW	= clockwise	LPF	= low pass filter	PH BRZ	= phosphor bronze	TGL	= toggle
				PHL	= phillips	THD	= thread
DEPC	= deposited carbon	M	= milli = 10^{-3}	PIV	= peak inverse voltage	TI	= titanium
DR	= drive	MEG	= meg = 10^{6}	PNP	= positive-negative-positive	TOL	= tolerance
		MET FLM	= metal film			TRIM	= trimmer
ELECT	= electrolytic	MET OX	= metallic oxide	P/O	= part of	TWT	= traveling wave tube
ENCAP	= encapsulated	MFR	= manufacturer	POLY	= polystyrene		
EXT	= external	MHZ	= mega hertz	PORC	= porcelain	U	= micro = 10^{-6}
		MINAT	= miniature	POS	= position(s)		
F	= farads	MOM	= momentary	POT	= potentiometer	VAR	= variable
FH	= flat head	MOS	= metal oxide substrate	PP	= peak-to-peak	VDCW	= dc working volts
FIL H	= fillister head	MTG	= mounting	PT	= point		
FXD	= fixed	MY	= "mylar"	PWV	= peak working voltage	W/	= with
						W	= watts
G	= giga (10^{9})	N	= nano (10^{-9})	RECT	= rectifier	WIV	= working inverse voltage
GE	= germanium	N/C	= normally closed	RF	= radio frequency		
GL	= glass	NE	= neon	RH	= round head or right hand	WW	= wirewound
GRD	= ground(ed)	NI PL	= nickel plate			W/O	= without

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 list, table 6-2 list all replaceable parts in reference designator order, and table 6-3 contains the names and addresses that correspond to the manufacturers' code numbers.

6-3. ABBREVIATIONS.

6-4. Table 6-1 lists abbreviations used in the parts list, the schematics, and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in other parts of the manual other abbreviation forms are 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. Illustrated parts breakdown.

b. Electrical assemblies in alphanumerical order by reference designation.

c. Chassis-mounted parts in alphanumerical order by reference designation.

d. Electrical assemblies and their components in alphanumerical order by reference designation.

The information given for each part consists of the following:

a. Complete reference designation.

b. Hewlett-Packard part number.

c. Total quantity (Qty) in the instrument.

d. Description of part.

e. Typical manufacturer of part in identifying five-digit code.

f. Manufacturers' number for part.

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

6-7. ORDERING INFORMATION.

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of part required. Address the order to the nearest Hewlett-Packard office.

6-10. DIRECT MAIL ORDER SYSTEM.

6-11. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

a. Direct ordering and shipment from HP Parts Center in Mountain View, California.

b. No maximum or minimum on any mail order (there is minimum order amount for parts ordered through local HP office when orders require billing and invoicing).

c. Prepaid transportation (there is small handling charge for each order).

d. No invoices—to provide these advantages, check or money order must accompany each order.

6-12. Mail order forms and specific ordering information is available through your local HP office.

REF DESIGNATOR	NOMENCLATURE	HP PART NUMBER	WHERE USED (QUANTITY)
H1	Washer, Star	2190-0005	Horiz/Vert Gnd (1) Vert. Output (2) Shield, CRT (2) CRT, Front Mtg (4) HV Box (2)
H2	Washer, lock, Int.	2190-0016	Panel, Rear (5) FOCUS Potentiometer (1) Panel, Front (7)
H3	Washer, lock, helical	2190-0017	Transformer (4)
H4	Washer, lock helical	2190-0018	Feet (4) Accessory Pouch (4)
H5	Washer, lock, helical	2190-0019	Delay Line (2) Cable Clamp, HV Assy (1) Clamp, lead, Multiplier (1) Receptacle, AC Power (2) Multiplier (2) Clamp, cable, gratical ILLUM (1)
H6	Washer, lock, Int.	2190-0084	Post, gnd (1)
H7	Washer, lock, helical	2190-0112	Preamplifier IC (4) Bracket, BNC (2)
H8	Screw, mach .250	2200-0103	Shield, CRT (2) Spring, switch gnd (2)
H9	Screw, mach .312	2200-0105	Cover, rear, CRT (2) LV Assy (5) Shield, safety (2) HV Box (2) Deck, rear (3) Bracket, HV (4) Main Horizontal Assy (4) Bracket, Vert Output (4) Deck, Vertical (1) Heat Sink, Vert Preamplifier (2) Delay Line (2) Control Assy, switch (1) Multiplier (2) Mount, rear, CRT (4) Shield, Preamplifier (2) Shield, Calibrator (2) Cover, line voltage (2)
H10	Screw, mach, 1.25	2200-0123	HV Box (2)
H11	Screw, mach, .375	2200-0143	Receptacle, AC Power (2) Clamp, cable, HV Assy (1) Clamp, cable, Multiplier lead (1) Delay line, Front/Rear (2) Transistor, pwr (1) Clamp, cable, gratical ILLUM (1)

REF DESIGNATOR	NOMENCLATURE	HP PART NUMBER	WHERE USED (QUANTITY)
H12	Screw, mach, .625	2200-0149	Output, vertical (2) Horiz Sweep/Vert gnd (1)
H13	Screw, mach, .250	2200-0762	Cover, top (4) Cover, bottom (4)
H14	Srew, mach, .093	2260-0002	Shield, CRT (2) Transistors (5) CRT, Front Mtg (4)
H15	Screw, mach, .500	2360-0135	Feet (4)
H16	Screw, mach, .375	2360-0197	Accessory Pouch (4) Handle (4) Vert Preamplifier (1)
H17	Screw, mach, .750	2510-0111	Handle (2)
H18	Screw, mach, 2.250	2510-0138	Transformer (4)
H19	Nut, 8-32, .125	2580-0004	Transformer (4)
H20	Grommet, Vinyl, .250	0400-0009	Shield, CRT (2)
H21	Nut, 3/8-32	2950-0043	Panel, rear (5) Panel, front (7) FOCUS Potentiometer (1) Attenuators (2)
H22	Nut, 1/4-32	2950-0072	Potentiometer, ILLUM (1) Post, gnd (1)
H23	Screw, Set, .188	3030-0196	Extenders, potentiometers (4)
H24	Washer, flat	3050-0010	Clamp, cable, ILLUM (1) Feet (4) Receptacle, AC Power (2) Multiplier (2) Clamp, cable, HV Assy (1) Clamp, cable, Multiplier (1)
H25	Screw, 2-56 x 3/16	0520-0127	Shield, vertical (2)
H26	Screw, 2-56 x 5/8	0520-0136	Preamplifier IC (4)
H27	Screw, taper, .500	0624-0306	Attenuators (8)
H28	Screw, taper, 1.000	0624-0313	Bracket, Attenuators (4)
H29	Grommet, Vinyl, .375	0400-0010	Cover, HV (1)
H30	Screw, taper, .750	0624-0279	Rail, side (8)
H31	Clamp, cable .312	1400-0017	Clamp, cable, chassis (1)
H32	Clamp, cable .187	1400-0053	Clamp, cable, chassis (1)
H33	Clamp, cable, .125	1400-0082	Clamp, cable, chassis (1)
H34	Washer, lock, dome, .275	2190-0910	Transistor, mtg (1)
H35	Washer, flat, No. 8	3050-0071	Transformer (4) Accessory Pouch (4) Delay Line (2)
H36	Washer, flat	3050-0160	Vertical BNCs (4)
H37	Washer, flat, teflon	3050-0481	Delay Sweep Control (1)
H38	Washer, flat, teflon	3050-0655	Attenuator Controls (2)
H39	Washer, shoulder	3050-0791	Transistors, rear panel (5)
H40	Screw, mach, 0.250	2360-0113	Preamplifier/Control Assy (1)
H41	Nut, hex, .468	2950-0035	Attenuator BNCs (2)
H42	Nut, hex	2950-0038	Post, Fuse (1)
H43	Washer, flat	2190-0037	Post, Fuse (1)
H44	Washer, rubber	1400-0090	Post, Fuse (1)

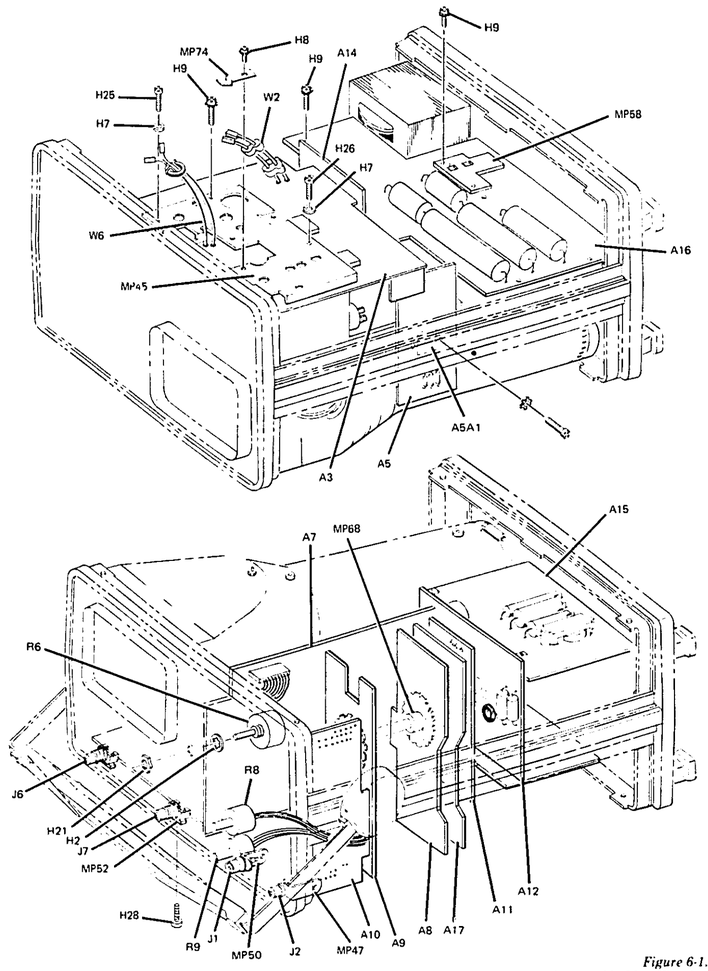


Figure 6-1.
Chassis Parts and Board Assembly Identification
(Sheet 1 of 2)

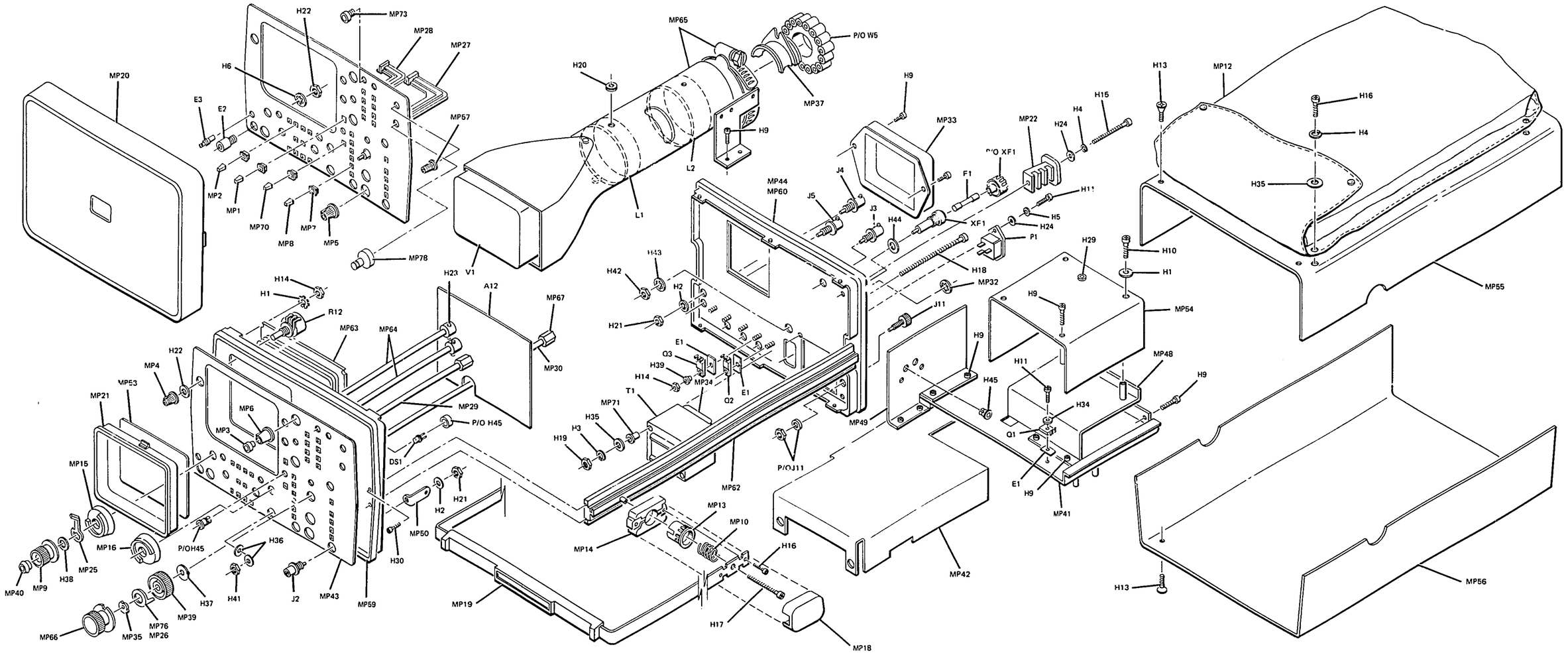


Figure 6-1. Chassis Parts and Board Assembly Identification (Sheet 2 of 2)

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01740-63401		ATTENUATOR ASSEMBLY, CHANNEL "A"	28480	01740-63401
A2	01740-63402		ATTENUATOR ASSEMBLY, CHANNEL "B"	28480	01740-63402
A3	01740-66530		VERTICAL PREAMPLIFIER ASSEMBLY	28480	01740-66530
A3	01740-66531		VERTICAL PREAMPLIFIER ASSEMBLY (OPT 101)	28480	01740-66531
A4	01743-61604		CABLE ASSEMBLY, DELAY LINE	28480	01743-61604
A5	01740-66505		VERTICAL OUTPUT ASSEMBLY	28480	01740-66505
A6	0960-0429		HV MULTIPLIER ASSEMBLY	28480	0960-0429
A7	01743-66507		HORIZONTAL SWEEP ASSEMBLY	28480	01743-66507
A7	01743-66509		HORIZONTAL SWEEP ASSEMBLY (OPT 101 ONLY)	28480	01743-66509
A8	01740-66532		MAIN SWEEP ASSEMBLY	28480	01740-66532
A9	01740-66522		DELAYED SWEEP ASSEMBLY	28480	01740-66522
A10	01740 66508		DELAYED TRIGGER ASSEMBLY	28480	01740 66508
A11	01740-66533		HORIZONTAL OUTPUT ASSEMBLY	28480	01740-66533
A12	01740-66503		GATE ASSEMBLY	28480	01740-66503
A13	01740-66516		VERTICAL LOGIC ASSEMBLY	28480	01740-66516
A16	01740 66540		INTERFACE ASSEMBLY	28480	01740 66540
A16	01740 66541		INTERFACE ASSEMBLY (OPTION 101 ONLY)	28480	01740 66541
A15	01740-66502		HIGH VOLTAGE POWER SUPPLY ASSEMBLY	28480	01740-66502
A16	01740 66542		LOW VOLTAGE POWER SUPPLY ASSEMBLY	28480	01740 66542
A17	01742 66501		TIME INTERVAL DECODER	28480	01742 66501
DS1	1990-0526	1	LED-VISIBLE LUM-INTM1MCD IFM20MA-MAX	28480	1990-0526
DS2	1990 0586	8	LED-VISIBLE LUM-INTM300UCD IFM50MA-MAX	28480	1990 0586
DS3	1990 0586		LED-VISIBLE LUM-INTM300UCD IFM50MA-MAX	28480	1990 0586
DS4	1990 0586		LED-VISIBLE LUM-INTM300UCD IFM50MA-MAX	28480	1990 0586
DS5	1990 0586		LED-VISIBLE LUM-INTM300UCD IFM50MA-MAX	28480	1990 0586
E1	0340-0630	6	INSULATOR-XSTR KAPTON	28480	0340 0630
E2	1510-0038	1	BINDING POST SGL THD-STUD	28480	1510-0038
E3	0360-1666	1	TERMINAL-STUD SPCL-FOTHRU PRESS-MTG	28480	0360-1666
E4	9170-0016	3	CORE-SHIELDING BEAD	01887	56-590-65A1/38
E5	9170-0016		CORE-SHIELDING BEAD	01887	56-590-65A1/38
E6	9170-0016		CORE-SHIELDING BEAD	01887	56-590-65A1/38
F1	2110-0007	1	FUSE 1A 250V SLO-BLO 1.25X.25 UL IEC	75915	313001
F1	2110-0202	1	FUSE .5A 250V SLO-BLO 1.25X.25 UL IEC (FOR 220 VAC OPERATION ONLY)	75915	313.500
J1	1250-0118	8	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	03316	28JR128-1
J2	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	03316	28JR128-1
J3	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	03316	28JR128-1
J4	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	03316	28JR128-1
J5	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	03316	28JR128-1
J6	1250-0524	2	CONNECTOR, RF BNC BER;BHD MT JK RCPT	04931	28JR251-1
J7	1250-0524		CONNECTOR, RF BNC BER;BHD MT JK RCPT	04931	28JR251-1
J8	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (OPTION 101 ONLY)	03316	28JR128-1
J9	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (OPTION 101 ONLY)	03316	28JR128-1
J10	1250 0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (OPTION 101 ONLY)	0331F	28JR128-1
J11	1251 0202	2	CONNECTOR, BANANA JACK	28480	1251 0202
J12	1251 0202		CONNECTOR, BANANA JACK	28480	1251 0202
L1	5080-0435	1	COIL, ALIGNMENT, X-AXIS	28480	5080-0435
L2	00180-65601	1	COIL, ALIGNMENT, Y-AXIS	28480	00180-65601
MP1	0370-0803	6	PUSHBUTTON;SQUARE, MINT GRAY	28480	0370-0803
MP2	0370-0671	9	PUSHBUTTON: SQUARE, LEG BLUE	28480	0370-0671
MP3	0370-0963	1	KNOB-CONC 1/2 JGK .125-IN-ID(FINE)	28480	0370-0963
MP4	0370-1005	5	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
MP5	0370-1099	4	KNOB-BASE-PTR 1/2 JGK .25-IN-ID	28480	0370-1099
MP6	0370-1100	1	KNOB-BASE-PTR 1/2 JGK .25-IN-ID	28480	0370-1100
MP7	0370-2826	32	BEZEL-PB GRAY	28480	0370-2826
MP8	0370-2830	16	PUSHBUTTON: SQUARE, WILLOW GRN	28480	0370-2830
MP9	0370-2783	2	KNOB-SKIRT	28480	0370-2783
MP10	1460-0804	2	SPRING-CPRSN .49-IN-OD 1.185-IN-LG MUS	28480	1460-0804
MP11	4324-0086	4	RUBBER-FORM, MTG	28480	4324-0086
MP12	1540-0292	1	CORE-ACCESSPVC 13.5LG 10.5MD 2.5DP	28480	1540-0292
MP13	5020-8733	2	GEAR, HUB HANDLE	28480	5020-8733
MP14	5020-8734	2	GEAR, RING HANDLE	28480	5020-8734
MP15	5020-8744	1	SPACER, DIAL CHANNEL "A"	28480	5020-8744
MP16	5020-8745	1	SPACER, DIAL CHANNEL "B"	28480	5020-8745
MP17	5040-0421	1	INSULATOR, POT	28480	5040-0421
MP18	5040-0511	2	CAP, TRIM HANDLE	28480	5040-0511
MP19	5040-0515	1	SHIP, HANDLE	28480	5040-0515
MP20	5040-0516	1	COVER, PANEL	28480	5040-0516
MP21	5040-0578	1	BEZEL, CRT	28480	5040-0578
MP22	5040-7829	4	FOOT, CORD WRAP	28480	5040-7829
MP23	1140-	1	DIAL, TURNS COUNT	28480	1140-
MP24	5040-7823	4	PUSH-ROD	28480	5040-7823
MP25	5040-7598	2	LEVER, COUPLING	28480	5040-7598

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP26	0350-1026	1	KNOB, DECAL	28480	0350-1026
MP27	5040-7705	4	EXTENDER, PUSHBUTTON	28480	5040-7705
MP28	5040-7706	4	EXTENDER, PUSHBUTTON	28480	5040-7706
MP29	5040-7755	1	EXTENDER, PUSHBUTTON	28480	5040-7755
MP30	5040-7756	1	EXTENDER, PUSHBUTTON	28480	5040-7756
MP31	00180-01218	2	BRACKET, COIL	28480	00180-01218
MP32	6960-0001	3	PLUG-HOLE DOME-HD FOR .375-D-HOLE STL	04213	0-3005-LC8
MP33	01701-04108	1	COVER, CRT	28480	01701-04108
MP34	01710-04103	1	COVER, TRANSFORMER	28480	01710-04103
MP35	01720-22501	1	RING, ANTIRUN ROUND	28480	01720-22501
MP36	01720-23705	1	SHAFT, DELAYED SWEEP	28480	01720-23705
MP37	00180-41207	2	CLAMP, CRT	28480	00180-41207
MP38	01743-63701	1	SHAFT ASSEMBLY, MAIN SWEEP	28480	01743-63701
MP39	01715-67403	1	KNOB, DELAYED SWEEP	28480	01715-67403
MP40	01720-67405	2	KNOB, VERNIER	28480	01720-67405
MP41	01740-00101	1	DECK, REAR	28480	01740-00101
MP42	01740-00102	1	DECK, FRONT	28480	01740-00102
MP43	01742-00201	1	PANEL, FRONT	28480	01742-00201
MP44	01742-00203	1	PANEL, REAR	28480	01742-00203
MP45	01740-00601	1	SHIELD, PREAMPLIFIER	28480	01740-00601
MP46	01740-00602	1	SHIELD, CAL	28480	01740-00602
MP47	01740-01201	1	BRACKET, DELAYED TRIGGER	28480	01740-01201
MP48	01740-01202	1	BRACKET, HV	28480	01740-01202
MP49	01740-01203	1	BRACKET, VERTICAL OUTPUT	28480	01740-01203
MP50	01740-01204	1	BRACKET, HORIZONTAL	28480	01740-01204
MP51	01740-01209	1	BRACKET, HORIZONTAL TOP	28480	01740-01209
MP52	01740-01212	2	BRACKET, BNC	28480	01740-01212
MP53	01740-02701	1	FILTER, CONTRAST	28480	01740-02701
MP54	01740-04101	1	COVER, HV	28480	01740-04101
MP55	01740-04102	1	COVER, TOP	28480	01740-04102
MP56	01740-04108	1	COVER, BOTTOM	28480	01740-04108
MP57	0370-1001	1	KNOB-BASE 3/8 JGK .125-IN-ID	28480	0370-1001
MP58	01740-04109	1	COVER, LINE	28480	01740-04109
MP59	01743-20501	1	FRAME, FRONT	28480	01743-20501
MP60	01740-20507	1	FRAME, REAR	28480	01740-20507
MP61	00180-41207	2	CLAMP, CRT BASE	28480	00180-41207
MP62	01740-23701	2	RAIL, SIDE	28480	01740-23701
MP63	01740-24702	1	SUPPORT, CRT CAMERA	28480	01740-24702
MP64	01740-63901	2	SHAFT, EXTENSION	28480	01740-63901
MP65	01740-80601	1	SHIELD ASSEMBLY, CRT	28480	01740-80601
MP66	01740-67402	1	KNOB ASSEMBLY, MAIN SWEEP	28480	01740-67402
MP67	01830-23201	2	COUPLER, SW EXTENSION	28480	01830-23201
MP68	0510-0041	1	COLLAR .109-HD STL	28480	0510-0041
MP69	1410-0094	2	BUSHING-PNL .281-ID .293-LG 3/8-32-THD	28480	1410-0094
MP70	0370-2842	1	PUSHBUTTON-WHITE	28480	0370-2842
MP71	0390-0006	*	INSULATOR-BSHG-FLG NYLON	71002	69-90
MP72	01741-09101	2	SPRING, GROUND	28480	01741-09101
MP73	1490-0968	1	BUSHING-PNL .14-ID .3-LG 1/4-32-THD	28480	1490-0968
MP74	01740-09101	2	SPRING, SW GROUND	28480	01740-09101
MP76	5040-5852	1	CORE, FLOATING	28480	5040-5852
MP77	7120-4660	1	LABEL, INFO, CRT	28480	7120-4660
MP78	1140-0068	1	DIAL, TURNS COUNT	28480	1140-0068
P1	1251-2357	1	CONNECTOR-AC PWR MP=9 MALE FLG=MTG	05057	EAC-301
Q1	1854-0433	1	TRANSISTOR NPN SI PD=900W FT=2MHZ	28480	1854-0433
Q2	1854-0803	1	TRANSISTOR NPN SI PD=30W FT=10MHZ	28480	1854-0803
Q3	1854-0370	3	TRANSISTOR NPN 2N5294 SI PD=1.8W	28480	1854-0370
Q4	1854-0370		TRANSISTOR NPN 2N5294 SI PD=1.8W	28480	1854-0370
Q5	1854-0858		TRANSISTOR NPN SI DARL PD=70W FT=1MHZ	28480	1854-0858
Q6	1854-0370		TRANSISTOR NPN 2N5294 SI PD=1.8W	28480	1854-0370
R1			NOT ASSIGNED		
R2	2100-2083	1	RESISTOR-VAR CONTROL CCP 20K 10% LIN ( )T=0)	28480	2100-2083
R3	0683-4705	2	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
R4	0683-4705		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
R5	0683-1505	2	RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
R6	2100-3586	2	RESISTOR-VAR PREC WW 10-TRN 50K 3% (START)	28480	2100-3586
R7	0684-1021		RESISTOR 1K 10% .85W FC TC=-400/+600	01121	CB1021
R8	2100-0657	1	RESISTOR-VAR W/SW 100K 30% LIN (TIME/DIV VERNIER)	28480	2100-0657
R9	2100-3397	1	RESISTOR-VAR W/SW 200K 20% 10CW SPST-NC (TRIGGER HOLDOFF)	28480	2100-3397
R10	0683-1505		RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
R11	2100-3731	1	RESISTOR-VAR DUAL 20K -20%-CCP (HORIZ POSITION)	28480	2100-3731
R12	2100-1439	1	RESISTOR-VAR CONTROL CC 1K 20% LIN (SCALE ILLUM)	71450	T200
R13	2100-3586		RESISTOR-VAR PREC WW 10-TRN 50K [illegible] TOP)	28480	2100-3586

See Introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
S1	3101-0040	1	SWITCH-TGL SUBMIN DPDT NS 5A 115VAC (.5 TIME)	28480	3101-0040
T1	9100-3499	1	TRANSFORMER, INPUT AC	28480	9100-3499
V1	5083-3552	1	CRT PDI ALIGNMENT	28480	5083-3552
W1	MH 7147	1	CABLE ASSEMBLY, 3-COND 18-AWG(STANDARD)	18628	8120-1521
W1	810	1	CABLE ASSEMBLY, 3-COND 18-AWG(STANDARD)	28480	810
W1	8120-1202	1	CABLE ASSEMBLY, 3-COND (OPT 001 ONLY)	28480	8120-1202
W1	8120-1703	1	CABLE ASSEMBLY, 3-COND (OPT 900 ONLY)	28480	8120-1703
W1	8120-0696	1	CABLE ASSEMBLY, 3-COND (OPT 901 ONLY)	28480	8120-0696
W1	402 310	1	CABLE ASSEMBLY, 3-COND (OPT 902 ONLY)	05934	8120-1692
W1	8120-2296	1	CABLE ASSEMBLY, 3-COND (OPT 906 ONLY)	28480	8120-2296
W2	01740-61602	1	CABLE ASSEMBLY, SYNC TWIN LEAD	28480	01740-61602
W3	01740-61621	1	CABLE ASSEMBLY, FRONT PANEL	28480	01740-61621
W4	01740-61603	1	CABLE ASSEMBLY, HORIZ OUT	28480	01740-61603
W5	01740-61601	1	CABLE ASSEMBLY, CRT BASE	28480	01740-61601
W6	01740-61609	1	CABLE ASSEMBLY, TRIG VIEW	28480	01740-61609
W7	01743-61601	1	CABLE ASSEMBLY, HORIZ POS	28480	01743-61601
W8	01743-61606	1	CABLE ASSEMBLY, SCALE ILLUM POT	28480	01743-61606
W9	01743-61602	1	CABLE ASSEMBLY	28480	01743-61602
W10	8120-0620	2	CABLE ASSY 28AWG 18-CNDCT	28480	8120-0620
W11	8120-0620		CABLE ASSY 28AWG 18-CNDCT	28480	8120-0620
XF1	1400-0084	1	FUSEHOLDER-EXTR POST 15A 250V UL	28480	1400-0084

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01740-63401	1	ATTENUATOR ASSEMBLY, CHANNEL "A"	28480	01740-63401
A1R1	2100-3551	2	RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO	28480	2100-3551
A2	01740-63402	1	ATTENUATOR ASSEMBLY, CHANNEL "B"	28480	01740-63402
A2R1	2100-3551		RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO	28480	2100-3551
A3	01740-66530	1	VERTICAL PREAMPLIFIER ASSEMBLY(STD.) DOES NOT INCLUDE A3A1-ORDER SEPARATELY	28480	01740-66530
A3	01740-66531	1	VERTICAL PREAMPLIFIER ASSEMBLY (OPT 101) DOES NOT INCLUDE A3A1-ORDER SEPARATELY	28480	01740-66531
A3A1	5081-3030	1	ASSEMBLY, SUBSTRATE(NOT SUPPLIED WITH A3-ORDER SEPARATELY)	28480	5081-3030
A3C1	0180-0204	8	CAPACITOR-FXD .033UF +-10% 500VDC CER	51642	300-500-X7R-333K
A3C2	0121-0060	4	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	30A322 2/8PF NPO
A3C3	0150-0021	3	CAPACITOR-FXD .47PF +-5% 500VDC TI DIGX	02366	TYPE JM
A3C4	0121-0060		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	30A322 2/8PF NPO
A3C5	0160-2150	1	CAPACITOR-FXD 33PF +-5% 300VDC	28480	0160-2150
A3C6	0160-3448	4	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C7	0160-3799	3	CAPACITOR-FXD 18PF +-10% 100VDC CER0+-30	28480	0160-3799
A3C8	0160 2055	49	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C9	0160-3508	2	CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0160-3508
A3C10	0160 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C11	0180-2752	2	CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	196D104X9035HE3
A3C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C14	0160-4804		CAPACITOR-FXD .033UF +-10% 500VDC CER	51642	300-500-X7R-333K
A3C15	0160-3567	2	CAPACITOR-FXD 10PF +-5% 100VDC CER0+-30	28480	0160-3567
A3C16	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C17	0121-0060		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	30A322 2/8PF NPO
A3C18	0150-0021		CAPACITOR-FXD .47PF +-5% 500VDC TI DIGX	02366	TYPE JM
A3C19	0121-0060		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	30A322 2/8PF NPO
A3C20	0160-2198	3	CAPACITOR-FXD 20PF +-5% 300VDC	28480	0160-2198
A3C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C25	0180-2752		CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	196D104X9035HE3
A3C26	0160-3443	5	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C28	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C29	0180-0374	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3C30	0160-3443		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A3C31	0160-3567		CAPACITOR-FXD 10PF +-5% 100VDC CER0+-30	28480	0160-3567
A3C32	0160-3470	3	CAPACITOR-FXD .01UF +10-20% 50VDC CER	28480	0160-3470
A3C33	0180-2255	4	CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C34	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C35	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C37	0160-4324	2	CAPACITOR-FXD 220PF +-10% 50VDC CER	05668	VK20BY221K
A3C38	0160-4324		CAPACITOR-FXD 220PF +-10% 50VDC CER	05668	VK20BY221K
A3C39	0150-0061	1	CAPACITOR-FXD 20PF +-10% 100VDC CER	28480	0150-0061
A3C40	0160-2055 1		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C41	0180-3508		CAPACITOR-FXD 1UF +80-20% 50VDC CER	28480	0180-3508
A3C42	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C44	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C47	0180-2217	1	CAPACITOR-FXD 910PF +-5% 300VDC MICA0+70	28480	0180-2217
A3C48	0180-0228	3	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3C49	0160-2207	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA0+70	28480	0180-2207
A3C50	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C51	0180-0820	4	CAPACITOR-FXD .05UF +80-20% 25VDC CER	28480	0180-0820
A3C52	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C53	0160-3448	3	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C54	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C55	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C56	0180-0820		CAPACITOR-FXD .05UF +80-20% 25VDC CER	28480	0180-0820
A3C57	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3C58	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A3C59	0180-0820		CAPACITOR-FXD .05UF +80-20% 25VDC CER	28480	0180-0820
A3C60	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C61	0160-0820		CAPACITOR-FXD .05UF +80-20% 25VDC CER	28480	0160-0820
A3C63	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	30[illegible]-000-C0M0-829C
A3C64	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3C65	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3C66	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A3C67	0160-3448		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3448
A3C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C69	0160-3470		CAPACITOR-FXD .01UF +80-20% 50VDC CER	28480	0160-3470
A3C70	0160-3470		CAPACITOR-FXD .01UF +80-20% 50VDC CER	28480	0160-3470
A3C71	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C72	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C73	0140-0192	8	CAPACITOR-FXD 68PF +-5% 300VDC	72136	DM[illegible]5Z680J0300WV1CR
A3C74	0150-0031	1	CAPACITOR-FXD 2PF +-5% 500VDC TI DIOX	02366	TYPE JM
A3C75	0160-2055		CAPACITOR-FXD .01UF +C +20% 100VDC CER	28480	0160-2055
A3C77	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C78	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C79	0160-3651	2	CAPACITOR-FXD 68PF +-20% 200V CER	28480	0160-3651
A3C80	0160-3651		CAPACITOR-FXD 68PF +-20% 200V CER	28480	0160-3651
A3CR1	1901-0040	58	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR2			NOT ASSIGNED		
A3CR3			NOT ASSIGNED		
A3CR4	1901-0047	6	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A3CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR7	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A3CR8	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A3CR9	1901-0047		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A3CR10			NOT ASSIGNED		
A3CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR18	1910-0016	4	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A3CR19	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR20	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR21	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR22			NOT ASSIGNED		
A3CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR24			NOT ASSIGNED		
A3CR25	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR26	1901-0049	2	DIODE-PWR RECT 100V 750MA DO-29	02713	MPG97
A3CR27	1901-0045		DIODE-PWR RECT 100V 750MA DO-29	02713	MPG97
A3CR28	1906-0042	1	DIODE-DUAL 70V 10MV	28480	1906-0042
A3E1	9170-0029	15	CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A3L1	9100-0670	2	COIL, FXD 5-TURN,#34AWG CU ON	06560	4A3\[illegible]
A3L2	9100-0670		COIL, FXD 5-TURN,#34AWG CU ON	06560	4A3\[illegible]
A3L3	9100-2284	3	COIL-MLD 6.8UH 10% Q=50 .095DX.25LG	02172	09-4446-2K
A3L4	9100-2284		COIL-MLD 6.8UH 10% Q=50 .095DX.25LG	02172	09-4446-2K
A3L5	9100-1650	2	COIL-MLD 680UH 5% Q=60 .190X.44LG	02172	19-1331-31J
A3L6	9100-1650		COIL-MLD 680UH 5% Q=60 .190X.44LG	02172	19-1331-31J
A3MP1	01740-00803	1	SHIELD, RESISTOR	28480	01740-00803
A3MP2	5040-7817	1	FRAME, IC	28480	5040-7817
A3MP3	01801-01206	3	BRACKET, ANGLE	28480	01801-01206
A3MP4	1206-0095	2	HTSK TRST, T05 (FOR Q2, Q4)	28480	1206-0095
A3P2	1251-3750	1	CONNECTOR 10-PIN M POST TYPE	81.08	09-05-1101
A3P3	1251-3908	2	CONNECTOR POST TYPE	28480	1251-3908
A3P4	1251-3908		CONNECTOR POST TYPE	28480	1251-3908
A3Q1	1853-0380	5	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0380
A3Q2	1855-0266 ?	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0266
A3Q3	1853-0380		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0380
A3Q4	1855-0266		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0266
A3Q5	1854-0092	15	TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092
A3Q6	1854-0626	2	TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A3Q7	1854-0626		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A3Q8	1854-0215	21	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q9	1853-0036	22	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3Q10	1854-0092		TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092
A3Q11	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q12	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3Q13	1855-0367	1	TRANSISTOR-UJT P CH N	28480	1855-0367
A3Q14	1854-0071	14	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q15	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3Q16	1853-0015	3	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q17	1853 0314	1	TRANSISTOR PNP SI TO-5 PD = 600MW	28480	1853 0314
A3Q18	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q19	1854-0213	1	TRANSISTOR NPN 2N2538 SI TO-5 PD=800MW	28480	1854-0213
A3Q20	1853-0086	1	TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A3Q21	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3R1	0698-8848	2	RESISTOR 50 2% .5W MO TC=0+-150	28480	0698-8848
A3R2	0698-7206	1	RESISTOR 56.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-56R2-G
A3R3	0698-8822	4	RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8822
A3R4	0698-3329	3	RESISTOR 10K .5% .125W F TC=0+-100	03888	RNC55-1/8-T0-1002-D
A3R5	0698-8822		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8822
A3R6	0698-1011	6	RESISTOR 100 10% .125W CC TC=-270/+540	01121	BB1011
A3R7	0698 7216	4	RESISTOR 147 1% .05 W F TC = 0 + -100	24546	C3-1/8-TO-147R G
A3R8	0687-2241	2	RESISTOR 220K 10% .5W CC TC=0+882	01121	EB2241
A3R9	0757-0401	13	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R10	0698-3157	4	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3R11	2100 3731	3	RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	73138	72-102-0
A3R12	0684-1001	17	RESISTOR 10 10% .25W FC TC=-400/+5(	01121	CB1001
A3R13	0683-4675	2	RESISTOR 4.7 5% .25W FC TC=-400/+50	01121	CB4705
A3R14	0757-0394	6	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R15	0698-7926	5	RESISTOR 470 10% .125W CC TC=-330/+800	01121	BB4711
A3R16	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R17	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3R18	2100-3531	6	RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	73138	72-177-0
A3R19	2100-3931		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	73138	72-177-0
A3R20	0757 0410	2	RESISTOR 301 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-301R-F
A3R21	0698-8848		RESISTOR 50 2% .5W MO TC=0+-150	28480	0698-8848
A3R22	2100-2041	1	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	62-201-1
A3R23	0698-8822		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8822
A3R24	0698-3329		RESISTOR 10K .5% .125W F TC=0+-100	03888	RNC55-1/8-T0-1002-D
A3R25	0698-8822		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8822
A3R26	0687-2241		RESISTOR 220K 10% .5W CC TC=0+882	01121	EB2241
A3R27	0698-1011		RESISTOR 100 10% .125W CC TC=-270/+540	01121	BB1011
A3R28	0698-7216	3	RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A3R29	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R30	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3R31	2100-0568		RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	73138	72-102-0
A3R32	2100-3212	6	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R33	0698-0082	5	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R34	0698-3495	2	RESISTOR 866 1% .125W F TC=0+-100	24546	C4-1/8-T0-866R-F
A3R35	0757-0403	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A3R36	2100-3433	2	RESISTOR-VAR CONTROL CCP 250 10% LIN	01121	73W1G040R251U
A3R37	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R38	0698 4125	2	RESISTOR 953 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-953R-F
A3R39	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A3R40	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R41	0757-0284	8	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A3R42	0757-0398	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R43	0698-7926		RESISTOR 470 10% .125W CC TC=-330/+800	01121	BB4711
A3R44	0684-0271	6	RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2701
A3R45	0757-0433	16	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R46	2100-0556	4	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A3R47	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R48	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3R49	2100-0556		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A3R50	0757-0398		RESISTOR 75 1% .12 F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R51	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A3R52	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2701
A3R53	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R54	0698-7216		RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A3R55	0698-7216		RESISTOR 147 1% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A3R56	0698 4125		RESISTOR 953 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-953R-F
A3R57	0698-3495		RESISTOR 866 1% .125W F TC=0+-100	24546	C4-1/8-T0-866R-F
A3R58	2100-3212		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R59	0698-7228	2	RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-4640-G
A3R60	0698-7228		RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-4640-G
A3R61	2100-3433		RESISTOR-VAR CONTROL CCP 250 10% LIN	01121	73W1G040R251U
A3R62	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A3R63	0757-0411	6	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R64	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R65	2100-0567	2	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	72-106-0
A3R66	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R67	0698-3455	3	RESISTOR 261K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2613-F
A3R68	0684-4721	17	RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A3R69	0684-1031	15	RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R70	0757-0462	2	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R71	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A3R72	0698-3161	3	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A3R73	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R74	0757-0739	1	RESISTOR 2K 1% .25W F TC=0+-100	27167	C5-1/4-T0-2001-F
A3R75	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A3R76	2100-3531		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	73138	72-177-0
A3R77	2100-3531		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	73138	72-177-0
A3R78	0757 0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A3R79	2100-3212		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R80	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MFC1/8-T0-6191-F
A3R81	0757-0417	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R82	0757-0443	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3R83	0698-4037	3	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A3R84	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A3R85	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A3R86	2100-0567		RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	72-106-0
A3R87	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R88	0757-0280	17	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R89	0757-1094	3	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3R90	2100-3212		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R91	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R92	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R93	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A3R94	0684-3321	6	RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A3R95	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R96	0757-1094		RESISTOR 1.47K 1% .25W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3R97	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R98	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R99	3699-0002		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R100	0757 0475		RESISTOR 274K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2743-F
A3R101	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R102	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R103	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R104	0757-0442	14	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R105	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A3R106	0757-0283	11	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A3R107	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A3R108	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A3R109	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R110	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A3R111	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R112	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A3R113	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A3R114	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MFC1/8-T0-6191-F
A3R115	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A3R116	2100-0556		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A3R117	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A3R118	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R119	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R120	0698-3150	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A3R121	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R122	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R123	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A3R124	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R125	0698-7096	2	RESISTOR 10 10% .125W CC TC=-120/+400	01121	BB1001
A3R126	0698-7229	2	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A3R127	0698-7096		RESISTOR 10 10% .125W CC TC=-120/+400	01121	BB1001
A3R128	0698-7229		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A3R129	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R130	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R131	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R132	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A3R133	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R134	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A3R135	0757-0462		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3R136	0757-0453	6	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A3R137	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2701
A3R138	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A3R139	0757-0416	9	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R140	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A3R141	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R142	0698 7238	2	RESISTOR 1.21K 1% .06W F TC=0+-100 (OPT 101 ONLY)	24546	C3-1/8-T0-1211-G
A3R142	0698 7238		RESISTOR 1.21K 1% .05W F TC=0+-100 (OPT 101 ONLY)	24546	C3-1/8-T0-1211-G
A3R144	0757 0440	5	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3R145	0698 7196	2	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-G
A3R146	0698 7196		RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-G
A3R147	0757 0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3RT1	0837-0035	2	THERMISTOR DISC 5K-OHM TC=-4.4%/C-DEG	28480	0837-0035
A3RT2	0837-0035		THERMISTOR DISC 5K-OHM TC=-4.4%/C-DEG	28480	0837-0035
A3S1	3101-1905	1	SWITCH-PB 4-STATION 10MM C-C SPACING	28480	3101-1905
A3U1	1820-1918	1	IC GATE TTL L NAND QUAD 2-INP	27014	DM74L00N
A3U2	1820-0596	2	IC FF TTL L D-TYPE POS-EDGE-TRIG	27014	DM74L74N
A3U3	1820-0585	1	IC GATE TTL L NAND QUAD 3-INP	27014	DM74L03N
A3U4	1820-0596		IC FF TTL L D-TYPE POS-EDGE-TRIG	27014	DM74L74N
A3VR1	1902-3082	1	DIODE-ZNR 6.04V 5% DO-7 PD=.4W TC=-.023%	04713	SZ 10939-84
A3VR2	1902-3236	1	DIODE-ZNR 10.6V 5% DO-7 PD=.4W TC=+.073%	07263	FZ7288
A3VR3	1902-0072	1	DIODE-ZNR 7.87V 2% DO-7 PD=.4W TC=+.051%	07263	FZ7450
A3VR4	1902-3137	1	DIODE-ZNR 8.06V 2% DO-7 PD=.4W TC=+.052%	07263	FZ7451
A3VR5	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=+.006%	04713	SZ 10939-98
A3VR6	1902-3002	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W	28480	1902-3002
A3W1	01740-61617	1	CABLE ASSEMBLY, COAX,	28480	01740-61617
A3XU1	1200-0474	4	SOCKET-IC 14-CONT DIP-SLDR	03269	C8A-3100-148
A3XU2	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	03269	C8A-3100-148
A3XU3	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	03269	C8A-3100-148
A3XU4	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	03269	C8A-3100-148
A4	01743-61604	1	CABLE ASSEMBLY, DELAY LINE	28480	01743-61604
A5	01740-66505	1	VERTICAL OUTPUT ASSEMBLY	28480	01740-66505
A5A1	1NA9-8005	1	ASSEMBLY, SUBSTRATE (NOT SUPPLIED ON/AS-ORDER SEPARATELY)	28480	1NA9-8005
A5C1	0160-0029	1	CAPACITOR-FXD 1PF +-10% 500VDC TI DIOX	02366	TYPE JM
A5C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C3	0160-3692	1	CAPACITOR-FXD 4.7PF +.5=4.7PF 200VDC	28480	0160-3692
A5C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C6	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A5C7	0180-2255		CAPACITOR-FXD 2.2UF+-20% 20VDC TA	72982	301-000-C0H0-229C
A5C8	0160-3650	1	CAPACITOR-FXD .018UF +-10% 50VDC CER	28480	0160-3650
A5C9	0160-3799		CAPACITOR-FXD 18PF +-10% 100VDC CER0+-30	28480	0160-3799
A5C10	0160-3799	2	CAPACITOR-FXD 18PF +-10% 100VDC CER0 +-30	28480	0160-3799
A5C11	0160-3651	1	CAPACITOR-FXD 68PF +-10% 200VDC CER	28480	0160-3651
A5C12	0160-3694	1	CAPACITOR-FXD 330PF +-10% 100VDC CER	28480	0160-3694
A5C13	0180-0230	4	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A5C14	0160-3799		CAPACITOR-FXD 18PF +-10% 100VDC CER0+-30	28480	0160-3799
A5C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C17	0160-3848	1	CAPACITOR-FXD 3.3PF +-.5PF 100VDC	28480	0160-3848
A5L1	9100-2598	8	COIL 80NH 10% Q=35 .26LG SRF=700MHZ	28480	9100-2598
A5L2	9100-2256	3	COIL-MLD 1.2UH 10% Q=32 .095DX.25LG	02172	09-4436-1K
A5L3	9100-2256		COIL-MLD 1.2UH 10% Q=32 .095DX.25LG	02172	09-4436-1K
A5L4	9100-2598		COIL 80NH 10% Q=35 .26LG SRF=700MHZ	28480	9100-2598
A5L5	9100-2250	2	COIL-MLD 180NH 10% Q=34 .095DX.25LG	02172	09-4419-4K
A5L6	9100-2250		COIL-MLD 180NH 10% Q=34 .095DX.25LG	02172	09-4419-4K
A5L7	9100-2252	2	COIL-MLD 270NH 10% Q=30 .095DX.25LG	02172	09-4419-8K
A5L8	9100-2252		COIL-MLD 270NH 10% Q=30 .095DX.25LG	02172	09-4419-8K
A5L9	9100-2256		COIL-MLD 1.2UH 10% Q=32 .095DX.25LG	02172	09-4436-1K
A5MP1	01740-20506	1	HEAT SINK, VERT OUTPUT	28480	01740-20506
A5Q1	1853-0354	15	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A5Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A5Q3	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A5Q4	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A5R1	0698-6389	8	RESISTOR 80.7 1% .125W F TC=0+-100	24546	C4-1/8-T0-80R7-F
A5R2	0757-0736	8	RESISTOR 1.21K 1% .25W F TC=0+-100	27167	C5-1/4-T0-1211-F
A5R3	0757-0719	1	RESISTOR 221 1% .25W F TC=0+-100	27167	C5-1/4-T0-221R-F
A5R4	0757-0736		RESISTOR 1.21K 1% .25W F TC=0+-100	27167	C5-1/4-T0-1211-F
A5R5	0698-6389		RESISTOR 80.7 1% .125W F TC=0+-100	24546	C4-1/8-T0-80R7-F
A5R6	0698-7028	1	RESISTOR 27 10% .125W CC TC=-270/+580	01121	BB2701
A5R7	0684-1011	17	RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A5R8	0757-0200	5	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-TC-5621-F
A5R9	0698-0083	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A5R10	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A5R11	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A5R12	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A5R13	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A5R14	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A5R15	0698-7386	2	RESISTOR 499.9 .5% .125W F TC=0+-50	19701	MFC1/8-T2-4990A9-D

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R16	0698-7386		RESISTOR 490.9 ,5% .125W F TC=0+-50	19701	MF4C1/8-T2-4909R-D
A9R17	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A9R18	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A9R19	2100-2216	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	73138	62-208-1
A9R20	2100-1788	1	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	62-208-1
A9R21	0698-8401	1	RESISTOR 95.3 1% .125W F TC=0+-100	24546	C4-1/8-T0-95R3-F
A9R22	2100-2216		RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	73138	62-208-1
A9R23	0698-7252	1	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A9R24	2100-1986	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	62-208-1
A9R25	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A9R26	0757-0720	1	RESISTOR 243 1% .25W F TC=0+-100	27167	CB-1/4-T0-243R-F
A9VR1	1902-3039	1	DIODE-ZNR 3.83V 5% DO-7 PD=.4W TC=-.051%	04713	SZ 10939-82
A9XA3	1251-3903	1	CONNECTOR 6-PIN F POST TYPE	27264	09-52-3061
A6	0960-0429	1	HV MULTIPLIER ASSEMBLY	28480	0960-0429
A7	01743-66507	2	HORIZONTAL SWEEP ASSEMBLY (LESS A7U2-ORDER SEPARATELY)	28480	01743-66507
A7	01743-66509	1	HORIZONTAL SWEEP ASSEMBLY (OPT 101 ONLY)	28480	01743-66509
A7C1	0160-3569		CAPACITOR-FXD 27PF +-5% 100VDC CER0+-30	28480	0160-3569
A7C2	0160-2055	25	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C3	0140-0202	1	CAPACITOR-FXD 15PF +-5% 500VDC	72136	DM15C150J0500WV1CR
A7C4	0150-0070	2	CAPACITOR-FXD .02UF +-20% 500VDC CER	28480	0150-0070
A7C5	0140-0196	2	CAPACITOR-FXD 150PF +-5% 300VDC MICA0+70	72136	DM15F151J0300WV1CR
A7C6	0160-3318	1	CAPACITOR-FXD .047UF +-10% 100VDC CER	28480	0160-3318
A7C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C8	0150-0021		CAPACITOR-FXD .47PF +-5% 500VDC TI DICK	02366	TYPE JM
A7C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C10	0140-0193	2	CAPACITOR-FXD 82PF +-5% 300VDC	72136	DM15E820J0300WV1CR
A7C11	0160-3883		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3883
A7C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C13	0180 0195	1	CAPACITOR-FXD 33UF +-20% 50VDC CER	28480	0180 0195
A7C14	0160-2204	6	CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70	28480	0160-2204
A7C15			NOT ASSIGNED		
A7C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C17	0160-0204	1	CAPACITOR-FXD 47PF +-5% 500VDC	72136	DM15E470J0500WV1CR
A7C18	0140-0193		CAPACITOR-FXD 82PF +-5% 300VDC	72136	DM15E820J0300WV1CR
A7C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C23	0180-1746	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D158X9020B2
A7C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C28	0180-0105	1	CAPACITOR-FXD 6UF+-20% 6VDC TA	56289	150D606X0006B2
A7C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C31	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A7C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C33	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D158X9020B2
A7C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A7C40	0160-2198		CAPACITOR-FXD 20PF +-5% 300VDC	28480	0160-2198
A7C41	0160-2198		CAPACITOR-FXD 20PF +-5% 300VDC	28480	0160-2198
A7C42	0160-2197	1	CAPACITOR-FXD 10PF +-5% 300VDC	28480	0160-2197
A7C43	0160-2204		CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70	28480	0160-2204
A7CR1	1901-0376	1	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A7CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR10	1901-0050	1	DIODE-SWITCHING 80V 200MA 3NS DO-7	28480	1901-0050

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7CR11	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR12	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR13	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR14	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR15	1910-0016		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A7CR16	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR17	1901-0047		DIODE-SWITCHING 20V 75MA 10NS (OPTION 101 ONLY)	28480	1901-0047
A7CR18	1901-0047		DIODE-SWITCHING 20V 75MA 10NS (OPTION 101 ONLY)	28480	1901-0047
A7CR19	1901-0047		DIODE-SWITCHING 20V 75MA 10NS (OPTION 101 ONLY)	28480	1901-0047
A7CR20	1901-0047		DIODE-SWITCHING 20V 75MA 10NS (OPTION 101 ONLY)	28480	1901-0047
A7CR21	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR22	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7CR23	1901-0040		DIODE-SWITCHING 35V 50MA 2NS DO-35	28480	1901-0040
A7E1	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A7E2	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A7E3	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A7E4	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A7E5	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A7L1	9140-0105	5	COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A7L2	9140-0094	3	COIL-MLD 1UH 10% Q=50 .155DX.375LG	02172	15.4425-6K
A7L3	9100-1613	2	COIL-MLD 470NH 20% Q=45 .155DX.375LG	02172	15.4425-2M
A7L4	9140-0094		COIL-MLD 1UH 10% Q=50 .155DX.375LG	02172	15.4425-6K
A7L5	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	28480	9140-0105
A7L6	9140-0094		COIL-MLD 1UH 10% Q=50 .155DX.375LG	02172	15.4425-6K
A7L7	9100-1613		COIL-MLD 470NH 20% Q=45 .155DX.375LG	02172	15.4425-2M
A7MP1	01801-01206		BRACKET, ANGLE	28480	01801-01206
A7P2	1251-3901	3	CONNECTOR 15-PIN M POST TYPE	27264	09-65-1151
A7P3	1251-3750		CONNECTOR 10-PIN M POST TYPE	27264	09-65-1101
A7P4	1251-4744	1	CONNECTOR 12-PIN M POST TYPE	27264	22-03-1121
A7P5	1251-3071	1	CONNECTOR 8-PIN M POST TYPE	27264	09-56-1081(2183-8A)
A7P6	1251-3901		CONNECTOR 15-PIN M POST TYPE	27264	09-65-1151
A7P7	1251-4771	1	CONNECTOR 4-PIN M POST TYPE	27264	22-03-1041
A7Q1	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q2	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q3	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q4	1855-0081	3	TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A7Q5	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q6	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q7	1853-0380		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0380
A7Q8	1853-0380		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0380
A7Q9	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A7Q10	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A7Q11	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A7Q12	1853-0380		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0380
A7Q13	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q14	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q15	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q16	1854-0691	3	TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0691
A7Q17	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q18	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200 MHZ	28480	1854-0071
A7Q19	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q20	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q21	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q22	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A7Q23	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q24	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q25	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q26	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7Q27	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q28	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q29	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q30	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q31	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q32	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q33	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q34	1854-0092		TRANSISTOR NPN SI PD=200MW FT=400MHZ	28480	1854-0092
A7Q35			NOT ASSIGNED		

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7Q36	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q37	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A7R1	0698-3263	3	RESISTOR 500K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R2	0698-3263		RESISTOR 500K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R3	0757-0476	1	RESISTOR 301K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3013-F
A7R4	0757-0486	2	RESISTOR 750K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R5	0757-0421	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A7R6	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A7R7	0757-0418	4	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A7R8	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A7R9	0684-2711	2	RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A7R10	0684-1061	2	RESISTOR 1 M 10% .25W FC TC=-900/+1100	01121	CB1061
A7R11	0698-3263		RESISTOR 510K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R12	0683-1505	3	RESISTOR 1.5 5% .25W FC TC=-400/+500	01121	CB1505
A7R13	0757-0488		RESISTOR 750K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R14	0684-6811	5	RESISTOR 680 10% .25W FC TC=-400/+600	01121	CB6811
A7R15	0684-6811		RESISTOR 680 10% .25W FC TC=-400/+600	01121	CB6811
A7R16	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A7R17	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A7R18	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A7R19	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A7R20	2100-3351	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	73138	72-142-0
A7R21	2100-3436	2	RESISTOR-VAR CONTROL CCP 50K 10% LIN	01121	73WAN068P503U
A7R22	0757-0453		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R23	0698-3446	4	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A7R24	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A7R25	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A7R26	0698-3433	5	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A7R27	0698-3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A7R28	0757-0427	4	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A7R29	0757-0281	2	RESISTOR 2.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2741-F
A7R30	0757-0466	2	RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A7R31	0757-0488	4	RESISTOR 909K 1% .125W F TC=0+-100	05624	CMF-55-1
A7R32	0684-4701	3	RESISTOR 47 10% .25W FC TC=-400/+500	01121	CB4701
A7R33	0684-2701	2	RESISTOR 27 10% .25W FC TC=-400/+500	01121	CB2701
A7R34	0757-0453		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R35	0757-0453		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R36	0757-0410	2	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A7R37	0757-0748	1	RESISTOR 4.75K 1% .25W F TC=0+-100	27167	C5-1/8-T0-4751-F
A7R38	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R39	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R40	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A7R41	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	73138	72-142-0
A7R42	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R43	0684-1511	5	RESISTOR 150 10% .25W FC TC=-400/+600	01121	CB1511
A7R44	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R45	0757-0281		RESISTOR 2.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2741-F
A7R46	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R47	0684-4701		RESISTOR 47 10% .25W FC TC=-400/+500	01121	CB4701
A7R48	0684-1521	1	RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A7R49	0757-0399		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A7R50	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A7R51	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A7R52	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2701
A7R53	0757-0408	5	RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A7R54	0757-0434	5	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A7R55	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R56	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R57	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A7R58	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A7R59	0684-4711	5	RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A7R60	0757-0412	2	RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-T0-365R-F
A7R61	0757-0422	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A7R62	0757-0406	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A7R63	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A7R64	0757-0447	1	RESISTOR 10.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1022-F
A7R65	0698-7926		RESISTOR 470 10% .125W CC TC=-330/+800	01121	BB4711
A7R66	0698-7926		RESISTOR 470 10% .125W CC TC=-330/+800	01121	BB4711
A7R67	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A7R68	0698-7926		RESISTOR 470 10% .125W CC TC=-330/+800	01121	BB4711
A7R69	0757-0415	2	RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A7R70	0757-0407	8	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A7R71	0757-0439	5	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R72	0684-1221	1	RESISTOR 1.2K 10% .25W FC TC=-400/+700	01121	CB1221
A7R73	0684-2221	5	RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A7R74	0684-6821	2	RESISTOR 6.8K 10% .25W FC TC=-400/+700	01121	CB6821
A7R75	0757-0415		RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R76	0757-0438	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A7R77	0698-3321	2	RESISTOR 3.3K 10% .125W CC TC=+350/+857	01121	BB3321
A7R78	0698-3321		RESISTOR 3.3K 10% .125W CC TC=+350/+857	01121	BB3321
A7R79	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R80	0757 0466		RESISTOR 100K 1% 125W F TC = 0 + -100	24546	C4-1/8-TO-1003-F
A7R81	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R82	0757-0273	1	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A7R83	0757-0465	4	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R84	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R85	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R86	0698 7926		RESISTOR 470 10% .25W FC TC=+400/+800	01121	CB7926
A7R87	0684-3311	3	RESISTOR 330 10% .25W FC TC=+400/+800	01121	CB3311
A7R88	0684-1511		RESISTOR 150 10% .25W FC TC=+400/+800	01121	CB1511
A7R89	0757-0199	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A7R90	0698-0085	2	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A7R91	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A7R92	0698-3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A7R93	2100-3211	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	72-103-0
A7R94	0757-0438	9	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R95	0757-0444	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A7R96	0757-0430	1	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A7R97	2100-3350	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	73138	72-141-0
A7R98	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A7R99	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A7R100	0757-0404	1	RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-T0-131-F
A7R101	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A7R102	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A7R103	0698-3155	3	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A7R104	0684-3311		RESISTOR 330 10% .25W FC TC=+400/+800	01121	CB3311
A7R105	2100-3253	3	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	72-111-0
A7R106	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R107	0757-0457	1	RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4752-F
A7R108	0757-0437	3	RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A7R109	0684-1021	12	RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A7R110	0684-2221		RESISTOR 2.2K 10% .25W FC TC=+400/+700	01121	CB2221
A7R111	0757-0474	1	RESISTOR 243K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2433-F
A7R112	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A7R113	0698-3158	2	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A7R114	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R115	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R116	0684-1511		RESISTOR 150 10% .25W FC TC=+400/+800	01121	CB1511
A7R117	2100-0568		RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	73138	72-102-0
A7R118	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R119	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R120	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R121	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R122	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R123	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R124	0684-1001		RESISTOR 10 10% .25W FC TC=+400/+800	01121	CB1001
A7R125	0684-1021		RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A7R126	0684-4711		RESISTOR 470 10% .25W FC TC=+400/+800	01121	CB4711
A7R127	0684-4721		RESISTOR 4.7K 10% .25W FC TC=+400/+700	01121	CB4721
A7R128	0684-1021		RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A7R129	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-3830-F
A7R130	0757-0435	5	RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A7R131	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A7R132	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A7R133	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A7R134	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MFBC1/8-T0-1332-F
A7R135	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A7R136	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A7R137	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R138	0757-0428	4	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A7R139	0757 0280		RESISTOR 1K 1% 125W F TC = 0 + -100	24546	C4-1/8-TO-1001-F
A7R140	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R141	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MFBC1/8-T0-6191-F
A7R142	0684-4721		RESISTOR 4.7K 10% .25W FC TC=+400/+700	01121	CB4721
A7R143	0684-4721		RESISTOR 4.7K 10% .25W FC TC=+400/+700	01121	CB4721
A7R144	0684-4711		RESISTOR 470 10% .25W FC TC=+400/+650	01121	CB4711
A7R145	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R146	0757 0416		RESISTOR 511 1% 125W F TC = 0 + -100	24546	C4-1/8-TO-511R-F
A7R147	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R148	0757-0419	3	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A7R149	0684-1021		RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A7R150	0757-0391	1	RESISTOR 39.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-39R2-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R151	0686-1011		RESISTOR 100 10% .25W FC TC=-400/+900	01121	CB1011
A7R152	0757-0466		RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A7R153	0686-4701		RESISTOR 47 10% .25W FC TC=-400/+900	01121	CB4701
A7R154	0686-4711		RESISTOR 470 10% .25W FC TC=-400/+800	01121	CB4711
A7R155	0757-0466	1	RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A7R156	0686-2701		RESISTOR 27 10% .25W FC TC=-400/+900	01121	CB2701
A7R157	0686-1811	1	RESISTOR 180 10% .25W FC TC=-400/+800	01121	CB1811
A7R158	0686-1001		RESISTOR 10 10% .25W FC TC=-400/+900	01121	CB1001
A7R159	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R160	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A7R161	2100-3207		RESISTOR-VAR 5K	28480	2100-3207
A7S1	3101-1906	1	SWITCH-PB 6-STATION 10MM C-C SPACING	28480	3101-1906
A7S2	3101-1909	2	SWITCH-PB 6-STATION 10MM C-C SPACING	28480	3101-1909
A7S3	3101-1907	2	SWITCH-PB 4-STATION 10MM C-C SPACING	28480	3101-1907
A7U1	1826-0039	4	IC OP AMP	27014	LM301AH
A7U2	5081-3019	2	IC (NOT SUPPLIED W/A7 -ORDER SEPARATELY)	28480	5081-3019
A7U3	1820-1211	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A7W1	01740-61605	1	CABLE ASSEMBLY, GATE DRIVE	28480	01740-61605
A7XU1	1200-0763	1	SOCKET-IC 8-CONT DIP-SLDR	04507	133-98-92-001
A7XU2	1200-0438	2	SOCKET-IC 16-CONT DIP-SLDR	01380	583529-1
A8	01740-66532	1	MAIN SHEEP ASSEMBLY	28480	01740-66532
A8C1	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C3	0180-0197	9	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C5	0140-0218	2	CAPACITOR-FXD 160PF +-2% 300VDC MICA	72136	DM15F161G300HV1CR
A8C6	0160-2204		CAPACITOR-FXD 100PF +-5% 1 0VDC MICA0+70	28480	0160-2204
A8C7			NOT ASSIGNED		
A8C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C9	0160-3226	2	CAPACITOR-FXD .01UF +-10% 400VDC	28480	0160-3226
A8C10	0160-3726	2	CAPACITOR-FXD 1UF +-10% 40VDC MET-POLYC	28480	0160-3726
A8C11	0180-0481	1	CAPACITOR-FXD 100UF+-10% 20VDC TA	56289	109D107X9030T2
A8C12	0140-0190	1	CAPACITOR-FXD 39PF +-5% 300VDC	72136	DM15E390J0300HV1CR
A8C13	0140-0207	1	CAPACITOR-FXD 330PF +-5% 500VDC MICA	72136	DM15F331J0500HV1CR
A8C14	0160-0155	1	CAPACITOR-FXD 33000PF +-10% 200VDC POLYE	56289	292P33292
A8C15	0160-0194	1	CAPACITOR-FXD .015UF +-10% 200VDC POLYE	56289	292P15392
A8C16	0180-2079	1	CAPACITOR-FXD .39UF+-10% 35VDC TA	56289	150D394X9035A2
A8C17	0180-1745	2	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A8C18	0180-2111	1	CAPACITOR-FXD 33UF+-10% 35VDC TA	56289	150D336X9035B2
A8C19	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C21	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8L1	9140-0105		COIL-MLD 5.2UH 10% Q=30 .155DX.375LG	28480	9140-0105
A8L2	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A8Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q3	1853-0244	2	TRANSISTOR PNP SI PD=310MW FT=600MHZ	28480	1853-0244
A8Q4	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q5	1855-0061		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A8Q6	1854-0019	4	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q7	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A8Q8	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=600MHZ	28480	1854-0071
A8Q10	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A8Q11	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q12	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q13	1854-0691		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0691
A8R1	0686-3901	8	RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A8R2	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A8R3	0757-0807		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A8R4	0686-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A8R5	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A8R6	0686-8201	1	RESISTOR 82 10% .25W FC TC=-400/+500	01121	CB8201
A8R7	0757-0428		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A8R8	0686-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A8R9	0686-2291	2	RESISTOR 2.2K 10% .25W FC TC=-900/+1100	01121	CB2291
A8R10			NOT ASSIGNED		

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R11			NOT ASSIGNED		
A8R12	2100-3...	7	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R13	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R14	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R15	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A8R16	0757-0880		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A8R17	0698-6450	2	RESISTOR 2.5K .1% .125W F TC=0+-50	24546	NC55
A8R18	0698-5449	3	RESISTOR 5K .1% .125W F TC=0+-50	19701	MFGC1/8-T2-5001-B
A8R19	0698-6157	2	RESISTOR 10K .1% .125W F TC=0+-50	24546	NC55
A8R20	0698-6942	2	RESISTOR 25K .1% .125W F TC=0+-50	24546	NC55
A8R21	0698-5450	2	RESISTOR 50K .1% .125W F TC=0+-50	19701	MFGC1/8-T2-5002-B
A8R22	0698-6158	2	RESISTOR 100K .1% .125W F TC=0+-50	24546	NC55
A8R23	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1031
A8R24	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A8R25			NOT ASSIGNED		
A8R26	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A8R27	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A8R28	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A8R29	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A8R30	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A8R31	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A8R32	0757-0273	2	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3001-F
A8R33	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A8R34	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A8R35	0684-3311		RESISTOR 330 10% .25W FC TC=-400/+600	01121	CB3311
A8R36	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A8R37	0684-6821		RESISTOR 6.8K 10% .25W FC TC=-400/+700	01121	CB6821
A8R38	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A8R39	0757-0420	6	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A8R40	0757-0454	2	RESISTOR 33.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3322-F
A8R41	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2705
A8R42	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2705
A8R43	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8S1MP1	01740-61901	1	SWITCH ASSY, ROTARY, MALE	28480	01740-61901
A8S1MP2	01740-61902	1	SWITCH ASSY, ROTARY, FEMALE	28480	01740-61902
A8S1MP3	01840-28502	2	ROLLER, DETENT	28480	01840-28502
A8S1MP4	1460-1148	2	SPRING-TRSN MUN CD	28480	1460-1148
A8U1	1826-0086	1	IC 776 OP AMP	07263	776HC
A8XA7	1251-0589	2	CONNECTOR 10-PIN F POST TYPE	27264	09-52-3101
A8XU1	1200-0475	2	CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	06749	75040-007
A9	01740-66522	1	DELAYED SWEEP ASSEMBLY	28480	01740-66522
A9C1	0160-2250	1	CAPACITOR-FXD 5.1PF +-.25PF 500VDC	28480	0160-2250
A9C2	0610 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0610 2055
A9C3	0610 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0610 2055
A9C4	0160-2204		CAPACITOR-FXD 100PF +-5% 300VDC MICA+70	28480	0160-2204
A9C5			NOT ASSIGNED		
A9C6	0160 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160 2055
A9C7	0160-0218		CAPACITOR-FXD 180PF +-2% 300VDC MICA	72136	DM15F181G300WV1CR
A9C8	0160-3226		CAPACITOR-FXD .01UF +-10% 400VDC	28480	0160-3226
A9C9	0160-3724		CAPACITOR-FXD 1UF +-10% 400VDC MET-POLYC	28480	0160-3724
A9C10	0160 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160 2055
A9C11	0180-2148	1	CAPACITOR-FXD .47UF+-20% 50VDC TA	56289	150D474X0050A2
A9C12			NOT ASSIGNED		
A9C13			NOT ASSIGNED		
A9C14	0160 2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160 2055
A9C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A9CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A9CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A9L1	9140-0105		COIL-MLD 6.8UH 10% Q=50 .155DX.375LG	28480	9140-0105
A9P1	1251-3072	1	CONNECTOR 12-PIN M POST TYPE	27264	09-56-1121
A9Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A9Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A9Q3	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A9Q4	1853-0244		TRANSISTOR PNP SI PD=310MW FT=500MHZ	28480	1853-0244
A9Q5	1854-0691		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0691
A9Q6	1853-0081		TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A9Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A9R1	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A9R2	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	03298	C4-1/8-T0-151-F
A9R3	0757-0834	1	RESISTOR 5.62K 1% .5W F TC=0+-100	02995	MF7C1/2-T0-5621-F
A9R4	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A9R5	0757-0193	1	RESISTOR 3.32K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-3321-F

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R6	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A9R8			NOT ASSIGNED		
A9R9			NOT ASSIGNED		
A9R10	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89P5K
A9R11	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89P5K
A9R12	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A9R13	0757-0460		RESISTOR 7.5K 1% .25W F TC=0+-100	24546	C4-1/8-T0-7501-F
A9R14	0698-6450		RESISTOR 2.5K .1% .125W F TC=0+-50	24546	NC55
A9R15	0698-5449		RESISTOR 5K .1% .125W F TC=0+-50	19701	MFAC1/8-T2-5001-B
A9R16	0698-4157		RESISTOR 10K .1% .125W F TC=0+-50	24546	NC55
A9R17	0698-4962		RESISTOR 25K .1% .125W F TC=0+-50	24546	NC55
A9R18	0698-5450		RESISTOR 50K .1% .125W F TC=0+-50	19701	MFAC1/8-T2-5002-B
A9R19	0698-6158		RESISTOR 100K .1% .125W F TC=0+-50	24546	NC55
A9R20	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A9R21	0683-0475		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB4705
A9R22	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A9R23	0684-1031		RESISTOR 1K 10% .25W FC TC=-400/+700	01121	CB1031
A9R24	0757-0400	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A9R25	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A9R26			NOT ASSIGNED		
A9R27	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB2705
A9R28	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89P5K
A9S1MP1	01740-61903	1	SWITCH ASSY, ROTARY, MALE	28480	01740-61903
A9S1MP2	01740-61904	1	SWITCH ASSY, ROTARY, FEMALE	28480	01740-61904
A9S1MP3	01860-22502		ROLLER, DETENT	28480	01860-22502
A9S1MP4	1460-1148		SPRING-TRSN MUW CD	28480	1460-1148
A9U1	1826-0045	1	IC OP AMP	28480	1826-0045
A9XA10	1251-3350	1	CONNECTOR 3-PIN F POST TYPE	22526	65609-003
A9XU1	1200-0475		CONNECTOR-SGL CONT SKT .018-IN-BRC-BZ	06749	75000-007
A10	01740-66608	1	BOARD ASSY, DELAYED TRIGGER	28480	01740-66608
A10C1	0150-0070		CAPACITOR FXD 02UF +-20% 500WVDC CER	28480	0150-0070
A10C2	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A10C3	0160-2055		CAPACITOR-FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10C4	0160-2055		CAPACITOR-FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10C5			NOT ASSIGNED		
A10C6	0160-2204		CAPACITOR FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A10C7	0160-2055		CAPACITOR-FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10C8	0180-0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A10C9	0160-2055		CAPACITOR FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10C10	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9030A2
A10C11	0160-2055		CAPACITOR-FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10C12	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A10C13	0150-0048	2	CAPACITOR-FXD 22PF +-5% 500WVDC TI DIOX	06121	TYPE QC
A10C14	0160-2055		CAPACITOR-FXD 01UF +80-20% 100WVDC CER	28480	0160-2055
A10CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR5			NOT ASSIGNED		
A10CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR8	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1920-0016
A10L1	9140-0105		COIL-FXD MOLDED RF CHOKE 8.2UH 10%	24226	157B21
A10P1			NSR		
A10Q1	1855-0262	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0262
A10Q2			NOT ASSIGNED		
A10Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A10Q4	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A10Q5	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A10Q6	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A10Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A10Q8	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A10Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A10Q10	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A10R1	0757-0465		RESISTOR 100K 1% 125W F	24546	C4 1.8 TO-1003 F
A10R2	0757-0488		RESISTOR 909K 1% 125W F TC=0+-100	24546	NA4
A10R3	0684-3901		RESISTOR 39 10% 25W CC	01121	CB3901
A10R4	0684-3901		RESISTOR 39 10% 25W CC	01121	CB3901
A10R5	0757-0407		RESISTOR 200 1% 125W F	24546	C4 1/8 TO 201 F
A10R6	0757-0419		RESISTOR 681 1% 125W FC TC=-400/+600	24546	C4-1/8-TO 681R-F
A10R7	0698-3433		RESISTOR 200 1% 125W F	24546	C4-1/8-TO-201-F
A10R8	0684-4721		RESISTOR 4.7K 10% .25W CC	01121	CB4721
A10R9	2100-3351		RESISTOR-VAR TRMR 500 OHM 10% C SIDE ADJ	73138	72XR500
A10R10	2100-3434		RESISTOR-VAR CONTROL CC 50K 10% LIN	01121	70M4N048P503U
A10R11	0757-0283	3	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A10R12			NOT ASSIGNED		

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10R13	0757 0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-TO-2433-F
A10R14	0684 4721		RESISTOR 4.7K 10% .25W CC	01121	CB4721
A10R15	0757 0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1501-F
A10R16	0698 3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-TO-2BR7-F
A10R17	0698 3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-TO-2BR7-F
A10R18	0698 3152		RESISTOR 3.48K 1% .125W F	16299	C4-1/8-TO-3481-F
A10R19	0757 0438		RESISTOR 5.11K 1% .125W F	24546	C4-1/8-TO-5111-F
A10R20	0684 1531	1	RESISTOR 15K 10% .25W FC TC=-400/+800	01121	CB1531
A10R21	0757 0420		RESISTOR 750 1% .125W F	24546	C4-1/8-TO-751-F
A10R22	0757 0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A10R23	0757 0420		RESISTOR 750 1% .125W F	24546	C4-1/8-TO-751-F
A10R24	0757 0438		RESISTOR 5.11K 1% .125W F	24546	C4-1/8-TO-5111-F
A10R25	0684 6811		RESISTOR 680 10% .25W FC TC=-400/+600	01121	CB6811
A10R26	0684 6811		RESISTOR 680 10% .25W FC TC=-400/+600	01121	CB6811
A10R27	0757 0200		RESISTOR 6.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6621-F
A10R28	0757 0420		RESISTOR 750 1% .125W F	24546	C4-1/8-TO-751-F
A10R29	0757 0418		RESISTOR 619 1% .125W F	24546	C4-1/8-TO-619R-F
A10R30	0757 0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3321-F
A10R31	0757 0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A10R32	0757 0420		RESISTOR 750 1% .125W F	24546	C4-1/8-TO-751-F
A10R33	0684 1001		RESISTOR 10 10% .25W CC	01121	CB1001
A10R34	0684 1001		RESISTOR 10 10% .25W CC	01121	CB1001
A10R35	0684 3901		RESISTOR 39 10% .25W CC	01121	CB3901
A10R36	0698 0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2611-F
A10R37	0757 0488		RESISTOR 909K 1% .125W F TC=0+-100	24546	NA4
A10R38	0757 0465		RESISTOR 100K 1% .125W F	24546	C4-1/8-TO-1003-F
A10R39	0684 1011	3	RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A10R40	0684 1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A10R41	0757 0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1621-F
A10S1	3101 1904		SWITCH-PB 6STA .304 IN-CTRS .4A 115VAC	28480	3101 1904
A10U1	5081 3019		INTEGRATED CIRCUIT, SEALED PACKAGE	28480	5081 3019
A10VR1	1902 3082		DIODE ZENER 4.64V PD=.4W	04713	SZ10939-86
A11	01740-66533	1	HORIZONTAL OUTPUT ASSEMBLY	28480	01740-66533
A11C1	0610-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0610-2055
A11C2	0610-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0610-2055
A11C3	0160-3665	9	CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C4	0160-3502	2	CAPACITOR-FXD .39PF +-5% 500VDC T DIOX	02114	TYPE JM
A11C5	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C6	0140-0192		CAPACITOR-FXD 68PF +-5% 300VDC	72136	DM15E680J300WVLCR
A11C7	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C8	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C9	0140-0192		CAPACITOR-FXD 68PF +-5% 300VDC	72136	DM15E680J300WVLCR
A11C10	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C11	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C12	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A11C13	0160-3502		CAPACITOR-FXD .39PF +-5% 500VDC T DIOX	02366	TYPE JM
A11C14	0140-0192		CAPACITOR-FXD 68PF +-5% 300VDC	72136	DM15E680J300WVLCR
A11E1	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A11E2	9170-0029		CORE-SHIELDING BEAD	01887	56-590-65A2/4A
A11HP1	1205-0095	2	HEAT SINK TO-5/TO-39-PKG	28480	1205-0095
A11Q1	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q2	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A11Q3	1854-0619	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0619
A11Q4	1853-0038	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A11Q5	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A11Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q7	1853-0232	2	TRANSISTOR PNP SI TO-39 PD=1W FT=800MHZ	28480	1853-0232
A11Q8	1854-0523	2	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A11R1	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A11R2	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A11R3	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A11R4	0757-0845	4	RESISTOR 18.2K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1822-F
A11R5	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A11R6	0683-0685	2	RESISTOR 6.8 5% .25W FC TC=-400/+500	01121	CB6805
A11R7	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A11R8	0683-6835	2	RESISTOR 68K 5% .25W FC TC=-400/+800	01121	CB6835
A11R9	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-TO-200-F
A11R10	2100-3273	4	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-104-0
A11R11	0757-0468	2	RESISTOR 47.5K 1% .25W F TC=0+-100	27167	C8-1/4-TO-4752-F
A11R12	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A11R13	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-TO-332R-F
A11R14	0683-6835		RESISTOR 68K 5% .25W FC TC=-400/+800	01121	CB6835
A11R15	2100-3273		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-104-0

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R16	0757-0807		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A11R17	0757-0788		RESISTOR 47.5K 1% .25W F TC=0+-100	27167	C5-1/4-T0-4752-F
A11R18	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A11R19	0757-0811		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A11R20	0683-0885		RESISTOR 8.8 5% .25W FC TC=-400/+500	01121	CB8865
A11R21	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A11R22	0684-4721		RESISTOR 4.7K 10% .25W FC TC=+400/+700	01121	CB4721
A11R23	0757-0845		RESISTOR 18.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1822-F
A11R24	0683-1825	1	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A11R25	0757-0845		RESISTOR 18.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1822-F
A11R26	0757-0845		RESISTOR 18.2K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1822-F
A11XA7	1251-0649	3	CONNECTOR 15-PIN F POST TYPE	27264	09-52-3151
A12	01740-66503	1	GATE ASSEMBLY	28480	01740-66503
A12C1	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A12C2	0140-0165	3	CAPACITOR-FXD .056UF +-10% 200VDC POLYE	56289	292P56392
A12C3	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A12C4	0160-3665		CAPACITOR-FXD .01UF +80-20% 500VDC CER	28480	0160-3665
A12C5	0140-0165		CAPACITOR-FXD .056UF +-10% 200VDC POLYE	56289	292P56392
A12C6	0160-3452	3	CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3452
A12C7	0140-0196		CAPACITOR-FXD 150PF +-5% 300VDC MICA 0+70	72136	DM15F151J0300WV1CR
A12C8			NOT ASSIGNED		
A12C9	0160-3452		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3452
A12C10	0160-3452		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3452
A12C11	-0478	1	CAPACITOR-V TRMR-AIR 2.2-34PF 350V	74970	189-0010-008
A12CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12HP1	1205-0095		HEAT SINK TO-5/TO-39-PKG	28480	1205-0095
A12HP2	01801-01206			28480	01801-01206
A12HP3	1200-0185	1	INSULATOR-XSTR NYLON	02606	77[illegible]-08N TO
A12P1	1251-3319	1	CONNECTOR 10-PIN M POST TYPE	27264	09-64-1101
A12Q1	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A12Q2	1853-0232		TRANSISTOR PNP SI TO-19 PD=1W FT=200MHZ	28480	1853-0232
A12Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SP[illegible] 3611
A12Q4	1854-0271		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A12R1	0684-1231	2	RESISTOR 12K 10% .25W FC TC=-400/+800	01121	CB1231
A12R2	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A12R3	2100-3023	1	RESISTOR-VAR CONTROL CCP 10K 20% LIN	28480	2100-3023
A12R4	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A12R5	0698-3159	1	RESISTOR 20.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2012-F
A12R6	0698-3158		RESISTOR 83.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8371-F
A12R7	0757-0128	1	RESISTOR 39.2K 1% .125W F TC=0+-100	01121	CC
A12R8	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A12R9	0757-0737	1	RESISTOR 1.62K 1% .25W F TC=0+-100	27167	C5-1/4-T0-1621-F
A12R10	0698-3646	1	RESISTOR 12F 5% 2W MO TC=0+-200	27167	FP42-2-T00-12R2-J
A12R11	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A12R12	2100-3273		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-144-0
A12R13	0757-0843	1	RESISTOR 15K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1502-F
A12R14	0687-1211	1	RESISTOR 120 10% .5W CC TC=0+520	01121	CB1211
A12R15	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A12R16	2100-3353	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	33A0X-T00-203
A12R17	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A12R18	0684-4731	2	RESISTOR 47K 10% .25W FC TC=-400/+[illegible]	01121	CB4731
A12R19	0684-3931	2	RESISTOR 39K 10% .25W FC TC=-400/+6[illegible]	01121	CB3931
A12R20	0684-3331	1	RESISTOR 33K 10% .25W FC TC=-400/+800	01121	CB3331
A12R21	0684-2211	1	RESISTOR 220 10% .25W FC TC=-400/+600	01121	CB2211
A12R22	2100-3028	1	RESISTOR-VAR CONTROL CCP SW 30K LIN	28480	2100-3028
A12S1	3101-1787	1	SWITCH-PB DPDT MOM 1A 300VAC	28480	3101-1787
A12U1	1821-0001	2	TRANSISTOR ARRAY	01921	CA3046
A12VR1	1902-0025	2	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	07263	FZT720
A12VR2	1902-3345	1	DIODE-ZNR 51.1V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-386
A12XA16	1251-0649		CONNECTOR 15-PIN F POST TYPE	27264	09-52-3151
A12XU1	1200-0474	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A13	01740-66516	1	VERTICAL LOGIC ASSEMBLY	28480	01740-66516
A13R1	0757-0282	3	RESISTOR 221 1% .125W [illegible] TC=0+-100	24546	C4-1/8-T0-221R-F
A13R2	0757-0282		RESISTOR 221 1% .125W [illegible] TC=0+-100	24546	C4-1/8-T0-221R-F

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13S1	3101-1908	1	SWITCH-PB 8-STATION 10MM C-C SPACING	28480	3101-1908
A13S2	3101-1907		SWITCH-PB 4-STATION 10MM C-C SPACING	28480	3101-1907
A13XA3P3	1251-3900	2	CONNECTOR 8-PIN POST TYPE	27264	09-52-3083
A13XA3P4	1251-3900		CONNECTOR 8-PIN POST TYPE	27264	09-52-3083
A14	01740-66540	1	INTERFACE ASSEMBLY (STANDARD)	28480	01740-66540
A14XA3	1251-0477	2	CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW	03394	91-6912-1700-00
A14XA7	1251-0213	2	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	03394	91-6915-1700-00
A14XA10	1251-5092	1	CONNECTOR 15-PIN P POST TYPE	28480	1251-5092
A14	01740-66541	1	INTERFACE ASSEMBLY (OPTION 101 ONLY) NOTE: THE FOLLOWING A14 ASSY PARTS ARE USED WITH OPT 101 ASSY ONLY)	28480	01740-66541
A14C1	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA-70	72136	DM15F391J0300WV1CR
A14C2	0140-0178	1	CAPACITOR-FXD 560PF +-2% 300VDC MICA	72136	DM15F561G*00WV1CR
A14CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14Q1	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A14Q2	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A14Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A14Q4	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A14Q5	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A14R1	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A14R2	0684-1031		RESISTOR 10K 10% .25W PC TC=-400/+700	01121	CB1031
A14R3	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A14R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R5	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A14R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A14R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R8	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A14R9	0757-0274	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A14R10	0684-1011		RESISTOR 100 10% .25W PC TC=-400/+900	01121	CB1011
A14R11	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R12	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A14R13	0757-0408		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-261R-F
A14R14	0757-0438		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A14R15	0757-0408		RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-261R-F
A14R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R17	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A14R18	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A14XA3	1251-0477		CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW	03394	91-6912-1700-00
A14XA7	1251-0213		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	03394	91-6915-1700-00
A14XA10	1251-5092		CONNECTOR 15-PIN P POST TYPE	28480	1251-5092
A15	01740-66502	1	HIGH VOLTAGE POWER SUPPLY ASSEMBLY	28480	01740-66502
A15C1	0180-1794	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	56289	150D226X9035R2
A15C2	0160-2264	1	CAPACITOR-FXD 20-P +-5% 500VDC CER+-30	28480	0160-2264
A15C3	0180-0269	1	CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A15C4	0160-0684	2	CAPACITOR-FXD 1000PF +-20% 4KVDC	28480	0160-0684
A15C5	0160-4051	1	CAPACITOR-FXD .01UF +-20% 4KVDC	28480	0160-4051
A15C6	0160-0544	1	CAPACITOR-FXD .022UF +-20% 4KVDC	28480	0160-0544
A15C7	0160-0588	1	CAPACITOR-FXD .068UF +-20% 4KVDC	56289	430P683D40
A15C8	0160-0684		CAPACITOR-FXD 1000PF +-20% 4KVDC	28480	0160-0684
A15C9	0160-4079	1	CAPACITOR-FXD 1500PF +-20% 4KVDC	28480	0160-4079
A15C10	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A15C11	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A15C12	0170-0040	1	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
A15C13	0160-3443		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-3443
A15C14	0160-0165		CAPACITOR-FXD .056UF +-10% 200VDC POLYE	56289	292P56392
A15C15	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A15C16	0160-0165	2	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	56289	292P10492
A15C17	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A15CR1	1901-0028	4	DIODE-PWR RECT 400V 750MA DO-29	02713	SPS93
A15CR2	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	02713	SPS93
A15CR3	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	02713	SPS93
A15CR4	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	02713	SPS93
A15CR5	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	02713	SPS93

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15CR6	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	02713	MP493
A15CR7	1901-0683	1	DIODE-HV RECT 10KV 5MA 250NS	28480	1901-0683
A15CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A15DS1	2140-0013	2	LAMP-GLOW SUB-MIN 70/57VDC 300UA T-2-BULB	74276	NE83A
A15DS2	2140-0013		LAMP-GLOW SUB-MIN 70/57VDC 300UA T-2-BULB	74276	NE83A
A15F1	2110-0269	1	FUSE-CLOSER-CLIP TYPE .25D-FUSE	28480	2110-0269
A15F1	2110-0007	2	FUSE 1A 250V SLO-BLO 1.25X.25 UL IEC	75915	313001
A15L1	9140-0171	1	COIL-MLD 40UH 10% Q=20 .296DX.968LG	28480	9140-0171
A15L2	9140-0210	1	COIL-MLD 100UH 5% Q=50 .1550X.375LG	02172	15-131B-12J
A15L3	9140-0129	1	COIL-MLC 220UH 5% Q=65 .1590X.375LG	02172	15-133B-20J
A15MP1	5040-0402	1	MOUNT,TRANSFORMER	28480	5040-0402
A15MP2	5040-0430	1	MOUNT,TRANSFORMER	28480	5040-0430
A15Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A15Q2	1853-0066	1	TRANSISTOR PNP SI TO-92 PD=625MW	28480	1853-0066
A15R1	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+900	01121	CB1021
A15R2	2100-3253		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	72-111-0
A15R3	0757-0485	1	RESISTOR 681K 1% .125W F TC=0+-100	05624	CMF-55-1
A15R4	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A15R5	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A15R6	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A15R7	0698-4112	1	RESISTOR 549 1% 25W F TC 0 + 100	05524	CMF 1/4 T1 5490 F
A15R8	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A15R9	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A15R10	0683-1065	1	RESISTOR 10M 5% .25W FC TC=+900/+1100	01121	CB1065
A15R11	0687-1531	1	RESISTOR 15K 10% .5W CC TC=0+705	01121	EB1531
A15R12	0687-3301	1	RESISTOR 33 10% .5W CC TC=0+412	01121	EB3301
A15R13	0698-8018	1	RESISTOR 30M 1% 3W CP TC=0+-100	03888	PVC175-3-T0-3004-F
A15R14	0684-6831	1	RESISTOR 68K 10% .25W FC TC=-400/+800	01121	CB6831
A15R15	0698-5353	1	RESISTOR 8.25M 5% 1W CP TC=0-2000	03888	PVC70
A15R16	0698-6580	1	RESISTOR 16.25M 5% 1W CP TC=0-3500	03888	PVC70
A15R17	0687-1011	1	RESISTOR 100 10% .5W CC TC=0+529	01121	EB1011
A15R18	0687-5611	1	RESISTOR 560 10% .5W CC TC=0+829	01121	EB5611
A15R19			NOT ASSIGNED		
A15R20	0683-2265	1	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A15R21	0757-0488		RESISTOR 909K 1% .125W F TC=0+-100	05624	CMF-55-1
A15R22	0757-0469	1	RESISTOR 150K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1503-F
A15R23	0684-1041	4	RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A15R24	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A15R25	0684-3931		RESISTOR 39K 10% .25W FC TC=-400/+800	01121	CB3931
A15R26	2100-3355	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	73138	72-150-0
A15R27	2100-3207	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	73138	72-145-0
A15R28	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A15R29	0757-0914	1	RESISTOR 390 2% .125W F TC=0+-100	24546	C4-1/8-T0-391-G
A15R30	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A15R31	0699-3849	1	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A15R32	0757-0471	1	RESISTOR 182K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1823-F
A15R33	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A15R34	0683-1025	1	RESISTOR 1M 5% .25W FC TC=-400/+600	01121	CB1025
A15T1	01740-61101	1	TRANSFORMER	28480	01740-61101
A15U1	1826-0167	1	IC OP AMP	01821	CA3094AT
A15VR1	1902-3256	1	DIODE-ZNR 23.7V 5% DO-7 POM,4W TC=+.078%	07263	PZT29A
A15VR2	1902-0766	1	DIODE-ZNR 10.2V 5% DO-7 POM,4W TC=+.068%	07263	PZT28A
A15XA12	1251-0589		CONNECTOR 10-PIN F POST TYPE	27264	09-52-3101
A16	01740-66542	1	LOW VOLTAGE POWER SUPPLY ASSEMBLY	28480	01740-66542
A16C1	0140-0208	1	CAPACITOR-FXD 680PF +-5% 300VDC MICA+-70	72136	DM15F681J0300WV1CR
A16C2	0160-0168		CAPACITOR-FXD .1UF +-10% 200VDC POLYE	56289	292P10492
A16C3	0180-1827	1	CAPACITOR-FXD 50UF+50-10% 25VDC AL	56289	30D506F250JE4
A16C4	0180-0089	1	CAPACITOR-FXD 10UF+50-10% 150VDC AL	56289	30D106F150DD2
A16C5	0180-1866	1	CAPACITOR-FXD 500UF+75-10% 75VDC AL	56289	39D507G075ML4
A16C6	0180-0091	1	CAPACITOR-FXD 10UF+50-10% 100VDC AL	56289	30D106F100DC2
A16C7	0180-2500	1	CAPACITOR-FXD 1500UF+75-10% 10VDC AL	37942	T71S2U016G1C3P
A16C8	0180-0583	1	CAPACITOR-FXD 6000UF+75-10% 30VDC AL	28480	0180-0583
A16C9	0160-2211	3	CAPACITOR-FXD 510PF +-5% 300VDC MICA+-70	28480	0160-2211
A16C10	0180-0059	2	CAPACITOR-FXD 10UF+75-10% 25VDC AL	56289	30D106G025BB2
A16C11	0180-0443	1	CAPACITOR-FXD 5300UF+75-10% 15VDC AL	28480	0180-0443
A16C12	0160-2211		CAPACITOR-FXD 510PF +-5% 300VDC MICA+-70	28480	0160-2211
A16C13	0180-0381	1	CAPACITOR-FXD 85UF+75-10% 12VDC AL	56289	30D258G012BB2
A16C14	0180-0576	1	CAPACITOR-FXD 3500UF+75-10% 30VDC AL	56289	39D358
A16C15	0160-2211		CAPACITOR-FXD 510PF +-5% 300VDC MICA+-70	28480	0160-2211

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16C16	0180-0039		CAPACITOR-FXD 10UF+75-10% 25VDC AL	56289	30D106G025BP2
A16C17	0180-0039	1	CAPACITOR-FXD 100UF+75-10% 12VDC AL	56289	30D107G012CC2
A16C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A16C19	0160-3451		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3451
A16C20	0180-0100	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A16CR1	1906-0006	4	DIODE-FW BRDG 400V 1A	28480	1906-0006
A16CR2	1906-0006		DIODE-FW BRDG 400V 1A	28480	1906-0006
A16CR3	1906-0006		DIODE-FW BRDG 400V 1A	28480	1906-0006
A16CR4	1906-0048	2	DIODE-FW BRDG 100V 5A	28480	1906-0048
A16CR5	1906-0048		DIODE-FW BRDG 100V 5A	28480	1906-0048
A16CR6	1906-0006		DIODE-FW BRDG 400V 1A	28480	1906-0006
A16CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16E1	0340-0511	2	INSULATOR-XSTR KAPTON	02608	413-77-2
A16MP1	1400-0747	2	CABLE TIE .062-.4-DIA .184-WD NYL	59730	TY-28M-0
A16MP2	1400-0747		CABLE TIE .062-.4-DIA .184-WD NYL	59730	TY-28M-0
A16MP3	1400-0249	1	CABLE TIE .062-.625-DIA .091-WD NYL	14956	08A74 BOX PACKAGE
A16P1	1251-3902	1	CONNECTOR 12-PIN M POST TYPE	27264	09-65-1121
A16P2	1251-6003	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-6003
A16P3	1251-3901		CONNECTOR 15-PIN M POST TYPE	27264	09-65-1151
A16P4	1251-3750		CONNECTOR 10-PIN M POST TYPE	27264	09-65-1101
A16P5	1251-3102	1	CONNECTOR 3-PIN M	28480	1251-3102
A16Q1	1853-0336	2	TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A16Q2	1853-0336		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A16Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A16Q4	1854-0575	1	TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPSA42
A16Q5	1853-0080	2	TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A16Q6	1853-0080		TRANSISTOR PNP SI PD=300MW FT=30MHZ	28480	1853-0080
A16Q7	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A16Q8	1854-0358	1	TRANSISTOR NPN SI PD=310MW FT=60MHZ	28480	1854-0358
A16Q9	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q10	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q11	1854-0872	1	TRANSISTOR NPN SI DARL PD=500MW	04713	MPSA14
A16Q12	1854-0558	2	TRANSISTOR NPN SI DARL PD=70MW FT=1MHZ	28480	1854-0558
A16R1	0757-0458		RESISTOR 33.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3322-F
A16R2	0699-0003	1	RESISTOR 8.2 10% .5W CC TC=0+412	01121	EB8Z1
A16R3	0684-1241	1	RESISTOR 120K 10% .25W FC TC=+800/+900	01121	CB1241
A16R4	0684-1031		RESISTOR 10K 10% .25W FC TC=+400/+700	01121	CB1031
A16R5	0698-3455		RESISTOR 261K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2613-F
A16R6	0698-4495	1	RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3742-F
A16R7	0684-1021		RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A16R8	0684-1041		RESISTOR 100K 10% .25W FC TC=+400/+800	01121	CB1041
A16R9	0757-0431	2	RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2431-F
A16R10	0811-1668	2	RESISTOR 1.5 5% 2W FW TC=0+-400	28480	RWW2-1R5-J
A16R11	0684-1231		RESISTOR 12K 10% .25W FC TC=+400/+800	01121	CB1231
A16R12	0684-1031		RESISTOR 10K 10% .25W FC TC=+400/+700	01121	CB1031
A16R13	0757-0450	1	RESISTOR 82.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A16R14	0698-3437	1	RESISTOR 12K .1% .125W F TC=0+-50	24546	NC55
A16R15	0684-1021		RESISTOR 1K 10% .25W FC TC=+400/+800	01121	CB1021
A16R16	0684-4731		RESISTOR 47K 10% .25W FC TC=+400/+800	01121	CB4731
A16R17			NOT ASSIGNED		
A16R18			NOT ASSIGNED		
A16R19			NOT ASSIGNED		
A16R20	2100-3253		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	72-111-0
A16R21	0684-8231	1	RESISTOR 82K 10% .25W FC TC=+400/+800	01121	CB8231
A16R22	0699-0721	1	RESISTOR 4.7K 10% .5W CC TC=0+847	01121	EB4721
A16R23	0757-0420		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A16R24	0811-1668		RESISTOR 1.5 5% 2W FW TC=0+-400	75042	RWW2-1R5-J
A16R25	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A16R26	2100-0596		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A16R27	0757-1093		RESISTOR 3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3001-F
A16R28	0698-3329		RESISTOR 10K .5% .125W F TC=0+-100	03888	PME55-1/8-T0-1002 D
A16R29	0698-3579	3	RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-T0-5001-D
A16R30	0811-1666	1	RESISTOR 1.5% 2W PW TC=0+-800	28480	0811-1666
A16R31	0684-3321		RESISTOR 3.3K 10% .25W FC TC=+400/+700	01121	CB3321
A16R32	0698-3579		RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-T0-5001-D
A16R33	0698-3579		RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-T0-5001-D
A16R34	0757-0431		RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2431-F
A16R35	0811-1667	1	RESISTOR 1.25% 2W PW TC=0+-800	28480	0811-1667
A16R36	0683-4715	2	RESISTOR 470 5% .25W FC TC=+400/+800	01121	CB4715
A16R37	0684-1011		RESISTOR 100 10% .25W FC TC=+400/+500	01121	CB1011
A16R38	0683-4715		RESISTOR 470 5% .25W FC TC=+400/+800	01121	CB4715
A16R39	0684-1011		RESISTOR 100 10% .25W FC TC=+400/+500	01121	CB1011
A16R40	0684-1041		RESISTOR 100K 10% .25W FC TC=+400/+800	01121	CB1041

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16R41	0757-0477	2	RESISTOR 332K 1% .125W F TC=0+-100	19701	MFC1/8-T0-3323-F
A16R42	0757-0477		RESISTOR 332K 1% .125W F TC=0+-100	19701	MFC1/8-T0-3323-F
A16R43	0757-0406		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-1620-F
A16R44	0757-0420	1	RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A16S1	3101-0555	1	SWITCH-PB DPDT ALTNG 6A 250VAC	28480	3101-0555
A16S2	3101-1914	1	SWITCH-SL 2-DPDT-MS STD 1.5A 250VAC PC	28480	3101-1914
A16U1	1820-0196	3	IC 723 V REGLTR	07263	723HC
A16U2	1820-0196		IC 723 V REGLTR	07263	723HC
A16U3	1820-0196		IC 723 V REGLTR	07263	723HC
A16VR1	1902-3068	1	DIODE-ZNR 3.48V 5% DO-7 POD,4W TC=+,058%	04713	SZ 10939-50
A16VR2	1902-0025		DIODE-ZNR 10V 5% DO-7 POD,4W TC=+,08%	07263	PZ7200
A16VR3	1902-3086	1	DIODE-ZNR 8.75V 2% DO-7 POD,4W TC=-,010%	04713	SZ 10939-90
A17	01742-66601	1	TIME INTERVAL DECODER	28480	01742-66601
A17C1	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C4	0180-1745		CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A17C5	0160-3406		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3406
A17C6	0180-0058	2	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A17C7	0180-0058		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A17CR3	1901-0513	3	DIODE-DUAL 100V	28480	1901-0513
A17CR4	1901-0513		DIODE-DUAL 100V	28480	1901-0513
A17CR5	1901-0535	1	DIODE-SCHOTTKY	28480	1901-0535
A17Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A17Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A17Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A17Q6	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q7	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q8	1854-0523		TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523
A17Q9	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A17Q10	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A17R2	0757-0282		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/8-T0-2210-F
A17R3	0757-0280		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A17R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R5	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A17R6	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A17R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R11	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A17R12	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A17R13	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A17R14	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R15	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R16	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A17R17	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R18	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R19	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R20	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A17R21	0684-2231	1	RESISTOR 22K 10% .25W FC TC=-400/+800	01121	CB2231
A17R24	0698-6688	2	RESISTOR 99.8K .1% .125W F TC=0+-25	24546	NE55
A17R25	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A17R26	0684-2251		RESISTOR 2.2K 10% .25W FC TC=-900/+1100	01121	CB2251
A17R27	0698-6688		RESISTOR 99.8K .1% .125W F TC=0+-25	24546	NE55
A17R28	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A17R29	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A17R30	2100-3274	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	73138	72-146-0
A17R31	0698-6600	1	RESISTOR 4.87K 1% .125W F TC=0+-25	24546	NE55
A17R32	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R33	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R34	0684-1061		RESISTOR 10M 10% .25W FC TC=-900/+1100	01121	CB1061
A17R35	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	73138	89P500
A17R36	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A17R37	0698-3156	1	RESISTOR 16.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1672-F
A17R38	0757-0465	1	RESISTOR 13K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1302-F
A17R39	2100-3273		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-144-0
A17R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17R41	0757-0467	1	RESISTOR 825K 1% .125W F TC=0+-100	06524	CMA-55-1
A17R42	2100-3044	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	73138	89PR100K
A17R43	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A17R44	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A17R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R46	0757-0412		RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-T0-3650-F
A17R47	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MFC1/8-T0-6191-F
A17R48	0757-0409	1	RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A17R49	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A17R50	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R51	0761-0030	1	RESISTOR 22K 5% 1W MO TC=0+-200	27167	PP-32
A17R52	0698-6977	1	RESISTOR 30K .1% .125W F TC=0+-25	24546	NE55
A17R53	0698-6360	1	RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A17R54	0698-5469		RESISTOR 5K .1% .125W F TC=0+-50	19701	MFC1/8-T2-5001-B
A17R55	0698-6368	1	RESISTOR 3K .1% .125W F TC=0+-25	24546	NE55
A17R56	0698-3491	1	RESISTOR 1K .1% .125W F TC=0+-50	24546	NC55
A17R57	0698-6517	1	RESISTOR 500 .1% .125W F TC=0+-25	03888	PME55-1/8-T9-500R-B
A17R58	0698-6265	1	RESISTOR 300 .1% .125W F TC=0+-50	24546	NC55
A17R59	0698-6363	2	RESISTOR 100 .1% .125W F TC=0+-50	24546	NC55
A17R60	0698-6363		RESISTOR 100 .1% .125W F TC=0+-50	24546	NC55
A17R61	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R62	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R63	0684 1011		RESISTOR 100 10% .25W	28480	0684 1011
A17R64	0684 1011		RESISTOR 100 10% .25W	28480	0684 1011
A17R65	0757 0439		RESISTOR 6.81K 1% .125W	28480	0757 0439
A17R66	0698 3438		RESISTOR 147 1% .125W	28480	0698 3438
A1781MP1	01722-61901	1	SWITCH, ROTARY, MALE	28480	01722-61901
A1781MP2	01722-61902	1	SWITCH, ROTARY, FEMALE	28480	01722-61902
A1781MP3	0510-1101	1	RETAINER-RING SNAP-E EXT .33-DIA BE-CU	28480	0510-1101
A17U1	1826-0059		IC OP AMP	27014	LM201AH
A17U2	1826-0059		IC OP AMP	27014	LM201AH
A17U3	1820-0803	1	IC 741 OP AMP	02763	741CE019
A17U4	1826-0059		IC OP AMP	27014	LM201AH
A17U7	1821 0001		TRANSISTOR ARRAY	01295	CA3046
A17U8	1820 1197	1	IC GATE TTL LS NAND QUAD 2 INP	01295	SN74LS00N
A17U9	1820 1112	1	IC FF TTL LS D TYPE POS EDGE TRIG	01921	SN74LS74N
A17XA7P6	1251 0649		CONNECTOR 16 PIN F POST TYPE	27264	09 52 4161

Table 6-3. List of Manufacturers' Codes

Mfr No.	Manufacturer Name	Address		Zip Code
01121	ALLEN BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01386	AMP INC	HARRISBURG	PA	17105
01887	FERROXCUBE CORP	SAUGERTIES	NY	12477
01921	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	07070
02172	AIRCO SPEER ELEK DIV AIR RDCN CO	NOGALES	AZ	85621
02306	AIRCO ELECTRONICS	BRADFORD	PA	16701
02332	C AND K COMPONENTS INC	WATERTOWN	MA	02172
02606	THERMALLOY CO	DALLAS	TX	75234
02713	GENERAL INSTR CORP SEMIDON PROD GP	HICKSVILLE	NY	11802
02763	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW	CA	94043
03259	STANFORD APPLIED ENGINEERING INC	SANTA CLARA	CA	95050
03316	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS	IN	46227
03394	METHODE ELETRONICS INC	CHICAGO	IL	60656
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04213	STIMPSON EDWIN B CO INC	BROOKLYN	NY	11705
04507	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VLGE	IL	60007
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
04931	GALILEO CORP OF AMERICA	NORTH PELHAM	NY	10803
05057	SWITCHCRAFT INC	CHICAGO	IL	60630
05624	DALE ELECTRONICS INC	COLUMBUS	NE	68601
05668	VITRAMON INC	BRIDGEPORT	CT	06601
05934	KABEL UND METALLWERKE NEUMEYER AG	NUERWBERG GERMANY		NA
06540	ASHLAND PRODUCTS CO	CHICAGO	IL	60628
06749	BERG ELEK DIV DUPONT	NEW CUMBERLAND	PA	17070
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
16428	BELDEN CORP	RICHMOND	IN	47374
16956	DENNISON MFG CO	FRAMINGHAM	MA	01701
18324	SIGNETICS CORP	SUNNYVALE	CA	94086
19701	MEPCO ELECTRA CORP	MINERAL WELLS	TX	76067
22526	BERG ELECTRONIC INC	CUMBERLAND	PA	17070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON	NC	28401
27264	MOLEX PRODUCTS CO	DOWNERS GROVE	IL	60515
28480	HP DIV 00 CORPORATE	PALO ALTO	CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
37942	MALLORY P R AND CO INC	INDIANAPOLIS	IN	46206
51642	CENTRE ENGINEERING INC	STATE COLLEGE	PA	16801
52763	STETTNER TRUSH INC	CAZENOVIA	NY	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
59730	THOMAS & BETTS CO THE	ELIZABETH	NJ	07207
71002	BIRNBACK CO INC	FREEPORT LI	NY	11520
71450	CTS CORP	ELKHART	IN	46514
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIAMANTIC	CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE	PA	16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON	CA	92634
74276	SIGNALITE DIV GENERAL INST CORP	NEPTUNE	NJ	07753
74970	JOHNSON E F CO	WASECA	MN	56093

See introduction to this section for ordering information

SECTION VII

MANUAL CHANGES

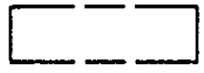
7-1. INTRODUCTION.

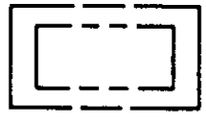
7-2. This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for additional important information about serial number coverage.

Table 8-1. Schematic Notes

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


ETCHED CIRCUIT BOARD


ASSEMBLY


ETCHED CIRCUIT BOARD ON ASSEMBLY

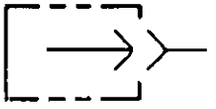
FRONT-PANEL MARKING

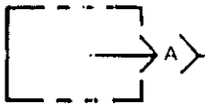
REAR-PANEL MARKING

MAIN SIGNAL PATH

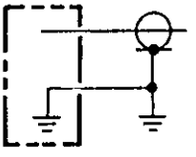
PRIMARY FEEDBACK PATH

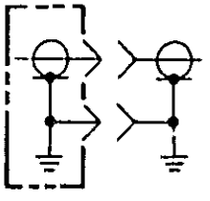
SECONDARY FEEDBACK PATH


SINGLE-PIN CONNECTOR ON BOARD



PIN OF A PLUG-IN BOARD (WITH LETTER OR NUMBER)


COAXIAL CABLE CONNECTED DIRECTLY TO BOARD


COAXIAL CABLE CONNECTED TO SNAP-ON JACK


FRONT-PANEL CONTROL

TEST POINT (TP WITH NUMBER)


SCREWDRIVER ADJUSTMENT

WAVEFORM TEST POINT (WITH NUMBER)


COMMON ELECTRICAL POINT (WITH LETTER); NOT NECESSARILY GROUND

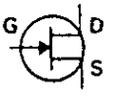
SIGNAL REFERENCE

SCHEMATIC REFERENCE


BREAKDOWN DIODE (VOLTAGE REGULATOR)


LIGHT EMITTING DIODE (LED)


TUNNEL DIODE



FIELD-EFFECT TRANSISTOR (N-TYPE BASE)


CIRCUITS OR COMPONENTS DRAWN WITH DASHED LINES (PHANTOM) SHOW FUNCTION ONLY AND ARE NOT INTENDED TO BE COMPLETE. THE CIRCUIT OR COMPONENT IS SHOWN IN DETAIL ON ANOTHER SCHEMATIC.

(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
NC	NO CONNECTION
P/O	PART OF

VF (A)	V - VOLTAGE
	F - FILTERED
	(A) - FILTER SOURCE

SECTION VIII

SERVICE

8-1. INTRODUCTION.

8-2. This section provides instructions for troubleshooting and repairing the Model 1742A Oscilloscope.

8-3. Detailed theory of operation and troubleshooting information are located opposite the schematics on foldout Service Sheets. Adjustment and assembly locations are shown in Section V of this manual. The remainder of this section has general service information that should help you service and repair the oscilloscope.

8-4. THEORY OF OPERATION.

8-5. Overall theory of operation appears on the foldout pages opposite the overall block diagram starting with Service Sheet 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. Table 8-1, Schematic Notes, explains any unusual symbols that appear on the schematics.

8-6. TROUBLESHOOTING.

WARNING

Maintenance and troubleshooting procedures described herein are performed with power applied to the instrument, and protective covers removed. Such maintenance and troubleshooting should be performed only by service-trained 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.

8-7. INITIAL TROUBLESHOOTING PROCEDURE. Before troubleshooting the 1742A 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.

8-8. 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.

8-9. 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.

8-10. 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).

8-11. RECOMMENDED TEST EQUIPMENT.

8-12. Test equipment and accessories required to maintain the 1742A are listed in Section I, table 1-3 of this manual. Equipment other than that listed may be used if it meets the listed critical specifications.

8-13. REPAIR.

8-14. 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.

8-15. PREVENTIVE MAINTENANCE.

8-16. 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.

8-17. 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.

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.

8-18. 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.

8-19. 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 9 for TIME/DIV switch shaft removal and appropriate Service Sheet for switch maintenance.

8-20. 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).

8-21. CIRCUIT BOARDS.

8-22. 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.

8-23. 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 5	NA	Service Sheet 5	NA	Service Sheet 5
A2	CHAN B ATTENUATOR	Service Sheet 5	NA	Service Sheet 5	NA	Service Sheet 5
A3	Vertical Preamplifier	Service Sheets 5 and 7	Service Sheet 5	Service Sheet 5	Service Sheets 5 and 7	Service Sheets 5 and 7
A4	Delay Line	Service Sheet 5	NA	Service Sheet 5	NA	Service Sheet 5
A5	Vertical Output	Service Sheet 6	Service Sheet 6	Service Sheet 6	Service Sheet 6	Service Sheet 6
A6	High-Voltage Multiplier	Service Sheet 3	NA	Service Sheet 3	NA	Service Sheet 3
A7	Horizontal Sweep	Service Sheet 8	Service Sheet 8	Service Sheet 8	Service Sheets 8, 12, and 13	Service Sheets 11-13, and 16
A8	Main Sweep	Service Sheet 9	Service Sheet 9	Service Sheet 9	Service Sheet 9	Service Sheet 9
A9	Delayed Sweep	Service Sheet 11	Service Sheet 11	Service Sheet 11	Service Sheet 11	Service Sheet 11
A10	Delayed Trigger	Service Sheet 10	Service Sheet 10	Service Sheet 10	Service Sheet 10	Service Sheet 10
A11	Horizontal Output	Service Sheet 12	Service Sheet 12	Service Sheet 12	Service Sheet 12	Service Sheet 12
A12	Gate	Service Sheet 4	Service Sheet 4	Service Sheet 4	Service Sheet 4	Service Sheets 3,4
A13	Vertical Control Switch	NA	Service Sheet 7	Service Sheet 5	NA	Service Sheets 5,7
A14	Interface	Option 101 - Service Sheet 15	Option 101 - Service Sheet 15	NA	NA	Service Sheet 14, Option 101 - 15
A15	High-Voltage Power Supply	Service Sheet 3	Service Sheet 3	Service Sheet 3	Service Sheet 3	Service Sheet 3
A16	Low-Voltage Power Supply	Service Sheet 2	Service Sheet 2	Service Sheet 2	Service Sheet 2	Service Sheet 2
A17	Time-Interval Decoder	Service Sheet 16	Service Sheet 16	Service Sheet 16	Service Sheet 16	Service Sheet 16

SERVICE SHEET 1

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 (50Ω, 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. In addition, the trigger generator also supplies signals to control the dual delay comparators on the time interval decoder board assembly. 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 defleciton 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 and BEAM INTENSITY 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 it increased four 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.

Time Interval - General. The two-marker sweep measurement technique is used for developing time interval measurements. Two separate markers enable the operator to select both the starting and stopping points of a time interval simultaneously. The markers are developed on alternate sweeps with the START control positioning the first marker and the STOP control positioning the second marker.

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.

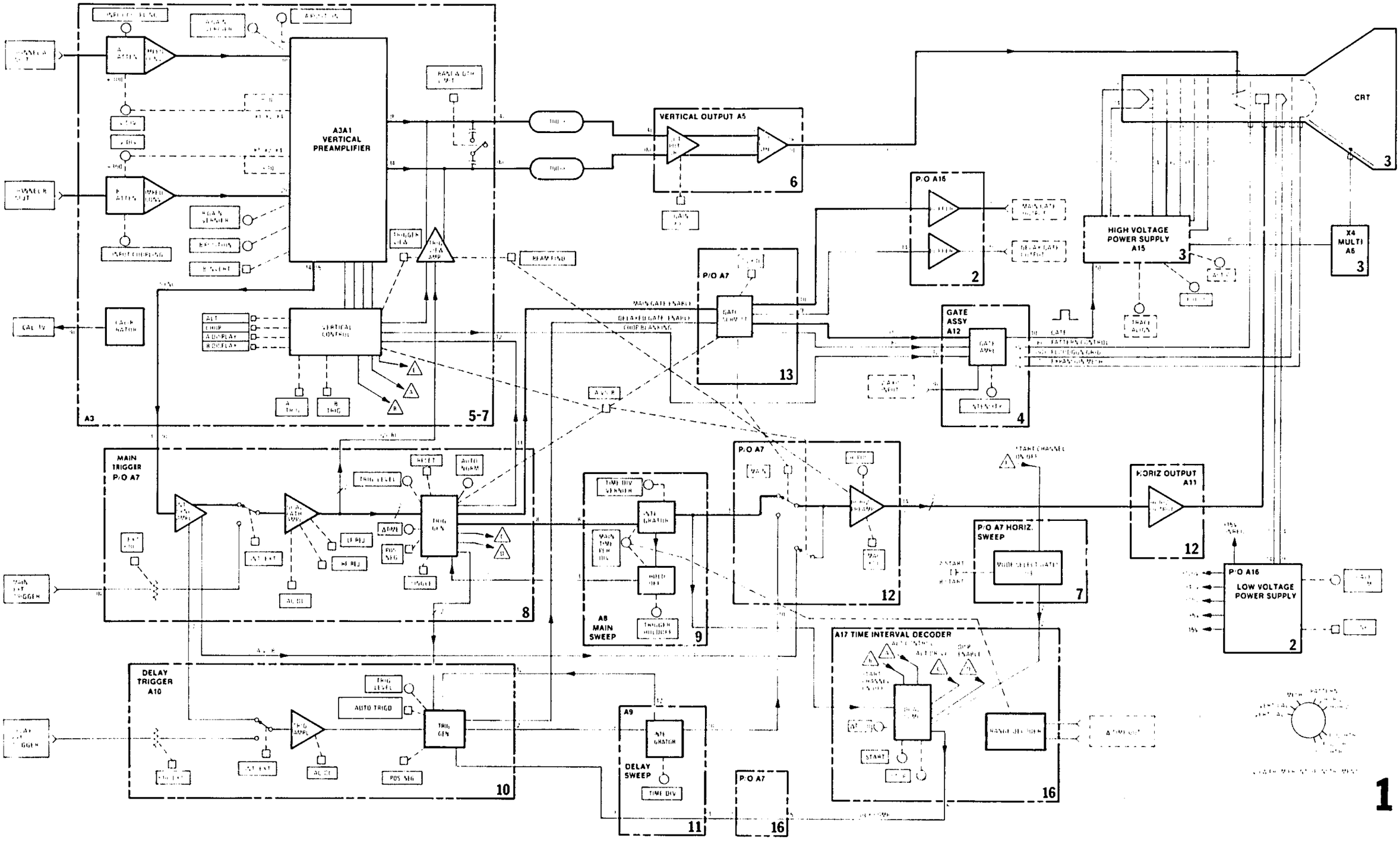


Figure 8-1.
Service Sheet 1, Overall Block Diagram

SERVICE SHEET 2

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 regualtor A16U1 that employs a built-in thermal shutdown and current-limiting circuits. Operation of the +15 V suply 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_{REF} 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_{REF} 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 8).

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 R12. 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, see figure 8-2 and 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.

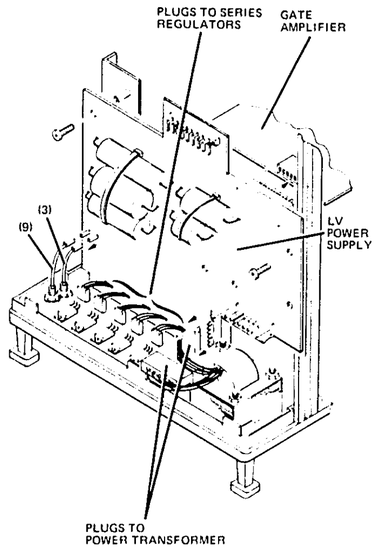


Figure 8-2. LV Power Supply Removal

a. Remove Interface Assembly A14.

b. Disconnect gate output wires (9) and (3).

c. Disconnect two plugs to power transformer.

d. Remove line cover MP58 by removing two screws.

e. Disconnect ac input leads (98) and (918).

f. Disconnect five plugs to series regulators Q2 thru Q6.

g. Disconnect cable from SCALE ILLUM control.

h. Remove five screws holding A16 to chassis.

i. Disconnect plug to Gate Amplifier Assembly A12.

j. Carefully lift and move A16 toward front of instrument. LINE switch shaft will protrude through front panel.

k. Unscrew LINE switch shaft and extract it.

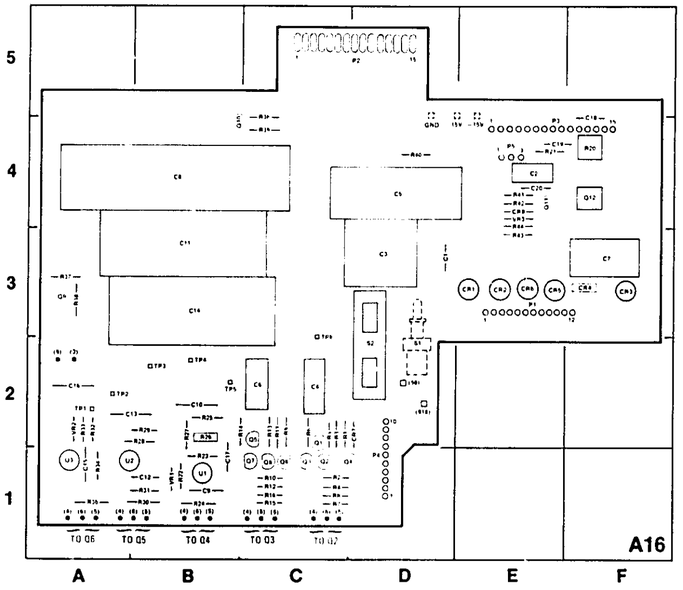
l. Remove button from shaft; A16 can now be removed.

m. 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 4).

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 Preamplifier 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

Figure 8-3. LVPS, A16, Component Identification

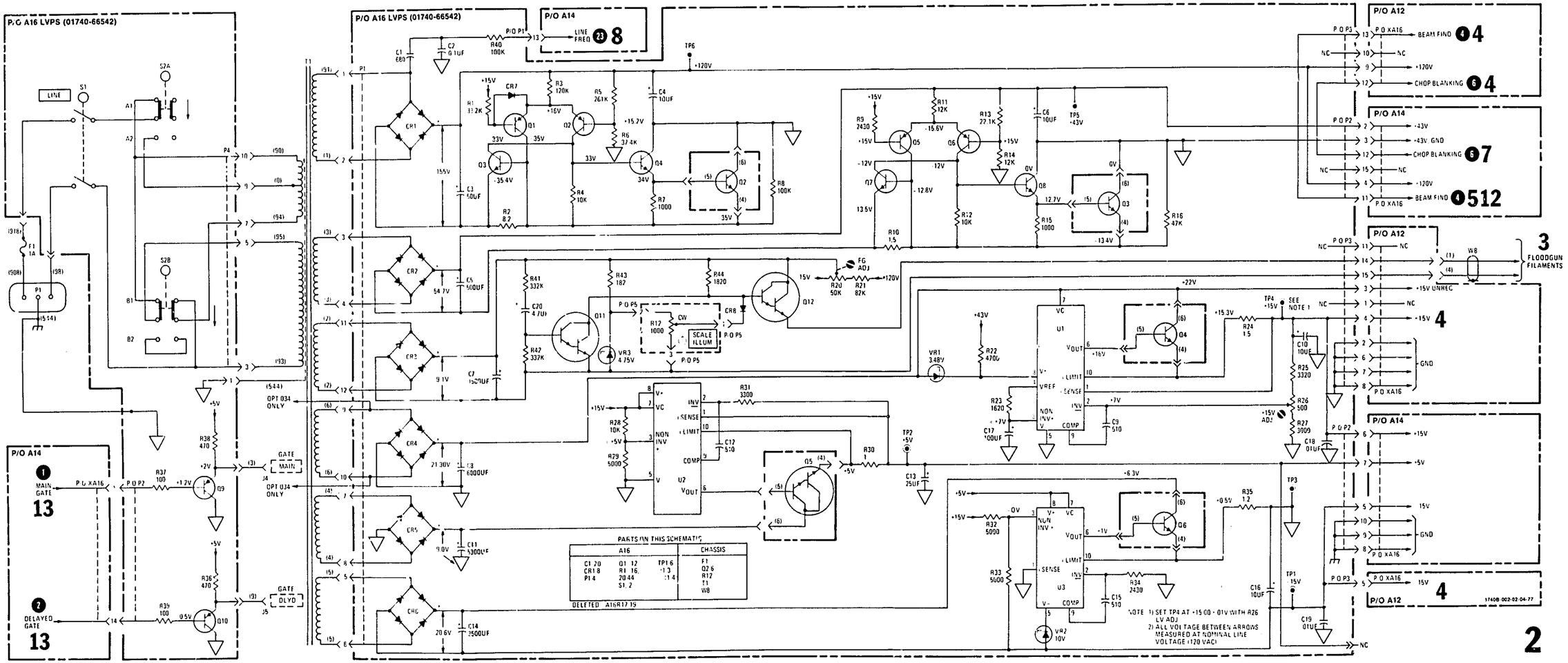


Figure 8-4.
Service Sheet 2, LV Power Supply
8-7

SERVICE SHEET 3

THEORY OF OPERATION

High-Voltage Oscillator. The high-voltage power supply consists of oscillator Q1 and a rectifying circuit. When the instrument is turned on, +15 volts unregulated is applied to Q1, turning it on. As Q1 conducts through the primary winding of A15T1 (pins 3 and 4), positive feedback to the base of Q1 occurs through another winding of the transformer (pins 1 and 2). When conduction through Q1 reaches saturation, the magnetic field developed in primary winding (pins 3 and 4) starts to collapse. This induces reverse feedback in the other winding, causing reduced conduction through Q1. The circuit oscillates at a rate determined by the inherent distributed inductance and capacitance of the oscillator circuit. The magnitude of oscillations, and consequently the power supply output, are controlled by the output of differential amplifier A15U1.

High-Voltage Regulator. A voltage divider, consisting of A15R13 and A15R22 (between the +15 V and −3000 V cathode supply) provides a voltage (≈0 V) relative to the two supplies to differential amplifier A15U1, pin 3. This voltage is compared to ground at pin 2 of A15U1 through A15R24.

Any change in CRT cathode voltage is detected by A15U1 and applied through the primary winding on A15T1 to the base of high-voltage oscillator Q1, changing the amplitude of its oscillation. This change is in such a direction as to correct the original change in the rectified cathode voltage. Diode A15CR1 protects the oscillator transistor from excess reverse voltage.

HV Disable. Transistor A15Q2 monitors the +120 V supply through resistor network A15R31 and A15R32. If the output of the +120 V supply drops below +100 Volts (approximate), A15Q2 conducts, turning on A15Q1. This effectively grounds the base of HV oscillator Q1, turning it off. Oscillations cease, and the high-voltage power supply is disabled to protect the CRT from possible damage. Also, if the +120 V supply surges above approximately +138 volts, zenier diode A15VR2 conducts, turning on A15Q1, disabling hv oscillator Q1.

If the −15 V supply is shorted to ground, A15Q1 turns on and disables Q1. If the +15 V supply is shorted to ground, the output of A15U1 goes low, turning off Q1. In both instances, the CRT is protected against deep phosphor burns.

High-Voltage Rectifier. The CRT cathode and grid voltages are developed in the secondary of high-voltage transformer A15T1. The cathode voltage is rectified and filtered before application to the cathode of the CRT. It is also used as a feedback control to the high-voltage oscillator, as a reference for the CRT filament winding, the grid bias supply, and for the focus voltage-divider network. CRT cathode voltage will vary between −2950 V to −3050 V, depending on component tolerances of A15R13 and A15R22; it is not adjustable.

The CRT grid voltage is picked off the secondary winding of transformer A15T1 at pin 5 and applied through RC network A15C2 /A15R3 to diodes that clamp the voltage swing to that established by intensity limit control A15R2 and the gate dc levels. The clipped sine wave is rectified and applied to the CRT grid, which is voltage-referenced to the cathode. This controls brightness of the CRT trace. The HV Multiplier voltage is picked off the secondary winding of transformer A15T1 at pin 7, applied to Assembly A6 where it is multiplied (X4), rectified, filtered, and then applied to the post accelerator of the CRT. The post-accelerator voltage is approximately 13 kV.

REMOVAL PROCEDURE

To remove High-Voltage Power Supply Assembly A15, proceed as follows:

a. Disconnect input ac power cord W1 from instrument.

b. Remove HV cover MP54.

WARNING

Failure to discharge high voltage can result in severe electrical shock to personnel and damage to the instrument.

c. Discharge high voltage by shorting test point A15TP1 to chassis.

d. Disconnect two (6) wires and one (2) wire to FOCUS potentiometer A12R22 at A15.

e. Disconnect (956) and (957) wires from rear of A15.

f. Remove CRT socket cover MP33.

g. Disconnect CRT socket.

h. Remove connector to HV oscillator, Q1. Note connector orientation (wires remain parallel from board to device).

i. Disconnect Gate Amplifier Assembly A12 from Low-Voltage Power Supply Assembly A16.

j. Disconnect A15 from A12.

WARNING

When performing next step, discharge high voltage by holding insulated part of wires and touching the two leads together.

k. Lift A15 and disconnect small (0) wire and large (0) wire from HV Multiplier Assembly A6.

l. Remove A15.

m. To reinstall A15, reverse removal procedure; remembering to reconnect small (0) wire and large (0) wire to HV Multiplier (removed in step k).

Cathode-Ray Tube Removal. To remove the CRT, see figure 8-5 of this Service Sheet and proceed as follows:

WARNING

To prevent personal injury, wear a face mask or goggles, protective gloves, and handle the CRT carefully. Do not lift the CRT or support its weight by the neck.

a. Disconnect input ac power cord W1 from instrument.

WARNING

Failure to discharge high voltage can result in severe electrical shock to personnel and damage to the instrument.

b. Disconnect post-accelerator lead and immediately discharge lead to ground.

c. Remove rear-panel CRT socket cover MP33 and disconnect socket.

d. Remove HV cover MP54.

e. Disconnect (956) and (957) wires from rear of HV Power Supply Assembly A15.

f. Disconnect all CRT neck-pin leads.

g. Disconnect CRT cable wires from top of Gate Amplifier A12, and lay this cable to outside of instrument.

h. Remove four screws (two per side) that secure rear of CRT shield MP65 to chassis.

i. Gently move CRT and shield about two inches toward rear of instrument.

j. Tilt shield up and gently lift CRT and shield from instrument.

CAUTION

When removing or installing CRT, be careful not to bend CRT neck pins.

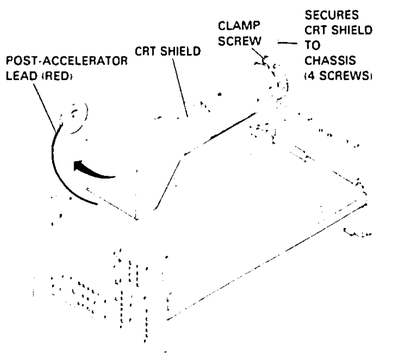


Figure 8-5. CRT Removal

k. Loosen clamp screw at rear of shield and remove CRT from shield.

l. To reinstall CRT, reverse removal procedure; however, do not tighten clamp screw until after shield is secured with four screws and CRT is positioned against front mount. Shield does not have to press completely onto front mount.

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.

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.

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 3

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).

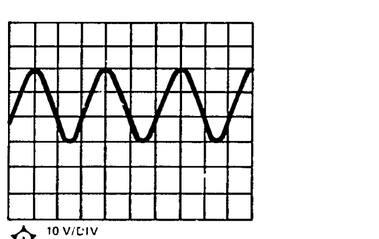
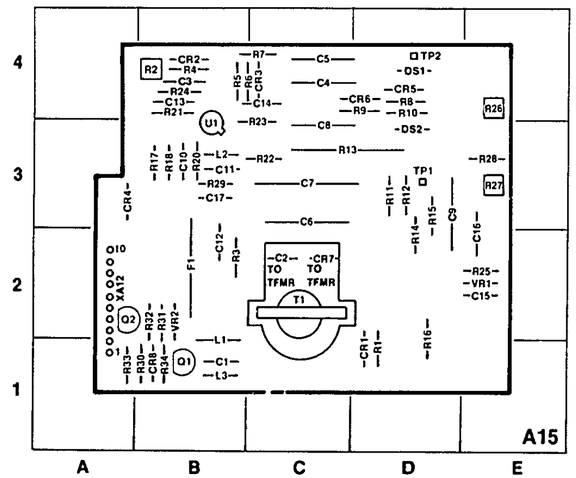


Figure 8-6. Waveforms for Service Sheet 3



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-1	C12	B-2	CR6	D-4	R1	D-1	R12	D-3	R23	C-3	R33	A-1
C2	C-2	C13	B-4	CR7	C-2	R2	B-4	R13	C-3	R24	B-4	R34	B-1
C3	B-4	C14	C-4	CR8	B-1	R3	B-2	R14	D-2	R25	E-2	T1	C-2
C4	C-4	C15	E-2	DS1	D-4	R4	B-4	R15	D-3	R26	E-4	TP1	D-3
C5	C-4	C16	E-3	DS2	D-3	R5	B-4	R16	D-1	R27	E-3	TP2	D-4
C6	C-3	C17	B-3	F1	B-2	R6	B-4	R17	B-3	R28	E-3	U1	B-3
C7	C-3	CR1	D-1	L1	B-1	R7	C-4	R18	B-3	R29	B-3	VR1	E-2
C8	C-3	CR2	B-4	L2	B-3	R8	D-4	R20	B-3	R30	B-1	VR2	B-2
C9	D-3	CR3	C-4	L3	B-1	R9	D-4	R21	B-4	R31	B-2	XA12	A-2
C10	B-3	CR4	A-3	Q1	B-1	R10	D-4	R22	C-3	R32	B-2		
C11	B-3	CR5	D-4	Q2	A-2	R11	D-3						

Figure 8 7. HVPS, A15, Component Identification

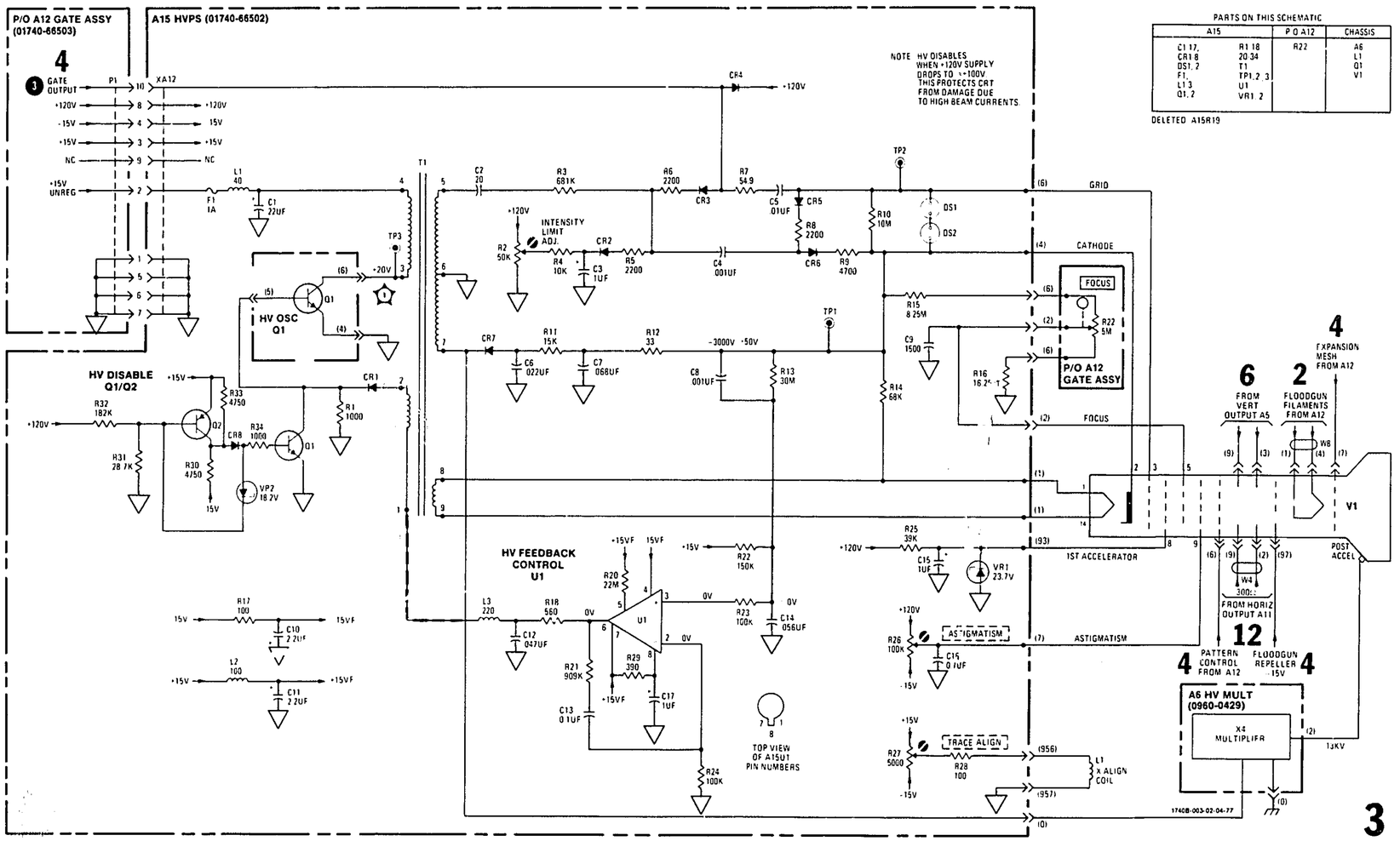


Figure 8-8.
Service Sheet 3, HV Power Supply

SERVICE SHEET 4

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 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 >50 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, see figure 8-9, and proceed as follows:

a. Remove HVPS cover MP54.

b. Disconnect nine wires on component side of A12.

c. Disconnect two (6) wires and one (2) wire from FOCUS potentiometer to A15 (HVPS).

d. Disconnect Z-axis wire (9) on rear of A12.

e. Remove FOCUS and 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.

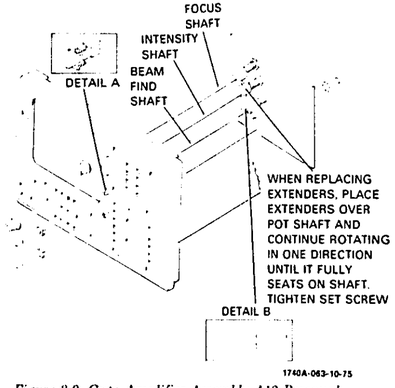


Figure 8-9. Gate Amplifier Assembly A12 Removal

TROUBLESHOOTING

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

DC VOLTAGE MEASUREMENT CONDITIONS SERVICE SHEET 4

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 4

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 1742A channel A INPUT connector.
4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V pk) at 5 kHz.

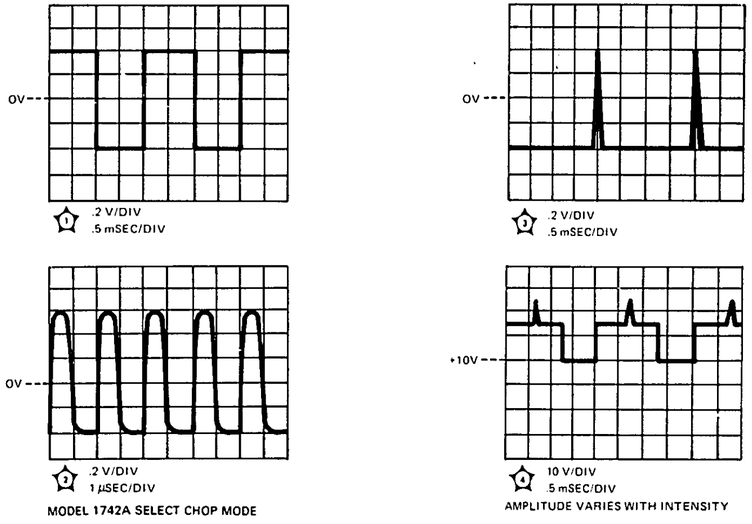
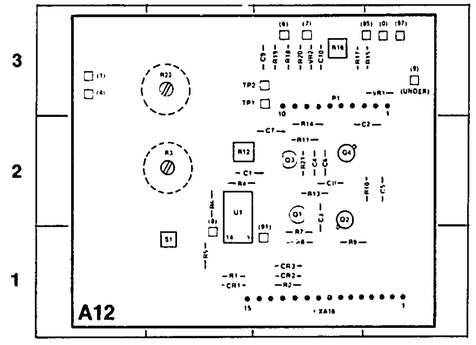
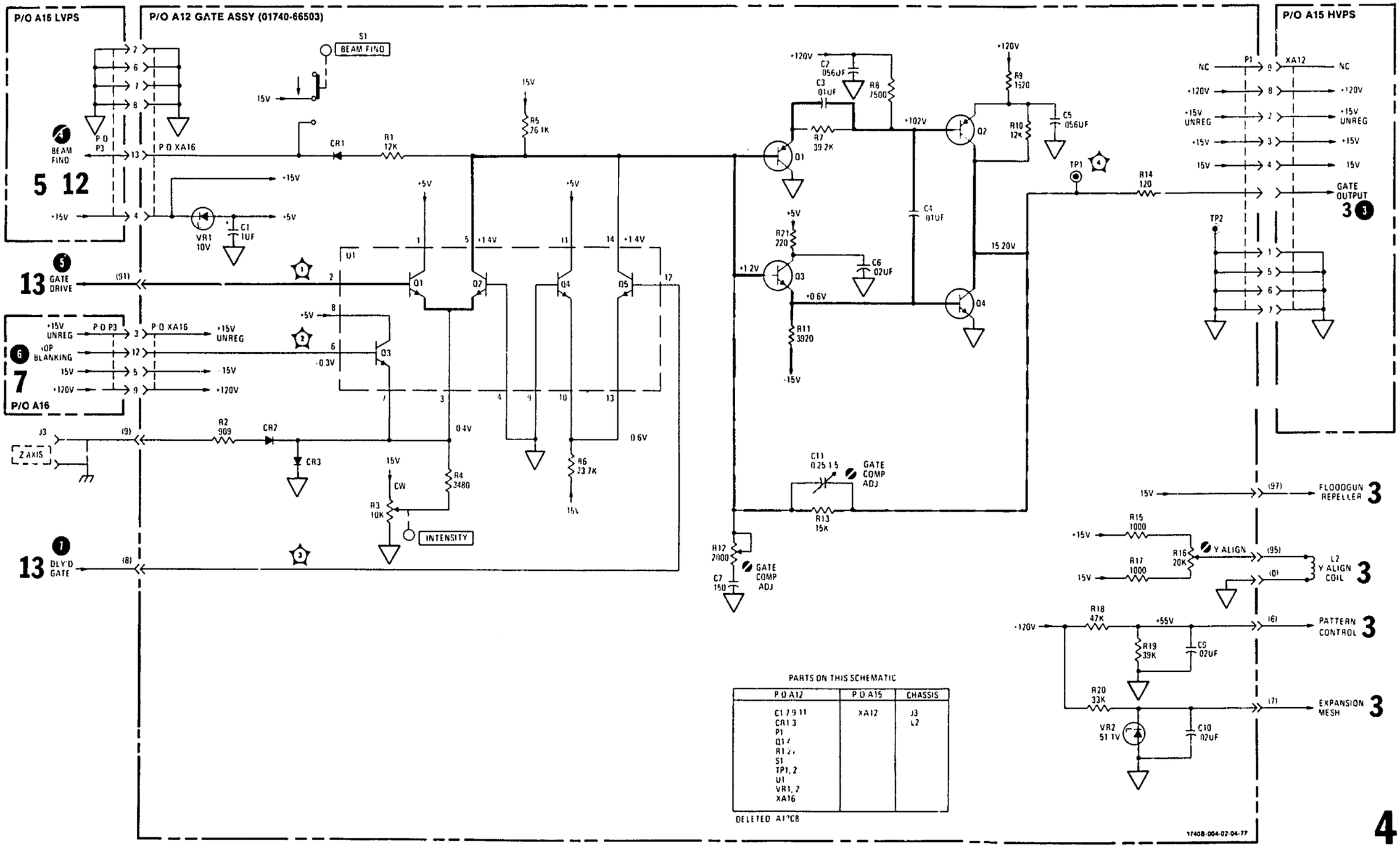


Figure 8-10. Waveforms for Service Sheet 4



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	CR1	B-1	R3	B-2	R13	C-2	S1	B-1
C2	D-2	CR2	C-1	R4	B-2	R14	C-3	TP1	B-3
C3	C-2	CR3	C-1	R5	B-1	R15	D-3	TP2	B-3
C4	C-2	P1	C-3	R6	B-2	R16	C-3	U1	B-2
C5	D-2	Q1	C-2	R7	C-1	R17	C-3	VR1	D-3
C6	C-2	Q2	C-2	R8	C-1	R18	C-3	VR2	C-3
C7	C-2	Q3	C-2	R9	C-1	R19	C-3	XA16	C-1
C9	C-3	Q4	C-2	R10	D-2	R20	C-3		
C10	C-3	R1	B-1	R11	C-2	R21	C-2		
C11	C-2	R2	C-1	R12	B-2	R22	B-3		

Figure 8-11. Gate Assembly, A12, Component Identification



PARTS ON THIS SCHEMATIC

P O A12	P O A15	CHASSIS
C1 7 9 11 CR1 3 P1 Q1 4 R1 2 4 S1 TP1, 2 U1 VR1, 2 XA16	XA12	J3 L2

DELETED A1 °C8

Figure 8-12.
Service Sheet 4, Gate Circuitry

SERVICE SHEET 5

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 pre-amplifier 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 8), 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 4) 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 7) 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 100 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:

a. Disconnect Interface Assembly A14.

b. Remove channel A and B POSN vernier, coupling, and VOLTS/DIV knobs.

c. Remove nuts and washers from both input BNC connectors.

d. Disconnect (9) wire from calibrator output.

e. Disconnect delay line wires (4), (6), and (0) from rear of Vertical Output Amplifier A5.

f. Remove delay line clamp screw from chassis.

g. Disconnect twin leads (2,6) and (1,9) at Horizontal Sweep Assembly A7.

h. Remove channel A attenuator shield by removing three screws.

i. 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.

j. Disconnect plug to A5.

k. Carefully tilt A3 outward and extract toward rear.

l. Disconnect vernier UNCAL light cable (95), (96), and two (0) wires.

m. To reinstall A3, reverse removal procedure.

Assembly A13 Removal:

a. Remove assembly A3 as described above.

b. Disconnect wires (4) and (9) from channel A and B vernier potentiometers (total of four wires).

c. Disconnect wires (3), (93), (913), (7), and (8) from front pc. A13.

d. Remove screw on component side of A3 that screws into standoff on A13 (near delay line).

e. Disconnect two plugs to Vertical Preamplifier Assembly A3.

f. To reinstall A13, reverse removal procedure.

IC A3A1 Removal (see figure 8-13):

a. Disconnect two leads (2, 6).

b. Remove six screws that hold vertical preamplifier shield MP45 to assembly A3, and remove shield.

c. Remove two remaining screws that hold IC to A3.

d. Lift IC frame and IC off A3.

e. To reinstall A3A1, reverse removal procedure, be certain that orientation of location pins is as shown in figure 8-13.

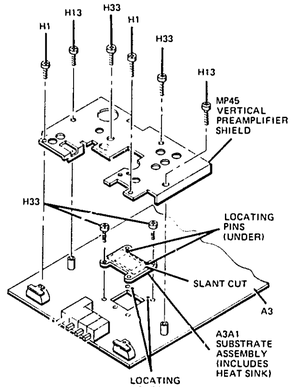


Figure 8-13. A3A1 Removal

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 5

1. Set front-panel controls in accordance with initital 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 5

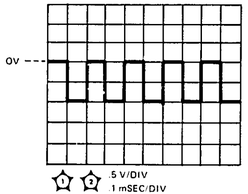
1. Set front-panel controls in accordance with initial control settings in Section V, except as follows:

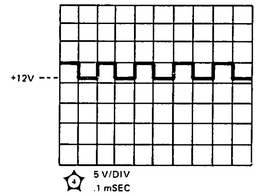
   Coupling (channel A) 50Ω
   TRIGGER LEVEL (main) ..... stable display

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 1742A channel A INPUT connector.

4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.





NOTE:

1. OPTION 101: BD. NO. CHANGES TO 01740-66531 AND THE FOLLOWING COMPONENTS ARE DELETED: C77, CR28, 29, Q21, R139 AND R140.

   R142 AND R143 ARE ADDED, AND CR25 IS MOVED TO OPT 101 POSITION.

   C22, C64, C65 AND C66 ARE LOADED ON BACK.

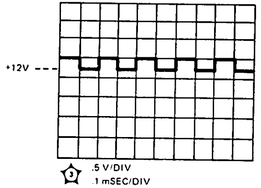
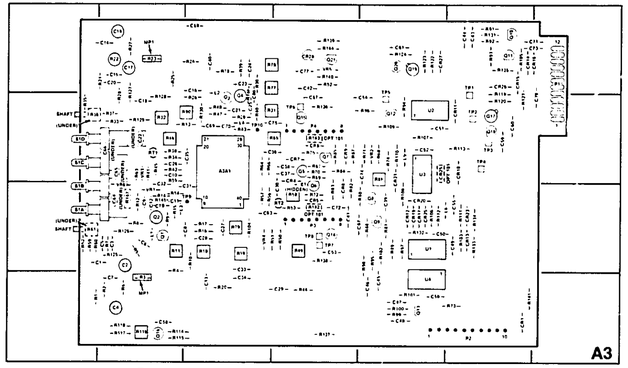


Figure 8-14. Waveforms for Service Sheet 5



A		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	REF DESIG	GRID LOC
A3A1	C-3	C39	E-2	C79	B-2	Q2	B-2	R19	C-2	R57	C-2	R95	E-2	R133	F-2
C1	B-2	C40	C-4	C80	C-3	Q3	C-3	R20	C-1	R58	D-2	R96	E-3	R134	F-2
C2	B-2	C41	D-2	CR1	F-1	Q4	C-3	R21	B-4	R59	A-2	R97	E-2	R135	F-4
C3	B-2	C42	D-4	CR4	D-2	Q5	D-3	R22	B-4	R60	A-2	R98	E-2	R136	D-3
C4	B-1	C43	F-4	CR5	D-2	Q6	D-2	R23	B-4	R61	A-2	R99	E-1	R137	D-1
C5	B-2	C44	F-4	CR6	D-3	Q7	D-3	R24	C-4	R62	A-2	R100	E-1	R138	D-2
C6	B-2	C45	E-1	CR7	D-3	Q8	E-2	R25	B-4	R63	B-3	R101	E-1	R139	D-4
C7	B-1	C46	E-1	CR8	D-2	Q9	E-2	R26	C-3	R64	C-3	R102	E-2	R140	D-4
C8	C-2	C47	E-1	CR9	D-3	Q10	F-4	R27	B-4	R65	C-3	R103	F-2	R141	F-1
C9	B-2	C48	E-1	CR11	F-3	Q11	F-4	R28	B-3	R66	C-3	R104	C-2	R142	D-2
C10	B-3	C49	F-2	CR12	E-2	Q12	E-3	R29	C-3	R67	D-3	R105	F-4	R143	D-3
C11	B-2	C10	E-2	CR13	F-2	Q13	E-1	R30	C-4	R68	D-3	R106	E-2	R144	D-4
C12	B-2	C51	E-3	CR14	F-4	Q14	D-2	R31	C-3	R69	D-3	R107	E-3	R145	B-2
C13	C-1	C52	E-3	CR15	F-4	Q15	D-3	R32	B-3	R70	D-3	R108	E-2	R146	C-3
C14	B-4	C53	D-2	CR16	F-4	Q16	B-1	R33	A-3	R71	E-3	R109	E-3	R147	B-2
C15	B-4	C54	E-3	CR17	E-2	Q17	F-3	R34	B-3	R72	D-2	R110	E-3	RT1	B-3
C16	C-4	C55	F-2	CR18	F-3	Q18	F-3	R35	A-3	R73	F-1	R111	F-2	RT2	D-2
C17	B-3	C56	E-1	CR19	E-2	Q19	E-4	R36	A-3	R74	E-3	R112	F-2	S1A	A-2
C18	B-3	C57	D-3	CR20	E-4	Q20	E-4	R37	B-3	R75	D-3	R113	F-3	S1B	A-2
C19	B-4	C58	B-1	CR21	E-3	Q21	D-4	R38	B-3	R76	C-4	R114	B-1	S1C	A-3
C20	B-4	C59	F-3	CR23	F-2	R1	A-1	R39	C-4	R77	C-4	R115	B-1	S1D	A-3
C21	C-3	C60	F-3	CR25	E-2	R2	B-1	R40	C-3	R78	C-4	R116	B-1	TP1	F-4
C22	B-3	C61	E-4	CR26	F-4	R3	B-1	R41	B-3	R79	C-2	R117	B-1	TP2	F-3
C23	C-4	C63	C-2	CR27	E-4	R4	B-1	R42	B-3	R80	D-2	R118	B-1	TP3	F-3
C24	C-4	C64	B-2	CR28	D-4	R5	B-2	R43	C-3	R81	E-2	R119	F-2	TP4	F-3
C25	C-3	C65	B-3	E1	D-2	R6	B-1	R44	D-1	R82	D-2	R120	F-3	TP5	E-4
C26	B-3	C66	B-3	L1	B-2	R7	B-2	R45	B-3	R83	D-2	R121	F-3	TP6	D-3
C27	C-2	C67	D-2	L2	C-3	R8	B-2	R46	B-3	R84	D-3	R122	E-4	TP7	D-2
C28	C-2	C68	C-4	L3	B-2	R9	B-2	R47	C-3	R85	D-3	R123	E-4	TP8	D-2
C29	D-1	C69	C-3	L4	C-3	R10	C-2	R48	C-3	R86	E-3	R124	E-4	TP9	C-2
C30	D-2	C70	C-3	L5	E-3	R11	B-2	R49	D-2	R87	D-3	R125	B-2	TP10	C-3
C31	C-2	C71	F-4	L6	E-2	R12	B-2	R50	D-2	R88	E-2	R126	B-3	U1	E-2
C32	B-2	C72	D-2	P1	G-4	R13	C-3	R51	C-2	R89	E-2	R127	B-4	U2	E-3
C33	C-2	C73	F-4	P2	F-1	R14	E-2	R52	D-4	R90	C-3	R128	B-3	U3	E-3
C34	C-1	C74	E-3	P3	D-2	R15	B-2	R53	D-2	R91	F-4	R129	B-3	U4	E-1
C35	C-3	C75	C-3	P4	D-3	R16	C-2	R54	B-2	R92	F-4	R130	C-3	VR1	B-2
C36	C-3	C77	D-4	Q1	B-2	R17	C-2	R55	B-3	R93	F-4	R131	F-4	VR2	E-3
C37	D-3	C78	G-3			R18	C-2	R56	C-2	R94	E-3	R132	E-2	VR3	B-3
C38	D-3													VR4	C-2
														VR5	D-4
														VR6	B-2

Figure 8-15. Vertical Preamplifier, A3, Component Identification

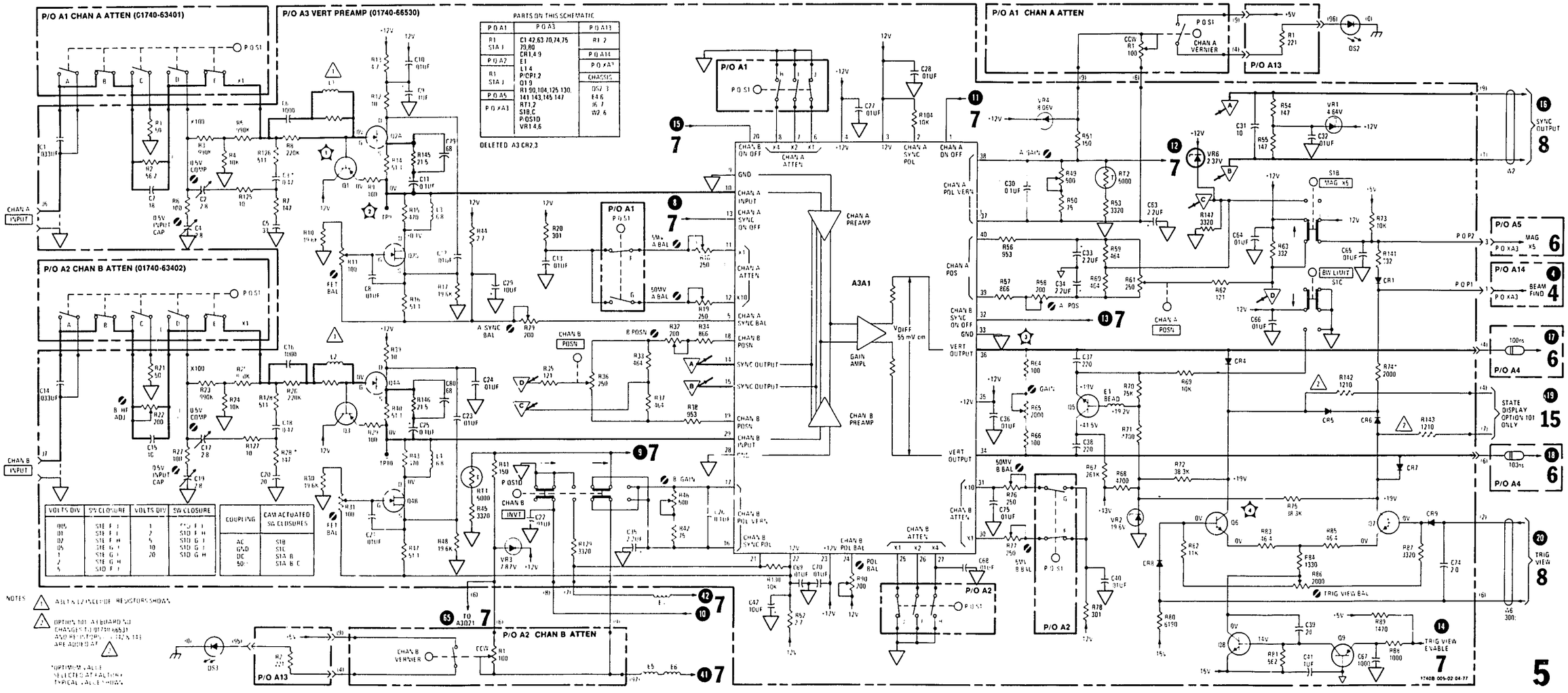


Figure 8-16.
Service Sheet 5, Vertical Preamplifier Circuitry

SERVICE SHEET 6

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 positi n 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 (see figure 8-17):

a. Disconnect delay line wires (4), (6), and (0) from back of A5.

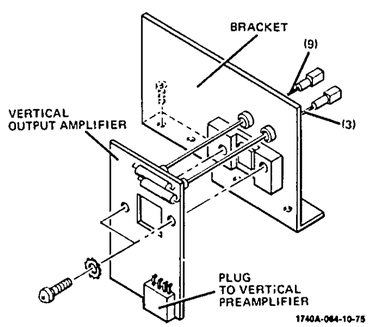


Figure 8-17. Vertical Output Amplifier Removal

b. Disconnect CRT leads (3) and (9).

c. Disconnect plug to Vertical Preamplifier Assembly A3 (push down gently on A3).

d. Remove four screws holding A5 and bracket to chassis, and remove assembly.

e. Remove two screws holding A5 to bracket and heat sink, and remove board.

f. To reinstall A5, reverse removal procedure.

IC A5A1 Removal (see figure 8-18):

a. Remove Vertical Output Amplifier A5 as described above.

b. A5A1 can be removed from heat sink. (Heat sink can remain on bracket or be removed.)

c. To reinstall A5A1, reverse removal provedure, being certain to note orientation of parts as shown in figure 8-18.

NOTE

Apply a thin coat of silicone grease (HP P/N 6040-0239) to points indicated in figure 8-18.

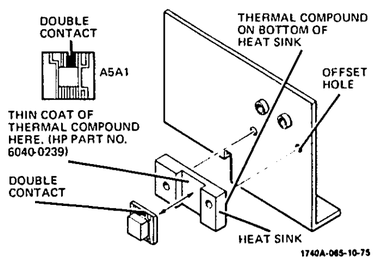


Figure 8-18. A5A1 Removal

TROUBLESHOOTING

Refer to Service Sheet 5 for vertical section troubleshooting.

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) 50Ω

2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicted under waveform(s).
3. Connect square-wave generator 50-ohm output to Model 1742A channel A INPUT connector.
4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

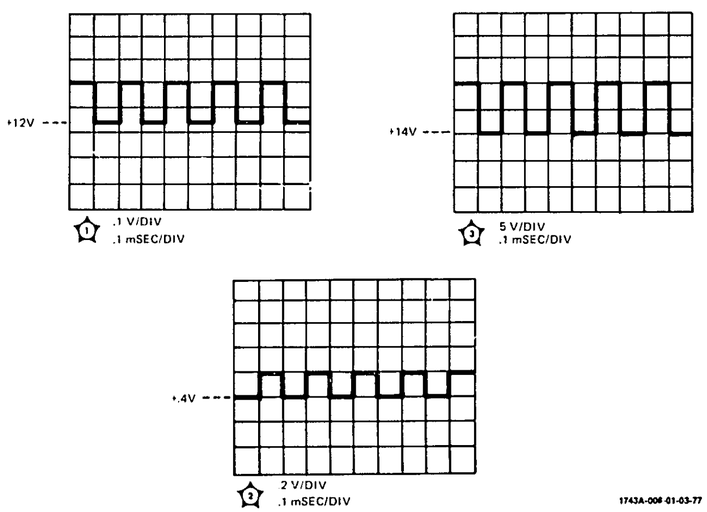
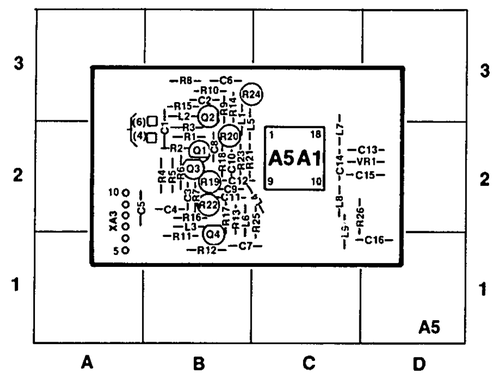


Figure 8-19. Waveforms for Service Sheet 6



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A5A1	C-2	C10	B-2	L4	C-2	R1	B-2	R11	B-1	R21	B-2
C1	B-2	C11	B-2	L5	B-2	R2	B-2	R12	B-1	R22	B-2
C2	B-3	C12	B-2	L6	B-2	R3	B-2	R13	B-2	R23	B-2
C3	B-2	C13	D-2	L7	C-2	R4	B-2	R14	B-3	R24	B-3
C4	B-2	C14	C-2	L8	C-2	R5	B-2	R15	B-3	R25	C-2
C5	A-2	C15	D-2	L9	C-1	R6	B-2	R16	B-2	R26	C-2
C6	B-3	C16	D-1	Q1	B-2	R7	B-2	R17	B-2	VR1	D-2
C7	B-1	L1	B-3	Q2	B-3	R8	B-3	R18	B-2	XA3	A-2
C8	B-2	L2	B-3	Q3	B-2	R9	B-3	R19	B-2		
C9	B-2	L3	B-2	Q4	B-1	R10	B-3	R20	B-2		

Figure 8-20. Vertical Output, A5, Component Identification

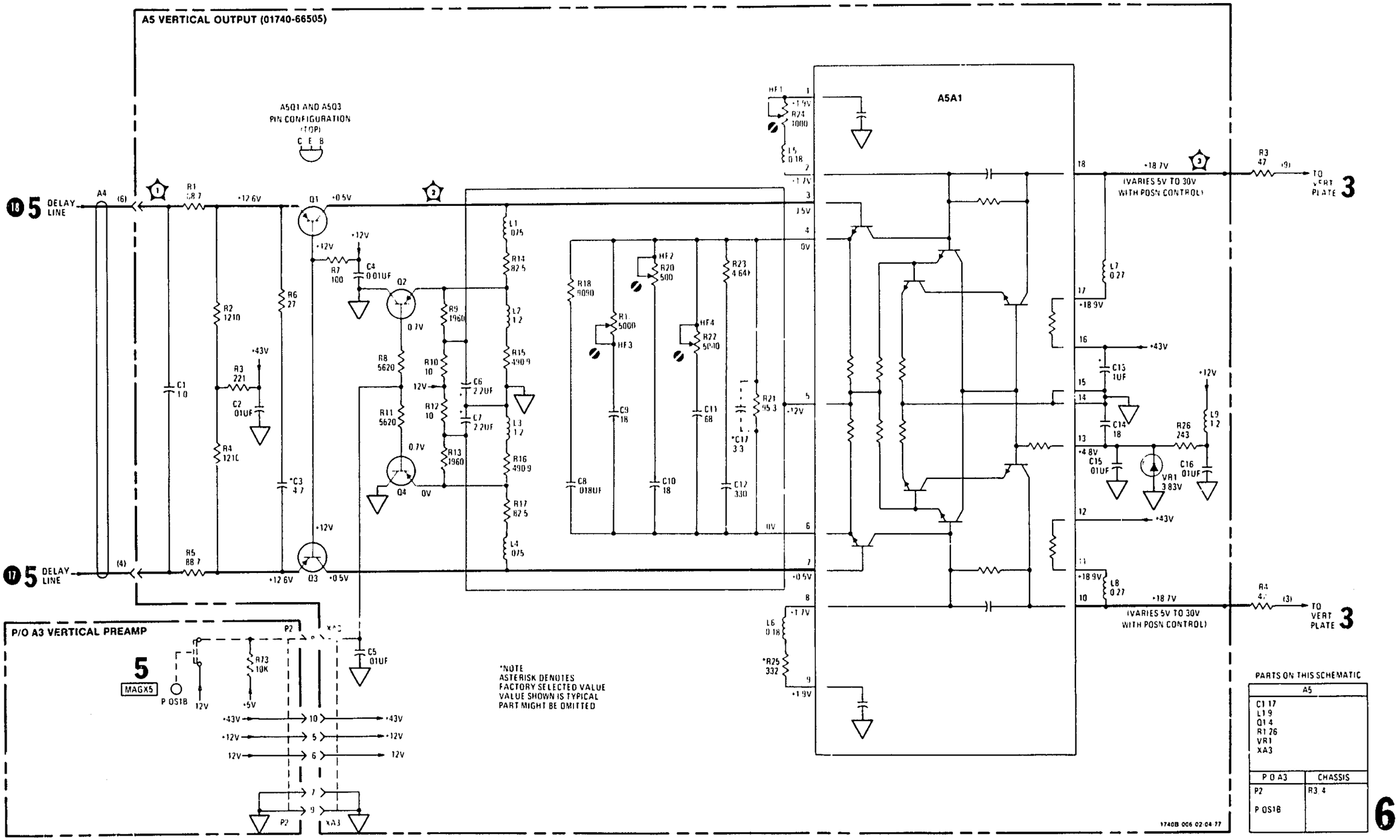


Figure 8-21.
Service Sheet 6, Vertical Output

SERVICE SHEET 7

THEORY OF OPERATION

General. Vertical Control Switching Assembly A13 selects the trigger and display modes by controlling the operation of Vertical Preamplifier 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 (≤2.7 V) at test point A3TP7 indicates channel A is on; a high (≈+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 $\overline{Q}$ (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. The channel B display signal is also used as the START CHANNEL ON-OFF signal that is applied to TIME/DIVISION DECODER Assembly A17.

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 $\overline{Q}$ 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. ALT display switch A13S2A applies an ALT CONTROL signal to TIME/DIVISION DECODER assembly A17.

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 $\overline{Q}$ 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 mode, 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 A3U3B, 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. A+B mode of display, low states are applied to both the preset and clear inputs on A3U2B causing both Q and $\overline{Q}$ outputs to go high. This forces the sync enable lines low through A3U3D-A3Q14 and A3U3B-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 5.

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 7

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 7

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
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 1742A channel A INPUT connector.
4. Adjust square-wave generator output for 6 divisions of signal amplitude (6 V) at 5 kHz.

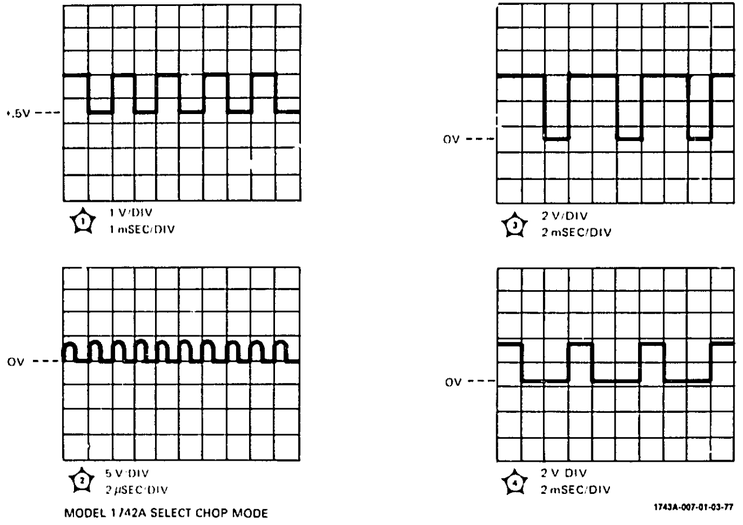
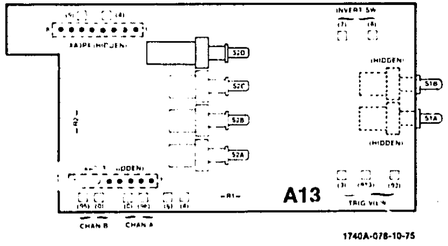


Figure 8-22. Waveforms for Service Sheet 7



NOTE
See Figure 8-13
for Assembly A3
Component Identification

Figure 8-23. Switch Control, A13, Component Identification

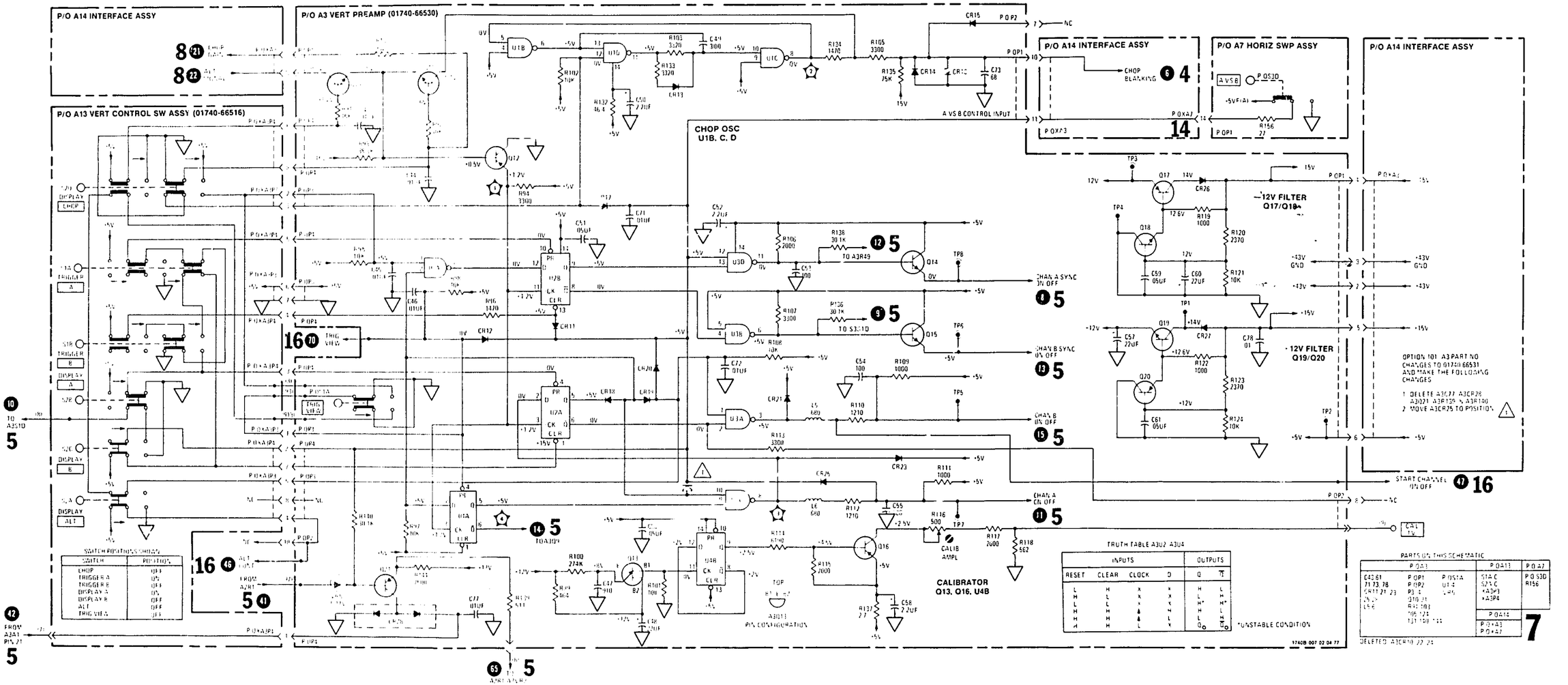


Figure 8-24.
Service Sheet 7. Vertical Control Circuitry

SERVICE SHEET 8

THEORY OF OPERATION

Sync Amplifier. The internal sync signal from assembly A3 is applied to the bases of A7Q9 and A7Q10 through cable W2. Shunt-feedback stage A7Q11 drives emitter followers A7Q7, A7Q8, A7Q12. The output of A7Q12 is used in A VS B display mode (see Service Sheet 12). A7Q7 provides sync drive for the main sweep and A7Q8 provides sync drive for the delayed sweep (Service Sheet 10). The instrument can be triggered externally by applying a sync signal to main EXT TRIGGER connector J1 and engaging INT/EXT switch A7S2E. The external sync signal can be attenuated by a factor of 10 by engaging +1/+10 switch A7S2F. The sync signal (external or internal) is applied to a high-frequency circuit and to a low-frequency circuit. The high-frequency path through A7U1 passes all frequencies above 4 kHz. The low-frequency path through A7U1 passes all frequencies below 4 kHz. The high- and low-frequency cutoffs are established by A7R5 and A7C6. Engaging LF REJ switch A7S2B removes the sync signal from the input to A7U1, and only the high-frequency path is enabled. Engaging HF REJ switch A7S2C applies reverse gate bias to A7Q4 disabling the high-frequency path. When both switches are engaged, a line frequency signal from the low-voltage power supply is applied to A7U1. The outputs from the high- and low-frequency amplifiers are summed at the base of emitter follower A7Q1. The signal developed through A7Q1 is applied to A7U2 (pin 14).

Triggering. Integrated circuit A7U2 contains a differential amplifier and three dual-input Schmitt triggers. The first Schmitt trigger determines the end of sweep and disables the other two Schmitt triggers until the end of holdoff period. At the end of holdoff, the holdoff comparator develops a reset signal that is applied to the first Schmitt trigger, which then arms the second Schmitt trigger. The second Schmitt trigger conducts when the input sync signal crosses the trigger level threshold established by TRIGGER LEVEL control A7R21. This arms the third Schmitt trigger which switches when the sync signal recrosses the trigger level threshold.

Auto/Norm. The output of A7U2 (pin 1) is applied to a transistor current switch consisting of A7Q19/A7Q20/A7Q21. With AUTO/NORM switch A7S1A in NORM position, the base of A7Q21 is held to +5 volts, disabling it. The bases of A7Q19 and A7Q20 are differentially driven from A7U2. When the collector of A7Q19 goes low (A7Q19 cut off), the main sweep starts. The complementary signal at the collector of A7Q20 (A7Q20 turned on) enables the gate Schmitt (Service Sheet 13) and turns the gate on.

Main Trig Signal. The output of A7U2 (pin 1) is also applied to the base of emitter follower A7Q30 (NPN-type transistor) turning it on. The complementary output of A7U2 (pin 2) is applied to emitter follower A7Q37 turning it off. The two transistors develop the MAIN TRIG signal that is applied to line receiver A10U2A on assembly A10 (Service Sheet 10).

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 switch 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 9, 11, and 16.

b. Remove assembly A11 as outlined in Service Sheet 12.

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.

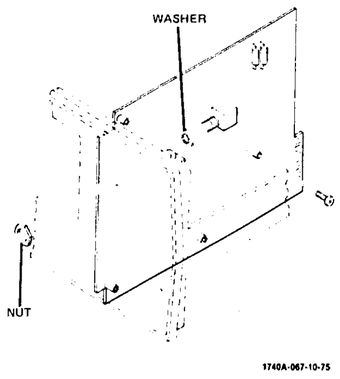


Figure 8-25. Location of A7 Attaching Screws

g. Remove Interface Assembly A14.

h. Remove four screws holding A7 to sheet metal (figure 8-25).

i. Remove A7 by pulling it toward rear and tilting away from sheet metal deck. Save lockwasher on trigger level potentiometer for reinstallation.

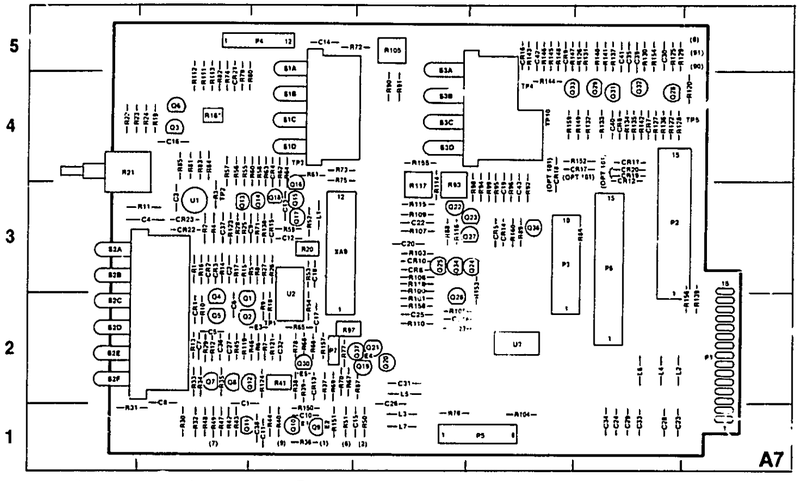
j. To reinstall A7, reverse removal procedure, except install four screws (step h) without tightening them until nut on TRIGGER LEVEL potentiometer (step f) is tightened. Lockwasher must be in place on TRIGGER LEVEL potentiometer before inserting in panel.

TROUBLESHOOTING

Troubleshooting the time base can be difficult since it is a closed-loop circuit and waveforms may be nonexistent in any part of the loop. Table 8-4 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.

Table 8-4. Time Base Troubleshooting

INDICATION	PROBLEM CAUSE
Is baseline present?	YES - Check input circuitry (HF/LF amplifiers or sync amplifier). NO - Proceed to next step.
RESET Lamp OFF Beam OFF Beam position left (Using BEAM FIND)	Check reset/holdoff circuitry.
RESET Lamp OFF Beam OFF Beam position right (Using BEAM FIND)	Check Miller integrator and associated circuitry.
RESET Lamp OFF 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 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 Beam ON (Left side)	Check Miller integrator and associated circuitry.
RESET Lamp ON 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	B-2	C39	F-5	L6	F-2	Q30	C-2	R32	B-1	R70	C-2	R108	D-2	R147	E-5
C2	B-3	C40	F-4	L7	D-1	Q31	F-4	R33	B-2	R71	C-3	R109	D-3	R148	E-5
C3	B-3	C41	F-5	P1	G-2	Q32	F-4	R34	B-2	R72	C-5	R110	D-2	R149	F-4
C4	B-3	C42	E-5	P2	F-3	Q33	E-4	R35	B-2	R73	C-4	R111	B-4	R150	C-1
C5	B-2	C43	E-3	P3	E-3	Q34	D-3	R36	C-1	R74	B-4	R112	B-4	R151	C-1
C6	B-2	CR1	B-2	P4	C-5	Q36	E-3	R37	C-2	R75	C-4	R113	B-4	R152	F-4
C7	B-2	CR2	B-3	P5	E-1	Q37	D-2	R38	C-2	R76	D-1	R114	D-3	R153	E-3
C8	B-2	CR3	B-3	P6	F-3	R1	B-3	R39	C-2	R77	C-2	R115	D-3	R154	F-5
C9	B-3	CR4	C-4	P7	C-2	R2	B-3	R40	B-1	R78	C-2	R116	D-3	R155	D-4
C10	C-1	CR5	E-3	Q1	B-2	R3	B-3	R41	C-2	R79	B-4	R117	D-3	R156	G-3
C11	B-1	CR6	D-3	Q2	B-2	R4	B-3	R42	B-1	R80	B-4	R118	D-3	R157	C-2
C12	C-2	CR7	F-4	Q3	B-4	R5	C-3	R43	B-1	R81	B-4	R 19	B-2	R158	D-
C13	C-3	CR8	B-2	Q4	B-2	R6	C-2	R44	B-1	R82	B-4	R120	G-4	R159	E-4
C14	C-5	CR9	E-5	Q5	B-2	R7	C-2	R45	B-2	R83	B-4	R121	C-2	R160	E-3
C15	D-1	CR10	D-3	Q6	B-4	R8	C-3	R46	C-2	R84	B-4	R122	F-4	R161	B-4
C16	B-4	CR11	F-4	Q7	B-2	R9	C-2	R47	B-1	R85	B-4	R123	G-3	S1A	C-5
C17	C-2	CR12	F-4	Q8	B-2	R10	B-2	R48	B-1	R86	F-3	R124	C-2	S1B	C-4
C18	C-3	CR13	C-2	Q9	C-1	R11	B-3	R49	B-1	R87	D-2	R125	F-5	S1C	C-4
C19	E-3	CR14	E-3	Q10	C-1	R12	B-2	R50	D-1	R88	D-3	R126	F-5	S1D	C-4
C20	D-3	CR15	C-3	Q11	B-1	R13	B-2	R51	C-1	R89	E-3	R127	F-4	S2A	A-3
C21	D-2	CR16	E-5	Q12	C-2	R14	B-3	R52	C-3	R90	D-4	R128	F-4	S2B	A-3
C22	D-3	CR17*	F-4	Q13	B-3	R15	B-3	R53	C-3	R91	D-4	R129	F-5	S2C	A-2
C23	F-1	CR18*	E-4	Q14	C-3	R16	B-3	R54	C-2	R92	E-3	R130	F-5	S2D	A-2
C24	F-1	CR19*	F-4	Q15	C-3	R17	B-3	R55	B-4	R93	D-3	R131	F-5	S2E	A-2
C25	D-2	CR20*	F-4	Q16	C-3	R18	C-2	R56	B-4	R94	E-3	R132	F-4	S2F	A-2
C26	D-2	CR21	B-4	Q17	C-3	R19	B-4	R57	B-4	R95	E-3	R133	F-4	S3A	D-5
C27	B-2	CR22	B-3	Q18	C-3	R20	C-3	R58	C-4	R96	E-3	R134	F-4	S3B	D-4
C28	F-1	CR23	B-3	Q19	D-2	R21	A-4	R59	C-3	R97	C-2	R135	F-4	S3C	D-4
C29	F-1	E1	C-1	Q20	D-2	R22	A-4	R60	C-4	R98	E-3	R136	F-4	S3D	D-4
C30	F-5	E2	C-1	Q21	D-2	R23	A-4	R61	C-4	R99	E-3	R137	F-5	TP1	C-2
C31	D-2	E3	C-2	Q22	D-3	R24	B-4	R62	C-4	R100	D-3	R138	C-3	TP2	B-
C32	C-2	E4	D-2	Q23	E-3	R25	B-3	R63	C-4	R101	D-2	R139	G-3	TP3	C-4
C33	F-1	E5	C-2	Q24	E-3	R26	C-3	R64	C-4	R102	D-2	R140	F-5	TP4	E-4
C34	F-1	L1	C-3	Q25	D-3	R27	C-3	R65	C-2	R103	D-3	R141	F-5	TP5	G-
C35	F-5	L2	F-2	Q26	D-2	R28	B-3	R66	C-2	R104	E-1	R142	F-4	TP10	E-4
C36	B-2	L3	D-1	Q27	E-3	R29	B-2	R67	C-2	R105	D-5	R143	E-5	U1	B-3
C37	B-3	L4	F-2	Q28	F-4	R30	B-1	R68	C-2	R106	D-3	R144	E-4	U2	C-2
C38	B-1	L5	D-2	Q29	F-4	R31	A-1	R69	C-2	R107	D-3	R145	E-5	U3	E-2
												R146	E-5	XA1	C-3

*USED WITH OPTION 101

Figure 8-26. Horizontal Sweep, A7, Component Identification

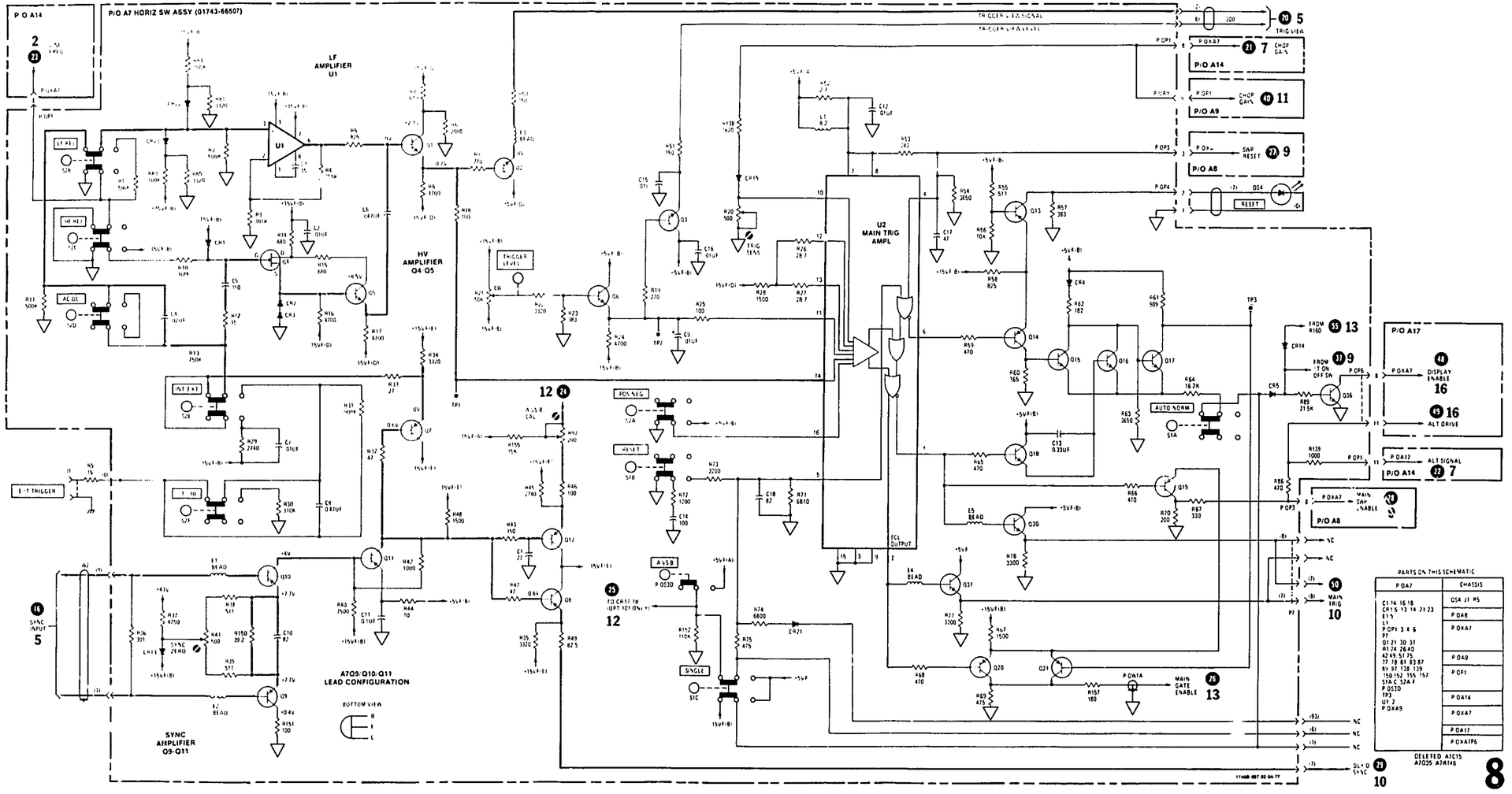


Figure 8-27.
Service Sheet 8, Main Trigger Circuitry

SERVICE SHEET 9

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 Section VIII, paragraph 8-20.

g. Place rotor sections on circuit board and reinstall 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 9

1. Set front-panel controls in accordance with intital 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 9

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 1742A channel A INPUT connector.

4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V), at 5 kHz.

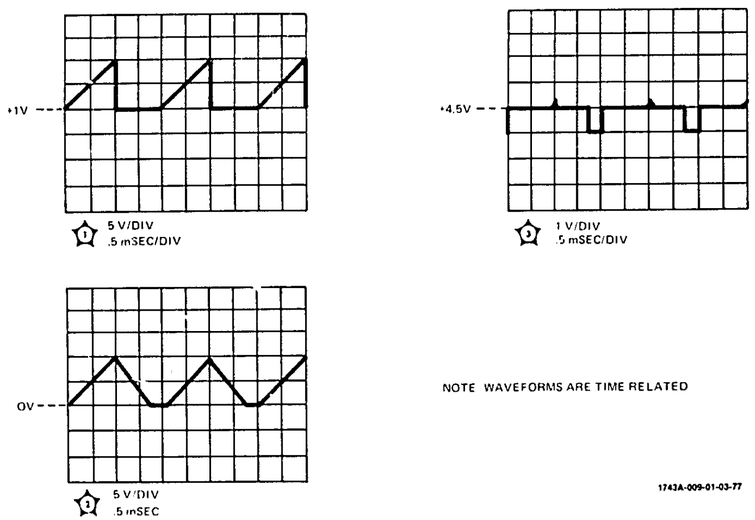
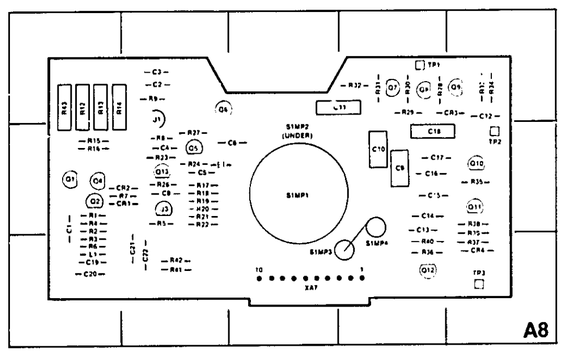


Figure 8-28. Waveforms for Service Sheet 9



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	R37	E-1
C3	B-3	C22	B-1	Q12	D-1	R19	B-2	R38	E-2
C4	B-2	CR1	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		

Figure 8-29. Main Sweep, A8, Component Identification

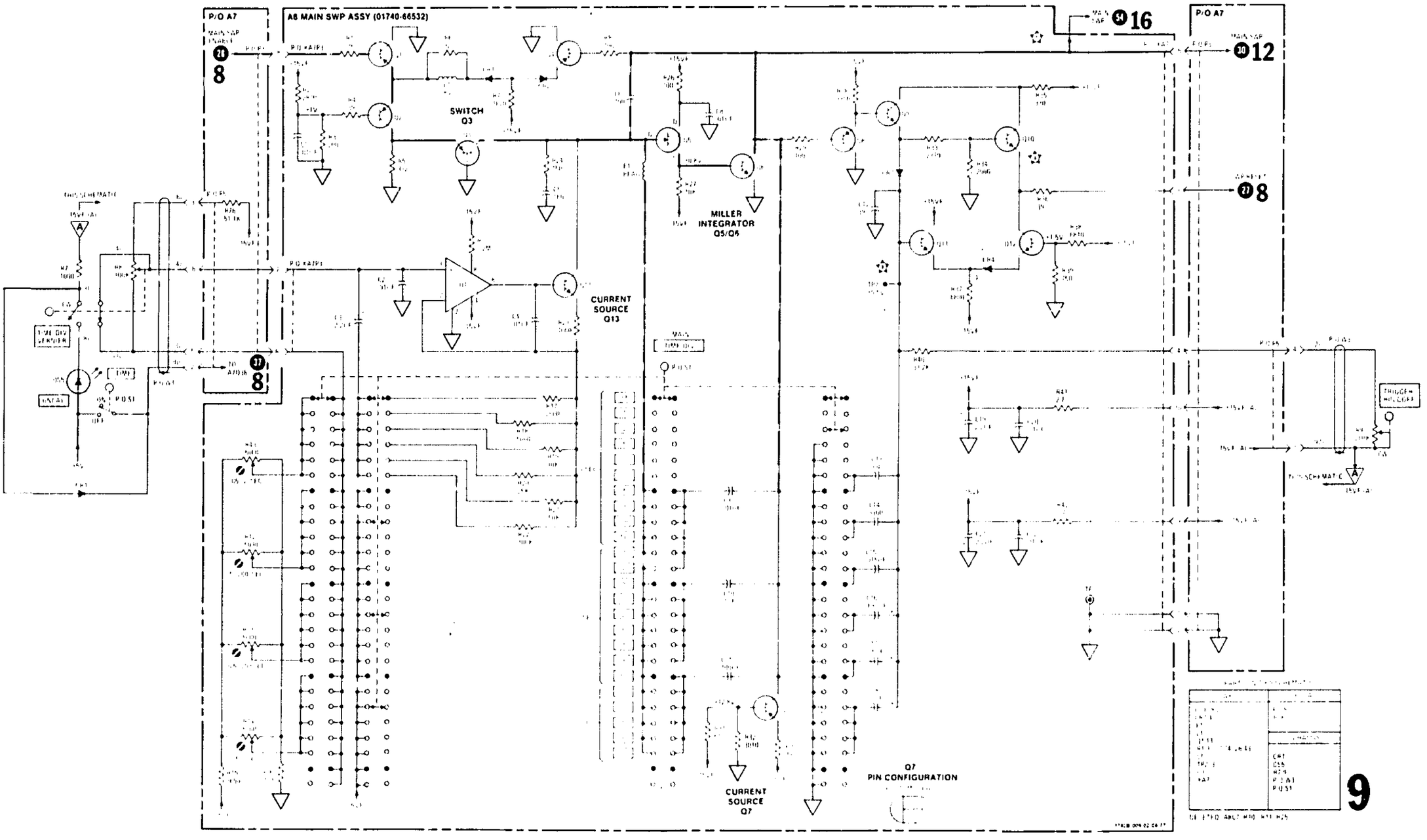


Figure 8-30.
Service Sheet 9, Main Sweep Generator

SERVICE SHEET 10

THEORY OF OPERATION

Arming Circuit. The positive going ramp of the main sweep is applied to the horizontal amplifier (Service Sheet 12) and to delay comparator A17U7 (Service Sheet 16). The delay comparator circuit compares the main sweep ramp, and the level established by either the START or STOP controls and develops the DLY COMP signal.

The DLY COMP signal, when high, arms delayed trigger circuit A10U1.

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 A10S10 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 11).

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

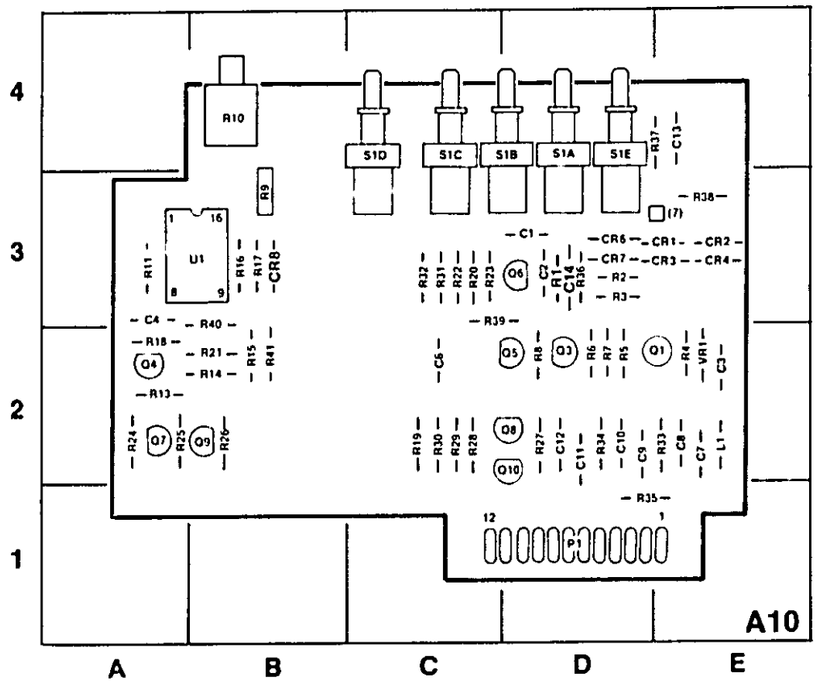
The delayed trigger assembly should cause little trouble in the operation of the instrument. If trouble is suspected, check the following inputs:

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	C14	D-3	Q3	D-2	R4	E-2	R16	B-3	R27	D-2	R38	E-3
C2	D-3	CR1	E-3	Q4	A-2	R5	D-2	R17	B-3	R28	C-2	R39	C-3
C3	E-2	CR2	E-3	Q5	D-2	R6	D-2	R18	A-2	R29	C-2	R40	B-3
C4	A-3	CR3	E-3	Q6	D-3	R7	D-2	R19	C-2	R30	C-2	R41	B-2
C6	C-2	CR4	E-3	Q7	A-2	R8	D-2	R20	C-3	R31	C-3	S1A	D-4
C7	E-2	CR6	D-3	Q8	D-2	R9	B-3	R21	B-2	R32	C-3	S1B	D-4
C8	E-2	CR7	D-3	Q9	B-2	R10	B-4	R22	C-3	R33	E-2	S1C	C-4
C9	D-2	CR8	B-3	Q10	D-2	R11	A-3	R23	C-3	R34	D-2	S1D	C-4
C10	D-2	L1	E-2	R1	D-3	R13	A-2	R24	A-2	R35	D-1	S1E	D-4
C11	D-2	P1	D-1	R2	D-3	R14	B-2	R25	A-2	R36	D-3	U1	B-3
C12	D-2	Q1	E-2	R3	D-3	R15	B-2	R26	B-2	R37	E-4	VR1	E-2
C13	E-4												

Figure 8-31. Delayed Trigger, A10, Component Identification

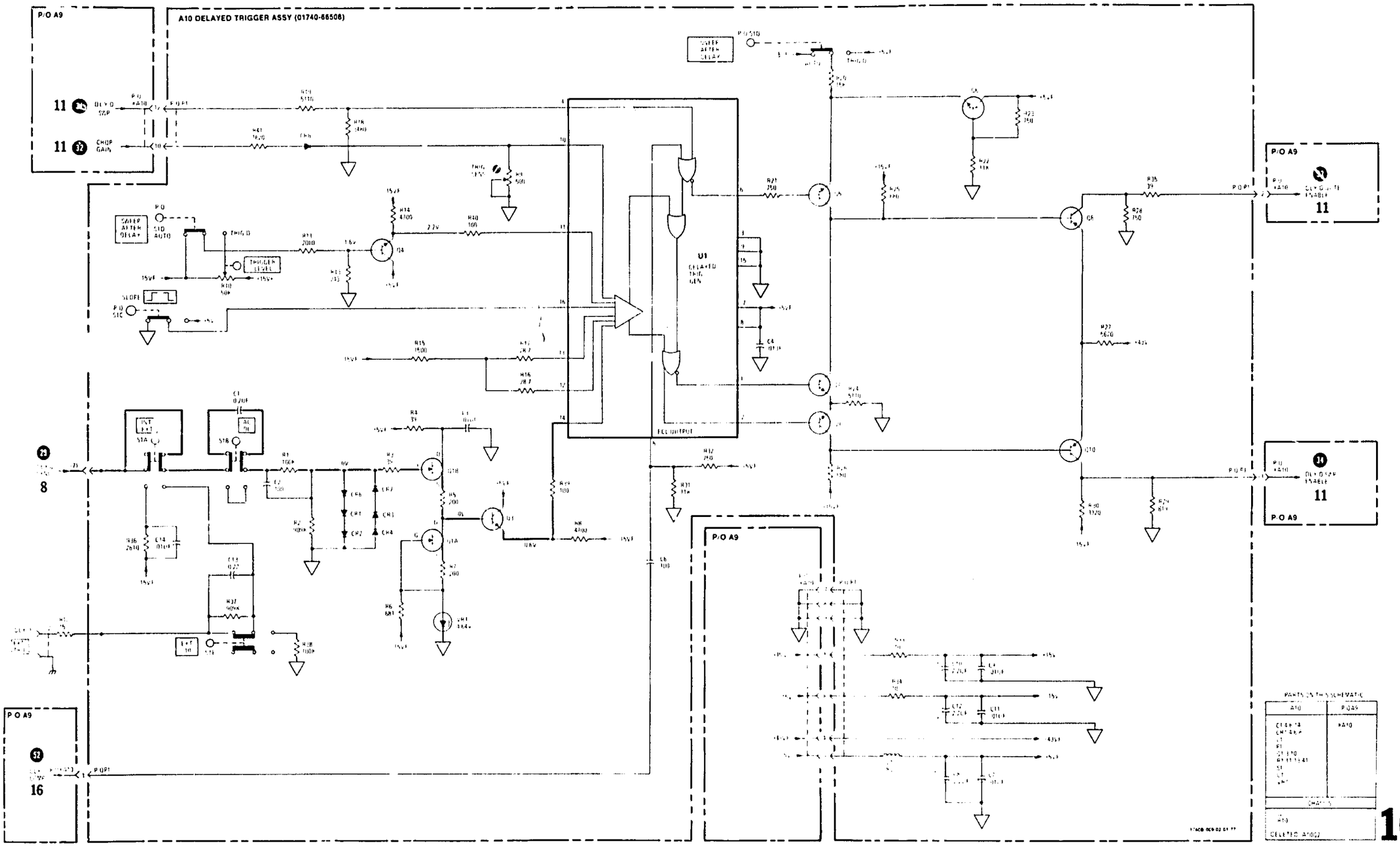


Figure 8-32.
Service Sheet 10, Delayed Trigger Circuitry

SERVICE SHEET 11

THEORY OF OPERATION

The operation of delayed sweep is similar to that of the main sweep (Service Sheet 9). 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:

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 A9 by gently rocking assembly toward rear of instrument to disconnect it from two connectors.

f. To replace, reverse removal procedure.

TIME/DIV SWITCH MAINTENANCE

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

a. Remove assembly A9 as described above.

b. After removing A9, 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 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 Section VIII, paragraph 8-20.

g. Place rotor sections on circuit board and reinstall retainer ring.

h. Position slotted portion of open rotor sections as noted in step b.

i. Reinstall assembly A9 in instrument.

j. 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 11

1. 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	

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 11

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

Coupling (channel A)	50Ω
DLY'D TIME DIV	10μSEC
START	midrange
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 1742A channel A INPUT connector.

4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

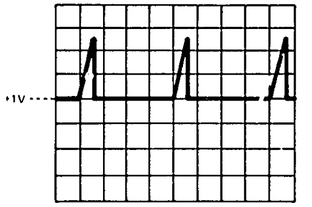
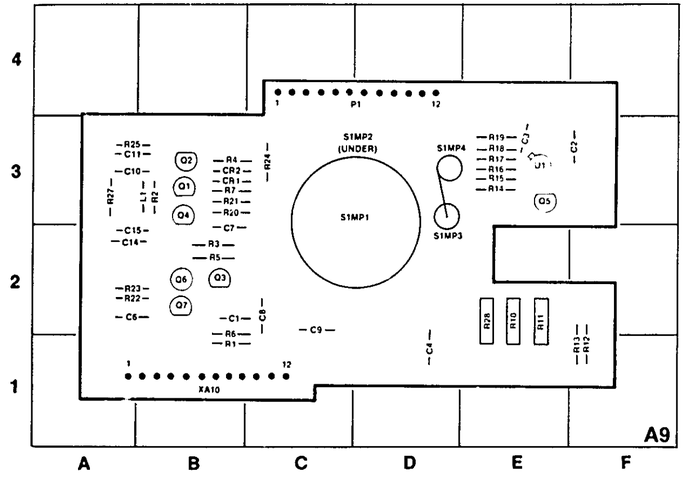
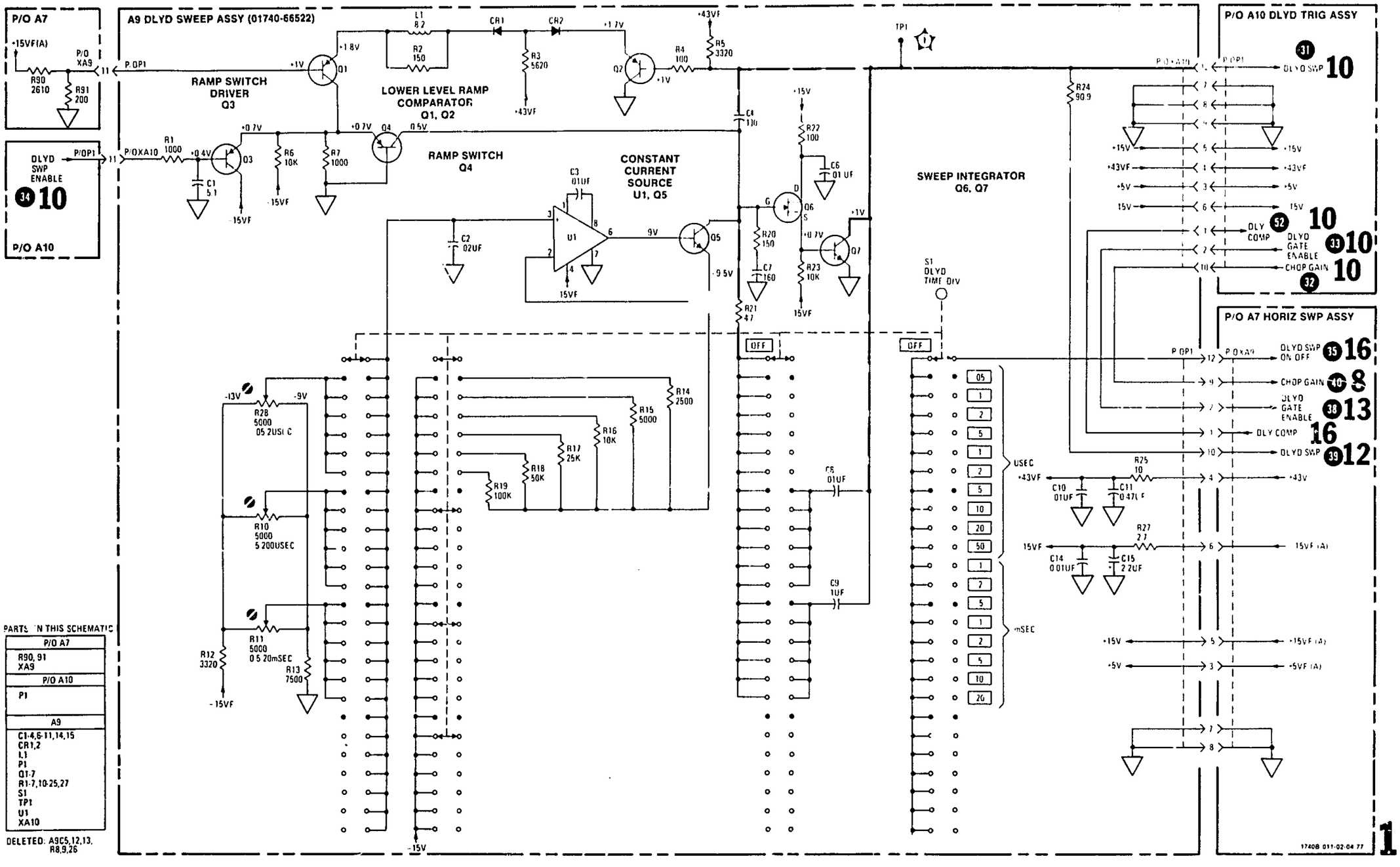


Figure 8-33. Waveforms for Service Sheet 11



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	E-2
C6	A-2	P1	C-4	R4	B-3	R17	E-3	S1MP1	C-3
C7	B-2	Q1	B-3	R5	B-2	R18	E-3	S1MP2	C-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	S1MP4	D-3
C10	A-3	Q4	B-3	R10	E-2	R21	B-3	U1	E-3
C11	A-3	Q5	E-3	R11	E-2	R22	A-2	XA10	B-1
C14	A-2	Q6	B-2	R12	F-1	R23	A-2		

Figure 8-34. Delayed Sweep, A9, Component Identification



PARTS IN THIS SCHEMATIC

P/O A7
R90, 91 XA9
P/O A10
P1
A9
C1-4,6-11,14,15 CR1,2 L1 P1 Q1-7 R1-7,10-25,27 S1 TP1 U1 XA10

DELETED: A9C5,12,13, R8,9,26

Figure 8-35.
Service Sheet 11, Delayed Sweep Generator

SERVICE SHEET 12

THEORY OF OPERATION

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 Ouput. 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 +11.5 volts.

REMOVAL PROCEDURE

Assembly A7 Removal: (see Service Sheet 8).

Assembly A11 Removal:

To remove assembly A11, proceed as follows:

a. Disconnect (2) and (9) wires from A11.

b. Remove A11 from connector by first pulling top of A11 away from assembly A7 and then pulling bottom of A11.

c. 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 12

1. 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

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 12

1. Set front-panel controls in accordance with initial control settings 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 1742A channel A INPUT connector.

4. Adjust square-wave generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

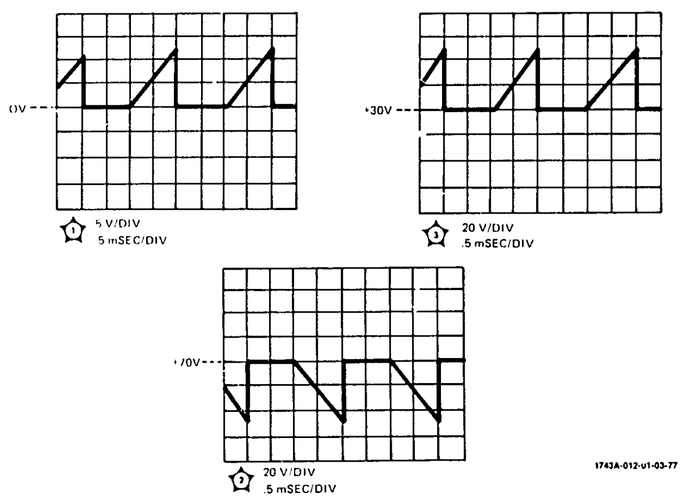
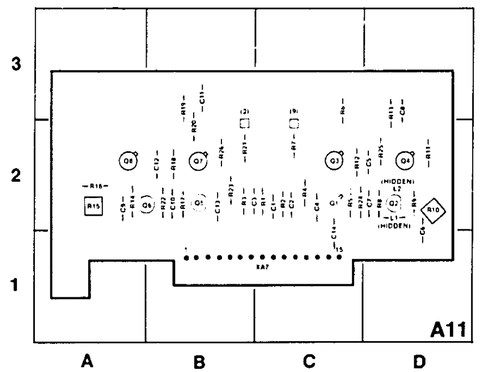


Figure 8-36. Waveforms for Service Sheet 12



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-2	C12	B-2	Q6	A-2	R8	D-2	R18	B-2
C2	C-2	C13	B-2	Q7	B-2	R9	D-2	R19	B-3
C3	B-2	C14	C-1	Q8	A-2	R10	D-2	R20	B-2
C4	C-2	L1	D-2	R1	C-2	R11	D-2	R21	B-2
C5	D-2	L2	D-2	R2	C-2	R12	C-2	R22	B-2
C6	D-2	Q1	C-2	R3	B-2	R13	D-3	R23	B-2
C7	D-2	Q2	D-2	R4	C-2	R14	A-2	R24	C-2
C8	D-3	Q3	C-2	R5	C-2	R15	A-2	R25	D-2
C9	A-2	Q4	D-2	R6	C-3	R16	A-2	R26	B-2
C10	B-2	Q5	B-2	R7	C-2	R17	B-2	XA7	C 1
C11	B-3								

Figure 8-37. Horizontal Output, A11, Component Identification

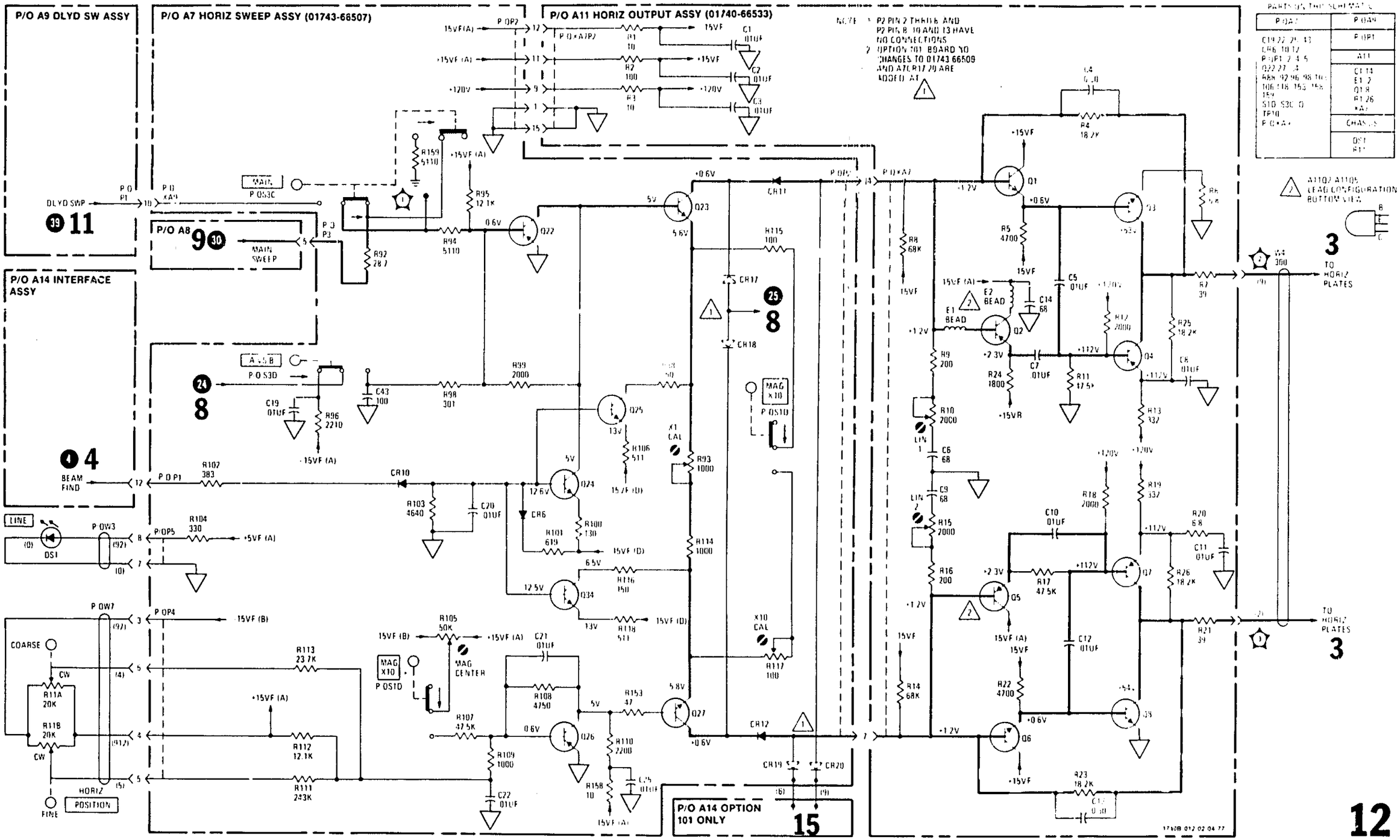


Figure 8-38.
Service Sheet 12, Horizontal Output

SERVICE SHEET 13

THEORY OF OPERATION

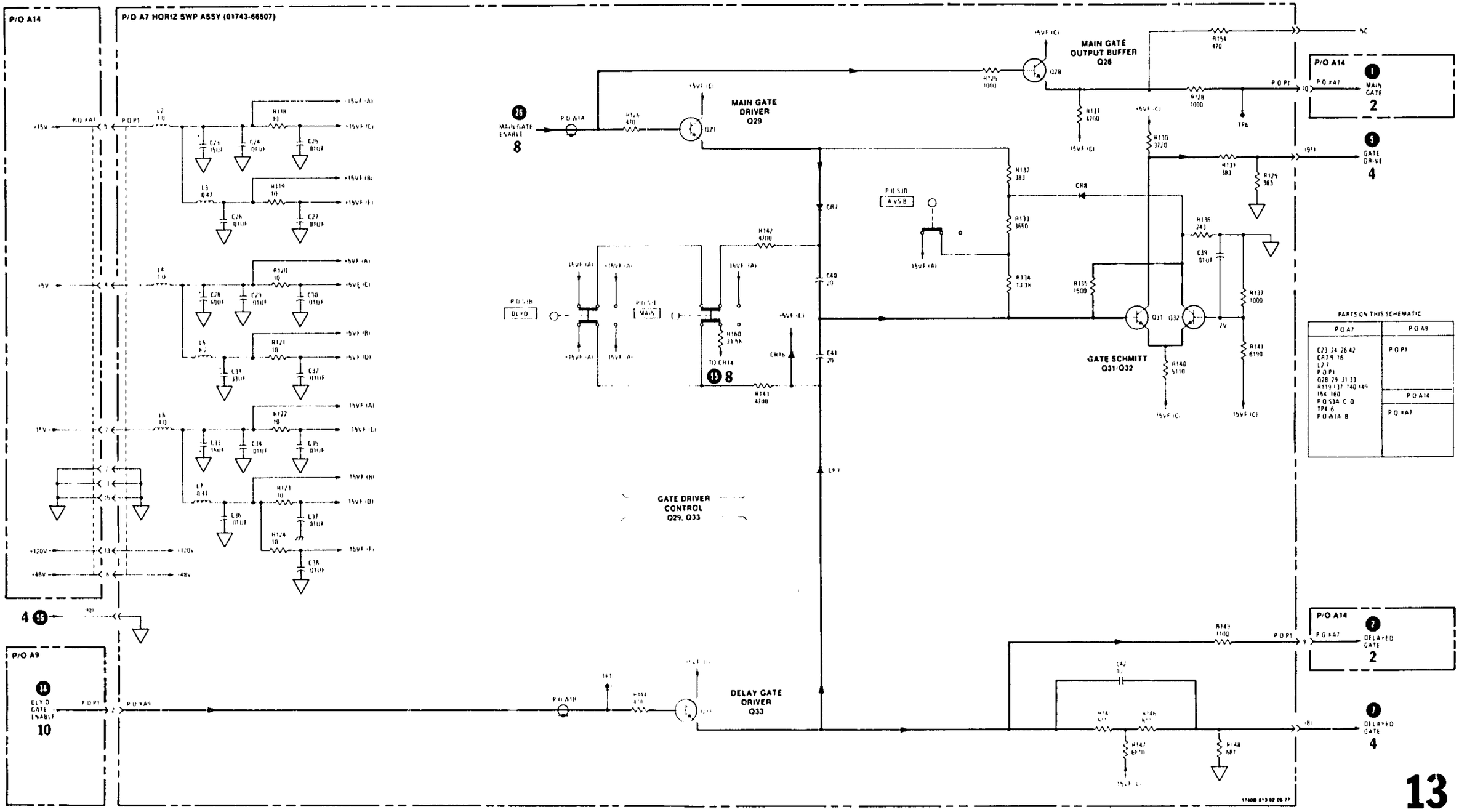
The gate Schmitt circuit, A7Q28 - A7Q32, provides Gate Amplifier Assembly A12 with main and delayed gate signals. The Schmitt circuit is controlled by horizontal mode switch A7S3. It is set by the first positive control pulse and resets on the first negative control pulse. In main sweep operation, the gate follows the main sweep. In ΔTIME operation, the gate follows the delayed 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 2).

REMOVAL PROCEDURE

To remove assembly A7 see Service Sheet 8.

TROUBLESHOOTING

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



13

Figure 8-39.
Service Sheet 13, Gate Control Circuitry

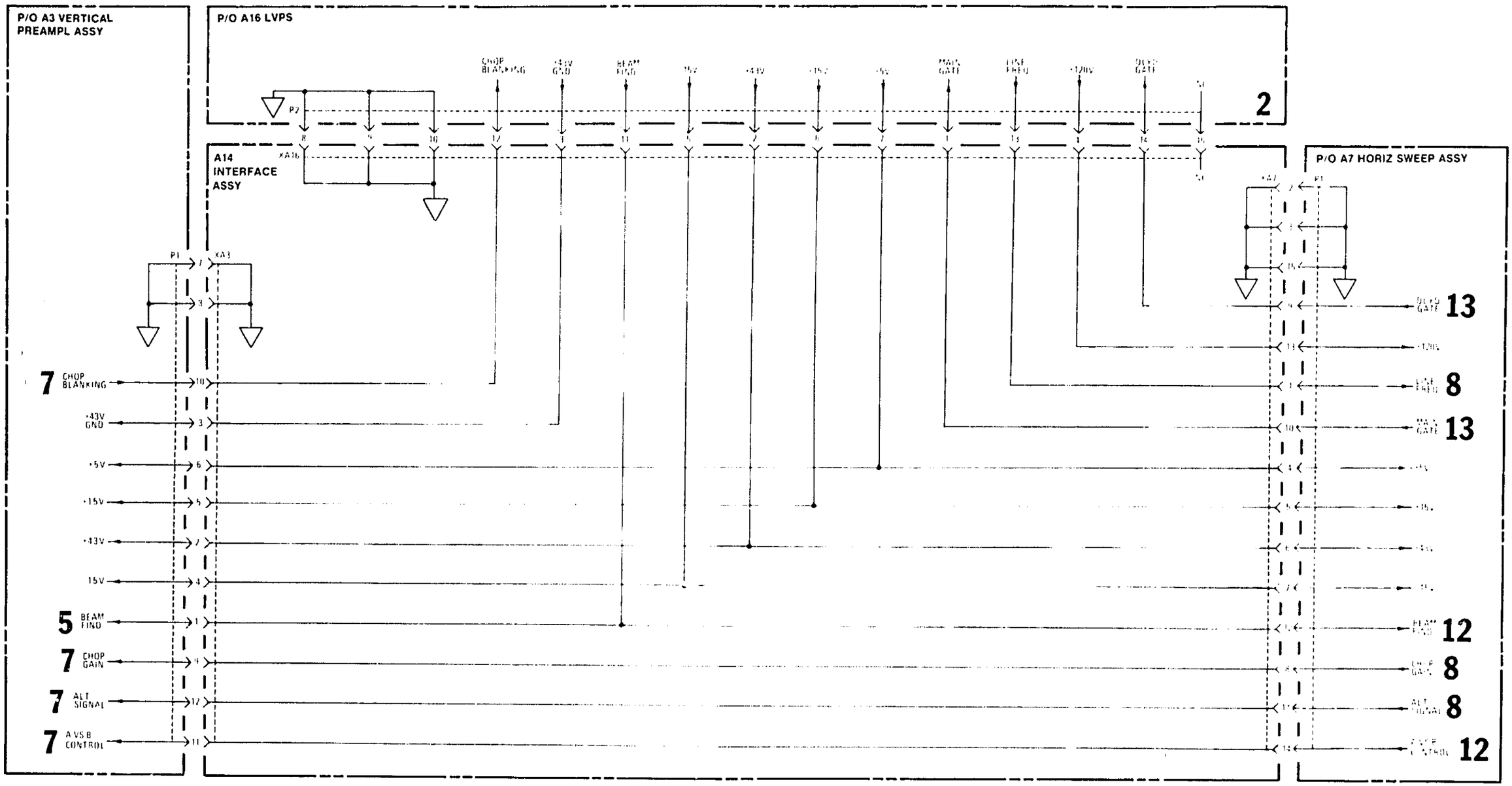


Figure 8-40.
Service Sheet 14, Interconnect Assembly

SERVICE SHEET 15

THEORY OF OPERATION - OPTION 101 ONLY

Option 101 provides the capability of using the Model 1742A to present logic state display information from a logic state anlayzer such as the HP Model 1607A. State display inputs are provided by input BNC connectors J8, J9, and J10 on the rear panel of the Model 1742A. With Option 101, the A VS B horizontal display mode is omitted and replaced by the state display mode push-button.

Option 101 incorporates the following changes to the standard Model 1742A:

a. Standard Interface Assembly A14 is replaced with Option 101 State Display Interface Assembly A14. Three wires from this assembly to the rear panel provide inputs from a logic state analyzer. Two wires from A14 are soldered to option inputs on Horizontal Sweep Assembly A7 (Service Sheet 12). Two more wires from A14 are soldered to Vertical Preamplifier Assembly A3 (Service Sheet 5).

b. Four diodes, A7CR17-A7CR20 are enabled to assembly A7.

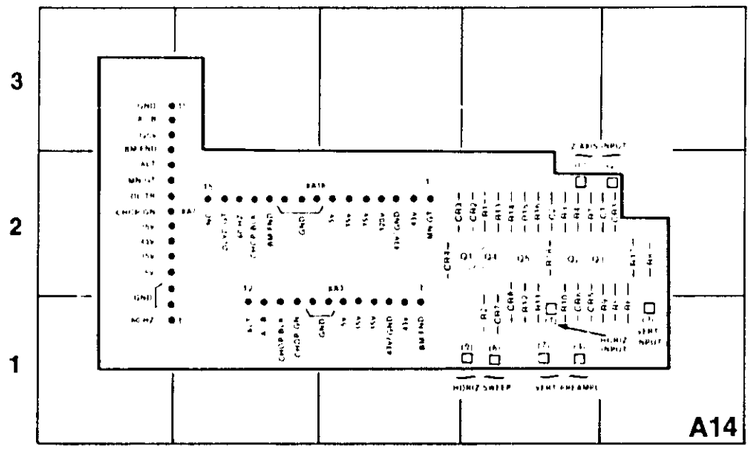
c. Two resistors, A3R142 and A3R143, are added to assembly A3, and A3CR25 is moved to a new position on A3 (Service Sheet 5). Components A3C77, A3CR28, A3Q21, A3R139, and A3R140, which are associated with A VS B vernier control, are omitted from assembly A3 for Option 101.

When the STATE DSPL button is engaged, switch A7S3D (labeled A VS B on schematics) performs the following functions: The main sweep is forced to single sweep. The horizontal preamplifier is disabled. Channels A and B of the vertical preamplifier are shut off. The trigger view amplifier is turned on. The gate Schmitt on assembly A7 is forced on, and control of the gate is from the rear panel Z-axis input J8.

Option 101 circuits on assembly A14 operate as follows: The gate is blanked by a positive signal to the rear-panel Z-axis input from Model 1607A Logic State Analyzer. When the state display mode is selected, the line labeled A VS B control on the interface board is forced to ground, turning A14Q1 off. When the Z-axis input goes positive, the cathode of A14CR4, which drives the chop blanking line, goes positive and blanks the gate.

Paraphase amplifier A14Q4 A14Q5 amplifies the horizontal input from J9 on the rear panel and drives Horizontal Output Assembly A11 through diodes A7CR19 nd A7CR20. The A VS B ground level signal on the anodes of A14CR7 and A14CR8 back bias the diodes and permit the paraphase amplifier to drive the output stage.

Paraphase amplifier A14Q2/A14Q3 amplifies the vertical input from J10 on the rear panel. The A VS B ground level signal turns off A14CR5 and A14CR6 and enables this paraphase amplifier. The collectors of A14Q2 and A14Q3 drive A3R142 and A3L143. The trigger view amplifier is enabled in this mode, and the vertical state display signal drives the delay line through the trigger-view amplifier. Gain and position of the vertical and horizontal sections are controlled from the logic state anlayzer.



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	E 2	CR5	D 1	Q3	D 2	R4	D 2	R10	D 1	R16	D 2
C2	D 2	CR6	D 1	Q4	D 2	R5	E 1	R11	D 1	R17	E 2
CR1	E 2	CR7	D 1	Q5	D 2	R6	E 1	R12	D 1	R18	D 2
CR2	D 2	CR8	D 1	R1	D 2	R7	D 2	R13	D 2	XA3	C 2
CR3	C 2	Q1	D 2	R2	D 1	R8	E 2	R14	D 2	XA7	B 2
CR4	C 2	Q2	D 2	R3	D 2	R9	E 1	R15	D 2	XA16	B 2

Figure 8-41. Interconnect, A14, Component Identification (Option 101)

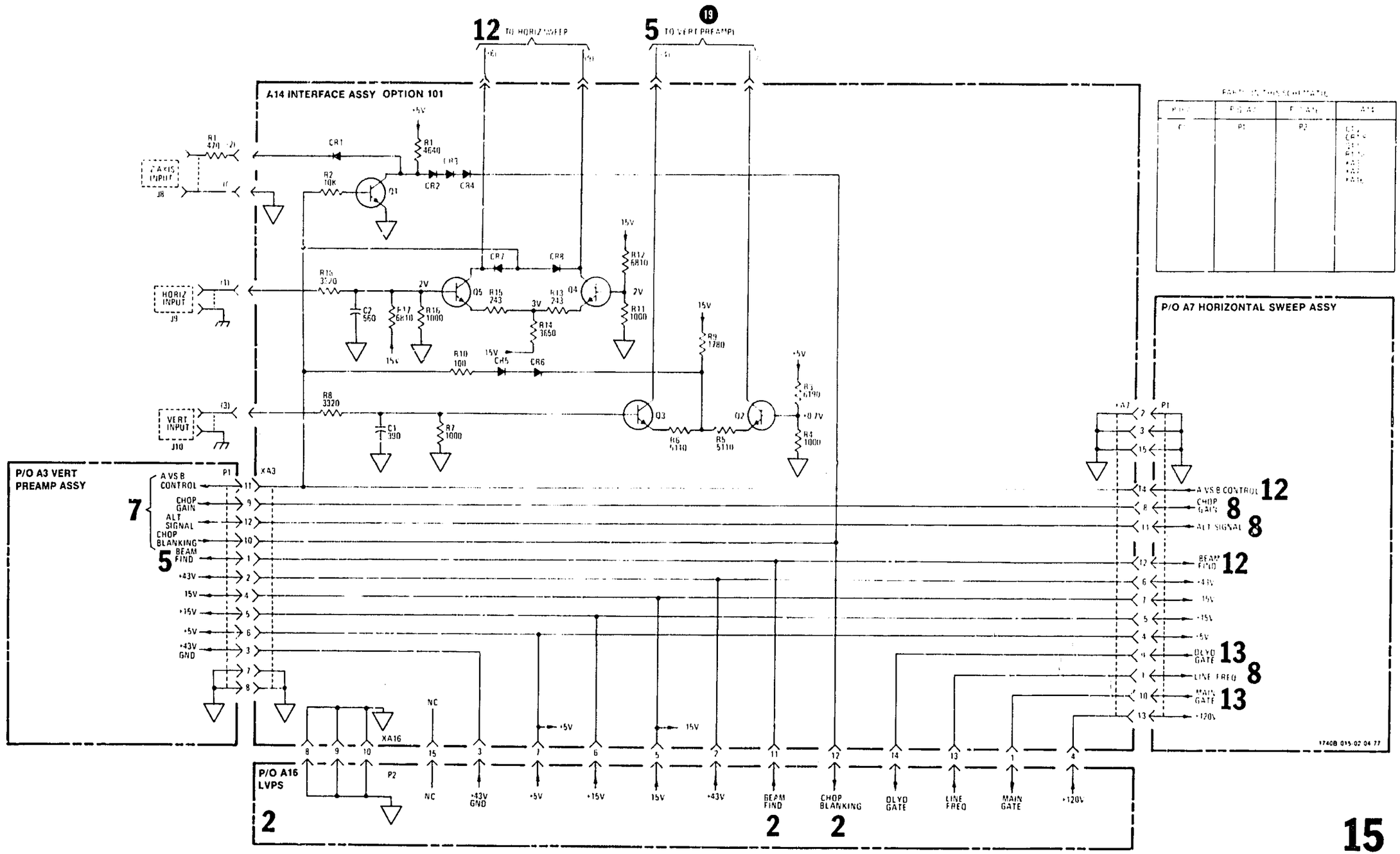


Figure 8-42.
Service Sheet 15, Interconnect Assembly - Option 101

SERVICE SHEET 16

THEORY OF OPERATION

The time interval decoder assembly produces the delay comparator signal used in conjunction with the main trigger signal to arm the delay trigger generator (Service Sheet 10) and the analog voltage that is applied to the rear-panel ΔTIME OUT connectors.

The NAND gate circuitry of A17U8 controls the D input to flip-flop A17U9A. When the instrument is operated in any vertical mode other than ALT, the ALT CONT signal is high, holding the output of A17U8B high (through A17U8A). The high from A17U8B is applied to an input on A17U8C. The other input to A17U8C is from the Q output of flip-flop A17U9A (through A17U8D). This arrangement causes the output of A17U8C to alternately go high and low after each main sweep (provided the DISPLAY ENABLE signal is not low). Flip-flop A17U9A is clocked at the start of each main sweep by the ALT DRIVE signal which turns A17Q13 on and off.

In the ALT mode of operation, the ALT CONT signal goes low, holding the outputs of A17U8A and A17U8D high. The output of A17U8C is now controlled by the START CHAN ON/OFF signal. The START CHAN ON/OFF signal is high when channel A is selected and low when channel B is selected. The Q and $\overline{Q}$ outputs of A17U9A are applied to transistors A17Q7 and A17Q9 alternately turning them on and off. When conducting, each transistor enables either diode gate A17CR3 or A17CR4. For example, when A17Q9 conducts, it forward biases A17CR3, allowing A17U7Q4 to conduct. This turns off A17U7Q1, which turns on A17Q9. The voltage applied to the base of A17U7Q4 is established by the position of START control R6.

The main sweep signal is applied to the base of A17U7Q5. When main sweep voltage slightly exceeds the voltage applied to the base of A17U7Q4, A17U7Q5 conducts, turning off A17U7Q4 and turning on A17U7Q1. A17Q9 turns off, A17Q10 turns on, causing the DLY COMP signal to go high. This arms the delay trigger generator (See Schematic 10).

On the next sweep, A17Q6 will bias A17CR4 on, turning on A17U7Q3 and, again turning off A17U7Q1. The voltage applied to the base of A17U7Q3 is established by STOP control R13 through START STOP summing amplifier A17U3. The start signal developed by START control R6 (through A17U1) is applied as a reference level to the non-inverting input on A17U3. When the main sweep voltage slightly exceeds that voltage applied to the base of A17U7Q3, A17U7Q5 again conducts, turning off A17U7Q3/A17U7Q2. Again the DLY COMP signal goes high arming the delayed trigger generator.

The output of STOP control buffer A17U2 is also applied to inverting amplifier A17U4. The output of A17U4 is applied through A17Q8 to a voltage-divider network consisting of A17R51-A17R60. This voltage-divider network is connected to different position of the TIME/DIV switch A17S1. Output from the TIME/DIV switch is applied to ΔTIME OUT connectors on the rear panel. SIGNAL OVERLAY (ΔT=0) potentiometer R2 is used to balance outputs from the START and STOP potentiometers.

REMOVAL PROCEDURE

Remove assembly A17 as follows:

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

b. Set main TIME/DIV control to 1 μSEC.

c. Set delayed TIME/DIV control to OFF.

d. Remove TIME DIV shaft by pulling through front panel of instrument.

e. Disconnect two square-pin wires to rear-panel ΔTIME OUT connectors at A17.

f. Disconnect square-pin wires (3), (4), and (96).

g. Remove assemblies A8 and A17 by pulling from connectors on assembly A7.

h. Unsolder bare wire from A8.

i. Disconnect A8 and A17 by removing standoff and mounting screw.

j. To replace, reverse removal procedure.

TIME/DIV SWITCH MAINTENANCE

To service the TIME DIV rotor switch on assembly A17, proceed as follows:

a. Remove A17 as described above.

b. After removing A17, 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 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 Section VIII, paragraph 8-20.

g. Place rotor sections on circuit board and reinstall retainer ring.

h. Position slotted portion of open rotor section as noted in step b.

i. Reinstall A17 in instrument.

j. Reinstall TIME/DIV shaft and knob assembly.

TROUBLESHOOTING

Varying the START and STOP controls will allow systematic checkout of the operational amplifiers and comparators. Voltages shown on the schematic are referenced to ground.

U8 and U9 are TTL (T^2L).

Amplifier Voltages:

U1: $V_{pin\ 2} = V_{pin\ 3} = 0$ V

$V_{pin\ 6} = (-)\ V_{wiper}$ of START control

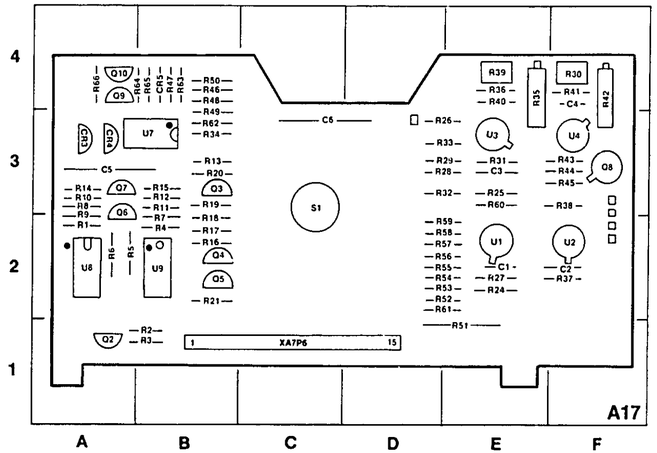
U2: $V_{pin\ 2} = V_{pin\ 3} = 1/2\ V_{pin\ 6}$

U3: $V_{pin\ 2} = V_{pin\ 3}$

$V_{pin\ 6} = V_{pin\ 5} + (-\ V_{pin\ 3})$

U4: $V_{pin\ 2} = V_{pin\ 3} = 0$ V

Q8: $V_{coll} = (-\cdots\ V_{wiper}$ of STOP control



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	R2	B-1	R21	B-2	R42	F-4	R61	E-2
C2	F-2	R3	B-1	R24	E-2	R43	F-3	R62	B-3
C3	E-3	R4	B-2	R25	E-3	R44	F-3	R63	B-4
C4	F-4	R5	A-2	R26	E-3	R45	F-4	R64	B-4
C5	A-3	R6	A-2	R27	E-2	R46	B-4	R65	B-4
C6	C-3	R7	B-2	R28	E-3	R47	B-4	R66	A-4
CR3	A-3	R8	A-3	R29	E-3	R48	B-4	S1	C-3
CR4	A-3	R9	A-3	R30	F-3	R49	B-4	U1	E-2
CR5	B-4	R10	A-3	R31	F-3	R50	B-4	U2	F-2
Q2	A-1	R11	B-3	R32	E-3	R51	E-2	U3	E-3
Q3	B-3	R12	B-3	R33	E-3	R52	E-2	U4	F-3
Q4	B-2	R13	B-3	R34	B-3	R53	E-2	U7	B-3
Q5	B-2	R14	A-3	R35	E-4	R54	E-2	U8	A-2
Q6	A-3	R15	B-3	R36	E-4	R55	E 2	U9	B-2
Q7	A-3	R16	B-3	R37	F-2	R56	E-2	XA7P6	C-1
Q8	F-3	R17	B-2	R38	F-3	R57	E 2		
Q9	A-4	R18	B-2	R39	E-4	R58	E 2		
Q10	A-4	R19	B-3	R40	E-4	R59	E-2		
R1	A-2	R20	B-3	R41	F-4	R60	E 3		

Figure 8-43. Interval Decoder, A17, Component Identification

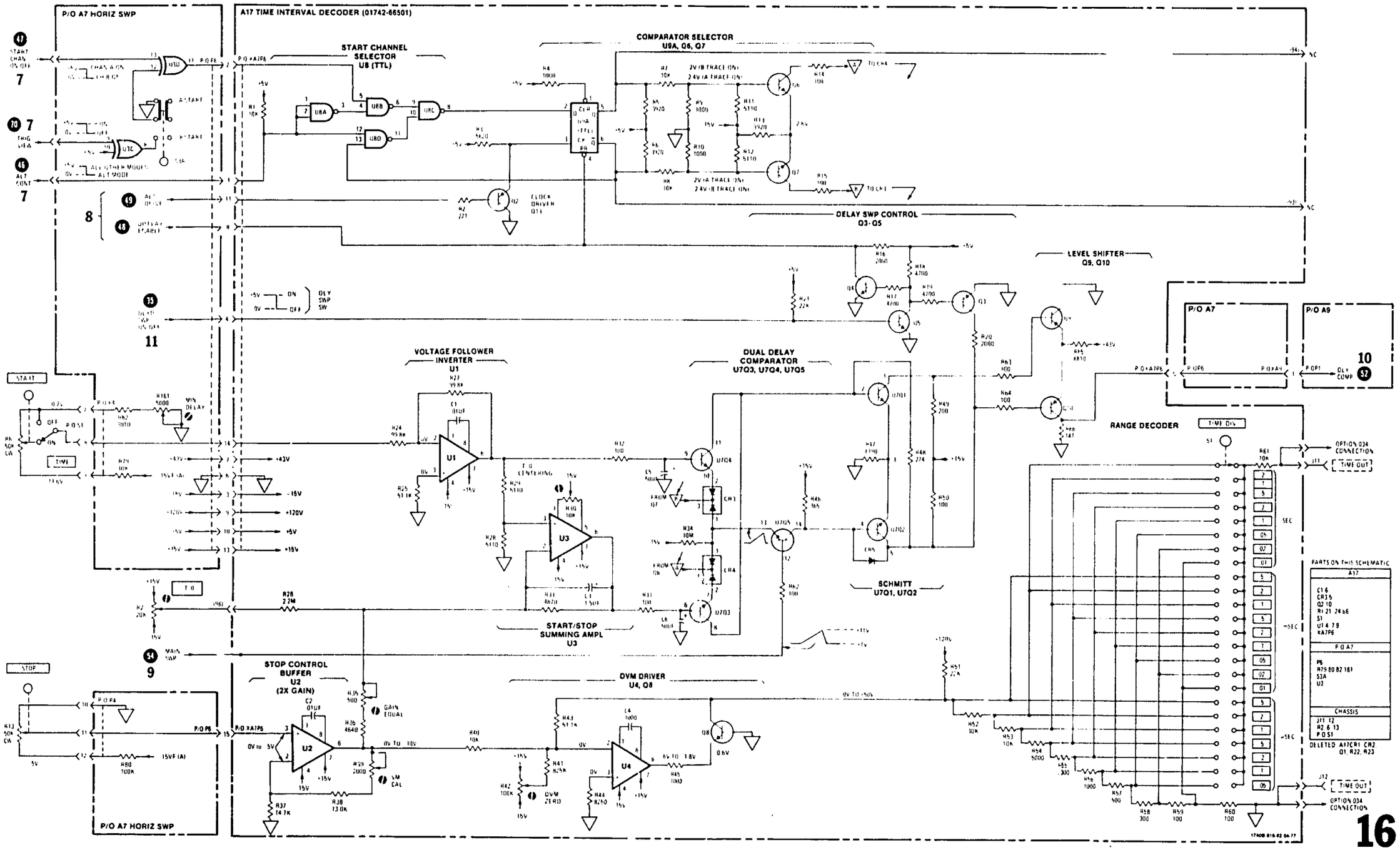


Figure 8-44.
Service Sheet 16, Time Interval Decoder

MANUAL CHANGES

MANUAL IDENTIFICATION

Model Number:	1742A
Date Printed:	July, 1978
Part Number:	01742-90903

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
1840A	1
1919A	1,2
2021A	1,2,3
2305A	1,2,3,4

Serial Prefix or Number	Make Manual Changes

▲ NEW ITEM

CHANGE 1

Page 3-0,

Change NOTE for controls 26 and 27 as follows:

NOTE: In TRIG'D, the 1742A provides conventional delayed sweep with a single marker controlled by the 10 turn stop control 18. Output from ΔTIME OUT connectors (or DMM on Option 034) in TRIG'D will indicate the position of the STOP control 18, not the time interval being displayed.

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.

HEWLETT hp PACKARD

Printed in U.S.A.

CHANGE 1 (CONT'D)

Table 6-2,
Change: A10 HP Part No. and Mfr Part No. to 01740-66555 (2 places).
Add: A10CR9 HP Part No. 1901-0040, DIODE-SWITCHING 30V 50MA 2NS DO-35, Mfr Code 28480, Mfr Part No. 1901-0040.

Figure 8-30,
Change Schematic 9 as shown below:

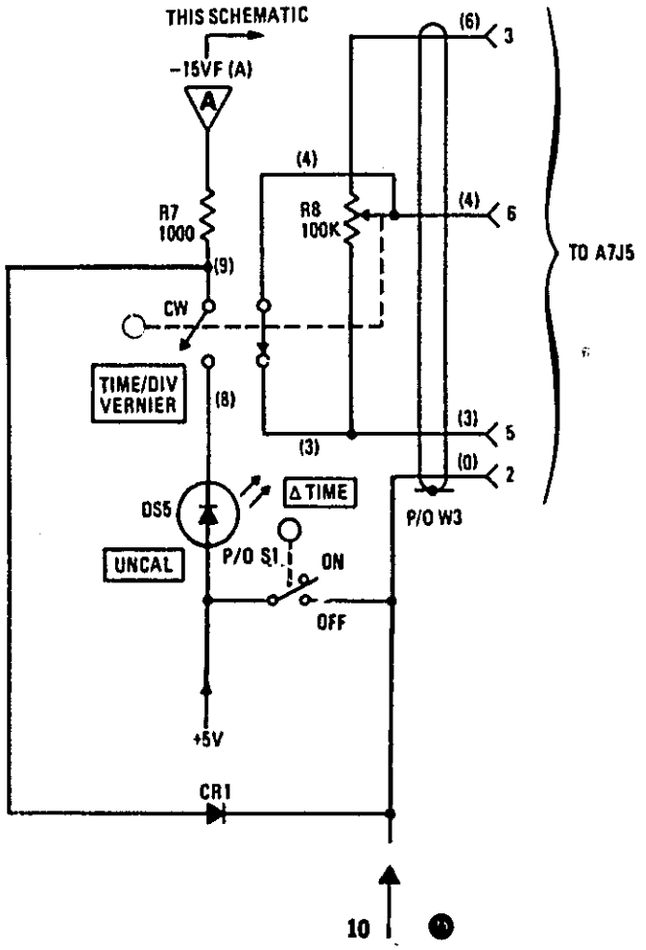
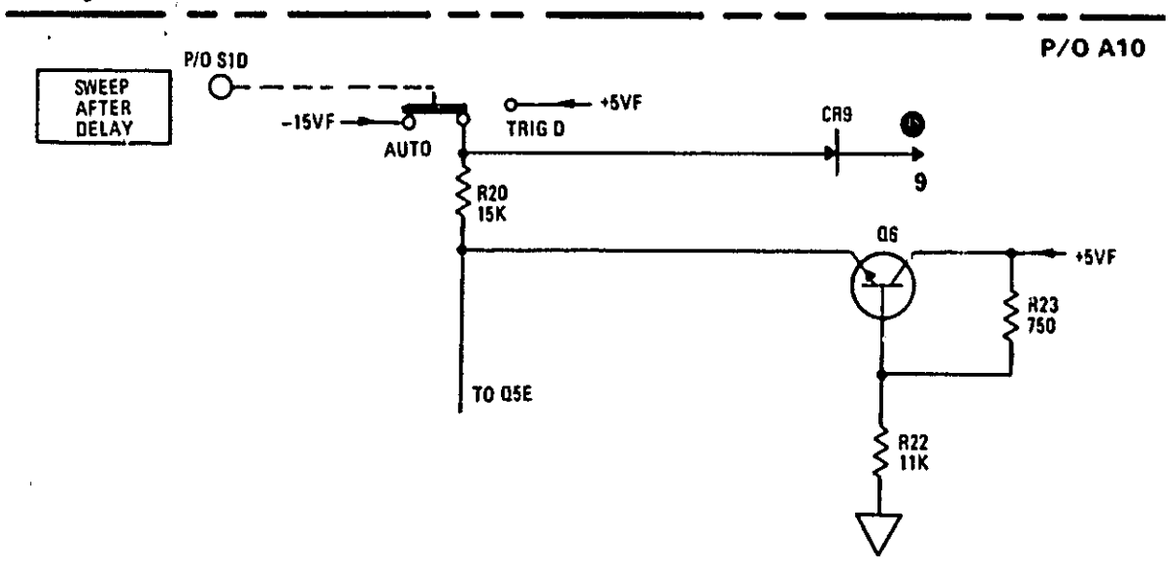


Figure 8-32,
Change Schematic 10 as shown below:



CHANGE 2

Figure 6-1. (Sheet 1 of 2),
Add: to H4 Where Used entry; CRT SHIELD (2).
Add: to H24 Where Used entry; CRT SHIELD (2).
Add: 145, SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI, HP PART NO. 2360-0195, CRT SHIELD (2).
Table 6-2,
Change: L2, HP and Mfr Part Nos. to 01336-66002.
Change: MP65, HP and Mfr Part Nos. to 01740-60602.

CHANGE 3

Change: A3, HP Part No. and Mfr Part No. to 01740-66567.
Change: A3(OPTION 101), HP Part No. and Mfr Part No. to 01740-66579.
Change: A5, HP Part No. and Mfr Part No. to 01740-66572.
Change: A7, HP Part No. and Mfr Part No. to 01743-66518.
Change: A7(OPTION 101), HP Part No. and Mfr Part No. to 01743-66519.
Change: A8, HP Part No. and Mfr Part No. to 01740-66568.
Change: A9, HP Part No. and Mfr Part No. to 01740-66565.
Change: A11, HP Part No. and Mfr Part No. to 01740-66569.
Change: A12, HP Part No. and Mfr Part No. to 01740-66582.
Change: A13, HP Part No. and Mfr Part No. to 01740-66564.
Change: A15, HP Part No. and Mfr Part No. to 01740-66570.
Change: A16, HP Part No. and Mfr Part No. to 01740-66563.
Change: A17, HP Part No. and Mfr Part No. to 01742-66502.
Change: T1, HP Part No. and Mfr Part No. to 9100-2619.
Change: W3, HP Part No. and Mfr Part No. to 01742-61602.
Change: W7, HP Part No. and Mfr Part No. to 01743-6[illegible]11.
Change: W8, HP Part No. and Mfr Part No. to 01743-61609.

Change: A3P2, HP Part No. and Mfr Part No. to 1251-5346.
Change: A3P3, HP Part No. and Mfr Part No. to 1251-6149.
Change: A3P4, HP Part No. and Mfr Part No. to 1251-6149.

Change: A5XA3, HP Part No. and Mfr Part No. to 1251-6137.

Change: A7P2, HP Part No. and Mfr Part No. to 1251-6009.
Change: A7P3, HP Part No. and Mfr Part No. to 1251-5346.
Change: A7P4, HP Part No. and Mfr Part No. to 1251-6144.
Change: A7P5, HP Part No. and Mfr Part No. to 1251-6012.
Change: A7P6, HP Part No. and Mfr Part No. to 1251-6009.
Change: A7P7, HP Part No. and Mfr Part No. to 1251-6146.
Add: A7XA9, HP Part No. 1251-6006, CONNECTOR 12-PIN F POST TYPE, Mfr Code 28480, Mfr Part No. 1251-6006.

Change: A8XA7, HP Part No. and Mfr Part No. to 1251-6136.

Change: A9P1, HP Part No. and Mfr Part No. to 1251-6105.

Change: A11XA7, HP Part No. and Mfr Part No. to 1251-6001.

Change: A12P1, HP Part No. and Mfr Part No. to 1251-3898.
Change: A12XA16, HP Part No. and Mfr Part No. to 1251-6007.

Change: A13XA3P3, HP Part No. and Mfr Part No. to 1251-6014.
Change: A13XA3P4, HP Part No. and Mfr Part No. to 1251-6014.

Change: A15XA12, HP Part No. and Mfr Part No. to 1251-6136.

CHANGE 3 (CONT'D)

Add: A16C21, HP Part No. 0160-5028, 1, CAPACITOR-FXD .1 UF 500 VDC CER, Mfr Code 72982, Mfr Part No. 8141-500-X7R0-101K.
Add: A16C22, HP Part No. 0160-3670, 5, CAPACITOR-FXD .1 UF 200 VDC CER, Mfr Code 72982, Mfr Part No. 8131-M212-651-104M.
Add: A16C23, HP Part No. 0160-3670, CAPACITOR-FXD .1 UF 200 VDC CER, Mfr Code 72982, Mfr Part No. 8131-M212-651-104M.
Add: A16C24, HP Part No. 0160-3670, CAPACITOR-FXD .1 UF 200 VDC CER, Mfr Code 72982, Mfr Part No. 8131-M212-651-104M.
Add: A16C25, HP Part No. 0160-3670, CAPACITOR-FXD .1 UF 200 VDC CER, Mfr Code 72982, Mfr Part No. 8131-M212-651-104M.
Add: A16C26, HP Part No. 0160-3670, CAPACITOR-FXD .1 UF 200 VDC Cer, Mfr Code 72982, Mfr Part No. 8131-M212-651-104M.
Change: A16P1, HP Part No. and Mfr Part No. to 1251-6008.
Change: A16P3, HP Part No. and Mfr Part No. to 1251-6009.
Change: A16P4, HP Part No. and Mfr Part No. to 1251-5346.

Section VIII. Schematic 2,
Add: C21 to T1 across pins 1 and 2.
Add: C22 to T1 across pins 3 and 4.
Add: C23 to T1 across pins 11 and 12.
Add: C24 to T1 across pins 9 and 10.
Add: C25 to T1 across pins 7 and 8.
Add: C26 to T1 across pins 5 and 6.

▲ CHANGE 4

Page 6-5, Table 6-2. Replaceable Parts.
Change: A4 HP and Mfr Part No. to 01740-61633.
Change: A8 HP and Mfr Part No. to 01740-66593.
Change: A9 HP and Mfr Part No. to 01740-66592.

Page 6-12, Table 6-2. Replaceable Parts.
Change: A5 HP and Mfr Part No. to 01740-61633.

Page 6-17, Table 6-2. Replaceable Parts.
Change: A8 HP and Mfr Part No. to 01740-66593.

Page 6-18, Table 6-2. Replaceable Parts.
Change: A9 HP and Mfr Part No. to 01740-66592.
Change: A9R5 to HP and Mfr Part No. 0761-0011, RESISTOR 3.3K 5% 1W MO TC=0±200. Mfr Code 28480.

Page 6-19, Table 6-2. Replaceable Parts.
Change: A9U1 to HP Part No. 1826-0311, IC OP AMP GP 8-DIP-P PKG, Mfr Code 04713, Mfr Part No. MLM201AP1.
Delete: A9XU1.

Page 8-25, Schematic 11.
Change: A9R5 to 3300 ohms.