Errata

Title & Document Type: **1722A Oscilloscope Operating and Service Manual**

Manual Part Number: **01722-90907**

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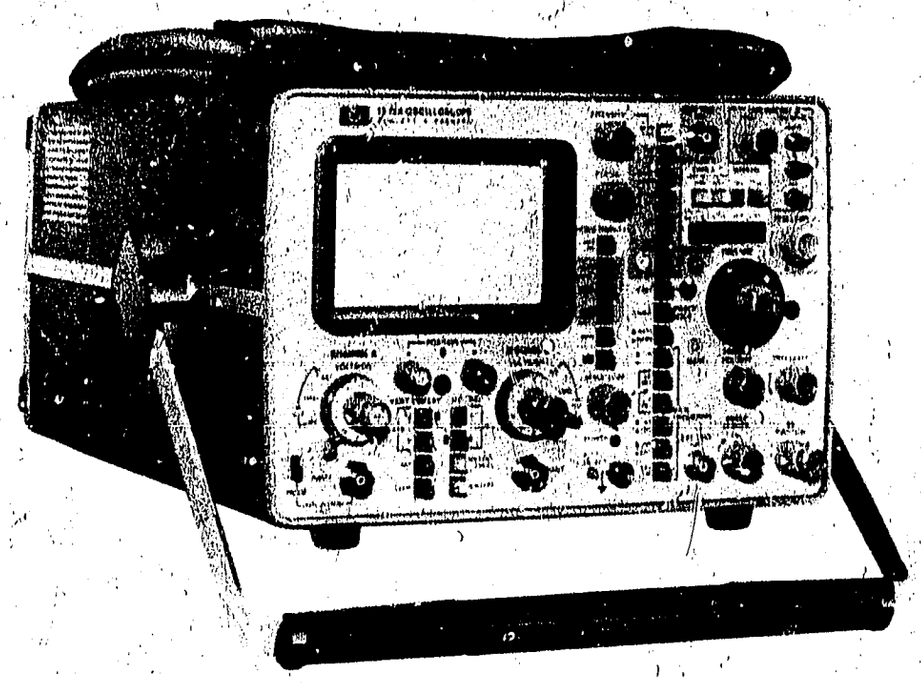
OPERATING AND SERVICE MANUAL

1722A OSCILLOSCOPE



HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

MODEL 1722A
OSCILLOSCOPE

(Including Options 001, 003, 011, 091, 092, 093, 095, 096, and 101)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed **1715A.**

With changes described in Section VII, this manual also applies to instruments with serial numbers prefixed from **1429A** through **1643A.**

For additional information about serial numbers, see INSTRUMENT AND MANUAL IDENTIFICATION in Section I.

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

Manual Part Number 01722-90907
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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Hewlett-Packard Model 1722A Oscilloscope is a general-purpose, wide-band oscilloscope designed for bench or field service. It provides accurate measurements of high-frequency signals and fast rise time pulses with 10-mV/div vertical deflection capability over the full 275 MHz bandwidth. Input impedances of either 50 ohms or 1 megohm permits impedance selection that best meets measurement application. Its low shunt capacitance of less than 11 pF reduces phase shift and signal loss in pulse or cw measurements.

1-3. In addition, the 1722A can make both voltage and time measurements without having to use the CRT for quantitative measurements. Instead, the CRT becomes a null indicator and all pertinent data can be obtained from the LED (light-emitting diode) readout.

1-4. This manual contains installation and operating instructions, as well as maintenance information for the 1722A. Instrument specification and procedures for verifying proper operation are included. Procedures are also included for adjusting the instrument to its performance specifications. Schematic diagrams, the theory of operation, and troubleshooting information are provided for use in maintaining the instrument.

1-5. This section of the manual contains performance specifications for the 1722A, and a list of available options. It also lists accessories that are available. Instrument and manual identification information are also included.

1-6. SPECIFICATIONS.

1-7. Table 1-1 is a complete list of the Model 1722A critical specifications that are controlled by tolerances. Any changes in specifications due to manufacturing, design, or traceability to the U.S. National Bureau of Standards are included in table 1-1 or on a manual change sheet included with this manual. The manual and manual change sheet (if any) supersedes all previous information concerning specifications of the Model 1722A. Table 1-2 contains general information concerning physical and operating characteristics of the 1722A.

1-8. ACCESSORIES SUPPLIED.

1-9. The following accessories are supplied with the Model 1722A:

Two Model 10017A Voltage Divider Probes
One Blue Light Filter, HP Model 10115A
One Front-panel Cover, HP Part No. 5040-0516
One Vinyl Storage Pouch, HP Part No. 1540-0292
One 7.5-ft Power Cord, refer to Section II for HP Part No.
One Attenuator Resistor Kit, HP Part No. 5080-9696

1-10. ACCESSORIES AVAILABLE.

1-11. The following accessories are available for the Model 1722A:

Model 10014A Voltage Divider Probe
Model 10016A Voltage Divider Probe
Model 10020A Resistive Divider Probe Kit
Model 1120A 500 MHz Active Probe
Model 1125A Impedance Converter Kit
Model 10491A Rack Mount Adapter

1-12. OPTIONS.

1-13. Standard options are modifications installed on HP instruments at the factory and are available on request. The following options extend the usefulness of the Model 1722A:

OPTION 001. This option supplies a fixed ac power cord in place of the normal detachable power cord. The option consists of the standard instrument modified by the addition of a power cord adapter plate (HP Part No. 01720-03201) and a power cord (HP Part No. 8120-1202).

OPTION 003. This options supplies two rear panel connectors for probe power. The option consists of the standard instrument and assembly A25 (HP Part No. 01720-66516). Refer to Section VII for additional information.

OPTION 011. Replaces standard P31 phosphor CRT (V1) with internal graticule P11 phosphor CRT (HP Part No. 5083-4042). The option also replaces as the standard assembly A14 with optional assembly A14 (HP Part No. 01720-66531).

OPTION 091. This option adds two Model 1125A Probe Impedance Converters to the basic Model 1722A.

OPTION 092. This option adds one Model 1120A 500-MHz Probe to the basic Model 1722A.

OPTION 093. This option adds two Model 10020A Resistor Divider Kits to the basic Model 1722A.

OPTION 095. This option adds two Model 10014A 10:1 Voltage Divider Probes to the basic Model 1722A.

OPTION 096. This option adds two Model 10016B 10:1 Voltage Divider Probes to the Basic Model 1722A.

OPTION 101. This option adapts the Model 1722A for use with HP Model 1607A Logic State Analyzer to provide both digital and analog analysis. Refer to Section VII for additional information.

1-14. INSTRUMENT AND MANUAL IDENTIFICATION.

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

1-16. This manual applies to instruments with a serial prefix number as shown on the title page. If changes have been made in the instrument since this manual was printed, a "Manual Changes" supplement supplied with the manual will define these changes. Be sure to record these changes in your manual. Backdating information in Section VII adapts the manual to instruments with serial numbers lower than that shown on the title page. Part numbers for the manual and the microfiche copy of the manual are also shown on the title page.

Table 1-1. Specifications

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 approx 1 MHz rate with blanking during switching (CHOP); channel A plus channel B (algebraic addition).

VERTICAL AMPLIFIERS (2)

BANDWIDTH (<3 dB down from a 6 div reference signal.)

DC-Coupled: dc to 275 MHz in both 50 ohm and high impedance input modes.

AC-Coupled: approx 10 Hz to 275 MHz.

BANDWIDTH LIMIT: limits upper bandwidth to approx 20 MHz.

RISE TIME: <1.3 ns (calculated by T_r = 0.35/Bandwidth in MHz).

DEFLECTION FACTOR

Ranges: 10 mV/div to 5 V/div (9 calibrated positions) in 1, 2, 5 sequence. ±2% attenuator accuracy.

Vernier: continuously variable between all ranges; extends maximum deflection factor to at least 12.5 V/div. Front panel light indicates when vernier is not in CAL position.

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

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

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

INPUT RC (SELECTABLE)

AC and DC: 1 megohm ±2% shunted by approx 11 pF.

50 Ohm: 50 ohms ±2%; VSWR, <1.3:1 on 10, 20, and 50 mV ranges and <1.15:1 on all other ranges.

MAXIMUM INPUT

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

50 Ohm: 5 V rms or ±250 V peak whichever is less.

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 40 dB from dc to 5 MHz decreasing to 26 dB at 50 MHz. Common mode signal amplitude equivalent to 12 cm with one vernier adjusted for optimum rejection.

TRIGGER SOURCE

Selectable from channel A, channel B, or Composite.

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.

CHANNEL A INPUT – DC VOLTS

DISPLAY: light emitting diodes (LED).

NUMBER OF DIGITS: 3-1/2.

DISPLAY UNITS: 0 exponent indicates volts; —3 exponent indicates millivolts.

X1 RANGE: 95 mV to 47 V full scale vertical deflection (10 mV/div to 5 V/div).

X10 RANGE: 0.95 V to 470 V full scale vertical deflection (100 mV/div to 50 V/div with X10 probe).

ACCURACY: ±0.5% reading ±0.5% full scale (full scale = 10 cm), 20°C to 30°C.

STABILITY: temperature coefficient, ≈±0.02%/°C.

INPUT IMPEDANCE: X1 range, 1 megohm shunted by approx 11 pF; X10 range (with X10 probe) 10 megohms shunted by approx 10 pF.

SAMPLE RATE: approx 2/s.

RESPONSE TIME: <1 s.

REFERENCE SET: meter may be zeroed permitting dc voltage measurements with respect to any voltage within selected range. Drift may be eliminated by the REF SET control.

OVERRANGE: flashing display indicates overrange condition.

Table 1-1. Specifications (Cont'd)

CHANNEL A POSITION - VOLTS

(Channel A vernier in CAL detent.) With the following exceptions, specifications are the same as Channel A Input - DC Volts.

MEASUREMENT: dc substitution method using channel A position control to determine voltage of any point on displayed waveform using any graticule line as reference.

BANDWIDTH: dc to 275 MHz (<3 dB down from a 6 div reference signal).

DYNAMIC RANGE: ±6 cm from ground referenced to center screen.

REFERENCE SET: meter may be zeroed, permits instantaneous voltage measurements with respect to any voltage within selected range.

ACCURACY: ±1% reading ±0.5% of full scale (10X the volts/div range) measured at dc.

CHANNEL A POSITION — %

(Channel A vernier out of CAL detent.)

MEASUREMENT: dc substitution method using channel A position control to determine percent of any waveform point with respect to user defined 0 and 100% points.

RANGE: 0 to ±140% (calibrated with vernier so that 100% equals 5 div).

ACCURACY: ±1%.

ZERO REFERENCE: meter may be zeroed to permit percent measurements with respect to any waveform point.

VERTICAL OUTPUT

AMPLITUDE: one division of vertical deflection produces approx 100 mV output (dc to 50 MHz).

CASCADED DEFLECTION FACTOR: 1 mV/div with both vertical channels set to 10 mV/div.

CASCADED BANDWIDTH: dc to 5 MHz with bandwidth limit engaged.

SOURCE RESISTANCE: approx 100 ohms.

SOURCE SELECTION: trigger source set to channel A selects channel A output; trigger source set to channel B selects channel B output.

HORIZONTAL DISPLAY MODES

Main, main intensified, mixed, delayed, mag X10, and X-Y.

MAIN TIME BASE

SWEEP

Ranges: 10 ns/div to 0.5 s/div (24 ranges) in 1, 2, 5 sequence.

Accuracy

Main Sweep Time/Div	Accuracy (0°C to 55°C)	
	X1	X10
10 ns to 50 ns	±3%	±5%
100 ns to 20 ms	±2%	±3%
50 ms to 0.5 s	±3%	±3%

Vernier: continuously variable between all ranges, extends slowest sweep to at least 1.25 s/div. Vernier uncalibrated light indicates when vernier is not in CAL position.

Magnifier: expands all sweeps by a factor of 10, extends fastest sweep to 1 ns/div.

SWEEP MODE

Normal: sweep is triggered by internal or external signal.

Automatic: bright baseline displayed in absence of input signal from 10 ns/div to 20 ms/div. Triggering is same as normal above 40 Hz. Normal triggering is generally required for sweep speeds from 50 ms/div to 0.5 s/div.

Single: in Normal mode, sweep occurs once with same triggering as normal, reset pushbutton arms sweep and lights indicator; in Auto mode, sweep occurs once each time Reset pushbutton is pressed.

MAIN TIME BASE TRIGGERING

INTERNAL: dc to 50 MHz on signals causing 0.5 division or more vertical deflection, increasing to 1 division of vertical deflection at 300 MHz in all display modes. Triggering on line frequency is also selectable.

EXTERNAL: dc to 100 MHz on signals of 50 mV p-p or more increasing to 100 mV p-p at 300 MHz.

EXTERNAL INPUT RC: approx 1 megohm shunted by approx 15 pF.

TRIGGER LEVEL AND SLOPE

Internal: at any point on the vertical waveform displayed.

External: continuously variable from +1.0 V to −1.0 V on either slope of the trigger signal, +10 V to −10 V in divide by 10 mode (÷10).

Maximum Input: ±250 V (dc + peak ac) at 1 kHz or less.

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

AC: attenuates signals below approx 10 Hz.

LF Reject: attenuates signals below approx 7 kHz.

HF Reject: attenuates signals above approx 7 kHz.

TRIGGER HOLDOFF: time between sweeps continuously variable, exceeding one full sweep from 10 ns/div to 50 ms/div.

MAIN INTENSIFIED

Intensifies that part of main time base to be expanded to full screen in delayed time base mode. Time interval controls adjust position of intensified portion of sweep. Rear panel intensity ratio control sets relative intensity of brightened segment.

DELAYED TIME BASE

SWEEP

Ranges: 10 ns/div to 20 ms/div (20 ranges) in 1, 2, 5 sequence.

Accuracy (0 to 55°C): same as main time base.

Magnifier (0 to 55°C): same as main time base.

DELAYED TIME BASE TRIGGERING

INTERNAL: same as main time base except there is no Line Frequency triggering.

Table 1-1. Specifications (Cont'd)

STARTS AFTER DELAY: delayed sweep automatically starts at end of delay period.
TRIGGER: with delayed trigger level control out of detent (Starts After Delay) delayed sweep is triggerable at end of delay period.
EXTERNAL: dc to 100 MHz on signals of 50 mV p-p or more, increasing to 100 mV p-p at 300 MHz.
Maximum Input: ±250 V (dc + peak ac) at 1 kHz or less.
EXTERNAL INPUT RC: approx 1 megohm shunted by approx 15 pF.

TRIGGER LEVEL AND SLOPE
Internal: at any point on the vertical waveform displayed when in triggered mode.
External: continuously variable from +1.0 V to —1.0 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 10 Hz.
LF Reject: attenuates signals below approx 7 kHz.
HF Reject: attenuates signals above approx 7 kHz.

TIME INTERVAL
Delay Time: first marker may be positioned anywhere from 0.5 to 10X of the main TIME/DIV setting of 20 ns to 0.5 s (minimum delay is 50 ns).
Delay Jitter: refer to Time Interval Measurements, Stability.

TIME INTERVAL MEASUREMENTS.
Function: measures time interval between two events on channel A (channel A display); between two events on channel B (channel B display); or between two events starting from an event on channel A and ending with an event on channel B (Alternate display).
Display Units: 0(s); —3(ms); —6(μs); or —9(ns).
Resolution: intervals <1 cm, >0.01% of full scale; intervals >1 cm, >0.1% of full scale; maximum display resolution, 20 ps.
Stability (0°C to +55°C): short term, <0.01%. Temperature, ±0.03%/°C deviation from calibration temperature range.

Accuracy

Main Time Base Setting	Accuracy (+20°C to +30°C)
100 ns/div to 20 ms/div	±0.5% of measurement ±0.02% of full scale for measurements <1 cm. For measurements >1 cm, ±0.5% of measurement ±0.05% of full scale.
50 ns/div*	±0.5% of measurement ±0.06% of full scale.
20 ns/div*	±0.5% of measurement ±0.15% of full scale.
50 ms/div to 0.5 s/div	±3%.

*Starting after 60 ns of sweep.

RECIPROCAL OF TIME INTERVAL MEASUREMENTS (1/TIME)
Function: calculates and displays the reciprocal of the measured time interval.
Display Units: 0 (Hz); 3 (kHz); 6 (MHz).
Accuracy: same as Time Interval Measurements.
Resolution: same as Time Interval Measurements.
Stability: same as Time Interval Measurements.

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.

X-Y OPERATION

BANDWIDTH
Y-axis (channel A): same as channel A.
X-axis (channel B): dc to >3 MHz.
DEFLECTION FACTOR: 10 mV/div to 5 V/div (9 calibrated positions) in 1, 2, 5 sequence.
PHASE DIFFERENCE BETWEEN CHANNELS: <3°, dc to 1 MHz.

Table 1-2. General Information

CATHODE-RAY TUBE AND CONTROLS

TYPE: post accelerator, approx 20.5 kV accelerating potential, aluminized P31 phosphor.

GRATICULE: 6 X 10 div internal graticule. 0.2 subdivision markings on major horizontal and vertical axes. 1 div = 1 cm. Rear panel adjustment aligns trace with graticule. Internal flood gun graticule illumination.

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

INTENSITY MODULATION: +5 V, >50 ns width pulse blanks trace of any intensity, useable to 20 MHz for normal intensity. Input R, 1 kΩ ±10%. Maximum input +10 V (dc + peak ac).

AUTO-FOCUS: automatically maintains beam focus with variations of intensity.

INTENSITY LIMIT: automatically limits beam current to reduce possible CRT damage. Circuit response time ensures full writing speed for viewing low duty cycle, fast rise time pulses.

REAR PANEL CONTROLS: astigmatism, pattern, main/delayed intensity ratio, and trace align.

GENERAL

REAR PANEL OUTPUTS: main and delayed gates, —0.7 V to +1.3 V capable of supplying approx 3 mA.

CALIBRATOR: 1 kHz ±15% square wave; 3 V p-p ±1%; rise time, <0.1 μs.

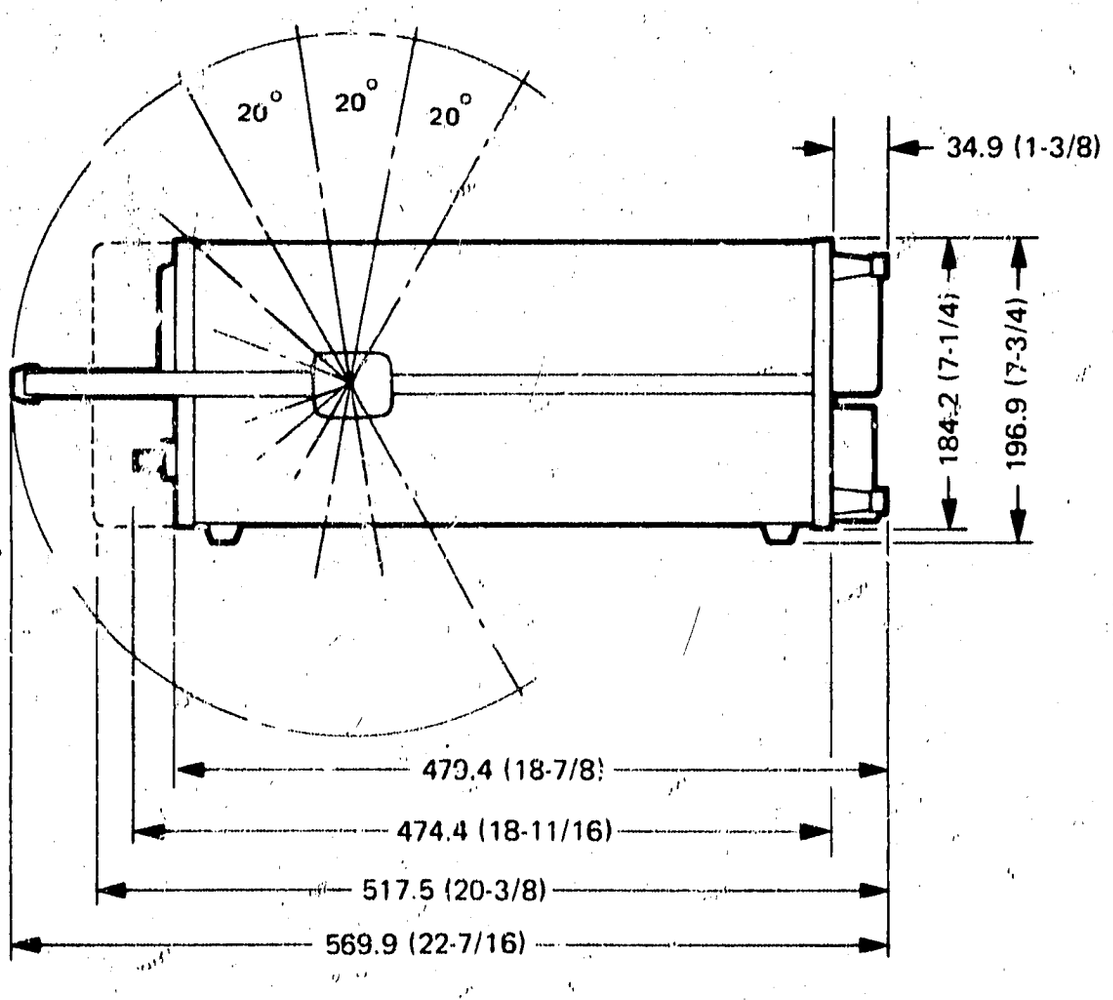
POWER: 100, 120, 220, 240, —10% +5%; 48 to 440 Hz; 110 VA max.

WEIGHT: net, 13.2 kg (29 lb); shipping, 18.1 kg (40 lb).

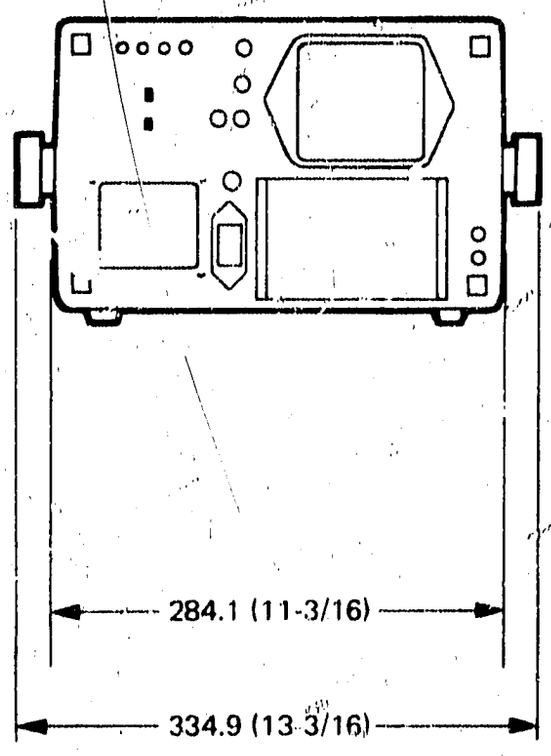
OPERATING ENVIRONMENT: temperature, 0°C to 55°C; humidity, up to 95% relative humidity at 40°C; altitude, to 4600 m (15 000 ft); vibration, vibrated in three planes for 15 minutes each with 0.254 mm (0.010 in.) excursion, 10 to 55 Hz.

DIMENSIONS: see outline drawing.

ACCESSORIES FURNISHED: Two Model 10017A Voltage Divider Probes, one Model 10115A blue light filter; one front panel cover; one 2.3 m (7.5 ft) power cord; one vinyl accessory storage pouch; one Operating and Service Manual.



NOTES
1. Dimensions are for general information only. If dimensions are required for building special enclosures, contact your HP Field Engineer.
2. Dimensions are in millimeters and (inches).



INSTALLATION

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions necessary for installing and interfacing the Model 1722A Oscilloscope. Included are initial inspection procedures, power and grounding requirements, installation instructions, and procedures for repacking the instrument for shipment.

2-3. INITIAL INSPECTION.

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

WARNING

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

2-5. POWER CORDS AND RECEPTACLES.

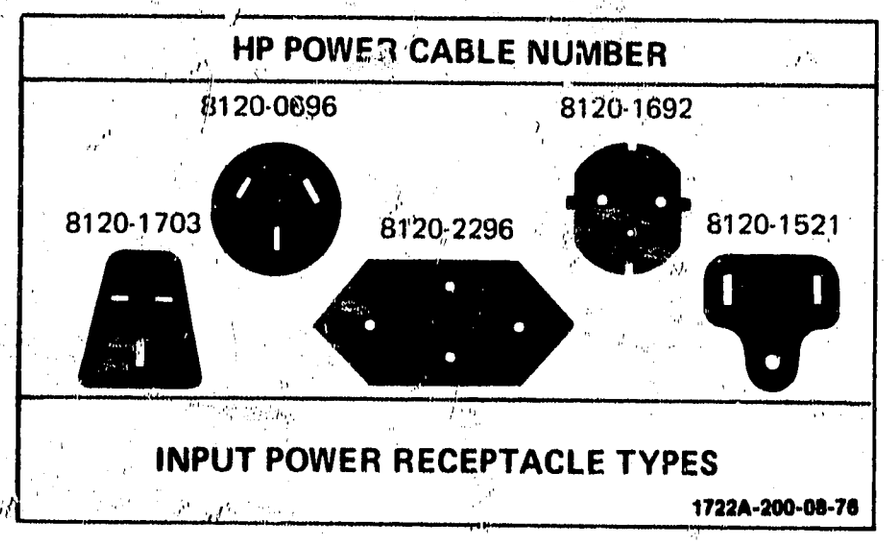


Figure 2-1. Power Cable Configurations

2-6. Figure 2-1 illustrates the standard configuration used for HP power cords. The HP part number directly above each drawing is the part number for an instrument power cord equipped with a connector of that configuration. If the appropriate power cord is not included with the instrument, notify the nearest HP Sales and Service Office and a replacement cord will be provided.

2-7. POWER REQUIREMENTS.

2-8. The Model 1722A can be operated from any power source supplying 100 V, 120 V, 220 V, or 240 V —10% +5%, single phase, 48 to 440 Hz. Power dissipation is 110 VA maximum.

CAUTION

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

2-9. The instrument is normally set at the factory for 120-volt operation. To operate the instrument from any other ac power source, proceed as follows:

a. Verify that Model 1722A power cable is not connected to any input power source.

b. Move LINE-VOLTAGE SELECT switch on rear panel to 220 or 240 position.

c. Replace 1.5 Amperes LINE FUSE with 0.8 ampere fuse (HP Part No. 2110-0020).

d. Connect input power cable to 220- or 240-Vac source.

2-10. REPACKING FOR SHIPMENT.

2-11. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office for service or repair, attach a tag showing owner (with address), complete instrument serial number, and a description of the service required.

2-12. Use the original shipping carton and packing material. If the original packing material is not available, the Hewlett-Packard Sales/Service Office will provide information and recommendations on materials to be used.

OPERATION

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides general operating instructions and applications information for the Model 1722A. Included are power and warmup information, functional identification of all controls and connectors, and special applications information.

3-3. INSTRUMENT CAPABILITIES.

3-4. VERTICAL SECTION. The instrument contains dual vertical preamplifiers for dual-channel operation. Each channel offers a choice of ac, high Z dc, or 50-ohm input coupling. With the dual trace feature, displays can be obtained on either channel A, channel B, or on both channels. Simultaneous display of two signals is possible in either chop or alternate mode of display. A+B and A—B modes of operation are available, and an X-Y mode of operation is also provided. In the X-Y mode, the instrument becomes an X-Y display with inputs through channel A (Y-axis) and channel B (X-axis). Sensitivity of each axis is controlled by the channel A or channel B attenuator.

3-5. Nine calibrated switch settings on each vertical amplifier provide a deflection factor range from 10 mV/div to 5 V/div in 1, 2, 5 sequence. The vertical verniers permit continuous adjustment between calibrated steps and extend the least sensitive deflection factor (5 V/div) to at least 12.5 V/div.

3-6. HORIZONTAL SECTION. Main horizontal amplifier sweep-speed settings from 10 ns/div to 0.5 s/div are available in a 1, 2, 5 sequence. The main sweep speed is calibrated when the SWEEP VERNIER control is set to CAL detent position.

3-7. After obtaining a desired sweep, any portion can be expanded up to 1 ns/div with 5% accuracy over the center eight major divisions (X10 magnification) or 10 ns/div with 3% accuracy. This permits viewing of critical rise times or signal shapes with increased resolution. Since main and delayed sweeps are independent, the main SWEEP VERNIER may be out of CAL detent and the delayed sweep will still be calibrated.

3-8. TIME INTERVAL MEASUREMENTS. The time interval mode of operation is useful in making accurate time interval measurements, including rise time, pulse width, period and propagation delay. Time interval measurements can be made between two events on channel A, two events on channel B, or the time between an event beginning on channel A and ending on channel B.

3-9. A 3-1/2-digit LED digital readout automatically, and continuously displays the time interval between the start of the first event and the start of the second event. Time interval measurements are always displayed in units of seconds (exponent 0), milliseconds (exponent —3), microseconds (exponent —6), or nanoseconds (exponent —9). Voltage measurements are always in volts (exponent 0) or millivolts (exponent —3).

3-10. FRONT- AND REAR-PANEL DESCRIPTIONS.

3-11. Front- and rear-panel features are described in figure 3-1. Description numbers match the numbers on the illustration.

3-12. GENERAL OPERATING INSTRUCTIONS.

3-13. Before connecting ac power to the Model 1722A, make sure the rear-panel line select switches are set to correspond to the voltage of the available power line. The instrument is normally shipped from the factory set to operate from a 120-Vac source. If a different voltage source is to be used, refer to Section II for correct fuse type and settings of the line select switches.

3-14. INITIAL TURN-ON. To place the 1722A into operation, perform the following steps:

a. Set INTENSITY fully counterclockwise.

b. Set VERT DISPLAY to ALT.

c. Set trigger source to A.

d. Set vertical vernier controls for channel A and channel B to CAL detent.

e. Set B INVERT switch to out position.

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

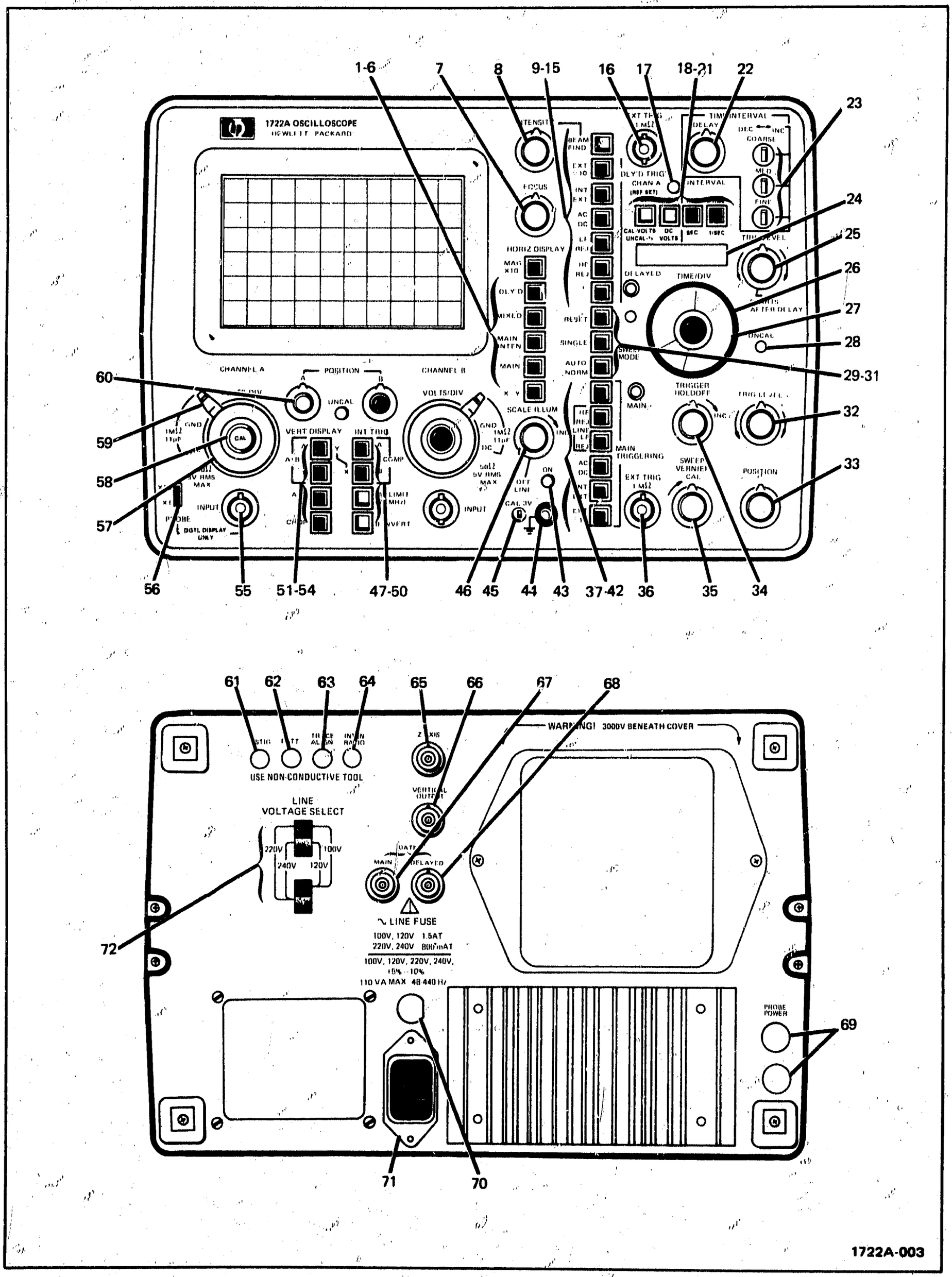
g. Set horizontal POSITION control to midrange.

h. Set main TIME/DIV to 1 mSEC position.

i. Set delayed TIME/DIV to OFF position.

j. Set main SWEEP VERNIER to CAL detent.

k. Set AUTO/NORM switch to AUTO.



1722A-003

Figure 3-1. Controls and Connectors (Sheet 1 of 2)

1. MAG X10. In X10 position, sweep or X in X-Y mode, is magnified 10 times.

2. DLY'D. Selects delayed sweep mode for display.

3. MIXED. Selects mixed sweep mode for display.

4. MAIN INTEN. Intensifies delayed sweep portion of main sweep when delayed TIME/DIV control in any position but OFF.

5. MAIN. Selects main sweep mode for display.

6. X-Y. Display mode for providing X-axis deflection with signal applied to channel B input.

7. FOCUS. Control to provide the best focused display.

8. INTENSITY. Controls brightness of display.

9. BEAM FIND. Returns display to viewing area.

10. delayed EXT ÷10. Attenuates external trigger signal by factor of 10; increases external trigger range to ±10 V.

11. delayed INT/EXT. Selects internal or external delayed sweep triggering.

12. delayed AC/DC. Selects delayed sweep trigger coupling.

13. delayed LF REJ. Attenuates delayed trigger signals below approximately 15 kHz.

14. delayed HF REJ. Attenuates delayed trigger signals above approximately 15 kHz.

15. delayed slope. Selects slope of delayed trigger signal that starts sweep.

16. delayed EXT TRIG. BNC connector for delayed external trigger signal input.

17. CHAN A (REF SET). Zeroes voltmeter display, permitting dc voltage measurements with respect to any desired reference voltage within selected range.

18. CHAN A POSN.

    a. CAL-VOLTS (X1). Measures displayed instantaneous voltage with respect to user defined reference.

    b. CAL-VOLTS (X10). Measures displayed instantaneous voltage when using X10 probe with respect to user defined reference.

    c. UNCAL—%. Direct reading of any point on waveform as a percent with respect to user defined zero and 100% reference points based on five major divisions of vertical deflection.

19. CHAN A INPUT.

    a. X1. Measures average voltage at channel INPUT connector (1 megohm AC or DC coupled) with respect to user-defined reference.

    b. X10. Measures average voltage at 10:1 divider probe tip with respect to user defined reference.

20. TIME. Measures time interval between two events. Range 0.1 ns to 5 s.

21. 1/TIME. Reciprocal of time interval. Denotes frequency or repetition rate for time intervals equal to the period.

22. DELAY. Selects delay time between start of main sweep and start of delayed sweep.

23. DEC/INC. Coarse, medium, and fine controls for setting delay time interval.

24. display. Voltage, time interval, and frequency displayed as floating point, eight-digit LED Display including decimal point, sign, and power of ten.

25. delayed TRIGGER LEVEL. Selects amplitude point on trigger signal that starts delayed sweep.

26. delayed TIME/DIV. Controls sweep time in MIXED and DLY'D sweep modes; controls intensified portion of sweep in MAIN INTEN sweep mode.

27. main TIME/DIV. Controls sweep time in MAIN sweep mode.

28. UNCAL light. Refer to step 35.

29. RESET. Resets sweep in SINGLE sweep mode; reset light indicates when sweep is armed.

30. SINGLE. Selects single or normal sweep operation.

31. AUTO/NORM.

    a. AUTO. Automatic sweep in absence of trigger signal; triggering occurs on trigger signals above 40 Hz.

    b. NORM. Sweep is triggered only by applying trigger signal.

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

33. horizontal POSITION. Controls coarse and fine horizontal position of display.

34. TRIGGER HOLDOFF. Provides control of time between sweeps. With control fully counterclockwise, holdoff time is minimum.

35. SWEEP VERNIER. Provides continuous control of sweep time between calibrated positions of TIME/DIV switch. UNCAL light indicates when control is out of CAL detent position.

36. main EXT TRIG. BNC connector for main external trigger signal.

37. main slope. Selects slope of main trigger signal that starts sweep.

38. main HF REJ. Attenuates main trigger signals above approximately 15 kHz.

39. main LF REJ. Attenuates main trigger signals below approximately 15 kHz.

NOTE

LINE trigger is selected by engaging both HF REJ and LF REJ pushbutton switches simultaneously.

40. main AC/DC. Selects main sweep trigger coupling.

41. main INT/EXT. Selects internal or external main sweep triggering.

42. main EXT ÷10. Attenuates external trigger signal by factor of 10; increases external trigger range to ±10 V.

43. power lamp. Lights when input LINE switch on.

44. ⏚ Chassis ground connection for external equipment.

45. CAL 3V. Provides 1-kHz, negative square wave of 3 volts ±1%.

46. SCALE ILLUM. Controls brightness of scale illumination; control also contains input ac power on-off switch. With control completely counterclockwise in LINE OFF position, ac power is disconnected internally.

47. internal trigger A. Selects channel A input signal for triggering.

48. internal trigger B. Selects channel B input signal for triggering.

49. BW LIMIT (20 MHz). Display bandwidth limited to 20 MHz. Useful for noise reduction in normal and cascade operation.

50. B INVERT. Control used to invert polarity of channel B signal display.

51. vertical display A. Selects channel A input signal for display.

52. vertical display B. Selects channel B input signal for display.

NOTE

Engaging both channel A and channel B vertical display pushbutton switches result in A+B (algebraic addition) display.

53. ALT. Displays each channel on alternate sweeps.

54. CHOP. Displays each channel by switching between channels at approximately 1 MHz rate.

55. INPUT. BNC connector for channel A input signal.

56. X1/X10.

    a. X1. Selects voltage measurement range of 10 mV/div to 5 V/div.

    b. X10. Used with 10:1 divider probe. Selects voltage measurement range of 100 mV/div to 50 V/div (for LED Display purposes only).

57. VOLTS/DIV. Selects vertical deflection factor necessary for calibrated measurements.

58. vernier. Provides continuous adjustment of volts/div between calibrated positions of VOLTS/DIV switch.

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

60. POSITION A. Varies vertical position of channel A display.

61. ASTIG. Adjusts roundness of writing spot.

62. PATT. Adjusts for uniform pattern over CRT viewing area.

63. TRACE ALIGN. Adjust to align trace with horizontal graticule.

64. INTEN RATIO. Adjusts intensity of intensified portion of sweep in MAIN INTEN mode of operation.

65. Z-AXIS. BNC connector for Z-axis input.

66. VERTICAL OUTPUT. BNC connector for vertical amplifier output signal; provides approximately X10 gain, dc coupled, and source impedance of 100 ohms.

67. MAIN GATE. BNC connector for main gate output to external equipment.

68. DELAYED GATE. BNC connector for delayed gate output to external equipment.

69. PROBE POWER. Connectors for supplying power to dynamic probes when Option 003 installed.

70. LINE FUSE. AC power input fuse.

71. power connector. AC power input connector.

72. LINE VOLTAGE SELECT. Selects 100/120/220/240 Vac input operation.

Figure 3-1.
Controls and Connectors (Sheet 2 of 2)

l. Set main INT/EXT trigger switch to INT.

m. Set LINE switch to ON and allow 30-minute warmup period.

n. Set INTENSITY for just visible trace.

3-15. TRACE ALIGN ADJUSTMENT. 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, proceed as follows:

a. Perform initial turn-on, paragraph 3-14.

b. Using channel A POSITION control position trace on center horizontal graticule line.

c. Using non-metalic alignment tool, adjust TRACE ALIGN screwdriver adjustment (rear panel) until trace aligns with horizontal graticule.

3-16. FOCUS AND ASTIGMATISM ADJUSTMENTS. To adjust focus and astigmatism, proceed as follows:

a. Turn INTENSITY control fully counterclockwise.

b. Set LINE switch to on position.

c. Set channel A controls as follows:

VOLTS/DIV	.01
Coupling	GND
VERT DISPLAY	A
Vernier	fully cw
Trigger select	B
POSITION	as required
HORIZ DISPLAY	X-Y

d. Set INTENSITY to observe spot.

e. Adjust front-panel FOCUS control and astigmatism adjustment A14R74 for best defined spot.

3-17. TIME INTERVAL ZERO ADJUSTMENT. To zero the analog amplifier with the LED display, proceed as follows:

a. Perform initial turn-on, paragraph 3-14.

b. Connect signal to be measured to channel A INPUT connector.

c. Set channel A VOLTS/DIV control as required.

d. Engage MAIN INTEN pushbutton switch.

e. Engage INTERVAL TIME pushbutton switch.

NOTE

If only one spot is observed, engage time interval DEC/INC COARSE switch until second spot is observed.

f. Set main and delayed TIME/DIV controls for desired display. Observe two intensified spots.

g. Using DEC/INC controls, set LED display to zero.

h. Engage DLY'D pushbutton switch.

i. Adjust A21R50 until the two observed waveforms are superimposed.

NOTE

A21R50 is accessible through hole in right side of top cover.

3-18. OPERATOR'S CHECKS.

3-19. Operation of the 1722A may be checked without additional test equipment by using the CAL 3 V output as a signal source. These functional checks will verify proper operation of display modes and the front-panel controls.

3-20. Operator's checks must be performed in the sequence given. Do not attempt to start a procedure in midsequence because succeeding steps depend on control settings and results of previous steps. If any of the results are unobtainable, refer to Section V and the schematics at the rear of this manual.

a. Set 1722A controls as follows:

CHANNEL A	
VOLTS/DIV	.5
Coupling	DC
Vernier	CAL
POSITION	as required
VERT DISPLAY	A
B INVERT	out
CHANNEL B	
VOLTS/DIV	N/A
Coupling	N/A
Vernier	N/A
POSITION	N/A
TIME BASE	
Horizontal POSITION	as required
SWEEP VERNIER	CAL
HORIZ DISPLAY	MAIN
Main TIME/DIV	0.5 mSEC
Delayed TIME/DIV	10 nSEC
AUTO/NORM	AUTO
Main trigger	INT
Main slope +/—	+
Delayed slope +/—	+
Main TRIGGER LEVEL	as required
Delayed TRIGGER LEVEL	ccw detent
TRIGGER HOLDOFF	ccw
MAG X10	out

b. Set INTENSITY, FOCUS, and POSITION controls for desired baseline display.

c. Apply CAL 3 V output directly to channel A INPUT.

d. Adjust main TRIGGER LEVEL for stable display. Observe six positive-going pulses with leading edge of first and sixth pulse on first and 11th vertical graticule lines respectively (±10%).

e. Set HORIZ DISPLAY for MAIN INTEN operation.

f. Set delayed TIME/DIV to 0.2 mSEC. Intensified portion of sweep should cover 4 to 5 divisions.

g. Adjust DELAY control until intensified portion is centered on CRT.

h. Set HORIZ DISPLAY for DLY'D operation. Observe that intensified portion is expanded to full 10 divisions.

i. Set HORIZ DISPLAY for MAIN INTEN operation.

j. Vary DELAY control and observe that intensified portion moves smoothly along display.

k. Set delayed TIME/DIV control to 10 nSEC.

l. Rotate SWEEP VERNIER counterclockwise to stop. Observe 15 or more pulses between first and 11th graticule lines.

m. Disconnect calibrator signal from vertical channel A INPUT connector.

n. Set main TIME/DIV to .1 SEC.

o. Set main TRIGGER LEVEL control to full clockwise position.

p. Set AUTO/NORM switch to NORM.

q. Select SINGLE operation.

r. Press RESET pushbutton switch. Observe no sweep.

s. Rotate main TRIGGER LEVEL to full counterclockwise position. Observe one sweep; RESET indicator goes off after sweep.

t. Set AUTO/NORM switch to AUTO.

u. Press RESET pushbutton switch. Observe one sweep.

3-21. OPERATING INFORMATION.

3-22. The following paragraphs provide additional information concerning use of one special function over another.

3-23. AUTO VERSUS NORM. In AUTO operation, there will always be a recurrent sweep, except in trigger operation. A trigger of 40 Hz or higher overrides AUTO operation and produces a stable presentation. Adjustment of main TRIGGER LEVEL control may be necessary for a stable display. If the trigger is 40-Hz or less, NORM operation must be used. A trigger signal is always needed in NORM operation to generate a sweep.

3-24. In delayed operation, the delayed sweep is armed at the end of the delay time established by the DELAY control. When the delayed TRIGGER LEVEL switch is out of detent position, the delayed sweep is started by the first trigger signal after the delay time established by the setting of the DELAY control providing the delayed TRIGGER LEVEL is adjusted for a stable display. In this mode, the delay time is longer than that set by the DELAY control. In starts after delay mode (detent position), the sweep starts immediately after arming.

3-25. AC VERSUS DC. AC coupling removes the dc level of trigger signals and attenuates signals below 10 Hz. For example, if the trigger signal contains a dc voltage component, extreme levels can cause the signal to move out of trigger level range of the 1722A and lose the trigger operation.

3-26. DELAYED SWEEP. After obtaining a desired sweep, any portion can be expanded up to 1 ns per division with 5% accuracy over the center eight major divisions (X10 magnification) or 10 ns per division with 3% accuracy. This permits viewing of critical rise times or signal shapes with increased resolution. Because the sweeps are independent, the main VERNIER may be out of CAL detent and the delayed sweep will still be calibrated.

3-27. Sweep jitter can be reduced by use of delayed trigger operation. By rotating the delayed TRIGGER LEVEL control out of detent, the delayed sweep starts on a new trigger. This reduces jitter that has accumulated since start of the main sweep.

3-28. MIXED SWEEP. In MIXED SWEEP modes of operation, a dual sweep-speed display is presented. The main sweep drives the first portion of sweep and the delayed sweep completes the display. This mode can also be selected when SINGLE sweep is desired.

3-29. APPLICATION PROCEDURES.

3-30. PROBE COMPENSATION. To adjust divider probes which have a compensation adjustment, proceed as follows:

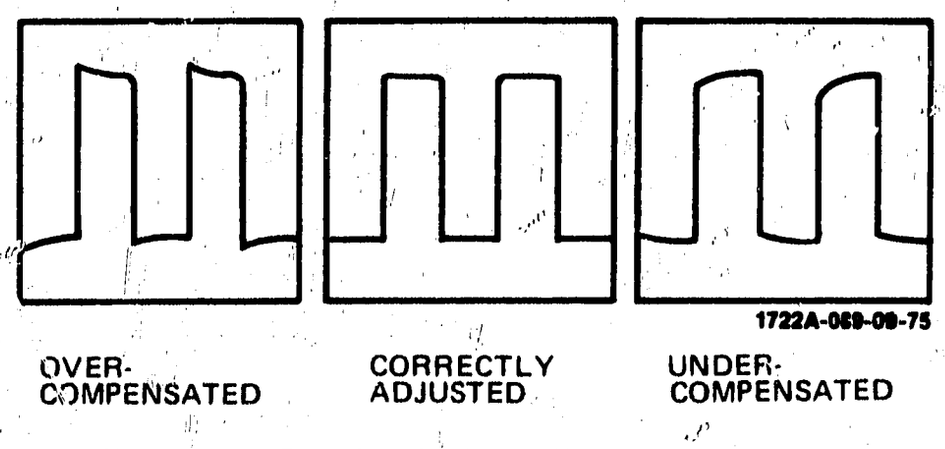


Figure 3-2. Divider Probe Adjustment Display

a. Perform initial turn-on, paragraph 3-14.

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

c. Connect probe tip to PROBE ADJ terminal.

d. Set channel A VOLTS/DIV control for a square-wave display with two or three divisions of vertical deflection.

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

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

3-31. X-Y PHASE MEASUREMENTS. The X-Y horizontal display mode provides a method of measuring phase differences between two signals of the same frequency (up to 3 MHz). In this mode, one input signal provides deflection along the horizontal (X) axis; the other input signal provides deflection along the vertical (Y) axis. The phase angle can be determined from the resulting Lissajous pattern. There are other uses for this mode, such as, establishing a horizontal sweep from a free-running sweep oscillator.

3-32. To determine phase relationship between two signals of the same frequency, proceed as follows:

a. Connect one signal to channel A and the other to channel B INPUT connectors.

b. Press VERT DISPLAY pushbutton switch A.

c. Press INT TRIG pushbutton switch B.

d. Press HORIZ DISPLAY pushbutton switch X-Y.

e. Set both channel A and channel B VOLTS/DIV switches for a display of approx 4 divisions (both horizontally and vertically).

f. Adjust POSITION controls until display is at center of CRT.

g. Measure distances A and B as shown in figure 3-3.

h. Divide A by B to obtain sine of phase angle (Φ), (sine (Φ) = $\frac{A}{B}$).

i. Determine sine value to determine phase angle.

j. Phase angle is accurate to within 3° for signals up to 1 MHz.

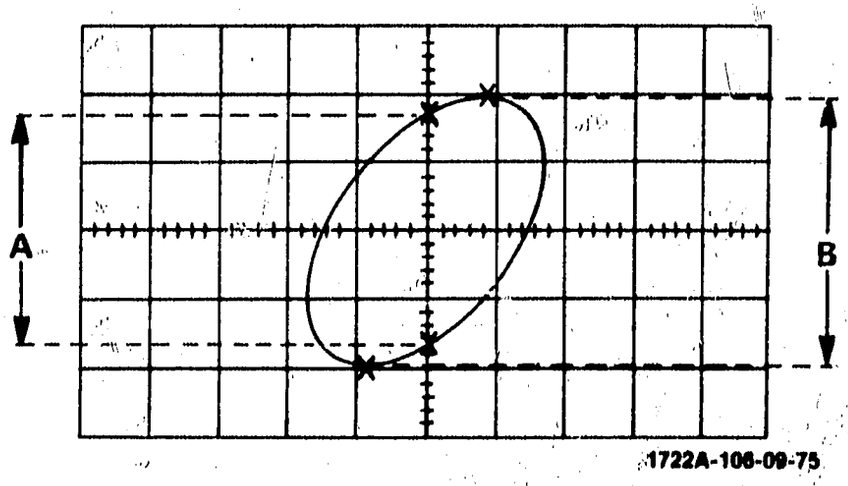


Figure 3-3. X-Y Waveform

3-33. TIME-INTERVAL MEASUREMENT. Time interval measurement accuracy is enhanced by the fact that start and stop events are displayed simultaneously. By superimposing waveforms rather than noting where the waveforms cross graticule lines, the CRT serves simply as a null indicator so that nonlinearities and drift in the vertical and horizontal amplifiers do not affect measurement accuracy. To measure time-interval, proceed as follows:

a. Perform steps in paragraphs 3-14 and 3-17.

b. Connect signal to be measured to channel A INPUT connector.

c. Set channel A VOLTS/DIV control as required.

d. Engage MAIN INTEN pushbutton switch.

e. Engage INTERVAL TIME pushbutton switch.

f. Set main and delayed TIME/DIV controls for desired display.

g. Using DELAY control, position first intensified spot to starting point of interval to be measured (A in figure 3-4).

h. Using DEC/INC controls, position second intensified spot to end point of interval being measured (A in figure 3-4).

i. Engage DLY'D pushbutton switch.

j. Using DEC/INC controls, superimpose two waveforms observed (B and C in figure 3-4).

k. Read time interval in seconds on LED display.

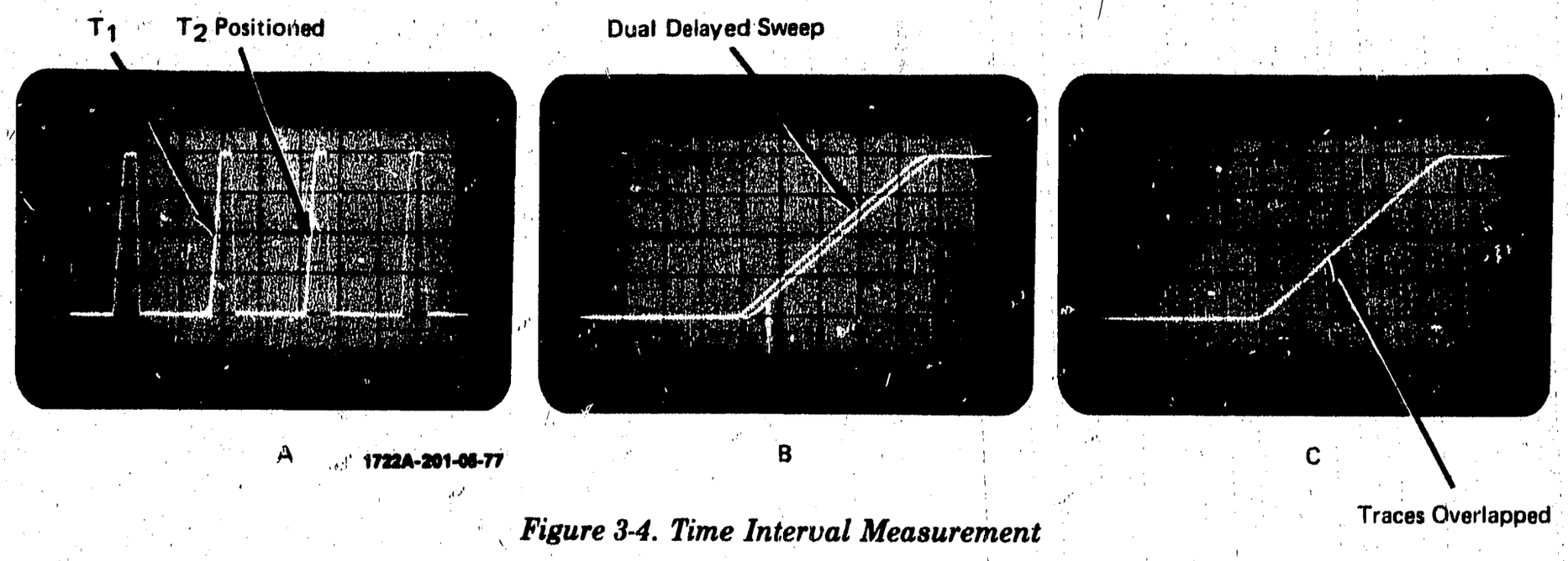


Figure 3-4. Time Interval Measurement

3-34. REPETITION RATE OR FREQUENCY MEASUREMENTS. The repetition rate or frequency of a signal is the reciprocal of the period. Use the time interval measurement technique described in paragraph 3-33 to measure the pulse period. Then take the reciprocal of the period to determine the repetition rate or frequency.

a. Perform paragraph 3-33, steps a through j, to superimpose the leading edges of two adjacent waveforms on the CRT. The LED will display the period of the waveform.

b. Engage INTERVAL 1/TIME pushbutton switch. The LED will now display the frequency or repetition rate of the waveform. Units are in Hz (exponent 0), kHz (exponent 3), or MHz (exponent 6).

3-35. INSTANTANEOUS DC VOLTAGE MEASUREMENTS. For measurement of a voltage at any point on a waveform with respect to any selected reference voltage, the instantaneous voltage mode provides both accuracy and convenience. To accomplish instantaneous dc voltage measurements, proceed as follows:

a. Perform initial turn-on, paragraph 3-14.

b. Connect signal of interest to channel A INPUT connector.

c. Set PROBE X1/X10 switch to X1 position.

NOTE

If 10:1 divider probe is used, set PROBE X1/X10 switch to X10 position.

d. Set channel A VOLTS/DIV switch as required.

e. Set channel A coupling to DC position.

f. Engage CHAN A POSN pushbutton switch.

g. Using channel A POSITION control, set top, bottom, or reference point of waveform on convenient horizontal graticule line (A in figure 3-5).

h. Press CHAN A (REF SET) pushbutton switch until LED display resets to zero.

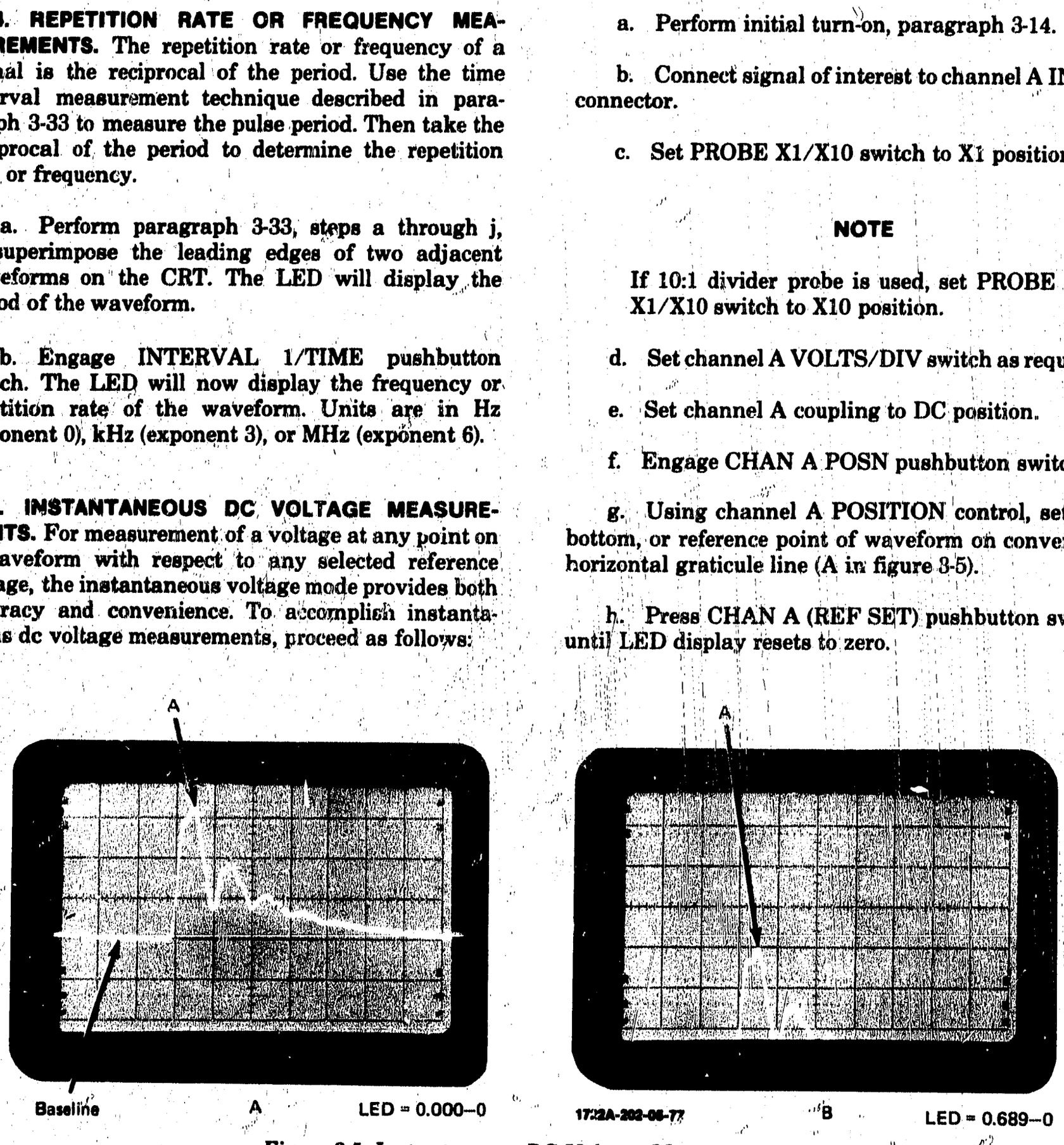


Figure 3-5. Instantaneous DC Voltage Measurements

i. Using channel A POSITION control, set second point of interest on horizontal graticule line selected in step g (B in figure 3-5).

j. Read voltage difference between reference point and point of interest on LED display.

NOTE

Peak-to-peak voltage measurements are made by using top and bottom points of waveform.

3-36. DC VOLTAGE MEASUREMENTS. For measurement of dc, dc differential, and average volts, the 1722A offers the accuracy and resolution of a 3-1/2 digit DVM. The LED display automatically tracks the attenuator setting and requires no user calculation. To measure dc voltages proceed as follows:

a. Perform initial turn-on, paragraph 3-14.

b. Connect 1:1 or 10:1 divider probe to channel A INPUT connector.

c. Set PROBE X1/X10 switch for divider probe being used.

d. Set channel A VOLTS/DIV switch as required.

e. Engage CHAN A INPUT pushbutton switch.

f. Press CHAN A (REF SET) switch until LED display resets to zero.

g. Connect divider probe to voltage source being measured.

h. Read voltage measurement directly from LED display.

NOTE

Using this measurement technique on signals with an ac component results in a display of the average amplitude of the signal. An overrange in dc level causes the LED display to flash on and off.

3-37. WAVEFORM PERCENTAGE MEASUREMENT. Relative amplitude measurements such as pulse overshoot, ringing, and preshoot are easily measured by using the channel A attenuator vernier in its uncalibrated position. To accomplish a percentage measurement on a waveform, proceed as follows:

a. Perform initial turn-on, paragraph 3-14.

b. Connect signal to be measured to channel A INPUT connector.

c. Set channel A VOLTS/DIV switch for slightly more than a 5-division vertical display.

d. Adjust channel A vernier until the 0% and 100% points are exactly 5 vertical divisions apart (A in figure 3-6).

e. Engage CHAN A POSN pushbutton switch.

f. Set reference 0% point on waveform to center horizontal graticule line using channel A POSITION control (B in figure 3-6).

g. Press CHAN A (REF SET) pushbutton switch until LED display resets to zero.

h. Adjust channel A POSITION control until LED display indicates exactly 100%.

i. Readjust channel A vernier until 100% point of waveform is on center horizontal graticule line (C in figure 3-6).

j. Using channel A POSITION control, set desired point of interest of waveform on center horizontal graticule line (D in figure 3-6).

k. Read percentage point on waveform directly from LED display window.

3-38. MEASUREMENT APPLICATIONS. For more detailed applications information, refer to the Application Notes listed in table 3-1. Any of these Application Notes can be obtained from your nearest HP Sales/Service Office.

Table 3-1. Application Notes

Number	Title
185	Waveform Parameter Measurements using the Microprocessor controlled Oscilloscope
185-2	Transmission Line Matching and Length Measurements using Dual-delayed Sweep in the Microprocessor Controlled Oscilloscope
185-3	Percent Amplitude Modulation Measurements in the Time Domain
185-4	Elimination of Computation on Analog Measurements by using the Direct Reading Oscilloscope
186	Dual-delayed Sweep for Precise Time Interval Measurements

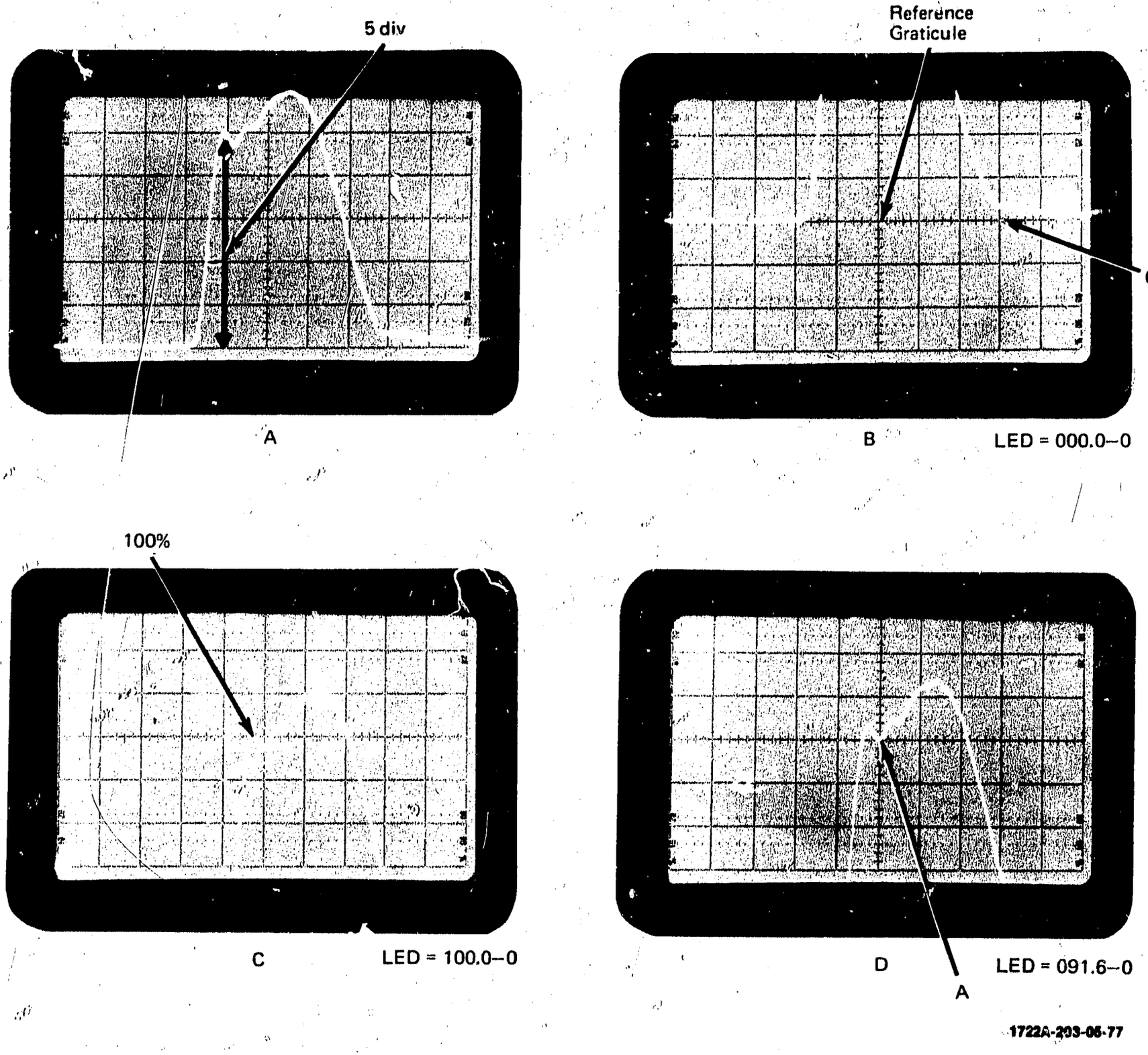


Figure 3-6. Waveform Percentage Measurement

THEORY

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains functional descriptions keyed to overall, simplified block diagrams of circuit groups (see figure 8-3). For simplicity, the block diagrams are drawn for function and do not show circuit details. The schematics are located in Section VIII.

4-3. VERTICAL SECTION BLOCK DIAGRAM.

4-4. INPUT ATTENUATORS. Channel A and channel B attenuators accept the input signals applied to the front-panel INPUT connectors. The attenuators have two functions: they select the type of input coupling (50Ω, DC, GND, AC) and they set the vertical deflection factor (10 mV/div to 5 V/div) as selected by the front-panel VOLTS/DIV switches.

4-5. VERTICAL PREAMPLIFIER AND CONTROL IC. The vertical preamplifier and control integrated circuit accepts a single ended signal from the attenuator and converts it to a differential signal. The differential signal is then amplified and a portion of it is used for the sync amplifier while the main path is then acted upon by the polarity switch, vernier, position, and channel switch controls (in that sequence).

4-6. DELAY LINE. The delay line assembly delays the vertical signal approximately 50 nanoseconds. This delay allows the sweep to trigger before the vertical signal reaches the CRT plates.

4-7. VERTICAL OUTPUT AMPLIFIER. The vertical output amplifier provides drive to the CRT vertical deflection plates.

4-8. HORIZONTAL SECTION BLOCK DIAGRAM.

4-9. 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. The 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.

4-10. SWEEP AND INTEGRATOR CIRCUITS. The sweep circuits initiate a horizontal sweep by the trigger signal that is applied to their inputs. A Miller integrator produces the horizontal sweep ramp whose slope is controlled by the TIME/DIV switch on the front panel of the instrument. Output from the Miller integrator is applied through the horizontal display control switches to the horizontal preamplifier circuit.

4-11. The horizontal sweep is also compared to a reference voltage by a sweep length comparator that drives the reset circuit. The reset circuit, along with other holdoff circuits, controls the timing sequence of the sweep ramp

4-12. HOLDOFF CIRCUITRY. The holdoff circuit establishes the time interval between trigger points. This time interval is adjustable by the TRIGGER HOLDOFF control. The sweep ramp and the TIME/DIV switch control the holdoff ramp generator. When the generator is activated, a ramp, determined by a selected holdoff capacitor and the TRIGGER HOLDOFF control, is produced. When the ramp reaches a predetermined voltage level, the reset circuit activates. This arms the trigger generator. Upon receipt of a new trigger signal, a new sweep is generated.

4-13. HORIZONTAL PREAMPLIFIER. The horizontal preamplifier provides amplification for the sweep-time ramp. A horizontal POSITION control establishes a reference level for the horizontal sweep. The BEAM FIND switch, when engaged, reduces emitter current in the output stage of the preamplifier, so that the horizontal sweep will be returned to the viewing area of the CRT.

4-14. HORIZONTAL OUTPUT. The horizontal output stage provides drive to the CRT horizontal deflection plates.

4-15. GATE CIRCUITRY.

4-16. The gate assembly contains the circuitry necessary to control the brightness of the CRT display. An intensity control circuit is used for brightening or blanking the CRT when necessary. Astigmatism, focus, pattern, and floodgun filament controls are part of the gate assembly. A 3-volt calibrator is also part of the gate assembly.

4-17. HIGH VOLTAGE POWER SUPPLY.

4-18. The high voltage power supply consists of the high voltage oscillator and a rectifying network. The high voltage oscillator produces the cathode and grid voltages for the CRT. A secondary winding on the

high voltage oscillator transformer furnishes the voltage for the CRT cathode heater.

4-19. The CRT cathode voltage is sampled and fed back to a HV oscillator control circuit on the gate assembly. If the cathode voltage becomes more negative, less current is supplied to the oscillator. With less current supplied, the output amplitude of the oscillator is reduced and the cathode voltage will return to its normal operating value. If the cathode becomes less negative, more current is supplied to the oscillator.

4-20. A tap on the secondary of the high voltage transformer is connected to a X6 multiplier assembly. The output of the multiplier assembly is connected to the CRT post accelerator terminal.

4-21. LOW VOLTAGE POWER SUPPLY.

4-22. The low voltage power supply operates from an ac power source. The ac line is applied to the input power circuit where 100/120/220/240-Vac operation is selectable. The input power circuit contains the ac line protection fuse. The ac input is applied to a step-down power transformer.

4-23. Secondary outputs from the power transformer are applied to rectifiers and voltage regulator circuits. These stages convert the input ac power to usable dc outputs of different voltage levels.

4-24. CIRCUIT DETAILS.

4-25. The following paragraphs provide a detailed explanation of the individual circuits in the Model 1722A. Circuits that are identical for both channels are only explained for channel A.

4-26. ATTENUATOR ASSEMBLIES.

4-27. GENERAL INFORMATION. (See schematic 1.) The channel A attenuator assembly is a two-section, cam-actuated attenuator. The first section is controlled by coupling switch A1S1. The second section is controlled by VOLTS/DIV switch A1S2. The attenuator components are closely mounted and their interrelationship is critical. If a malfunction occurs in an attenuator assembly, it is recommended that the attenuator board be replaced with a like unit.

4-28. In describing the attenuator assembly only basic reference designators will be used. When referring to table 6-2 (Section VI) prefix all basic reference designators (except A3 assembly components) with A1. See figure 4-1 for simplified block diagram of the attenuator.

4-29. INPUT. The input signal applied to channel A INPUT connector J1 is routed to coupling switch A1S1 through a 50-ohm stripline that is part of the etched circuit board. With A1S1 in its AC position, the input signal is applied through capacitor A1C1 to the first section of the attenuator. The value of A1C1 is such that signals below 10 Hz will be attenuated. In GND position, A1S1 disconnects the input signal and applies a ground to the attenuator input. In DC position, A1S1 forms a straight-through connection and applies the input signal directly to the high impedance section of the attenuator. In 50Ω position, A1S1 terminates the input signal in 50 ohms. The termination consists of two 100-ohm resistors, A1R1 and A1R2.

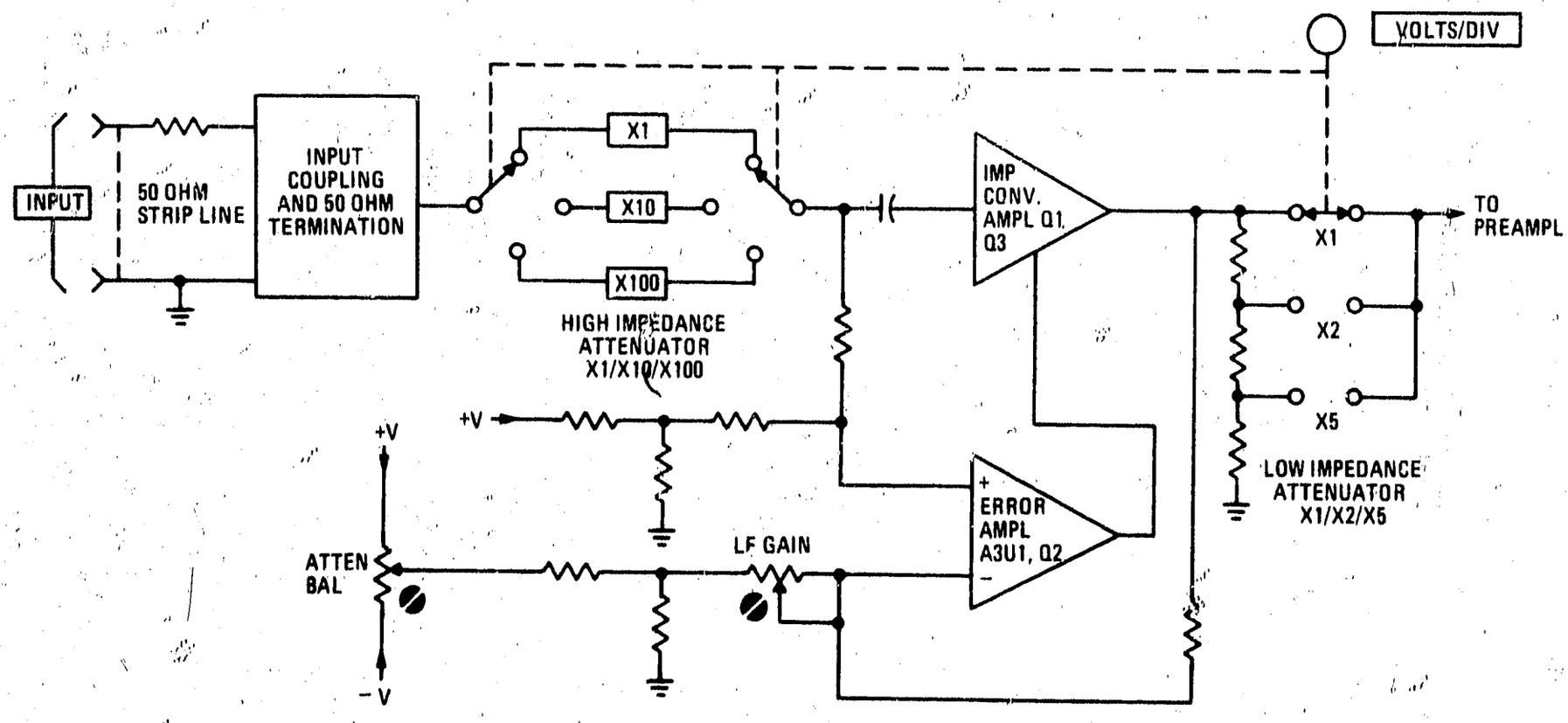


Figure 4-1. Attenuator Simplified Block Diagram

CERTIFICATION

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

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment. The cathode-ray tube (CRT) in the instrument and any replacement CRT purchased from HP are also warranted against electrical failure for a period of one year from the date of shipment from Colorado Springs. BROKEN TUBES AND TUBES WITH PHOSPHOR OR MESH BURNS, HOWEVER, ARE NOT INCLUDED UNDER THIS WARRANTY. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the preventive maintenance procedures in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

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NOTE

These resistors are constructed of flame-proof type material as a precaution against overvoltage application in the 50Ω position of A1S1. The resistors are mounted in sockets to facilitate replacement.

4-30. ATTENUATORS STAGES. The VOLTS/DIV switch A1S2 controls a two-section cascaded attenuator. Each section consists of a group of attenuation networks. The high impedance section contains X1, X10, and X100 networks. The low impedance section contains X1, X2, and X5 networks. Each position of A1S2 cascades a network in the high impedance section with a network in the low impedance section. By cascading different network combinations, the attenuator provides 10 mV/div to 5 V/div vertical deflection. In addition, the channel A attenuator has a third section added to A1S2 This section of the VOLTS/DIV switch provides the correct signal to the LED Display circuits (see schematic 17).

4-31. A high-to-low impedance converter stage is inserted between the two sections of attenuator switch A1S2. The high frequency amplifier section of the impedance converter consists of field-effect transistor (FET) A1Q1 connected in a source follower configuration. Input to the gate of the FET is capacitively coupled through A1C5. Transistor A1Q2 functions as the current source for A1Q1. Emitter follower A1Q3 drives the resistive divider network of the low impedance section of attenuator switch A1S2. Under input overvoltage conditions, A1CR1 prevents the reverse breakdown of the base-emitter junction of A1Q3.

4-32. The low frequency path of the input signal consists of error amplifier A3U1 and level shifter A3Q5. The error amplifier samples the input and output signals within a frequency range of DC to 1 kHz. It generates a correction signal to the high frequency amplifier to replace the missing low frequency signal components. The input signal sample is accomplished through a resistor divider network consisting of A1R8 and A3R57-A3R59. This provides isolation of capacitive loading to high frequency signals and overvoltage protection for the error amplifier. The gain of the low frequency path is set by adjusting the resistor divider ratio used to sample the output signal. Adjustment is accomplished with A3R55. Transistor A3Q5 functions as a level shifter for the low frequency correction signal. The low frequency correction signal is applied through current source A1Q2 to the high frequency amplifier circuit.

4-33. The channel B attenuator (A2) functions identically as the channel A attenuator described in paragraphs 4-27 through 4-32 except for the VOLTS/DIV switch. Channel B has no input to the LED Display circuits. See schematic 2 for channel B component identification.

4-34. VERTICAL SECTION.

4-35. GENERAL INFORMATION. (See schematic 3.) Each channel preamplifier circuit consists of an integrated circuit (IC) and associated biasing networks. Both ICs are mounted on substrate assembly A3A1. The IC provides two outputs: one output is the main vertical signal and the other is the internal sync signal.

4-36. PREAMPLIFIER STAGE. Since channel A and channel B are similar, only channel A will be described in detail. Where channel B differs from channel A, the difference will be discussed.

4-37. The input signal from attenuator A1 is applied to the channel A section of substrate assembly A3A1. The input amplifier stage is balanced by main balance potentiometer A3R4 (A3R12 for channel B). A signal split is then accomplished with the two signals taken out separately (main signal and sync signal for time base triggering).

4-38. Outputs from channel A and channel B are combined in a common load resistor and applied to the input of delay line driver stage A3Q1/A3Q2. The sync outputs of channel A and channel B are combined in a common base stage and its output drives a balanced 300 Ω line to the input of the main sync amplifier (A10).

4-39. The output of A3Q1/A3Q2 is connected to delay line assembly A4 through a bandwidth limit circuit. The bandwidth limit circuit limits the amplifier, 3 dB down to 5 MHz. A3Q1/A3Q2 operates as a differential common emitter amplifier.

4-40. BEAM FIND switch A8S1A (see schematic 15) supplies emitter bias (—15 V) to amplifier A3Q1/A3Q2. When A8S1A is pressed, the emitter bias is removed from the circuit. The signal sensitivity is reduced enough to return the trace to the viewing area of the CRT.

4-41. Each channel has a vertical POSITION control (R3 and R4) located on the front panel of the instrument. Vertical positioning of the viewed display is accomplished by adding to or subtracting current in the main signal path. This results in shifting the vertical dc level of the output signal and causes the trace on the CRT to move up or down.

4-42. With front-panel vernier controls A1R1 and A2R1 in CAL detent position, the gain of each channel is adjusted by A3R1 (channel A) and A3R14 (channel B). By adjusting the ratio of bias current through two parallel connected junctions, the current division between the two junctions can be controlled.

4-43. An input signal applied to channel B can be inverted for A—B operation by front-panel B INVERT switch A6S1D. A saturated switch and bias circuit

is also provided so that only a dc level change is needed to switch polarity. The dc level change (+15 V) is supplied by the B INVERT switch when engaged.

4-44. PREAMPLIFIER CONTROLS. (See schematic 5.) Internal Trigger Switch Assembly A6 and Vertical Display Switch Assembly A7 control the operation of substrate assembly A3A1. Control of the substrate assembly is described in the following paragraphs.

4-45. Channel A Display. Engaging VERT DISPLAY switch A7S1A selects the channel A input signal for display on the CRT. When engaged, A7S1A applies a constant high (+4.3 V) to the set input on flip-flop A7U1, causing its Q output (pin 13) to be held high and its $\overline{Q}$ output (pin 1) to be held low.

4-46. Since A7U1 is held in its set condition, the base bias applied to A7Q2 is more positive than that applied to A7Q1. Transistor A7Q2 conducts, and applies a disabling voltage to the channel B channel switch on assembly A3. With +V1 bias removed, output from the channel B preamplifier is inhibited.

4-47. Channel B Display. Engaging VERT DISPLAY switch A7S1B selects the channel B input signal for display on the CRT. When engaged, A7S1B applies a constant high to the reset input (pin 12) on flip-flop A7U1.

4-48. With A7S1B engaged and A7U1 held in its reset condition, the $\overline{Q}$ output of A7U1 is held high and the Q output is held low. With its base bias more positive, A7Q1 conducts and applies a disabling voltage to the channel A channel switch on assembly A3. With +V1 bias removed, output from the channel A preamplifier is inhibited.

4-49. Channel A and Channel B Displays. To display signals applied to both channels, VERT DISPLAY switches A7S1A and A7S1B are not engaged. The set and reset voltages applied to A7U1 are low. The flip-flop is controlled by inputs from either the ALT signal through OR/NOR gate A7U2A or by the CHOP signal generated by chop oscillator A7U2B. The high and low inputs from either the ALT signal or the chop oscillator causes the Q and $\overline{Q}$ output of A7U1 to alternate between high and low logic levels. This action causes A7Q1 and A7Q2 to conduct alternately.

4-50. Channel A+B Display. To algebraically display input signals applied to both channels, VERT DISPLAY switches A7S1A and A7S1B are pressed simultaneously. With both switches engaged, —15 V bias is removed from the emitter circuits of A7Q1 and A7Q2, cutting them off. This causes both channel A and channel B preamplifier stages on assembly A3 to be operational. In addition, with both A7S1A and A7S1B engaged, +15 V is applied to the junction of A3R21 and A3VR3. This increases the current available at the output circuit of the preamplifiers by effectively bypassing A3R21.

4-51. For composite triggering in A+B or CHOP mode of operation, +15 V is applied to the emitter circuits of A3Q3/A3Q4 through trigger switches A6S1A and A6S1B. This increases the current available at the emitters of sync amplifier A3Q3/A3Q4.

4-52. CHOP Mode Display. When CHOP mode of display is selected by VERT DISPLAY switch A7S1D, a low (+3.5 V) is applied to pin 11 of OR/NOR gate A7U2B. With a low applied to pin 11, A7U2B operates as an astable multivibrator. The repetition rate of A7U2B, controlled by feedback capacitor A7C3, is approximately 1 MHz. The NOR gate output of A7U2B is applied as a clock signal to flip-flop A7U1. The Q and $\overline{Q}$ output of the flip-flop control the operation of A7Q1/A7Q2 which was explained previously.

4-53. The NOR gate output of A7U2B is applied also to gate assembly A14 as a chop blanking signal. The chop blanking signal blanks the CRT trace during channel switching.

4-54. ALT Mode Display. When ALT mode of display is selected by VERT DISPLAY switch A7S1C, it mechanically releases all other display switches (A7S1A, A7S1B, and A7S1D).

4-55. The ALT signal that is developed on main sweep assembly A8 is applied to an input on OR/NOR gate A7U2A. At the start of the main sweep the ALT signal goes low. With all inputs low, the NOR output of U2A (pin 5) is high. The high is applied as a clock input to flip-flop A7U1. At the end of the main sweep, the ALT signal becomes high and the NOR output of A7U2A becomes low. The negative transition at the input to flip-flop A7U1 causes it to change states. Thus, at the end of each sweep, channel control flip-flop, A7U1, alternately disables channel A or channel B.

4-56. Channel A Sync Circuit. Internal sync switch assembly A6 contains the sync control circuitry necessary for selective internal triggering.

4-57. Engaging channel A sync switch A6S1A applies a low to the base of A7U3Q1. Since channel B switch is not engaged, a high is applied to the base of A7U3Q2 turning it on. Since A7U3Q5 is conducting, the emitter bias of A7U3Q1/A7U3Q2 (pin 3) is approximately the bias applied to A7U3 pin 13. With A7U3Q2 conducting, the negative bias developed at A7U3 pin 5 is applied to the channel B sync enabling network on assembly A3, preventing a channel B sync signal from being generated.

4-58. Channel B Sync Circuit. Engaging channel B sync switch A6S1B applies a low to the base of A7U3Q2. Since channel A switch is not engaged, a high is applied to the base of A7U3Q1 turning it on. Since A7U3Q5 is conducting, the emitter bias of A7U3Q1/A7U3Q2 (pin 3) is approximately the bias applied to A7U3 pin 13. With A7U3Q1 conducting, the negative bias developed at A7U3 pin 1 is applied to the channel A sync enabling network on assembly

A3, preventing a channel A sync signal from being generated.

4-59. Composite Sync Circuit. When composite sync is selected, channel A and channel B sync switches (A6S1A and A6S1B) are engaged simultaneously. With both sync switches engaged, a ground is applied to the emitter circuit of A7U3Q5, cutting it off. With A7U3Q5 cut off, the emitter circuit of A7U3Q1/A7U3Q2 is disabled, cutting off A7U3Q1 and A7U3Q2. In addition, with both sync switches engaged, —15 V is applied to the emitter circuit of A7U3Q3 and A7U3Q4 through CHOP display switch A7S1D.

4-60. For composite sync, the outputs of A7U3Q3 and A7U3Q4 are controlled by the Q and $\overline{Q}$ outputs of A7U1. When the Q output of A7U1 is high ($\overline{Q}$ output low) A7U3Q4 conducts and A7U3Q3 is cut off. With A7U3Q4 conducting, its output (A7U3 pin 11) is approximately the bias voltage applied to its emitter (A7U3 pin 10). The negative bias at A7U3 pin 11 is applied to the B sync enabling network on assembly A3, preventing a channel B sync signal from being generated.

4-61. When the input to the base of A7U3Q3 is high (input to the base of A7U3Q4 is low), the collector output of A7U3Q3 (pin 8) is approximately the bias voltage applied to its emitter (A7U3 pin 7). The negative bias at A7U3 pin 8 is applied to the A sync enabling network on assembly A3, preventing a channel A sync signal from being generated.

4-62. Composite Sync Chop Mode Display. When composite sync is selected for CHOP mode of display, A7U3 is disabled by removing the —15 V bias from both sections of the IC. This prevents A7U3 from applying a disabling voltage to either channel A or channel B enabling networks on assembly A3. The sync signal generated is a composite of the signals applied to channel A and channel B.

4-63. Also, when composite sync is selected for CHOP mode of display, +15 V is applied by CHOP switch A7S1D through sync switches A6S1A and A6S1B to the emitter circuits of sync amplifier A3Q3/A3Q4. The additional voltage source increases the current available at the input to the sync amplifier (similar to A+B operation of the main signal amplifier A3Q1/A3Q2). When B INVERT switch A6S1D is engaged during this mode of operation, the channel B sync signal is inverted prior to developing the composite sync signal by applying +15 V through A6R1 and A6S1D to a cross over network in the channel B sync circuit on A3A1. This results in the channel B sync signal being inverted prior to combining with the channel A sync signal.

4-64. DELAY LINE ASSEMBLY. The output of the main signal amplifier A3Q1/A3Q2 is applied to delay line assembly A4. The delay line has a differential impedance of approximately 125 ohms and provides a time delay of approximately 50 nanoseconds. This delay is sufficient to allow the internal sync signal to trigger the time base to start the horizontal sweep. Without the insertion of this time delay in the signal path, the sweep would start after the signal reached the vertical deflection plates of the CRT and the leading edge of fast rise time signals would not be displayed.

4-65. VERTICAL OUTPUT AMPLIFIER. (See schematic 4.) The vertical output amplifier assembly A5 consists of two integrated circuits with their associated control components. Integrated circuit A5U1 is the main vertical amplifier. It receives the differential signal from delay line assembly A4, amplifies it and applies it to output amplifier A5U2. High frequency adjustments A5C4, A5C6, A5C7, A5C13, A5R11, and A5R22 are adjusted for optimum pulse response.

4-66. Output amplifier A5U2 is a shunt feedback differential amplifier whose transimpedance converts the current gain of A5U1 to a voltage gain at the input of the CRT. The CRT's vertical section is the distributed line type with a 330-ohm terminating impedance.

4-67. HORIZONTAL SECTION.

4-68. MAIN TRIGGER CIRCUITRY. (See schematics 6 and 7.) The internal sync signal developed on preamplifier assembly A3 is connected to horizontal display switch assembly A10 through a 300-ohm impedance cable. Signal amplification is accomplished by sync amplifier stages A10Q1-A10Q6. Output from A10Q5 is applied through X-Y switch A10S1F to VERTICAL OUTPUT connector J4 on the rear panel of the instrument. Output from A10Q6 drives dual emitter followers consisting of A10Q7/A10Q8. Transistor A10Q7 supplies the main sync signal. Transistor A10Q8 supplies the delayed sync signal.

NOTE

The output signal applied to VERTICAL OUTPUT connector J4 is a complementary image of the input signal. For cascade mode of operation (channel A into channel B or vice versa) engage B INVERT pushbutton switch for a true representation on the CRT of the input signal.

4-69. There are two sources of sync inputs to the main trigger circuit (see figure 4-4 for time base simplified block diagram). One input is from EXT TRIG connector J1 on the front panel of the instrument. The other input is from internal sync source A10Q7. The position of INT/EXT switch A8S10 determines which trigger source is selected. The external sync is applied to A8S10 through EXT +10 switch A8S1P. When A8S1P is engaged, a voltage divider network is connected to the external input circuit. The network reduces the input signal by a factor of 10.

4-70. The sync signal (external or internal) is applied to a high-frequency circuit and to a low-frequency circuit (see schematic 9). The high-frequency circuit consists of A8Q1/A8Q2. This circuit readily passes all frequencies above 15 kHz. The low frequency circuit consists of A8U1/A8Q3 and readily passes all frequencies below 15 kHz.

4-71. The low-frequency path for the trigger signal is through the INT/EXT switch, AC/DC switch, and LF REJ switch to the input of an inverting operational amplifier A8U1. The output of A8U1 is applied to A8Q3 that functions as an emitter follower. The output of the low frequency path is applied to integrated circuit U2 pin 14. The front-panel TRIGGER LEVEL control R15 is part of the low frequency path.

4-72. With AC/DC switch A8S1N in its AC position, A8C1 blocks the dc component of the trigger signal. When LF REJ switch A8S1M is engaged, the low-frequency circuit is disconnected and the input to A8U1 is grounded. Pressing both the LF REJ switch and the HF REJ switch applies the line-frequency signal from primary ac power transformer T1 (see schematic 24) to the input of A8U1.

4-73. For high-frequency rejection, HF REJ switch A8S1L is engaged. When engaged, the HF REJ switch applies −15 V through A8R7 to the gate of A8Q1. The source of A8Q1 and the emitter of A8Q2 are clamped by diodes A8CR2 through A8CR4 turning them off.

4-74. After conditioning by the high- and low-frequency bandpass circuits, the sync signal is applied to integrated circuit A8U2. The IC contains the pulse shaping network, arming circuitry, and trigger controls required to develop the trigger signal.

4-75. The sync signal is amplified by A8U2 and converted to differential signals. The differentially constructed signals are applied to the inputs of a pair of dual-input Schmitt trigger circuits located in the IC. Another Schmitt trigger on the IC controls the dual-input Schmitts.

4-76. At the end of the holdoff period, the holdoff-comparator develops a reset signal that is applied to the first Schmitt trigger on A8U2. The Schmitt trigger changes state, arming the second Schmitt trigger. When the applied trigger signal reaches the selected trigger level established, the second Schmitt trigger fires and one-half cycle later (when the trigger signal falls below the selected trigger level) the third Schmitt trigger fires producing the trigger outputs from A8U2 (pin 1 and pin 2).

4-77. The input sensitivity where A8U2 generates a trigger pulse is controlled by main trigger sensitivity potentiometer A8R47. The input sync signal slope on which A8U2 generates a trigger pulse is controlled by main slope switch A8S1K. The switch applies +5 V to pin 16 for positive slope triggering and a ground for negative slope triggering.

4-78. The output of A8U2 (pin 2) is applied as one input of a dual-input current switch consisting of A8Q8 through A8Q10. The other input to the current switch is from the bright-line auto generator A8U3. When the output of A8U2 (pin 2) or A8U3 (pin 5) goes low, either transistor A8Q8 or A8Q9 will conduct. With either transistor conducting, the current path for the current switch is through A8R36, A8R37, the conducting transistor, and A8R41. The signal developed at the high end of A8R41 is the main gate signal applied to the gate Schmitt circuit (see schematic 14). In addition, when A8Q8 or A8Q9 conducts, A8Q10 cuts off. With A8Q10 cut off, a sweep ramp is generated by the integrator circuit (see schematic 10).

4-79. Transistor array A8U3 forms the bright-line auto circuit. In the absence of a sync signal, the output at A8U2 pin 2 is high, cutting off A8Q8. The complementary low output at A8U2 pin 1 is applied to the base of transistor A8U3Q3 which drives the base of A8Q11 low causing A8C15 to change to the lower voltage level. The emitter of A8Q11 follows the negative charging of A8C11 which will reach its final charge in 25 milliseconds unless a new sync signal occurs. With the lower voltage at the emitter of A8Q11, A8U3Q1 will now follow the auto signal applied to the base of A8U3Q5. A8U3Q1/A8U3Q2 form a Schmitt trigger circuit. With a sync signal applied, A8U3Q1 conducts constantly, holding off A8U3Q2. In the absence of a sync signal, the Schmitt trigger will follow the auto signal. When A8U3Q2 conducts, its collector goes low, turning on A8Q9, and in turn, cutting off A8Q10. With A8Q10 cut off, the main sweep is activated. At the end of the main sweep, the reset signal goes high and is applied to A8U2 pin 4. With a high applied to A8U2 pin 4, the output at A8U2 pin 6 is low, turning on A8Q5. When A8Q5 conducts it turns on A8U3Q5 which turns on A8U3Q1. With A8U3Q1 conducting, bias is removed from A8U3Q2 cutting it off. The output at A8U3 pin 5 goes high turning off A8Q9 and turning on A8Q10. With A8Q10 conducting, a new sweep ramp will not be generated. At the end of the holdoff period, the reset signal goes low, the output at A8U2 pin 6 goes high, and A8Q5 turns off. When A8Q5 turns off, the cycle is repeated and a new sweep is initiated.

4-80. In NORM position of the AUTO/NORM switch A8S1K, +5 V is applied to the base of A8U3Q4 turning it on. With A8U3Q4 conducting, forward bias is applied to the base of A8U3Q5 turning it on. This applies a constant forward bias to A8U3Q1 turning it on. With A8U3Q1 conducting, A8U3Q2 and A8Q9 are cut off. In the absence of a trigger signal A8Q8 is also cut off and A8Q10 is conducting, preventing the generation of a sweep ramp. When a sync signal is applied to A8U2, the output at A8U2 pin 2 goes low. This turns on A8Q8 and turns off A8Q10, starting a new sweep.

4-81. For single sweep operation, SINGLE switch A8S11 is pressed. With A8S11 engaged, +5 V is applied through resistor network A8R30, A8R32, and A8R34 to A8U2 pin 5. This prevents A8U2 from developing a trigger signal. When RESET switch A8S1H is pressed, it causes a negative-going spike to be applied to A8U2 pin 5. A8U2 is armed, causing the output at A8U2 pin 6 to go high, turning off A8Q5. Transistor A8Q4 and A8Q6 turn on and the reset lamp (DS4) on the front-panel of the instrument lights. A sync signal will provide one sweep.

4-82. MAIN SWEEP AND INTEGRATOR. (See schematic 8.) The main integrator, in conjuction with the sweep time controls, generates the main sweep ramp. The sweep is applied to the horizontal circuits.

4-83. The main integrator circuit is controlled by A8Q10 on assembly A8. When conducting A8Q10 serves as a current source and prevents generation of a main sweep ramp. When A8Q10 is cut off by the bright-line auto circuit or the receipt of a trigger signal, A11Q1B and A11Q2 turn off, removing the reset current from the ramp capacitors. With A11Q2 cut off, Miller integrator circuit A11Q3/A11Q4 is activated. Depending upon the position of main TIME/DIV switch A11S1, a specific integrating capacitor is connected between the gate of A11Q3 and the collector of A11Q4. The TIME/DIV switch also connects a specific integrating resistor to the emitter circuit of A11Q6 that functions as a constant current source for the ramp capacitors. When A11Q2 turns off, the charging current drained by A11Q6 flows through the selected ramp capacitor (A11C11 through A11C17). This results in a linear, positive-going ramp at the output of A11Q4. The linear ramp is applied to emitter follower A11Q5. The output of A11Q5 is applied to the horizontal preamplifier through horizontal display switch assembly A10.

4-84. The output of constant current source A11Q6 is controlled by operational amplifier A11U1. A different reference voltage is developed for different ranges covered by the TIME/DIV switch. This reference voltage is applied to A11U1 pin 3. When different ranges are selected by the TIME/DIV switch, the values of the ramp capacitor, integrating resistor, and A11U1 reference voltage are changed. This action changes the ramp slope for the various sweep speeds. The ramp slope can be varied for any selected range with main SWEEP VERNIER potentiometer R12. The potentiometer is part of a voltage divider in parallel with the reference voltage applied to operational amplifier A11U1. When the fastest range (10 ns) of the TIME/DIV switch is selected, capacitors A11C3 and A11C4 function as the ramp generator.

4-85. The sweep ramp, developed at the collector of A11Q4 is applied to the base of A12Q14. Conduction through A12Q14 and A12Q15 follows the positive-going sweep ramp and charges (positively) a particular holdoff capacitor (A12C2 through A12C8) in the collector circuits of A12Q1 through A12Q7. The holdoff capacitor that charges positively is determined by which transistor is conducting. Depending upon the position of TIME/DIV switch A11S1 (see schematic 8), base bias is applied to only one transistor that conducts. With the TIME/DIV switch in either the 10-nanosecond or 20-nanosecond position, no transistor is biased on. The holdoff capacitor, which is always in the circuit, is A13C1.

4-86. When the selected holdoff capacitor charges to approximately +11 V, transistor A12Q8 turns off and transistor A12Q9 turns on. The output of A12Q9 is the positive reset pulse applied to A8U2 (refer to paragraph 4-79.)

4-87. While the reset pulse is positive, A8Q8 and A8Q9 are turned off and A8Q10 turns on (see schematic 7). Since the base bias on A11Q1A (see schematic 8) is more positive than A11Q1B, A11Q1B conducts heavily and discharges the selected ramp capacitor (A11C11 through A11C17) through A11Q2. When the voltage on the base of A11Q1A reaches the voltage level applied to the base of A11Q1B, both A11Q1B and A11Q2 turn on and the sum of currents at the gate of A11Q3 is zero and the ramp is reset.

4-88. As the sweep ramp resets, transistors A12Q14 and A12Q15 turn off (see schematic 11). The selected holdoff capacitor (A12C1-A12C8) discharges through A12R1 and TRIGGER HOLDOFF potentiometer R8. The position of R8 determines the rate of discharge and therefore the holdoff period. When the holdoff capacitor discharges to approximately +1.4 V, A12Q10 turns off and A12Q11 turns on causing the reset signal to go negative. The negative transition of the reset signal arms trigger generator A8U2. Upon receipt of the next sync signal a new sweep is generated.

4-89. The positive-going ramp of the main sweep is also applied to integrated circuit A12U1 (pin 4). The IC is a transistor array that generates the delay comparator control signal used to energize the delay trigger generator (see schematic 9). There are four signals applied to A12U1 from the time-voltage measurement section of the instrument. Two of the signals are control signals and two of the signals are level references. The two control signals, H1M and H2M, are complementary and alternately become high and low during successive sweeps of the main ramp. For example, on one sweep of the trace, H1M is high and H2M is low. On the next sweep of the trace, H1M is low and H2M is high. When H1M is high, it enables a section of A12U1 that compares the input reference signal V1M with the sweep ramp. When the sweep ramp reaches the level established by V1M, A12U1 energizes the delay trigger generator causing a bright segment to appear on the trace. On the next sweep of the trace, H2M becomes high. With H2M high another section of A12U1 is enabled causing it to compare V2M with the sweep ramp. When the

sweep ramp reaches the level established by V2M, A12U1 energizes the delay trigger generator causing a bright segment to appear on the trace. Therefore, for every two sweeps, two bright segments appear on the trace. The first bright segment is used as the reference point where measurements begin. The second bright segment indicates the end of the time period being measured.

4-90. The Schmitt control circuit (see schematic 12) provides gate assembly A14 with the proper input for each display mode. The main and delayed sweep require their own respective gates (see figure 4-2 for simplified block diagram of gate Schmitt circuit). In MIXED mode of display, a gate is generated at the start of the main sweep and stops at the end of the delayed sweep. Depending upon which input is supplied, the gate Schmitt (A8U7) changes state on the first positive control pulse and resets on the first negative control pulse. The pulses are provided by differentiating the control pulses. Buffered outputs are provided to rear-panel BNC connectors (J5 and J6) for both the main gate and delayed gate.

4-91. DELAYED SWEEP CIRCUITRY. (See schematics 9 and 10.) The delayed trigger, integrator, and sweep circuitry function similar to the main sweep circuitry described previously. The one exception is that the slowest speed for delayed sweep is 20 milliseconds. Refer to paragraphs 4-68 through 4-89 for theory of operation of trigger, integrator, and sweep circuits.

4-92. HORIZONTAL DISPLAY SWITCH ASSEMBLY. (See schematic 6.) The horizontal display switch assembly selects the mode of horizontal display. The different modes are X10 magnification, delayed sweep, main sweep, and X-Y display.

4-93. X10 Magnification. The MAG switch A10S1A supplies bias to one of two circuits in the horizontal preamplifier. When not engaged, A10S1A supplies forward bias to a X1 stage (A8Q28/A8Q29) on the horizontal preamplifier. When engaged, A10S1A removes the forward bias from the X1 stage and applies it to a X10 stage (A8Q26/A8Q27).

4-94. Delayed Sweep. The DLY'D sweep switch A10S1B performs two functions. When engaged, A10S1B reverse biases the main gate control circuit preventing development of a main gate signal. Also, when engaged, A10S1B routes the delayed sweep ramp to the horizontal preamplifier.

4-95. Mixed Sweep. The MIXED sweep switch A10S1C performs two functions. When engaged, A10S1C applies the main sweep ramp as the reset reference to the delayed sweep integrator circuit. Also, when engaged, A10S1C routes the delayed sweep ramp to the horizontal preamplifier.

4-96. Main Intensified. The MAIN INTEN sweep switch A10S1D performs three functions. When engaged, A10S1D removes the +5 V bias applied to intensity gate A14Q10. It also applies +5 V to the delayed gate control circuit, disabling it. In addition, A10S1D routes the main sweep ramp to the horizontal preamplifier.

4-97. Main Sweep. The MAIN sweep switch A10S1E performs three functions. When engaged, A10S1E applies +5 V to the delay comparator control circuit, disabling it. It also applies +5 V to the delayed gate control circuit disabling it. In addition, A10S1E routes the main sweep ramp to the horizontal preamplifier.

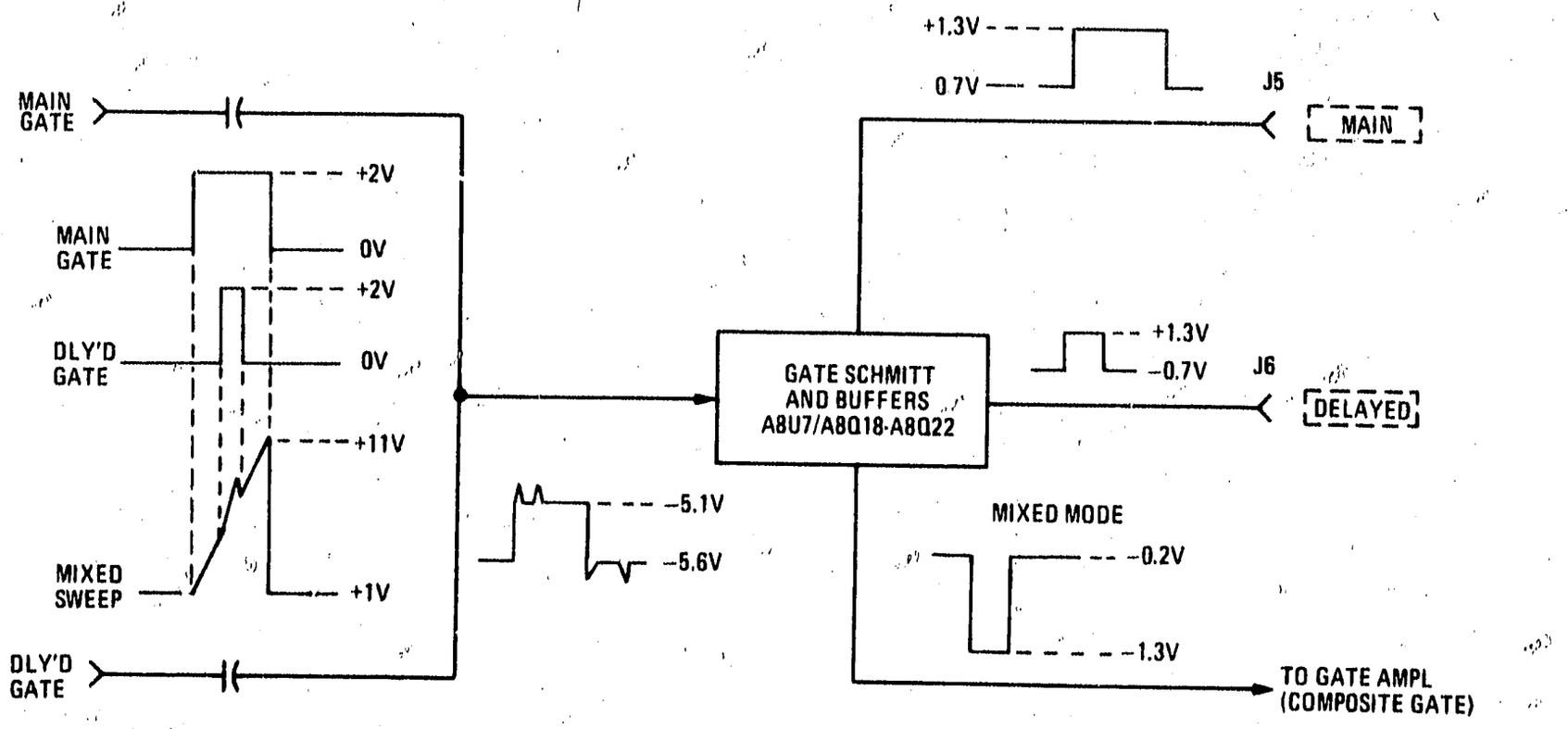

Figure 4-2. Gate Schmitt Simplified Block Diagram (Mixed Mode)

4-98. X-Y Control. The X-Y switch A10S1F performs a number of functions. When engaged, A10S1F removes the sync signal from rear-panel connector J4 and applies it to the horizontal preamplifier. It applies the x-y offset voltage to the horizontal preamplifier. The x-y control signal is grounded. This prevents generation of the composite gate signal. It also inhibits the main and delayed gate signals applied to connectors on the rear of the instrument, inhibits the sweep circuit, and unblanks the CRT.

4-99. HORIZONTAL PREAMPLIFIER. (See schematic 13.) The horizontal preamplifier converts the single-ended sweep from the sweep generator into a differential sweep for driving the horizontal output amplifier. During x-y operation, horizontal position and the x-signal are summed and applied to the preamplifier. The preamplifier provides sweep gain adjustment, trace magnification (X10), and trace centering.

4-100. Transistors A8Q23 and A8Q24 are emitter followers used to provide input isolation. Current in the collector circuit of A8Q25 is determined by the setting of horizontal POSITION control R13A/B. The output current from A8Q25 is applied to A8Q24 base resistor A8R137. In x-y operation, channel B vernier controls the x-axis gain. Potentiometer A8R133 serves as the *x*-axis gain calibrator adjustment. An offset current is supplied to the junction of A8R132, A8R133, and A8R135 to center the x-y display. Variable capacitor A8C45 compensates the x-y phase.

4-101. The emitter outputs from transistors A8Q23/A8Q24 are applied to a dual differential stage that furnishes the X1 or X10 magnification for the horizontal sweep. When MAG switch A10S1A is not engaged, +53 V is applied to the emitter circuits of transistors A8Q28 and A8Q29, biasing them on. Gain for the X1 range is adjusted by A8R148. Engaging MAG switch A10S1A removes the +53 V bias from A8Q28/A8Q29 and applied it to the emitter circuits of A8Q26 and A8Q27. Gain for the X10 range is adjusted by A8R146. Resistors A8R152, A8R153, and A8R154 provide a dc balance network for the differential amplifier.

4-102. Differential amplifier A8Q30/A8Q31 provides differential drive to the horizontal output amplifier. This stage, as well as the preceding differential stage, will current limit when overdriven. This prevents saturation of the output amplifier. Transistor A8Q32 functions as a constant current source for the amplifier stage. When BEAM FIND switch A8S1A is pressed less current is supplied to the amplifier stage. This ensures that the horizontal portion of the trace is returned to the viewing area of the CRT.

4-103. HORIZONTAL OUTPUT. (See schematic 14.) The horizontal output is a differential shunt-feedback amplifier. The currents through A13R3 and A13R4 determine the output voltage since little current flows in the bases of transistors A13Q1, A13Q2, A13Q3, and A13Q4. Variable capacitors A13C5 and A13C7 control the fast corner response and A13C6 and A13C8 control the slightly slower corner response of the circuit. Resistors A13R1 and A13R2 establish the minimum output voltage level. With the input circuit disconnected, the minimum output voltage level is approximately +9 V.

4-104. Transistors A13Q1 through A13Q4 are emitter followers with A13Q1 and A13Q4 providing the dc signal path and A13Q2 and A13Q3 providing the ac signal path. In a similar manner, A13Q5 and A13Q8 are the dc signal path, and A13Q6 and A13Q7 are the ac signal path. Transistors A13Q6 and A13Q7 are current sources and resistors A13R23 and A13R24 serve to lower the power in these transistors. Each side of the output amplifier can swing from approximately +9 V to approximately +95 V.

4-105. GATE ASSEMBLY AND CALIBRATOR.

4-106. GATE CIRCUITRY. (See schematics 15 and 16.) The gate assembly controls the intensity of the trace on the CRT. The gate preamplifier, consisting of A14Q1 through A14Q10 sums all the desired functions necessary for control of the trace intensity.

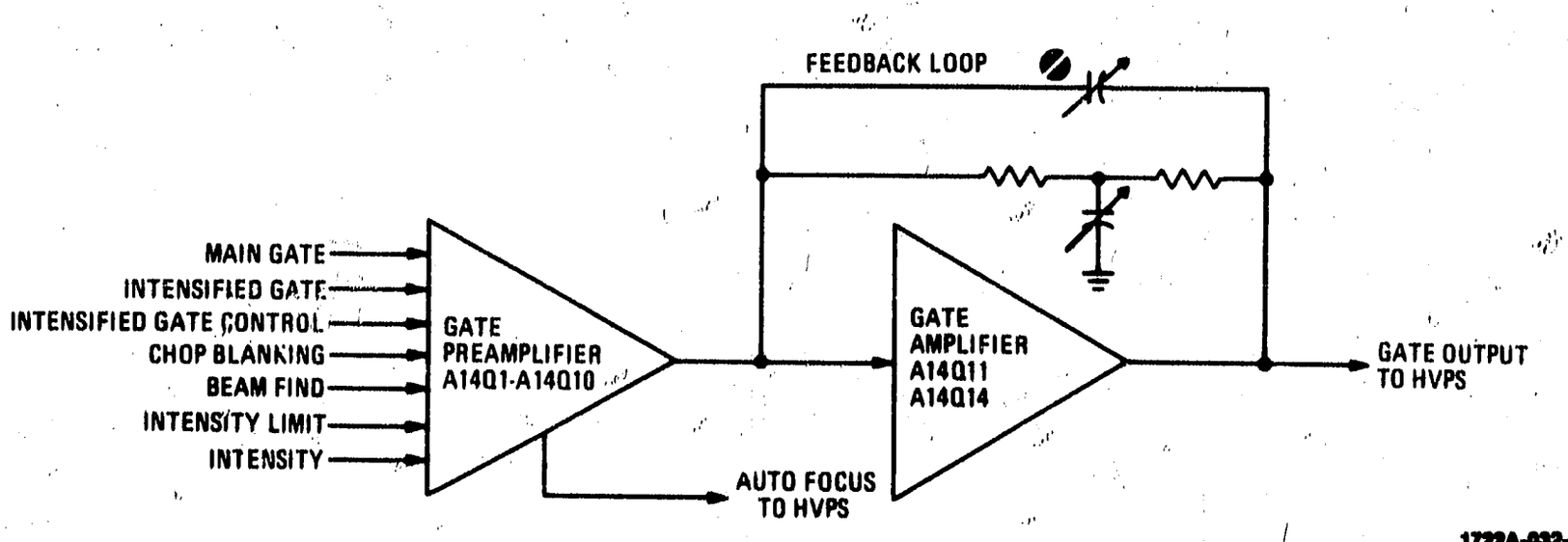

Figure 4-3. Gate Control Simplified Block Diagram

This is accomplished with current switches (see figure 4-3 for simplified block diagram of gate circuit).

4-107. Gate Preamplifier. The setting of front-panel INTENSITY control R2 controls the base voltage applied to A14Q8. The emitter voltage of A14Q8 follows the base voltage and is 0.6 V above the base voltage. This voltage applied to A14R18 establishes the current for current switch A14Q1, A14CR3, and A14Q9.

4-108. The composite gate signal from the gate Schmitt is applied to the base of A14Q1. This signal switches the current path between A14Q1 or A14Q9, thus causing the gate output voltage to the high voltage power supply to change.

4-109. The intensified gate functions in a similar manner. It is a current switch consisting of A14Q10, A14CR4, and A14CR5. Its current source is the voltage at the emitter of A14Q8 across A14R22 and A14R23. Zener diode A14VR1 and A14R24 limit the maximum level of the intensified gate. The main intensity control signal is applied through A14R25 to this current switch. The main intensity signal enables the current switch during main intensified mode only.

4-110. Chop blanking is accomplished by another current switch A14Q2 and A14Q3. When CHOP mode of operation is selected, the chop blanking signal applied to the base of A14Q2 turns it on and off. The alternating action switches the current path between A14Q2 and A14Q3. Transistor A14Q3 supplies additional current to A14Q9 increasing the brightness of the trace.

4-111. When BEAM FIND switch A8S1A is pressed, the front-panel INTENSITY control R2 is disabled and a fixed voltage is supplied through the gate amplifier to the high voltage power supply. A z-axis voltage applied to A14R6 similarly causes a current change through the gate amplifier. A z-axis signal of >+1 V, pulse with >50 nanoseconds, dc to 20 MHz will blank the CRT trace of normal intensity. A z-axis signal of +8 V will blank the CRT trace regardless of intensity setting.

4-112. Transistors A14Q4 and A14Q5 make up an intensity limit circuit. As the intensity becomes excessive in the CRT, its first accelerator begins to draw current. This increases the current through A14R16, causing the voltage on the base of A14Q4 to change. The voltage at the emitter of A14Q4 follows the base voltage and is 0.6 V below the base. This raises the voltage applied to the base of A14Q8 through front-panel INTENSITY control R2. Variable resistor A14R15 establishes the level at which limiting takes place. Variable resistor A14R10 sets the maximum level the gate output can reach. This provides optimum CRT gate drive to the CRT.

4-113. An auto focus circuit is incorporated in the instrument. Varying INTENSITY control R2 varies the bias applied to the emitter circuit of A14Q7. As conduction through A14Q7 increases or decreases the voltage drop across FOCUS control R1 changes accordingly (see schematic 18). This automatically corrects the focus adjustment for changes in intensity level.

4-114. Gate Amplifier. The gate amplifier output is a shunt feedback stage consisting of A14Q11 through A14Q14. Transistors A14Q11 and A14Q13 are emitter followers with A14Q11 providing the ac signal path. Resistors A14R30 and A14R31 provide the dc feedback path. Variable capacitor A14C7 controls the fast corner response while A14C8 controls the slightly slower corner response.

4-115. Due to the high open loop gain of the amplifier most of the current appearing at the summing junction (bases of A14Q11 and A14Q13) flows through the feedback resistors A14R30 and A14R31. This results in a change in output voltage equal to the input current times the feedback resistance (A14R30 plus A14R31). Under certain conditions the gate output may swing from +5 V to +100 V.

4-116. CALIBRATOR. (See schematic 15.) The calibrator consists of integrated circuit A14U1 and associated bias controls. It is connected in a multivibrator configuration and free-runs at approximately 1 kHz. The calibrator amplifier adjustment, A14R51, is adjusted to produce a square wave with three volts amplitude at the CAL 3V terminal on the front-panel of the instrument.

4-117. CRT CONTROLS. (See schematic 16.) There are a few CRT adjustments that are physically located on gate assembly A14 yet are accessible at the rear panel of the instrument for CRT control. These adjustments are TRACE ALIGN (A14R67), ASTIG (A14R74), and PATT (A14R76). A functional description of these controls is given in Section III.

4-118. Two additional CRT controls are physically located on gate assembly A14 and are screwdriver adjustment. Floodgun pattern control A14R64 adjusts the voltage applied to the floodgun filaments of the CRT to control scale illumination range. ORTHO ADJ control A14R70 adjusts the current through the y-axis alignment coil on the CRT.

4-119. HIGH VOLTAGE POWER SUPPLY.

4-120. The high voltage power supply contains a high voltage oscillator and a rectifying circuit. The high voltage regulator is part of gate assembly A14.

4-121. When the instrument is turned on, +20 V unregulated is applied to transistor Q1, turning it on. As Q1 conducts through the primary winding of

A15T1 (pins 3 and 4), positive feedback to the base of Q1 occurs through another winding on the transformer (pins 1 and 2). The circuit oscillates at a rate determined by the inherent distributed inductance and capacitance of the circuit. The magnitude of the oscillations, and consequently the output of the power supply, is controlled by the voltage on the collector of voltage regulator A14Q17 on gate assembly A14.

4-122. A voltage reference from the +15 V supply is established at the junction of A15R10 and A15R12. This reference voltage is applied to the base of A14Q15 on gate assembly A14. A sample of the rectified cathode voltage is fed back to the base of A14Q15 through A15R10. Any difference in cathode voltage is amplified and inverted by Darlington amplifier A14Q15/A14Q16. The output of the Darlington pair drives the base of A14Q17, causing

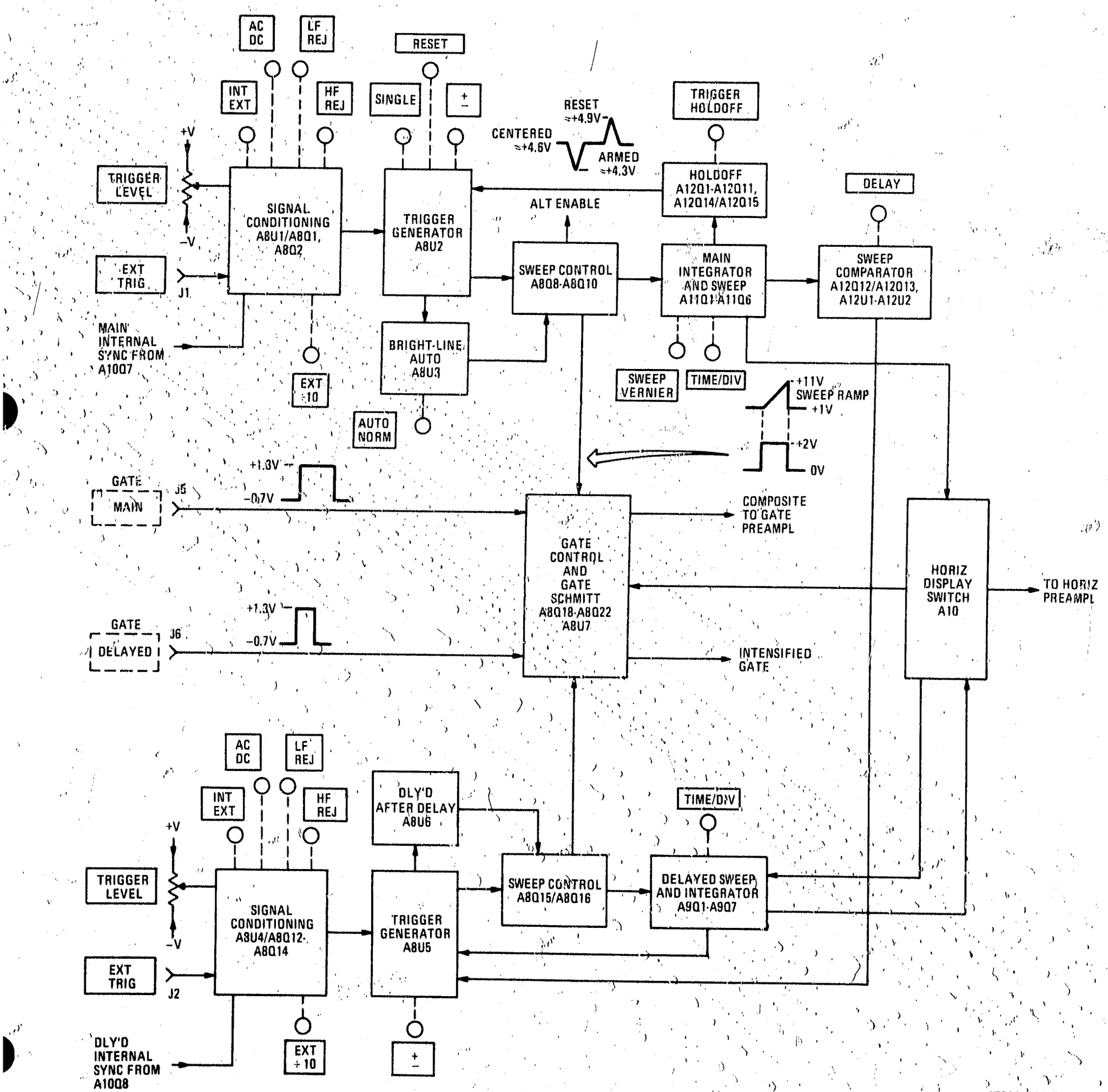

Figure 4-4. Time Base Simplified Block Diagram

its collector voltage to change. This change is coupled through a winding on A15T1 to the base of Q1 and causes the amplitude of its oscillations to change. The change is in such a direction as to correct the original change in the rectified cathode voltage. Diodes A15CR1 and A15CR2 protect the oscillator transistor base from excess reverse voltage.

4-123. The CRT cathode and grid voltages are developed in the secondary of high voltage transformer A15T1. The cathode voltage is rectified and filtered before application to the cathode of the CRT. It is also used as a feedback control to the high voltage oscillator, as a reference for the CRT filament winding, for grid bias supply, and for the focus voltage divider network. The cathode voltage will vary between —2827 V to —2973 V, depending on component tolerances and is not adjustable.

4-124. The CRT grid voltage is supplied by a voltage tap (pin 5) on the secondary winding of A15T1. Approximately 300 V peak is developed and applied through a series RC network (A15C2/A15R2) to diodes that clamp the voltage swing between that established by INT SET control A15R3 and the gate dc levels. The peak-to-peak voltage swing is rectified, and applied to the grid with reference to cathode voltage and controls the beam brightness.

4-125. The unrectified cathode voltage in the secondary of A15T1 is applied to multiplier assembly A16 where the voltage is multiplied approximately six times. The output of the multiplier (approximately +17.5 kV) is applied to the post accelerator connector on the CRT.

4-126. Another secondary winding of transformer A15T1 furnishes the filament voltage for the CRT. This winding is referenced to the rectified cathode voltage through A15R5.

4-127. TIME-VOLTAGE MEASUREMENT CIRCUITRY.

4-128. The time-voltage measurement section of the Model 1722A is made up of the following assemblies: Processor and Display Driver Assembly A18, Input Encoder Assembly A19, Output Interface Assembly A20, Analog Assembly A21, Time Delay Switch Assembly A22, LED Display Assembly A23, and Selector Switch Assembly A24. See figure 4-5 for a simplified block diagram of the time-voltage measurement section.

4-129. Since the time-voltage measurement section consists primarily of logic circuits such as counters, read-only memories, serial input/parallel output converters, etc., signal tracing will not be attempted. The following paragraphs will discuss each assembly as to function only. Control signals are also identified (see table 4-1 for quick identification of time/voltage section abbreviations).

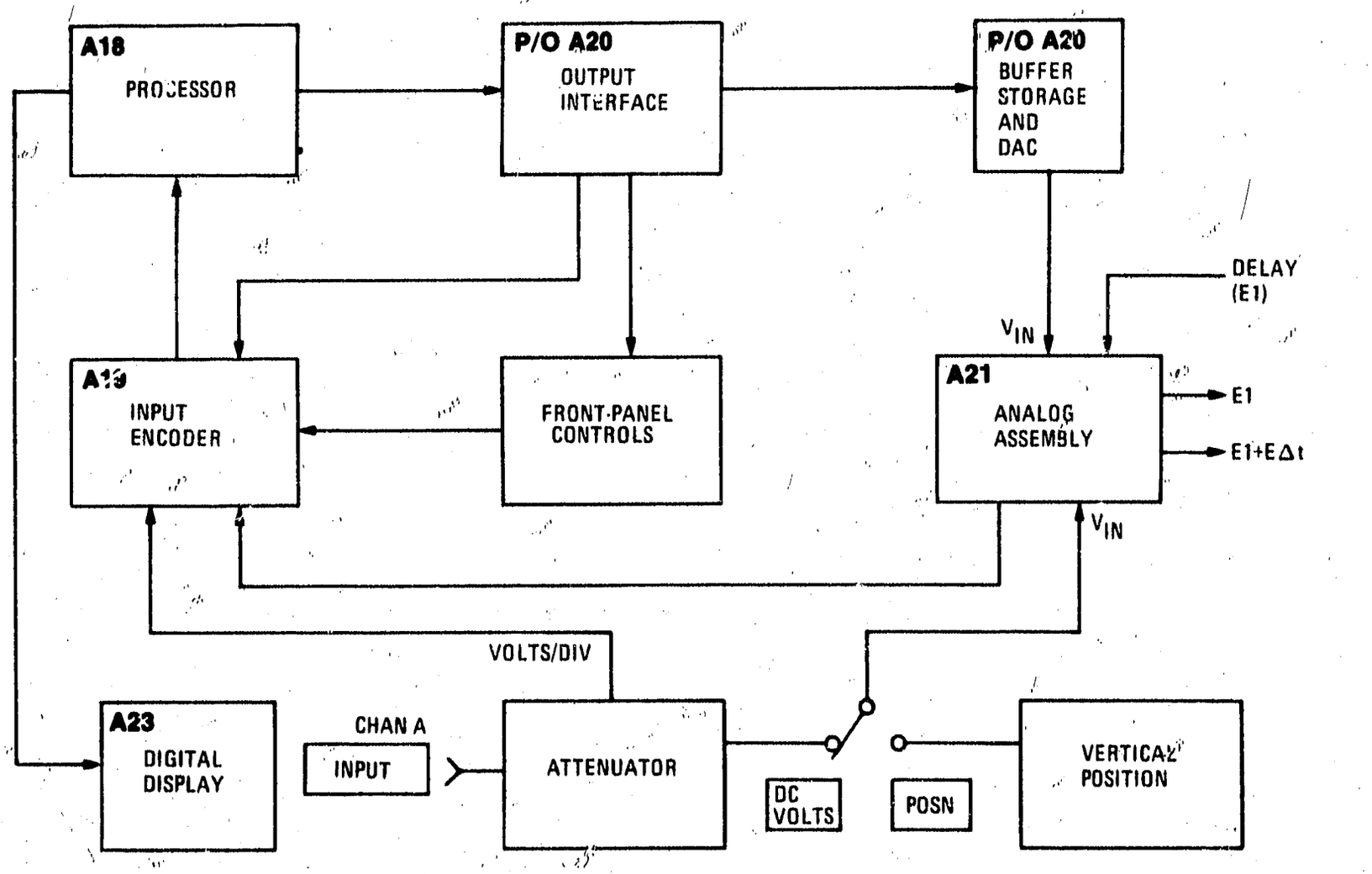

Figure 4-5. Digital Display Simplified Block Diagram

Table 4-1. Time/Voltage Section Abbreviations

Abbreviation	Description
A&R	Arithmetic and Register Circuitry.
BCD	Binary-coded decimal signal from A&R unit to Output Interface Assembly A20.
C&T	Control and Timing Circuitry.
C0, C2, C3, C4, and C6	Output control signals from Input Encoder Assembly A19.
DACO	Digital-to-Analog Converter output.
DCLR	Dc-level reference signal from vertical preamplifier.
DCPO	Dc voltage established by channel A POSITION control.
DCVE	Dc vertical input from channel A attenuator.
HAT	Signal indicating delayed TRIGGER LEVEL control in STARTS AFTER DELAY detent.
HCAL	Signal indicating horizontal SWEEP VERNIER in CAL detent position.
HDLY	Control signal from front-panel DLY'D pushbutton switch.
HMI	Control signal from front-panel MAIN INTEN pushbutton switch.
HNOK	Signal indicating front-panel controls are not positioned for valid time interval measurements. Causes .0 to be displayed in LED Display window.
HUP	Signal used to increase or decrease output from D/A Converter.
H(—)	Signal used to display minus sign in LED Display window when in CHAN A VOLTS modes.
H1M	Signal that enables V1M section of delay comparator.
H2M	Signal that enables V2M section of delay comparator.
Is	Instructions generated serially from ROMs.
LALT	Signal that indicates selection of ALT mode of operation.
Mb1	Signal that enables the voltage measurement section of the time/voltage measurement circuitry.
Mb2	Signal used by C&T section to invert time measurement (1/TIME).
HPCT	Signal indicates channel A vernier is out of CAL detent position. Percentage indication given in LED Display window.
LTRE	Enable signal for range portion of TIME DELAY Switch Assembly A22.
RFS	Control signal to CHAN A (REF SET) pushbutton switch.
R1-R4	Enabling signals from C&T circuit that controls outputs from the Input Encoder Assembly A19.

Table 4-1. Time/Voltage Section Abbreviations (Cont'd)

Abbreviation	Description
SYNC	Word synchronization signal generated by 56-state counter.
HTBE	Enable signal for time section of TIME DELAY Switch Assembly A22.
V1M	Reference signal used to generate first bright segment displayed on CRT trace.
V2M	Offset signal used to generate second bright segment displayed on CRT trace.
WS	Gating signal from C&T or ROMs that enables A&R circuitry.
Φ1	Clock signal to Output Interface Assembly A20.
000-111	Signals used to enable gates on Input Encoder Assembly A19.

4-130. Prior to discussing each assembly, a brief description of the time-voltage measurement section is necessary. Basically, the time-voltage measurement section operates in much the same manner as a hand-held calculator. The front-panel controls serve as the calculator keyboard with the controls encoded and multiplexed to appear as key strokes. The processor continuously scans the control settings to see which task is called for (TIME, 1/TIME, DC VOLTS, POSN, %) and which range factors should enter into the calculations. Input Encoder A19 encodes the appropriate front-panel controls settings, and these are sent to the processor assembly as particular memory addresses. Programs stored at these addresses in the read-only memories (ROMs) perform the indicated function (compute time, increment, decrement, etc.).

4-131. INPUT ENCODER. (See schematics 17 and 18). Input Encoder Assembly A19 encodes the appropriate front-panel control settings as directed by the processor assembly. When the 1722A is turned on, the processor assembly begins its program algorithm (refer to figure 4-6 for logic flow diagram). At start up, it clears its registers and generates an initial zeroed display. It then interrogates the input encoder by way of Output Interface Assembly A20. The interrogation commands from the ROMs are generated as serial-bit instructions on the Is line from the processor to the output interface assembly. The output interface assembly converts the serial-bit instructions to parallel-bit interrogations. The interrogation signals are designated as 000-101. Each signal enables one or more NAND/AND gates on the input encoder assembly. The other input to the NAND/AND gates are front-panel control settings.

4-132. The output of the enabled NAND/AND gates are further gated and enabled by read commands R1-R4 from the Control and Timing Unit. The gated outputs from A19U1-A19U4 (C0, C2, C3, C4, C6) are applied as particular memory address to the ROMs through the Control and Timing Unit (see schematic 19). Programs stored at these ROM addresses are then performed.

4-133. Input Signal PCT. A logic high PCT signal is applied to the input encoder when the channel A VOLTS/DIV vernier is not in CAL detent position and the CHAN A POSN switch A24S1A in engaged. It is applied through inverter A19U7A to VOLTS/DIV switch A1A1S2. When the output of A19U7A is low, the input from the VOLTS/DIV switch is disabled. Also, when PCT is high it is applied through A19CR1 to an input on NAND gate A19U9B. At read-time R2 (from the C & T Unit) the output of NAND gate A19U3D (ROM address C4) goes low. This instructs the processor to read the attenuator setting as 20 V/div and to translate an on-screen deflection of five divisions as 100%. If the attenuator vernier is in its CAL position, PCT is logic low and the processor reads the vertical sensitivity and proceeds to the read/search mode (refer to figure 4-6) where it begins to find the unknown voltage through a successive approximation algorithm.

4-134. Input Signal Mb1. A logic high Mb1 signal enables the voltage measurement section of the input encoder and disables the time-measurement section. Signal Mbl is high when either CHAN A POSN switch or CHAN A INPUT switch is engaged (see schematic 23). Mb1 enables A19U18B. Interrogation signal 000 strobes A18U19B and produces a toggling signal to the volts/div NAND gates.

4-135. Outputs of the volts/div NAND gates and the TIME/DELAY switch A22S1A are connected in a wired-OR configuration. A low from either section

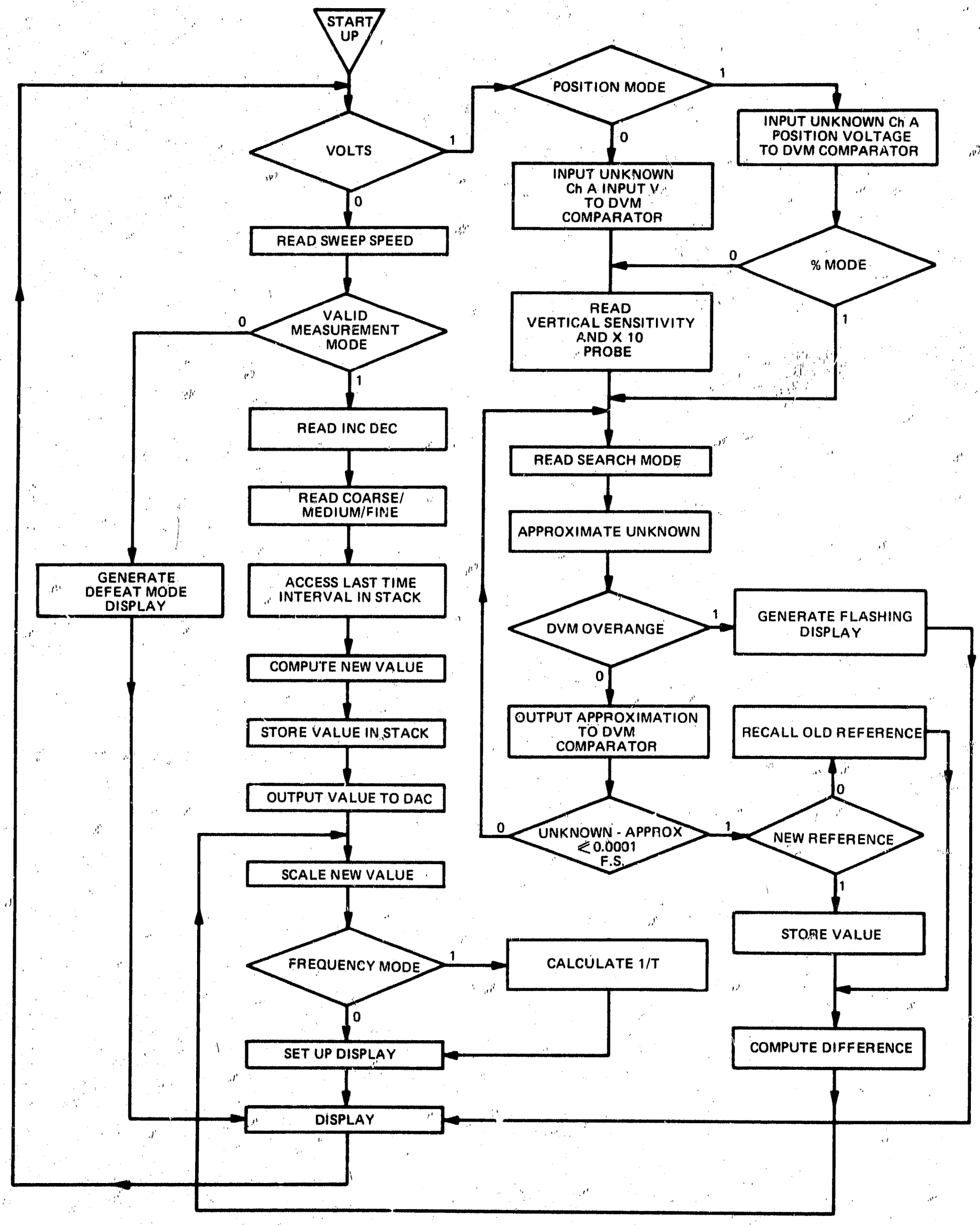

Figure 4-6. Processor Flow Algorithm

controls the input to its associated inverter on A19U5, A19U6, or A19U7.

4-136. Input Signal Mb2. The Mb2 signal is logic high when the 1/TIME switch is engaged. It is applied to output gate A19U2D through A19U17A and A19U6E. NAND gate A19U17A is strobed by interrogation signal Ø1Ø. At read-time R3 the output of A19U2D (ROM address CØ) goes low. This instructs the processor to compute the inverse of time and display it on the LEDs.

4-137. HNOK Signal. The HNOK signal is generated when certain front-panel horizontal controls are not positioned for valid time interval measurements. It is logic low when the following controls are positioned as stated: either the horizontal display MAIN INTEN or the DLY'D pushbutton switch is engaged, the main SWEEP VERNIER control is in CAL detent position, and the delayed TRIGGER LEVEL is in START AFTER DELAY detent. If any of the conditions are not satisfied, HNOK becomes high. The signal enables NAND gate A19U13B which is strobed by AND gate A19U16B. The output of A19U16B is high when signal Mb1 is low and interrogation signal Ø01 is high. The output of A19U13B is applied to output gate A19U2A. At read-time R3, the output of A19U2A (ROM address C3) goes low. This informs the procesor that a horizontal control is not positioned correctly for time measurements. The processor causes a .0 to be displayed on the LEDs indicating to the user that something is wrong.

4-138. Input Signal H(—). Analog Assembly A21 (see schematic 23) develops two pieces of information: the polarity of the input voltage [H(—)] and whether the voltage derived in the processor is greater or less than the input (HUP). The H(—) signal is gated through the input encoder assembly to the processor. When H(—) is high it indicates to the processor that a minus sign should be shown in the LED display. In addition, the H(—) is gated through the input encoder with the HUP signal. The combination of both signals indicate to the processor to increase or decrease the derived voltage in either a positive or negative direction.

4-139. Input Signal HUP. Voltage measurements are made by comparing the input voltage to a voltage derived by the processor. The derived voltage is stored as a digital number in the processor and converted to a dc voltage in the digital analog circuit on the output interface assembly A20 (see schematic 21). The comparison of the input voltage (DCPO or DCVE) and the derived voltage (DACO) is accomplished by analog assembly A21. The resultant signal (HUP) is gated to the processor through the input encoder assembly. When the HUP signal is high, it tells the processor to increment its derived voltage. When the HUP signal is low, it tells the processor to decrement its derived voltage.

4-140. The HUP signal is applied to the D input of flip-flop A19U14 (see schematic 17). The flip-flop is clocked by AND gate A19U16D. When HUP is high, the Q output of A19U14 remains high, enabling AND gate A19U10D which is strobed by the output of A19U16D. Conversely, when HUP is low, the $\overline{Q}$ output of A19U14 is high, enabling AND gate A19U10C which is also strobed by the output of A19U16D. The outputs of A19U10C/A19U10D and the H(—) signal from the analog assembly are gated to the output NAND gates through NAND gates A19U15A-D. At read-time R2, the HUP and H(—) signals are gated to the processor over control lines CØ, C2, C3, or C4.

4-141. PROCESSOR AND DISPLAY DRIVERS. (See schematic 19). Processor and Display Driver Assembly A18 contains control and timing circuitry (C & T), read-only memories (ROMs), arithmetic and register circuits (A&R), and LED display controls. The processor is organized on a digit-serial, bit-serial basis. Each data word consists of 14 binary-coded-decimal (BCD) digits; each word is 56 bits long.

4-142. Essentially, the processor interrogates the front-panel controls, calculates any intermediate steps, and displays the resultant measurement. When the instrument is turned on, the processor initiates its program (see figure 4-5). At start up it clears its registers and generates an initial zeroed display. It then interrogates the measurement-mode controls and proceeds into one of two measurement branches - either volts or time. If either the CHAN A POSN or INPUT switch is depressed, it indicates to the processor that a voltage measurement is required. The processor then determines which of the voltage modes was selected. If the INPUT mode was selected, the processor uses the dc voltage on the channel A INPUT connector as the voltage to be measured. If the POSN mode was selected, the processor uses the voltage from the channel A POSITION control as the voltage to be measured. It first determines, however, if the channel A attenuator vernier is in its calibrated position. If the vernier is not in its calibrated position, the processor automatically determines the attenuator setting to be 20 V/div and translates an on-screen deflection of 5 divisions as 100%. If the vernier is in its calibrated position, the processor reads the vertical sensitivity and proceeds to the read/search mode where it finds the unknown voltage through a successive approximation algorithm. If, during the algorithm, an overrange condition is encountered, the iteration is stopped and a flashing display is presented on the LEDs. If an overrange condition is not encountered, the iteration continues until the difference between the unknown voltage and the processor generated approximation is less than 0.001 of full scale (full scale is always 10 times the attenuator range setting). If this value is selected as a new reference (by pressing the REF SET switch), the processor stores this value and displays a zero reading on the

LEDs. If it not to be used as a new reference, the old reference is recalled from memory and the difference is displayed on the LEDs.

4-143. If one of the time modes is selected (either TIME or 1/TIME), the processor reads the main TIME/DIV setting and then determines if either the MAIN INTEN or DLY'D mode is selected. If neither mode is selected, a defeat mode display (.0) is generated on the LEDs. If a valid condition exits, the processor reads the DEC/INC coarse, medium, and fine control settings. It then accesses the value of the last time interval in the stack and computes the new value. The processor stores this computed value in the stack and outputs it to the digital/analog converter. It scales this value and determines whether the 1/TIME mode was selected. If so, the processor computes the inverse of time and displays it on the LEDs. If not, it displays the time interval.

4-144. Control and Timing Unit. The main control and timing circuits are contained on MOS/LSI (metal-oxide-semiconductor/large-scale integration) A18U8. Integrated circuits (IC) A18U9 through A18U11 function as buffers and signal level translators. A18U8 performs the major nonarithmetic functions required to operate the time and voltage measurement section of the oscilloscope. These functions include interrogating the input encoder, keeping track of the status of the system, and changing instruction addresses to the ROMs. The C&T unit continuously scans the input encoder assembly for changes in front-panel status. The signals used for scanning are R1 through R4. When a change in status is detected, the ROM addresses are updated and sent serially to the ROMs.

4-145. Read-only Memories. Programmed mathematical routines are stored in two read-only memories, A18U6 and A18U7. A specific select code is assigned each ROM so that only one ROM is energized at any one time. When a selection instruction is generated by the C&T unit, a decoder in each ROM checks the select-code field of the instruction. In case of a match, the selected ROM turns on and the unselected ROM turns off.

4-146. Arithmetic and Register Unit. The A&R MOS/LSI A18U3 executes the bit-serial instructions on information line Is. Most arithmetic instructions must be enabled by the word-select signal (WS). Display data is sent to LED anode driver A18U2 on five lines. One carry line transfers carry data back to the C&T unit. A BCD output from the A&R unit is applied through A18U10 and A18U11 to Output Interface Assembly A20.

4-147. The A&R unit is divided into five sections: instruction storage and decoding circuits, a timing circuit, seven 56-bit registers, an adder-subtractor, and a display decoder. Transfers into and out of the registers are always whole-word transfers.

4-148. Display and Drivers. Light-emitting diodes are more efficient if they are pulsed at a low duty cycle rather than driven by a dc source. Bi-polar cathode and anode drivers A18U1 and A18U2, incorporating this feature, are used to control the LED display. The anode driver A18U2 generates the two-phase system clock and the anode segment drive signals, decodes the data from the A&R unit, and inserts the decimal point. In addition, it sends shift signals to the cathode driver. The cathode driver A18U1 contains a 15-position shift register which is incremented for each digit position.

4-149. Clock Driver. Clock driver A18U4 amplifies the clock signal used to serially process the bit information into and out of the MOS/LSIs. The clock signal is also applied to Output Interface Assembly A20 where it is used to clock the serial-bit input data into the buffer register. The repetition rate of the clock is approximately 200 kHz.

4-150. OUTPUT INTERFACE. (See schematics 20 and 21.) The output interface assembly A20 contains circuitry for connecting the BCD output from the microprocessor to an analog voltage and for connecting instructions on the Is line to interrogation signals 000-110.

4-151. Input-output Controls. Serial-bit instructions (Is) are applied to four-stage static shift register A20U5 which converts the serial information into a parallel output. The register is clocked by the Φ1 signal from clock driver A18U4. The clocking function is synchronized by the SYNC signal applied to NOR gate A20U2C. The SYNC signal enables A20U3A. This causes the output of NOR gate A20U2C to follow clock driver signal Φ1. The output of A20U2C clocks shift register A20U5 and D-type flip-flop A20U6.

4-152. At the end of the serial word, the SYNC signal goes low, inhibiting the clock to A20U5 and A20U6. In addition, when the SYNC signal goes low, A20U7 is clocked by A20U2D, causing it to store the parallel outputs from A20U5A.

4-153. The binary-coded output from A20U7 is applied to BCD-to-decimal decoder A20U9. The decoder produces a high at the decoded output. The outputs from A20U9 are applied through buffer amplifiers on A20U25 to Input Encoder Assembly A19. The control signals (000, 001, 010, 100, 101, and 110) strobe selected NAND gates on A19 for scanning by the C&T unit. The decoder also generates control signal (111) for NAND gate A20U3C. The output of A20U3C clocks D-type latches A20U13 through A20U16 which store the data from the BCD line. NAND gate A20U3C is enabled by flip-flop A20U17A which is clocked by Φ1.

4-154. The BCD signal from the A&R unit is applied to shift register A20U10/A20U11 where the serial input is converted to parallel outputs (see schematic 21). The output of the shift register is stored in ICs A20U13 through A20U16. The parallel output of these latches are applied to digital rate multipliers (DRMs) where the digital information is converted to pulse-train outputs. The outputs of the DRMs (A20U20 through A20U23) are averaged by operational amplifier A20U24. The output of A20U24 (DACO signal) is applied to Analog Assembly A21 where it is compared to either the DCPO or DCVE signal developed in the vertical preamplifier stage.

4-155. BCD information from the A&R unit is clocked into shift register A20U10/A20U11 by clock signal Φ1 through gating circuit A20U2A, A20U3B, and A20U2B. The gating circuit is controlled by flip-flop A20U8A. Flip-flop A20U8A is clocked by control signal 111 from A20U9.

4-156. NOR gates A20U19A and A20U19B form a free-running oscillator that clocks flip-flop A20U17. The output of A20U17 provides the clock signal for DRMs A20U20 through A20U23. The clock frequency is approximately 145 kHz.

4-157. ANALOG ASSEMBLY. (See schematics 22 and 23.) The analog assembly produces the control signals and reference voltages applied to the delay comparator circuit. In addition, it compares certain voltages with the output of the D/A converter and generates the control signals (HUP and H(—)) to A19. The signals developed on the analog assembly are described in the following paragraphs.

4-158. DCPO Signal. When CHAN A POSN pushbutton switch is engaged, a dc level (DCPO), established by the channel A POSITION control R3, is applied to A21U6. When CHAN A INPUT pushbutton switch is engaged it applies the output signal from channel A attenuator (DCVE) to A21U6. Operational Amplifier A21U6 compares the DCPO (or DCVE) signal with the DCLR signal from the vertical preamplifier assembly. The DCLR signal is a fixed reference level developed through A3R41 (see schematic 3).

4-159. Since the DCPO (or DCVE) signal may be either positive or negative while the output of the digital/analog converter (DACO) is always negative (0 V to —9 V), a conversion circuit (A21U3) has been added to comparator circuit A21U5. The conversion circuit functions as follows: if DCPO (or DCVE) is negative, the output of A21U6 is positive (since the input signals are applied to A21U6 inverting input). The positive output of A21U6 is applied to the inverting input on A21U3 and A21U4. The negative output of A21U4 is applied to the non-inverting input on comparator A21U5. The negative output of A21U3 forward biases A21CR5 and reverse biases A21CR6-A21CR9. With A21CR5 conducting, the input of A21U3 is clamped to its output. A21U3 will remain clamped until the output state of A21U6 changes. In addition, the negative output of A21U3 turns off transistor A21Q1, causing the H(—) signal to go high. When H(—) is high a minus sign is displayed by the LEDs. If the DCPO (or DCVE) signal is positive, the output of A21U6 is negative. The negative output is applied to the inverting inputs on A21U3 and A21U4. The positive output of A21U3 applies reverse bias to A21CR5 and forward bias to A21CR6-A21CR9. With these diodes conducting, a current source is enabled with twice the current capacity of that generated by A21U6/A21R17 but of opposite polarity. This results in a positive current of the same amplitude as the positive output of A21U6 when DCPO (or DCVE) was negative. A21U4 inverts the signal and applies it to the non-inverting input on comparator A21U5. In addition, the positive output of A21U3 turns on A21Q1 causing signal H(—) to go low and telling the processor to extinguish the minus sign in the LED display. Resistors A21R16 and A21R28 are used to calibrate the negative and positive DVM respectively.

4-160. DACO Signal. Amplifier A21U5 compares the vertical preamplifier signal (DCPO or DCVE) with the DACO signal developed by the digital/analog converter (see schematic 21). The output of A21U5 is applied to Schmitt trigger A21Q11/A21Q12. The Schmitt trigger circuit establishes the level of the HUP signal by turning A21Q2 on or off. The HUP signal is used by the processor to increment or decrement the value of DACO. When the DACO signal and the DCPO (or DCVE) signals are approximately equal, the readout on the LEDs becomes constant.

4-161. The DACO signal is also applied to isolation amplifier A21U1. The output of A21U1 is applied to one input on comparator A21U2. The other input to A21U2 is the V1M signal developed by the time interval DELAY control R7 through isolation amplifier A21U8. Amplifier A21U2 sums the two inputs and develops the offset signal V2M. The two signals (V1M and V2M) are applied to the delay comparator circuit (see schematic 11) and are used to generate the two bright segments on the CRT trace.

4-162. H1M-H2M Signal. The two signals (H1M and H2M) are used to enable different sections of the delay comparator IC, A12U1 (see schematic 11). The signals are developed by flip-flop A21U7 and are complementary. The ALT GATE signal, developed during each sweep of the trace is used to clock the flip-flop.

4-163. The output of NAND gate A21U9 (see schematic 22) is the HNOK signal described previously. When a front-panel horizontal control is improperly positioned for time-frequency measurements, the output of A21U9 is high, turning off transistor A21Q4.

With A21Q4 turned off, a constant high is applied to the clear input terminal of flip-flop A21U7, holding its $\overline{Q}$ output (H1M) high and its Q output (H2M) low. In this configuration only one bright segment is generated on the CRT trace.

4-164. When the instrument is used for voltage measurements, the Mb1 signal is high. The signal is applied to the base of A21Q4 through A21CR14/A21R49, turning it off. With A21Q4 turned off, only one bright segment is generated on the CRT trace as explained in the previous paragraph.

4-165. The transistor circuitry of A21Q3, A21Q8, and A21Q9 control the D-input to flip-flop A21U7. When the instrument is not operated in the ALT mode of vertical display, the LALT signal is high, turning off A21Q8 and applying reverse bias to A21CR17. With A21Q8 turned off, A21Q9 is turned on, applying reverse bias to A2CR16. When the Q output of A21U7 is low, the signal is applied through A21CR19 to the base of A21Q3 turning it off. This action applies a high through A21R47 to the D-input on the flip-flop. At the next ALT GATE signal, the flip-flop is clocked causing the Q output to go high. With the Q output high, A21CR19 is reverse biased and A21Q3 turns on, applying a low to the D-input of the flip-flop. At the next ALT GATE signal, the flip-flop is clocked and the Q output becomes low, completing the cycle. Therefore, the H1M and H2M signals alternate between high and low with each ALT GATE signal. Consequently, to display two bright segments on the CRT trace requires two sweeps of the trace are required.

4-166. When the instrument is operated in the ALT mode of vertical display, a low is applied to the junction or A21R46 and A21CR17. The low forward biases A21CR17 clamping A21Q3 in its off condition. The low signal through A21R46 biases the base of A21Q8 to approximately +5 V. Transistor A21Q9 is now controlled by the CHAN B signal applied to its base. As the CHAN B signal alternates between high and low for each sweep of the trace, A21Q9 alternately turns on and off. When A21Q9 turns off a low is applied to the D-input of the flip-flop. When A21Q9 turns on, a high (through A21R47) is applied to the D-input of the flip-flop. This action ensures that the H1M and H2M signals are generated in the proper sequence so as to guarantee that when in ALT mode of operation, the first mark appears on channel A and the second mark appears on channel B.

4-167. LOW VOLTAGE POWER SUPPLY.

4-168. The low voltage power supply provides regulated +5 V, +15 V, +53.3 V, +115 V, and —15 V for operation of the various circuits in the instrument. All low voltage supplies are referenced to the +15 V supply for regulation purposes.

4-169. ±15-VOLT SUPPLIES. (See schematic 25). One of the secondary windings on input power transformer T1 is connected to bridge rectifier A17CR7. The rectified voltage (nominally +20 Vdc) is filtered by A17C8. The output of the supply is maintained at +15 volts by integrated circuit A17U2 and series regulator transistor Q5. Regulator A17U2 contains a differential amplifier with a Darlington output. The reference circuit (A17VR3/A17R29) is connected to the noninverting input of the differential amplifier (pin 3) through A17R20. The +15-volt output is attenuated through A17R22, A17R23, and A17R24. The wiper of potentiometer A17R23 is connected to the inverting input of the differential amplifier. The Darlington output (pin 6) drives the base of series transistor Q5. Resistor A17R23 is adjusted to compensate for variations in the value of the reference voltage (nominally +7.15 volts) so that with an output of +15 volts from the supply, the inverting and noninverting input voltages are equal.

4-170. The IC regulation includes an output current limiting circuit consisting of an NPN transistor whose collector is connected to the differential amplifier and first base of the Darlington pair (within the IC). The emitter and base connections for the NPN transistor are pin 1 and pin 10 on A17U2. When load current through A17R21 produces a sufficient voltage drop, the NPN transistor conducts, pulling the input to the Darlington pair toward the emitter potential of Q5. This limits the output current. The output current limit is 0.55 ampere to 0.75 ampere.

4-171. The operation of the —15 V regulator A17U3 is identical to that of the +15 V regulator except that the inverting input to the IC is the sum of the +15 V and —15 V outputs (nominally 0 V).

4-172. +5-VOLT SUPPLY. (See schematic 24.) The +5-volt regulator A17U1 functions identically to that of the +15 V regulator A17U2 except that the reference is provided by the output of the +15 V supply and attenuated by A17R15 and A17R16.

4-173. +115-VOLT AND +53.3-VOLT POWER SUPPLIES. (See schematic 24.) The +115-volt and +53.3-volt power supplies function identically, therefore only the +115-volt supply will discussed.

4-174. The ac input voltage from power transformer T1 is applied to bridge rectifier A17CR1. The dc output from A17CR1 is filtered by A17C1. A +15 V reference is applied through A17CR5 to the emitter of transistor A17Q3. The base of A17Q3 is connected to a voltage divider network across the output circuit. If the output falls below +115 V, the base of A17Q3 becomes less positive than the emitter and it conducts. With A17Q3 turned on, conduction through Darlington pair Q2 and A17Q2 increases. This results in an increase in output voltage. When the output voltage again reaches +115 volts, A17Q3 turns off.

Transistor A17Q1 and resistor A17R2 form a current limiting circuit. As the current requirements increase toward the limit of the supply capability, the voltage drop across A17R2 is applied to the base of A17Q1 which conducts and limits the current drain from the Darlington pair.

4-175. The +53.3-volt power supply functions identically as the +115-volt supply. The Darlington pair consists of transistor Q3 and A17Q5. The current limiting circuit consists of transistor A17Q4 and resistor A17R8.

4-176. LINE FREQUENCY. The line frequency trigger signal is developed in the same secondary winding of power transformer T1 that is used for the +5-volt power supply. The line frequency signal is applied through A17R18 to HF REJ switch A8S1M on assembly A8 (see schematic 7).

4-177. FLOOD GUN FILAMENT VOLTAGE. (See schematic 25.) Flood gun filament voltage is developed in a secondary winding of ac power transformer T1. The ac input voltage is rectified by A17CR9/A17CR10 and filtered by A17C14. One branch of the output circuit is applied directly to the floodgun filament connection on the CRT. The other branch is applied to a control circuit on gate assembly A14. The output of the control circuit on assembly A14 is applied to the other filament connection on the CRT (see schematic 16).

PERFORMANCE CHECK

ADJUSTMENTS

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

WARNING

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

5-2. This section contains step-by-step procedures for checking instrument performance and for making all internal adjustments. Performance checks should be made in numerical sequence for best results. Also included are test setup illustrations and a list of recommended test equipment. Most test points and adjustment locations are shown within the procedures in which they are referenced.

5-3. EQUIPMENT REQUIRED.

5-4. A complete list of required test equipment and accessories is given in table 5-1. Test equipment equivalent to that recommended may be substituted, provided it meets the required characteristics listed in table 5-1. For best results, use recently calibrated test equipment.

5-5. PERFORMANCE CHECKS.

5-6. The performance checks given in this section are suitable for incoming inspections, preventative maintenance, and troubleshooting. The checks are designed to verify the published instrument specifications. Perform the checks in the order given, and record the measured information on the performance check record at the end of this section.

5-7. ADJUSTMENTS.

5-8. The adjustment procedures are arranged in a recommended sequence. While most adjustments may be made independently, it is recommended that adjustments be made sequentially as a number of adjustments are directly related to preceding or following adjustments.

5-9. PERFORMANCE CHECK RECORD.

5-10. Each measurement point in the performance check is repeated in the performance check record. The pages may be removed for filing. The first time the performance check is made, enter the results on the performance check record and file it for future reference.

5-11. FRONT-PANEL CONTROL SETTINGS.

5-12. Set up the instrument, and perform initial adjustments outlined in Section III before proceeding with the performance check and adjustment procedures.

5-13. The control settings listed below are to be used for each performance check and adjustment procedure. If a control is to be set to another position, it will be listed in the procedure. After the completion of each performance check or adjustment procedure, set the controls back to the original front-panel settings.

Control	Position
Vertical (channels A and B):	
POSITION	centered
VOLTS/DIV	0.1
Coupling	DC
Verniers	CAL
VERT DISPLAY	A
INT TRIG	A
BW LIMIT	out position
B INVERT	out position
Horizontal:	
POSITION (coarse and fine)	centered
HORIZ DISPLAY	MAIN
MAG X10	X1 position
DELAY	ccw
TIME/DIV (main)	0.1 mSEC
TIME/DIV (delayed)	OFF
TRIGGER LEVEL (delayed)	STARTS AFTER DELAY
TRIGGER LEVEL (main)	midrange
SWEEP VERNIER	CAL
TRIGGER HOLDOFF	detent position
All time base pushbuttons	out position
INTENSITY	visible trace
INTERVAL	TIME

5-14. PERFORMANCE CHECK PROCEDURES.

5-15. DEFLECTION FACTOR. The ranges are from 10 mV/div to 5 V/div (9 ranges) in 1, 2, 5 sequence. The accuracy is ±2% with the vernier in calibrated position. The vernier is continuously variable between all ranges and extends maximum deflection factor to at least 12.5 V/div. The UNCAL light indicates when vernier is not in CAL position.

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.

SS-2-1/76

Table 5-1. Recommended Test Equipment

Instrument Type	Recommended Model	Required Characteristics	Required For
DC Standard	HP Model 740B	Voltage: 50 mV to 30 V Accuracy: to .01%	P, A
VHF Oscillator	HP Model 3200B	Frequency: to 300 MHz Accuracy: ±2%	P, A
Test Oscillator	HP Model 651B	Frequency: 10 MHz	P, A
RF Voltmeter	HP Model 3406A	Voltage: to 3 V	P, A
Time-mark Generator	HP Model 226A	Time marks: 2 ns to 0.5 s	P, A
Fast-rise Pulse Generator	HP Model 1105A and 1108A	Pulse rise time: <400 ps	P
Multifunction Digital Voltmeter	HP Model 34702A with 34740A	Voltage Range: >115 V Accuracy: ±0.1%	A
Adapter	HP Part No. 1250-0849	GR874 to BNC male	P
Adapter (2)	HP Part No. 1250-0850	GR874 to BNC female	P
Adapter	HP Model 10110A	Twin Banana Plug to BNC male adapter	P, A
Adapter	HP Part No. 1250-0080	BNC female to BNC female	P
Adapter (3)	HP Part No. 1250-0082	Male type N to female BNC	P
Adapter	HP Part No. 1251-2277	Twin Banana Plug to BNC female adapter	
44-in. BNC Cable (2)	HP Model 10501A	BNC, 44-in. cable	P, A
9-in. BNC Cable (3)	HP Model 10502A	BNC, 9-in. cable	P
Test Leads	HP Model 11002A		P, A
50-ohm Tee	HP Model 11063A	Accessory for RF voltmeter	P
BNC Tee (2)	HP Part No. 1250-0781	BNC Tee Adapter	P
Probe	HP Model 10006D	Divide Ratio: 10:1	A
20 dB Attenuator	HP Model 355D	Attenuator 20 dB	A

Table 5-1. Recommended Test Equipment (Cont'd)

Instrument Type	Recommended Model	Required Characteristics	Required For
50-ohm Power Divider	HP Model 11549A		P
Test Oscilloscope	HP Model 180C/1808A/1820C	Blanking Gate Output; Sweep Output	A
Pulse Generator	HP Model 8013B	Trigger Output Frequency: 10 kHz	A
50-ohm Load	HP Part No. 0950-0090		P
50-ohm Termination	HP Model 10100C	Termination: 50 ohms	P
Note: P = Performance Check, A = Adjustment Procedure.			

5-16. The deflection factor is checked by applying a voltage-calibrated signal to the input. The displayed signal is compared against the voltage standard.

Equipment Required:

DC standard
Adapter (HP Part No. 1215-2277)
44-in. BNC cable

5-17. Perform deflection factor check as follows:

a. Connect instruments as shown in figure 5-1.

b. Set dc standard for 0 volt output.

c. Set channel A and channel B VOLTS/DIV controls to .01 positions.

d. Set baseline to bottom horizontal graticule line.

e. Set dc standard for +50 mV output.

f. Note display, vertical deflection should be 5 divisions ±2%.

g. Observe vertical deflection factors specified in table 5-2.

h. Connect dc standard to channel B INPUT connector.

i. Set VERT DISPLAY control to B.

j. Set INT TRIG control to B.

k. Repeat steps d through g for channel B.

l. Disconnect test equipment.

m. Set Model 1722A front-panel controls to initial settings.

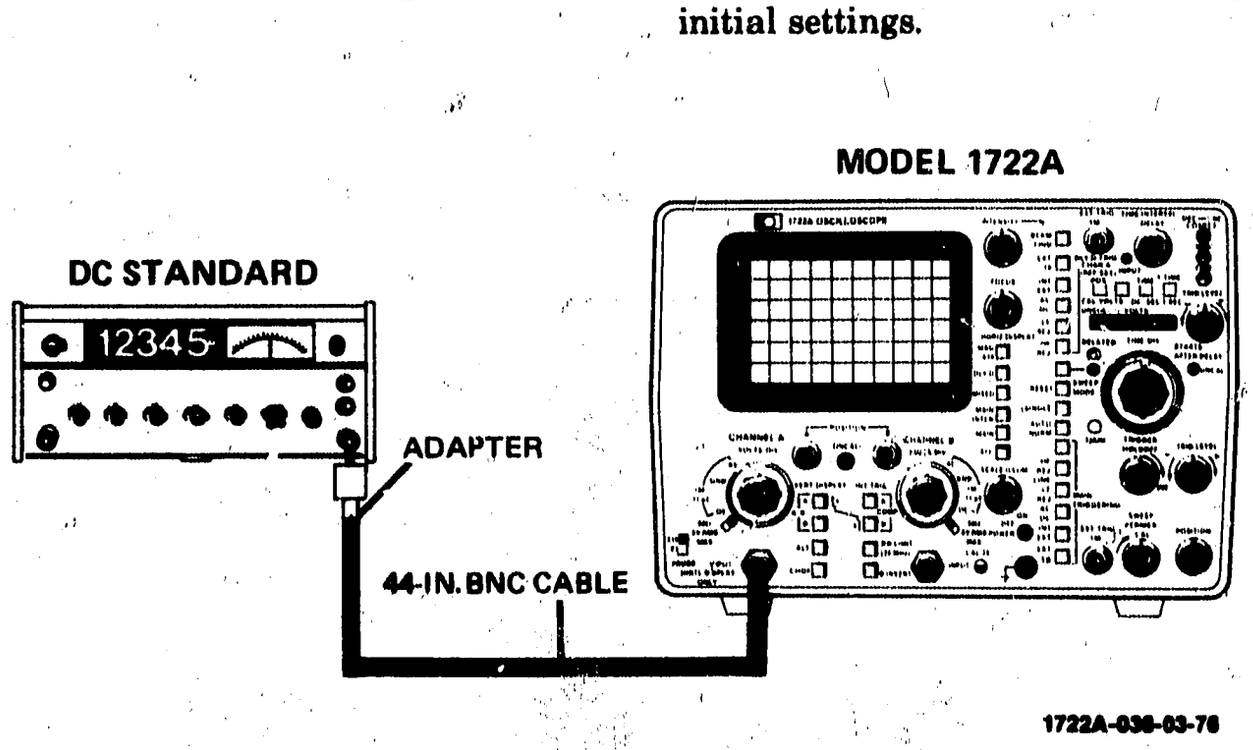

Figure 5-1. Deflection Factor Test Setup

Table 5-2. Deflection Factor Accuracy

DC Standard Settings	VOLTS/DIV Settings	Vertical Display (div)
.05	.01	5 ±2%
.1	.02	5 ±2%
.3	.05	6 ±2%
.5	.1	5 ±2%
1	.2	5 ±2%
3	.5	6 ±2%
5	1	5 ±2%
10	2	5 ±2%
30	5	6 ±2%

5-18. CALIBRATOR ACCURACY. The calibrator output is a square wave with 3 V ±1% amplitude, at approximately 1 kHz.

5-19. The amplitude is checked by comparing the p-p signal against a known signal.

Equipment Required:

DC standard
Adapter (HP Part No. 1251-2277)
Adapter (HP Model 10110A)
44-in. BNC cable
Test lead

5-20. Perform calibrator accuracy check as follows:

a. Connect equipment as shown in figure 5-2.

b. Set Model 1722A controls as follows:

TIME/DIV (main) ..... 0.5 mSEC
VOLTS/DIV (channel A) 0.5

c. Set dc standard for 3 V output.

d. Note vertical deflection on CRT.

e. Disconnect dc standard from Model 1722A.

f. Connect Model 1722A CAL 3V output to channel A INPUT connector using test lead and HP Model 10110A adapter.

g. Note vertical deflection on CRT. Vertical deflection should be same as noted in step d ±1%. Frequency should be approximately 1 kHz.

h. Disconnect test lead.

i. Set Model 1722A front-panel controls to initial settings.

5-21. DIGITAL VOLTMETER ACCURACY. DC Volts ±0.5% of reading; ±0.5% of full scale. Channel A Position-VOLTS, ±1% of readings, ±0.5% of full scale, measured at dc.

5-22. The digital display indication is compared to a known voltage input.

Equipment Required:

DC standard
44-in. BNC cable
Adapter (HP Model 1251-2277)

5-23. Perform digital voltmeter accuracy check as follows:

a. Connect equipment as shown in figure 5-1.

b. Set Model 1722A controls as follows:

Ch A VOLTS/DIV 0.01
Coupling ..... GND
INPUT DC VOLTS ..... engaged

c. Set dc standard for +50 mV output.

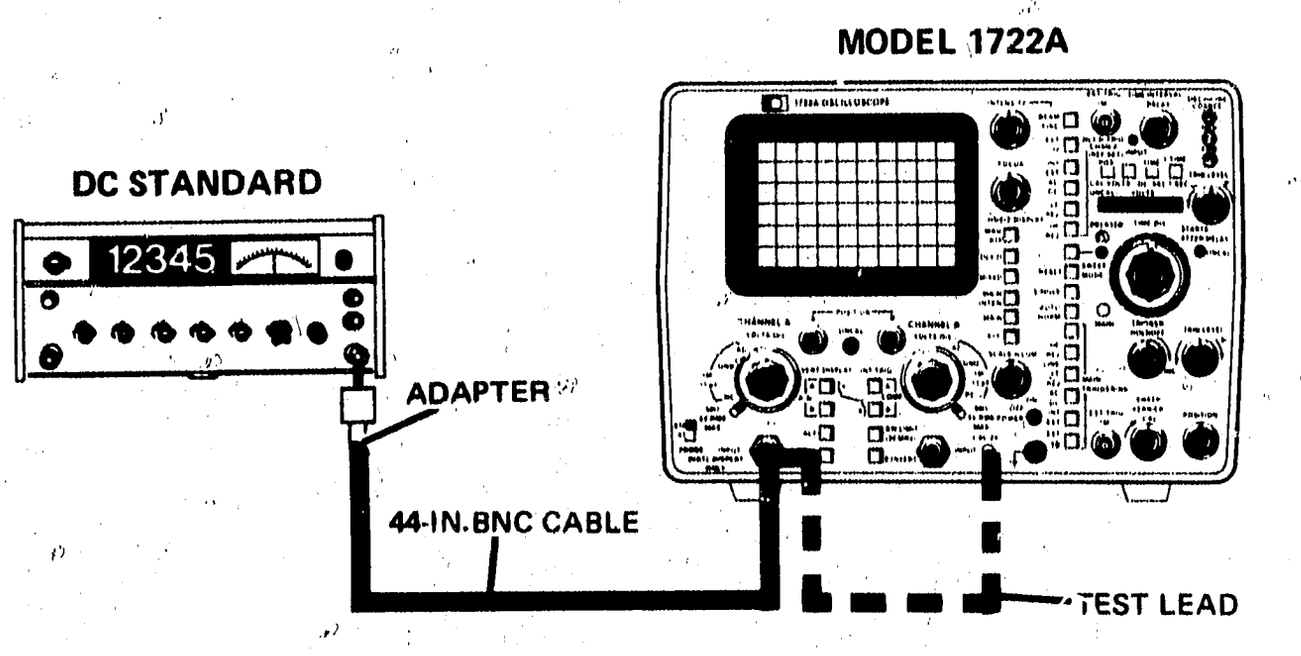

Figure 5-2. Calibrator Accuracy Test Setup

Table 5-3. Digital Voltmeter Accuracy

VOLTS/DIV	DC Standard	Display	Tolerance
.01	50 mV	050.0 —3	± .75
.02	100 mV	100.0 —3	±1.5
.05	200 mV	200.0 —3	±3.5
.1	300 mV	0.300 —0	± .0065
.2	1 V	1.000 —0	± .015
.5	2 V	2.000 —0	± .035
1	5 V	05.00 —0	± .075
2	10 V	10.00 —0	± .15
5	20 V	20.00 —0	± .35

d. Press CHAN A (REF SET) until display indicates 000.0 —3.

e. Set channel A coupling to DC.

f. Display should indicate 050.0 —3 ±0.75.

g. Check other sensitivity ranges as indicated in table 5-3 using sequence established in steps b thru f.

h. Change output polarity of dc standard to negative and repeat procedure, noting that polarity of display is reversed.

i. Disconnect dc standard.

j. Set Model 1722A controls as follows:
Ch A VOLTS/DIV 1
CHAN A POSN ..... engaged

k. Adjust channel A vertical POSITION to place baseline exactly on center horizontal graticule line.

l. Depress REF SET until display indicates 00.00 —0.

m. Connect dc standard to channel A INPUT and set dc standard for —5 Vdc.

n. Rotate channel A vertical POSITION to relocate baseline exactly on center horizontal graticule line. Display should indicate —05.00 ±0.10.

o. Disconnect dc standard and return controls to initial settings.

5-24. Z-AXIS BLANKING. A signal of +8 volts, >50-ns wide pulse will blank a trace of any intensity. Usable to 20 MHz for normal intensity.

5-25. A free-running trace of normal intensity is obtained on CRT. A signal of +8 volts is applied to the Z-AXIS input connector on the rear panel of Model 1722A. The display should be blanked regardless of INTENSITY setting.

Equipment Required:

DC standard
Adapter (HP Part No. 1251-2277)
44-in. BNC cable

5-26. Perform Z-axis blanking check as follows:

a. Obtain free-running baseline on CRT.

b. Adjust INTENSITY control for normal viewing level of baseline.

c. Connect equipment as shown in figure 5-3.

d. Set dc standard for +8 V output.

e. Observe baseline is blanked.

f. Disconnect test equipment.

g. Set Model 1722A front-panel controls to initial settings.

5-27. BANDWIDTH. Direct or with HP Model 10020A probe, or with 10X, 10-megohm divider probe (HP Model 10014A). (3 dB down from a 10-MHz, 6-division reference signal.) DC coupled: dc to 275 MHz; AC coupled: 10 Hz to 275 MHz.

5-28. To check the bandwidth, a vhf oscillator is used to apply a 6-division, 10-MHz reference signal to the input of Model 1722A. An rf voltmeter is used

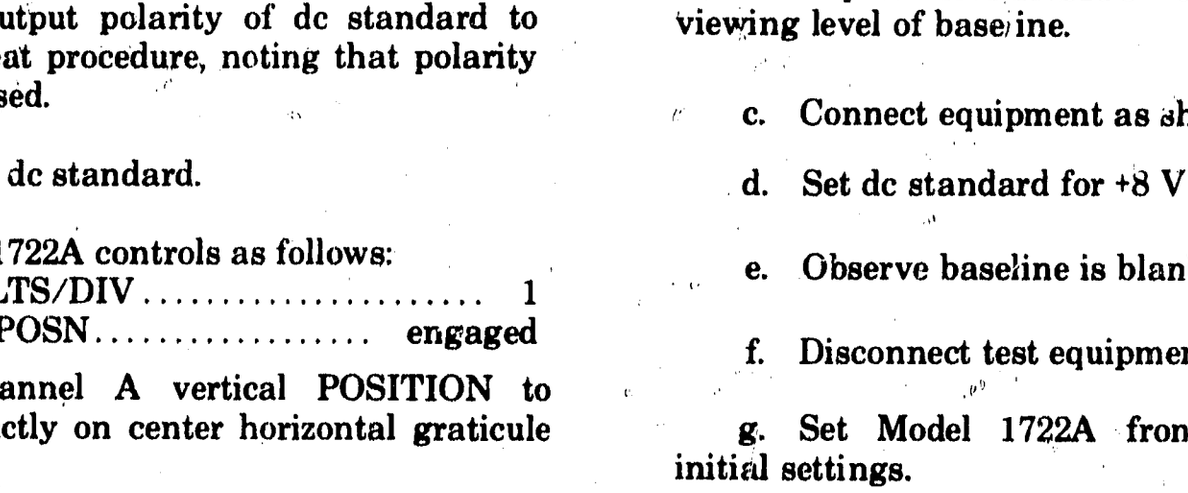

Figure 5-3. Z-axis Blanking Test Setup

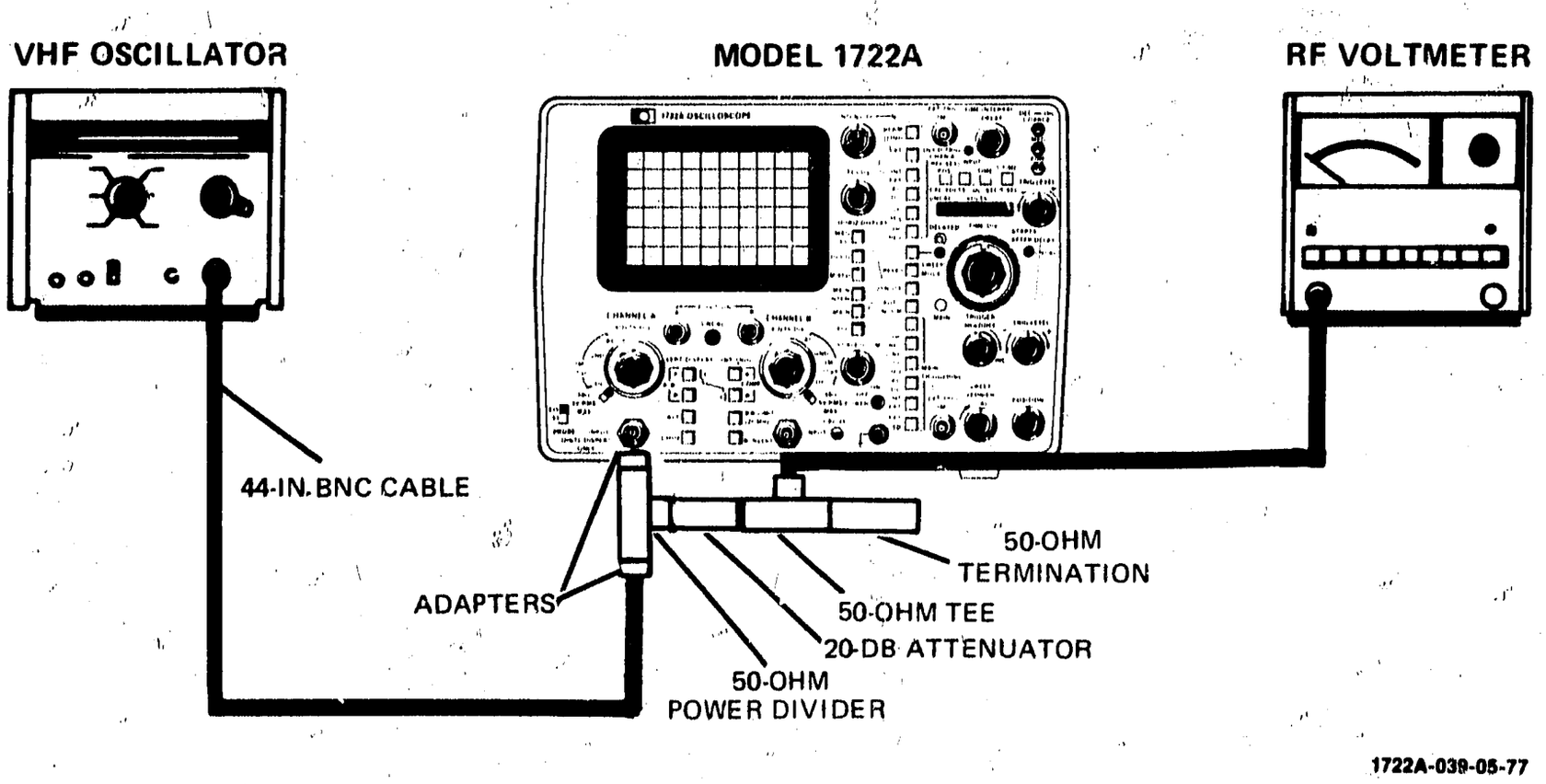

Figure 5-4. Bandwidth Test Setup

to measure the signal level. The vhf oscillator frequency is increased to 275 MHz and the amplitude is adjusted to give the same indication on the rf voltmeter. Displayed amplitude on CRT must be equal to or greater than 4.2 divisions.

Equipment Required:

VHF oscillator
RF voltmeter
44-in. BNC cable
50-ohm tee
Adapter (HP Part No. 1250-0859)
Adapter (HP Part No. 1250-0849)
50-ohm load
50-ohm power divider

5-29. Perform bandwidth check as follows:

a. Connect equipment as shown in figure 5-4.

b. Set channel A and channel B input coupling to 50Ω positions.

c. Set channel A and channel B VOLTS/DIV switches to 0.02 positions.

d. Adjust vhf oscillator for 10-MHz, 6-division display on CRT.

e. Note indication on rf voltmeter.

f. Increase vhf oscillator output to 275 MHz.

g. Adjust amplitude of signal from vhf oscillator until rf voltmeter indication is same as noted in step e.

h. Observe display on CRT. Signal amplitude should be equal to or greater than 4.2 divisions.

i. Disconnect input signal from channel A INPUT connector.

j. Connect input signal to channel B INPUT connector.

k. Set VERT DISPLAY control to B.

l. Set INT TRIG control to B.

m. Repeat steps d through h for channel B.

n. Disconnect test equipment.

o. Set Model 1722A front-panel controls to initial settings.

5-30. TRIGGER. Internal triggering occurs from dc to 100 MHz on signals causing 0.5 division or more of vertical deflection, increasing to 1-division vertical deflection at 300 MHz in all display modes. Triggering on line frequency is also selectable. External triggering occurs from dc to 100 MHz on signals with an amplitude of 50-mV p-p or more, increasing to 100-mV p-p at 300 MHz.

5-31. Internal triggering is checked against certain vertical deflections on the CRT. For external triggering, the input signal amplitude is monitored with an rf voltmeter.

Equipment Required:

VHF oscillator
RF voltmeter
Two 9-in. BNC cables
44-in. BNC cable
50-ohm tee
50-ohm power divider
50-ohm termination

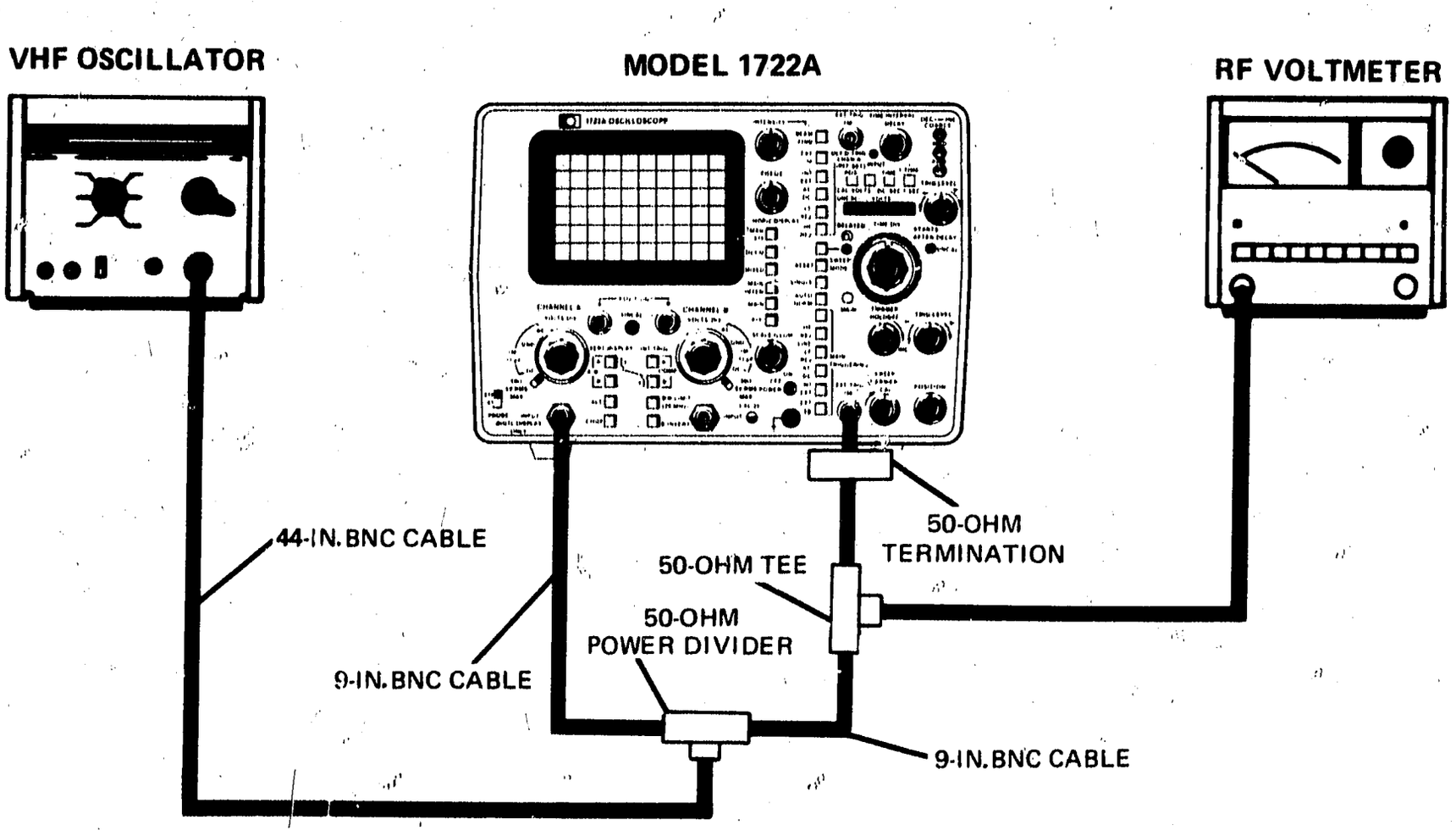

Figure 5-5. Main Triggering Test Setup

5-32. Perform trigger check as follows:

a. Connect equipment as shown in figure 5-5.

b. Set Model 1722A channel A coupling to 50Ω position.

c. Set output of vhf oscillator for 100 MHz, 0.5 division of vertical deflection.

d. Adjust main TIME/DIV and main TRIGGER LEVEL controls for stable display. (Stable display indicates proper triggering.)

e. Set output of vhf oscillator for 300 MHz, 1 division of vertical deflection.

f. Adjust main TRIGGER LEVEL control for stable display. (Stable display indicates proper triggering.)

g. Set main INT/EXT switch to EXT position.

h. Set output of vhf oscillator for 100 MHz, 17.7 mV as observed on rf voltmeter (50 mV p-p).

i. Adjust main TRIGGER LEVEL control for stable display. (Stable display indicates proper triggering.)

j. Set output of vhf oscillator for 300 MHz, 35.4 mV as observed on rf voltmeter (100 mV p-p).

k. Adjust main TRIGGER LEVEL control for stable display. (Stable display indicates proper triggering.)

l. Set main INT/EXT switch to INT position.

m. Set main TIME/DIV control to 20-nSEC position.

n. Set delayed TIME/DIV control to 10-nSEC position.

o. Set output of vhf oscillator for 1 division of vertical deflection.

p. Adjust main TRIGGER LEVEL control for stable display.

q. Set HORIZ DISPLAY control to DLY'D.

r. Adjust delayed TRIGGER LEVEL control for stable display.

s. Connect equipment as shown in figure 5-6.

t. Set delayed INT/EXT switch to EXT position.

u. Set HORIZ DISPLAY control to MAIN.

v. Set output of vhf oscillator for 300 MHz, 35.4 mV as observed on rf voltmeter (100 mV p-p).

w. Set channel A VOLTS/DIV switch to 0.05 position.

x. Adjust main TRIGGER LEVEL control for stable display.

y. Set HORIZ DISPLAY control to DLY'D.

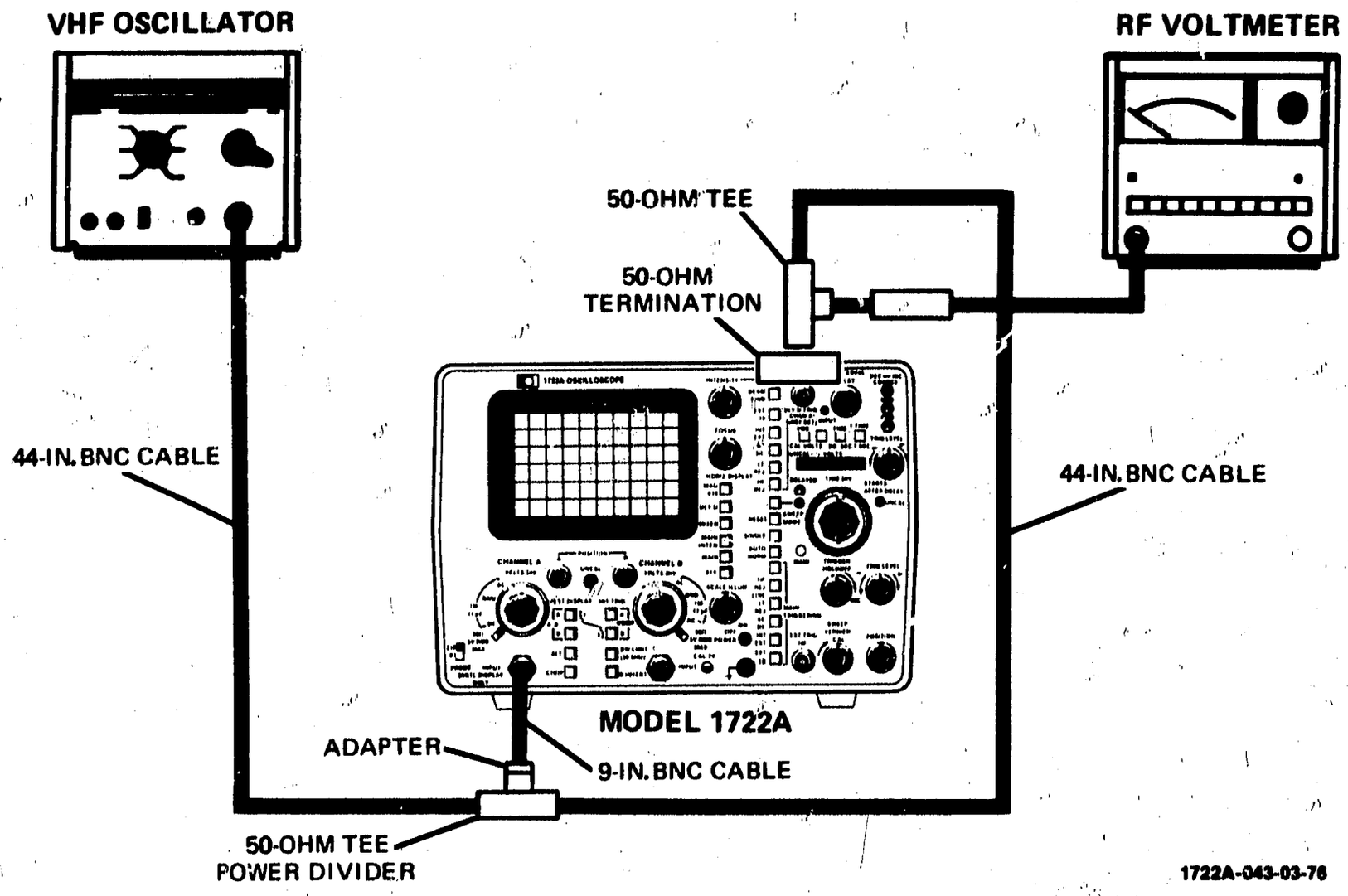

Figure 5-6. Delayed Triggering Test Setup

z. Adjust delayed TRIGGER LEVEL control for stable display. (Readjust main TRIGGER LEVEL control if necessary.)

aa. Stable display indicates proper triggering.

ab. Disconnect test equipment.

ac. Set Model 1722A front-panel controls to initial settings.

5-33. COMMON MODE REJECTION. At least 40 dB, dc to 5 MHz, decreasing to 26 dB at 50 MHz. The common mode signal amplitude is equivalent to 12 divisions with one vernier adjusted for optimum rejection.

5-34. Identical signals are applied to both channel A and channel B with channel B set to the inverted mode. The displayed signal is the common mode signal.

Equipment Required:

Test oscillator
50-ohm power divider
44-in. BNC cable
Two 9-in. BNC cables

5-35. Perform common mode rejection check as follows:

a. Connect equipment as shown in figure 5-7.

NOTE

Cables used to connect channel A and channel B INPUT connectors to 50-ohm power divider must be of the same electrical length.

b. Set Model 1722A front-panel controls as follows:

VOLTS/DIV (channels A and B)	0.1
VERT DISPLAY	ALT
Coupling (channels A and B)	50Ω
B INVERT	engaged

c. Set test oscillator for 5-MHz, 2-division amplitude display on CRT.

d. Set channel A and channel B VOLTS/DIV controls to 0.01 positions.

e. Set VERT DISPLAY control for A+B operation (both A and B pushbutton switches depressed).

f. Adjust either channel A or channel B vernier (whichever is most effective) to achieve minimum deflection.

g. Deflection should be less than one minor division (40 dB).

h. Set test oscillator for 50-MHz output.

i. Repeat steps b through f using 50 MHz.

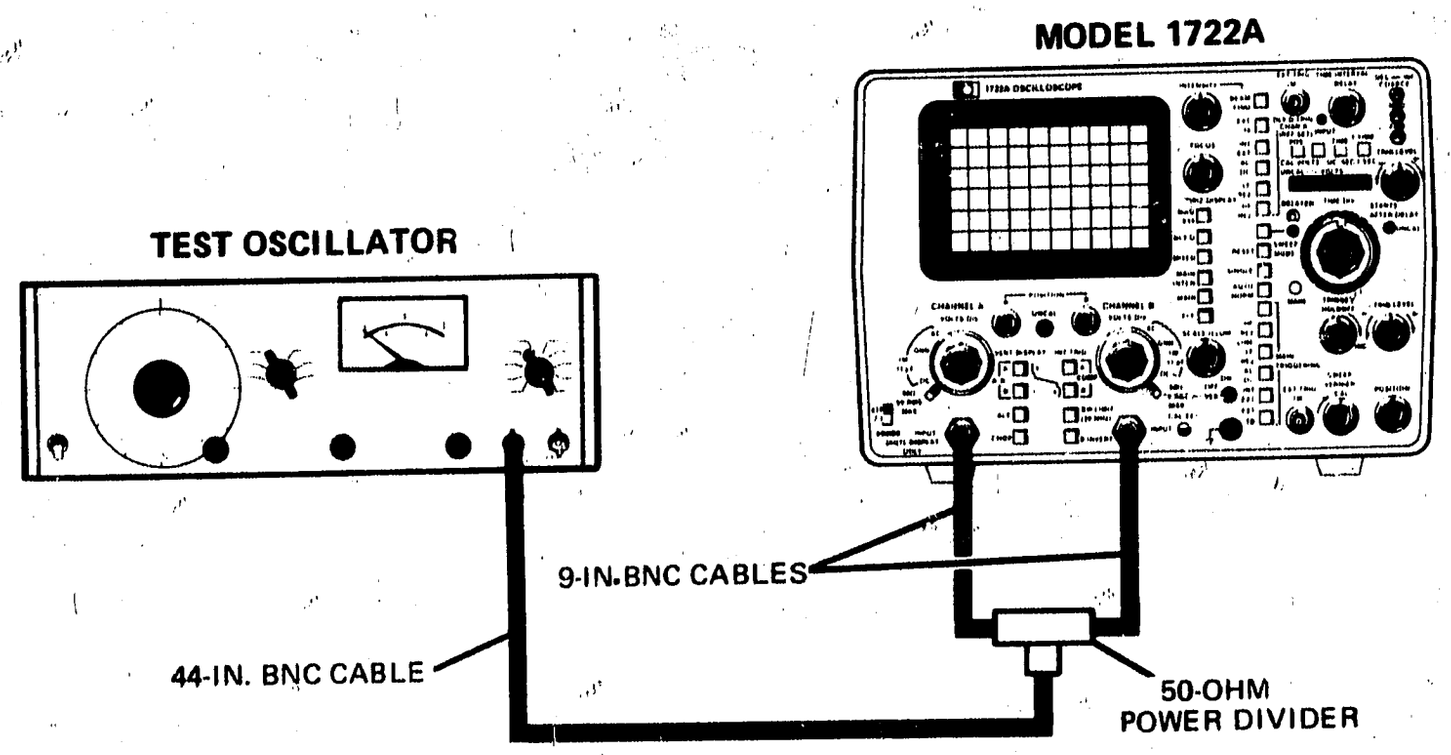

Figure 5-7. CMRR Test Setup

j. Deflection should be less than 1.1 major division (26 dB).

k. Disconnect test equipment.

l. Set Model 1722A front-panel controls to initial settings.

5-36. SWEEP TIME ACCURACY The ranges are from 10 ns/div to 0.5 s/div (24 ranges) in 1, 2, 5 sequence. The accuracy of the 10 ns/div through 50 ns/div and 50 ms/div through 0.5 s/div ranges is ±3%. The accuracy of the 100 ns/div through 20 ms/div ranges is ±2%. The stipulated accuracies of all ranges are with the vernier in calibrated position. The vernier is continuously variable between all ranges and extends slowest sweep to at least 1.25 s/div. The vernier UNCAL light indicates when the vernier is not in CAL position.

5-37. The Model 1722A time base is compared to a time-mark generator to verify accuracy.

Equipment Required:

Time-mark generator
44-in. BNC cable

5-38. Perform sweep time accuracy check as follows:

a. Connect equipment as shown in figure 5-8.

b. Set channel A input coupling to 50Ω position.

c. Set channel A VOLTS/DIV switch as required.

d. Check main sweep accuracy in accordance with table 5-4.

Table 5-4. Main Sweep Performance Check

Main TIME/DIV and Time-mark Generator Settings	*Accuracy (0°C to 55°C)	
	X1	X10
10 nSEC to 50 nSEC**	±3% (within .3 div)	±5% (within .4 div)***
.1 μSEC to 20 mSEC	±2% (within .2 div)	±3% (within .3 div)
50 mSEC to .5 SEC	±3% (within .3 div)	±3% (within .3 div)

* Set one time mark at 1st left graticule line and read error at 11th graticule line. Adjust main TRIGGER LEVEL control as necessary for stable display.

** Exclude time marks occuring in first 10 nanoseconds of sweep.

*** Measure accuracy over inside eight divisions on X10, 10 nSEC to 50 nSEC sweep speeds.

Table 5-5. Delayed Sweep Performance Check

*Delayed TIME/DIV and Time-mark Generator Settings	**Accuracy (0°C to 55°C)	
	X1	X10
10 nSEC to 50 nSEC***	±3% (within .3 div)	±5% (within .4 div)****
.1 μSEC to 20 mSEC	±2% (within .2 div)	±3% (within .3 div)

* Main TIME/DIV switch is always one sweep position slower than delayed TIME/DIV switch setting.

** Set one time mark at lst left graticule line and read error at 11th graticule line. Adjust main and delayed TRIGGER LEVEL controls as necessary for stable display.

*** Exclude time marks occuring in first 10 nanoseconds of sweep.

**** Measure accuracy over inside eight divisions on X10, 10 nSEC to 50 nSEC sweep speeds.

e. Set HORIZ DISPLAY control to DLY'D.

f. Press INPUT DC VOLTS control.

g. Check delayed sweep accuracy in accordance with table 5-5.

h. Disconnect test equipment.

i. Set 1722A front-panel controls to initial settings.

5-39. SHORT TERM STABILITY. Delay jitter should be less than .01% (1 part in 10 000).

5-40. Delay jitter is checked by expanding the sweep by 10 000 and visually monitoring the jitter.

Equipment Required:

Time-mark generator
44-in. BNC cable

5-41. Perform delay jitter check as follows:

a. Connect equipment as shown in figure 5-8.

b. Set 1722A front-panel controls as follows:

TIME/DIV (main) ..... 1 mSEC
VOLTS/DIV (channel A) 5
TIME/DIV (delayed) ..... 1 μSEC
HORIZ DISPLAY ..... MAIN INTEN
INTERVAL ..... CH A POSN

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

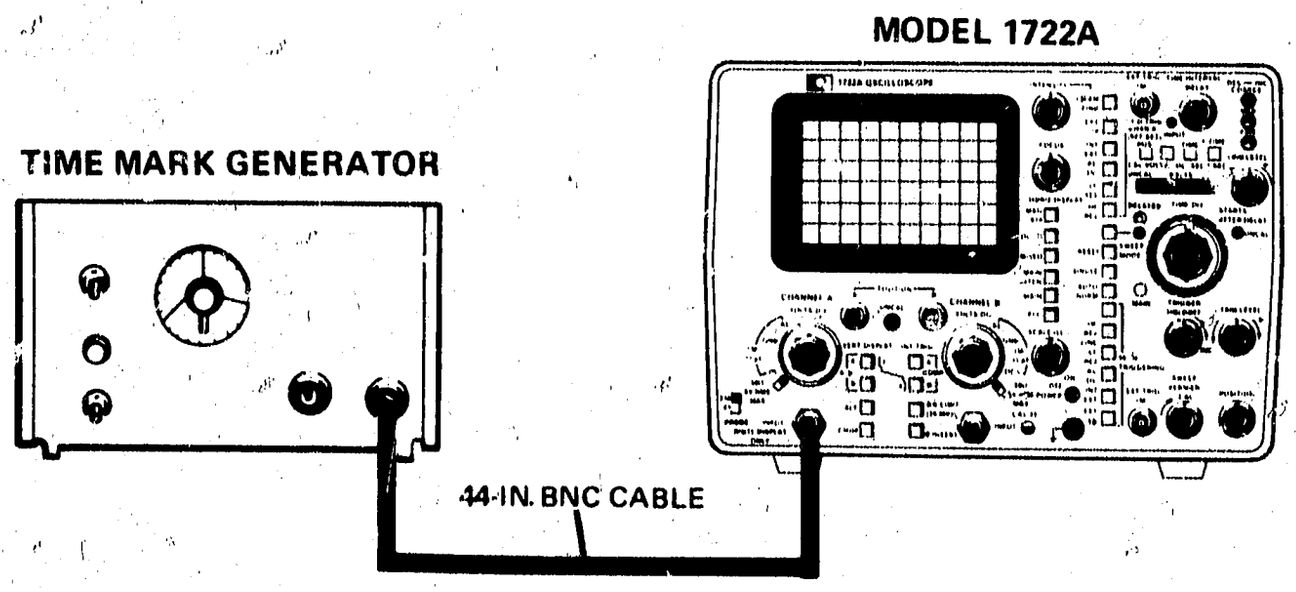

Figure 5-8. Main Sweep Time Test Setup

d. Adjust DELAY control so intensified portion of sweep starts at 11th graticule line.

e. Set HORIZ DISPLAY control to DLY'D.

f. Adjust DELAY control so display is centered. Delay jitter (horizontal axis) should be less than 1 division, which is equal to less than 0.01%.

g. Disconnect test equipment.

h. Set 1722A front-panel control to initial settings.

5-42. DIFFERENTIAL TIME MEASUREMENT AND FREQUENCY ACCURACY. Refer to table 1-1 for specifications.

5-43. Time difference and frequency is measured using a known time standard.

Equipment Required:

Time-mark generator
44-in. BNC cable

5-44. Check differential time measurement and frequency accuracy as follows:

NOTE

Perform Time Interval zero adjustment prior to this check (refer to paragraph 3-17).

a. Connect equipment as shown in figure 5-8.

b. Set 1722A controls as follows:

Channel A coupling	50Ω
Channel A VOLTS/DIV	.5
HORIZ DISPLAY	MAIN INTEN
Main TIME/DIV	.5 μSEC
Delayed TIME/DIV	10 nSEC
INTERVAL	TIME

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

d. Adjust TIME INTERVAL DELAY control to superimpose first intensified spot over second time marker. Do not use far left marker.

e. Using TIME INTERVAL DEC/INC controls, superimpose second intensified spot over tenth time marker.

f. Change HORIZ DISPLAY to DLY'D.

g. Using TIME INTERVAL FINE DEC/INC control, superimpose selected two markers. (Increase INTENSITY control as required).

h. Display should indicate 4.000 —6 ±.022.

i. Press 1/Time switch.

j. Display should indicate 0.250 +6 ±.002.

k. Disconnect test equipment.

l. Set 1722A front-panel controls to initial settings.

5-45. RISE TIME. The rise time is equal to or less than 1.3 nanoseconds (measured from the 10% to 90% points of a 6-division input step). Measurements can be made directly with HP Model 10020A probe or with 10X, 10-megohm divider probe (HP Model 10014A).

5-46. A step with a rise time of less than 400 picoseconds is applied to the vertical input. The displayed rise time is then checked to see that is is equal to or less than 1.3 nanoseconds.

Equipment Required:

Fast-rise pulse generator
44-in. BNC cable

5-47. Perform rise time check as follows:

a. Connect equipment as shown in figure 5-9.

b. Set main TIME/DIV control to 10 nSEC position.

c. Set channel A and channel B input coupling to 50Ω position.

d. Adjust channel A VOLTS/DIV and fast-rise pulse generator controls for display signal having exactly 6-division amplitude.

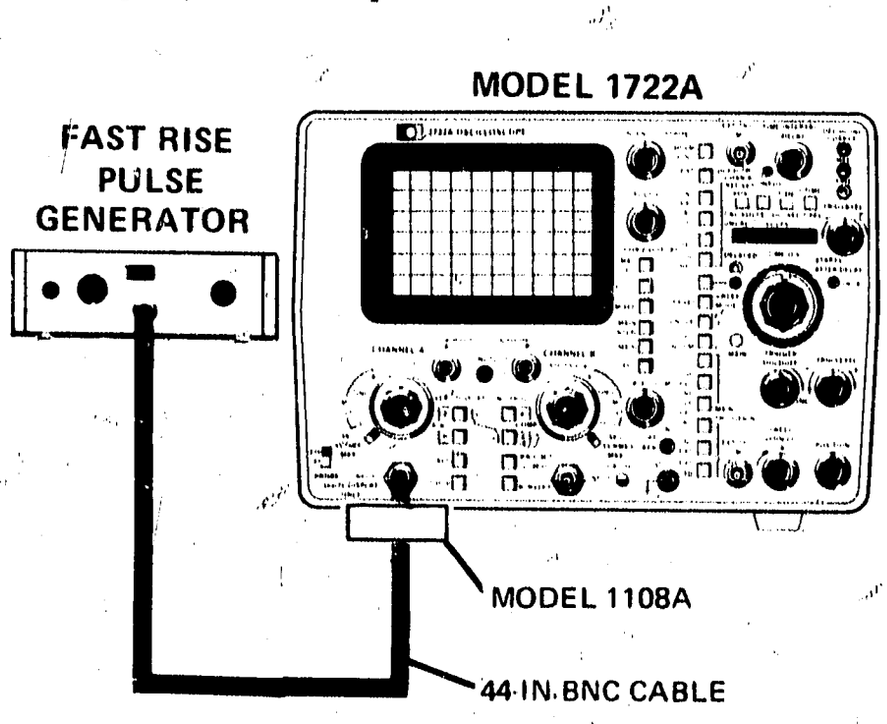

Figure 5-9. Rise Time Test Setup

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e. Adjust main TRIGGER LEVEL control for stable display.

f. Set HORIZ DISPLAY control to MAG X10.

g. Adjust horizontal POSITION control as necessary to measure rise time.

h. Observed rise time should be equal to or less than 1.3 nanoseconds (10% to 90% points).

i. Disconnect pulse generator from channel A INPUT connector.

j. Connect pulse generator to channel B INPUT connector.

k. Set VERT DISPLAY control to B.

l. Set INT TRIG control to B.

m. Repeat steps d through h for channel B.

n. Disconnect test equipment.

o. Set 1722A front-panel controls to initial settings.

5-48. ADJUSTMENT PROCEDURES.

WARNING

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

5-49. Remove top and bottom covers from the instrument; set front-panel controls to initial settings (paragraph 5-11); apply power and allow thirty minutes for instrument to warm up.

5-50. LOW-VOLTAGE POWER SUPPLY ADJUSTMENT. (See schematic 25 and figure 5-10.)

Equipment Required:

Multifunction digital voltmeter
Test leads

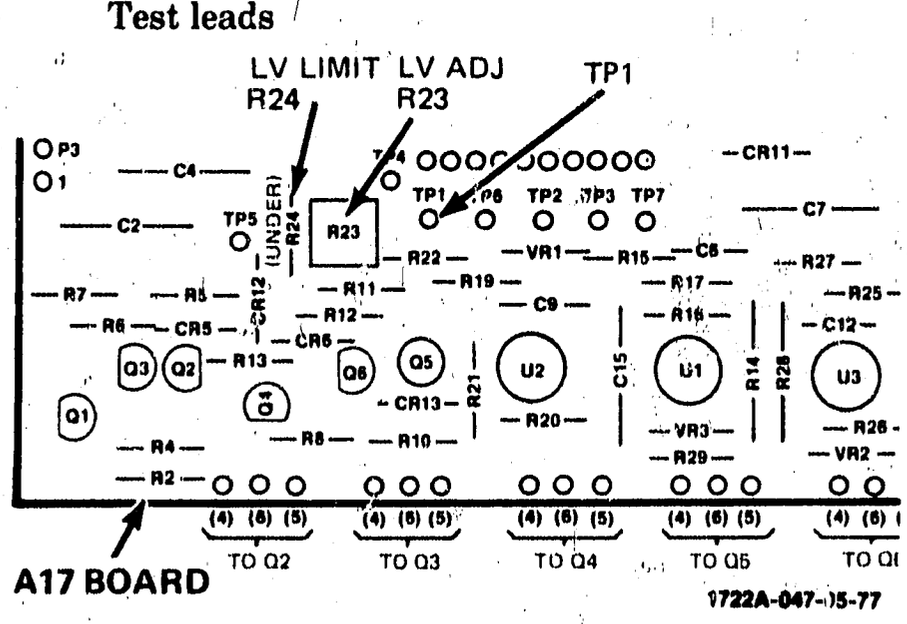

Figure 5-10. Low-voltage Power Supply Adjustment

5-51. Adjust low-voltage power supply as follows:

NOTE

Perform steps a through j only if LVPS Assembly A17 has been replaced. Otherwise adjust LVPS by performing only steps f and k through m.

a. Set A17R23, LV ADJ, fully clockwise.

b. Turn off ac input power to 1722A.

c. Remove LVPS assembly A17 retaining screws.

d. Raise front of assembly A17 until adjustment A17R24 is accessible.

CAUTION

Be careful not to short A17 assembly to chassis or other assemblies.

e. Turn on ac input power to 1722A.

f. Connect multifunction digital-voltmeter (DVM) test lead to test point A17TP1.

g. Adjust A17R24, LV LIMIT, for indication on DVM of +15.3 V.

h. Turn off ac input power to 1722A.

i. Remount LVPS assembly A17 with screws removed in step c.

j. Turn on ac input power to 1722A.

k. Adjust A17R23 for DVM indication of +15 V ±50 mV.

l. Check power supply outputs as indicated in table 5-6.

m. Disconnect test equipment.

Table 5-6. Power Supply Outputs

Power Supply Output	Measurement Test Point	Tolerance
+ 15 V	A17TP1	±50 mV
+ 115 V	A17TP5	± 2.5 V
+ 53.3 V	A17TP4	± 1.25 V
+ 5 V	A17TP2	± .06 V
+ 20 V	A17TP7	— 0.5 V, +3.0 V
— 15 V	A17TP3	± .32 V
—2950 V	A15TP1	<2973 V, >2827 V

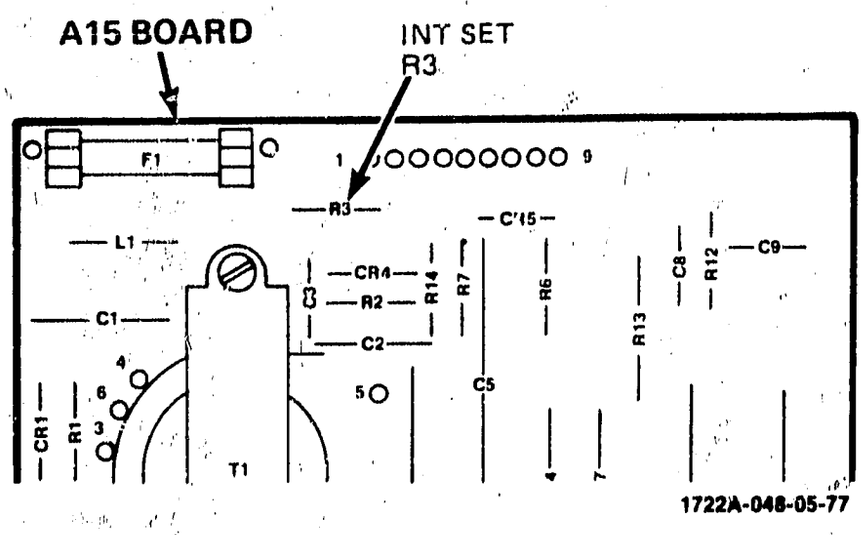

Figure 5-11. Intensity Set Adjustment

5-52. INTENSITY SET ADJUSTMENT. (See figure 5-11.)

Equipment Required:

Test oscilloscope
10:1 divider probe

5-53. Adjust intensity set as follows:

a. Set front-panel main TIME/DIV control to 5 μs position.

b. Connect test oscilloscope to test point A14TP4 using 10:1 divider probe.

c. Connect 10:1 divider probe ground lead to A14TP5.

d. Set front-panel INTENSITY control for 10 V p-p gate pulse.

e. Adjust A15R3, INT SET, to barely extinguish trace on 1722A CRT.

f. Disconnect test equipment.

g. Set 1722A front-panel controls to initial settings.

5-54. GATE-RESPONSE, AMPLITUDE, AND AUTO-FOCUS ADJUSTMENTS. (See figure 5-12.)

Equipment Required:

Test oscilloscope
10:1 divider probe

5-55. Adjust gate response, amplitude, and auto-focus as follows:

a. Set 1722A front-panel controls as follows:

POSITION (channel A) ..	trace off screen
TIME/DIV (main)	.5 μSEC
INTENSITY	fully clockwise

b. Connect test oscilloscope to A14TP4 using 10:1 divider probe.

c. Connect 10:1 divider probe ground lead to A14TP5.

d. Set intensity limit adjust A14R15 fully cow.

e. Adjust A14R10 for gate amplitude of +70 volts.

f. Expand sweep time of test oscilloscope to observe leading edge and overshoot of gate pulse.

g. Alternately adjust gate-response adjustment A14C7 and A14C8 for fastest rise time and flattest pulse top (A14C7 adjusts fast corner).

h. Set Auto Focus Adj A14R20 fully ccw.

i. Set controls as follows:

TIME/DIV (main)	10 μSEC
TIME/DIV (delayed)	10 nSEC
HORIZ DISPLAY	DLY'D
INTENSITY	maximum
POSITION (channel A) ...	trace centered

j. Center screen trace width (at optimum focus) should be 1 mm. If not, adjust A14R10 slightly until trace width is 1 mm.

k. Set INTENSITY to 10 o'clock position.

l. Set HORIZ DISPLAY to MAIN.

m. Adjust A14R20 for best focus.

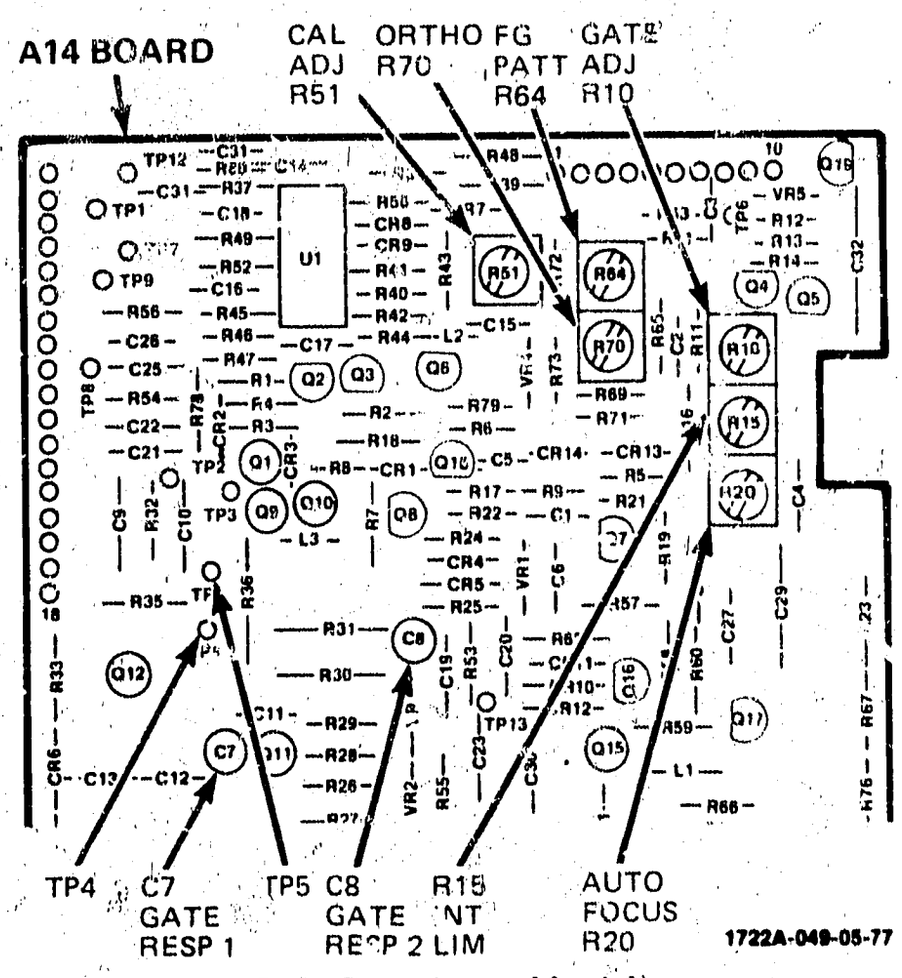

Figure 5-12. Gate Assembly Adjustments

n. Set HORIZ DISPLAY to DLY'D.

o. Set INTENSITY to maximum.

p. Refocus, using front-panel FOCUS, if necessary.

q. Set INTENSITY to 10 o'clock position.

r. Set HORIZ DISPLAY to MAIN.

s. Readjust A14R20 if necessary for best focus.

t. Set 1722A front-panel controls to initial settings except as follows:

POSITION (channel A) .. trace off screen
TIME/DIV (main) ..... 10 mSEC
INTENSITY ..... fully clockwise

u. Set test oscilloscope TIME/DIV control to 20 mSEC/div.

v. Using test oscilloscope (connected to A14TP4 through 10:1 divider probe) observe waveform as shown in figure 5-13. If necessary, readjust intensity limit A14R15 to make pulse 30 V to 50 V as shown

w. Disconnect test equipment.

x. Set 1722A front-panel controls to initial settings.

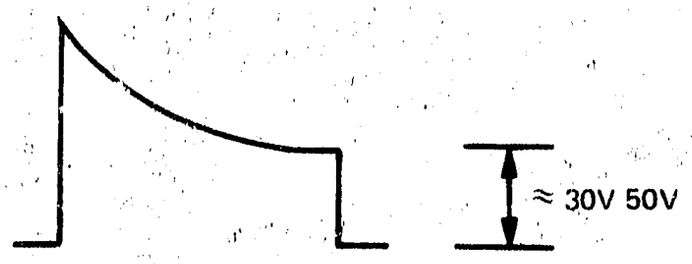

Figure 5-13. Intensity Limit Adjustment

5-56. TRACE ALIGN. (See schematic 16.) Adjust trace align as follows:

a. Adjust front-panel INTENSITY and FOCUS controls to obtain sharp trace on CRT.

b. Adjust rear-panel TRACE ALIGN control A14R67 so that horizontal trace exactly parallels center horizontal graticule line.

5-57. ORTHOGONALITY AND PATTERN ADJUSTMENTS. (See schematic 16 and figure 5-12.)

Equipment Required:

Test oscillator
44-in. BNC cable

5-58. Adjust orthogonality and pattern as follows:

a. Connect test oscillator to channel A INPUT connector.

b. Set test oscillator controls for 1 kHz, greater than 6-division output display signal.

c. Set INT TRIG control to B.

d. Set HORIZ DISPLAY control for X-Y mode of display.

e. Align vertical trace with center vertical graticule line using horizontal POSITION control.

f. Adjust orthogonal control A14R70 so that vertical trace exactly parallels center vertical graticule line.

g. Set HORIZ DISPLAY control for MAIN mode of display.

h. Set INT TRIG control to A.

i. Set test oscillator controls for 500 kHz, 6-division output display signal.

j. Adjust rear-panel PATT control A14R76 to obtain best raster display (minimum pincushioning or barreling at top, bottom, and both sides of display).

k. Disconnect test equipment.

l. Set 1722A front-panel controls to initial settings.

5-59. FLOOD GUN PATTERN AND INTENSITY RATIO ADJUSTMENTS. (See schematics 15, 16, and figure 5-12.) Adjust flood gun pattern and intensity ratio as follows:

a. Set AUTO/NORM pushbutton switch to NORM.

b. Set SCALE ILLUM control fully clockwise.

c. Set flood gun pattern control A14R64 fully counterclockwise.

d. Slowly adjust A14R64 clockwise until even intensity pattern is noted.

e. Set 1722A front-panel controls as follows:

AUTO/NORM ..... AUTO
HORIZ/DISPLAY ..... MAIN INTEN
TIME/DIV (delayed) ..... 20 μSEC

f. Set rear-panel INTEN RATIO control A14R23 fully clockwise.

g. Adjust A14R23 counterclockwise until desired contrast between normal and intensified portion of trace is obtained.

h. Set 1722A front-panel controls to initial settings.

5-60. ATTENUATOR BALANCE ADJUSTMENT. (See schematics 1, 2, and figure 5-14.) Adjust attenuator balance as follows:

a. Set channel A VOLTS/DIV switch to 0.05 position.

b. Center trace using channel A POSITION control.

c. Set channel A VOLTS/DIV switch to 0.1 position.

d. Center trace by adjusting channel A attenuator balance control A3R52.

e. Set VERT DISPLAY control to channel B.

f. Repeat steps a through d for channel B attenuator balance adjustment A3R66.

g. Set 1722A front-panel controls to initial settings.

5-61. VERTICAL PREAMPLIFIER BALANCE ADJUSTMENT. (See schematic 3 and figure 5-14.) Adjust vertical balance as follows:

a. Center channel A trace on CRT.

b. Adjust main bal adjustment A3R4 for minimum trace shift as channel A vernier is rotated through its range.

c. Set VERT DISPLAY control to channel B.

d. Repeat steps a and b for channel B using channel B main balance adjustment A3R12.

e. Set 1722A front-panel controls to initial settings.

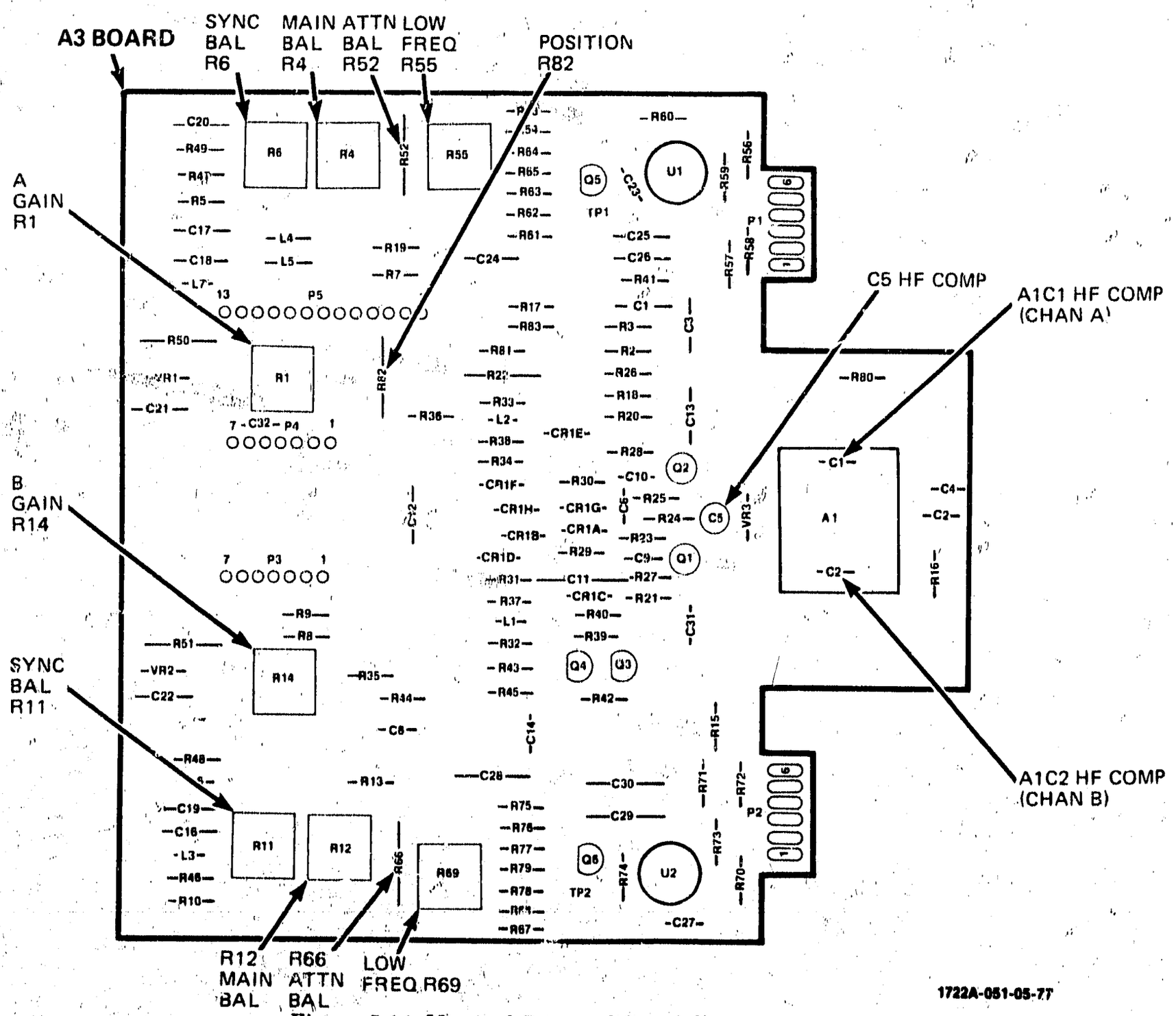

Figure 5-14. Vertical Preamplifier Adjustments

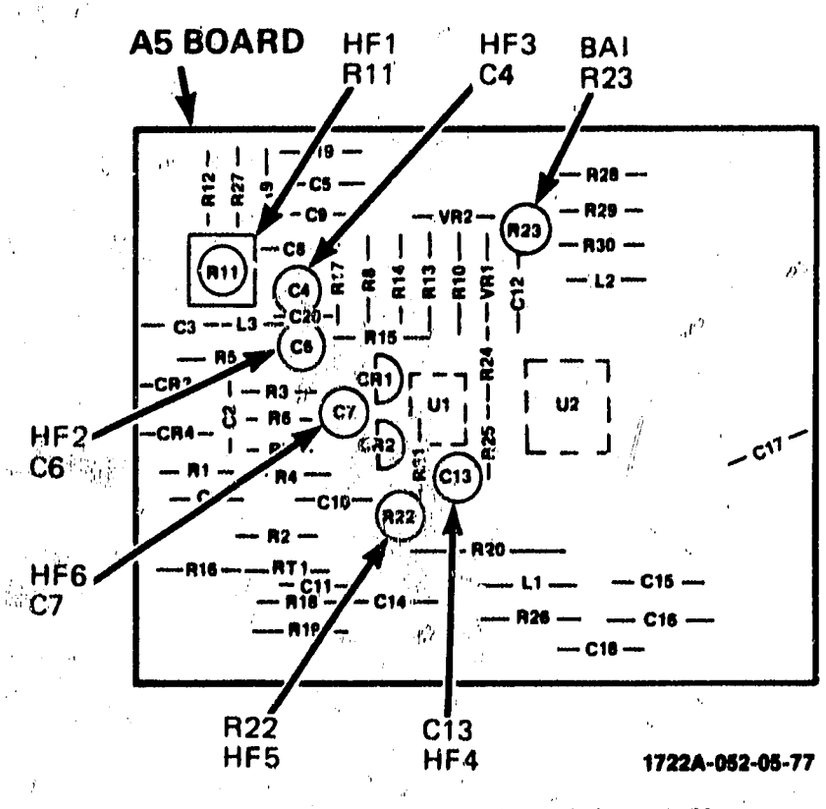

Figure 5-15. Vertical Output Amplifier Adjustments

5-62. OUTPUT AMPLIFIER BALANCE ADJUSTMENT. (See schematic 4 and figure 5-15.) Adjust output amplifier balance as follows:

a. Press BEAM FIND switch.

b. Center trace by adjusting balance control A5R23.

c. Release BEAM FIND switch.

5-63. SYNC AMPLIFIER BALANCE ADJUSTMENT. (See schematics 3 and 6; figures 5-14 and 5-16.)

Equipment Required:

Multifunction digital voltmeter
Test leads

5-64. Adjust sync amplifier balance as follows:

a. Connect multifunction digital voltmeter (DVM) across test points A10TP1 and A10TP2 (DVM ground lead connected to A10TP2).

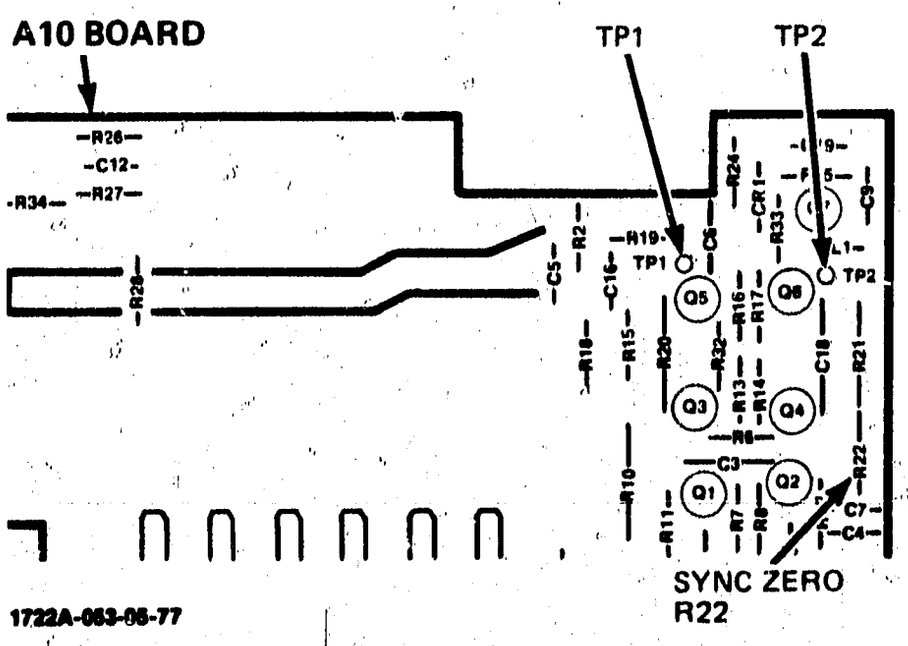

Figure 5-16. Sync Balance Adjustment

b. Adjust channel A sync balance adjustment A3R6 for indication of 0 volt ±10 mV on DVM.

c. Set front-panel INT TRIG control to B.

d. Adjust channel B sync balance adjustment A3R11 for indication of 0 volt ±10 mV on DVM.

e. Disconnect DVM ground lead from A10TP2.

f. Connect DVM ground lead to chassis ground.

g. Adjust sync zero balance adjustment A10R22 for indication of 0 volt ±20 mV on DVM.

h. Disconnect test equipment.

i. Set 1722A front-panel controls to initial settings.

5-65. LOW FREQUENCY RESPONSE ADJUSTMENT. (See schematics 1, 2, and figure 5-14.)

Equipment Required:

Pulse generator
44-in. BNC cable

5-66. Adjust low frequency response as follows:

a. Connect output of pulse generator to channel A INPUT connector.

b. Set 1722A front-panel controls as follows:

Coupling (both channels)..... 50Ω
TIME/DIV (main) ..... 1 mSEC

c. Set pulse generator controls for ≈100 Hz, ≈6-division output display signal.

d. Adjust main TRIGGER LEVEL control for stable display.

e. Adjust channel A low frequency adjustment A3R55 for best signal response.

f. Connect output from pulse generator to channel B INPUT connector.

g. Set VERT DISPLAY control to B.

h. Set INT TRIG control to B.

i. Adjust channel B low frequency adjustment A3R69 for best signal response.

j. Disconnect test equipment.

k. Set 1722A front-panel controls to initial settings.

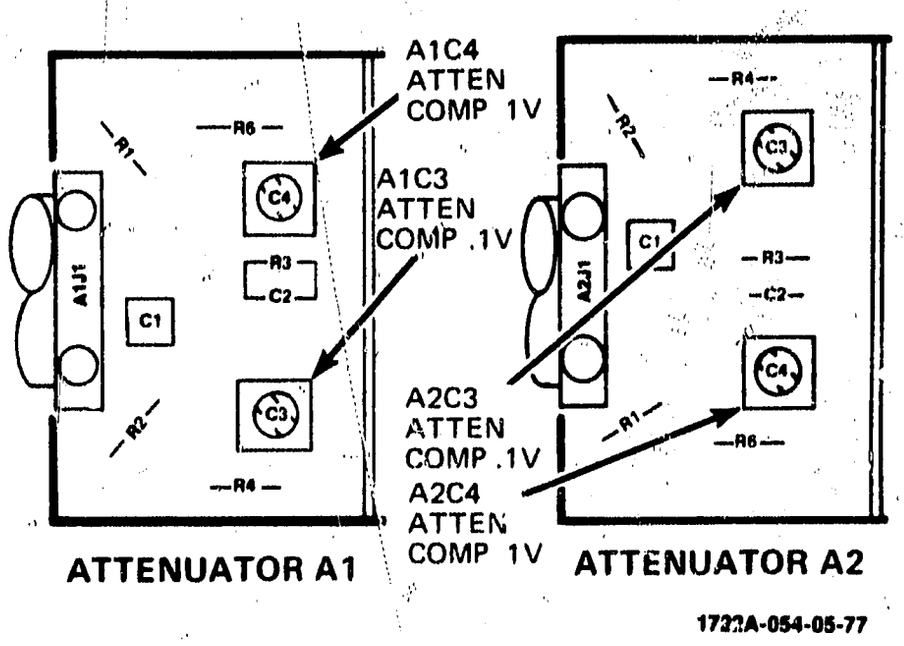

Figure 5-17. Attenuator Adjustments

5-67. ATTENUATOR COMPENSATION ADJUSTMENT. (See schematics 1, 2, and figure 5-17.)

Equipment Required:

Pulse generator
44-in. BNC cable

5-68. Adjust attenuator compensation as follows:

a. Connect pulse generator output to channel A INPUT connector.

b. Set 1722A front-panel controls as follows:

VOLTS/DIV (both channels)..... .1
Coupling (both channels)..... 50Ω
TIME/DIV (main) ..... 10 μSEC

c. Set pulse generator for 10-kHz, ≈0.5 V output display signal.

d. Adjust channel A 0.1 V attenuator compensation adjustment A1A1C3 for optimum square-wave response.

e. Set channel A VOLTS/DIV switch to 1 VOLT/DIV position.

f. Increase pulse generator output to ≈5 volts.

g. Adjust channel A 1 V attenuator compensation adjustment A1A1C4 for optimum square-wave response.

h. Disconnect pulse generator from channel A INPUT connector.

i. Connect pulse generator 50-ohm output to channel B INPUT connector.

j. Set VERT DISPLAY control to B.

k. Set INT TRIG control to B.

l. Repeat steps b through g for channel B attenuator using adjustments A2A1C3 for 0.1 V compensation and A2A1C4 for 1 V compensation.

m. Disconnect test equipment.

n. Set 1722A front-panel controls to initial settings.

5-69. CALIBRATOR AMPLITUDE ADJUSTMENT. (See schematic 15 and figure 5-12.)

Equipment Required:

DC standard
44-in. BNC cable
Adapter (twin banana plug to BNC female)
Test leads

5-70. Adjust calibrator amplitude as follows:

a. Set channel A VOLTS/DIV switch to 0.5 V position.

b. Set channel A coupling to DC position.

c. Connect dc standard to channel A INPUT connector.

d. Set dc standard to 3 V output.

e. Adjust channel A vernier for displacement of six divisions.

f. Disconnect dc standard from 1722A.

g. Connect CAL 3 V output to channel A INPUT connector.

h. Adjust cal ampl adj A1R51 for 6-division display.

i. Disconnect CAL 3 V output from channel A INPUT connector.

j. Set 1722A front-panel controls to initial settings.

5-71. VERTICAL GAIN ADJUSTMENT. (See schematic 3 and figure 5-14.)

Equipment Required:

Test leads
Adapter (Twin banana plug to BNC male)

5-72. Adjust vertical gain as follows:

a. Using test lead and adapter, connect CAL 3 V output to channel A INPUT connector.

b. Set channel A and channel B VOLTS/DIV switches to 0.5 position.

c. Adjust channel A gain adjustment A3R1 for exactly six division of vertical deflection.

d. Using test lead and adapter, connect CAL 3 V output to channel B INPUT connector.

e. Set VERT DISPLAY control to B.

f. Set INT TRIG control for B.

g. Adjust channel B gain adjustment A3R14 for exactly six divisions of vertical deflection.

h. Disconnect test lead.

i. Set 1722A front-panel controls to initial settings.

5-73. TRIGGER RECOGNITION THRESHOLD ADJUSTMENT. (See schematics 7, 9, and figure 5-18.)

Equipment Required:

Test oscillator
44-in. BNC cable

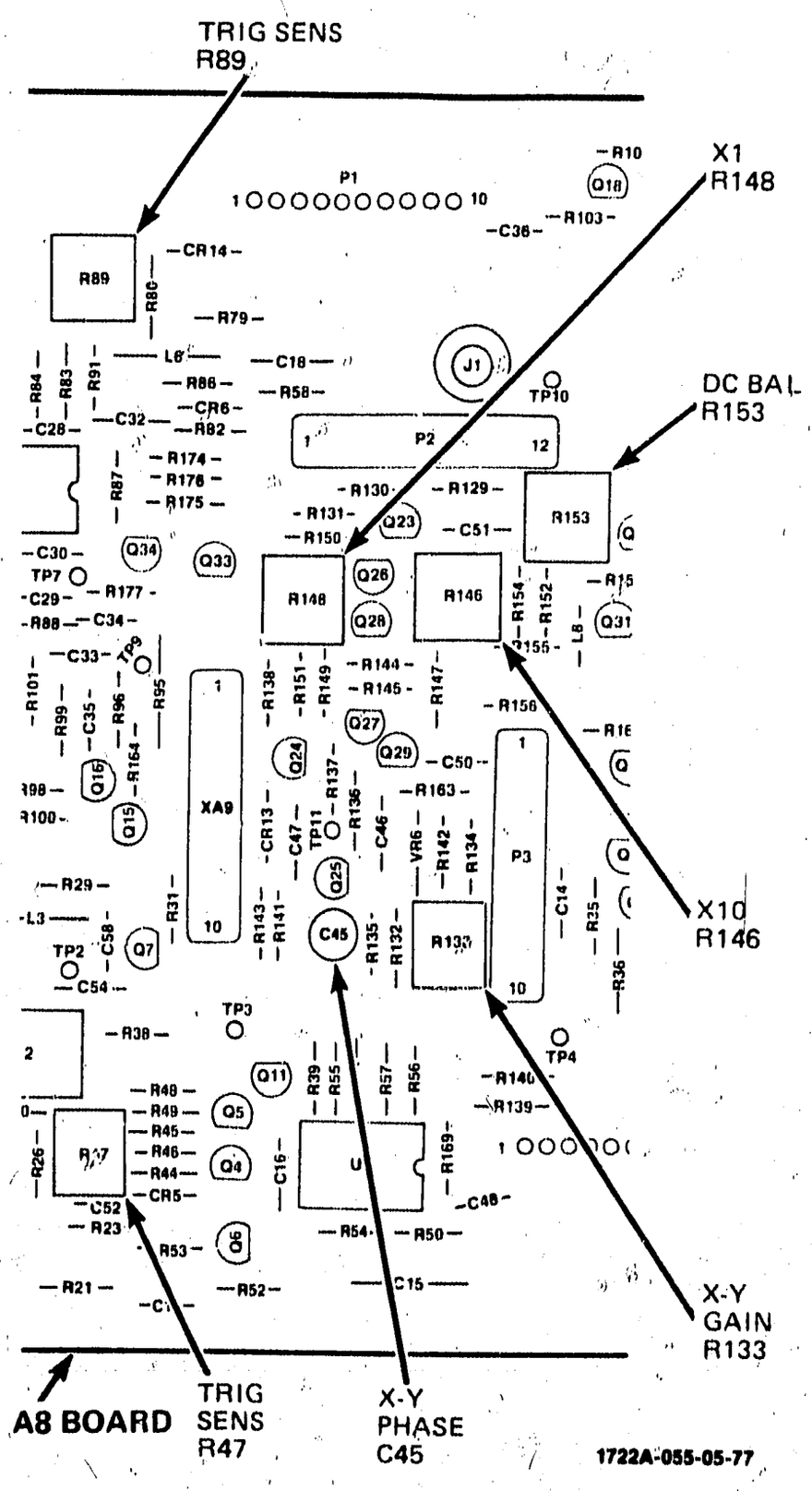

Figure 5-18. Horizontal Sweep Assembly Adjustments

5-74. Adjust trigger recognition threshold as follows:

a. Set 1722A front-panel controls as follows:

Coupling (channel A)	GND
AUTO/NORM	NORM
TIME/DIV (main)	1 mSEC
INT/EXT (main)	EXT

b. Set main trigger sensitivity adjustment A8R47 fully clockwise.

c. Set test oscillator controls for 30 mV p-p, 10 MHz sine wave output.

d. Connect test oscillator to main EXT TRIG input connector.

e. Slowly rotate main TRIGGER LEVEL control from one extreme to other. Note that one sweep occurs for each direction of rotation.

f. While rotating main TRIGGER LEVEL control, slowly adjust A8R47 counterclockwise until sweep occurs for only one direction of rotation of main TRIGGER LEVEL control.

g. Set 1722A front-panel controls as follows:

AUTO/NORM	AUTO
HORIZ DISPLAY	DLY'D
INT/EXT (delayed)	EXT
TIME/DIV (delayed)	.5 mSEC
TRIGGER LEVEL (main)	fully cw
TRIGGER LEVEL (delayed)	midrange

h. Set test oscillator controls for 30 mV p-p, 10 MHz sine wave output.

i. Connect test oscillator to delayed EXT TRIG input connector.

j. Set delayed trigger sensitivity adjustment A8R89 fully clockwise.

k. While rotating delayed TRIGGER LEVEL control from one extreme to the other, adjust A8R89 counterclockwise until sweep occurs for only one direction of rotation.

l. Disconnect test equipment.

m. Set 1722A front-panel controls to initial settings.

5-75. DIGITAL TO ANALOG CONVERTER ADJUSTMENT. (See schematic 19 and figure 5-19.)

Equipment Required:

Time-mark generator
44-in. BNC cable

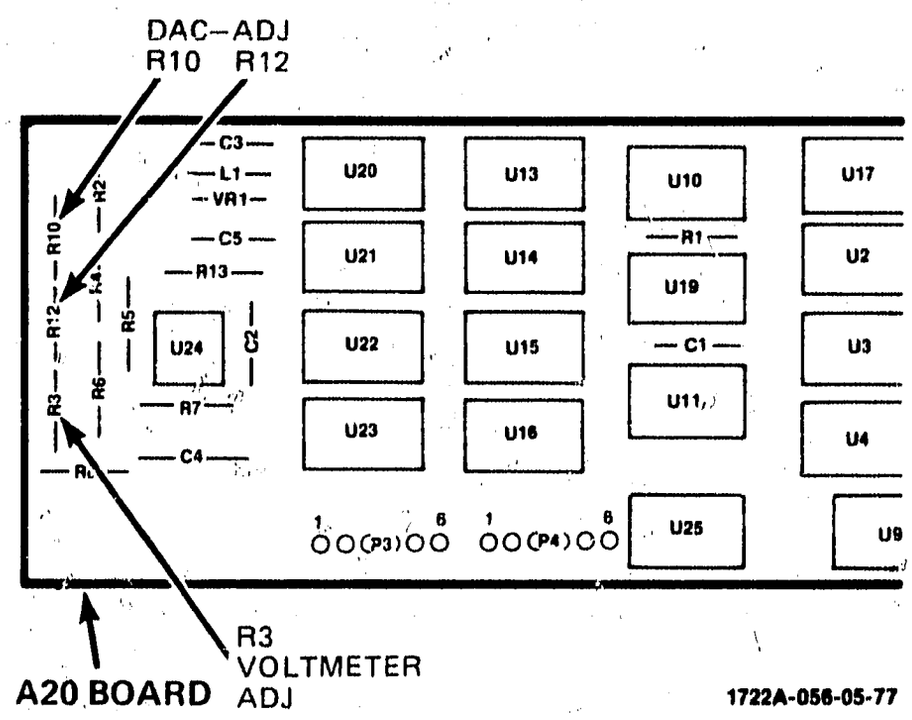

Figure 5-19. D/A Converter Adjustments

5-76. Adjust digital to analog converter as follows:

a. Set 1722A controls as follows:

Coupling (channel A)	50Ω
VOLTS/DIV (channel A)	.5
Main TIME/DIV	1 μSEC
Delayed TIME/DIV	10 nSEC
HORIZ DISPLAY	MAIN INTEN
INTERVAL	TIME

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

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

d. Vary TIME INTERVAL DEC/INC controls until display indicates 01.00 –6.

e. Using DELAY control, position second intensified spot to center screen, being sure that intensified spot coincides with time marker.

f. Change HORIZ DISPLAY to DLY'D. An increase in intensity will be necessary.

g. Using FINE DEC/INC control, locate point when one click (DEC) results in display change to 0.999 –6, and one click (INC) results in display of 01.00 –6.

h. While switching between 01.00 –6 and 0.999 –6, adjust A20R10 until second intensified time marker shifts 0.5 minor division ±0.1 minor division.

NOTE

When the switch is pushed to INC, time marker should shift left. When the switch is pushed to DEC, time marker should shift right.

i. Vary TIME INTERVAL DEC/INC control until display indicates 0.100 –6.

j. Using FINE DEC/INC control, locate point where one click (DEC) results in display of 0.099 –6 and one click (INC) results in display of 0.100 –6.

k. While switching between 0.100 –6 and 0.099 –6, adjust A20R12 until second intensified time marker shifts 0.5 minor division ±0.1 minor division (it may be necessary to readjust DELAY control to view second marker).

l. Repeat steps d through k since some interaction may occur.

m. Disconnect test equipment.

n. Set 1722A front-panel controls to initial settings.

5-77. DIGITAL VOLTMETER ADJUSTMENT. (See schematic 23 and figure 5-21.)

Equipment Required:

DC standard
44-in. BNC cable
Adapter (twin banana plug to BNC female)

5-78. Adjust digital voltmeter as follows:

a. Connect equipment as shown in figure 5-20.

b. Set dc standard controls for –1-volt dc output.

c. Set 1722A controls as follows:

CHAN A	INPUT/DC VOLTS
VOLTS/DIV (channel A)	1
Coupling (channel A)	GND

d. Press CHAN A REF SET until display indicates 00.00.

e. Change channel A coupling to DC. Note value of display (≈–1 V).

f. Set dc standard to +1 V output.

g. Adjust A20R3 for reading noted in step e.

h. Repeat steps d through g until readings noted in steps e and g are same.

i. Change channel A coupling to AC.

j. Press CHAN A REF SET until display indicates 00.00.

k. Change channel A coupling to DC.

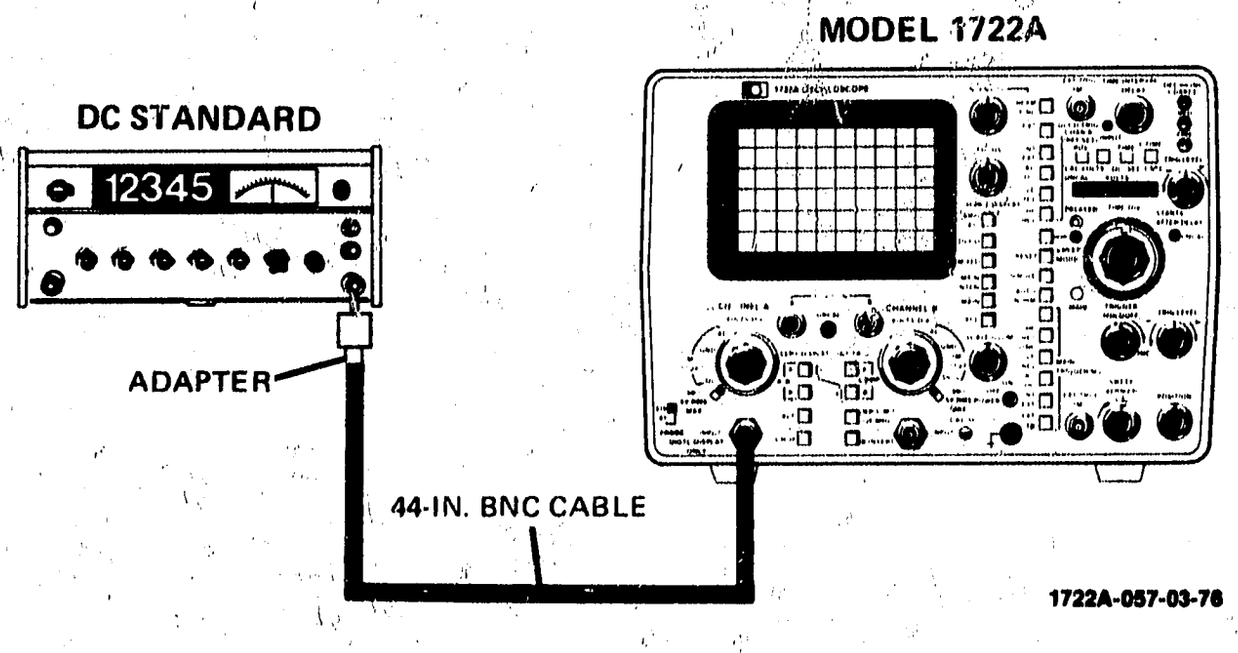

Figure 5-20. Digital Voltmeter Test Setup

l. Set dc standard to —5 V output.

m. Adjust A21R16 for display indication of —05.00.

n. Set dc standard to +5 V output.

o. Adjust A21R28 for display indication of +05.00.

p. Disconnect test equipment.

q. Set 1722A front-panel controls to initial settings.

5-79. CHANNEL A POSITION ADJUSTMENT. (See schematic 3 and figure 5-14.)

Equipment Required:

DC standard
44-in. BNC cable
Adapter (twin banana plug to BNC female)

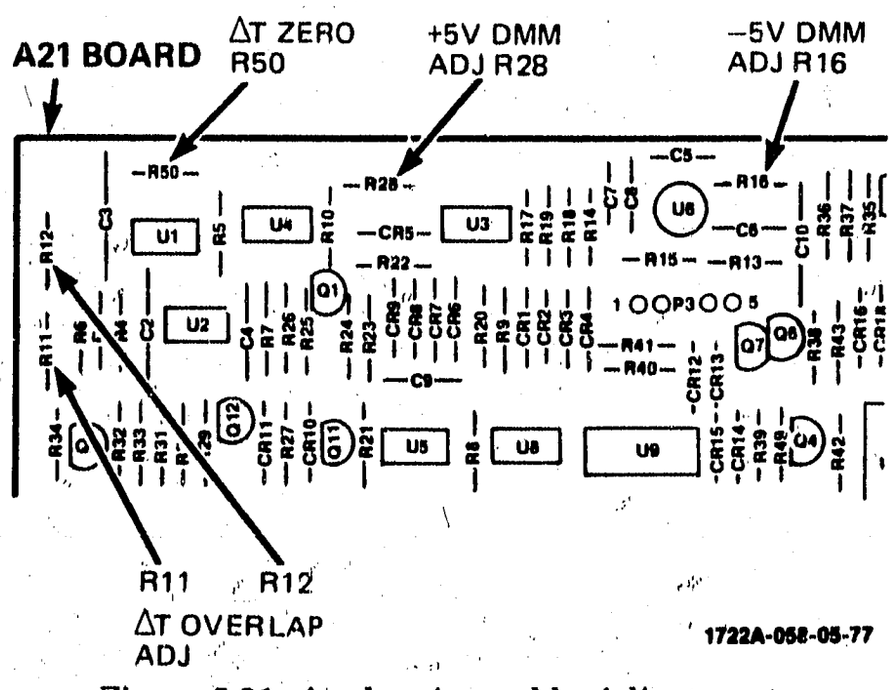

Figure 5-21. Analog Assembly Adjustments

5-80. Adjust channel A position as follows:

a. Set 1722A front-panel controls as follows:

VOLTS/DIV (channel A)	1
VERT DISPLAY	A
INT TRIG	B
HORIZ DISPLAY	X-Y
CHAN A POSN	engaged
Coupling (channel A)	DC

b. Adjust FOCUS and INTENSITY controls for smallest and sharpest spot possible.

c. Using channel A vertical POSITION control, position spot to center of CRT.

d. Press CHAN A REF SET until display indicates 00.00.

e. Connect —4.0 V from dc standard to channel A INPUT connector.

f. Reposition spot to center screen.

g. If display does not indicate exactly —04.00, adjust channel A Pos adj A3R82 for indication halfway between actual reading and —04.00. (Example: if reading is —03.80, then adjust A3R82 for indication of —03.90).

h. Repeat steps c through g as necessary until indication is exactly 04.00 ±.01.

i. Disconnect test equipment.

j. Set 1722A front-panel controls to initial settings.

5-81. DELAY CONTROL ADJUSTMENT. (See schematic 23 and figure 5-21.)

Equipment Required:

Time-mark generator
44-in. BNC cable

5-82. Adjust delay control as follows:

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

b. Set 1722A controls as follows:

Coupling (channel A)	50Ω
VOLTS/DIV (channel A)	1
Main TIME/DIV	.5 μSEC
Delayed TIME/DIV	10 nSEC
HORIZ DISPLAY	MAIN INTEN
INTERVAL	TIME

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

d. Using TIME INTERVAL DELAY control, position intensified spot on second time marker.

e. Using TIME INTERVAL DEC/INC controls, set display for an indication of 0.000 —9.

f. Set HORIZ DISPLAY to DLY'D.

g. Adjust INTENSITY and TIME INTERVAL DELAY controls as necessary to view two time markers.

h. Set A21R50 to mid-range.

i. Adjust A21R12 to overlap traces.

j. Slowly rotate TIME INTERVAL DELAY control clockwise, counting markers as they pass. Stop on 8th marker from those viewed in step g.

k. Adjust A21R11 until two markers are superimposed.

l. Repeat steps g through k until markers remain overlapped when TIME INTERVAL DELAY control is rotated from clockwise to counterclockwise position.

m. Disconnect test equipment.

n. Set 1722A front-panel controls to initial settings.

5-83. HORIZONTAL AMPLIFIER X1 GAIN ADJUSTMENT. (See schematics 8 and 13; figures 5-18 and 5-22.)

Equipment Required:

Time-mark generator
44-in. BNC cable

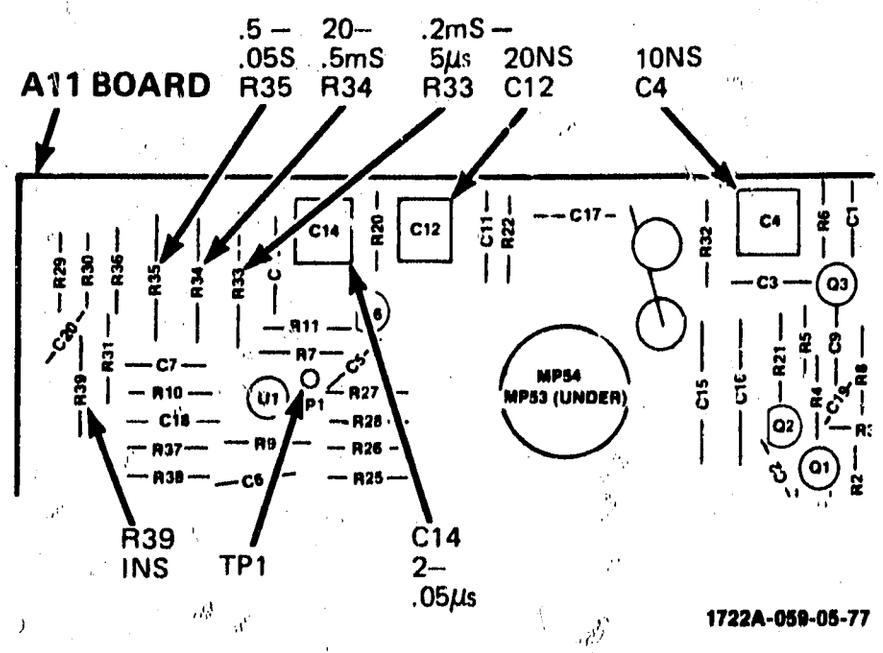

Figure 5-22. Main Sweep Adjustments

5-84. Adjust horizontal amplifier X1 gain as follows:

a. Set 1722A controls as follows:

HORIZ DISPLAY	MAIN INTEN
Coupling (channel A)	GND
Main TIME/DIV	10 μSEC
Delayed TIME/DIV	10 nSEC

b. Vary TIME INTERVAL DEC/INC controls until display indicates 080.0 —6.

c. Using FINE DEC/INC control, locate point where one click (DEC) results in display of 079.9 —6 and one click (INC) results in indication of 080.0 —6. Leave in 080.0 —6 position.

d. Adjust TIME INTERVAL DELAY control until two intensified spots are observed.

e. Adjust X1 Gain Adj A8R148 for exactly 8 div of separation between two spots.

f. Set channel A coupling to 50Ω.

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

h. Adjust A11R33 until exactly 1 marker/div occurs.

i. Press MAG X10 switch.

j. Adjust X10 Gain Adj A8R146 until one time marker coincides with far left graticule line and one coincides with far right graticule line.

k. Disconnect test equipment.

l. Set 1722A front-panel controls to initial setting.

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5-85. X10 AMPLIFIER BALANCE ADJUSTMENT. (See schematic 13 and figure 5-18.)

Equipment Required:

Time-mark generator
44-in. BNC cable

5-86. Adjust X10 amplifier balance as follows:

a. Set 1722A front-panel controls as follows:

Coupling (channel A)	50Ω
VOLTS/DIV (channel A)	.5
TIME/DIV (main)	.2 μSEC

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

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

d. Set HORIZ DISPLAY control to MAG X10.

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

f. Set HORIZ DISPLAY control to MAG X1.

g. Using dc balance adjustment A8R153, position center time marker to center of CRT screen.

h. Repeat steps e through g switching between X1 and X10 displays until middle time marker remains at center of CRT screen when magnified.

i. Disconnect test equipment.

j. Set 1722A front-panel controls to initial settings.

5-87. 1, 10, and 20 NS SWEEP TIME AND LINEARITY ADJUSTMENTS. (See schematics 8 and 14; figures 5-22 and 5-23.)

Equipment Required:

Time-mark generator
Two 44-in. BNC cables

5-88. Adjust sweep time as follows:

a. Set 1722A controls as follows:

Coupling (channel A)	50Ω
VOLTS/DIV (channel A)	.5
Main EXT/INT	EXT
Main TIME/DIV	10 nSEC

b. Connect time-mark generator to channel A INPUT connector. Externally trigger main sweep.

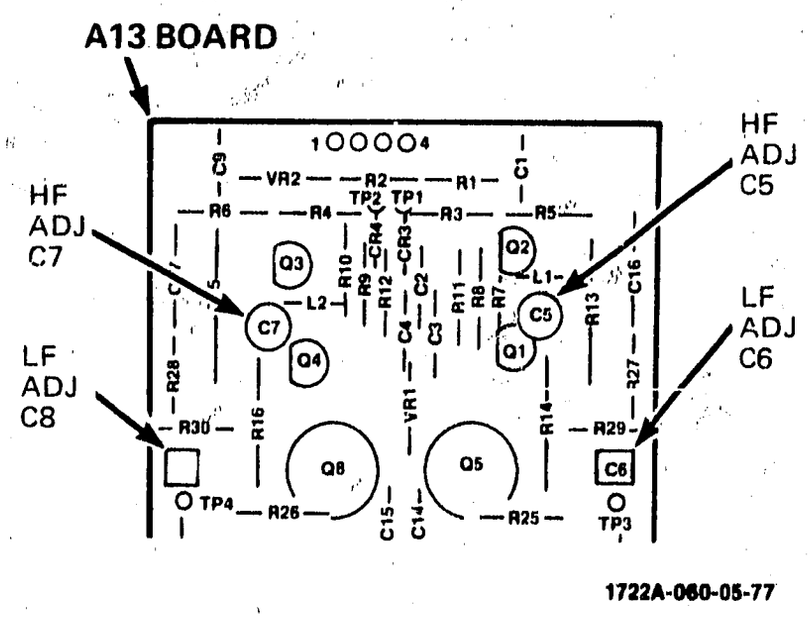


Figure 5-23. Horizontal Linearity Adjustments

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

d. Adjust 10-ns adj A11C4 until one marker is on each graticule. (Disregard 1st major div of sweep.)

e. Set 1722A controls as follows:

Main TIME/DIV	20 nSEC
Delayed TIME/DIV	10 nSEC
HORIZ DISPLAY	DLY'D
MAG X10	engaged

f. Set display to read 050.0 —9 (one click above 049.9 —9).

g. Set time-mark generator for 50-ns output.

h. Increase INTENSITY and rotate horizontal POSITION control until leading edge of first marker is displayed at center screen. Then rotate horizontal POSITION control to display the second leading edge.

i. Adjust 20-ns adj A11C12 until first time mark coincides with second one. (This is marker that can be positioned either before or after displayed one when rotating A11C12 from one extreme to other.)

j. Set time-mark generator for 2-ns output.

k. Set 1722A controls as follows:

Delayed TIME/DIV	OFF
VOLTS/DIV (channel A)	.2
MAG X10	X1
HORIZ DISPLAY	MAIN

l. Center display on CRT with horiz POSITION control. Press MAG X10 switch.

m. Note whether 2-ns sweep is slow across right half of CRT (more than 2 complete cycles for every 2 major divisions) or fast (less than 2 complete cycles for every 2 major divisions).

n. If sweep is slow, slowly adjust A13C6 and A13C8 cw in 180° increments until linearity is within ±0.5 minor div.

o. Repeat steps m and n, as necessary.

p. Observe sweep across left half of CRT. If sweep is slow, adjust A13C5 and A13C7 ccw in 180° increments for best linearity. If sweep is fast, adjust A13C5 and A13C7 cw in 180° increments for best linearity. (Disregard first 15 ns of sweep.)

q. Repeat steps m through p to compensate for interaction.

r. Set 1722A controls as follows:

Main TIME/DIV	10 nSEC
MAG X10	X1

s. Center display.

t. Press MAG X10 switch.

u. Adjust A11R39 until one cycle is displayed every two divisions over inside eight divisions (±2 minor divisions).

v. Disconnect test equipment.

w. Set 1722A front-panel controls to initial settings.

NOTE

From this point on, do not adjust the 10 NS (A11C3) or the 20 NS (A11C12) trimmer capacitors.

5-89. PRELIMINARY (COARSE) MAIN SWEEP TIME ADJUSTMENT. (See schematic 8 and figure 5-22.)

Equipment Required:

Time-mark generator
Two 44-in. BNC cables

5-90. Perform preliminary sweep time adjustments as follows:

a. Connect time-mark generator to channel A INPUT connector. Externally trigger main sweep.

b. Set 1722A controls as follows:

Coupling (channel A)	50Ω
VOLTS/DIV (channel A)	5
Main TIME/DIV	50 nSEC
Main EXT/INT	EXT

c. Set main TIME/DIV and time-mark generator output as shown in table 5-7 and make adjustments as indicated for one marker per div.

Table 5-7. Initial Main Sweep Adjustments

Time Marks	Main Time/Div	Adj
50 nSEC	50 nSEC	A11C14
5 µSEC	5 µSEC	A11R33
.5 mSEC	.5 mSEC	A11R34
50 mSEC	50 mSEC	A11R35

5-91. DELAYED SWEEP TIME ADJUSTMENTS. (See schematic 10 and figure 5-24.)

Equipment Required:

Time-mark generator
Two 44-in. BNC cables

5-92. Adjust delayed sweep time as follows:

a. Connect time-mark generator to channel A INPUT connector. Externally trigger delayed time base.

b. Set 1722A controls as follows:

Coupling (channel A)	50Ω
HORIZ DISPLAY	DLY'D
Main TIME/DIV	20 nSEC
Delayed TIME/DIV	10 nSEC
Delayed EXT/INT	EXT
TIME INTERVAL DELAY	fully ccw
Delayed TRIG LEVEL	as required for stable triggering

c. Set time-mark generator and other controls as outlined in table 5-8 and make adjustments as required.

d. Disconnect test equipment.

e. Set 1722A front-panel controls to initial settings.

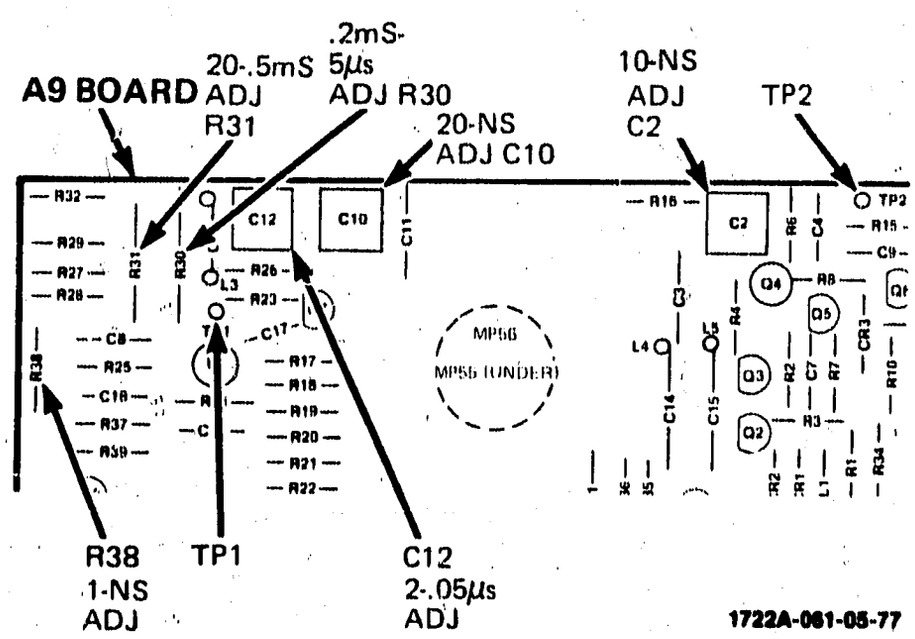


Figure 5-24. Delayed Sweep Adjustments

Table 5-8. Delayed Sweep Adjustment

Time-mark Generator	Main Time/Div	Delayed Time/Div	Adjust	Test Limit (Minor Div)
10 ns	20 nSEC	10 nSEC	A9C2	±5
2 ns	20 nSEC	10 nSEC (X10 MAG)	A9R38	±2*
20 ns	50 nSEC	20 nSEC	A9C10	±.5*
50 ns	.1 µSEC	50 nSEC	A9C12	±.5
.1 µs	.2 µSEC	.1 µSEC	A9C12	±.5
.2 µs	.5 µSEC	.2 µSEC	A9C12	±.5
.5 µs	1 µSEC	.5 µSEC	A9C12	±.5
1 µs	2 µSEC	1 µSEC	A9C12	±.5
2 µs	5 µSEC	2 µSEC	A9C12	±.5
5 µs	10 µSEC	5 µSEC	A9R30	±.5
10 µs	20 µSEC	10 µSEC	A9R30	±.5
20 µs	50 µSEC	20 µSEC	A9R30	±.5
50 µs	.1 mSEC	50 µSEC	A9R30	±.5
.1 ms	.2 mSEC	.1 mSEC	A9R30	±.5
.2 ms	.5 mSEC	.2 mSEC	A9R30	±.5
.5 ms	1 mSEC	.5 mSEC	A9R31	±.5
1 ms	2 mSEC	1 mSEC	A9R31	±.5
2 ms	5 mSEC	2 mSEC	A9R31	±.5
5 ms	10 mSEC	5 mSEC	A9R31	±.5
10 ms	20 mSEC	10 mSEC	A9R31	±.5
20 ms	50 mSEC	20 mSEC	A9R31	±.5

*over center 8 div.

5-93. MAIN SWEEP FINE ADJUSTMENT. (See schematic 8 and figure 5-22.)

NOTE

These adjustments use the accuracy of the microprocessor to calibrate the main sweep more accurately than is possible using the visual method. These adjustments must be performed if the differential time accuracy specification is to be met.

Equipment Required:

Time-mark generator
44-in. BNC cable

5-94. Perform main-sweep fine adjustments as follows:

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

b. Set 1722A front-panel controls as follows:

Main TIME/DIV ..... .5 µSEC
Delayed TIME/DIV ..... 10 nSEC
INTERVAL ..... TIME
HORIZ DISPLAY ..... MAIN INTEN
TIME INTERVAL DELAY .... fully ccw
Display ..... 4.000 –6
(1 click over 3.999 –6)

c. Set time-mark generator to 0.5 µs.

d. Set HORIZ DISPLAY to DLY'D.

e. Rotate TIME INTERVAL DELAY cw until first time mark is displayed at center screen.

f. Adjust 0.5 µs adj A11C14 until first time mark coincides with ninth, ±0.23 div.

g. Set MAG X10 to X10 position.

h. Set time-mark generator, and other controls as indicated in table 5-9 and check test limits. If any are not met, readjust A11C14 to distribute any error evenly among all effected ranges.

i. Set MAG X10 to X1.

j. Check ranges indicated in table 5-10 and adjust A11R33, 0.2 ms through 5 µs adj, as required. Rotate DELAY fully ccw, then rotate cw to locate pulses in each case.

k. Set time-mark generator and other controls as indicated in table 5-11 and check test limits. Adjust A11R34, 20 ms through .5 ms adj, as necessary to make all tests within limits. Rotate DELAY fully ccw then cw to locate pulses in each case.

l. Disconnect test equipment.

Table 5-9. 2 - .05 US Sweep Adjustment (MAG X10)

Time-mark Generator	Main Time/Div	Delayed Time/Div	LED Display	Adjust	Test Limit (Major Div)
50 ns	50 nSEC	10 nSEC	400.0 —9	A11C14	±2.3
.1 µs	.1 µSEC	10 nSEC	0.800 —6		±4.5
.2 µs	.2 µSEC	20 nSEC	1.600 —6		±4.5
1 µs	1 µSEC	.1 µSEC	08.00 —6		±4.5
2 µs	2 µSEC	.2 µSEC	16.00 —6		±4.5

Table 5-10. 20 - 5 US Sweep Adjustment (MAG X1)

Time-mark Generator	Main Time/Div	Delayed Time/Div	LED Display	Adjust	Test Limit (Major Div)
5 µs	5 µSEC	.1 µSEC	40.00 —6	A11R33	±2.25
10 µs	10 µSEC	.2 µSEC	080.0 —6		±2.25
20 µs	20 µSEC	.5 µSEC	160.0 —6		±1.8
50 µs	50 µSEC	1 µSEC	400.0 —6		±2.25
.1 ms	.1 mSEC	2 µSEC	0.800 —3		±2.25
.2 ms	.2 mSEC	5 µSEC	1.600 —3		±1.8

Table 5-11. 20 - 5 MS Sweep Adjustment (MAG X1)

Time-mark Generator	Main Time/Div	Delayed Time/Div	LED Display	Adjust	Test Limit (Major Div)
.5 ms	.5 mSEC	10 µSEC	4.000 —3	A11R34	±2.25
1	1 mSEC	20 µSEC	08.00 —3		±2.25
2 ms	2 mSEC	50 µSEC	16.00 —3		±1.8
5 ms	5 mSEC	.1 mSEC	40.00 —3		±2.25
10 ms	10 mSEC	.2 mSEC	080.0 —3		±2.25
20 ms	20 mSEC	.5 mSEC	160.0 —3		±1.8

m. Set 1722A front-panel controls to initial settings.

5-95. VERTICAL AMPLIFIER PULSE RESPONSE ADJUSTMENT. (See schematics 3 and 4; figures 5-14 and 5-15.)

Equipment Required:

Fast-rise pulse generator
44-in. BNC cable

5-96. Adjust vertical amplifier pulse response as follows:

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

b. Set 1722A front-panel controls as follows:

Coupling (both channels)..... 50Ω
TIME/DIV (main) ..... 10 µSEC

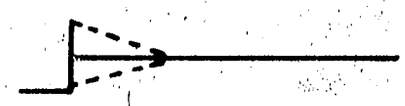
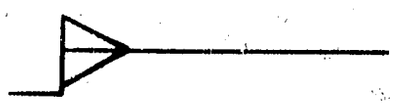
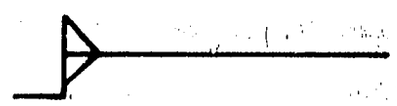
c. Adjust pulse generator output and channel A VOLTS/DIV control to obtain exactly 6 divisions of vertical deflection.

NOTE

Verify that channel A VOLTS/DIV vernier is in CAL detent position.

d. Adjust HF compensation capacitor A3C5 and TRIM A capacitor A3A1C1 for minimum overshoot (minimum capacitance).

Table 5-12. Vertical Amplifier Adjustments

Adjustment	Reference Designation	Effect on Pulse
HF1 HF2	A5R11 A5C6	
HF3	A5C4	
HF4 HF5	A5R22 A5C13	
HF6	A5C7	
HF Comp TRIM A TRIM B	A3C5 A3A1C1 A3A1C2	

e. Make adjustments shown in table 5-12 for vertical preamplifier A3 and output amplifier A5.

NOTE

If pulse generator being used is specified for 3% overshoot, do not set adjustments for less than 3% since this is effectively detuning the vertical amplifier bandwidth. Also, when performing step e, change sweep times as necessary to display best pulse. Repeat the procedure if necessary until optimum pulse response is obtained.

f. Connect pulse generator to channel B INPUT connector.

g. Set VERT DISPLAY control to B.

h. Set INT TRIG control to B.

i. Adjust TRIM B capacitor A3A1C2 to make channel B response most similar to channel A response.

j. Disconnect test equipment.

k. Set 1722A front-panel controls to initial settings.

5-97. X-Y GAIN ADJUSTMENT. (See schematic 13 and figure 5-18.)

Equipment Required:

Test oscillator
44-in. BNC cable

5-98. Adjust X-Y gain as follows:

a. Connect test oscillator to 1722A channel A INPUT connector.

b. Set 1722A front-panel controls as follows:

Coupling (both channels)..... 50Ω
VOLTS/DIV (both channels)..... .1
VERT DISPLAY and INT TRIG ..... X-Y operation
HORIZ DISPLAY ..... X-Y

c. Set test oscillator output for approximately 100 kHz.

d. Adjust oscillator output for exactly 6 divisions of Y-axis deflection.

e. Disconnect oscillator from 1722A channel A INPUT connector.

f. Connect test oscillator to 1722A channel B INPUT connector.

g. Adjust X-Y gain adjustment A8R133 for exactly 6 divisions of X-axis deflection.

h. Disconnect test equipment.

i. Set 1722A front-panel controls to initial settings.

5-99. X-Y PHASE ADJUSTMENT. (See schematic 13 and figure 5-18.)

Equipment Required:

Test oscillator
44-in BNC cable
Two 9-in. BNC cables
50-ohm power divider

5-100. Perform X-Y phase adjustment as follows:

a. Connect test oscillator to both channel A INPUT connector and channel B INPUT connector using 50-ohm power divider.

NOTE

Cable length from TEE connector to channel INPUT connections should be as short as possible and of the same electrical length.

b. Set 1722A front-panel controls as follows:

Coupling (both channels)	50Ω
VERT DISPLAY and INT TRIG	X-Y operation
VOLTS/DIV (both channels)	.05
HORIZ DISPLAY	X-Y

c. Adjust oscillator output for 1 MHz, ≈500 mV p-p.

d. Adjust X-Y phase adjustment A8C45 until ellipse most resembles straight diagonal line.

e. Disconnect test equipment.

f. Set 1722A front-panel controls to initial settings.

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LIST OF ILLUSTRATIONS (Cont'd)

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PERFORMANCE CHECK CON'T

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01722-63402		CHANNEL A ATTENUATOR	28480	01722-63402
A2	01720-63404		ATTENUATOR, CHANNEL B	28480	01720-63404
A3	01722-66517		VERTICAL PREAMPLIFIER ASSY	28480	01722-66517
A4	01720-61626		CABLE ASSY, DELAY LINE	28480	01720-61626
A5	01720-66538		BOARD ASSY; VERTICAL OUTPUT	28480	01720-66538
A6	01720-66534		BOARD ASSY, INT. TRIGGER SWITCH	28480	01720-66534
A7	01720-66535		BOARD ASSY, VERTICAL DISPLAY SWITCH	28480	01720-66535
A8	01722-66519		HORIZONTAL SWEEP ASSY	28480	01722-66519
A9	01720-66547		BOARD ASSY, DELAYED SWEEP SWITCH	28480	01720-66547
A10	01720-66536		BOARD ASSY, HORIZONTAL DISPLAY SWITCH	28480	01720-66536
A11	01720-66546		MAIN SWEEP SWITCH	28480	01720-66546
A12	01722-66520		DELAYED COMPARATOR & HOLDOFF	28480	01722-66520
A13	01720-66537		BOARD ASSY, HORIZONTAL OUTPUT	28480	01720-66537
A14	01720-66551		BOARD ASSY, GATE	28480	01720-66551
A15	01720-66532		BOARD ASSY, H.V.P.S.	28480	01720-66532
A16	0960-0117		ASSY, H.V. MULTIPLIER	28480	0960-0117
A17	01720-66528		BOARD ASSY, L.V.P.S.	28480	01720-66528
A18	01722-66501		PROCESSOR & DISPLAY DRIVER ASSY	28480	01722-66501
A19	01722-66502		INPUT ENCODER ASSY	28480	01722-66502
A20	01722-66516		OUTPUT INTERFACE ASSY	28480	01722-66516
A21	01722-66515		ANALOG ASSY	28480	01722-66515
A22	01722-26506		TIME DELAY SWITCH BD (DOES NOT INCLUDE A22MP1 AND A22MP2)	28480	01722-26506
A23	01722-66507		LED DISPLAY ASSY	28480	01722-66507
A24	01722-66508		SELECTOR SWITCH ASSY	28480	01722-66508
C1	0180-0195		CAPACITOR-FXD 0.33 UF 20% 35 WVDC TA	56289	150D334X0035A2-DSY
DS1	2140-0391	1	LAMP, GLOW	08806	ANSI G2B
DS4	1990-0324	3	PHOTO-DEVICE; SW PNP-SI 3V .05 MW PD	28480	1990-0324
DS5	1990-0324		PHOTO-DEVICE; SW PNP-SI 3V .05 MW PD	28480	1990-0324
DS6	1990-0324		PHOTO-DEVICE; SW PNP-SI 3V .05 MW PD	28480	1990-0324
E1	1510-0038	1	BINDING-POST; SINGLE; 1/4-32	28480	1510-0038
E2	0340-0511	5	INSULATOR, TRANSISTOR	13103	43-77-2
E3	5080-9670	1	INSULATOR:IC	28480	5080-9670
F1	2110-0304	1	FUSE 1.5A 250V SLO-BLO (115V STANDARD)	71400	MDX-1-1/2A
F1	2110-0020		FUSE 0.8A 250V SLO-BLO (230V OPTIONAL)	71400	MDL 8/10
H1	2360-0133		SCREW-MACH 6-32 1.25-IN-LG PAN-HD	28480	2360-0133
H2	2190-0046		WASHER-LK HLCL NO. 6.141-IN-ID .239-IN-OD	28480	2190-0046
H3	2420-0003		NUT-HEX-DBL CHAM 6-32 THD .094-THK .25 OD	28480	2420-0003
H4	3050-0022		WASHER-FL MTLC NO. 5/16 .318-IN-ID .438-IN-OD	28480	3050-0022
H5	2200-0103		SCREW-MACH 4-40 .25-IN-LG PAN HD	28480	2200-0103
H6	2190-0910		WASHER-LK NO. 4.12-IN-ID .275-IN-OD	04713	04A52200F01
H7	2200-0145		SCREW-MACH 4-40 .438-IN-LG PAN HD	28480	2200-0145
H8	2200-0141		SCREW-MACH 4-40 .312-IN-LG PAN HD	28480	2200-0141
H9	3050-0791		WASHER-SHLDR NO. 4 .116-IN-ID .21-IN-OD	28480	3050-0791
H10	2360-0201		SCREW-MACH 6-32 .5-IN-LG PAN-HD POZI	28480	2360-0201
H11	2190-0037		WASHER-LK INTL T NO. 1/2 .512-IN-ID .789-IN-OD	78189	1224-08
H12	2950-0038		NUT-SPECIALTY 1/2-24-THD .125 THK	75915	903-12
H13	3050-0010		WASHER-FL MTLC .147 IN. D. .312 IN. D.	76210	65
H14	2190-0006		WASHER-LK HLCL NO. 6 .141 IN. D. .314 IN.	28480	2190-0006
H15	2360-0207		SCREW-MACH 6-32 PAN HD POZI REC SST-300	28480	2360-0207
H16	0360-1632		TERMINAL, SLDR LUG, 3/8 SCR, .375/.109	79963	761-3/8
H17	2950-0043		NUT-HEX-DBL CHAM 3/8-32 THD .094 THK	73743	2X 28200
H18	2190-0030		WASHER-LK HLCL NO. 4 .115-IN-ID .173 IN-OD	28480	2190-0030
H19	3050-0235		WASHER-FL MTLC NO. 4 .117-IN-ID .25-IN-OD	28480	3050-0235
H20	2200-0107		SCREW-MACH 4-40 .375-IN-LG PAN HD	28480	2200-0107
H21	2510-0138		SCREW-MACH 8-32 3-IN-LG PAN HD POZI	28480	2510-0138
H22	3050-0152		WASHER-SHLDR NO. 8 .172-IN-ID .438-IN-OD	28480	3050-0152
H23	3050-0077		WASHER-FL GR BLK NO. 5/16 .375-IN-ID	28480	3050-0077
H24	2190-0017		WASHER-LK HLCL NO. 8 .168-IN-ID .31-IN-OD	28480	2190-0017
H25	2660-0001		NUT-HEX-DBL CHAM 8-32-THD .125-THK	28480	2660-0001
H26	2190-0007		WASHER-LK INTL T NO. 6 .141-IN-ID .288-IN-OD	78189	1906-00
H27	0624-0334		SCREW-TPG 8-15 1.25-IN-LG PAN HD	28480	0624-0334
H28	2950-0072		NUT-HEX-DBL CHAM 1/4-32-THD .062-THK	82339	P 1075
H29	2190-0102		WASHER-LK INTL T NO. 7/16 .472 IN-ID	78189	1922-01
H30	2200-0167		SCREW, MACH 4-40 82 DEG FL HD POZI REC	28480	2200-0167
H31	2260-0002		NUT, HEX DBL CHAM 4-40 THD	28480	2260-0002
H32	0624-0279		SCREW, TPG 8-32 PAN	28480	0624-0279
H33	2510-0111		SCREW, MACH 8-32 PAN HD POZI REC SST-300	28480	2510-0111
H34	2360-0370		SCREW, MACH 6-32 PAN HD POZI REC SST-300	28480	2360-0370
J1	1250-0118	6	CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
J2	1250-0118		CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
J3	1250-0118		CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
J4	1250-0118		CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
J5	1250-0118		CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
J6	1250-0118		CONNECTOR-COAX; BNC; 50 OHM FEMALE	9D949	31-2221-1022
L1	5060-0436	1	COIL:ALIGNMENT Z AXIS	28480	5060-0436
L2	00191-66004	1	COIL, ALIGNMENT, Y-AXIS	28480	00191-66004
MP1	0370-2787	2	KNOB, VOLTS/DIV	28480	0370-2787
MP2	01740-67402	1	KNOB, MAIN SWEEP	28480	01740-67402
MP3	01720-67403	1	KNOB, DELAYED SWEEP	28480	01720-67403
MP4	01722-63701	1	SHAFT ASSY, MAIN SWEEP	28480	01722-63701
MP5	01720-01211	1	BRACKET, FOCUS	28480	01720-01211

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
MP6	01720-00603	1	SHIELD, SCALE ILLUM.	28480	01720-00603
MP7	0370-0684	2	PUSHBUTTON: H GOLD SQ	28480	0370-0684
MP8	01720-61201	1	BRACKET, DELAY LINE	28480	01720-61201
MP9	5060-0451	1	LENS ASSY	28480	5060-0451
MP10	0370-0963	1	KNOB, CONC; HORIZ POSITION (FINE)	28480	0370-0963
MP11	5040-7598	2	LEVER, COUPLING	28480	5040-7598
MP12	0370-1005	1	KNOB, JADE GRAY (CHAN B POSITION)	28480	0370-1005
MP13	0370-1100	1	KNOB: BASE CONC PTR, .5 IN, JGK	28480	0370-1100
MP14	0370-0603	3	PUSHBUTTON: SQUARE, MINT GRAY	28480	0370-0603
MP15	0370-2630	14	PUSHBUTTON: WILLOW GRN	28480	0370-2630
MP16	4040-0814	1	BEZEL: OLIVE, BLACK	28480	4040-0814
MP17	5040-7829	4	FOOT	28480	5040-7829
MP18			DELETED		
MP19	5020-8745	1	SPACER: DIAL	28480	5020-8745
MP20	5020-8744	1	SPACER: DIAL	28480	5020-8744
MP21	01701-04108	1	COVER, CRT	28480	01701-04108
MP22	01710-04103	1	COVER, TRANSFORMER	28480	01710-04103
MP23	01722-00202	1	PANEL, FRONT	28480	01722-00202
MP24	01720-00213	1	PANEL, REAR	28480	01720-00213
MP25	01722-04101	1	COVER, TOP	28480	01722 04101
MP26	01720-04103	1	COVER, BOTTOM	28480	01720-04103
MP27	01720-01212	1	BRACKET, GATE/H.V.	28480	01720-01212
MP28	01720-04105	1	BRACKET, VERTICAL OUTPUT	28480	01720-04105
MP29	01720-04106	1	COVER, H.V.	28480	01720-04106
MP30	01722-20501	1	FRAME, FRONT	28480	01722-20501
MP31	01720-20504	1	FRAME, REAR	28480	01720-20504
MP32	01720-23201	6	EXTENDER, SWITCH	28480	01720-23201
MP33	01720-23701	2	RAIL, SIDE	28480	01720-23701
MP34	01720-23705	1	SHAFT: DELAYED SWEEP	28480	01720-23705
MP35	10115-22701	1	FILTER, CRT	28480	10115 22701
MP36	01720-24702	1	SUPPORT, CRT CAMERA	28480	01720-24702
MP37	5020-8733	2	GEAR: HUB HANDLE	28480	5020-8733
MP38	5040-0515	1	ASSY, HANDLE	28480	5040-0515
MP38MP1	7120-4237	1	LABEL:HANDLE	28480	7120-4237
MP39	01720-60601	1	SHIELD ASSY, CRT	28480	01720-60601
MP40	01720-60101	1	DECK, MAIN	28480	01720-60101
MP41	0370-2626	34	BEZEL: PUSHBUTTON, GRAY	28480	0370-2626
MP42	0370-1099	6	KNOB: JADE GRAY, .5 IN.	28480	0370-1099
MP43	01720-22501	1	RING, ANTI-RUN	28480	01720-22501
MP44	01720-01209	2	BRACKET, CRT	28480	01720-01209
MP45	0370-0671	15	PUSHBUTTON: LEGAL BLU SQ	28480	0370-0671
MP46	5040-7648	1	PLATE: COVER, CRT BASE	28480	5040-7648
MP47	01830-23201	6	COUPLER, BAL SHAFT	28480	01830-23201
MP48	5040-5952	1	CORE:DIAL TIME/DIV	28480	5040-5952
MP49	01720-67405	1	KNOB:VERNIER (CHAN B)	28480	01720-67405
MP50	5020-8734	2	GEAR-RING:HANDLE	28480	5020-8734
MP51	1400-0534	1	CLAMP:HOSE, 2.37 DIA .37W STL	28480	1400-0534
MP52	5060-0458	1	HEADER: LAMP	28480	5060-0458
MP53	01720-61901	1	SWITCH, ROTOR, MALE	28480	01720 61901
MP54	01720-61902	1	SWITCH, ROTOR, FEMALE	28480	01720-61902
MP55	01720-61903	1	SWITCH, ROTOR, MALE	28480	01720 61903
MP56	01720-61904	1	SWITCH, ROTOR, FEMALE	28480	01720-61904
MP57	01720-64101	1	COVER, PANEL	28480	01720-64101
MP57MP1	7120-4184	1	LABEL, IDENTIFICATION	28480	7120-4184
MP58	00180-09105	1	CLIP, GROUND	28480	00180-09105
MP59	01220-42301	1	HOLDER, TUBE	28480	01220-42301
MP60	0350-0984	1	DECAL, CORE, TIME/DIV DIAL	28480	0350 0984
MP61	01722 09101	3	SPRING, HOLD DOWN	28480	01722 09101
MP62	01720-20503	1	HEAT SINK	28480	01720 20503
MP63	01720-23707	1	SHAFT, EXTENSION	28480	01720-23707
MP64	5040-0511	2	CAP, TRIM	28480	5040-0511
MP65	1540-0292	1	POUCH, ACCESSORY	28480	1540-0292
MP66	1400-0540	3	CLAMP; RETAINER RING: LED MTG; .27 IN.	28480	1400 0540
MP67	1400-0547	3	CLAMP; CLIP-LED PANEL MT; BLK POLYP	28480	1400-0547
MP68	01722-29101	1	SPRING, RETAINING	28480	01722 29101
MP69	1500-0215	1	COUPLER: SOLID	28480	1500-0215
MP70	1460-0604	2	SPRING CPRSN CYL .95 OD 1.185 LG MUW	28480	1460-0604
MP71	3131-0364	3	CAP: LEVER, COLOR	28480	3131 0364
MP72	10115-22701	1	CONTRAST, FILTER	28480	10115 22701
MP74			NOT ASSIGNED		
MP75			NOT ASSIGNED		
MP76	5040-7694	1	BEZEL, WINDOW DISPLAY	28480	5040-7694
MP77	01722-01201	1	BRACKET, PUSHBUTTON SWITCH	28480	01722 01201
MP78	01722 01204	1	BRACKET: SYNC SHIELD	28480	01722 01204
MP79	01722-67403	1	KNOB: POSITION, CHAN A (FINE)	28480	01722 67403
MP80	0370-1091	1	KNOB: JADE GRAY (DELAY)	28480	0370-1091
MP82	01722 01203	1	BRACKET: REF SWITCH	28480	01722 01203
MP83	01722 67402		KNOB: VERNIER (CHAN A)	28480	01722 67402
MP84	5040-0421	1	INSULATOR: POT	28480	5040 0421
MP85	01722 24701	2	SPACER .2 IN.	28480	01722 24701
MP86	2950-0072	3	NUT: HEX 1/4-32; ERS, NI PL	82389	P 1975
MP87	0370-1006		KNOB: POSITION; CHAN A (COARSE)	28480	0370-1006

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
MP88	01720-24101	1	SHIELD, SAFETY, CRT	28480	01720-24101
MP89	0403-0088	1	FOOT BUMPER:MAIN DECK, BLUE	28480	0403-0088
MP90	01720-01210	1	BRACKET:HV CABLE	28480	01720-01210
P1	1251-2357	1	CONNECTOR; AC,PWR; HP-9 MALE FLANGE	28480	1251-2357
Q1	1854-0320	1	TRANSISTOR NPN SI PD=83.5W FT=40MHZ	28480	1854-0320
Q2	1854-0330	1	TRANSISTOR NPN SI PD=21W FT=10MHZ	28480	1854-0330
Q3	1854-0737	1	TRANSISTOR SI PD=30W FT=3.0MHZ	28480	1854-0737
Q4	1854-0370	3	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	2100-0665	1	RESISTOR: VAR; 5M 20% (FOCUS)	71590	MODEL 2 HV
R2	2100-3638	1	RESISTOR: VAR; 10K 20% 2.5W (INTENSITY)	28480	2100-3638
R3	2100-3464	1	RESISTOR: VAR DUAL 2K/2K (CHAN A POSITION)	28480	2100-3464
R4	2100-3385	1	RESISTOR: VAR 2K 20% (CHAN B POSITION)	28480	2100-3385
R5	0687-3311	1	RESISTOR 330 OHM 10% .5W CC TUBULAR	01121	EB3311
R6	0684-1221		RESISTOR 1.2K 10% .25W CC TUBULAR	01121	CB1221
R7	2100-3567	1	RESISTOR: VAR; 50K 10T (DELAY)	28480	2100-3567
R8	2100-0660	1	RESISTOR: VAR; 100K CCSW (TRIGGER HOLDOFF)	28480	2100-0660
R9	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
R10	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
R11	0757-0458		RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4 1/8 T0 5112 F
R12	2100-0657	1	RESISTOR: VAR; 100K CWSW (SWEEP VERNIER)	28480	2100-0657
R13	2100-3014	1	RESISTOR: VAR; 20K/20K (HORIZ POSITION)	28480	2100-3014
R14	2100-0680	1	RESISTOR: VAR; 50K DPST 5W (DELAY TRIG LEVEL)	28480	2100-0680
R15	2100-0661	1	RESISTOR: VAR; 50K 30% (MAIN TRIG LEVEL)	28480	2100-0661
R18	0687-8211	1	RESISTOR 820 OHM 10% .5W CC TUBULAR	01121	EB8211
R19	0687-3931	1	RESISTOR 39K 10% .5W CC TUBULAR	01121	EB3931
R20	2100-3387	1	RESISTOR: VAR; 5K DPST SW (SCALE ILLUM)	28480	2100-3387
R21	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 101 F
R22	0684-1811	1	RESISTOR 180 10% .25CC	01121	CB1811
R23	0757-0440		RESISTOR 7500 OHM 1% .125W F TUBULAR	28480	0757-0440
R24	0757-0459		RESISTOR 56.2K OHM 1% .125W F TUBULAR	28480	0757-0459
S1			(PART OF R20)		
S2	3101-0625	1	SWITCH: SWSL 2 SEC 2 POS (LINE VOLTAGE SELECT)	28480	3101-0625
S3	3101-1261	1	SWITCH: PUSHBUTTON (REF SET)	09353	PB121
S4	3101-1887	3	SWITCH: TOGGLE DPDT (DEC-INC COARSE)	28480	3101-1887
S5	3101-1887		SWITCH: TOGGLE DPDT (DEC-INC MED)	28480	3101-1887
S6	3101-1887		SWITCH: TOGGLE DPDT (DEC-INC FINE)	28480	3101-1887
S7	3101-0199	1	SWITCH: SL, DPDT (PROBE X1/X10)	79727	GF126-0012A
T1	9100-3410	1	TRANSFORMER, POWER	28480	9100-3410
U1	1826-0122		IC: LIN; VOLTAGE REGULATOR	07263	7805UC
V1	5083-4070	1	CRT, P31	28480	5083-4070
W1	8120-1521	1	CABLE: UNSHLD 3-COND 18 AWG	28480	8120-1521
W2	01720-61622	1	CABLE ASSY, SYNC	28480	01720-61622
W3	01720-61623	1	CABLE ASSY, HORIZONTAL INPUT	28480	01720-61623
W4	01720-61624	1	CABLE ASSY, HORIZONTAL OUTPUT	28480	01720-61624
W5	01720-61630	1	CABLE ASSY: CRT	28480	01720-61630
W6	01720-61605	1	CABLE ASSY, CRT NECK PINS	28480	01720-61605
W7	01720-61631	1	CABLE ASSY, H.V. OSCILLATOR	28480	01720-61631
W8	01722-61607		CABLE ASSY: INTERFACE FROM A21 TO A20P4	28480	01722-61607
W9	01722-61608		CABLE ASSY: DIGITAL (FROM A21P2 TO A20P5)	28480	01722-61608
XF1	1400-0084	1	FUSEHOLDER; EXTR POST; BAY CAP; 15A	28480	1400-0084
XV1	5040-7649	1	SOCKET, CRT (P/O W5)	28480	5040-7649
A1	01722-63402	1	ATTENUATOR ASSY, CHANNEL A	28480	01722-63402
A1A1	01722-66521	1	CHANNEL A ATTEN. ASSY	28480	01722-66521
A1A1Q1	5080-9691	1	TRANSISTOR MATCHED PAIR (NOT P/O A1A1) (ORDER SEPARATELY)	28480	5080-9691
A1A1Q2	1854-0636	9	TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A1A1Q3	1854-0632	2	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR-91
A1A1R1	0698-6433	4	RESISTOR 100 OHM 1% .25W F TUBULAR	28480	0698-6433
A1A1R2	0698-6433		RESISTOR 100 OHM 1% .25W F TUBULAR	28480	0698-6433
A1C1	0160-3451	82	CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A1R1	2100-0664	2	RESISTOR-VAR 5K 10% SPST SW	28480	2100-0664
A1R2	0698-3132	4	RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A2	01720-63404	1	ATTENUATOR ASSY, CHANNEL B	28480	01720-63404
A2A1	01720-66545	1	BOARD ASSY, CHANNEL B ATTENUATOR	28480	01720-66545
A2A1Q1			TRANSISTOR, P/O A1A1Q1		
A2A1Q2	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A2A1Q3	1854-0632		TRANSISTOR NPN SI PD=180MW FT=4GHZ	28480	1854-0632
A2A1R1	0698-6433		RESISTOR 100 OHM 1% .25W F TUBULAR	28480	0698-6433
A2A1R2	0698-6433		RESISTOR 100 OHM 1% .25W F TUBULAR	28480	0698-6433
A2C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A2R1	2100-3453	1	RESISTOR: VAR 2.5K 5K CC LIN	28480	2100-3453
A2R2	0698-3132		RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A3	01722-66517	1	VERTICAL PREAMPLIFIER ASSY	28480	01722-66517
A3A1	5081-3023	1	ASSY, SUBSTRATE (NOT SUPPLIED WITH A3, ORDER SEPARATELY)	28480	5081-3023
A3C1	0160-0174	1	CAPACITOR-FXD .47UF +80-20% 25WVDC	28480	0160-0174
A3C2	0160-3802		CAPACITOR-FXD 150PF +80-20% 100WVDC	28480	0160-3802

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C3	0160-3470		CAPACITOR-FXD .01UF +80-20% 50WVDC	28480	0160-3470
A3C4	0160-3470		CAPACITOR-FXD .01UF +80-20% 50WVDC	28480	0160-3470
A3C5	0121-0467	3	CAPACITOR-VAR TRMR; CER; 3-9PF	28480	0121-0467
A3C6	0140-0203	1	CAPACITOR-FXD 30PF +-5% 500WVDC	72136	DM15E300J0500WV
A3C7			NOT ASSIGNED		
A3C8	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A3C9	0140-0196	3	CAPACITOR-FXD 150PF +-5% 300WVDC	72136	DM15F151J0300WV1CR
A3C10	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC	72136	DM15F151J0300WV1CR
A3C11	0140-0190	2	CAPACITOR-FXD 39PF +-5% 300WVDC	72136	DM15E390J0300WV1CR
A3C12	0140-0190		CAPACITOR-FXD 39PF +-5% 300WVDC	72136	DM15E390J0300WV1CR
A3C13	0160-2209	2	CAPACITOR-FXD 360PF +-5% 300WVDC	28480	0160-2209
A3C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A3C15			... T ASSIGNED		
A3C16	0180-0230	11	CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A3C17	1080-0223		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A3C18	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A3C19	0180-0230		CAPACITOR-VXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A320	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A3C21	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A3C22	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20WVDC TA	56289	150D105X9020A2
A3C23	0160-3446	4	CAPACITOR-FXD 220PF +-10% 1000WVDC	28480	0160-3446
A3C24	0180-1746	10	CAPACITOR-FXD 15UF +-10% 20VDC TA-SOLID	56289	150D156X9020B2
A3C25	0180-0229	2	CAPACITOR-FXD 33UF +-10% 10VDC TA SOLID	56289	150D336X9010B2
A3C26	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA SOLID	56289	150D156X9020B2
A3C27	0160-3446		CAPACITOR-FXD 220PF +-10% 1000WVDC	28480	0160-3446
A3C28	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA SOLID	56289	150D156X9020B2
A3C29	0180-0229		CAPACITOR-FXD 33UF +-10% 10VDC TA SOLID	56289	150D336X9010B2
A3C30	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA SOLID	56289	150D156X9020B2
A3C31	0180-0291		CAPACITOR-FXD 1UF +-10% 35WVDC TA	56289	150D105X9035A2
A3C32	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A3CR1	5080-0442	1	DIODES, MATCHED	28480	5080-0442
A3CR2	1901-0179	2	DIODE, SWITCHING 15 V 50 MA DO-7	28480	1901-0179
A3CR3	1901-0179		DIODE, SWITCHING 15 V 50 MA DO-7	28480	1901-0179
A3L1	9100-2257	2	COIL:FXD MOLDED RF CHOKE; .82UH 10%	24226	10/820
A3L2	9100-2257		COIL:FXD MOLDED RF CHOKE; .82UH 10%	24226	10/820
A3L3	9140-0142	5	COIL:FXD MOLDED RF CHOKE; 2.2 UH 10%	24226	10/221
A3L4	9140-0142		COIL:FXD MOLDED RF CHOKE; 2.2 UH 10%	24226	10/221
A3L5	9140-0142		COIL:FXD MOLDED RF CHOKE; 2.2 UH 10%	24226	10/221
A3L6	9140-0142		COIL:FXD MOLDED RF CHOKE; 2.2 UH 10%	24226	10/221
A3L7	9140-0142		COIL:FXD MOLDED RF CHOKE; 2.2 UH 10%	24226	10/221
A3L8	9170-0029	9	CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A3L9	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A3L10	9170-0016	3	CORE, SHIELDING BEAD	02114	56-590-65A1/3B
A3L11	9170-0016		CORE, SHIELDING BEAD	02114	56-590-65A1/3B
A3Q1	1854-0724		TRANSISTER, (MATCHED PAIR WITH A3Q2)	28480	1854-0724
A3Q2			(MATCHED PAIR WITH A3Q1)		
A3Q3	1854-0345	2	TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A3Q4	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A3Q5	1853-0036	27	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A3Q6	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A3R1	2100-3252	4	RESISTOR, VAR, TRMR 5K OHM 10% C	32997	3389P-1-502
A3R2	0757-0419	6	RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A3R3	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A3R4	2100-3211	3	RESISTOR, VAR, TRMR 1K OHM 10% C	32997	3389P-1-102
A3R5	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MFC-1/8-T0-6191-F
A3R6	2100-3252		RESISTOR, VAR, TRMR 5K OHM 10% C	32997	3389P-1-502
A3R7	0684-1021	25	RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A3R8	0684-2211	12	RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A3R9	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A3R10	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MFC-1/8-T0-6191-F
A3R11	2100-3252		RESISTOR, VAR, TRMR 5K OHM 10% C	32997	3389P-1-502
A3R12	2100-3211		RESISTOR, VAR, TRMR 1K OHM 10% C	32997	3389P-1-102
A3R13	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A3R14	2100-3252		RESISTOR, VAR, TRMR 5K OHM 10% C	32997	3389P-1-502
A3R15	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A3R16	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A3R17	0757-0440		RESISTOR 7500 OHM 1% .125W F TUBULAR	28480	0757-0440
A3R18	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A3R19	0757-0447		RESISTOR 16.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-1622-F
A3R20	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A3R21	0698-3437	1	RESISTOR 133 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-133R-F
A3R22	0757-0820	2	RESISTOR 1.1K 1% .5W F TUBULAR	30983	M-7C1/2-T0-1101-F
A3R23	0698-7196	3	RESISTOR 21.5 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-21R5-G
A3R24	0698-7196		RESISTOR 21.5 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-21R5-G
A3R25	0698-7196		RESISTOR 21.5 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-21R5-G
A3R26	0684-5621	2	RESISTOR 5.6K 10% .25W CC TUBULAR	01121	CB5621
A3R27	0757-0410	5	RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A3R28	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A3R29	0757-0276	6	RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A3R30	0757-0276		RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A3R31	0757-0280	11	RESISTOR 1K 1% .125W F TUBULAR	28480	0757-0280
A3R32	0684-1811	3	RESISTOR 180 OHM 10% .25W CC TUBULAR	01121	CB1811
A3R33	0684-1811		RESISTOR 180 OHM 10% .25W CC TUBULAR	01121	CB1811
A3R34	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	28480	0757-0280

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
A3R35	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	28480	0757 0280
A3R36	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	28480	0757 0280
A3R37	0757 1094	4	RESISTOR 1.47K 1% .125W F TUBULAR	24546	C4 1/8 TO 1471 F
A3R38	0757 1094		RESISTOR 1.47K 1% .125W F TUBULAR	24546	C4 1/8 TO 1471 F
A3R39	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4 1/8 TO 1001 F
A3R40	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4 1/8 TO 1001 F
A3R41	0698 5674	2	RESISTOR 5.62K 1% .125W F TUBULAR	19701	MF4C1/8 T9 5621 F
A3R42	0698 3433	2	RESISTOR 28.7 OHM 1% .125W F TUBULAR	03888	MPE55 1/8 TO 28R7 F
A3R43	0698 3433		RESISTOR 28.7 OHM 1% .125W F TUBULAR	03888	PME55 1/8 TO 28R7 F
A3R44	0757 0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4 1/8 TO 681R F
A3R45	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4 1/8 TO 1001 F
A3R46	0684 0271	6	RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A3R47	0684 0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A3R48	0684 0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A3R49	0684 0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A3R50	0761 0025	5	RESISTOR 120 OHM 5% 1W MO TUBULAR	24546	FP32 1 T00 121 J
A3R51	0761 0025		RESISTOR 120 OHM 5% 1W MO TUBULAR	24546	FP32 1 T00 121 J
A3R52	2100 3094	2	RESISTOR, VAR, TRMR 100K OHM 10% C	3299	3006P 1 104
A3R53	0757 0462	2	RESISTOR 75K 1% .125W F TUBULAR	24546	C4 1/8 TO 7502 F
A3R54	0757 0394	8	RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 TO 51R1 F
A3R55	2100 3253	4	RESISTOR, VAR, TRMR 50K OHM 10% C	32997	3389P 1 503
A3R56	0698 4525	2	RESISTOR 187K 1% .125W F TUBULAR	24546	C4 1/8 TO 1873 F
A3R57	0698 3263	2	RESISTOR 500K 1% .125W F TUBULAR	19701	MF5C1/8 TO 5003 F
A3R58	0757 0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 TO 51R1 F
A3R59	0698 6426	2	RESISTOR 213K 1% .125W F TUBULAR	24546	C4, T O
A3R60	0698 6439	2	RESISTOR 10M 5% .125W F TUBULAR	28480	0698 6439
A3R61	0684 5601	8	RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A3R62	0757 0431	4	RESISTOR 2.43K 1% .125 W F TUBULAR	24546	C4 1/8 TO 2431 F
A3R63	0757 0274	7	RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4 1/8 TO 1213 F
A3R64	0757 0431		RESISTOR 2.43K 1% .125W F TUBULAR	24546	C4 1/8 TO 2431 F
A3R65	0757 0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4 1/8 TO 1213 F
A3R66	2100 3094		RESISTOR, VAR TRMR 100K OHM 10% C	32997	3006P 1 104
A3R67	0757 0462		RESISTOR 75K 1% .125W F TUBULAR	24546	C4 1/8 TO 7502 F
A3R68	0757 0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 TO 51R1 F
A3R69	2100 3253		RESISTOR, VAR, TRMR 50K OHM 10% C	32997	3389P 1 503
A3R70	0698 4525		RESISTOR 187K 1% .125W F TUBULAR	24546	C4 1/8 TO 1873 F
A3R71	0698 3263		RESISTOR 500K 1% .125W F TUBULAR	19701	MF5C1/8 TO 5003 F
A3R72	0757 0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 TO 51R1 F
A3R73	0698 6426		RESISTOR 213K 1% .125W F TUBULAR	24546	C4, T O
A3R74	0698 6439		RESISTOR 10M 5% .125W F TUBULAR	28480	0698 6439
A3R75	0698 5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A3R76	0757 0431		RESISTOR 2.43K 1% .125W F TUBULAR	24546	C4 1/8 TO 2431 F
A3R77	0757 0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4 1/8 TO 1213 F
A3R78	0757 0429		RESISTOR 1.82K 1% .125W F TUBULAR	24546	C4 1/8 TO 1821 F
A3R79	0757 0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4 1/8 TO 1213 F
A3R80	0698 5674	1	RESISTOR 5.62K 1% .125W F TUBULAR	19701	MF4C1/8 T9 5621 F
A3R81	0757 0479	1	RESISTOR 392K OHM 1% .125W F TUBULAR	30983	MC4C1/8 TO 3923 F
A3R82	2100 3061	1	RESISTOR, VAR, TRMR 500K 10% C SIDE ADJ	32997	3006P 1 504
A3R83	0698 3381	1	RESISTOR:FXD 150 OHM 5% .125W CC	01121	BB1515
A3U1	1826 0187	2	IC, LINEAR	28480	1826 0187
A3U2	1826 0187		IC LINEAR	28480	1826 0187
A3VR1	1902 0049	2	DIODE ZNR 6.10V 5% DO 7 PD .4W	28480	1902 0049
A3VR2	1902 0049		DIODE ZNR 6.19V 5% DO 7 PD .4W	28480	1902 0049
A3VR3	1902 3082	2	DIODE ZNR 4.64V 5% DO 7 PD .4W TC	04713	SZ 10939 86
A3A1	5081 3023	1	ASSY, SUBSTRATE (NOT SUPPLIED WITH A3, ORDER SEPARATELY)	28480	5081 3023
A4	1720 61626	1	CABLE ASSY, DELAY LINE	28480	01720 61626
A5	01720 66538	1	BOARD ASSY, VERTICAL OUTPUT	28480	01720 66538
A5C1	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C2	0160 3567	7	CAPACITOR FXD 10PF +-5% 100WVDC	28480	0160 3567
A5C3	0160 2264	2	CAPACITOR FXD 20PF +-5% 500WVDC	28480	0160 2264
A5C4	0121 0467		CAPACITOR VAR, TRMR CER 3 9PF	28480	0121 0467
A5C5	0160 0160	1	CAPACITOR FXD .0082UF +-10% 200WVDC	56289	292P82292
A5C6	0121 0046	3	CAPACITOR:VAR, TRMR CER 9/35PF	73899	DV11PS35D
A5C7	0121 0466	1	CAPACITOR CAPACITOR:VAR, TRMR CER 1 3PF	28480	0121 0466
A5C8	0140 0193	1	CAPACITOR FXD 82PF +-5% 300WVDC	72136	DM15E820J0300WV1CR
A5C9	0160 0297	1	CAPACITOR FXD .0012UF +-10% 200WVDC	56289	292P12292
A5C10	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C11	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C12	0160 3443	3	CAPACITOR FXD 1UF +80 -20% 50WVDC	28480	0160 3443
A5C13	0121 0467		CAPACITOR:VAR, TRMR CER 3 9PF	28480	0121 0467
A5C14	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C15	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C16	0180 0230		CAPACITOR FXD 1UF +-20% 50VDC TA SOLID	56289	150D106X0050A2
A5C17	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C18	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A5C19	0180 1735	1	CAPACITOR FXD 22UF +-10% 35VDC TA	56289	150D224X9035A2

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
A5C20	0160-2198		CAPACITOR FXD 20PF +-5% 300WVDC	72136	RDM15C200J3C
A5CR1	0122-0077	2	DIO VVC 6.8PF C1/C10=1900000 MIN	04713	MV2201
A5CR2	0122-0077		DIO VVC 6.8PF C1/C10=1900000 MIN	04713	MV2201
A5CR3	1901-0047		DIODE:SWITCHING; 20V MAX VRM 75MA	28480	1901 0047
A5CR4	1901 0047		DIODE:SWITCHING; 20V MAX VRM 75MA	28480	1901 0047
A5L1	9140-0098	2	COIL:FXD MOLDED RF CHOKE 2.2UH 10%	24226	15/221
A5L2	9140-0098		COIL:FXD MOLDED RF CHOKE 2.2UH 10%	24226	15/221
A5L3	9170 0029		CORE, MAG, SHIELDING BEAD .138 OD .047	02114	56-590 65A/4A
A5R1	0757 0388	1	RESISTOR 30.1 OHM 1% .125W F TUBULAR	24546	C4 1/8-T0-30R1 F
A5R2	0684-1001	24	RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A5R3	0757-0276		RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8 T0-6192 F
A5R4	0757-0276		RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4 1/8-T0-6192-F
A5R5	0757-0424	1	RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8 T0-1101-F
A5R6	0698-7203	3	RESISTOR 42.2 OHM 2% .05W F TUBULAR	24546	C3 1/8-T00-42R2 G
A5R7	0698-7203		RESISTOR 42.2 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-42R2 G
A5R8	0698-3441	2	RESISTOR 215 OHM 1% .125W F TUBULAR	16299	C4-1/8 T0-215R F
A5R9	0698-0084	3	RESISTOR:FXD 2.15K 1% .125W TUBULAR	16299	C4-1/8 T0-2151 F
A5R10	0757-0278	2	RESISTOR 1.78K 1% .125W F TUBULAR	24546	C4-1/8 T0 1781-F
A5R11	2100-0567	1	RESISTOR, VAR TRMR 2K OHM 10% C	73138	72PR2K
A5R12	0698-3132		RESISTOR 261 OHM1% .125W F TUBULAR	16299	C4-1/8 T0-2610-F
A5R13	0698-3150	1	RESISTOR:FXD 2.37K 1% .125W F TUBULAR	16299	C4 1/8-T0 2371 F
A3R14	0757-0429	12	RESISTOR:FXD 1.82K 1% .125W F TUBULAR	24546	C4 1/8 T0-1821 F
A5R15	0698-7238	1	RESISTOR 1K 2% .125W F TUBULAR	24546	C3-1/8-T0-1001 G
A5R16	0757-0455	2	RESISTOR 36.5K 1% .125W F TUBULAR	24546	C4 1/8-T0-3652-F
A5R17	0757 0437	4	RESISTOR 4.75K 1% .125W F TUBULAR	24546	C4-1/8-T0 4751-F
A5R18	0757-0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4-1/8 T0-1213 F
A5R19	0757 0818	1	RESISTOR 825 OHM 1% .5W F TUBULAR	30983	MF7C1/2 T0 825R-F
A5R20	0757-0798	1	RESISTOR 110 OHM 1% .5W F TUBULAR	30983	MF7C-1/2 T0-111-F
A5R21	0757-0408	2	RESISTOR 243 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 243 F
A5R22	2100-2061		RESISTOR,VAR TRMR 200 OHM 10% C	73138	62 204 1
A5R23	2100-2060	1	RESISTOR, VAR, TRMR 50 OHM 20% C	32997	3329H-1-50R
A5R24	0757-0398	6	RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4-1/8 T0 75R0-F
A5R25	0757-0398		RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 75R0-F
A5R26	0698-3394	1	RESISTOR 31.6 OHM 1% .5W F TUBULAR	19701	MF7C1/2-T0 31R6 F
A5R27	0757-0437		RESISTOR 4.75K 1% .125W F TUBULAR	24546	C4 1/8 T0 4751 F
A5R28	0761 0025		RESISTOR 120 OHM 5% 1W MO TUBULAR	24546	FP32 1 T00 121 J
A5R29	0761 0025		RESISTOR 120 OHM 5% 1W MO TUBULAR	24546	EP32 1 T00 121 J
A5R30	0761-0025		RESISTOR 120 OHM 5% 1W MO TUBULAR	24546	FP32-1 T00-121 J
A5RT1	0837-0113	1	THERMISTOR, NEG TC, 100K DISC	0041N	4D101
A5U1	5081-3022	1	ASSY, SUBSTRATE (NOT SUPPLIED W/A5, ORDER SEPARATELY)	28480	5081 3022
A5U2	5081-3024	1	(NOT SUPPLIED W/A5, ORDER SEPARATELY)	28480	5081 3024
A5VR1	1902-0025	1	DIODE-ZNR 10V 5% D0-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A5VR2	1902-3059		DIODE-ZNR 3.83V 5% D0-7 PD=.4W TC=.051%	15818	CD35586
A5XU1	1200-0473	3	SOCKET, ELEC, IC 16-CONT DIP SLDR TERM	28480	1200-0473
A5A1	5081-3021		ASSY, SUBSTRATE (NOT SUPPLIED WITH A5, ORDER SEPARATELY)	28480	5081-3021
A6	01720-66534	1	BOARD ASSY, INT. TRIGGER SWITCH	28480	01720-66534
A6CR1	1901 0040	54	DIODE-SWITCHING 2NS 30V 50MA	28480	1901 0040
A6J1	1251-0628	1	CONNECTOR, 10-CONT, FEM POST TYPE	27264	09 52 3103
A6J2	1251-3472	2	CONNECTOR, 8-CONT, FEM POST TYPE	27264	09-52 3081
A6R1	0684-2731	2	RESISTOR 27K 10% .25W CC TUBULAR	01121	CB2731
A6R2	0684-2731		RESISTOR 27K 10% .25W CC TUBULAR	01121	CB2731
A6S1	3101-0658	1	SWITCH, PB 4-STA 4PDT	28480	3101 0658
A7	01720-66535	1	BOARD ASSY, VERTICAL DISPLAY SWITCH	28480	01720-66535
A7C1	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A7C2	0180-0230		CAPACITOR-FXD 1UF +-20% 50VDC TA SOLID	56289	150D105X0050A2
A7C3	0160-2209		CAPACITOR-FXD 360PF +-5% 300WVDC	28480	0160-2209
A7C4	0160-3470		CAPACITOR FXD .01UF +80--20% 50WVDC	28480	0160 3470
A7C5	0160-2204		CAPACITOR FXD 100PF +-5% 300WVDC	28480	0160-2204
A7CR1	1901 0040		DIODE SWITCHING 2 NS 30V 50MA	28480	1901 0040
A7CR2	1901-0040		DIODE SWITCHING 2 NS 30V 50MA	28480	1901 0040
A7J1	1251-3472		CONNECTOR, 8-CONT, FEM POST TYPE	27264	09 52 3081
A7P1	1251-0629	1	CONNECTOR, 10-CONT, MALE POST TYPE	27264	09-64 1103
A7Q1	1854-0071	8	TRANSISTOR NPN SI PD=300MW FT=20MHZ	28480	1854 0071
A7Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=20MHZ	28480	1854 0071
A7R1	0698-3150	1	RESISTOR 2.3K 1% .125W F TUBULAR	16299	C4-1/8 T0-2371 F
A7R2	0757-0441	1	RESISTOR 8.25K 1% .125W F TUBULAR	24546	C4-1/8 T0-8251 F
A7R3	0757-0273	2	RESISTOR 3.01K 1% .125W F TUBULAR	24546	C4 1/8 T0-3011 F
A7R4	0757-0407	3	RESISTOR 200 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 210 F
A7R5	0757-0398		RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 75R0 F
A7R6	0757-0398		RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 75R0 F
A7R7	0757-0809	1	RESISTOR 332 OHM 1% .5W F TUBULAR	30983	MF 7C1/2 T0 332R F
A7R8	0757-0740	2	RESISTOR 2.2K 1% .25W F TUBULAR	24546	C5 1/4 T0 2211 F
A7R9	0757-0740		RESISTOR 2.2K 1% .25W F TUBULAR	24546	C5 1/4 T0 2211 F
A7R10	0683-1825	3	RESISTOR 1.8K 5% .25W CC TUBULAR	01121	CB1825
A7R11	0684-2211		RESISTOR-FXD 220 OHM 10% .25W CC	01121	CB2211

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
A7R12	0684-2211		RESISTOR-FXD 220 OHM 10% .25 W CC	01121	CB2211
A7S1	3101-0661	1	SWITCH:PB 4-STA	28480	3101-0661
A7U1	1820-0102	1	IC:DGTL;FLIP-FLOP	04713	MC1013P
A7U2	1820-0142	1	IC:DGTL;GATE	04713	MC1004P
A7U3	1821-0001	6	IC:LIN;TRANSISTOR ARRAY	02735	CA3046
A7XU1 THRU A7XU3	1200-0474	3	SOCKET, ELECT, IC 14-CONT DIP SLDR TERM	28480	1200-0474
A8	01722-66519	1	BOARD ASSY, HORIZONTAL SWEEP	28480	01722-66519
A8C1	0160-2146	2	CAPACITOR-FXD .02 UF +80–20% 100WVDC	28480	0160-2146
A8C2	0160-3446		CAPACITOR-FXD 220 PF +–10% 1000WVDC	28480	0160-3446
A8C3 THRU A8C5	0160-3451		CAPACITOR-FXD .01 UF +80–20% 100WVDC	28480	0160-3451
A8C7	0160-2246	2	CAPACITOR-FXD 3.6 PF +–.25 PF 500 WVDC	28480	0160-2246
A8C8	0160-3318	2	CAPACITOR-FXD .047 UF +–10% 100 WVDC CER	61637	K06SK473K
A8C9	0160-3451		CAPACITOR-FXD .01 UF +80–20% 100WVDC	28480	0160-3451
A8C10	0160-3569	2	CAPACITOR-FXD 27 PF +–5% 100WVDC	28480	0160-3569
A8C11	0160-3318	6	CAPACITOR-FXD .047 UF +–10% 100WVDC CER	61637	K06SK473K
A8C12	0160-3451		CAPACITOR-FXD .01 UF +80–20% 100WVDC	28480	0160-3451
A8C13	0160-2265	6	CAPACITOR-FXD 22 PF +–5% 500WVDC	28480	0160-2265
A8C14	0160-3451		CAPACITOR-FXD .01 UF +80–20% 100WVDC	28480	0160-3451
A8C15	0160-0168	2	CAPACITOR-FXD .1 UF +–10% 200WVDC	56289	292P10492
A8C16	0180-0197	26	CAPACITOR-FXD 2.2 UF +–10% 20VDC TA	56289	150D225X9020A2
A8C17	0160-3451		CAPACITOR-FXD .01 UF +80–20% 100WVDC	28480	0160-3451
A8C18	0160-2265		CAPACITOR-FXD 22PF +–5% 500WVDC	28480	0160-2265
A8C19	0160-3446		CAPACITOR-FXD 220PF +–10% 1000WVDC	28480	0160-3446
A8C20	0160-2146		CAPACITOR-FXD .02UF +80–20% 100WVDC	28480	0160-2146
A8C21	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C22	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C23	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C24	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C25	0160-2246		CAPACITOR-FXD 3.6PF +–.25PF 500WVDC	28480	0160-2246
A8C26	0160-3318		CAPACITOR-FXD .047UF +–10% 100WVDC CER	28480	0160-3318
A8C27	0160-3451	3	CAPACITOR:FXD .01UF +80–20%	28480	0160-3451
A8C28	0160-3569		CAPACITOR-FXD 27PF +–5% 100WVDC	28480	0160-3569
A8C29	0160-3318		CAPACITOR-FXD .047UF +–10% 100WVDC CER	28480	0160-3318
A8C30	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C31	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C32	0150-0116		CAPACITOR-FXD 47PF +–5% 500WVDC	28480	0150-0116
A8C33	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C34	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C35	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C36	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C37	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C38	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C39	0160-2265		CAPACITOR-FXD 22PF +–5% 500WVDC	28480	0160-2265
A8C40	0160-2265		CAPACITOR-FXD 22PF +–5% 500WVDC	28480	0160-2265
A8C41	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C42	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C43	0180-0197		CAPACITOR-FXD 2.2UF +–10% 20VDC TA	56289	150D225X9020A2
A8C44	0180-0197		CAPACITOR-FXD 2.2UF +–10% 20VDC TA	56289	150D225X9020A2
A8C45	0121-0046		CAPACITOR, VAR, TRMR CER 9/35PF	73899	DV11PS35D
A8C46	0160-2257	1	CAPACITOR-FXD 10PF +–5% 500WVDC	28480	0160-2257
A8C47	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C48	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C49	0180-0197		CAPACITOR-FXD 2.2UF +–10% 20VDC TA	56289	150D2225X9020A2
A8C50	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C51	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C52	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C53	0160-3451		CAPACITOR-FXD .01UF +80–20% 100WVDC	28480	0160-3451
A8C54	0150-0115	1	CAPACITOR-FXD 27PF +–10% 500WVDC	28480	0150-0115
A8C55			DELETED		
A8C56	0160-3451		CAPACITOR-FXD 0.01UF +80–20% 100WVDC CER	56289	C023B101F103Z
A8C57	0160-3451		CAPACITOR-FXD 0.01UF +80–20% 100WVDC CER	56289	C023B101F1032S25 CDH
A8C58	0160-2202		CAPACITOR-FXD 75PF +–5% 300WVDC MICA	28480	0160-2202
A8CR1	1901-0376	2	DIODE-GEN PRP 35V 50MA	28480	1901-0376
A8CR2	1901-0047	10	DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR3	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR4	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR5	1910-0016	2	DIODE-SWITCHING 1US 60V 60MA	28480	1910-0016
A8CR6	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR7	1901-0376		DIODE-GEN PRP 35V 50MA	28480	1901-0376
A8CR8	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR9	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR10	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR11	1910-0016		DIODE-SWITCHING 1US 60V 60MA	28480	1901-0016
A8CR12	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR13	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR14	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8J1	1250-0083	1	CONNECTOR COAX, BNC 50 OHM FEMALE	24931	28JR-130-1
A8L1	01921-61303	2	COIL, BEAD	28480	01921-61303
A8L2	9170-0029		CORE, MAG, SHIELDING BEAD .138 OD .047	02114	56-590-65A2/4A
A8L3	9140-0115	3	COIL, FXD, MOLDED RF CHOKE 22UH 10%	82142	22-4422-8K
A8L4	01921-61303		COIL, BEAD	28480	01921-61303
A8L5	9170-0029		CORE, MAG, SHIELDING BEAL .138 OD .047	02114	56-590-65A2/4A
A8L6	9140-0115		COIL, FXD, MOLDED RF CHOKE, 22UH 10%	82142	22-4422-8K
A8L7	9140-0138	1	COIL, FXD, MOLDED RF CHOKE 180UH 5%	24226	15/183
A8L8	9100-2256	1	COIL, FXD, MOLDED RF CHOKE .56UF 1[illegible]	24226	10/560
A8P1	1251-3319	3	CONNECTOR, 10-CONT, MALE POST TYPE	27264	09-64-1101(A2402-10A)
A8P2	1251-3072	2	CONNECTOR, 12-CONT, MALE POST TYPE	27264	09-56-1121
A8P3	1251-3319		CONNECTOR, 10 CONT, MALE POST TYPE	27264	09-64-1101(A2402-10A)
A8P4	1251-3197	1	CONNECTOR, 12-CONT, MALE POST TYPE	27264	09-60-1121(2403-12A)
A8P5	1251-3276	1	CONNECTOR, 6-CONT, MALE POST TYPE	27264	09-60-1061(A2403-6A)
A8Q1	1855-0081	4	TRANSISTOR, J FET N CHAN, D-MODE SI	01295	2N5245
A8Q2	1854-0546	6	TRANSISTOR, NPN SI TO-72 PD=200MW	28480	1854 0546
A8Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854 0071
A8Q4	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q5	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q7	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0036
A8Q8	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q9	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0036
A8Q10	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0036
A8Q11	1854-0691	5	TRANSISTOR NPN SI	28480	1854 0691
A8Q12	1855-0081		TRANSISTOR, J FET N-CHAN, D-MODE SI	01295	2N5245
A8Q13	1854-0546		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854 0546
A8Q14	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q15	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0036
A8Q16	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q17	1853-0015	5	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A8Q18	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q19	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q20	1854-0092	8	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q21	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q22	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q23	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q24	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q25	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q26	1853-0015		TRANSISTOR PNP SI CHIP PD=200MW	28480	1853 0015
A8Q27	1853-0015		TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A8Q28	1853-0015		TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A8Q29	1853-0015		TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A8Q30	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854 0092
A8Q31	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q32	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q33	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A8Q34	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8R1	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R2	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A8R3	0757-0488	4	RESISTOR 909K 1% .125W F TUBULAR	19701	MFF-1/8,T-1
A8R4	0757-0465	4	RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A8R5	0757-0488		RESISTOR 909K 1% .125W F TUBULAR	19701	MFF-1/8,T-1
A8R6	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A8R7	0684-1061	3	RESISTOR 10M 10% .25W CC TUBULAR	01121	CB1061
A8R8	0684-3321	11	RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R9	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R10	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151 F
A8R11	0757-0487	2	RESISTOR 825K 1% .125W F TUBULAR	28480	0757-0487
A8R12	0757-0464		RESISTOR 90.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-9092 F
A8R13	0757-0488		RESISTOR 909K 1% .125W F TUBULAR	28480	0757-0488
A8R14	0684-2221	19	RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R15	0757-0485		RESISTOR 681K 1% .125W F TUBULAR	28480	0757-0485
A8R16	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R17	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R18	0684-3901		RESISTOR 39 OHM 10% .25W CC	01121	CB3901
A8R19	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R20	0684-2721	2	RESISTOR 2.7K 10% .25W CC TUBULAR	01121	CB2721
A8R21	0684-1011	23	RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R22	0683-2705	2	RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	CB2705
A8R23	0757-0734	2	RESISTOR 1.21K 1% .25W F TUBULAR	24546	C5-1/4-T0-1211-F
A8R24	0757-0416	8	RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A8R25	0698-3431	4	RESISTOR 23.7 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-23R7-F
A8R26	0698-3431		RESISTOR 23.7 OHM 1% .125W F TUBULAR	03888	C4-1/8-T0-1821-F
A8R27	0757-0429	4	RESISTOR 1.82K 1% .125W F TUBULAR	24546	C4-1/8-T0-1821-F
A8R28	0757-0404	1	RESISTOR 130 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-131-F
A8R29	0684-0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1

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
A8R30	0684-1011		RESISTOR-FXD 100 OHM 10% .25W CC	01121	CB1011
A8R31	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R32	0698-3153	4	RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A8R33	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A8R34	0757-0409	4	RESISTOR 274 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-274R-F
A8R35	0684-3901	9	RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R36	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R37	0757-0427	6	RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-1501-F
A8R38	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R39	0684-3311	15	RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A8R40	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R41	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A8R42	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A8R43	0757-0409		RESISTOR 274 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-274R-F
A8R44	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R45	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A8R46	0757-0281	1	RESISTOR-FXD 2.74K 1% .125W F TUBULAR	24546	C4-1/8-T0-2741-F
A8R47	2100-0554	4	RESISTOR:VAR, TRMR 500 OHM 10% C	73138	72PR500K
A8R48	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R49	0757-0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4-1/8-T0-1213-F
A8R50	0757-0421	4	RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A8R51	0757-0280		RESISTOR 1K 1% .125W F	24546	C4-1/8-T0-1001-F
A8R52	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R53	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A8R54	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R55	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R56	0757-0419		RESISTOR-FXD 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R57	0684-1031	2	RESISTOR 10K 10% .25W C	01121	CB1031
A8R58	0690-0085	3	RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A8R59	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R61	0757-0488		RESISTOR 909K 1% .125W F TUBULAR	19701	MFF-1/8-T-1
A8R62	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A8R63	0757-0464		RESISTOR 90.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-9092-F
A8R64	0757-0488		RESISTOR 909K 1% .125W F TUBULAR	19701	MFF-1/8-T-1
A8R65	0684-1061		RESISTOR 10M 10% .25W CC TUBULAR	01121	CB1061
A8R66	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A8R67	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R68	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R69	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A8R70	0757-0487		RESISTOR 825K 1% .125W F TUBULAR	28480	0757-0487
A8R71	0757-0488		RESISTOR 909K 1% .125W F TUBULAR	28480	0757-0488
A8R72	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R73	0757-0485		RESISTOR 681K 1% .125W F TUBULAR	28480	0757-0485
A8R74	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R75	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R76	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R77	0683-2705		RESISTOR 27 OHM 5% .25W CC TUBULAR	01121	CB2705
A8R78	0684-2721		RESISTOR 2.7K 10% .25W CC TUBULAR	01121	CB2721
A8R79	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R80	0757-0734		RESISTOR 1.21K 1% .25W F TUBULAR	24546	C5-1/4-T0-1211-F
A8R81	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A8R82	0698-3151		RESISTOR-FXD 2.87K 1% .125W F TUBULAR	16299	C4-1/8-T0-2871-F
A8R83	0698-3431		RESISTOR 23.7 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-23R7-F
A8R84	0698-3431		RESISTOR 23.7 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-23R7-F
A8R85	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R86	0684-0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A8R87	0757-0409		RESISTOR 274 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-274R-F
A8R88	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R89	2100-0554		RESISTOR:VAR, TRMR 500 OHM 10% C	73138	72PR500K
A8R90	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R91	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A8R92	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R93	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R94	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A8R95	0757-0834	2	RESISTOR-FXD 5.62K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-5621-F
A8R96	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R97	0757-0417	3	RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A8R98	0698-0084	1	RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A8R99	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R100	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R101	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A8R102	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R103	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A8R104	0757-0419		RESISTOR-FXD 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R105	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R106	0757-0428	4	RESISTOR 1.62K 1% .125W F TUBULAR	24546	C4-1/8-T0-1621-F
A8R107	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R108	0698-6612	3	RESISTOR 2K .1% .125W F TUBULAR	19701	MF4C-1/8-T2-2001-B
A8R109	0698-6612		RESISTOR 2K .1% .125W F TUBULAR	19701	MF4C-1/8-T2-2001-B
A8R110	0698-3441		RESISTOR 215 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-215R-F

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R111	0757-0417		RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A8R112	0757-0420	1	RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A8R113	0757-0428		RESISTOR 1.62K 1% .125W F TUBULAR	24546	C4-1/8-T0-1621-F
A8R114	0698-7401	1	RESISTOR 1.71K .1% .125W F TUBULAR	30983	MF4C-1/8-T2-1711-B
A8R115	0698-6612		RESISTOR 2K .1% .125W F TUBULAR	19701	MF4C-1/8-T2-2001-B
A8R116	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R117	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R118	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R119	0698-3136	2	RESISTOR 17.8K 1% .125W F TUBULAR	16299	C4-1/8-T0-1782-F
A8R120	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A8R121	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R122	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R123	0698-3445	1	RESISTOR 348 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-348R-F
A8R124	0757-0405	1	RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-162R-F
A8R125	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A8R126	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A8R127	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R128	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A8R129	0757-0278		RESISTOR 1.78K 1% .125W F TUBULAR	24546	C4-1/8-T0-1781-F
A8R130	0757-0422	1	RESISTOR 909 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-909R-F
A8R131	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A8R132	0757-0447		RESISTOR 16.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-1622-F
A8R133	2100-0554		RESISTOR:VAR, TRMR 500 OHM 10% C	73138	72PR500K
A8R134	0698-3439	2	RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-178R-F
A8R135	0757-0407		RESISTOR 200 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-201-F
A8R136	0757-0401	6	RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R137	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A8R138	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A8R139	0757-0455		RESISTOR 36.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-3652-F
A8R140	0698-0085	3	RESISTOR-FXD 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A8R141	0757-0435	5	RESISTOR 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A8R142	0757-0436	4	RESISTOR 4.32K 1% .125W F TUBULAR	24546	C4-1/8-T0-4321-F
A8R143	0757-0440	1	RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R144	0757-0451	5	RESISTOR 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A8R145	0757-0451		RESISTOR 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A8R146	2100-0568	1	RESISTOR:VAR TRMR 100 OHM 10% C	73138	72PR100K
A8R147	0757-0284	5	RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A8R148	2100-3211		RESISTOR:VAR, TRMR 1K OHM 10% C	32997	3389P-1-102
A8R149	0757-0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-1501-F
A8R150	0757-0451		RESISTOR 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A8R151	0757-0451		RESISTOR 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A8R152	0757-0124	2	RESISTOR 39.2K 1% .125W F TUBULAR	24546	C5-1/4-T0-3922-F
A8R153	2100-3253		RESISTOR:VAR, TRMR 50K OHM 10% C	32997	3389P-1-503
A8R154	0757-0124		RESISTOR 39.2K 1% .125W F TUBULAR	24546	C5-1/4-T0-3922-F
A8R155	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A8R156	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A8R157	0757-0398		RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A8R158	0757-0398		RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A8R159	0757-0417		RESISTOR-FXD 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A8R160	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R161	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R162	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A8R163	0684-1221	4	RESISTOR 1.2K 10% .25W CC TUBULAR	01121	CB1221
A8R164	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-178R-F
A8R165	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A8R166	0757-0416		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A8R167	0757-0282		RESISTOR-FXD 221 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-2210-F
A8R168	0757-0274		RESISTOR-FXD 1.21K 1% .125W F TUBULAR	24546	C4-1/8-T0-1211-F
A8R169	0757-0398		RESISTOR-FXD 75 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A8R170	0757-0480		RESISTOR 432K 1% .125W F TUBULAR	28480	0757-0480
A8R171	0757-0480		RESISTOR 432K 1% .125W F TUBULAR	28480	0757-0480
A8R172	0684-1021		RESISTOR-FXD 1K 10% .25W CC TUBULAR	01121	CB1021
A8R173	0684-1021		RESISTOR-FXD 1K 10% .25W CC TUBULAR	01121	CB1021
A8R174	0757-0280		RESISTOR-FXD 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R175	0757-0283		RESISTOR-FXD 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R176	0757-0280		RESISTOR-FXD 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R177	0757-0283		RESISTOR-FXD 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A8R178	0684-1051		RESISTOR 1M OHM 10% .25W CC TUBULAR	01121	CB1051
A8R179	0684-1011		RESISTOR 100 OHM 5% .25W CC TUBULAR	01121	CB1011
A8S1	3101-0659	1	SWITCH-PB 16-STA	28480	3101-0659
A8U1	1826-0086	4	IC-LIN, OPERATIONAL AMPLIFIER	07263	776HC
A8U2	5081-3019	2	ASSY:SUBSTRATE (NOT P/O A8 ORDER SEPARATELY)	28480	5081-3019
A8U3	1821-0001		IC:LIN, TRANSISTOR ARRAY	02735	CA3046
A8U4	1826-0086		IC:LIN, OPERATIONAL AMPLIFIER	07263	776HC
A8U5	5081-3019		ASSY:SUBSTRATE (NOT SUPPLIED W/A8, ORDER SEPARATELY)	28480	5081-3019
A8U6	1821-0001		IC:LIN, TRANSISTOR ARRAY	02735	CA3046
A8U7	1821-0001		IC:LIN, TRANSISTOR ARRAY	02735	CA3046
A8VR1	1902-3048	4	DIODE-ZNR 3.48V 5% D0-7 PD=.4W	04713	SZ10939-50
A8VR2	1902-3048		DIODE-ZNR 3.48V 5% D0-7 PD=.4W	04713	SZ10939-50
A8VR3	1902-3048		DIODE-ZNR 3.48V 5% D0-7 PD=.4W	04713	SZ10939-50

See introduction to this section for ordering information

PERFORMANCE CHECK RECORD
MODEL 1722A

Instrument Serial Number _____ Date _____

Check	Specification	Measured CH A	Measured CH B
DEFLECTION FACTOR			
.01 VOLTS/DIV	5 div ±2%		
.02 VOLTS/DIV	5 div ±2%		
.05 VOLTS/DIV	6 div ±2%		
.1 VOLTS/DIV	5 div ±2%		
.2 VOLTS/DIV	5 div ±2%		
.5 VOLTS/DIV	6 div ±2%		
1 VOLTS/DIV	5 div ±2%		
2 VOLTS/DIV	5 div ±2%		
5 VOLTS/DIV	6 div ±2%		
CALIBRATOR			
Accuracy	3 V ±1%		
Frequency	≈1 kHz		
DIGITAL VOLTMETER ACCURACY			
DC Volts			
050.0 —3	±.75		
100.0 —3	±1.5		
200.0 —3	±3.5		
0.300 —0	±.0065		
1.000 —0	±.015		
2.000 —0	±.035		
05.00 —0	±.075		
10.00 —0	±.15		
20.00 —0	±.35		
CHAN A POSN —06.00 —0	±.11		
Z-AXIS BLANKING			
CRT blanked	+8 V input		
BANDWIDTH			
Channel A bandwidth	>4.2 div		
Channel B bandwidth	>4.2 div		
TRIGGERING			
Main Internal Triggering (100 MHz)	(✓)		
Main Internal Triggering (300 MHz)	(✓)		
Main External Triggering (100 MHz)	(✓)		
Main External Triggering (300 MHz)	(✓)		
Delayed Internal Triggering (300 MHz)	(✓)		
Delayed External Triggering (300 MHz)	(✓)		

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8VR4	1902-3048		DIODE ZNR 3.48V 5% DO-7 PD=.4W	04713	SZ10939-50
A8VR5	1902-3104	1	DIODE ZNR 5.62V 5% DO-7 PD=.4W	04713	SZ10939-110
A8VR6	1902-3149	4	DIODE ZNR 9.09V 5% 0.4W MAX	04713	SZ10939-170
A8W1	01720-61620	1	CABLE ASSY, COAX	28480	01720-61620
A8XA9	01722-27601	3	CONNECTOR:PC EDGE 10-CONT, DIP SOLDER	28480	01722-27601
A8XA11	01722-27601		CONNECTOR:PC EDGE 10-CONT, DIP SOLDER	28480	01722-27601
A8XA12	01722-27601		CONNECTOR:PC EDGE 10-CONT, DIP SOLDER	28480	01722-27601
A8XA19	1251-1886		CONNECTOR: 30F RECP	28480	1251-1886
A8XA22	1251-2571		CONNECTOR: 15F RECP	28480	1251-2571
A8XU1	1200-0475	88	CONNECTOR: 1-CONT SKT .016 DIA (8 REQD)	22526	75060-005
A8XU2	1200-0438	2	SOCKET:ELEC, IC 16-CONT DIP SLDR TERM	24995	583529-1
A8XU3	1200-0441	5	SOCKET:ELEC, IC 14 CONT DIP SLDR TERM	24995	583527-1
A8XU4	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (8 REQD)	22526	75060-005
A8XU5	1200-0438		SOCKET:ELEC, IC 16-CONT DIP SLDR TERM	24995	563529-1
A8XU6	1200-0441		SOCKET:ELEC, IC 14 CONT DIP SLDR TERM	24995	583527-1
A8XU7	1200-0441		SOCKET:ELEC, IC 14-CONT DIP SLDR TERM	24995	583527-1
A9	01720-66547	1	BOARD ASSY, DELAYED SWEEP SWITCH	28480	01720-66547
A9C1	0150-0116	1	CAPACITOR-FXD 47PF +-10% 500WVDC	28480	0150-0116
A9C2	0121-0495	6	CAPACITOR VAR 1.9/15.7PF	28480	0121-0495
A9C3	0150-0063	1	CAPACITOR FXD 10PF +-.5PF 500WVDC	28480	0150-0063
A9C4	0140-0218	2	CAPACITOR-FXD 160PF +-2% 300WVDC	72136	DM15F161G0300WV1CR
A9C5	0140-0218		CAPACITOR-FXD 160PF +-2% 300WVDC	72136	DM15F161G0300WV1CR
A9C6	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A9C7	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A9C8	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A9C9	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A9C10	0121-0495		CAPACITOR VAR 1.9/15.7PF	28480	0121-0495
A9C11	0160-2261	3	CAPACITOR FXD 15PF +-5% 500WVDC	28480	0160-2261
A9C12	0121-0495		CAPACITOR VAR 1.9/15.7PF	28480	0121-0495
A9C13	0160-0974	2	CAPACITOR-FXD 80PF +-2% 300WVDC	28480	0160-0974
A9C14	0160-3541	1	CAPACITOR-FXD .01UF +-5% 100WVDC	84411	HEW-192
A9C15	0160-3324	2	CAPACITOR-FXD 1UF +-5% 100WVDC	28480	0160-3324
A9C16	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A9C17	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A9C18	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A9C19	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500WVDC CER	72982	301-000-COHO-519C
A9CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A9CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A9CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A9L1	9140-0115		COIL-FXD, MOLDED RF CHOKE, 22UH 10%	82142	22-4422-8K
A9L2			DELETED		
A9L3	9170-0029		CORE, MAG SHIELDING BEAD	02114	56-590-65A2/4A
A9L4	9170-0029		CORE, MAG SHIELDING BEAD	02114	56-590-65A2/4A
A9L5	9170-0029		CORE, MAG SHIELDING BEAD	02114	56-590-65A2/4A
A9MP1	1460-1148	2	SPRING:TORSION	00000	OBD
A9MP2	01840-22502	2	ROLLER, DETENT	28480	01840-22502
A9Q1	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A9Q2	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A9Q3	1853-0244	2	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0244
A9Q4	1855-0081		TRANSISTOR, J-FET N-CHAN, D-MODE SI	01295	2N5245
A9Q5	1854-0019	13	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A9Q6	1854-0628	2	TRANSISTOR NPN SI TO-92 PD=625MW	04713	MPS-H17
A9Q7	1854-0691		TRANSISTOR NPN SI	28480	1854-0691
A9Q8	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A9Q9	1854-0691		TRANSISTOR NPN SI	28480	1854-0691
A9R1	0698-3446	1	RESISTOR 383 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-383R-F
A9R2	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R3	0757-0288	3	RESISTOR 9.09K 1% .125W F TUBULAR	30983	MF4C-1/8-T0-9091-F
A9R4	0684-2201	4	RESISTOR 22 OHM 10% .25W CC TUBULAR	01121	CB2201
A9R5	0698-0082	1	RESISTOR 464 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-4640-F
A9R6	0757-0420	1	RESISTOR FXD 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751R-F
A9R7	0683-1035	1	RESISTOR 10K 5% .25W CC TUBULAR	01121	CB1035
A9R8	0684-5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A9R9	0684-5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A9R10	0687-1821	1	RESISTOR 1.8K 10% .5W CC TUBULAR	01121	EB1821
A9R11	0684-4721	9	RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A9R12	0687-3321	1	RESISTOR 3.3K 10% .5W CC TUBULAR	01121	EB3321
A9R13	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A9R14	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A9R15	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A9R16	0687-2721	2	RESISTOR 2.7K 10% .5W CC TUBULAR	01121	EB2721
A9R17	0698-6450	2	RESISTOR 2.5K .1% .125W F TUBULAR	03888	PME55, T-2
A9R18	0698-5449	2	RESISTOR 5K .1% .125W F TUBULAR	30983	MF4C-1/8-T2-5001-B
A9R19	0698-6360	7	RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C-1/8-T9-1002-B
A9R20	0698-6942	2	RESISTOR 25K .1% .125W F TUBULAR	19701	MF4C-1/8-T2-2502-B
A9R21	0698-5450	2	RESISTOR 50K .1% .125W F TUBULAR	30983	MF4C-1/8-T2-5002-B
A9R22	0698-4158	2	RESISTOR 100K .1% .125W F TUBULAR	19701	MF4C-1/8-T2-1003-B
A9R23	0757-0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-1501-F
A9R24	0684-5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A9R25	0684-4751	2	RESISTOR 4.7M 10% .25W CC TUBULAR	01121	CB4751

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R26	0757-0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4-1/8 T0 1501 F
A9R27	0757-0426		RESISTOR 1.3K 1% .125W F TUBULAR	24546	C4-1/8 T0 1301 F
A9R28	0757-0435		RESISTOR 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921 F
A9R29	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4 1/8 T0-2611 F
A9R30	2100-3056	5	RESISTOR:VAR, TRMR 5K OHM 10% C	32997	3006P-1-502
A9R31	2100-3056		RESISTOR:VAR, TRMR 5K OHM 10% C	32997	3006P-1-502
A9R32	0757-0439	1	RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811 F
A9R33	0757-0836	1	RESISTOR 7.5K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-7501-F
A9R34	0684-5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A9R35	0757-0434	5	RESISTOR 3.65K 1% .125W F TUBULAR	24546	C4-1/8-T0-3651-F
A9R36	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A9R37	0757-0446		RESISTOR FXD 15K .1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A9R38	2100-3354		RESISTOR:VAR, TRMR 50K OHM 10% C	73138	72XR504
A9R39	0684-1011		RESISTOR FXD 100 OHM 10% .25W CC	01121	CB1011
A9U1	1826-0086		IC:LIN, OPERATIONAL AMPLIFIER	07263	776HC
A9XU1	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (8 REQD)	22526	75060-005
A10	01720-66536	1	BOARD ASSY, HORIZONTAL DISPLAY SWITCH	28480	01720-66536
A10C1	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C2	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C3	0160-2253	1	CAPACITOR-FXD 6.8PF +-.25PF 500WVDC	28480	0160-2253
A10C4	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C5	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C6	0160-2261		CAPACITOR-FXD 15PF +-5% 500WVDC	28480	0160-2261
A10C7	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C8	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C9	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C10	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C11			NOT ASSIGNED		
A10C12	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C13	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C14	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C15	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C16	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C17	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C18	0160-0160	1	CAPACITOR-FXD .0082UF +-10% 200WVDC	56289	292P82292
A10C19	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10C20	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A10CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A10CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A10J1	1251-3272	4	CONNECTOR, 6-CONT, FEM, POST TYPE	27264	09-52-3063(2145-6C)
A10J2	1251-3274	2	CONNECTOR, 4-CONT, FEM, POST TYPE	27264	09-52-3043(2145-4C)
A10L1	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A10L2	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A10Q1	1854-0546		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A10Q2	1854-0546		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A10Q3	1853-0352	4	TRANSISTOR PNP SI CHIP TO-92 PD=350MW	28480	1853-0352
A10Q4	1853-0352		TRANSISTOR PNP SI CHIP TO-92 PD=350MW	28480	1853-0352
A10Q5	1853-0352		TRANSISTOR PNP SI CHIP TO-92 PD=350MW	28480	1853-0352
A10Q6	1853-0352		TRANSISTOR PNP SI CHIP TO-92 PD=350MW	28480	1853-0352
A10Q7	1854-0546		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A10Q8	1854-0546		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0546
A10R1	0757-0434		RESISTOR 3.65K 1% .125W F TUBULAR	24546	C4-1/8 T0 3651-F
A10R2	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A10R3	0698-3447	1	RESISTOR 422 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-422R-F
A10R4	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A10R5	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A10R6	0757-0284	1	RESISTOR-FXD 150 OHM 1% .125W F	24546	C4-1/8-T0-151-F
A10R7	0757-0276		RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A10R8	0757-0276		RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A10R9	0757-0815	1	RESISTOR 562 OHM 1% .5W F TUBULAR	28480	0757-0815
A10R10	0757-1060	1	RESISTOR 196 OHM 1% .5W F TUBULAR	28480	0757-1060
A10R11	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A10R12	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A10R13	0698-3429	2	RESISTOR 19.6 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-19R6-F
A10R14	0698-3429		RESISTOR 19.6 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-19R6-F
A10R15	0757-0069	1	RESISTOR 121 OHM 1% .25W F TUBULAR	30983	MF52C1/4-T0-121R-F
A10R16	0684-2201		RESISTOR 22 OHM 10% .25W CC TUBULAR	01121	CB2201
A10R17	0684-2201		RESISTOR 22 OHM 10% .25W CC TUBULAR	01121	CB2201
A10R18	0684-6811	3	RESISTOR 680 OHM 10% .25W CC TUBULAR	01121	CB6811
A10R19	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A10R20	0757-0817	2	RESISTOR 750 OHM 1% .5W F TUBULAR	19701	MF7C1/2-T0-751-F
A10R21	0757-0817		RESISTOR 750 OHM 1% .5W F TUBULAR	19701	MF7C1/2-T0-751-F
A10R22	2100-3351	1	RESISTOR:VAR, TRMR, 500 OHM 10% C	73138	72XR501
A10R23	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A10R24	0684-6811		RESISTOR 680 OHM 10% .25W CC TUBULAR	01121	CB6811
A10R25	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A10R26	0684-6811		RESISTOR 680 OHM 10% .25W CC TUBULAR	01121	CB6811
A10R27	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A10R28	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A10R29	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10R30	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 511R F
A10R31	0757-0434		RESISTOR 3.65K 1% .125W F TUBULAR	24546	C4 1/8 T0 3651 F
A10R32	0757 0422	1	RESISTOR FXD 909 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 909R F
A10R33	0757 0393		RESISTOR FXD 47.5 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 47R5 F
A10R34	0757 0393		RESISTOR FXD 47.5 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 47R5 F
A10S1	3101-0678	1	SWITCH:PB 6 STA 4PDT	28480	3101 0678
A11	01720-66546	1	MAIN SWEEP SWITCH	28480	01720-66546
A11C1	0140 0203	1	CAPACITOR FXD 30PF +-5% 500WVDC	72136	DM15E300J0500WV1CR
A11C2	0160 3451		CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0160 3451
A11C3	0160 2257		CAPACITOR FXD 10PF +-5% 500WVDC	28480	0160 2257
A11C4	0121 0495		CAPACITOR VAR 1.9/15.7PF	74970	187 0309 105
A11C5	0160 3451		CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0160 3451
A11C6	0160 3451		CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0160 3451
A11C7	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A11C8	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A11C9	0180-0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A11C10	0180-0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A11C11	0160-2261		CAPACITOR FXD 15PF +-5% 500WVDC	28480	0160-2261
A11C12	0121 0495		CAPACITOR VAR 1.9/15.7PF	74970	187-0309-105
A11C13	0160-0974		CAPACITOR FXD 80PF +-2% 300WVDC	28480	0160-0974
A11C14	0121 0495		CAPACITOR VAR 1.9/15.7PF	74970	187-0309-105
A11C15	0160-3541	1	CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0160-3541
A11C16	0160-3324		CAPACITOR FXD 1UF +-5% 100WVDC	28480	0160 3324
A11C17	0180 0481	1	CAPACITOR FXD 100UF +-10% 30VDC TA WET	28480	0180-0481
A11C18	0160-3451		CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0160-3451
A11C19			DELETED		
A11C20	0160 3451		CAPACITOR FXD .01UF +80--20% 100WVDC	56289	C0238101F103ZS25 CDH
A11CR1			DELETED		
A11CR2			DELETED		
A11CR3	1901-0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A11CR4	1906-0042	1	DIODE:MULT, SILICON, DUAL	28480	1906 0042
A11CR5	1910 0030	1	DIODE SWITCHING 1US 15V 50MA	28480	1910 0030
A11J1	1251 3272		CONNECTOR, 6 CONT, FEM, POST TYPE	27264	09 52 3063(2145 6C)
A11J2	1251 3274		CONNECTOR, 4 CONT, FEM, POST TYPE	27264	09 52 3043(2145 4C)
A11L1	9140 0112	1	COIL FXD, MOLDED RF CHOKE, 4.7UH 10%	28480	9140 0112
A11L2	9170 0029		CORE, MAG, SHIELDING BEAD	02114	56 590 65A2/4A
A11MP1	1460-1148		SPRING:TORSION	00000	OBD
A11MP2	01840-22502		ROLLER, DETENT	28480	01840 22502
A11MP3	1205-0235	1	HEAT DISSIPATOR, SGL, T0 36 PKG	28480	1205 0235
A11Q1	1853-0316	1	TRANSISTOR BIPOL SI PNP DUAL	28480	1853 0316
A11Q2	1853 0244		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0244
A11Q3	1856-0081		TRANSISTOR, J FET N CHAN, D MODE SI	01295	2N5245
A11Q4	1854 0723		TRANSISTOR NPN SI T0-72	28480	1854 0723
A11Q5	1854-0628		TRANSISTOR NPN SI T0 92 PD=625MW	04713	MPS-H17
A11Q6	1854-0691		TRANSISTOR NPN SI	28480	1854-0691
A11Q7	1853-0354	3	TRANSISTOR PNP SI CHIP T0 92 PD=350MW	28480	1853 0354
A11Q8	1854-0691		TRANSISTOR NPN SI	28480	1854 0691
A11R1	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A11R2	0757 0282		RESISTOR FXD 221 OHM 1% .125WF TUBULAR	24546	C4 1/8 T0 221R F
A11R3	0757-0288		RESISTOR 9.09K 1% .125W F TUBULAR	30983	MF4C1/8 T0 9091 F
A11R4	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4 1/8 T0 1001 F
A11R5	0684-2201		RESISTOR 22 OHM 10% .25W CC TUBULAR	01121	CB2201
A11R6	0757 0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R7	0757 0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4 1/8 T0 1501 F
A11R8	0683-1035		RESISTOR FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A11R9	0684 5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A11R10	0684 4751		RESISTOR 4.7M 10% .25W CC TUBULAR	01121	CB4751
A11R11	0757-0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4 1/8 T0 1501 F
A11R12	0684 3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A11R13	0684 1031	2	RESISTOR FXD 10K 10% .25W CC TUBULAR	01121	CB1031
A11R14	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A11R15	0684 5601		RESISTOR 56 OHM 10% .25W CC TUBULAR	01121	CB5601
A11R16	0684 4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A11R17	0684 1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A11R18	0684 1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A11R19	0684 1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A11R20	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A11R21	0684 1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A11R22	0684 1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A11R23	0698 6688		RESISTOR 99.8K .1% .125W F TUBULAR	28480	0698 6688
A11R24	0698-8562		RESISTOR 49.9K 1% .125W F TUBULAR	28480	0698-8562
A11R25	0698-6042		RESISTOR 25K 1% .125W F TUBULAR	19701	MF4C 1/8 T2 2502 B
A11R26	0698 6360		RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C 1/8 T9 1002 B
A11R27	0698 5449		RESISTOR 5K .1% .125W F TUBULAR	30983	MF4C 1/8 T2 5001 B
A11R28	0698-6450		RESISTOR 2.5K .1% 125W F TUBULAR	03888	PME55, T 2
A11R29	0757-0426		RESISTOR 1.3K 1% .125W F TUBULAR	24546	C4 1/8 T0 1301 F
A11R30	0757 0435		RESISTOR 3.92K 1% .125W F TUBULAR	24546	C4 1/8 T0 3921 F
A11R31	0757 0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4 1/8 T0 2001 F
A11R32	0687 2721		RESISTOR 2.7K 10% .5W CC TUBULAR	01121	EB2721
A11R33	2100-3056		RESISTOR:VAR, TRMR, 5K OHM 10% C	32997	3006P 1 502
A11R34	2100 3056		RESISTOR:VAR, TRMR, 5K OHM 10% C	32997	3006P 1 502

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R35	2100-3056		RESISTOR:VAR, TRMR, 5K OHM 10% C	32997	3006P-1-502
A11R36	0757-0438	7	RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A11R37	0757-0446		RESISTOR FXD 15K 1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A11R38	0684-1011		RESISTOR FXD 100 OHM 10% .25W CC	01121	CB1011
A11R39	2100-3354		RESISTOR:VAR, TRMR, 50K OHM C	73138	72XR504
A11U1	1826-0086		IC:LIN, OPERATIONAL AMPLIFIER	07263	776HC
A11VR1	1902-0041	4	DIODE-ZNR 5.11V 5% DO-7 PD=.4W	04713	SZ10939-98
A11XQ1	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (6 REQD)	22526	75060-005
A11XU1	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (8 REQD)	22526	75060-005
A12	01722-66520	1	ASSY, HOLDOFF DELAY COMPARATOR	28480	01722-66520
A12C1	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC	72136	DM15E560J0300WV1CR
A12C2	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300WVD MICA	28480	0160-2204
A12C3	0160-0298	1	CAPACITOR FXD 1500PF +-10% 200WVDC POLYS	56289	292P15292
A12C4	0160-0161	1	CAPACITOR FXD .01UF +-10% 200WVDC POLYS	56289	292P10392-PTS
A12C5	0160-0162		CAPACITOR FXD .022UF +-10% 200WVDC	56289	292P22392
A12C6	0180-0230		CAPACITOR FXD 1UF +-20% 50VDC TA-SOLID	56289	150D105X0050A2
A12C7	0180-0197	1	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150C225X9020A2
A12C8	0180-0094	1	CAPACITOR-FXD 100UF +&5--10% 25VDC AL	56289	30D107G025DD2
A12C9	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A12C10	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC	28480	0160-3451
A12C11	0180-1746		CAPACITOR FXD 15UF +-10% 20VDC TA-SOLID	56289	150D156X9020B2
A12C12	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA SOLID	56289	150D156X9020B2
A12C13	0180-3451		CAPACITOR FXD .01UF +80--20% 100WVDC	28480	0180-3451
A12C14	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A12C15	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A12C16	0180-0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A12C17	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A12CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR7	5080-9697	1	DIODE:MATCHED QUAD	28480	5080-9697
A12P1			(P/O P. C. BOARD)		
A12P2	1251-3319		CONNECTOR, 10-CONT, MALE, POST TYPE	27264	09-64-1121(A2402-10A)
A12P3	1251-3195	1	CONNECTOR, 4-CONT, MALE, POST TYPE	27264	09-60-1081(2403-08A)
A12Q1	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q2	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q3	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q4	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q5	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q6	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q7	1854-0636		TRANSISTOR NPN SI TO-92 PD=350MW	28480	1854-0636
A12Q8	1853-0086	1	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0086
A12Q9	1853-0086	1	TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0086
A12Q10	1854-0642	3	TRANSISTOR NPN SI TO-92 PD=350MW	04713	MPS-A17
A12Q11	1854-0642		TRANSISTOR NPN SI TO-92 PD=350MW	04713	MPS-A17
A12Q12	1853-0354		TRANSISTOR PNP SI PD=350MW	28480	1853-0354
A12Q13	1854-0642		TRANSISTOR NPN SI TO-92 PD=350MW	04713	MPS-A17
A12Q14	1854-0215	19	TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A12Q15	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A12Q16	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A12Q17	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A12Q18	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A12Q19	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A12R1	0757-0446	5	RESISTOR 15K 1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A12R2	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R3	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R4	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R5	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R6	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R7	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R8	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R9	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A12R10	0757-0274		RESISTOR 1.21K 1% .125W F TUBULAR	24546	C4-1/8-T0-1213-F
A12R11	0757-0437		RESISTOR 4.75K 1% .125W F TUBULAR	24546	C4-1/8-T0-4751-F
A12R12	0757-0427		RESISTOR 1.5K OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-1501-F
A12R13	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A12R14	0757-0437		RESISTOR 4.75K 1% .125W F TUBULAR	24546	C4-1/8-T0-4751-F
A12R15	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A12R16	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A12R17	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A12R18	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A12R20	0684-3921	3	RESISTOR 3.9K 10% .25W CC TUBULAR	01121	CB3921
A12R21	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R22	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A12R23	0757-0428		RESISTOR 1.62K 1% .125W F TUBULAR	24546	C4-1/8-T0-1621-F
A12R24	0687-1521	1	RESISTOR 1.5K 10% .5W CC TUBULAR	01121	EB1521
A12R25	0757-0442	5	RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-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
A12R26	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A12R27	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R28	0684-3311		RESISTOR 330 OHM 10% .25W CC TUBULAR	01121	CB3311
A12R29	0757-0429		RESISTOR 1.82K 1% .125W F TUBULAR	24546	C4-1/8-T0-1821-F
A12R30	0684-5631	2	RESISTOR 56K 10% .25W CC TUBULAR	01121	CB5631
A12R31	0684-2701	4	RESISTOR 27 OHM 10% .25W CC TUBULAR	01121	CB2701
A12R32	0684-2701		RESISTOR 27 OHM 10% .25W CC TUBULAR	01121	CB2701
A12R33	0684-2701		RESISTOR 27 OHM 10% .25W CC TUBULAR	01121	CB2701
A12R34	0684-2701		RESISTOR 27 OHM 10% .25W CC TUBULAR	01121	CB2701
A12R35	0698-3132		RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A12R36	0757-0273		RESISTOR 3.01K 1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A12R37	0757-0399	1	RESISTOR 82.5 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-82R5-F
A12R38	0757-0409		RESISTOR 274 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-274R-F
A12R39	0757-0434		RESISTOR 3.65K 1% .125W F TUBULAR	24546	C4-1/8-T0-3651-F
A12R40	0757-0407		RESISTOR 200 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-201-F
A12R41	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A12R42	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A12R43	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A12R44	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A12R45	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A12R46	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A12U1	1858-0040	1	IC-LIN, TRANSISTOR ARRAY	02735	CA3127E
A12VR1	1902-0041		DIODE-ZNR 5.11V 5% D0-7 PD=.4W	04713	SZ10939-98
A12VR2	1902-3182		DIODE-ZNR 12.1V 5% D0-7 PD=.4W	15818	CD35730
A12XQ1	1200-0763		SOCKET, ELEC, IC 8-CONT DIP SLDR TERM	71785	133-98-92-061
A12XU1	1200-0438		SOCKET, ELEC, IC 16-DIP SLDR TERM	24995	583519-1
A13	01720-66537	1	BOARD ASSY, HORIZONTAL OUTPUT	28480	01720-66537
A13C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A13C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A13C3	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A13C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A13C5	0121-0168	4	CAPACITOR-VAR, TRMR, PSTN, .2/1.5PF	28480	0121-0168
A13C6	0132-0004	2	CAPACITOR-VAR, TRMR, PSTN, .7/3PF	72982	535-009-4R
A13C7	0121-0168		CAPACITOR-VAR, TRMR, PSTN, .2/1.5PF	28480	0121-0168
A13C8	0132-0004		CAPACITOR-VAR, TRMR, PSTN, .7/3PF	72982	535-009-4R
A13C9	0160-3451		CAPACITOR-FXD, .01UF +80-20% 100WVDC	28480	0160-3451
A13C10	0160-3665	9	CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A13C11	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A13C12	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A13C13	0160-3451	4	CAPACITOR-FXD .01UF +80-20% 100WVDC	28480	0160-3451
A13C14	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A13C15	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A13C16	0160-2240	2	CAPACITOR-FXD 2PF +-.25PF 500WVDC	28480	0160-2240
A13C17	0160-2240		CAPACITOR-FXD 2PF +-.25PF 500WVDC	28480	0160-2240
A13CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A13CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A13CR3	1901-0047		DIODE-SWITCHING 20V MAX VRM 75MA	28480	1901-0047
A13CR4	1901-0047		DIODE-SWITCHING 20V MAX VRM 75MA	28480	1901-0047
A13L1			DELETED		
A13L2			DELETED		
A13L3	9140-0179	1	COIL-FXD, MOLDED RF CHOKE, 22UH 10%	24226	15/222
A13MP1	1205-0033	2	HEAT-DISSIPATOR; SGL, T0-5 PKG	28480	1205-0033
A13Q1	1853-0354		TRANSISTOR PNP SI CHIP T0-92 PD=350MW	28480	1853-0354
A13Q2	1854-0019		TRANSISTOR NPN SI T0-18 PD=360MW	28480	1854-0019
A13Q3	1854-0019		TRANSISTOR NPN SI T0-18 PD=360MW	28480	1854-0019
A13Q4	1853-0354		TRANSISTOR PNP SI CHIP T0-92 PD=350MW	28480	1853-0354
A13Q5	1854-0419	3	TRANSISTOR NPN SI T0-39 PD=1W FT=200MHZ	28480	1854-0419
A13Q6	1853-0232	3	TRANSISTOR PNP SI CHIP T0-39 PD=1W	28480	1853-0232
A13Q7	1853-0232		TRANSISTOR PNP SI CHIP T0-39 PD=1W	28480	1853-0232
A13Q8	1854-0419		TRANSISTOR NPN SI T0-39 PD=1W FT=200MHZ	28480	1854-0419
A13R1	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A13R2	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A13R3	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A13R4	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A13R5	0757-0421		RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A13R6	0757-0421		RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A13R7	0757-0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A13R8	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A13R9	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A13R10	0757-0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A13R11	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A13R12	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A13R13	0698-6542	2	RESISTOR 3.6K 2% 1W MO TUBULAR	FR003	C32
A13R14	0760-0017	2	RESISTOR 3.9K 2% 1W MO TUBULAR	FR003	C32
A13R15	0698-6542		RESISTOR 3.6K 2% 1W MO TUBULAR	FR003	C32
A13R16	0760-0017		RESISTOR 3.9K 2% 1W MO TUBULAR	FR003	C32
A13R17	0757-0853	3	RESISTOR 51.1K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-5112-F
A13R18	0757-0853		RESISTOR 51.1K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-5112-F
A13R19	0757-0436		RESISTOR 4.32K 1% .125W F TUBULAR	24546	C4-1/8-T0-4321-F
A13R20	0757-0436		RESISTOR 4.32K 1% .125W F TUBULAR	24546	C4-1/8-T0-4321-F
A13R21	0757-0726	2	RESISTOR 511 OHM 1% .25W F TUBULAR	24546	C5-1/4-T0-511R-F
A13R22	0757-0726		RESISTOR 511 OHM 1% .25W F TUBULAR	24546	C5-1/4-T0-511R-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
A13R23	0761 0006	2	RESISTOR 10K 5% 1W MO TUBULAR	24546	FP32 1 1002 J
A13R24	0761 0006		RESISTOR 10K 5% 1W MO TUBULAR	24546	FP32 1 1002 J
A13R25	0757 0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 51R1 F
A13R26	0757 0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4 1/8 T0 51R1 F
A13R27	0698 3162	2	RESISTOR FXD 46.4K 1% .125W F TUBULAR	16299	C4 1/8 T0 4642 F
A13R28	0698 3162		RESISTOR FXD 46.4K 1% .125W F TUBULAR	16299	C4 1/8 T0 4642 F
A13R29	0757 0442		RESISTOR FXD 10K 1% .125W F TUBULAR	24546	C4 1/8 T0 1002 F
A13R30	0757 0442		RESISTOR FXD 10K 1% .125W F TUBULAR	24546	C4 1/8 T0 1002 F
A13VR1	1902 0041		DIODE ZNR 5.11V 5% DO 7 PD .4W	04713	SZ 10939 98
A13VR2	1902 0041		DIODE ZNR 5.11V 5% DO 7 PD .4W	04713	SZ 10939 98
A14	01720 66551	1	BOARD ASSY, GATE	28480	01720 66551
A14C1	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A14C2	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A14C3	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A14C4	0180 0291	8	CAPACITOR FXD 1UF +-10% 35VDC TA SOLID	56289	150D 105X9035A2
A14C5	0160 3451		CAPACITOR FXD .01UF +80 -20% 100WVDC	28480	0160 3451
A14C6	0180 0291		CAPACITOR FXD 1UF +-10% 35VDC TA SOLID	56289	150D 105X9035A2
A14C7	0121 0168		CAPACITOR VAR TRMR, PSTN, .2/1.5PF	28480	0121 0168
A14C8	0121 0168		CAPACITOR VAR TRMR, PSTN, .2/1.5PF	28480	0121 0168
A14C9	0150 0052	2	CAPACITOR FXD .05UF +-20% 400WVDC	28480	0150 0052
A14C10	0150 0052		CAPACITOR FXD .05UF +-20% 400WVDC	28480	0150 0052
A14C11	0160 3665		CAPACITOR FXD .01UF +80-20% 500WVDC	28480	0160 3665
A14C12	0160 3665		CAPACITOR FXD .01UF +80-20% 500WVDC	28480	0160 3665
A14C13	0160 3665		CAPACITOR FXD .01UF +80-20% 500WVDC	28480	0160 3665
A14C14	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D 225X9020A2
A14C15	0180 0291		CAPACITOR FXD 1UF +-10% 35VDC TA SOLID	56289	150D 105X9035A2
A14C16	0160 3451		CAPACITOR FXD .01UF +80-20% 100WVDC	28480	0160 3451
A14C17	0180 1745	3	CAPACITOR FXD 1.5UF +-10% 20VDC TA	56289	150D 155X9020A2
A14C18	0180 0291		CAPACITOR FXD 1UF +-10% 35VDC TA SOLID	56289	150D 105X9035A2
A14C19	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D 225X9020A2
A14C20	0160 3451		CAPACITOR FXD .01UF +80-20% 100WVDC	28480	0160 3451
A14C21	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D 225X9020A2
A14C22	0160 3451		CAPACITOR FXD .01UF +80-20% 100WVDC	28480	0160 3451
A14C23	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D 225X9020A2
A14C24	0160 3451		CAPACITOR FXD .01UF +80-20% 100WVDC	28480	0160 3451
A14C25	0180 0197		CAPACITOR FXD 2.2UF +-10% 20VDC TA	56289	150D 225X9020A2
A14C26	0160 3451		CAPACITOR FXD .01UF +80-20% 100WVDC	28480	0160 3451
A14C27	0180 1746		CAPACITOR FXD 15UF +-10% 20VDC TA SOLID	56289	150D 156X9020B2
A14C28	0160 3453	2	CAPACITOR FXD .05UF +80 -20% 100WVDC	28480	0160 3453
A14C29	0170 0040		CAPACITOR FXD .047UF +-10% 200WVDC	56289	292P47392
A14C30	0180 0291		CAPACITOR FXD 1UF +-10% 35VDC TA SOLID	56289	150D 105X9035A2
A14C31	0160 2198	1	CAPACITOR FXD 20PF +-5% 300WVDC	28480	0160 2198
A14C32	0180 0094		CAPACITOR FXD 100UF +75-10% 25VDC AL	56289	30D107G025DD2
A14CR1	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR2	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR3	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR4	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR5	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR6	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR7	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR8	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR9	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR10	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR11	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR12	1901 0040		DIODE SWITCHING 2NS 30V 50MA	28480	1901 0040
A14CR13	1901 0040		DIODE SWITCHING 30V MAX VRM 50MA	28480	1901 0040
A14CR14	1901 0040		DIODE SWITCHING 30V MAX VRM 50MA	28480	1901 0040
A14CR15	1901 0376		DIODE; GEN PRP 35V 50MA	28480	1901 0376
A14CR16	1901 0040		DIODE; SWITCHING; 30V MAX VRM 50MA	28480	1901 0040
A14CR17	1901 0040		DIODE; SWITCHING; 30V MAX VRM 50MA	28480	1901 0040
A14L1	9140 0129	1	COIL FXD RF CHOKE 220UH 5%	24226	15/223
A14L2	9170 0029		CORE, MAG, SHIELDING BEAD	02114	56 590 65A2/4A
A14L3	9170 0029		CORE, MAG, SHIELDING BEAD	02114	56 590 65A2/4A
A14MP1	1205 0033		HEAT DISSIPATOR, SGL, TO 5 PKG	28480	1205 0033
A14Q1	1854 0019	3	TRANSISTOR NPN SI TO 18 PD 360MW	28480	1854 0019
A14Q2	1853 0036		TRANSISTOR PNP SI CHIP PD 310MW	28480	1853 0036
A14Q3	1853 0036		TRANSISTOR PNP SI CHIP PD 310MW	28480	1853 0036
A14Q4	1854 0071		TRANSISTOR NPN SI PD 300MW FT 200MHZ	28480	1854 0071
A14Q5	1853 0036		TRANSISTOR PNP SI CHIP PD 310MW	28480	1853 0036
A14Q6	1854 0053	1	TRANSISTOR NPN 2N2218 SI PD 800MW	04713	2N2218
A14Q7	1853 0336		TRANSISTOR PNP SI CHIP PD 625MW	28480	1853 0336
A14Q8	1853 0036		TRANSISTOR PNP SI CHIP PD 310MW	28480	1853 0036
A14Q9	1854 0019		TRANSISTOR NPN SI TO 18 PD 360MW	28480	1854 0019
A14Q10	1854 0019		TRANSISTOR NPN SI PD=360MW FT=500MHZ	28480	1854 0019
A14Q11	1853 0203	1	TRANSISTOR PNP SI CHIP TO 18 PD 360MW	28480	1853 0203
A14Q12	1853 0232		TRANSISTOR PNP SI CHIP TO 39 PD 1W	28480	1853 0232
A14Q13	1854 0019		TRANSISTOR NPN SI TO 18 PD 360MW	28480	1854 0019
A14Q14	1854 0419		TRANSISTOR NPN SI TO 39 PD=1W FT=200MHZ	28480	1854 0419
A14Q15	1854 0023	1	TRANSISTOR NPN SI TO 18 PD 360MW	28480	1854 0023
A14Q16	1854 0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A14Q17	1853 0036		TRANSISTOR PNP SI CHIP PD 310MW	28480	1853 0036
A14Q18	1854 0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A14Q19	1884 0074		THYRISTOR, SCR JEDEC 2N5060	04713	2N5060
A14Q20	1855 0255	2	TRANSISTOR FET	28480	1855 0255
A14Q21	1855 0255		TRANSISTOR FET	28480	1855 0255

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
A14R1	0684-2211		RESISTOR 220 OHM 10% .25W CC TUBULAR	01121	CB2211
A14R2	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A14R3	0757-0418	1	RESISTOR 619 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-619R-F
A14R4	0757-0429		RESISTOR 1.82K 1% .125W,F TUBULAR	24546	C4-1/8-T0-1821-F
A14R5	0684-2211		RESISTOR-FXD 220 OHM 10% .25W CC	01121	CB2211
A14R6	0684-4711	2	RESISTOR FXD 470 OHM 10% .25W CC	01121	CB4711
A14R7	0698-3450	1	RESISTOR 42.2K 1% .125W F TUBULAR	16299	C4-1/8-T0-4222-F
A14R8	0684-5621		RESISTOR 5.6K 10% .25W CC TUBULAR	01121	CB5621
A14R9	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A14R10	2100-0558	2	RESISTOR:VAR, TRMR 20K OHM 10% C	73138	72P
A14R11	0698-3136		RESISTOR 17.8K 1% .125W F TUBULAR	16299	C4-1/8-T0-1782-F
A14R12	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A14R13	0757-0469	1	RESISTOR 150K 1% .125W F TUBULAR	24546	C4-1/8-T0-1503-F
A14R14	0757-0451		RESISTOR 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A14R15	2100-3213	2	RESISTOR:VAR, TRMR 200K OHM 10% C	32997	3389P-1-204
A14R16	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A14R17	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A14R18	0757-0820		RESISTOR 1.1K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-1101-F
A14R19	0687-4751	1	RESISTOR 4.7M 10% .5W CC TUBULAR	01121	EB4751
A14R20	2100-3213		RESISTOR:VAR, TRMR 200K OHM 10% C	32997	3389P-1-204
A14R21	0684-4731		RESISTOR 47K 10% .25W CC	01121	CB4731
A14R22	0683-5615		RESISTOR FXD 560 OHM 5% .25W CC TUBULAR	01121	CB5615
A14R23	2100-3274	4	RESISTOR:VAR, TRMR 10K OHM 10% C	32997	3389H
A14R24	0757-0780		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A14R25	0757-1094		RESISTOR 1.47K 1% .125W F TUBULAR	24546	C4-1/8-T0-1471-F
A14R26	0684-4701	2	RESISTOR 47 OHM 10% .25W CC TUBULAR	01121	CB4701
A14R27	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A14R28	0684-1811		RESISTOR 180 OHM 10% .25W CC TUBULAR	01121	CB1811
A14R29	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A14R30	0757-0831	1	RESISTOR 4.32K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-4321-F
A14R31	0757-0834	1	RESISTOR 5.62K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-5621-F
A14R32	0699-0002	1	RESISTOR 6.8 OHM 10% .5W CC TUBULAR	01121	EB68G1
A14R33	0757-0436		RESISTOR 4.32K 1% .125W F TUBULAR	24546	C4-1/8-T0-4321-F
A14R34	0757-0853		RESISTOR 51.1K 1% .5W F TUBULAR	30983	MF7C-1/2-T0-5112-F
A14R35	0757-0728	1	RESISTOR 619 OHM 1% .25W F TUBULAR	24546	C5-1/4-T0-619R-F
A14R36	0761-0073	1	RESISTOR 13K 5% 1W MO TUBULAR	24546	FP32-1-T00-1302-J
A14R37	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A14R38	0757-0448	3	RESISTOR 18.2K 1% .125W F TUBULAR	25546	C4-1/8-T0-1822-F
A14R39	0757-0435		RESISTOR 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A14R40	0684-2711	1	RESISTOR 270 OHM 10% .25W CC TUBULAR	01121	CB2711
A14R41	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A14R42	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A14R43	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A14R44	0757-1094		RESISTOR 1.47K 1% .125W F TUBULAR	24546	C4-1/8-T0-1471-F
A14R45	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A14R46	0757-0435		RESISTOR 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A14R47	0698-3154	1	RESISTOR 4.22K 1% .125W F TUBULAR	16299	C4-1/8-T0-4221-F
A14R48	0757-0448		RESISTOR 18.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-1822-F
A14R49	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A14R50	0757-0317	1	RESISTOR 1.33K 1% .125W F TUBULAR	24546	C4-1/8-T0-1331-F
A14R51	2100-3212		RESISTOR:VAR, TRMR 200 OHM 10% C	32997	3389P-1-201
A14R52	0721-0001	1	RESISTOR 450 OHM 1% .1W CF TUBULAR	91637	DC1/10-451-F
A14R53	0683-0475	4	RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A14R54	0683-0475		RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A14R55	0683-0475		RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A14R56	0683-0475		RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A14R57	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A14R58	0757-0458	4	RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A14R59	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A14R60	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A14R61	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A14R62	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A14R63	0684-3921		RESISTOR 3.9K 10% .25W CC TUBULAR	01121	CB3921
A14R64	2100-3210	1	RESISTOR:VAR, TRMR 10K OHM 10% C	32997	3389P-1-103
A14R65	0684-1221		RESISTOR 1.2K 10% .25W CC TUBULAR	01121	CB1221
A14R66	0758-0028	4	RESISTOR 270 OHM 5% .25W F TUBULAR	28480	0758-0028
A14R67	2100-3363	1	RESISTOR:VAR, TRMR 20K OHM 10% C	73138	2XR203
A14R68	0758-0028		RESISTOR 270 OHM 5% .25W F TUBULAR	28480	0758-0028
A14R69	0758-0028		RESISTOR 270 OHM 5% .25W F TUBULAR	28480	0758-0028
A14R70	2100-0558		RESISTOR:VAR, TRMR 20K OHM 10% C	73138	72P
A14R71	0758-0028		RESISTOR 270 OHM 5% .25W F TUBULAR	28480	0758-0028
A14R72	0757-0446		RESISTOR 15K 1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A14R73	0698-3162	3	RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A14R74	2100-3355	1	RESISTOR:VAR, TRMR 100K OHM 10% C	73138	72XR104
A14R75	0684-5631		RESISTOR 56K 10% .25W CC TUBULAR	01121	CB5631
A14R76	2100-3354	1	RESISTOR:VAR, TRMR 50K OHM 10% C	73138	72XR504
A14R77	0684-3931		RESISTOR 39K 10% .25W CC TUBULAR	01121	CB3931
A14R78	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A14R79	0684-1521	3	RESISTOR 1.5K 10% .25W CC TUBULAR	01121	CB1521
A14R80	0757-0397		RESISTOR 68.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-68R1-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
A14R81	0684-1041	3	RESISTOR 100K 10% .25W CC TUBULAR	01121	CB1041
A14U1	1821-0001		IC:LIN, TRANSISTOR ARRAY	02735	CA3046
A14VR1	1902-3036	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W	04713	SZ10939-38
A14VR2	1902-3096	3	DIODE-ZNR 5.23V 5% DO-7 PD=.4W	04713	SZ10939-101
A14VR3	1902-3096		DIODE-ZNR 5.23V 5% DO-7 PD=.4W	04713	SZ10939-101
A14VR4	1902-3096		DIODE-ZNR 5.23V 5% DO-7 PD=.4W TC=	04713	SZ10939-101
A14VR5	1902-3149		DIODE-ZNR 9.09V 5% .4W MAX	04713	SZ10939-170
A14XU1	1200-0441		SOCKET-ELEC, IC 14-CONT DIP SLDR TERM	24995	583527-1
A15	01720-66532	1	BOARD ASSY, H.V.P.S.	28480	01720-66532
A15C1	0180-0116	1	CAPACITOR-FXD 6.8UF +-10% 35WVDC TA	56289	150D685X9035B2-DYS
A15C2	0160-2264		CAPACITOR-FXD 20PF +-5% 500WVDC	28480	0160-2264
A15C3	0160-3665		CAPACITOR-FXD .01UF +80-20% 500WVDC	28480	0160-3665
A15C4	0160-4079	3	CAPACITOR-FXD .0015UF +-20% 4000WVDC	28480	0160-4079
A15C5	0160-0544	1	CAPACITOR-FXD .022UF +-20% 4000WVDC	84411	HEW-337
A15C6	0160-4024	1	CAPACITOR-FXD 0.1UF +-20% 4000WVDC	56289	430P104040
A15C7	0160-4079		CAPACITOR-FXD .0015UF +-20% 4000WVDC	28480	0160-4079
A15C8	0160-3453		CAPACITOR-FXD .05UF +80-20% 100WVDC	28480	0160-3453
A15C9	0160-4079		CAPACITOR-FXD .0015UF +-20% 4000WVDC	28480	0160-4079
A15CR1	1901-0028	15	DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A15CR2	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A15CR3	1901-0683	1	DIODE-HV RECT 250NS 10KV 5MA	28480	1901-0683
A15CR4	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A15CR5	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A15CR6	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A15CR7	1901-0028		DIODE PWR RECT 400V 750MA	04713	SR1358-9
A15DS1	2140-0013	5	LAMP, GLOW, BULB T-2, 57V	74276	NE23A
A15DS2	2140-0013		LAMP, GLOW, BULB T-2, 57V	74276	NE23A
A15DS3	2140-0013		LAMP, GLOW, BULB T-2, 57V	74276	NE23A
A15DS4	2140-0013		LAMP, GLOW, BULB T-2, 57V	74276	NE23A
A15DS5	2140-0013		LAMP, GLOW, BULB T-2, 57V	74276	NE23A
A15E1	2110-0269	2	FUSEHOLDER	28480	2110-0269
A15F1	2110-0020	1	FUSE .8A 250V SLO-BLO	71400	MDL-8/10
A15L1	9100-3139	1	COIL:75UH	28480	9100-3139
A15MP1	5040-0402	1	MOUNT:TRANSFORMER	28480	5040-0402
A15MP2	5040-0430	1	MOUNT:TRANSFORMER	28480	5040-0430
A15P1	1251-3319		CONNECTOR, 10-CONT, MALE, POST TYPE	27264	09-64-1101(A2402-10A)
A15R1	0757-0412	1	RESISTOR 365 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-365R-F
A15R2	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A15R3	2100-3253		RESISTOR:VAR, TRMR 50K OHM 10% C	32997	3389P-1-503
A15R4	0683-1825		RESISTOR 1.8M 5% .25W CC TUBULAR	01121	CB1825
A15R5	0684-1041		RESISTOR 100K 10% .25W CC TUBULAR	01121	CB1041
A15R6	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A15R7	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A15R8	0684-1061		RESISTOR 10M 10% .25W CC TUBULAR	01121	CB1061
A15R9	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A15R10	0698-8018	1	RESISTOR 30M +1-19% 3W CP TUBULAR	03888	PVC175-3-T0-3004-F
A15R11	0698-6441	1	RESISTOR 6.5M 5% 1W CF TUBULAR	28480	0698-6441
A15R12	0698-4211	1	RESISTOR 158K 1% .125W F TUBULAR	16299	C4-1/8-T0-1583-F
A15R13	0698-6442	1	RESISTOR 13M 5% 1W CF TUBULAR	28480	0698-6442
A15R14	0684-4731		RESISTOR 47K 10% .25W CC TUBULAR	01121	CB4731
A15R15	0811-1666	1	RESISTOR 1 OHM 5% 2W PW TUBULAR (FACTORY SELECTED)	75042	8WH2-1R0-J
A15T1	01720-61101	1	TRANSFORMER, H.V.	28480	01720-61101
A15W1	01720-61627		CABLE ASSY, HV OSCILLATOR	28480	01720-61627
A16	0960-0117	1	ASSY, H.V. MULTIPLIER	28480	0960-0117
A17	01720-66528	1	BOARD ASSY, L.V.P.S.	28480	01720-66528
A17C1	0180-2172	1	CAPACITOR-FXD 130UF +75--10% 200VDC AL	56289	39D137G200HL4
A17C2	0180-0089	2	CAPACITOR-FXD 10UF +50--10% 150VDC AL	56289	30D106F150DD2
A17C3	0180-0489	1	CAPACITOR-FXD 520UF +75--10% 100VDC AL	56289	39D527F100JP4
A17C4	0180-0089		CAPACITOR-FXD 10UF +50--10% 150VDC AL	56289	30D106F150DD2
A17C5	0180-1988	1	CAPACITOR-FXD 2600UF +75--10% 15VDC AL	56289	39D268G015JJ1
A17C6	0160-3448		CAPACITOR-FXD .001UF +-10% 1000WVDC	28480	0160-3448
A17C7	0180-0341	1	CAPACITOR-FXD 25UF +75--10% 12VDC AL	56289	30D256G012BD2
A17C8	0180-2371	1	CAPACITOR-FXD 4700UF +75--10% 30VDC AL	28480	0180-2371
A17C9	0160-3448		CAPACITOR-FXD .001UF +-10% 1000WVDC	28480	0160-3448
A17C10	0180-0045	2	CAPACITOR-FXD 20UF +75--10% 25VDC AL	56289	30D206G025CB2
A17C11	0180-2351	1	CAPACITOR-FXD 2000UF +75--10% 50VDC AL	28480	0180-2351
A17C12	0160-3448		CAPACITOR-FXD .001UF +-10% 1000WVDC	28480	0160-3448
A17C13	0180-0045		CAPACITOR-FXD 20UF +75--10% 25VDC AL	56289	30D206G025CB2
A17C14	0180-2500	1	CAPACITOR-FXD 1500UF +50--10% 16VDC AL	28480	0180-2500
A17C15	0180-1747		CAPACITOR-FXD 150UF 20% 15WVDC TA	56289	150D157X0015
A17CR1	1906-0006	2	DIODE, MULT, FULL WAVE BRIDGE RECTIFIER	28480	1906-0006
A17CR2	1906-0006		DIODE, MULT, FULL WAVE BRIDGE RECTIFIER	28480	1906-0006
A17CR3	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17CR4	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17CR5	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17CR6	1901-0028		DIODE PWR RECT 400V 750MA	04713	SR1358-9
A17CR7	1906-0048	2	DIODE, MULT, FULL WAVE BRIDGE RECTIFIER	28480	1906-0048
A17CR8	1906-0048		DIODE, MULT, FULL WAVE BRIDGE RECTIFIER	28480	1906-0048
A17CR9	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17CR10	1901-0028		DIODE PWR RECT 400V 750MA	04713	SR1358-9
A17CR11	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17CR12	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A17DS1	2140-0018	1	LAMP, GLOW, BULB T-2, 58V	08806	A9A (NE-2E1)

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
A17E1	2110-0269		FUSEHOLDER	28480	2110-0269
A17P1	1251-3475	2	CONNECTOR, 10-CONT, MALE, POST TYPE	27264	09-60-1101
A17P2	1251-3475		CONNECTOR, 10-CONT, MALE, POST TYPE	27264	09-60-1101
A17P3	1251-3192	1	CONNECTOR, 3-CONT, MALE, POST TYPE	27264	09-60-1031(2403-03A)
A17Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A17Q2	1854-0575	1	TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	SPS0780
A17Q3	1853-0317	1	TRANSISTOR PNP SI CHIP PD=625MW	28480	1853-0317
A17Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A17Q5	1854-0395	1	TRANSISTOR NPN SI TO-39 PD=10W FT=50MHZ	28480	1854-0395
A17Q6	1853-0080	1	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0080
A17R1	0684-1041		RESISTOR 100K 10% .25W CC TUBULAR	01121	CB1041
A17R2	0683-0515	1	RESISTOR 5.1 OHM 5% .25W CC TUBULAR	01121	CB51G5
A17R3	0687-1041	1	RESISTOR 100K 10% .5W CC TUBULAR	01121	EB1041
A17R4	0683-1025	2	RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A17R5	0684-2741	1	RESISTOR 270K 10% .25W CC TUBULAR	01121	CB2741
A17R6	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A17R7	0757-0446		RESISTOR 15K 1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A17R8	0698-3547	1	RESISTOR 1 OHM 5% .5W CC TUBULAR	01121	EB10G5
A17R9	0687-6831	1	RESISTOR 68K 10% .5W CC TUBULAR	01121	EB6831
A17R10	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A17R11	0684-6831	1	RESISTOR 68K 10% .25W CC TUBULAR	01121	CB6831
A17R12	0757-0454	1	RESISTOR 33.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-3322-F
A17R13	0757-0445	2	RESISTOR 13K 1% .125W F TUBULAR	24546	C4-1/8-T0-1302-F
A17R14	0811-1665	3	RESISTOR .82 OHM 5% 2W PW TUBULAR	75042	BWH2-82/100-J
A17R15	0698-3329	3	RESISTOR 10K .5% .125W F TUBULAR	03888	PME55-1/8-T0-1002-D
A17R16	0698-5579	1	RESISTOR 5K .5% .125W F TUBULAR	24546	C4-1/8-T0-5001-D
A17R17	0757-0433		RESISTOR 3.32K 1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A17R18	0683-3355	1	RESISTOR 3.3M 5% .25W CC TUBULAR	01121	CB3355
A17R19	0757-0443	1	RESISTOR 6.2K 2% .125W F TUBULAR	24546	C4-1/8-T0-6201-G
A17R20	0757-0429		RESISTOR 1.82K 1% .125W F TUBULAR	24546	C4-1/8-T0-1821-F
A17R21	0811-1553	2	RESISTOR .68 OHM 5% 2W PW TUBULAR	75042	BWH2-11/16-J
A17R22	0757-0437		RESISTOR 4750 OHM 1% .125W F TUBULAR	28480	0757-0437
A17R23	2100-3212		RESISTOR:VAR, TRMR 200 OHM 10% C	73138	72PR200
A17R24	2100-3056		RESISTOR:VAR, TRMR 5K 10% .75W CER	73138	89PR5K
A17R25	0698-3329		RESISTOR 10K .5% .125W F TUBULAR	03888	PME55-1/8-T0-1002-D
A17R26	0698-3329		RESISTOR 10K .5% .125W F TUBULAR	03888	PME55-1/8-T0-1002-D
A17R27	0683-5125	1	RESISTOR 5.1K 5% .25W CC TUBULAR	01121	CB5125
A17R28	0811-1553		RESISTOR .68 OHM 5% 2W PW TUBULAR	75042	BWH2-11/16-J
A17R29	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	28480	0757-0280
A17U1	1820-0196	3	IC:LIN, VOLTAGE REGULATOR	07263	723HC
A17U2	1820-0196		IC:LIN, VOLTAGE REGULATOR	07263	723HC
A17U3	1820-0196		IC:LIN, VOLTAGE REGULATOR	07263	723HC
A17VR1	1902-3036		DIODE-ZNR 3.16V 5% DO-7 PD=.4W	04713	SZ10939-38
A17VR2	1902-3149		DIODE-ZNR 9.09V 5% DO-7 PD=.4W	04713	SZ10939-170
A17VR3	1902-0680		DIODE-ZNR 6.2V 5% DO-7 PD=.25W	12954	1N827
A17VR4	1902-3323		DIODE-ZNR 42.2V 5% DO-7 PD=.4W	04713	SZ-10939-362
A17XU1	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (10 REQD)	22526	75060-005
A17XU2	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (10 REQD)	22526	75060-005
A17XU3	1200-0475		CONNECTOR: 1-CONT SKT .016 DIA (10 REQD)	22526	75060-005
A18	01722-66501	1	PROCESSOR AND DISPLAY DRIVER ASSY	28480	01722-66501
A18C1	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18C2	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18C3	0160-3447	2	CAPACITOR-FXD 470PF +-10% 1000WVDC	28480	0160-3447
A18C4	0160-3447		CAPACITOR-FXD 470PF +-10% 1000WVDC	28480	0160-3447
A18C5	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18C6	0180-0106	1	CAPACITOR-FXD 60UF +-20% 6VDC TA-SOLID	56289	150D606X0060B2
A18C7	0180-0228	1	CAPACITOR-FXD 22UF +-10% 15VDC TA-SOLID	56289	150D226X9015B2
A18C8	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18C9	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18C10	0140-0196		CAPACITOR-FXD 150 PF +-5% 300 WVDC MICA	72136	DM15F151J0300WV1CR
A18C11	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A18CR1	1910-0034	6	DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18CR2	1910-0034		DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18CR3	1910-0034		DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18CR4	1910-0034		DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18CR5	1910-0034		DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18CR6	1910-0034		DIODE-SWITCHING 8NS 30V 80MA	28480	1910-0034
A18L1	9100-1638	8	COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L2	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L3	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L4	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L5	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L6	9100-1633	1	COIL-FXD, MOLDED RF CHOKE 68UH 5%	24226	15/682
A18L7	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L8	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A18L9	9100-1644	1	COIL-FXD, MOLDED RF CHOKE 330UH 10%	28480	9100-1644
A18L10	9170-0016		CORE-SHIELDING BEAD	02114	56-590-65A1/3B
A18Q1	1854-0550	1	TRANSISTOR NPN SI PD=500MW FT=60MHZ	28480	1854-0550
A18Q2	1853-0020	1	TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A18R1	0684-4701		RESISTOR 47 OHM 10% .25W CC TUBULAR	01121	CB4701
A18R2	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18R3	0757-0445		RESISTOR 13K 1% .125W F TUBULAR	24546	C4-1/8-T0-1302-F
A18R4	0698-3156	1	RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A18R5	0684-5631	1	RESISTOR FXD 56K 10% .25W CC TUBULAR	01121	CB5631
A18R6	0684-2231	7	RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A18R7	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A18R8	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A18R9	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A18R10	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R11	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R12	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R13	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R14	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R15	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A18R16	0684-4721	5	RESISTOR FXD 4.7K 10% .25W CC TUBULAR	01121	CB4721
A18R17	0684-4721		RESISTOR FXD 4.7K 10% .25W CC TUBULAR	01121	CB4721
A18R18	0684-4721		RESISTOR FXD 4.7K 10% .25W CC TUBULAR	01121	CB4721
A18R19	0684-4721		RESISTOR FXD 4.7K 10% .25W CC TUBULAR	01121	CB4721
A18R20	0684-4721		RESISTOR FXD 4.7K 10% .25W CC TUBULAR	01121	CB4721
A18T1	9100-0540	1	TRANSFORMER	28480	9100-0540
A18U1	1820-1226	1	IC:DGTL, SHIFT REGISTER	28480	1820-1226
A18U2	1820-1029	1	IC:DGTL, MISCELLANEOUS (DIGITAL)	28480	1820-1029
A18U3	1820-1169	1	IC:DGTL, MISCELLANEOUS (DIGITAL)	28480	1820-1169
A18U4	1820-1128	1	IC	28480	1820-1128
A18U5	1820-1145	2	IC:DGTL, TRANSLATOR	28480	1820-1145
A18U6	1818-0088	1	IC	28480	1818-0088
A18U7	1818-0089	1	IC	28480	1818-0089
A18U8	1818-0012	1	IC	28480	1818-0012
A18U9	1820-1146		IC:DGTL, CMOS HEX BUFFER CONVERTER	02735	CD4050AE
A18U10	1820-0979		IC:DGTL, TRANSLATOR (LOGIC LEVEL)	86684	CD4009AE
A18U11	1821-0001		IC:LIN, TRANSISTOR ARRAY	02735	CA3046
A18W1	R120-0643	1	CABLE, UNSHLD 16 COND 26AWG	28480	8120-0643
A18XU1	1200-0637	2	SOCKET, IC 20-PIN DIP	28480	1200-0337
A18XU2	1200-0637		SOCKET, IC 20-PIN DIP	28480	1200-0637
A18XU6	1200-0476		CONNECTOR, 1 CONT .016 DIA (10 REQD)	22526	75060-005
A18XU7	1200-0476		CONNECTOR, 1 CONT .016 DIA (10 REQD)	22526	75060-005
A19	01722-66502	1	INPUT ENCODER ASSY	28480	01722-66502
A19CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A19CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A19CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A19CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A19R1	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A19R2	0683-3625	1	RESISTOR 3.6K 5% .25W CC TUBULAR	01121	CB3625
A19R3	0634-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A19R4	1810-0076	1	CIRCUIT, PSIV, NON-RPRABLE IN	28480	1810-0076
A19R5	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A19R6	0684-1811	2	RESISTOR FXD 180 OHM .25W CC	01121	CB1811
A19R7	1810-0055	3	CIRCUIT, PSIV, NON-RPRABLE IN	28480	1810-0055
A19R9	1810-0055		CIRCUIT, PSIV, NON-RPRABLE IN	28480	1810-0055
A19R10	1810-0055		CIRCUIT, PSIV, NON-RPRABLE IN	28480	1810-0055
A19R11	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A19U1	1820-1198	12	IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U2	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U3	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U4	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U5	1820-1199	4	IC:DGTL, INVERTER SN74LS 04N	01295	SN74LS04N
A19U6	1820-1199		IC:DGTL, INVERTER SN74LS 04N	01295	SN74LS04N
A19U7	1820-1199		IC:DGTL, INVERTER SN74LS 04N	01295	SN74LS04N
A19U8	1820-1198		IC:DGTL, GATE SN 74LS 03N	01295	SN74LS03N
A19U9	1820-1198		IC:DGTL, GATE SN 74LS 03N	01295	SN74LS03N
A19U10	1820-1201	2	IC:DGTL, GATE SN74LS 08N	01295	SN74LS08N
A19U11	1820-1199		IC:DGTL, INVERTER SN 74LS 04N	01295	SN74LS04N
A19U12	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U13	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U14	1820-1112	1	IC:DGTL, FLIP-FLOP SN74LS 74N	01295	SN74LS74N
A19U15	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U16	1820-1201		IC:DGTL, GATE SN74LS 08N	01295	SN74LS08N
A19U17	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U18	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A19U19	1820-1198		IC:DGTL, GATE SN74LS 03N	01295	SN74LS03N
A20	01722-66516	1	OUTPUT INTERFACE ASSY	28480	01722-66516
A20C1	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300WVDC	28480	0160-2204
A20C2	0180-0291		CAPACITOR-FXD 1UF +-10% 35VDC TA SOLID	56289	150D105X9035A2
A20C3	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC	56289	292P10492
A20C4	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC	28480	0160-3443
A20C5	0180-0230		CAPACITOR-FXD 1UF 20% 50WVDC TA	56289	150D105X0050A2-DYS
A20J1	1251-3620	1	CONNECTOR-6 PIN	28480	1251-3620
A20J2	1200-0473		SOCKET-IC 16-CONT	01295	C931602
A20J3	1200-0474		SOCKET-IC 14-CONT	01295	C931402
A20J4	1200-0571		SOCKET-IC 8-CONT	28480	1200-0571
A20L1	9100-1638		COIL-FXD, MOLDED RF CHOKE 130UH 5%	24226	15/133
A20P3	1251-3166		CONNECTOR, 6-CONT, MALE, POST TYPE	27264	09-56-1061 (A 2183-6)
A20P4	1251-3620		CONNECTOR-6 PIN	28480	1251-3620
A20R1	0757-0289	1	RESISTOR 13.3K 1% .125W F TUBULAR	30983	MF4C-1/8-T0-1332-F
A20R2	0757-0458		RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F

See introduction to this section for ordering information

PERFORMANCE CHECK RECORD (Cont'd)
MODEL 1722A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
COMMON MODE REJECTION		
Channels A and B (5 MHz)	<minor div	_____
Channels A and B (50 MHz)	<1.1 div	_____
SWEEP TIME ACCURACY		
Main TIME/DIV	(over 10 div)	
10 nSEC	±3% (within .3 div)	_____
20 nSEC		_____
50 nSEC		_____
.1 μSEC	(over 10 div) ±2% (within .2 div)	_____
.2 μSEC		_____
.5 μSEC		_____
1 μSEC		_____
2 μSEC		_____
5 μSEC		_____
10 μSEC		_____
20 μSEC		_____
50 μSEC		_____
.1 mSEC		_____
.2 mSEC		_____
.5 mSEC		_____
1 mSEC		_____
2 mSEC		_____
5 mSEC		_____
10 mSEC		_____
20 mSEC		_____
50 mSEC	(over 10 div) ±3% (within .3 div)	_____
.1 SEC		_____
.2 SEC		_____
.5 SEC		_____
Delayed TIME/DIV	(over 10 div)	
10 nSEC	±3% (within .3 div)	_____
20 nSEC		_____
50 nSEC		_____
.1 μSEC	(over 10 div) ±2% (within .2 div)	_____
.2 μSEC		_____
.5 μSEC		_____
1 μSEC		_____
2 μSEC		_____
5 μSEC		_____
10 μSEC		_____
20 μSEC		_____
50 μSEC		_____

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20R3	2100-3274		RESISTOR:VAR, TRMR 10K OHM 10% C	32997	3389H
A20R4	0698-3162		RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A20R5	0698-3162		RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A20R6	0757-0458		RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A20R7	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A20R8	0757-0460	3	RESISTOR 61.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A20R9			NOT ASSIGNED		
A20R10	2100-3274		RESISTOR:VAR, TRMR 10K OHM 10% C	32997	3389H
A20R11			NOT ASSIGNED		
A20R12	2100-3274		RESISTOR:VAR, TRMR 10K OHM 10% C	32997	3389H
A20R13	0757-0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A20U1			NOT ASSIGNED		
A20U2	1820-0946	1	IC:DGTL, GATE	86684	CD4001AE
A20U3	1820-0949	1	IC:DGTL, GATE	86684	CD4011AE
A20U4	1820-1339	2	IC:MDS DUAL OR	28480	1820-1339
A20U5	1820-0976	3	IC:DGTL, SHIFT REGISTER	86684	CD4015AE
A20U6	1820-0939	3	IC:DGTL, FLIP-FLOP	86684	CD4013AE
A20U7	1820-0958	5	IC:DGTL, LATCH	02735	CD4042AE
A20U8	1820-0939		IC:DGTL, FLIP-FLOP	86684	CD4013AE
A20U9	1820-0927	1	IC:DGTL, DECODER/DECODER DRVR/DATA DISTR	02735	CD4028AE
A20U10	1820-0976		IC:DGTL, SHIFT REGISTER	86684	CD4015AE
A20U11	1820-0976		IC:DGTL, SHIFT REGISTER	86684	CD4015AE
A20U12			NOT ASSIGNED		
A20U13	1820-0958		IC:DGTL, LATCH	02735	CD4042AE
A20U14	1820-0958		IC:DGTL, LATCH	02735	CD4042AE
A20U15	1820-0958		IC:DGTL, LATCH	02735	CD4042AE
A20U16	1820-0958		IC:DGTL, LATCH	02735	CD4042AE
A20U17	1820-0939		IC:DGTL, FLIP-FLOP	86684	CD4013AE
A20U18			NOT ASSIGNED		
A20U19	1820-1339		IC:MDS DUAL OR	28480	1820-1339
A20U20	1820-1265	4	IC	28480	1820-1265
A20U21	1820-1265		IC	28480	1820-1265
A20U22	1820-1265		IC	28480	1820-1265
A20U23	1820-1265		IC	28480	1820-1265
A20U24	1820-0217	7	IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A20U25	1820-1146		IC:DGTL, CMOS HEX BUFFER/CONVERTER	02735	CD4050AE
A20VR1	1902-3193		DIODE-ZNR 13.3V 5% PD=0.4W	04713	SZ10939-218
A21	01722-66515	1	ANALOG ASSY	28480	01722-66515
A21C1	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA-SOLID	56289	150D156X9020B2
A21C2	0180-0374		CAPACITOR-FXD 10UF +-10% 20VDC TA-SOLID	56289	150D106X9020B2
A21C3	0180-0374		CAPACITOR-FXD 10UF +-10% 20VDC TA-SOLID	56289	150D106X9020B2
A21C4	0180-1745		CAPACITOR-FXD 1.5UF +-10% 20VDC TA	56289	150D155X9020A2
A21C5	0160-3443		CAPACITOR-FXD .1UF +80-20% 50WVDC	28480	0160-3443
A21C6	0160-3452		CAPACITOR-FXD .02UF +-20% 100WVDC	28480	0160-3452
A21C7	0160-0820	1	CAPACITOR-FXD .05UF +80-20% 25WVDC	28480	0160-0820
A21C8	0160-3452		CAPACITOR-FXD .02UF +-20% 100WVDC	28480	0160-3452
A21C9	0180-1745		CAPACITOR-FXD 1.5UF +-10% 20VDC TA	56289	150D155X9020A2
A21C10	0160-3452		CAPACITOR-FXD .02UF +-20% 100WVDC	28480	0160-3452
A21C11	0180-0291		CAPACITOR-FXD 1UF +-10% 35VDC TA-SOLID	56289	150D105X9035A2
A21C12	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A21C13	0180-0374		CAPACITOR-FXD 10UF +-10% 20VDC TA-SOLID	56289	150D106X9020B2
A21C14	0180-0197		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A21C15	0180-0374		CAPACITOR-FXD 10UF +-10% 20VDC TA-SOLID	56289	150D106X9020B2
A21C16	0180-1746		CAPACITOR-FXD 15UF +-10% 20VDC TA-SOLID	56289	150D156X9020B2
A21CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR10	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR13	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR16	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR17	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR18	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21CR19	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A21J1	1251-3272		CONNECTOR, 6-CONT, FEM, POST TYPE	27264	09-52-3063(2145-6C)
A21J2	1251-3272		CONNECTOR, 6-CONT, FEM, POST TYPE	27264	09-52-3063(2145-6C)
A21J3 THRU A21J8	1200-0571		SOCKET IC 8-CONT	28480	1200-0571
A21L1	9100-2276		COIL-FXD, MOLDED RF CHOKE 100UH 10%	24226	10/103
A21L2	9100-2276		COIL-FXD, MOLDED RF CHOKE 100UH 10%	24226	10/103

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
A21P1			(P/O P.C. BOARD)		
A21P2	1251-0674	1	CONNECTOR, 10-CONT, MALE, POST TYPE	77264	09-66-1101
A21P4	1251-4026		CONNECTOR 6-PIN	28480	1251-4026
A21Q1	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21Q2	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21Q3	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21Q4	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21Q5			NOT ASSIGNED		
A21Q6	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A21Q7	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A21Q8	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A21Q9	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A21Q10			NOT ASSIGNED		
A21Q11	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21Q12	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A21R1	0757-0451		RESISTOR-FXD 24.3K 1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A21R2	0757-0440	1	RESISTOR-FXD 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A21R3	0757-0290		RESISTOR-FXD 6.19K 1% .125W F TUBULAR	30983	MF4C-1/8-T0-6191-F
A21R4	0757-0290		RESISTOR-FXD 6.19K 1% .125W F TUBULAR	30983	MF4C-1/8-T0-6191-F
A21R5	0757-0444	1	RESISTOR-FXD 12.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A21R6	0698-6599	2	RESISTOR 4.64K 1% .125W F TUBULAR	03888	PME55
A21R7	0698-6600	1	RESISTOR 4.87K 1% .125W F TUBULAR	03888	PME55
A21R8	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A21R9	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A21R10	0698-6360		RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C-1/8-T9-1002-B
A21R11	2100-3622	1	RESISTOR:VAR, TRMR 500 OHM 10% 0.5W C	32997	3339W-1-501
A21R12	2100-3274	3	RESISTOR:VAR, TRMR 10K OHM 10% C	28480	2100-3274
A21R13	0757-0484	1	RESISTOR 619K 1% .125W F TUBULAR	30983	MF6C-1/8-T0-6193-F
A21R14	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A21R15	0684-3901		RESISTOR 39 OHM 10% .25W CC TUBULAR	01121	CB3901
A21R16	2100-3352		RESISTOR:VAR, TRMR 1K OHM 10% C	73138	72XR102
A21R17	0698-6360		RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C-1/8-T9-1002-B
A21R18	0698-6360		RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C-1/8-T9-1002-B
A21R19	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A21R20	0698-6360		RESISTOR 10K .1% .125W F TUBULAR	19701	MF4C-1/8-T9-1002-B
A21R21	0684-4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A21R22	0698-6599		RESISTOR 4.64K 1% .125W F TUBULAR	03888	PME55
A21R23	0684-4721		RESISTOR 4.7K 01% .25W CC TUBULAR	01121	CB4721
A21R24	0684-4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A21R25	0684-4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A21R26	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A21R27	0684-3921		RESISTOR 3.9K 10% .25W CC TUBULAR	01121	CB3921
A21R28	2100-3352		RESISTOR:VAR, TRMR 1K OHM 10% C	73138	72XR102
A21R29	0684-4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A21R30	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A21R31	0684-1521		RESISTOR 1.5K 10% .25W CC TUBULAR	01121	CB1521
A21R32	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A21R33	0684-1231	1	RESISTOR 12K 10% .25W CC TUBULAR	01121	CB1231
A21R34	0684-4721		RESISTOR 4.7K 10% .25W CC TUBULAR	01121	CB4721
A21R35	0684-1011		RESISTOR 100 OHM 10% .25W CC TUBULAR	01121	CB1011
A21R36	0684-3321		RESISTOR 3.3K 10% .25W CC TUBULAR	01121	CB3321
A21R37	0698-3152	1	RESISTOR 3.84K 1% .125W F TUBULAR	28480	0698-3152
A21R38	0757-0317		RESISTOR 1.33K 1% .125W F TUBULAR	28480	0757-0317
A21R39	0757-0421		RESISTOR 825 OHM 1% .125W F TUBULAR	28480	0757-0421
A21R40	0683-2025	1	RESISTOR 2K 5% FC TC=-400/+700	01121	CB2025
A21R41	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A21R42	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A21R43	0757-0421		RESISTOR 825 OHM 1% .125W F TUBULAR	28480	0757-0421
A21R44	0684-2221		RESISTOR 2.2K 10% .25W CC TUBULAR	01121	CB2221
A21R45	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	28480	0698-3153
A21R46	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	28480	0698-0085
A21R47	0684-2231		RESISTOR 22K 10% .25W CC TUBULAR	01121	CB2231
A21R48	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A21R49	0684-1031		RESISTOR 10K 10% .25W CC TUBULAR	01121	CB1031
A21R50	2100-3274		RESISTOR:VAR, TRMR 10K OHM 10C	28480	2100-3274
A21U1	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U2	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U3	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U4	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U5	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U6	1826-0009	1	IC:LIN, OPERATIONAL AMPLIFIER	07263	725HC
A21U7	1820-0596	1	IC:DGTL, FLIP-FLOP	27014	DM74L74N
A21U8	1820-0217		IC:LIN, OPERATIONAL AMPLIFIER	28480	1820-0217
A21U9	1820-1204	1	IC:DGTL, GATE SN74LS 20N	01295	SN74LS20N
A22	01722-26506	1	TIME DELAY SWITCH PC BOARD (DOES NOT INCLUDE A22MP1 AND A22MP2)	28480	01722-26506
A22MP1	01722-61901	1	ROTOR SWITCH ASSY, MALE	28480	01722-61901
A22MP2	01722-61902	1	ROTOR SWITCH ASSY, FEMALE	28480	01722-61902
A23	01722-66507	1	LED DISPLAY ASSY	28480	01722-66507
A23U1	1990-0463	2	DISPLAY-NUM	28480	1990-0463
A23U2	1990-0463		DISPLAY-NUM	28480	1990-0463

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
A23XU1	1200-0768	2	SOCKET, ELEC, IC 14-CONT, DIP SLDR TERM	91506	314-AG5D-3R
A23XU2	1200-0768		SOCKET, ELEC, IC 14-CONT, DIP SLDR TERM	91506	314-AG5D-3R
A24	01722-66508	1	SELECTOR SWITCH ASSY	28480	01722-66508
A24CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A24CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A24S1	3101-0697	1	SWITCH:PB 4-STA DPDT	28480	3101-0697
			PARTS LIST FOR OPTION 101		
A26	01710-66553	1	BOARD ASSY-STATE DISPLAY	28480	01710-66553
A26C1	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC CER	28480	0160-3451
A26C2	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC CER	28480	0160-3451
A26C3	0160-3446		CAPACITOR-FXD 220PF +-10% 1000WVDC CER	28480	0160-3446
A26C4	0160-3451		CAPACITOR-FXD .01UF +80--20% 100WVDC CER	28480	0160-3451
A26CR1	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR2	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR3	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR4	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR5	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR6	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR7	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26CR8	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A26P1	1251-3976		CONNECTOR:MALE	28480	1251-3976
A26P2	1251-3976		CONNECTOR:MALE	28480	1251-3976
A26Q1	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q2	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q3	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q4	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q5	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A26Q6	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q7	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853 0036
A26Q8	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26Q9	1853-0036		TRANSISTOR PNP SI CHIP PD=310MW	28480	1853-0036
A26Q10	1854-0215		TRANSISTOR NPN SI PD=310MW FT=300MHZ	04713	SPS3611
A26R1	0684-0271		RESISTOR 2.7 OHM 10% .25W CC TUBULAR	01121	CB27G1
A26R2	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A26R3	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A26R4	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A26R5	0757-0283		RESISTOR 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A26R6	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-151-F
A26R7	0757 0729		RESISTOR 681 OHM 1% .25W F TUBULAR	24546	C4-1/8-T0-681R-F
A26R8	0757-0284		RESISTOR 150 OHM 1% .125W F TUBULAR	24546	C4-1/8 T0-151-F
A26R9	0757-0427		RESISTOR 1.5K 1% .125W F TUBULAR	24546	C4 1/8 T0-1501-F
A26R10	0698-3152		RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3481 F
A26R11	0757-0288		RESISTOR 9.09K 1% .125W F TUBULAR	19701	MF4C-1/8-T0-9091 F
A26R12	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A26R13	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A26R14	0757-0410		RESISTOR 301 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-301R-F
A26R15	0757 0421		RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A26R16	0698 0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4 1/8-T0-2611-F
A26R17	1810-0243		RESISTOR 6.8K, 8 SECTION	28480	1810-0243
A26R18	0684-4711		RESISTOR 470 OHM 10% .5W CC TUBULAR	01121	EB4711
A26R19	0757-0932		RESISTOR 2.2K 2% .125W F TUBULAR	24546	C4-1/8-T0-2201 G
A26R20	0684-1001		RESISTOR 10 OHM 10% .25W CC TUBULAR	01121	CB1001
A26R21	0684-1021		RESISTOR 1K 10% .25W CC TUBULAR	01121	CB1021
A26S1	3101-0973		SWITCH, SL, DPDT .5A 125VAC/DC	79727	GF126-0018
A26VR1	1902-3094		DIODE-ZNR 5.11V 2% D0-7 PD=.4W	04713	SZ10939-99
A26VR2	1902-3149		DIODE ZNR 9.09V 5% D0-7 PD=.4W	04713	SZ.10939-170
A27	01710-66554		BOARD ASSY DIODE INTERFACE	28480	01710-66554
A27CR1	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A27CR2	1901-0047		DIODE SWITCHING 10NS 20V 75MA	28480	1901-0047
A27CR3	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901 0047
A27CR4	1901 0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
MP42	01720-67403	1	KNOB ASSY/101 (INTENSITY CONTROL ONLY)	28480	01720-67403
R2	2100-3244	1	RESISTOR VAR 10K 10% 4PSW (INTENSITY)	28480	2100-3244
W8	01710-61635		CABLE-OPT 101 MAIN	28480	01710-61635
W9	01710-61636		CABLE OPT 101 TWIN	28480	01710-61636
W10	01710-61637		CABLE-OPT 101 COAX	28480	01710-61637

See introduction to this section for ordering information

Table 6-3. List of Manufacturers' Codes

Mfr No.	Manufacturer Name	Address	Zip Code
FR003	SOVCOR ELECTRONIQUE	LE VESINET FRANCE	
00000	COMMON USA MFR.		
0041N	NL INDUSTRIES	HIGHSTOWN NJ	08520
01121	ALLEN BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03888	PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
07716	TRW INC BURLINGTON DIV	BURLINGTON IA	52601
08806	GE CO MINIATURE LAMP PROD DEPT	CLEVELAND OH	44112
09353	C AND K COMPONENTS INC	WATERTOWN MA	02172
12954	DICKSON ELECTRONICS CORP	SCOTTSDALE AZ	85252
13103	THERMALLOY CO	DALLAS TX	75247
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW CA	94040
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
22526	BERG ELECTRONIC INC	NEW CUMBERLAND PA	17070
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS	BRADFORD PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
24995	ENVIRONMENTAL CONTAINER SYSTEMS INC	PALO ALTO CA	94304
25403	AMPEREX SOLID STATE ACTIVE DVC DIV	SLATTERSVILLE RI	02876
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
30983	MEPCO/ELECTRA CORP	SAN DIEGO CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
4H713	CINCH MFG CO	SHELBYVILLE IN	46176
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
61637	UNION CARBIDE CORP	NEW YORK NY	10017
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	ST LOUIS MO	63017
71590	CENTRALAB ELEK DIV GLOBE-UNION INC	MILWAUKEE WI	53201
71744	CHICAGO MINIATURE LAMP WORKS	CHICAGO IL	60640
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE PA	16512
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634
73899	J F D ELECTRONICS CORP	BROOKLYN NY	11219
74276	SIGNALITE INC	NEPTUNE NJ	07753
74970	JOHNSON E F CO	WASECA MN	56093
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA PA	19108
79727	C-W INDUSTRIES	WARMINSTER PA	18974
82389	SWITCHCRAFT INC	CHICAGO IL	60630
84411	TRW CAPACITOR DIV	OGALLALA NE	69153
86684	RCA CORP ELECTRONIC COMPONENTS	HARRISON NJ	07029
9D949	AMPHENOL SALES DIV OF BUNKER-RAMO	HAZELWOOD MO	63042
91506	AUGAT INC	ATTLEBORO MA	02703
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601

See introduction to this section for ordering information

BACK DATING MANUAL CHANGES

SECTION VII

MANUAL CHANGES

7-1. INTRODUCTION.

7-2. This section contains information required to backdate this manual for a specific instrument. Descriptions of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. Refer to paragraph 7-13 for changes. When making changes listed in table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either on the title page or in table 7-1, refer to the enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA corrections.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1429A	9 thru 1,
1507A	9 thru 2,
1508A	9 thru 3,
1515A	9 thru 4,
1531A	9 thru 5,
1544A	9 thru 6,
1552A	9 thru 7,
1634A	9, 8
1643A	9

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this manner will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information (and MANUAL CHANGES sheet information, if applicable). When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. The following paragraphs list the options available for Model 1722A.

7-11. OPTION 003. This option supplies two rear-panel connectors for probe power. The option consists of the standard instrument and assembly A25. See figure 7-1 for option 003 schematic. Refer to table 7-2 for component part numbers.

Table 7-2. Option 003 Parts List

Ref Desig	HP Part No.	Description
A25	01720-60001	ASSY:PROBE POWER
A25A1	01720-66516	BOARD ASSY: PROBE POWER
A25A1C1	0180-1746	C:15UF 20VDCW
A25A1CR1	1901-0028	CR:DIODE SI
A25A1MP1	1205-0095	HEATSINK FOR Q1
A25A1Q1	1854-0039	TSTR:SI NPN
A25A1Q2	1853-0086	TSTR:SI PNP
A25A1R1	0698-3155	R:4.64K 1/8W
A25A1R2	0757-0451	R:24.3K 1/8W
A25A1R3	0683-1525	R:1.5K 1/4W
A25J1, 2	5060-0467	CONN:MALE PROBE
A25MP1, 2	01710-24704	SPACER:JACK
A25MP3	01720-01208	BRACKET:POWER PROBE
A25W1	01720-61606	CABLE ASSY:3-COND

7-12. OPTION 101. Consists of Board Assembly A26, HP Part No. 01710-66553, and Board Assembly A27, HP Part No. 01710-66554. The board assemblies adapt the Model 1722A for use with HP Model 1607A Logic State Analyzer. When modified, the Model 1722A can be used normally or as a 16-channel logic state display. (See figures 7-2 through 7-4 for schematic and assembly component identification. Refer to the end of table 6-2 for Option 101 parts list.)

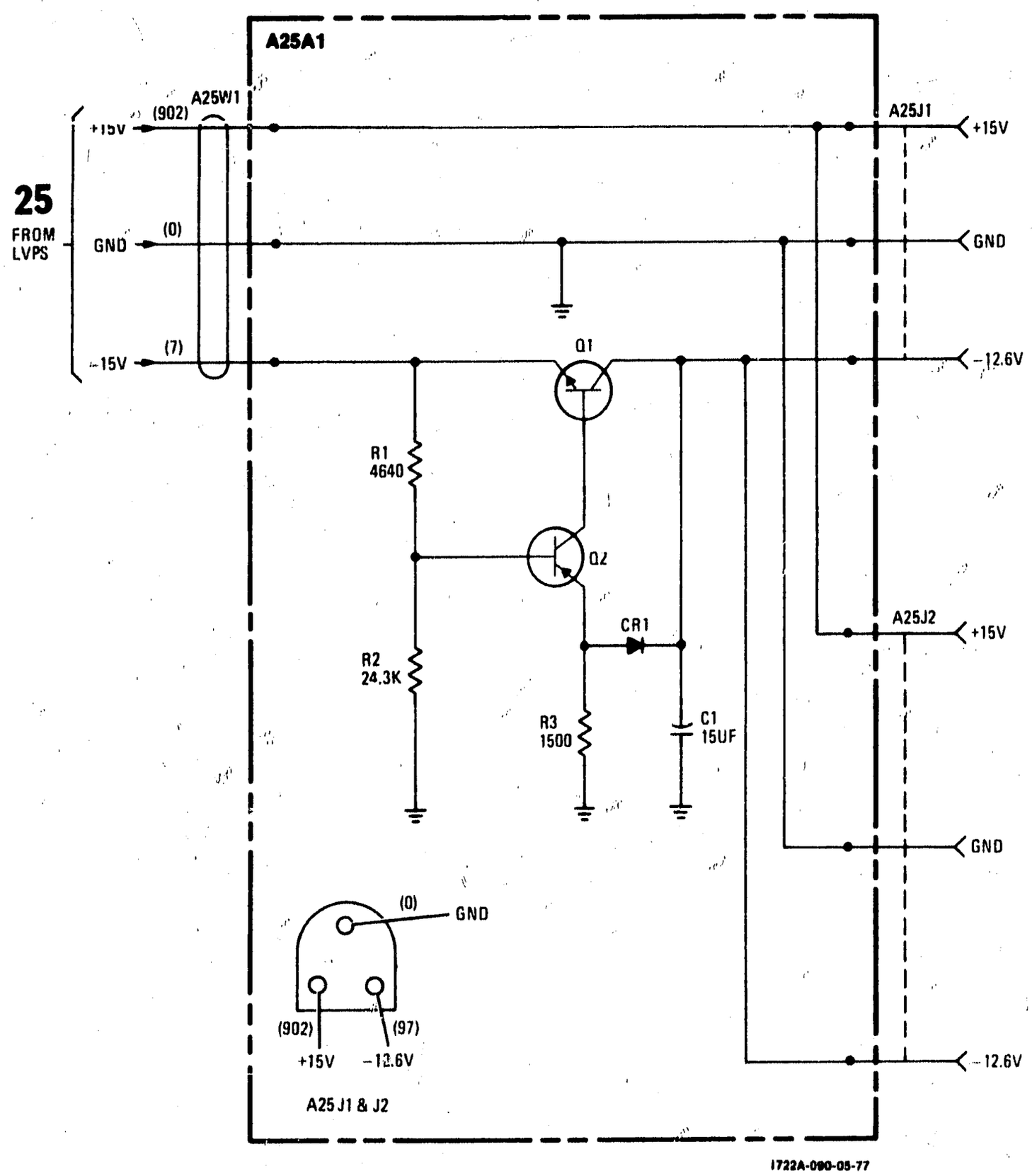


Figure 7-1. Option 003 Probe Power Schematic

7-13. MANUAL CHANGES LISTING.

CHANGE 1

Page 6-3, figure 6-1,
MP79/MP87: show as one knob; label MP79 (MP87 deleted).
Table 6-2,
A3: Change HP Part No. and Mfr Part No. to 01722-66509; Description unchanged.
MP79: Change HP Part No. and Mfr Part No. to 01722-67401. Description: KNOB:POSITION (CHAN A).
Delete: MP87.
R3: Change to HP Part No. 2100-3389, RESISTOR: VAR 2K (CHAN A POSITION); Mfr Code 28480, Mfr Part No. 2100-3389.
Delete: R23 and R24.
A3R17: Change to HP Part No. 0757-0447, RESISTOR 16.2K OHM 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1622-F.
A3R81: Change to HP Part No. 0698-3191, RESISTOR 1M .25% .25W F TUBULAR; Mfr Code 07716, Mfr Part No. CCA1/4-T2-1004-C.
Schematic 3,
A3R17: Change value to 16.2K.
A3R81: Change value to 1M.
Delete: R3B and R25.
Delete: R23. Make straight through connection from wiper of R3A to A3P5 pin 6.
R3A: Relabel as R3, CHAN A POSITION.

CHANGE 2

Table 6-2,
A8: Change HP Part No. and Mfr Part No. to 01722-66510. Description unchanged.

A8C8: Change to HP Part No. 0160-3650, CAPACITOR-FXD .018 UF +—10% 50 WVDC; Mfr Code 28480, Mfr Part No. 0160-3650.
A8C11: Change to HP Part No. 0160-3448, CAPACITOR-FXD .001 UF +—10% 1000 WVDC; Mfr Code 28480, Mfr Part No. 0160-3448.
A8C26: Change to HP Part No. 0160-3650, CAPACITOR-FXD .018 UF +—10% 50 WVDC; Mfr Code 28480, Mfr Part No. 0160-3650.
A8C29: Change to HP Part No. 0160-3448, CAPACITOR-FXD .001 UF +—10% 1000 WVDC; Mfr Code 28480, Mfr Part No. 0160-3448.
Add: A8R2; HP Part No. 0757-0471, RESISTOR 182K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1823-F.
A8R10: Change to HP Part No. 0698-3427, RESISTOR 13.3 OHM 1% .125W F TUBULAR; Mfr Code 03888, Mfr Part No. PME55-1/8-T0-13R3-F.
A8R11: Change to HP Part No. 0698-3451, RESISTOR 133K 1% .125W F TUBULAR; Mfr Code 16299, Mfr Part No. C4-1/8-T0-1333-F.
A8R12: Change to HP Part No. 0757-0471, RESISTOR 182K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1823-F.
A8R13: Change to HP Part No. 0698-8198, RESISTOR 1.58M 1% .125W F TUBULAR; Mfr Code 30983, Mfr Part No. MF5C-1/8-TO-1584-F.
A8R15: Change to HP Part No. 0684-3341, RESISTOR 330K 10% .25W F TUBULAR; Mfr Code 01121, Mfr Part No. CB3341.
A8R18: Change to HP Part No. 0684-1011, RESISTOR 100 OHM 10% .25W CC TUBULAR; Mfr Code 01121, Mfr Part No. CB1011.
Add: A8R60; HP Part No. 0757-0471, RESISTOR 182K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1823-F.
A8R63: Change to HP Part No. 0757-0471, RESISTOR 182K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-1823-F.
A8R69: Change to HP Part No. 0698-3427, RESISTOR 13.3 OHM 1% .125W F TUBULAR; Mfr Code 03888, Mfr Part No. PME55-1/8-T0-13R3-F.
A8R70: Change to HP Part No. 0698-3451, RESISTOR 133K 1% .125W F TUBULAR; Mfr Code 16299, Mfr Part No. C4-1/8-T0-1333-F.
A8R71: Change to HP Part No. 0698-8198, RESISTOR 1.58M 1% .125W F TUBULAR; Mfr Code 30983, Mfr Part No. MF5C1/8-T0-1584-F.
A8R73: Change to HP Part No. 0684-3341, RESISTOR 330K 10% .25W CC TUBULAR; Mfr Code 01121, Mfr Part No. CB3341.
A8R85: Change to HP Part No. C684-1011, RESISTOR 100 OHM 10% .25W CC TUBULAR; Mfr Code 01121, Mfr Part No. CB1011.
A8R170: 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.
A8R171: Change to HP Part No. 0757-0464, RESISTOR 90.9 K 1% .125W F TUBULAR; Mfr Code 24546, Mfr Part No. C4-1/8-T0-9092-F.
A12: Change HP Part No. and Mfr Part No. to 01722-66505; Description unchanged.
A12C2: Change to HP Part No. 0140-0149, CAPACITOR-FXD 470 PF +—5% 300 WVDC; Mfr Code 72136, Mfr Part No. DM15F471J0300WV1CR.
A12C3: Change to HP Part No. 0160-0300, CAPACITOR-FXD .0027 UF +—10% 200 WVDC; Mfr Code 56289, Mfr Part No. 292P27292.
A12C4: Change to HP Part No. 0160-0162, CAPACITOR-FXD .022 UF +—10% 200 WVDC; Mfr Code 56289, Mfr Part No. 292P22392.
A12C5: Change to HP Part No. 0170-0040, CAPACITOR-FXD .047 UF +—10% 200 WVDC; Mfr Code 56289, Mfr Part No. 292P47392.
A12C7: Change to HP Part No. 0180-0301, CAPACITOR-FXD 5 UF +75—10% 50 VDC AL; Mfr Code 56289, Mfr Part No. 30D505G050BB2.
Delete: A12R45 and A12R46.

Page 8-30, figure 8-10,
Replace with figure 7-5.

Schematic 7,
A8C8: Change value to .018 UF.
A8C11: Change value to 1000 PF.
Add: A8R2. Connect between right, center terminal of A8S1N and ground. Value of A8R2 is 182K.
A8R10: Change value to 13.3 ohms.
A8R11: Change value to 133K.
A8R12: Change value to 182K.
A8R13: Change value to 1.58M.
A8R15: Change value to 330K.
A8R18: Change value to 100 ohms.
A8R171: Change value to 90.9K.

Schematic 9,
Replace with figure 7-6.

Schematic 11,
Delete A12R45 and A12R46; make straight through connections.
A12C2: Change value to 470 PF.
A12C3: Change value to 2700 PF.
A12C4: Change value to .022 UF.
A12C5: Change value to .047 UF.
A12C7: Change value to 5 UF.

CHANGE 3

Table 6-2,
A20: Change HP Part No. and Mfr Part No. to 01722-66503; Description unchanged.
Delete: A20C5.
Add: A20P1 and A20P2; HP Part No. 1251-3166, CONNECTOR, 6-CONT, MALE, POST TYPE; Mfr Code 27264, Mfr Part No. 09-56-1061-(A2183-6).
A20P4: Change to HP Part No. 1251-3166, CONNECTOR, 6-CONT, MALE, POST TYPE; Mfr Code 27264, Mfr Part No. 09-56-1061-(A-2183-6).
Delete: A20R13.
Delete: A20VR1.
A21: Change HP Part No. and Mfr Part No. to 01722-66518; Description unchanged.
Delete: A21P4.

Page 8-56, figure 8-23,
Replace with figure 7-7.

Schematic 17,
Replace with figure 7-8.
Schematic 20,
Replace with figure 7-9.
Schematic 21,
Change: +12VF to read +15VF for each IC circuit on assembly A20.
Page 8-60, figure 8-25,
Change: A21P4 designation to A21XA20A.
Add: A21XA20B to D-3 location (to right side of A21C13).
Schematic 23,
Replace with figure 7-10.

CHANGE 4

Table 6-2,
A14: Change HP Part No. and Mfr Part No. to 01720-66513; Description unchanged.
A15: Change HP Part No. and Mfr Part No. to 01720-66512; Description unchanged.
Add: DS2 and DS3; HP Part No. 2140-0008; LAMP, GLOW, BULB T-2, 59 V; Mfr Code 71744, Mfr Part No. A1A(NE2).
W5: Change HP Part No. and Mfr Part No. to 01720-61604; Description unchanged.
Delete: A14C32.
Delete: A14CR13 and A14CR14.
Delete: A14Q18 and A14Q19.
Delete: A14R5.
A14R6: Change to HP Part No. 0684-1021; RESISTOR 1K OHM 10% .25W CC TUBULAR; Mfr Code 01121, Mfr Part No. CB1021.
Delete: A14R80 and A14R81.
Delete: A14VR5.
Delete: A15DS1 and A15DS2.
Delete: A15R14.
Figure 8-18,
Replace with figure 7-11.
Schematic 15,
Replace with figure 7-12.
Figure 8-19,
Replace with figure 7-13.
Schematic 16,
Replace with figure 7-14.

CHANGE 5

Table 6-2,
A5: Change HP Part No. and Mfr Part No. to 01720-66525; Description unchanged.
Delete: A5CR3 and A5CR4.
A6: Change HP Part No. and Mfr Part No. to 01720-66501; Description unchanged.
A7: Change HP Part No. and Mfr Part No. to 01720-66502; Description unchanged.
A10: Change HP Part No. and Mfr Part No. to 01720-66520; Description unchanged.
A13: Change HP Part No. and Mfr Part No. to 01720-66523; Description unchanged.
Delete: A13CR3 and A13CR4.
Page 8-24, figure 8-7,
Delete: A5CR3 and A5CR4.
Schematic 4,
Delete: A5CR3 and A5CR4.
Page 8-44, figure 8-17,
Delete: A13CR3 and A13CR4.
Schematic 14,
Delete: A13CR3 and A13CR4.

CHANGE 6

Table 6-2,
A9: Change HP Part No. and Mfr Part No. to 01720-66522; Description unchanged.
A11: Change HP Part No. and Mfr Part No. to 01720-66521; Description unchanged.
A9C2, A9C10, A9C12: Change to HP Part No. 0121-0456, Description unchanged; Mfr Code 74970, Mfr Part No. 187-0109-105.
A11C4, A11C12, A11C14: Change to HP Part No. 0121-0456, Description unchanged; Mfr Code 74970, Mfr Part No. 187-0109-105.

CHANGE 7

Table 6-2,
Add: H34, HP Part No. 2360-0117, SCREW-MACH 6-32 PAN HD POZI REC SST-300, Mfr Code 28480, Mfr Part No. 2360-0117.
MP5: Change HP Part No. and Mfr Part No. to 01720-01207.
MP63: Change HP Part No. and Mfr Part No. to 01720-23706.
Delete: MP90.
W7: Change HP Part No. and Mfr Part No. to 01720-61627.

CHANGE 8

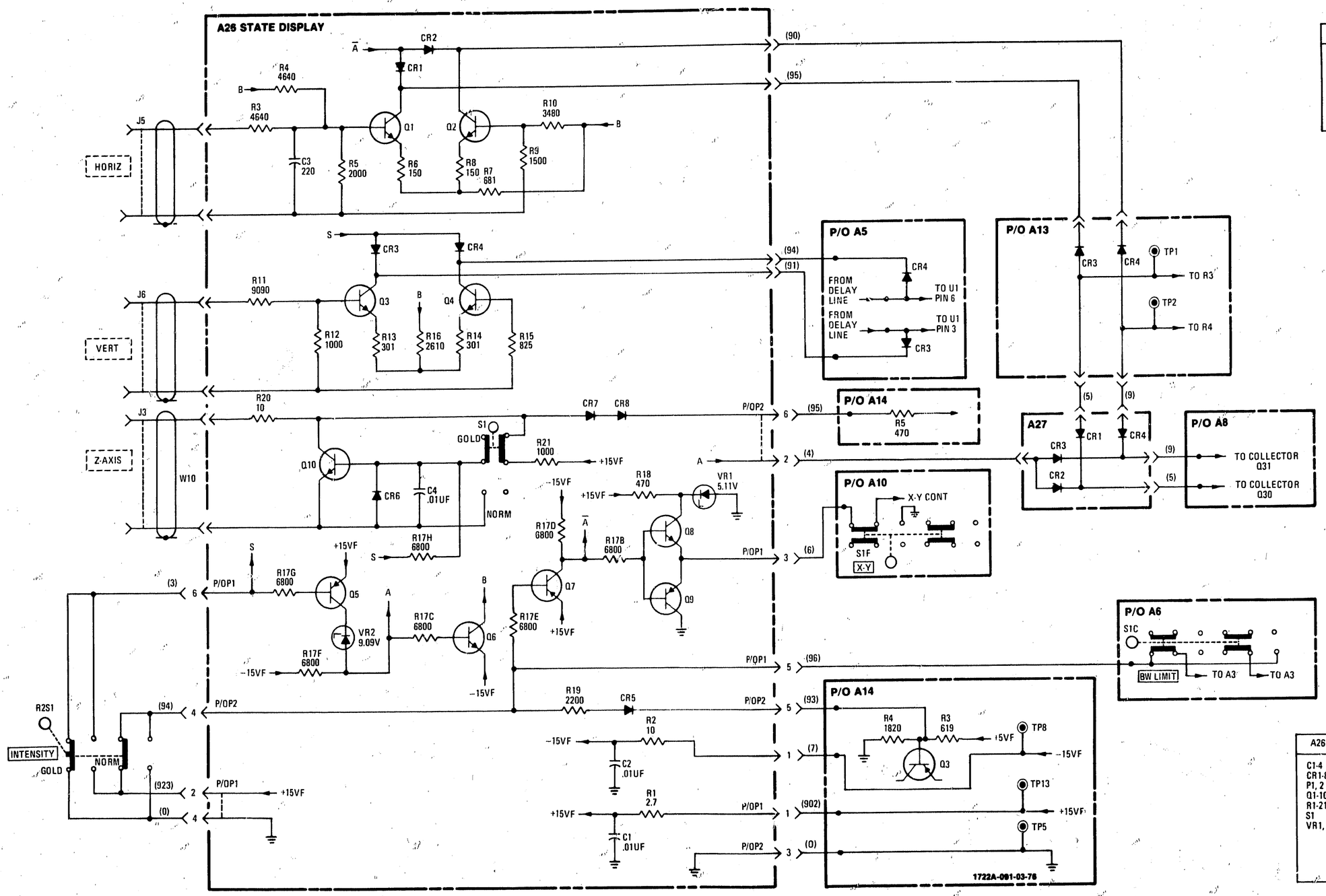
Table 6-2,
Delete: A3CR2, A3CR3, A3L10, and A3L11.
Schematic 3,
Delete: A3CR2, A3CR3, A3L10, and A3L11.

CHANGE 9

Table 6-2,
A14: Change HP Part No. and Mfr Part No. to 01720-66533.
Delete: A14Q20 and A14Q21.
A14R5: Change to HP Part No. 0684-4711, RESISTOR-FXD 470 OHM 10% .25W CC, Mfr Code 01121, Mfr Part No. CB4711.
Schematic 15,
Delete: A14Q20 and A14Q21.
A14R5: Change value to 470 and connect directly to J3.

VOLTAGE LEVEL TABLE

SYMBOL	GOLD	NORM
S	GND	+15VF
A	+6V	−15V
Ā	−7.5V	+15V
B	−15V	OPEN



PARTS ON THIS SCHEMATIC

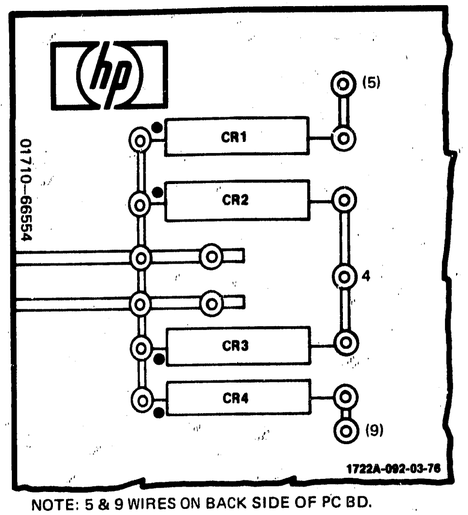
A26	A27	P/O A5	P/O A6
C1-4 CR1-8 P1, 2 Q1-10 R1-21 S1 VR1, 2	CR1-4	CR3, 4	S1C
		P/O A10	P/O A13
		S1F	CR3, 4

Figure 7-2.
Option 101 Schematic

PERFORMANCE CHECK RECORD (Cont'd)
MODEL 1722A

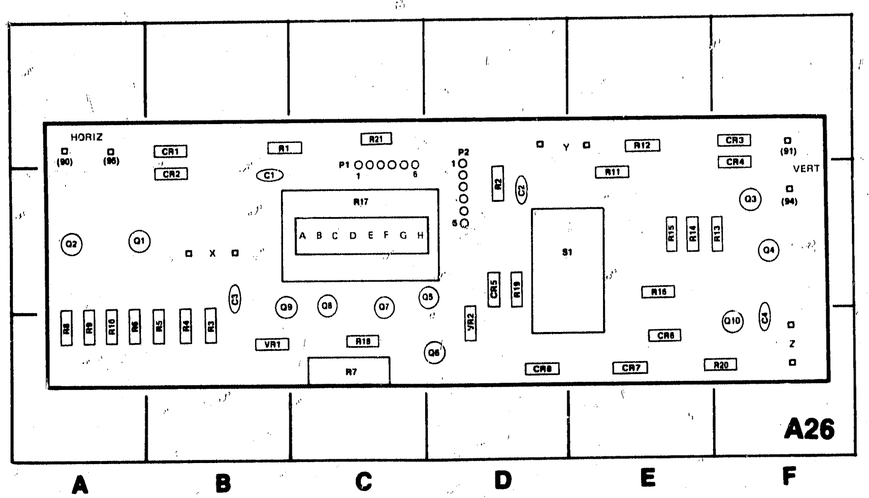
Instrument Serial Number _____ Date _____

Check	Specification	Measured
Delayed TIME/DIV (Cont'd) .1 mSEC .2 mSEC .5 mSEC 1 mSEC 2 mSEC 5 mSEC 10 mSEC 20 mSEC	(over 10 div) ±2% (within .2 div)	_____ _____ _____ _____ _____ _____ _____ _____
SHORT TERM STABILITY Delay Jitter	<1 div	_____
DIFFERENTIAL TIME MEASUREMENT and FREQUENCY ACCURACY time 01.00 –6 1/time 1.000 +6	 ±.01 ±.006	 _____ _____
RISE TIME Channel A rise time Channel B rise time	 <1.3 ns <1.3 ns	 _____ _____



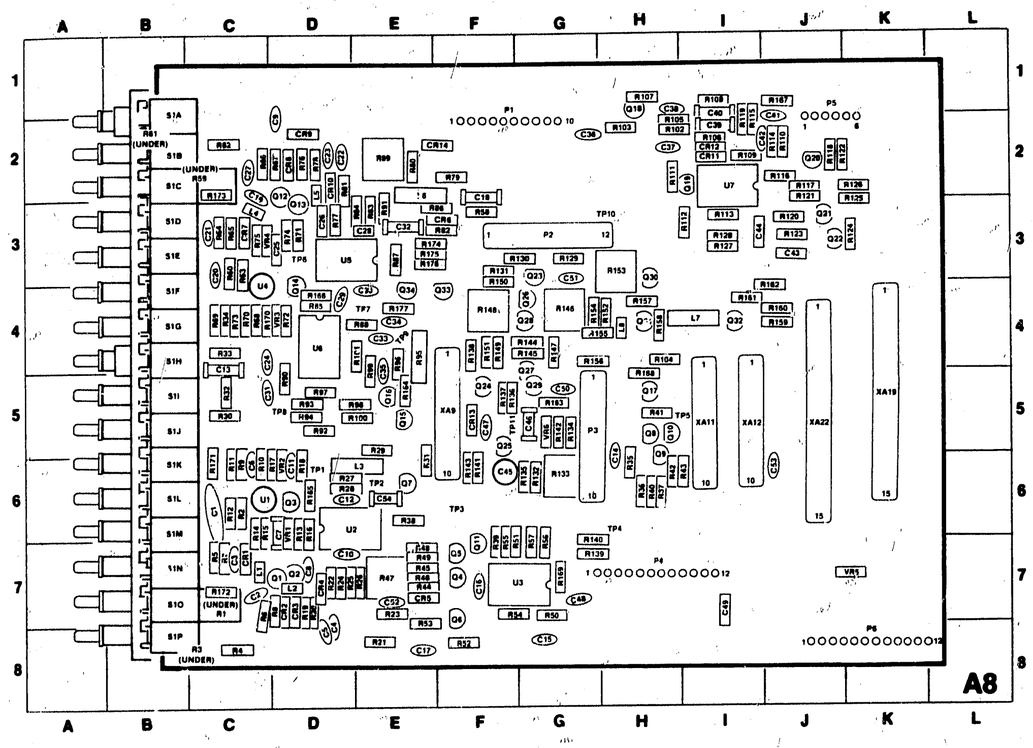
NOTE: 5 & 9 WIRES ON BACK SIDE OF PC BD.

Figure 7-3. Assembly A27 Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	P1	C-3	R1	B-3	R13	F-2
C2	D-2	P2	D-3	R2	D-2	R14	E-2
C3	B-2	Q1	A-2	R3	B-1	R15	E-2
C4	F-1	Q2	A-2	R4	B-1	R16	E-2
CR1	B-3	Q3	F-2	R5	B-1	R17	C-2
CR2	B-2	Q4	F-2	R6	A-1	R18	C-1
CR3	F-3	Q5	D-2	R7	C-1	R19	D-2
CR4	F-3	Q6	D-1	R8	A-1	R20	F-1
CR5	D-2	Q7	C-2	R9	A-1	R21	C-1
CR6	E-1	Q8	C-2	R10	A-1	S1	D-2
CR7	E-1	Q9	B-2	R11	E-2	VR1	B-1
CR8	D-1	Q10	F-1	R12	E-3	VR2	D-1

Figure 7-4. Assembly A26 Component Identification



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C2	D-7	C35	E-5	L1	C-7	Q21	E-8	R21	E-8	R55	F-7	R89	E-2	R123	J-3	R157	H-4	S1N	B-7
C3	C-7	C36	G-2	L2	D-7	Q22	J-3	R22	D-7	R56	G-7	R90	D-5	R124	K-3	R158	H-4	S1O	B-7
C4	D-8	C37	H-2	L3	E-6	Q23	E-7	R23	E-7	R57	G-7	R91	E-3	R125	K-3	R159	J-4	S1P	B-8
C5	D-8	C38	H-1	L4	C-3	Q24	F-5	R24	D-7	R58	H-4	R92	D-5	R126	K-2	R160	J-4	TP1	D-6
C6	C-6	C39	I-2	L5	D-2	Q25	F-5	R25	D-7	R59	C-2	R93	D-5	R127	I-3	R161	I-4	TP2	E-6
C7	C-7	C40	I-1	L6	E-2	Q26	G-4	R26	E-7	R60	C-3	R94	D-5	R128	I-3	R162	J-4	TP3	F-6
C8	D-7	C41	J-2	L7	I-4	Q27	G-5	R27	E-6	R61	B-2	R95	E-4	R129	G-3	R163	G-5	TP4	H-6
C9	D-2	C42	I-2	L8	H-4	Q28	G-4	R28	E-6	R62	C-2	R96	E-4	R130	G-3	R164	E-5	TP5	I-5
C10	E-7	C43	J-3	P1	F-1	Q29	G-5	R29	E-5	R63	C-3	R97	D-5	R131	F-3	R165	D-6	TP6	D-3
C11	D-6	C44	I-3	P2	G-3	Q30	H-3	R30	C-5	R64	C-3	R98	E-5	R132	G-6	R166	D-4	TP7	E-4
C12	E-6	C45	F-6	P3	G-5	Q31	H-4	R31	E-6	R65	C-3	R99	E-5	R133	G-6	R167	J-1	TP8	D-5
C13	C-4	C46	G-5	P4	H-7	Q32	I-4	R32	C-5	R66	C-2	R100	E-5	R134	G-5	R168	H-5	TP9	E-4
C14	H-5	C47	F-5	P5	J-1	Q33	F-4	R33	C-4	R67	D-2	R101	E-5	R135	G-6	R169	G-7	TP10	H-3
C15	G-8	C48	G-7	P6	K-7	Q34	E-4	R34	C-4	R68	C-4	R102	H-2	R136	F-5	R170	D-4	TP11	F-5
C16	C-7	C49	I-7	Q1	D-7	R1	C-7	R35	H-5	R69	C-4	R103	H-2	R137	F-5	R171	C-6	U1	D-6
C17	E-8	C50	G-5	Q2	D-7	R2	C-6	R36	H-6	R70	C-4	R104	H-4	R138	F-4	R172	C-7	U2	D-4
C18	F-3	C51	G-3	Q3	D-6	R3	C-8	R37	H-6	R71	D-3	R105	H-1	R139	G-7	R173	C-2	U3	F-7
C19	C-3	C52	E-7	Q4	F-7	R4	C-8	R38	E-6	R72	D-4	R106	I-2	R140	G-7	R174	E-3	U4	D-3
C20	C-3	C53	J-6	Q5	F-7	R5	C-7	R39	F-7	R73	C-4	R107	H-1	R141	F-6	R175	E-3	U5	D-3
C21	C-3	C54	E-6	Q6	F-7	R6	D-7	R40	H-6	R74	D-3	R108	I-2	R142	G-5	R176	E-3	U6	D-4
C22	D-2	CR1	C-7	Q7	E-6	R7	C-7	R41	H-5	R75	C-3	R109	I-2	R143	F-6	R177	E-4	U7	I-2
C23	D-2	CR2	D-7	Q8	H-5	R8	D-7	R42	H-6	R76	D-2	R110	J-2	R144	G-4	S1A	B-1	VR1	D-7
C24	D-4	CR3	D-7	Q9	H-6	R9	C-6	R43	I-6	R77	D-3	R111	H-2	R145	G-4	S1B	B-2	VR2	D-6
C25	D-3	CR4	D-7	Q10	H-5	R10	C-6	R44	E-7	R78	D-2	R112	H-2	R146	G-4	S1C	B-2	VR3	D-4
C26	D-3	CR5	E-7	Q11	F-7	R11	C-6	R45	E-7	R79	F-2	R113	I-3	R147	G-4	S1D	B-3	VR4	D-3
C27	C-2	CR6	F-3	Q12	D-2	R12	C-6	R46	E-7	R80	E-2	R114	J-2	R148	F-4	S1E	B-3	VR5	G-5
C28	E-3	CR7	C-3	Q13	D-3	R13	D-7	R47	E-7	R81	D-2	R115	I-2	R149	F-4	S1F	B-4	VR6	G-5
C29	D-4	CR8	D-2	Q14	D-3	R14	C-7	R48	E-7	R82	F-3	R116	J-2	R150	F-3	S1G	B-4	XA9	F-5
C30	E-4	CR9	D-2	Q15	E-5	R15	C-7	R49	E-7	R83	E-3	R117	J-2	R151	F-5	S1H	B-4	XA11	I-5
C31	D-5	CR10	D-2	Q16	E-5	R16	D-7	R50	G-7	R84	E-3	R118	J-2	R152	H-4	S1I	B-5	XA12	I-5
C32	E-2	CR11	I-2	Q17	H-5	R17	D-6	R51	F-7	R85	D-4	R119	I-2	R153	H-3	S1J	B-5	XA19	K-5
C33	E-4	CR12	I-2	Q18	H-1	R18	D-6	R52	F-8	R86	F-3	R120	J-3	R154	G-4	S1K	B-6	XA22	J-5
		CR13	F-5	Q19	I-2	R19	D-7	R53	E-7	R87	E-3	R121	J-2	R155	H-4	S1L	B-6		

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Figure 7-5. Replacement for Figure 8-10

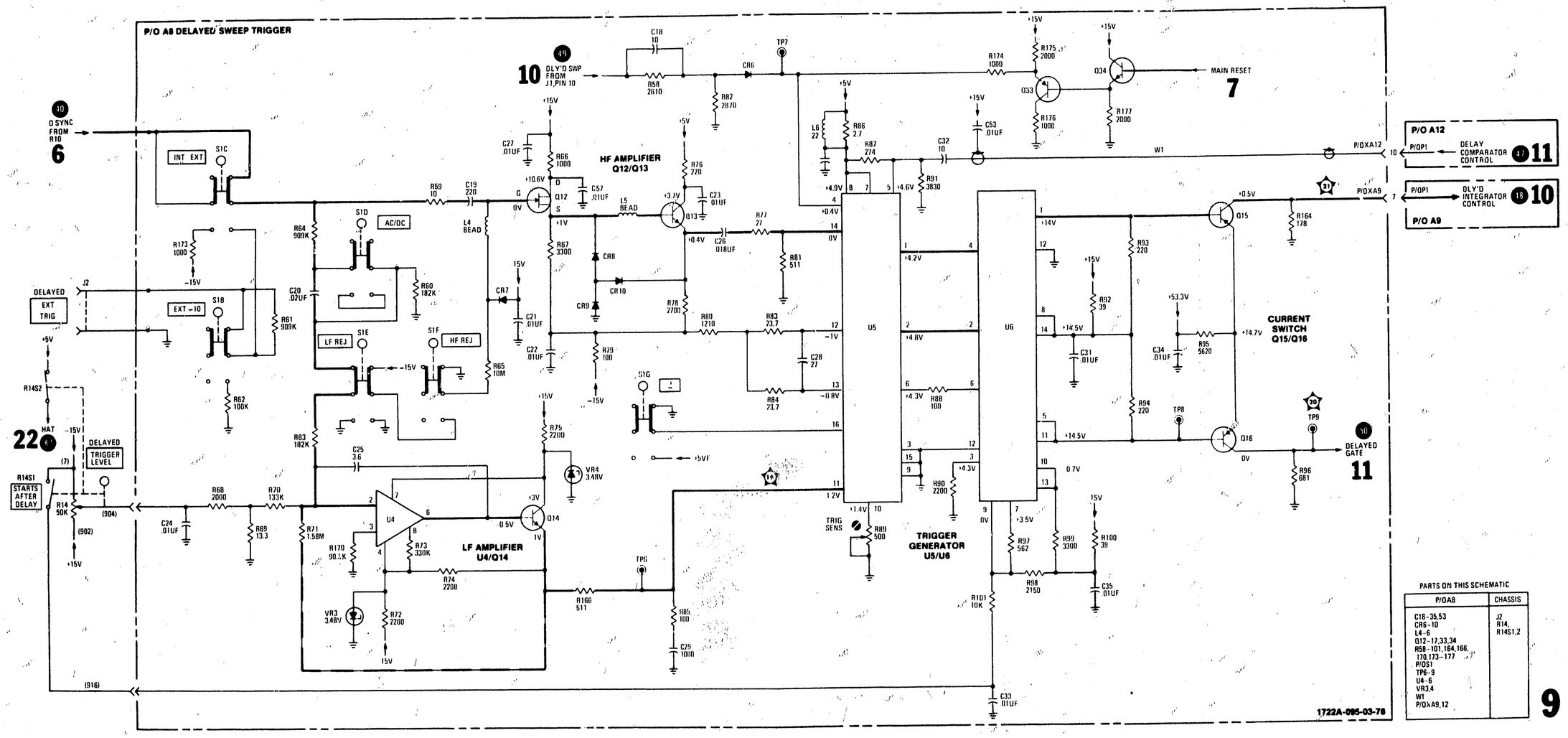
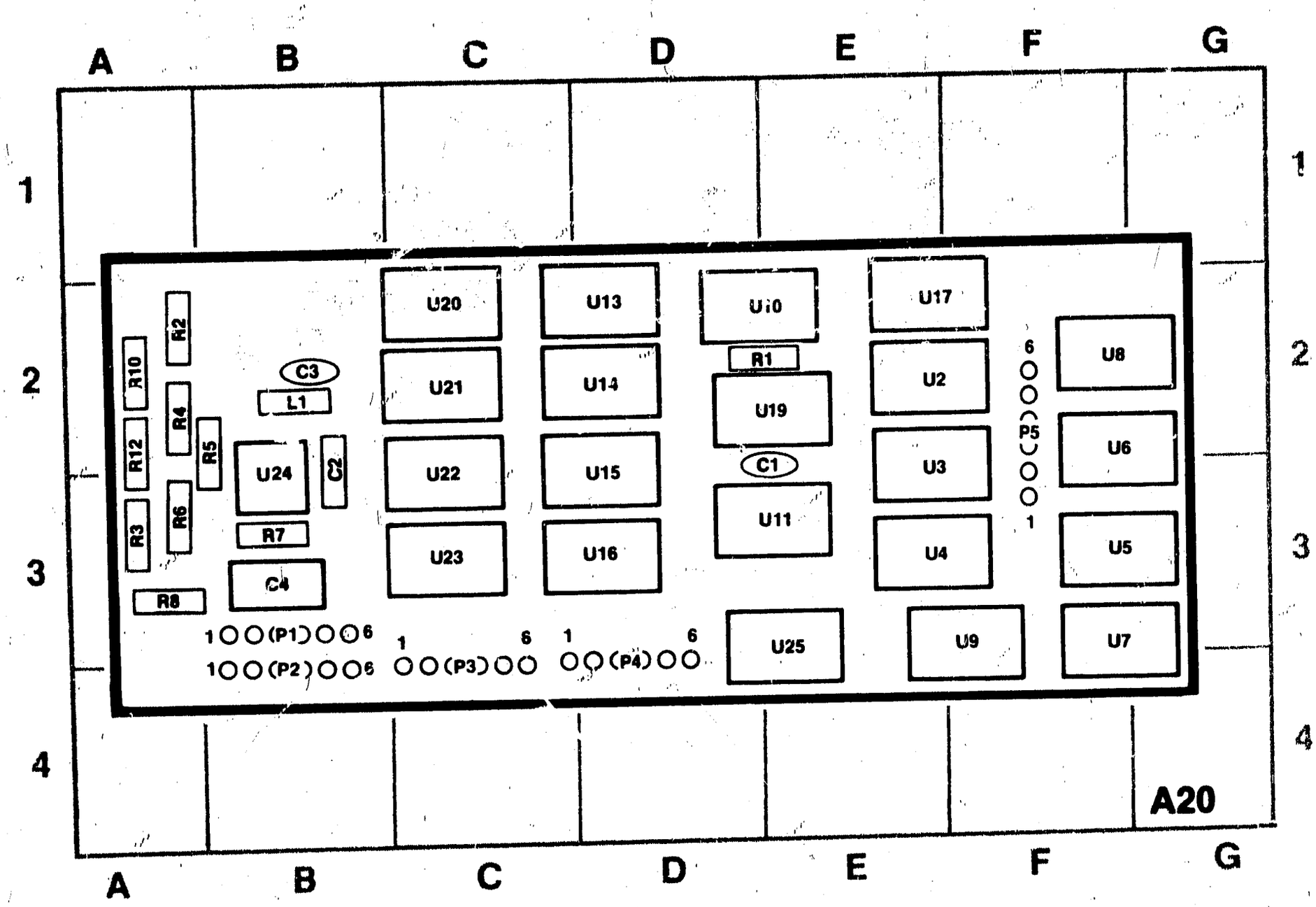


Figure 7-6.
Replacement for Schematic 9



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C3	B-2	R4	A-2	R12	A-2	U6	F-2	U11	E-3	U17	E-2	U23	C-3
C4	B-3	R5	B-2	U2	E-2	U7	F-3	U13	D-2	U19	E-2	U24	B-3
L1	B-2	R6	A-3	U3	E-3	U8	F-2	U14	D-2	U20	C-2	U25	E-3
R1	E-2	R7	B-3										

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Figure 7-7. Replacement for Figure 8-23

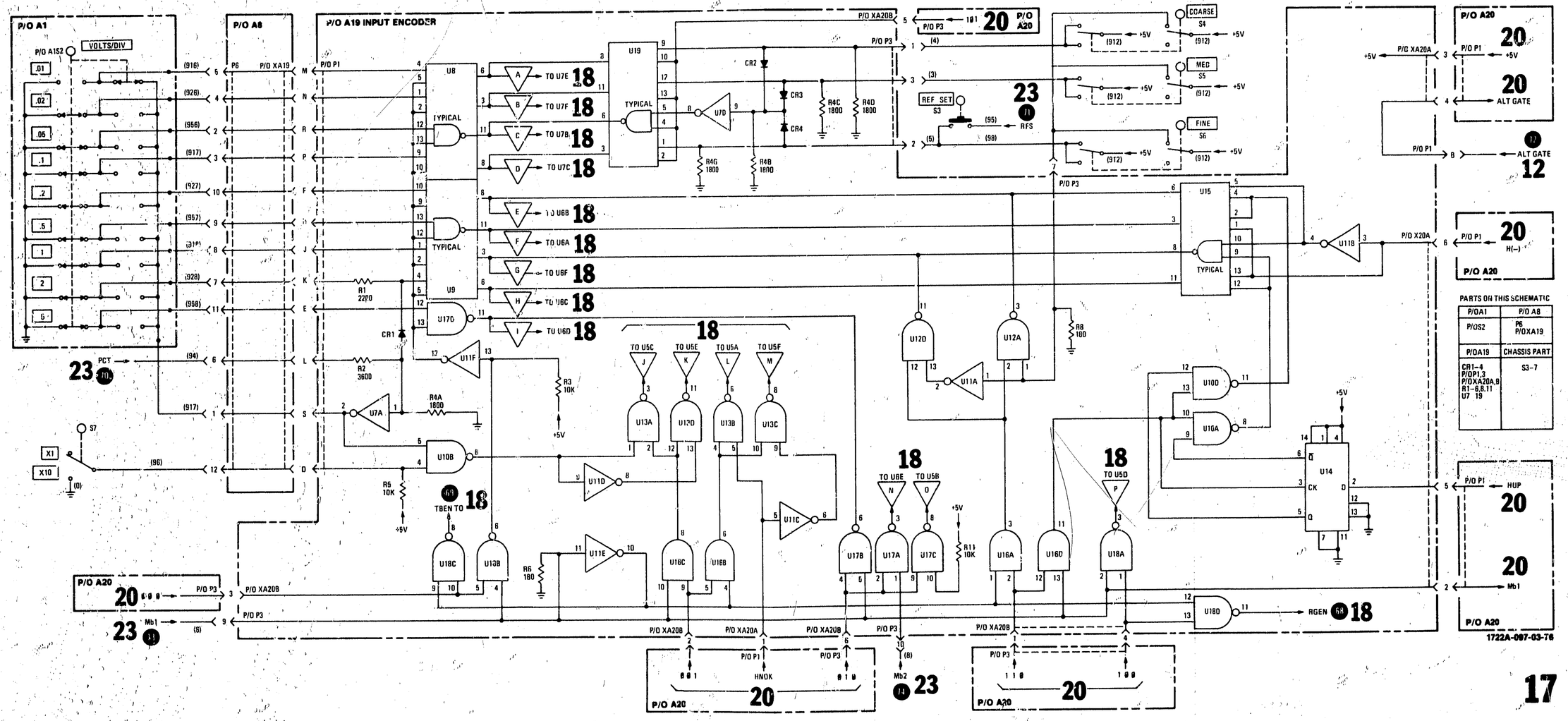
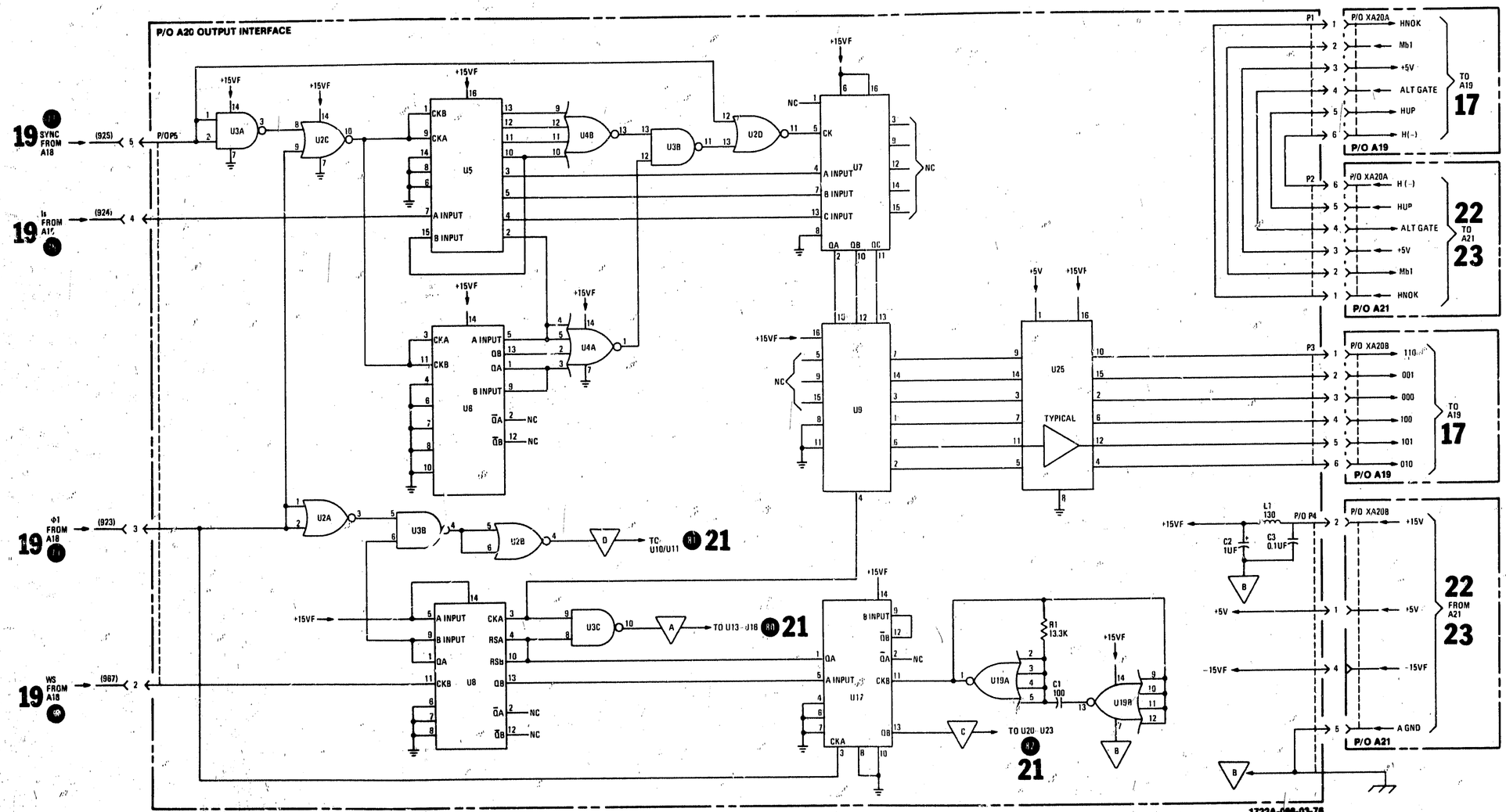


Figure 7-8.
Replacement for Schematic 17

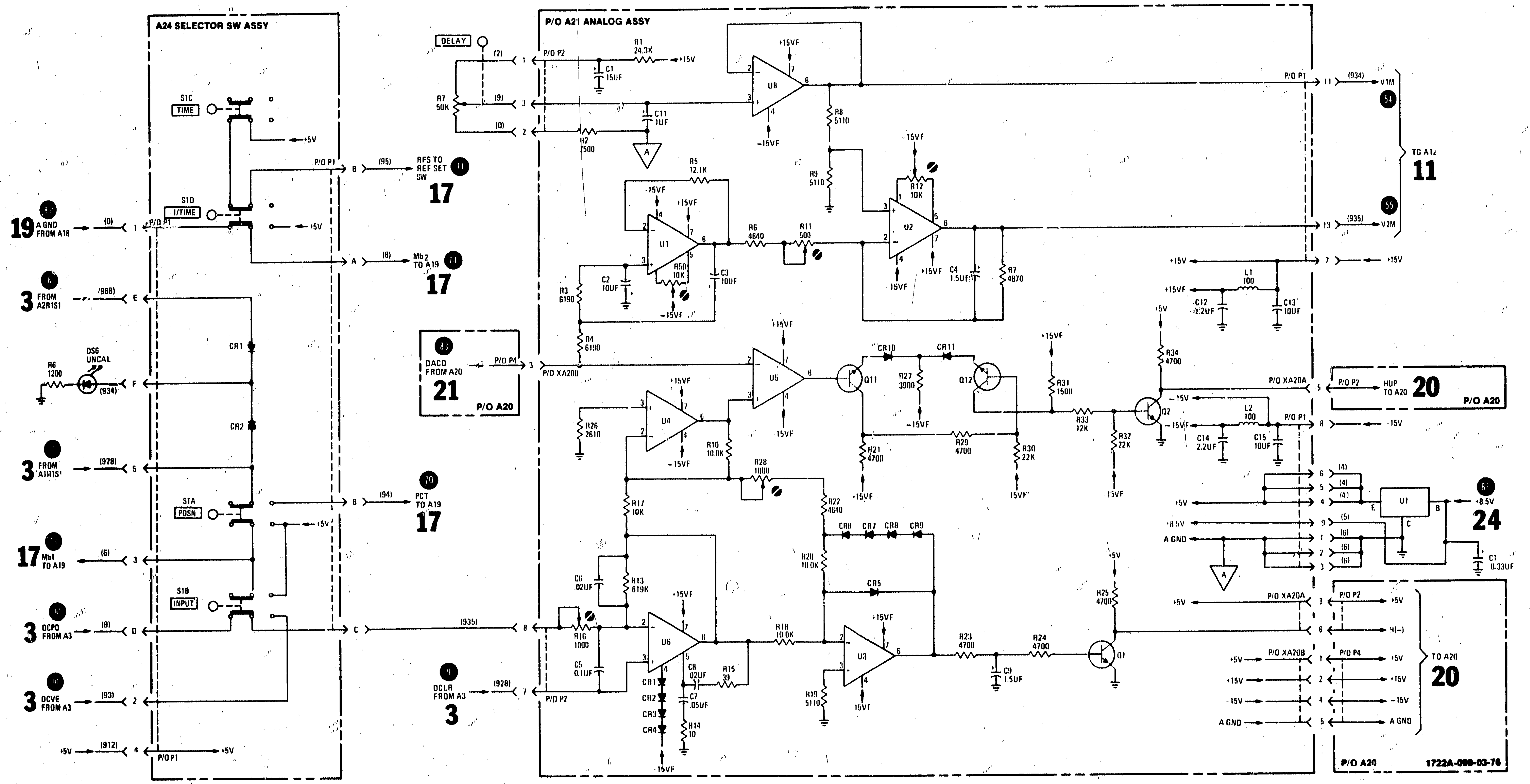


PARTS ON THIS SCHEMATIC

P/O A20	P/O A19
C1-3 L1 P/O P4,5 P1-3 R1 U2,3,5-9 17,19,25	P/O XA20A,B
	P/O A21
	P/O XA20A,B
	CHASSIS

20

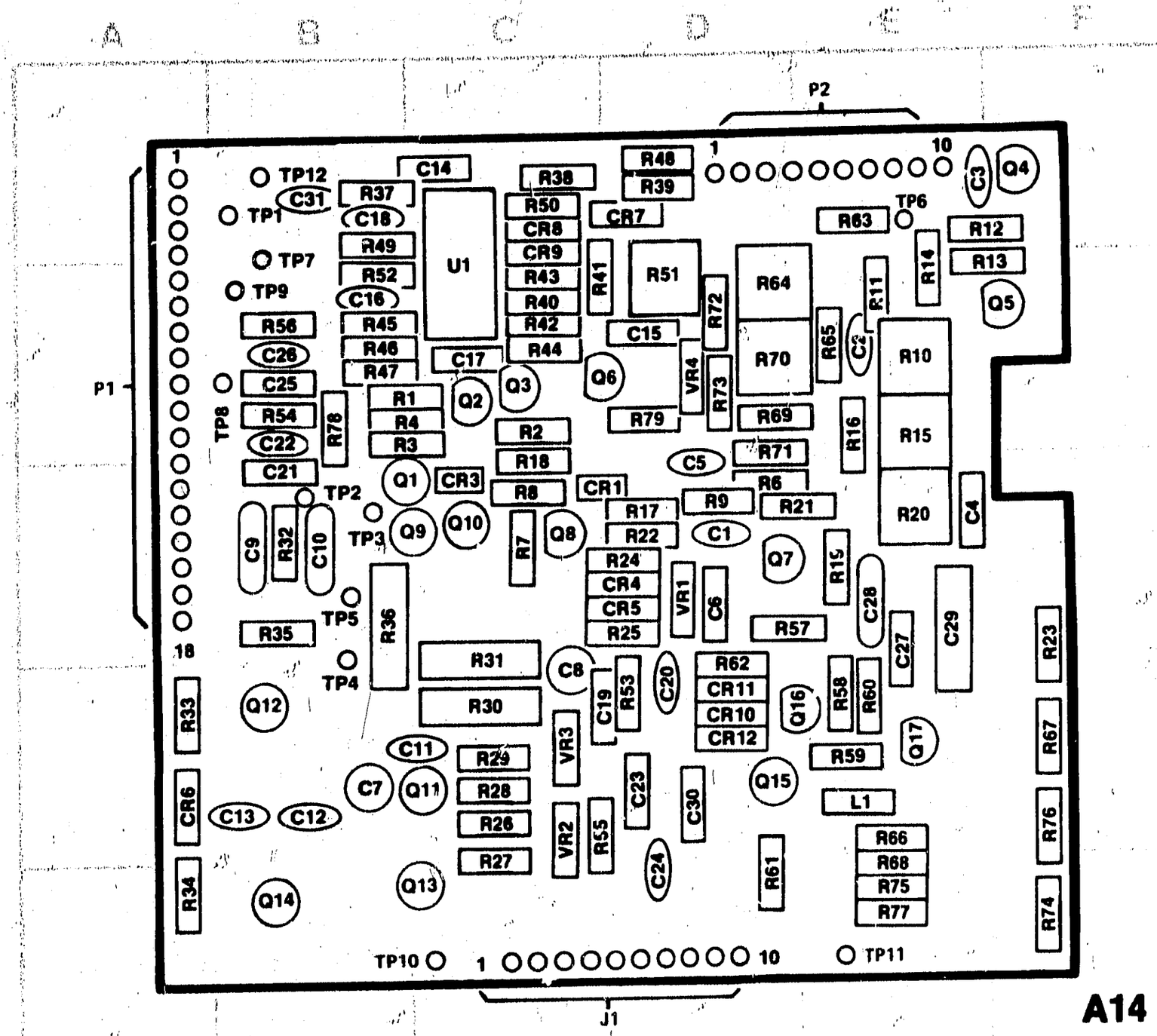
Figure 7-9. Replacement for Schematic 20



PARTS ON THIS SCHEMATIC	
P/O A20	A24
P/O P2,4	CH1,2 P1 S1
P/O A21	
C1-9, 11-15 CR1-11 P/O J1,2 L1,2 P/O P1,2 Q1,2,11,12 R1 34,50 U1 6,8	CHASSIS
	DS6 R6 U1 C1
DELETED:C10	

23

Figure 7-10.
Replacement for Schematic 23



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C2	E-2	C29	E-3	Q9	B-3	R20	E-3	R46	B-2	R72	D-2
C3	E-1	C30	D-4	Q10	C-3	R21	D-3	R47	B-2	R73	D-2
C4	E-3	C31	B-1	Q11	C-4	R22	D-3	R48	D-1	R74	F-5
C5	D-3	CR1	D-3	Q12	B-4	R23	F-3	R49	B-1	R75	E-5
C6	D-3	CR2	B-3	Q13	C-5	R24	D-3	R50	C-1	R76	F-4
C7	B-4	CR3	C-3	Q14	B-5	R25	D-3	R51	D-2	R77	E-5
C8	C-4	CR4	D-3	Q15	D-4	R26	C-4	R52	B-2	R78	B-2
C9	B-3	CR5	D-3	Q16	D-4	R27	C-5	R53	D-4	R79	D-2
C10	B-3	CR6	A-4	Q17	E-4	R28	C-4	R54	B-2	TP1	B-1
C11	B-4	CR7	D-1	R1	B-2	R29	C-4	R55	C-4	TP2	B-3
C12	B-4	CR8	C-1	R2	C-2	R30	C-4	R56	B-2	TP3	B-3
V13	B-4	CR9	C-1	R3	B-2	R31	C-4	R57	D-3	TP4	B-4
C14	C-1	CR10	D-4	R4	B-2	R32	B-3	R58	E-4	TP5	B-3
C15	D-2	CR11	D-4	R6	D-3	R33	A-4	R59	E-4	TP6	E-1
C16	B-2	CR12	D-4	R7	C-3	R34	A-5	R60	E-4	TP7	B-1
C17	C-2	J1	C-5	R8	C-3	R35	B-3	R61	D-5	TP8	B-2
C18	B-1	L1	E-4	R9	D-3	R36	B-3	R62	D-4	TP9	B-2
C19	D-4	P1	A-2	R10	E-2	R37	B-1	R63	E-1	TP10	C-5
C20	D-4	P2	E-1	R11	E-2	R38	C-1	R64	D-2	TP11	E-5
C21	B-3	Q1	B-3	R12	E-1	R39	D-1	R65	E-2	TP12	B-1
C22	B-2	Q2	C-2	R13	E-2	R40	C-2	R66	E-4	U1	C-2
C23	D-4	Q3	C-2	R14	E-2	R41	C-2	R67	F-4	VR1	D-3
C24	D-5	Q4	F-1	R15	E-2	R42	C-2	R68	E-5	VR2	C-5
C25	B-2	Q5	F-2	R16	E-2	R43	C-2	R69	D-2	VR3	C-4
C26	B-2	Q6	D-2	R17	D-3	R44	C-2	R70	D-2	VR4	D-2
C27	E-4	Q7	D-3	R18	C-2						

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Figure 7-11. Replacement for Figure 8-18

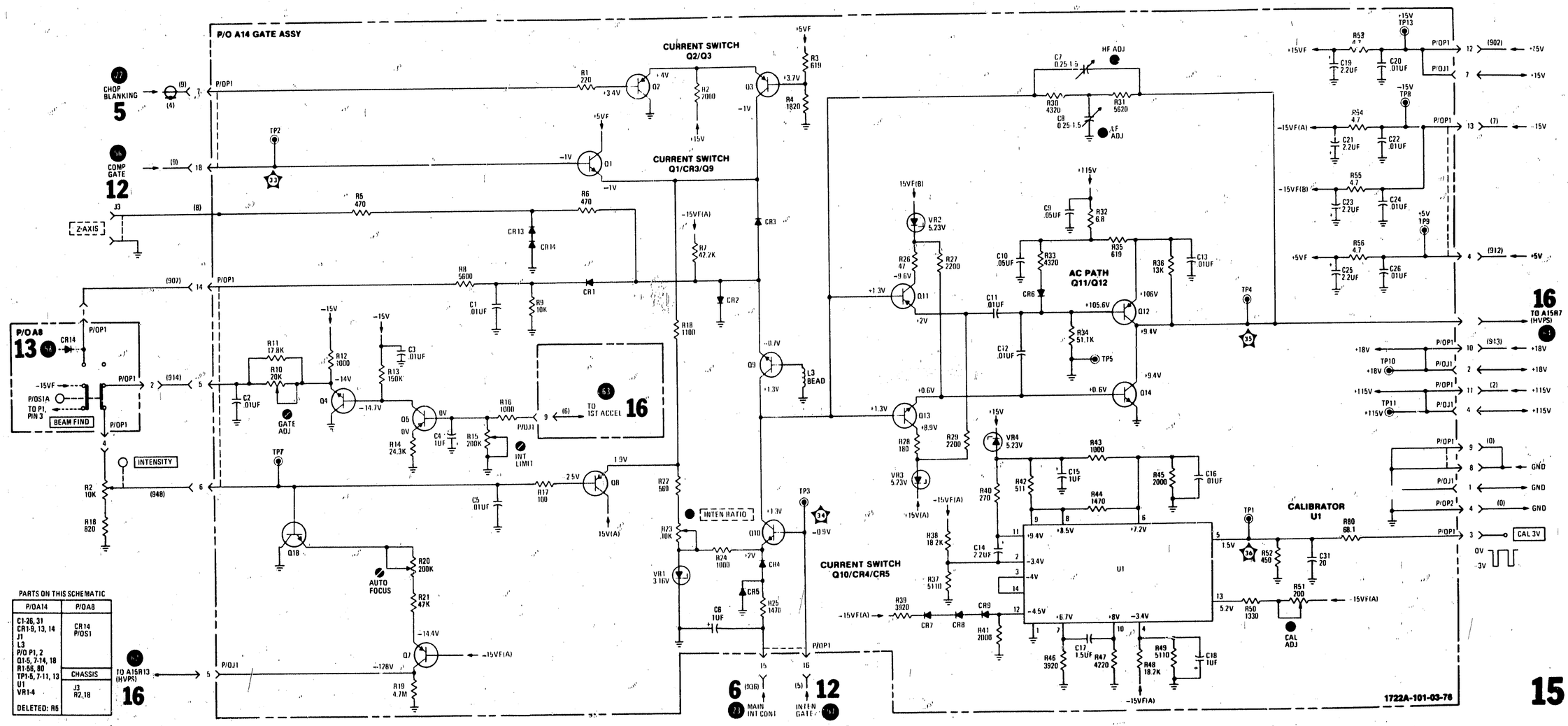
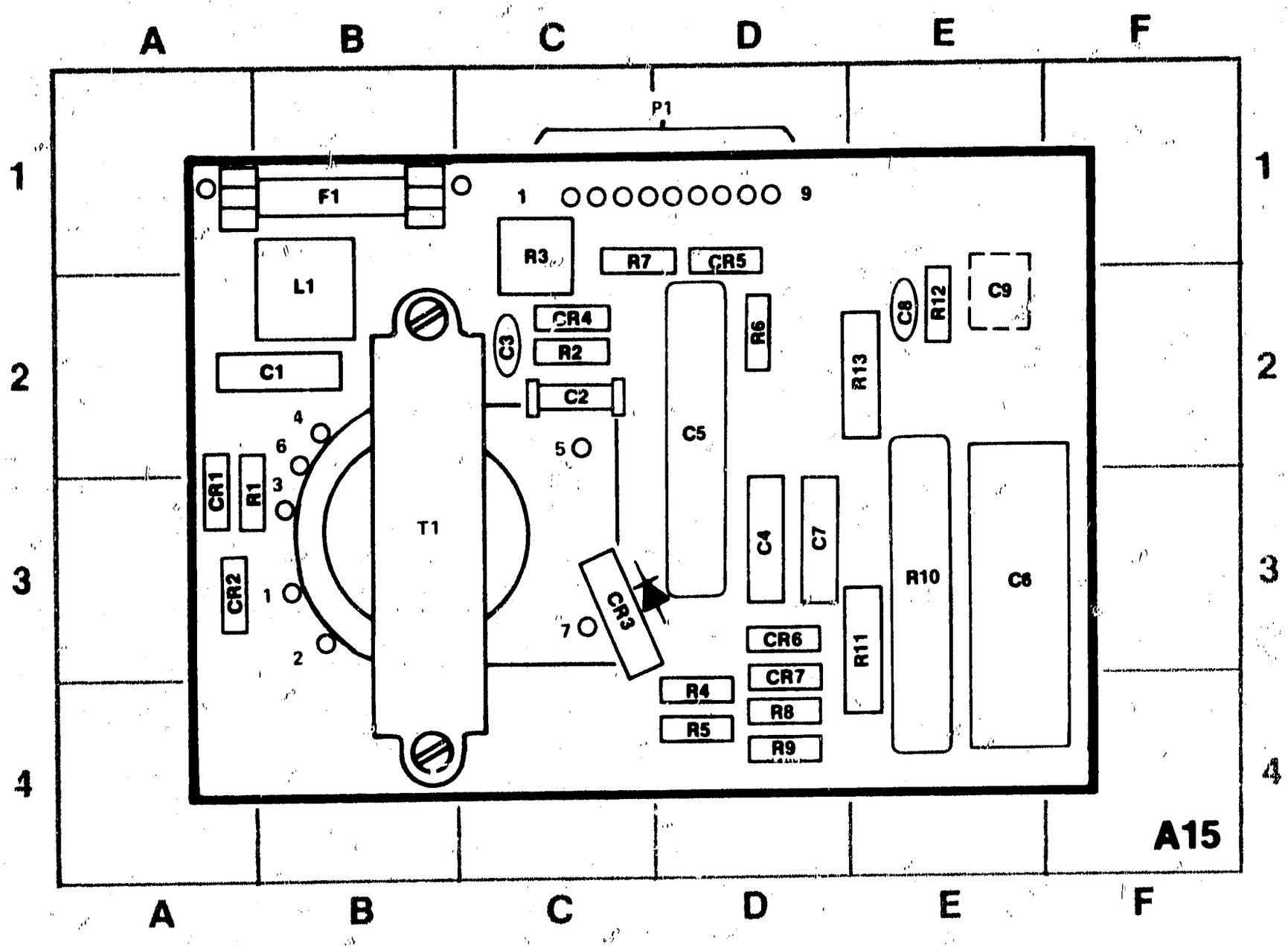


Figure 7-12.
Replacement for Schematic 15



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C2	C-2	C9	E-2	CR7	D-4	R2	C-2	R9	D-4
C3	C-2	CR1	A-3	E1	A-1	R3	C-1	R10	E-3
C4	D-3	CR2	A-3	E2	C-1	R4	D-4	R11	E-3
C5	D-2	CR3	C-3	F1	B-1	R5	D-4	R12	E-2
C6	E-3	CR4	C-2	L1	B-2	R6	D-2	R13	E-2
C7	D-3	CR5	D-2	P1	C-1	R7	C-2	T1	B-3

Figure 7-13. Replacement for Figure 8-19

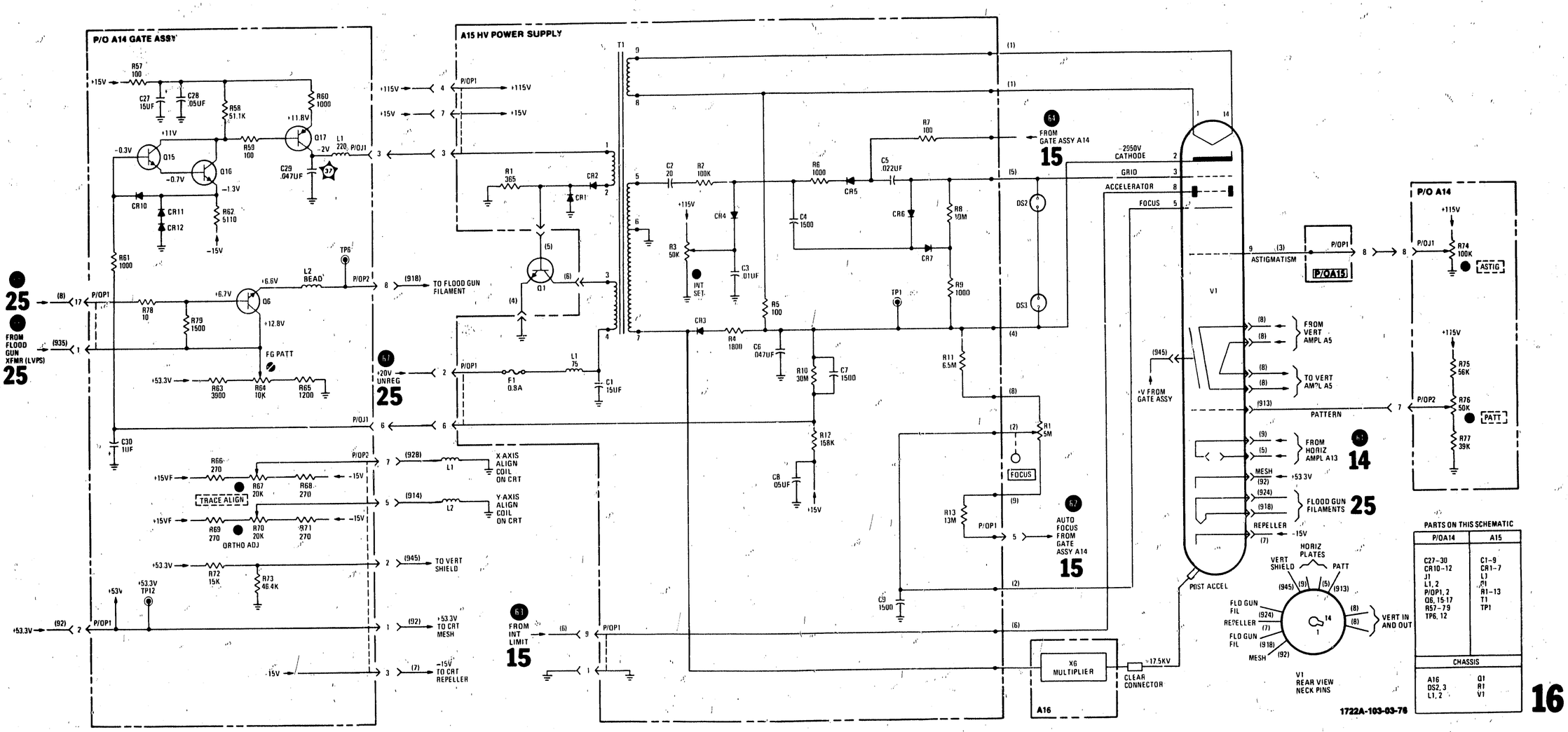


Figure 7-14.
Replacement for Schematic 16
7-15/(7-16 blank)

PARTS LIST

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

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

6-3. REPLACEABLE PARTS LIST.

6-4. Table 6-2 is the list of replaceable parts and is organized as follows:

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

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

c. Miscellaneous parts.

d. Illustrated parts breakdowns, if appropriate.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. A typical manufacturer of the part in a five-digit code.

e. The manufacturers' number for the part.

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

6-5. ORDERING INFORMATION.

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

6-7. 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.

6-8. SPARE PARTS KIT.

6-9. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a Spare Parts Kit available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the Recommended Spares list are based on failure reports and repair data, and parts support for one year. A Recommended Spares list for this instrument may be obtained on request and the Spare Parts Kit may be ordered through your 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 the HP Parts Center in Mountain View, California.

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

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

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

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

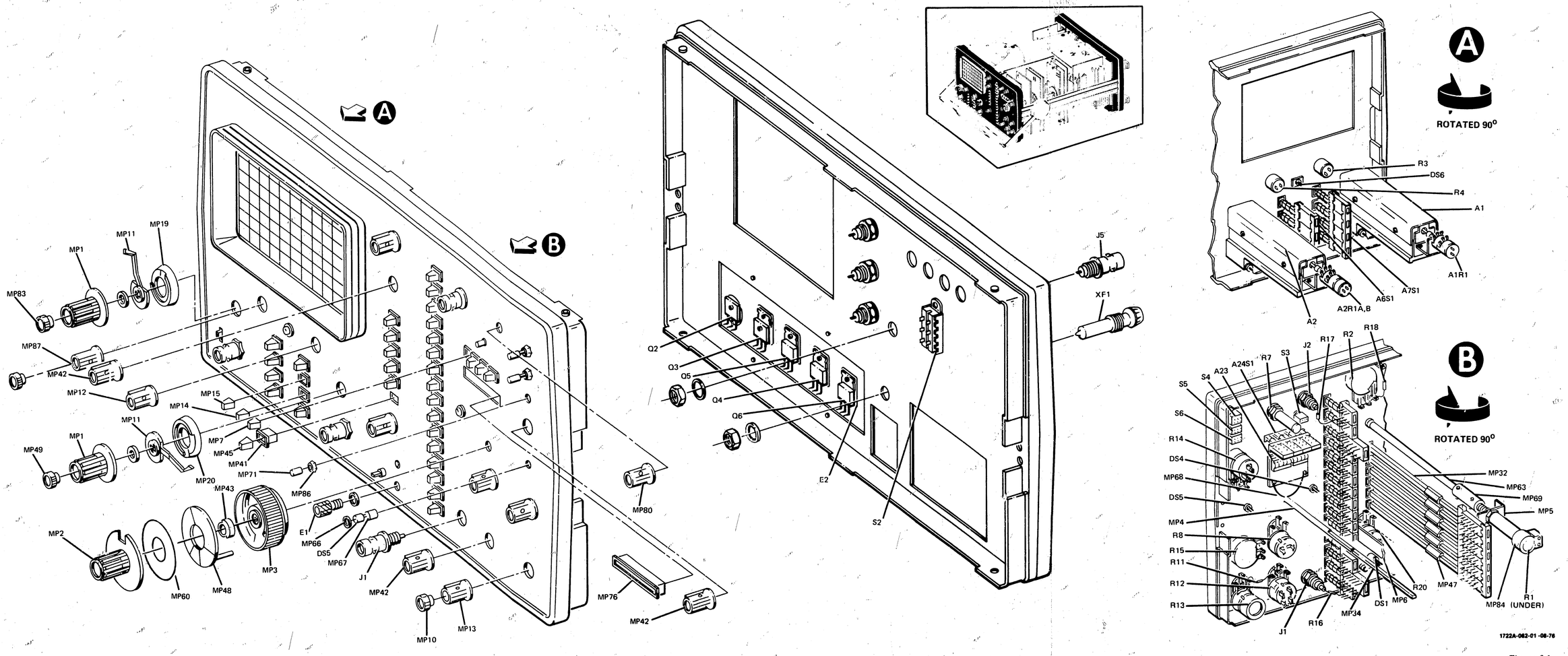


Figure 6-1.
Illustrated Parts Breakdown (Sheet 1 of 2)

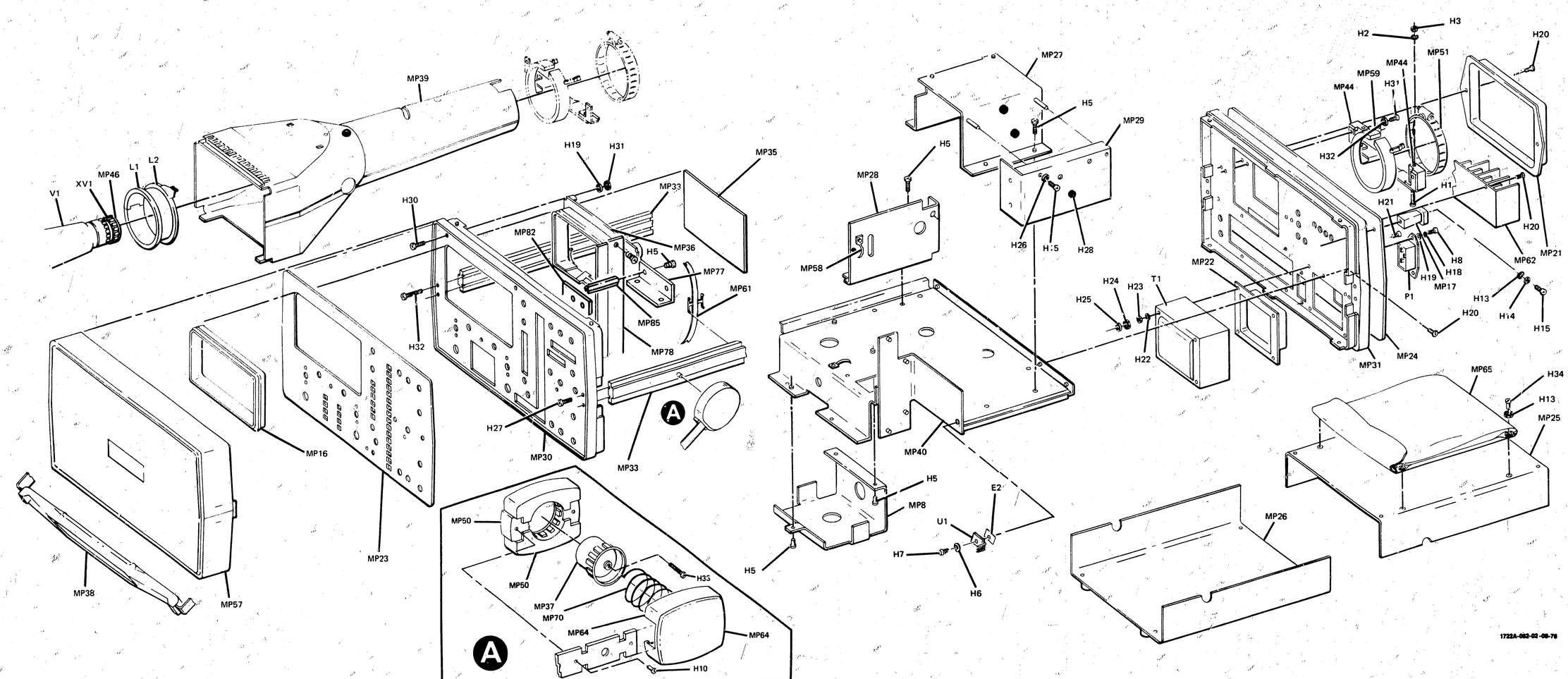
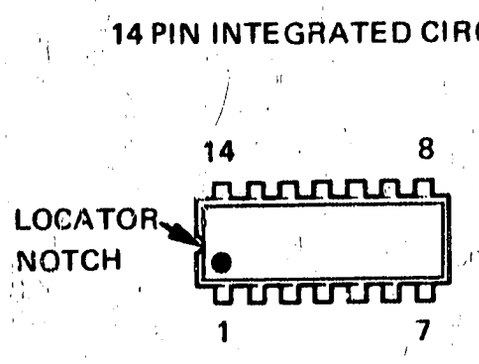
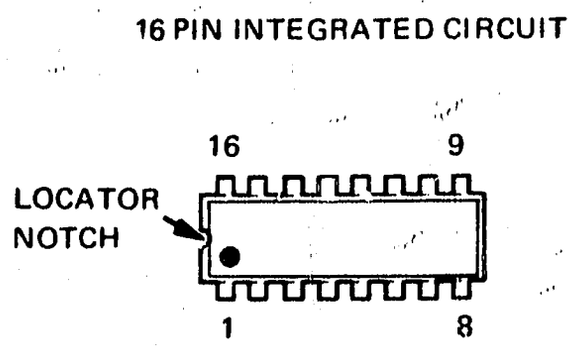


Figure 6-1. Illustrated Parts Breakdown (Sheet 2 of 2)

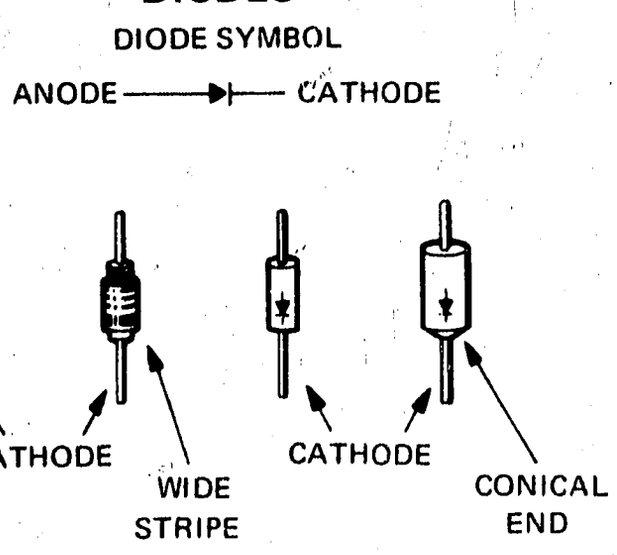
SCHEMATIC DIAGRAMS TROUBLE-SHOOTING

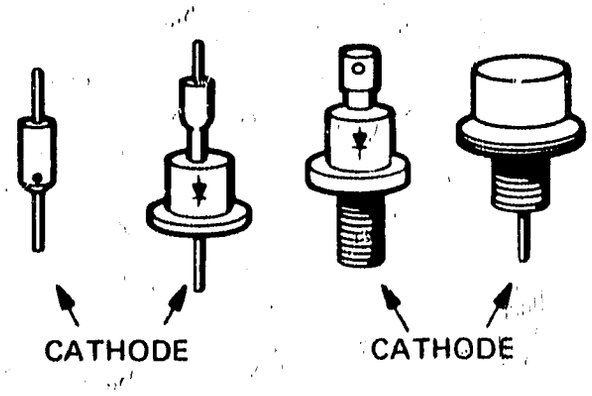
INTEGRATED CIRCUITS

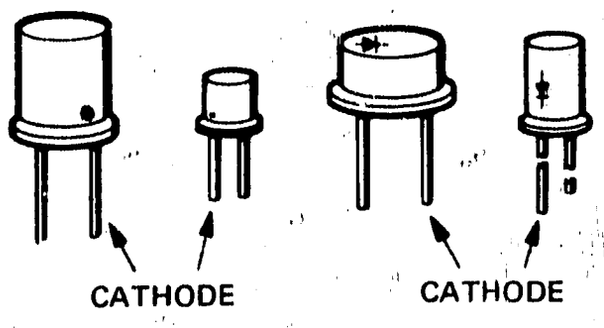




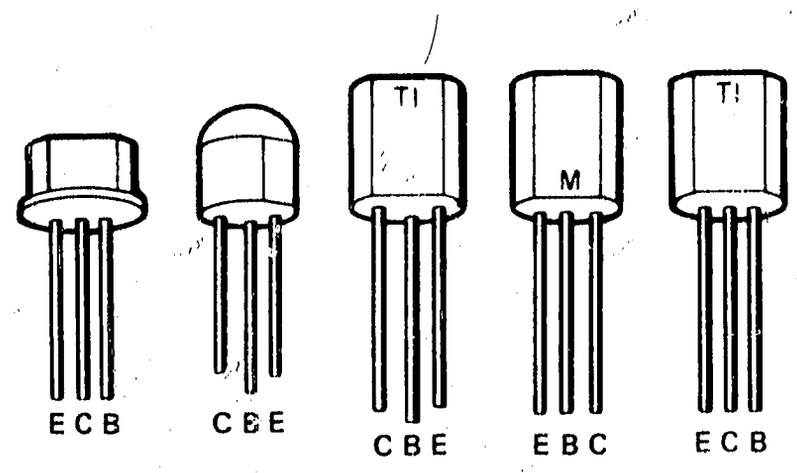
DIODES

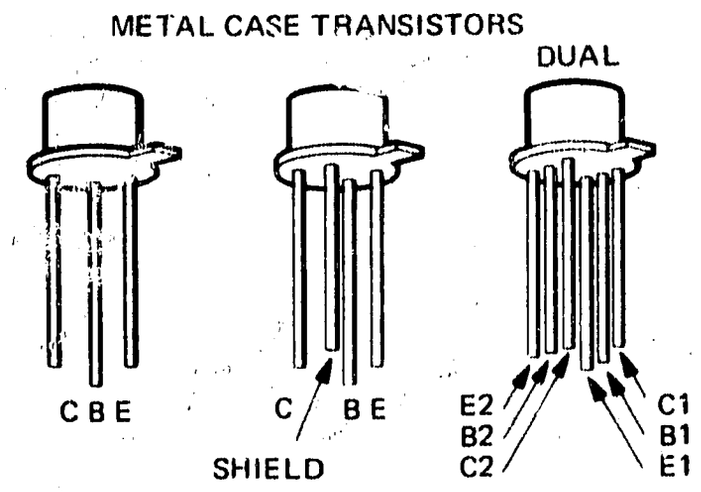






BI-POLAR TRANSISTORS





FIELD EFFECT TRANSISTORS

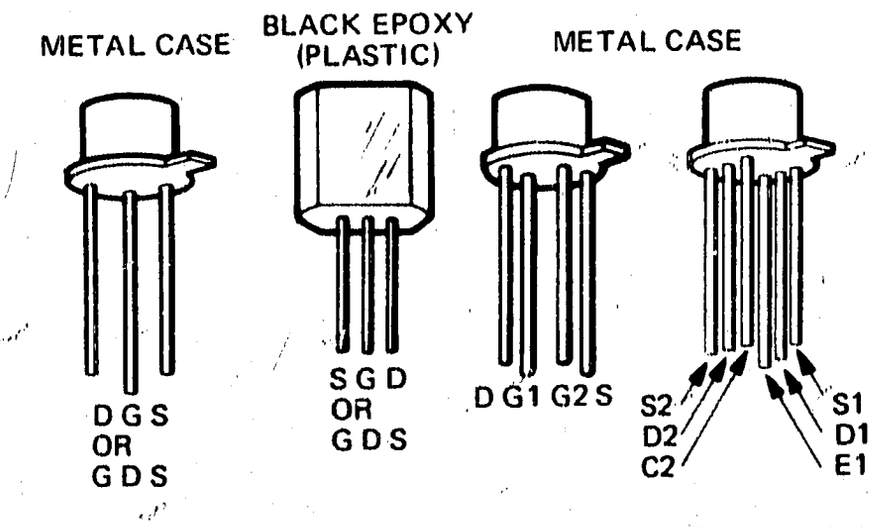


Figure 8-1. Semiconductor Terminal Identification

8-52. When handling or testing the MOS devices on assemblies A18 and A20, observe the following precautions:

a. Ground test equipment and tools used in testing or handling MOS devices.

b. Apply no power to assembly board while MOS device is being installed. This permits accumulated static charges on MOS device to be safely removed before power is applied.

c. When not in use, short all MOS leads. This prevents voltage differences from occurring on leads.

WARNING

When accomplishing step d, never expose personnel directly to hard electrical ground. For safety reasons, resistance of at least 100 kilohms should be placed between using personnel and hard electrical ground.

d. Do not handle MOS devices by their leads. Before handling any MOS device, personnel should touch electrical ground to discharge accumulated static charges.

e. Avoid use of plastics, rubber, and silk in MOS areas. Do not use any material susceptible to static charge accumulation.

f. Handle assembly boards and modules containing MOS devices in the same manner as individual MOS devices. Regardless of configuration, whenever leads of MOS devices are exposed, damage due to static charge buildup can occur.

g. Use conductive, grounded table tops in MOS work area.

h. Humidity in work area should be maintained above 50%. Static charge generation increases exponentially as relative humidity decreases.

8-53. SOLDERING TOOL, SOLDER, AND AIDS. Table 8-2 contains a list of soldering tools, solder, and soldering aids. These items or equivalents should be used to obtain best results when repairing and replacing soldered-in components on etched circuit boards.

8-54. TROUBLESHOOTING.

WARNING

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

8-55. Two important prerequisites for successful troubleshooting are understanding how the instrument is designed to operate and correct use of front-panel controls. Improper control settings or circuit connections can cause apparent malfunctions. Read Section III (Operation) for an explanation of controls, connectors, and general operating considerations. Read Section IV (Principles of Operation) for explanation of circuit theory.

8-56. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that may suggest a source of trouble. Verify that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check power supply voltages in the instrument; also check external power sources.

8-57. DC VOLTAGES. On some schematics, dc voltages are indicated for active components (transistors, IC's, etc.). Conditions for making these voltage measurements are listed adjacent to the schematics. Since the conditions for making measurements may differ from one circuit to another, always check the specific conditions listed adjacent to the schematic.

8-58. INITIAL TROUBLESHOOTING PROCEDURE. Before troubleshooting the instrument in detail, try to perform the adjustment procedures listed in Section V of this manual. Some apparent malfunctions can be corrected by these adjustments; in addition, the inability to obtain a correct adjustment will often reveal the source of trouble.

8-59. If possible, perform the adjustment procedures in listed sequence since the power supplies should be checked first for any malfunction.

8-60. TROUBLE DIAGNOSIS. By use of front-panel controls, note as many symptoms of the malfunction as possible. From these symptoms, it can usually be determined which section (vertical, horizontal, power supplies, or time/voltage measurement section) is malfunctioning. Normally, the vertical and horizontal sections will not malfunction simultaneously, although symptoms may indicate that this has occurred.

Table 8-2. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 37.5 Tip Temp: 750-800 degrees	Ungar #775 handle with Ungar #1237 Heating Unit
Soldering Tip	Soldering	Shape: chisel	Ungar #PL 113
Desoldering aid	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co., Arleta, California
Resin (flux) Solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead). 18-gauge (SWG) preferred	
Protective Coating	Contamination, Corrosion protection	Good electrical insulation, corrosion-prevention properties	Silicone Resin such as GE DRI-FILM 88

8-61. VERTICAL SECTION TROUBLESHOOTING. Although a sweep may not be generated on the CRT, vertical deflection of an input signal on the CRT will normally indicate that the vertical section is functioning properly.

8-62. The sync pulse required for internal triggering is developed in the vertical preamplifier and sync amplifier located on horizontal display switch assembly A10. If the instrument does not trigger internally, but triggers properly when an external trigger is applied, the vertical preamplifier section should be checked.

8-63. Due to low levels of the signal in the preamplifier, signal tracing becomes difficult. When troubleshooting the preamplifier, check dc bias voltages for best results.

8-64. HORIZONTAL SECTION TROUBLESHOOTING. The horizontal section of the instrument consists of the trigger assembly, gate assembly, holdoff-comparator assembly, horizontal preamplifier, and horizontal output assembly. From symptoms derived in paragraph 8-60, check the input and output signals of the suspected assembly(s) until the problem is isolated to a particular circuit. Refer to table 8-3 for troubleshooting hints on the horizontal section of the instrument.

NOTE

Table 8-3 is to be used as a guide only. Slight variations in voltage readings may occur.

8-65. TIME/VOLTAGE MEASUREMENT SECTION TROUBLESHOOTING. The time/voltage measurement section of the instrument consists of the processor assembly, input encoder assembly, output interface assembly, analog assembly, time delay switch assembly, selector switch assembly, and LED Display assembly. From symtoms derived in paragraph 8-60, trouble should be isolated to either the oscilloscope section or the time/voltage measurement section of the instrument. Refer to tables 8-4 and 8-5 for a list of malfunction descriptions and a truth table associated with that type of malfunction. Once the faulty assembly has been located, normal troubleshooting techniques should be employed.

NOTE

A mnemonic is a letter designator (term) that describes the active state and function of a signal line. In table 8-5, an H prefix indicates the function is active in the HI state, and an L prefix indicates the function is active in the LO state.

8-66. LOW-VOLTAGE POWER SUPPLY TROUBLESHOOTING. The Model 1722A contains seven low-voltage power supplies (two are unregulated). The nominal +20V (unregulated) supply is used in the HV power supply oscillator circuit. The nominal +15V (regulated) supply furnishes the reference voltage for the other regulated supplies. A check at the output of each regulated supply will indicate a malfunction. A convenient test point is located on each supply. All supplies are regulated to better than ±2%. If a malfunction occurs in the low-voltage supplies, always check the +15V supply since it furnishes the reference voltage for the other regulated supplies.

Table 8-3. Troubleshooting Guide - Horizontal Section

The following table is a troubleshooting guide to help analyze the problem under no sweep condition in AUTO mode of operation. Once the sweep is running, individual circuits can be analyzed using schematics and associated waveforms.

Step	Circuit	Test Point	Test Point Measurement	Action
1	Output of Integrators (main-delayed)	Main - A11TP2	1 volt	Go to Step 2.
		Delayed - A9TP2	14 volts	Go to Step 3.
			other	Go to Step 4.
2	Measure Gate	Main - A8TP5	2 volts	Problem in Integrator - troubleshoot.
		Delayed - A8TP9	0 volt	Go to Step 5.
3	Measure Gate	Main -A8TP5	2 volts	Go to Step 5.
		Delayed - A8TP9	0 volt	Problem in Integrator - troubleshoot.
4	Measure Gate	Main - A8TP5	0 volt or 2 volts	Problem in Integrator - troubleshoot.
		Delayed - A8TP9	other	Problem in sweep control circuit - troubleshoot.
5	Measure Reset input to trigger circuit.	Main - A8TP2	4.3 volts	Go to Step 6.
		Delayed - A8TP7	4.9 volts	Go to Step 9.
			other	Problem in holdoff (main only) or sweep length circuits, rarely in trigger circuits - troubleshoot.
6		Main - A8TP4	+5 volts	Go to Step 7.
			+4 volts	Problem in sweep control circuit - troubleshoot.
		Delayed - A8TP8	+14 volts	Problem in sweep control circuit - troubleshoot.
			+15 volts	Go to Step 8.
7		A8U2 - pin 6	+4.3 volts	Auto problem - check A8U3 and associated circuits.

Table 8-3. Troubleshooting Guide - Horizontal Section (Cont'd)

Step	Circuit	Test Point	Test Point Measurement	Action
8		A8U5 - pin 6	+4.9 volts	Problem in A7U2.
			+4.3 volts	Auto problem - check A8U6 and associated circuits.
9		Main - A8TP4	+4.9 volts	Problem in A8U5.
			+4 volts	Go to Step 10.
		Delayed - A8TP8	+5 volts	Problem in sweep control circuit - troubleshoot.
			+15 volts	Problem in sweep control circuit - troubleshoot.
10		A8U2 - pin 6	+14 volts	Go to Step 11.
			+4.3 volts	Problem in A8U2.
			+4.9 volts	Auto problem - check A8U3 and associated circuits.
11		A8U5 - pin 6	+4.3 volts	Problem in A8U5.
			+4.9 volts	Auto problem - check A8U6 and associated circuits.

Table 8-4. Troubleshooting Guide - Time/Voltage Measurement Section

Symptom	Intermediate Check	Probable Faulty Assembly
1. No LED Display or One digit very bright, others intermittent or off.		Processor Assembly A18 (see schematic 19)
2. LED Display flashes rapidly or intermittently.	a. Two control signals (000-110) are logic high simultaneously or One or more control signals are never high.	Output Interface Assembly A20 (see schematic 20)
	b. Otherwise	Input Encoder Assembly A19 (see schematics 17 and 18)
3. LED Display presents incorrect information (improper scaling, invalid readings, etc.).	a. Only one enable signal applied to Input Encoder Assembly A19 for each position of TIME/DIV control.	Input Encoder Assembly A19 (see schematic 18)
	b. No enable signal or multiple enable signals applied to Input Encoder Assembly A19 for each position of TIME/DIV control.	Time Delay Switch Assembly A22 (see schematic 18)
	c. Only one enable signal applied to Input Encoder Assembly A19 for each position of VOLTS/DIV control.	Input Encoder Assembly A19 (see schematic 18)
	d. No enable signal or multiple enable signals applied to Input Encoder Assembly A19 for each position of VOLTS/DIV control.	VOLT/DIV Switch A1S2 (see schematic 17)
4. LED Display fixed. Some or all controls ignored.	a. All output signals from Processor Assembly A18 are good.	Output Interface Assembly A20 (see schematics 20 and 21)
	b. Otherwise	Processor Assembly A18 (see schematic 19)
5. In time-interval mode, second marker moves erratically or not at all.	a. DACO signal moves smoothly as DEC/INC controls are manipulated.	Analog Assembly A21 (see schematic 23)
	b. Otherwise	Output Interface Assembly A20 (see schematics 20 and 21)
6. Voltage measurement mode fails although Symptom 5 is not present.	a. Activity on HUP and H(—) lines switches as polarity of unknown input signal changes.	Input Encoder Assembly A19 (see schematic 17)
	b. No activity on HUP and H(—) lines.	Analog Assembly A21 (see schematic 23)

Table 8-5. Signal Truth Table

Mnemonic Symbol	Identification	Signal Generated (Logic High)	Signal Gate	Schematic
LSNG	LO: indicates front-panel horizontal settings no good	001•$\overline{Mb1}$•HN0K	A19U13B	17
LSOK	LO: indicates front-panel horizontal settings OK	001•$\overline{Mb1}$•$\overline{HN0K}$	A19U13C	17
HPCT	HI: read percentage	A1R1S1•A24S1A	A19U9B	18
LTRE	LO: time range enable	100•$\overline{Mb1}$	A19U18D	17
LRI2	LO: read instruction No. 2	010	A19U17C	17
HTBE	HI: time base enable	000•$\overline{Mb1}$	A19U18C	17
HVDE	HI: VOLTS/DIV enable	$\overline{A24S1A}$	A19U7A	18
LVI0	LO: voltage-measurement instruction No. 0	000•Mb1	A19U18B	17
LVI1	LO: voltage-measurement instruction No. 1	100•Mb1	A19U18A	17
LVSX1	LO: voltage scale switch at X1	001•Mb1•$\overline{PCT}$•S7X1	A19U13A	17
LRTI2	LO: reciprocal time instruction No. 2	010•Mb2	A19U17A	17
LVSX10	LO: voltage scale switch at X10 or PCT reading required	001•Mb1•(PCT+S7X10)	A19U13D	17
LVI2	LO: voltage-measurement instruction No. 2	010•Mb1	A19U17B	17
HNOK	HI: horizontal controls not OK	$\overline{(HMI+HDLY)}$+$\overline{HCAL}$+$\overline{HAT}$	A21U9	22
LHPC	LO: horizontal position change	[110•$\overline{Mb1}$•(S4+S5+S6)] + [110•Mb1•HUP•$\overline{H(—)}$]	A19U12A A19U15B	17 17
LNHC	LO: no horizontal change	[110•$\overline{Mb1}$•$\overline{(S4+S5+S6)}$] + [110•Mb1•$\overline{HUP}$•$\overline{H(—)}$]	A19U12D A19U15C	17 17
LIDV	LO: increase a negative Digital/Analog voltage	110•Mb1•HUP•H(—)	A19U15A	17
LDDV	LO: decrease a negative Digital/Analog voltage	110•Mb1•$\overline{HUP}$•H(—)	A19U15D	17

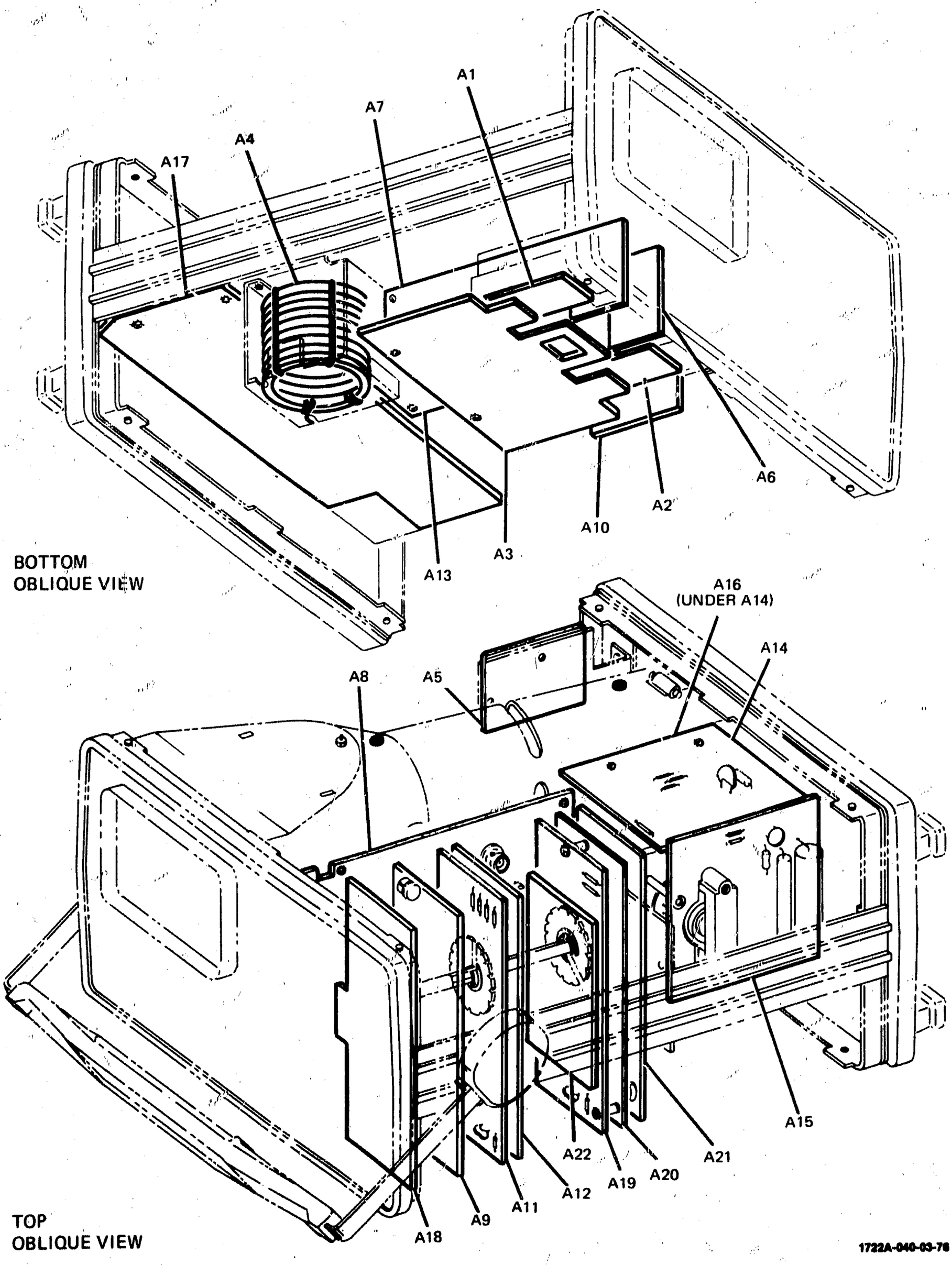


Figure 8-2. Board Assembly Identification

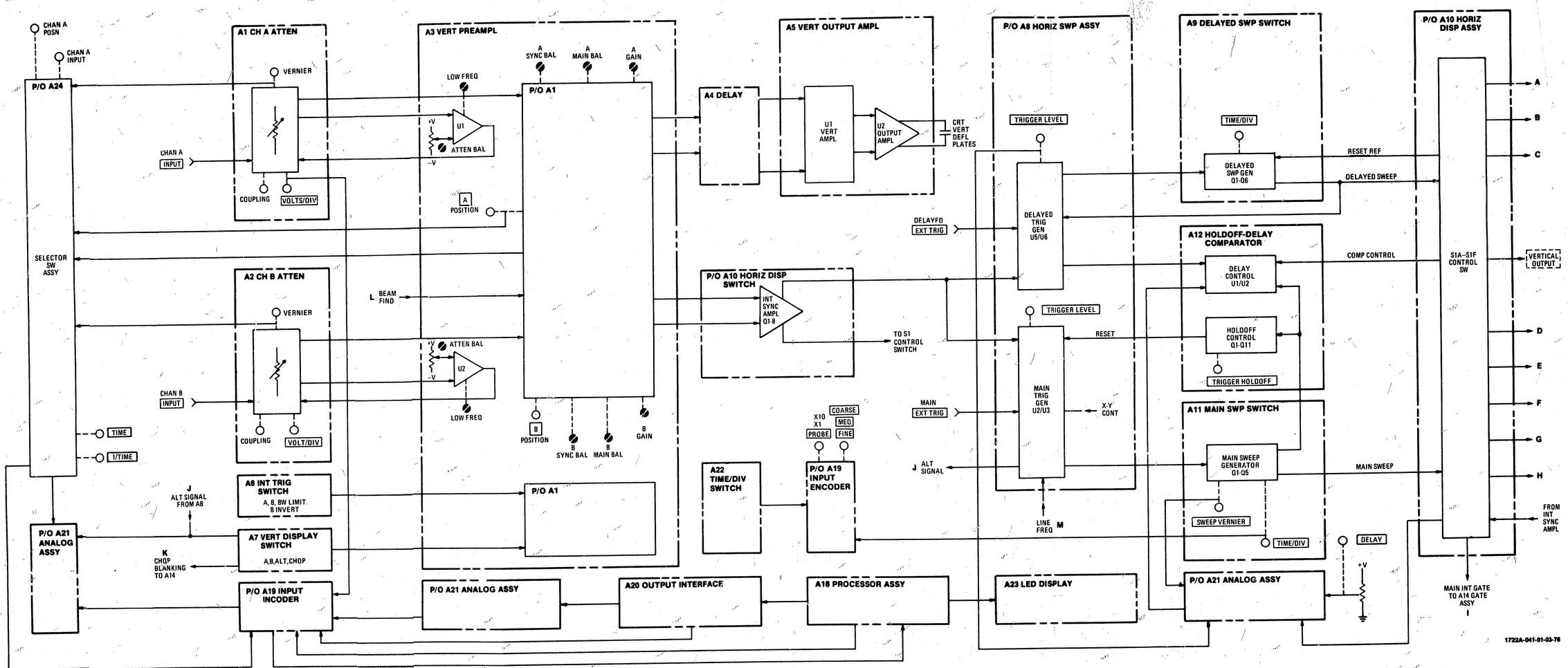


Figure 8-3.
Overall Block Diagram (Sheet 1 of 2)

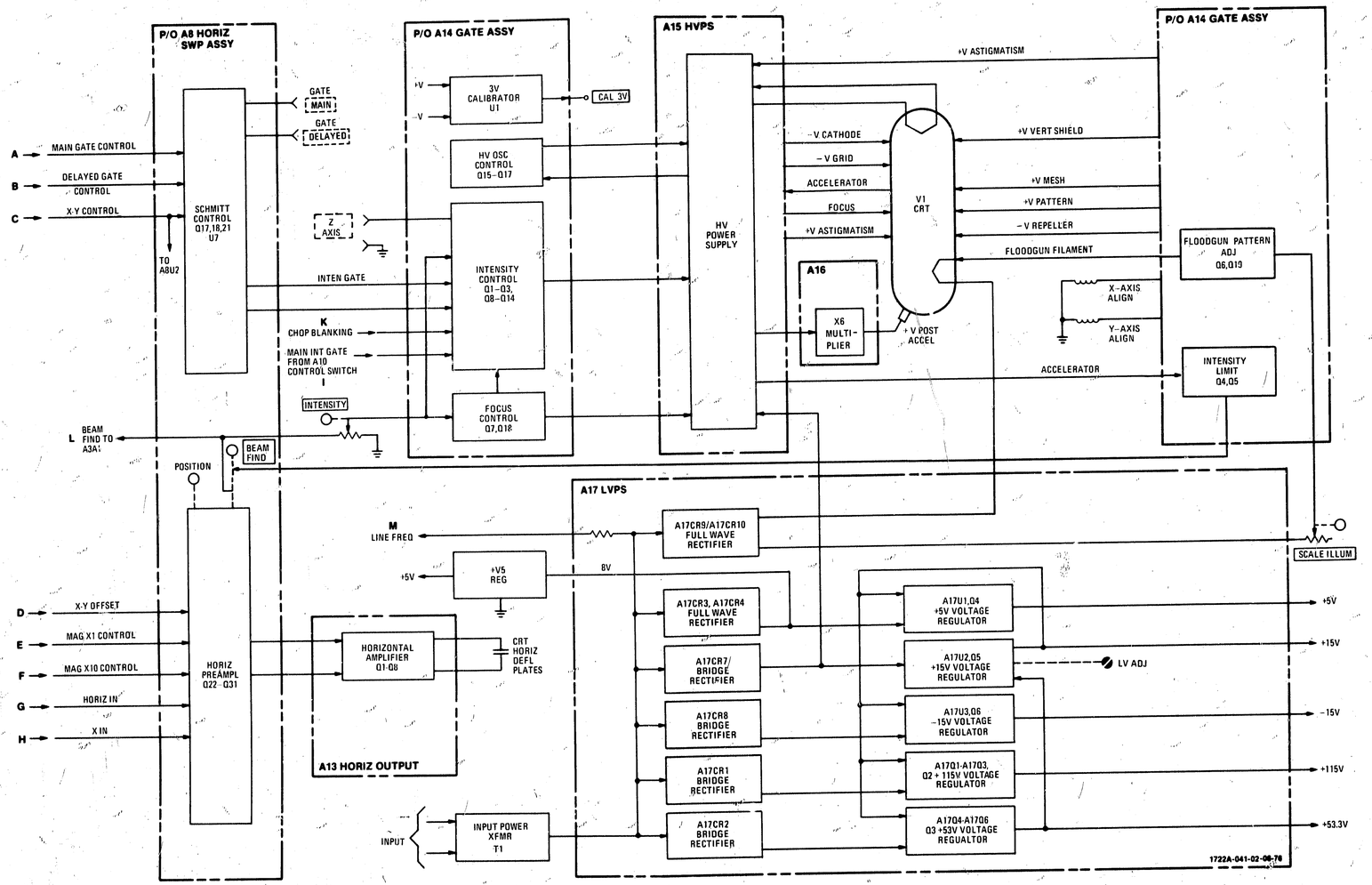
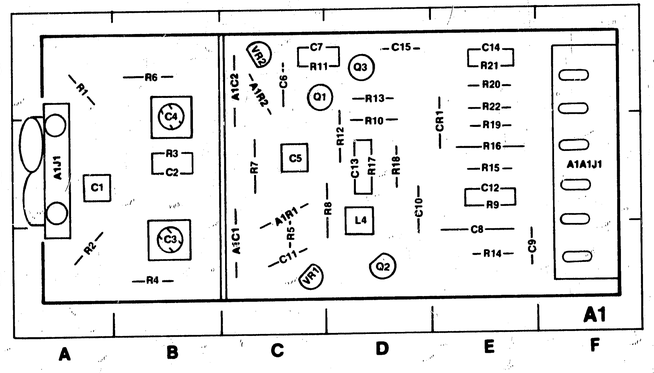


Figure 8-3. Overall Block Diagram (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1C1	C-1	C9	E-1	R1	A-3	R13	D-3
A1C2	C-3	C10	D-2	R2	A-1	R14	E-1
A1R1	C-2	C11	C-1	R3	B-2	R15	E-2
A1R2	C-3	C12	E-2	R4	B-1	R16	E-2
C1	A-2	C13	D-2	R-5	C-1	R17	D-2
C2	B-2	C14	E-3	R6	B-3	R18	D-2
C3	B-2	C15	E-3	R7	C-2	R19	E-2
C4	B-3	CR1	D-3	R8	C-2	R20	E-3
C5	C-2	L4	D-2	R9	E-2	R21	E-3
C6	C-3	Q1	C-3	R10	D-2	R22	E-3
C7	C-3	Q2	D-1	R11	C-3	VR1	C-1
C8	E-1	Q3	D-3	R12	D-2	VR2	C-3

1722A-001-01-03-78

Figure 8-4. Service Information, Channel A Attenuator, Assembly A1 (Sheet 1 of 2)

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component-identification illustrations, waveforms, and test conditions. A disassembly procedure for removing the CRT and instrument modules for repair and replacement is also contained in this section.

8-3. SCHEMATICS.

8-4. Schematics are printed on foldout pages for easy reference to the text and figures in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies. Non-MIL-standard symbols and conventions used in the schematics are defined in table 8-1.

8-5. The schematics are numbered in sequence with a bold number at the lower right-hand corner of each page. These numbers are used to cross reference signal connections between the schematics. At most circuit breaking points, a number in a circle is shown, followed by another number in bold type. The circled number indicates the signal or circuit and the bold number indicates the associated schematic that contains the source or destination of the signal. To find the source or destination of the signal, turn to the indicated schematic and find the circled number (if assigned).

8-6. A table on each schematic lists all components shown on the schematic by reference designation. Component reference designators that have been deleted from the schematic are listed below the table.

8-7. All components within the bordered areas of the schematic are physically located on etched circuit boards. Components not physically located on an etched circuit board are shown in the unbordered areas of the schematic.

8-8. REFERENCE DESIGNATIONS.

8-9. The unit system of reference designations used in this manual is in accordance with the provisions of USA Standard Y32.16-1968. Reference Designations for Electrical and Electronics Parts and Equipments, dated March 1, 1968. Minor variations from the standard, due to design and manufacturing practices, may be noted.

8-10. Each electrical component is assigned a class letter and a number. This letter-number combination is the basic reference designation. Components which are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly of which the component is a part. For instance, resistor R23 on assembly A1 is called A1R23.

8-11. Assemblies are numbered consecutively. If an assembly reference designation is assigned and later deleted, that number is not reused.

8-12. COMPONENT LOCATIONS.

8-13. Locations of components on assemblies and subassemblies are illustrated on line drawings adjacent to the schematics. Since the schematics are drawn to show function, portions of a particular assembly may appear on several different schematics The component-location drawing is printed next to the schematic that shows most of the circuitry on the assembly.

8-14. PREVENTIVE MAINTENANCE.

8-15. Preventive maintenance consists of periodic performance checks, calibration, mechanical inspection, lubrication, and other services designed to prevent breakdown and failure. Performance checks and calibration are covered in Section V of this manual. The other preventive maintenance services are covered in the following paragraphs.

8-16. MECHANICAL INSPECTION. Periodically inspect the instrument for damaged components, excess grease, dirt, and corrosion. Look for loose and misaligned assemblies. Ensure that all screws and fasteners are tight and serviceable.

8-17. Refer to the paragraphs in this section on repair and replacement for instructions on replacing damaged components.

8-18. Painted surfaces can be cleaned with a commercial, spray-type, window cleaner or with a mild soap and water solution. Excess grease can be removed with a degreaser such as M-180 FREON TF DEGREASER produced by Miller-Stevenson Company.

8-19. Corroded spots are best removed with soap and water. Stubborn residues can be removed with a fine abrasive. When using abrasives, be careful that fine particles do not fall into instrument. Such areas

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 1

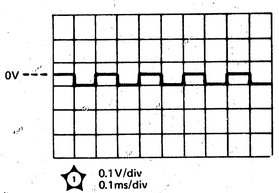
1. Set front-panel controls in accordance with paragraph 5-13, Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 1

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TIME/DIV (delayed)	10 uSEC
DELAY	5.00
HORIZ DISPLAY	MIXED
TRIGGER LEVEL (main)	stable display

2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. **Connect pulse generator output to Model 1722A channel A INPUT connector.**
4. **Adjust pulse generator output for four divisions of signal amplitude (.4V).**



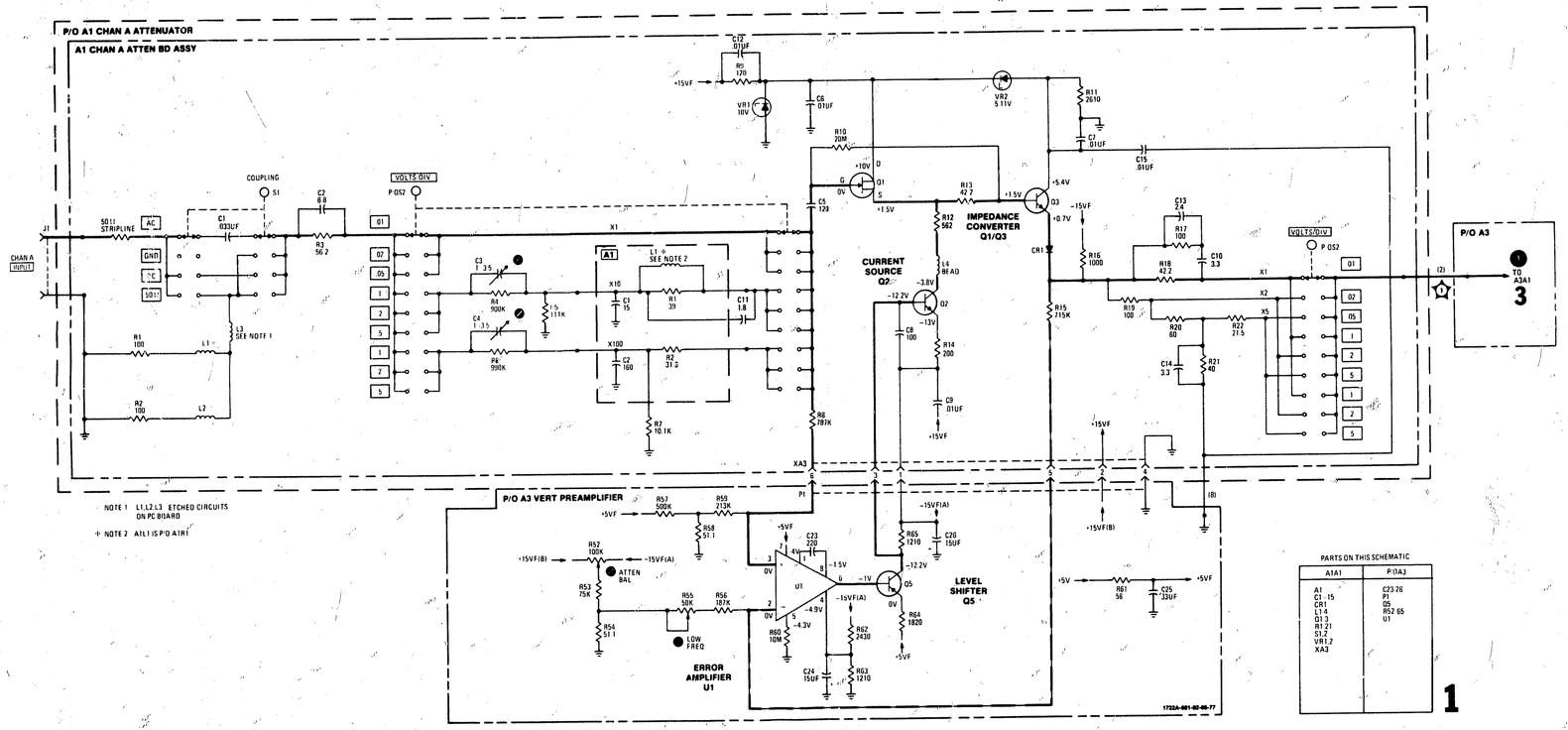
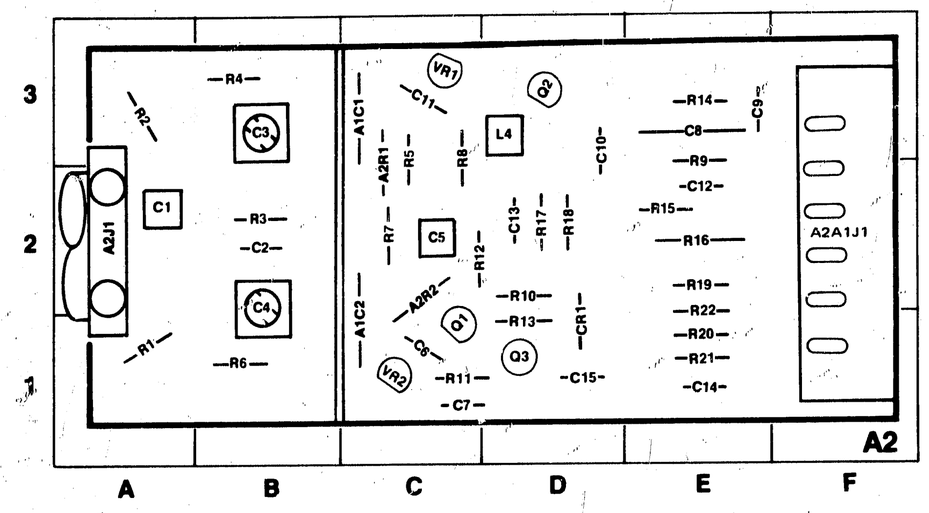


Figure 8-4.
Service Information, Channel A Attenuator, Assembly A1 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A2A1J1	F-2	C5	C-2	C15	D-1	R5	C-3	R15	E-2
A1C1	C-3	C6	C-1	CR1	D-1	R6	B-1	R16	E-2
A1C2	C-1	C7	C-1	L4	D-3	R7	C-2	R17	D-2
A2R1	C-3	C8	E-3	Q1	C-1	R8	C-3	R18	D-2
A2R2	C-1	C9	E-3	Q2	D-3	R9	E-3	R19	E-2
A2J2	A-2	C10	D-3	Q3	D-1	R10	D-2	R20	E-1
C1	A-2	C11	C-3	R1	A-1	R11	C-1	R21	E-1
C2	B-2	C12	E-2	R2	A-3	R12	C-2	R22	E-1
C3	B-3	C13	D-2	R3	B-2	R13	D-1	VR1	C-3
C4	B-2	C14	E-1	R4	B-3	R14	E-3	VR2	C-1

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 2

1. Set front-panel controls in accordance with paragraph 5-13, 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 2

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel B)	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 output to Model 1722A channel B INPUT connector.
4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 5 kHz.

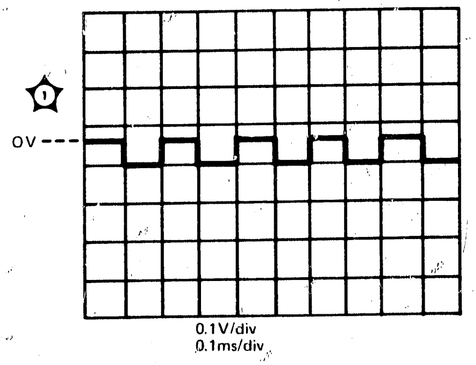
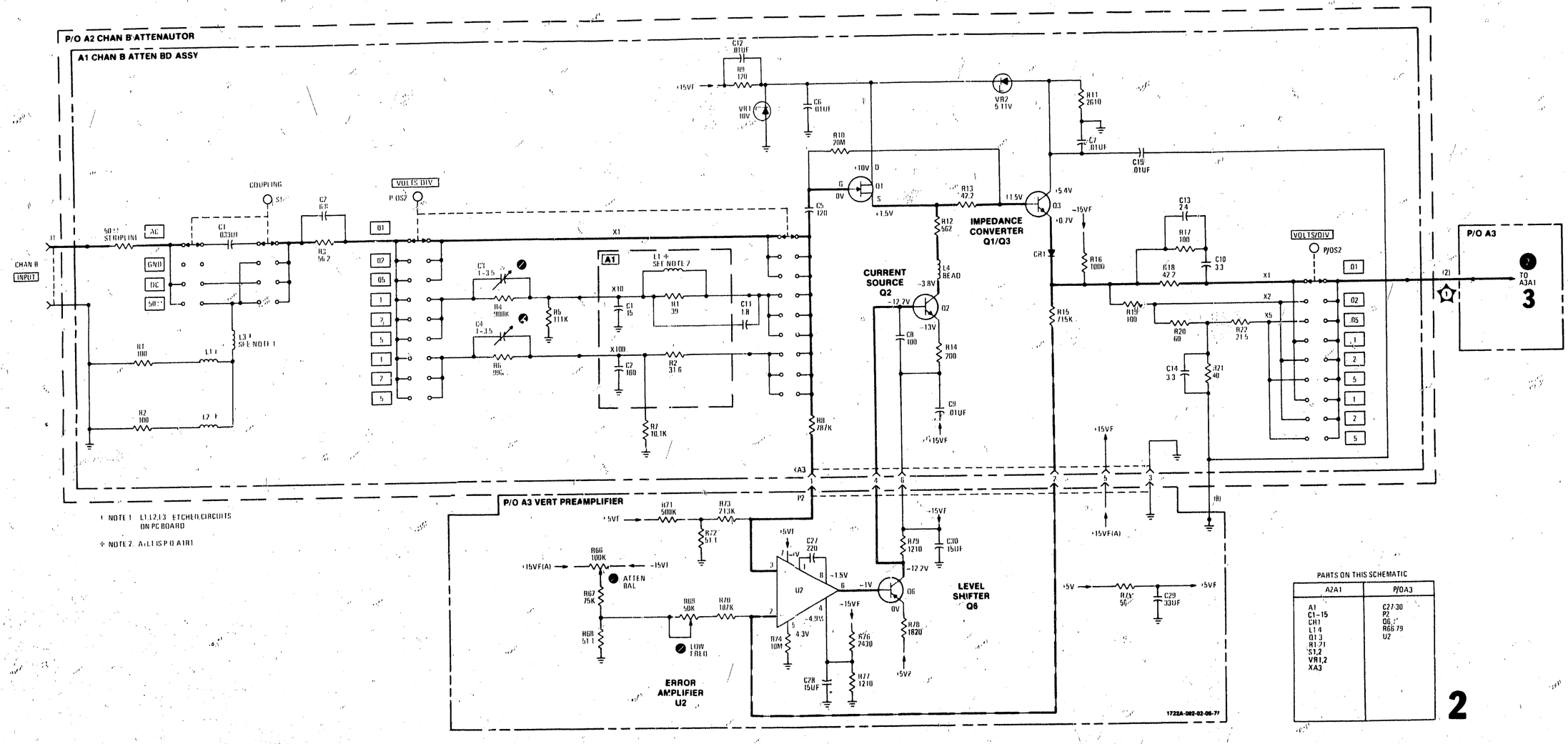


Figure 8-5. Service Information, Channel B Attenuator, Assembly A2 (Sheet 1 of 2)

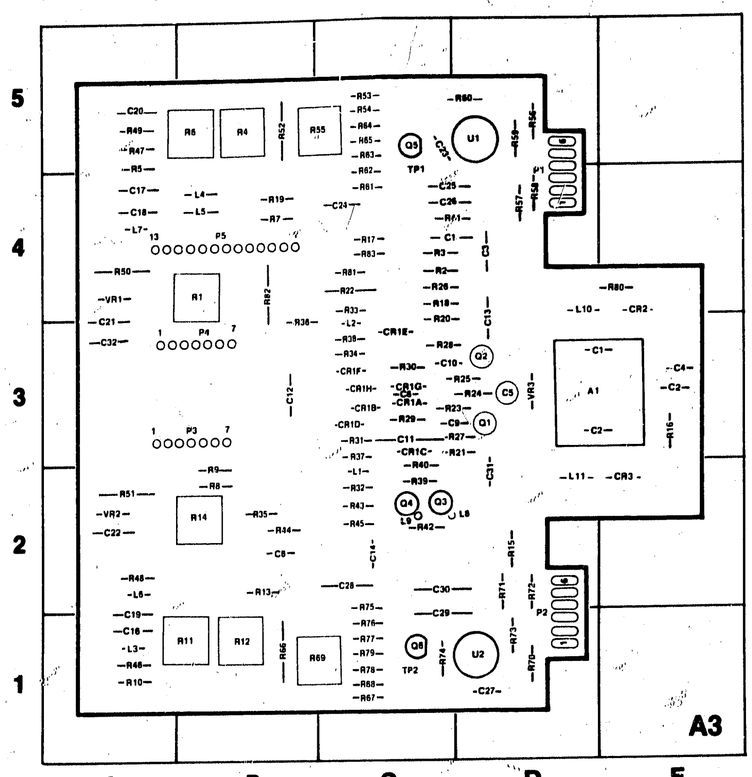


PARTS ON THIS SCHEMATIC

A2A1	P/O A3
A1 C1-15 CR1 L1-4 Q1,3 R1-71 S1,2 VR1,2 XA3	C27-30 P2 Q6 R66-79 U2

2

Figure 8-5.
Service Information, Channel B Attenuator, Assembly A2 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1	D-3	CR1A	C-3	Q6	C-1	R31	C-3	R61	C-4
C1	D-4	CR1B	C-3	R1	B-4	R32	C-2	R62	C-5
C2	E-3	CR1C	C-3	R2	C-4	R33	C-4	R63	C-5
C3	D-4	CR1D	C-3	R3	C-4	R34	C-3	R64	C-5
C4	E-3	CR1E	C-3	R4	B-5	R35	B-2	R65	C-5
C5	D-3	CR1F	C-3	R5	A-5	R36	B-3	R66	B-1
C6	C-3	CR1G	C-3	R6	B-5	R37	C-3	R67	C-1
C8	B-2	CR1H	C-3	R7	B-4	R38	C-3	R68	C-1
C9	D-3	CR2	E-4	R8	B-2	R39	C-2	R69	C-1
C10	D-3	CR3	E-2	R9	B-2	R40	C-2	R70	D-1
C11	C-3	L1	C-2	R10	A-1	R41	D-4	R71	D-2
C12	B-3	L2	C-3	R11	B-1	R42	C-2	R72	D-2
C13	D-4	L3	A-1	R12	B-1	R43	C-2	R73	D-1
C14	C-2	L4	B-4	R13	B-2	R44	B-2	R74	C-1
C16	A-1	L5	B-4	R14	B-2	R45	C-2	R75	C-2
C17	A-4	L6	A-2	R15	D-2	R46	A-1	R76	C-1
C18	A-4	L7	A-4	R16	E-3	R47	A-5	R77	C-1
C19	A-1	L8	D-2	R17	C-4	R48	A-2	R78	C-1
C20	A-5	L9	C-2	R18	C-4	R49	A-5	R79	C-1
C21	A-4	L10	D-3	R19	B-4	R50	A-4	R80	E-4
C22	A-2	L11	D-2	R20	C-3	R51	A-2	R81	C-4
C23	C-5	P1	D-4	R21	D-3	R52	B-5	R82	B-4
C24	C-4	P2	D-1	R22	C-4	R53	C-5	R83	C-4
C25	C-4	P3	B-3	R23	D-3	R54	C-5	TP1	C-4
C26	C-4	P4	B-3	R24	D-3	R55	C-5	TP2	C-1
C27	D-1	P5	B-4	R25	D-3	R56	D-5	U1	D-5
C28	C-2	Q1	D-3	R26	C-4	R57	D-4	U2	D-1
C29	C-1	Q2	D-3	R27	D-3	R58	D-4	VR1	A-4
C30	C-2	Q3	C-2	R28	C-3	R59	D-5	VR2	A-2
C31	D-2	Q4	C-2	R29	C-3	R60	D-5	VR3	D-3
C32	A-3	Q5	C-5	R30	C-3				

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 3

1. Set front-panel controls in accordance with paragraph 5-13, 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

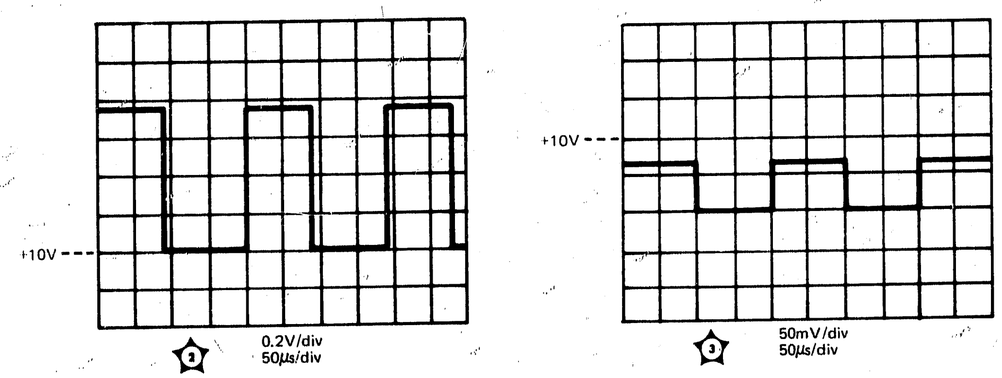
1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

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 output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for four divisions of signal amplitude (.4V) at 5 kHz.



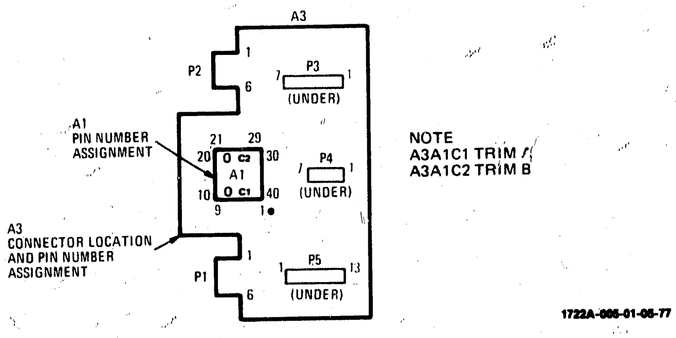
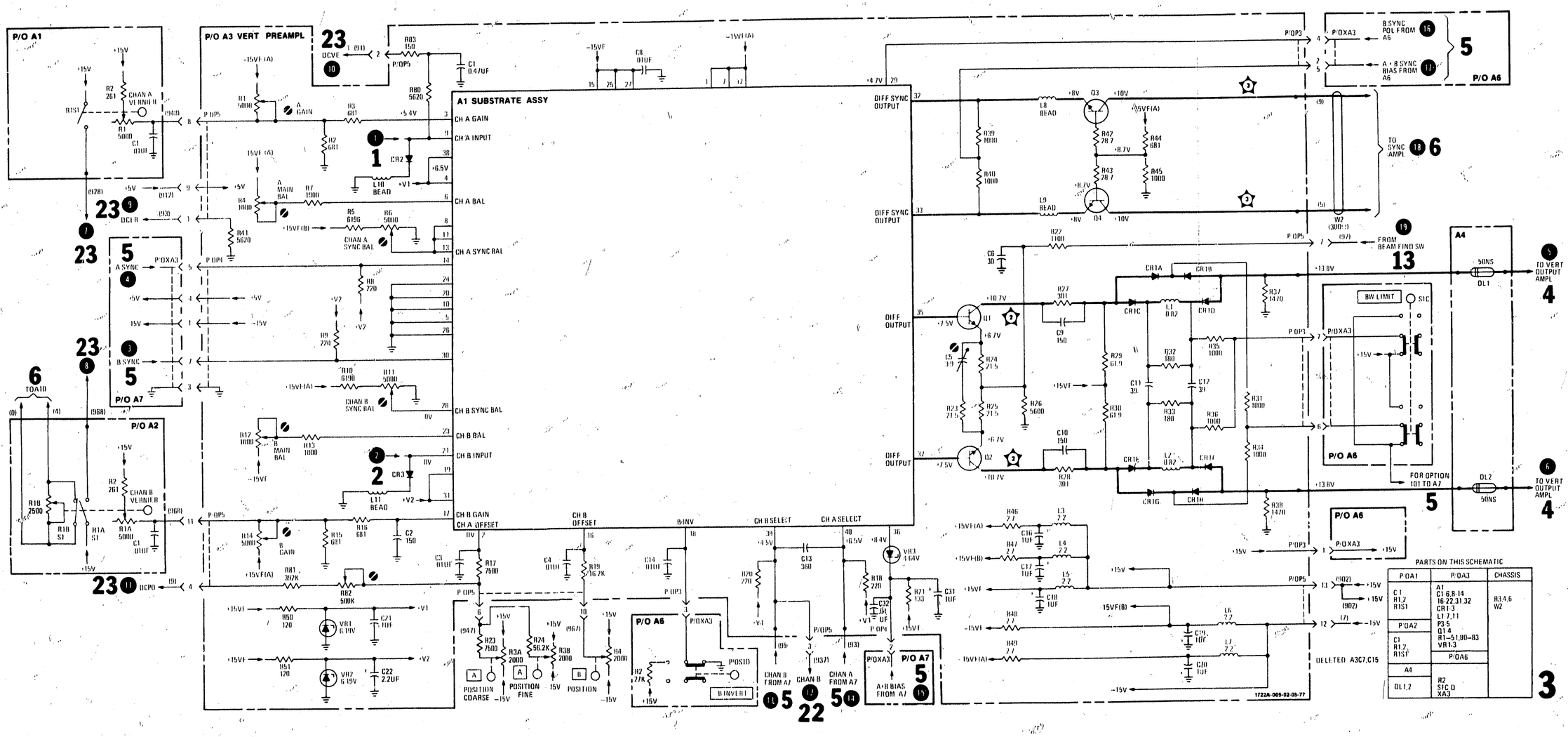
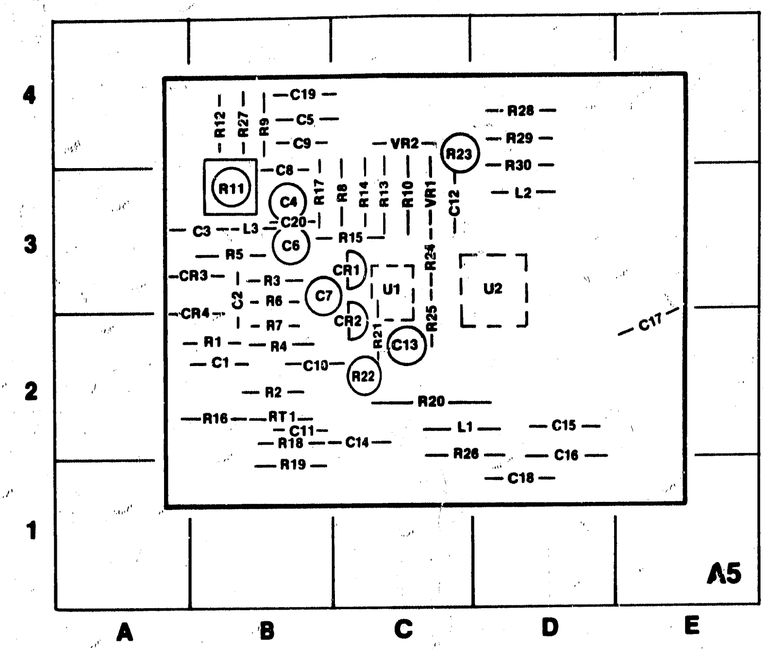


Figure 8-6. Service Information, Vertical Preamplifier, Assembly A3 (Sheet 1 of 2)



P/O A1	P/O A3	CHASSIS
C1 R1,2 R1S1	A1 C1-6,8-14 16-22,31,32 CR1-3 L1,7,11 P3-5 Q1-4 R1—51,80—83 VR1-3	R3,4,6 W2
P/O A2		
C1 R1,2, R1S1	P/O A6	
A4	A2 S1C,D XA3	
DL1,2		

Figure 8-6.
Service Information, Vertical Preamplifier, Assembly A3 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	C17	E-2	R5	B-3	R20	C-2
C2	B-3	C18	D-1	R6	B-3	R21	C-2
C3	B-3	C19	B-4	R7	B-2	R22	C-2
C4	B-3	C20	B-3	R8	C-3	R23	C-4
C5	B-4	CR1	C-3	R9	B-4	R24	C-3
C6	B-3	CR2	C-2	R10	C-3	R25	C-2
C7	B-3	CR3	B-3	R11	B-3	R26	C-1
C8	B-3	CR4	B-2	R12	B-4	R27	B-4
C9	B-4	L1	C-2	R13	C-3	R28	D-4
C10	B-2	L2	D-3	R14	C-3	R29	D-4
C11	B-2	L3	B-3	R15	C-3	R30	D-3
C12	C-3	R1	B-2	R16	B-2	RT1	B-2
C13	C-2	R2	B-2	R17	B-3	U1	C-3
C14	C-2	R3	B-3	R18	B-2	U2	D-3
C15	D-2	R4	B-2	R19	B-1	VR1	C-3
C16	D-1					VR2	C-4

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 4

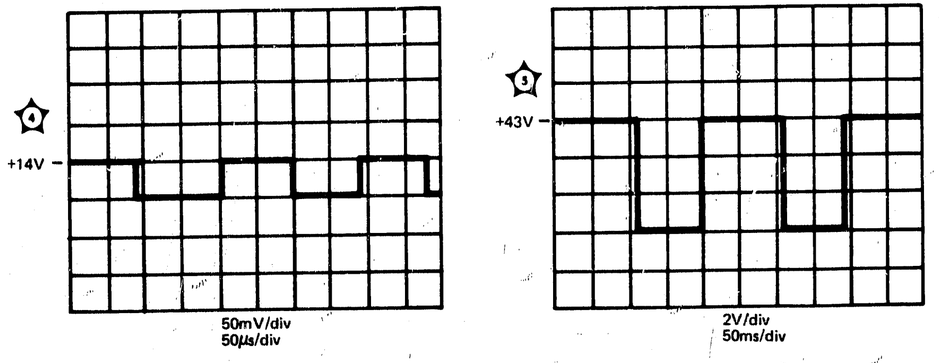
1. Set front-panel controls in accordance with paragraph 5-13, Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 4

1. Set front-panel controls in accordance with paragraph 5-13, 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 output to Model 1722A channel A INPUT connector.
4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 5 kHz.



1722A-004-01-03-76

Figure 8-7. Service Information, Vertical Output, Assembly A5 (Sheet 1 of 2)

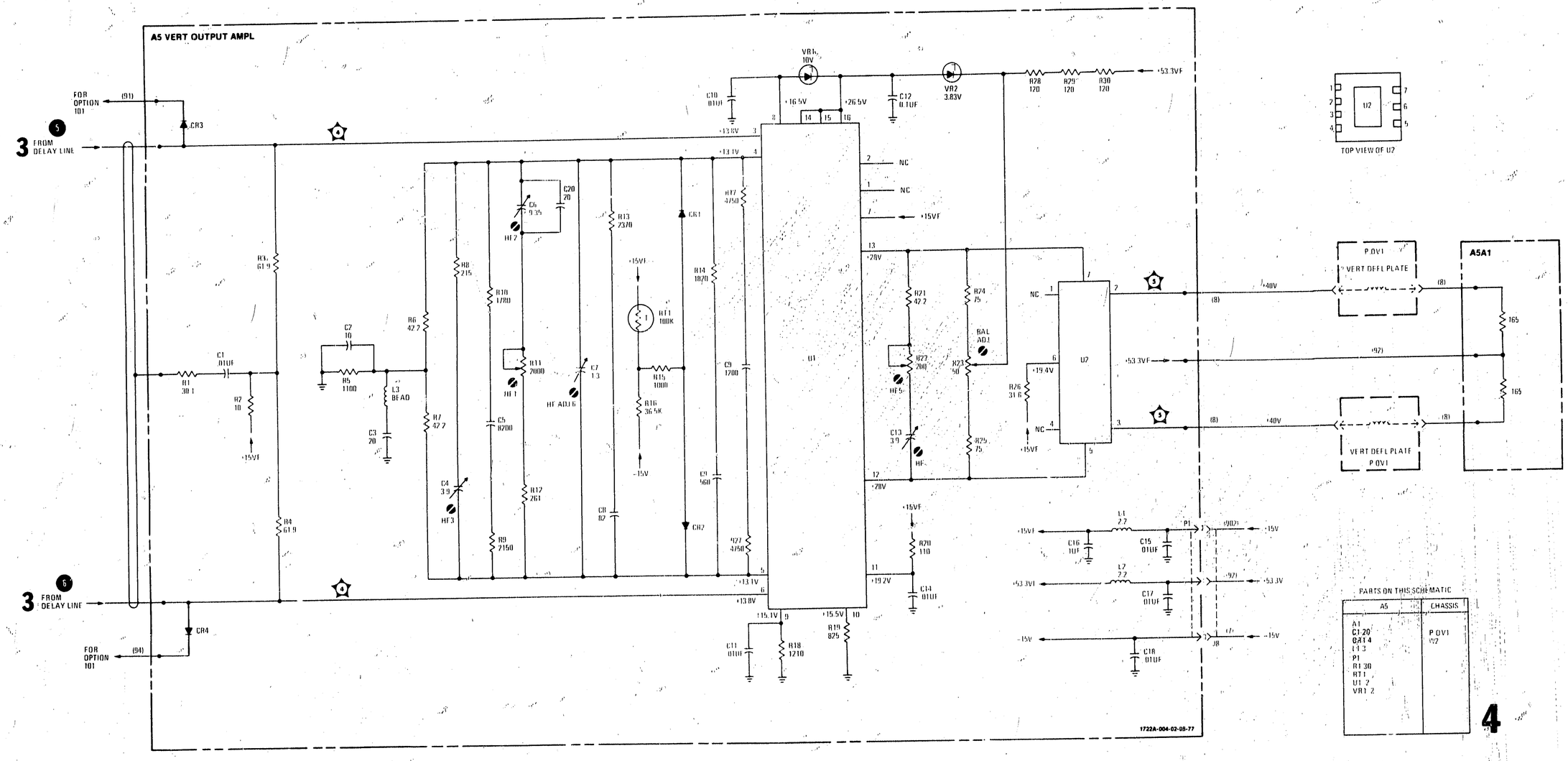
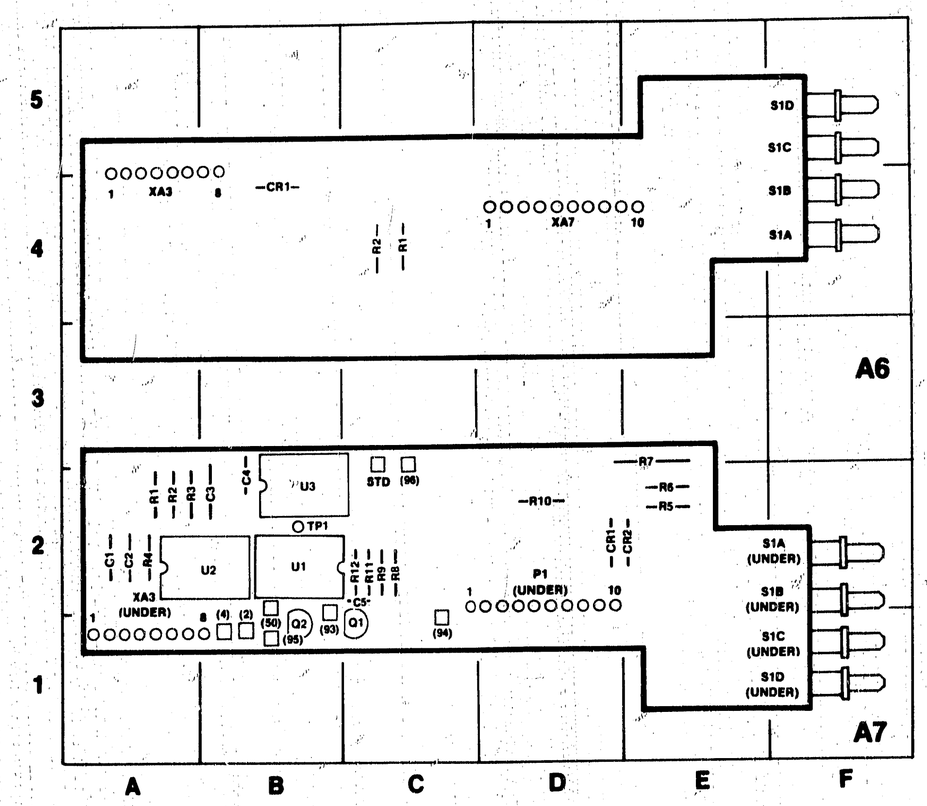


Figure 8-7.
Service Information, Vertical Output, Assembly A5 (Sheet 2 of 2)



A6

REF DESIG	GRID LOC
CR1	B-4
R1	C-4
R2	C-4
S1A	F-4
S1B	F-4
S1C	F-5
S1D	F-5
XA3	A-4
XA7	D-4

A7

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	A-2	R1	A-2	R11	C-2
C2	A-2	R2	A-2	R12	C-2
C3	B-2	R3	A-2	S1A	F-2
C4	B-2	R4	A-2	S1B	F-2
C5	C-2	R5	E-2	S1C	F-1
CR1	D-2	R6	E-2	S1D	F-1
CR2	E-2	R7	E-2	TP1	B-2
P1	D-2	R8	C-2	U1	B-2
Q1	C-1	R9	C-2	U2	B-2
Q2	B-1	R10	C-2	U3	B-1
				XA3	A-3

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 5

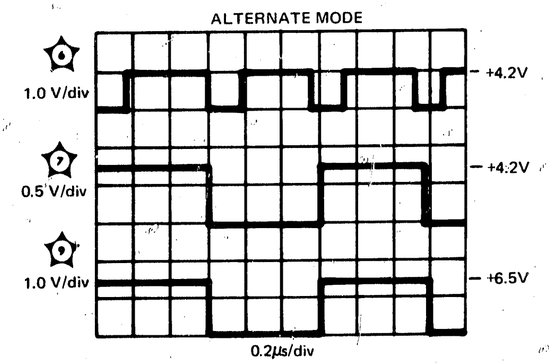
1. Set front-panel controls in accordance with paragraph 5-13, Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

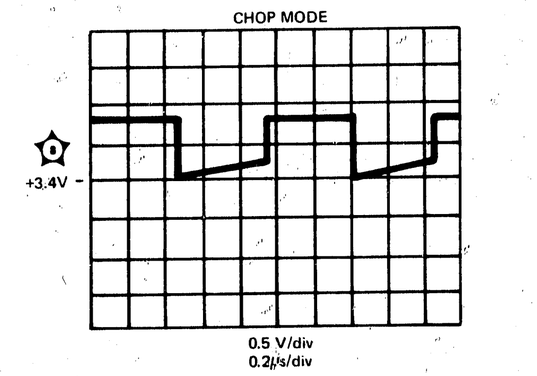
WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 5

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIGGER LEVEL (main)	stable display
VOLTS/DIV	see waveforms

2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. Connect pulse generator output to Model 1722A channel A INPUT connector.
4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 5 kHz.





1722A-006-01-06-76

Figure 8-8. Service Information, Display/Trigger Switches, Assemblies A6 and A7 (Sheet 1 of 2)

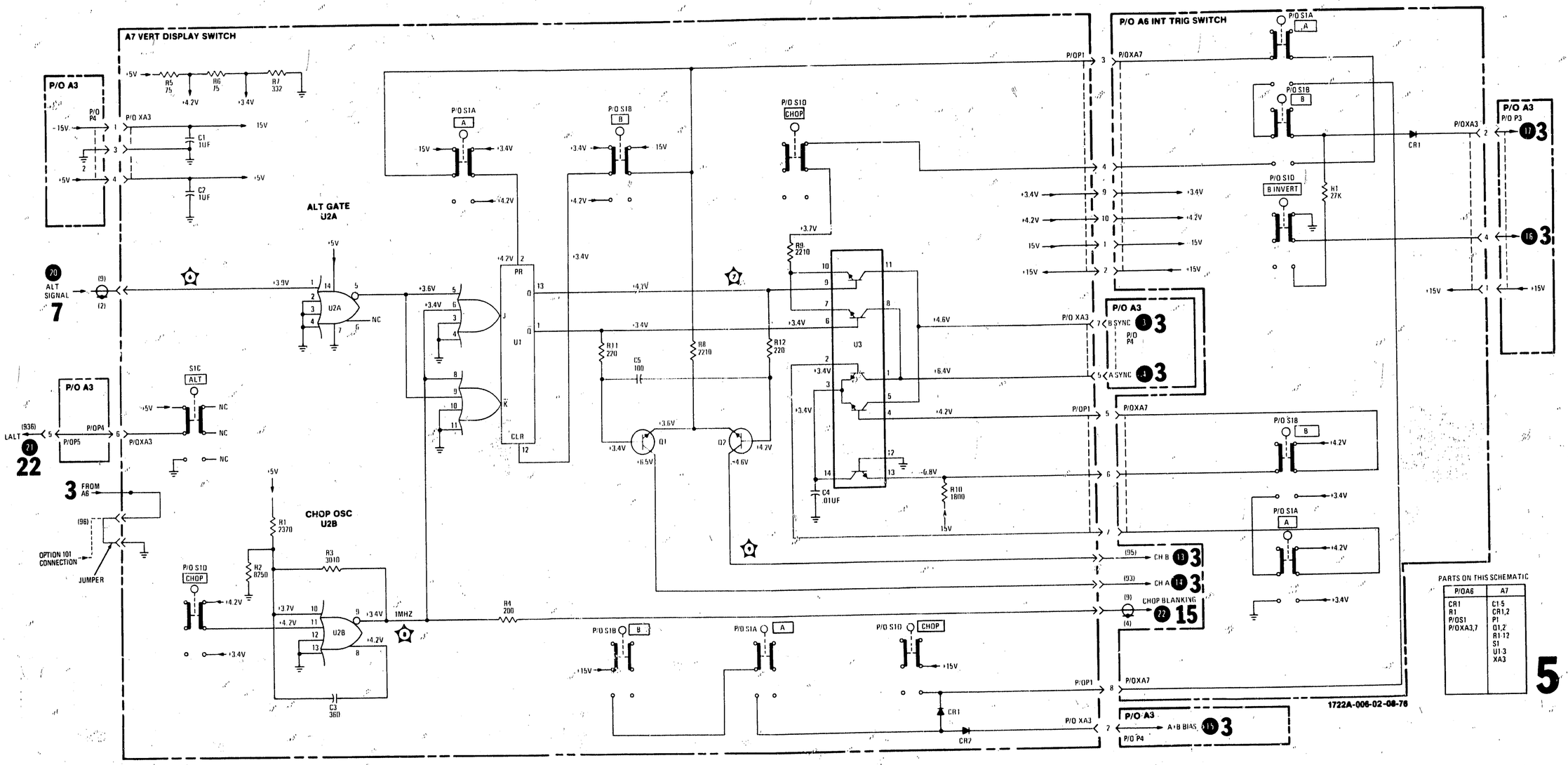
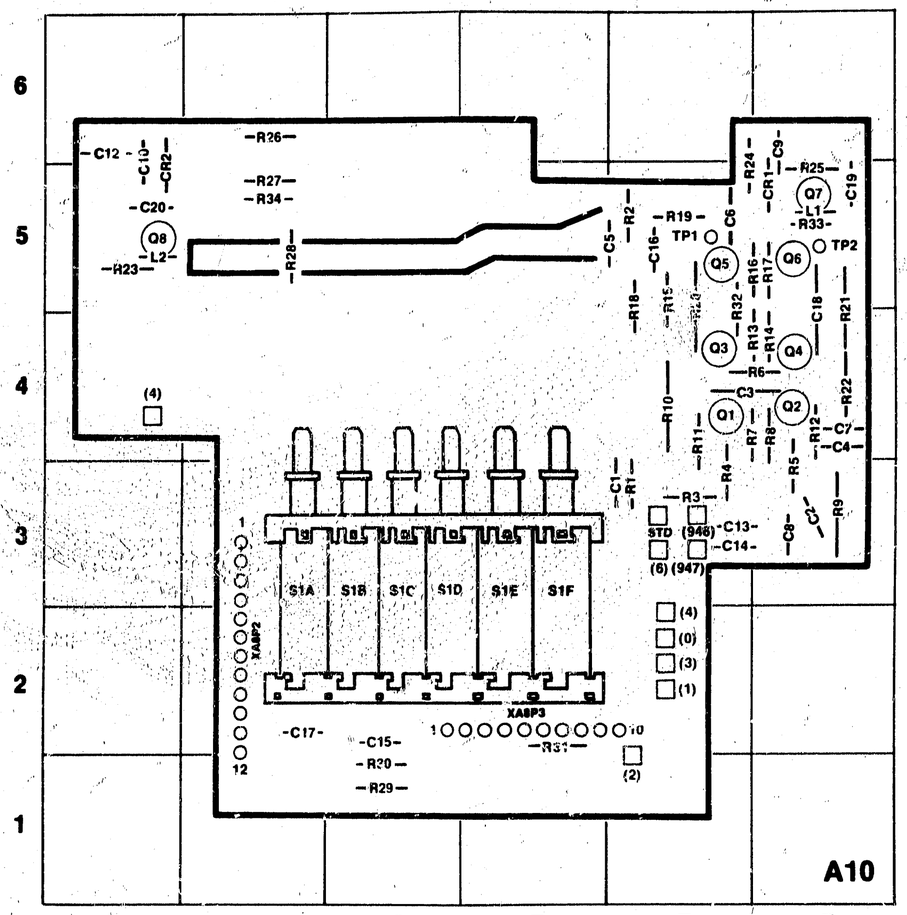


Figure 8-8.
Service Information, Display/Trigger Switches, Assemblies A6 and A7 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	C17	D-2	Q8	A-5	R15	E-5	R30	C-1
C2	F-3	C18	F-4	R1	E-3	R16	F-5	R31	D-2
C3	E-4	C19	F-5	R2	E-5	R17	F-5	R32	E-4
C4	F-4	C20	A-5	R3	E-3	R18	E-5	R33	F-5
C5	E-5	CR1	F-5	R4	E-3	R19	E-5	R34	B-5
C6	E-5	CR2	A-5	R5	F-3	R20	E-5	S1A	B-3
C7	F-4	L1	F-5	R6	F-4	R21	F-4	S1B	C-3
C8	F-3	L2	A-5	R7	F-4	R22	F-4	S1C	C-3
C9	F-6	Q1	E-4	R8	F-4	R23	A-5	S1D	C-3
C10	A-5	Q2	F-4	R9	F-3	R24	F-5	S1E	D-3
C12	A-6	Q3	E-4	R10	E-4	R25	F-5	S1F	D-3
C13	E-3	Q4	F-4	R11	E-4	R26	B-6	TP1	E-5
C14	E-3	Q5	E-5	R12	F-4	R27	B-5	TP2	F-5
C15	C-2	Q6	F-5	R13	F-4	R28	B-5	XA8P2	B-2
C16	E-5	Q7	F-5	R14	F-4	R29	C-1	XA8P3	D-2

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 6

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

VERTICAL DISPLAY	X-Y
HORIZ DISPLAY	X-Y
POSITION (horizontal)	centered

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 paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIGGER LEVEL (main)	stable display
VERTICAL DISPLAY	X-Y
HORIZONTAL MODE	X-Y

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

3. Connect pulse generator output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 5 kHz.

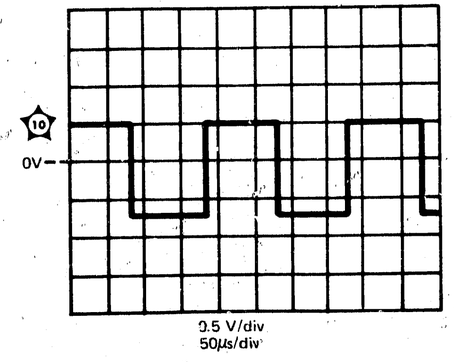


Figure 8-9. Service Information, Horizontal Display Switch, Assembly A10 (Sheet 1 of 2)

Table 8-1. Schematic Notes

Refer to American National Standard Y32.2 for schematic symbols not listed in this table.

ETCHED CIRCUIT BOARD

FRONT-PANEL MARKING

REAR-PANEL MARKING

FRONT-PANEL CONTROL

SCREWDRIVER ADJUSTMENT

TP1 ELECTRICAL TEST POINT TP (WITH NUMBER)

WAVEFORM TEST POINT (WITH NUMBER)

SINGLE-PIN CONNECTOR ON BOARD

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

COAXIAL CABLE CONNECTED TO SNAP-ON JACK

COAXIAL CABLE CONNECTED DIRECTLY TO BOARD

MAIN SIGNAL PATH

PRIMARY FEEDBACK PATH

SECONDARY FEEDBACK PATH

P/O PART OF

NC NO CONNECTION

CW CLOCKWISE END OF VARIABLE RESISTOR

G D S FIELD-EFFECT TRANSISTOR (P-TYPE BASE)

G D S FIELD-EFFECT TRANSISTOR (N-TYPE BASE)

BREAKDOWN DIODE (VOLTAGE REGULATOR)

TUNNEL DIODE

STEP-RECOVERY DIODE

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

6 SIGNAL REFERENCE

2 SCHEMATIC REFERENCE

(925) WIRE COLORS ARE GIVEN BY NUMBERS IN PARENTHESIS USING THE RESISTOR COLOR CODE

[(925) IS WHT-RED-GRN]

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

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

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

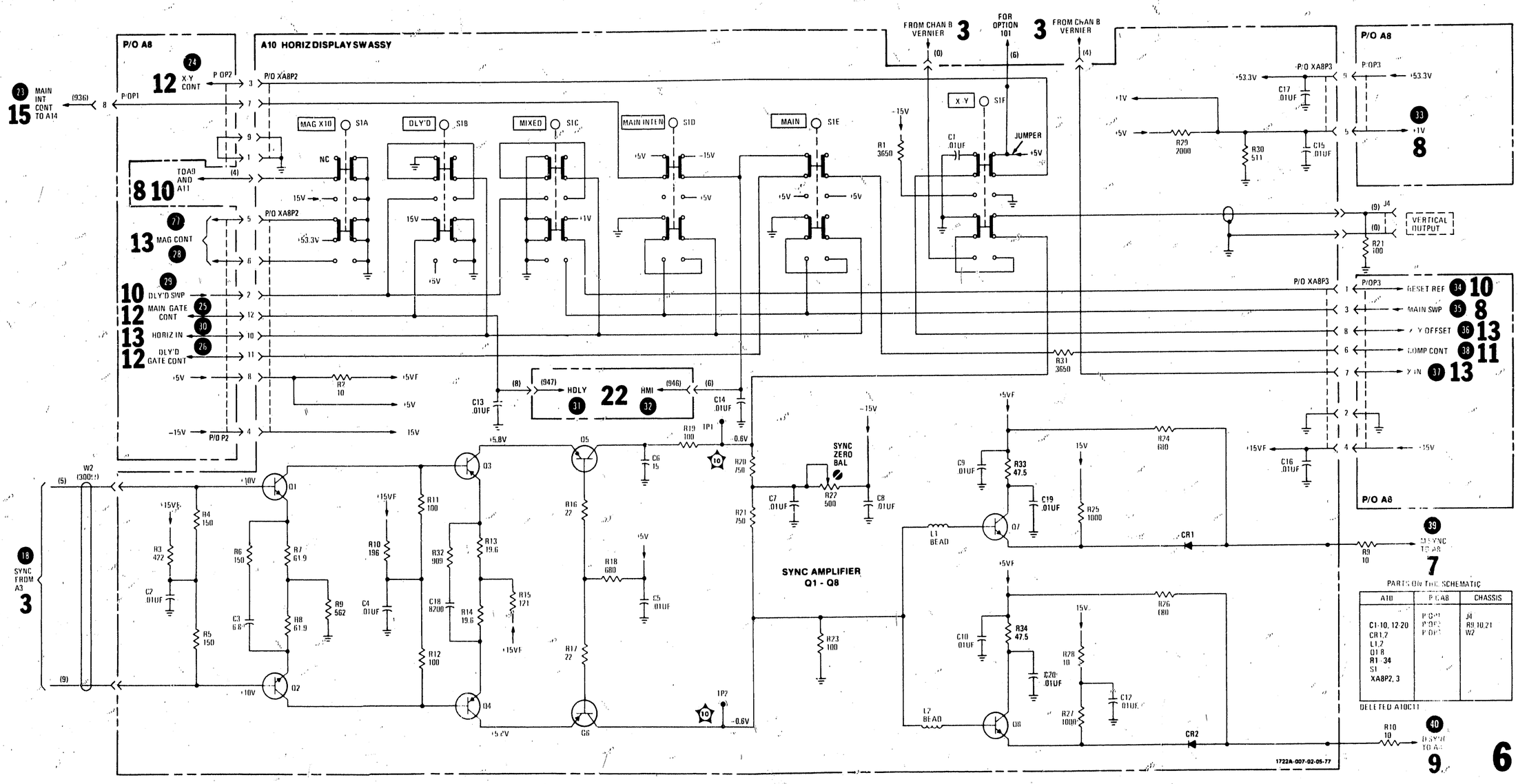
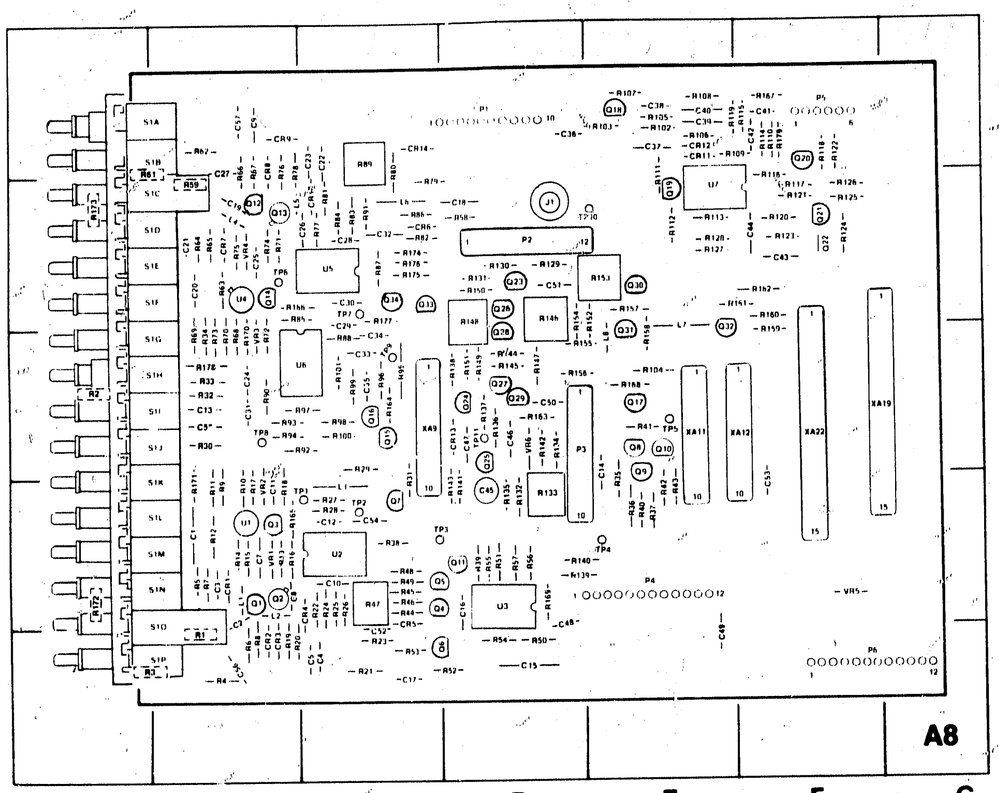


Figure 8-9.
Service Information, Horizontal Display Switch, Assembly A10 (Sheet 2 of 2)



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-2	C37	E-5	J1	D-4	Q20	F-5	R20	B-1	R54	D-1	R89	C-5	R123	F-4	R157	E-4	S1L	B-2
C2	B-2	C38	E-5	L1	B-2	Q21	F-4	R21	C-1	R55	D-2	R90	B-3	R124	F-4	R158	E-3	S1M	B-2
C3	B-2	C39	E-5	L2	B-2	Q22	F-4	R22	C-2	R56	D-2	R91	C-4	R125	F-4	R159	F-3	S1N	B-2
C4	C-1	C40	E-5	L3	C-2	Q23	D-4	R23	C-1	R57	D-2	R92	C-3	R126	F-4	R160	F-4	S1O	B-2
C5	C-1	C41	F-5	L4	B-4	Q24	D-3	R24	C-2	R58	D-4	R93	B-3	R127	E-4	R161	F-4	S1P	B-1
C7	B-2	C42	F-5	L5	C-4	Q25	D-3	R25	C-2	R59	B-5	R94	B-3	R128	E-4	R162	F-4	TP1	C-2
C8	B-2	C43	F-4	L6	C-4	Q26	D-4	R26	C-2	R61	A-5	R95	C-3	R129	D-4	R163	D-3	TP2	C-2
C9	B-5	C44	F-4	L7	E-3	Q27	D-3	R27	C-2	R62	B-5	R96	C-3	R130	D-4	R164	C-3	TP3	C-2
C10	C-2	C45	D-2	L8	E-3	Q28	D-3	R28	C-2	R63	B-4	R97	C-3	R131	D-4	R165	B-2	TP4	E-2
C11	B-2	C46	D-3	P1	D-5	Q29	D-3	R29	C-3	R64	B-4	R98	C-3	R132	D-3	R166	C-4	TP5	E-3
C12	C-2	C47	D-3	P2	D-4	Q30	E-4	R30	B-3	R65	B-4	R99	C-3	R133	D-3	R167	F-5	TP6	B-4
C13	B-3	C48	D-2	P3	D-3	Q31	E-3	R31	C-3	R66	B-5	R100	C-3	R134	D-3	R168	E-3	TP7	C-4
C14	E-3	C49	E-1	P4	E-2	Q32	E-3	R32	B-3	R67	B-5	R101	C-3	R135	D-3	R169	D-2	TP8	B-3
C15	D-1	C50	D-3	P5	F-5	Q33	C-4	R33	B-3	R68	B-3	R102	E-5	R136	D-3	R170	B-3	TP9	C-3
C16	D-2	C51	D-4	P6	F-1	Q34	C-4	R34	B-3	R69	B-3	R103	E-5	R137	D-3	R171	B-2	TP10	E-4
C17	C-1	C52	C-1	Q1	B-2	R1	B-2	R35	E-5	R70	B-3	R104	E-3	R138	D-3	R172	A-2	TP11	D-3
C18	D-4	C53	F-2	Q2	B-2	R2	A-3	R36	E-3	R71	B-4	R105	E-5	R139	D-3	R173	A-4	U1	B-2
C19	B-4	C54	C-2	Q3	B-2	R3	B-1	R37	E-3	R72	B-3	R106	E-5	R140	D-3	R174	C-4	U2	C-2
C20	B-4	C56	B-1	Q4	C-2	R4	B-1	R38	C-2	R73	B-3	R107	E-5	R141	D-2	R175	C-4	U3	D-3
C21	B-4	C57	B-5	Q5	C-2	R5	B-2	R39	D-2	R74	B-4	R108	E-5	R142	D-3	R176	C-4	U4	B-4
C22	C-5	C58	B-3	Q6	D-1	R6	B-1	R40	E-2	R75	B-4	R109	F-5	R143	D-2	R177	C-4	U5	C-4
C23	C-5	CR1	B-2	Q7	C-2	R7	B-2	R41	E-3	R76	B-5	R110	F-5	R144	D-3	R178	B-3	U6	C-3
C24	B-3	CR2	B-1	Q8	E-5	R8	B-1	R42	E-2	R77	C-4	R111	E-4	R145	D-3	R179	F-5	U7	E-4
C25	B-4	CR3	B-1	Q9	E-5	R9	B-2	R43	E-2	R78	B-5	R112	F-5	R146	D-4	S1A	B-5	VR1	B-2
C26	C-4	CR4	C-2	Q10	E-5	R10	B-2	R44	C-2	R79	C-4	R113	F-4	R147	D-3	S1B	B-5	VR2	B-3
C27	B-5	CR5	C-2	Q11	D-2	R11	B-2	R45	C-2	R80	C-5	R114	F-5	R148	D-4	S1C	B-4	VR3	B-3
C28	C-4	CR6	C-4	Q12	B-4	R12	B-2	R46	C-2	R81	C-4	R115	F-5	R149	D-3	S1D	B-4	VR4	B-4
C29	C-4	CR7	B-4	Q13	B-4	R13	B-2	R47	C-2	R82	C-4	R116	F-4	R150	D-4	S1E	B-4	VR5	F-2
C30	C-4	CR8	B-5	Q14	B-4	R14	B-2	R48	C-2	R83	C-4	R117	F-4	R151	D-3	S1F	B-4	VR6	D-3
C31	B-3	CR9	B-5	Q15	C-3	R15	B-2	R49	C-2	R84	C-4	R118	F-5	R152	E-4	S1G	B-3	XA9	C-3
C32	C-4	CR10	C-4	Q16	C-3	R16	B-2	R50	D-1	R85	C-4	R119	F-5	R153	E-4	S1H	B-3	XA11	E-3
C33	C-3	CR11	E-5	Q17	E-3	R17	B-2	R51	D-2	R86	C-4	R120	F-4	R154	D-4	S1I	B-3	XA12	E-3
C34	C-3	CR12	E-5	Q18	E-5	R18	B-2	R52	D-1	R87	C-4	R121	F-4	R155	D-3	S1J	B-3	XA19	G-3
C35	C-3	CR13	D-3	Q19	E-4	R19	B-1	R53	C-1	R88	C-3	R122	F-5	R156	D-3	S1K	B-2	XA22	F-3
C36	D-5	CR14	C-5																

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 7

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Sweep Mode	SINGLE
AUTO/NORM	NORM
RESET	armed
TRIGGER LEVEL (main)	cw

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

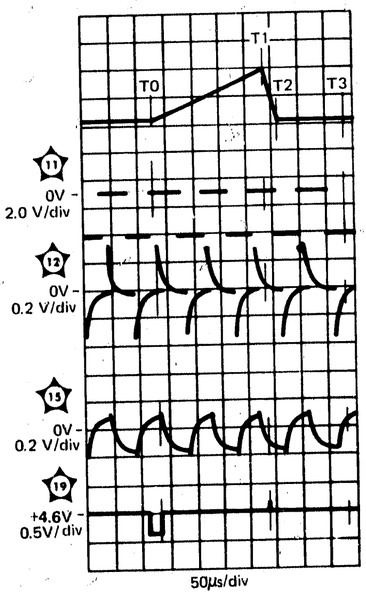
WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 7

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIGGER LEVEL (main)	stable display
TIME/DIV (main)	20 µs/div

2. Set monitor oscilloscope TIME/DIV and VOLTS/DIV controls as indicated under waveform(s).
3. Connect pulse generator output to Model 1722A channel A INPUT connector.
4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 10 kHz.
5. Waveform timing conditions:

T_0 - Sweep start; position trigger occurs at A8U2 pin 11.
T_1 - Sweep ends; holdoff starts.
T_2 - Holdoff ends; armed starts.
T_3 - Armed ends.



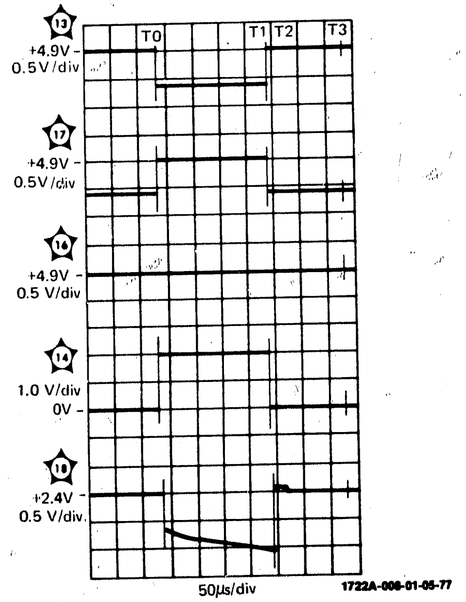


Figure 8-10. Service Information, Main Sweep Trigger, P/O Assembly A8 (Sheet 1 of 2)

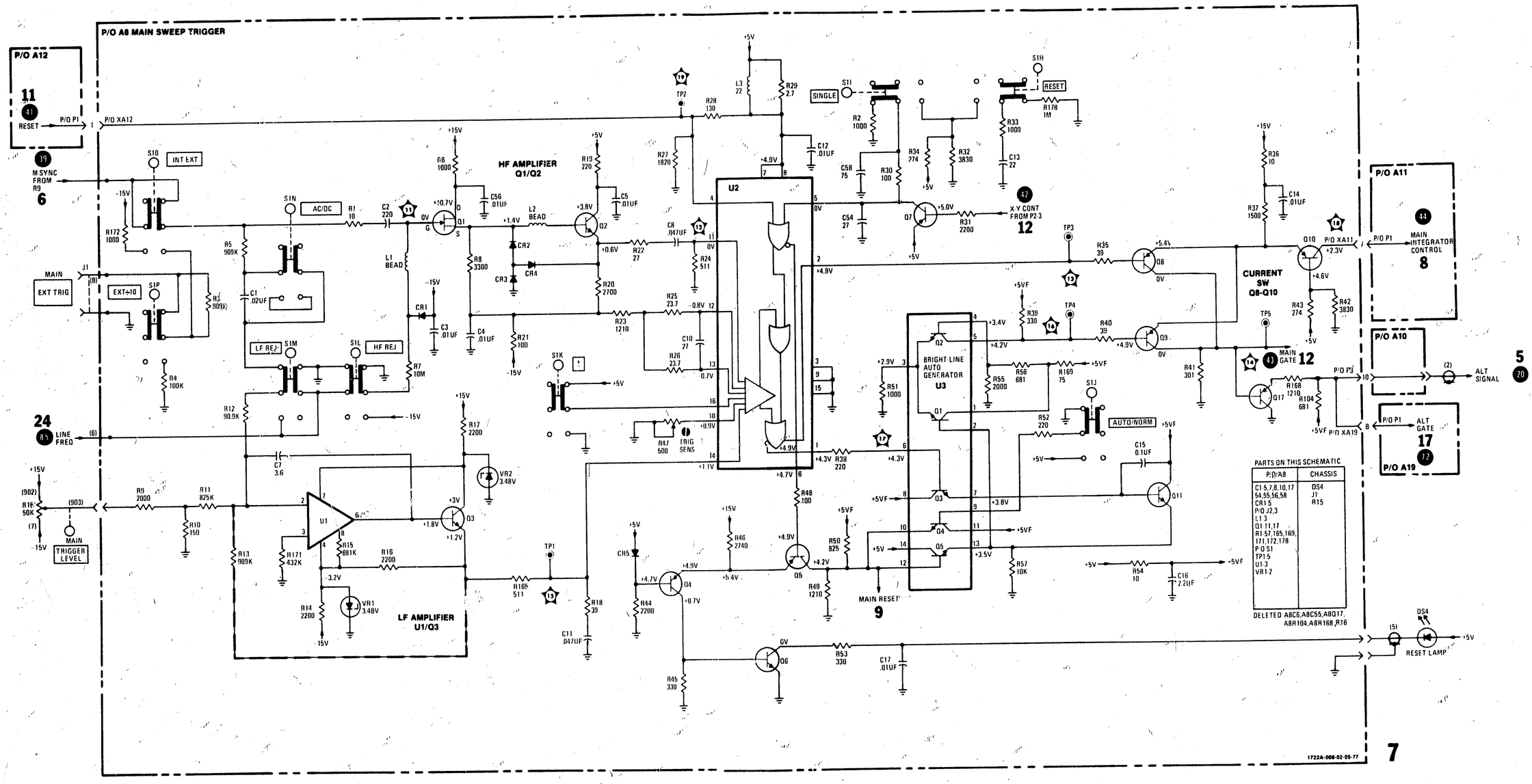
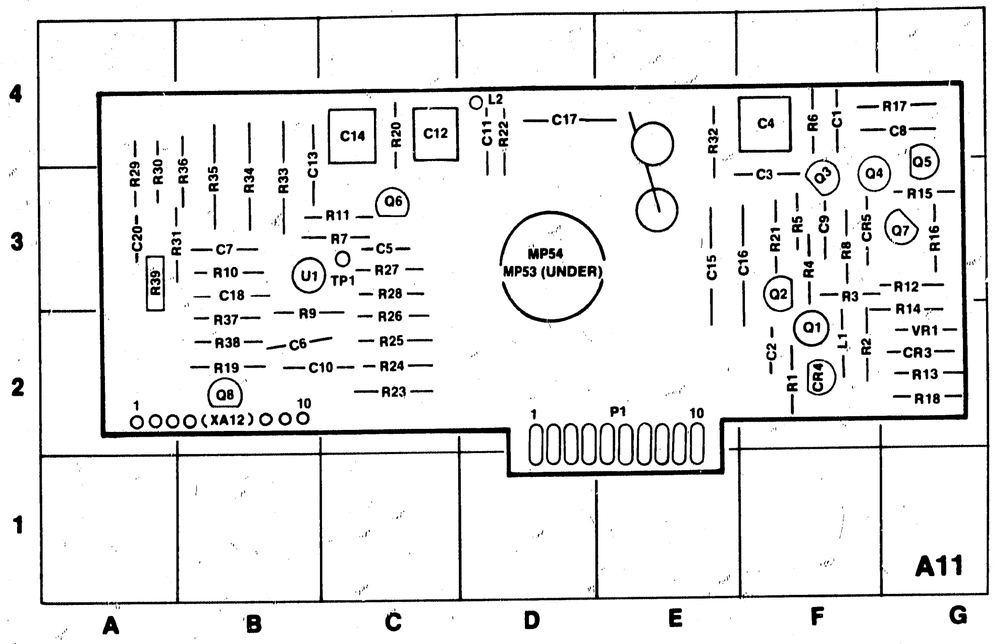


Figure 8-10.
Service Information, Main Sweep Trigger, P/O Assembly A8 (Sheet 2 of 2)



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
C1	F-4	C13	B-3	L1	F-2	Q7	G-3	R10	B-3	R21	F-3	R32	D-4
C2	F-2	C14	C-4	L2	D-4	Q8	B-2	R11	C-3	R22	D-4	R33	B-3
C3	F-3	C15	E-3	MP53	D-3	R1	F-2	R12	G-3	R23	C-2	R34	B-3
C4	F-4	C16	F-3	MP54	D-3	R2	F-2	R13	G-2	R24	C-2	R35	B-3
C5	C-3	C17	D-4	P1	E-1	R3	F-3	R14	G-2	R25	C-2	R36	B-3
C6	B-2	C18	B-3	Q1	F-2	R4	F-3	R15	G-3	R26	C-2	R37	B-2
C7	B-3	C20	A-3	Q2	F-3	R5	F-3	R16	G-3	R27	C-3	R38	B-2
C8	G-4	CR3	G-2	Q3	F-3	R6	F-4	R17	G-4	R28	C-3	R39	A-3
C9	F-3	CR4	F-2	Q4	G-3	R7	C-3	R18	G-2	R29	A-3	TP1	C-3
C10	C-2	CR5	F-3	Q5	G-3	R8	F-3	R19	B-2	R30	A-3	U1	B-3
C11	D-4	XA12	B-2	Q6	C-3	R9	B-2	R20	C-4	R31	B-3	VR1	G-2
C12	C-4												

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 8

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Sweep Mode	SINGLE
AUTO/NORM	NORM
RESET	armed
TRIGGER LEVEL (main)	cw

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 paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIGGER LEVEL (main)	stable display
TIME/DIV (main)	20 μs/div

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

3. Connect pulse generator output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for four divisions of signal amplitude (.4 V) at 10 kHz.

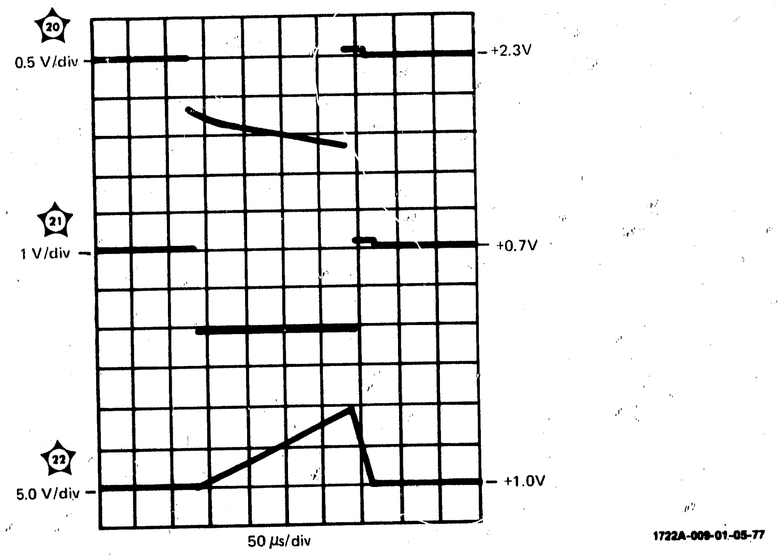


Figure 8-11. Service Information, Main Sweep Integrator, Assembly A11 (Sheet 1 of 2)

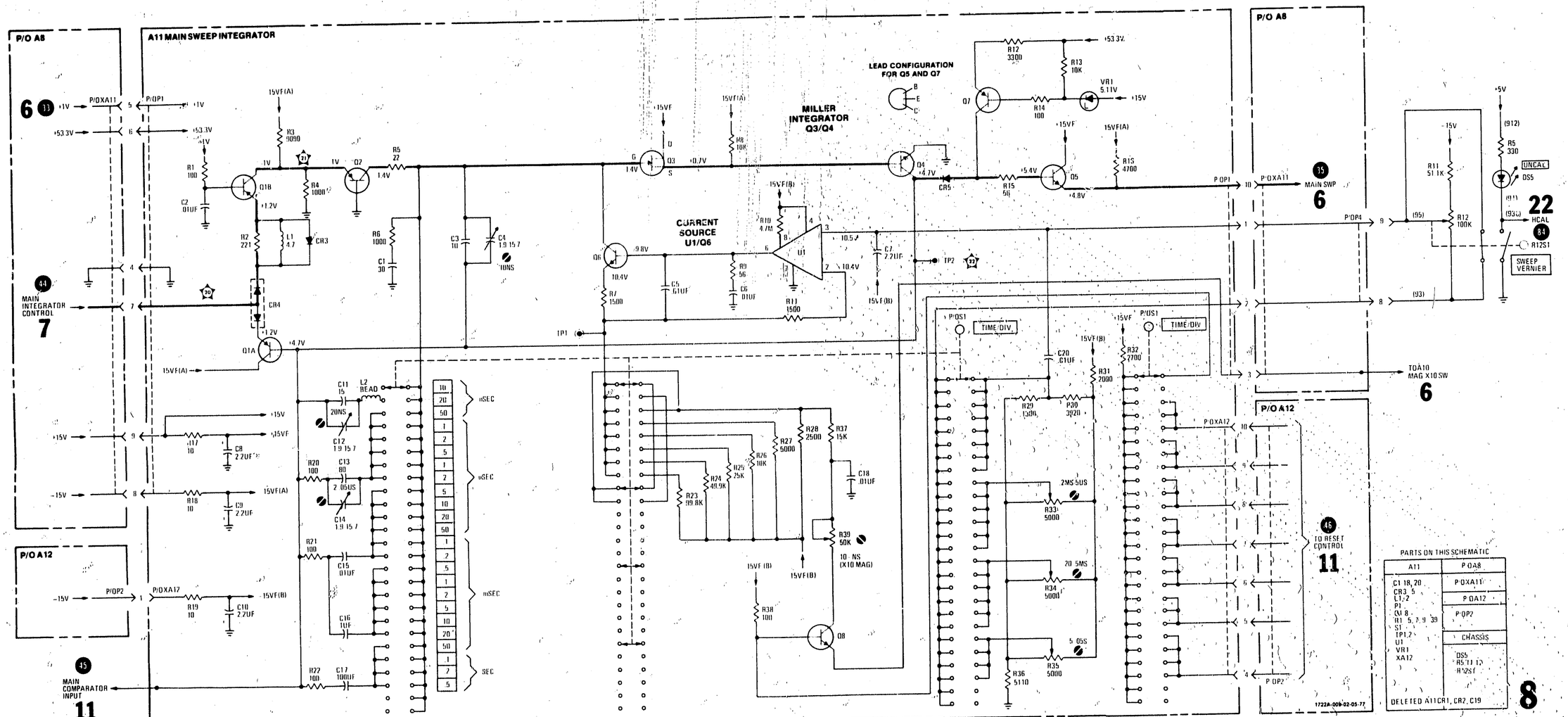


Figure 8-11.
Service Information, Main Sweep Integrator, Assembly A11 (Sheet 2 of 2)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 9

1. Set front-panel controls in accordance with paragraph 5-13, Section V.

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

WAVEFROM MEASUREMENT CONDITIONS
SCHEMATIC 9

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIG LEVEL (delayed)	stable display
TIME/DIV (main)	.1 mSEC
TIME/DIV (delayed)	50 μSEC
HORIZ DISPLAY	DLY'D

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

3. Connect pulse generator 50-ohm output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for 5 kHz, four divisions of signal amplitude (0.4 V).

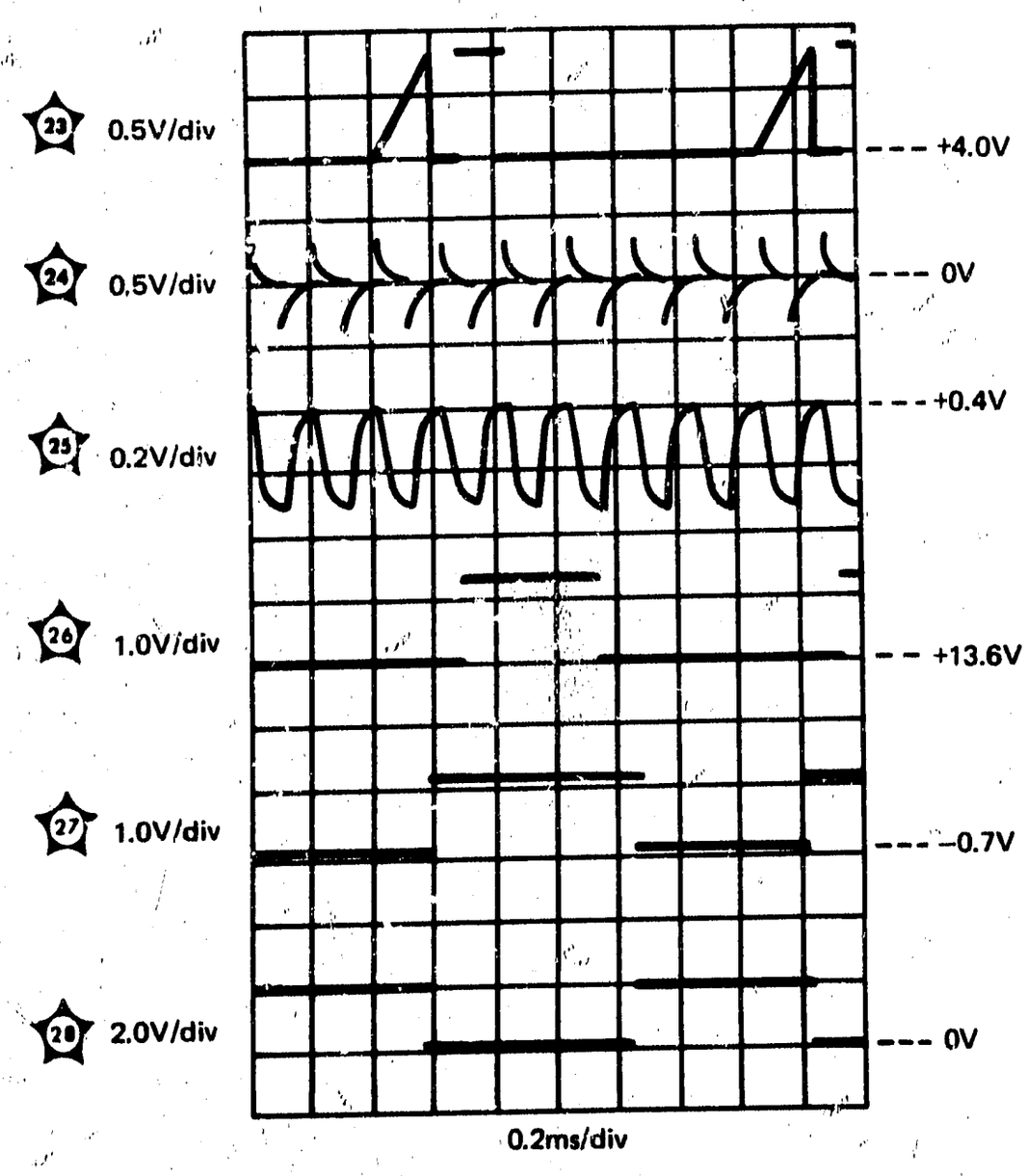
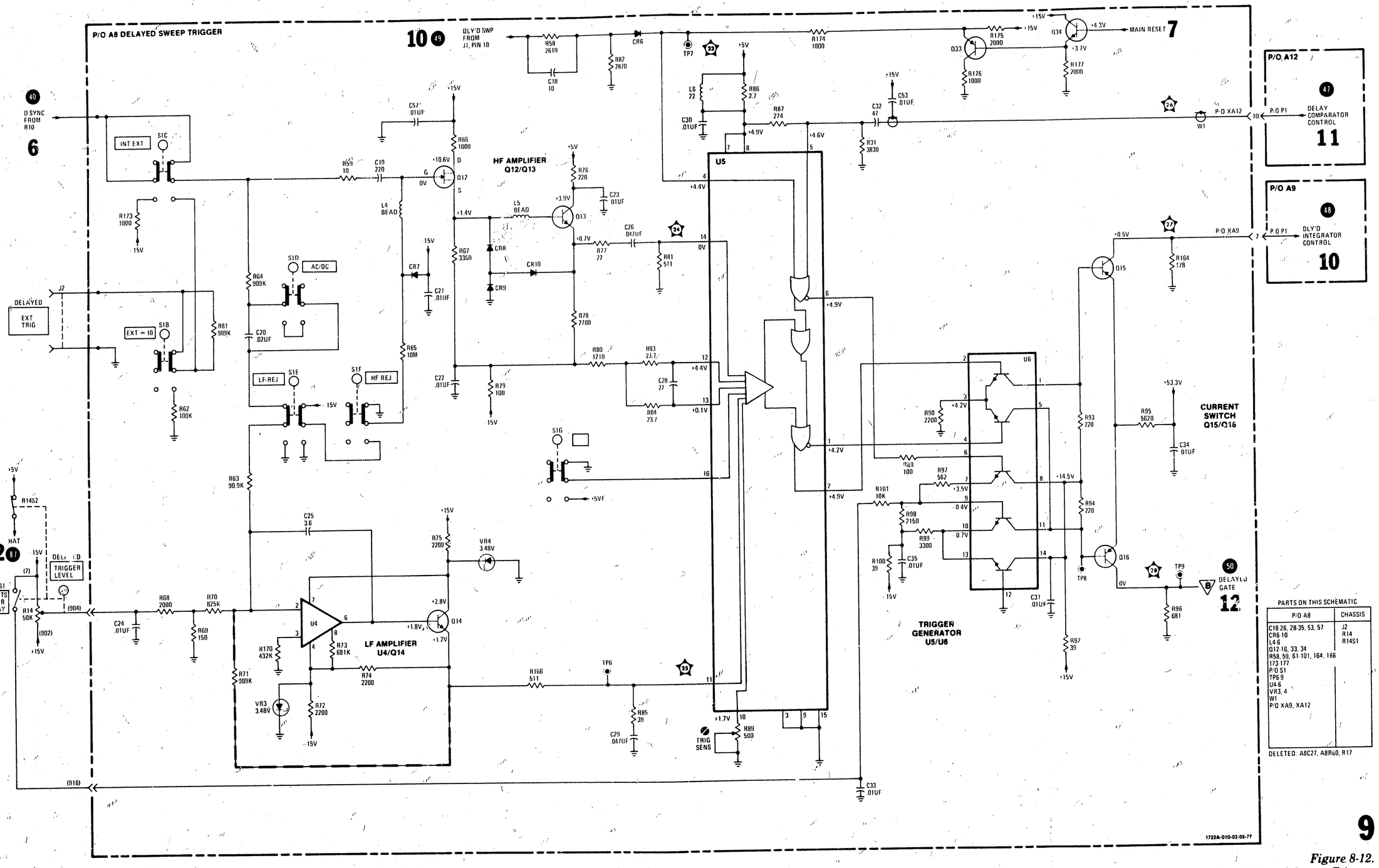


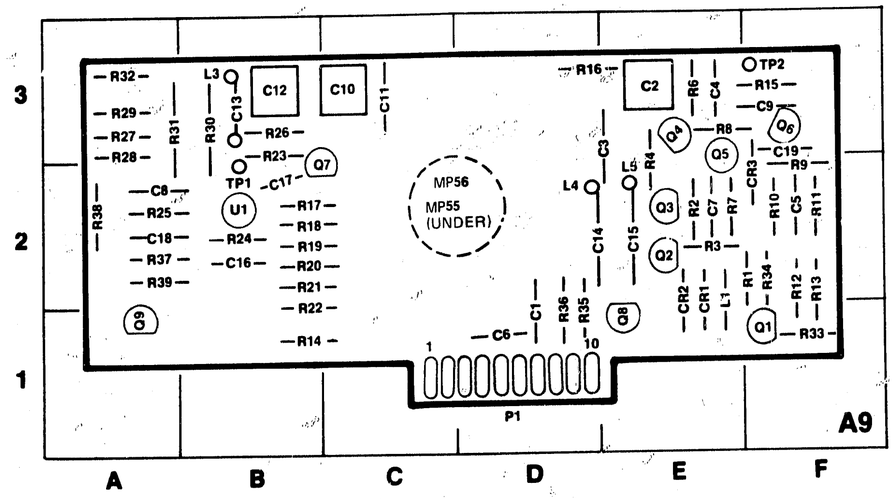
Figure 8-12. Service Information, Delayed Sweep Trigger, P/O Assembly A8 (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC	
P/O A8	CHASSIS
C18-26, 28-35, 53, 57 CR6-10 L4-6 Q12-16, 33, 34 R58, 59, 61-101, 164, 166 173-177 P/O S1 TP6-9 U4-6 VR3, 4 W1 P/O XA9, XA12	J2 R14 R14S1

DELETED: A8C27, A8R60, R17

Figure 8-12.
Service Information, Delayed Sweep Trigger, P/O Assembly A8 (Sheet 2 of 2)
8-35



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-1	C13	B-3	L4	D-2	Q7	B-2	R10	F-2	R21	B-2	R32	A-3
C2	E-3	C14	E-2	L5	E-2	Q8	E-1	R11	F-2	R22	B-1	R33	F-1
C3	E-3	C15	E-2	MP55	C-2	Q9	A-1	R12	F-2	R23	B-3	R34	F-2
C4	E-3	C16	B-2	MP56	C-2	R1	F-2	R13	F-2	R24	B-2	R35	D-1
C5	F-2	C17	B-2	P1	D-1	R2	E-2	R14	B-1	R25	A-2	R36	D-1
C6	D-1	C18	A-2	Q1	F-1	R3	E-2	R15	F-3	R26	B-3	R37	A-2
C7	E-2	C19	F-2	Q2	E-2	R4	E-2	R16	D-3	R27	A-3	R38	A-2
C8	A-2	CR1	E-1	Q3	E-2	R6	E-3	R17	B-2	R28	A-3	R39	A-2
C9	F-3	CR2	E-1	Q4	E-3	R7	E-2	R18	B-2	R29	A-3	TP1	B-2
C10	C-3	CR3	F-2	Q5	E-2	R8	E-3	R19	B-2	R30	B-3	TP2	F-3
C11	C-3	L1	E-1	Q6	F-3	R9	F-2	R20	B-2	R31	A-3	U1	B-2
C12	B-3	L3	B-3										

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 10

1. Set front-panel controls in accordance with paragraph 5-13, 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 10

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIG LEVEL (delayed)	stable display
TIME/DIV (main)	.1 mSEC
TIME/DIV (delayed)	50 μSEC
HORIZ DISPLAY	DLY'D

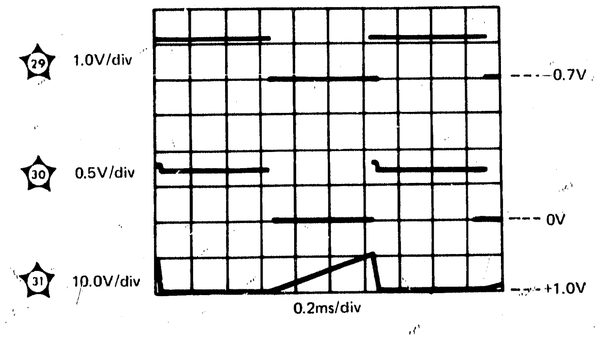


Figure 8-13. Service Information, Delayed Sweep Integrator, Assembly A9 (Sheet 1 of 2)

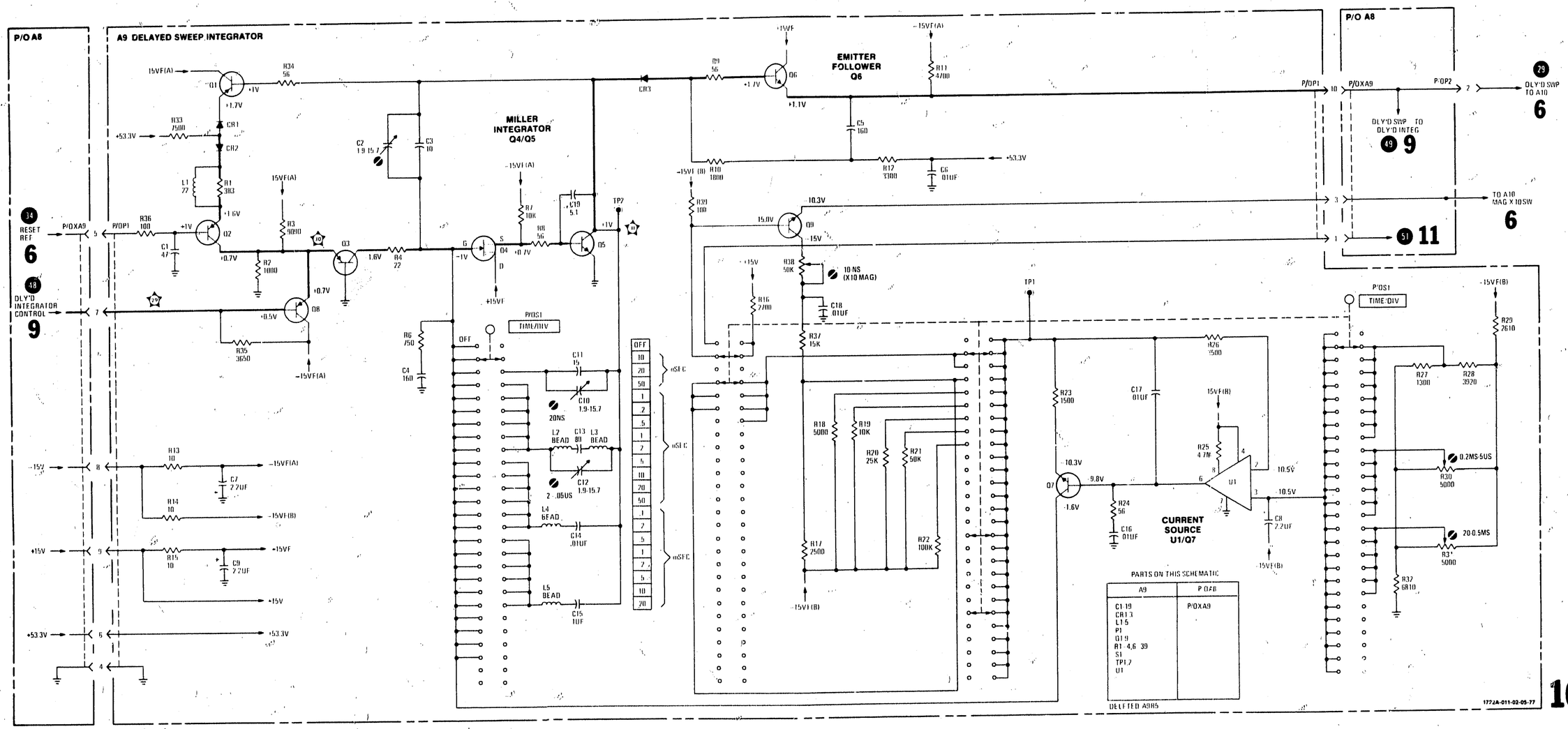
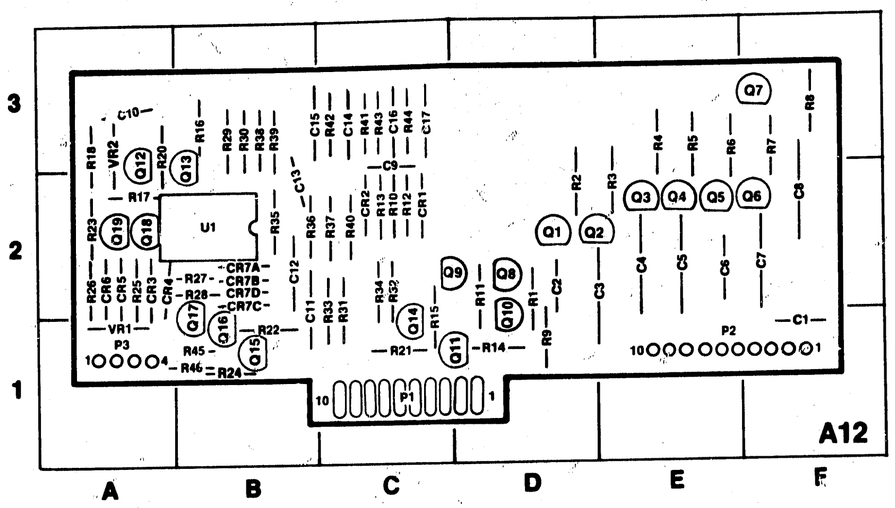


Figure 8-13.
Service Information, Delayed Sweep Integrator, Assembly A9 (Sheet 2 of 2)
8-37



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	F-1	C12	B-2	CR6	A-2	Q8	D-2	R1	D-2	R13	C-2	R26	A-2	R38	B-3
C2	D-2	C13	B-2	CR7A	B-2	Q9	C-2	R2	D-2	R14	D-1	R27	B-2	R39	B-3
C3	E-2	C14	C-3	CR7B	B-2	Q10	D-1	R3	E-2	R15	C-1	R28	B-2	R40	C-2
C4	E-2	C15	B-3	CR7C	B-2	Q11	C-1	R4	E-3	R16	B-3	R29	B-3	R41	C-3
C5	E-2	C16	C-3	CR7D	B-2	Q12	A-3	R5	E-3	R17	A-2	R30	B-3	R42	C-3
C6	E-2	C17	C-3	Q1	D-2	Q13	B-3	R6	E-3	R18	A-3	R31	C-2	R43	C-3
C7	F-2	CR1	C-2	Q2	D-2	Q14	C-1	R7	F-3	R20	A-3	R32	C-2	R44	C-3
C8	F-2	CR2	C-2	Q3	E-2	Q15	A-1	R8	F-3	R21	C-1	R33	C-2	R45	B-1
C9	C-2	CR3	A-2	Q4	E-2	Q16	A-1	R9	D-1	R22	B-1	R34	C-2	R46	B-1
C10	A-3	CR4	A-2	Q5	E-2	Q17	B-2	R10	C-2	R23	A-2	R35	B-2	U1	B-2
C11	B-2	CR5	A-2	Q6	F-2	Q18	A-2	R11	D-2	R24	B-1	R36	B-2	VR1	A-1
				Q7	F-3	Q19	A-2	R12	C-2	R25	A-2	R37	C-2	VR2	A-3

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 11

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Sweep mode	SINGLE
AUTO/NORM	NORM
RESET	armed
TRIG LEVEL (main)	fully cw
TIME/DIV (delayed)	1 μSEC
INC-DEC	set LED display for 0.500
TIME INTERVAL (DELAY dial)	fully ccw
HORIZ DISPLAY	MAIN INTEN

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

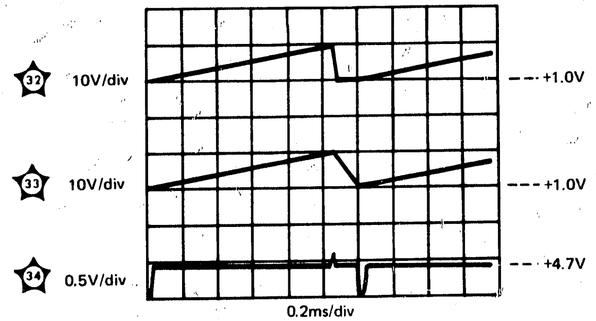
1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

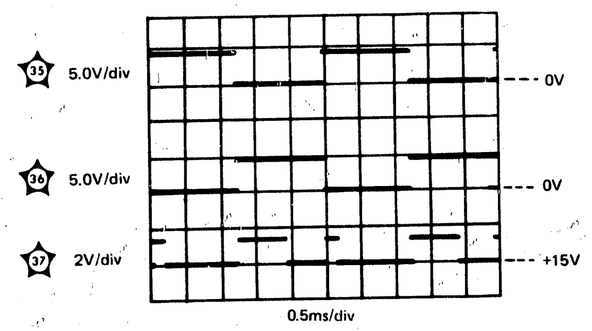
HORIZ DISPLAY	MAIN INTEN
TIME/DIV (delayed)	1 μSEC
INC-DEC	set LED display for 0.500
Coupling (channel A)	50Ω

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

3. Connect pulse generator 50-ohm output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for 5 kHz, four division of signal amplitude (0.4 V).





1722A-012-01 -08-76

Figure 8-14. Service Information, Holdoff-Delayed Comparator, Assembly A12 (Sheet 1 of 2)

should be protected from further corrosion by an application of a silicone resin such as GE DRI-FILM 88.

8-20. SWITCH MAINTENANCE. The pushbutton switches used in this instrument have been designed for long, trouble-free service. In the event that one of these switches becomes defective, replacement rather than repair is recommended.

8-21. The rotary switches in this instrument can easily be serviced after removal of the assembly on which the switch is mounted. In the case of the TIME/DIV switch, the TIME/DIV switch shaft must be removed. Refer to the paragraphs on repair and replacement in this section for instructions on disassembly of the modules in the instrument.

8-22. Conventional rotary switches are serviced by cleaning the contacts with a degreaser such as M-180 FREON TF DEGREASER. The contact surfaces are then lubricated with a lubricant comparable to LUBRIPLATE FML produced by the Fiske Brothers Refining Company. LUBRIPLATE FML is available from the Hewlett-Packard Company (HP Part No. 6040-0305).

CAUTION

Do not attempt to clean attenuator switches with any cleaning agent. Attenuator switches have self-cleaning contacts.

8-23. The rotary switches on assemblies A9, A11, and A22 can be serviced as follows:

a. Remove TIME/DIV knob and shaft (refer to paragraph 8-31).

b. Remove plug-in assembly (A9, A11, or A22) from assembly A8.

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

d. Remove metal retainer ring uniting male and female section of rotor switch.

e. Separate two rotor sections.

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

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

h. Clean and lubricate contacts on etched circuit board and rotors as described in paragraph 8-22.

i. Place rotor sections on etched circuit board and reinstall retainer ring.

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

k. Reinstall assembly in instrument.

l. Reinstall TIME/DIV shaft and knob assembly.

8-24. REMOVAL AND REPLACEMENT.

8-25. The following paragraphs provide procedures for removal and replacement of assemblies, subassemblies, and components. Special servicing instructions for etched circuit boards are provided in paragraph 8-47. Section VI provides a detailed parts list for use in ordering replacement parts.

WARNING

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

8-26. CRT REMOVAL AND REPLACEMENT. To remove and replace the CRT, see figure 6-1 and proceed as follows:

a. Remove top and bottom covers from instrument.

b. Remove rear-panel CRT socket cover MP21.

c. Remove front-panel CRT bezel MP16 by squeezing at midpoint on bottom and rotating outward and upward.

d. Remove CRT contrast filter (if in use).

e. Remove four VERT IN wires (gray) from side of CRT neck.

f. Disconnect horizontal input cable W4 (wires (9) and (5)) from neck pins.

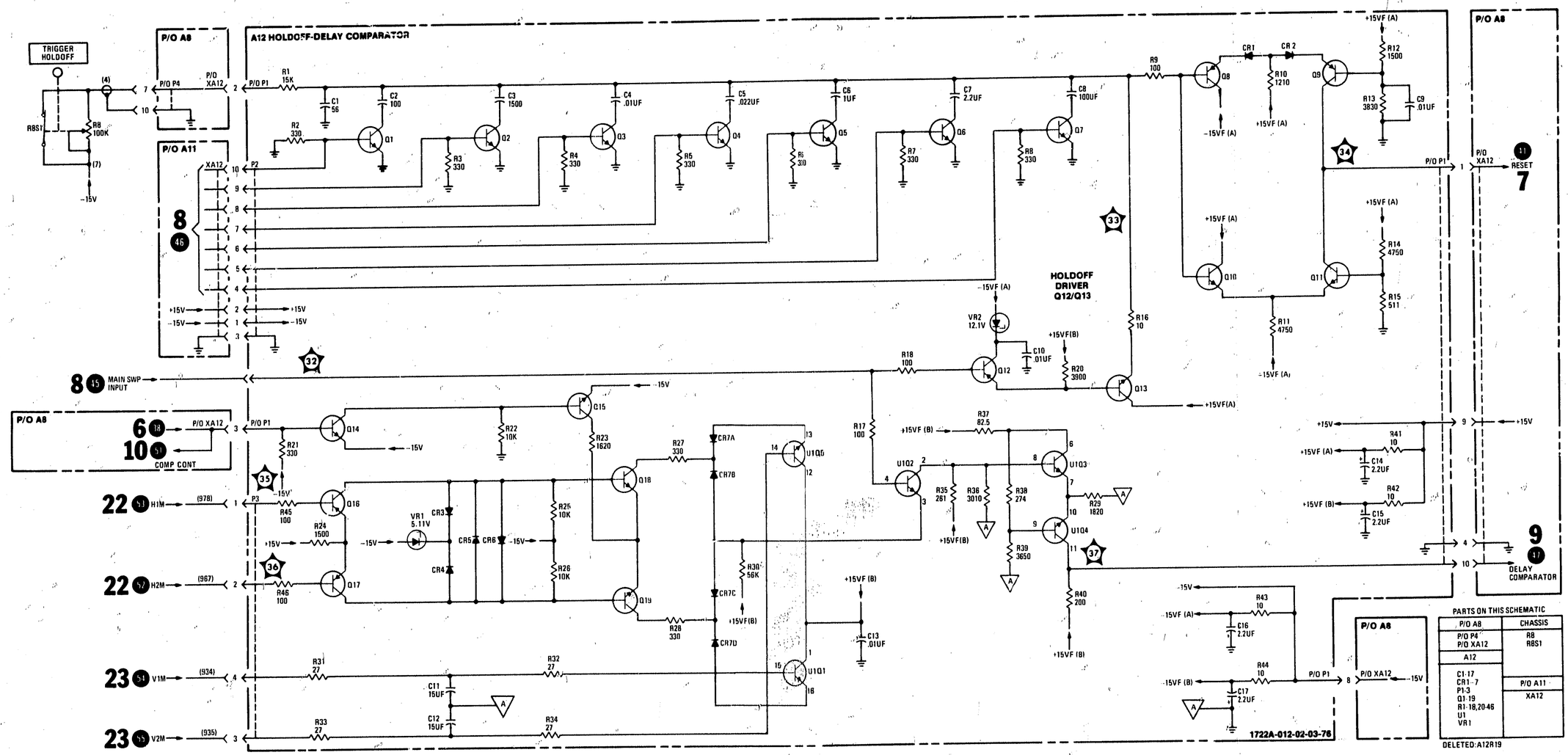
g. Disconnect CRT cable connector from gate assembly at A14P2.

h. Disconnect floodgun filament wire (924) from CRT neck pin.

i. Carefully disconnect CRT socket XV1.

j. Remove two CRT shield mounting screws from rear panel of instrument (at MP44 and MP48).

k. Slide CRT shield toward rear of instrument until shield is clear of instrument front panel.



11

Figure 8-14.
Service Information, Holdoff-Delayed Comparator, Assembly A12 (Sheet 2 of 2)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 12

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Sweep mode	SINGLE
AUTO/NORM	NORM
RESET	armed
TRIG LEVEL (main)	fully cw

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

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 12

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

HORIZ DISPLAY	MIXED
TIME/DIV (delayed)	10 μSEC
TIME INTERVAL (DELAY dial)	adjust for 5 div delay from leading edge of trace

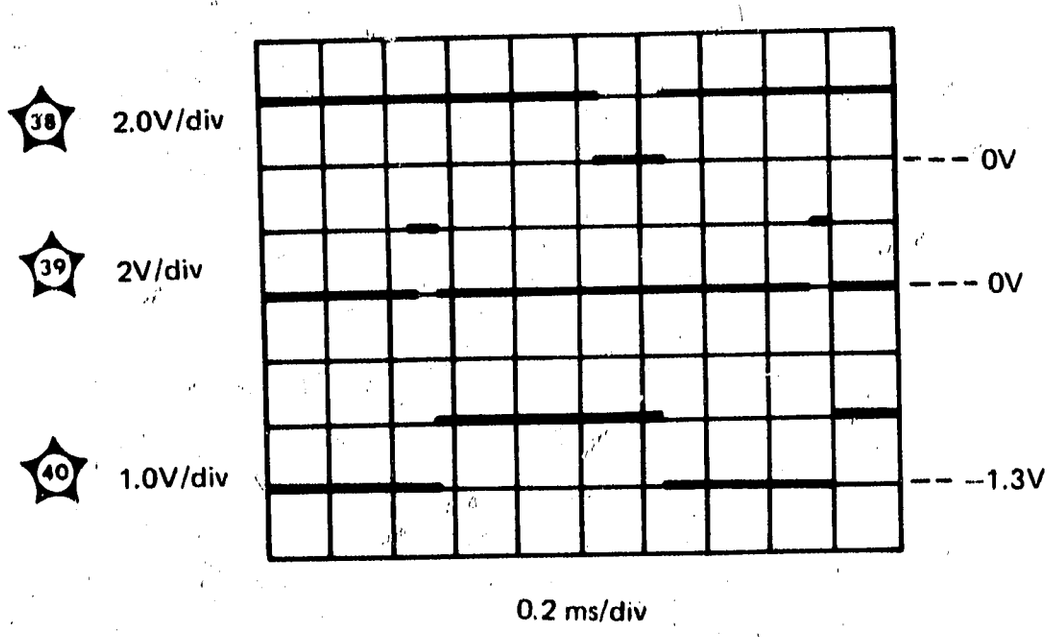
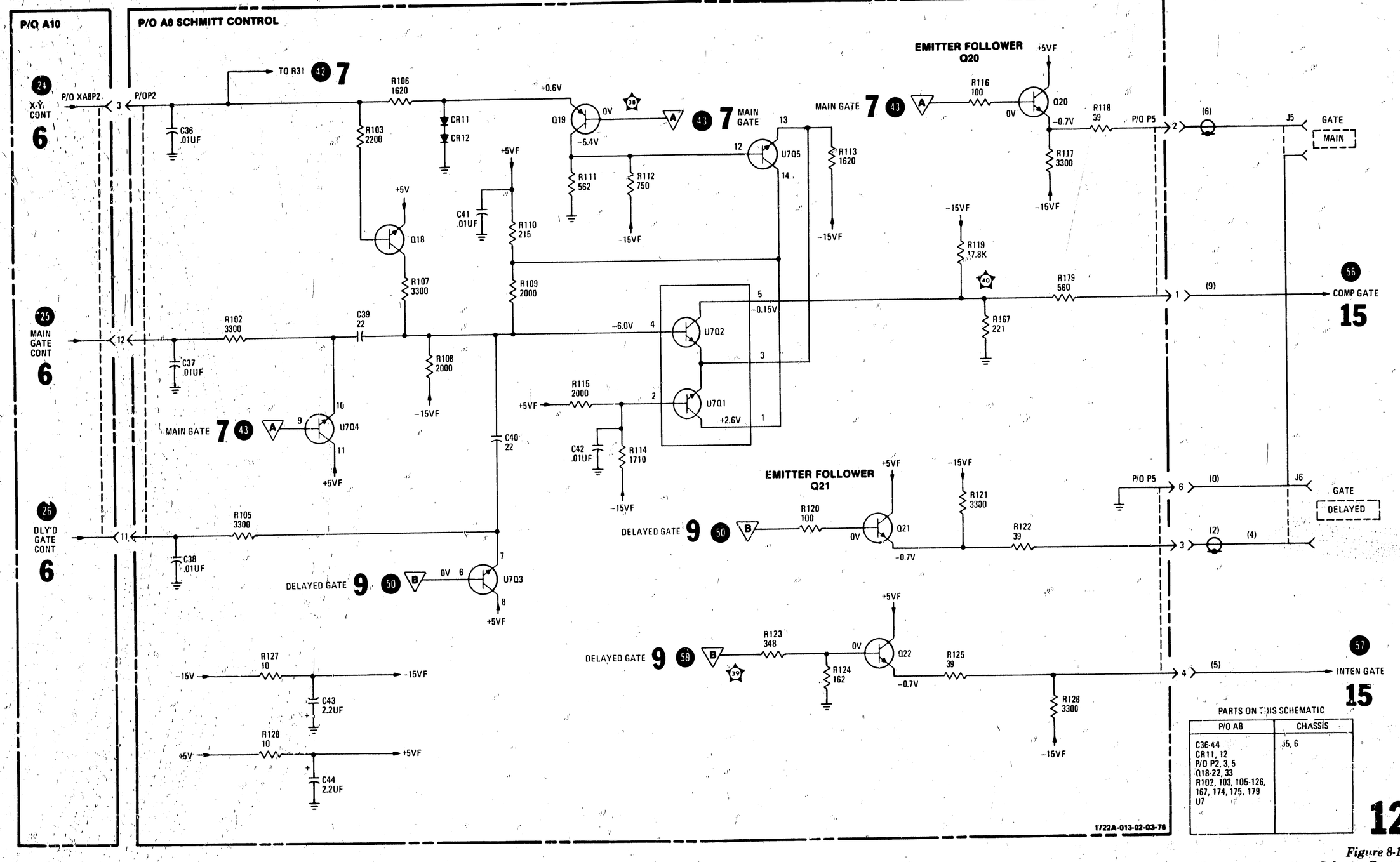


Figure 8-15. Service Information, Schmitt Control, P/O Assembly A8 (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC

P/O A8	CHASSIS
C3E-44 CR11, 12 P/O P2, 3, 5 Q18-22, 33 R102, 103, 105-126, 167, 174, 175, 179 U7	J5, 6

12

Figure 8-15. Service Information, Schmitt Control, P/O Assembly A8 (Sheet 2 of 2)

DC VOTAGE MEASUREMENT CONDITIONS
SCHEMATIC 13

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

VERT DISPLAY	X-Y
HORIZ DISPLAY	X-Y
POSITION (horizontal)	centered

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 13

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIG 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 1722A channel A INPUT connector.

4. Adjust pulse generator output for 5 kHz, four divisions of signal amplitude (0.4 V).

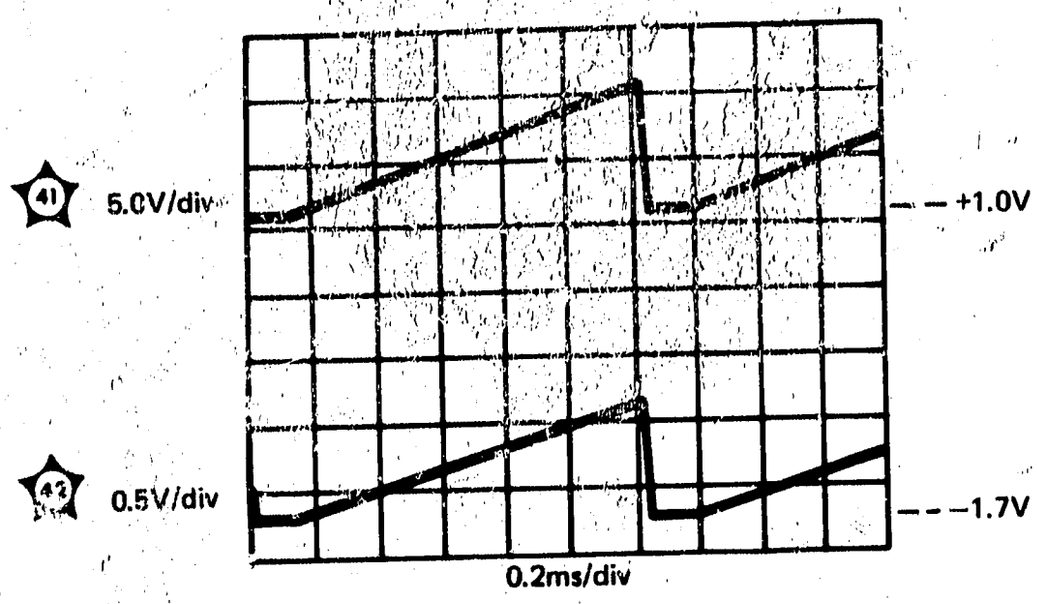
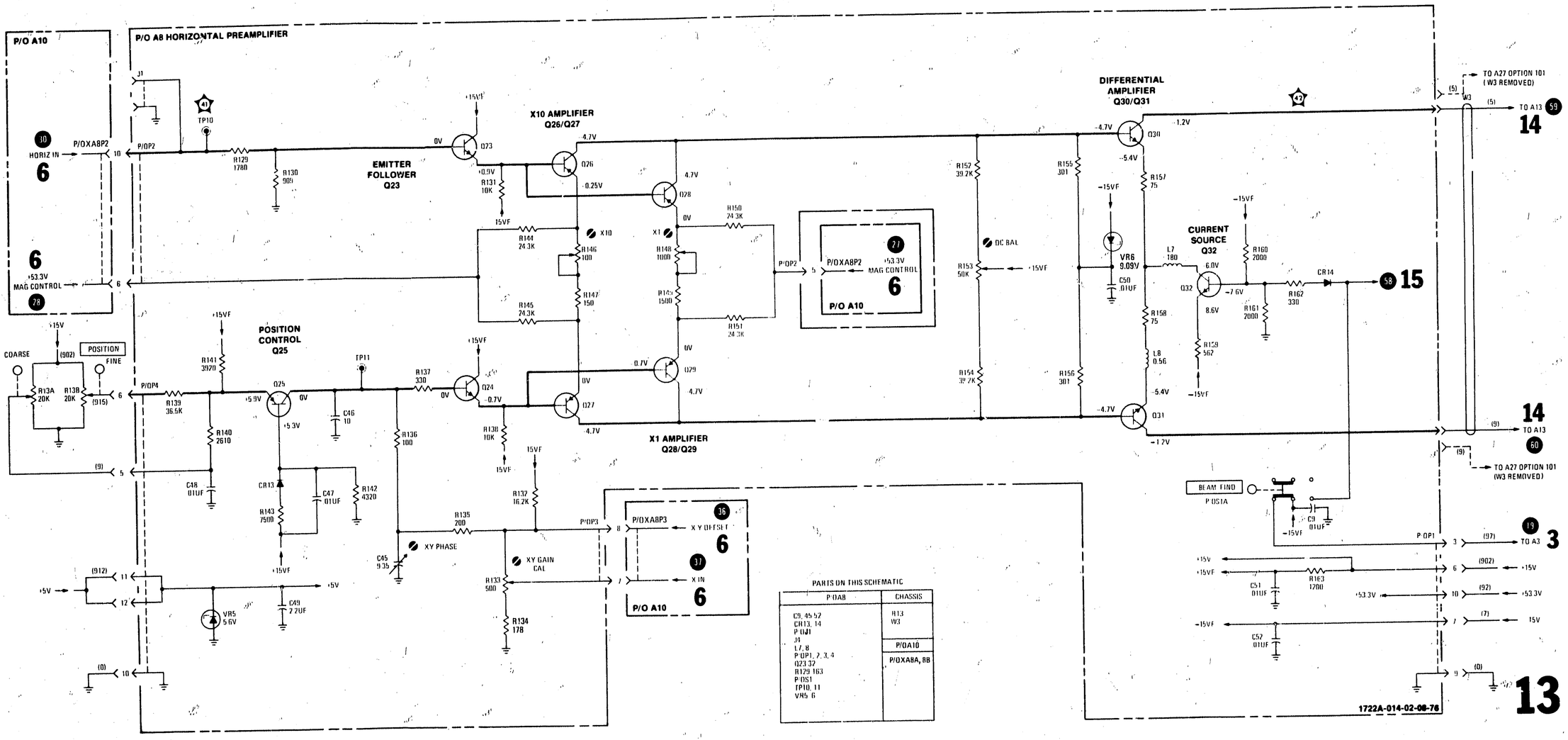
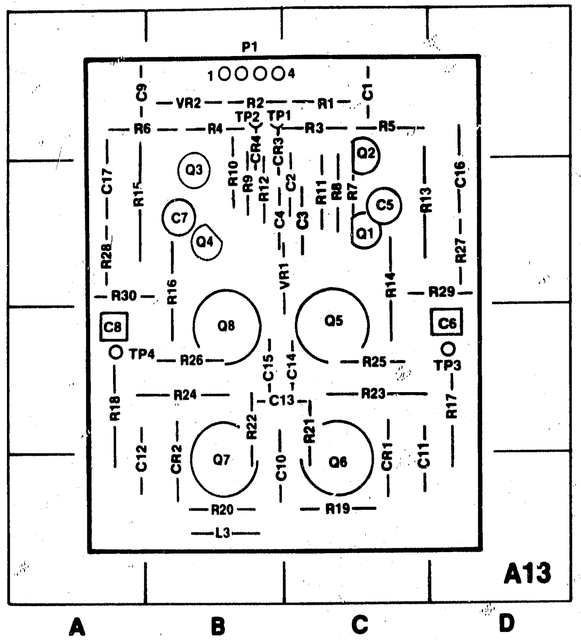


Figure 8-16. Service Information, Horizontal Preamplifier, P/O Assembly A8 (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC	
P/OA8	CHASSIS
C9, 45 52 CR13, 14 P/OJ1 J4 L7, 8 P/OP1, 2, 3, 4 Q23 32 R129 163 P/OS1 TP10, 11 VR5, 6	R13 W3
	P/OA10
	P/OXA8A, 8B

Figure 8-16.
Service Information, Horizontal Preamplifier, P/O Assembly A8 (Sheet 2 of 2)
8-43



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	C13	B-2	P1	B-4	R4	B-4	R15	A-3	R26	B-2
C2	C-3	C14	C-2	Q1	C-3	R5	C-4	R16	B-3	R27	D-3
C3	C-3	C15	B-2	Q2	C-4	R6	A-4	R17	C-2	R28	A-3
C4	B-3	C16	D-3	Q3	B-3	R7	C-3	R18	A-2	R29	D-3
C5	C-3	C17	A-3	Q4	B-3	R8	C-3	R19	C-1	R30	A-3
C6	D-2	CR1	C-1	Q5	C-2	R9	B-3	R20	B-1	TP1	B-4
C7	B-3	CR2	B-1	Q6	C-1	R10	B-3	R21	B-2	TP2	B-4
C8	A-2	CR3	B-4	Q7	B-1	R11	C-3	R22	B-2	TP3	D-2
C9	A-4	CR4	C-4	Q8	B-2	R12	B-3	R23	C-2	TP4	A-2
C10	B-1	L3	B-1	R1	C-4	R13	D-3	R24	B-2	VR1	C-3
C11	C-2			R2	B-4	R14	C-2	R25	C-2	VR2	B-4
C12	A-1			R3	C-4						

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 14

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

VERT DISPLAY	X-Y
HORIZ DISPLAY	X-Y
POSITION (horizontal)	centered

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

WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 14

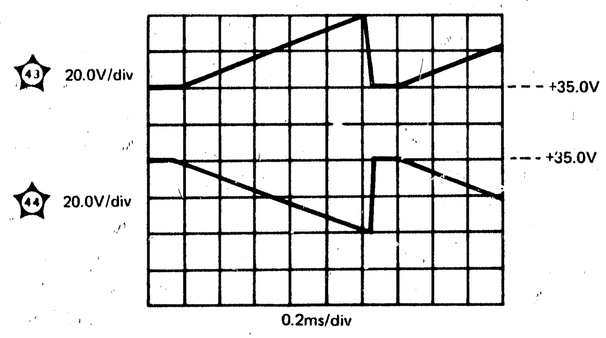
1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIG 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 1722A channel A INPUT connector.

4. Adjust pulse generator output for 5 kHz, four divisions of signal amplitude (0.4 V).



1722A-015-01-06-76

Figure 8-17. Service Information, Horizontal Output, Assembly A13 (Sheet 1 of 2)

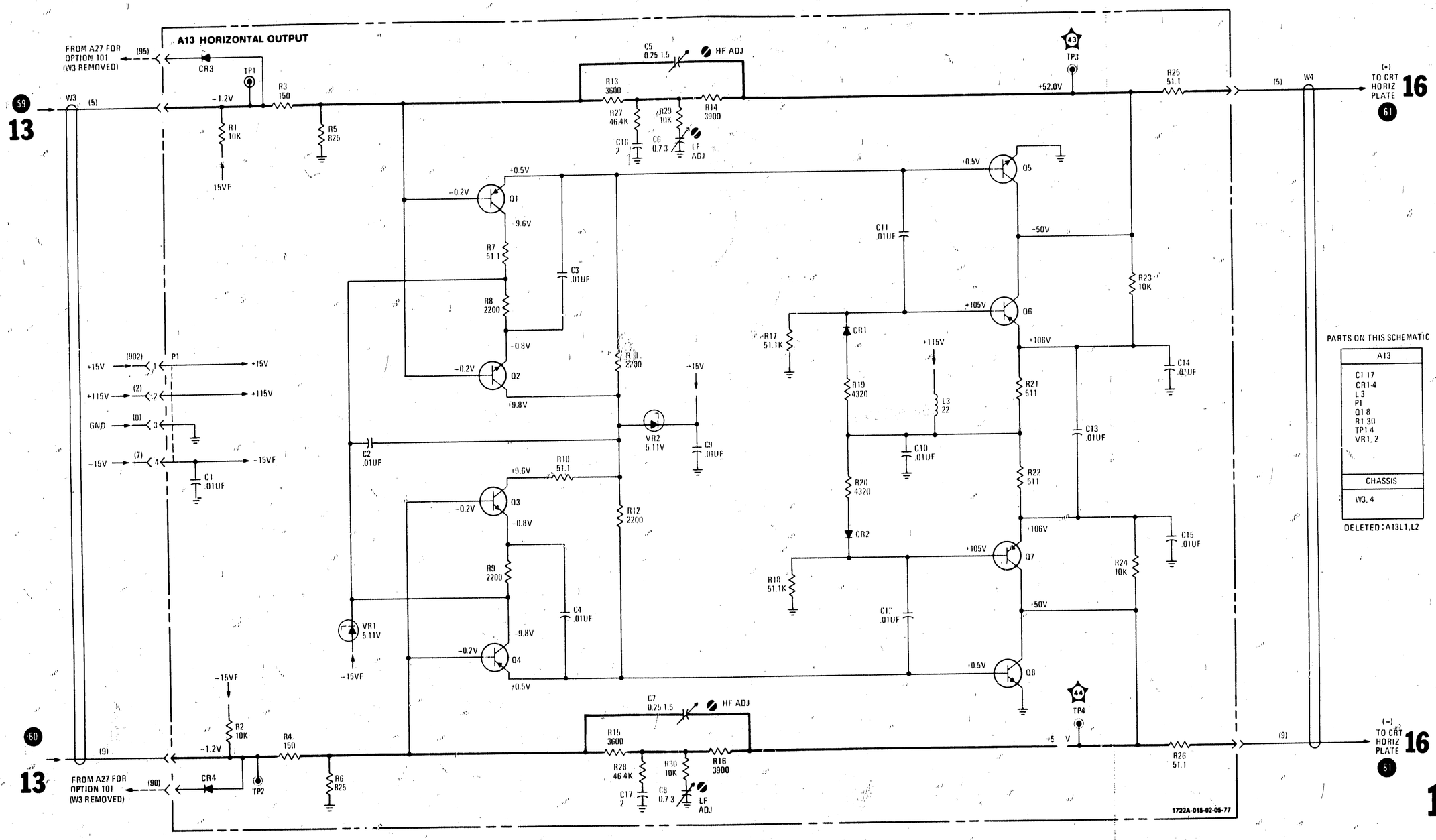
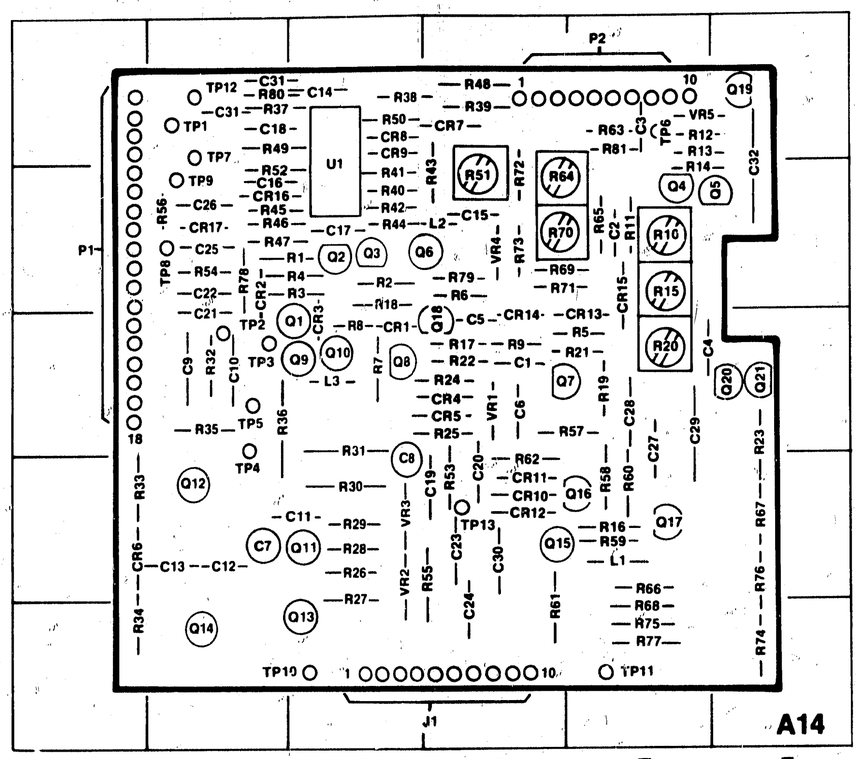


Figure 8-17.
Service Information, Horizontal Output, Assembly A13 (Sheet 2 of 2)
8-45



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	CRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	C26	A-4	L1	E-2	R2	B-2	R27	B-2	R52	A-4	R77	E-1
C2	E-5	C27	E-3	L2	D-4	R3	B-4	R28	B-2	R53	D-2	R78	A-4
C3	E-5	C28	E-3	L3	B-3	R4	B-4	R29	B-2	R54	A-4	R79	D-4
C4	E-3	C29	E-3	P1	A-4	R5	E-3	R30	B-2	R55	D-2	R80	A-5
C5	D-3	C30	D-2	P2	E-5	R6	D-4	R31	B-3	R56	B-4	R81	E-5
C6	D-3	C31	A-5	Q1	B-3	R7	B-3	R32	A-3	R57	E-3	TP1	A-5
C7	B-2	C32	F-4	Q2	B-4	R8	C-3	R33	A-2	R58	E-2	TP2	A-2
C8	B-2	CR1	B-3	Q3	B-4	R9	D-3	R34	A-1	R59	E-2	TP3	B-2
C9	A-3	CR2	B-4	Q4	E-4	R10	E-4	R35	A-3	R60	E-2	TP4	B-2
C10	A-3	CR3	B-3	Q5	F-4	R11	E-4	R36	A-3	R61	C-1	TP5	A-3
C11	B-2	CR4	D-3	Q6	D-4	R12	E-5	R37	A-5	R62	D-2	TP6	E-5
C12	B-2	CR5	D-3	Q7	D-3	R13	E-5	R38	B-5	R63	E-5	TP7	A-5
C13	B-2	CR6	A-2	Q8	B-3	R14	E-4	R39	D-5	R64	D-4	TP8	A-4
C14	B-5	CR7	D-5	Q9	B-3	R15	E-4	R40	B-4	R65	E-4	TP9	A-4
C15	D-4	CR8	B-5	Q10	B-3	R16	E-2	R41	D-4	R66	E-1	TP10	B-1
C16	A-4	CR9	B-5	Q11	B-2	R17	D-3	R42	B-4	R67	F-1	TP11	E-1
C17	B-4	CR10	D-2	Q12	B-2	R18	B-4	R43	B-4	R68	E-1	TP12	A-5
C18	A-5	CR11	D-2	Q13	B-1	R19	E-3	R44	B-4	R69	D-3	TP13	D-2
C19	D-2	CR12	D-2	Q14	A-1	R20	E-3	R45	A-4	R70	D-4	U1	B-4
C20	D-2	CR13	E-3	Q15	D-2	R21	E-3	R46	A-4	R71	D-3	VR1	D-3
C21	A-3	CR14	D-3	Q16	E-2	R22	D-3	R47	A-4	R72	D-4	VR2	B-2
C22	A-4	CR15	E-4	Q17	E-2	R23	F-3	R48	D-4	R73	D-3	VR3	B-2
C23	D-2	CR16	B-4	Q18	D-3	R24	D-3	R49	A-5	R74	F-1	VR4	D-4
C24	C-1	CR17	B-4	Q19	F-5	R25	D-3	R50	B-5	R75	E-1	VR5	E-5
C25	A-4	J1	D-1	Q20	F-3	R26	B-2	R51	D-4	R76	F-1		
				Q21	F-3								
				R1	B-4								

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 15

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

VERT DISPLAY	X-Y
HORIZ DISPLAY	X-Y
POSITION (horizontal)	off-screen
INTENSITY	normal
	maximum ( )

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 15

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

Coupling (channel A)	50Ω
TRIG LEVEL (main)	stable display
TIME/DIV (delayed)	50 μSEC

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

3. Connect pulse generator 50-ohm output to Model 1722A channel A INPUT connector.

4. Adjust pulse generator output for 5 kHz, four divisions of signal amplitude (0.4 V).

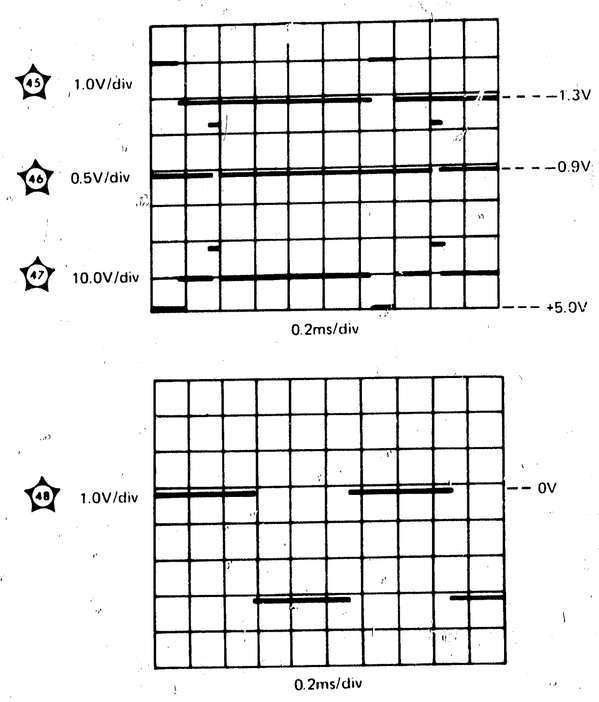


Figure 8-18. Service Information, Gate Control, Assembly A14 (Sheet 1 of 2)

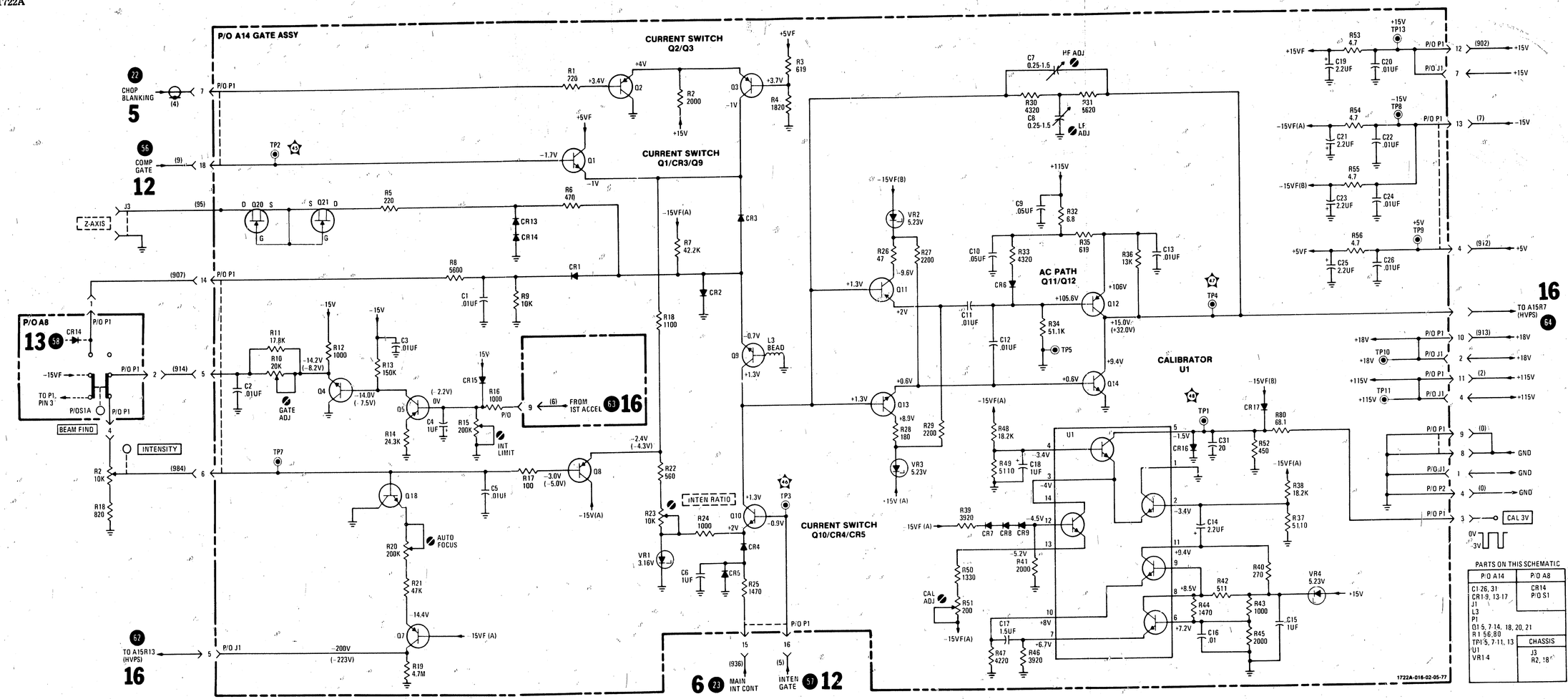
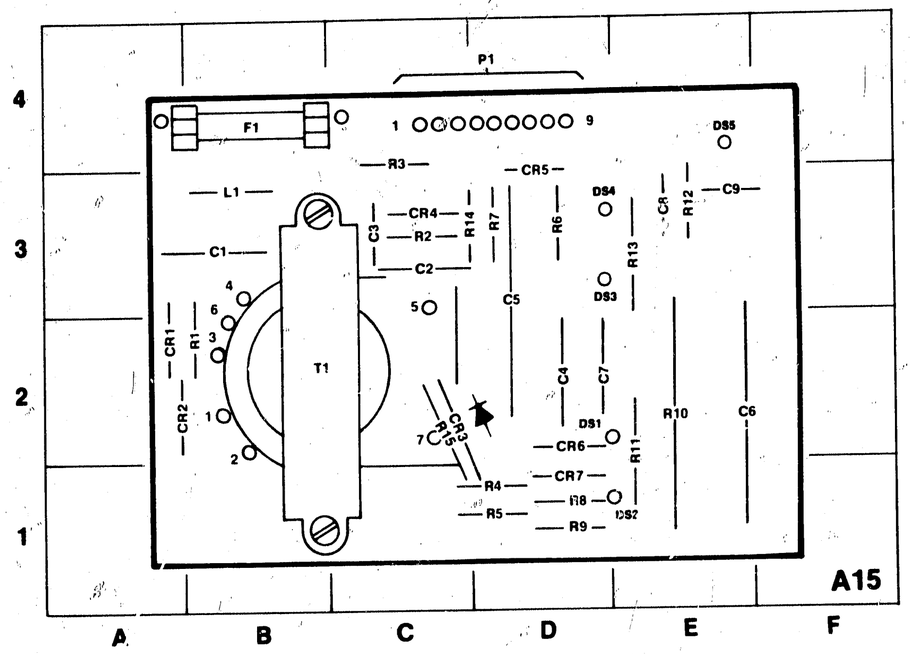


Figure 8-18.
Service Information, Gate Control, Assembly A14 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-3	C9	E-3	DS1	D-2	L1	B-3	R8	D-1
C2	C-3	CR1	A-2	DS2	E-1	P1	D-4	R9	D-1
C3	C-3	CR2	A-2	DS3	D-3	R1	B-2	R10	E-2
C4	D-2	CR3	C-2	DS4	D-3	R2	C-3	R11	E-2
C5	D-3	CR4	C-3	DS5	E-4	R3	C-4	R12	E-3
C6	E-2	CR5	D-3	E1	A-4	R4	D-1	R13	E-3
C7	D-2	CR6	D-2	E2	C-4	R5	D-1	R14	D-3
C8	E-3	CR7	D-1	F1	B-4	R6	D-3	R15	C-2
						R7	D-3	T1	B-2

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 16

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

SCALE ILLUM ..... maximum

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 16

1. Set front-panel controls in accordance with paragraph 5-13, Section V.

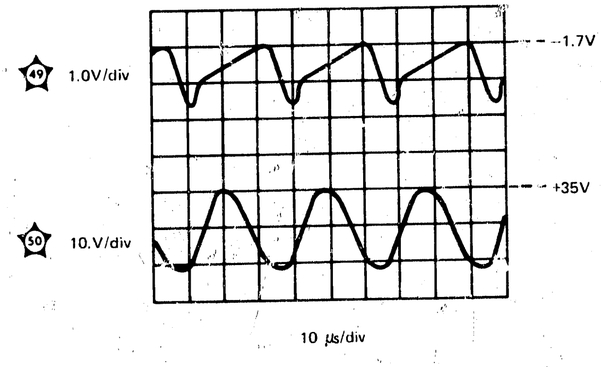


Figure 8-19. Service Information, HV Power Supply. Assembly A15 (Sheet 1 of 2)

WARNING

Failure to discharge high voltage can result in severe electrical shock to personnel and damage to the instrument. Do not attempt to remove lead from CRT glass.

l. Disconnect white plastic post-accelerator connector and immediately discharge lead to ground.

m. Carefully remove CRT and shield from instrument.

n. Disconnect remaining wires from CRT neck pins.

o. Loosen CRT clamp MP51.

CAUTION

When removing CRT from shield, care should be taken to avoid damage to CRT neck pins and align/ortho coils.

p. Remove CRT from shield.

q. To reinstall CRT, reverse removal procedure.

8-27. ATTENUATOR REMOVAL AND REPLACEMENT. To remove the attenuator assemblies from the instrument, proceed as follows:

a. Remove screw holding channel A attenuator shield to vertical preamplifier assembly A3.

b. Remove screw holding channel B attenuator shield to vertical preamplifier assembly and ground lug attached to top of attenuator cover.

c. Unsolder two lead-in wires to vertical preamplifier assembly from channel A attenuator.

d. Unsolder two lead-in wires to vertical preamplifier assembly from channel B attenuator.

e. Remove two retaining screws holding vertical preamplifier to main deck of instrument.

f. Disconnect sync cable W2 from square pin connections on horizontal display switch assembly A10.

g. Pull vertical preamplifier toward rear of instrument until A3P1 and A3P2 clear attenuator connectors.

NOTE

Assemblies A6 and A7 are connected to the underside of vertical preamplifier A3. They will also move to the rear. When reinstalling, ensure that push-button switches are aligned with front-panel holes.

h. Remove vernier, volt/div, and coupling lever from channel attenuator being removed.

i. Remove retaining hardware from INPUT BNC connector of channel attenuator being removed.

j. Pull attenuator toward rear of instrument until attenuator assembly clears front panel of instrument.

NOTE

Step j clears the attenuator for required maintenance efforts. If complete removal of the attenuator is desired continue with step k.

k. Remove two screws holding vernier bracket to attenuator.

l. Slide attenuator from vernier shaft.

m. Remove vernier shaft from vernier.

n. To reinstall attenuators, reverse removal procedure.

8-28. VERTICAL PREAMPLIFIER REMOVAL AND REPLACEMENT. To remove the vertical preamplifier assembly from the instrument, proceed as follows:

a. Remove screw holding channel A attenuator shield to vertical preamplifier assembly.

b. Remove screw holding channel B attenuator shield to vertical preamplifier assembly.

c. Unsolder two lead-in wires to vertical preamplifier assembly from channel A attenuator.

d. Unsolder two lead-in wires to vertical preamplifier assembly from channel B attenuator.

e. Remove two retaining screws holding vertical preamplifier to main deck of instrument.

f. Disconnect sync cable W2 from square pin connections on horizontal display switch assembly A10.

g. Pull vertical preamplifier toward rear of instrument until A3P1 and A3P2 clear attenuator connectors.

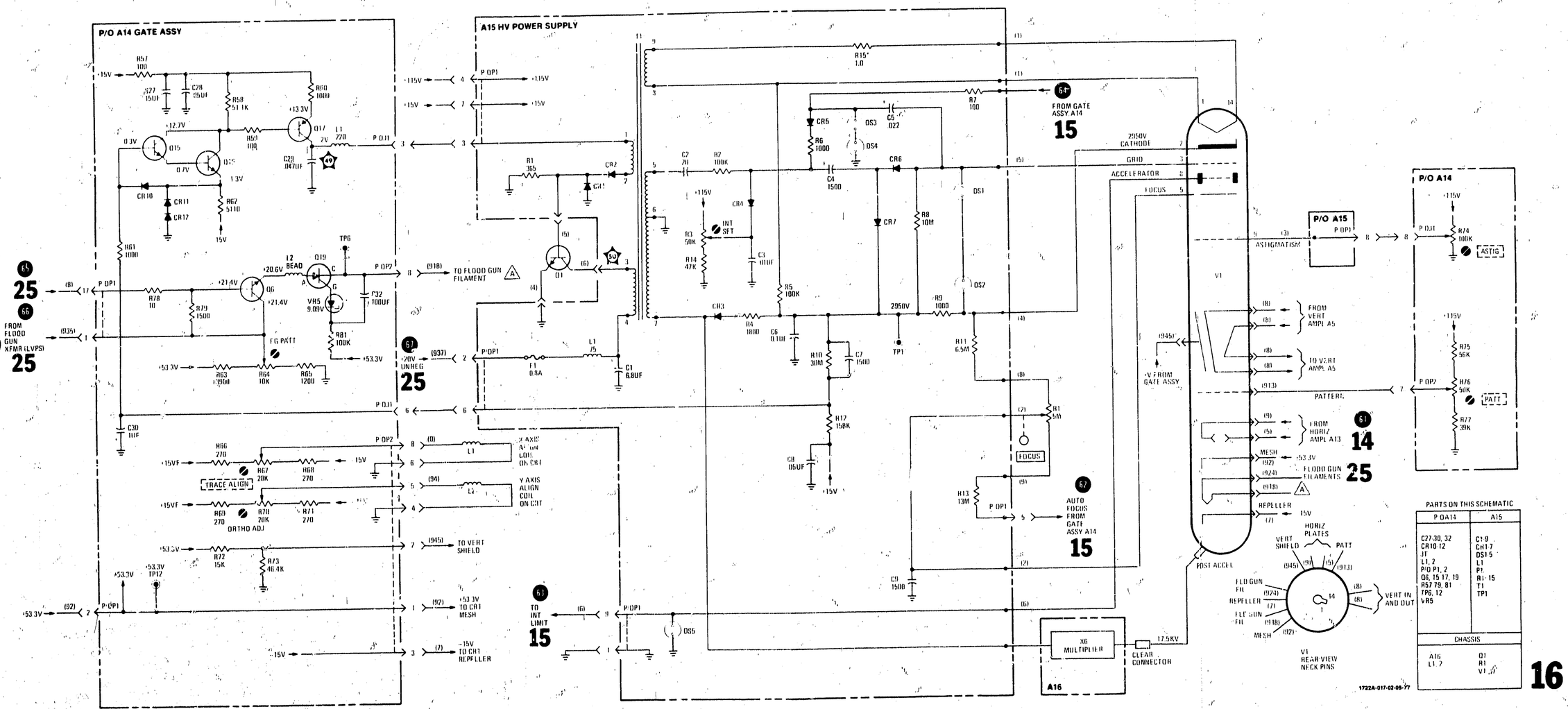
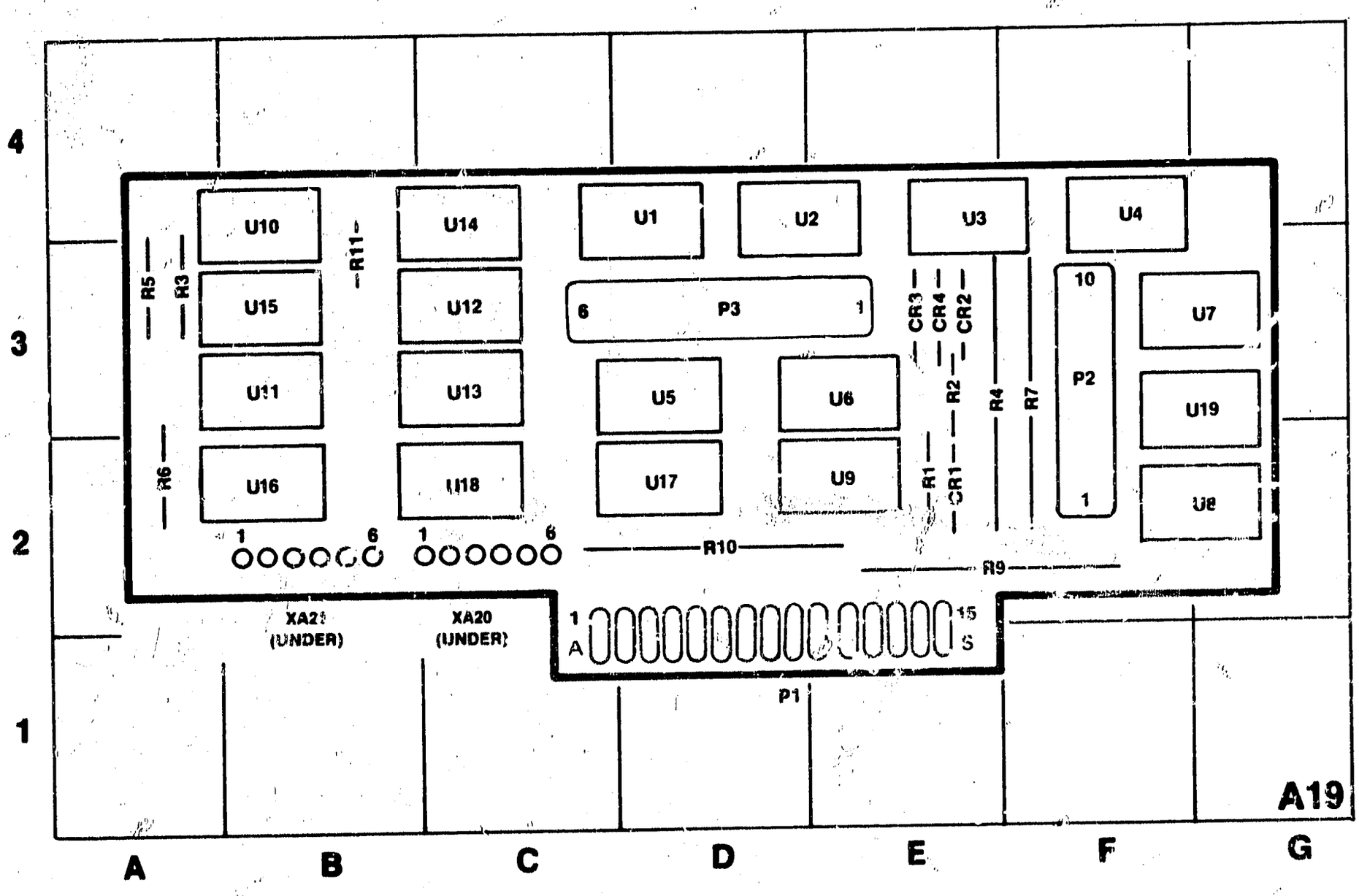


Figure 8-19.
Service Information, HV Power Supply, Assembly, A15 (Sheet 2 of 2)



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
CR1	E-2	R2	E-3	R7	F-3	U1	D-4	U6	E-3	U11	B-3	U16	B-2
CR2	E-3	R3	A-3	R9	E-2	U2	E-4	U7	G-3	U12	C-3	U17	D-2
CR3	E-3	R4	F-3	R10	D-2	U3	E-4	U8	G-2	U13	C-3	U18	C-2
CR4	E-3	R5	A-3	R11	B-3	U4	F-4	U9	E-2	U14	C-4	U19	G-3
R1	E-2	R6	A-2			U5	D-3	U10	B-4	U15	B-3	XA20	C-2
												XA21	B-2

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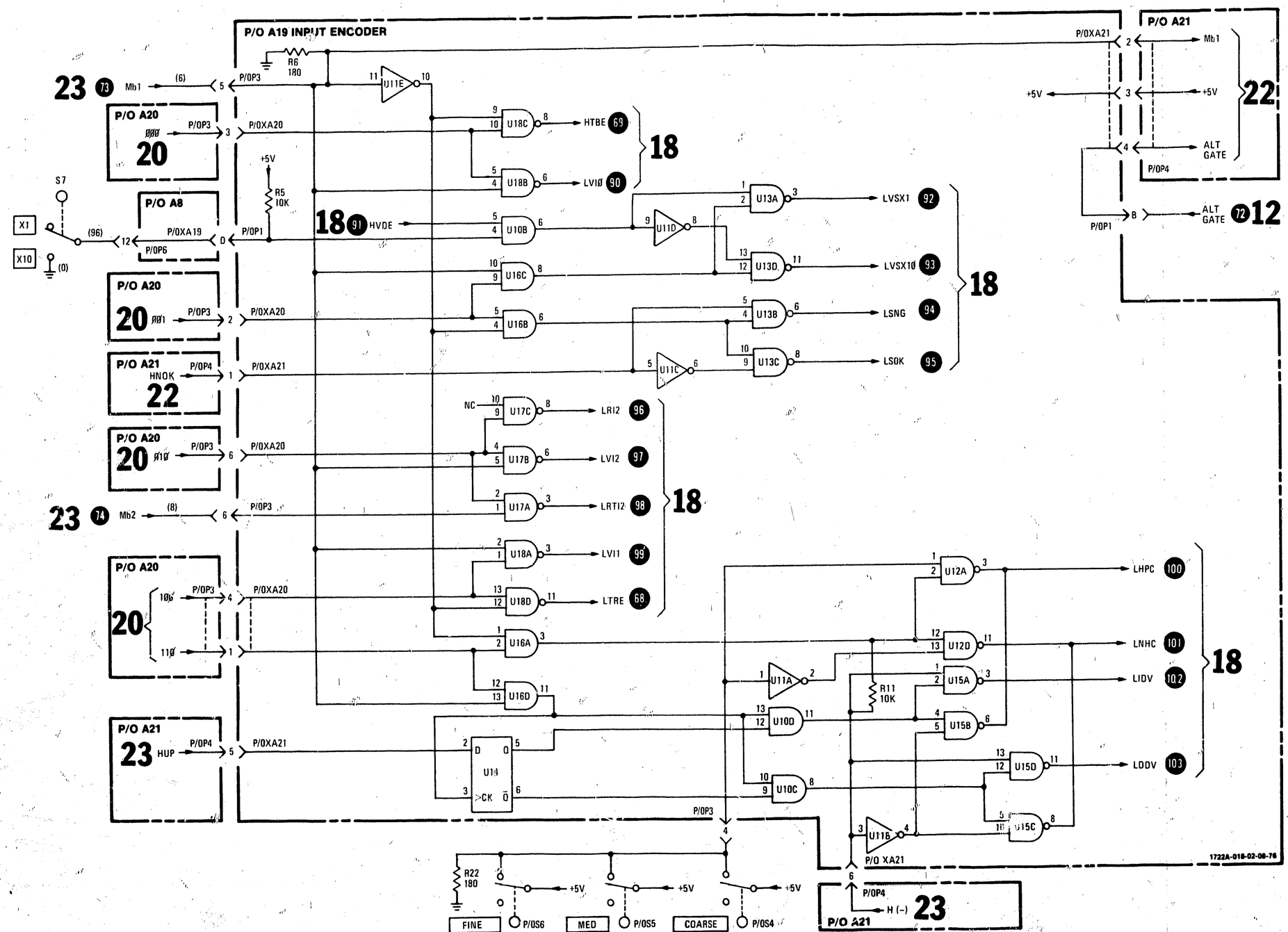
Figure 8-20. Service Information, VOLTS/DIV Encoder, P/O Assembly A19 (Sheet 1 of 2)



PARTS ON THIS SCHEMATIC

P/OA19	P/OP6 P/OXA19	CHASSIS
P/OP1, 3 R5, 6, 11 U10, 12-15, 18 P/OU11, 17 P/OXA20, 21	P/OA21 P/OP4	R22 P/OS4-6 S7
P/OA20 P/OP3		

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Figure 8-20.
Service Information, VOLTS/DIV Encoder, P/O Assembly A19 (Sheet 2 of 2)

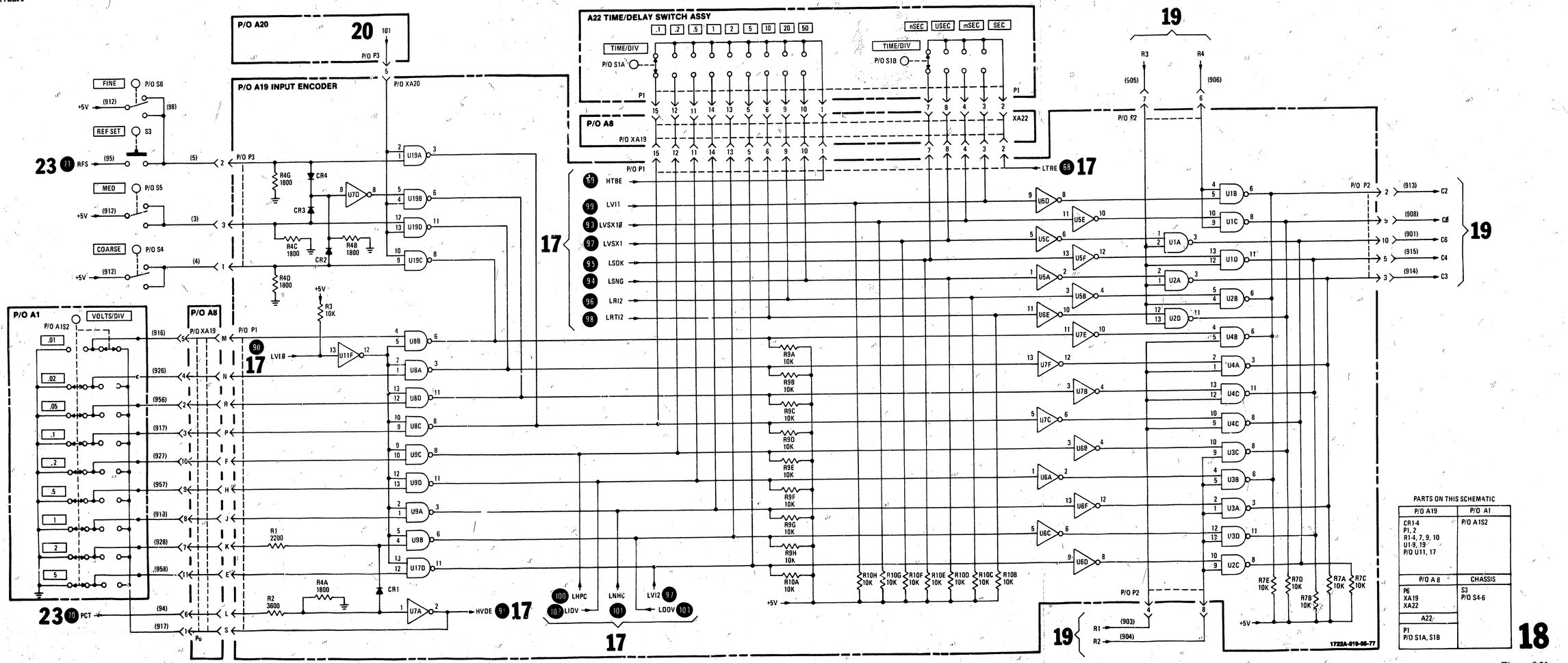
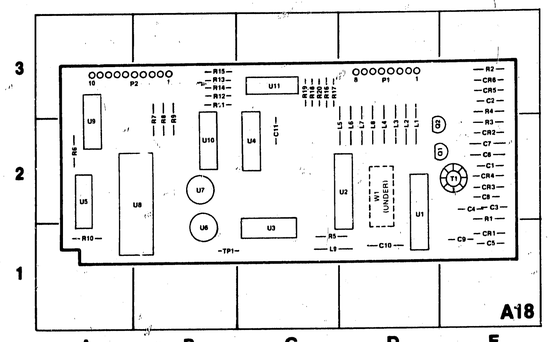
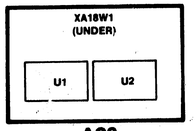


Figure 8-21.
Service Information, TIME/DIV Encoder P/O Assembly A19



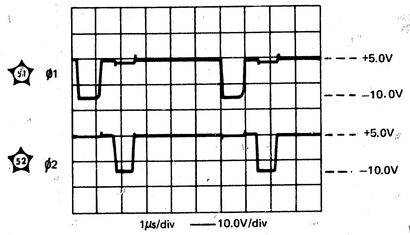
REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	CR2	E-2	L8	D-2	R9	B-2	TP1	B-1
C2	E-3	CR3	E-2	L9	C-1	R10	A-1	U1	D-2
C3	E-2	CR4	E-2	Q1	E-2	R11	B-3	U2	D-2
C4	E-2	CR5	E-3	Q2	E-2	R12	B-3	U3	C-1
C5	E-1	CR6	E-3	R1	E-2	R13	B-3	U4	C-2
C6	E-2	L1	D-2	R2	E-3	R14	B-3	U5	A-2
C7	E-2	L2	D-2	R3	E-2	R15	B-3	U6	B-1
C8	E-2	L3	D-2	R4	E-3	R16	C-3	U7	B-2
C9	E-1	L4	D-2	R5	C-1	R17	C-3	U8	B-2
C10	D-1	L5	D-2	R6	A-2	R18	C-3	U9	A-2
C11	C-3	L6	D-2	R7	B-2	R19	C-3	U10	B-2
CR1	E-1	L7	D-2	R8	B-2	R20	C-3	U11	C-3
								W1	D-2

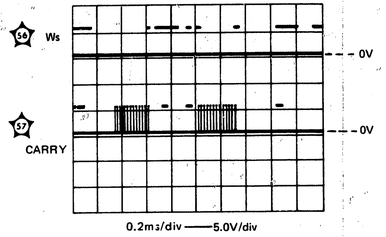


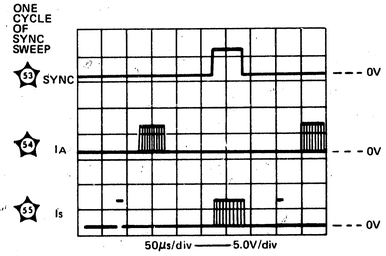
A23

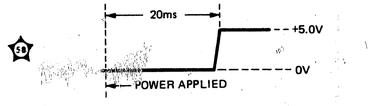
VOLTAGES AND WAVEFORM MEASUREMENT CONDITIONS SCHEMATIC 19

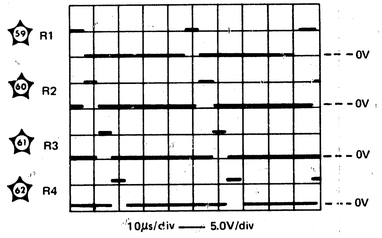
1. Set front-panel controls in accordance with paragraph 5-13, Section V.

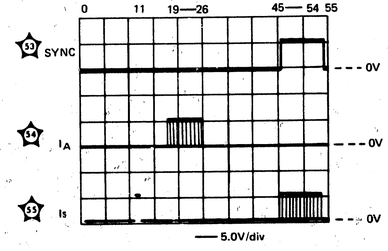


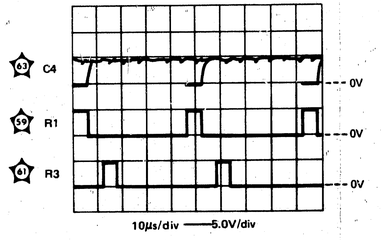












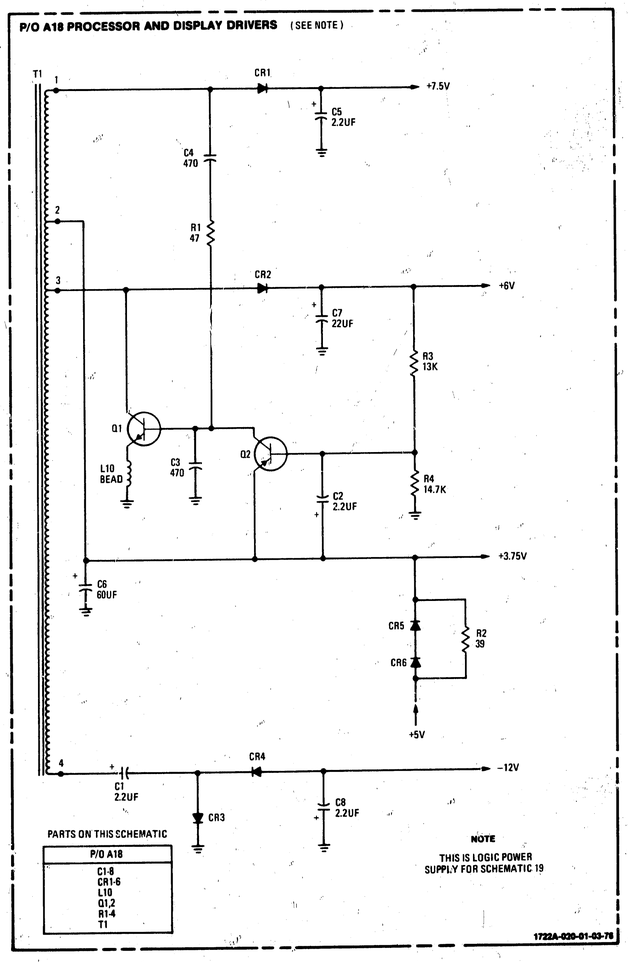


Figure 8-22. Service Information, Processor/Display, Assembly A18 (Sheet 1 of 2)

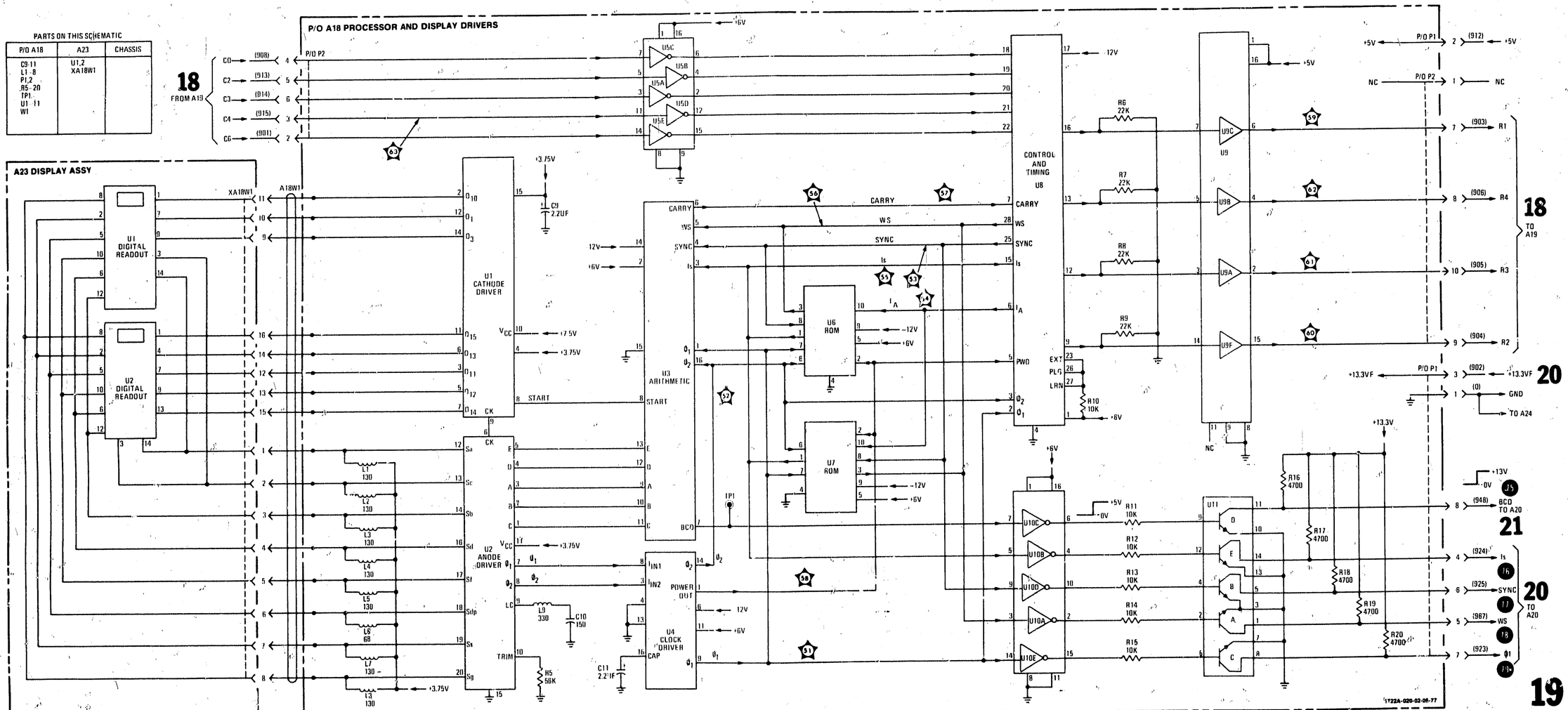


Figure 8-22.
Service Information, Processor/Display, Assembly A18 (Sheet 2 of 2)
8-55

NOTE

Assemblies A6 and A7 are connected to the underside of vertical preamplifier A3. They will also move to the rear. When reinstalling, ensure that push-button switches are aligned with front-panel holes.

h. Disconnect plastic connector at A3P5.

i. Remove gate and blanking coaxial cables from A7 (square-pin connectors).

j. Remove two screws securing delay line cable to vertical preamplifier assembly.

k. Unsolder delay line cable wires at vertical preamplifier assembly.

l. Note orientation of delay line. Red marked side of delay line goes to dot on board assembly.

m. Remove assemblies A3, A6, and A7 from instrument.

n. Disconnect ASW (9) and BSW (0) wires from square-pin connectors on assembly A7.

o. Simultaneously pull assemblies A6 and A7 from male connectors mounted on assembly A3.

p. To reinstall vertical preamplifier assembly, reverse installation procedure.

8-29. DELAY LINE REMOVAL AND REPLACEMENT. To remove the delay line from the instrument, proceed as follows:

a. Remove two screws holding delay line cable to vertical preamplifier assembly A3.

b. Unsolder two wires from end of delay line cable to vertical preamplifier.

c. Note orientation of delay line. Red marked side of delay line goes to dot on board assembly.

d. Remove two screws holding delay line cable to vertical output amplifier A5.

e. Unsolder two wires from end of delay line cable to vertical output assembly.

f. Note orientation of delay line. Red marked side of delay line goes to dot on board assembly.

g. Remove two retaining screws holding delay line bracket MP8 to main deck.

h. Remove delay line assembly from instrument.

i. To reinstall delay line assembly, reverse removal procedure.

8-30. REMOVAL AND REPLACEMENT OF ASSEMBLIES IN HORIZONTAL SECTION. The following paragraphs provide information required to remove and replace the various assemblies in the horizontal section of the instrument.

8-31. TIME/DIV Switch Removal and Replacement. To remove the TIME/DIV switches, proceed as follows:

a. Set TIME/DIV controls as follows:

TIME/DIV (main) ..... 0.1 mSEC
TIME/DIV (delayed) ..... OFF

b. Remove retaining spring from TIME/DIV shaft (inside front panel of instrument).

c. Pull TIME/DIV shaft out.

d. To reinstall TIME/DIV shaft, reverse removal procedure.

e. Snap retaining spring into groove on TIME/DIV shaft.

8-32. Main Horizontal Sweep Switch Assembly and Hold-off Comparator Assembly Removal and Replacement. To remove horizontal sweep switch assembly A11, proceed as follows:

a. Remove TIME/DIV shaft (paragraph 8-31).

b. Gently rock main horizontal sweep switch assembly and holdoff-comparator assembly A12 while pulling upward to remove from sockets on horizontal sweep assembly A8.

c. Separate horizontal sweep switch assembly and holdoff-comparator assembly by removing two retaining screws and soldered wire.

d. To reinstall assemblies, reverse removal procedure.

8-33. Delayed Horizontal Sweep Switch Assembly Removal and Replacement. To remove delayed horizontal sweep switch assembly A9, proceed as follows:

a. Remove TIME/DIV shaft (paragraph 8-31).

b. Gently rock delayed horizontal sweep switch assembly while pulling upward to remove from socket on horizontal sweep assembly A8.

c. To reinstall assembly, reverse removal procedure.

8-34. Horizontal Sweep Assembly A8 Removal and Replacement. To remove the horizontal sweep assembly, proceed as follows:

a. Accomplish paragraphs 8-31 through 8-33.

b. Unsolder flex wire from main EXT +10 switch A8S1P.

c. Unsolder flex wire from delayed EXT +10 switch A8S1B.

d. Unsolder two ground straps from A8 to chassis ground.

e. Disconnect reset lamp coaxial cable (5) from A8 assembly (square-pin connections).

f. Disconnect line sync wire (6) from A8 assembly (square-pin connection).

g. Disconnect main trig level wire (903) from A8 assembly (square-pin connection).

h. Disconnect delay trig level wire (904) from A8 assembly (square-pin connection).

i. Disconnect start after delay wire (916) from A8 assembly (square-pin connection).

j. Disconnect plastic connectors at A8P1 and A8P5.

k. Remove two retaining screws at rear edge of assembly A8.

NOTE

Horizontal display switch assembly A10 is mounted on the rear of assembly A8. It must also clear the front panel during the next step.

l. Move assembly A8 toward right rear of instrument until pushbutton controls clear front panel.

m. Disconnect sync cable W2 from assembly A10 (square-pin connections).

n. Disconnect plastic connector at A8P4.

o. Disconnect coaxial cable at A10 (square-pin connections) to VERTICAL OUTPUT connector J4.

p. Disconnect horizontal input cable W3 at horizontal output assembly A13 (square-pin connections).

q. Remove assemblies A8 and A10 from instrument.

r. To reinstall assembly A8 and A10, reverse removal procedure.

8-35. Horizontal Display Switch Assembly A10 Removal and Replacement. To remove horizontal display switch assembly, proceed as follows:

a. Accomplish paragraph 8-34 steps a through q.

b. Unsolder R9 and R10 (connected between A8 and A10) at A10 terminals.

c. Remove three retaining screws holding A8 and A10 together.

d. To reinstall horizontal display switch assembly, reverse removal procedure.

8-36. REPAIR OF ASSEMBLIES.

8-37. GENERAL. The board assemblies used in this instrument are etched-circuit type and have plated-through component holes to facilitate replacement of components. Refer to paragraph 8-44 for information covering circuit board repair and recommended soldering equipment.

8-38. The only assemblies not recommended for repair are the attenuator assemblies. The attenuator components are closely mounted and their interrelationship is critical. The only components recommended for replacement are R1, R2, Q1, Q2, and Q3. These items are socket mounted and easily replaced. If other components fail, replacement of the board assembly is recommended.

8-39. REPLACEMENT OF ATTENUATOR TERMINATION RESISTORS.

CAUTION

Do not attempt to clean attenuator assemblies with any cleaning agent. Always wear protective cotton gloves (such as HP Part Number 8650-0030) while handling the attenuator board assemblies. The board assemblies are extremely susceptible to conduction paths caused by fingerprints.

8-40. To replace attenuator termination resistors R1/R2, proceed as follows:

a. Remove two screws holding top cover of attenuator.

b. Slide attenuator cover from attenuator.

c. Remove resistors R1/R2 from attenuator board assembly using long-nosed pliers.

CAUTION

If new resistors are to be installed, replace with flame-proof type only (HP Part No. 0698-6433). Recompensate attenuator assembly.

d. Replace resistors R1/R2 reversing above procedure.

8-41. CIRCUIT BOARDS.

8-42. The following paragraphs provide information regarding servicing procedures for etched circuit boards, use of heat sinks, and special soldering considerations.

8-43. BOARD CONNECTIONS. Square-pin connectors are identified on circuit boards by color code of connecting wire or by the signal name. Connector pins on plugs and jacks are identified by either a numeral or a letter. The letters G, I, O, and Q have been omitted. Table 8-1 shows the types of board connections used in the instrument.

8-44. SERVICING ETCHED CIRCUIT BOARDS. All the etched circuit boards have plated-through component holes. This allows components to be removed or replaced by unsoldering or soldering from either side of the board. When removing large components such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information for repair of etched circuit boards.

8-45. SEMICONDUCTOR REMOVAL AND REPLACEMENT. Figure 8-1 is included to help identify the leads on the common shapes and sizes of semiconductor devices. When removing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as used for the original part.

8-46. INTEGRATED CIRCUIT REMOVAL AND REPLACEMENT.

CAUTION

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

8-47. The integrated circuits (IC's) in this instrument are of two general configurations, plug-in types, and those soldered in place. Remove a plug-in integrated circuit with a straight pull away from the board. Soldered integrated circuits can be removed with soldering irons which simultaneously heat all connections. These irons are available from various manufacturers. Soldering irons with built-in desoldering tools also facilitate quick removal.

8-48. Use the following procedure for removing an integrated circuit with a standard soldering iron.

a. Heat lead solder joint. Use small tip such as on Weller No. PT-H7 iron.

b. When solder is fluid, remove with desoldering tool such as deluxe Model Soldapullt manufactured by Edsyn Company of California.

c. Repeat steps a and b for each lead until all leads are free.

d. Grasp each lead with long-nosed pliers and check that is mechanically free from circuit board.

e. When all leads are free, carefully remove integrated circuit. Dual in-line type can be removed by gently gripping top and bottom with long-nosed pliers and rolling circuit out.

f. Use desoldering tool or toothpick to remove all remaining solder from circuit board holes.

CAUTION

Be careful not to damage the integrated circuit with excessive heat. Work quickly.

g. Insert replacement integrated circuit into circuit board and solder in place.

8-49. When replacing an integrated circuit, note the mark or notch used for orientation. The component-identification photographs and the integrated circuit pin-location diagrams in this manual show the correct orientation.

8-50. ASSEMBLY A5 IC REPLACEMENT. Use the following procedure when replacing integrated circuits on vertical output assembly A5:

a. Remove A5 assembly mounting bracket from instrument by removing two screws securing it to the rear panel and removing two screws securing it to main deck of instrument.

b. Disconnect four gray wires from CRT neck pins (two wires from A5 assembly and two wires from A5A1 assembly).

c. Remove A5 assembly and mounting bracket from instrument.

NOTE

The delay line cable remains attached to A5 assembly.

d. Disconnect power supply connector J8 from A5P1.

e. Unsolder wire (92) from termination assembly A5A1 at A5 assembly.

NOTE

Read next two steps prior to accomplishing them.

f. Remove four screws attaching A5 assembly to mounting bracket.

g. Carefully separate A5 assembly from mounting bracket so as not to lose yellow plastic insulator (HP Part No. 5080-9670) held captive between gain cell A5U1 (gold-colored IC) and mounting bracket.

h. Remove A5U1 from its mounting socket.

i. To replace output amplifier A5U2, remove four screws holding it to circuit board and remove. (go to step 1.)

j. Replace gain cell IC (A5U1) by matching mark on gain cell leg (solid line) with polarity dot on circuit board.

CAUTION

Do not use lettering on gain cell (A5U1) and number "1" marking on socket as a reference.

k. Insert gain cell in socket but do not push in to its final position. (When circuit board is remounted on mounting bracket, the mounting screws will seat IC to required depth.)

l. Replace output amplifier IC (A5U2) by matching contacts on circuit board with gold pads on IC.

m. Secure A5U2 by replacing four mounting screws and lock washers.

n. Using Thermalloy Compound (HP Part No. 6040-0239) coat surface of both IC's (A5U1 and A5U2) that will come in contact with mounting bracket.

o. Attach yellow plastic insulator to rear of gain cell A5U1.

p. Coat exposed side of yellow plastic insulator with Themalloy Compound.

q. Carefully feed two gray wires through hole in mounting bracket.

r. Position A5 assembly and mounting bracket so that yellow plastic insulator is properly positioned between A5U1 and mounting bracket.

s. Using four screws, attach A5 assembly to mounting bracket.

NOTE

Ensure that yellow plastic insulator is properly positioned and IC is flat against mounting bracket.

t. Resolder wire (92) from termination assembly A5A1 to A5 assembly.

u. Connect power supply connector J8 to A5P1.

v. Insert mounting bracket with A5 assembly into instrument.

w. Start two screws through rear panel to mounting bracket.

x. Start two screws through mounting bracket to main deck of instrument.

y. Tighten lower screw through rear panel and tighten rear screw through mounting bracket to main deck of instrument.

z. Tighten two remaining screws; one through rear panel and one through mounting bracket to main deck of instrument.

NOTE

Steps y and z should be followed carefully to ensure that mounting bracket is positioned correctly for lowest IC operating temperature.

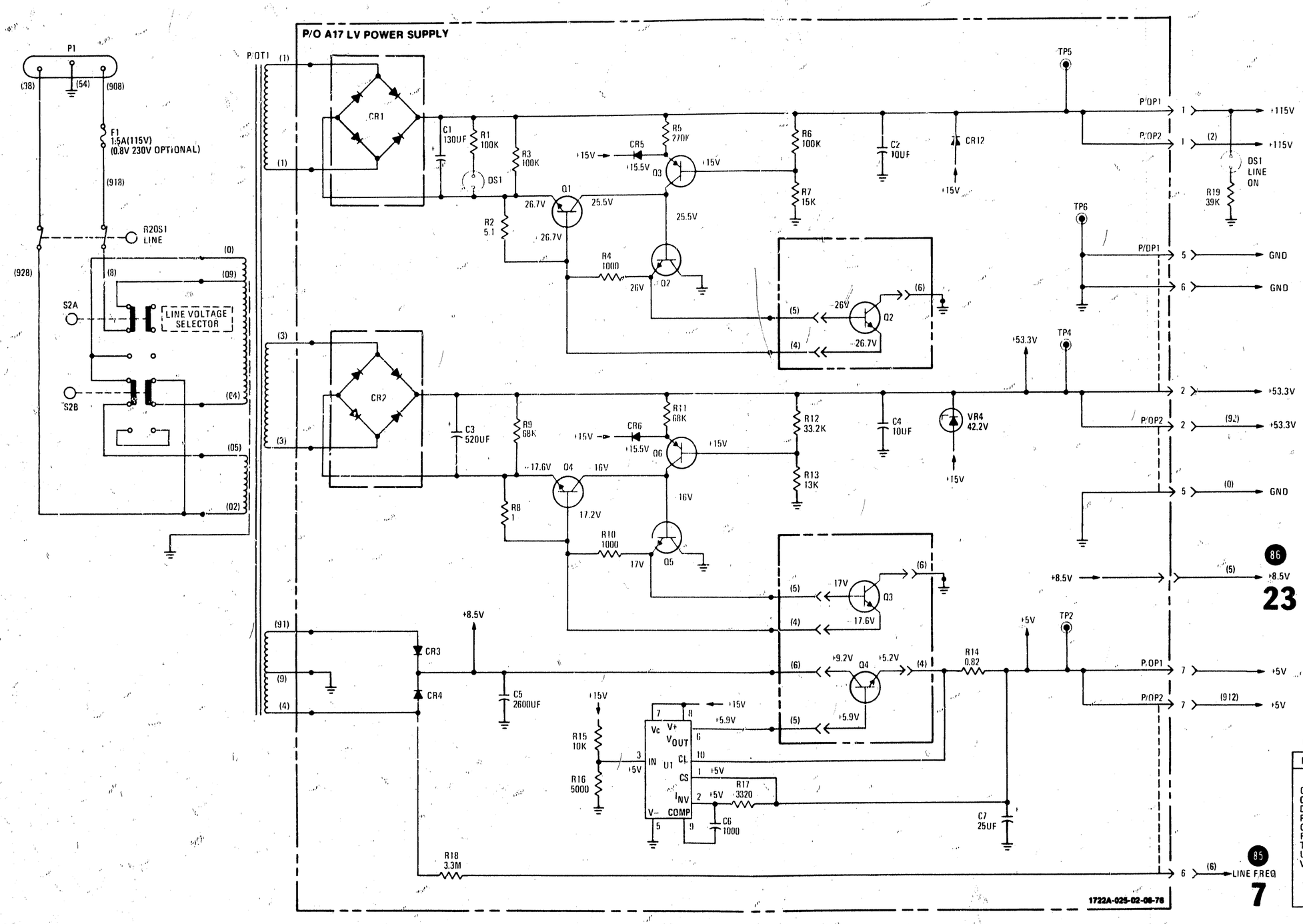
aa. Reconnect four gray wires to CRT neck pins.

ab. Verify mounting bracket ground clip is making contact with ground shield.

8-51. MOS HANDLING PRECAUTIONS. All MOS devices are subject to damage from static charge buildup. The generation of static charges is not the problem, but the accumulation of static charges is. In general, any device not connected directly to ground can accumulate static charges. Electrical discharge can occur to ground or to any object or person having a lower potential. Therefore, handling precautions are recommended for all personnel coming into contact with MOS devices.

SCHEMATIC DIAGRAMS

CON'T



PARTS ON THIS SCHEMATIC

P/OA17	CHASSIS
C1-7 CR1-6, 12 DS1 P/OP1,2 Q1-6 R1-18 TP2,4,5 U1 VR4	DS1 F1 P1 Q2 4 R19 R20S1 S2 P/OT1

Figure 8-27.
Service Information, LV Power Supply Input, P/O Assembly A17 (Sheet 2 of 2)

DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 25

1. Set front-panel controls in accordance with paragraph 5-13, Section V.

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

Figure 8-28. Service Information, LV Power Supply, P/O Assembly A17 (Sheet 1 of 2)

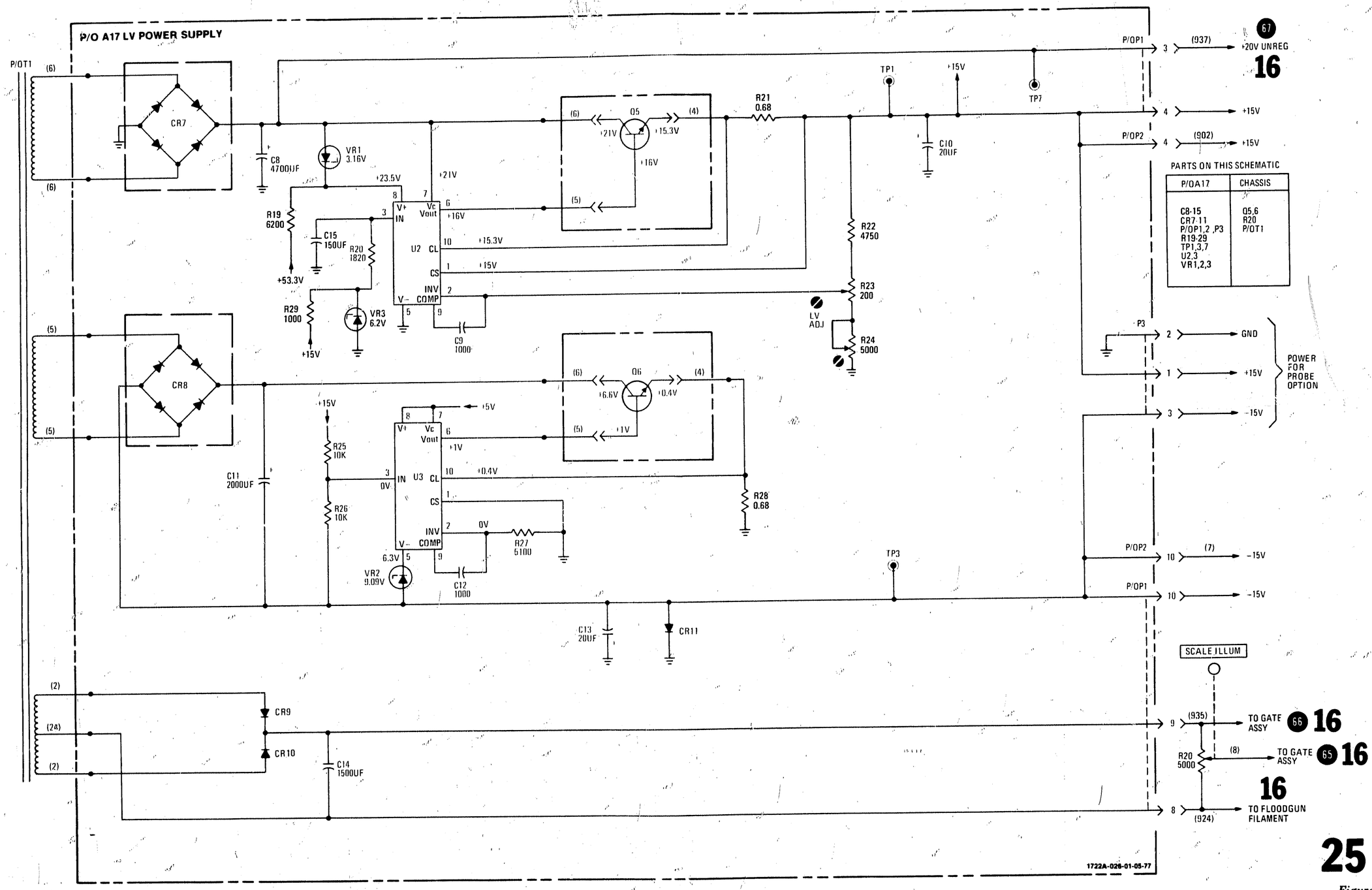


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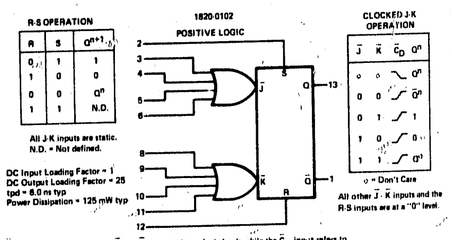
Figure 8-28.
Service Information, LV Power Supply, P/O Assembly A17 (Sheet 2 of 2)



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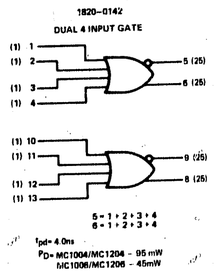

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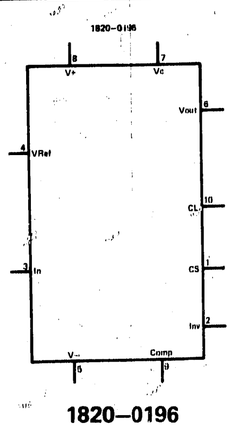

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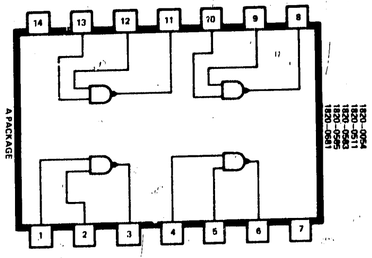

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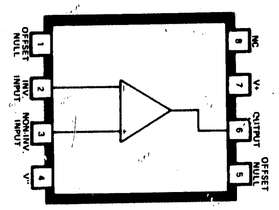
1820–058[illegible]



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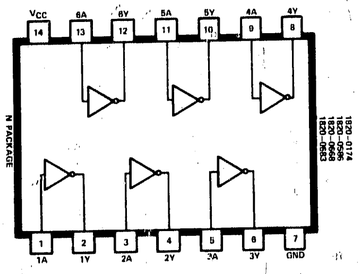

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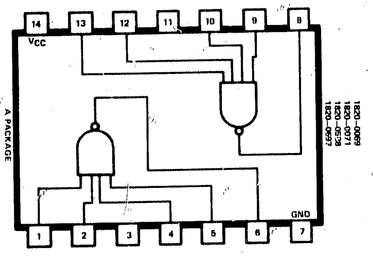

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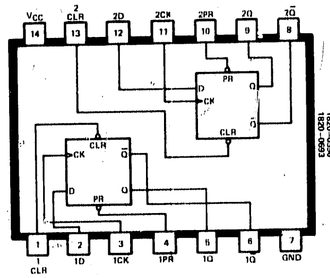

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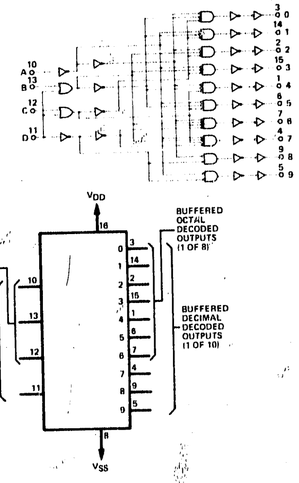

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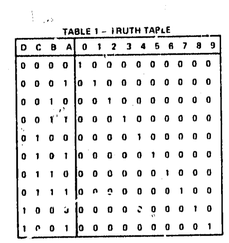

TABLE 1 – TRUTH TABLE

D	C	B	A	0	1	2	3	4	5	6	7	8	9
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0	0	0	1	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1	0	0	0	0	0	0
0	1	0	0	0	0	0	0	1	0	0	0	0	0
0	1	0	1	0	0	0	0	0	1	0	0	0	0
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0	1	1	1	0	0	0	0	0	0	0	1	0	0
1	0	0	0	0	0	0	0	0	0	0	0	1	0
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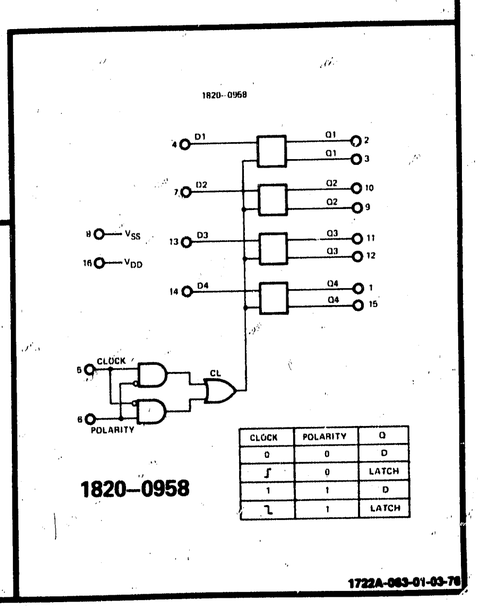
1820–0927



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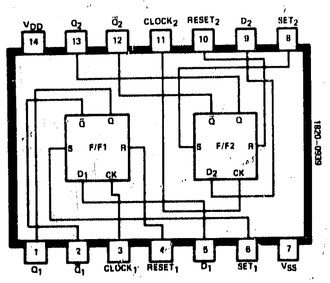

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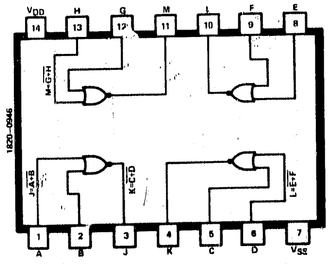

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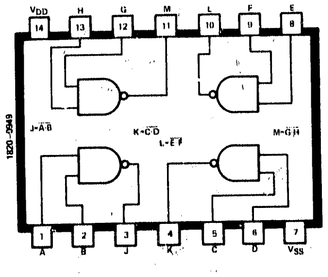

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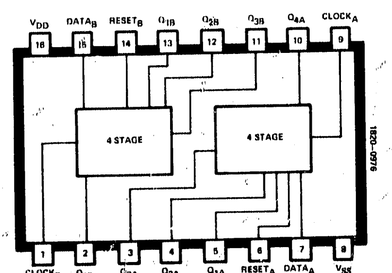

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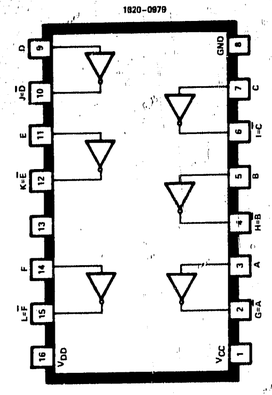
Figure 8-29. IC Configurations (Sheet 1 of 2)



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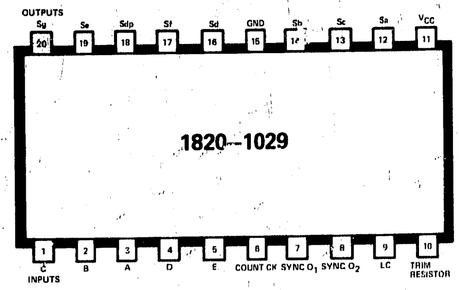

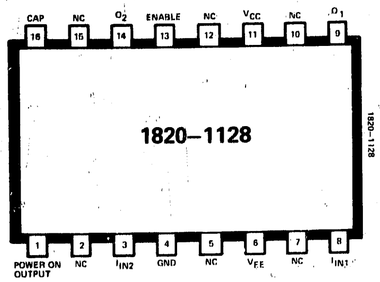

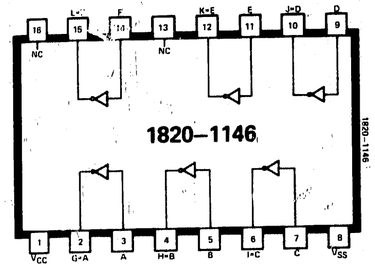

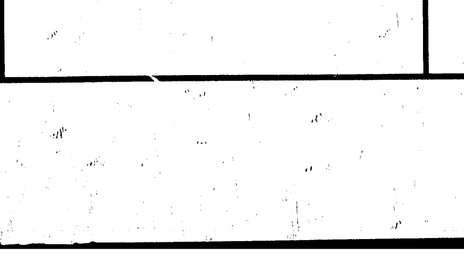

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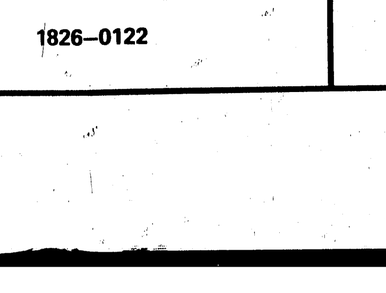

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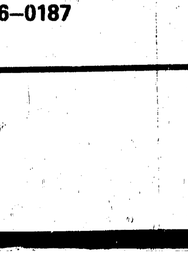

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1821–0001

1826–0009

1826–0086

1826–0122

1826–0187

1858–0040

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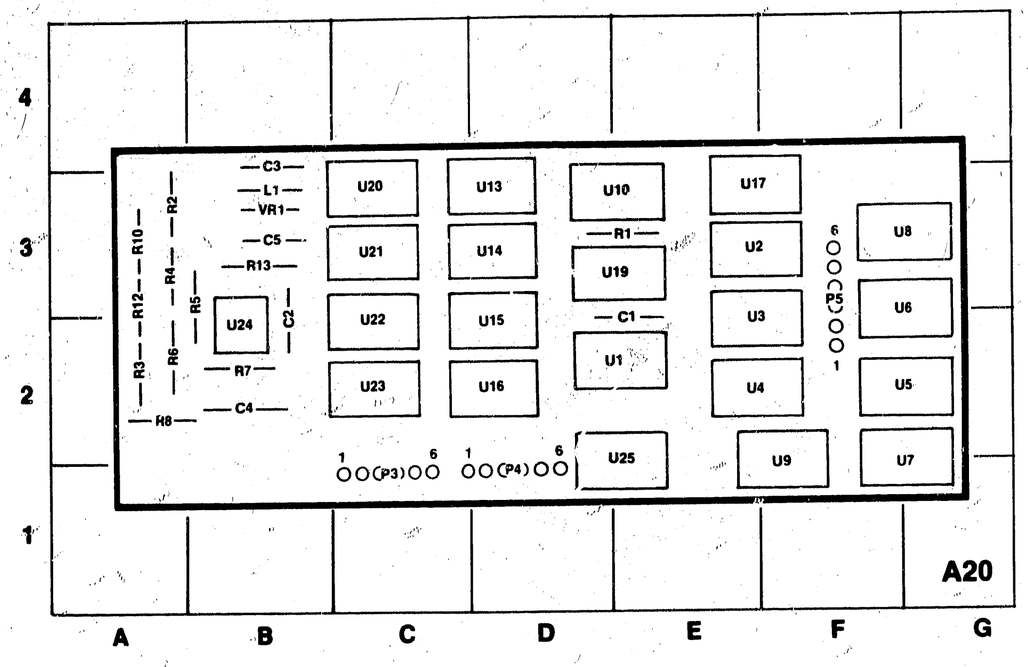
Figure 8-29.
IC Configurations (Sheet 2 of 2)



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
C1	E-3	L1	B-3	R5	B-3	R10	A-3	U4	E-1	U9	F-1	U15	D-2	U21	C-3
C2	B-3	R1	E-3	R6	A-2	R12	A-3	U5	G-2	U10	E-3	U16	D-2	U22	C-2
C3	B-4	R2	A-3	R7	B-2	R13	B-3	U6	G-3	U11	E-2	U17	E-3	U23	C-2
C4	B-2	R3	A-2	R8	A-2	U2	F-3	U7	G-1	U13	D-3	U19	E-3	U24	B-2
C5	B-3	R4	A-3	R9	F-1	U3	F-2	U8	G-3	U14	D-3	U20	C-3	U25	E-1
														VR1	B-3

WAVEFORMS AND DC VOLTAGE MEASUREMENT CONDITIONS SCHEMATIC 20

1. Set front-panel controls in accordance with paragraph 5-13, except as follows:

HORIZ DISPLAY ..... MAIN INTEN

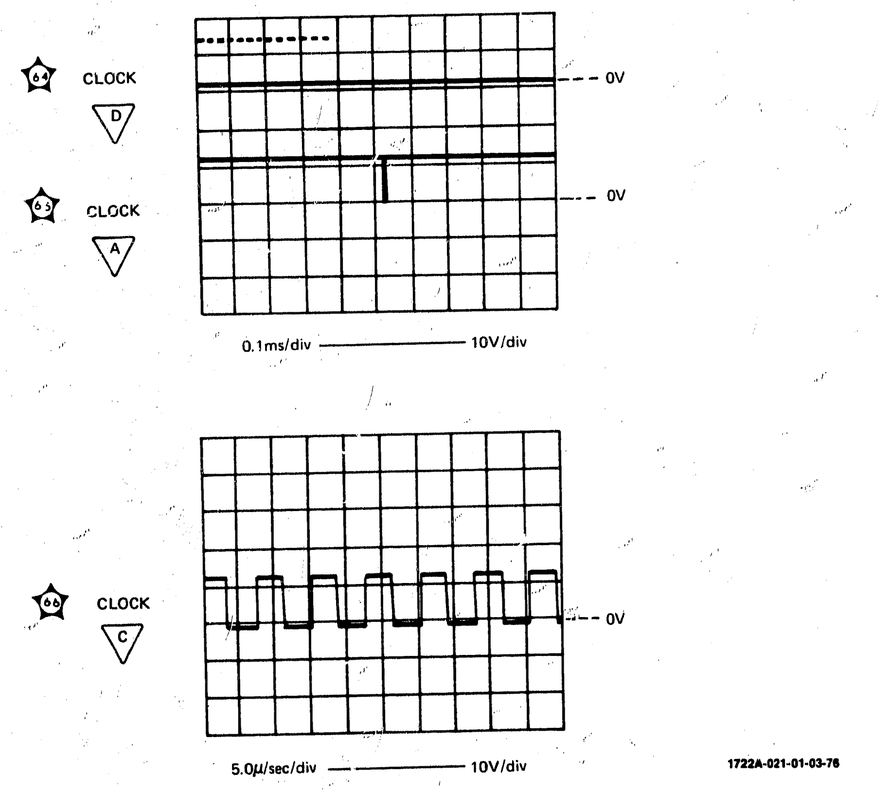


Figure 8-23. Service Information, Output Interface, P/O Assembly A20 (Sheet 1 of 2)

P/O A20 OUTPUT INTERFACE

P/O A19

19 16 IS (924) 4 P/OP5

19 17 SYNC (925) 5

19 79 01 (923) 3

19 78 WS (9S7) 2

U5A U5B U6A U6B U7 U9 U8A U8B U17A U17B U19A U19B U2A U2B U2C U2D U3A U3B U3C U4A U4B U8B U3B

+13.3VF

P/O P3

XA20 000 001 010 100 101 110

17 18

P/OP4

+15V

R13 51.1

C5 1UF

VR1 13.3V

C3 0.1UF

L1 130

C2 1UF

P/OW8

(902) +15V

(912) +5V

(7) −15V

(902) +13.3VF TO A18 19

TO U10/U11 81 21

TO U13-U16 80 21

TO U20-U23 82 21

R1 13.3K

C1 100

PARTS ON THIS SCHEMATIC

P/OA20	P/OA19
C1-3, 5 L1 P3 P/OP4, P5 R1, 13 U2, 3, 4, 5, 9, 17, 19, 25 VR1	XA20
	CHASSIS
	P/OW8

20

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Figure 8-23. Service Information, Output Interface, P/O Assembly A20 (Sheet 2 of 2)

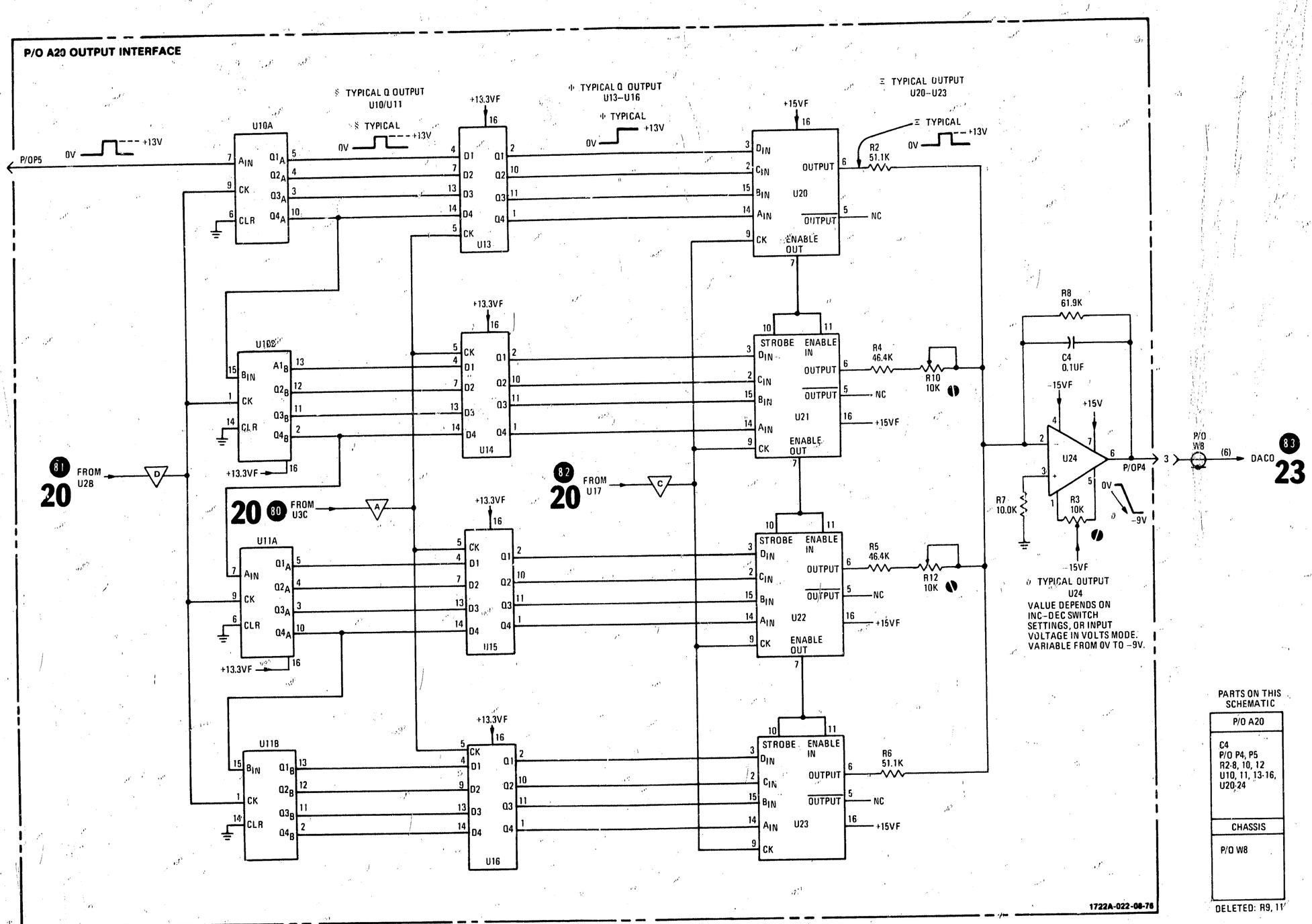

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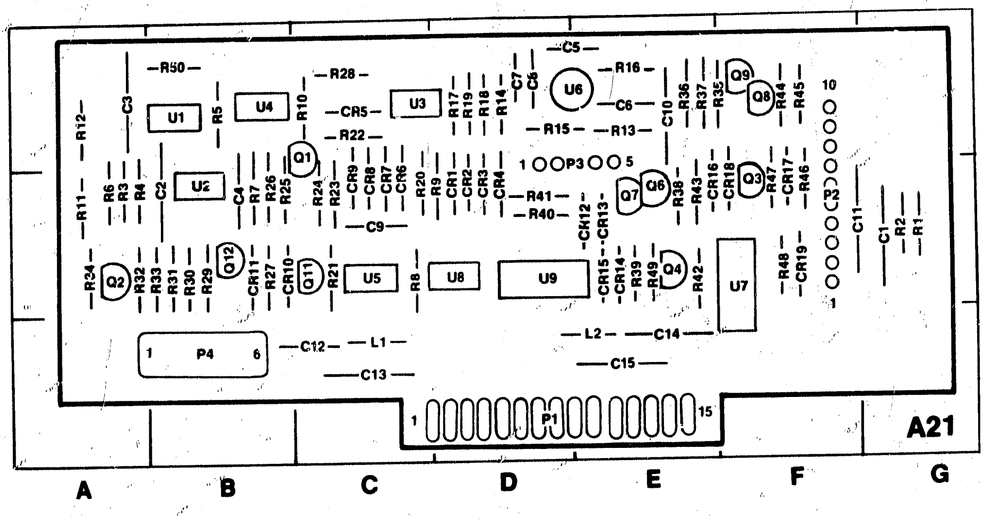
Figure 8-24. Service Information, Output Buffer Storage, P/O Assembly A20



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	G-2	CR3	D-3	CR18	E-3	Q11	C-2	R15	D-3	R30	B-2	R45	F-3
C2	B-3	CR4	D-3	L1	C-2	R1	G-2	R15	E-3	R31	B-2	R46	F-3
C3	A-3	CR5	C-3	L2	E-2	R2	G-2	R17	D-3	R32	A-2	R47	F-3
C4	B-3	CR6	C-2	P1	D-1	R3	A-3	R18	D-3	R33	A-2	R48	F-2
C5	D-4	CR7	C-2	P2	F-3	R4	A-3	R19	D-3	R34	A-2	R49	E-2
C6	E-3	CR8	C-2	P3	D-3	R5	B-3	R20	C-3	R35	E-3	R50	A-4
C7	D-3	CR9	C-2	P4	B-2	R6	A-3	R21	C-2	R36	E-3	U1	B-3
C8	D-3	CR10	B-2	Q1	C-3	R7	B-3	R22	C-3	R37	E-3	U2	B-3
C9	C-2	CR11	B-2	Q2	A-2	R8	C-2	R23	C-3	R38	E-3	U3	C-3
C11	F-2	CR12	E-2	Q3	F-3	R9	C-3	R24	C-3	R39	E-2	U4	B-3
C12	B-2	CR13	E-2	Q4	E-2	R10	C-3	R25	B-3	R40	D-3	U5	C-2
C13	C-1	CR14	E-2	Q6	E-3	R11	A-3	R26	B-3	R41	D-3	U6	D-3
C14	E-1	CR15	E-2	Q7	E-3	R12	A-3	R27	B-2	R42	E-2	U7	F-2
C15	E-1	CR16	E-3	Q8	F-3	R13	E-3	R28	C-3	R43	E-3	U8	D-2
CR1	D-3	CR17	F-3	Q9	F-3	R14	D-3	R29	B-2	R44	F-3	U9	D-2
CR2	D-3												

DC AND WAVEFORM MEASUREMENT CONDITIONS
SCHEMATIC 22

1. Set front-panel controls in accordance with paragraph 5-13, Section V.

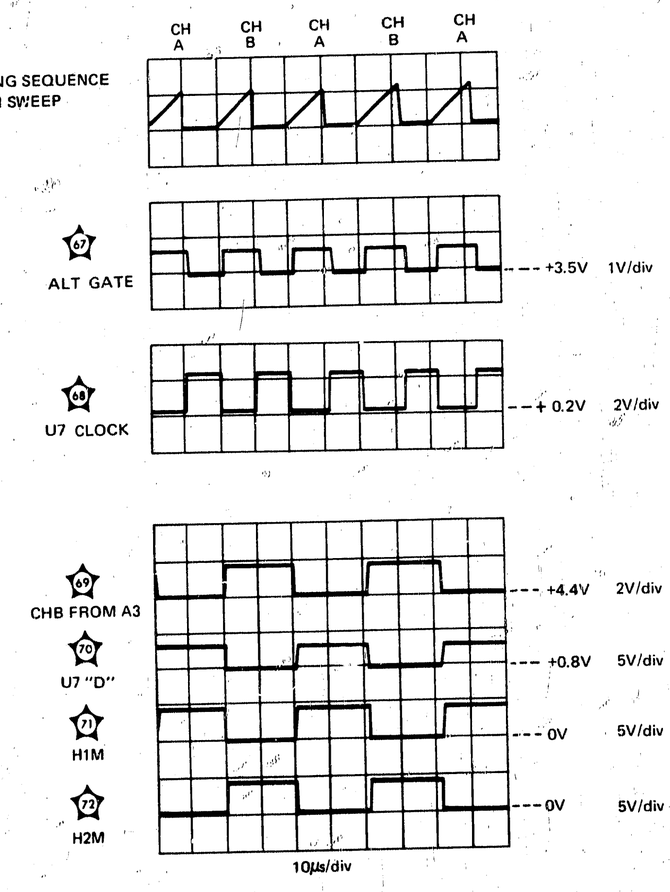
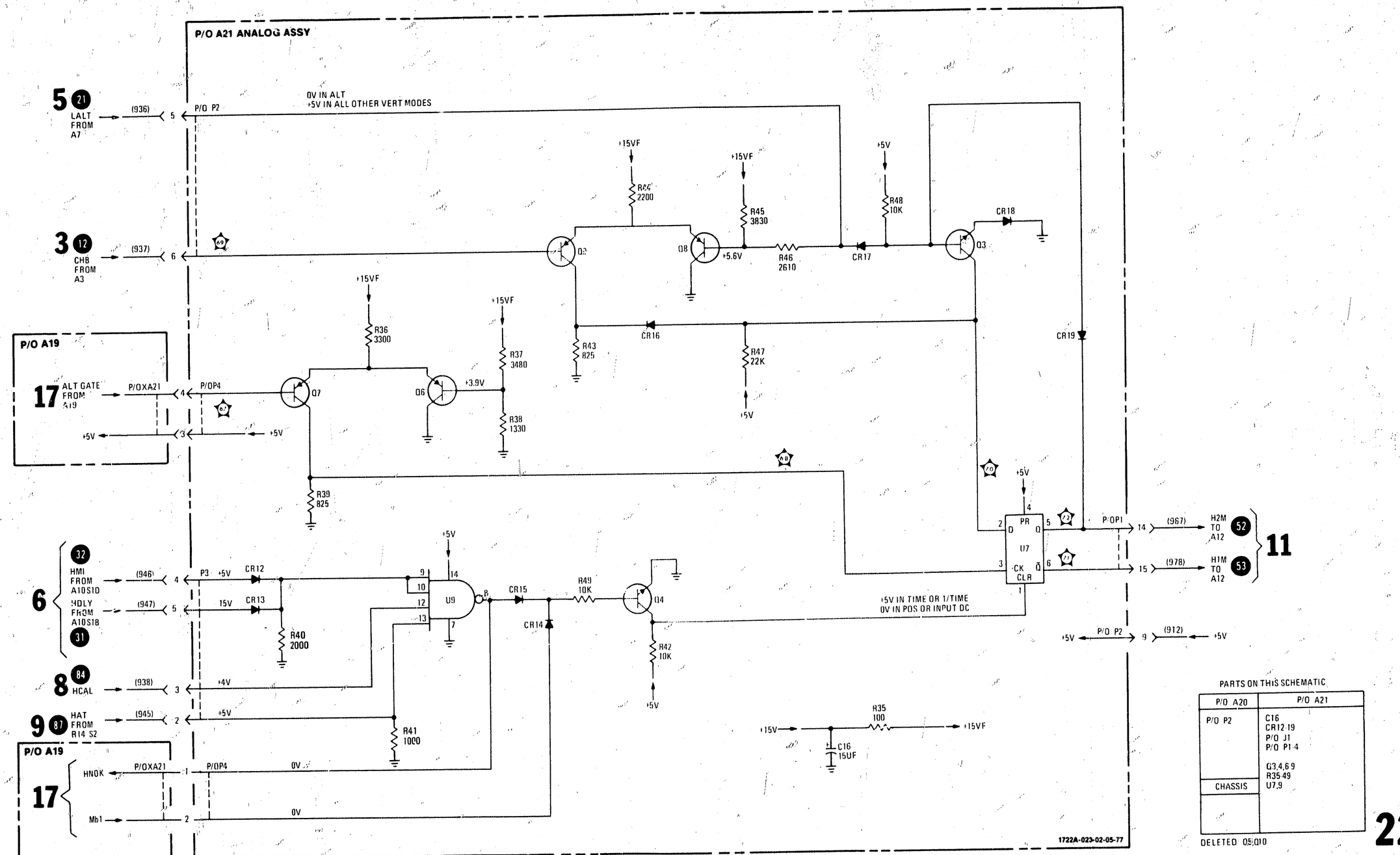


Figure 8-25. Service Information, Analog Control, P/O Assembly A21 (Sheet 1 of 2)



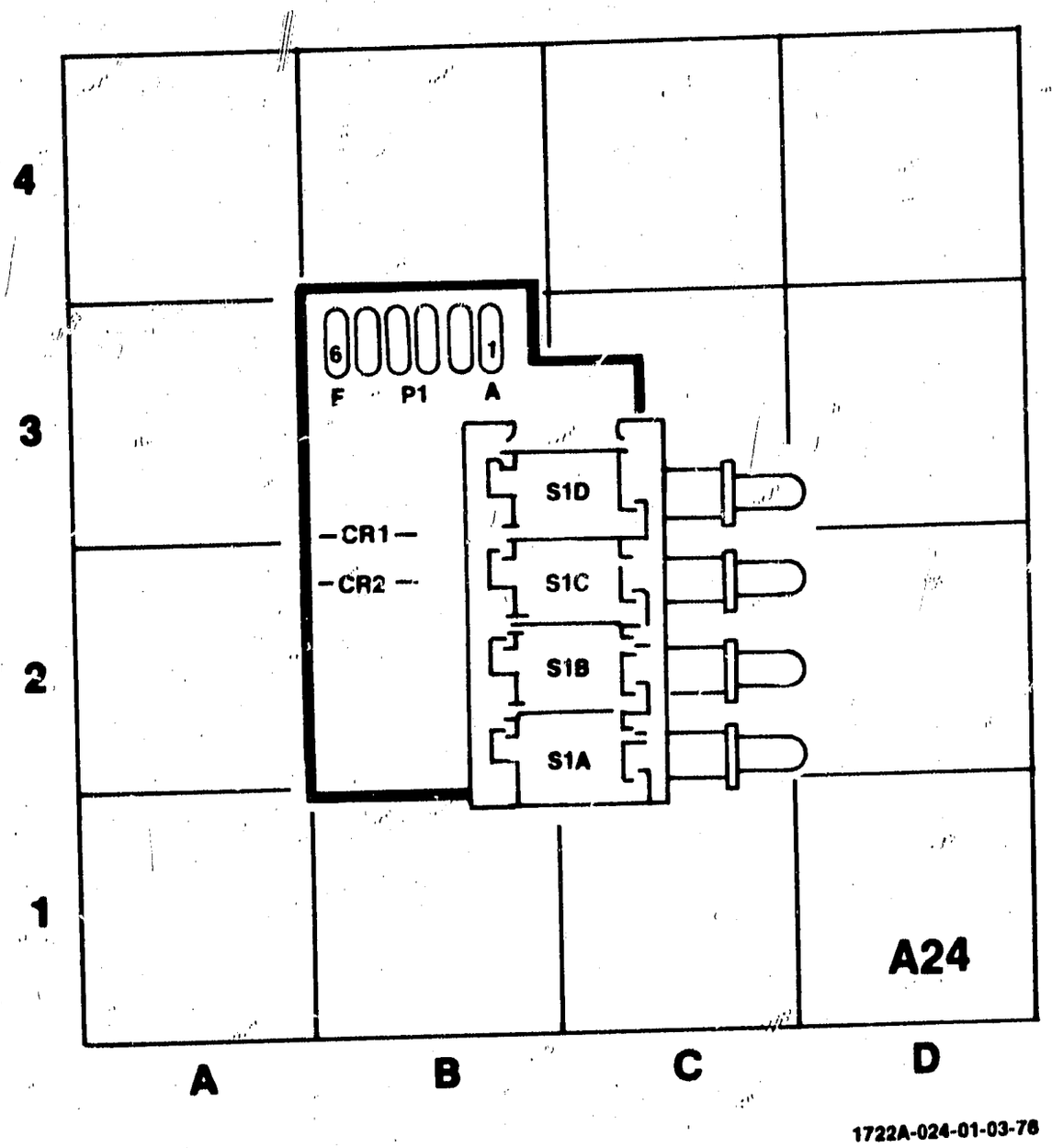
PARTS ON THIS SCHEMATIC

P/O A20	P/O A21
P/O P2	C16 CR12,19 P/O J1 P/O P1-4 Q3,4,6,9 R35,49
CHASSIS	U7,9

DELETED Q5,Q10

22

Figure 8-25.
Service Information, Analog Control,
P/O Assembly A21 (Sheet 2 of 2)

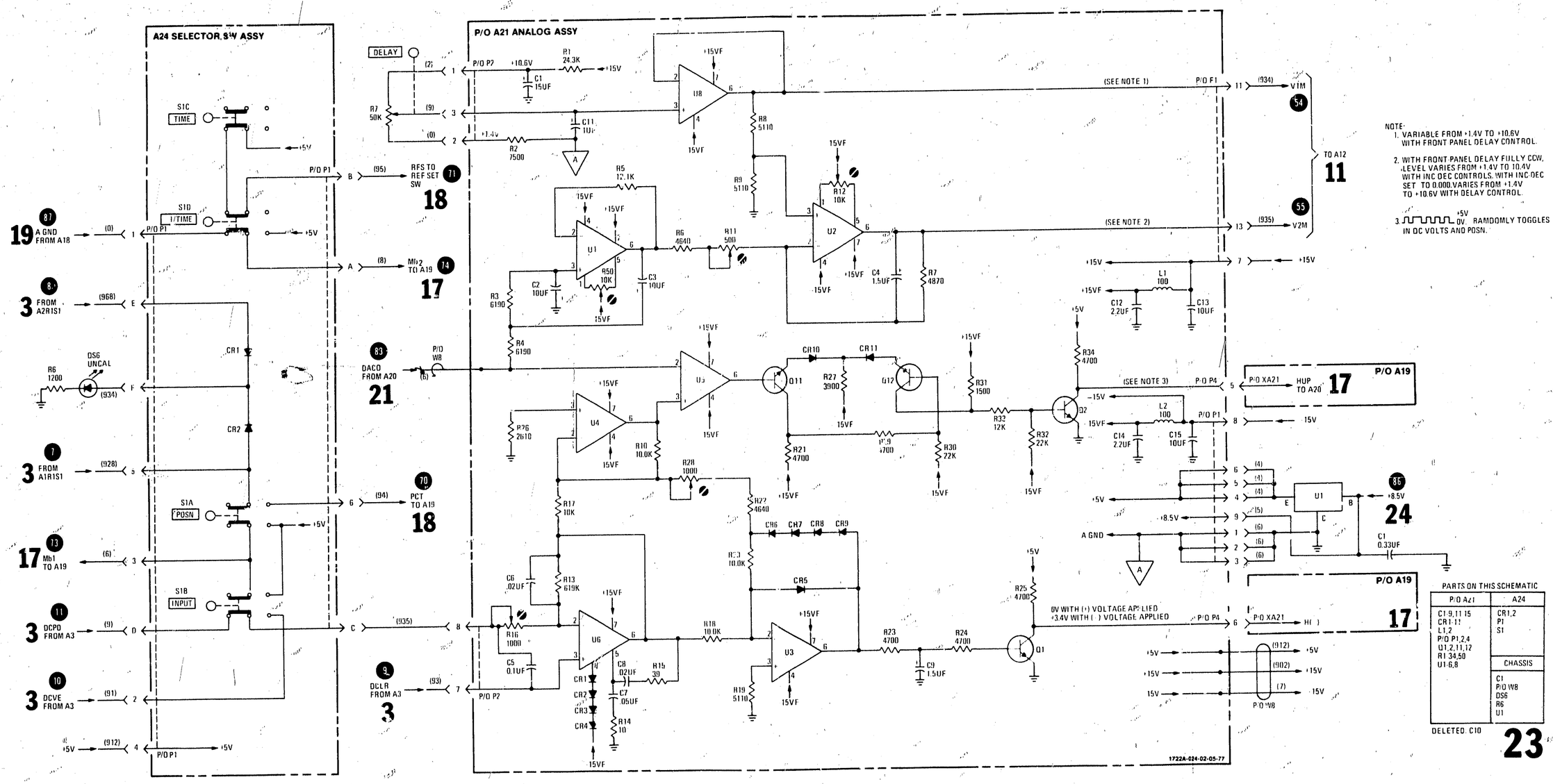


DC VOLTAGE MEASUREMENT CONDITIONS
SCHEMATIC 23

1. Set front-panel controls in accordance with paragraph 5-13, Section V, except as follows:

VOLTS/DIV (channel A) 1
INTERNAL ..... DC VOLTS

Figure 8-26. Service Information, Delay Control and Selector, Assembly A24 and I/O Assembly A21 (Sheet 1 of 2)



NOTE:
1. VARIABLE FROM +1.4V TO +10.6V WITH FRONT PANEL DELAY CONTROL.
2. WITH FRONT PANEL DELAY FULLY CCW, LEVEL VARIES FROM +1.4V TO 10.4V WITH INC DEC CONTROLS. WITH INC DEC SET TO 0.000 VARIES FROM +1.4V TO +10.6V WITH DELAY CONTROL.
3. +5V 0V RANDOMLY TOGGLES IN DC VOLTS AND POSN.

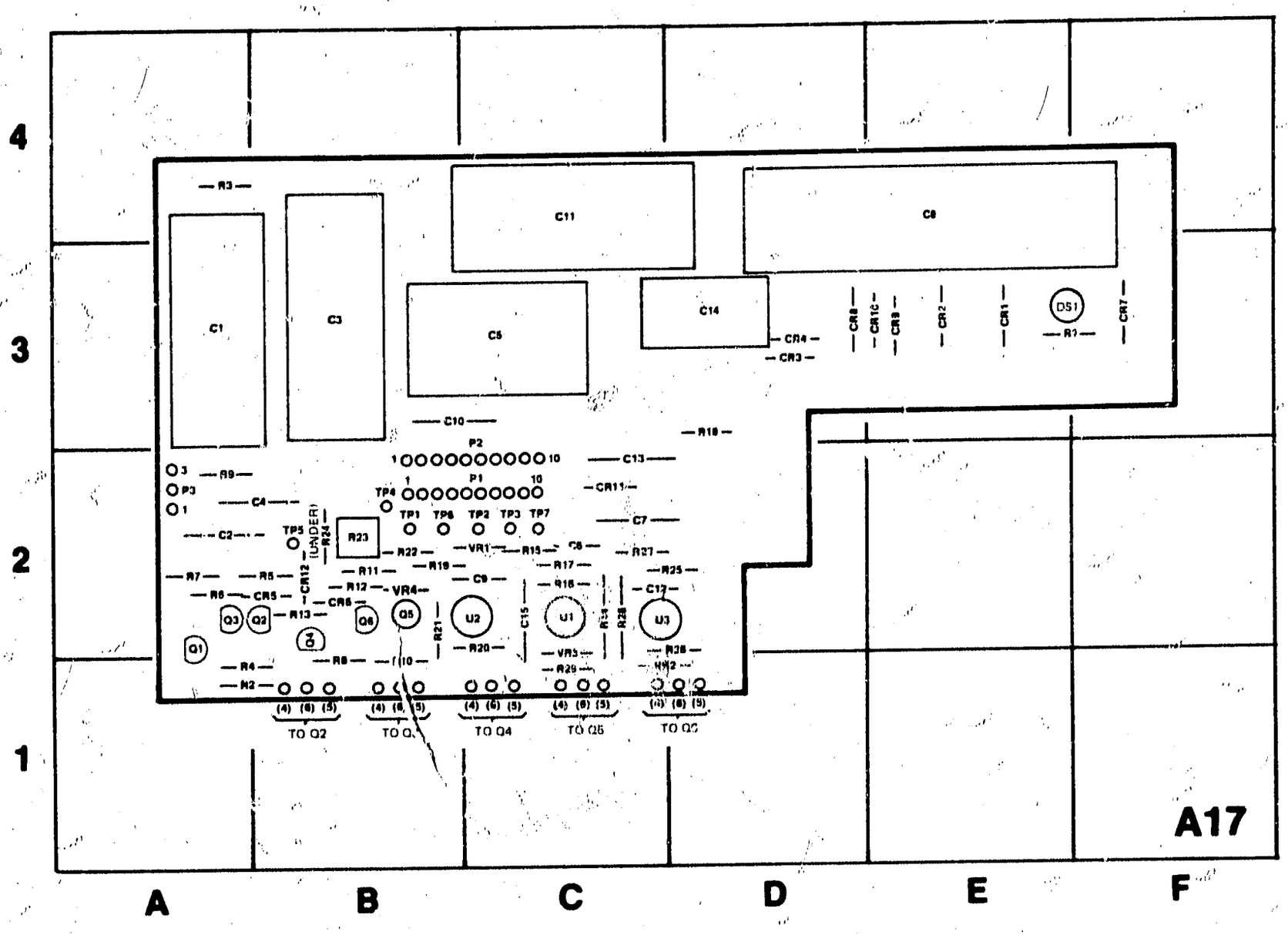
PARTS ON THIS SCHEMATIC

P/O A21	A24
C1-9,11 15 CR1-11 L1,2 P/O P1,2,4 Q1,2,11,12 R1-34,50 U1-6,8	CR1,2 P1 S1
	CHASSIS
	C1 P/O W8 DS6 R6 U1

DELETED: C10

23

Figure 8-26.
Service Information, Delay Control and Selector, Assembly A24 and P/O Assembly A21 (Sheet 2 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	A-3	CR6	B-2	R4	A-1	R24	B-2
C2	A-2	CR7	F-3	R5	B-2	R25	D-2
C3	B-3	CR8	D-3	R6	A-2	R26	D-2
C4	B-2	CR9	E-3	R7	A-2	R27	C-2
C5	C-3	CR10	E-3	R8	B-1	R28	C-2
C6	C-2	CR11	C-2	R9	A-2	R29	C-1
C7	C-2	CR12	B-2	R10	B-1	TP1	B-2
C8	E-4	DS1	E-3	R11	B-2	TP2	C-2
C9	C-2	P1	C-2	R12	B-2	TP3	C-2
C10	B-3	P2	C-3	R13	B-2	TP4	B-2
C11	C-4	P3	A-2	R14	C-2	TP5	B-2
C12	C-2	Q1	A-2	R15	C-2	TP6	B-2
C13	C-2	Q2	B-2	R16	C-2	TP7	C-2
C14	D-3	Q3	A-2	R17	C-2	U1	C-2
C15	C-2	Q4	B-2	R18	D-3	U2	C-2
CR1	E-3	Q5	B-2	R19	B-2	U3	C-2
CR2	E-3	Q6	B-2	R20	C-2	VR1	C-2
CR3	D-3	R1	E-3	R21	B-2	VR2	C-1
CR4	D-3	R2	A-1	R22	B-2	VR3	C-1
CR5	B-2	R3	A-4	R23	B-2	VR4	B-2

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DC VOLTAGE MEASUREMENT CONDITIONS SCHEMATIC 24

1. Set front-panel controls in accordance with paragraph 5-13, Section V.
2. All voltages are referenced to chassis ground. All indications are nominal and 15% variation from those indicated should be considered normal.

Figure 8-27. Service Information, LV Power Supply Input, P/O Assembly A17 (Sheet 1 of 2)