Errata

Title & Document Type: 1741A Oscilloscope Operating and Service Manual

Manual Part Number: 01741-90911

Revision Date: February 1978

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, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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.

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.tm.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

1741A
OSCILLOSCOPE

HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

MODEL 1741A OSCILLOSCOPE

(Including Options 001, 090, and 580)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed **1812A.**

With changes described in Section VII, this manual also applies to instruments with serial numbers prefixed **1608A through 1749A.**

Manual Part Number 01741-90911
Microfiche Part Number 01741-90811

PRINTED: FEBRUARY 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 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 1741A Oscilloscope. A separate Operators Guide is also supplied with 1741A. 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- by 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 standards 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 THIS 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 HP Model 1741A is a dual-channel, 100 MHz, delayed-sweep, storage and variable-persistence oscilloscope designed for general-purpose bench or field use. The dual-channel dc to 100 MHz vertical deflection system has 12 calibrated ranges from 5 mV/div to 20 V/div. Maximum sensitivity of 1 mV/div to 30 MHz is provided on each channel by means of a MAG 5X vertical magnification pushbutton. Selectable input impedance of either 50 ohms or 1 megohm permits impedance selection that best meets measurement requirements. The horizontal deflection system has calibrated sweep rates from 2 s/div to 0.05 μs/div and delayed sweep rates from 20 ms/div to 0.05 μs/div. A MAG 10X pushbutton magnifies all sweeps by a factor of 10 and extends the fastest sweep to 5 ns/div.

1-13. In alternate or chop mode, a trigger-view control will display three signals: the trigger signal, channel A signal, and channel B signal. This permits correlation of time between the trigger signal and the channel A and channel B signals. In trigger-view operation, center screen represents the trigger threshold point and allows the viewer to see the triggering level location. With A VS B control, an X-Y mode of operation is possible; channel A input (Y-axis) is plotted versus the channel B input (X-axis).

1-14. A trigger-view control permits observation of the channel A signal, channel B signal and an external trigger signal on the same display when operating in ALT or CHOP modes. Automatic storage is provided for capturing single-shot data that occurs randomly. Automatic erasure permits continuously repeated erase cycles with continuously variable viewing time between erase cycles.

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 1741A:

OPTION 001 (U.S. ONLY): Supplies a fixed ac power cord in place of the standard detachable power cord. Instead of the detachable cord, Option 001 has a power cord adapter plate (HP Part No. 01720-03201) and a fixed power cord (HP Part No. 8120-1202).

OPTION 090: Omits the two Model 10041A divider probes normally supplied as accessories. More suitable probes, listed under Accessories Available, may be specified.

OPTION 580: Instrument shipped with CSA label indicating compliance with CSA Bulletin 556B.

AC POWER CORD OPTIONS. See Section II for ac power cord options available for the 1741A.

1-17. ACCESSORIES SUPPLIED.

1-18. The following accessories are supplied with the 1741A:

One Blue Light Filter, HP Part No. 01740-02701
One RFI Filter, HP Model 10173A
One Viewing Hood, HP Model 10140A
One Front-panel Cover, HP Part No. 5040-0516
One AC Power Cord, HP Part No. 8120-1521
One Vinyl Accessory Pouch, HP Part No. 1540-0292
Two 10:1 Divider Probes, HP Model 10041A

1-19. EQUIPMENT AVAILABLE.

1-20. The following items are available for use with the 1741A:

HP Model 197A with Option 008 Oscilloscope Camera
HP Model 10376A Camera Adapter (not required for HP Model 197A with Option 008)
HP Model 124A Camera
HP Model 10491B Rack Mount Adapter
HP Model 10002A 50:1 Divider Probe
HP Model 10004D 10:1 Divider Probe
HP Model 10007B 1:1 Divider Probe
HP Model 10020A Resistive Divider Probe Kit
HP Models 1001A, 1002A, and 1114A Testmobiles

1-21. RECOMMENDED TEST EQUIPMENT.

1-22. Equipment required to test and maintain the 1741A is listed in Section IV of this manual.

Table 1-1. Specifications

VERTICAL AMPLIFIERS (2)

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

BANDWIDTH: 3 dB down from 6 div reference signal.

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

AC-Coupled: approx 10 Hz to 100 MHz; 1 Hz with 10:1 divider probes.

BANDWIDTH LIMIT: limits upper bandwidth to approx 20 MHz.

RISE TIME: ≤3.5 ns, measured from 10% to 90% points of a 6 div input step.

DEFLECTION FACTOR

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

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

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

INPUT RC (selectable)

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

50 Ohm: 50Ω ±3%.

MAXIMUM INPUT

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

50 Ohm: 5 V rms.

A+B OPERATION

Amplifier: bandwidth and deflection factors are unchanged; channel B may be inverted for 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 divisions with one vernier adjusted for optimum rejection.

VERTICAL MAGNIFICATION (X5)

BANDWIDTH: 3 dB down from 6 div reference signal.

DC-Coupled: dc to approx 30 MHz.

AC-Coupled: approx 10 Hz to 30 MHz.

RISE TIME: ≤12 ns (measured from 10% to 90% points of 8 div input step).

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

TRIGGER SOURCE

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

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

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

COMPOSITE: all display modes triggered by displayed signal except in Chop. In Chop mode, trigger signal is derived from channel A.

Table 1-1. Specifications (Cont'd)

LINE FREQUENCY: trigger signal is derived from power line frequency.

TRIGGER VIEW

Displays internal or external trigger signal. In Alternate or Chop mode, channel A, channel B, and the trigger signals are displayed. In channel A or B mode, Trigger View overrides that channel. Internal trigger signal amplitude approximates vertical signal amplitude. External trigger signal deflection factor is approx 100 mV/div or 1 V/div in EXT ÷10. Triggering point is approx center screen. With identically timed signals to a vertical input and the Ext trigger input, trigger signal delay is 2.5 ns ±1 ns.

MAIN AND DELAYED TIME BASES

RANGES

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

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

Accuracy:

Sweep Time/Div	*Accuracy		Temp Range
	X1	X10	
50 ns to 20 ms	±3% ±2% ±3%	±4% ±3% ±4%	0°C to +15°C +15°C to +35°C +35°C to +55°C
*Add 1% for 50 ms to 2 s ranges.			

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

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

CALIBRATED SWEEP DELAY

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

DIFFERENTIAL TIME MEASUREMENT ACCURACY

Main Time Base Setting	*Accuracy (+15°C to +35°C)
100 ns/div to 20 ms/div	±(0.5% + 0.1% of full scale)
50 ms/div to 2 s/div	±(1% + 0.1% of full scale)
*Add 1% for temperatures from 0°C to +15°C and +35°C to +55°C.	

DELAY JITTER: <0.002% (1 part in 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.

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 (required signal level is increased by 2 when in Chop mode and by 5 when X5 vertical magnifier is used). Triggering on Line frequency is also selectable.

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

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

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

LEVEL and SLOPE

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

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

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

AC: attenuates signals below approx 20 Hz.

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

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

CALIBRATED MIXED TIME BASE

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

A vs B OPERATION

BANDWIDTH

Channel A (Y-AXIS): same as channel A.

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

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

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

CATHODE-RAY TUBE AND CONTROLS

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

PERSISTENCE

Variable: approx 100 ms to 1 min.

Conventional: natural persistence of P31 phosphor (approx 40 μs).

STORAGE WRITING SPEED: >100 cm/μs (118 div/μs) over center 7 x 9 div (with viewing hood).

STORAGE TIME

Display Mode: at least 10 s at 22°C.

Store Mode: at least 30 s at 22°C.

BRIGHTNESS: approx 170 cd/m² (50 fl).

ERASE TIME: approx 300 ms.

Table 1-1. Specifications (Cont'd)

GENERAL

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

AMPLITUDE CALIBRATOR (0°C to +55°C)

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

POWER: 100, 120, 220, 240 Vac, ±10%; 48 to 440 Hz; 100 VA max.

WEIGHT: net, 13.8 kg (30.5 lb); shipping, 16.6 kg (36.5 lb).

OPERATING ENVIRONMENT

Temperature: 0°C to +55°C.

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

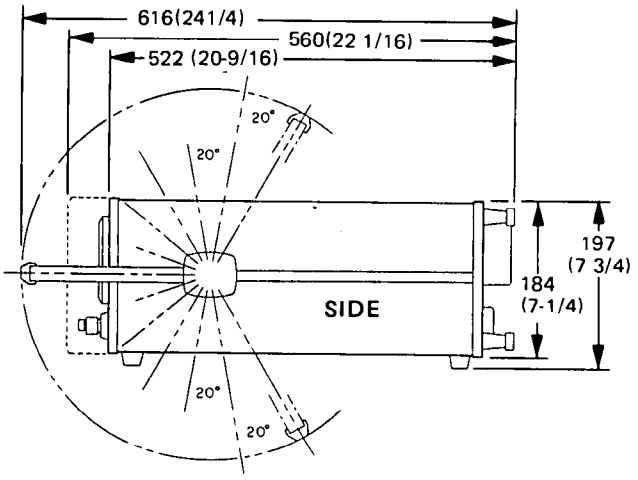
Altitude: to 4600 m (15 000 ft).

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

DIMENSIONS: see outline drawing.

NOTES:

1. DIMENSIONS ARE FOR GENERAL INFORMATION ONLY. IF DIMENSIONS ARE REQUIRED FOR BUILDING SPECIAL INCLOSURES, CONTACT YOUR HP FIELD ENGINEER.
2. DIMENSIONS ARE IN MILLIMETERS AND (INCHES).



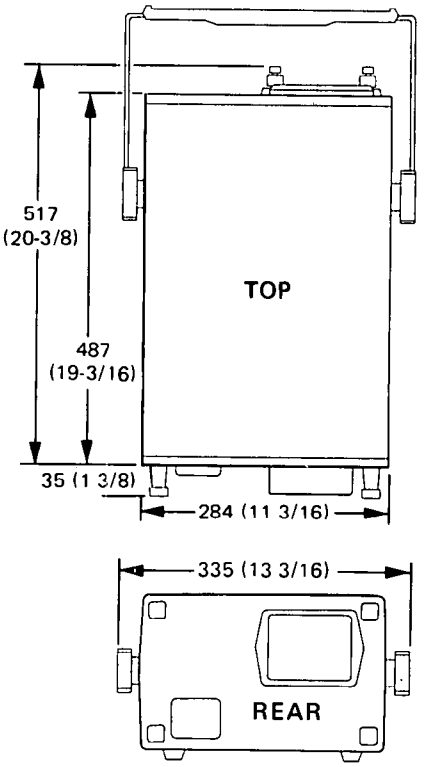


Table 1-2. General Characteristics

VERTICAL DEFLECTION

VERTICAL DISPLAY MODES

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

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

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

HORIZONTAL DISPLAY MODES

Main, main intensified, mixed, delayed, 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. Above 40 Hz, triggering is same as normal. For stable triggering at approx 40 Hz and below, use Normal triggering.

Single: automatically switches triggering to Normal and the sweep occurs once with same triggering as Normal; reset pushbutton arms sweep and lights indicator. Single sweep is also initiated with Erase pushbutton, sweep is armed after the erase cycle.

DELAYED SWEEP (SWEEP AFTER DELAY)

Auto: delayed sweep automatically starts at end of delay.

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

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

CATHODE-RAY TUBE AND CONTROLS

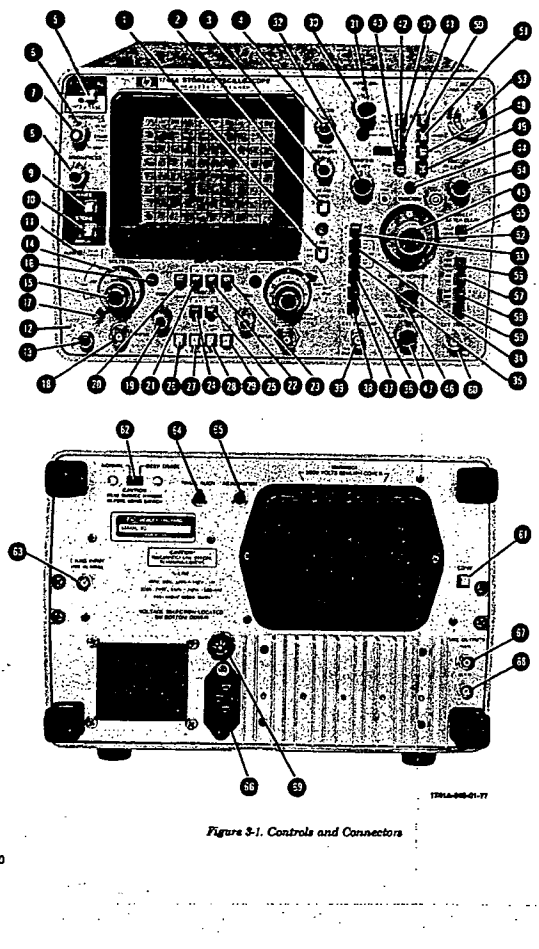
TYPE: Hewlett-Packard, 12.7 cm (5 in.) rectangular CRT, post accelerator, approx 7.5 kV accelerating potential, aluminized P31 phosphor.

GRATICULE: 8 x 10 div (1 div = 0.85 cm) internal, non-parallax graticule, 0.2 subdivision marking on major horizontal and vertical axes, with markings for rise time measurements. Graticule illumination is achieved with Persistence control set to minimum.

BEAM FINDER: returns trace to CRT screen regardless of setting of horizontal and vertical controls.

OPERATING MODES: write, store, display, auto-store, auto-erase, and conventional (rear panel pushbutton).

REAR PANEL CONTROLS: astigmatism, trace align deep area, and conventional pushbutton.



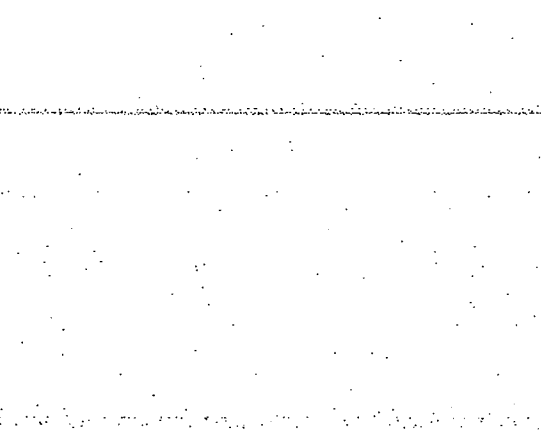


Figure 3-1. Controls and Connectors

CRT CONTROLS

1 LINE OFF/ON. Switch turns power on and off. Indicator lamp lights when power is ON.

2 BEAM FND. Restricts intensified beam to viewing area regardless of control settings. Permits operator to determine necessary adjustments to return beam to viewing area (reduce input signal amplitude, change deflection factor, increase intensity, change position controls, etc.).

3 BEAM INTENSITY. Determines intensity of electron beam as it writes on storage mesh (or CRT phosphor in conventional mode).

CAUTION

INTENSITY set too high in conventional mode can cause residual traces or CRT damage.

4 FOCUS. Adjusts writing beam for sharp, well-defined trace.

5 AUTO STORE/AUTO ERASE. Two-function pushbutton to select either AUTO STORE or AUTO ERASE mode of operation. Respective indicator lamps light to indicate which mode is selected.

AUTO STORE - Simplifies set-up for single-shot capture applications. This mode is selected by pressing SINGLE (11) pushbutton. Pressing either RESET (10) or ERASE (7) arms trigger circuit.

AUTO ERASE - In auto erase, Instrument operates as if in repetitive single-shot mode, even when continuous signal is available. In this mode, instrument automatically switches to maximum persistence, providing maximum trace retention between erasures. This mode of operation is convenient for initial set-up to capture single-shot events by making it easier to obtain optimum focus and intensity for writing signal. Also, when viewing more than one trace (one or two channels plus trigger view), the instrument will wait for required number of sweeps to be displayed before automatically erasing display. Operating at high drive levels in variable persistence and storage modes may cause storage mesh to retain residual images. These residual images may appear as a cluttered display when BRIGHTNESS (1) is at or near maximum. Residual traces are conveniently removed by operating auto erase mode for several minutes with INTENSITY (3) off. For stubborn image removal, a DEEP ERASE feature is provided. When using DEEP ERASE, switch (2) must be set to DEEP ERASE in addition to the AUTO ERASE mode.

6 PERSISTENCE/VIEW TIME. Two-function potentiometer to vary persistence or viewing time of signal, depending on operating mode selected.

PERSISTENCE - Variable persistence adjusts trace retention for optimum display when viewing low repetition rate, fast rise time signals. Adjusting persistence to match repetition rate causes trace to "integrate up" providing sharp, clear display for accurate measurement of low-duty-cycle pulse trains such as those from disc, tape, or drum peripheral units. Variable persistence permits high-resolution timing measurements on exceptionally fine traces such as those produced by dual trace, alternate sweep signals at sweep speeds of 5 ns/div.

VIEW TIME - In AUTO ERASE (5) mode, this control determines length of time sweep trace is retained on display before another erase cycle is initiated.

7 ERASE. Manual pushbutton which initiates erase cycle to remove stored traces from CRT storage mesh. Inoperative when STORE/DISPLAY indicators are on, preventing accidental erasure of stored signal. In AUTO STORE mode, ERASE (7) pushbutton switch may be pressed to arm trigger circuit.

8 BRIGHTNESS. Trace retained on storage mesh is made visible by turning BRIGHTNESS cw. BRIGHTNESS is also used in WRITE mode to vary writing rate. Store time is inversely proportional to BRIGHTNESS.

9 WRITE. Conditions instrument to write applied signals in storage and variable persistence operation. Indicator lights when WRITE is selected.

10 STORE/DISPLAY. Pressing this pushbutton when operating in WRITE (9) mode causes instrument to change to STORE mode after sweep has completed. STORE indicator lights. Pressing pushbutton again causes both STORE and DISPLAY indicators to light and stored trace may be displayed by turning BRIGHTNESS (8) control cw. After trace has been examined, push pushbutton again to enter STORE mode and provide longest store time.

11 CONV. Indicator lamp lights to indicate that instrument is operating as conventional oscilloscope. This mode overrides all storage modes. All measurements can be made in storage, variable persistence mode of operation.

VERTICAL AMPLIFIER CONTROLS

12 CAL 1 V. Provides 1 V p-p (±1%) square-wave voltage signal output with frequency of 1.4 kHz (100 mV p-p when terminated in 50 ohms).

13 ⏚ Provides convenient front-panel chassis ground.

14 CHAN A (B) 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 (15) in CAL detent.

15 Vernier. Provides continuous control of deflection factor between calibrated ranges. Vernier range is at least 2.5:1.

16 UNCAL. Lights when Vernier (either CHAN A or CHAN B) is out of CAL detent. Indicates that VOLTS/DIV setting is uncalibrated.

17 COUPLING.

AC - Selects input coupling and impedance for vertical amplifiers. In AC position, dc component of input signal is blocked. Lower 3-dB limit is 10 Hz.

GND - Input signal is disconnected from amplifier, and amplifier input is grounded.

DC - All elements of input signal are passed to vertical amplifier. Input impedance is 1 megohm shunted by 20 pF.

50Ω - Input signal is dc coupled, and input impedance is 50Ω. Pull lever forward and down to select this position. Do not apply more than 5 V rms to input connector.

18 INPUT. BNC connector for external signal application to channel A and B amplifiers. Impedance and coupling are selectable by (17). Do not apply more than 250 V (dc + peak ac at 1 kHz or less) or more than 500 V (p-p ac at 1 kHz or less).

19 POSN (↕). Controls vertical position of display.

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

21 Channel A. Displays channel A input signal.

22 Channel B. Displays channel B input signal.

A + B. Pressing both channel A (21) and channel B (22) displays algebraic sum of channel A and channel B input signals. If channel B display is inverted (press CH B INVT (19)), A minus B display results.

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

24 TRIGGER A. Selects sample of channel A signal as trigger signal when INT/EXT (25) is in INT.

25 TRIGGER B. When in INT (24), sample of channel B signal is selected as trigger signal.

COMP. When display mode is set for channel A, channel B, A + B, or ALT, and both (23) and (26) are pressed, sweep is triggered by displayed signal. When display is set to CHOP, sweep is triggered by channel A signal only.

26 TRIG VIEW. Displays selected internal trigger signal with same sensitivity indicated on corresponding channel VOLTS/DIV (14) control. Selected external trigger signal is displayed with fixed sensitivity of 100 mV/div with INT/EXT (25) set to EXT (1 V/div if EXT + 10 (29) pressed). TRIGGER LEVEL (27) positions trigger signal vertically about center horizontal graticule line. Center screen indicates trigger threshold level with respect to trigger signal. In ALT (20) or CHOP (23) modes, three signals appear on same display: channel A, selected trigger signal (at center screen), and channel B, with no need for erasing between each display. TRIG VIEW is helpful in establishing discrete trigger levels.

27 MAG X5. Magnifies vertical presentation five times, and increases maximum sensitivity to 1 mV/div. Bandwidth is decreased to 30 MHz.

28 BW LIMIT. Reduces bandwidth of channel A and channel B to approximately 20 MHz.

29 CH B INVT. Inverts polarity of channel B signal. In A + B (23 & 26) mode, pressing CH B INVT (29) results in A minus B display.

MAIN TIME BASE CONTROLS

30-31 POSITION (⇔). Coarse (30) and FINE (31) adjustments position trace horizontally.

32-34 TRIGGER LEVEL. Selects voltage level on input trigger signal where sweep is triggered. With external trigger signals, trigger level is continuously variable from +1 V to −1 V on either slope of input trigger signal; +10 V to −10 V in EXT +10 (29) mode. With internal trigger signals, trigger level selects any point on vertical waveform displayed.

33 POS/NEG. Two-position pushbuttons used to select either positive or negative slope of trigger signal as starting point for sweep.

35 LF REJ. Attenuates internal or external trigger signals below 4 kHz. Useful to condition high-frequency signals for best synchronization by eliminating unwanted low-frequency signals such as power line interference.

36 HF REJ. Attenuates internal or external trigger signals above 4 kHz. Useful to condition low-frequency signals for best synchronization by eliminating unwanted high-frequency signals such as RF.

LINE. Selecting both LF REJ (35) and HF REJ (36) removes all EXT (7) input or INT (24) displayed signals from trigger circuits and applies power-line frequency signal for triggering.

37 AC/DC. Selects ac or dc coupling for EXT input (7) or (29) signal applied to trigger circuit. DC position must be selected for signals below 20 Hz.

38 INT/EXT. INT selects sample of internal vertical signal chosen by TRIGGER source (24 or 25), while EXT selects signal at EXT TRIGGER (7) or (29) input for application to main trigger circuit. Internal signals from dc to 25 MHz displaying 0.3-div amplitude or more are sufficient for stable triggering, increasing to 1 div of amplitude at 100 MHz. Externally applied signals 50 mV p-p from dc to 50 MHz, increasing to 100 mV p-p at 100 MHz are sufficient for stable triggering.

39 EXT ÷10. Attenuates EXT TRIGGER (7) or (29) input signal by factor of 10.

40 EXT TRIGGER. BNC connector for external trigger input. Input impedance is one megohm shunted by 20 pF. Do not apply more than 250 V (dc + peak ac at 1 kHz or less) or 500 V (p-p ac at 1 kHz or less).

41 AUTO/NORM. AUTO sweep mode (pushbutton out). Free-running sweep provides bright display in absence of trigger signal. Trigger signal input (internal or external) of 40 Hz or more overrides AUTO operation and sweep triggering is same as in NORM mode.

42 RESET. Momentary pushbutton that arms trigger circuit in single-sweep mode. After RESET, sweep can be triggered by internal or external trigger signal or by rotating TRIGGER LEVEL control (32) through zero.

43 SINGLE. Sweep occurs once with same triggering as in NORM. After each sweep, trigger circuit must be manually RESET (42). Must also be pressed in conjunction with WRITE (9), AUTO STORE (5), and ERASE (7) to condition instrument for AUTO STORE operation. Indicator lamp lights to indicate circuit armed for next trigger signal.

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

45 UNCAL. Lights when SWEEP VERNIER (46) is out of CAL detent position, and indicates sweep is not calibrated.

46 MAIN TIME/DIV. Inner knob controls main sweep rate, which is indicated by numbers displayed in knob skirt opening.

47 SWEEP VERNIER. Provides continuous adjustment of main sweep TIME/DIV between calibrated positions, expanding slowest sweep to 6 s/div.

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

49 MAIN. Selects main sweep for horizontal display. Sweep rate and triggering are selected by main-sweep controls (46–47), and (54–57).

50 A VS B. Selects X-Y mode of operation with channel A input (Y-axis) plotted versus channel B input (X-axis). Vertical positioning is adjusted by channel A POSN (19), and horizontal positioning is adjusted by POSITION (30) and (31).

DELAYED TIME BASE CONTROLS

51 DLY'D. Selects delayed sweep for horizontal display.

52 MIXED. Selects main and delayed sweeps for horizontal display. First portion of sweep is at main sweep rate, and second portion (starting point chosen by DELAY (53)) is at delayed-sweep rate.

53 DLY'D TIME/DIV. Outer rotating ring selects delayed sweep rate (indicated by marker on ring). Sweep accuracy is same as with MAIN TIME/DIV (46). Interlock is incorporated so delayed sweep is always faster than main sweep. When rotated from OFF position in MAIN (49) mode, portion of main sweep is intensified indicating length and delayed position of delayed sweep with respect to main sweep.

54 DELAY. Provides variable delay time from 0.5 to 10X MAIN TIME/DIV (46) settings of 100 ns to 2 s.

55 TRIGGER LEVEL. Refer to TRIGGER LEVEL (32).

56 SWEEP AFTER DELAY AUTO/TRIG. Selects method of starting delayed-sweep when in delayed, or mixed mode operation. In AUTO (pushbutton released), delayed sweep starts immediately after delay interval, which is the product of DELAY (53) dial reading (div) and MAIN TIME/DIV (46) reading. In TRIG (pushbutton pressed), delayed-trigger circuit is armed after delay interval and delayed sweep must be triggered by either internal or external trigger signal.

57 POS/NEG. Refer to POS/NEG (33).

58 AC/DC. Refer to AC/DC (37).

59 INT/EXT. Refer to INT/EXT (38).

60 EXT ÷ 10. Refer to EXT ÷ 10 (39).

61 EXT TRIGGER. Refer to EXT TRIGGER (40).

REAR PANEL CONTROLS

62 CONV. Two-position pushbutton switch to disable variable persistence and storage functions of instrument so it operates as conventional oscilloscope. Refer to CONV (11).

63 NORMAL/DEEP ERASE. Switch to allow stronger erasure of stubborn images.

64 Z-AXIS INPUT. BNC connector allowing input of signal to modulate CRT beam intensity.

65 TRACE ALIGN. Aligns horizontal trace parallel to horizontal graticule lines.

66 ASTIGMATISM. Controls roundness of displayed spot. (Interacts with FOCUS (4).)

67 Line input. Power cord connector.

68 MAIN GATE OUTPUT. Provides rectangular output of +2.5 V coincident with main gate.

69 DELAYED GATE OUTPUT. Provides rectangular output of +2.5 V coincident with delayed gate.

70 LINE FUSE. AC power input fuse.

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides installation instructions for the Model 1741A Oscilloscope. This section also includes information about initial inspection and damage claims, preparation for using the 1741A, 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 1741A 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.

c. Through opening in bottom cover, set power selector 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 the 0.5 A slow-blow fuse supplied with the instrument.

e. Connect 1741A power cable to input power source.

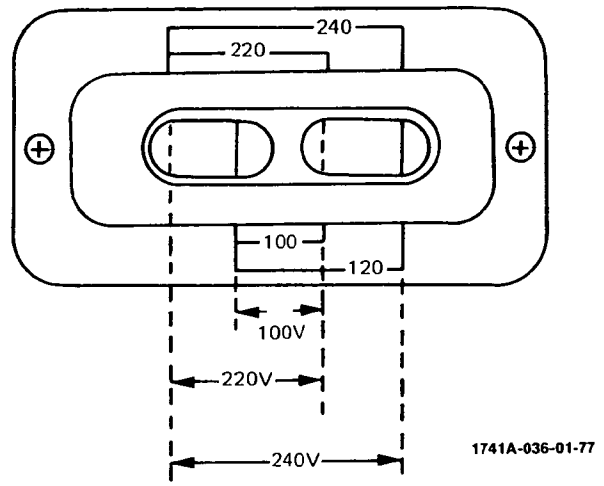


Figure 2-1. Line Voltage Selection Switch Settings

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.

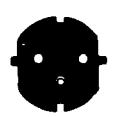
HP POWER CABLE PART NUMBERS	
8120 - 1692	8120 - 0696
 Option 902	 Option 901
8120 - 1703	8120 - 2296
 Option 900	 Option 906
INPUT POWER RECEPTACLE TYPES	

Figure 2-2. Power Receptacles

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.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This operating section explains the function of controls, indicators, and connectors on the 1741A. 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.

NOTE

The blue light filter should not be used at the same time as the RFI filter because spring contacts on the RFI filter must touch contacts at the top and bottom of CRT.

3-5. OPERATORS CHECK.

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 troubleshooting guide in Section VIII to isolate the problem.

CAUTION

Before connecting ac power to the 1741A, make sure the low-voltage power supply line select switches are set to correspond to the voltage of the available ac power line. Refer to Section II for proper switch settings.

3-7. INITIAL TURN-ON PROCEDURE. To place the 1741A into operation and avoid CRT damage, accomplish the following steps in the sequence listed:

a. Turn all control knobs to 12 o'clock positions except, turn BEAM INTENSITY 3, PERSISTENCE VIEW TIME 6 and BRIGHTNESS 8 fully ccw; all VERNIERS 15, 46 to CAL position; TRIGGER HOLDOFF 47 to MIN, and main TIME/DIV 45 fully cw.

b. All pushbuttons should be disengaged except DISPLAY A 21, TRIGGER A 24, and MAIN 48.

c. Engage LINE 1 switch; LINE indicator lamp should light.

d. Press WRITE 9 pushbutton; WRITE indicator lamp should light.

e. After CRT warmup, free-running trace should be observed near center of screen. BEAM INTENSITY 3 adjustment may be required.

f. Increase (or decrease) BEAM INTENSITY 3 to comfortable viewing level; adjust FOCUS 4 for sharpest 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. With vertical POSITION 19 control, align trace with center graticule line.

c. Using non-metallic alignment tool, adjust TRACE ALIGN 64 (on rear panel) until trace aligns with horizontal graticule line.

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

a. Select A VS B 49 operation.

b. Set BEAM INTENSITY 3 for low-level intensified spot.

c. Using POSN 19 and POSITION 30 controls, place spot near center of CRT.

d. Adjust FOCUS 4 and ASTIGMATISM 65 (rear panel) for smallest, round spot.

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

a. Perform initial turn-on procedure.

b. Connect divider probe cable to channel A INPUT 18 connector.

c. Connect probe tip to CAL 1 V (12) output.

d. Set channel A input coupling (17) to DC position.

e. Set main TIME/DIV (45) for horizontal display of at least two full square waves.

f. Set channel A VOLTS/DIV (15) control for square-wave display with two or three divisions of vertical deflection.

g. Adjust TRIGGER LEVEL (32) for stable display.

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

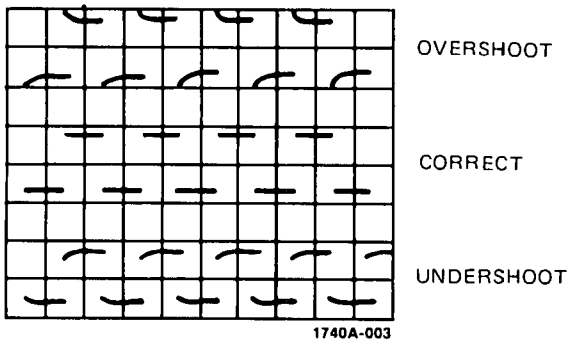


Figure 3-2. Probe Compensation

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

a. Accomplish initial turn-on procedure.

b. Connect CAL 1 V (12) output to channel A INPUT (18) connector using BNC to banana plug adapter and test lead with alligator clip.

c. Set channel A VOLTS/DIV (14) control to 0.2 V/DIV position.

d. Set main TIME/DIV (45) control to 0.2 mSEC position.

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

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

a. Accomplish initial turn-on procedure.

b. Connect time-mark generator to channel A INPUT (18) connector.

c. Set main TIME/DIV (45) to 0.5 μSEC position.

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

e. Using horizontal POSITION (30) (31) controls, set one marker on far left vertical 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 divisions of last vertical graticule line.

3-13. OPERATING INSTRUCTIONS.

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

3-15. TRIGGER SELECTION TABLE. Table 3-1 will aid in determining the best mode of triggering for various signal conditions.

3-16. OBTAINING BASIC DISPLAYS. These procedures will aid the operator in becoming familiar with operation of the instrument. Before performing the procedures, complete the initial turn-on procedure. In addition, set 1741A front-panel controls as follows:

VOLTS/DIV (14) (channel A)	0.05
Coupling (17) (channel A)	DC
Main TIME/DIV (45)	.05 mSEC
DELAY (53)	fully ccw

3-17. Normal Sweep Display. Obtain normal sweep display as follows:

a. Connect divider probe (provided with 1741A) between channel A INPUT (18) connector and CAL 1 V (12) output.

b. Connect divider probe grounding strap to ground post (13).

c. Adjust main TRIGGER LEVEL (32) for stable display.

d. Adjust channel A POSN (19) to align base of square wave on center graticule line.

e. Observe square-wave display of five to nine positive-going pulses with amplitude of two divisions (see figure 3-3A).

3-18. Magnified Sweep Display. Obtain magnified sweep display as follows:

a. Accomplish normal sweep display procedure (paragraph 3-17).

b. Using horizontal POSITION (30), place waveform to be magnified on center graticule line.

c. Engage MAG X10 (43) pushbutton.

d. Adjust horizonal POSITION (31) for precise placement of magnified display (see figure 3-3B).

Table 3-1. Display and Trigger Selection Table

SIGNAL CONDITIONS	DISPLAY MODE	TRIGGER SELECTION				
		A		B	COMP	EXT
1. Single Signals Applied to Channel A or B	A or B	OK	or	OK	OK	OK[1]
	ALT[5] or CHOP[5]	OK	or	OK	NG	OK[1]
II. Time Related Signals Applied to Channels A & B	ALT	OK[2]		OK[2]	NG[3]	OK[2]
	CHOP A+B (A-B)	OK[2]		OK[2]	NG[4]	OK[2]
		OK		OK	OK[6]	OK
III. Nontime Related Signals Applied to Channels A & B	ALT	NG		NG	OK	NG

1 Assume time related signal applied.

2 Time relation displayed.

3 No time relation displayed.

4 If COMP is selected in CHOP, switching overrides and selects A.

5 Signal is only displayed on one channel.

6 Triggers on algebraic sum or difference of signals.

OK Usable trigger mode.

OK Good trigger mode.

OK Best trigger mode.

NG Unusable trigger mode.

3-19. Delayed Sweep Display. Obtain delayed sweep display as follows:

a. Accomplish normal sweep display procedure (paragraph 3-17).

b. Set delayed TIME/DIV (52) to 50 μSEC position. Observe portion of square wave that is intensified.

c. Adjust BEAM INTENSITY (3) for comfortable viewing level.

d. Ensure SWEEP AFTER DELAY (55) pushbutton is in AUTO position.

e. Adjust DELAY (53) clockwise until intensified portion of trace is over area to be investigated (see example in figure 3-3C).

f. Engage DLY'D (50) pushbutton. Note intensified portion of trace is now displayed across entire CRT (see figure 3-3D).

NOTE

Other pulses in the pulse train may be observed by varying the position of the DELAY (53) control.

3-20. Mixed Sweep Display. Obtain mixed sweep display as follows:

a. Accomplish normal sweep display procedure (paragraph 3-17).

b. Set delayed TIME/DIV (52) to 50 μSEC position. Observe portion of square wave that is intensified.

c. Adjust BEAM INTENSITY (3) for comfortable viewing level.

d. Adjust DELAY (53) clockwise until intensified portion of waveform is in second half of CRT (see figure 3-3E).

e. Engage MIXED (51) pushbutton. Verify that first portion of display is at main TIME/DIV (45) sweep rate and second portion is at delayed TIME/DIV (52) sweep rate (see figure 3-3F).

3-21. X-Y Display. Obtain X-Y display as follows:

a. Engage A VS B (49) pushbutton.

b. Adjust BEAM INTENSITY (3) for comfortable viewing level.

c. Apply vetical (Y-axis) signal to channel A INPUT (18) connector.

d. Apply horizontal (X-axis) signal to channel B INPUT (18) connector.

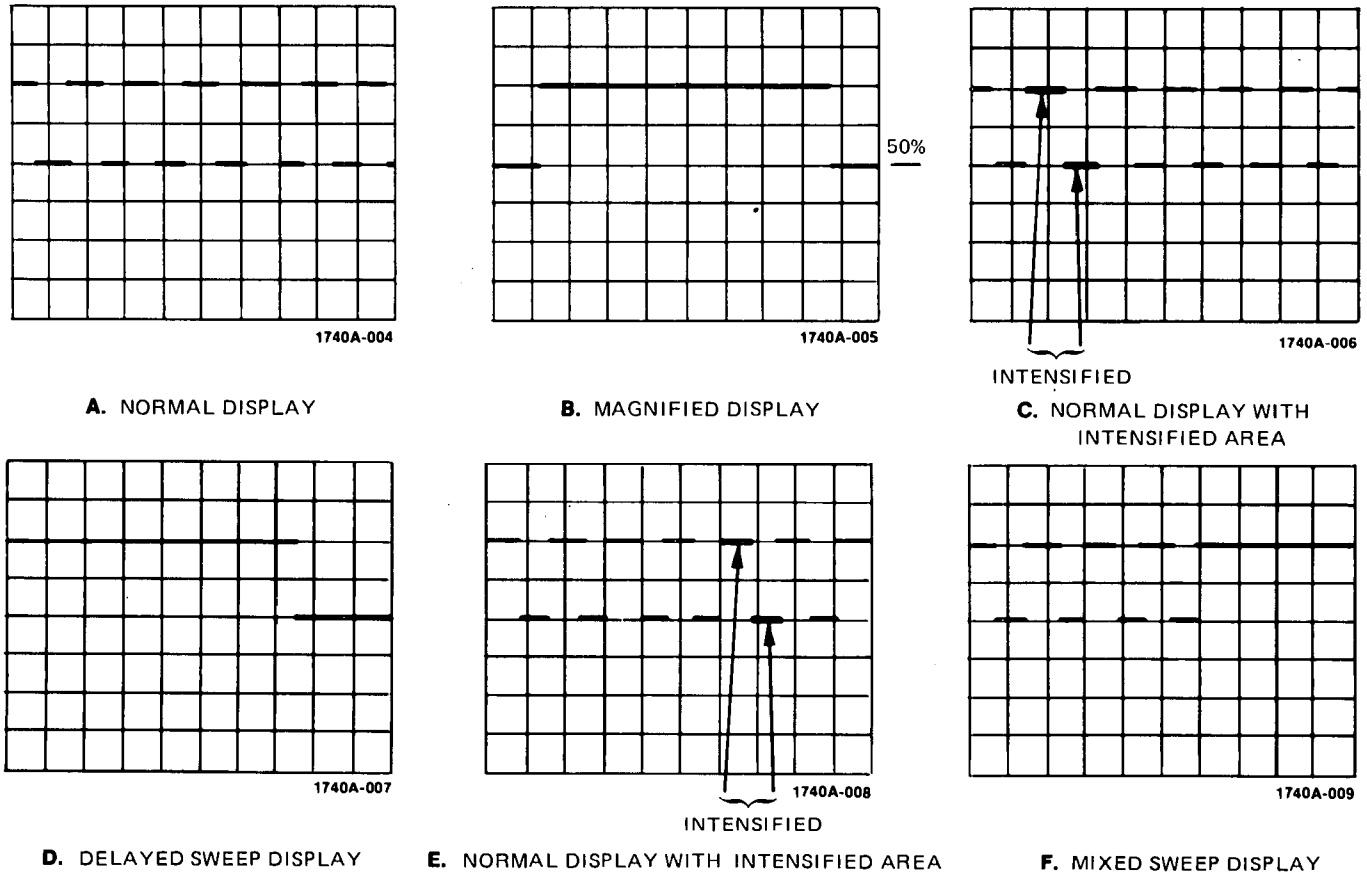


Figure 3-3. Display Waveforms

NOTE

Channel A POSN (19) will adjust vertical position of the waveform. Horizontal POSITION (30) will adjust the horizontal position.

e. Adjust channel A and channel B VOLTS/DIV (14) controls as required.

f. If display is not visible, engage BEAM FIND (2) to locate display. Make necessary control adjustments to center display on CRT.

3-22. Variable Persistence Display. Obtain variable persistence display as follows:

a. Accomplish initial turn-on procedure.

b. Using signal generator, apply fast rise time, low repetition rate signal to channel A INPUT (18) connector.

c. Note waveform transition gives very faint trace as in figure 3-4A.

d. Turn PERSISTENCE (6) slowly clockwise. Observe transition portion of waveform gradually integrates up to bright, easily observed trace (see figure 3-4B).

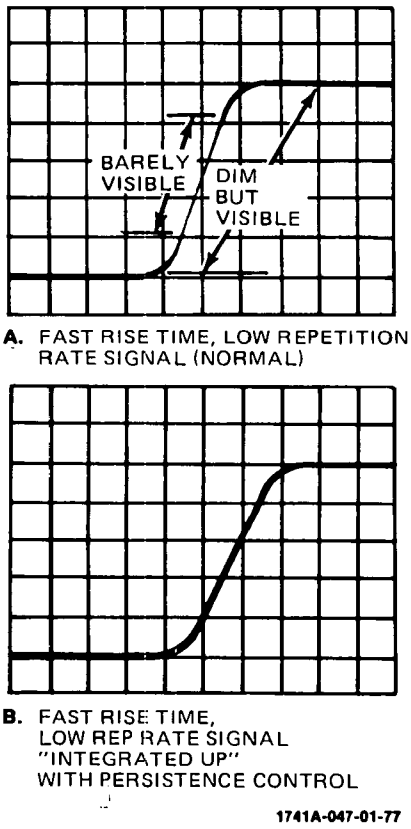


Figure 3-4. Variable Persistence Display

3-23. OPERATOR MAINTENANCE.

3-24. REMOVING DEEPLY STORED IMAGES. The following procedures will remove deeply stored images from the CRT but will not restore a permanently damaged CRT. The procedures should be accomplished in sequence, i.e., AUTO ERASE first, DEEP ERASE second, and B-Scan AUTO ERASE last.

CAUTION

Deviation from the following procedure may result in permanent CRT damage.

3-25. Auto Erase. Accomplish AUTO ERASE as follows:

a. Set 1741A controls as follows:

CONV (61) (rear panel)	Out
NORMAL/DEEP ERASE (62) (rear panel)	Normal
BEAM INTENSITY (3)	fully ccw
PERSISTENCE VIEW TIME (6)	fully ccw
BRIGHTNESS (8)	fully ccw
TRIGGER HOLDOFF (47)	Minimum
MAIN TIME/DIV (43)	fully cw
ALL VERNIER (15), (46)	Cal detent
DISPLAY A (21)	In
TRIGGER A (24)	In
AUTO STORE/AUTO ERASE (5)	In
SINGLE (42)	Out
All others	Out or midrange

b. Allow oscilloscope to operate in the AUTO ERASE mode for one to two hours before checking for adequate image erasure. If further erasure is required, proceed with paragraph 3-26.

3-26. Deep Erase. Acomplish DEEP ERASE as follows:

a. Set 1741A controls as follows:

NORMAL/DEEP ERASE (62)	DEEP ERASE
All others	same as 3-25a

b. Allow oscilloscope to operate in the DEEP ERASE mode for approximately 30 minutes before checking for adequate image erasure. The 1741A may be operated in DEEP ERASE as long as desired with no damage to the CRT. When adequate erasure has been accomplished, return to normal operation. If further erasure is required, proceed with paragraph 3-27.

3-27. B-Scan Auto Erase. Accomplish B-SCAN AUTO ERASE as follows:

a. Set 1741A controls the same as listed in paragraph 3-25, step a.

b. Set TIME/DIV to .2 sec/div.

c. Set AUTO/NORM switch to NORM (In).

d. Set BEAM INTENSITY for medium intensity (approximately eleven o'clock position).

e. Set FOCUS for slightly defocused trace.

f. Connect a sine wave generator or the RC Network (shown in figure 3-5) to 1741A CALIBRATOR output and to Channel A INPUT connector.

g. Adjust Channel A VOLTS/DIV and Vernier so that vertical deflection is slightly larger than fullscreen.

h. Allow oscilloscope to operate in the BSCAN/AUTO ERASE mode for 14-16 hours.

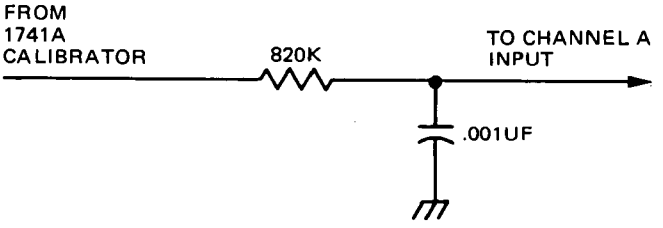


Figure 3-5. RC Network for B-scan Erase

SECTION IV

PERFORMANCE TESTS

4-1. INTRODUCTION.

4-2. The procedures in this section test the instrument's electrical performance using the published specifications 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 Operator's Guide supplied with the instrument.

4-3. EQUIPMENT REQUIRED.

4-4. Equipment required for the performance tests is listed in table 4-1. Any equipment that satisfies critical specifications given in the table may be substituted for the recommended model(s). For best results use recently calibrated test equipment.

4-5. TEST RECORD.

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

4-7. CALIBRATION CYCLE.

4-8. The 1741A requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked using the following performance tests 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 the tests listed in table 4-2.

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 1741A 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 (full 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	midrange
TRIGGER LEVEL (Main and Delayed)	3 o'clock
Sweep Mode	MAIN
DELAY	fully CCW
MAIN TIME/DIV	.1 mSEC
DELAYED TIME/DIV	OFF
SWEEP VERNIER	CAL
TRIGGER HOLDOFF	MIN
WRITE mode	engaged
PERSISTENCE	fully ccw
BRIGHTNESS	fully ccw
CONV (rear panel)	disengaged

4-13. PERFORMANCE TEST PROCEDURES.

4-14. BANDWIDTH. 3 dB down from a 6-division reference signal; dc to 100 MHz, dc coupled; and 10 Hz to 100 MHz, ac coupled. In the vertical MAG X5 mode, bandwidth is reduced to 30 MHz.

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

Equipment Required:

Signal generator
RF voltmeter
BNC cable
50-ohm Tee
Adapter: GR874 to male BNC
Adapter: GR874 to female BNC

4-16. Perform bandwidth test as follows:

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

b. Set 1741A controls as follows:

Coupling (both channels)	50Ω
Channel A VOLTS/DIV	.01
MAIN TIME/DIV	1 μSEC

Table 4-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	**Model**		
Digital Voltmeter	HP Model 34701A with 34750A	Accuracy: 0.1%	A
Oscilloscope	HP Model 1740A	Bandwidth: 100 MHz 10:1 divider probe	A
Oscillator	HP Model 204C	1 kHz to 500 kHz, 1 V p-p	A
Signal Generator	HP Model 3200B	100 MHz, 30 mV p-p	P, A
Time-mark Generator	HP Model 226A	Time Marks 2 s to 5 ns	P, A
LCR Meter	HP Model 4332A	20 pF range	A
Pulse Generator	HP Model 8013B	10-kHz square wave 3 V pk	A
Fast-rise Pulse Generator	HP Model 1105A and 1108A	Rise time: less than 500 ps 50-ohm output 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	Monitor Signal Generator output	P, A
Adapter	HP Part No. 1251-2277	Dual banana plug to female BNC adpater	P, A
Adapters (3)	HP Part No. 1250-0850	GR874 to female BNC	P, A
48-inch BNC Cables (2)	HP Model 10503A	50-ohm, BNC male to BNC male, approximately 48 inches long	P, A
9-inch BNC Cables (2)	HP Model 10502A	50-ohm, BNC male to BNC male, approximately 9 inches long (must be equal length)	P, A
Power Divider	General Radio Model 874 TPD	50-ohm at all connections	P, A
BNC Tee	HP Part No. 1250-0781	1 male, 2 female	A

7000-A-19

Table 4-1. Recommended Test Equipment (Cont'd)

Instrument		Required Characteristics	Required For
Type	**Model**		
Adapter	HP Part No. 1250-1264	Dual banana post to male BNC adpater	P
Adapter	HP Part No. 1250-0849	GR874 to male BNC	P
1000:1 Divider Probe	HP K05-3440A	100-Megohm input Z; 1000:1 division	A
Test Leads	HP Model 11002A		A
Feedthrough Termination	HP Model 10100C	50-ohm, male BNC at the end, female BNC at other end	P

NOTE: P = Performance Tests, A = Adjustment Procedure.

7000-A-19

Table 4-2. Operation Verification Tests

Para. No.	Performance Test	Alteration	Remarks
4-23	Sweep Time Accuracy	None	Check accuracy from .05 μSEC thru 2 SEC
4-33	Deflection Factor	None	Check deflection factor on .005 V/div through 20 V/div ranges
4-35	Maximum Brightness Writing Rate	None	Check writing rate equivalent to 100 div/ μsec
4-37	Persistence Performance Test	None	Trace should remain visible for 1 minute after one sweep of trace
4-39	Store Time	None	Display stored for 10 seconds

c. Set signal generator frequency for approximately 10 MHz with exactly 6 divisions of vertical deflection on oscilloscope.

d. Note rf voltmeter indication.

e. Set signal generator frequency to 100 MHz.

f. Adjust signal generator amplitude to obtain same indication as in step d. Amplitude of display should be equal to or greater than 4.24 divisions.

g. Set 1741A 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
50-ohm, 48-inch BNC cable
Two 50-ohm, 9-inch BNC cables
Three GR874 to female BNC adapters
50-ohm power divider

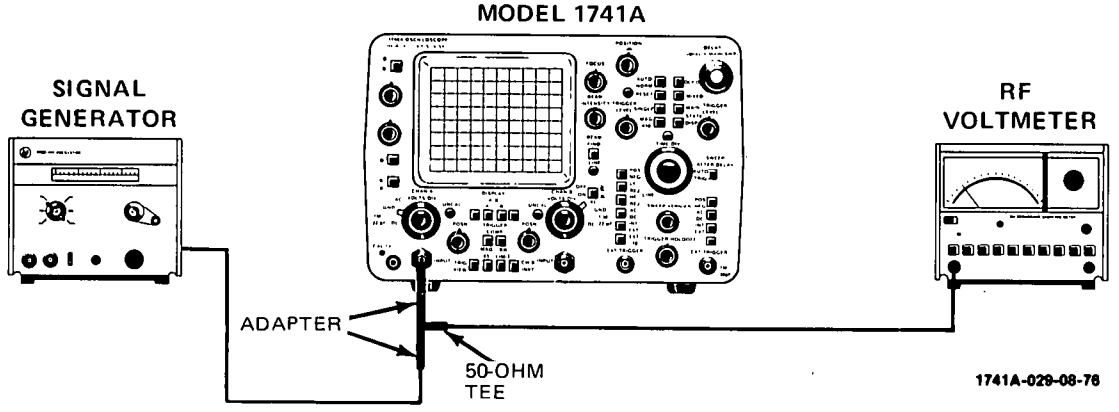


Figure 4-1. Bandwidth Test Setup

check out
cable

.3
3)1.0
9

4-18. Perform CMRR test as follows:

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

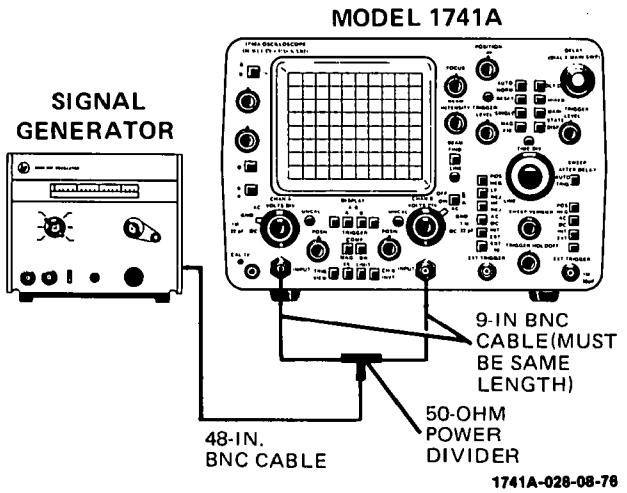


Figure 4-2. CMRR Test Setup

b. Set 1741A controls as follows:

VOLTS/DIV (both channels)	.1
DISPLAY	A
MAIN TIME/DIV	1 μSEC
Coupling (both channels)	50Ω

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

d. Set 1741A 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). DC to 25 MHz on signals causing 0.3 division vertical deflection increasing to 1 division at 100 MHz. The output of a signal generator is applied to the veritcal input to check internal triggering.

Equipment Required:

Signal generator
50-ohm, 48-inch BNC cable

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

a. Connect signal generator to channel A INPUT.

b. Set signal generator to obtain 25-MHz signal with 0.3-division amplitude.

c. Set 1741A controls as follows:

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

d. Adjust main TRIGGER LEVEL to obtain stable display. Stable display confirms proper triggering.

e. Set signal generator to obtain 1-division signal at 100 MHz.

f. Readjust main TRIGGER LEVEL to obtain stable display. Stable display confirms proper triggering.

g. Change 1741A controls as follows:

MAIN TIME/DIV	.1 μSEC
DELAYED TIME/DIV	.05 μSEC
SWEEP AFTER DELAY	TRIG
Sweep Display	DLY'D

h. Adjust delayed TRIGGER LEVEL to obtain stable display (slight readjustment of main TRIGGER LEVEL may be required).

i. Set signal generator output to 0.3-division amplitude at 25 MHz.

j. Readjust delayed TRIGGER LEVEL (and main TRIGGER LEVEL if necessary) to obtain stable display.

k. Disconnect test equipment.

4-21. TRIGGERING (EXTERNAL). Main Sweep: dc to 50 MHz on signals of 50 m V p-p or more, increasing to 100 m V p-p at 100 MHz. Delayed Sweep (ΔTIME): dc to 50 MHz on signals of 50 m V p-p or more, increasing to 100 m V 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 the channel A and the EXT TRIGGER INPUT connectors to check external triggering.

Equipment Required:

Signal Generator
RF Voltmeter
50-ohm Power Divider

4-22. Perform external triggering test as follows:

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

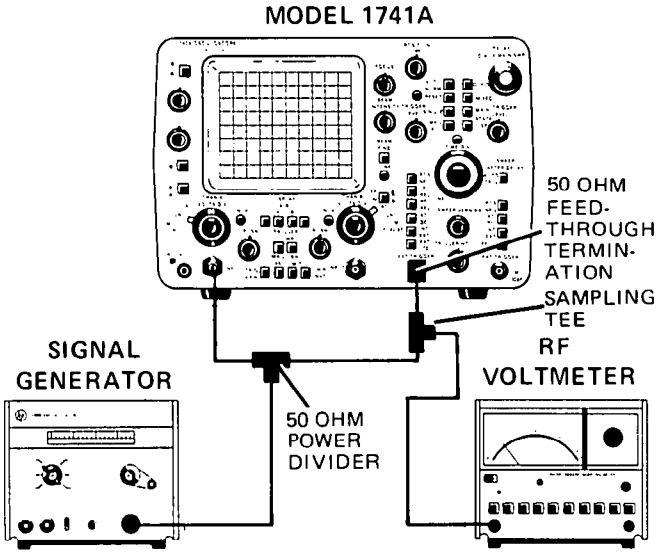


Figure 4-3. External Triggering Test Setup

b. Set 1714A controls as follows:

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

c. Set signal generator controls to obtain 50-MHz, 50-m V p-p signal. (Indication on RF Voltmeter should be 35.3 m V rms.)

d. Adjust main TRIGGER LEVEL to obtain stable display.

e. Set signal generator controls to obtain 100-MHz, 100-m V p-p signal. (Indication on RF Voltmeter should be 70.7 m V rms.)

f. Adjust main TRIGGER LEVEL to obtain stable triggering.

g. Set 1741A controls as follows:

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

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 m V p-p signal. (Indication on RF Voltmeter should be 35.3 m V rms.)

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

l. Set signal generator controls to obtain 100-MHz, 100-m V p-p signal. (Indication on RF Voltmeter should be 70.7 m V rms.)

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

n. Disconnect test equipment.

4-23. SWEEP TIME ACCURACY. (+15°C to +35°C) ±2% in unmagnified mode and ±3% in MAG X10 mode. Refer to table 1-1 for other variations in ambient temperatures. In 50 ms to 2 s ranges, add 1% error.

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

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 4-3 and check accuracy as indicated.

NOTE

It may be necessary to adjust DELAY dial slightly to align markers with graticule lines.

c. Change 1741A sweep display to DLY'D.

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

e. Disconnect test equipment.

4-25. DIFFERENTIAL TIME ACCURACY. Main time base: 100 nSEC/div to 20 mSEC/div, ±(0.5% of measurement +0.1% 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
50-ohm, 48-inch BNC cable

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

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

b. Set 1741A controls as follows:

MAIN TIME/DIV	1 mSEC
DELAYED TIME/DIV	10 μSEC
Channel A Coupling	50Ω

Table 4-3. Main TIME/DIV Accuracy

Main TIME/DIV Settings	Time-mark Generator Settings	Accuracy (15°C to +35°C)	
		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 4-4. Delayed TIME/DIV Accuracy

Main TIME/DIV Settings	Delayed TIME/DIV Settings	Time-mark Generator Settings	Accuracy (+15°C to +35°C)	
			X1	X10
.1 µSEC	.05 µSEC	50 nSEC	1 mark/div ±2%	1 mark/div ±3%
.2 µSEC	.1 µSEC	.1 µSEC	1 mark/div ±2%	1 mark/div ±3%
.5 µSEC	.2 µSEC	.2 µSEC	1 mark/div ±2%	1 mark/div ±3%
1 µSEC	.5 µSEC	.5 µSEC	1 mark/div ±2%	1 mark/div ±3%
2 µSEC	1 µSEC	1 µSEC	1 mark/div ±2%	1 mark/div ±3%
5 µSEC	2 µSEC	2 µSEC	1 mark/div ±2%	1 mark/div ±3%
10 µSEC	5 µSEC	5 µSEC	1 mark/div ±2%	1 mark/div ±3%
20 µSEC	10 µSEC	10 µSEC	1 mark/div ±2%	1 mark/div ±3%
50 µSEC	20 µSEC	20 µSEC	1 mark/div ±2%	1 mark/div ±3%
.1mSEC	50 µSEC	50 µSEC	1 mark/div ±2%	1 mark/div ±3%
.2mSEC	.1 mSEC	.1mSEC	1 mark/div ±2%	1 mark/div ±3%
.5mSEC	.2 mSEC	.2mSEC	1 mark/div ±2%	1 mark/div ±3%
1 mSEC	.5 mSEC	.5mSEC	1 mark/div ±2%	1 mark/div ±3%
2 mSEC	1 mSEC	1 mSEC	1 mark/div ±2%	1 mark/div ±3%
5 mSEC	2 mSEC	2 mSEC	1 mark/div ±2%	1 mark/div ±3%
10 mSEC	5 mSEC	5 mSEC	1 mark/div ±2%	1 mark/div ±3%
20 mSEC	10 mSEC	10 mSEC	1 mark/div ±2%	1 mark/div ±3%
50 mSEC	20 mSEC	20 mSEC	1 mark/div ±2%	1 mark/div ±3%

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

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

e. Set sweep display to DLY'D.

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

g. Record DELAY dial reading _____.

h. Set sweep display to MAIN.

i. Adjust DELAY dial to intensify 10th line marker from left.

j. Set sweep display to DLY'D.

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

l. Record DELAY dial reading _____.

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

n. Disconnect test equipment.

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

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

4-28. Perform delay jitter test as follows:

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

b. Set 1741A controls as follows:

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

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

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

e. Disconnect test equipment.

4-29. RISE TIME. ≤3.5 ns, measured from 10% to 90% points of a 6-division input step, and ≤12 ns in X5 vertical magnification mode. A fast-rise pulse generator is applied to the vertical input; display rise time is then checked for accuracy.

Equipment Required:

Fast-rise pulse generator
Adapter: GR874 to male BNC

4-30. Perform rise time test as follows:

a. Connect fast-rise 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 1741A 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. Engage vertical MAG X5 switch.

g. Reset channel A VOLTS/DIV and pulse generator controls to obtain 3-division display.

h. Center display on CRT. Rise time should be equal to or less than 12 ns.

i. Connect fast-rise pulse generator to channel B input and repeat steps 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
50-ohm, 48-inch BNC cable
Adapter: dual banana plug to female BNC

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 power supply is connected to the vertical inputs and deflection is checked on all ranges.

Equipment Required:

Dc standard
50-ohm, 48-inch BNC cable
Adapter: dual banana plug to female BNC

4-34. Perform deflection factor test as follows:

a. Connect dc standard to channel A INPUT.

b. Set channel A VOLTS/DIV and dc standard as indicated in table 4-5. Deflection should be 8-divisions ±3% for each checkpoint.

Table 4-5. 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; TRIGGER to B.

d. Repeat steps a and b for Channel B.

e. Disconnect test equipment.

4-35. WRITING RATE AND STORE TIME. Maximum writing rate (brightness control near maximum) results in a writing rate of 100 cm/μsec. Store time in a view mode shall be at least 10 seconds.

Equipment Required:

Viewing hood
Oscillator
50-ohm, 48-inch BNC cable

4-36. Perform writing rate and store time tests as follows:

a. Set 1741A controls as follows:

AUTO/NORM	NORM
MAIN TIME/DIV	.2 μSEC
BRIGHTNESS	fully ccw

b. Connect oscillator to channel A INPUT connector.

c. Set oscillator output for 4.7 MHz, 8-division display.

d. Adjust main TRIGGER LEVEL for stable display.

e. Select AUTO ERASE mode of operation.

f. Set BEAM INTENSITY fully clockwise.

g. Slowly turn BRIGHTNESS clockwise until trace is just visible.

NOTE

Keep BRIGHTNESS control at minimum setting that still allows trace to be viewed.

h. Adjust FOCUS if required.

i. Select SINGLE sweep mode of operation and press WRITE. This places 1741A in AUTO STORE MODE.

j. Press ERASE pushbutton. This will erase CRT, reset main sweep, initiate one sweep, and automatically change to STORE mode.

k. Set BRIGHTNESS fully counterclockwise.

l. Select STORE DISPLAY mode of operation.

m. Turn BRIGHTNESS slowly clockwise until trace is just visible. Display should remain visible in quality area of CRT (center 7- by 9-divisions) for at least 10 seconds, using viewing hood. This corresponds to writing rate of 100 cm/μsec.

n. Disconnect test equipment.

4-37. PERSISTENCE PERFORMANCE TEST. With BRIGHTNESS control fully ccw, the persistence is variable from less than 100 milliseconds to greater than 1 minute.

Equipment Required: None

4-38. Perform persistence check as follows:

a. Set 1741A front-panel controls as follows:

MAIN TIME/DIV	.2 SEC
BRIGHTNESS	fully ccw
PERSISTENCE/VIEW TIME	fully ccw

b. Adjust BEAM INTENSITY for just visible spot.

c. Observe tail length of spot as it moves across CRT. Tail length should be less than 0.5 division.

d. Turn PERSISTENCE/VIEW TIME fully cw.

e. Press ERASE pushbutton.

f. After one sweep has occurred, set BEAM INTENSITY fully ccw. Trace should remain visible with no fade positive or negative for at least one minute.

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 accessories is given in table 4-1 (Section IV). The 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 suggested that they be made in the recommended sequence because several adjustments are directly related to preceding or following adjustments. Refer to table 5-1 for a list of adjustable components and their functions.

5-9. In addition to complete step-by-step adjustment procedures, a condensed adjustment procedure is provided in table 5-6 for the convenience of the technicians who have sufficient experience with the 1741A. For best results, adjustments should be performed at normal room temperature. Adjustment locations are shown in figure 5-3 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- and rear-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.

CONTROL	POSITION
All Pushbuttons (except as noted below)	disengaged
VOLTS/DIV (Channel A and B)	.1
VOLTS/DIV Vernier (Channels A and B)	CAL 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	midrange
TRIGGER LEVEL (main and delayed)	3 o'clock
Sweep Mode	MAIN
DELAY	fully ccw
MAIN TIME/DIV	.1 mSEC
DELAYED TIME/DIV	OFF
SWEEP VERNIER	CAL
TRIGGER HOLDOFF	MIN
WRITE mode	engaged
PERSISTENCE/VIEW TIME	ccw (min)
BRIGHTNESS	ccw (min)
CONV (rear-panel control)	disengaged

5-13. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT.

Equipment Required:

Digital voltmeter

5-14. Adjust low-voltage power supply as follows:

a. Connect digital voltmeter between A16TP4 and A16TP3 (ground).

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

Table 5-1. Adjustable Components

REFERENCE DESIGNATOR	ADJUSTMENT NAME	ADJUSTMENT PARAGRAPH	SCHEMATIC NUMBER	DESCRIPTION
A16R26	+15 V ADJ	5-14	1	Adjusts +15 Vdc supply to within ±10 mV.
A15R38	HV ADJ	5-16	2	Adjusts CRT cathode voltage for approx -2295 V.
A15R33	CONV GAIN ADJ	5-18	2	Compensates for gain in conventional mode of operation (versus storage mode of operation).
A12R12/ A12C8	Gate Response	5-20	3	Adjusts for best gate pulse response.
A12R16	Y-ALIGN	5-23	3	Align signal with vertical axis of CRT.
A12R19	PATT	5-25	3	Adjusts CRT display for minimum barrel or pincushion distortion.
A3R116	CALIB AMPL	5-27	6	Adjust calibrator output for 1 V p-p.
A7R20	TRIG SENS (Main)	5-29	7	Adjust for symmetrical triggering of main TRIGGER LEVEL control.
A10R9	TRIG SENS (Delayed)	5-29	9	Adjust for symmetrical triggering of delayed TRIGGER LEVEL control.
A7R41	SYNC ZERO	5-31	7	Compensate for sync signal AC/DC coupling.
A3R86	TRIG VIEW BAL	5-33	4	Center trigger view display on CRT.
A7R169	DLYD SWP START	5-34	9	Adjusts start of delayed sweep with reference to main sweep and DELAY dial setting.
A7R93	X1 CAL	5-36	11	Adjust X1 gain of horizontal amplifier.
A8R43	.05-2 μSEC	5-36	8	Adjust sweep range.
A7R117	X10 CAL	5-36	11	Adjust X10 gain of horizontal amplifier.
A7R105	MAG CENTER	5-38	11	Balance display around center screen when magnifier is engaged.
A11R10 A11R15	LIN 1 LIN 2	5-40	11	Adjust for best horizontal linearity.
A9R28 A9R10 A9R11	.05-2 μSEC 5-200 μSEC 0.5-20 mSEC	5-44	10	Delayed sweep adjustments.
A8R43 A8R12 A8R13 A8R14	.05-2 μSEC 5-200 μSEC 0.5-20 mSEC .05-2 SEC	5-46	8	Main sweep adjustments.

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

REFERENCE DESIGNATOR	ADJUSTMENT NAME	ADJUSTMENT PARAGRAPH	SCHEMATIC NUMBER	DESCRIPTION
A3R11 A3R31	FET BAL (Channel A) FET BAL (Channel B)	5-48	4	Input channel balance adjustment to vertical preamplifier.
A3R18 A3R77	5 mV BAL (Channel A) 5 mV BAL (Channel B)	5-48	4	Calibrate vertical amplifier gain on 5-mV range.
A3R19 A3R76	50 mV BAL (Channel A) 50 mV BAL (Channel B)	5-48	4	Calibrate vertical amplifier gain on 50-mV range.
A3R90	POL BAL	5-48	4	Balance channel B polarity selection.
A3R79	A SYNC BAL	5-50	4	Balances channel A sync signal with channel B input signal.
A3R58 A3R32	A POSN B POSN	5-50	4	Compensates for position variations between normal and MAG X5 operation.
A3C2 A3C17	0.5 V COMP (Channel A) 0.5 V COMP (Channel B)	5-52	4	Adjusts for best input response on .5 V range.
A3C4 A3C19	0.5 V INPUT CAP (Channel A) 0.5 V INPUT CAP (Channel B)	5-52	4	Adjust input capacitance for 0.5 V range.
A3R49 A3R46	A GAIN B GAIN	5-54	4	Equalizes vertical gain of each channel.
A3R65	GAIN	5-54	4	Adjusts overall gain of vertical preamplifier.
A17R21 A17R19 A17R22 A17C6 A3R22	HF 4 HF 3 HF 2 HF 1 B HF ADJ	5-56	5	Vertical output pulse response adjustments.
A7R97	A VS B CAL	5-58	7	Calibrates channel A versus channel B.

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

REFERENCE DESIGNATOR	ADJUSTMENT NAME	ADJUSTMENT PARAGRAPH	SCHEMATIC NUMBER	DESCRIPTION
A17R115	COLL ADJ	5-61	16	Adjust collimation pattern.
A17R103 A17R105	FGG1-1 FGG1-2	5-61	16	CRT floodgun adjustment.
A18R3	WRA	5-62	14	Adjust CRT to pre-fogged condition.
A15R2	INTENSITY LIMIT ADJ	5-62	2	Insure spot is extinguished with minimum intensity.
A12R3	CURRENT LIMIT	5-64	3	Adjusted for discernible display.
A12R24	AMP LIMIT	5-66	3	Adjust gate output amplitude.
A15R32 A15R39	KNEE SLOPE	5-66	2	Adjustments to compensate for interaction between INTENSITY and FOCUS controls.

Table 5-2. LVPS Ripple Specifications

VOLTAGE	TEST POINT	LIMITS	RIPPLE SPECIFICATION
+15 V	A16TP4	±10 mV (adjustable)	20 mV
-15 V	A16TP1	±150 mV	20 mV
+5 V	A16TP2	±50 mV	10 mV
+48 V	A16TP5	± 3 V	10 mV
+120 V	A16TP6	± 6 V	20 mV
+156 V	P5 PIN 6	±15 V	200 mV
-100 V	P5 PIN 1	±10 V	300 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.

5-15. HIGH-VOLTAGE POWER SUPPLY ADJUSTMENT.

Equipment Required:

Digital voltmeter
1000:1 hv divider probe

5-16. Adjust high-voltage power supply as follows:

a. Connect digital voltmeter through 1000:1 high-voltage divider probe to +15 V test point (A16P5 pin 1). Note indication on digital voltmeter and from this calculate percent of error in high voltage divider probe.

b. Connect digital voltmeter through 1000:1 high voltage divider probe to high-voltage test point A15TP4 on high-voltage power supply assembly A15.

NOTE

HV ADJ A15R38 is set at the factory (using special electronic tools) to obtain optimum CRT filament voltage rather than an absolute value of cathode potential. Therefore, the cathode voltage may not be exactly -2250 volts. If the voltage measured at test point A15TP4 is within ±50 volts (2%) of -2250 volts, do not readjust A15R38.

c. If voltage measured at test point A15TP4 is not within ±50-volt tolerance, adjust HV ADJ A15R38 for -2250 volts (make allowance for probe error noted in step a).

d. Disconnect test equipment.

5-17. CONVENTIONAL GAIN ADJUSTMENT.

Equipment Required:

Oscillator
50-ohm, 48-inch BNC cable

5-18. Adjust conventional gain as follows:

a. Connect oscillator to channel A INPUT connector.

b. Adjust oscillator output for approximately 50 kHz and exactly 6-division amplitude display.

c. Set CONV control (rear panel) for conventional mode of operation.

CAUTION

Keep INTENSITY control at minimum usable level to prevent damage to CRT storage mesh.

d. Adjust CONV GAIN ADJ A15R33 for exactly 6 divisions of vertical deflection on CRT.

e. Disconnect test equipment.

5-19. GATE AMPLIFIER RESPONSE ADJUSTMENTS.

Equipment Required:

Monitor oscilloscope
10:1 divider probe

5-20. Adjust gate amplifier response as follows:

a. Connect monitor oscilloscope through 10:1 divider probe to test point A12TP2 (see figure 8-18 for test point location).

b. Set DEEP ERASE switch A15S1 to deep erase position. (This disables amplitude limit circuit.)

c. Adjust BEAM INTENSITY A12R25 so that peak amplitude of gate signal at A12TP2 is 25 volts.

d. Set 1741A Main TIME/DIV to .05 μs/div.

e. Adjust gate COMP adj A12R12 and A12C8 for best square-wave response. (Overshoot, undershoot, etc., should be less than 3%.)

f. Return DEEP ERASE switch A15S1 to normal position.

g. Disconnect test equipment.

5-21. ASTIGMATISM AND FOCUS ADJUSTMENTS. Adjust focus and astigmatism as follows:

a. Set 1741A front-panel controls as follows:

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

b. While spot moves slowly across CRT, adjust FOCUS control and ASTIGMATISM control (rear panel) for smallest and best-defined spot.

5-22. TRACE ALIGN AND Y-AXIS ALIGN ADJUSTMENTS.

Equipment Required:

Oscillator
50-ohm, 48-inch BNC cable

5-23. Adjust trace align and Y-axis align as follows:

a. Obtain horizontal baseline on CRT.

b. Adjust rear-panel TRACE ALIGN control A15R27 so that horizontal trace exactly parallels center horizontal graticule line.

c. Set display mode to A VS B.

d. Connect oscillator to channel A INPUT connector.

e. Adjust oscillator output for approximately 1-kHz, 8-division vertical amplitude display.

f. Adjust Y-ALIGN A12R16 so that vertical trace exactly parallels center vertical graticule line.

g. Disconnect test equipment.

5-24. PATTERN ADJUSTMENT.

Equipment Required:

Oscillator
50-ohm, 48-inch BNC cable

5-25. Adjust pattern control as follows:

a. Connect oscillator to channel A INPUT connector.

b. Set oscillator output for approximately 500 kHz, 6-division vertical amplitude display.

c. Adjust PATT control A12R19 to obtain best raster display (minimum pincushioning or barrelling at top, bottom, and both sides of display).

d. Disconnect test equipment.

5-26. CALIBRATOR AMPLITUDE ADJUSTMENT.

Equipment Required:

Digital voltmeter
Test leads

5-27. Adjust calibrator output as follows:

a. Connect digital voltmeter between CAL 1 V output and ground.

b. Adjust CALIB AMPL A3R116 for indication of 0.500 V ±5 mV. (Since calibrator signal is symmetrical square wave, adjusting for 0.5 V average value gives peak value of calibrator pulse of 1 V ±10 mV.)

c. Disconnect test equipment.

5-28. TRIGGER SENSITIVITY ADJUSTMENT.

Equipment Required:

Oscillator
BNC tee
Adapter, dual banana plug to female BNC
50-ohm feedthrough termination
Two 50-ohm, 48-inch BNC cables

5-29. Adjust trigger sensitivity as follows:

a. Set 1741A controls as follows:

VOLTS/DIV (Channel A	.005
Coupling (Channel A)	50Ω
Main INT/EXT	EXT

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

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

d. Set main AUTO/NORM to NORM.

e. Adjust main trig sens A7R20 fully cw.

f. Slowly turn main TRIGGER LEVEL from one extreme to other. Note one sweep occurs for each direction of rotation.

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

h. Set main AUTO/NORM to AUTO.

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

j. Set main AUTO/NORM to NORM.

k. Turn main TRIGGER LEVEL; sweep should occur for each direction of rotation.

l. Change 1741A controls as follows:

Main AUTO/NORM	AUTO
Sweep mode	DLY'D
MAIN TIME/DIV	.1 mSEC
DELAYED TIME/DIV	50 μSEC
Main INT/EXT	INT
Delayed INT/EXT	EXT

m. Disconnect oscillator from main EXT TRIGGER and connect to delayed EXT TRIGGER.

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

o. Set SWEEP AFTER DELAY to TRIG position.

p. Adjust delayed trig sens A10R9 fully cw.

q. While turning delayed TRIGGER LEVEL from one extreme to other, Adjust A10R9 ccw until sweep occurs for only one direction of rotation or not at all.

r. Set SWEEP AFTER DELAY to AUTO.

s. Increase oscillator output to 20 mV p-p.

t. Set SWEEP AFTER DELAY to TRIG.

u. Turn delayed TRIGGER LEVEL; sweep should occur for each direction of rotation.

v. Disconnect test equipment.

5-30. SYNC ZERO ADJUSTMENT.

Equipment Required:

Oscillator
50-ohm, 48-inch BNC cable

5-31. Adjust sync zero as follows:

a. Connect oscillator to channel A INPUT.

b. Set oscillator output for 1-kHz sine wave at approximately six divisions.

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.

5-32. TRIGGER VIEW BALANCE ADJUSTMENT.

Equipment Required:
Oscillator
50-ohm, 48-inch BNC cable

5-33. Adjust trigger view balance as follows:

a. Set 1741A controls as follows:

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

b. Connect oscillator to main EXT TRIGGER input.

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

d. Adjust main TRIGGER LEVEL for stable display.

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

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

g. Disconnect test equipment.

5-34. DELAYED SWEEP START ADJUSTMENT. Adjust delayed sweep start as follows:

a. Set 1741A front-panel controls as follows:

MAIN TIME/DIV ..... .1 mSEC
DELAYED TIME/DIV..... .05 μSEC
DELAY ..... .2 (fully ccw)

b. Adjust horizontal POSITION control so that main sweep starts exactly on first vertical graticule line.

c. Adjust delay start adj, A7R169, so that intensified spot is placed exactly 2 mm (1 minor div) after main sweep starting point.

5-35. HORIZONTAL AMPLIFIER GAIN ADJUSTMENTS.

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

5-36. Adjust horizontal amplifier gain as follows:

a. Set 1741A controls as follows:

Coupling (Channel A)..... 50Ω
VOLTS/DIV (Channel A)..... .5
DELAYED TIME/DIV..... .05 μSEC
DELAY..... 1.00

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

NOTE

A slight reduction in intensity may be helpful.

c. Set DELAY control to 9.00.

d. Adjust A7R93, X1 gain, until intensified spot is on 10th vertical graticule line from left.

e. Set DELAY control to 1.00 position.

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

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

h. Set time-mark generator for .5 μSEC time markers.

i. Set MAIN TIME/DIV to .5 μSEC.

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

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

l. Set HORIZ DISPLAY control to MAG X10.

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

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

o. Disconnect test equipment.

5-37. X10 AMPLFIER BALANCE ADJUSTMENT.

Equipment Required:
Time-mark Generator
50-ohm, 48-inch BNC cable

5-38. Adjust X10 amplifier balance as follows:

a. Set 1741A controls as follows:

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

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

c. Set time-mark generator for 5 μSEC time markers and observe three time marks.

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

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

f. Disconnect test equipment.

5-39. HORIZONTAL LINEARITY ADJUSTMENT.

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

5-40. Adjust horizontal linearity as follows:

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

b. Set 1741A controls as follows:

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

c. Set time mark generator for 10 ns markers.

d. Set Lin 1, A11R10 and Lin 2, A11R15 fully cw.

e. Adjust both A11R10 and A11R15 for best overall linearity in center 8 division of unmagnified sweep (center 80 divisions of magnified sweep).

f. Disconnect test equipment.

5-41. PRELIMINARY MAIN SWEEP CALIBRATION.

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

5-42. Accomplish preliminary calibration of main sweep as follows:

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

b. Set MAIN TIME/DIV and time-mark generator as indicated in table 5-3 and make adjustments to obtain one marker/division.

Table 5-3. Preliminary Main Sweep Calibration

MAIN TIME/DIV Settings	Time-mark Generator Settings	Adjust
1 μSEC	1 μs	A8R43
10 μSEC	10 μs	A8R12
1 mSEC	1 ms	A8R13
50 mSEC	50 ms	A8R14

c. Disconnect test equipment.

5-43. DELAYED SWEEP ADJUSTMENT.

Equipment Required:

Time-mark generator
50-ohm, 48-inch BNC cable

5-44. Adjust delayed sweep as follows:

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

b. Set 1741A controls as follows:

Coupling (Channel A) 50Ω
VOLTS/DIV 5
Sweep Mode ..... DLY'D

c. Set time-mark generator, MAIN TIME/DIV, and DELAYED TIME/DIV as indicated in table 5-4 and make necessary adjustments. If necessary, compromise so that all ranges controlled by particular adjustment are in specified tolerance.

d. Disconnect test equipment.

5-45. MAIN SWEEP FINE ADJUSTMENTS. These adjustments utilize the accuracy of the DELAY dial to calibrate main sweep more accurately than is possible using the visual method (paragraph 5-42). These adjustments must be accomplished if the differential time accuracy specification is to be met.

Equipment Required:
Time-mark generator
50-ohm, 48-inch BNC cable

5-46. Adjust main sweep as follows:

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

b. Set 1741A front-panel controls as follows:

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

Table 5-4. Delayed Sweep Calibration Adjustments

MAIN TIME/DIV Settings	DELAYED 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		
0 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		

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

d. Set DELAY potentiometer to 1.00 position.

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

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

g. Set DELAY potentiometer to 9.00.

h. Adjusting .05 - 2 µSEC, A8R43 set leading edge of time marker to center CRT graticule line.

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

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

k. Disconnect test equipment.

5-47. VERTICAL AMPLIFIER BALANCE ADJUSTMENT.

Equipment Required:
Digital voltmeter

5-48. Adjust vertical amplifier balance as follows:

a. Set channel A and B coupling to 50Ω and VOLTS/DIV (channels A and B) to .05.

b. Connect digital voltmeter to A3TP9.

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

d. Change DISPLAY to B.

e. Connect digital voltmeter to A3TP10.

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

g. Disconnect voltmeter.

Table 5-5. Main Sweep Fine Adjustment

Step	Time-mark Generator Setting	MAIN TIME/DIV Setting	DELAYED TIME/DIV Settings	Adjust
1	.5 µs	.5 µSEC	.05 µSEC	A8R43
2	10 µs	10 µSEC	1 µSEC	A8R12
3	1 ms	1 mSEC	.1 mSEC	A8R13
4	50 ms	50 mSEC	5 mSEC	A8R14

h. Change DISPLAY to A.

i. Set channel A and B VOLTS/DIV switches to .005.

j. While changing channel A VOLTS/DIV between .005, .01, and .02, adjust channel A 5-mV balance A3R18 for minimum trace shift between these three ranges.

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

l. Change DISPLAY to B.

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

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

o. 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 m and n for correct balance. If additional adjustments are made for m and n, recheck adjustment of A3R90 as described above.

5-49. POSITION AND SYNC BALANCE ADJUSTMENT.

Equipment Required:

Oscillator
BNC tee
Two 50-ohm, 9-inch BNC cables
50-ohm, 48-inch BNC cable

5-50. Adjust position and sync balance as follows:

a. Set 1741A controls as follows:

DISPLAY	B
POSN (Channel B)	12 o'clock

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

c. Change 1741A controls as follows:

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

d. Connect oscillator output to both channel INPUT connectors using BNC tee.

NOTE

Cables between BNC tee and input connectors should be of equal electrical length.

e. Adjust oscillator output for 10 kHz sine wave, 0.5 division of vertical deflection.

f. Adjust sync A bal A3R79 until both channels trigger stably and are in phase. If A3R79 is changed, recheck steps j and k in paragraph 5-48 for correct balance. If additional adjustments are made for j and k, recheck adjustment of A3R79 as described above.

g. Disconnect oscillator.

h. Return 1741A 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.

5-51. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION ADJUSTMENTS.

Equipment Required:

Square-wave generator
LCR meter
50-ohm, 48-inch BNC cable

5-52. Adjust input capacitance and attenuator compensation as follows:

a. Connect square-wave generator to channel A INPUT.

b. Set 1741A controls as follows:

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

c. Set square-wave generator controls to obtain 3-V peak, 5-kHz square wave.

d. Adjust .5 volt comp A3C2 with insulated adjusting tool for best square-wave response.

e. Disconnect square-wave generator.

f. Set 1741A controls as follows:

VOLTS/DIV (both channels)	.2
Coupling (Channel A)	DC

g. Connect LCR Meter to channel A INPUT and observe reading (typically 19.5 to 21.5 pF).

h. Set channel A VOLTS/DIV to .5.

i. Adjust A3C4, channel A input cap., to obtain same reading as noted on .2 range (step g).

j. Disconnect LCR meter.

k. Change DISPLAY to B and repeat steps a through j for channel B, by adjusting A3C17 for channel B .5 V input comp. and A3C19 for channel B .5 V cap.

l. Disconnect test equipment.

5-53. VERTICAL GAIN ADJUSTMENT.

Equipment Required:

Test lead
Adapter: dual banana plug to male BNC

5-54. Adjust vertical gain as follows:

a. Connect CAL 1 V output to channel A INPUT using test lead and adapter.

b. Set 1741A 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 change CAL signal from A to B input.

e. If channel B amplitude is larger than channel A, turn A3R46 channel B gain 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.

g. Disconnect CAL 1 V from INPUT connector.

5-55. PULSE RESPONSE ADJUSTMENT.

Equipment Required:

Fast-rise pulse generator
50-ohm, 48-inch BNC cable

5-56. Adjust pulse response as follows:

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

b. Set 1741A controls as follows:

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

NOTE

If assembly A17 or vertical output amplifier IC has been replaced, accomplish step c; otherwise, go to step d.

c. Set following adjustments on A17 as indicated:

A17R19	fully ccw
A17R21	fully ccw
A17R22	fully ccw

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

e. Adjust A17R21 (HF 4) for flattest pulse top (long time constant).

f. Set MAIN TIME/DIV contol to .2 μSEC.

g. Engage MAG X10 switch.

h. Adjust A17R19 (HF 3) for flattest pulse top (medium time constant).

i. Alternately adjust A17R22 (HF 2) and A17C6 (HF 1) to set leading edge of pulse to that which most resembles its known characteristics.

NOTE

If pulse generator being used is specified for 3% overshoot, do not set adjustments for less than 3% overshoot since this is effectively detuning the vertical amplifier bandwidth.

j. Repeat steps e through i since some interaction will occur.

k. Change DISPLAY to B.

l. Select TRIGGER B mode.

m. Connect fast-rise pulse generator to channel B INPUT connector.

n. Adjust B HF ADJ A3R22 to make channel B display as similar as possible to channel A display.

NOTE

Check bandwidth after accomplishing response adjustments. If bandwidth is low or marginal, a slight readjustment of HF 1 and HF 2 may be necessary.

o. Disconnect test equipment.

5-57. X-Y GAIN ADJUSTMENT.

Equipment Required:

Oscillator
50-ohm, 48-in. BNC cable

5-58. Adjust X-Y gain as follows:

a. Select A vs B mode of operation.

b. Connect oscillator to channel A INPUT connector.

c. Adjust oscillator and channel A VOLTS/DIV for exactly 6 div of vertical deflection.

d. Disconnect oscillator from channel A and connect to channel B.

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

f. Disconnect test equipment.

5-59. STORAGE ADJUSTMENTS.

5-60. If adjustments are for periodic calibration, no initial settings are necessary. However, if Storage Assembly A17 has been replaced or has had major repairs, or if the CRT has been replaced, set internal adjustments as follows:

A17R115 (coll)	midrange
A17R103 (FGG1-1)	fully ccw
A17R105 (FGG1-2)	fully ccw
A18R3 (WRA)	fully ccw
A12R24 (AMP LIMIT)	fully ccw
A12R3 (CURRENT LIMIT)	fully cw
A15R32 (KNEE)	fully cw
A15R39 (SLOPE)	fully cw

Set 1741A front- and rear-panel controls as follows:

AUTO ERASE/STORE	out position
PERSISTENCE/VIEW TIME	fully ccw (min)
BRIGHTNESS	fully ccw (min)
WRITE/STORE/DISPLAY	WRITE
CONV (rear panel)	disengaged

5-61. COLLIMATOR AND FLOODGUN ADJUSTMENTS. Adjust collimator and floodgun as follows:

NOTE

Do not over-collimate since this will degrade writing rate.

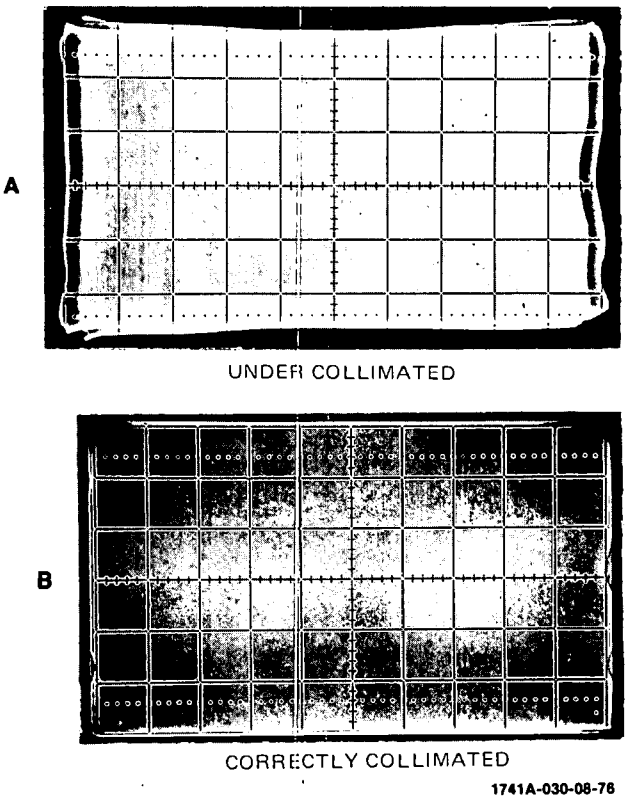


Figure 5-1. Collimator Pattern Adjustment

a. Turn COLL ADJ A17R115 clockwise until edges of pattern just fill CRT viewing area. (This should be done while alternately erasing pattern.) See figure 5-1 for proper display.

b. Set PERSISTENCE and BRIGHTNESS controls to maximum.

c. Adjust FGG-1 (A17R103) and FGG1-2 (A17R105) for most uniform and brightest illumination. (Alternately erase display while performing adjustment.)

NOTE

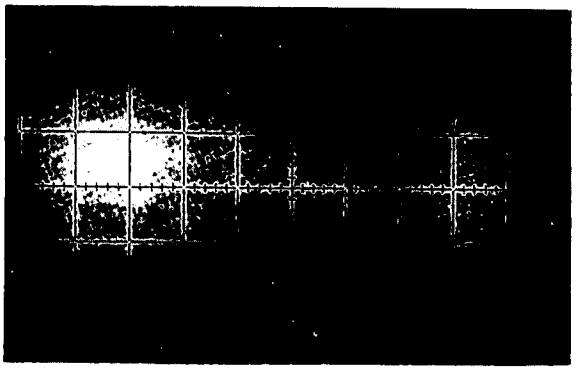
FGG1-1 affects right side of display and FGG1-2 affects left side of display. Typically, these two adjustments will remain close to fully ccw.

5-62. WRITING RATE AND INTENSITY LIMIT ADJUSTMENTS. Adjust writing rate and intensity limit as follows:

a. Set PERSISTENCE control fully clockwise.

b. Set BRIGHTNESS control to 4 o'clock position.

c. Turn A18R3 (WRA) clockwise so that CRT is in prefogged condition (CRT is neither completely



1741A-031-08-76

Figure 5-2. Write Rate Pattern Adjustment

black nor bright green but somewhere between; see figure 5-2). Alternately erase display while making this adjustment.

d. Set 1741A front-panel controls as follows:

A VS B	engaged
BEAM INTENSITY	fully ccw

e. Adjust INTENSITY LIMIT ADJ A15R2 so that spot is just extinguished with no fade positive of CRT.

5-63. CURRENT LIMIT ADJUSTMENT.

Equipment Required:

Signal generator
50-ohm, 48-inch BNC cable

CAUTION

CRT damage can result if this adjustment procedure is not followed closely. Avoid high BEAM INTENSITY settings for extended periods.

5-64. Adjust current limit as follows:

a. Set 1741A front-panel controls as follows:

PERSISTENCE	fully ccw
BRIGHTNESS	fully ccw
BEAM INTENSITY	12 o'clock
MAIN TIME/DIV	10 μSEC
MAG X10	X10

b. Connect signal generator to channel A INPUT connector.

c. Set signal generator output for 1 MHz sine wave, 5-division amplitude display.

d. Set BEAM INTENSITY fully clockwise. Note individual lines of sine-wave display are discernible over entire screen. (Keep FOCUS control optimized.)

e. If lines are not discernible, adjust CURRENT LIMIT A12R3 counterclockwise until lines are barely discernible.

f. Disconnect test equipment.

5-65. AMPLITUDE LIMIT, KNEE, AND SLOPE ADJUSTMENTS.

Equipment Required:

Monitor oscilloscope
10:1 divider probe
Digital voltmeter
1000:1 hv divider probe
Signal generator
50-ohm, 48-inch BNC cable

5-66. Adjust amplitude limit, knee, and slope as follows:

a. Disconnect input ac power from 1741A.

b. Remove high-voltage lead clamp H35.

c. Remove high-voltage assembly cover MP54.

d. For grounding purposes, reinstall two long screws that secure rear of high-voltage assembly board to chassis.

WARNING

Contact with the high-voltage power supply voltage can result in injury or death.

e. Set BEAM INTENSITY fully counterclockwise.

f. Apply input ac power to instrument (LINE switch ON).

g. Using digital voltmeter and 1000:1 hv divider probe, measure CRT cathode voltage at test point A15TP4.

h. Using digital voltmeter and 1000:1 hv divider probe, measure CRT grid voltage at test point A15TP5. Note difference between grid voltage and cathode voltage indication obtained in step g.

i. Connect monitor oscilloscope through 10:1 divider probe to gate output at test point A12TP2.

j. Set 1741A front-panel controls as follows:

Channel A POSN	fully cw
BEAM INTENSITY	fully cw

k. Set NORMAL/DEEP ERASE selector switch to DEEP ERASE.

l. Adjust AMP LIMIT A12R24 as observed on monitor oscilloscope for gate p-p amplitude signal of 5 volts less than difference between cathode and grid voltages noted in step h.

NOTE

If the gate signal amplitude is less than 5 volts difference noted in step h, set A12R24 fully counter clockwise (maximum output).

m. Set NORM/DEEP ERASE switch to NORMAL.

n. Disconnect monitor oscilloscope from test point A12TP2.

o. Set 1741A front-panel controls as follows:

BEAM
INTENSITY ..... just visible trace
POSN (Channel A)..... midrange
PERSISTENCE..... fully ccw
MAIN TIME/DIV ..... 1 μSEC

p. Connect signal generator to channel A INPUT connector.

q. Set signal generator output for 1 MHz, 8-division display.

r. Adjust FOCUS control for best focused display.

s. While pressing ERASE pushbutton frequently, increase BEAM INTENSITY control until trace just starts to defocus.

t. Connect digital voltmeter to test point A15TP6.

u. Slowly adjust KNEE control A15R32 ccw to point where indicated voltage on digital voltmeter begins to drop rapidly from its normal value. Stop adjustment at this point (just before drop begins).

v. Set BEAM INTENSITY fully cw.

w. While pressing ERASE pushbutton frequently, adjust SLOPE control A15R39 for best focused display.

NOTE

Upon completion of this procedure, check maximum brightness writing rate as outlined in Section IV Performance Checks. View the waveform using a CRT viewing hood and adjust BRIGHTNESS until waveform is visible over entire quality viewing area of CRT (7-div by 9-div).

x. If necessary, readjust COLL (A17R115), FGG1-1 (A17R103), and FGG1-2 (A17R105) for best uniformity.

y. Disconnect test equipment.

Table 5-6. Condensed Adjustment Procedure

Adjustment	Procedure
+15 V Adj., A16R26	+15 Vdc ±20 mV.
HVPS Adj., A15R38	1. Connect DVM through 1000:1 divider probe to -100 V. 2. Multiply step 1 indication by 22.95. 3. Connect DVM through 1000:1 divider probe to test point A15TP4. 4. Adjust A15R38 for indication noted in step 2.
CONV Gain Adj., A15R33	1. Disengage CONV switch on rear panel. 2. Apply 50 kHz, exactly 6-division amplitude signal display to instrument. 3. Engage CONV switch to rear panel. 4. Adjust A15R33 for exactly 6 divisions of vertical deflection on CRT.
Gate Comp Adj., A12R12 and A12C8	1. Set DEEP ERASE switch to deep erase position.

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

Adjustment	Procedure
Gate Comp Adj., A12R12 and A12C8 (Cont'd)	2. Set BEAM INTENSITY control for 25 V peak amplitude as measured at test point A12TP2. 3. Adjust A12R12 and A12C8 for best square-wave response.
Trace Align, A15R27, and Y-axis Align, A12R16	1. Perform trace alignment first. 2. Apply 1-kHz, 8-division vertical amplitude signal to channel B while in A vs B mode. 3. Adjust A12R16 for perpendicular line.
Patt Adj., A12R19 (Trace Align before Patt adj.)	1. Apply a 6-division, 500-kHz signal to instrument. 2. Adjust A12R19 for best raster display.
DLYD Swp Start, A7R169	Adjust so that delayed sweep starts 2mm after main sweep with DELAY dial pegged at 0.2 position.
Calib Ampl Adj., 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.
Sync Zero Adj., A7R41	1. Apply 1 kHz sine wave. 2. Adjust A7R41 for no shift in trigger point while switching time base between AC and DC coupling.
Trig View Bal., A3R86	1. Apply small sine wave to main EXT TRIGGER. 2. Select TRIG VIEW mode. 3. Adjust A3R86 to center trigger view display on middle horizontal graticule line.
Horiz. Ampl X1 Gain Adj., A7R93 .05 - 2 μSEC Adj., A8R43 X10 Gain, A7R117	1. Set delayed TIME/DIV to .05 μSEC to obtain intensified spot on main sweep. 2. Set DELAY control to 1.00 and position intensified spot to 2nd graticule line. 3. Set DELAY control to 9.00. Adjust A7R93 to position bright spot on 10th graticule line. 4. Set for 1 marker/div. 5. Set for 1 marker/div.
Mag Center Adj., A7R105	Adjust so that display at center screen remains at center screen when MAG X10 is engaged.

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

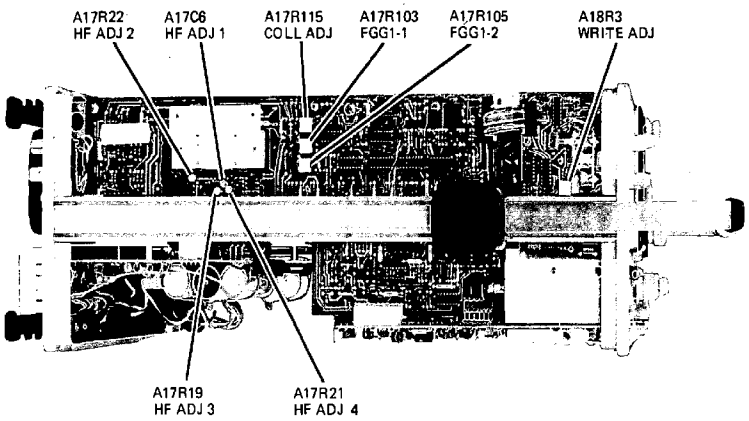
Adjustment	Procedure
HORIZONTAL LINEARITY A11R10 A11R15	Adjust on .05 μSEC range, using MAG X10, using 10 ns markers.
PRELIMINARY MAIN SWEEP CAL A8R43 A8R12 A8R13 A8R14	1. 1 μSEC range. 2. 10 μSEC range. 3. 1 mSEC range. 4. 50 mSEC range.
DELAYED SWEEP CAL A9R28 A9R10 A9R11	1. .5 μSEC range. 2. 5 μSEC range. 3. .5 mSEC range.
MAIN SWEEP FINE ADJ A8R43 A8R12 A8R13 A8R14	Use DELAY dial at setting of 1.00 and 9.00 to adjust main sweep. Main Sweep and Time Mark / Delayed Sweep .5 μSEC / .05 μSEC 10 μSEC / 1 μSEC 1 mSEC / .1 mSEC 10 mSEC / 5 mSEC
VERTICAL AMPLIFIER BALANCE A FET Bal., A3R11 B FET Bal., A3R31 A 5 mV Bal., A3R18 A 50 mV Bal., A3R19 B 5 mV Bal., A3R77 B 50 mV Bal., A3R78	1. Connect DVM to A3TP9 and adjust A3R11 for 0 V ±0.5 mV. Adjust on 50 mV range. 2. Connect DVM to A3TP10 and adjust A3R31 for 0 V ±0.5 mV. Adjust on 50 mV range. 3. Switch channel A VOLTS/DIV control between .005 and .02 positions and adjust A3R18 for minimum trace shift. 4. Switch channel A VOLTS/DIV control between .005 and .05 positions and adjust A3R19 for minimum trace shift. 5. Switch channel B VOLTS/DIV control between .005 and .02 positions and adjust A3R77 for minimum trace shift. 6. Switch channel B VOLTS/DV control between .005 and .05 positions and adjust A3R78 for minimum trace shift.

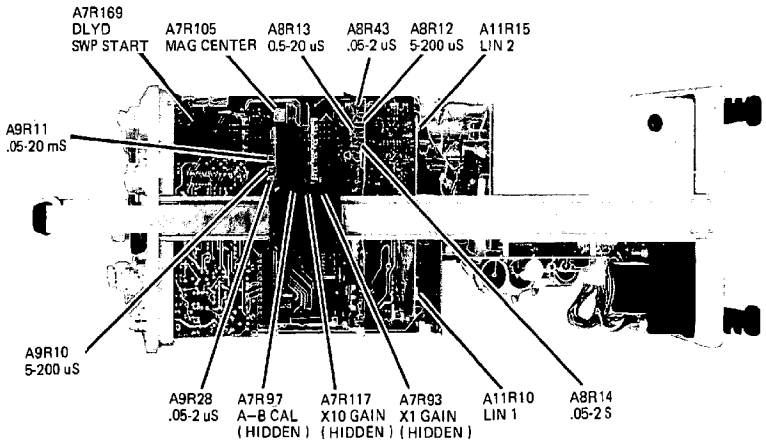
Table 5-6. Condensed Adjustment Procedure (Cont'd)

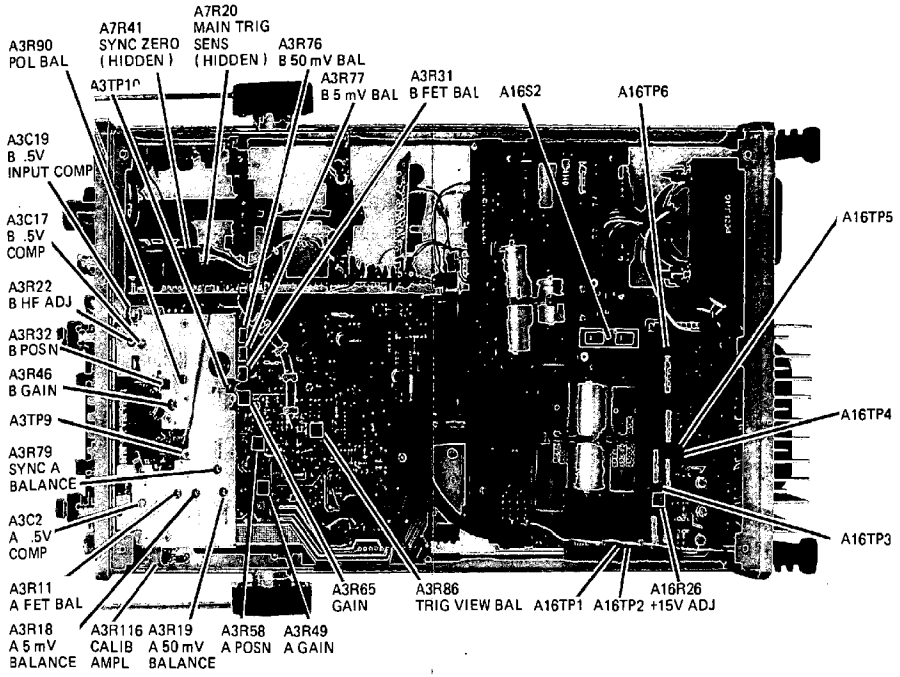
Adjustment	Procedure
VERTICAL AMPLIFIER BALANCE (Cont'd)	
Pol Bal Adj., A3R90	7. Engage/disengage CH B INVT switch and adjust A3R90 for minimum trace shift. Readjust A3R77 and A3R76, if necessary.
POSITION AND SYNC BALANCE	
B Pos Adj., A3R32	1. Select B DISPLAY; switch between normal and MAG X5, and adjust A3R32 for minimum trace shift.
Sync A Bal., A3R79	2. Apply 10-kHz sine wave to both channels. Select ALT mode and COMP trigger. Adjust A3R79 for stable triggering and minimum phase shift. Readjust A3R18 and A3R19, if necessary.
Mag X5 Adj., A3R58	3. Select A DISPLAY; switch between normal and MAG X5, and adjust A3R58 for minimum trace shift.
INPUT C AND ATTENUATOR COMPENSATION	
CHANNEL A:	
.5 V Comp, A3C2	1. Apply 5-kHz, 3-V peak squarewave to channel A. Adjust A3C2 for best response.
A Input Cap, A3C4	2. Adjust A3C4 to make .5 VOLTS/DIV range match reading on .2 range.
CHANNEL B:	
.5 V Comp, A3C17	3. Apply 5-kHz, 3-V peak squarewave to channel B. Adjust A3C17 for best response.
B Input Cap, A3C19	4. Adjust A3C19 to make .5 VOLTS/DIV range match reading on .2 range.
VERTICAL GAIN	
A Gain, A3R49	1. Channel A fine gain.
B Gain, A3R46	2. Channel B fine gain.
Overall Gain, A3R65	3. Composite gain.
PULSE RESPONSE	
HF Adj No. 4, A17R21	1. Long time constant.
HF Adj No. 3, A17R19	2. Medium time constant.
HF Adj No. 2, A17R22	3. Short time constant.

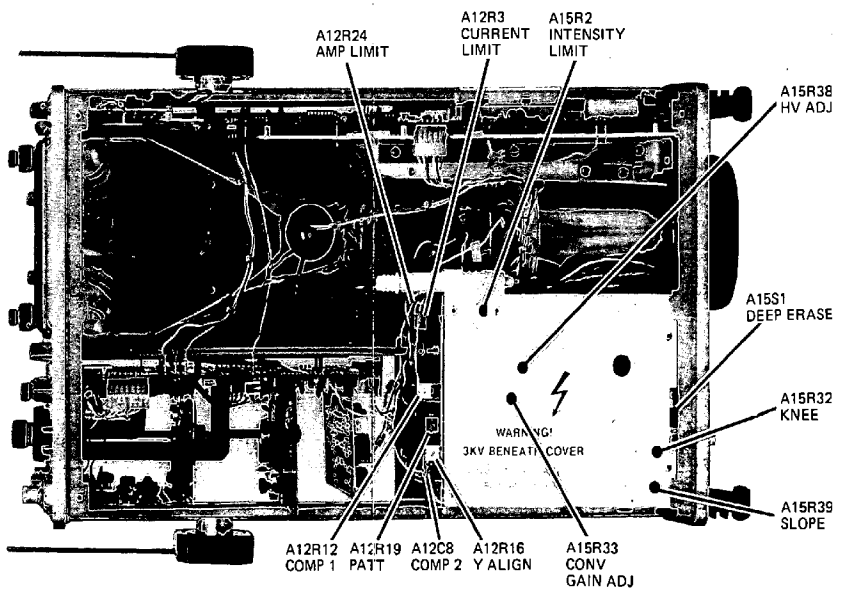
Table 5-6. Condensed Adjustment Procedure (Cont'd)

Adjustment	Procedure
PULSE RESPONSE (Cont'd)	
HF Adj No. 1, A17C6	4. Short time constant.
B HF Adj, A3R22	5. Adjust to make channel B signal most resemble channel A.
X-Y Gain	
A-B Cal, A7R97	Adjust for same gain on X-axis as displayed on Y-axis.
COLLIMATOR AND FLOODGUN ADJUSTMENTS	
Coll Adj., A17R115	1. Adjust A17R115 until pattern just fills CRT viewing area.
FGG1-1, A17R103 and FGG1-2, A17R105	2. Adjust A17R103 and A17R105 for most uniform and brightest illumination.
WRITING RATE AND INTENSITY LIMIT	
WRA, A18R3	1. Adjust A18R3 so that CRT is neither completely black nor bright green but somewhere between.
Intensity Limit Adj., A15R2	2. Adjust A15R2 so that spot is just extinguished with no fade positive of CRT.
Current Limit Adj., A12R3	Set main TIME/DIV to 10 μSEC; engage MAG 10; apply 1 MHz (1 cycle per horizontal division), 5-vertical division signal to instrument. Adjust A12R3 for discernible lines over entire screen with minimum persistence.
AMPLITUDE, KNEE, AND SLOPE	1. Using DVM and 1000:1 divider probe note difference between CRT cathode (A15TP4) and CRT grid voltage (A15TP5).
Amp Limit, A12R24	2. Set NORMAL/DEEP ERASE switch to deep erase. Using monitor oscilloscope connected to A12TP2, adjust A12R24 for p-p signal of 5 volts less than difference between CRT cathode and grid voltages.
Knee Adj., A15R32	3. Adjust A15R32 until voltage reading at A15TP6 begins to drop rapidly.
Slope Adj., A15R39	4. Adjust A15R39 for best focused display. If necessary, repeat Collimator and Floodgun Adjustments.









1741A-019-02-78

Figure 5-3.
Adjustment Location

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 lists all replaceable parts in reference designator order, and table 6-3 contains the names and addresses that correspond to the manufacturer's 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 lower case and upper case 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 alpha-numerical order by reference designation.

c. Chassis-mounted parts in alpha-numerical order by reference designation.

d. Electrical assemblies and their components in alpha-numerical 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 instrument.

d. Description of part.

e. Typical manufacture 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 parts 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 offices when orders require billing and invoicing).

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

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

6-12. Mail order forms and specific ordering information is available through your local HP office. Addresses and phone numbers are located at the back of this manual.

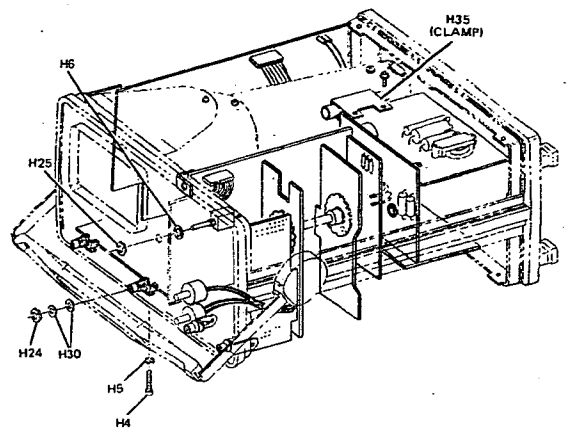
Table 6-1. Reference Designators and Abbreviations

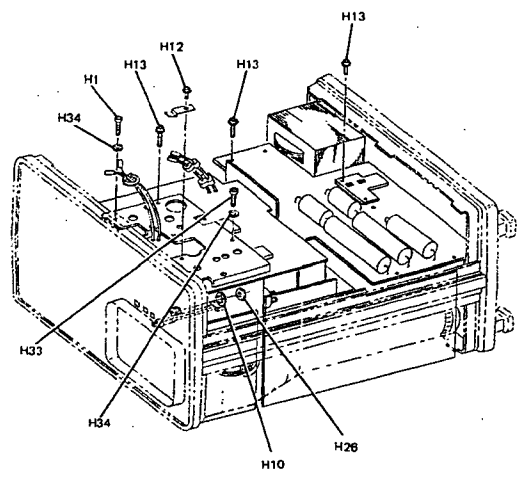
REFERENCE DESIGNATORS

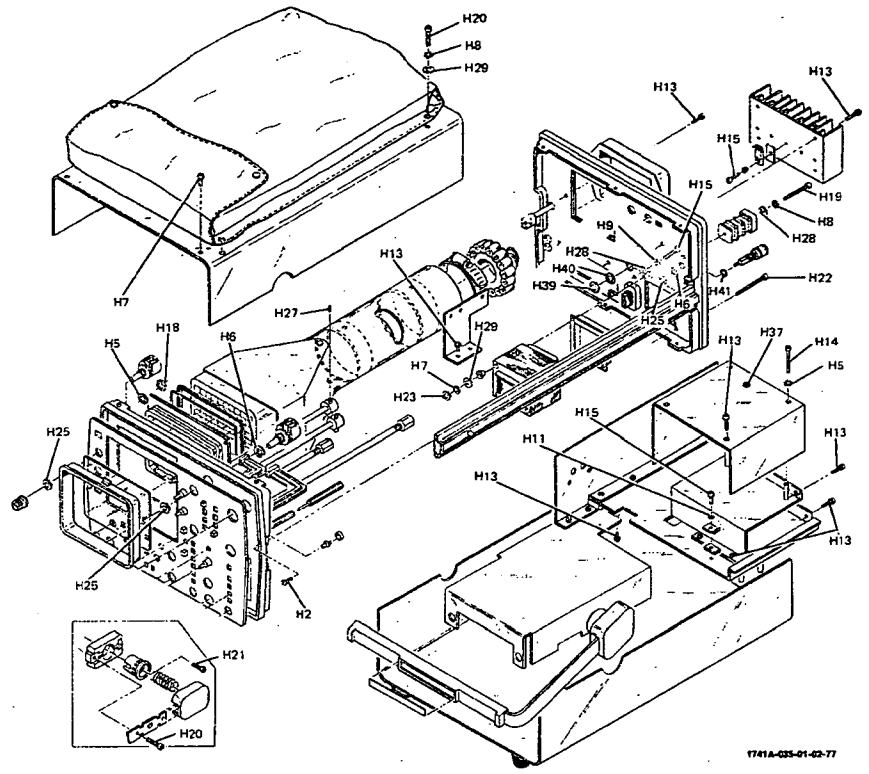
A	= assembly	**F**	= fuse	**MP**	= mechanical part	**U**	= integrated circuit
B	= motor	**FL**	= filter	**P**	= plug	**V**	= vacuum, tube, neon bulb, photocell, etc.
BT	= battery	**IC**	= integrated circuit	**Q**	= transistor		
C	= capacitor	**J**	= jack	**R**	= resistor	**VR**	= voltage regulator
CP	= coupler	**K**	= relay	**RT**	= thermistor	**W**	= cable
CR	= diode	**L**	= inductor	**S**	= switch	**X**	= socket
DL	= delay line	**LS**	= loud speaker	**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**	= section(s)
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	**TGI**	= 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







REF DESIGNATOR	NOMENCLATURE	HP PART NO.	WHERE USED (QUANTITY)
H1	SCREW	0520-0127	VERT AMPL SHIELD (2)
H2	SCREW	0624-0279	SIDE RAILS (8)
H3	SCREW	0624-0306	ATTENUATORS (8)
H4	SCREW	0624-0313	ATTENUATOR BRKTS (4)
H5	WASHER, STAR	2190-0005	HEAT SINK BRKT (2) HORIZ-VERT GND (1) VERT OUTPUT (2) CRT FRONT MTG (4) HV COVER (2)
H6	WASHER, LOCK	2190-0016	REAR PANEL (5) FOCUS POT (1) FRONT PANEL (7)
H7	WASHER, LOCK	2190-0017	TRANSFORMER (4)
H8	WASHER, SPLIT	2190-0006	FEET (4) POUCH (4)

REF DESIGNATOR	NOMENCLATURE	HP PART NO.	WHERE USED (QUANTITY)
H9	WASHER, LOCK	2190-0019	DELAY LINE MTG (2) CABLE CLAMP HV BD (1) AC POWER PLUG (2) MULTIPLIER (2)
H10	WASHER, LOCK	2190-0084	VIEW TIME POTENTIOMETER (1) GND CONNECTOR (1) PERSISTENCE POT BUSHING (1)
H11	WASHER, DOME	2190-0910	DECK TRANSISTOR (1)
H12	SCREW	2200-0103	SWITCH GND SPRINGS (2) VERT PREAMPL (2)
H13	SCREW	2200-0105	REAR HEAT SINK (4) STORAGE BRKT (6) CRT REAR COVER (2) LV BD MTG (6) CONTROL BRKT (2) HV COVER (2) REAR DECK (3) HV BRKT (4) SAFETY SHIELD (2) HORIZ BD/DLYD TRIG (4) FRONT DECK (1) VERT PREAMPL (2) DELAY LINE (2) MULTIPLIER (2) CRT REAR MTG (4) VERT PREAMPL SHIELD (2) COVER, LINE VOLTAGE SW (2)
H14	SCREW	2200-0123	HV COVER (2)
H15	SCREW	2200-0143	AC POWER PLUG (2) CABLE CLAMP HV BD (1) REAR HEAT SINK TRANSISTORS (5) DELAY LINE (2) PWR TRANSISTOR (1)
H16	SCREW	2200-0149	HORIZ-VERT GND (1)
H17	SCREW	2200-0762	TOP AND BOTTOM COVERS (8)
H18	NUT	2260-0002	CRT FRONT MTG (4)
H19	SCREW	2380-0207	FEET (4)
H20	SCREW	2360-0197	HANDLE (4) POUCH (4)
H21	SCREW	2510-0111	HANDLE (2)
H22	SCREW	2510-0138	TRANSFORMER (4)
H23	NUT	2580-0004	TRANSFORMER (4)
H24	NUT	2950-0035	ATTENUATOR BNC'S (2)
H25	NUT	2950-0043	REAR PANEL (5) FRONT PANEL (7)
H26	NUT	2950-0072	FOCUS POT (1) CONTROL BRKT (2) PERSISTENCE POT BUSHING (1) GND CONNECTOR (1) REAR PANEL POTENTIOMETERS (2)
H27	SCREW, SET	3030-0196	POT EXTENDERS (4)
H28	WASHER, FLAT	3050-0010	FEET (4) AC POWER PLUG (2) MULTIPLIER (2) CABLE CLAMP HV BD (1)
H29	WASHER, FLAT	3050-0071	TRANSFORMER (4) POUCH (4) DELAY LINE (2)
H30	WASHER, FLAT	3050-0160	VERT BNC'S (4)
H31	WASHER, FLAT	3050-0481	DLYD SWP KNOB (1)
H32	WASHER, FLAT	3050-0655	ATTENUATOR KNOBS (2)
H33	SCREW	0520-0136	VERT PREAMPL IC (4) VERT OUTPUT H.S. (4)
H34	WASHER, LOCK	2190-0112	VERT PREAMPL IC (4) VERT OUTPUT IC (4) BNC BRKT (2)
H35	CLAMP, HV LEAD	01741-01205	HV LEAD (1)
H36	SCREW	2200-0155	VERT OUTPUT HEAT SINK BRKT (2)
H37	GROMMET	0400-0010	HV COVER (3) CRT SHIELD (1)
H38	CLAMP	1400-0017	HV ASSEMBLY (1)
H39	NUT	2950-0038	FUSE POST (1)
H40	WASHER	2190-0037	FUSE POST (1)
H41	WASHER, RUBBER	1400-0090	FUSE POST (1)
H42	GROMMET	0400-0158	CRT SHIELD (1)
H43	PLUG, HOLE	6960-0006	REAR PANEL (1)

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

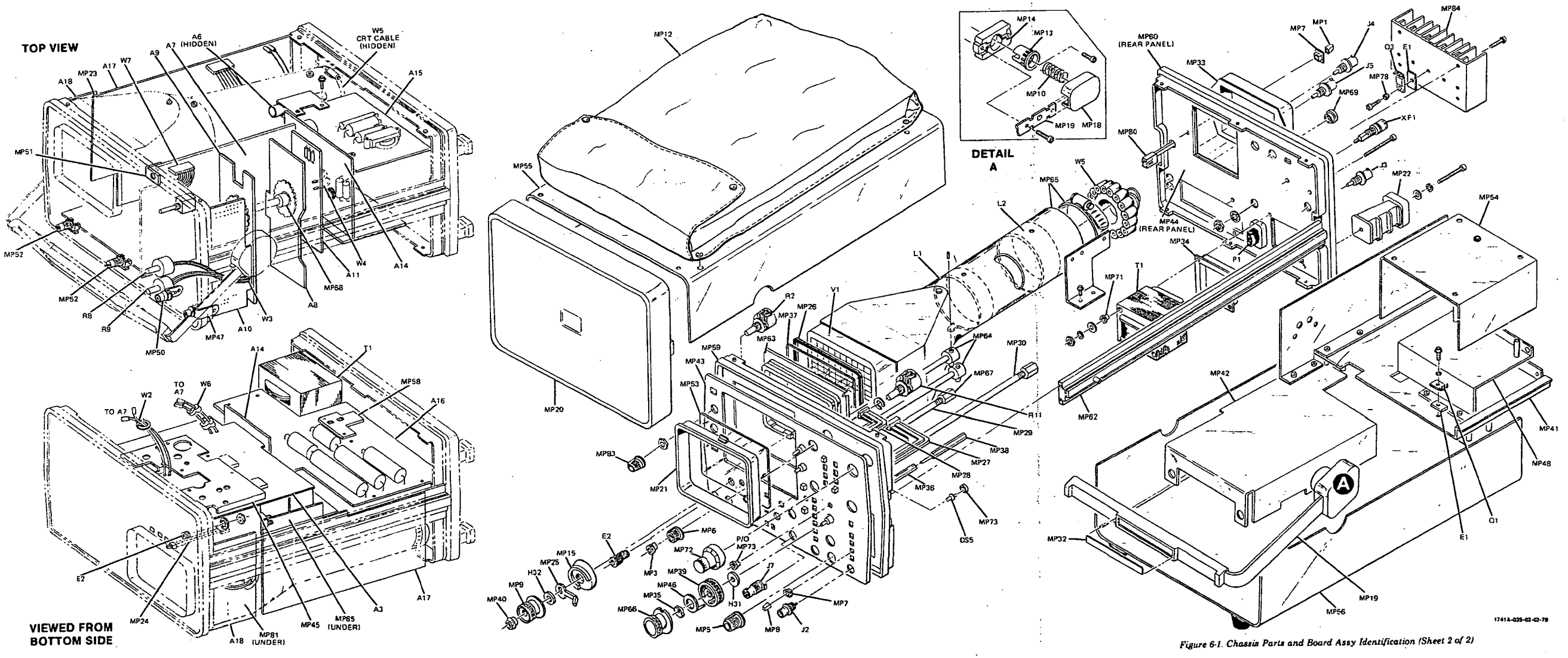


Figure 6-1. Chassis Parts and Board Assy Identification (Sheet 2 of 2)

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01740-63401	1	ATTENUATOR ASSEMBLY, CHANNEL A	28480	01740-63401
A2	01740-63402	1	ATTENUATOR ASSEMBLY, CHANNEL B	28480	01740-63402
A3	01740-66530	1	VERTICAL PREAMPLIFIER ASSEMBLY	28480	01740-66530
A4	01740-61611	1	DELAY LINE ASSEMBLY	28480	01740-61611
A5			NOT ASSIGNED		
A6	0960-0432	1	HV MULTIPLIER ASSEMBLY	28480	0960-0432
A7	01740-66524	1	HORIZONTAL SWEEP ASSEMBLY	28480	01740-66524
A8	01740-66523	1	MAIN SWEEP ASSEMBLY	28480	01740-66523
A9	01740-66522	1	DELAYED SWEEP ASSEMBLY	28480	01740-66522
A10	01740-66508	1	DELAYED TRIGGER ASSEMBLY	28480	01740-66508
A11	01740-66521	1	HORIZONTAL OUTPUT ASSEMBLY	28480	01740-66521
A12	01741-66516	1	GATE AMPLIFIER ASSEMBLY	28480	01741-66516
A13	01740-66516	1	VERTICAL CONTROL SWITCHING ASSEMBLY	28480	01740-66516
A14	01740-66540	1	INTERFACE ASSEMBLY	28480	01740-66540
A15	01741-66511	1	HV POWER SUPPLY ASSEMBLY	28480	01741-66511
A16	01741-66514	1	LV POWER SUPPLY ASSEMBLY	28480	01741-66514
A17	01741-66509	1	STORAGE BOARD ASSEMBLY	28480	01741-66509
A18	01741-66512	1	STORAGE CONTROL ASSEMBLY	28480	01741-66512
DS1	1990-0524	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0524
DS2	1990-0586	4	LED-VISIBLE LUM-INT=800UCD IF=50MA-MAX	28480	1990-0586
DS3	1990-0586		LED-VISIBLE LUM-INT=800UCD IF=50MA-MAX	28480	1990-0586
DS4	1990-0586		LED-VISIBLE LUM-INT=800UCD IF=50MA-MAX	28480	1990-0586
DS5	1990-0586		LED-VISIBLE LUM-INT=800UCD IF=50MA-MAX	28480	1990-0586
E1	0340-0511	6	INSULATOR-XSTR KAPTON	13103	43-77-2
E2	1510-0038	1	BINDING POST-SGL 1/4-32 THD STUD	28480	1510-0038
E3	0360-1646	1	TERMINAL, CAL JACK	28480	0360-1646
F1	2110-0007	1	FUSE 1A 250V SLO-BLO 1.25X.25 UL IEC	75915	313.001
F1	2110-0202	1	FUSE 0.5A SLO-BLO (FOR 220/240V OPERATION)	75915	OBD
H1	0520-0127	3	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	28480	0520-0127
H2	0624-0279	8	SCREW-TPG 8-32 .75-IN-LG PAN-HD-POZI	28480	0624-0279
H3	0624-0306	8	SCREW-TPG 2-28 .5-IN-LG PAN-HD-POZI STL	28480	0624-0306
H4	0624-0313	4	SCREW-TPG 4-20 1-IN-LG PAN-HD-POZI STL	28480	0624-0313
H5	2190-0005	11	WASHER-LK EXT T NO.-4 .116-IN-ID	78189	1804-01
H6	2190-0016	13	WASHER-LK INTL T NO.-3/8 .377-IN-ID	28480	2190-0016
H7	2190-0017	4	WASHER-LK HLCL NO.-8 .168-IN-ID	28480	2190-0017
H8	2190-0006	8	WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0006
H9	2190-0019	7	WASHER-LK HLCL NO.-4 .115-IN-ID	28480	2190-0019
H10	2190-0084	2	WASHER-LK INTL T NO.-1/4 .256-IN-ID	78189	1214-05
H11	2190-0910	1	WASHER-LK NO.-4 .12-IN-ID .275-IN-OD STL	78189	4704-04-02-0531
H12	2200-0103	24	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
H13	2200-0105	52	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	28480	2200-0105
H14	2200-0123	2	SCREW-MACH 4-40 1.25-IN-LG PAN-HD-POZI	28480	2200-0123
H15	2200-0143	11	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	28480	2200-0143
H16	2200-0149	1	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	28480	2200-0149
H17	2200-0762	8	SCREW-MACH 4-40 .25-IN-LG TR-HD-POZI	28480	2200-0762
H18	2260-0002	4	NUT-HEX-DBL-CHAM 4-40-THD .062-THK	28480	2260-0005
H19	2360-0207	4	SCREW-MACH 6-32 .875-IN-LG PAN-HD-POZI	28480	2360-0207
H20	2360-0197	9	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0197
H21	2510-0111	2	SCREW-MACH 8-32 .75-IN-LG PAN-HD-POZI	28480	2510-0111
H22	2510-0138	4	SCREW-MACH 8-32 3-IN-LG PAN-HD-POZI	28480	2510-0138
H23	2580-0004	4	NUT-HEX-DBL-CHAM 8-32-THD .125-THK	28480	2580-0004
H24	2950-0035	2	NUT-HEX-DBL-CHAM 15/32-32-THD .078-THK	28480	2950-0039
H25	2950-0043	13	NUT-HEX-DBL-CHAM 3/8-32-THD .094-THK	73743	2X 28200
H26	2950-0072	4	NUT-HEX-DBL-CHAM 1/4-32-THD .062-THK	28480	2950-0078
H27	3030-0196	4	SCREW-SET 4-40 .188-IN-LG SMALL CUP-PT	28480	3030-0196
H28	3050-0010	9	WASHER-FL MTLC NO.-6 .147-IN-ID	76210	65
H29	3050-0071	10	WASHER-FL MTLC NO.-8 .169-IN-ID	28480	3050-0071
H30	3050-0160	4	WASHER-FL MTLC NO.-7/16 .47-IN-ID	28480	3050-0160
H31	3050-0481	1	WASHER-FL NM NO.-12 .25-IN-ID .75-IN-OD	28480	3050-0481
H32	3050-0655	2	WASHER-FL NM NO.-6 .156-IN-ID .375-IN-OD	06540	2320-T156
H33	0520-0136	8	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	28480	0520-0136
H34	2190-0112	10	WASHER-LK HLCL NO.-2 .088-IN-ID	28480	2190-0112
H35	01741-01205	1	CLMAP, HV LEAD	28480	01741-01205
H36	2200-0155	2	SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	28480	2200-0155
H37	0400-0010	4	GROMMET:VINYL 0.250" ID	00000	OBD#
H38	1400-0017	1	CLAMP-CA .312-DIA .375-WD NYL	71616	CPC-1953-58
H39	2950-0038	1	NUT-SPCLY 1/2-24-THD .125-THK .688-A/F	75915	903-12
H40	2190-0037	1	WASHER-LK INTL T NO.-1/2 .512-IN-ID	78189	1224-08
H41	1400-0090	1	WASHER:RUBBER 5/8" OD	00000	OBD
H42	0400-0158	1	GROMMET .75 ID CRT SHIELD	28480	0400-0158
J1	1250-0118	5	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR128-1
J2	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR128-1
J3	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR128-1
J4	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR128-1
J5	1250-0118		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JR128-1

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
J6	1250-0524	2	CONNECTOR, RF BNC SER; BHD MT JK RCPT	04931	28JR251-1
J7	1250-0524		CONNECTOR, RF BNC SER; BHD MT JK RCPT	04931	28JR251-1
L1	5060-0443	1	COIL, X-AXIS ALIGNMENT	28480	5060-0443
L2	00191-66004	1	COIL, Y-AXIS ALIGNMENT	28480	00191-66004
L3	9170-0016	3	CORE-SHIELDING BEAD	02114	56-590-65A1/3B
L4	9170-0016		CORE-SHIELDING BEAD	02114	56-590-65A1/3B
L5	9170-0016		CORE-SHIELDING BEAD	02114	56-590-65A1/3B
MP1	0370-0603	5	PUSHBUTTON:SQUARE, MINT GRAY	28480	0370-0603
MP2	0370-0671	9	PUSHBUTTON:SQUARE LEGEND BLUE	28480	0370-0671
MP3	0370-0963	1	KNOB-CONC-RND .5 IN JGK SGI-DECAL	28480	0370-0963
MP4	0370-1005	5	KNOB-BASE-PTR .375 IN JGK SGI-DECAL	28480	0370-1005
MP5	0370-1099	4	KNOB-BASE-PTR .5 IN JGK SGI-DECAL	28480	0370-1099
MP6	0370-1100	1	KNOB-BASE-CONC PTR .5 IN JGK	28480	0370-1100
MP7	0370-2626	34	BEZEL-PB GRAY	28480	0370-2626
MP8	0370-2630	15	PUSHBUTTON:SQUARE, WILLOW GRN	28480	0370-2630
MP10	1460-0604	2	SPRING-CPRSN .95-OD 1.185-LG MUW	28480	1460-0604
MP11	0370-0684	3	PUSHBUTTON:SQUARE, HARVEST GOLD	28480	0370-0684
MP12	1540-0292	1	CASE-ACCESS PVC 13.5 LG 10.5 WD 2.5 DP	28480	1540-0292
MP13	5020-8733	2	GEAR, HUB HANDLE	28480	5020-8733
MP14	5020-8734	2	RING, HANDLE	28480	5020-8734
MP15	5020-8744	1	SPACER-DIAL	28480	5020-8744
MP16	5020-8745	1	SPACER-DIAL	28480	5020-8745
MP17	5040-0421	1	INSULATOR COVER:POTENTIOMETER (FOCUS)	28480	5040-0421
MP18	5040-0511	2	CAP, TRIM HANDLE	28480	5040-0511
MP19	5040-0515	1	ASSY, 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	1	FOOT, CORD WRAP	28480	5040-7829
MP23	01741-01206	1	STRAP, BOARD SUPPORT	28480	01741-01206
MP24	5040-7023	4	ROD-PUSH	28480	5040-7023
MP25	5040-7598	2	LEVER, COUPLING	28480	5040-7598
MP26	01741-07101	1	MASK, CRT	28480	01741-07101
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	01741-09101	2	SPRING, GROUND (FOR CAMERA SUPPORT MP63)	28480	01741-09101
MP32	7120-4399	1	LABEL, HANDLE	28480	7120-4399
MP33	01701-04108	1	COVER, CRT	28480	01701-04108
MP34	01710-04103	1	COVER, XFMR	28480	01710-04103
MP35	01720-22501	1	RING, ANTIRUN RND	28480	01720-22501
MP36	01720-23705	1	SHAFT, DLYD SWP	28480	01720-23705
MP37	01740-20601	1	SAFETY SHIELD, CRT	28480	01740-20601
MP38	01720-63703	1	SHAFT ASSY-MAIN SWP	28480	01720-63703
MP39	01720-67403	1	KNOB, DLYD SWP	28480	01720-67403
MP40	01720-67405	2	KNOB, VERNIER	28480	01720-67405
MP41	01741-00101	1	DECK, REAR	28480	01741-00101
MP42	01740-00102	1	DECK, FRONT	28480	01740-00102
MP43	01741-00206	1	PANEL, FRONT	28480	01741-00206
MP44	01741-00207	1	PANEL, REAR	28480	01741-00207
MP45	01740-00601	1	SHIELD, PREAMPLIFIER	28480	01740-00601
MP48	0350-0999	1	DECAL, KNOB, TIME/DIV	28480	0350-0999
MP47	01740-01201	1	BRACKET, DLYD TRIGGER	28480	01740-01201
MP48	01740-01202	1	BRACKET, HV	28480	01740-01202
MP49			NOT ASSIGNED		
MP50	01740-01204	1	BRACKET, HORIZ	28480	01740-01204
MP51	01740-01209	1	BRACKET, HORIZ TOP	28480	01740-01209
MP52	01740-01212	2	BRACKET, BNC	28480	01740-01212
MP53	01740-02701	1	FILTER, CONTRAST	28480	01740-02701
MP54	01741-04106	1	COVER, HIGH VOLTAGE	28480	01741-04106
MP55	01741-04102	1	COVER, TOP	28480	01741-04102
MP56	01741-04105	1	COVER, BOTTOM	28480	01741-04105
MP57	01741-20501	1	HEAT SINK, OUTPUT (A17A1)	28480	01741-20501
MP58	01740-04109	1	COVER, LINE SELECT SWITCHES	28480	01740-04109
MP59	01740-20501	1	FRAME, FRONT	28480	01740-20501
MP60	01741-20507	1	FRAME, REAR	28480	01741-20507
MP61			NOT ASSIGNED		
MP62	01741-23701	2	RAIL, SIDE	28480	01741-23701
MP63	01740-24702	1	SUPPORT, CRT CAMERA	28480	01740-24702
MP64	01740-43901	2	SHAFT, EXTENSION	28480	01740-43901
MP65	01741-60601	1	SHIELD ASSEMBLY, CRT	28480	01741-60601
MP66	01740-67402	1	KNOB, MAIN SWP	28480	01740-67402
MP67	01830-23201	2	COUPLER, SW EXTENSION	28480	01830-23201
MP68	0510-0541	3	DRIVE-COLLAR .305-WD STL	28480	0510-0541
MP69	1410-0094	2	BUSHING-PNL .261-ID .293-LG 3/8-32-THD	28480	1410-0094
MP70	0370-2862	1	PUSHBUTTON, CORP WHITE	28480	0370-2862
MP71	0390-0006	4	INSULATOR-BSHG-FLG NYLON	71002	6549B

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
MP72	7120-6927	1	LABEL, CRT NECK	28480	7120-6927
MP73	1400-0665	7	RETAINER R-LED 0.270-IN SERRATED ID	28480	1400-0665
MP74			NRS P/O MP73		
MP75	1410-0515	1	BUSHING-PNL .159-ID .362-LG 1/4-32-THD	28480	1410-0515
MP76	5040-5952	1	KNOB CORE, STA, 1.5 IN, JGK	28480	5040-5952
MP77	01741-63701	1	SHAFT ASSEMBLY, PB (ERASE)	28480	01741-63701
MP78	3050-0791	5	INSULATOR-XSTR NYLON	28480	3050-0791
MP79	01703-24701	1	SPACER, SHAFT, PB (ERASE)	28480	01703-24701
MP80	5040-7675	1	PUSHROD, SWITCH	28480	5040-7675
MP81	01741-01201	1	BRACKET, CONTROL	28480	01741-01201
MP83	01703-67401	1	KNOB ASSEMBLY, CONC BS	28480	01703-67401
MP84	01720-20503	1	HEAT SINK	28480	01720-20503
MP85	01741-01202	1	BRACKET, STORAGE ASSEMBLY	28480	01741-01202
MP86	01741-01207	1	BRACKET, HEAT SINK (USED WITH A17A1)	28480	01741-01207
P1	1251-2357	1	CONNECTOR-AC PWR	28480	1251-2357
Q1	1854-0433	1	TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q2	1854-0803	1	TRANSISTOR NPN	01295	TIP75B
Q3	1854-0370	4	TRANSISTOR NPN 2N5294 SI PD=1.8W	02735	2N5294
Q4	1854-0370		TRANSISTOR NPN 2N5294 SI PD=1.8W	02735	2N5294
Q5	1854-0370		TRANSISTOR NPN 2N5294 SI PD=1.8W	02735	2N5294
Q6	1854-0370		TRANSISTOR NPN 2N5294 SI PD=1.8W	02735	2N5294
R1	2100-3499	1	RESISTOR-VAR CONTROL CC 10K 20% LIN (BRIGHTNESS)	28480	2100-3499
R2	2100-3500	1	RESISTOR-VAR CONTROL CC 1M 20% LIN (PERSISTENCE)	28480	2100-3500
R5	0683-1505	2	RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
R6	2100-1443	1	RESISTOR-VAR PREC WW 10-TRN 50K 3% (DELAY)	28480	2100-1443
R7	0684-1021	1	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
R8	2100-0657	1	RESISTOR-VAR W/SW 100K 30% LIN (SWP 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%-CP 20K-20%CP (HORIZ POSITION)	32997	82A2D-G36-B16/B16
T1	9100-3496	1	TRANSFORMER	28480	9100-3496
V1	5083-5070	1	CRT	28480	5083-5070
W1	8120-1521	1	CABLE ASSY 3-COND 18-AWG	28480	8120-1521
W2	01740-61602	1	CABLE ASSEMBLY, SYNC TWIN LEAD	28480	01740-61602
W3	01740-61621	1	CABLE ASSY, FRONT PANEL	28480	01740-61621
W4	01741-61603	1	CABLE ASSEMBLY, HORIZONTAL OUTPUT	28480	01741-61603
W5	01741-61608	1	CABLE ASSEMBLY, CRT BASE	28480	01741-61608
W6	01740-61609	1	CABLE ASSEMBLY, TRIG VIEW	28480	01740-61609
W7	01740-61622	1	CABLE ASSEMBLY, HORIZ POS	28480	01740-61622
W8	8120-0643	1	CABLE ASSEMBLY	28480	8120-0643
W9	01741-61605	1	CABLE ASSEMBLY, HORIZONTAL STORE	28480	01741-61605
W10	01741-61606	1	CABLE ASSEMBLY, CRT NECK	28480	01741-61606
W11	01741-61607	1	CABLE ASSY, VERT OUT	28480	01741-61607
XF1	1400-0084	1	FUSEHOLDER-EXTR POST 15A 250V UL	28480	1400-0084

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	2100-3155	2	RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO	28480	2100-3155
A2	01740-63402	1	ATTENUATOR ASSEMBLY, CHANNEL B	28480	01740-63402
A2R1	2100-3155		RESISTOR-VAR W/SW 100 10% LIN DPST-NC-NO	28480	2100-3155
A3	01740-66530	1	VERTICAL PREAMPLIFIER ASSEMBLY	28480	01740-66530
A3C1	0160-4690	2	CAPACITOR-FXD .02UF -20+80% 600WVDC	28480	0160-4690
A3C2	0121-0060	4	CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A3C3	0150-0021	3	CAPACITOR-FXD .47PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A3C4	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A3C5	0160-2150	2	CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-2150
A3C6	0160-3448	6	CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A3C7	0160-3799	2	CAPACITOR-FXD 18PF +-10% 100WVDC CER	28480	0160-3799
A3C8	0160-3451	91	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C9	0160-3508	4	CAPACITOR-FXD 1UF +80-20% 50WVDC CER	28480	0160-3508
A3C10	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C11	0180-2752	2	CAPACITOR-FXD .1UF+-10% 35VDC TA	28480	0180-2752
A3C12	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C13	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C14	0160-4690		CAPACITOR-FXD .02UF -20+80% 600 WVDC	28480	0160-4690
A3C15	0160-3567	3	CAPACITOR-FXD 10PF +-5% 100WVDC CER	28480	0160-3567
A3C16	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A3C17	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A3C18	0150-0021		CAPACITOR-FXD .47PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A3C19	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A3C20	0160-2198	3	CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A3C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C23	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C24	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C25	0180-2752		CAPACITOR-FXD .1UF+-10% 35VDC TA	28480	0180-2762
A3C26	0160-3443	5	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3C27	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C28	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C29	0180-0374	4	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3C30	0160-3443	4	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A3C31	0160-3567		CAPACITOR-FXD 10PF +-5% 100WVDC CER	28480	0160-3567
A3C32	0160-3470	3	CAPACITOR-FXD .01UF +80-20% 50WVDC CER	28480	0160-3470
A3C33	0180-2255	7	C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C34	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C35	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C36	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C37	0160-4324	2	CAPACITOR-FXD 220PF +-10% 50WVDC CER	6F364	TYPE 100-100-X7R-221K
A3C38	0160-4324		CAPACITOR-FXD 220PF +-10% 50WVDC CER	6F364	TYPE 100-100-X7R-221K
A3C39	0150-0061	1	CAPACITOR-FXD 20PF +-10% 100WVDC CER	28480	0150-0061
A3C40	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C41	0160-3508		CAPACITOR-FXD 1UF +80-20% 50WVDC CER	28480	0160-3508
A3C42	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A3C43	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C44	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C45	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C46	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C47	0160-2217	1	CAPACITOR-FXD 910PF +-5% 300WVDC MICA	28480	0160-2217
A3C48	0180-0228	4	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X901582
A3C49	0160-2207	1	CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A3C50	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C51	0160-0820	4	CAPACITOR-FXD .05UF +80-20% 25WVDC CER	28480	0160-0820
A3C52	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C53	0160-3466	4	CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3C54	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3C55	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3C56	0160-0820		CAPACITOR-FXD .05UF +80-20% 25WVDC CER	28480	0160-0820
A3C57	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X901582
A3C58	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C59	0160-0820		CAPACITOR-FXD .05UF +80-20% 25WVDC CER	28480	0160-0820
A3C60	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X901582
A3C61	0160-0820		CAPACITOR-FXD .05UF +80-20% 25WVDC CER	28480	0160-0820
A3C62			NOT ASSIGNED		
A3C63	0180-2255		C:FXD TA ELECT 2.2 UF 20% 20VDCW	72982	301-000-C0H0-829C
A3C64	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C65	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C66	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C67	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A3C68	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C69	0160-3470		CAPACITOR-FXD .01UF +80-20% 50WVDC CER	28480	0160-3470
A3C70	0160-3470		CAPACITOR-FXD .01UF +80-20% 50WVDC CER	28480	0160-3470
A3C71	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C72	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C73	0140-0192	5	CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CM
A3C74	0150-0051	1	CAPACITOR-FXD 2PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A3C75	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C76			DELETED		
A3C77	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C78	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A3C79	0160-3651		CAPACITOR-FXD 68PF +-10% 200 VDC CER	16546	CW108680K
A3C80	0160-3651		CAPACITOR-FXD 68PF +-10% 200 VDC CER	16546	CW108680K
A3CR1	1901-0040	61	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR4	1901-0047	4	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
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	7	DIODE-GE 60V 60NA 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
A3CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR25	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR26	1901-0045	2	DIODE-PWR RECT 100V 750MA DO-29	28480	1901-0045
A3CR27	1901-0045		DIODE-PWR RECT 100V 750MA DO-29	28480	1901-0045
A3CR28	1906-0042	1	DIODE-DUAL 70V 10MV	28480	1906-0042
A3CR29	1901-0773	2	DIODE, SIL HOT CARRIER 250MW	28480	1901-0773
A3CR30	1901-0773		DIODE, SIL HOT CARRIER 250MW	28480	1901-0773
A3L1	9100-0670	2	COIL, FXD 3-TURN,#34AWG CU ON	06560	4A3- (
A3L2	9100-0670		COIL, FXD 3-TURN,#34AWG CU ON	06560	4A3- (
A3L3	9100-2264	2	COIL-MLD 6.8UH 10% Q=50 .0950X.25LG	06560	09-4446-2K
A3L4	9100-2264		COIL-MLD 6.8UH 10% Q=50 .0950X.25LG	06560	09-4446-2K
A3L5	9100-1650	2	COIL-MLD 680UH 5% Q=60 .19DX.44LG	99800	2500-20
A3L6	9100-1650		COIL-MLD 680UH 5% Q=60 .19DX.44LG	99800	2500-20
A3L7	9170-0029	5	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A3MP1	01740-00603	2	SHIELD, RESISTOR	28480	01740-00603
A3MP2	1205-0095		HEAT SINK (FOR Q2,4)	13103	2225B
A3P1			P/O ASSEMBLY A3		
A3P2	1251-3750	3	CONNECTOR 10-PIN M POST TYPE	27264	09-65-1101
A3P3	1251-3904	2	CONNECTOR POST TYPE	28480	1251-3904
A3P4	1251-3904		CONNECTOR POST TYPE	28480	1251-3904
A3Q1	5080-7656	2	TRANSISTOR PNP SI TO-92 SELECTED	28480	5080-7656
A3Q2	1855-0268	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE	28480	1855-0268
A3Q3	5080-7656		TRANSISTOR PNP SI TO-92 SELECTED	28480	5080-7656
A3Q4	1855-0268		TRANSISTOR-JFET DUAL N-CHAN D-MODE	28480	1855-0268
A3Q5	1854-0092	11	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q6	1854-0628	2	TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A3Q7	1854-0628		TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A3Q8	1854-0215	22	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q9	1853-0036	36	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3Q10	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	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 ON 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
A3Q16	1853-0015	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q17	1853-0314	1	TRANSISTOR PNP 2N2905A SI TO-39 600MW	04713	2N2905A
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	1854-0215
A3Q20	1853-0086	1	TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086

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
A3U21	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3R1	0698-8648	2	RESISTOR 50 2% .5W MO TC=0+-150	28480	0698-8648
A3R2	0698-7206	1	RESISTOR 56.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-56R2-G
A3R3	0698-8622	4	RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8622
A3R4	0698-3329	2	RESISTOR 10K .5% .125W F TC=0+-100	03888	PME55-1/8-T0-1002-D
A3R5	0698-8622		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8622
A3R6	0675-1011	2	RESISTOR 100 10% .125W CC TC=-270/+540	01121	BB1011
A3R7	0698-7216	1	RESISTOR 147 1% .05W 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	12	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R10	0698-3157	6	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A3R11	2100-0568	3	RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	73138	72-102-0
A3R12	0684-1001	16	RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A3R13	0683-0475	3	RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A3R14	0757-0394	4	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	4	RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	02111	63P
A3R19	2100-3531		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	02111	63P
A3R20*	0757-0410	2	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-TO-301R
A3R21	0698-8648		RESISTOR 50 2% .5W MO TC=0+-150	28480	0698-8648
A3R22	2100-2061	1	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	62-2D4-1
A3R23	0698-8622		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8622
A3R24	0698-3329		RESISTOR 10K .5% .125W F TC=0+-100	03888	PME55-1/8-T0-1002-D
A3R25	0698-8622		RESISTOR 990K .5% .125W F TC=0+-50	28480	0698-8622
A3R26	0687-2241		RESISTOR 220K 10% .5W CC TC=0+882	01121	EB2241
A3R27	0675-1011		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	4	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R33	0698-0082	3	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	73M1GG40R251U
A3R37	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R38	0757-1098	2	RESISTOR 945 1% .125W F TC=0+-100	24546	C4-1/8-T0-945R-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	3	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	CB27G1
A3R45	0757-0433	14	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R46	2100-0554	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	2100-0554		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A3R50	0757-0398		RESISTOR 75 1% .125W 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	CB27G1
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	0757-1098		RESISTOR 945 1% .125W F TC=0+-100	24546	C4-1/8-T0-945R-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-T0-464R-G
A3R60	0698-7228		RESISTOR 464 1% .05W F TC=0+-100	24546	C3-1/8-T0-464R-G
A3R61	2100-3433		RESISTOR-VAR CONTROL CCP 250 10% LIN	01121	73M1GG40R251U
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	3	RESISTOR-TRMR 2K 10% C TOP-ADJ	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	21	RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A3R69	0684-1031	27	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
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	19701	MF52C-1
A3R75	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-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
A3R76	2100-3531		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	02111	63P
A3R77	2100-3531		RESISTOR-TRMR 250 10% C TOP-ADJ 1-TRN	02111	63P
A3R78*	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-TO-301-F
A3R79	2100-3212		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-103-0
A3R80	0757-0290	4	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3R81	0757-0417	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-TO-562R-F
A3R82	0757-0443	5	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A3R83	0698-4037	3	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-TO-46R4-F
A3R84	0757-0317	2	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1331-F
A3R85	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-TO-46R4-F
A3R86	2100-0567		RESISTOR-TRMR 2K 10% C TOP-ADJ	73138	72-106-0
A3R87	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3321-F
A3R88	0757-0280	15	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R89	0757-1094	3	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-3832-F
A3R94	0684-3321	9	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% .125W F TC=0+-100	24546	C4-1/8-TO-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	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A3R100	0757-0476		RESISTOR 301K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3013-F
A3R101	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-3321-F
A3R104	0757-0442	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-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-TO-1001-F
A3R110	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3R111	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R112	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-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	MF4C1/8-TO-6191-F
A3R115	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A3R116	2100-0554		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-TO-2001-F
A3R118	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-TO-562R-F
A3R119	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R120	0698-3150	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2371-F
A3R121	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R122	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R123	0757-0462		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7502-F
A3R124	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-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-TO-511R-G
A3R129	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3321-F
A3R130	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R131	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-TO-332R-F
A3R132	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-TO-46R4-F
A3R133	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3321-F
A3R134	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A3R136	0757-0453	5	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A3R137	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB27G1
A3R138	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A3R139	0757-0416	10	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A3R140	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A3R141	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-TO-332R-F
A3R144	0757-0440	6	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A3R145	0698-7196	2	RESISTOR 21.5 2% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A3R146	0698-7196		RESISTOR 21.5 2% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A3R147	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
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	1820-1518	1	IC-DIGITAL DM74L00N TTL L QUAD 2 NAND	27014	DM74L00N
A3U2	1820-0596	2	IC-DIGITAL DM74L74N TTL L DUAL	27014	DM74L74N
A3U3	1820-0585	1	IC-DIGITAL DM74L03N TTL L QUAD 2 NAND	27014	DM74L03N
A3U4	1820-0596		IC-DIGITAL DM74L74N TTL L DUAL	27014	DM74L74N

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3VR1	1902-3082	3	DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	15818	CD 35610
A3VR2	1902-3234	1	DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	04713	SZ 10939-266
A3VR3	1902-0072	1	DIODE-ZNR 7.87V 2% DO-7 PD=.4W TC=+.051%	28480	1902-0072
A3VR4	1902-3137	1	DIODE-ZNR 8.06V 2% DO-7 PD=.4W TC=+.052%	04713	SZ 10939-156
A3VR5	1902-0041	2	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	15818	CD 35622
A3VR6	1900-3002	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=.074%	15818	CD 35526
A3W1	01740-61617	1	CABLE ASSEMBLY	28480	01740-61617
A3XU1	1200-0474	13	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A3XU2	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A3XU3	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A3XU4	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A3A1	5081-3030	1	SUBSTRATE ASSEMBLY (NOT SUPPLIED WITH A3 - ORDER SEPARATELY)	28480	5081-3030
A4	01740-61611	1	CABLE ASSEMBLY, DELAY LINE	28480	01740-61611
A5			NOT ASSIGNED		
A6	0960-0432	1	HV MULTIPLIER ASSEMBLY	28480	0960-0432
A7	01740-66524	1	HORIZONTAL SWEEP ASSEMBLY	28480	01740-66524
A7C1	0160-3569	1	CAPACITOR-FXD 27PF +-5% 100WVDC CER	28480	0160-3569
A7C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C3	0140-0202	1	CAPACITOR-FXD 15PF +-5% 500WVDC MICA	72136	DM15C150J0500WV1CR
A7C4	0150-0070	2	CAPACITOR-FXD .02UF +-20% 500WVDC CER	28480	0150-0070
A7C5	0140-0196	3	CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A7C6	0160-3318	1	CAPACITOR-FXD .047UF +-10% 100WVDC CER	28480	0160-3318
A7C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C8	0150-0021		CAPACITOR-FXD .47PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A7C9	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C10	0140-0193	2	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A7C11	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A7C12	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C13	0180-0195	1	CAPACITOR-FXD .33UF +-20% 35WVDC TA	56289	150D334X0035A2
A7C14	0160-2204	6	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A7C15	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C16	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C18	0180-0058	1	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A7C19	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C23	0180-1746	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A7C24	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C25	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C26	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C27	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C28	0180-0106	8	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A7C29	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C30	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C31	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A7C32	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C33	0160-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A7C34	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C35	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C36	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C37	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C38	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C39	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C40	0160-2198		CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A7C41	0160-2198		CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A7C42	0160-2197	1	CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A7C43			NOT ASSIGNED		
A7C44	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C45	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C46	0140-0204	1	CAPACITOR-FXD 47PF +-5% 500WVDC MICA	72136	DM15E470J0500WV1CR
A7C47	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A7C48	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A7C49	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
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	1901-0513	1	DIODE-DUAL 100V	28480	1901-0513

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
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		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH6308
A7CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR15	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A7CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR21	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR22	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR24	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A7L1	9140-0105	5	COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	24226	15/821
A7L2	9140-0096	3	COIL-MLD 1UH 10% Q=50 .155DX.375LG	99800	1537-12
A7L3	9100-1613	2	COIL-MLD 470NH 20% Q=45 .155DX.375LG	24226	15/470
A7L4	9140-0096		COIL-MLD 1UH 10% Q=50 .155DX.375LG	99800	1537-12
A7L5	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	24226	15/821
A7L6	9140-0096		COIL-MLD 1UH 10% Q=50 .155DX.375LG	99800	1537-12
A7L7	9100-1613		COIL-MLD 470NH 20% Q=45 .155DX.375LG	24226	15/470
A7L8	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A7L9	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A7L10	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A7P1			P/O ASSEMBLY A7		
A7P2	1251-3901	2	CONNECTOR 15-PIN M POST TYPE	27264	09-65-1151
A7P3	1251-3750		CONNECTOR 10-PIN M POST TYPE	27264	09-65-1101
A7P4	1251-4238	1	CONNECTOR 9-PIN M POST TYPE	28480	1251-4238
A7P5	1251-3071	1	CONNECTOR 8-PIN M POST TYPE	27264	09-56-1081(2183-8A)
A7Q1	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q2	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A7Q3	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	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=600MHZ	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	9	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=200MHZ	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=600MHZ	28480	1854-0092
A7Q25	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	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=600MHZ	28480	1854-0092
A7Q30	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
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=600MHZ	28480	1854-0092
A7R1	0698-3263	3	RESISTOR 500K 1% .125W F TC=0+-100	91637	MFF-1/8, T-1
A7R2	0698-3263		RESISTOR 500K 1% .125W F TC=0+-100	91637	MFF-1/8, T-1
A7R3	0757-0476	1	RESISTOR 301K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3013-F
A7R4	0757-0486	3	RESISTOR 750K 1% .125W F TC=0+-100	24546	NA4
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	3	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	7	RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A7R10	0684-1061	1	RESISTOR 10M 10% .25W FC TC=-900/+1100	01121	CB1061

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R11	0698-3263		RESISTOR 500K 1% .125W F TC=0+-100	91637	MFF-1/8, T-1
A7R12	0683-1505	1	RESISTOR 15 5% .25W FC TC=-400/+500	01121	CB1505
A7R13	0757-0486		RESISTOR 750K 1% .125W F TC=0+-100	24546	NA4
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	19	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	3	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	73138	72-142-0
A7R21	2100-3434	2	RESISTOR-VAR CONTROL CCP 50K 10% LIN	01121	73M4N048P503U
A7R22	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R23	0698-3446	6	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 26.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A7R27	0698-3433		RESISTOR 26.7 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	3	RESISTOR 909K 1% .125W F TC=0+-100	24546	NA4
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	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R35	0757-0433		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	0757-0746	1	RESISTOR 4.75K 1% .25W F TC=0+-100	19701	MF52C-1
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	3	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	5	RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A7R49	0757-0399	1	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	0684-2271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB27G1
A7R53	0757-0408	3	RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A7R54	0757-0435	3	RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-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	8	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	1	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A7R62	0757-0436	1	RESISTOR 182 1% .125W F TC=0+-100	24546	C4-1/8-T0-182R-F
A7R63	0757-0434	3	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A7R64	0757-0447	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-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	19	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
A7R76	0757-0124	1	RESISTOR 39.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3922-F
A7R77	0757-0448	1	RESISTOR 18.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1822-F
A7R78	0757-0437	3	RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A7R79	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R80	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R81	0757-0409	1	RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A7R82	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R83	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A7R84	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A7R85	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-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
A7R86	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A7R87	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A7R88	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A7R89	0757-0412		RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-TO-3650-F
A7R90	0698-0085	3	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2611-F
A7R91	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-TO-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	72-105-0
A7R94	0757-0438	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A7R95	0757-0444	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A7R96	0757-0430	1	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-301R-F
A7R99	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A7R100	0757-0404	1	RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-TO-131-F
A7R101	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-TO-619R-F
A7R102	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-TO-383R-F
A7R103	0698-3155	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4641-F
A7R104	0684-3311	3	RESISTOR 330 10% .25W FC TC=-400/+600	01121	CB3311
A7R105	2100-3253	2	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-TO-511R-F
A7R107	0757-0457	2	RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4752-F
A7R108	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4751-F
A7R109	0684-1021	18	RESISTOR 1K 10% .25W FC TC=-400/+600	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-TO-2433-F
A7R112	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A7R113	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2372-F
A7R114	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A7R115	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A7R117	2100-0568		RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	73138	72-102-0
A7R118	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R119	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R120	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R121	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R122	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R123	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R124	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R125	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A7R126	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	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/+600	01121	CB1021
A7R129	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-TO-383R-F
A7R130	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3921-F
A7R131	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-TO-383R-F
A7R132	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-TO-383R-F
A7R133	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3651-F
A7R134	0757-0289	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A7R135	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1501-F
A7R136	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-TO-243R-F
A7R137	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A7R138	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A7R139	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A7R140	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A7R141	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-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/+600	01121	CB4711
A7R145	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-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-TO-6811-F
A7R148	0757-0419	3	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-TO-681R-F
A7R149	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A7R150	0757-0391	1	RESISTOR 39.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-39R2-F
A7R151	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A7R152	0757-0466		RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1103-F
A7R153	0684-4701		RESISTOR 47 10% .25W FC TC=-400/+500	01121	CB4701
A7R154	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A7R155	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A7R156	0684-2701		RESISTOR 27 10% .25W FC TC=-400/+500	01121	CB2701
A7R157	0684-1811	1	RESISTOR 180 10% .25W FC TC=-400/+600	01121	CB1811
A7R158	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A7R159	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A7R160	0757-0428	3	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1621-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
A7R161	0684-1511		RESISTOR 150 10% .25W FC TC=-400/+600	01121	CB1511
A7R162	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R163	0684-1511		RESISTOR 150 10% .25W FC TC=-400/+600	01121	CB1511
A7R164	0684-3311		RESISTOR 330 10% .25W FC TC=-400/+600	01121	CB3311
A7R165	0757-0465	4	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R166	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R167	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A7R168	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A7R169	2100-0567		RESISTOR-TRMR 2K 10% C TOP-ADJ	73138	72-106-0
A7S1	3101-1906	1	SWITCH-PB 4-STATION 10MM C-C SPACING	28480	3101-1906
A7S2	3101-1909	1	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	1826-0059	3	IC: OP AMP	27014	LM201AH
A7U2	5081-3019	2	ASSY, SUBSTRATE	28480	5081-3019
A7U3	1826-0059		IC: OP AMP	27014	LM201AH
A7U4	1821-0002		TRANSISTOR ARRAY DIP	02735	CA3045
A7W1	01740-61605	1	CABLE ASSEMBLY	28480	01740-61605
A7XA9	1251-0588	2	CONNECTOR 12-PIN F POST TYPE	27264	09-52-3121
A7XU1	1200-0763	5	SOCKET-IC 8-CONT DIP-SLDR	71785	133-98-92-061
A7XU2	1200-0473	2	SOCKET-IC 16-CONT DIP-SLDR-TERMS	28480	1200-0473
A7XU3	1200-0763		SOCKET-IC 8-CONT DIP-SLDR	71785	133-98-92-061
A7XU4	1200-0474	5	SOCKET-IC 14-CONT DIP-SLDR-TERMS	28480	1200-0474
A8	01740-66523	1	MAIN SWEEP ASSEMBLY	28480	01740-66523
A8C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C3	0180-0197	7	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C5	0140-0218	2	CAPACITOR-FXD 160PF +-2% 300WVDC MICA	72136	DM15F161G0300WV1CR
A8C6	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A8C8	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C9	0160-3226	2	CAPACITOR-FXD .01UF +-10% 400WVDC MET	28480	0160-3226
A8C10	0160-3726	2	CAPACITOR-FXD 1UF +-10% 40WVDC 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% 300WVDC MICA	72136	DM15E390J0300WV1CR
A8C13	0140-0207	1	CAPACITOR-FXD 330PF +-5% 500WVDC MICA	72136	DM15F331J0500WV1CR
A8C14	0160-0155	1	CAPACITOR-FXD 3300PF +-10% 200WVDC POLYE	56289	292P33292
A8C15	0160-0194	1	CAPACITOR-FXD .015UF +-10% 200WVDC POLYE	56289	292P15392
A8C16	0180-2079	1	CAPACITOR-FXD .39UF+-10% 35VDC TA	56289	150D394X9035A2
A8C17	0180-1745	1	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A8C18	0180-2111	1	CAPACITOR-FXD 33UF+-10% 35VDC TA	56289	150D336X9035SA
A8C19	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C21	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
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 8.2UH 10% Q=50 .1550X.375LG	24226	15/821
A8L2	9170-0029	2	CORE-SHIELDING BEAD	28480	9170-0029
A8L3	9170-0029		CORE-SHIELDING BEAD	28480	9170-0029
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=500MHZ	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	5	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=200MHZ	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	0684-3901	9	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	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A8R4	0684-3901		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

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
A8R6	0684-8201	1	RESISTOR 82 10% .25W FC TC=-400/+500	01121	CB8201
A8R7	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A8R8	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A8R9	0684-2251	1	RESISTOR 2.2M 10% .25W FC TC=-900/+1100	01121	CB2251
A8R12	2100-3056	7	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A8R13	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A8R14	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A8R15	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A8R16	0757-0440		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	2	RESISTOR 5K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-5001-B
A8R19	0698-4157	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	MF4C1/8-T2-5002-B
A8R22	0698-4158	2	RESISTOR 100K .1% .125W F TC=0+-50	24546	NC55
A8R23	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A8R24	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A8R25	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
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	0757-1093	1	RESISTOR 3K 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	4	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	CB2761
A8R42	0684-0271		RESISTOR 2.7 10% .25W FC TC=-400/+500	01121	CB2761
A8R43	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A8S1MP1	01740-61901	1	SWITCH ASSY-ROTARY, MALE (P/O A8S1)	28480	01740-61901
A8S1MP2	01740-61902	1	SWITCH ASSY-ROTARY, FEMALE (P/O A8S1)	28480	01740-61902
A8S1MP3	01840-22502	2	ROLLER, DETENT	28480	01840-22502
A8S1MP4	1460-1148	2	SPRING-TRSN	28480	1460-1148
A8U1	1826-0086	1	IC UA 776 OP AMP	07263	776HC
A8XA7	1251-0589	3	CONNECTOR 10-PIN F POST TYPE	27264	09-52-3101
A8XU1	1200-0763		SOCKET-IC 8-CONT DIP-SLDR	71785	133-98-92-061
A9	01740-66522	1	DELAYED SWEEP ASSEMBLY	28480	01740-66522
A9C1	0160-2250	1	CAPACITOR-FXD 5.1PF +-.25PF 500WVDC CER	28480	0160-2250
A9C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C3	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C4	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A9C6	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C7	0140-0218		CAPACITOR-FXD 160PF +-2% 300WVDC MICA	72136	DM15F161G0300WV1CR
A9C8	0160-3226		CAPACITOR-FXD .01UF +-10% 400WVDC MET	28480	0160-3226
A9C9	0160-3726		CAPACITOR-FXD 1UF +-10% 40WVDC MET POLYC	28480	0160-3726
A9C10	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C11	0180-2148	1	CAPACITOR-FXD .47UF+-20% 50VDC TA	56289	1500474X0050A2
A9C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	1500225X9020A2
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 8.2UH 10% Q=50 .155DX.375LG	24226	15/821
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

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9Q6	1855-0081		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	24546	C4-1/8-T0-151-F
A9R3	0757-0834	1	RESISTOR 5.62K 1% .5W F TC=0+-100	19701	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
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
A9R10	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A9R11	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A9R12	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A9R13	0757-0440		RESISTOR 7.5K 1% .125W 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	MF4C1/8-T2-5001-B
A9R16	0698-4157		RESISTOR 10K .1% .125W F TC=0+-50	24546	NC55
A9R17	0698-6942		RESISTOR 25K .1% .125W F TC=0+-50	24546	NC55
A9R18	0698-5450		RESISTOR 50K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-5002-B
A9R19	0698-4158		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	CB47G5
A9R22	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A9R23	0684-1031		RESISTOR 10K 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
A9R27	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A9R28	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A9S1MP1	01740-61903	1	SWITCH ASSY-ROTARY, MALE (P/O A9S1)	28480	01740-61903
A9S1MP2	01740-61904	1	SWITCH ASSY-ROTARY, FEMALE (P/O A9S1)	28480	01740-61904
A9S1MP3	01840-22502		ROLLER, DETENT	28480	01840-22502
A9S1MP4	1460-1148		SPRING-TRSN	28480	1460-1148
A9U1	1826-0059		IC: OP AMP	27014	LM201AH
A9XA10	1251-3352	1	CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW	26742	91-6912-0702-00
A9XU1	1200-0763		SOCKET-IC 8-CONT DIP-SLDR	71785	133-98-92-061
A10	01740-66508	1	DELAYED TRIGGER ASSEMBLY	28480	01740-66508
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	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C5			NOT ASSIGNED		
A10C6	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A10C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C9	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C10	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C11	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C12	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C13	0150-0048	1	CAPACITOR-FXD .22PF +-5% 500WVDC TI DIDX	95121	TYPE QC
A10C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
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
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 60MA 1US DO-7	28480	1910-0016
A10L1	9140-0105		COIL-MLD 8.2UH 10% Q=50 .155DX.375LG	24226	15/821
A10P1			P/O ASSEMBLY A10		
A10Q1	1855-0262	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE	28480	1855-0262
A10Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A10Q4	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
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

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
A10R1	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	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 FC TC=-400/+500	01121	CB3901
A10R4	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A10R5	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A10R6	0684-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A10R7	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A10R8	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A10R9	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	73138	72-142-0
A10R10	2100-3434		RESISTOR-VAR CONTROL CCP 50K 10% LIN	01121	73M4N048P503U
A10R11	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A10R13	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A10R14	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A10R15	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A10R16	0698-3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A10R17	0698-3433		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A10R18	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A10R19	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A10R20	0684-1531	2	RESISTOR 15K 10% .25W FC TC=-400/+800	01121	CB1531
A10R21	5081-7482	1		28480	5081-7482
A10R22	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A10R23	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A10R24	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-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	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A10R28	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A10R29	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A10R30	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A10R31	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A10R32	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A10R33	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A10R34	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A10R35	0684-3901		RESISTOR 39 10% .25W FC TC=-400/+500	01121	CB3901
A10R36	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A10R37	0757-0488		RESISTOR 909K 1% .125W F TC=0+-100	24546	NA4
A10R38	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A10R39	0684-1011		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-T0-1621-F
A10S1	3101-1904	1	SWITCH-PB 6-STATION 10MM C-C SPACING	28480	3101-1904
A10U1	5061-3019		ASSY, SUBSTRATE	28480	5081-3019
A10VR1	1902-3082		DIODE-ZNR 4.64V 5% DO-7 PD=.4W TC=-.023%	15818	CD 35610
A10XU1	1200-0473		SOCKET IC 16 CONT DIP-SLDR	28480	1200-0473
A11	01740-66521	1	HORIZONTAL OUTPUT ASSEMBLY	28480	01740-66521
A11C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C3	0160-3665	8	CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C4	0160-3502	2	CAPACITOR-FXD .3PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A11C5	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C6	0140-0192		CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A11C7	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C8	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C9	0140-0192		CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A11C10	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C11	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C12	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A11C13	0160-3502		CAPACITOR-FXD .3PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A11C14	0140-0192		CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A11L1	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A11L2	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A11MP1	1205-0095	3	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	1854-0419	1	TRANSISTOR NPN SI TO-39 PD=1W FT=200MHZ	28480	1854-0419
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=200MHZ	28480	1853-0232
A11Q8	1854-0523	1	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0523

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
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-T0-1822-F
A11R5	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A11R6	0683-0395	1	RESISTOR 3.9 5% .25W FC TC=-400/+500	01121	CB39G5
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-T0-201-F
A11R10	2100-3273	3	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-144-0
A11R11	0757-0768	2	RESISTOR 47.5K 1% .25W F TC=0+-100	19701	MF52C-1
A11R12	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A11R13	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-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	72-144-0
A11R16	0757-0768		RESISTOR 47.5K 1% .25W F TC=0+-100	19701	MF52C-1
A11R17	0757-0457		RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4752-F
A11R18	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A11R19	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A11R20	0683-0685	1	RESISTOR 6.8 5% .25W FC TC=-400/+500	01121	CB6805
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	1	CONNECTOR 15-PIN F POST TYPE	27264	09-52-3151
A12	01741-66516	1	GATE AMPLIFIER ASSEMBLY	28480	01741-66516
A12C1	0180-0230	12	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A12C2	0160-0165	3	CAPACITOR-FXD .056UF +-10% 200WVDC POLYE	56289	292P56392
A12C3	0160-3665	2	CAPACITOR-FXD .01UF +-20% 500WVDC CER	28480	0160-3665
A12C4	0160-3665		CAPACITOR-FXD .01UF +-20% 500WVDC CER	28480	0160-3665
A12C5	0160-0298	1	CAPACITOR-FXD 1500PF +-10% 200WVDC POLYE	56289	292P15292
A12C6	0160-3452	2	CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3452
A12C7	0160-2150		CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-2150
A12C8	0121-0474	1	CAPACITOR-V TRMR-PSTN .3/1.5PF 600V	28480	0121-0474
A12C9	0160-0162	1	CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A12C10	0160-0165		CAPACITOR-FXD .056UF +-10% 200WVDC POLYE	56289	292P56392
A12C11			NOT ASSIGNED		
A12C12	0160-4686		CAPACITOR-FXD .22UF+-10% 100WVDC POLYE	19701	C280MCH/A220K
A12C13	0160-3451	1	CAPACITOR-FXD .01UF+80-20% 100VDC CER	56289	C023B101F103ZS25-CDH
A12CR1	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A12CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12CR3			NOT ASSIGNED		
A12CR4			NOT ASSIGNED		
A12CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12H1	2200-0103	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A12H2	2260-0002	1	NUT-HEX-DBL-CHAM 4-40-THD .062-THK	28480	2260-0005
A12H3	2190-0016	1	WASHER-LK INTL T NO.-3/8 .377-IN-ID	28480	2190-0016
A12H4	2950-0043	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-THK	73743	2X 28200
A12MP1	1205-0095		HEAT SINK TO-5/TO-39-PKG	28480	1205-0095
A12MP2	01801-01206	1	ANGLE, BRACKET	28480	01801-01206
A12P1	1251-3319	1	CONNECTOR 10-PIN M POST TYPE	27264	09-64-1101(A2402-10A)
A12Q1	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A12Q2	1853-0232		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0232
A12Q3	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A12Q4	1854-0271	1	TRANSISTOR NPN SI TO-39 PD=1W FT=150MHZ	28480	1854-0271
A12Q5	1854-0472	1	TRANSISTOR NPN SI DARL PD=500MW	04713	MPS-A14
A12Q6	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A12Q7	1853-0402	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0402
A12Q8	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q9			NOT ASSIGNED		
A12Q10	1853-0080		TRANSISTOR PNP SI PD=300MW	28480	1853-0080
A12R1	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A12R2	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A12R3	2100-3359	1	RESISTOR-TRMR 2M 20% C SIDE-ADJ 1-TRN	73138	72-155-0
A12R4	0757-0426	1	RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1301-F
A12R5	0757-0460	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A12R6	0684-3921	5	RESISTOR 3.9K 10% .25W FC TC=-400/+700	01121	CB3921
A12R7	0757-0770	1	RESISTOR 56.2K 1% .25W F TC=0+-100	19701	MF52C-1
A12R8	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A12R9	0757-0730	1	RESISTOR 750 1% .25W F TC=0+-100	19701	MF52C-1
A12R10	0698-3647	1	RESISTOR 15K 5% 2W MO TC=0+-200	11502	RG42

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
A12R11	0684-3921		RESISTOR 3.9K 10% .25W FC TC=-400/+700	01121	CB3921
A12R12	2100-3273		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	73138	72-144-0
A12R13	0757-0840	1	RESISTOR 11K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1102-F
A12R14	0687-5601	2	RESISTOR 56 10% .5W CC TC=0+412	01121	EB5601
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	3386X-Y46-203
A12R17	0757-0456	1	RESISTOR 43.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4322-F
A12R18	0684-3931	2	RESISTOR 39K 10% .25W FC TC=-400/+800	01121	CB3931
A12R19	2100-3355	3	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	73138	72-150-0
A12R20	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A12R21	0684-2211	2	RESISTOR 220 10% .25W FC TC=-400/+600	01121	CB2211
A12R22	0684-1051		RESISTOR 1M 10% .25W CC TUBULAR	01121	CB1051
A12R23	0684-8211	12	RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A12R24	2100-3274	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ	73138	72-146-0
A12R25	2100-3423	1	RESISTOR-VAR CONTROL CC 10K 20% LIN	28480	2100-3423
A12R26	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A12R27			NOT ASSIGNED		
A12R28			NOT ASSIGNED		
A12R29	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A12R30	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+700	01121	CB1021
A12R31	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A12R32	0684-3331	1	RESISTOR 33K 10% .25W FC TC=-400/+800	01121	CB3331
A12R33	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A12R34	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A12R35	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A12R36	0683-0335	1	RESISTOR 3.3 5% .25W FC TC=-400/+500	01121	CB33G5
A12R37	2100-3424	1	RESISTOR-VAR CONTROL CC 5M 30% LIN	28480	2100-3424
A12R38	0684-1051		RESISTOR 1M 1% .125W F TUBULAR	24546	C4-1/8-T0-1004-F
A12S1	3101-1767	1	SWITCH-PB DPDT MOM 1A 300VAC	28480	3101-1767
A12U1	1821-0002		TRANSISTOR ARRAY DIP	02735	CA3045
A12VR1	1902-0025	2	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A12VR2	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	15818	CD 35622
A12VR3	1902-3393	1	DIODE-ZNR 75V 5% DO-7 PD=.4W TC=+.083%	28480	1902-3393
A12VR4	1902-3002	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W	04713	SZ 10939-2
A12XA16	1251-0588		CONNECTOR 12-PIN F POST TYPE	27264	09-52-3121
A12XU1	1200-0474		SOCKET-IC 14-CONT DIP-SLDR-TERMS	28480	1200-0474
A13	01740-66516	1	VERTICAL CONTROL SWITCHING ASSEMBLY	28480	01740-66516
A13R1	0757-0282	2	RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/8-T0-221R-F
A13R2	0757-0282		RESISTOR 221 1% .125W F TC=0+-100	24546	C4-1/8-T0-221R-F
A13S1	3101-1908	1	SWITCH-PB 2-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	28480	01740-66540
A14XA3	1251-0477	1	CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW	9D949	143-012-07-109
A14XA7	1251-0213	1	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	26742	91-6915-1700-00
A14XA16	1251-5092	1	CONNECTOR 15 PIN	28480	1251-5092
A15	01741-66511	1	HV POWER SUPPLY ASSEMBLY	28480	01741-66511
A15C1	0180-1794	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	56289	150D226X9035R2
A15C2	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500WVDC CER	28480	0160-2264
A15C3	0180-0269	2	CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A15C4	0160-0684	2	CAPACITOR-FXD 1000PF +-20% 4000WVDC MET	28480	0160-0684
A15C5	0160-0544	2	CAPACITOR-FXD .022UF +-20% 4000WVDC MET	28480	0160-0544
A15C6	0160-0544		CAPACITOR-FXD .022UF +-20% 4000WVDC MET	28480	0160-0544
A15C7	0160-4024	1	CAPACITOR-FXD .1UF +-20% 4000WVDC MET	56289	430P104040
A15C8	0160-0684		CAPACITOR-FXD 1000PF +-20% 4000WVDC MET	28480	0160-0684
A15C9	0160-4079	1	CAPACITOR-FXD 1500PF +-20% 4000WVDC MET	28480	0160-4079
A15C10	0180-1731	2	CAPACITOR-FXD 4.7UF+-10% 50VDC TA	56289	150D475X9050B2
A15C12	0160-0164	1	CAPACITOR-FXD .039UF +-10% 200WVDC POLYE	56289	292P39392
A15C13	0160-3508		CAPACITOR-FXD 1UF +80-20% 50WVDC CER	28480	0160-3508
A15C14	0160-0168	2	CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A15C15	0180-1731		CAPACITOR-FXD 4.7UF+-10% 50VDC TA	56289	150D475X9050B2
A15C16	0160-0165		CAPACITOR-FXD .056UF +-10% 200WVDC POLYE	56289	292P56392
A15C17	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA	56289	150D105X0050A2
A15C18	0180-0228		CAPACITOR-FXD 22UF +-10% 15VDC TA	56289	150D226X9015B2
A15C19	0160-3720		CAPACITOR-FXD POLY 0.1 UF 10% 160VDCW	28480	0160-3720
A15CR1	1901-0028	5	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A15CR2	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A15CR3	1901-0683	1	DIODE-HV RECT 10KV 5MA 250NS	28480	1901-0683
A15CR4	1901-0036	8	DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A15CR5	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15CR6	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A15CR7	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A15CR8	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A15CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A15CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A15CR11	1901-0646		DIODE-PWR RECT 150NS 200V 1A	14099	S2F
A15DS1	2140-0014	3	LAMP, GLOW, BULB, T-2, 70V	74276	4AB(NE-96)
A15DS2	2140-0014		LAMP, GLOW, BULB, T-2, 70V	74276	4AB(NE-96)
A15DS3	2140-0014		LAMP, GLOW, BULB, T-2, 70V	74276	4AB(NE-96)
A15DS4	2140-0013	2	LAMP-GLOW 5AB-A 70/75VDC 300UA T-2-BULB	74276	NE23A
A15DS5	2140-0013		LAMP-GLOW 5AB-A 70/75VDC 300UA T-2-BULB	74276	NE23A
A15E1	2110-0269	2	FUSEHOLDER-CLIP TYPE .25 FUSE	28480	2110-0269
A15F1	2110-0007	2	FUSE 1A 250V SLO-BLO 1.25X.25 UL IEC	75915	313.001
A15H1	2190-0019	1	WASHER-LK HLCL NO. -4 .115-IN-ID	28480	2190-0019
A15H2	2200-0103		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
A15H3	2200-0125	1	SCREW-MACH 4-40 1.5-IN-LG PAN-HD-POZI	28480	2200-0125
A15H4	2260-0001	1	NUT-HEX-DBL-CHAM 4-40-THD .094-THK	28480	2260-0002
A15H5	3050-0235	1	WASHER-FL MTLC NO. -4 .117-IN-ID	28480	3050-0235
A15L1	9140-0171	1	COIL-MLD 40UH 10% Q=20 .296DX .96BLG	28480	9140-0171
A15L2	9140-0210	1	COIL-MLD 100UH 5% Q=50 .155DX .375LG	24226	15/103
A15L3	9140-0129	1	COIL-MLD 220UH 5% Q=65 .155DX .375LG	24226	15/223
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	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A15Q3	1854-0575	5	TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A15Q4	1853-0086		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0086
A15Q5	1854-0575		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A15R1	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A15R2	2100-3253		RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	72-111-0
A15R3	0684-4741	1	RESISTOR 470K 10% .25W FC TC=-800/+900	01121	CB4741
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	0687-5601		RESISTOR 56 10% .5W CC TC=0+412	01121	EB5601
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	0683-2265	2	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A15R11	0687-5621	1	RESISTOR 5.6K 10% .5W CC TC=0+647	01121	EB5621
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	3	RESISTOR 68K 10% .25W FC TC=-400/+800	01121	CB6831
A15R15	0698-6441	1	RESISTOR 6.5M 5% 1W CF TC=0-2000	28480	0698-6441
A15R16	0698-8876	1	RESISTOR 22M 5% 1W CF TC=0-5000	28480	0698-8876
A15R17	0684-1531		RESISTOR 15K 10% .25W FC TC=-400/+800	01121	CB1531
A15R18	0687-5611	1	RESISTOR 560 10% .5W CC TC=0+529	01121	EB5611
A15R19	0684-5611	2	RESISTOR 560 10% .25W FC TC=-400/+600	01121	CB5611
A15R20	0698-5102	1	RESISTOR 1.2M 10% .25W FC TC=-900/+1100	01121	CB1251
A15R21	0684-1051	1	RESISTOR 1M 10% .25W FC TC=-800/+900	01121	CB1051
A15R22	0684-4731	4	RESISTOR 47K 10% .25W FC TC=-400/+800	01121	CB4731
A15R23	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A15R24	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A15R25	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
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	0687-1011	2	RESISTOR 100 10% .5W CC TC=0+529	01121	EB1011
A15R29	0684-2211		RESISTOR 220 10% .25W FC TC=-400/+600	01121	CB2211
A15R30	0757-0436		RESISTOR 4.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4321-F
A15R31	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A15R32	2100-0558	4	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	72-109-0
A15R33	2100-0569	1	RESISTOR-TRMR 1M 20% C TOP-ADJ 1-TRN	73138	72-116-0
A15R34	0684-5631	2	RESISTOR 56K 10% .25W FC TC=-400/+800	01121	CB5631
A15R35	0687-1011		RESISTOR 100 10% .5W CC TC=0+529	01121	EB1011
A15R36	0757-0288	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A15R37	0757-0471	2	RESISTOR 182K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1823-F
A15R38	2100-3210	2	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	72-108-0
A15R39	2100-3214	1	RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	73138	72-112-0
A15R40	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A15R41	0757-0471		RESISTOR 182K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1823-F
A15R42	0757-0437		RESISTOR 4.75K 1% .125W F TU8ULAR	24546	C4-1/8-T0-4751-F
A15R43	0684-2721		RESISTOR 2.7K 10% .25W CC TUBULAR	01121	CB2721
A15R44	0684-6831		RESISTOR 68K 10% .22W CC TU8ULAR	01121	CB6831
A15R45	0684-2711		RESISTOR 270 OHM 10% .25W CC TUBULAR	01121	CB2711
A15R46	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A15R47	0684-5601		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB5601
A15R48	0684-2221		RESISTOR 2.2K 10% .25W CC TU8ULAR	01121	CB2221
A15R49	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A15S1	3101-1652	1	SWITCH-SL DPDT-NS STD .5A 125VAC/DC SLDR	28480	3101-1652
A15T1	01741-61101	1	TRANSFORMER ASSEMBLY, HIGH VOLTAGE	28480	01741-61101
A15U1	1826-0167	1	IC CA 3094A OP AMP	02735	CA3094AT
A15U2	1990-0607	1	OPTICAL ISOLATOR	28480	1990-0607
A15VR1	1902-0040	2	DIODE-ZNR 14V 5% DO-7 PD=.4W	07263	FZ1201
A15VR2	1902-0040		DIODE-ZNR 14V 5% DO-7 PD=.4W	07263	FZ1201
A15VR3	1902-3428	1	DIODE-ZNR 100V 5% DO-7 PD=.4W	04713	SZ10939-470
A15VR4	1902-3171	1	DIODE-ZNR 11V 5% DO-7 PD=.4W	04713	SZ10939-194
A15VR5	1902-0766	1	DIODE-ZNR 18.2V 5% DO-7 PD=.4W	04713	SZ10939-257
A15XA12	1251-0589		CONNECTOR 10-PIN F POST TYPE	27264	09-52-3101
A15XU1	1200-0763		SOCKET-IC 8-CONT DIP-SLDR	71785	133-98-92-061

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
A16	01741-66514	1	LV POWER SUPPLY ASSEMBLY	28480	01741-66514
A16C1	0140-0208	1	CAPACITOR-FXD 680PF +-5% 300WVDC MICA	72136	DM15F681J0300WV1CR
A16C2	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A16C3	0180-1827	1	CAPACITOR-FXD 50UF+50-10% 25VDC AL	56289	39D506F250JE4
A16C4	0180-0089	1	CAPACITOR-FXD 10UF+50-10% 150VDC AL	56289	30D106F150DD2
A16C5	0180-0489	1	CAPACITOR-FXD 520UF+75-10% 100VDC AL	56289	39D527F100JP4
A16C6	0180-0091	2	CAPACITOR-FXD 10UF+50-10% 100VDC AL	56289	30D106F100DC2
A16C7	0180-0091		CAPACITOR-FXD 10UF+50-10% 100VDC AL	56289	30D106F100DC2
A16C8	0180-0583	1	CAPACITOR-FXD 6000UF+75-10% 30VDC AL	28480	0180-0583
A16C9	0160-2211	3	CAPACITOR-FXD 510PF +-5% 300WVDC MICA	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% 300WVDC MICA	28480	0160-2211
A16C13	0180-0341	1	CAPACITOR-FXD 25UF+75-10% 12VDC AL	56289	30D256G012BB2
A16C14	0180-0576	1	CAPACITOR-FXD 3500UF+75-10% 30VDC AL	56289	39D596
A16C15	0160-2211		CAPACITOR-FXD 510PF +-5% 300WVDC MICA	28480	0160-2211
A16C16	0180-0059		CAPACITOR-FXD 10UF+75-10% 25VDC AL	56289	30D106G025BB2
A16C17	0180-0039	1	CAPACITOR-FXD 100UF+75-10% 12VDC AL	56289	30D107G012CC2
A16C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A16C19	0180-0691	1	CAPACITOR-FXD 10UF+50-10% 200VDC AL	56289	430100F200FE1
A16C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A16C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A16CR1	1906-0006	5	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	1906-0006		DIODE-FW BRDG 400V 1A	28480	1906-0006
A16CR5	1906-0048	3	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0048
A16CR6	1901-0638		DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1901-0638
A16CR7	1906-0048		DIODE-MULT FULL WAVE BRIDGE RECTIFIER	28480	1906-0048
A16CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16E1	2110-0269		FUSEHOLDER-CLIP TYPE .25FUSE	28480	2110-0269
A16MP1	1205-0095		HEAT SINK TO-5/TO-39-PKG	28480	1205-0095
A16P1	1251-3901		CONNECTOR 15-PIN M POST TYPE	27264	09-65-1151
A16P2	1251-5093	1	CONNECTOR 15-PIN	28480	1251-5093
A16P3	1251-3902	1	CONNECTOR 12-PIN M POST TYPE	27264	09-65-1121
A16P4	1251-3750		CONNECTOR 10-PIN M POST TYPE	27264	09-65-1101
A16P5	1251-3638	2	CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A16Q1	1853-0336	4	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=310MW FT=300MHZ	28480	1854-0215
A16Q4	1854-0575		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
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=310MW FT=300MHZ	28480	1854-0215
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	1854-0234	1	TRANSISTOR NPN 2N3440 SI TO-5 PD=1W	02735	2N3440
A16Q12	1853-0037		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0037
A16R1	0757-0454		RESISTOR 33.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3322-F
A16R2	0699-0002	1	RESISTOR 6.8 10% .5W CC TC=0+412	01121	EB68G1
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-TO-2613-F
A16R6	0698-4495	1	RESISTOR 37.4K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3742-F
A16R7	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A16R8	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A16R9	0757-0431	1	RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2431-F
A16R10	0811-1668	2	RESISTOR 1.5 5% 2W PW TC=0+-400	75042	BWH2-1R5-J
A16R11	0684-1231	2	RESISTOR 12K 10% .25W FC TC=-400/+800	01121	CB1231
A16R12	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A16R13	0757-0449	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2002-F
A16R14	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-9091-F
A16R15	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A16R16	0684-4731		RESISTOR 47K 10% .25W FC TC=-400/+800	01121	CB4731
A16R17	0684-2231	4	RESISTOR 22K 10% .25W FC TC=-400/+800	01121	CB2231
A16R18	0698-3338	1	RESISTOR 1.5K 5% 2W MO TC=0+-200	11502	RG42
A16R19	0684-4721	1	RESISTOR 4.7K 10% .25W FC TC=-400/+800	01121	CB4721
A16R22	0687-4721	1	RESISTOR 4.7K 10% .5W CC TC=0+647	01121	EB4721
A16R23	0757-0278	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1781-F
A16R24	0811-1668		RESISTOR 1.5 5% 2W PW TC=0+-400	75042	BWH2-1R5-J
A16R25	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-TO-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
A16R26	2100-0554		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	73138	72-104-0
A16R27	0757-0273	1	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3011-F
A16R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A16R29	0698-5579	3	RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-TO-5001-D
A16R30	0811-1665	1	RESISTOR .82 5% 2W PW TC=0+-800	75042	BWH2-82/100-J
A16R31	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A16R32	0698-5579		RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-TO-5001-D
A16R33	0698-5579		RESISTOR 5K .5% .125W F TC=0+-100	24546	C4-1/8-TO-5001-D
A16R34	0757-0933	1	RESISTOR 2.4K 2% .125W F TC=0+-100	24546	C4-1/8-TO-2401-G
A16R35	0811-1553	1	RESISTOR .68 5% 2W PW TC=0+-800	75042	BWH2-11/16-J
A16R36	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A16R37	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A16R38	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
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
A16R41	0684-3331		RESISTOR 33K 10% .25WFC TC=-400/+800	01121	CB3331
A16S1	3101-0555	1	SWITCH-PB DPDT ALTNG 4A 250VAC	28480	3101-0555
A16S2	3101-1914	1	SWITCH-SL 2-DPDT-NS STD 1.5A 250VAC PC	28480	3101-1914
A16U1	1820-0196	3	IC UA 723C V RGLTR	07263	723HC
A16U2	1820-0196		IC UA 723C V RGLTR	07263	723HC
A16U3	1820-0196		IC UA 723C V RGLTR	07263	723HC
A16VR1	1902-3048	1	DIODE-ZNR 3.48V 5% DO-7 PD=.4W TC=-.058%	04713	SZ 10939-50
A16VR2	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A16VR3	1902-0026	1	DIODE-ZNR 36.5V 10% DO-7 PD=.4W	28480	1902-0026
A16VR4	1902-3428	1	DIODE-ZNR 100V 5% DO-7 PD=.4W TC=+.083%	28480	1902-3428
A16XU1	1200-0475	3	SOCKET-IC 10-CONT TO-5 DIP-SLDR	28480	1200-0475
A16XU2	1200-0475		SOCKET-IC 10-CONT TO-5 DIP-SLDR	28480	1200-0475
A16XU3	1200-0475		SOCKET-IC 10-CONT TO-5 DIP-SLDR	28480	1200-0475
A17	01741-66509	1	STORAGE BOARD ASSEMBLY	28480	01741-66509
A17A1	INA9-8005	1	IC: VERTICAL OUTPUT	28480	INA9-8005
A17C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C2*	0160-3567		CAPACITOR-FXD 10PF +-5% 100WVDC CER	28480	0160-3567
A17C3	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C5	0160-3650	1	CAPACITOR-FXD .018UF +-10% 50WVDC CER	28480	0160-3650
A17C6	0121-0491	1	CAPACITOR-V TRMR-CER 5/30PF 50V PC-MTG	72982	518-000-5-30A
A17C7	0160-3647	1	CAPACITOR-FXD 22PF +-5% 100WVDC CER	28480	0160-3647
A17C8	0160-3651	1	CAPACITOR-FXD 68PF +-10% 200WVDC CER	28480	0160-3651
A17C9	0160-3694	1	CAPACITOR-FXD 330PF +-10% 100WVDC CER	28480	0160-3694
A17C10	0160-3654	2	CAPACITOR-FXD 4700PF +-20% 50WVDC CER	28480	0160-3654
A17C11	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC CER	28480	0160-3665
A17C12	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C13	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C14	0160-3799		CAPACITOR-FXD 18PF +-10% 100WVDC CER	28480	0160-3799
A17C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C16	0160-3654		CAPACITOR-FXD 4700PF +-20% 50WVDC CER	28480	0160-3654
A17C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C18	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A17C19	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0160-3443
A17C20	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	1500606X0006B2
A17C21	0160-3447	3	CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3447
A17C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C23	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	1500606X0006B2
A17C24	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C25	0140-0178	2	CAPACITOR-FXD 560PF +-2% 300WVDC MICA	72136	DM15F561G0300WV1CR
A17C26	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C27	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C28	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C29	0140-0178		CAPACITOR-FXD 560PF +-2% 300WVDC MICA	72136	DM15F561G0300WV1CR
A17C30	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C31	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A17C32	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A17C33	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A17C34	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C35	0160-3447		CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3447
A17C37	0180-0374		CAPACITOR-FXD 10UF +-10% 20VDC TA	56289	150D106X9020B2
A17C38	0160-3447		CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3447
A17C39	0140-0192		CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A17C40	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C41	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C43	0160-0159	1	CAPACITOR-FXD 6800PF +-10% 200WVDC POLYE	56289	292P68292
A17C44	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C45	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	1500606X0006B2

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
A17C46	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C47	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902GB2
A17C48	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C50	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C52	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A17C53	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A17C54	0180-0155	1	CAPACITOR-FXD 2.7UF +-20% 20VDC TA	56289	150D225X0020A2
A17C55	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C56	0160-3448		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3448
A17C57	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C58	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A17C59	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C60	0180-0309	3	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A17C61	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A17C62	0180-0309		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A17C63	0180-0309		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A17C64	0180-0269		CAPACITOR-FXD 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A17C65	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A17C66	0170-0018	1	CAPACITOR-FXD 1UF +-5% 200WVDC POLYE	28480	0170-0018
A17C67	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C68	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A17C69	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A17C70	0160-3508		CAPACITOR-FXD 1UF +80-20% 50WVDC CER	28480	0160-3508
A17CR1	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A17CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR6	1910-0030		DIODE-SWITCHING 1US 15V 50MA	28480	1910-0030
A17CR7	1910-0030		DIODE-SWITCHING 1US 15V 50MA	28480	1910-0030
A17CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR14	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A17CR15	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A17CR16	1901-0028		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A17CR17	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A17CR18	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A17CR19	1901-0036		DIODE-HV RECT 1KV 600MA DO-29	28480	1901-0036
A17CR20	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR21	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A17CR22	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR24	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR25	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR26	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17J1	1200-0473	3	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0473
A17L1	9100-2598	2	COIL-MLD 75NH 10% Q=35 .095DX.25LG	28480	9100-2598
A17L2	9100-2261	2	COIL-FXD MOLDED RF CHOKE 2.7UH 10%	99800	1025-30
A17L3	9100-2261		COIL-FXD MOLDED RF CHOKE 2.7UH 10%	99800	1025-30
A17L4	9100-2598		COIL-MLD 75NH 10% Q=35 .095DX.25LG	28480	9100-2598
A17L5	9100-2250	2	COIL-FXD MOLDED RF CHOKE .18UH 10%	24226	10/180
A17L6	9100-2250		COIL-FXD MOLDED RF CHOKE .18UH 10%	24226	10/180
A17L7	9100-2251	2	COIL-FXD MOLDED RF CHOKE .22UH 10%	24226	10/220
A17L8	9100-2251		COIL-FXD MOLDED RF CHOKE .22UH 10%	24226	10/220
A17L9	9170-0029	1	CORE-SHIELDING BEAD	28480	9170-0029
A17L10	9100-3332	2	INDUCTOR	06560	70208-1J
A17L11	9100-3332	2	INDUCTOR	06560	70208-1J
A17P1	1251-3638		CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A17P2	1251-4322	1	CONNECTOR 3-PIN M POST TYPE	27264	22-03-1031
A17Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q4	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q5	1853-0336		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
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	1854-0575		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A17Q9	1854-0254	1	TRANSISTOR NPN SI TO-5 PD=800MW	28480	1854-0254
A17Q10	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q11	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q12	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q13	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q14	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q15	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036

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
A17Q16	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q17	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A17Q18	1853-0354		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A17Q20	1853-0336		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A17Q21	1854-0575		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A17Q22	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q23	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q24	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q25	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q26	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17Q27	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q28	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A17R1	0698-4399	2	RESISTOR 88.7 1% .125W F TC=0+-100	24546	C4-1/8-T0-88R7-F
A17R2	0757-0734	2	RESISTOR 1.21K 1% .25W F TC=0+-100	19701	MF52C-1
A17R3	0698-3404	1	RESISTOR 383 1% .5W F TC=0+-100	91637	MFF-1/2-10
A17R4	0757-0734		RESISTOR 1.21K 1% .25W F TC=0+-100	19701	MF52C-1
A17R5	0698-4399		RESISTOR 88.7 1% .125W F TC=0+-100	24546	C4-1/8-T0-88R7-F
A17R6	0698-7028	1	RESISTOR 27 10% .125W CC TC=-270/+540	01121	BB2701
A17R7	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A17R8	0698-5074	2	RESISTOR 5.62K 1% .125W F TC=0+-25	24546	NE55
A17R9	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A17R10	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A17R11	0698-5074		RESISTOR 5.62K 1% .125W F TC=0+-25	24546	NE55
A17R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R13	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A17R14	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A17R15	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A17R16	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17R17	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A17R18	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A17R19	2100-1986	2	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	62-206-1
A17R20	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A17R21	2100-2497	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN	73138	62-207-1
A17R22	2100-1986		RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	62-206-1
A17R23	0698-7248	1	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-G
A17R24	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A17R25			NOT ASSIGNED		
A17R26	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A17R27	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A17R28	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A17R29	0757-0806	1	RESISTOR 243 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-243R-F
A17R30			NOT ASSIGNED		
A17R31	0683-0475		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A17R32	0684-2231		RESISTOR 22K 10% .25W FC TC=-400/+800	01121	CB2231
A17R33	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R34	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R35	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R36	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R37	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R38	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R39	0684-2231		RESISTOR 22K 10% .25W FC TC=-400/+800	01121	CB2231
A17R40	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R41	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R42	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A17R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R44	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R45	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R46	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R47	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R48	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R49	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R50	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A17R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R52	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R53	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R54	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R55	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R56	0684-1521		RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A17R57	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A17R58	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R59	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R60	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R61	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R62	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R63	0684-3921		RESISTOR 3.9K 10% .25W FC TC=-400/+700	01121	CB3921
A17R64	0684-3921		RESISTOR 3.9K 10% .25W FC TC=-400/+700	01121	CB3921
A17R65	0757-0482	1	RESISTOR 511K 1% .125W F TC=0+-100	91637	MFF-1/8, T-1

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
A17R67	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R68	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R69	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R70	0684-3321		RESISTOR 3.3K 10% .25W FC TC=-400/+700	01121	CB3321
A17R71	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A17R72	0684-3911	2	RESISTOR 390 10% .25W FC TC=-400/+600	01121	CB3911
A17R73	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A17R74	0684-3921		RESISTOR 3.9K 10% .25W FC TC=-400/+700	01121	CB3921
A17R75	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A17R76	0757-0459		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003F
A17R78	0683-2265		RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A17R79	0757-0413		RESISTOR 392 1% .125W F TUBULAR	24546	C4-1/8-TO-392H
A17R80	0684-8221	1	RESISTOR 8.2K 10% .25W FC TC=-400/+700	01121	CB8221
A17R81	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R82	0757-0454	1	RESISTOR 33.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3322-F
A17R83	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R84	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R85	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R86	0757-0450	1	RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2212-F
A17R87	0684-1521		RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A17R88	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R89	0684-5621	2	RESISTOR 5.6K 10% .25W FC TC=-400/+700	01121	CB5621
A17R90	0684-6831		RESISTOR 68K 10% .25W FC TC=-400/+800	01121	CB6831
A17R91	0684-3931		RESISTOR 39K 10% .25W FC TC=-400/+800	01121	CB3931
A17R92	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R93	0684-2231		RESISTOR 22K 10% .25W FC TC=-400/+800	01121	CB2231
A17R94	0684-1231		RESISTOR 12K 10% .25W FC TC=-400/+800	01121	CB1231
A17R95	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R96	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R97	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R100	0684-1221		RESISTOR 1.2K 10% .25W FC TC=-400/+600	01121	CB1221
A17R101	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R102	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A17R103	2100-0558		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	72-109-0
A17R104	0757-0760	1	RESISTOR 20K 1% .25W F TC=0+-100	19701	MF52C-1
A17R105	2100-0558		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	72-109-0
A17R106	0684-5631		RESISTOR 56K 10% .25W FC TC=-400/+800	01121	CB5631
A17R107	0811-1788	1	RESISTOR 15 5% 2W PW TC=0+-400	75042	BWH2-15R-J
A17R110	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R111	0757-0950	1	RESISTOR 12K 2% .125W F TC=0+-100	24546	C4-1/8-TO-1202-G
A17R112	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A17R113	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A17R114	0684-1521		RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A17R115	2100-3210		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	72-108-0
A17R116	0684-4731		RESISTOR 47K 10% .25W FC TC=-400/+800	01121	CB4731
A17R117	0684-4731		RESISTOR 47K 10% .25W FC TC=-400/+800	01121	CB4731
A17R118	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A17R119	0698-3243	1	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1783-F
A17R120	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R121	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R122	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A17R123	0684-8231	1	RESISTOR 82K 10% .25W FC TC=-400/+800	01121	CB8231
A17R124	0684-5621		RESISTOR 5.6K 10% .25W FC TC=-400/+700	01121	CB5621
A17R125	0684-6831		RESISTOR 68K 10% .25W FC TC=-400/+800	01121	CB6831
A17R126	0684-4721		RESISTOR 4.7K 10% .25W FC TC=-400/+700	01121	CB4721
A17R127	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A17R128	0684-1521		RESISTOR 1.5K 10% .25W FC TC=-400/+700	01121	CB1521
A17R129	0684-8211		RESISTOR 820 10% .25W FC TC=-400/+600	01121	CB8211
A17R130	0684-1031		RESISTOR 10K 10% .25W FC TL=-400/+700	01121	CB1031
A17R131	0757-0278		RESISTOR 1780 1% .125W F TUBULAR	24546	C4-1/8-T0-1781-F
A17R132	0757-0433		RESISTOR 3320 1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A17R133	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A17R134	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A17S1	3101-1241	1	SWITCH-PB 4PDT ALTNG .45A 115VAC	71590	PB1
A17U1	1826-0205	1	IC NE 556 TIMER	18324	NE556A
A17U2	1820-1116	1	IC-DIGITAL SN74109N TTL DUAL J-K BAR	01295	SN74109N
A17U3	1820-0269	6	IC-DIGITAL SN7403N TTL QUAD 1 NAND	01295	SN7403N
A17U4	1820-0511	2	IC-DIGITAL SN7408N TTL QUAD 2 AND	01295	SN7408N
A17U5	1820-0077	1	IC-DIGITAL SN7474N TTL DUAL D-TYPE	01295	SN7474N
A17U7	1820-0269		IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A17U8	1820-0269		IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A17U9	1820-0511		IC-DIGITAL SN7408N TTL QUAD 2 AND	01295	SN7408N
A17U10	1820-0054	2	IC-DIGITAL SN7400N TTL QUAD 2 NAND	01295	SN7400N

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17U11	1820-0579	1	IC-DIGITAL SN74123N TTL DUAL	01295	SN74123N
A17U12	1820-0269		IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A17VR1	1902-3070		DIODE: ZNR 4.22V DO-7 PD=.4W	04713	SZ 10939-74
A17VR2	1902-0243	.2	DIODE-ZNR 30.1V 5% DO-7 PD=.4W TC=+.075%	04713	SZ 10939-320
A17VR3	1902-0243		DIODE-ZNR 30.1V 5% DO-7 PD=.4W TC=+.075%	04713	SZ 10939-320
A17VR4	1902-3070	1	DIODE-ZNR 4.22V 5% DO-7 PD=.4W TC=-.038%	15818	CD 35598
A17VR5	1902-3193	1	DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	04713	SZ 10939-218
A17XA3	1251-0589		CONNECTOR 10-PIN F POST TYPE	27264	09-52-3101
A17XA16	1251-3903	1	CONNECTOR 6-PIN F POST TYPE	27264	09-52-3061
A17XU1	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU2	1200-0473		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0473
A17XU3	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU4	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU5	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU6	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU7	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU9	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU10	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A17XU11	1200-0473		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0473
A17XU12	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A18	01741-66512	1	STORAGE CONTROL ASSEMBLY	28480	01741-66512
A18DS1	1990-0487	5	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0487
A18DS2	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0487
A18DS3	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0487
A18DS4	1990-0487		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0487
A18DS5	1990-0485		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0485
A18DS6	1990-0486	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0486
A18J1	1200-0438		SOCKET-IC 16-CONT DIP-SLDR-TERMS	00779	583529-1
A18R1	0684-1041		RESISTOR 100K 10% .25W FC TC=-400/+800	01121	CB1041
A18R2	0757-0441	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A18R3	2100-0558		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	72-109-0
A18R4	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A18R5	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A18R6	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A18R7	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A18R8	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A18R9	0684-2711		RESISTOR 270 10% .25W FC TC=-400/+600	01121	CB2711
A18R10	0684-3911		RESISTOR 390 10% .25W FC TC=-400/+600	01121	CB3911
A18R11	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A18R12	0684-2221		RESISTOR 2.2K 10% .25W FC TC=-400/+700	01121	CB2221
A18R13	0684-1021		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
A18R14	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A18S1	3101-1374	2	SWITCH-PB DPDT MOM .45A 115VAC	28480	3101-1374
A18S2	3101-1374		SWITCH-PB DPDT MOM .45A 115VAC	28480	3101-1374
A18S3	3101-1400	1	SWITCH-PB DPDT ALTNG .45A 115VAC	28480	3101-1400
A18S4	3101-1628	1	SWITCH-PB SPDT MOM 1A 115VAC	09353	P8121K WITH A7089-5 CAP.
A18U1	1820-0054		IC-DIGITAL SN7400N TTL QUAD 2 NAND	01295	SN7400N
A18U2	1820-0269		IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A18U3	1820-0269		IC-DIGITAL SN7403N TTL QUAD 2 NAND	01295	SN7403N
A18XU1	1200-0474		SOCKET-IC 14-CONT DIP-SLDR-TERMS	28480	1200-0474
A18XU2	1200-0474		SOCKET-IC 14-CONT DIP-SLDR-TERMS	28480	1200-0474
A18XU3	1200-0474		SOCKET-IC 14-CONT DIP-SLDR-TERMS	28480	1200-0474

See introduction to this section for ordering information

Table 6-3. List of Manufacturers' Codes

Mfr Code	Manufacturer Name	Address	Zip Code
00000	U.S.A. COMMON	ANY SUPPLIER OF USA	
00779	AMP INC	HARRISBURG PA	17105
0086S	STETTNER-TRUSH INC	CAZENOVIA NY	13035
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02111	SPECTROL ELECTRONICS CORP	CITY OF INDUSTRY CA	91745
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03888	KDI PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
04931	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
06540	AMATOM ELEK HARDWARE DIV OF MITE	NEW ROCHELLE NY	10802
06560	AIRCO SPEER ELEK DIV AIR RDCN CO	NOGALES AZ	85621
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
07716	TRW INC BURLINGTON DIV	BURLINGTON IA	52601
09353	C AND K COMPONENTS INC	WATERTOWN MA	02172
11502	TRW INC BOONE DIV	BOONE NC	28607
13103	THERMALLOY CO	DALLAS TX	75247
13603	SPYRAFLO INC	MIAMI FL	33169
14298	AMERICAN COMPONENTS INC SUB INSILCO	CONSHOHOCKEN PA	19428
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW CA	94040
17856	SILICONIX INC	SANTA CLARA CA	95050
18324	SIGNETICS CORP	SUNNYVALE CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
26742	METHODE ELECTRONICS INC	CHICAGO IL	60656
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
27264	MOLEX PRODUCTS CO	DOWNERS GROVE IL	60515
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
6F364	CENTRE ENGINEERING INC	STATE COLLEGE PA	16801
71002	BIRNBACK CO INC	FREEPORT LI NY	11520
71590	CENTRALAB ELEK DIV GLOBE-UNION INC	MILWAUKEE WI	53201
71616	COMMERCIAL PLASTICS CO	MUNDELEIN IL	60060
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE PA	16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634
73743	FISCHER SPECIAL MFG CO	CINCINNATI OH	45206
74276	SIGNALITE INC	NEPTUNE NJ	07753
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA PA	19108
75915	LITTLEFUSE INC	DES PLAINES IL	60016
76210	MARWEDEL C W	SAN FRANCISCO CA	94103
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60126
9D949	AMPHENOL SALES DIV OF BUNKER-RAMO	HAZELWOOD MO	63042
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
95121	QUALITY COMPONENTS INC	ST MARYS PA	15857
99800	AMER PRCN IND INC DELEVAN DIV	AURORA NY	14052

See introduction to this section for ordering information

SECTION VII

MANUAL CHANGES

7-1. INTRODUCTION.

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

7-3. MANUAL CHANGES.

7-4. To adapt this manual to your instrument, refer to table 7-1 and make all manual changes listed for your instrument serial prefix number. Perform these changes in the sequence listed. If your instrument serial prefix number is not listed on the title page or in table 7-1, it may be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Prefix Number

Serial Prefix Number	Make Manual Changes
1608A	6, 5, 4, 3, 2, 1
1624A	6, 5, 4, 3, 2
1701A	6, 5, 4, 3
1704A	6, 5, 4
1739A	6, 5
1749A	6

7-5. MANUAL CHANGE INSTRUCTIONS.

CHANGE 1

Table 6-2,

A16: Change HP Part No. and Mfr Part No. to 01741-66501.

Delete: F1, H41, and XF1.

MP44: Change HP Part No. and Mfr Part No. to 01741-00204.

MP56: Change HP Part No. and Mfr Part No. to 01741-04103.

MP58: Change HP Part No. and Mfr Part No. to 01741-04106.

MP60: Change HP Part No. and Mfr Part No. to 01741-20503.

Add: MP88, HP Part No. 01740-04107; COVER-LINE VOLT; Mfr Code 28480, Mfr Part No. 01740-04107.

Add: R3, HP Part No. 2100-0651; RESISTOR-VAR 250 K .5W; Mfr Code 01121, Mfr Part No. Type W.

A16CR5, A16CR7: Change to HP Part No. 1906-0023; DIODE-MULT FULLWAVE BRIDGE RECTIFIER; Mfr Code 04713, Mfr Part No. MDA922-4.

A17R56: Change to HP Part No. 0684-3321; RESISTOR 3.3 K 10% .25W CC TUBULAR; Mfr Code 01121, Mfr Part No. CB3321.

Figure 7-8, (schematic 16):

Make changes shown in figure 7-1.

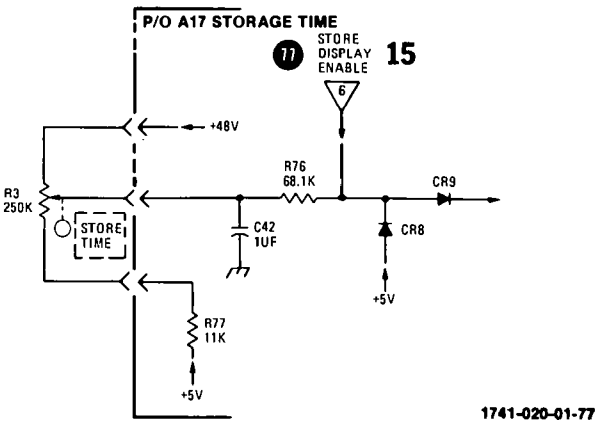


Figure 7-1. Backdating Information - Schematic 16

CHANGE 2

A15R15: Change to HP Part No. 0698-5353, RESISTOR 8.25M 5% 1W CF TC=0-2000; Mfr Code 07716, Mfr Part No. CCR-7.

A15R16: Change to HP Part No. 0698-8658, RESISTOR 24M 5% 1W CF TC=0-5000; Mfr Code 14298, Mfr Part No. HVX-1/2.

CHANGE 3

Table 6-2,

MP43: Change HP Part No. and Mfr Part No. to 01741-00202.

MP44: Change HP Part No. and Mfr Part No. to 01741-00205.

Add: MP49, HP Part No. 01740-09101, SPRING-SWITCH GROUND; Mfr Code 28480, Mfr Part No. 01740-09101.

MP54: Change HP Part No. and Mfr Part No. to 01741-04101.

MP60: Change HP Part No. and Mfr Part No. to 01741-20505.

Add: R4, HP Part No. 2100-0651, RESISTOR-VAR 250K 20% LIN (VIEW TIME); Mfr Code 01121, Mfr Part No. TYPE W.

A12: Change HP Part No. and Mfr Part No. to 01741-66504.

Delete: A12Q10, A12R38, and A12VR4.

A12R22: Change to HP Part No. 0757-0486, RESISTOR 750K 1% .125W F TC=0+-100; Mfr Code 24546, Mfr Part No. NA4.

A15: Change HP Part No. and Mfr Part No. to 01741-66505.

Delete: A15C18, A15C19, A15CR10, A15DS4, A15DS5, A15Q4, A15Q5, A15R42 thru A15R49, A15U2, A15VR3 thru A15VR5.

CHANGE 3 (Cont'd)

Table 6-2 (Cont'd),

A15R31: Change to HP Part No. 0757-0453, RESISTOR 30.1K 1% .125W F; Mfr Code 24546, Mfr Part No. C4-1/8-T0-3012-F.

A17: Change HP Part No. and Mfr Part No. to 01741-66502.

Add: A17C36, HP Part No. 0180-0230, CAPACITOR-FXD 1UF +-20% 50VDC TA; Mfr Code 56289, Mfr Part No. 150D105X0050A2.

A17C37: Change to HP Part No. 0180-0106, CAPACITOR-FXD 60UF +-20% 6VDC TA; Mfr Code 56289, Mfr Part No. 150D606X0006B2.

Add: A17C42, HP Part No. 0180-0230, CAPACITOR-FXD 1UF +-20% 50VDC TA; Mfr Code 56289, Mfr Part No. 150D105X0050A2.

Add: A17C49, HP Part No. 0160-0159, CAPACITOR-FXD 6800PF +-10% 200WVDC POLY; Mfr Code 56289, Mfr Part No. 292P68292.

Delete: A17C50.

Delete: A17CR6, A17CR7, and A17CR26.

Add: A17Q19, HP Part No. 1854-0215, TRANSISTOR NPN SI PD=350MW FT=300MHZ; Mfr Code 04713, Mfr Part No. SPS3611.

A17R65: Change to HP Part No. 0757-0464, RESISTOR 90.9K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-9092-F.

Add: A17R66, HP Part No. 0757-0443, RESISTOR 11K 1% .125W F; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1102-F.

A17R76: Change to HP Part No. 0757-0461, RESISTOR 68.1K 1% .125W F; Mfr Code 24546, Mfr Part No. C4-1/8-T0-6812-F.

Add: A17R77, HP Part No. 0757-0443, RESISTOR 11K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1102-F.

A17R79: Change to HP Part No. 0757-0317, RESISTOR 1.33K 1% .125W F; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1331-F.

A17R82: Change to HP Part No. 0757-0199, RESISTOR 21.5K 1% .125W F; Mfr Code 24546, Mfr Part No. C4-1/8-T0-2152-F.

Add: A17R98, HP Part No. 0757-0443, RESISTOR 11K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1102-F.

Add: A17R99, HP Part No. 0684-2221, RESISTOR 2.2K 10% .25W FC; Mfr Code 01121, Mfr Part No. CB2221.

A17R100: Change to HP Part No. 0684-1021, RESISTOR 1K 10% .25W FC; Mfr Code 01121, Mfr Part No. CB1021.

Add: A17R108, HP Part No. 0684-2221, RESISTOR 2.2K 10% .25W FC; Mfr Code 01121, Mfr Part No. CB2221.

Add: A17R109, HP Part No. 0684-5621, RESISTOR 5.6K 10% .25W FC; Mfr Code 01121, Mfr Part No. CB5621.

Delete: A17R130, A17R131, A17R132, A17R133, A17R138.

Add: A17U6, HP Part No. 1820-0913, IC-DIGITAL SN74L122N TTL MONOSTBL; Mfr Code 01295, Mfr Part No. SN74L122N.

A18: Change HP Part No. and Mfr Part No. to 01741-66503.

CHANGE 4

Table 6-2

A14: Change HP Part No. and Mfr Part No. to 01740-66504.

A14XA16: Change to HP Part No. 1251-3852, CONNECTOR 15 PIN F POST TYPE, Mfr Code 27264, Mfr Part No. 09-52-3153.

A16: Change HP Part No. and Mfr Part No. to 01741-66508.

A16P2: Change to HP Part No. 1251-3401, CONNECTOR 15 PIN M POST TYPE, Mfr Code 27264, Mfr Part No. 09-66-1151.

CHANGE 5

Table 6-2

MP72: Change HP Part No. and Mfr Part No. to 7120-5139.

V1: Change HP Part No. and Mfr Part No. to 5083-5052.

W5: Change HP Part No. and Mfr Part No. to 01741-61601.

CHANGE 6

Table 6-2

A16: Change HP Part No. and Mfr Part No. to 01741-66514.

A16CR5: Change HP Part No. and Mfr Part No. to 1901-0638.

A16CR6: Change HP Part No. and Mfr Part No. to 1906-0006.

A16CR7: Change HP Part No. and Mfr Part No. to 1901-0638.

Delete: A16Q12

A16R19: Change to HP Part No. 0764-0003; RESISTOR 3.3K 5% 2W MO TC = 0+-200; Mfr Code 11502, Mfr Part No. CB4721

Delete: A16R41

A16VR4: Change to HP Part No. 1902-0175; DIODE - ZNR 100 V 5% DO-7 PD = 1W TC = +.083%; Mfr Code 04713, Mfr Part No. SZ-11213-428

Figure 8-16

Replace A16 component identification drawing with figure 7-9.

Replace Schematic 1 with Figure 7-10.

Figure 8-17,

Replace A15 component identification drawing with figure 7-2.

Replace Schematic 2 with figure 7-3.

Figure 8-18,

Replace A12 component identification drawing with figure 7-4.

Change Schematic 3 circuitry to that shown in figure 7-5.

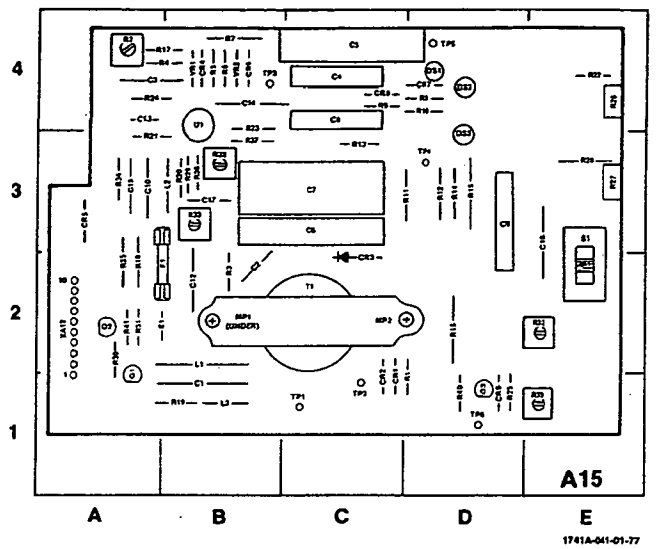
Figure 8-30,

Replace A17 component identification drawing with figure 7-6.

Replace Schematic 15 with figure 7-7.

Figure 8-31,

Replace Schematic 16 with figure 7-8.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-1	CR7	D-4	R8	D-4	R31	A-2
C2	B-2	CR8	C-4	R9	C-4	R32	E-2
C3	A-4	CR9	D-1	R10	D-4	R33	B-3
C4	C-4	DS1	D-4	R11	C-3	R34	A-3
C5	C-4	DS2	D-4	R12	D-3	R35	A-2
C6	C-3	DS3	D-4	R13	C-3	R36	B-3
C7	C-3	E1	A-2	R14	D-3	R37	B-3
C8	C-4	F1	A-2	R15	D-3	R38	B-3
C9	D-3	L1	B-2	R16	D-2	R39	E-1
C10	A-3	L2	B-3	R17	A-4	R40	D-1
C12	B-2	L3	B-1	R18	A-2	R41	A-2
C13	A-4	MP1	B-2	R19	B-1	S1	E-3
C14	B-4	MP2	C-2	R20	B-3	T1	C-2
C15	A-3	Q1	A-2	R21	A-3	TP1	C-1
C16	E-3	Q2	A-2	R22	E-4	TP2	C-1
C17	B-3	Q3	D-1	R23	B-4	TP3	B-4
CR1	C-1	R1	D-1	R24	A-4	TP4	D-3
CR2	C-1	R2	A-4	R25	D-1	TP5	D-4
CR3	C-2	R3	B-2	R26	E-4	TP6	D-1
CR4	B-4	R4	A-4	R27	E-3	U1	B-4
CR5	A-3	R5	B-4	R28	E-3	VR1	B-4
CR6	B-4	R6	B-4	R29	B-3	VR2	B-4
		R7	B-4	R30	A-2	XA12	A-2

Figure 7-2. A15 Component Identification Replacement

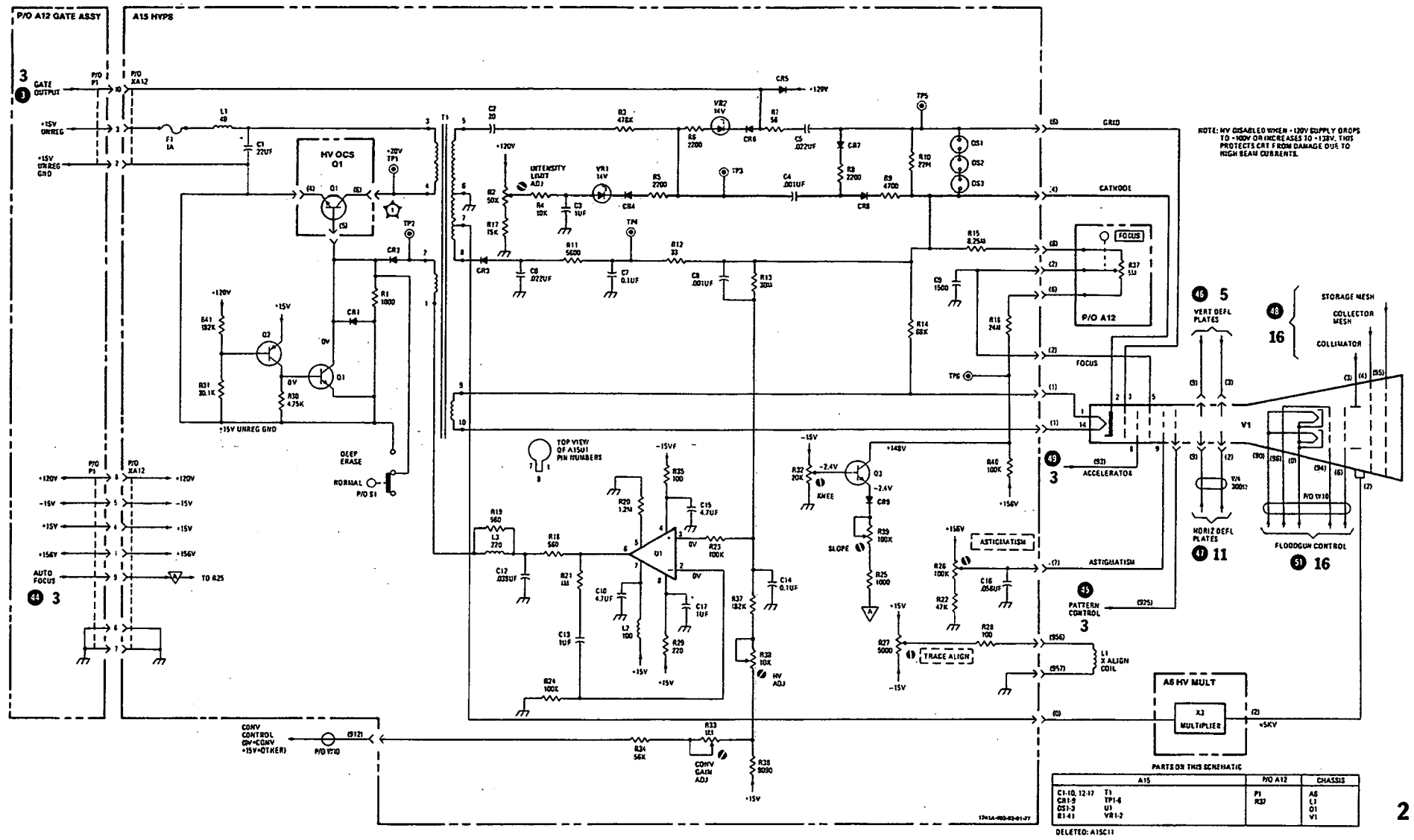
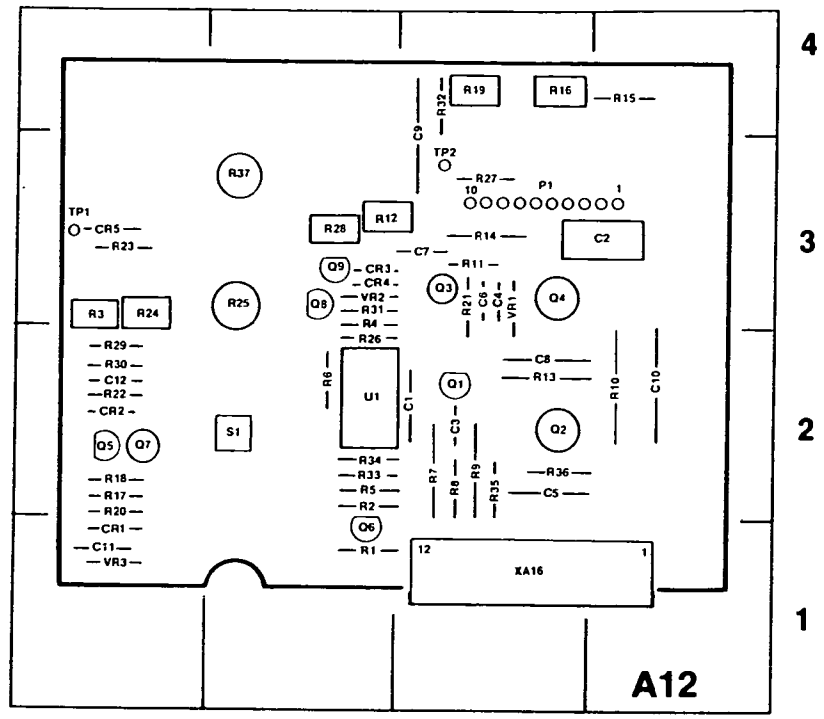


Figure 7-3. Backdating Information—Schematic 2



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	Q2	B-2	R11	B-3	R28	C-3
C2	A-3	Q3	B-3	R12	C-3	R29	D-2
C3	B-2	Q4	B-3	R13	B-2	R30	D-2
C4	B-3	Q5	D-2	R14	B-3	R31	C-3
C5	B-2	Q6	C-1	R15	A-4	R32	B-4
C6	B-3	Q7	D-2	R16	B-4	R33	C-2
C7	B-3	Q8	C-3	R17	C-3	R34	C-2
C8	B-2	Q9	C-3	R18	D-2	R35	B-2
C9	B-3	R1	C-1	R19	B-4	R36	B-2
C10	A-2	R2	C-2	R20	D-2	R37	C-3
C11	D-1	R3	D-3	R21	B-3	S1	C-2
CR1	D-1	R4	C-3	R22	D-2	TP1	D-3
CR2	D-2	R5	C-2	R23	D-3	TP2	B-3
CR3	C-3	R6	C-2	R24	D-3	U1	C-2
CR4	C-3	R7	B-2	R25	C-3	VR1	B-3
CR5	D-3	R8	B-2	R26	C-2	VR2	C-3
P1	B-3	R9	B-2	R27	B-3	XA16	B-1
Q1	B-2	R10	A-2				

Figure 7-4. A12 Component Identification Replacement

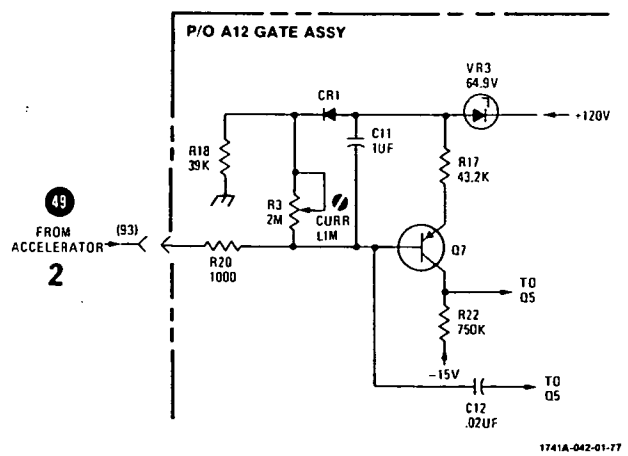
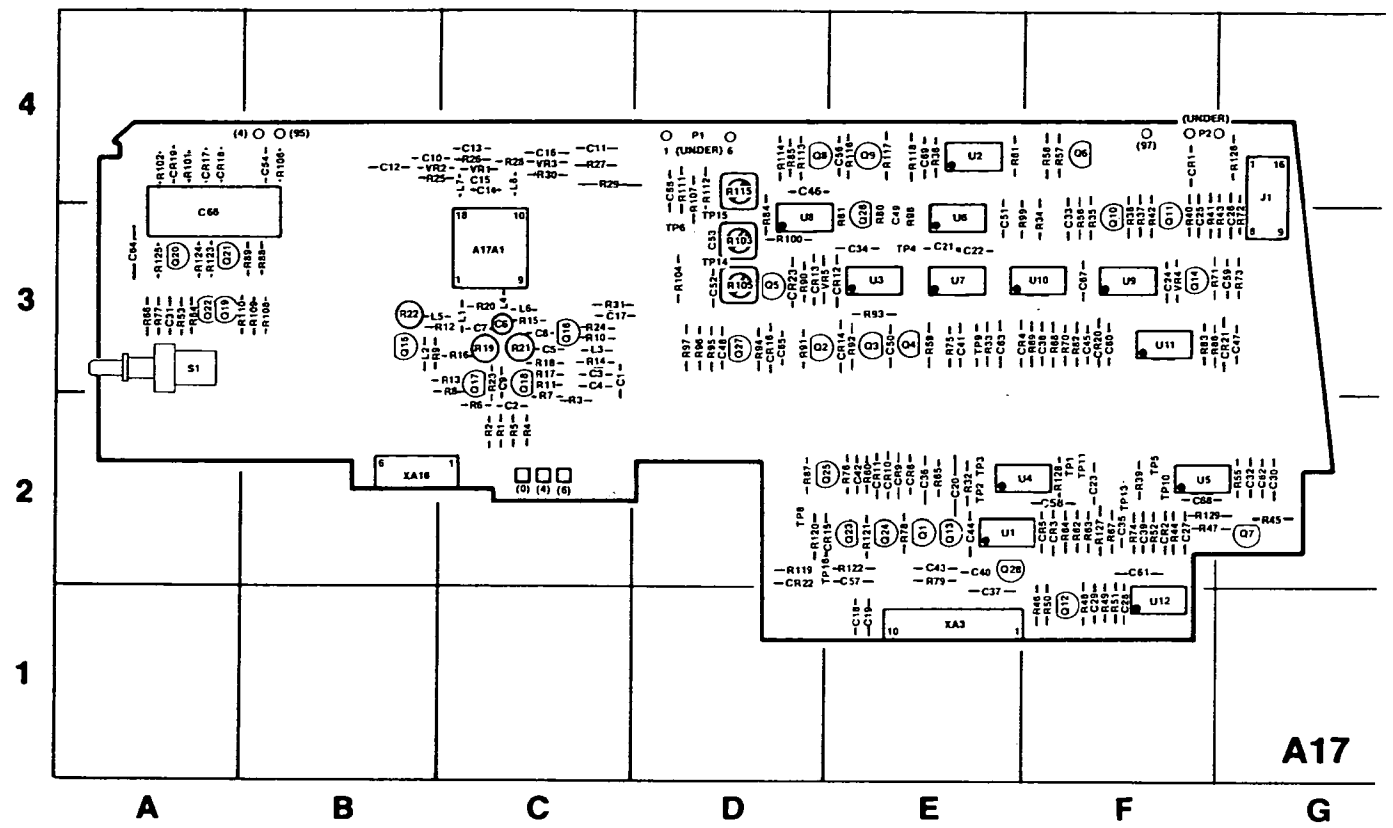


Figure 7-5. Backdating Information—Schematic 3



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	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A17A1	C-3	C29	F-1	C58	F-2	CR20	F-3	Q15	B-3	R16	C-3	R45	G-2	R74	F-2	R103	D-3	TP2	E-2
C1	C-3	C30	G-2	C59	G-3	CR21	G-3	Q16	C-3	R17	C-3	R46	F-1	R75	E-3	R104	D-3	TP3	E-2
C2	C-2	C31	A-1	C60	F-3	CR22	D-2	Q17	C-3	R18	C-3	R47	F-2	R76	E-2	R105	D-3	TP4	E-3
C3	C-3	C32	G-2	C61	F-2	CR23	D-3	Q18	C-3	R19	C-3	R48	F-1	R77	A-3	R106	B-4	TP5	F-2
C4	C-3	C33	F-3	C62	G-2	J1	G-4	Q19	A-3	R20	C-3	R49	F-1	R78	E-2	R107	D-4	TP6	D-3
C5	C-3	C34	E-4	C63	E-3	L1	C-3	Q20	A-3	R21	C-3	R50	F-1	R79	E-2	R108	D-3	TP8	D-2
C6	C-3	C35	F-2	C64	A-3	L2	B-3	Q21	A-3	R22	B-3	R51	F-1	R80	E-3	R109	B-3	TP9	E-3
C7	C-3	C36	E-2	C65	D-3	L3	C-3	Q22	A-3	R23	C-3	R52	F-2	R81	E-3	R110	A-3	TP10	F-2
C8	C-3	C37	E-1	C66	A-3	L4	C-3	Q23	E-2	R24	C-3	R53	A-3	R82	F-3	R111	D-4	TP11	F-2
C9	C-3	C38	F-3	C67	F-3	L5	B-3	Q24	E-2	R25	B-4	R54	A-3	R83	F-3	R112	D-4	TP13	F-2
C10	B-4	C39	F-2	C68	F-2	L6	C-3	Q25	E-2	R26	C-4	R55	G-2	R84	D-3	R113	D-4	TP14	D-3
C11	C-4	C40	E-2	C69	E-4	L7	C-4	Q26	E-3	R27	C-4	R56	F-3	R85	D-4	R114	D-4	TP15	D-3
C12	B-4	C41	E-3	CR1	F-4	L8	C-4	Q27	D-3	R28	C-4	R57	F-4	R86	F-3	R115	D-4	TP16	D-2
C13	C-4	C42	E-2	CR2	F-2	P1	D-4	Q28	E-2	R29	C-4	R58	F-4	R87	D-2	R116	E-4	U1	E-2
C14	C-4	C43	E-2	CR3	F-2	P2	F-4	R1	C-2	R30	C-4	R59	E-3	R88	B-3	R117	E-4	U2	E-4
C15	C-4	C44	E-2	CR4	E-3	Q1	E-2	R2	C-2	R31	C-3	R60	E-2	R89	B-3	R118	E-4	U3	E-3
C16	C-4	C45	F-3	CR5	F-2	Q2	D-3	R3	C-2	R32	E-2	R61	E-4	R90	D-3	R119	D-2	U4	F-2
C17	C-3	C46	D-4	CR8	E-2	Q3	E-3	R4	C-2	R33	E-3	R62	F-2	R91	D-3	R120	D-2	U5	F-2
C18	E-1	C47	G-3	CR9	E-2	Q4	E-3	R5	C-2	R34	F-3	R63	F-2	R92	E-3	R121	E-2	U6	E-3
C19	E-1	C48	D-3	CR10	E-2	Q5	D-3	R6	C-2	R35	F-3	R64	F-2	R93	E-3	R122	E-2	U7	E-3
C20	E-2	C49	E-3	CR11	E-2	Q6	F-4	R7	C-2	R36	E-4	R65	E-2	R94	D-3	R123	A-3	U8	D-3
C21	E-3	C50	E-3	CR12	E-3	Q7	G-2	R8	C-3	R37	F-3	R66	A-3	R95	D-3	R124	A-3	U9	F-3
C22	E-3	C51	E-3	CR13	D-3	Q8	D-4	R9	B-3	R38	F-3	R67	F-2	R96	D-3	R125	A-3	U10	F-3
C23	F-2	C52	D-3	CR14	E-3	Q9	E-4	R10	C-3	R39	F-2	R68	F-3	R97	D-3	R126	G-4	U11	F-3
C24	F-3	C53	D-3	CR15	E-2	Q10	F-3	R11	C-3	R40	F-3	R69	F-3	R98	E-3	R127	F-2	U12	F-1
C25	F-3	C54	B-4	CR16	D-3	Q11	F-3	R12	C-3	R41	F-3	R70	F-3	R99	E-3	R128	F-2	VR1	C-4
C26	G-3	C55	D-4	CR17	A-4	Q12	F-1	R13	C-3	R42	F-3	R71	F-3	R100	D-3	R129	F-2	VR2	B-4
C27	F-2	C56	E-4	CR18	A-4	Q13	E-2	R14	C-3	R43	F-3	R72	G-3	R101	A-4	S1	A-3	VR3	C-4
C28	F-1	C57	E-2	CR19	A-4	Q14	F-3	R15	C-3	R44	F-2	R73	G-3	R102	A-4	TP1	F-2	VR4	F-3
																		VR5	D-3
																		XA3	E-1
																		XA16	B-2

Figure 7-6. A17 Component Identification Replacement

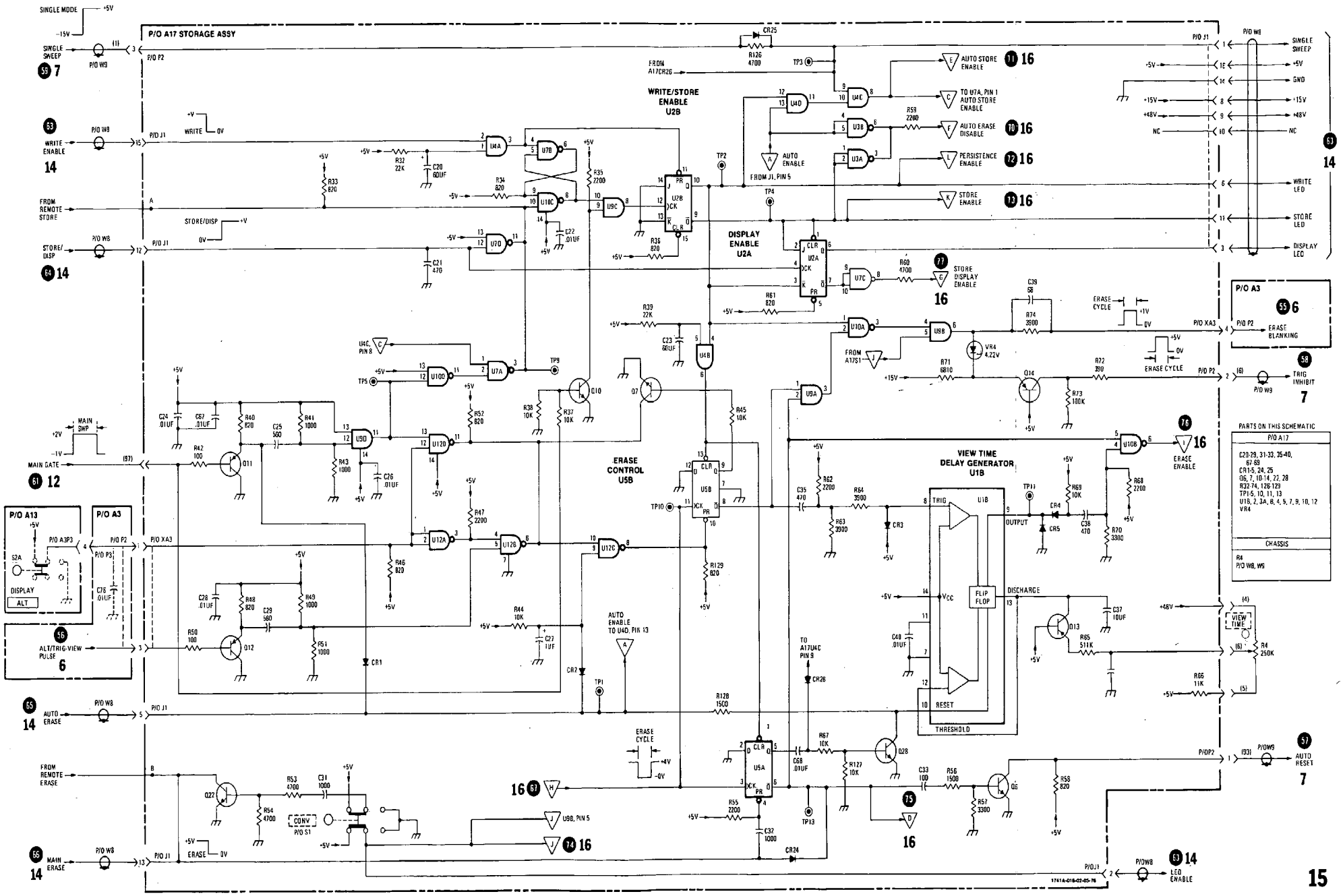


Figure 7-7.
Schematic 15 Replacement

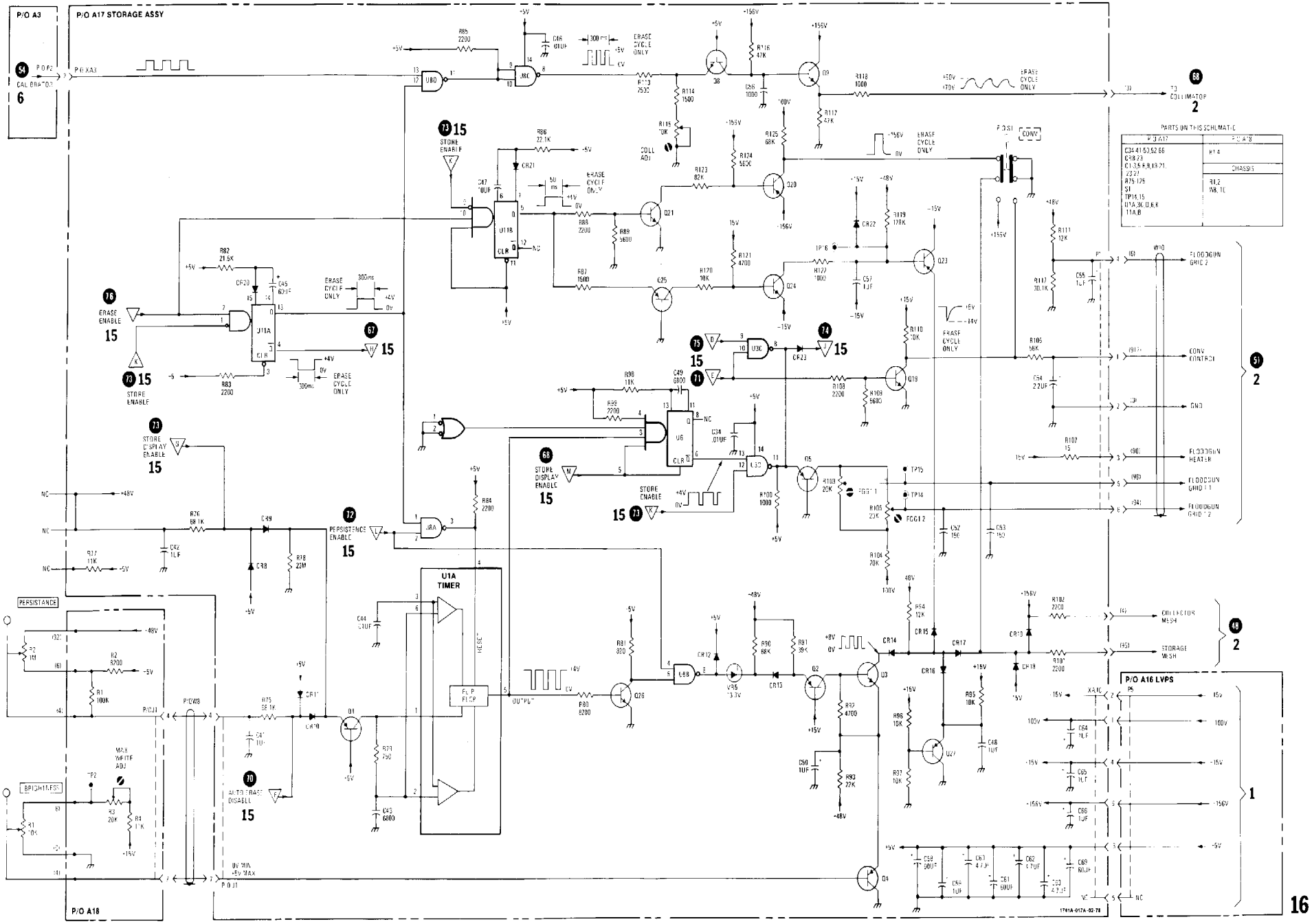
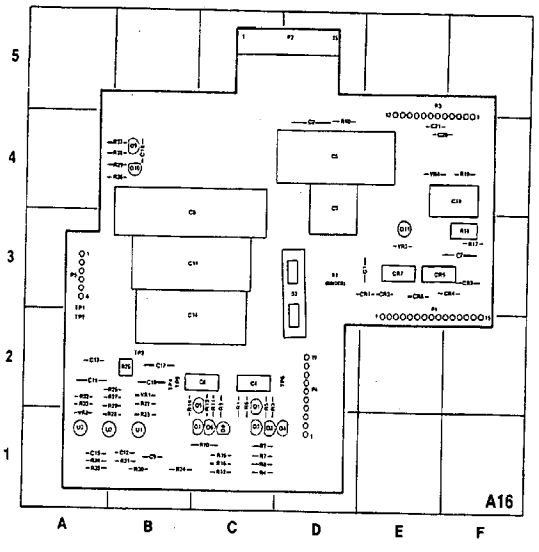


Figure 7-8. Schematic 16 Replacement



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-3	C17	B-3	P4	D-2	R4	C-1	R22	B-2	R39	B-4
C2	D-4	C18	B-4	P5	A-3	R5	C-2	R23	B-1	R40	D-4
C3	D-4	C19	F-4	Q1	C-2	R6	C-2	R24	B-1	S1	D-3
C4	C-2	C20	E-4	Q2	C-1	R7	C-1	R25	B-2	S2	D-3
C5	D-4	C21	E-4	Q3	C-1	R8	C-1	R26	B-2	TP1	A-2
C6	C-2	CR1	E-3	Q4	D-1	R9	C-2	R27	B-2	TP2	A-2
C7	F-3	CR2	E-3	Q5	C-2	R10	C-1	R28	B-1	TP3	B-2
C8	B-3	CR3	F-3	Q6	C-1	R11	C-2	R29	B-2	TP4	B-2
C9	B-1	CR4	F-3	Q7	C-1	R12	C-1	R30	B-1	TP5	B-2
C10	B-2	CR5	E-3	Q8	C-1	R13	C-2	R31	B-1	TP6	D-2
C11	B-3	CR6	E-3	Q9	B-4	R14	B-2	R32	A-2	U1	B-1
C12	B-1	CR7	E-3	Q10	B-4	R15	C-1	R33	A-2	U2	B-1
C13	A-2	CR8	D-1	Q11	E-3	R16	C-1	R34	A-1	U3	A-1
C14	B-2	P1	E-3	R1	C-2	R17	F-3	R35	A-1	VR1	B-2
C15	A-1	P2	D-5	R2	C-1	R18	F-3	R36	B-4	VR2	A-1
C16	A-2	P3	E-5	R3	C-2	R19	F-4	R37	B-4	VR3	E-3
								R38	B-4	VR4	E-4

Figure 7-9. A16 Component Identification Replacement

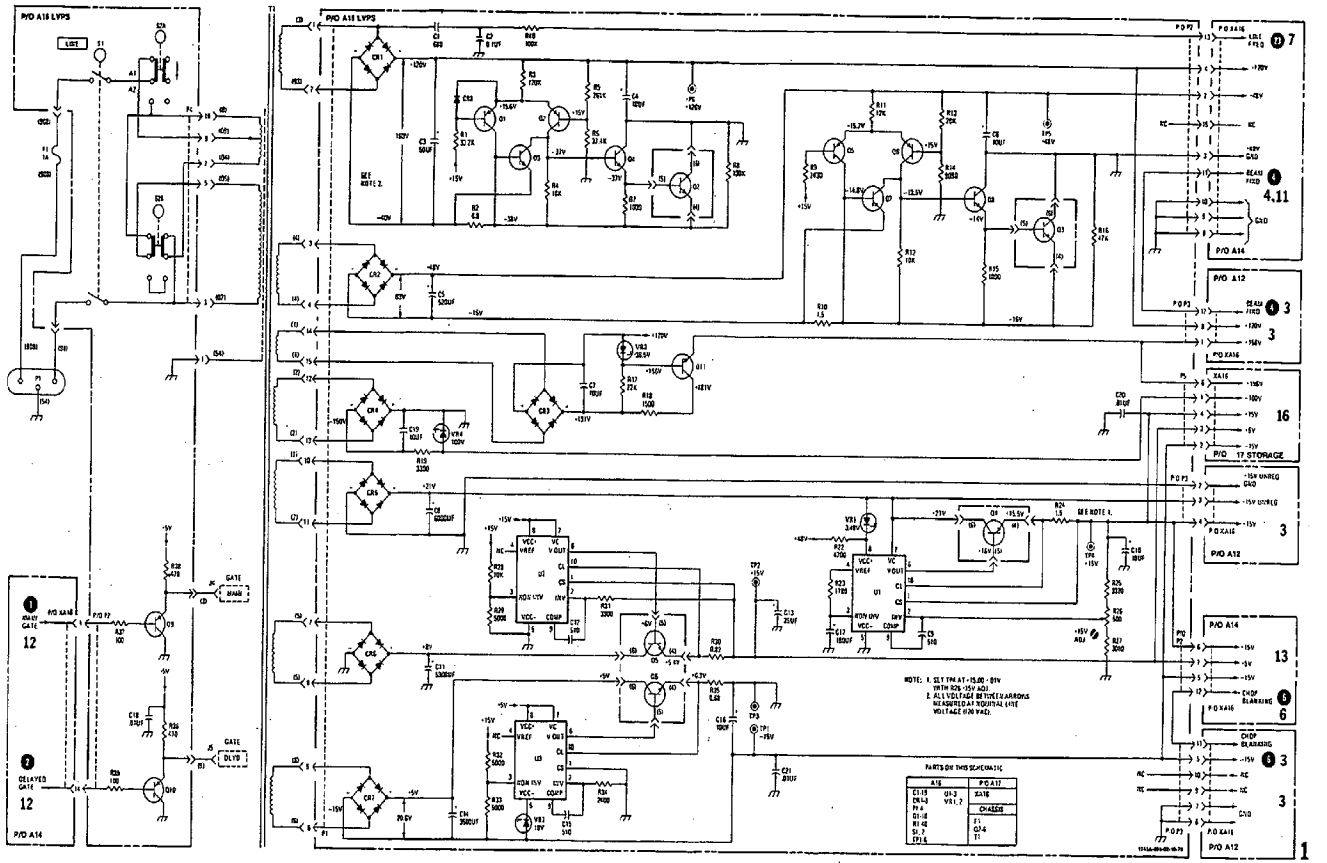


Figure 7-10. Schematic 1 Replacement
7-7/(7-8 blank)

SECTION VIII

SERVICE

8-1. INTRODUCTION.

8-2. This section contains schematics, troubleshooting data, repair information, and component-identification illustrations. An interconnection diagram is also provided.

8-3. PREVENTIVE MAINTENANCE.

8-4. CLEANING. Painted surfaces can be cleaned with a commercial, spray-type window cleaner or with a mild soap and water solution.

CAUTION

Do not use chemical cleaning agents that may damage plastics used in this instrument. Recommended cleaning agents are isopropyl alcohol, kelite solution (1 part kelite and 20 parts water), or a solution of 1% mild detergent and 99% water.

8-5. 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 DRI-FILM 88.

8-6. SWITCH MAINTENANCE. Pushbutton switches in this instrument are designed for long, trouble-free service. If one of these switches should become defective, replacement rather than repair is recommended.

8-7. 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 the paragraphs on repair in this section for disassembly instructions.

8-8. 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 FML produced by the Fiske Brothers Refining Company. LUBRIPLATE FML is available from Hewlett-Packard (HP Part No. 6040-0305).

8-9. To service rotary switches on assemblies A8 and A9, proceed as follows:

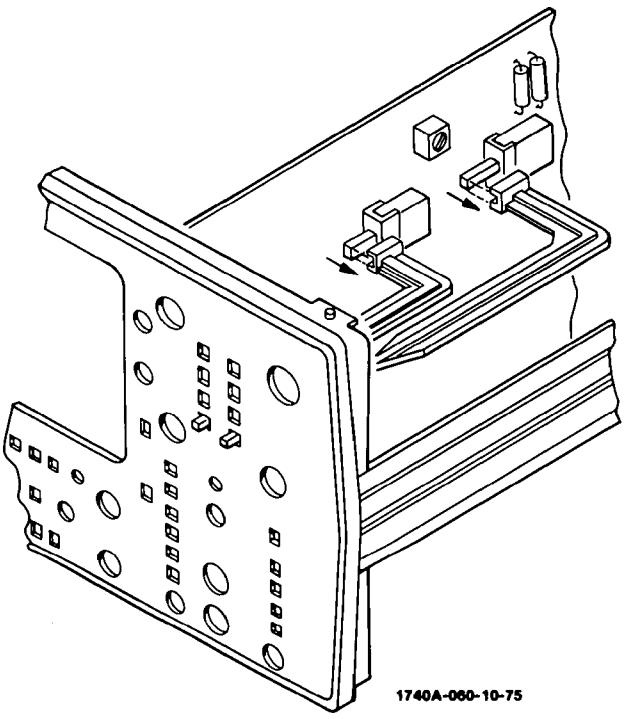


Figure 8-1. Switch Extender Shaft Removal

a. Remove TIME/DIV knob and shaft (refer to paragraph 8-24).

b. Remove plug-in assembly (A8 or A9) from assembly A7.

c. Note orientation of slot in rotor section of switch.

d. Remove metal retainer ring from rotor switch and separate two sections.

e. Check contact area on etched circuit board. If contact area shows excessive wear, replace circuit board.

f. Check contacts on both rotor sections. If contacts show excessive wear, replace rotor section.

g. Clean and lubricate contacts on circuit board and rotors as described in paragraph 8-8.

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

i. Position slotted portion of open rotor section as noted in step c.

j. Reinstall assembly in instrument.

k. Reinstall TIME/DIV shaft and knob assembly.

8-10. Switches in the vertical attenuators do not require lubrication, cleaning, or maintenance.

8-11. To remove the horizontal right-angle switch extender shafts, depress the switch connected to the extender shaft to be removed. While supporting switch shaft with finger, gently pull extender shaft away from circuit board (90° from switch axis). To reinstall, reverse removal procedure (see figure 8-1).

8-12. REMOVAL AND REPLACEMENT PROCEDURES.

8-13. Instructions for removing major assemblies are contained in the following paragraphs. Instructions for repairing circuit board assemblies are in paragraph 8-29. The replaceable parts list is in Section VI.

8-14. CRT REMOVAL. To remove the CRT, see figures 6-1 and 8-2, and proceed as follows:

WARNING

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

a. Disconnect line cord and remove top and bottom covers from instrument.

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

WARNING

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

c. Remove rear-panel CRT socket cover MP33.

d. Carefully disconnect CRT socket from base of CRT.

e. Remove post accelerator lead clamp H35 from HVPS cover MP54.

f. Remove HVPS cover MP54.

g. Disconnect (956) and (957) wires from rear of HVPS assembly A15.

h. Disconnect all wires (10 each) from CRT neck pins.

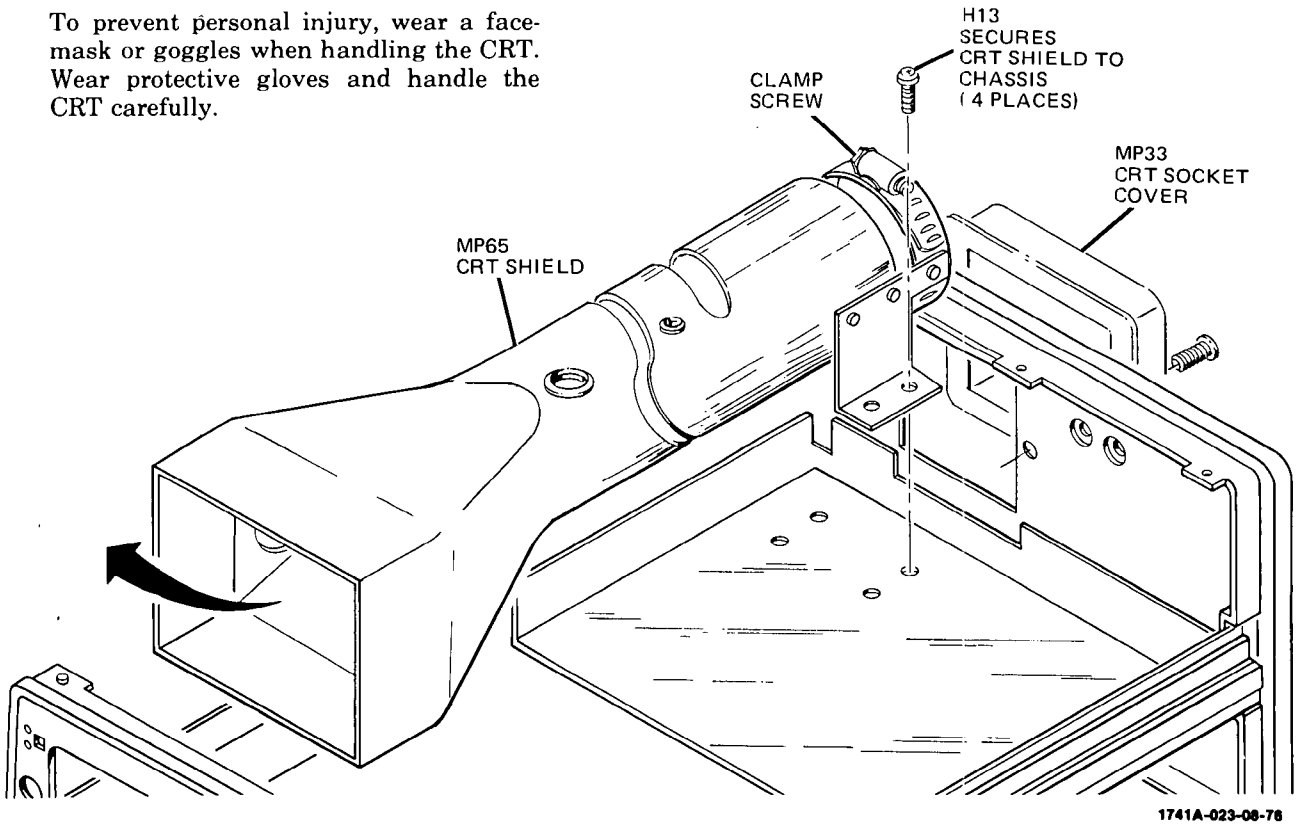


Figure 8-2. CRT Removal

i. Disconnect 6-pin connector A17P1, 3-pin connector A17P2, and (97), (3), (4), and (95) wires from storage assembly A17.

j. Disconnect (0) and (95) wires from gate amplifier assembly A12.

k. Remove four screws (H13) that secure rear of CRT shield MP65 to chassis.

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

m. Tilt shield up and gently lift CRT and shield out of instrument.

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

CAUTION

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

o. 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.

8-15. HIGH-VOLTAGE POWER SUPPLY ASSEMBLY A15 REMOVAL. To remove A15, see figure 6-1 and proceed as follows:

a. Remove post accelerator lead clamp H35 from HVPS cover MP54.

b. Remove HV cover MP54.

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

WARNING

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

d. Remove screw from nylon clamp holding five wires to CRT socket.

e. At assembly A15, disconnect two (6) wires and one (2) wire from FOCUS potentiometer A12R22.

f. Disconnect (956), (957), (6), (4), (912), (2), (7), and two (1) wires from assembly A15.

g. Disconnect (9) wire from rear of Gate Amplifier A12.

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

i. Disconnect A12 from Low-voltage Power Supply 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 to HV Multiplier Assembly A6.

l. Remove A15.

m. To reinstall A15, reverse removal procedure; remembering to again short (0) wire and large wire from HV Multiplier as in step k.

8-16. HV MULTIPLIER ASSEMBLY A6 REMOVAL. To remove A6, see figure 6-1 and proceed as follows:

a. Disconnect post-accelerator lead from CRT at ceramic quick disconnect connector and immediately discharge lead to ground.

WARNING

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

b. Remove A15 (see paragraph 8-15).

c. Remove bracket MP48 over A6 (two screws to chassis and two screws to rear panel).

d. Lift bracket off large (0) wire to A6 from A15.

e. Remove post-accelerator lead cable clamp H35.

f. Remove two screws securing A6 to chassis and remove A6.

g. To reinstall A6, reverse removal procedure.

8-17. LOW-VOLTAGE POWER SUPPLY ASSEMBLY REMOVAL. To remove Low-voltage Power Supply Assembly A16, see figures 6-1 and 8-3 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.

a. Remove Interface Assembly A14.

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

c. Disconnect two plugs to power transformer.

d. Remove line cover MP57 by removing two screws.

e. Disconnect ac input leads (90) and (908).

f. Disconnect five plugs to series regulators (Q2-6).

g. Remove five screws holding A16 to chassis.

h. Disconnect plug to Gate Amplifier A12.

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

j. Unscrew LINE switch shaft and extract it.

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

l. To reinstall A16, reverse removal 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 (refer to paragraph 8-18, figure 8-4).

8-18. GATE AMPLIFIER ASSEMBLY REMOVAL. To remove Gate Amplifier Assembly A12, see figures 6-1 and 8-4 and proceed as follows:

a. Remove post-accelerator lead cable clamp H35.

b. Remove HVPS cover MP54.

c. Disconnect seven wires on component side of A12.

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

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

f. Remove FOCUS and INTENSITY shafts from potentiometers using small hex wrench (Allen 050).

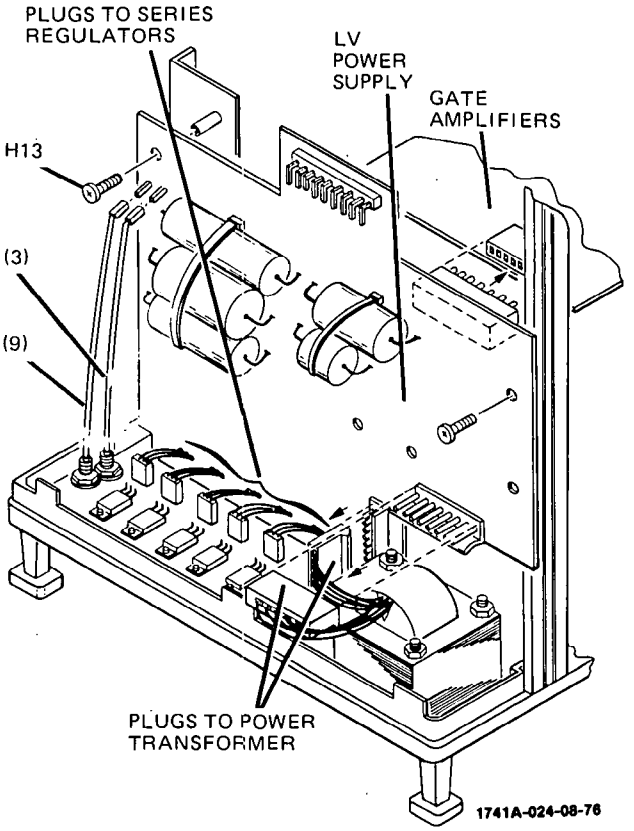


Figure 8-3. LV Power Supply Removal

g. Disconnect A12 from A16 (LVPS).

h. Disconnect A12 from A15 (HVPS).

i. Remove BEAM FIND shaft by pushing A12 forward so that button clears front panel and unscrew shaft.

j. Remove button from shaft.

k. Remove A12.

l. 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.

8-19. STORAGE AND VERTICAL OUTPUT AMPLIFIER ASSEMBLY A17 REMOVAL. To remove A17 proceed as follows:

a. Disconnect delay line wires (4), (6), and (0) from front of assembly A17.

b. Remove screw holding delay line cable clamp to A17.

c. Unsolder vertical output wires (3) and (9) from A17.

d. Disconnect wires (97), (3), (4), and (95) from rear of A17.

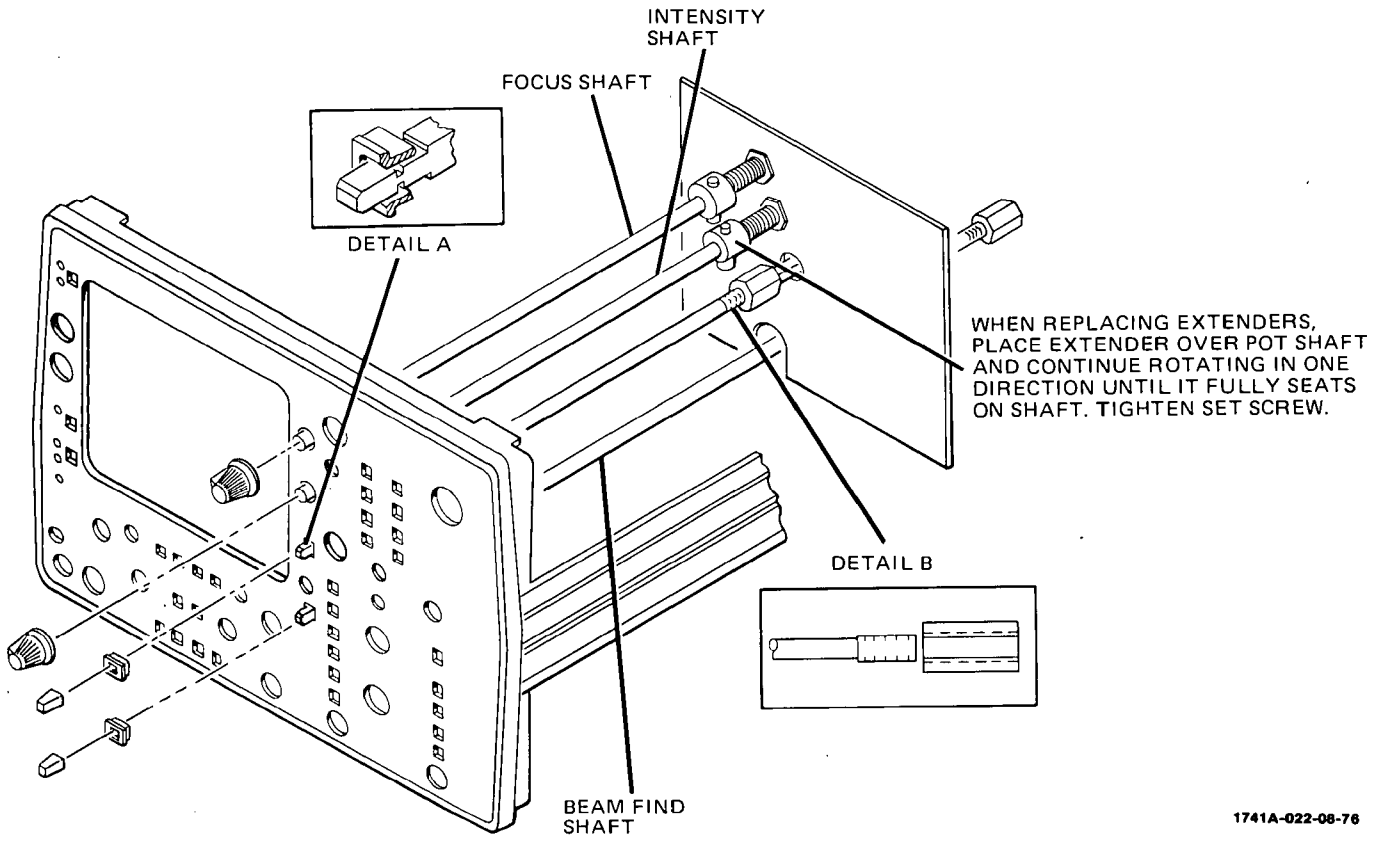


Figure 8-4. Gate Amplifier Assembly Removal

e. Disconnect 6-pin connector A17P1 and 3-pin connector A17P2 from A17.

f. Disconnect 16-pin connector from A17.

g. Disconnect two 3-pin connectors from rear of A17.

h. Remove heat sink bracket MP86 from heat sink MP57.

i. Remove four mounting screws from top of A17.

CAUTION

Be careful not to damage the CONV push-button switch at the rear of assembly A17.

j. Remove A17.

k. To reinstall A17, reverse removal procedure.

8-20. VERTICAL OUTPUT AMPLIFIER IC A17A1 REMOVAL. To remove A17A1, see figure 8-5 and proceed as follows:

a. Remove heat sink bracket MP86 from heat sink MP57.

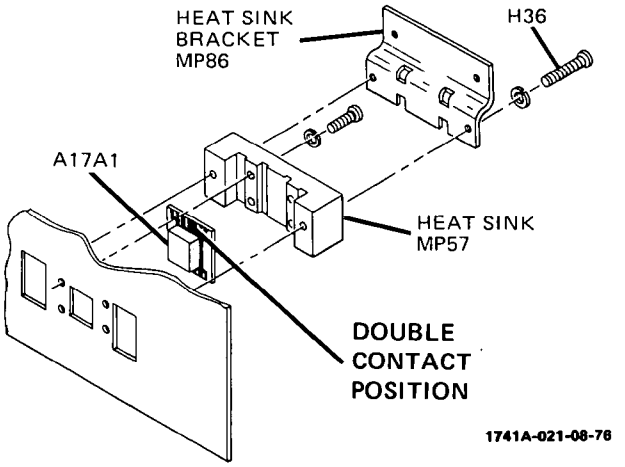


Figure 8-5. A17A1 Assembly Removal

b. Remove heat sink MP57 from assembly A17.

c. Remove A17A1 from heat sink MP57.

d. To reinstall A17A1, reverse removal procedure, being certain to orient A17A1 properly with A17 (see figure 8-5).

8-21. VERTICAL PREAMPLIFIER ASSEMBLY A3, DELAY LINE ASSEMBLY A4, AND VERTICAL CONTROL SWITCHING ASSEMBLY A13 REMOVAL. To remove A3, A4, and A13 Assemblies, proceed as follows:

a. Disconnect Interface Assembly A14.

b. Remove channel A and B POS, 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 back side of A17.

f. Remove delay line clamp from A17.

g. Disconnect twin leads (2, 6) and (94, 915) from Horizontal Sweep Assembly A7.

h. Remove screw that connects A7, shield, and A3 together. This screw is close to point where twin lead (94, 915) attaches to A7.

i. Disconnect plug to A17.

j. Carefully tilt A3 outward and extract toward rear.

k. Disconnect vernier UNCAL light cable (95), (96), and two (0) wires from A13.

l. To reinstall A3, reverse removal procedure.

8-22. Vertical Control Switching Assembly A13 Removal. To remove A13, proceed as follows:

a. Remove A3 as described in paragraph 8-21.

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

c. Disconnect wires (3), (93), (913), and (8) from component side of A13.

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

e. Disconnect two plugs to A3.

f. To reinstall A13, reverse removal procedure.

8-23. Vertical Preamplifier IC A3A1 Removal. To remove A3A1, see figure 8-6 and proceed as follows:

a. Disconnect twin lead (2, 6) from A7.

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

c. Remove two remaining screws that hold vertical preamp substrate assembly A3A1 to A3.

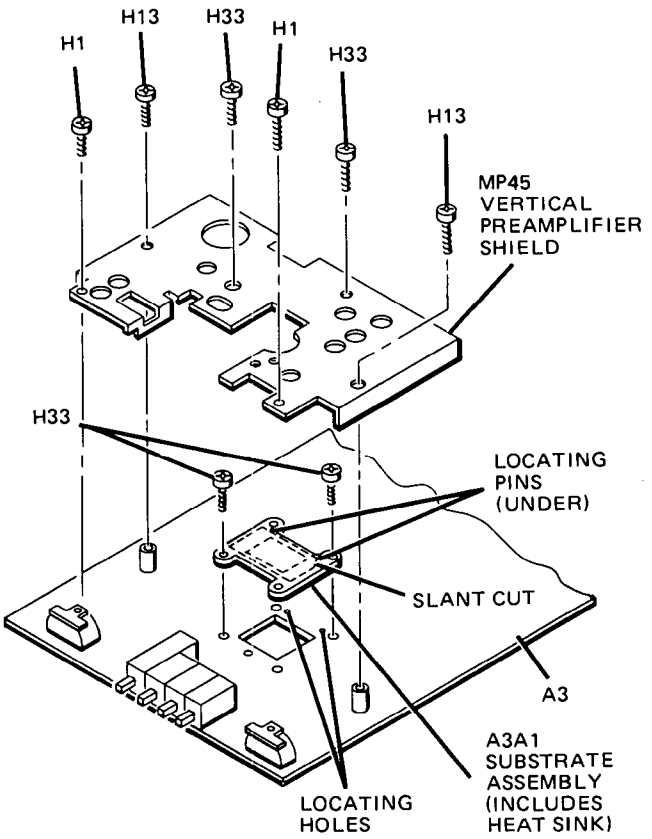


Figure 8-6. A3A1 Removal

d. Lift substrate assembly A3A1.

e. To reinstall substrate assembly A3A1 reverse removal procedure; be certain that orientation of parts is as shown in figure 8-6.

8-24. MAIN SWEEP ASSEMBLY A8 AND DELAYED SWEEP ASSEMBLY A9 REMOVAL. To remove A8 and A9, proceed as follows:

a. Loosen hex screws (3/32) of TIME/DIV shaft collar located directly behind A9.

b. Loosen hex screws (3/32) of TIME/DIV shaft collars located in front and behind A8.

c. Set MAIN TIME/DIV to 1 μSEC and DLY'D TIME/DIV to OFF.

d. Sweep time shaft can now be removed.

e. Remove A8 by pulling from socket.

f. Remove A9 by gently rocking board toward rear of instrument to disconnect it from two connectors.

g. To reinstall, reverse removal procedure.

8-25. HORIZONTAL OUTPUT ASSEMBLY A11 REMOVAL. To remove 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 Horizontal Sweep Assembly A7 and then pulling bottom of A11.

c. To reinstall A11, reverse removal procedure.

8-26. HORIZONTAL SWEEP ASSEMBLY A7 REMOVAL. To remove A7, proceed as follows:

a. Remove A8 and A9 (paragraph 8-24).

b. Remove A11 (paragraph 8-25).

c. Unsolder resistor from main EXT TRIGGER BNC connector J1.

d. Remove two cable connector plugs.

e. Remove twin leads (2, 6) and (1, 9).

f. Disconnect wires (93), (1), (6), and (97) from back of A7.

g. Disconnect wire (7) from component side of A7.

h. Remove main TRIGGER LEVEL knob and nut from potentiometer.

i. Remove A14.

j. Remove four screws holding A7 to sheet metal (figure 8-7).

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

l. To reinstall A11, reverse removal procedure, except install four screws (step j) without tightening them until nut on TRIGGER LEVEL potentiometer (step h) is tightened. Lockwasher must be in place on TRIGGER LEVEL potentiometer before inserting in panel.

8-27. DELAYED TRIGGER ASSEMBLY A10 REMOVAL. To remove the A10, proceed as follows:

a. Remove A9 (paragraph 8-24).

b. Unsolder resistor from delayed EXT TRIGGER BNC connector.

c. Disconnect wire (7) from component side of A10.

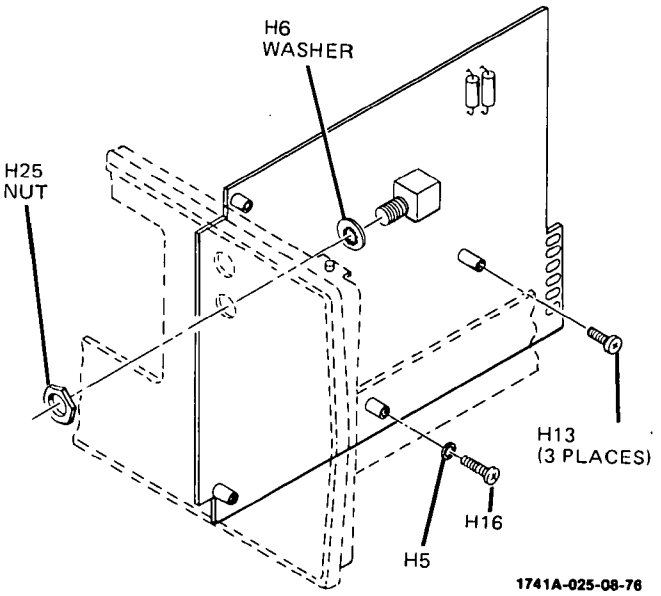


Figure 8-7. Location of A7 Attaching Screws

d. Remove delayed TRIGGER LEVEL knob and nut underneath.

e. Remove screw from A10 (corner next to delayed EXT TRIGGER BNC connector).

f. Gently pull A10 to rear and remove from instrument. Save lockwasher on TRIGGER LEVEL potentiometer for reinstallation.

g. To reinstall A10, reverse removal procedure; lockwasher must be in place on TRIGGER LEVEL potentiometer before inserting it in front panel.

8-28. STORAGE CONTROL ASSEMBLY A18 REMOVAL. To remove A18, proceed as follows:

a. Remove ERASE pushbutton shaft by removing collar behind PERSISTENCE control.

b. Remove PERSISTENCE and BRIGHTNESS control knobs.

c. Disconnect 16-pin connector from assembly A17.

d. Remove one screw that holds A18 to board support strap MP23.

e. Remove two screws that hold A18 mounting bracket MP81 to front deck.

f. Remove A18 by sliding it to rear of instrument.

g. To reinstall A18, reverse removal procedure.

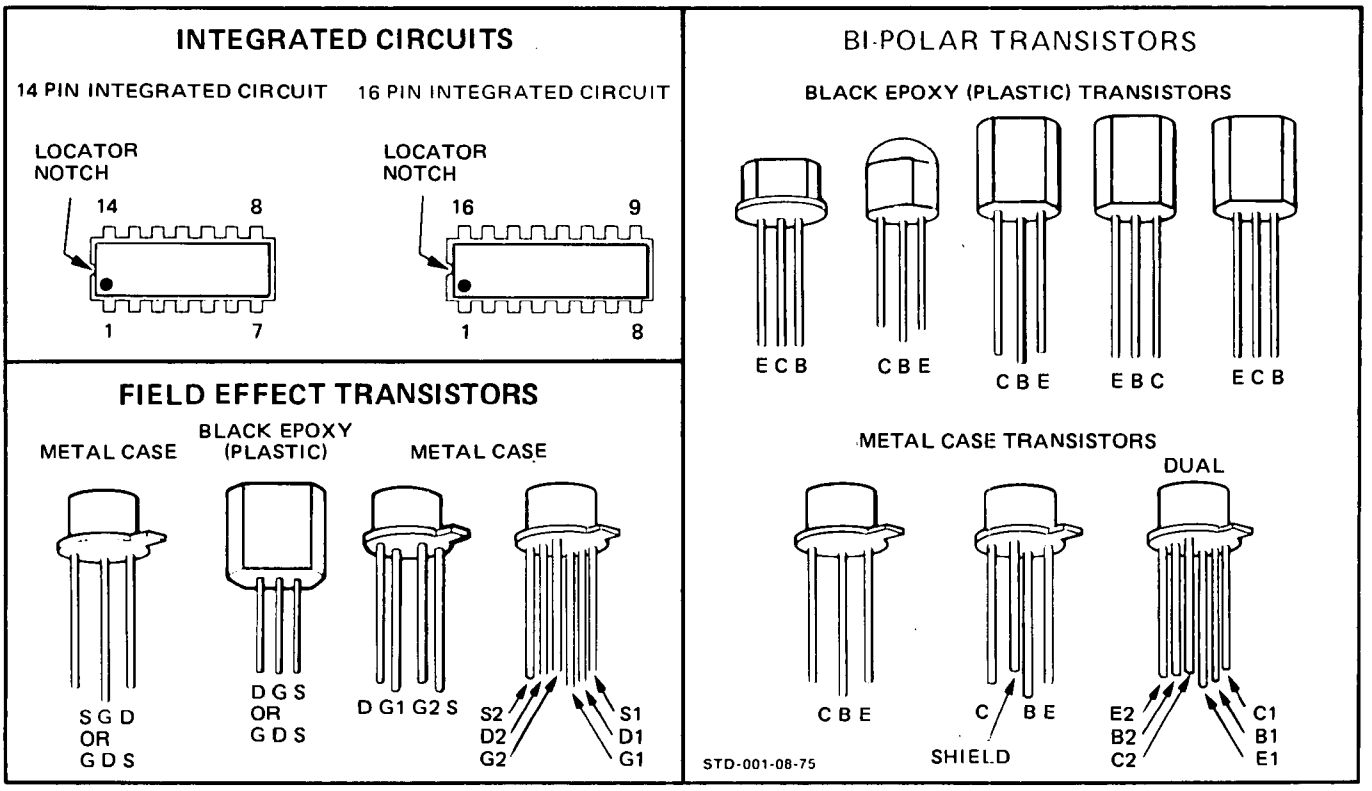


Figure 8-8. Semiconductor Terminal Identification

8-29. CIRCUIT BOARD REPAIRS.

8-30. The following paragraphs provide information for repairing etched circuit boards.

8-31. BOARD CONNECTIONS. Square-pin connectors are identified on circuit boards by color code of connecting wire or by the signal name. Each connector pin on plugs and jacks are identified by either a numeral or a letter; letters G, I, O, and Q are not used.

8-32. SOLDERING. All the etched circuit boards have plated-through component holes. This allows soldered-in components to be removed or replaced from either side of the board. When removing or replacing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. See figure 8-8 for more information on semiconductors. HP Service Note M-20E contains additional information for repair of etched circuit boards.

8-33. INTEGRATED CIRCUIT REMOVAL AND REPLACEMENT. The integrated circuits (IC's) in this instrument are plug-in types. Remove a plug-in IC with a straight pull away from the board. When replacing an IC, note the mark or notch used for pin number identification (see figure 8-8).

CAUTION

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

8-34. THEORY OF OPERATION.

8-35. The following paragraphs contain functional descriptions keyed to simplified block diagrams. The block diagrams are drawn for function and do not show circuit details. Schematics, along with a detailed description of each circuit, and an interconnection diagram are located at the end of this section.

8-36. VERTICAL SECTION BLOCK DIAGRAM. (Figure 8-9.)

8-37. INPUT ATTENUATORS. The attenuators have two functions: they select the type of input coupling (50Ω, DC, GND, or AC), and they 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 a X100 section preceding the discrete, dual-FET impedance converter in each channel.

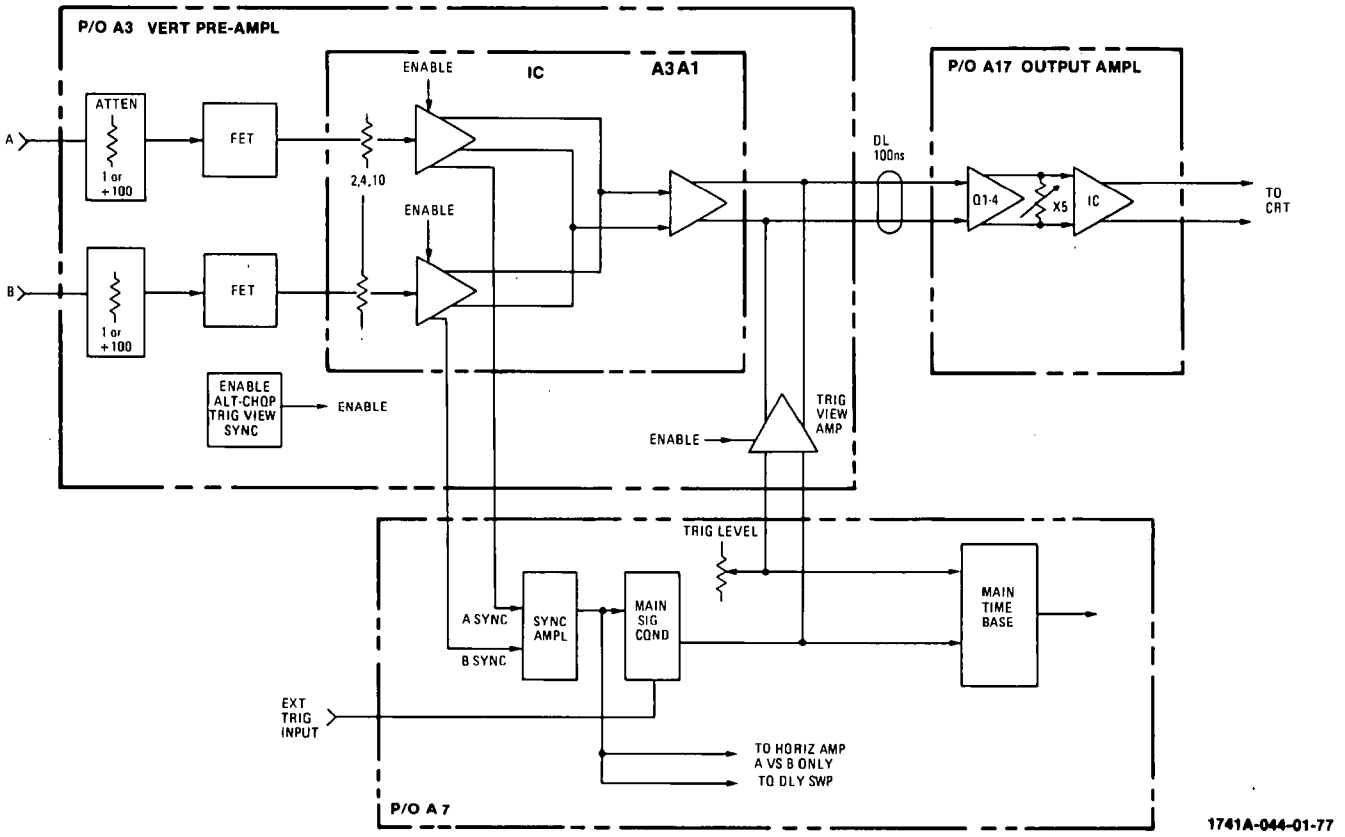


Figure 8-9. Vertical Section Block Diagram

8-38. VERTICAL PREAMPLIFIER. 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 signals from the external trigger input through the delay line and output amplifier.

8-39. DELAY LINE. The purpose of this assembly is to delay the vertical signal approximately 100 nanoseconds. This allows the sweep to trigger before the vertical signal reaches the CRT plates.

8-40. VERTICAL OUTPUT AMPLIFIER. The vertical output amplifier provides drive to the CRT vertical deflection plates.

8-41. HORIZONTAL SECTION BLOCK DIAGRAM. (Figure 8-10.)

8-42. TRIGGER CIRCUIT. The internal sync amplifier provides a synchronization signal for the main and delayed trigger generators. The generators develop the trigger signals that start the main and delayed sweep. 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 the reset signal is low, the generator is operational and a trigger signal will be developed if there is an internal or external sync input. In addition, an inhibit signal from the storage assembly is applied to the trigger generator during the erase cycle. This prevents a new sweep from starting during the erase operation.

8-43. In delayed sweep, the main sweep and the DELAY potentiometer drive the delay comparator. When the comparator conducts, it enables the set and trigger gates for delayed sweep. In the AUTO SWEEP AFTER DELAY mode, delayed sweep starts when the comparator conducts. In TRIG SWEEP AFTER DELAY, delayed sweep will not conduct unless a trigger signal occurs after the trigger gates are enabled.

8-44. SWEEP AND INTEGRATOR CIRCUITS. The main and delayed sweep circuits initiate horizontal sweeps by the trigger signal applied to their inputs. Miller integrators produce the horizontal sweep ramps; their slopes are controlled by the front-panel TIME/DIV switches. Outputs from the Miller integrators are applied through the horizontal display mode switches to the horizontal preamplifier.

8-45. The horizontal sweep is also compared to a reference voltage by a ramp comparator that drives the

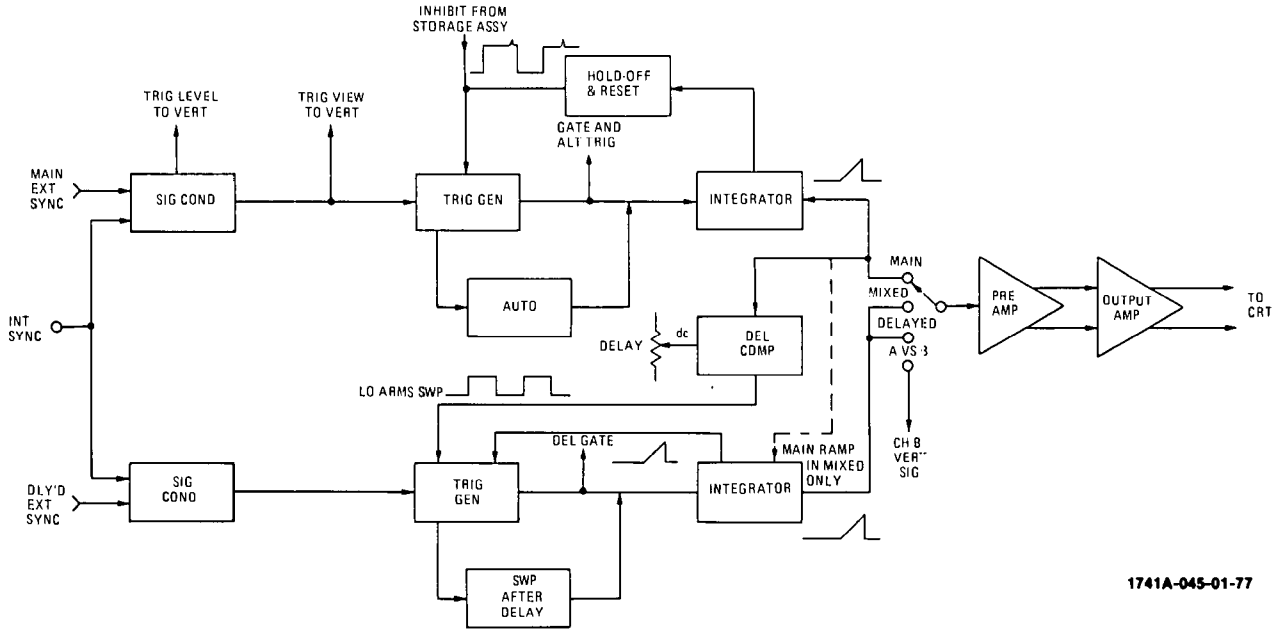


Figure 8-10. Horizontal Section Block Diagram

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

8-46. HOLDOFF CIRCUIT. 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.

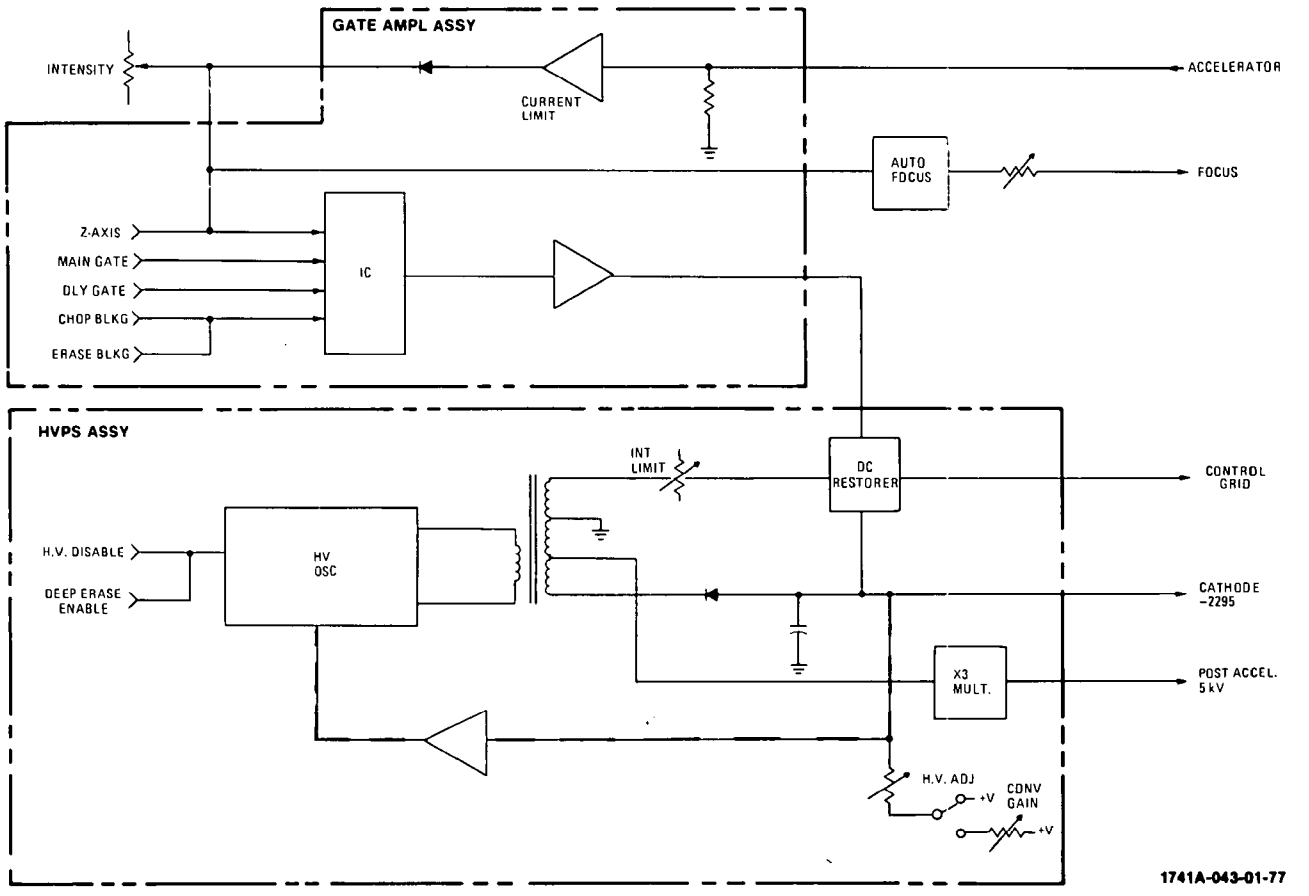


Figure 8-11. Gate and HV Power Supply Block Diagram

8-47. GATE AMPLIFIER AND HV POWER SUPPLY. (Figure 8-11.)

8-48. GATE CIRCUITRY. The gate amplifier contains circuitry necessary to control brightness of the CRT trace. An intensity control circuit is used for brightening or blanking the CRT. A current limit circuit controls the limit of intensity current that can be developed, protecting the CRT meshes.

8-49. An auto focus circuit is included so that the focus of the trace is automatically adjusted with changes in trace intensity.

8-50. HV POWER SUPPLY. 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.

8-51. The rectified CRT cathode voltage is sampled and fed back to the high-voltage oscillator. Changes in cathode voltage are fed back to the high-voltage oscillator, causing the amplitude of its oscillation to change. The change corrects the rectified cathode voltage returning it to the normal operating value.

8-52. The cathode voltage is adjusted by the high-voltage adjust potentiometer in the variable persistence mode of operation. Since floodgun elements within the CRT affect the write gun electron beam during variable persistence mode of operation, a cathode voltage correction must be made during conventional oscilloscope operation. This is accomplished by CONV GAIN adjust potentiometer.

8-53. If the +120-volt supply fluctuates above or below a certain value, the high-voltage oscillator is disabled, preventing a high-intensity burns from damaging the CRT. In addition, a deep erase switch is used to disable the high-voltage oscillator, permitting erasure of deeply written images.

8-54. The unrectified cathode voltage in the secondary of the high-voltage transformer is applied to a multiplier assembly where it is multiplied three times. The multiplier output is connected to the CRT post-accelerator.

8-55. VARIABLE PERSISTENCE AND STORAGE.

8-56. GENERAL STORAGE THEORY. The storage CRT used in the 1741A contains a conventional electron gun with deflection plates (write gun), an aluminized phosphor viewing screen, a pair of floodguns operated in parallel, flood beam shaping and accelerating grids, a flood beam collimator, a collector mesh, and a storage mesh as shown in figure 8-12.

8-57. The write gun functions as a conventional electrostatic deflection gun, delivering high-velocity electrons to selected points on the phosphor viewing screen. The elements that provide storage and variable persistence are located between the write gun and the phosphor.

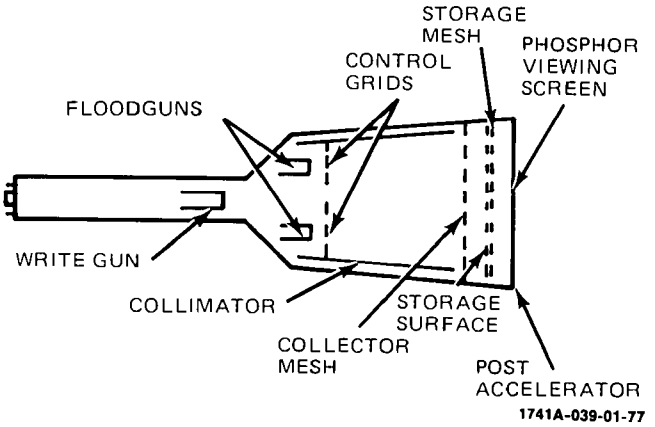


Figure 8-12. Simplified CRT Construction

8-58. The floodguns are physically located just outside the horizontal deflection plates. A cloud of electrons is emitted by each floodgun cathode. These clouds are combined, shaped, and accelerated by two control grids. The combined cloud is further shaped and accelerated by the collimator (a coating on the inside of the funnel section of the glass). The positive voltage on the collimator is adjusted so that the floodgun electron cloud just fills the CRT viewing screen. The cloud is further accelerated toward the storage mesh and viewing screen by the collector mesh. After passing through the collector mesh, the floodgun electrons are further controlled by potentials on the storage mesh and surface.

8-59. The storage mesh is located between the collector mesh and the phosphor. The backside of this mesh is coated with a layer of nonconductive material. The storage of information takes place on the surface of this nonconductive material (storage surface).

8-60. When the ERASE pushbutton is pressed, the storage mesh is changed to the same potential as the collector mesh (+156 V). The storage surface is also changed to nearly this same potential by capacitive coupling. Since the surface is then being bombarded by electrons with energies much higher than first crossover energy, the entire storage potential becomes equal to +156 volts. The surface potential cannot increase beyond +156 volts because the collector mesh would then repel the emitted electrons back to the storage surface, tending to decrease the surface potential.

8-61. After approximately 60 milliseconds, the storage mesh potential steps down negatively to -14.7 volts and immediately begins to ramp in a positive direction as an RC time constant response to almost +6.9 volts in about 75 milliseconds (see figure 8-13). Approximately 225 milliseconds after this time (at the

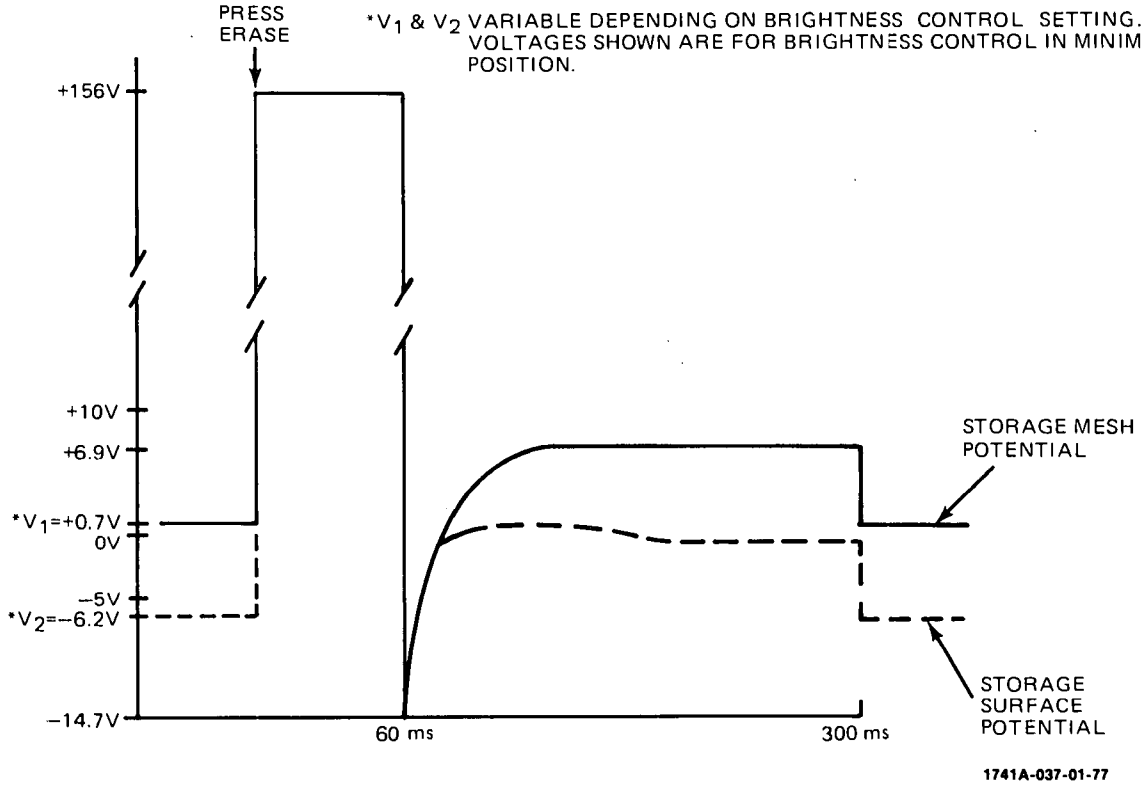


Figure 8-13. Storage Mesh and Surface Potentials During Erase

end of the erase cycle), the storage mesh potential steps down again, but this time to V_1 (dc voltage set by the BRIGHTNESS control).

8-62. Figure 8-14 represents the method of obtaining variable persistence. The following voltages apply when the BRIGHTNESS control is in the minimum position. The unwritten storage surface after erasure is at approximately -6.2 volts. Those areas of the storage surface which are struck by electrons from the write gun become charged to approximately 0 volts. A +6.2 volt pulse applied to the storage mesh moves the unwritten areas of the storage surface to 0 volts and the written areas to +6.2 volts. While at this potential, the written areas of the storage surface attract and capture floodgun electrons, which tend to lower the potential of these areas. When the storage mesh returns to its normal level, the storage surface drops 6.2 volts. The unwritten areas of the storage surface return to a -6.2 volt potential and the written areas return to a slightly negative potential, somewhat lower (more negative) than their initial value. This decrease in potential reduces the ability of the post-accelerator potential to reach through and capture floodgun electrons, thus reducing the trace brightness slightly.

8-63. If this procedure is repeated many times, the stored trace will eventually be erased. The time required to accomplish this erasure is controlled by varying the repetition rate of pulses applied to the storage mesh. During the time the storage mesh is

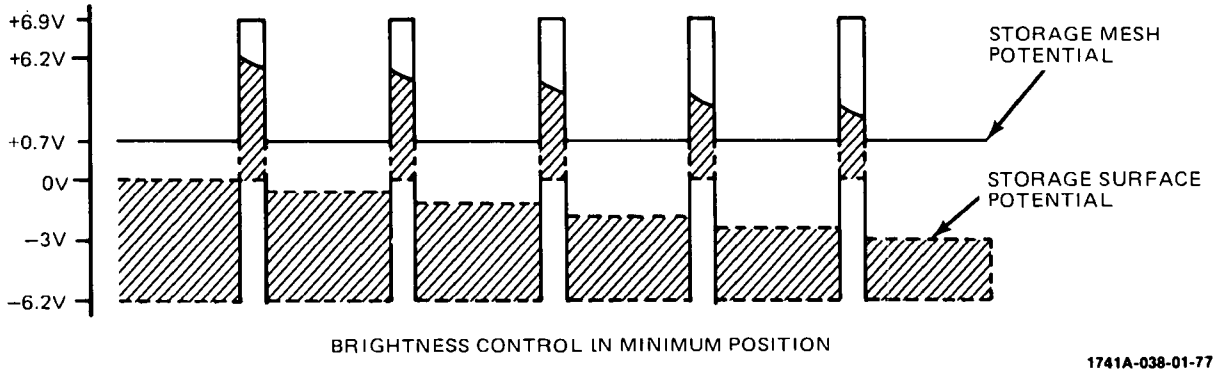


Figure 8-14. Variable Persistence Storage

pulsed positive, floodgun electrons are allowed through to the phosphor viewing screen. Thus, a light background glow is visible when the CRT is used in the variable persistence mode.

8-64. In the conventional mode of operation the floodguns are turned off by the floodgun control grids. This eliminates screen illumination and reduces persistence. At the same time, the storage mesh is raised to the collector mesh potential, +156 volts, to stabilize the storage surface when write gun electrons strike it. When changing from conventional to storage operation, the CRT is automatically run through an erase cycle to prepare it for storage operation.

8-65. In order to view a stored trace for 1 minute or more, the storage mesh is held at a constant voltage with the BRIGHTNESS control. This may be accomplished by reducing the rate of the variable persistence erase pulses to zero (corresponding to maximum persistence) or by actually disconnecting the pulses from the storage mesh.

8-66. The mechanism that limits viewing time is the fade positive of the storage surface (entire screen illuminated). This is caused by positive ions reaching the storage surface and charging it positive. The positive ions are generated by floodgun electrons striking residual gas molecules in the CRT. To obtain extended storage time, the floodguns should be turned off. This is done in the store mode.

8-67. STORAGE ASSEMBLY BLOCK DIAGRAM. (Figure 8-15.) In the write mode of operation, the persistence enable signal enables the storage mesh driver circuit. The driver circuit is then pulsed by timer U1A; pulse duration is a function of the PERSISTENCE control. The timer is inhibited during the store mode and auto erase mode of operations.

8-68. The CRT floodguns are turned on during the write and store display modes of operation. During the store mode of operation, the floodguns are disabled. In addition, the floodguns are disabled by the CONV switch during conventional operation.

8-69. The erase function is controlled by flip-flops that create an erase enable signal. The flip-flops enable an erase blanking gate whose output blanks the CRT during the erase cycle and prevents generation of a new sweep by inhibiting the main trigger circuit. Output of the auto erase flip-flop is applied to a timer which controls the initiation of an erase cycle. Time delay between erasures is controlled by the view time potentiometer.

8-70. An output from either the view time delay generator or the main erase flip-flop will trigger two monostable flip-flops. One monostable produces a 60-millisecond erasure pulse that is used to condition the storage mesh in the CRT. The other monostable produces a 300-millisecond erasure pulse which completes the erase cycle, resets the persistence timer, and resets the auto/main erase flip-flops. In addition, the 300-millisecond pulse enables the collimator pulser circuit which is then pulsed by the signal from the instrument's calibrator. This causes the collimator voltage to vary, resulting in a more uniform erase. Both flip-flops are inhibited during store and store display modes of operation by the store enable signal.

8-71. TROUBLESHOOTING.

WARNING

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

8-72. Two important prerequisites for successful troubleshooting are: (1) understanding how the instrument is designed to operate and (2) knowing the correct use of front-panel controls. Improper control settings or circuit connections can cause apparent malfunctions. Read Section III for an explanation of controls, connectors, and general operating considerations.

8-73. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that may suggest a source of trouble. Verify that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check power supply voltages in the instrument. Also check the external power source.

8-74. INITIAL TROUBLESHOOTING PROCEDURE. Before troubleshooting the Model 1741A in detail, try to perform the adjustment procedures listed in Section V of this manual. Some apparent malfunctions may be corrected by these adjustments, or failure to obtain a correct adjustment will often reveal the source of trouble.

8-75. DC VOLTAGES AND WAVEFORMS. Dc voltages, waveforms, and conditions for making these measurements are given on or adjacent to the schematics. Since conditions for making the measurements may differ from one circuit to another, always check the specific conditions listed for each schematic.

8-76. TROUBLE DIAGNOSIS. By the use of front-panel controls, note as many symptoms of the malfunction as possible. From these symptoms it can usually be determined which section (vertical, horizontal, power supplies, or high voltage) is malfunctioning. But even if the problem is 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 other circuits. Table 8-1 is an index of service information for each assembly. Table 8-2 lists the sequence of checks that should be used when troubleshooting.

Table 8-1. Assembly Information Index

ASSEMBLY NO.	ASSEMBLY NAME	SERVICE INFORMATION
A1	Channel A Attenuator	Schematic 4
A2	Channel B Attenuator	Schematic 4
A3	Vertical Preamplifier	Schematic 4, 6
A4	DELAY LINE	Schematic 4
A5	NOT ASSIGNED	
A6	HV MULTIPLIER	Schematic 2
A7	Horizontal Sweep	Schematic 7, 8, 9, 11, 12
A8	Main Sweep	Schematic 8
A9	Delayed Sweep	Schematic 10
A10	Delayed Trigger	Schematic 9
A11	Horizontal Output	Schematic 11
A12	Gate	Schematic 2, 3
A13	Vertical Control Switches	Schematic 6
A14	Interconnect	Schematic 13
A15	High Voltage Power Supply	Schematic 2
A16	Low Voltage Power Supply	Schematic 1
A17	Storage	Schematic 15, 16
A18	Storage Control	Schematic 14

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.

8-77. LOW-VOLTAGE POWER SUPPLY. Most low-voltage supplies are referenced, directly or indirectly, to the +15 V supply; therefore, the +15 V supply should be checked first. The supplies are current-limiting type, so any excessive loading from the vertical, horizontal, etc., will cause the supply to read 20 to 30% low.

8-78. To quickly check if an external load is causing Low-voltage Power Supply 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 the supplies return to normal, then an external short is definitely loading the supply. Assembly A3 can be flexed upward, so A14 can be connected between assemblies A16 and 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 assembly A16 by disconnecting A15 from the bottom of A16.

8-79. HIGH-VOLTAGE POWER SUPPLY AND CRT. To troubleshoot HV Power Supply A15, remove the HV cover and reinstall the two screws nearest the rear of the instrument. This provides the necessary ground connections for A15.

8-80. Reconnect HV lead clamp H35 to mounting bracket on assembly A12. This keeps the HV lead connector clear of the HV assembly.

WARNING

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

8-81. The high-voltage oscillator, collector, and base waveform measurements are accessible directly on assembly A15, as well as control grid and cathode voltages. A high voltage disable circuit turns off the oscillator if the +120 V supply drops to less than +100 V. This protects the CRT from high beam current and burns.

8-82. If grid and cathode voltages are present on A15, verify that voltages are present at the CRT socket; a faulty socket or wire can cause an open circuit.

CAUTION

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

8-83. 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 turned clockwise, the beam will get brighter, up to a point; beyond this point it will decrease in brilliance and may defocus.

8-84. 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.).

8-85. 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.

8-86. GATE AMPLIFIER. Malfunctions in Gate Amplifier Assembly A12 will usually be transistor failures in output driver stages. At high intensity levels, these transistors are sometimes operating at fairly high voltages and are therefore subject to failure. If intensity is low check the current limit circuit.

8-87. VERTICAL SECTION. Problems in the vertical amplifier may show up as a variety of symptoms. Low gain problems may be located by applying an

Table 8-3. 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

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.

8-88. Problems can be isolated to A3A1 or to the vertical output circuit on assembly A17 by pressing TRIG VIEW on the front panel while applying a known signal to the main EXT TRIGGER input connector. If it is displayed properly (approximately 100 mV/div, this indicates that the vertical output circuit on A17 is operating properly and the problem is in A3A1.

8-89. 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.

8-90. HORIZONTAL OUTPUT AMPLIFIER. If no horizontal deflection can be obtained under normal sweep conditions, the problem may be in the time base or in Horizontal Output Assembly A11. To quickly determine which is at fault, put the oscilloscope in 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, then assembly A11 is probably defective.

8-91. TIME BASE. 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 8-3 will help analyze problems under a no-sweep condition. Select main sweep, set the main TIME/DIV control to .1 mSEC, and put all other time base pushbuttons in the out position. This puts the time base in an auto sweep mode. Set INTENSITY to approximately midrange.

8-92. STORAGE ASSEMBLY. When troubleshooting the storage section of the instrument refer to the schematics covering storage assembly A17. Waveforms and dc voltages are shown adjacent to the schematics to aid in troubleshooting.

SCHEMATIC 1

LOW VOLTAGE POWER SUPPLY - CIRCUIT THEORY

GENERAL. The low-voltage power supply provides regulated +5 V, +15 V, +48 V, +120 V, +156 V, -15 V and -100 V for operation of various circuits in the instrument. Most low voltage supplies are referenced to the +15 V supply, directly or indirectly.

+15-VOLT SUPPLY. The ac input is applied through transformer T1 to full-wave, diode-bridge rectifier A16CR5. The rectified voltage from A16CR5 (nominally +21 Vdc) is applied to integrated circuit A16U1 and series regulator Q4 to produce the regulated +15 V output. A16U1 contains a compensation reference circuit (pin 4) and a differential amplifier with a Darlington output (pin 6). The compensation reference circuit is applied to the non-inverting input of the amplifier.

The Darlington output drives the base of series regulator Q4. The emitter output is applied to a voltage divider network consisting of A16R25, R26, and R27. +15 V ADJ potentiometer A16R26 is adjusted to compensate for variations of the reference voltage so that with an output of +15 volts from the supply, the inverting and non-inverting input voltages to A16U1 are equal.

IC A16U1 includes an output current limiting circuit consisting of an NPN transistor whose collector is connected to differential amplifier and input to the Darlington amplifier located within the IC. The emitter and base connections for the NPN transistor are pins 1 and 10 respectively. When the load current through A16R24 produces a sufficient voltage drop, the NPN transistor conducts, pulling the input to the Darlington pair toward the emitter potential of Q4. This limits the output current.

-15-VOLT SUPPLY. The -15-volt supply, consisting of A16U3 and Q6, operates in the same way as the +15-volt supply except that the non-inverting input to A16U3 (pin 3) is the sum of the +15 V and -15 V outputs (nominally zero volts).

+5-VOLT SUPPLY. The +5-volt regulator A16U2 functions in the same way as the +15-volt regulator except that the reference voltage is provided by the attenuated output of the +15-volt supply. The attenuation network consists of A16R28 and A16R29.

+120-VOLT SUPPLY. The dc output of full-wave, diode-bridge rectifier A16CR1 is filtered by A16C3. A +15-volt reference is applied to the base of A16Q1 through A16R1. A16Q1/A16Q2 form a differential amplifier with the base of A16Q2 connected to a voltage divider network across the +120-volt output circuit. If the output falls below +120 volts, the base of A16Q2 becomes less positive causing it to conduct harder. The collector of A16Q2 is directly coupled to Darlington pair A16Q4 and Q2. When conduction through A16Q2 increases, conduction through the Darlington pair increases, resulting in an increase in output voltage. When the output reaches +120 volts, conduction through A16Q2 is such that equilibrium is reached. Transistor A16Q3 and resistor A16R2 form a current limiting circuit. As current requirements increase toward the limit of supply capability, the voltage drop across A16R2 is applied to the base of A16Q3 which conducts and limits current drain from the Darlington pair.

+48-VOLT SUPPLY. The +48-volt supply consists of A16CR2, A16Q5-A16Q8, and Q3. It operates in the same manner as the +120-volt supply.

+156-VOLT SUPPLY. The +156-volt supply consists of A16CR3 and emitter follower A16Q11. Its output is referenced to the +120-volt output and is used in the astigmatism and auto-focus circuitry. It is also used in the storage mesh and collector mesh circuits.

-100-VOLT SUPPLY. The -100-volt supply consists of A16CR4 and A16VR4. It is not referenced to any other supply. Its output is regulated by zener diode A16VR4 and is used in the storage mesh and floodgun grid circuits.

LINE FREQUENCY. The line frequency sync signal is developed in the same secondary winding of input power transformer T1 that is used for the +120-volt supply. The signal is applied through A16R40 to HF REJ switch A7S2C on assembly A7 (see schematic 7).

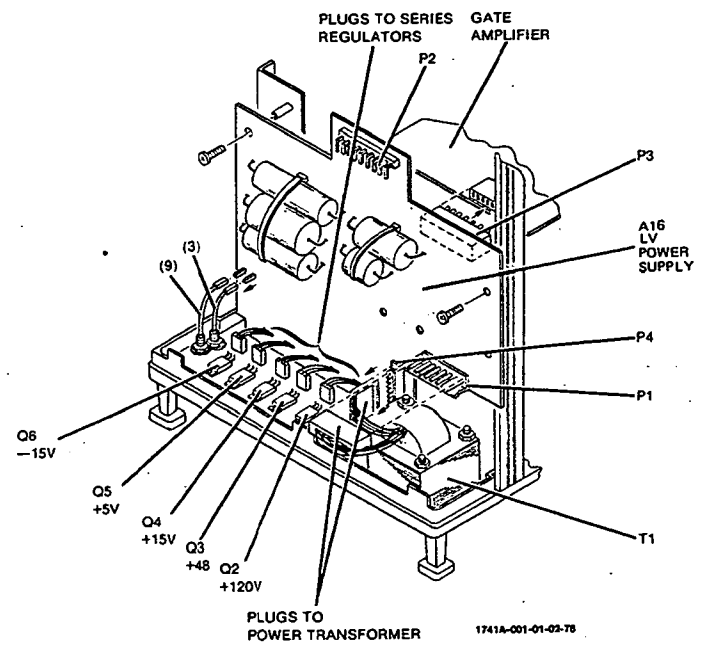
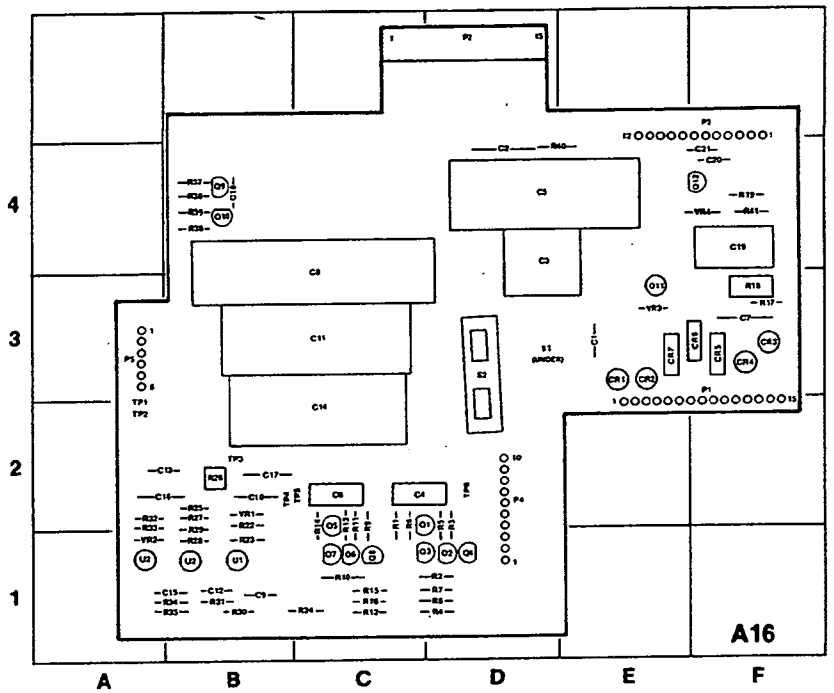


Figure 8-16. Service Information, Low-voltage Power Supply Assembly A16 (Sheet 1 of 3)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	C17	B-2	P5	A-3	R4	D-1	R22	B-2	R39	B-4
C2	D-4	C18	B-4	Q1	C-1	R5	D-1	R23	B-1	R40	E-4
C3	D-4	C19	F-4	Q2	D-1	R6	C-2	R24	C-1	R41	F-4
C4	C-2	C20	F-4	Q3	C-1	R7	D-1	R25	B-2	S1	D-3
C5	D-4	C21	F-4	Q4	D-1	R8	D-1	R26	B-2	S2	D-3
C6	C-2	CR1	E-3	Q5	C-1	R9	C-2	R27	B-2	TP1	A-2
C7	F-3	CR2	E-3	Q6	C-1	R10	C-1	R28	B-1	TP2	A-2
C8	C-4	CR3	F-3	Q7	C-1	R11	C-2	R29	B-1	TP3	B-2
C9	B-1	CR4	F-3	Q8	C-1	R12	C-1	R30	B-1	TP4	B-2
C10	B-2	CR5	F-3	Q9	B-4	R13	C-2	R31	B-1	TP5	C-2
C11	C-3	CR6	F-3	Q10	B-4	R14	C-1	R32	A-2	TP6	D-2
C12	B-1	CR7	E-3	Q11	E-3	R15	C-1	R33	A-2	U1	B-1
C13	A-2	P1	F-3	Q12	F-4	R16	C-1	R34	B-1	U2	B-1
C14	C-2	P2	D-5	R1	C-2	R17	F-3	R35	B-1	U3	A-1
C15	B-1	P3	F-5	R2	D-1	R18	F-3	R36	B-4	VR1	B-2
C16	A-2	P4	D-2	R3	D-1	R19	F-4	R37	B-4	VR2	A-1
								R38	B-4	VR3	E-3
										VR4	F-4

Power Supply A16 Component Locator
(01741-66514)

Figure 8-16. Service Information, Low-voltage Power Supply Assembly A16 (Sheet 2 of 3)

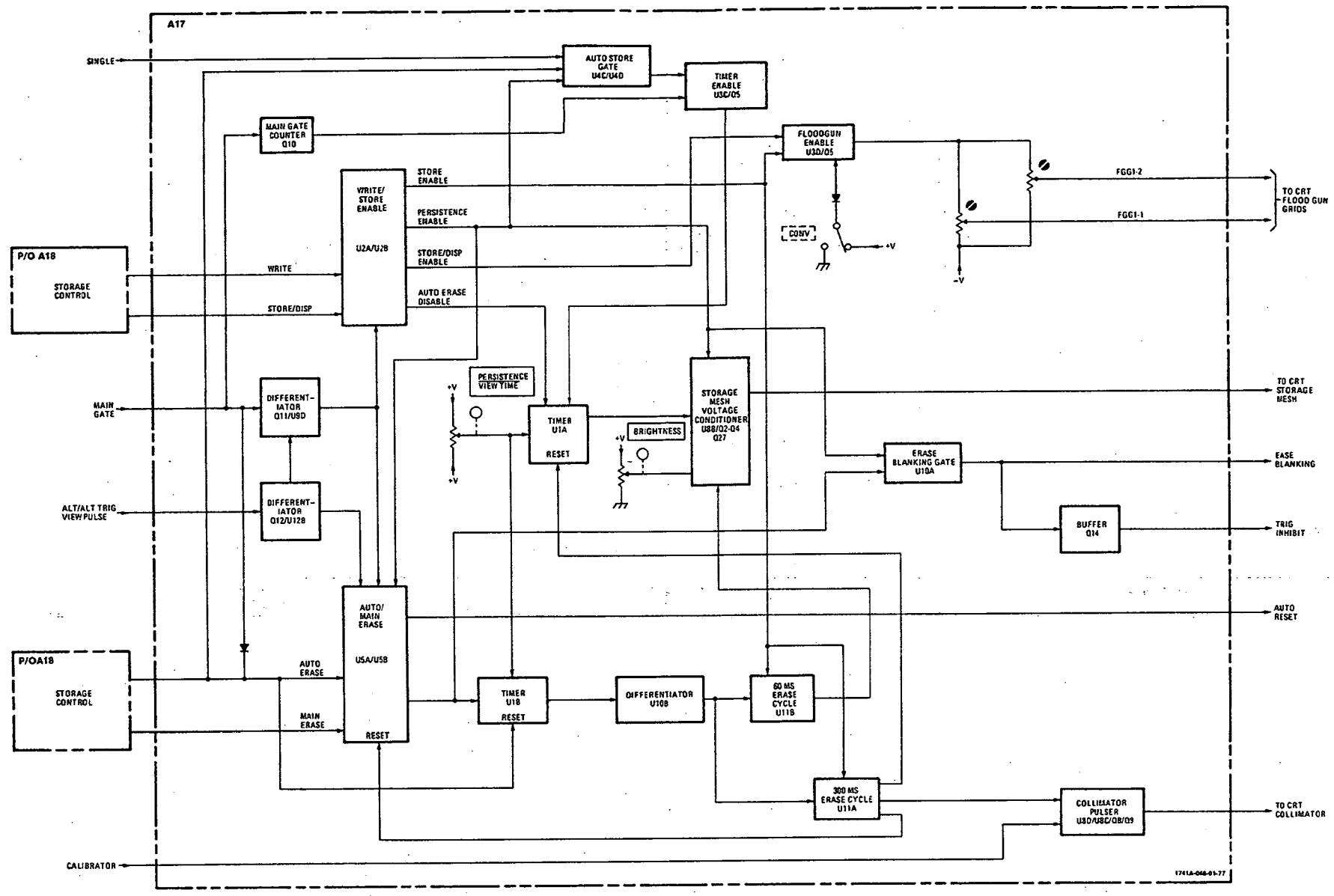


Figure 8-15.
Storage Section Block Diagram

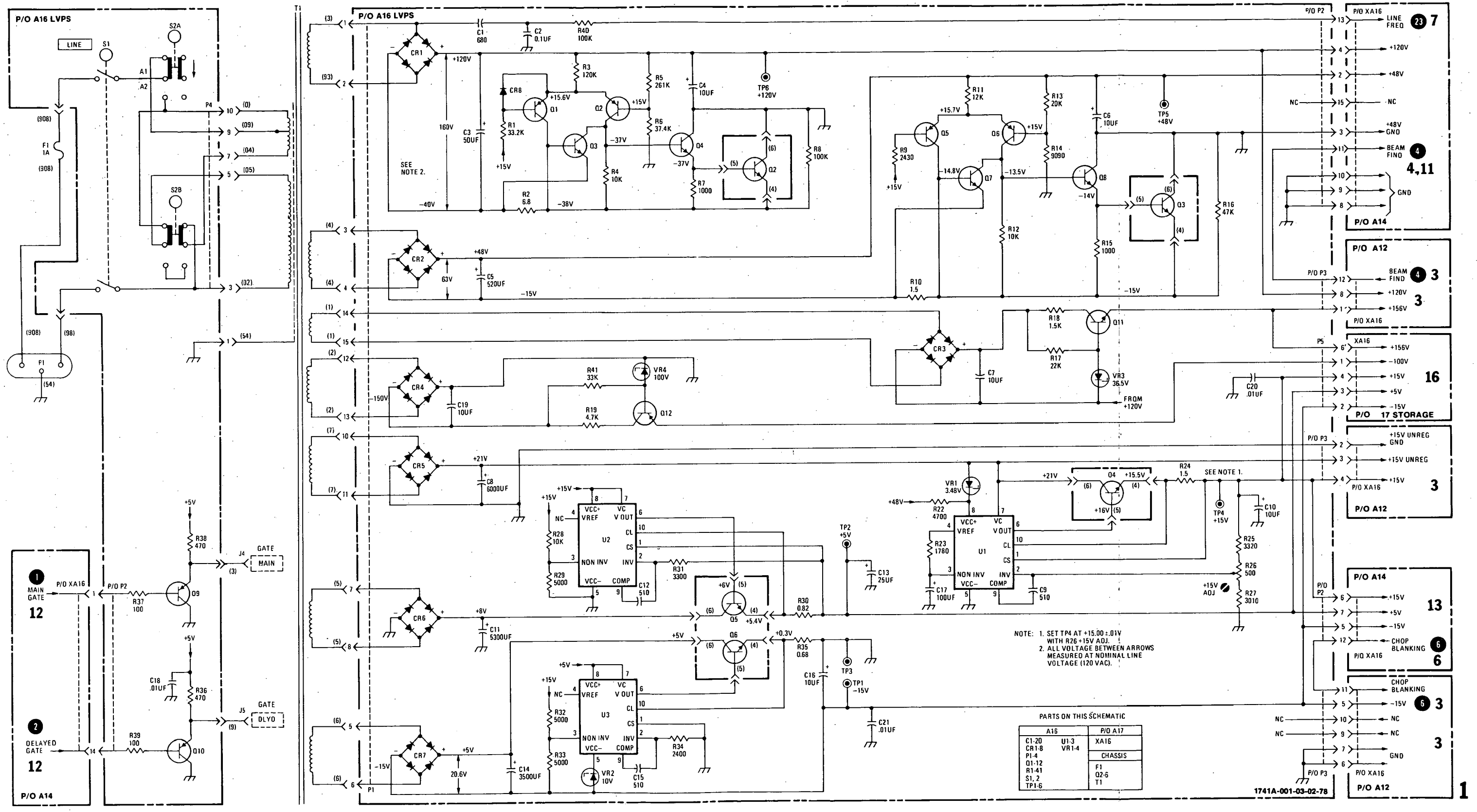


Figure 8-16. Service Information
Low-voltage Power Supply Assembly A16 (Sheet 3 of 3)

SCHEMATIC 2

HIGH-VOLTAGE POWER SUPPLY-CIRCUIT THEORY

HIGH-VOLTAGE OSCILLATOR. The high-voltage power supply consists of an 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 feed back 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 feed back in the other winding, causing reduced conduction through Q1. With varying conduction through Q1, the circuit oscillates at a rate determined by the inherent distributed inductance and capacitance of the oscillator circuit. The magnitude of the oscillations, and consequently the output of the power supply, is controlled by the voltage at the output of differential amplifier A15U1.

HIGH VOLTAGE REGULATOR. A reference voltage from the +15-volt supply is established at the junction of A15R13 and A15R37. The voltage is applied to a differential input on amplifier A15U1 through A16R23. A sample of the cathode voltage for the CRT is also applied at the junction of A15R23 and A15R37 through A15R13/A15C8. Any change in the cathode voltage is amplified by A15U1 and applied through the primary winding on A15T1 to the base of high voltage oscillator Q1, changing the amplitude of its oscillation. The change is in such a direction as to correct the original change in the rectified cathode voltage. Diodes A15CR1/A15CR2 protect the oscillator transistor from excess reverse voltage.

HV DISABLE. Transistor A15Q2 monitors the +120 V supply through resistor network A15R41 and A15R31. If the output of the +120 V supply drops below approximately +100 volts, A15Q2 conducts, turning on A15Q1. With A15Q1 conducting, a ground is applied to the base of high-voltage oscillator Q1, cutting it off. In addition, if the +120 V supply surges above approximately +138 volts, zener diode A15VR5 conducts, turning on A15Q1. Again the high-voltage oscillator turns off. This protects the CRT from high-intensity burns. DEEP ERASE switch A15S1, when engaged, disables the high-voltage oscillator and gate circuitry to the CRT. The switch is engaged when deep erasure is required to remove deeply written images from the storage mesh. In the event that the -15 V supply is shorted to ground, A15Q2 turns on, turning off A15Q1, protecting the CRT from high intensity burns. Shorting the +15 V supply to ground causes the output of A15U1 to go low, turning off A15Q1, again protecting the CRT. A protection circuit consisting of A15Q4/A15U2/A15Q5 is incorporated in the cathode circuit to prevent accidental burning of the CRT during deep erase operations, while turning the instrument on and off, and during quick power dropouts.

When the instrument is turned off or the DEEP ERASE switch is engaged, A15C18 discharges, turning off A15Q4. When the instrument is turned on or the DEEP ERASE switch is returned to its NORMAL position, A15C18 starts charging towards the -15 volt supply through A15R44. Until A15C18 becomes fully charged, A15Q4 is cut off and there is no current flow through A15R45. A15U2 is an opto-electrical device consisting of an LED and a light-sensitive transistor. With no current flowing through A15R45, the LED is non-conducting and the light sensitive transistor is turned off. This turns off A15Q5 and the CRT cathode is now 100 volts positive with respect to the grid by A15VR3. This action disables the write gun in the CRT.

The time that it takes A15C18 to charge to -15 volts allows the high-voltage regulator circuit to stabilize the output from the high-voltage oscillator. When A15C18 becomes fully charged, A15Q4 conducts causing the LED in A15U2 to turn on. This turns on the light-sensitive transistor, turning on A15Q5, effectively by-passing A15VR3. This action enables the write gun of the CRT.

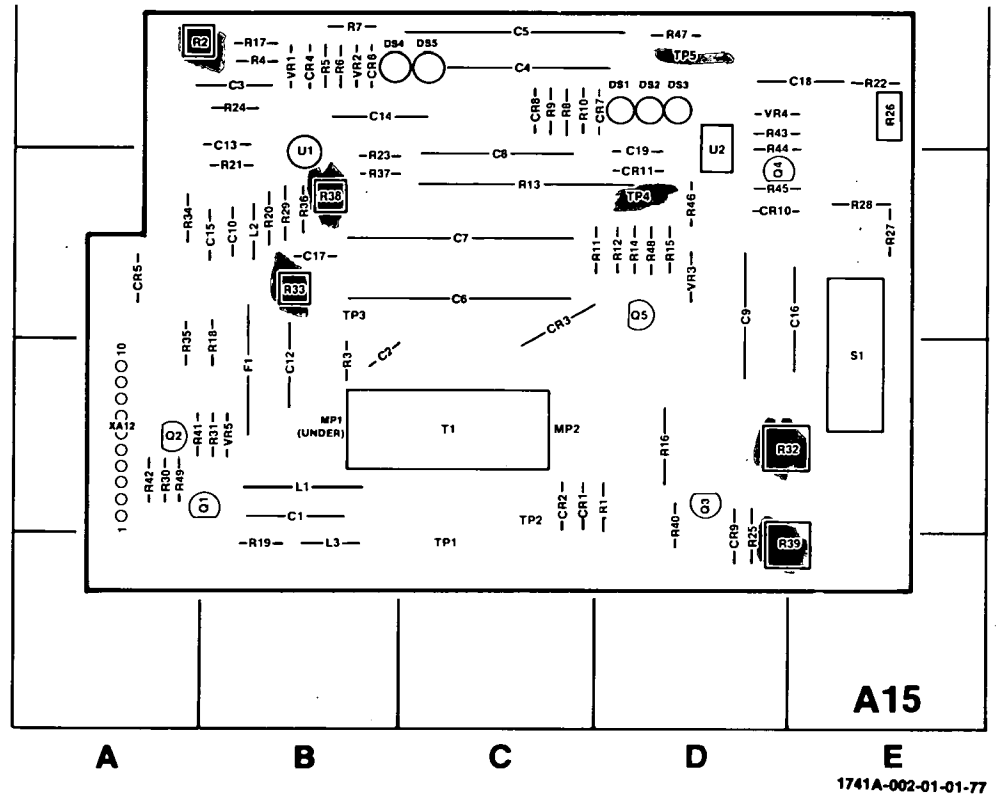
HIGH VOLTAGE RECTIFIER. The CRT cathode and grid voltages are developed in the secondary of high-voltage transformer A15T1. The cathode voltage is rectified by A15CR3 and filtered by network A15C6/A15R11/A15C7 before application to the CRT. The rectified cathode voltage is also used as a reference level for the CRT filament voltage (developed on a separate secondary winding on A15T1), the grid bias voltage, and focus voltage. The cathode voltage is adjusted to -2295 V by HV ADJ potentiometer A15R38.

The CRT grid voltage is picked off the secondary winding of transformer A15T1 at pin 5. The voltage is applied through an RC network (A15C2/A15R3) to diodes that clamp the voltage swing between that established by intensity limit control A15R2 and the gate dc levels. The peak-to-peak voltage swing is rectified and applied to the CRT grid which is voltage-referenced to the cathode. This controls the brightness of the CRT trace.

The HV Multiplier voltage is picked off the secondary winding of transformer A15T1 at pin 7. The voltage is applied to HV Multiplier Assembly A6 where it is multiplied (X3) and then applied to the post accelerator of the CRT. The post accelerator voltage is approximately +5 kV.

CONVENTIONAL MODE OF OPERATION. The gain of the vertical and horizontal amplifiers are adjusted in the variable persistence mode of operation with the CRT cathode voltage adjusted for -2295 volts. Since floodgun elements within the CRT develop electrostatic fields when in use, the accelerating potential in the variable persistence mode is greater than that required in the conventional mode of operation. This is accomplished by setting the cathode voltage more negative in the variable persistence mode of operation.

In conventional mode of operation a ground is applied to A15R34 from storage assembly A17, establishing a voltage divider network consisting of A15R36/A15R33/A15R34. The additional gain required in the vertical and horizontal amplifiers in the variable persistence mode is compensated for by CONV GAIN ADJ, A15R33, which varies the reference voltage applied to HV ADJ A15R38. Therefore, when switching between variable persistence mode and conventional mode of operation, no additional gain adjustments are required to calibrate the instrument.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-1	CR4	B-3	Q5	D-3	R22	E-4	R44	D-4
C2	B-2	CR5	A-3	R1	D-2	R23	B-3	R45	D-3
C3	B-4	CR6	B-3	R2	A-4	R24	B-3	R46	D-3
C4	C-4	CR7	D-4	R3	B-1	R25	D-2	R47	D-4
C5	C-4	CR8	C-4	R4	B-4	R26	E-4	R48	D-3
C6	C-3	CR9	D-2	R5	B-3	R27	E-3	R49	A-2
C7	C-3	CR10	D-3	R6	B-3	R28	E-3	S1	E-2
C8	C-3	CR11	D-3	R7	B-4	R29	B-3	T1	C-2
C9	D-3	DS1	D-4	R8	C-4	R30	A-2	TP1	C-1
C10	B-3	DS2,3	D-4	R9	C-4	R31	B-1	TP2	C-2
C11	D-2	DS4	B-3	R10	C-4	R32	D-2	TP3	B-3
C12	B-1	DS5	C-4	R11	C-3	R33	B-3	TP4	D-3
C13	B-4	F1	B-1	R12	D-3	R34	A-3	TP5	D-4
C14	B-3	L1	B-1	R13	C-3	R35	A-2	U1	B-3
C15	B-3	L2	B-3	R14	D-3	R36	B-3	U2	D-4
C16	D-3	L3	B-1	R15	D-3	R37	B-3	VR1	B-3
C17	B-3	MP1	B-1	R16	D-2	R38	B-3	VR2	B-3
C18	E-4	MP2	C-2	R17	B-3	R39	D-2	VR3	D-3
C19	D-4	Q1	A-2	R18	B-2	R40	D-2	VR4	D-4
CR1	C-2	Q2	A-2	R19	B-1	R41	A-2	VR5	B-1
CR2	C-2	Q3	D-2	R20	B-3	R42	A-2	XA12	A-2
CR3	C-3	Q4	D-3	R21	B-2	R43	D-4		

Power Supply A15 Component Location
(01741-66511)

Figure 8-17. Service Information, High-voltage Power Supply Assembly A15 (Sheet 1 of 2)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 2

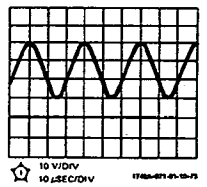
1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variations from those indicated should be considered normal.

WARNING

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

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 2

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



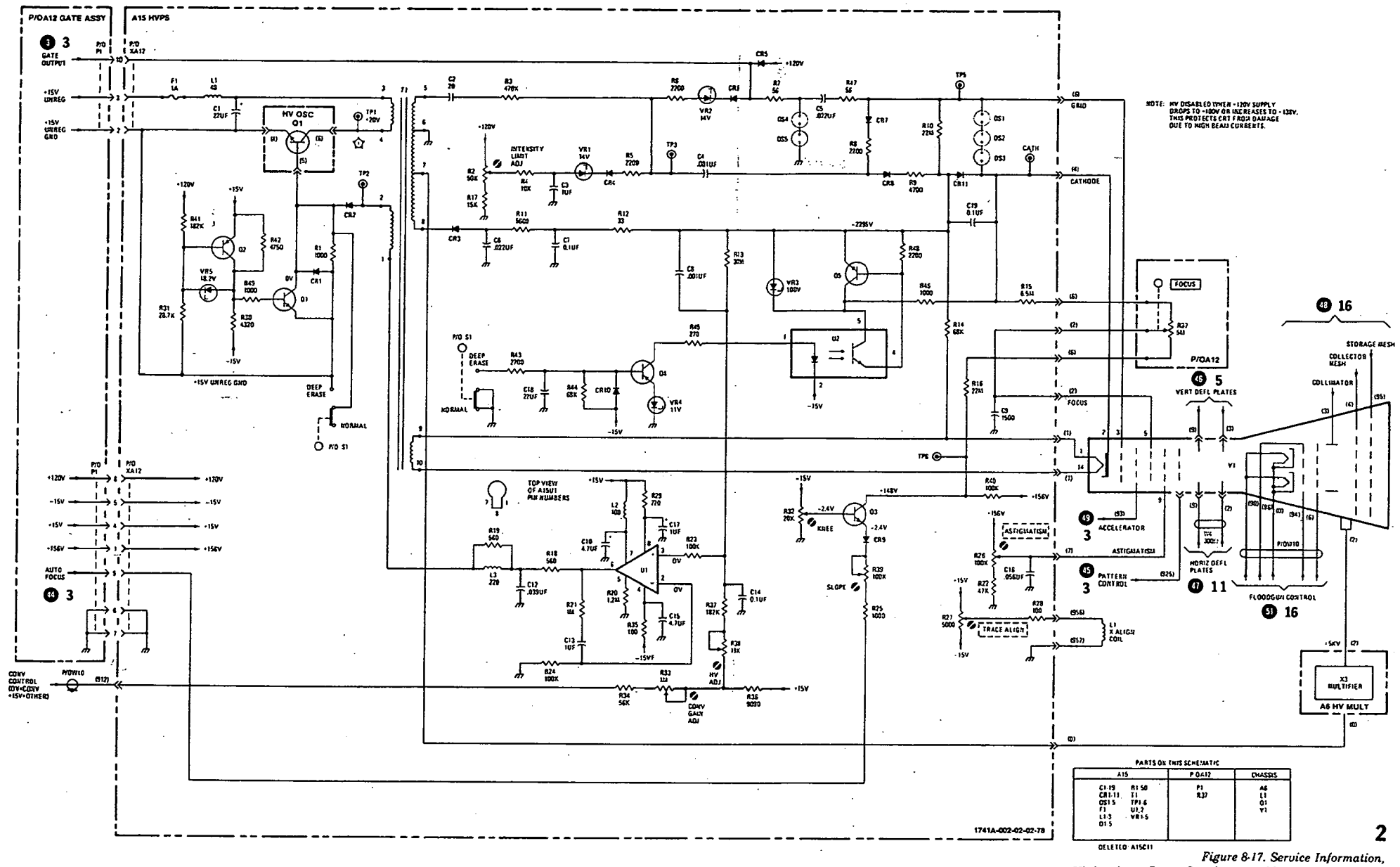


Figure 8-17. Service Information, High-voltage Power Supply Assembly A15 (Sheet 2 of 2)

SCHEMATIC 3

GATE ASSEMBLY - CIRCUIT THEORY

GENERAL. Gate assembly A12 controls trace intensity on the CRT. A12U1 sums all functions necessary for control of trace intensity. Inputs to A12U1 are external Z AXIS inputs, main gate, delayed gate, chop blanking, and erase blanking.

BEAM INTENSITY. Front-panel BEAM INTENSITY control A12R25 establishes the amount of current supplied by current source A12Q8 to current switches in A12U1. Outputs from the current switches are applied to gate amplifier circuit A12Q1 through A12Q4. The greater the current, the brighter the trace.

INTENSITY LIMIT. Transistors A12Q5/A12Q7 make up an intensity limit circuit. As intensity becomes excessive in the CRT, the accelerator element begins to draw current. This increases the current through A12R20, causing the base voltage of A12Q7 to change. The collector output of A12Q7 follows this change and is applied to Darlington amplifier A12Q5. The output of A12Q5 is applied to the base of current source A12Q8, limiting the current available from BEAM INTENSITY control A12R25.

AUTO FOCUS. BEAM INTENSITY also controls the auto-focus circuit through current source A12Q8. Varying the BEAM INTENSITY control varies the bias applied to the emitter circuit of A15Q3 (see schematic 2). As conduction through A15Q3 increases or decreases, the voltage drop across A15R40 increases or decreases. This varies the reference voltage applied to FOCUS control A12R37 and automatically changes beam focus to be compatible with the BEAM INTENSITY setting.

MAIN GATE. The main gate signal is applied to the base of A12U1Q1 to control its operation. When the main gate signal is low, A12U1Q1 turns off and A12U1Q2 turns on, unblanking the CRT. When the main gate signal is high, A12U1Q1 turns on and A12U1Q2 turns off, blanking the CRT.

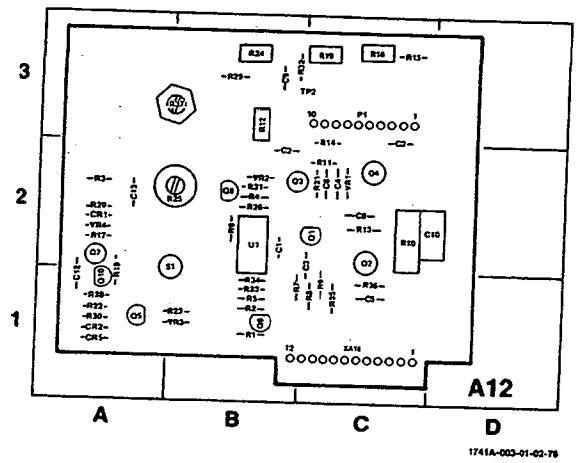
DELAYED GATE. The delayed gate signal is applied to the base of A12U1Q5. With the delay gate signal high, A12U1Q5 conducts, unblanking the CRT. When the delayed gate signal is low, A12U1Q5 turns off and A12U1Q4 turns on (keeping A12U1Q5 turned off).

CHOP BLANKING. Chop blanking is accomplished by A12U1Q3. When CHOP mode of operation is selected the chop blanking signal causes A12U1Q3 to alternately turn on and off at the chop blanking repetition rate (≈250 kHz). When conducting, A12U1Q3 turns off A12U1Q2, blanking the CRT. When A12U1Q3 is not conducting, A12U1Q2 turns on, unblanking the CRT.

Z-AXIS BLANKING. A signal of +4 volts (greater than 50 nanoseconds in pulse width) applied to the Z-AXIS input connector will cause A12Q6 to conduct heavily turning off A12U1Q2, blanking the CRT.

BEAM FIND CONTROL. Engaging BEAM FIND switch A12S1 adds a fixed voltage level to the setting of the BEAM INTENSITY control. The signal is applied through the gate amplifier causing intensification of the CRT trace.

GATE AMPLIFIER. The gate amplifier is a shunt feedback stage consisting of A12Q1 through A12Q4. Transistors A12Q1 and A12Q3 are emitter followers with A12Q1 furnishing the ac signal path. Network A12R13/A12C8 provides the feedback path.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	Q3	B-2	R11	C-2	R30	A-1
C2	C-3	Q4	C-2	R12	B-3	R31	B-2
C3	C-2	Q5	A-1	R13	C-2	R32	B-3
C4	C-2	Q6	B-1	R14	C-2	R33	B-1
C5	C-1	Q7	A-2	R15	C-3	R34	B-1
C6	C-2	Q8	B-2	R16	C-3	R35	C-1
C8	C-2	Q10	A-1	R17	A-2	R36	C-1
C9	B-3	R1	B-1	R18	A-1	R37	B-2
C10	D-2	R2	B-1	R19	C-3	R38	B-3
C12	A-1	R3	B-2	R20	A-2	S1	A-1
C13	B-2	R4	B-2	R21	C-2	TP2	B-1
CR1	A-2	R5	B-1	R22	A-1	U1	C-3
CR2	A-1	R6	B-2	R23	B-1	VR1	B-2
CR5	A-1	R7	B-1	R24	B-3	VR2	C-2
P1	C-3	R8	C-1	R25	B-2	VR3	B-2
Q1	C-2	R9	C-1	R26	B-2	VR4	B-1
Q2	C-2	R10	C-2	R29	B-3	XA16	A-2

Gate Amplifier A12 Component Locator
(01741-66516)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 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% variation from those indicated should be considered normal.

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 3

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

Coupling (channel A)	50Ω
TIME/DIV (delayed)	1 μSEC
DELAY	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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 Vpk) at 5 kHz.

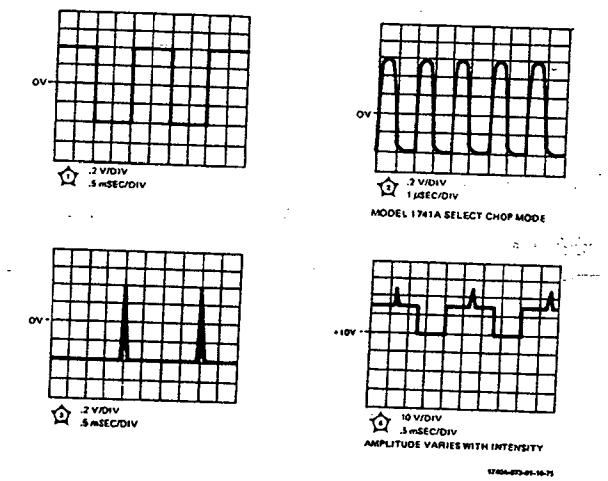


Figure 8-18. Service Information, Gate Amplifier Assembly A12 (Sheet 1 of 2)

SCHEMATIC 4

CHANNEL A, CHANNEL B PREAMPLIFIER-CIRCUIT THEORY

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. The contacts connect appropriate pads on the preamplifier assembly to complete coupling and attenuation requirements for the input circuit. Refer to charts on the schematic which indicate appropriate switch closures for VOLTS/DIV and coupling settings. The VOLTS/DIV switch selects X1 or X100 attenuation circuits in the input circuit, X1 or X10 attenuation circuits in preamplifier substrate A3A1, and X1, X2, or X4 attenuation circuits, also in substrate A3A1.

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. 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 substrate 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; they also 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.

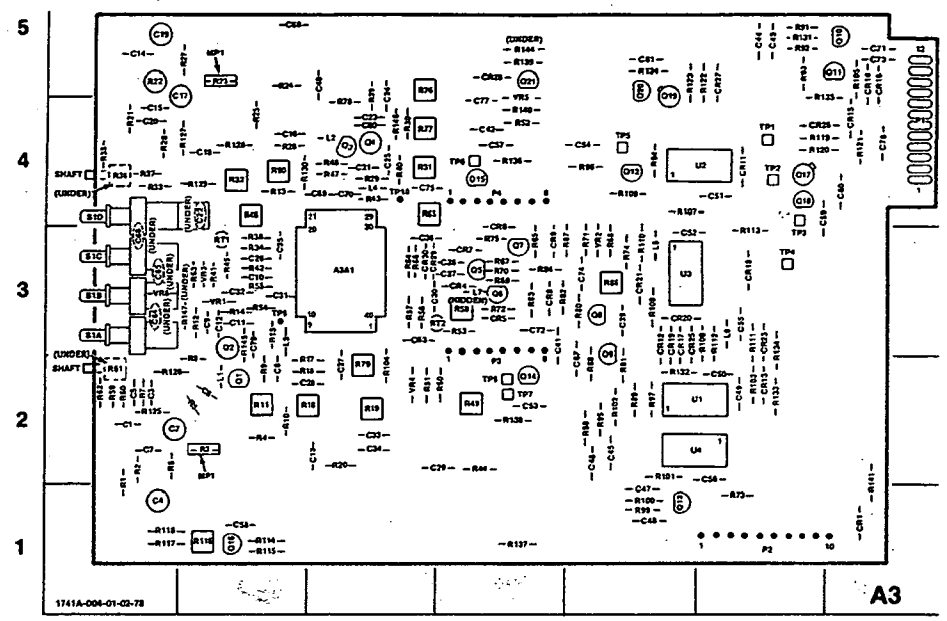
The bandwidth limit circuit shunts the delay line input, and by switching the appropriate capacitance across the line, limits frequency response to approximately 20 MHz. Diodes CR29 and CR30 are hot-carrier type diodes that limit the output swing of the vertical preamplifier.

Trigger view amplifier A3Q6/A3Q7 routes output signals from trigger conditioning circuit A7Q1 (schematic 7) to delay line 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 (schematic 3) is pressed, sufficient current is applied through A3CR4/A3CR5 and A3CR6/A3CR7 to lower sensitivity of the input to the delay line, causing the trace to return to the viewing area of the CRT.

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

DELAY LINE. Output of the vertical preamplifier is applied to delay line assembly A4. The delay line has a differential impedance of approximately 180 ohms and provides a time delay of 100 nanoseconds which allows the internal sync signal sufficient time to trigger the horizontal sweep before the input vertical signal is applied to the CRT vertical deflection plates.



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
A3A1	C-3	C38	D-3	C78	G-4	P4	D-4	R17	C-2	R55	B-3	R93	F-5	R131	F-5
C1	A-2	C39	E-3	C79	B-3	Q1	B-2	R18	C-2	R56	C-3	R94	E-4	R132	E-2
C2	A-2	C40	D-5	C80	C-4	Q2	B-3	R19	C-2	R57	C-3	R95	E-2	R133	F-2
C3	A-2	C41	D-3	CR1	G-1	Q3	C-2	R20	C-2	R58	C-3	R96	E-4	R134	F-2
C4	A-1	C42	D-4	CR4	D-3	Q4	C-4	R21	A-4	R59	A-2	R97	E-2	R135	F-5
C5	A-2	C43	F-4	CR5	D-2	Q5	C-3	R22	A-5	R60	A-2	R98	E-2	R136	D-4
C6	B-2	C44	F-5	CR6	D-3	Q6	D-3	R23	B-5	R61	A-2	R99	E-1	R137	D-1
C7	A-2	C45	E-2	CR7	D-3	Q7	D-3	R24	B-5	R62	A-2	R100	E-1	R138	D-2
C8	B-2	C46	E-2	CR8	D-3	Q8	E-3	R25	B-4	R63	B-3	R101	E-2	R139	D-5
C9	B-3	C47	E-1	CR9	D-3	Q9	E-3	R26	B-4	R64	B-3	R102	E-2	R140	D-4
C10	B-3	C48	E-1	CR11	F-4	Q10	G-5	R27	B-5	R65	C-4	R103	F-2	R141	G-2
C11	B-3	C49	F-2	CR12	E-3	Q11	G-5	R28	A-4	R66	C-3	R104	C-2	R144	D-5
C12	B-3	C50	F-2	CR13	F-2	Q12	E-4	R29	C-4	R67	D-3	R105	G-5	R145	B-3
C13	C-2	C51	F-4	CR14	G-5	Q13	E-1	R30	C-4	R68	E-3	R106	F-3	R146	C-4
C14	A-5	C52	D-3	CR15	E-4	Q14	D-2	R31	C-4	R69	D-3	R107	E-4	R147	B-3
C15	A-4	C53	D-2	CR16	G-5	Q15	D-4	R32	B-4	R70	D-3	R108	E-3	RT1	B-3
C16	B-4	C54	E-4	CR17	E-3	Q16	B-1	R33	A-4	R71	E-3	R109	E-4	RT2	C-3
C17	A-5	C55	F-3	CR18	F-3	Q17	F-4	R34	B-3	R72	D-3	R110	E-3	S1A	A-3
C18	B-4	C56	F-2	CR19	E-3	Q18	F-4	R35	A-4	R73	F-1	R111	F-3	S1B	A-3
C19	A-5	C57	D-4	CR20	E-3	Q19	E-5	R36	A-4	R74	E-3	R112	F-3	S1C	A-3
C20	A-4	C58	B-1	CR21	E-3	Q20	E-5	R37	A-4	R75	D-3	R113	F-3	S1D	A-4
C21	C-4	C59	F-4	CR23	F-3	Q21	D-5	R38	B-3	R76	C-5	R114	B-1	TP1	F-4
C22	B-4	C60	G-4	CR25	E-3	R1	C-4	R39	B-5	R77	C-4	R115	B-1	TP2	F-4
C23	C-4	C61	E-5	CR26	F-4	R2	A-2	R40	C-4	R78	C-4	R116	B-1	TP3	F-4
C24	C-5	C62	C-3	CR27	F-5	R3	B-2	R41	B-3	R79	C-2	R117	A-1	TP4	F-3
C25	C-4	C64	A-3	CR28	D-5	R4	B-2	R42	B-3	R80	E-3	R118	A-1	TP5	E-4
C26	B-3	C65	A-3	CR29	C-3	R5	B-2	R43	C-4	R81	E-2	R119	F-4	TP6	D-4
C27	C-2	C66	A-2	CR30	C-3	R6	A-2	R44	D-2	R82	D-3	R120	F-4	TP7	D-2
C28	C-2	C67	E-2	L1	B-2	R7	A-2	R45	B-3	R83	D-3	R121	G-4	TP8	D-2
C29	D-2	C68	B-5	L2	C-4	R8	B-2	R46	B-4	R84	D-3	R122	F-5	TP9	B-3
C30	C-3	C69	C-4	L3	B-3	R9	B-3	R47	C-4	R85	D-3	R123	E-5	TP10	C-4
C31	B-3	C70	C-4	L4	C-4	R10	B-2	R48	C-4	R86	E-3	R124	E-5	U1	E-2
C32	B-3	C71	G-5	L5	E-3	R11	B-2	R49	D-2	R87	D-3	R125	A-2	U2	F-4
C33	C-2	C72	D-3	L6	E-3	R12	B-3	R50	D-2	R88	E-2	R126	A-2	U3	E-3
C34	C-3	C73	G-5	L7	D-3	R13	B-4	R51	C-2	R89	E-2	R127	B-4	U4	E-2
C35	B-3	C74	E-3	P1	G-4	R14	B-3	R52	D-4	R90	B-4	R128	B-4	VR1	B-3
C36	C-3	C75	C-4	P2	F-1	R15	B-3	R53	D-3	R91	F-5	R129	B-4	VR2	E-3
C37	D-3	C77	D-4	P3	D-2	R16	C-2	R54	B-3	R92	F-5	R130	B-4	VR3	B-3
														VR4	C-2
														VR5	D-4
														VR6	A-3

Vertical Preamplifier A3 (01740-66530)

DC VOLTAGE MEASUREMENT CONDITIONS SCHEMATIC 4

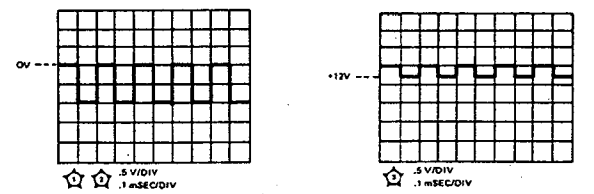
1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those *indicated should be considered* normal.

WAVEFORM MEASUREMENT CONDITIONS SCHEMATIC 4

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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



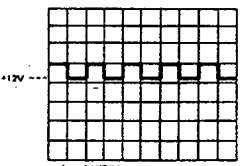


Figure 8-19. Service Information, Vertical Preamplifier Assembly A3 (Sheet 1 of 2)

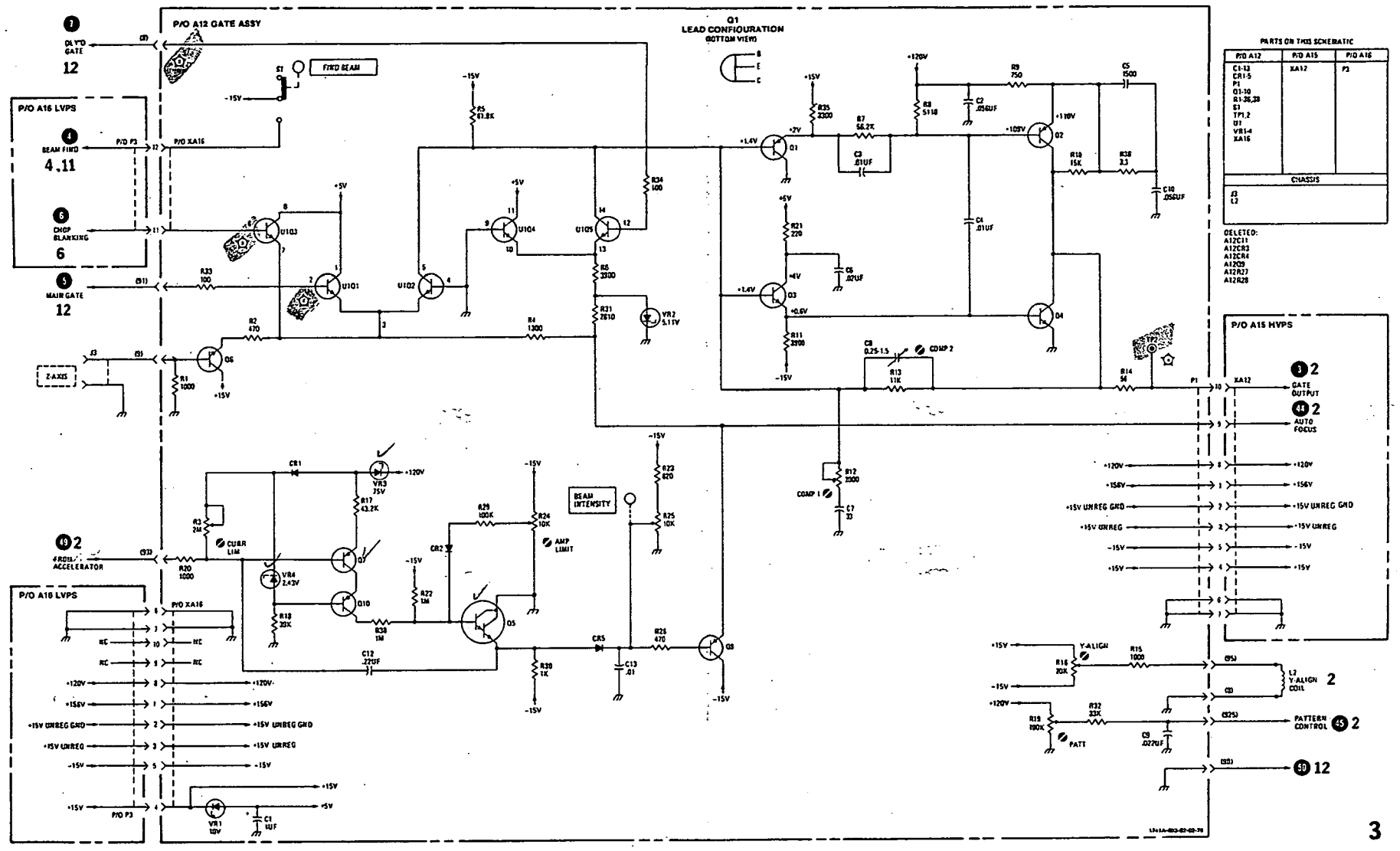


Figure 8-18. Service Information, Gate Amplifier Assembly A12 (Sheet 2 of 2)

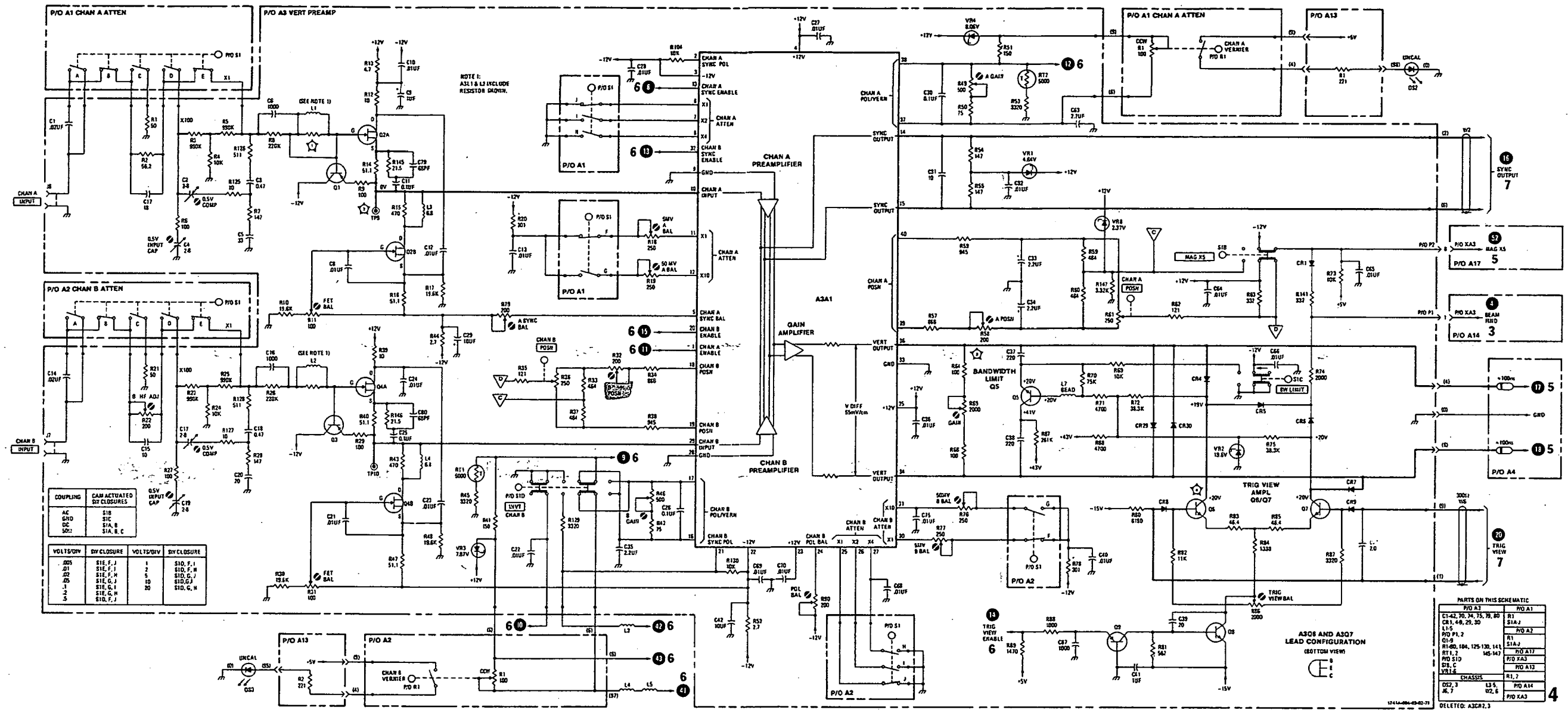


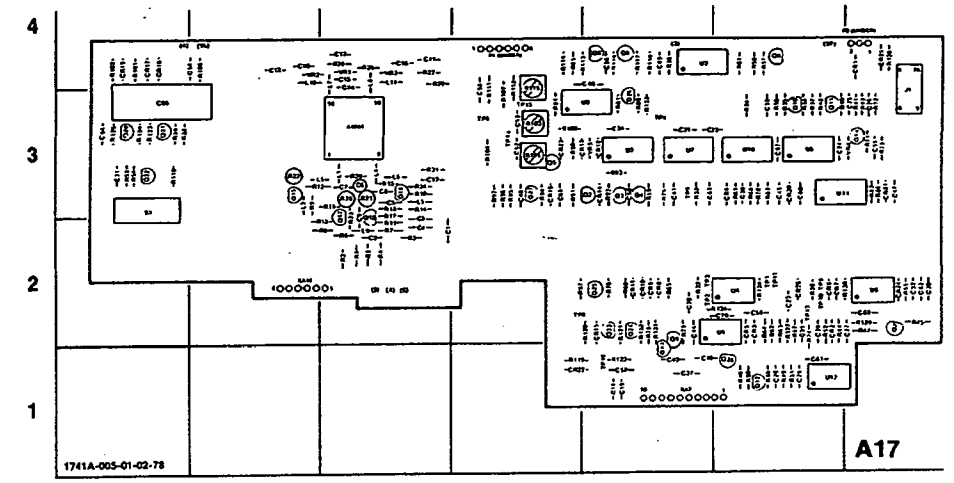
Figure 8-19. Service Information, Vertical Preamplifier Assembly A3 (Sheet 2 of 2)

SCHEMATIC 5

VERTICAL OUTPUT AMPLIFIER - CIRCUIT THEORY

VERTICAL OUTPUT PREAMPLIFIER. The vertical output amplifier consists of a vertical output preamplifier and output amplifier substrate A17A1. Vertical output preamplifier A17Q17/A17Q18 terminates differential delay line A4 and translates the common-mode bias level to ground for the output amplifier substrate. A X5 magnifier circuit (A17Q15/A17Q16) is incorporated in the output preamplifier stage. Normally, with MAG X5 switch A3S1B not engaged, A17Q15/A17Q16 conducts and functions as a current sink for the input signal to the output preamplifier. When MAG X5 is engaged, A3S1B turns off A17Q15/A17Q16, increasing the system gain by a factor of five. Complementary circuitry on the vertical preamplifier assembly (schematic 4) simultaneously diminishes position range by the same factor to maintain a consistent position control range.

VERTICAL OUTPUT AMPLIFIER. Substrate A17A1 contains resistors, a high-frequency monolithic chip, and two discrete transistor chips. It provides drive for the CRT vertical deflection plates and has a differential voltage gain in excess of 100. High frequency adjustments A17C6, A17R19, A17R21, and A17R22 control the shape of the pulse response.



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	REF DESIG	GRID LOC
A17A1	C-3	C38	F-3	CR8	E-2	Q5	D-3	R14	C-3	R52	F-2	R90	D-3	R131	E-2
C1	C-2	C39	F-2	CR9	E-2	Q6	F-4	R15	C-3	R53	A-3	R91	D-3	R132	E-2
C2	C-2	C40	E-1	CR10	E-2	Q7	G-2	R16	C-3	R54	A-3	R92	E-3	R133	E-3
C3	C-2	C41	E-3	CR11	E-2	Q8	E-4	R17	C-3	R55	G-2	R93	E-3	R134	F-2
C4	C-2	C43	E-1	CR12	E-3	Q9	E-4	R18	C-3	R56	F-3	R94	D-3	S1	A-3
C5	C-3	C44	E-2	CR13	E-3	Q10	F-3	R19	C-3	R57	F-4	R95	D-3	TP1	F-2
C6	C-2	C45	F-3	CR14	E-3	Q11	F-3	R20	C-3	R58	F-4	R96	D-3	TP2	E-2
C7	C-2	C46	E-4	CR15	E-2	Q12	F-1	R21	C-3	R59	E-3	R97	D-3	TP3	E-2
C8	C-2	C47	G-3	CR16	D-3	Q13	E-1	R22	C-3	R60	E-2	R100	D-3	TP4	E-3
C9	C-3	C48	D-3	CR17	A-4	Q14	G-3	R23	C-3	R61	F-4	R101	A-4	TP5	F-2
C10	B-4	C50	E-3	CR18	A-4	Q15	B-3	R24	C-3	R62	F-2	R102	A-4	TP6	D-3
C11	C-4	C52	D-3	CR19	A-4	Q16	C-3	R26	C-4	R63	F-2	R103	D-3	TP8	D-2
C12	B-4	C53	D-3	CR20	F-3	Q17	C-3	R27	C-4	R64	F-2	R104	D-3	TP9	E-3
C13	C-4	C54	A-4	CR21	G-3	Q18	C-3	R28	C-4	R65	E-2	R105	D-3	TP10	F-2
C14	C-4	C55	D-3	CR22	D-1	Q20	A-3	R29	C-4	R67	F-2	R106	B-4	TP11	F-2
C15	C-4	C56	E-4	CR23	D-3	Q21	A-3	R31	C-3	R68	F-3	R107	D-4	TP13	F-2
C16	C-4	C57	E-1	CR24	G-2	Q22	A-3	R32	E-2	R69	F-3	R110	A-3	TP14	D-3
C17	C-3	C58	F-2	CR25	G-4	Q23	E-2	R33	E-3	R70	F-3	R111	D-3	TP15	D-3
C18	E-1	C59	G-3	CR26	F-2	Q24	E-2	R34	F-3	R71	G-3	R112	D-4	TP16	E-1
C19	E-1	C60	F-3	J1	G-3	Q25	E-2	R35	F-3	R72	G-3	R113	D-4	U1	F-2
C20	E-2	C61	F-1	L1	C-3	Q26	E-3	R36	E-4	R73	G-3	R114	D-4	U2	E-4
C21	E-3	C62	G-2	L2	B-3	Q27	D-3	R37	F-3	R74	F-2	R115	D-4	U3	E-3
C22	E-2	C63	E-3	L3	C-3	Q28	F-1	R38	F-3	R75	E-3	R116	E-4	U4	F-2
C23	F-2	C64	A-3	L4	C-3	R1	C-2	R39	F-2	R76	E-2	R117	E-4	U5	G-2
C24	F-3	C65	D-3	L5	B-3	R2	C-2	R40	F-3	R78	E-2	R118	E-4	U7	E-3
C25	G-3	C66	A-3	L6	C-3	R3	C-2	R41	G-3	R79	E-2	R119	D-1	U8	E-3
C26	G-3	C67	F-3	L7	C-4	R4	C-2	R42	F-3	R80	E-3	R120	E-2	U9	F-3
C27	F-2	C68	G-2	L8	C-4	R5	C-2	R43	G-2	R81	E-3	R121	E-2	U10	F-3
C28	F-1	C69	E-4	L9	C-2	R6	C-2	R44	F-2	R82	F-3	R122	E-1	U11	G-3
C29	F-1	C70	F-2	L10	B-4	R7	C-2	R45	G-2	R83	G-3	R123	A-3	U12	F-1
C30	G-2	CR1	G-4	L11	C-4	R8	C-2	R46	F-1	R84	D-3	R124	A-3	VR1	C-4
C31	A-3	CR2	F-2	P1	D-4	R9	B-3	R47	G-2	R85	D-4	R125	A-3	VR2	B-4
C32	G-2	CR3	F-2	P2	G-4	R10	C-3	R48	F-1	R86	G-3	R126	G-4	VR3	C-4
C33	F-3	CR4	F-3	Q1	E-2	R11	C-2	R49	F-1	R87	D-2	R127	F-2	VR4	G-3
C34	E-3	CR5	F-2	Q2	E-3	R12	B-3	R50	F-1	R88	A-3	R128	F-2	VR5	E-3
C35	F-2	CR6	F-2	Q3	E-3	R13	C-2	R51	F-1	R89	A-3	R129	G-2	XA3	E-1
C37	E-1	CR7	F-2	Q4	E-3					R90	D-3	R130	G-2	XA16	B-2

Vertical Output A17 Component Locator
(01741-66509)

Figure 8-20. Service Information, Vertical Output P/O Assembly A17 (Sheet 1 of 2)

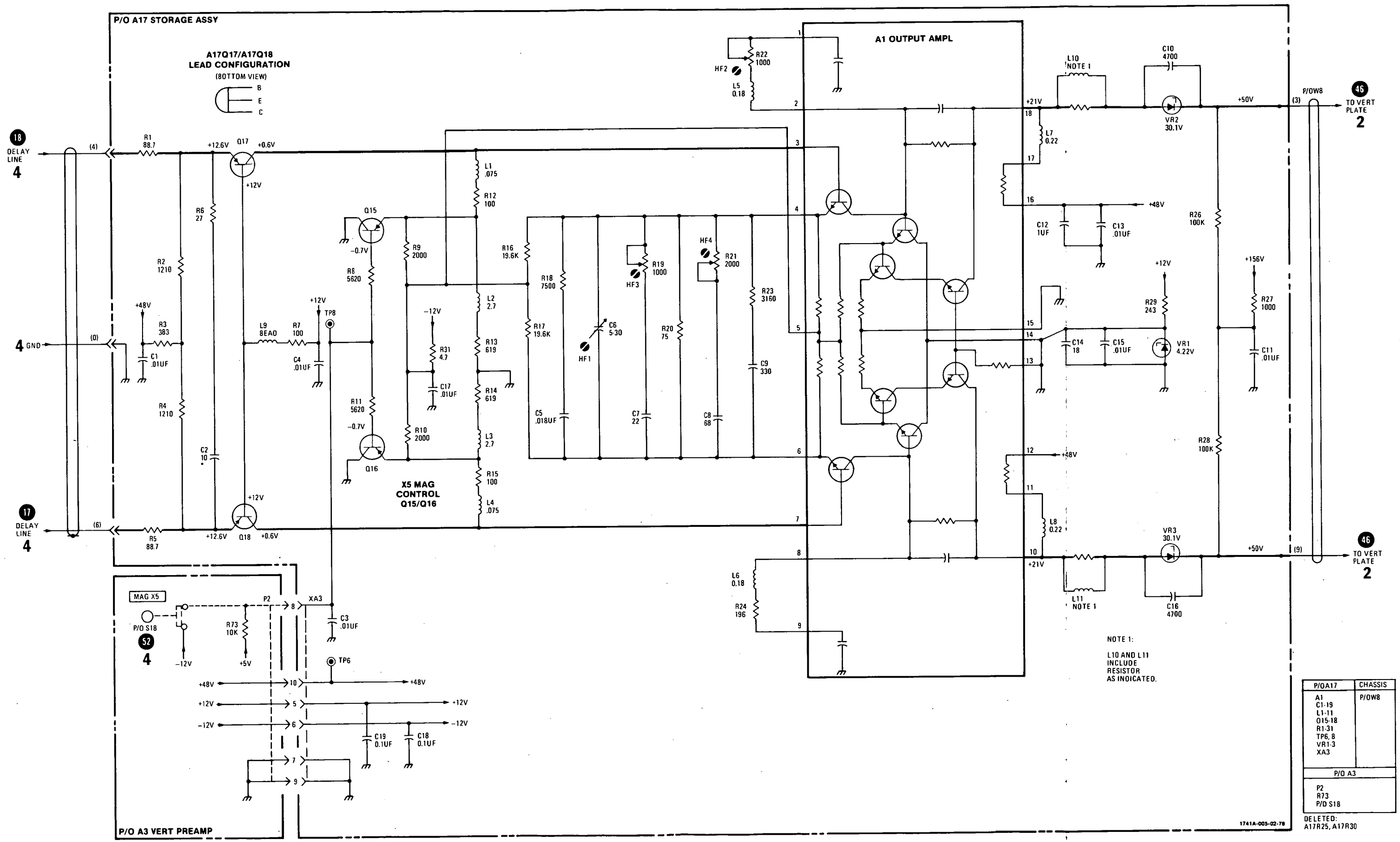


Figure 8-20. Service Information, Vertical Output P/O Assembly A17 (Sheet 2 of 2)

SCHEMATIC 6

PREAMPLIFIER CONTROLS - CIRCUIT THEORY

GENERAL. Vertical control Switching Assembly A13 selects the trigger and display modes by controlling 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 A13TP 5 indicates channel B is on; a high indicates channel B is off.

CHANNEL A+B DISPLAY. To algebraically display channel A and channel B, DISPLAY switches A13S2B and A13S2C are engaged simultaneously; both clear and preset inputs to A3U2A are grounded, forcing both Q and $\overline{Q}$ 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, channels A and B are alternately turned on and off.

CHOP MODE DISPLAY. In CHOP mode display, channel A and channel B are alternately switched on/off as in ALT mode of operation, except 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, causing each channel to be displayed at a 250-kHz rate.

TRIG VIEW MODE DISPLAY. If channel A or channel B display is selected, engaging TRIG VIEW switch A3S1A forces a low state on one 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, and A3U3C, is clocked by either the chop oscillator signal or the ALT SIGNAL. In this manner, the trigger signal, channel A, and channel B are switched on alternately.

CHANNEL A TRIGGER CIRCUIT. Engaging TRIGGER A sync switch A13S1A grounds the preset input on A3U2B (pin 10), forcing Q high (pin 9). This state is inverted by A3U3D, turning off A3Q14, and causing a low on channel A sync enable line. A low at test point A3TP8 indicates sync A is on; a high 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 $\overline{Q}$ (pin 8) to go high. The high is inverted by A3U3B, turning off A3Q15, and causing a low on channel B sync enable line. A low at test point A3TP6 indicates sync B is on; a high indicates sync B is off.

COMPOSITE TRIGGER CIRCUIT. When composite triggering is selected, channel A and channel B TRIGGER switches are engaged simultaneously. In A+B mode of display, low states are applied to both the preset and clear inputs on A3U2B causing both Q and $\overline{Q}$ 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 mode of display, engaging channel A and channel B TRIGGER switches simultaneously removes the preset and clear overrides from A3U2B and allows 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 of display, engaging channel A and channel B TRIGGER switches selects sync A only as the internal trigger source. Again, pin 1 on A3U1A is grounded.

DC VOLTAGE MEASUREMENT CONDITIONS SCHEMATIC 6

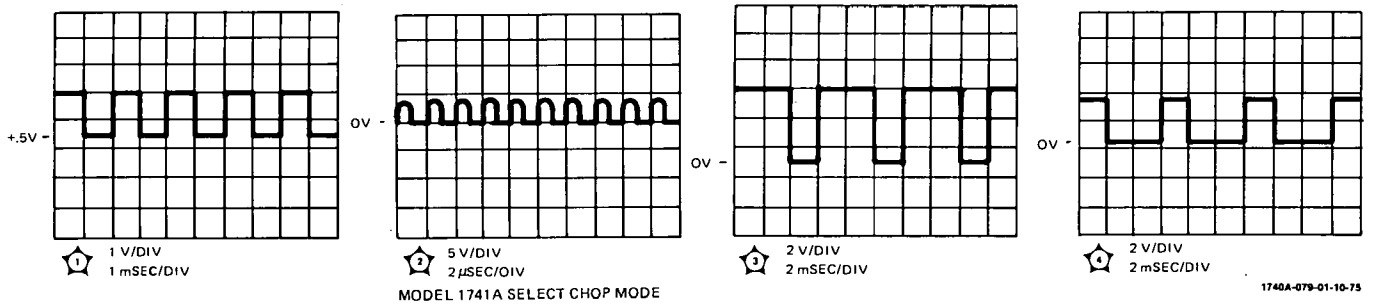
1. Set front-panel controls in accordance with initial control settings in Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

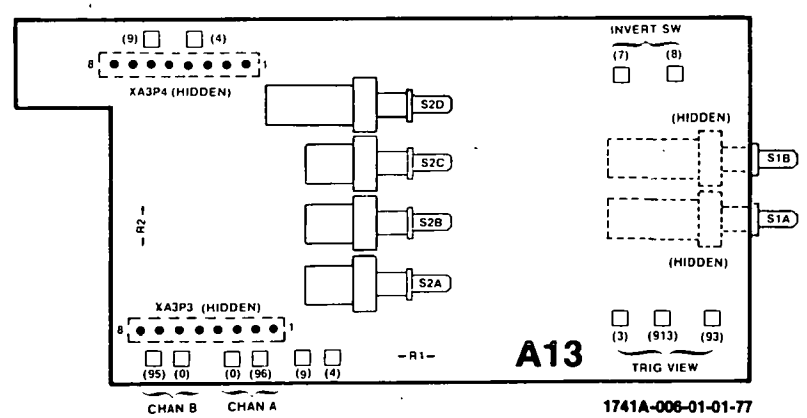
WAVEFORM MEASUREMENT CONDITIONS SCHEMATIC 6

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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.





NOTE
See Figure 8-19
for Assembly A3
Component Identification

Vertical Control A13 Component Locator
(01740-66516)

Figure 8-21. Service Information, Vertical Control Assembly A13 (Sheet 1 of 2)

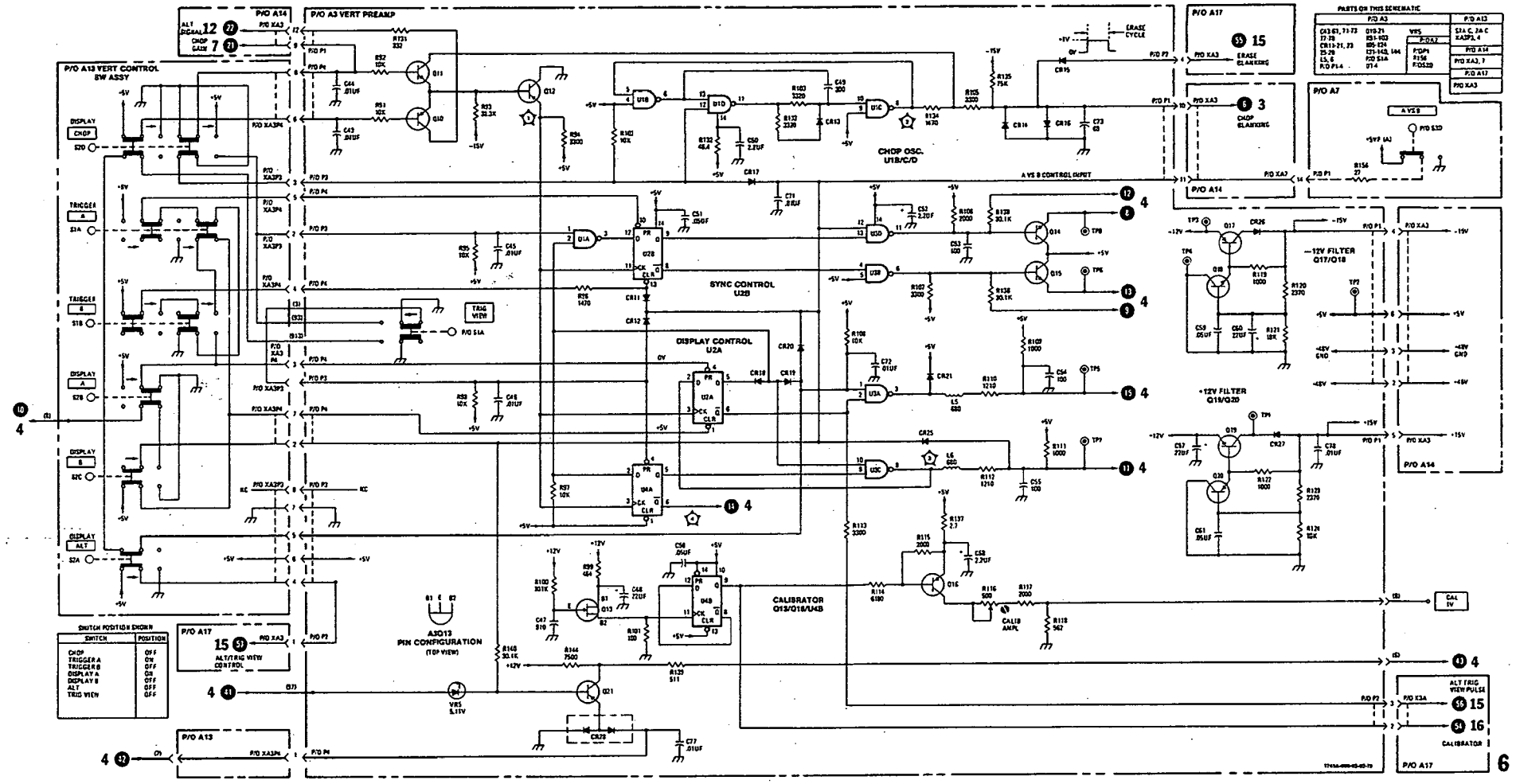
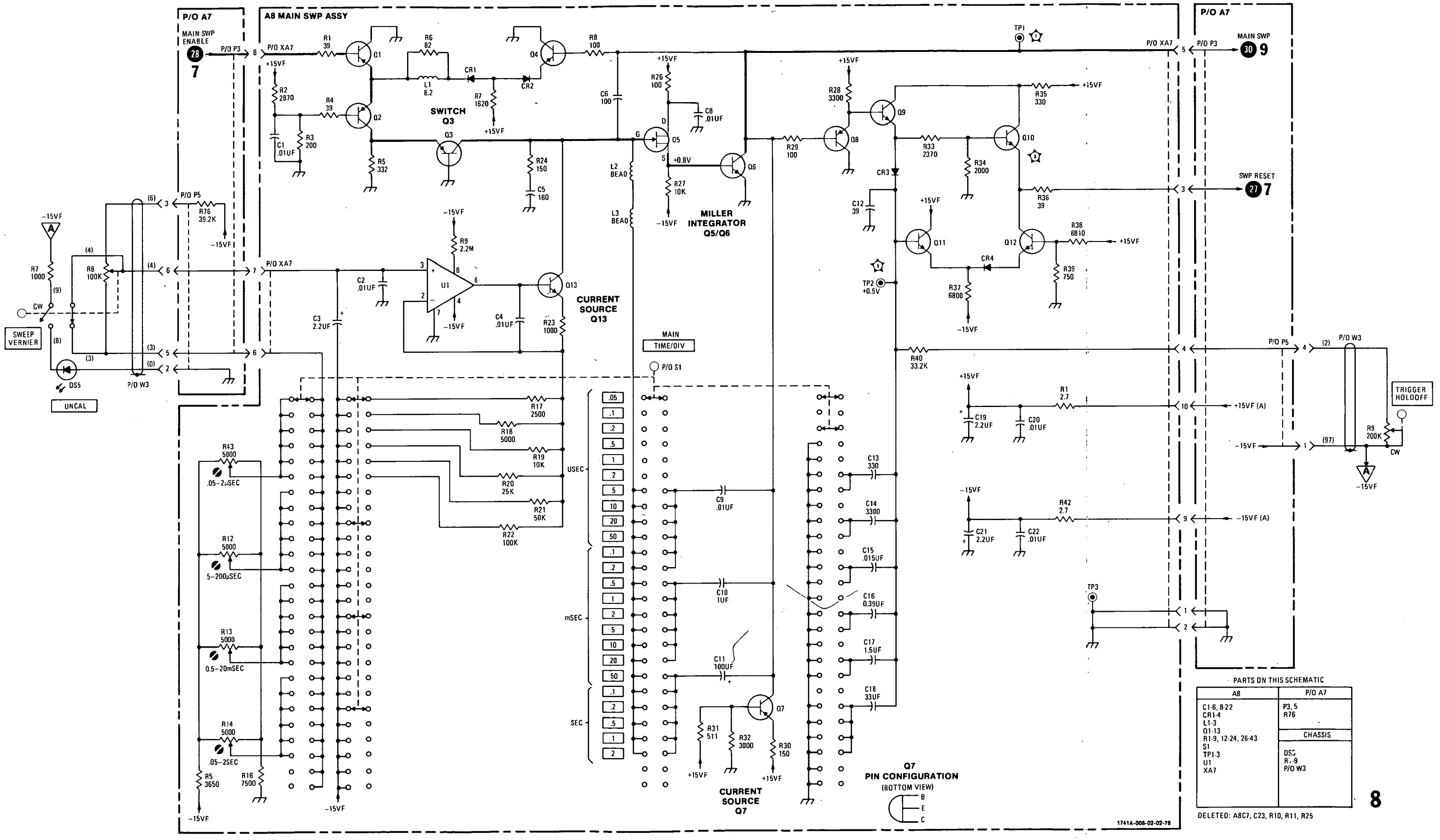


Figure 8-21. Service Information, Vertical Control Assembly A13 (Sheet 2 of 2)



PARTS ON THIS SCHEMATIC

A8	P/O A7
C1-6, 8-22 CR1-4 L1-3 Q1-13 R1-9, 12-24, 26-43 S1 TP1-3 U1 XA7	P3, 5 R76 CHASSIS DS5 P/O W3

DELETED: A8C7, C23, R10, R11, R25

8

Figure 8-23. Service Information, Main Sweep Assembly A8 (Sheet 2 of 2)

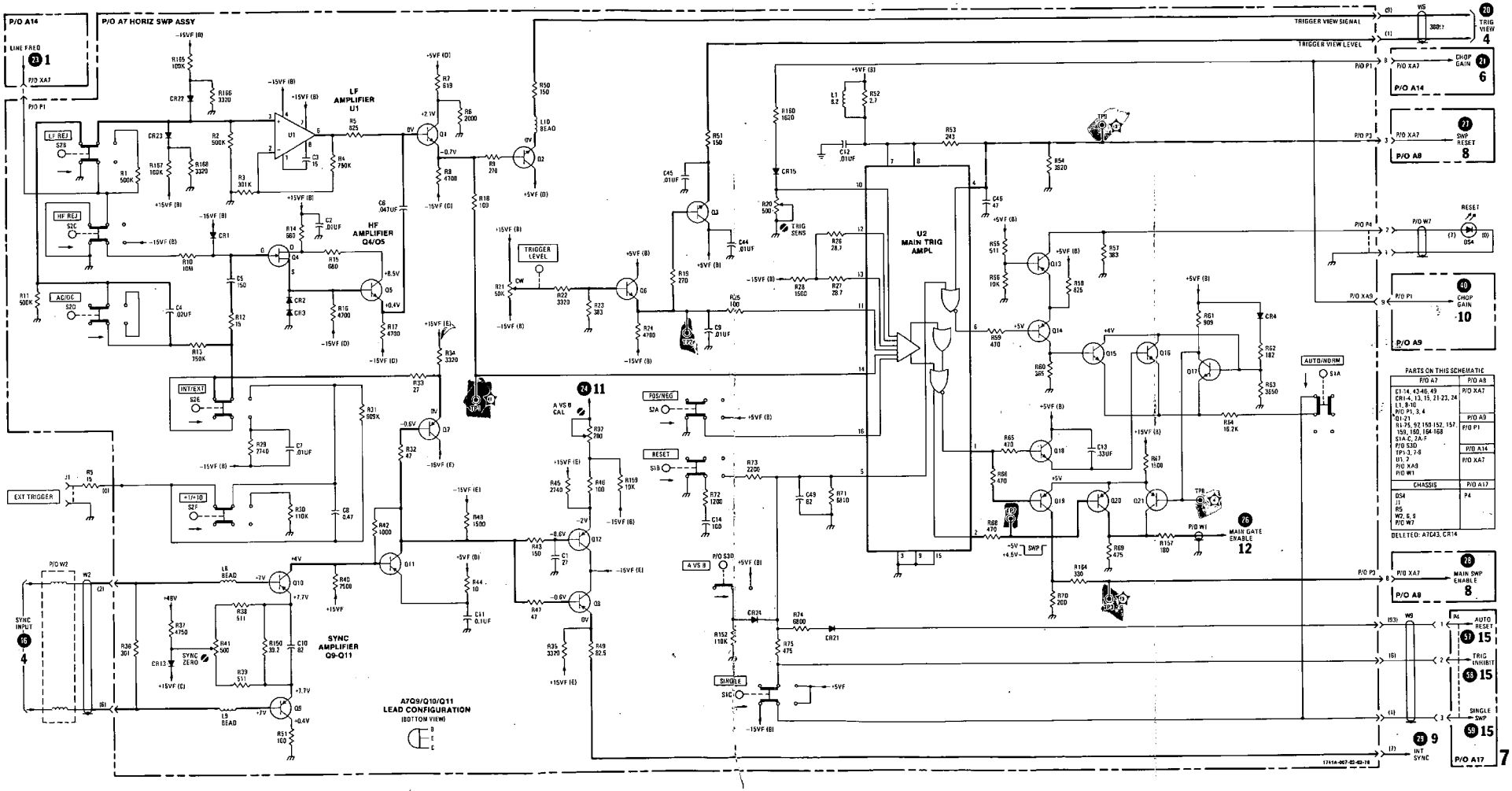


Figure 8-22. Service Information, Main Trigger P/O Assembly A7 (Sheet 2 of 2)

SCHEMATIC 8

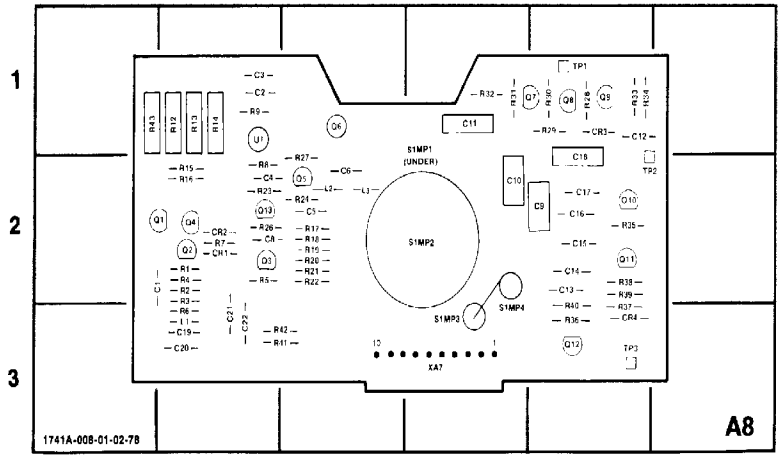
MAIN SWEEP - CIRCUIT THEORY

The main sweep integrator consists of current source A8Q13, source follower A8Q5, common-emitter stage A8Q6, and integrating capacitor between the gate of A8Q5 and the collector of A8Q6. In the reset condition, current from A8Q13 is drained through A8Q3 which is conducting. 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 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 by the TIME/DIV switch, 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 SWEEP VERNIER potentiometer R8.

The emitter of A8Q9 drives a particular holdoff capacitor (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 allowing it to accept another sync signal.



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	A-2	C13	E-2	CR2	B-2	Q7	E-1	R5	B-2	R18	C-2	R30	E-1	R41	B-3
C2	B-1	C14	E-2	CR3	E-1	Q8	E-1	R6	B-3	R19	C-2	R31	D-1	R42	B-3
C3	B-1	C15	E-2	CR4	E-3	Q9	E-1	R7	B-2	R20	C-2	R32	D-1	R43	A-1
C4	B-2	C16	E-2	L1	B-3	Q10	E-2	R8	B-2	R21	C-2	R33	E-1	S1MP1	D-2
C5	C-2	C17	E-2	L2	C-2	Q11	E-2	R9	B-1	R22	C-2	R34	E-1	S1MP2	D-2
C6	C-2	C18	E-2	L3	C-2	Q12	E-3	R12	B-1	R23	B-2	R35	E-2	S1MP3	D-3
C8	B-2	C19	B-3	Q1	B-2	Q13	B-2	R13	B-1	R24	C-2	R36	E-3	S1MP4	D-3
C9	E-2	C20	B-3	Q2	B-2	R1	B-2	R14	B-1	R26	B-2	R37	E-3	TP1	E-1
C10	D-2	C21	B-3	Q3	B-2	R2	B-2	R15	B-2	R27	C-2	R38	E-2	TP2	E-2
C11	D-1	C22	B-3	Q4	B-2	R3	B-2	R16	B-2	R28	E-1	R39	E-2	TP3	E-3
C12	E-1	CR1	B-2	Q5	C-2	R4	B-2	R17	C-2	R29	E-1	R40	E-2	U1	B-1
				Q6	C-1									XA7	D-3

Main Sweep A8 Component Locator (01740-66523)

DC VOLTAGE MEASUREMENT CONDITIONS SCHEMATIC 8

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

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

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

WAVEFORM MEASUREMENT CONDITIONS SCHEMATIC 8

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

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

2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. Connect pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

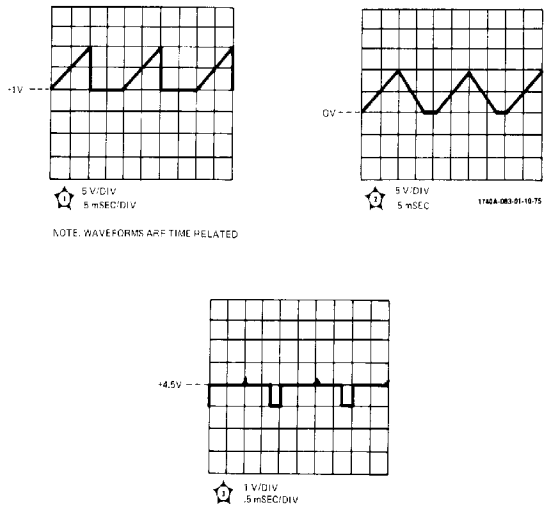


Figure 8-23. Service Information, Main Sweep Assembly A8 (Sheet 1 of 2)

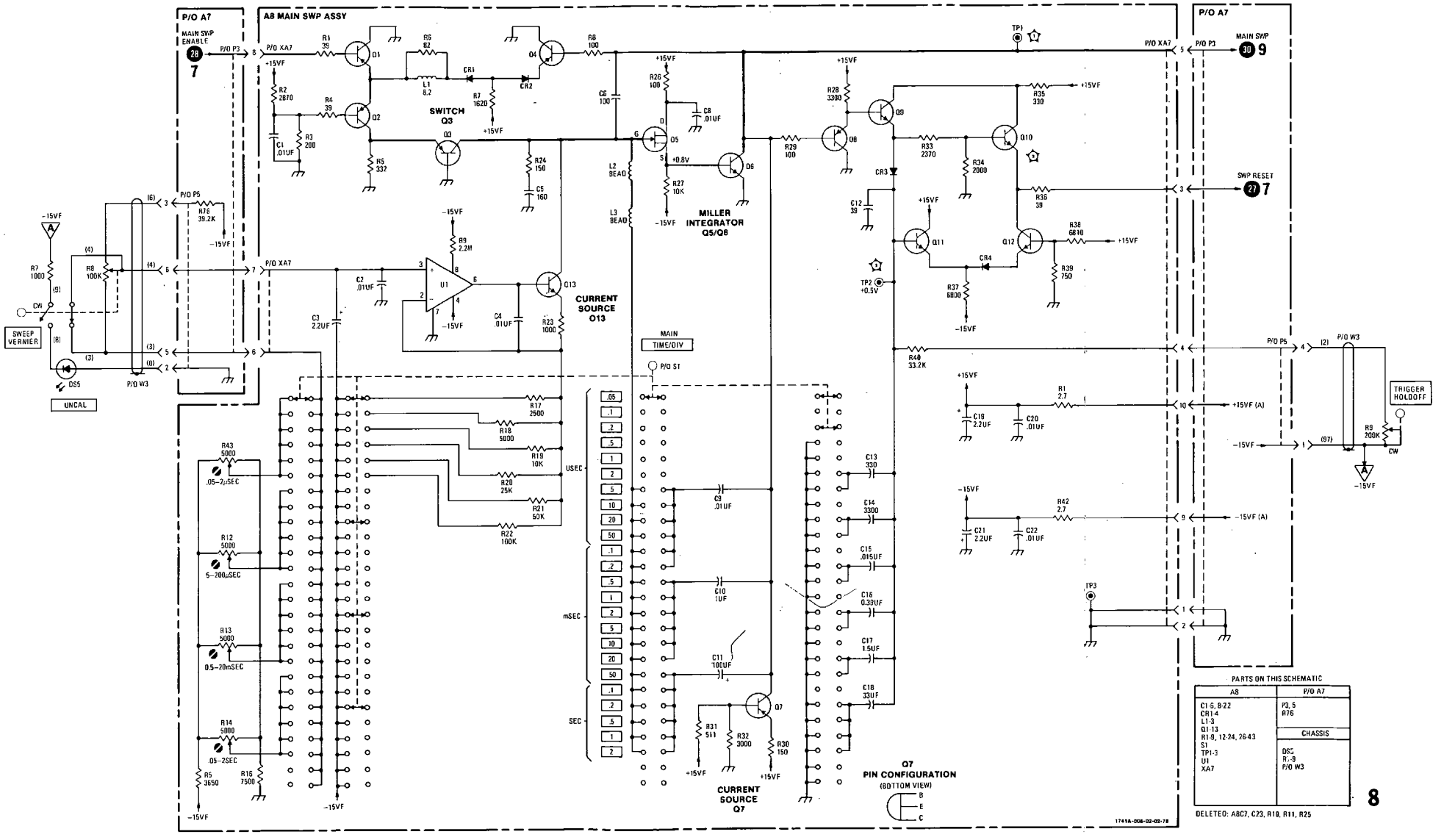


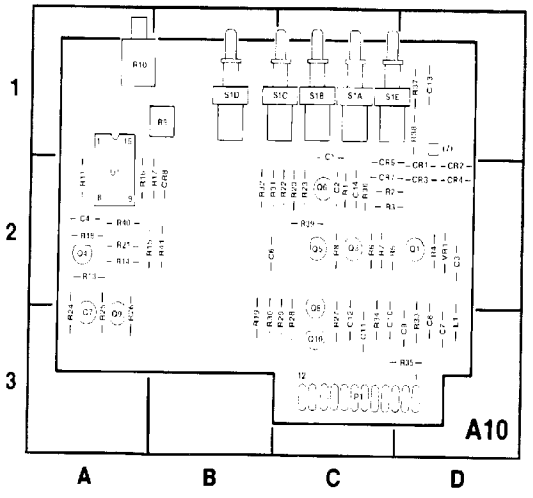
Figure 8-23. Service Information, Main Sweep Assembly A8 (Sheet 2 of 2)

SCHEMATIC 9

DELAYED TRIGGER - CIRCUIT THEORY

ARMING CIRCUITRY. The positive-going ramp of the main sweep is applied to the horizontal amplifier (see schematic 11) and to delay comparator A7U4 (pin 9). A7U4 is a transistor array which controls arming of the delayed sweep. DELAY potentiometer R6 establishes a reference voltage that is applied through isolation amplifier A7U3 to A7U4 (pin 6). When the main sweep ramp voltage applied to the base of A7U4Q4 (pin 9) slightly exceeds the level established by R6 at the base of A7U4Q3 (pin 6), A7U4Q5 conducts, turning off A7U4Q3. This causes the delayed enable signal, generated at A7U4 pin 1, to arm the delayed trigger circuit. When delayed TIME/DIV switch A9S1 (schematic 10) is in its OFF position, A7U4Q5 is inhibited, preventing the delayed enable signal from being generated.

DELAYED TRIGGER. Delayed trigger operation is similar to main trigger operation. The sync input to delayed trigger IC A10U1 is supplied through an impedance converter consisting of an FET matched pair (A10Q1A and A10Q1B) and emitter follower A10Q3. The delayed sweep is started by a negative-going pulse at the collector of A10Q10. With SWEEP AFTER DELAY switch A10S1D in AUTO, the delayed sweep starts as soon as A10U1 is armed (at pin 5) by the negative-going delayed enable signal from A7U4. With A10S1D in TRIG, the negative-going transition from A7U4 does not immediately cause the delayed sweep to start. It arms A10U1 and a delayed trigger will be formed if a sync pulse occurs during the main sweep time.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-1	C14	C-2	Q3	C-2	R4	D-2	R16	A-2	R27	C-3	R38	D-1
C2	C-2	CR1	D-2	Q4	A-2	R5	D-2	R17	B-2	R28	C-3	R39	C-2
C3	D-2	CR2	D-2	Q5	C-2	R6	C-2	R18	A-2	R29	C-3	R40	A-2
C4	A-2	CR3	D-2	Q6	C-2	R7	C-2	R19	B-3	R30	C-3	R41	B-2
C6	B-2	CR4	D-2	Q7	A-3	R8	C-2	R20	C-2	R31	C-2	S1A	C-1
C7	D-3	CR6	C-2	Q8	C-2	R9	B-1	R21	A-2	R32	B-2	S1B	C-1
C8	D-3	CR7	C-2	Q9	A-3	R10	A-1	R22	C-2	R33	D-3	S1C	C-1
C9	D-3	CR8	B-2	Q10	C-3	R11	A-2	R23	C-2	R34	C-3	S1D	B-1
C10	D-3	L1	D-3	R1	C-2	R13	A-2	R24	A-3	R35	D-3	S1E	C-1
C11	C-3	P1	C-3	R2	C-2	R14	A-2	R25	A-3	R36	C-2	U1	A-2
C12	C-3	Q1	D-2	R3	C-2	R15	B-2	R26	A-3	R37	D-1	VR1	D-2
C13	D-1												

Delayed Trigger A10 Component Location
(01740-66508)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 9

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

   DLY'D TIME/DIV ..... 50 μSEC

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
SCHEMATIC 9

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 ..... 10 μSEC
   DELAY 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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.

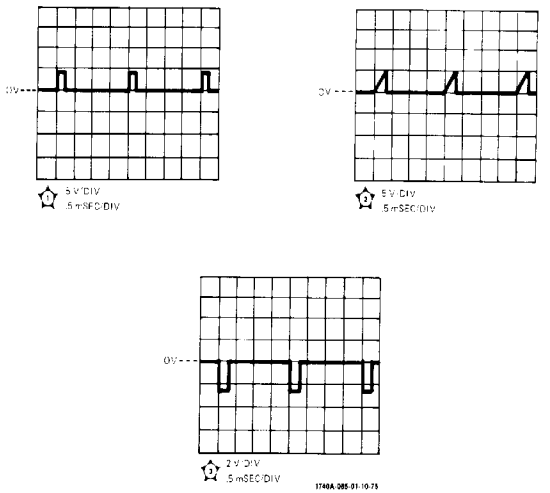


Figure 8-24. Service Information, Delayed Trigger Assembly A10 (Sheet 1 of 2)

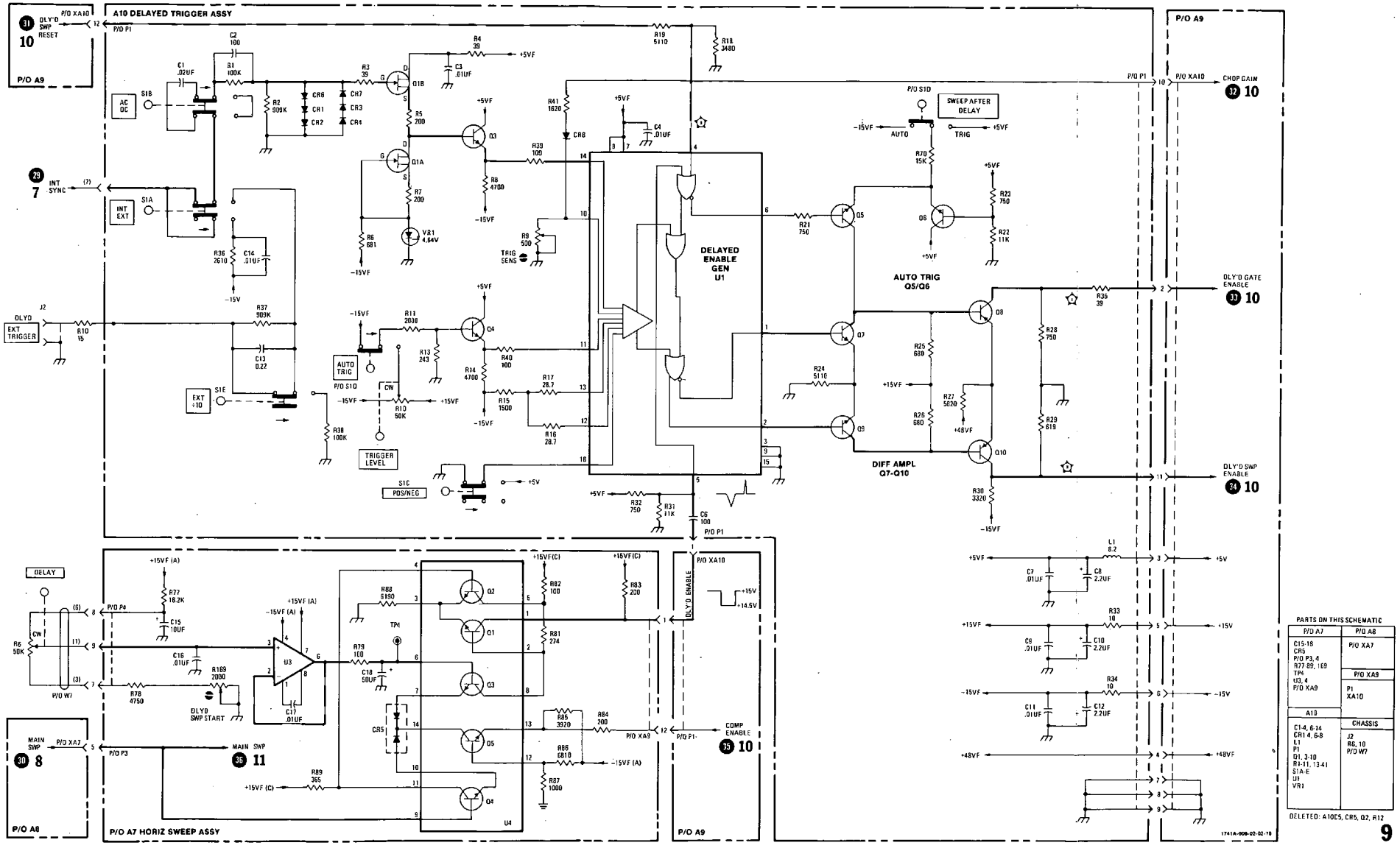
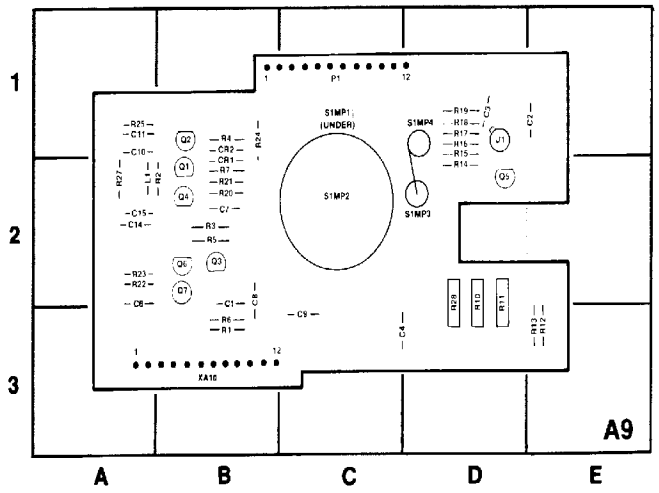


Figure 8-24. Service Information, Delayed Trigger Assembly A10 (Sheet 2 of 2)

SCHEMATIC 10

DELAYED SWEEP - CIRCUIT THEORY

The operation of delayed sweep is similar to that of main sweep (see schematic 8). One major difference is the delayed sweep reset level applied to the base of A9Q1. In delayed mode, this level is set at 1 volt; but in mixed mode of operation, the reference level is established by the main sweep ramp. Output of the delayed integrator (A10TP1) follows the main sweep ramp until the delayed sweep enable signal applied to the base of A9Q3 goes low. At this point, the delayed integrator no longer follows the reference level of the main sweep but ramps up at a slope determined by the selected integrating capacitor and selected current source resistor.



1741A-010-01-02-78

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	E-3	R24	B-1
C2	E-1	CR1	B-2	R1	B-3	R14	D-2	R25	A-1
C3	D-1	CR2	B-1	R2	B-2	R15	D-1	R27	A-2
C4	C-3	L1	A-2	R3	B-2	R16	D-1	R28	D-2
C6	A-2	P1	C-1	R4	B-1	R17	D-1	S1MP1	C-1
C7	B-2	Q1	B-2	R5	B-2	R18	D-1	S1MP2	C-2
C8	B-2	Q2	B-1	R6	B-3	R19	D-1	S1MP3	D-2
C9	C-3	Q3	B-2	R7	B-2	R20	B-2	S1MP4	D-1
C10	A-1	Q4	B-2	R10	D-2	R21	B-2	U1	D-1
C11	A-1	Q5	D-2	R11	D-2	R22	A-2	XA10	B-3
C14	A-2	Q6	B-2	R12	E-3	R23	A-1		

Delayed Sweep A9 Component Locator
(01740-66522)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 10

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
SCHEMATIC 10

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	10 μSEC
DELAY	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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.

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

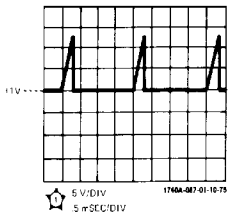


Figure 8-25. Service Information, Delayed Sweep Assembly A9 (Sheet 1 of 2)

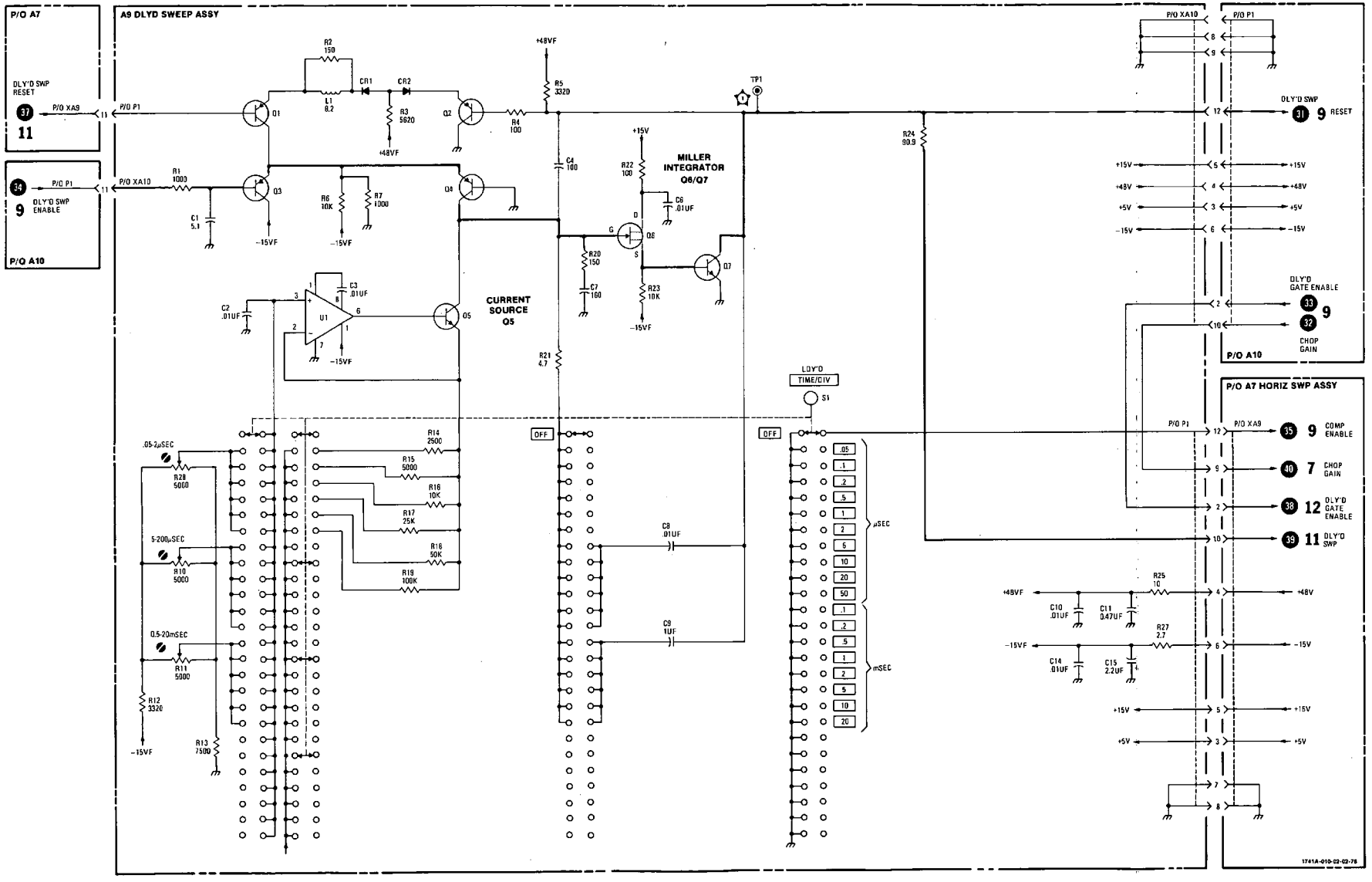


Figure 8-25. Service Information, Delayed Sweep Assembly A9 (Sheet 2 of 2)

SCHEMATIC 11

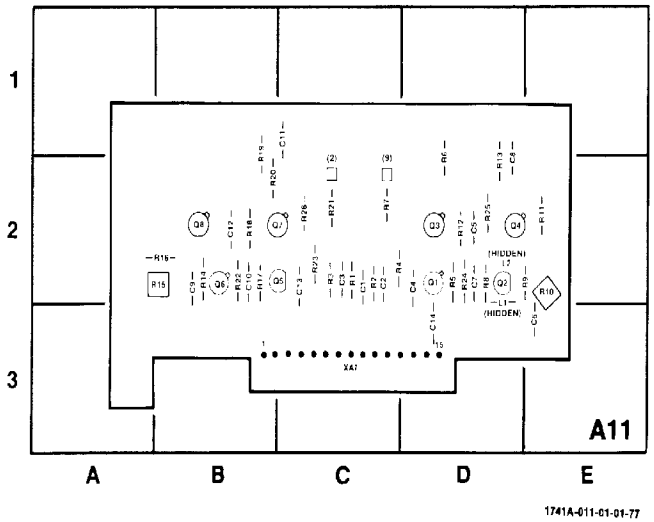
HORIZONTAL PREAMPLIFIER - CIRCUIT THEORY

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 is used as a temperature compensator for A7Q22. Horizontal POSITION control R11 drives A7Q26. MAG CENTER control A7R105 also drives A7Q26 when MAG X10 switch A7S1D is engaged. Current source A7Q24 provides bias for A7Q22. Current sources A7Q25 and A7Q34 provide bias for the differential amplifier. The X1 sweep speed is calibrated by A7R93. MAG X10 control is calibrated by A7R117.

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

HORIZONTAL OUTPUT. The output amplifier is a differential shunt feedback amplifier. Current required by A7Q23 is supplied through A11R4. This determines the voltage driving one horizontal plate through A11R7. Current required for A7Q27 is supplied through A11R23 establishing the voltage required to drive the other horizontal plate through A11R21. Transistors A11Q1, Q2, Q5, and Q6 are emitter followers that provide a high impedance for each side of the amplifier. High speed linearity is controlled by a log network at the input to each side of the amplifier. Resistor A11R10 controls one side, while A11R15 controls the other. Each side of the output amplifier can swing from approximately +8 volts to +110 volts.



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

Horizontal Output A11 Component Locator
(01740-66521)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 11

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
SCHEMATIC 11

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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.

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

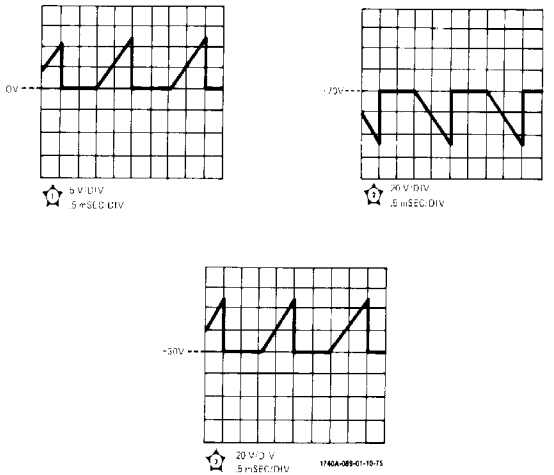


Figure 8-26. Service Information, Horizontal Output Assembly A11 (Sheet 1 of 2)

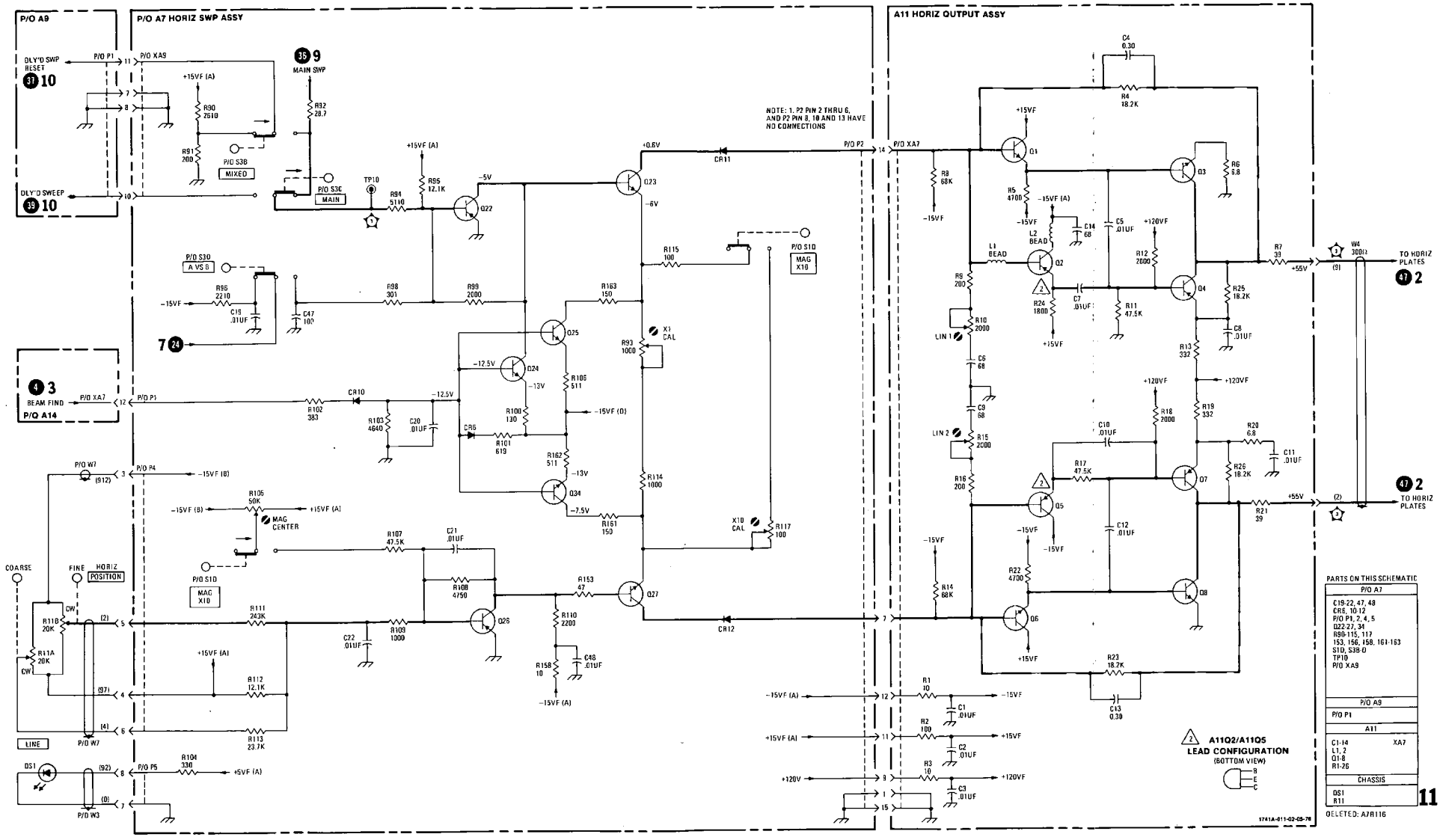
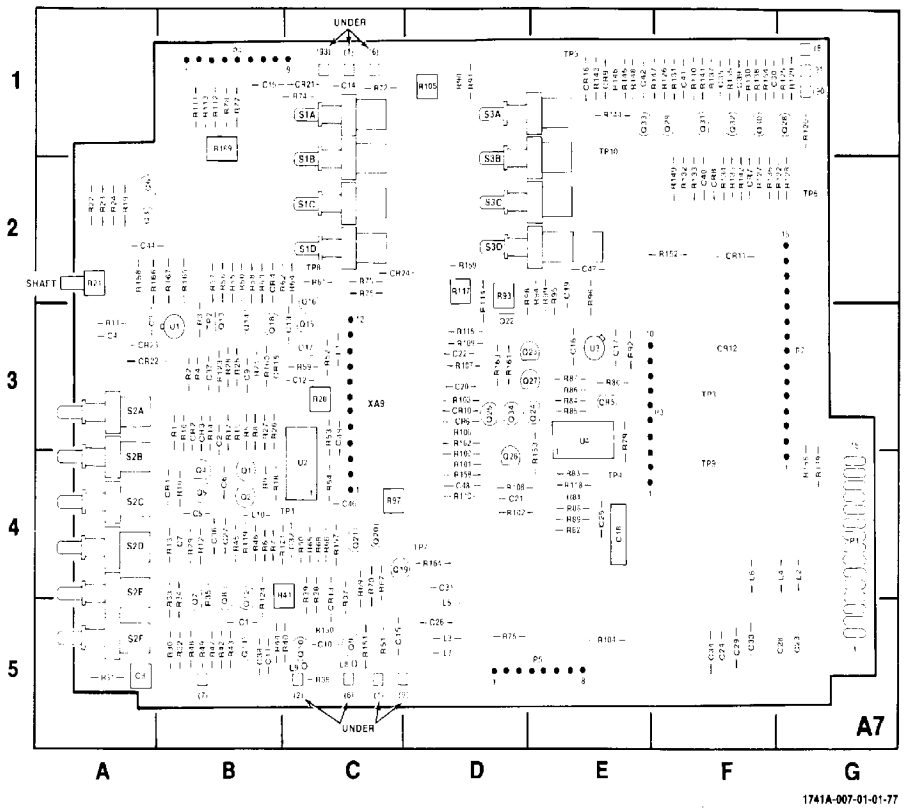


Figure 8-26. Service Information, Horizontal Output Assembly A11 (Sheet 2 of 2)



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	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	C29	F-5	CR9	F-1	Q4	B-4	Q32	F-1	R26	B-3	R54	C-4	R82	E-4	R111	B-1	R141	F-1	S1A	C-1
C2	B-3	C30	F-1	CR10	D-3	Q5	B-4	Q33	E-1	R27	B-3	R55	B-2	R83	E-4	R112	B-1	R142	F-2	S1B	C-2
C3	A-3	C31	D-4	CR11	F-2	Q6	A-2	Q34	D-3	R28	B-3	R56	B-2	R84	E-3	R113	B-1	R143	E-1	S1C	C-2
C4	A-3	C32	C-4	CR12	F-3	Q7	B-5	R1	B-3	R29	B-4	R57	B-2	R85	E-3	R114	D-2	R144	E-1	S1D	C-2
C5	B-4	C33	F-5	CR13	C-4	Q8	D-5	R2	D-3	R30	B-5	R58	D-2	R86	E-3	R115	D-3	R145	E-1	S2A	A-3
C6	B-4	C34	F-5	CR15	B-3	Q9	C-5	R3	B-3	R31	A-5	R59	C-3	R87	E-3	R117	D-2	R146	E-1	S2B	A-4
C7	B-4	C35	F-1	CR16	E-1	Q10	C-5	R4	B-3	R32	B-5	R60	B-2	R88	E-4	R118	E-4	R147	E-1	S2C	A-4
C8	A-5	C36	B-4	CR21	C-1	Q11	B-5	R5	B-3	R33	B-5	R61	C-2	R89	E-4	R119	B-4	R148	E-1	S2D	A-4
C9	B-3	C37	B-3	CR22	A-3	Q12	B-5	R6	B-4	R34	B-5	R62	B-2	R90	D-1	R120	G-1	R149	F-2	S2E	A-4
C10	C-5	C38	B-5	CR23	A-3	Q13	B-3	R7	B-4	R35	B-5	R63	B-2	R91	D-1	R121	C-4	R150	C-5	S2F	A-5
C11	B-5	C39	F-1	CR24	C-2	Q14	B-3	R8	B-3	R36	C-5	R64	C-2	R92	E-3	R122	F-2	R151	C-5	S3A	D-1
C12	C-3	C40	F-2	L1	C-3	Q15	C-3	R9	B-4	R37	C-4	R65	C-4	R93	D-2	R123	B-3	R152	F-2	S3B	D-2
C13	C-3	C41	F-1	L2	G-4	Q16	C-2	R10	B-4	R38	C-4	R66	C-4	R94	L-2	R124	B-4	R153	E-4	S3C	D-2
C14	C-1	C42	E-1	L3	D-5	Q17	C-3	R11	A-3	R39	C-4	R67	C-4	R95	E-2	R125	G-1	R154	F-1	S3D	D-2
C15	B-1	C44	A-2	L4	G-4	Q18	B-3	R12	B-4	R40	C-5	R68	C-4	R96	E-2	R126	F-1	R155	F-1	TP1	C-4
C16	E-3	C45	C-5	L5	D-5	Q19	C-4	R13	B-4	R41	C-4	R69	C-4	R97	C-4	R127	F-2	R156	G-4	TP2	B-3
C17	F-3	C46	C-4	L6	F-4	Q20	C-4	R14	B-3	R42	B-5	R70	C-4	R98	D-2	R128	F-2	R157	C-4	TP3	F-2
C18	F-4	C47	C-3	L7	D-5	Q21	C-4	R15	B-3	R43	B-5	R71	B-3	R99	E-2	R129	G-1	R158	D-4	TP4	E-4
C19	E-2	C48	D-4	L8	C-5	Q22	D-3	R16	B-3	R44	B-5	R72	C-1	R100	D-4	R130	F-1	R159	D-2	TP5	E-1
C20	D-3	C49	C-1	L9	C-5	Q23	E-3	R17	B-3	R45	B-4	R73	C-2	R101	D-4	R131	F-1	R160	B-3	TP6	G-2
C21	D-4	CR1	B-4	L10	B-4	Q24	L-3	R18	B-4	R46	B-4	R74	C-1	R102	D-4	R132	F-2	R161	D-3	TP7	D-4
C22	D-3	CR2	B-3	P2	G-3	Q25	D-3	R19	A-2	R47	B-5	R75	C-2	R103	D-3	R133	F-2	R162	D-3	TP8	C-2
C23	G-5	CR3	B-3	P3	F-3	Q26	D-4	R20	C-3	R48	B-5	R76	D-5	R104	E-5	R134	F-2	R163	D-3	TP9	F-4
C24	F-5	CR4	B-2	P4	B-1	Q27	E-3	R21	A-2	R49	B-5	R77	B-1	R105	D-1	R135	F-2	R164	D-4	TP10	E-1
C25	E-4	CR5	E-3	P5	E-5	Q28	G-1	R22	A-2	R50	C-4	R78	B-1	R106	D-3	R136	F-2	R165	B-2	U1	B-3
C26	D-5	CR6	D-3	Q1	B-4	Q29	F-1	R23	A-2	R51	C-5	R79	F-3	R107	D-3	R137	F-1	R166	A-2	U2	C-4
C27	B-4	CR7	F-2	Q2	B-4	Q30	F-1	R24	A-2	R52	C-3	R80	E-3	R108	D-4	R138	F-1	R167	B-2	U3	E-3
C28	G-5	CR8	F-2	Q3	A-2	Q31	F-1	R25	B-3	R53	C-3	R81	E-4	R109	D-3	R139	C-4	R168	A-2	U4	E-3
														R110	D-4	R140	F-1	R169	B-1	XA9	C-3

Gate Schmitt A7 Component Locator
(01740-66524)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 12

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

   Sweep mode ..... A VS B
   BEAM INTENSITY ..... barely visible spot
   Spot centered on CRT

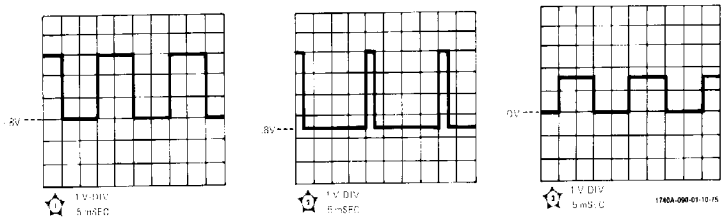
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 12

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 pulse generator 50-ohm output to Model 1741A channel A INPUT connector.
4. Adjust pulse generator output for 6 divisions of signal amplitude (.6 V) at 5 kHz.



SCHEMATIC 12

GATE SCHMITT - CIRCUIT THEORY

Gate Schmitt circuit A7Q28 - A7Q32 provides gate amplifier 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 delayed sweep, the gate follows the delayed sweep. In mixed operation, the gate is started by the main sweep and terminated by the end of delayed sweep. The following waveforms show the timing relationship of the gate and sweep waveforms.

The gate Schmitt also furnishes main and delayed gate outputs to rear-panel BNC connectors for external use (see schematic 1).

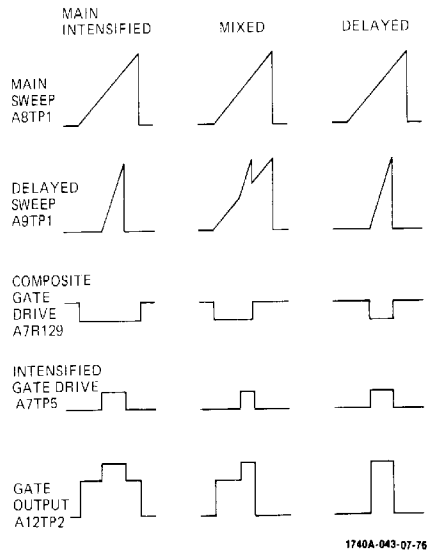
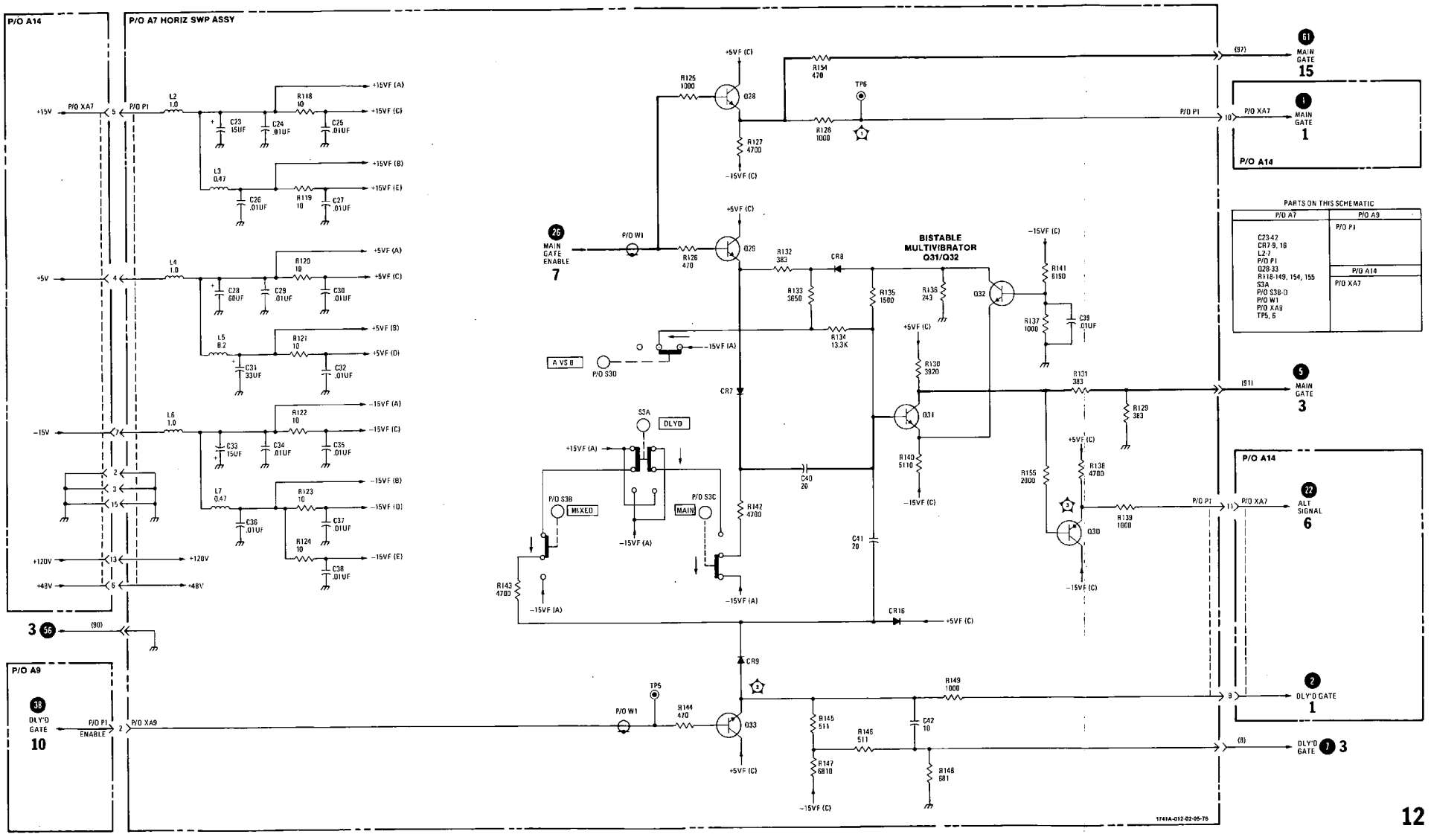


Figure 8-27. Service Information, Gate Schmitt, P/O Assembly A7 (Sheet 1 of 2)



12

Figure 8-27. Service Information, Gate Schmitt P/O Assembly A7 (Sheet 2 of 2)

8-41

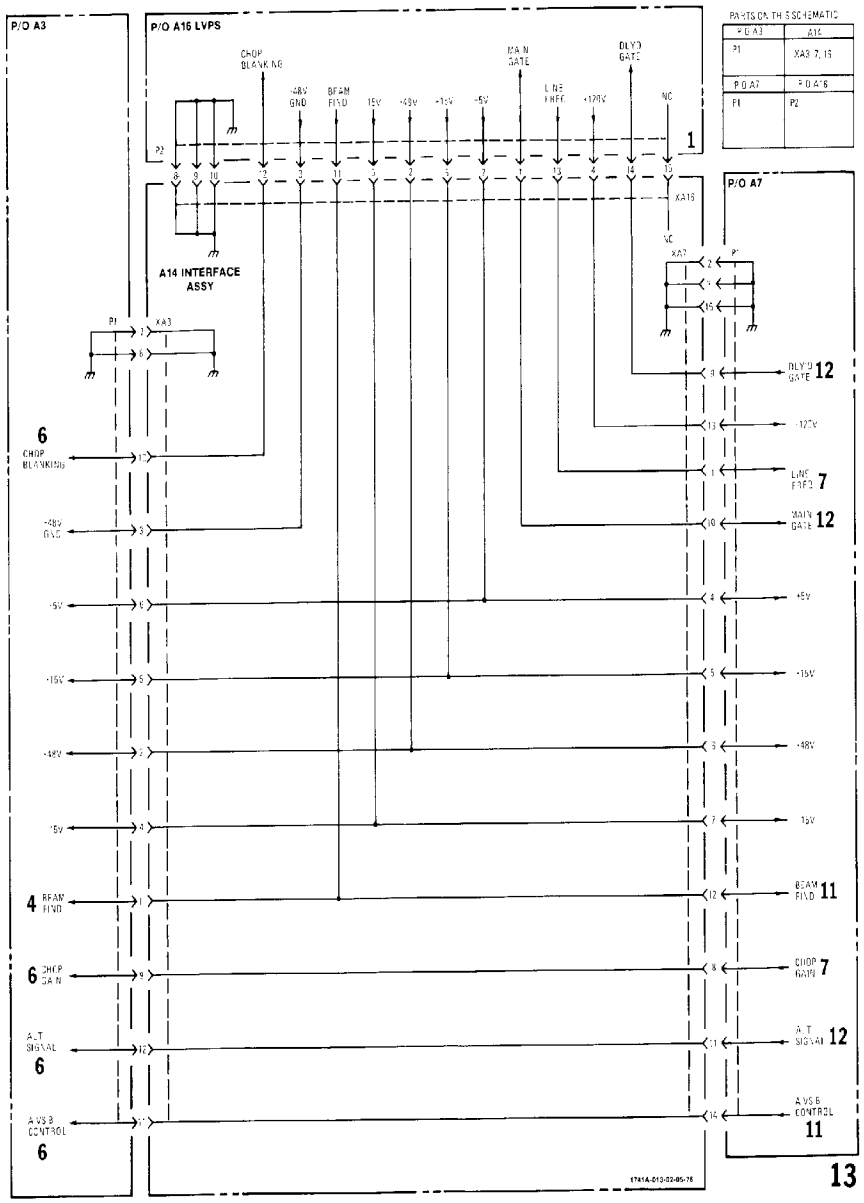


Figure 8-28. Service Information, Interface Assembly A14

SCHEMATICS 14 - 16

STORAGE ASSEMBLY - CIRCUIT THEORY

NORMAL WRITE MODE. WRITE/STORE ENABLE flip-flop A17U2B exstablishes the operating mode of the instrument when it is not used as a conventional oscilloscope. In the write mode, the flip-flop is clocked to its set condition. In the store or store display mode, the flip-flop is held in its reset condition.

When engaged, WRITE switch A18S2 (schematic 14) applies the WRITE ENABLE signal (logic low) to preset input on flip-flop U2B through AND gate U4A (schematic 15), setting the flip-flop. The Q output (high) lights the WRITE LED and applies the PERSISTENCE ENABLE signal to persistence timer NAND gate U8B, enabling it (schematic 16). The other input to U8B is from persistence control timer U1A through buffer transistor Q26. The timer functions as a free-running multivibrator whose repetition rate is determined by the voltage level applied by PERSISTENCE/VIEW TIME potentiometer R2 through current source transistor Q1. The timer output is applied through Q26 and U8B to level-shifting circuit Q2-Q4. Amplitude of the pulses developed at the collector of Q3 can be varied by BRIGHTNESS potentiometer R1; however, the maximum amplitude is limited to approximately +8 volts by Q27 and its associated circuitry. The output from Q3 is applied through an OR-diode summing network to the CRT storage mesh. The amplitude and pulse rate of the signal applied to the storage mesh determine the amount of floodgun electrons that reach the phosphor viewing screen.

WRITE MODE - MAIN ERASE. In the write mode, the Q (high) output of U2B (schematic 15) is applied through AND gate U4B to the clear (CLR) input on flip-flop U5A. This conditions the flip-flop so that a negative-going signal applied to the preset (PR) input will set the flip-flop.

When ERASE pushbutton switch A18S4 is pressed, the MAIN ERASE signal goes low, developing a differentiated, negative-going pulse at the junction of R55 and C32. This sets U5A, causing its $\overline{Q}$ output to go low. The low is applied to the base of Q6 through C33/R56, turning it off. The AUTO RESET signal goes high, resetting main trigger amplifier A7U2 (schematic 7).

The $\overline{Q}$ output of U5A is also applied to AND gate U9A causing its output to go low, forcing the output of NAND gate U10A high. With both inputs to U9B high, its output (high) develops the ERASE BLANKING signal that cuts off the CRT write gun during the erase cycle (schematics 6 and 3). The output of U9B, when high, also turns on Q14, producing the TRIG INHIBIT signal to the horizontal sweep circuit, preventing a new sweep from being generated (schematic 7).

In addition, the $\overline{Q}$ output of U5A is applied to NAND gate U10B producing the ERASE ENABLE signal that is applied simultaneously to monostable multivibrators U11A and U11B (schematic 16). Since the STORE ENABLE signal is low in the write mode, the monostable multivibrators are triggered by the high ERASE ENABLE signal. The Q output of U11B is a 60-millisecond pulse that is applied to two circuits. One signal path is through level-shifting circuit Q21, Q20, and S1. This circuit conducts during the erase cycle and applies +156 volts to the CRT storage mesh, bringing its potential to the same level as the collector mesh.

NOTE

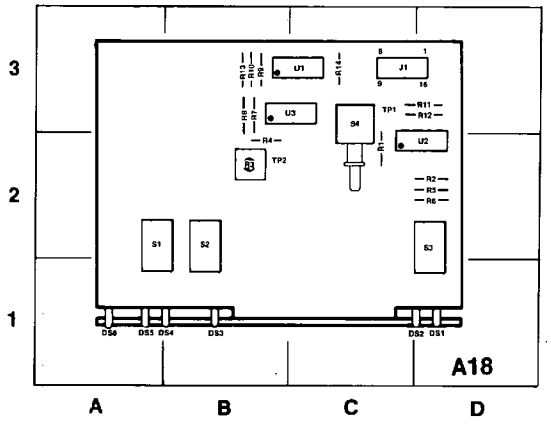
In CONV mode of operation, A17S1 applies a constant +156 volts to the CRT storage mesh.

The other circuit driven by the 60-millisecond erase pulse is a ramp-generator circuit consisting of Q23-Q25. During the 60-millisecond erase cycle, Q25 and Q24 are turned on. When conducting, Q24 simultaneously turns on Q23 and charges capacitor C57 negatively. With Q23 (conducting, approximately -15 volts are applied through CR15 to the OR-diode summing gate (CR14-CR17).

At the end of the erase cycle, Q25 and Q24 turn off but Q23 continues to conduct through CR15 and R94 for a time period determined by the discharge time constant of C57 and R119. While conducting during this cutoff time, Q23 produces a voltage ramp at the OR-diode summing point that starts from approximately -15 volts and ramps toward the +48 volts applied through R94. When the ramp reaches approximately +8 volts, it is clamped by the Q27 circuitry through CR16.

The Q output of U11A is a 300-millisecond pulse applied to NAND gates U8A and U8D. Since the PERSISTENCE ENABLE signal is high during the write mode, the output of U8A goes low, holding the reset input to timer U1A low. With a low applied to its reset terminal, timer U1A is inhibited during the erase cycle.

The inverted output of NAND gate U8D is a pulse train generated by the instrument calibrator. The signal is applied through NAND gate U8C and level-shifting circuit Q8/Q9 to the CRT collimator. The collimator erase signal (300 milliseconds in duration) is a waveform that varies from a referenced dc level to 20 volts above the referenced dc level.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
DS1	D-1	R4	B-2	S1	A-2
DS2	D-1	R5	D-2	S2	B-2
DS3	B-1	R6	D-2	S3	D-2
DS4	B-1	R7	B-3	S4	C-3
DS5	A-1	R8	B-3	TP1	C-3
DS6	A-1	R9	B-3	TP2	B-2
J1	C-3	R10	B-3	U1	C-3
R1	C-2	R11	D-3	U2	D-2
R2	D-2	R12	D-3	U3	C-3
R3	B-2	R13	B-3		

Storage Control A18 Component Locator
(01741-66512)

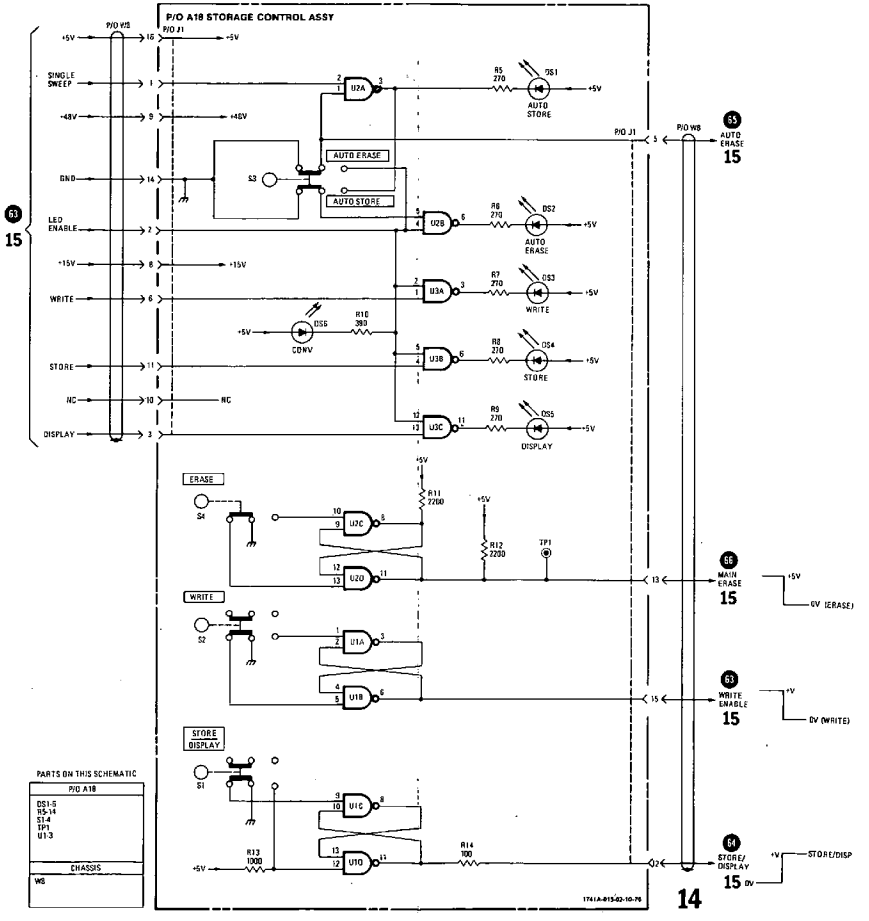


Figure 8-29. Service Information, Storage Control Assembly A18

The $\overline{Q}$ output from U11A is a complementary 300-millisecond pulse developed at the Q output during the erase cycle. This complementary pulse is applied as a clock to erase flip-flops U5A and U5B (schematic 15). At the end of the erase cycle, the $\overline{Q}$ output goes high, clocking both U5A and U5B to their reset condition (D inputs grounded). This completes the erase cycle.

WRITE MODE - AUTO ERASE. Engaging AUTO ERASE/AUTO STORE switch A18S3 produces an AUTO ERASE signal (high) that lights the AUTO ERASE LED (schematic 14). When disengaged, the AUTO ERASE/AUTO STORE switch applies a low through CR1 to the emitter of Q11 (schematic 15), inhibiting the main gate function in the storage assembly. In addition, a low is applied through CR2 to NAND gate U12C, holding its output high. The output of U12C supplies the preset input signal to erase flip-flop U5B. A low is applied also through CR6 to the clear input of U5B. With these conditions established on the clear and preset inputs to U5B, the flip-flop is held in its reset state. With AUTO ERASE/AUTO STORE switch engaged, CR1, CR2, and CR6 are reverse biased.

The main gate signal (high during a main sweep) is buffered by transistor Q11. When the main gate signal goes low at the end of the main sweep, Q11 conducts, producing a negative-going, differentiated pulse at an input to AND gate U9D. The output of U9D goes low momentarily, forcing the output of U12D high. Since both inputs to NAND gate U12C are high, its output goes low, setting flip-flop U5B. The $\overline{Q}$ output (low) from U5B is differentiated by C35/R62 and applied as a trigger signal to view time delay generator U1B, causing its output to go high. Duration of the output pulse from U1B is a function of PERSISTENCE/VIEW TIME potentiometer R2 that regulates the discharge rate of the generator through current source Q13. During AUTO ERASE mode, persistence timer U1A is disabled (refer to later explanation). At the end of the output pulse, a negative-going, differentiated pulse is applied to U10B causing its output to go high momentarily. The high is applied to erase-cycle monostable multivibrators U11A and U11B (schematic 16), initiating the erase cycle. At the end of the erase cycle, U5B is clocked to its reset condition by multivibrator U11A.

The $\overline{Q}$ output from U5B is also applied as an input to AND gate U9A. When the $\overline{Q}$ output goes low, it initiates the ERASE BLANKING and TRIG INHIBIT signals discussed previously.

During AUTO ERASE mode, the AUTO ERASE signal is applied to NAND gate U3B (schematic 15), causing the AUTO ERASE DISABLE signal to go low. This low is applied to the anode of CR10 (schematic 16) inhibiting the enabling voltage from PERSISTENCE/VIEW TIME potentiometer R2, causing Q1 to cut off. Since Q1 is the current source for timer U1A, the timer is inhibited. The PERSISTENCE/VIEW TIME potentiometer is now used to establish the auto erase cycle rate.

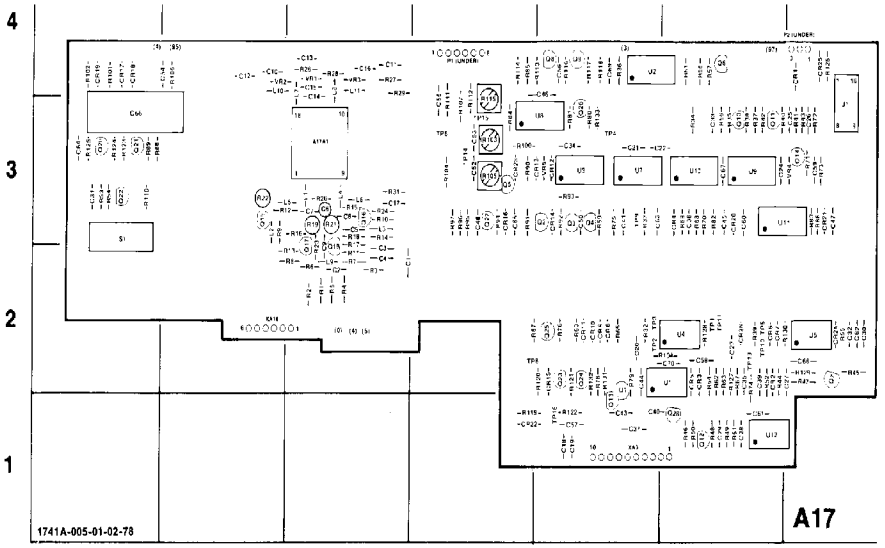
WRITE MODE - AUTO STORE. The AUTO ERASE signal is applied to AND gate U4D (schematic 15). In write mode of operation, the PERSISTENCE ENABLE signal applied to the other input on U4D is also high, forcing the output of U4D high. The high from U4D is applied to AND gate U4C. The other input to U4C is the SINGLE SWEEP signal from A7S1C (schematic 7). When SINGLE switch A7S1C is engaged, the SINGLE SWEEP signal (high) switches the instrument from auto erase to auto store operation. The AUTO ERASE LED turns off and the AUTO STORE LED turns on (schematic 14). In addition, the high is applied through CR26/R67 to the base of Q28, turning it on (schematic 15). With Q28 conducting, a low is applied to the reset input on view time delay generator U1B, inhibiting the AUTO ERASE function.

NOTE

The instrument is now in the WRITE, AUTO STORE, SINGLE mode of operation. Normally, in this mode, the operator wishes to capture a single event and store it for observation.

The output of U4C (high) accomplishes two things. First, it is applied to an input on NAND gate U7A enabling it. At the end of the main sweep (event of interest written on screen), the main gate signal causes the output of U9D to go low, forcing the output of U10D high. With both inputs high, the output of U7A goes low, triggering WRITE/STORE ENABLE flip-flop U2B through R/S latch U7B/U10C and AND gate U9C. This automatically switches the instrument from WRITE to STORE mode of operation, and stores the event of interest.

Secondly, the output of U4C is applied to a circuit which maintains the instrument in a state of readiness, regardless of time interval between placing the instrument in WRITE, AUTO STORE, and SINGLE mode of operation, and the arrival of the event of interest. The high from U4C is applied to an input on NAND gate U3C (schematic 16). The other input to U3C is the MAIN GATE CONTROL signal from the collector circuit of Q10 (schematic 15). Since the main gate signal is low (no main sweep-awaiting arrival of the event of interest), the collector circuit of Q10 is high. With both inputs to U3C high, its output is low, holding the output of U7C high. The high output from U7C is applied to the current source circuit for persistence control timer U1A, enabling it. The timer now generates a train of pulses (equivalent to maxi-



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	REF DESIG	GRID LOC
A17A1	C-3	C38	F-3	CR8	E-2	Q5	D-3	R14	C-3	R62	F-2	R90	D-3	R131	E-2
C1	C-2	C39	F-2	CR9	E-2	Q6	F-4	R15	C-3	R53	A-3	R91	D-3	R132	E-2
C2	C-2	C40	E-1	CR10	E-2	Q7	G-2	R16	C-3	R54	A-3	R92	E-3	R133	E-3
C3	C-2	C41	E-3	CR11	E-2	Q8	E-4	R17	C-3	R55	G-2	R93	E-3	R134	F-2
C4	C-2	C43	E-1	CR12	E-3	Q9	E-4	R18	C-3	R56	F-3	R94	D-3	S1	A-3
C5	C-3	C44	E-2	CR13	E-3	Q10	F-3	R19	C-3	R57	F-4	R95	D-3	TP1	F-2
C6	C-2	C45	F-3	CR14	E-3	Q11	F-3	R20	C-3	R58	F-4	R96	D-3	TP2	E-2
C7	C-2	C46	E-4	CR15	E-2	Q12	F-1	R21	C-3	R59	E-3	R97	D-3	TP3	E-2
C8	C-2	C47	G-3	CR16	D-3	Q13	E-1	R22	C-3	R60	E-2	R100	D-3	TP4	E-3
C9	C-3	C48	D-3	CR17	A-4	Q14	G-3	R23	C-3	R61	F-4	R101	A-4	TP5	F-2
C10	B-4	C50	E-3	CR18	A-4	Q15	B-3	R24	C-3	R62	F-2	R102	A-4	TP6	D-3
C11	C-4	C52	D-3	CR19	A-4	Q16	C-3	R26	C-4	R63	F-2	R103	D-3	TP8	D-2
C12	B-4	C53	D-3	CR20	F-3	Q17	C-3	R27	C-4	R64	F-2	R104	D-3	TP9	E-3
C13	C-4	C54	A-4	CR21	G-3	Q18	C-3	R28	C-4	R65	E-2	R105	D-3	TP10	F-2
C14	C-4	C55	D-3	CR22	D-1	Q20	A-3	R29	C-4	R67	F-2	R106	B-4	TP11	F-2
C15	C-4	C56	E-4	CR23	D-3	Q21	A-3	R31	C-3	R68	F-3	R107	D-4	TP13	F-2
C16	C-4	C57	E-1	CR24	G-2	Q22	A-3	R32	E-2	R69	F-3	R110	A-3	TP14	D-3
C17	C-3	C58	F-2	CR25	G-4	Q23	E-2	R33	E-3	R70	F-3	R111	D-3	TP15	D-3
C18	E-1	C59	G-3	CR26	F-2	Q24	E-2	R34	F-3	R71	G-3	R112	D-4	TP16	E-1
C19	E-1	C60	F-3	J1	G-3	Q25	E-2	R35	F-3	R72	G-3	R113	D-4	U1	F-2
C20	E-2	C61	F-1	L1	C-3	Q26	E-3	R36	E-4	R73	G-3	R114	D-4	U2	E-4
C21	E-3	C62	G-2	L2	B-3	Q27	D-3	R37	F-3	R74	F-2	R115	D-4	U3	E-3
C22	E-2	C63	E-3	L3	C-3	Q28	F-1	R38	F-3	R75	E-3	R116	E-4	U4	F-2
C23	F-2	C64	A-3	L4	C-3	R1	C-2	R39	F-2	R76	E-2	R117	E-4	U5	G-2
C24	F-3	C65	D-3	L5	B-3	R2	C-2	R40	F-3	R78	E-2	R118	E-4	U7	E-3
C25	G-3	C66	A-3	L6	C-3	R3	C-2	R41	G-3	R79	E-2	R119	D-1	U8	E-3
C26	G-3	C67	F-3	L7	C-4	R4	C-2	R42	F-3	R80	E-3	R120	E-2	U9	F-3
C27	F-2	C68	G-2	L8	C-4	R5	C-2	R43	G-2	R81	E-3	R121	E-2	U10	F-3
C28	F-1	C69	E-4	L9	C-2	R6	C-2	R44	F-2	R82	F-3	R122	E-1	U11	G-3
C29	F-1	C70	F-2	L10	B-4	R7	C-2	R45	G-2	R83	G-3	R123	A-3	U12	F-1
C30	G-2	CR1	G-4	L11	C-4	R8	C-2	R46	F-1	R84	D-3	R124	A-3	VR1	C-4
C31	A-3	CR2	F-2	P1	D-4	R9	B-3	R47	G-2	R85	D-4	R125	A-3	VR2	B-4
C32	G-2	CR3	F-2	P2	G-4	R10	C-3	R48	F-1	R86	G-3	R126	G-4	VR3	C-4
C33	F-3	CR4	F-3	Q1	E-2	R11	C-2	R49	F-1	R87	D-2	R127	F-2	VR4	G-3
C34	E-3	CR5	F-2	Q2	E-3	R12	B-3	R50	F-1	R88	A-3	R128	F-2	VR5	E-3
C35	F-2	CR6	F-2	Q3	E-3	R13	C-2	R51	F-1	R89	A-3	R129	G-2	XA3	E-1
C37	E-1	CR7	F-2	Q4	E-3					R90	D-3	R130	G-2	XA16	B-2

Storage Logic A17 Component Locator
(01741-66509)

Figure 8-30. Service Information, Storage Logic P/O Assembly A17 (Sheet 1 of 2)

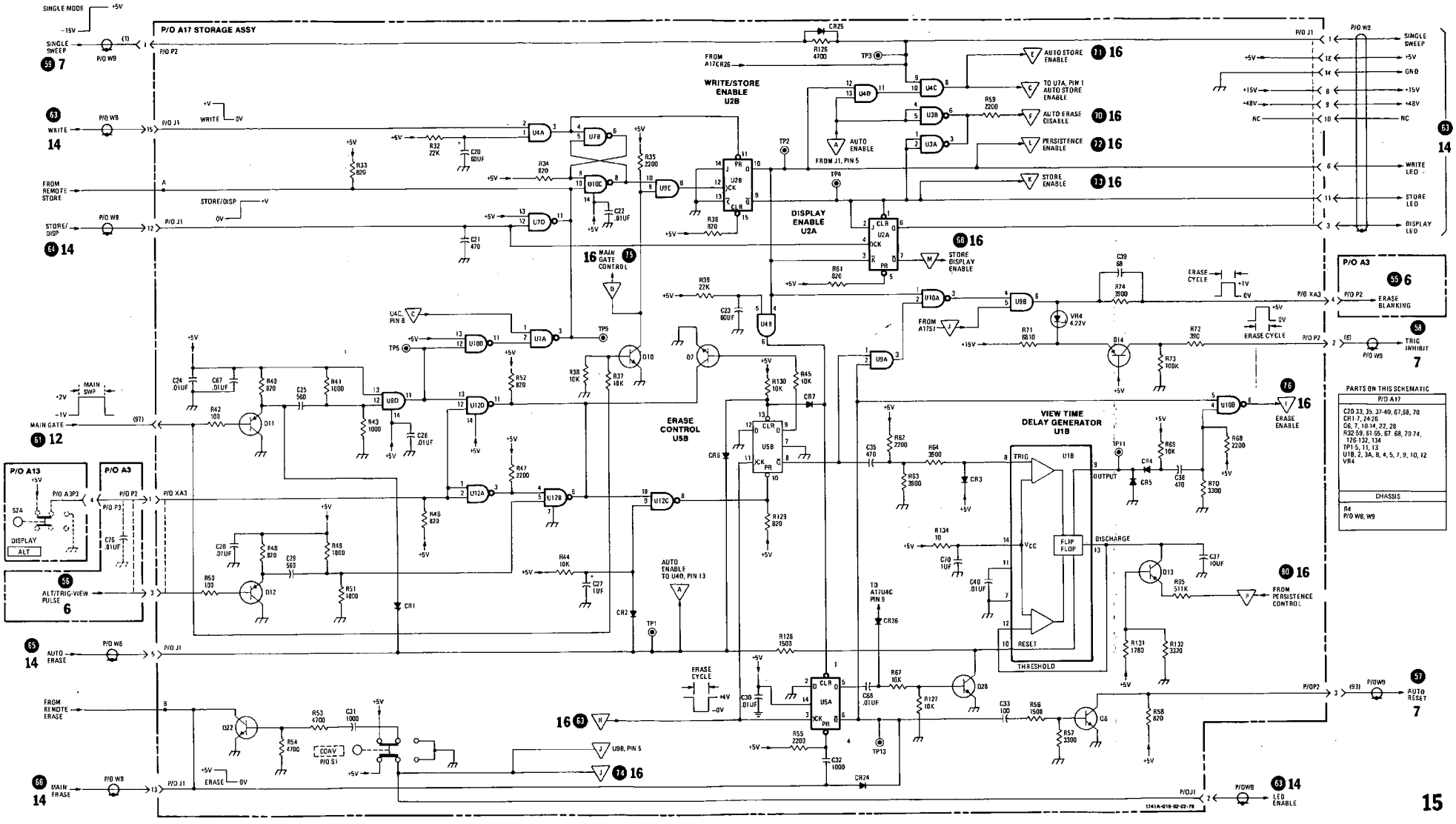


Figure 8-30. Service Information, Storage Logic P/O Assembly A17 (Sheet 2 of 2)

mum persistence setting of R2) that is applied to the CRT storage mesh. Without this conditioning, the CRT could fade positive (from electrons emitted by the floodguns) before arrival of the event of interest. Upon receiving a signal, the main sweep is triggered and the MAIN GATE signal goes high, turning on transistor Q10, and causing the MAIN GATE CONTROL signal to go low. The output of U3C goes high, forcing the output of U7C low. A low applied to the junction of R76/CR9 disables the current source circuit of U1A and turns it off. The CRT storage mesh is no longer pulsed. As explained previously, at the end of the main sweep when the event of interest is written, the instrument switches from the WRITE to the STORE mode of operation. This causes the AUTO STORE ENABLE signal to go low, holding the output of U3C high. This prevents persistence control timer U1A from turning on again at the end of the main sweep (MAIN GATE CONTROL signal goes high).

ALT MODE. In ALT mode of display, two or three sweeps across the CRT are required before an erase cycle is desired; therefore, the main gate signal must be ignored during this mode of display because it is generated during each sweep. When ALT display switch A13S2A is engaged, a ground is applied to an input on NAND gate U12D (schematic 15), holding its output high. This prevents the main gate signal from presetting erase control flip-flop U5B. The ground is also applied to both inputs on U12A holding its output high. The high is applied to an input on U12B.

In ALT mode or ALT-TRIG VIEW mode of display, channel B is always the last channel to be displayed. At the end of the channel B sweep, the ALT/TRIG-VIEW pulse is developed. The pulse is applied to buffer Q12 turning it off. At the end of the ALT/TRIG-VIEW pulse, A17Q12 turns on, developing a negative-going, differentiated pulse input to NAND gate U12B, forcing its output high. Both inputs to NAND gate U12C are now high, causing its output to go low, setting erase control flip-flop U5B and the erase cycle is initiated.

STORE MODE. Engaging STORE/DISPLAY switch A18S1 causes the STORE/DISP signal from R/S latch A18U1C/A18U1D (schematic 14) to go high. The signal is applied as a clock signal to display enable flip-flop U2A (schematic 15); however, the CLR, J, and $\overline{K}$ inputs are such that the Q and $\overline{Q}$ outputs remain unchanged. The STORE/DISP signal is also applied through NAND gate U7D to R/S latch U7B/U10C. The output of the latch goes high, clocking flip-flop U2B through AND gate U9C, provided the main gate signal is low. As explained previously, the main gate signal, which is high during the main sweep, is applied to Q10, causing it to conduct. This holds the output of U9C low, preventing U2B from toggling during a trace sweep. At the end of the main sweep, Q10 turns off and U2B resets.

The Q output of U2B (low) extinguishes the WRITE LED and holds the output of NAND gate U8B high, inhibiting the function of persistence control timer U1A (schematic 16). The Q output also is applied through U4D and U4C to an input on NAND gate U7A, holding its output high. This prevents U7A from clocking U2B after each sweep.

In addition, the Q output of U2B is applied through AND gate U4B to the CLR inputs on erase flip-flops and U5A and U5B (through CR7). The low holds the erase flip-flops in their reset state.

The $\overline{Q}$ output of U2B (high) lights the STORE LED. The signal is inverted by NAND gate U3A and applied to the junction of R75/CR10 (schematic 16), disabling the PERSISTENCE/VIEW TIME potentiometer R2 input to timer U1A. Also, the $\overline{Q}$ output of U2B is applied to the inverted inputs on both erase cycle monostable multivibrators U11A and U11B, inhibiting them. This prevents generation of the erase cycle functions during the store mode of operation.

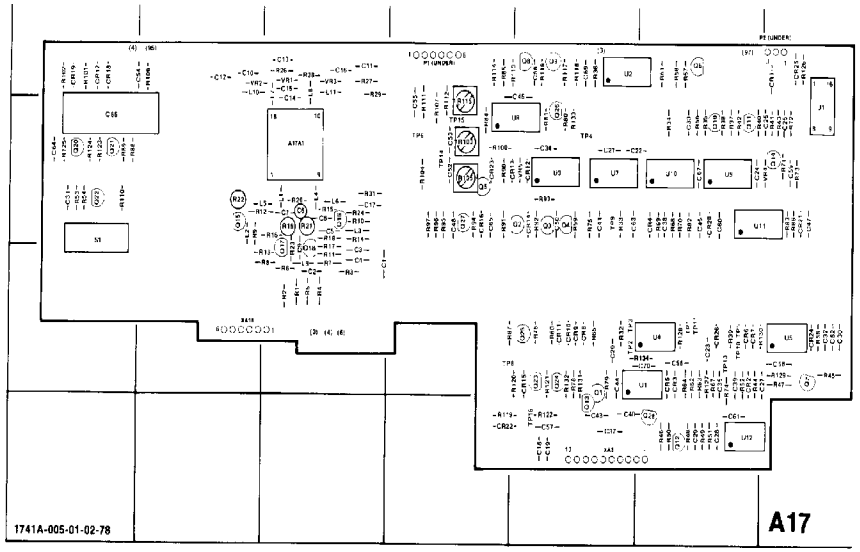
In addition, the $\overline{Q}$ output of U2B is applied to an input on NAND gate U3D (schematic 16). Since the other input to the gate is the STORE DISPLAY ENABLE signal (always high except in store display mode), the output of U3D goes low, turning off Q5. With Q5 cut off, -100 volts is applied to both CRT floodgun grids (FGG1-1 and FGG1-2), turning off the floodguns.

STORE DISPLAY MODE. The store mode of operation preconditions display enable flip-flop U2A (schematic 15) by applying a high to the CLR and J inputs, and by applying a low to the $\overline{K}$ input. Engaging STORE/DISPLAY switch A18S1 while in the store mode of operation toggles U2A (Q output high) and the DISPLAY LED lights. With the CLR and J inputs high and the $\overline{K}$ input low, U2A will toggle from one state to the other (set-reset) each time the STORE/DISPLAY switch is engaged.

The $\overline{Q}$ output of U2A (low) is applied to an input on U3D as the STORE DISPLAY ENABLE signal. The signal holds the output of U3D high allowing Q5 to conduct, turning on the CRT floodguns. This allows the operator to view the stored display.

NOTE

In CONV mode of operation, switch S1 (schematic 15) grounds the emitter of Q5 through CR23, disabling the CRT floodguns.



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	REF DESIG	GRID LOC
A17A1	C-3	C38	F-3	CR8	E-2	Q5	D-3	R14	C-3	R52	F-2	R90	D-3	R131	E-2
C1	C-2	C39	F-2	CR9	E-2	Q6	F-4	R15	C-3	R53	A-3	R91	D-3	R132	E-2
C2	C-2	C40	E-1	CR10	E-2	Q7	G-2	R16	C-3	R54	A-3	R92	E-3	R133	E-3
C3	C-2	C41	E-3	CR11	E-2	Q8	E-4	R17	C-3	R55	G-2	R93	E-3	R134	F-2
C4	C-2	C43	E-1	CR12	E-3	Q9	E-4	R18	C-3	R56	F-3	R94	D-3	S1	A-3
C5	C-3	C44	E-2	CR13	E-3	Q10	F-3	R19	C-3	R57	F-4	R95	D-3	TP1	F-2
C6	C-2	C45	F-3	CR14	E-3	Q11	F-3	R20	C-3	R58	F-4	R96	D-3	TP2	E-2
C7	C-2	C46	E-4	CR15	E-2	Q12	F-1	R21	C-3	R59	E-3	R97	D-3	TP3	E-2
C8	C-2	C47	G-3	CR16	D-3	Q13	E-1	R22	C-3	R60	E-2	R100	D-3	TP4	E-3
C9	C-3	C48	D-3	CR17	A-4	Q14	G-3	R23	C-3	R61	F-4	R101	A-4	TP5	F-2
C10	B-4	C50	E-3	CR18	A-4	Q15	B-3	R24	C-3	R62	F-2	R102	A-4	TP6	D-3
C11	C-4	C52	D-3	CR19	A-4	Q16	C-3	R26	C-4	R63	F-2	R103	D-3	TP8	D-2
C12	B-4	C53	D-3	CR20	F-3	Q17	C-3	R27	C-4	R64	F-2	R104	D-3	TP9	E-3
C13	C-4	C54	A-4	CR21	G-3	Q18	C-3	R28	C-4	R65	E-2	R105	D-3	TP10	F-2
C14	C-4	C55	D-3	CR22	D-1	Q20	A-3	R29	C-4	R67	F-2	R106	B-4	TP11	F-2
C15	C-4	C56	E-4	CR23	D-3	Q21	A-3	R31	C-3	R68	F-3	R107	D-4	TP13	F-2
C16	C-4	C57	E-1	CR24	G-2	Q22	A-3	R32	E-2	R69	F-3	R110	A-3	TP14	D-3
C17	C-3	C58	F-2	CR25	G-4	Q23	E-2	R33	E-3	R70	F-3	R111	D-3	TP15	D-3
C18	E-1	C59	G-3	CR26	F-2	Q24	E-2	R34	F-3	R71	G-3	R112	D-4	TP16	E-1
C19	E-1	C60	F-3	J1	G-3	Q25	E-2	R35	F-3	R72	G-3	R113	D-4	U1	F-2
C20	E-2	C61	F-1	L1	C-3	Q26	E-3	R36	E-4	R73	G-3	R114	D-4	U2	E-4
C21	E-3	C62	G-2	L2	B-3	Q27	D-3	R37	F-3	R74	F-2	R115	D-4	U3	E-3
C22	E-2	C63	E-3	L3	C-3	Q28	F-1	R38	F-3	R75	E-3	R116	E-4	U4	F-2
C23	F-2	C64	A-3	L4	C-3	R1	C-2	R39	F-2	R76	E-2	R117	E-4	U5	G-2
C24	F-3	C65	D-3	L5	B-3	R2	C-2	R40	F-3	R78	E-2	R118	E-4	U7	E-3
C25	G-3	C66	A-3	L6	C-3	R3	C-2	R41	G-3	R79	E-2	R119	D-1	U8	E-3
C26	G-3	C67	F-3	L7	C-4	R4	C-2	R42	F-3	R80	E-3	R120	E-2	U9	F-3
C27	F-2	C68	G-2	L8	C-4	R5	C-2	R43	G-2	R81	E-3	R121	E-2	U10	F-3
C28	F-1	C69	E-4	L9	C-2	R6	C-2	R44	F-2	R82	F-3	R122	E-1	U11	G-3
C29	F-1	C70	F-2	L10	B-4	R7	C-2	R45	G-2	R83	G-3	R123	A-3	U12	F-1
C30	G-2	CR1	G-4	L11	C-4	R8	C-2	R46	F-1	R84	D-3	R124	A-3	VR1	C-4
C31	A-3	CR2	F-2	P1	D-4	R9	B-3	R47	G-2	R85	D-4	R125	A-3	VR2	B-4
C32	G-2	CR3	F-2	P2	G-4	R10	C-3	R48	F-1	R86	G-3	R126	G-4	VR3	C-4
C33	F-3	CR4	F-3	Q1	E-2	R11	C-2	R49	F-1	R87	D-2	R127	F-2	VR4	G-3
C34	E-3	CR5	F-2	Q2	E-3	R12	B-3	R50	F-1	R88	A-3	R128	F-2	VR5	E-3
C35	F-2	CR6	F-2	Q3	E-3	R13	C-2	R51	F-1	R89	A-3	R129	G-2	XA3	E-1
C37	E-1	CR7	F-2	Q4	E-3					R90	D-3	R130	G-2	XA16	B-2

CRT Control A17 Component Locator
(01741-66509)

Figure 8-31. Service Information, CRT Control P/O Assembly A17 (Sheet 1 of 2)

MODE OF OPERATION							
ELEMENT	TEST POINT	CONV	WRITE	ERASE	AUTO ERASE	STORE	DISPLAY
FLOODGUN GRID 1-1 GRID 1-2	A17TP15 A17TP14	−100 V	0 V to −30 V (Adjustment)	0 V to −30 V (Adjustment)	0 V to −30 V (Adjustment)	−100 V	0 V to −30 V (Adjustment)
FLOODGUN GRID 2	A17P1 PIN 4	+35 V	+35 V	+35 V	+35 V	+35 V	+35 V
COLLI-MATOR	A17Q9 EMITTER	+70 V	+70 V	+90 V / +70 V ≈1 kHz	+90 V / +70 V ≈1 kHz	+70 V	+70 V
COLLEC-TOR MESH	A17R102 (4) WIRE	+156 V	+156 V	+156 V	+156 V	+156 V	+156 V
STORAGE MESH	A17R101 (95) WIRE	+156 V	+8 V / +1 V FREQ VARIES WITH PERSIS-TENCE (+1 V BASELINE VARIES WITH BRIGHTNESS)	+156 V / +8 V / +1 V / −14 V +1 V BASE LINE VARIES WITH BRIGHTNESS	+156 V / +1 V to +7 V / −14 V +1 V TO +7 V (VARIES WITH BRIGHTNESS)	+1 V (MIN BRIGHTNESS) +7 V (MAX BRIGHTNESS)	+1 V (MIN BRIGHTNESS) +7 V (MAX BRIGHTNESS)

Figure 8-31. Service Information, CRT Control, P/O Assembly A17 (Sheet 2 of 2)

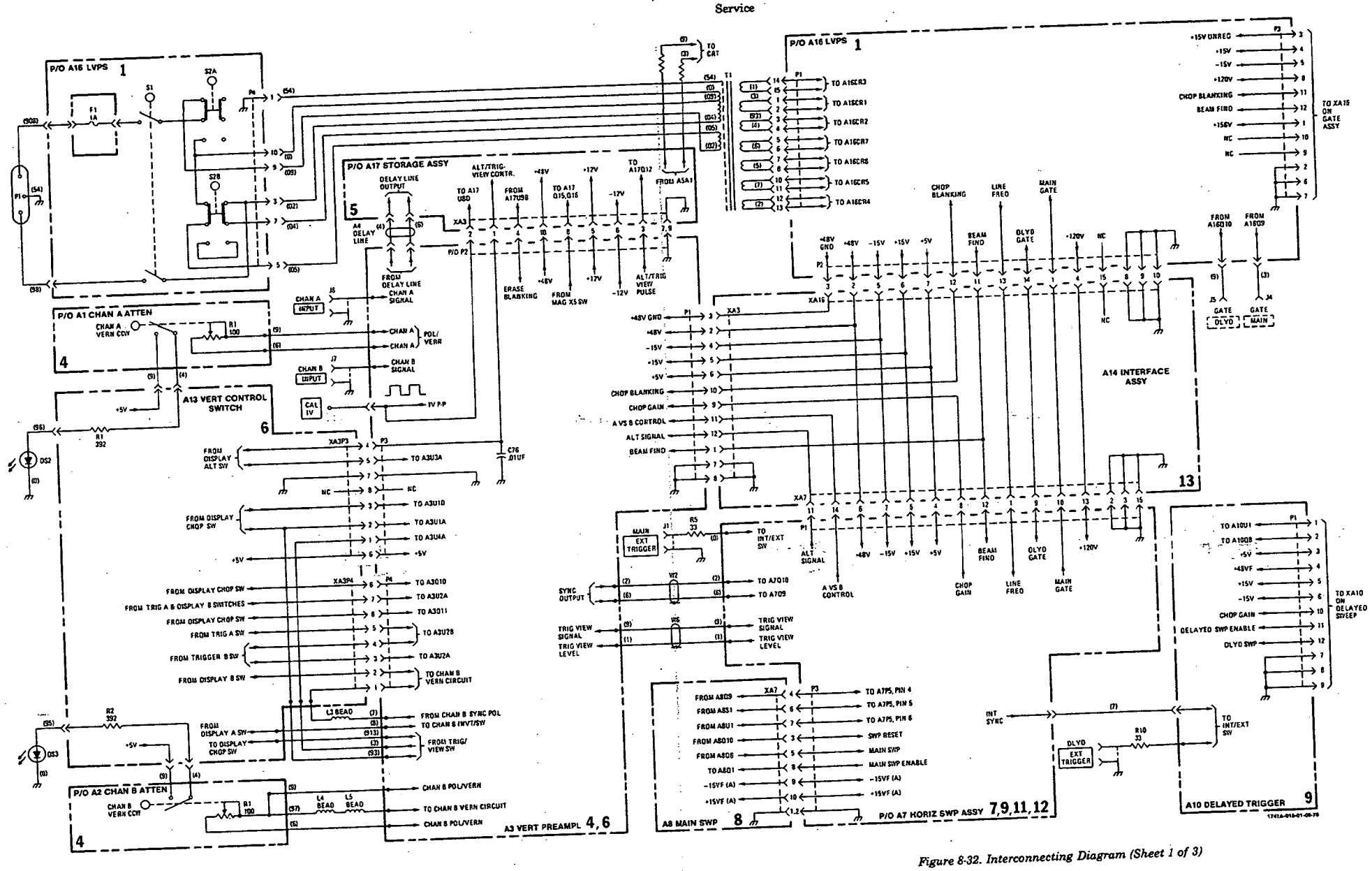


Figure 8-32. Interconnecting Diagram (Sheet 1 of 3)

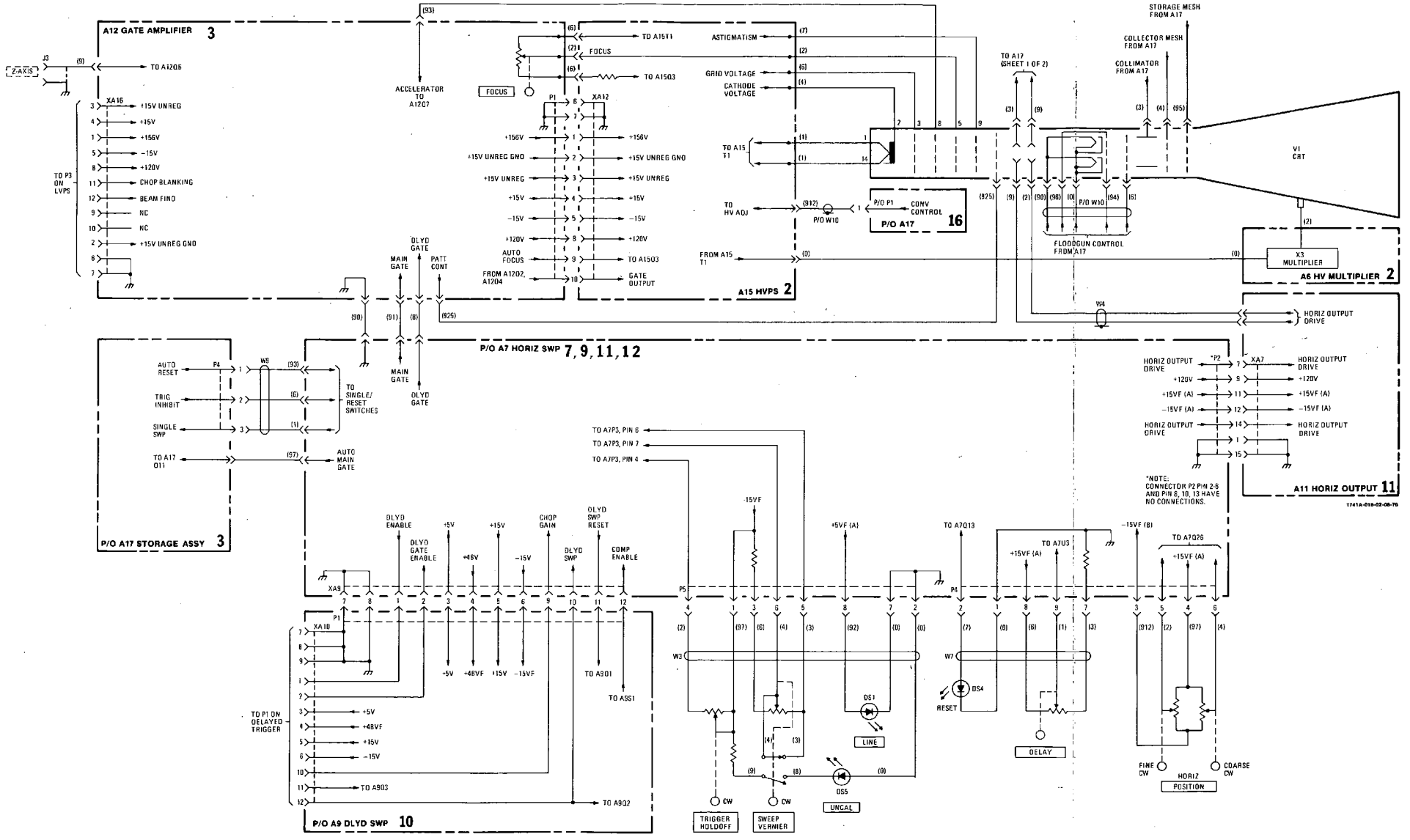


Figure 8-32.
Interconnecting Diagram (Sheet 2 of 3)

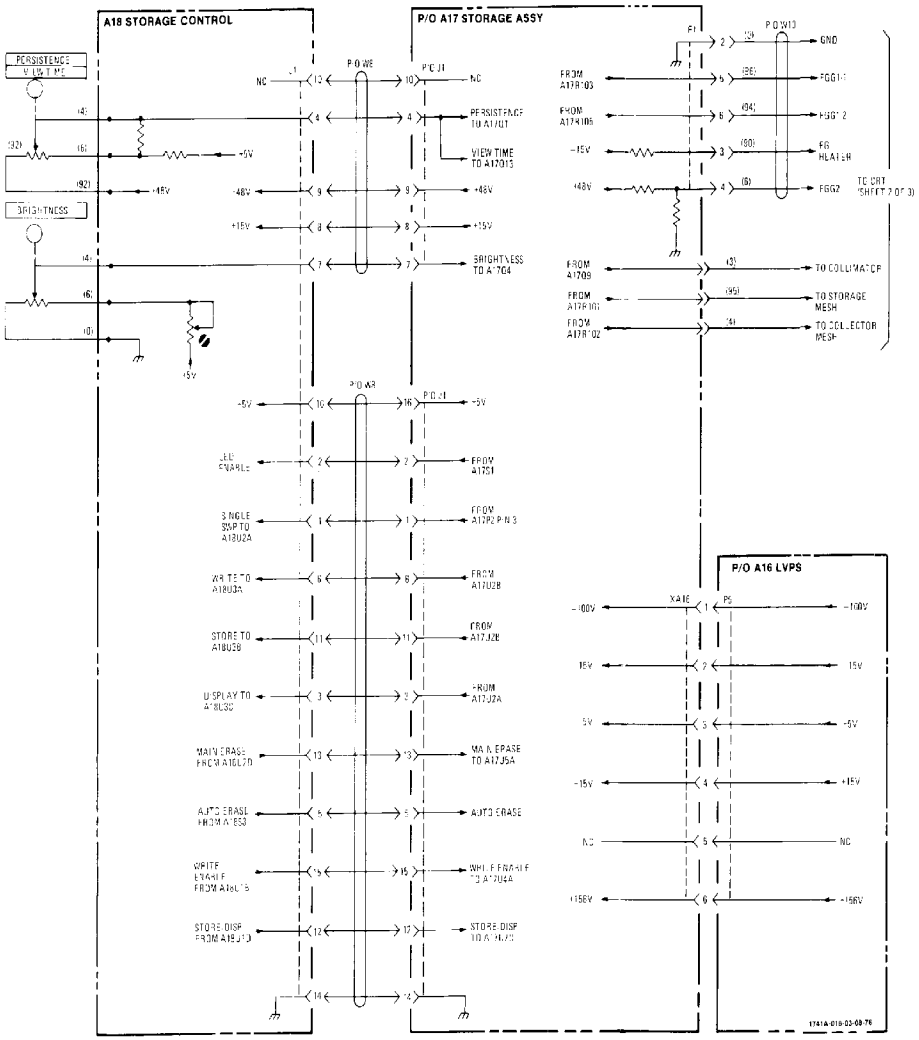


Figure 8-32. Interconnecting Diagram (Sheet 3 of 3)

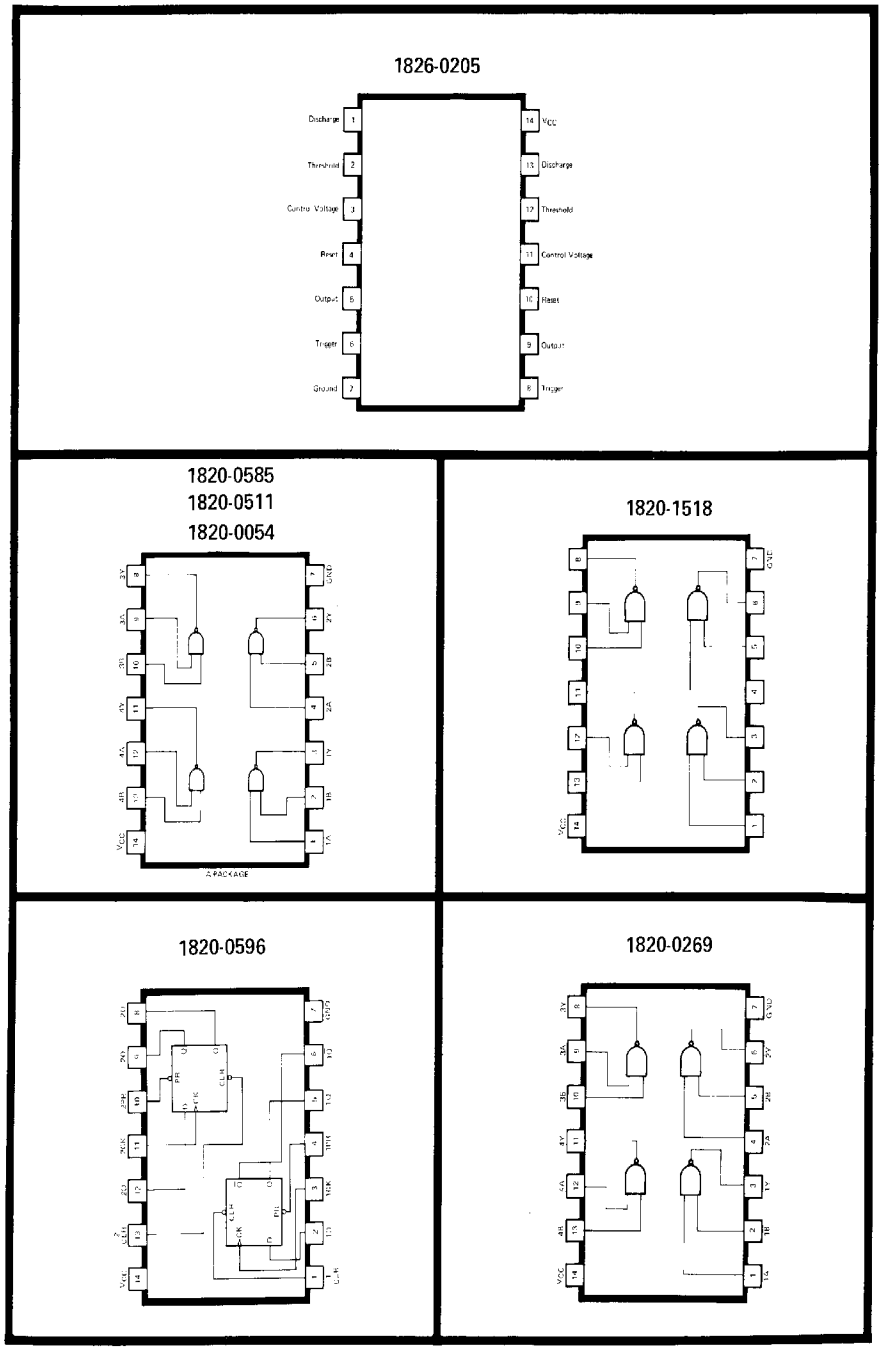
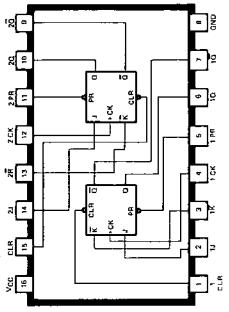
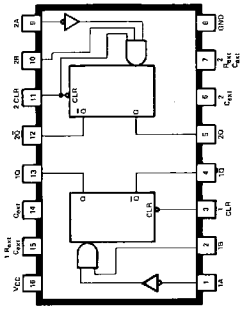


Figure 8-33. IC Configurations (Sheet 1 of 2)

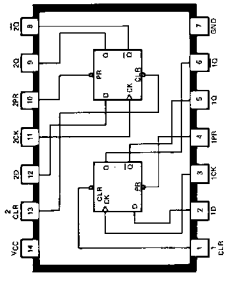
1820-1116



1820-0579



1820-0077

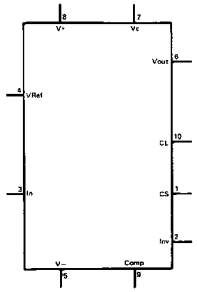


TRUTH TABLE (Each Flip Flop)

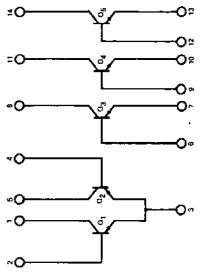
t_n	t_{n+1}	
tINPUT	OUTPUT	OUTPUT
D	Q	Q
L	L	H
H	H	L

NOTES:
t_n = bit time before clock pulse.
t_{n+1} = bit time after clock pulse.

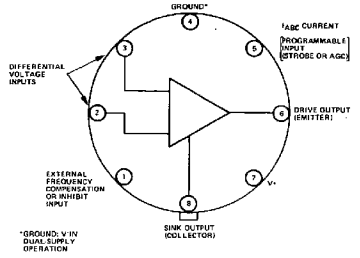
1820-0196



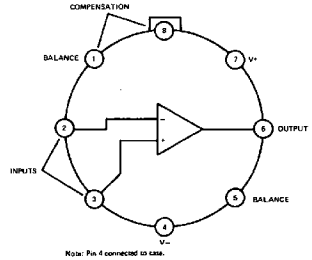
1821-0001



1826-0167



1826-0059



Note: Pin 4 connected to case.

1826-0086

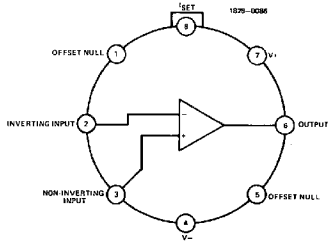


Figure 8-33.
IC Configurations, (Sheet 2 of 2)