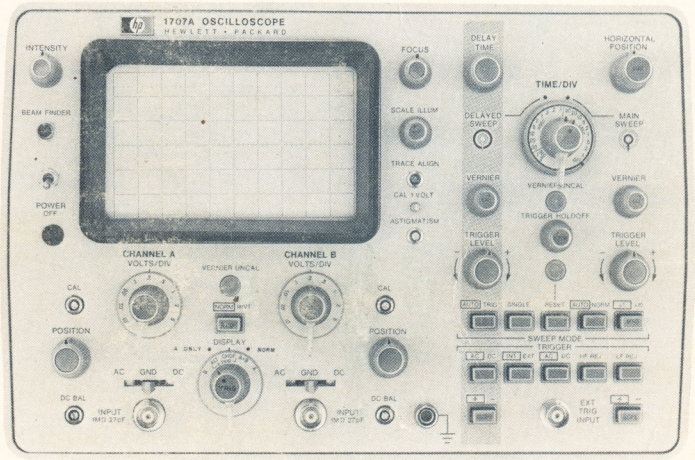
OPERATING AND SERVICE MANUAL

OSCILLOSCOPE
1707A



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OPERATING AND SERVICE MANUAL

MODEL 1707A
OSCILLOSCOPE

SERIALS PREFIXED: 1117A–

Refer to Section VII for instruments with other Serial Prefixes.

Refer to Section VII for instruments with the following Standard Options: 001, 002, 003, 006, 007, 011, 012, 090, 091, 092, 093, 094, 602, 607, 611, and 631.

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

Manual Part Number 01707-90901.
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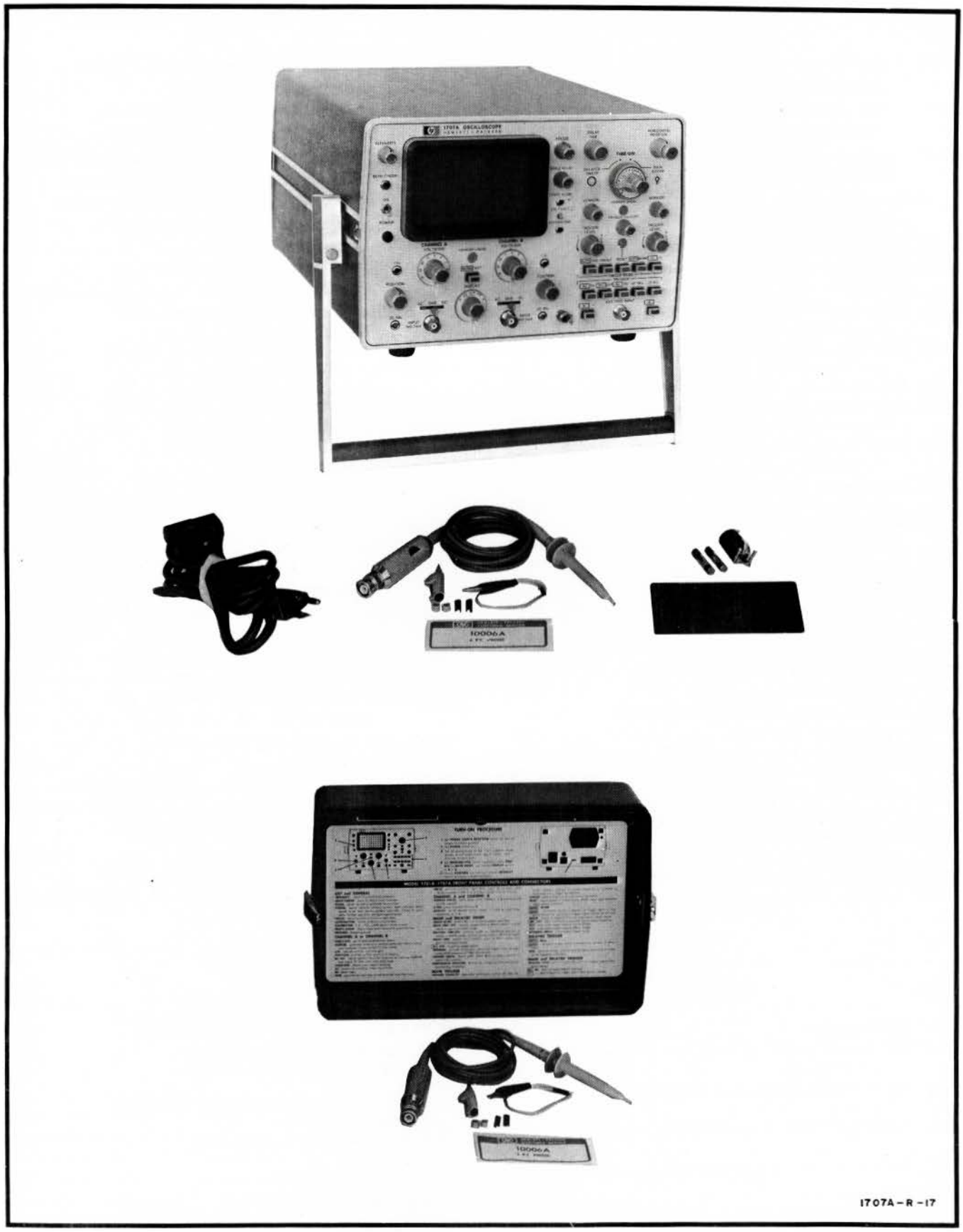


Figure 1-1. Model 1707A Oscilloscope and Accessories

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and servicing information for the Hewlett-Packard Model 1707A Oscilloscope (Figure 1-1). The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section contains a description of the Model 1707A. The instrument specifications are listed in Table 1-1. Table 1-2 lists and describes the abbreviations used in this manual. Table 1-3 lists the accessories available for the Model 1707A. Standard options available for this instrument are listed in Section VII.

1-4. DESCRIPTION.

1-5. INTRODUCTION.

1-6. The Hewlett-Packard Model 1707A Oscilloscope is a general purpose wide-band oscilloscope designed for bench or field service. The Model 1707A operates from an ac line, dc line or an optional battery pack. The optional rechargeable nickel cadmium battery provides up to 4 1/2 hours of operation and requires a recharge time of approximately 14 hours.

1-7. A carrying handle provides for ease of transportation and is adjustable to allow the Model 1707A to be placed at an angle for viewing the CRT. The CRT dimensions are 6 by 10 centimeters.

1-8. VERTICAL CIRCUITS.

1-9. The Model 1707A contains two identical vertical amplifiers for single or dual channel operation. Each channel offers a choice of ac or dc coupling. Common mode rejection is at least 40 dB at 10 mV/div, and 20 dB for the rest of the deflection ranges.

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

1-11. With the dual trace feature, (Channel A, Channel B) displays can be obtained on either Channel A or B, Channels A and B, Channels A + B and Channels A − B. Simultaneous display of two signals is possible in either chop or alternate mode of operation. During chop operation, channels are switched at about 100-kHz rate during each sweep. In alternate mode of operation, the signal applied to each channel is displayed on alternate sweeps. Sweep is triggered on the displayed signal in A, B, and A + B modes. In chop or alternate modes the sweep is triggered by Channel A only.

1-12. HORIZONTAL CIRCUITS.

1-13. Vertical input signals can be displayed by either an internally generated trigger or an external trigger signal. Trigger level, slope, and coupling are also selectable.

1-14. Operation of the delayed sweep while in the main mode provides for intensification of the trace. The amount of intensification width depends on the delay front panel settings. In the delay mode, the intensified portion is displayed across the entire CRT.

1-15. Sweep speed settings from 0.1 usec/div to 0.2 sec/div (Main mode) and 0.1 usec/div to 0.1 sec/div (Delayed mode) are available in a 1, 2, 5 sequence. Vernier controls allow continuous adjustment between steps and extends the slowest sweep to 0.5 sec/div (Main) and 0.25 sec/div (Delayed). Using the MAG X10 function, the fastest sweep speed can be expanded to 10 ns/div.

1-16. By operating in AUTO Mode, a bright baseline is displayed in the absence of a trigger input signal. When a trigger signal above 40 Hz is applied, it overrides the auto baseline circuit and controls the sweep. NORM mode of operation provides a baseline only in the presence of a trigger signal.

1-17. Single sweep operation can be operated in two modes.

a. SINGLE (RESET) NORM. Sweep activates when next trigger signal is applied.

b. SINGLE (RESET) AUTO. Sweep activates immediately when RESET button is pressed.

1-18. CATHODE-RAY TUBE.

1-19. The Model 1707A uses a post-accelerator CRT with a non-glare rectangular faceplate. An internal graticule is located on the same plane as the display to eliminate parallax errors. The tube has a 20.2 K-volt accelerating potential. The six vertical by ten horizontal divisions are square centimeters.

1-20. A type P31 phosphor is used in the standard CRT. Other types of phosphors are optional. Special graticules

(or no graticule) are also available by special order. Refer to Section VII for further information about optional and special-order modification.

NOTE

Due to phosphor burn sensitivity, instruments with a P11 phosphor do not have the intensified function of the beam-finder.

1-21. WARRANTY.

1-22. The instrument (except the CRT) is certified and warranted as stated on the inside front cover of this manual. The CRT is covered by a separate warranty. The CRT warranty and a warranty claim form are located at the rear of this manual. Should the CRT fail within the time specified on the CRT warranty page, complete the warranty claim form and return it with the defective CRT. The procedure for returning a defective CRT is described on the CRT warranty page.

CAUTION

The warranty may be void for instruments having a mutilated serial tag.

1-23. INSTRUMENT AND MANUAL IDENTIFICATION.

1-24. This manual applies directly to Model 1707A instruments with a serial prefix number as listed on the manual title page. The serial prefix number is the first group of digits in the instrument serial number (Figure 1-2). The instrument serial number is on a tag located on the rear panel.

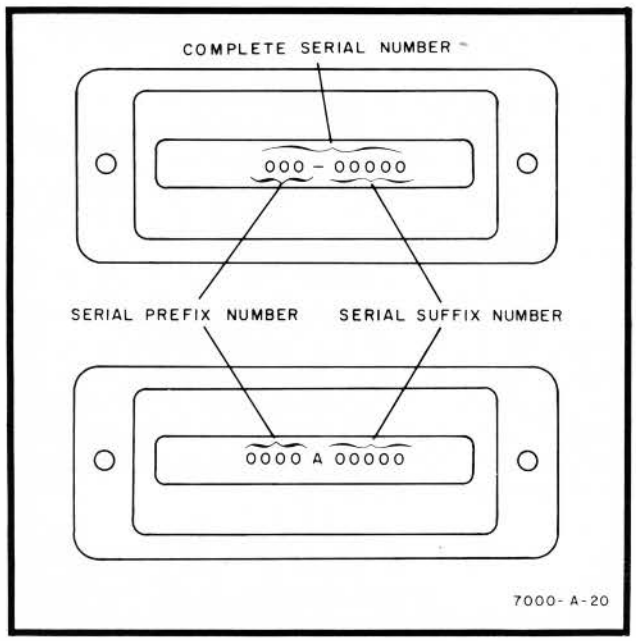


Figure 1-2. Instrument Serial Number

1-25. Check the serial prefix number of the instrument. If the serial prefix number is different from that listed on the title page of this manual, refer to Section VII for instructions to adapt this manual for proper instrument coverage.

1-26. Technical corrections to the manual are listed under errata on an enclosed MANUAL CHANGES sheet (if any).

1-27. INQUIRIES.

1-28. Refer any questions regarding the manual, the change sheet, or the instrument to the nearest HP Sales/Service Office. Always identify instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a world-wide listing of HP Sales/Service Offices.

Table 1-1. Specifications

VERTICAL AMPLIFIERS

MODES OF OPERATION: Channel A alone; Channel B alone; Channels A and B displayed alternately on successive sweeps (ALT); Channels A and B displayed by switching between channels at approx 100 kHz rate (CHOP), with blanking during switching; Channel A plus Channel B algebraic addition).

BANDWIDTH: (Direct or with Model 10006B probe; 3 dB down from 6 div reference signal at 50 kHz from 25-ohm source).

DC-Coupled: dc to 75 MHz.

AC-Coupled: 10 Hz to 75 MHz.

RISETIME: <4.7 ns Direct or with Model 10006A probe; 10% to 90% with 6 div input step from 25-ohm source).

DEFLECTION FACTOR

Ranges: from 10 mV/div to 5 V/div (9 ranges) in 1, 2, 5 sequence. ±3% accuracy with vernier in calibrated position.

Vernier: continuously variable between all ranges. Extends maximum deflection factor to at least 12.5 V/div.

POLARITY: NORM or INVT, selectable on Channel B only.

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

INPUT RC: 1 megohm ±2% shunted by approx 24 pF.

INPUT COUPLING: AC, DC, or Ground selectable. Ground position disconnects signal input and grounds amplifier input.

MAXIMUM INPUT

AC-Coupled: ±600V (dc + peak ac); rms ac <350V, 5 V/div to 20 mV/div; <150V at 10 mV/div (10 kHz or less).

DC-Coupled: <350V (rms) 5 V/div to 20 mV/div; <150V at 10 mV/div (10 kHz or less).

A + B OPERATION

Amplifier: bandwidth and deflection factors are unchanged; Channel B may be inverted for A − B operation.

COMMON MODE (A − B)

Frequency: dc to 1 MHz.

Rejection Ratio: at least 40 dB on 10 mV/div, at least 20 dB on all other ranges with verniers set for optimum rejection. Common mode signal amplitude equivalent to 30 div.

TRIGGERING SOURCE

A, B, A + B: on the signal displayed.

Chop and Alternate Modes: on Channel A only.

MAIN TIME BASE

SWEEP

Ranges: from 0.1 usec/div to 0.2 sec/div (20 ranges) in 1, 2, 5 sequence. ±3% accuracy with vernier in calibrated position.

Vernier: continuously variable between all ranges; extends slowest sweep to at least 0.5 sec/div. Vernier uncalibrated light indicates when vernier is not in CAL position.

Magnifier: expands all sweeps by a factor of 10 and expands fastest sweep to 10 ns/div. Accuracy ±5%.

SWEEP MODE

Normal: sweep is triggered by an internal or external signal.

Automatic: bright baseline displayed in absence of input signal. Triggering same as normal except low frequency limit is 40 Hz.

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.

TRIGGERING

Internal: dc to 35 MHz on signals causing 0.5 division or more vertical deflection increasing to 1.5 divisions at 75 MHz in all display modes except chop; dc to 100 kHz in CHOP mode.

External: from dc to 35 MHz on signals 50 mV p-p or more, increasing to 100 mV p-p at 75 MHz.

Input RC: 1 megohm, ±2% shunted by approximately 27 pF.

Level and Slope:

Internal: at any point on the vertical waveform displayed.

External: continuously variable from +1.5V to −1.5V on either slope of the trigger signal. Maximum input, ±100V.

Coupling: (AC, DC, HF REJ, LF REJ).

AC: attenuates signals below approx 20 Hz.

LF REJ: attenuates signals below approx 15 kHz.

HF REJ: attenuates signals above approx 30 kHz.

TRIGGER HOLDOFF: time between sweeps continuously variable, exceeding one full sweep at 20mS/div and faster.

DELAYED TIME BASE

SWEEP

Ranges: from 0.1 usec/div to 0.1 sec/div (19 ranges) in 1, 2, 5 sequence. ±3% accuracy with vernier in calibrated position.

Vernier: continuously variable between all ranges; extends slowest sweep to 0.25 sec/div.

TRIGGERING

Internal: dc to 35 MHz on signals causing 0.5 divisions or more vertical deflection increasing to 1 division at 75 MHz in all display modes except chop; dc to 100 kHz in CHOP mode.

Automatic: delayed sweep is automatically triggered at end of delay time.

Level and Slope

Internal: at any point on the vertical waveform displayed.

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of the Model 1707A. Installation procedures and precautions are presented in step-by-step order. The procedures for making a claim for warranty repairs and for repacking the instrument for shipment are also described in this section.

2-3. INITIAL INSPECTION.

2-4. The instrument was inspected mechanically and electrically before shipment. Upon receipt, inspect it for damage that may have occurred in transit. Check for broken knobs, bent or broken connectors, and dents or scratches. If damage is found, refer to the claims paragraph in this section. Retain the packing material for possible future use.

2-5. Check the electrical performance of the instrument immediately after receipt. Refer to Section V for the performance check procedure. The performance check will determine whether or not the instrument is operating within the specifications listed in Table 1-1. Initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to the claims paragraph in this section.

WARNING

Voltages are present inside the instrument when the power switch is off and ac power cord connected.

2-6. CLAIMS.

2-7. The warranty statement applicable to this instrument is printed inside the front cover of this manual. Refer to the rear of this manual for the CRT warranty statement. If physical damage is found or if operation is not as specified when the instrument is received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office immediately (refer to the list in back of this manual for addresses). The HP Sales/Service Office will arrange for repair or replacement without waiting for settlement of the claim with the carrier.

2-8. PREPARATION FOR USE.

2-9. THREE-CONDUCTOR AC POWER CABLE.

2-10. For the protection of operating personnel, Hewlett-Packard Company recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three-conductor ac power cable that, when connected to an appropriate receptacle, grounds the instrument through the offset pin. The power jack and mating plug of the power cord meet International Electrotechnical Commission (IEC) safety standards. To preserve this protection feature when operating from a two-contact outlet, use a three-conductor to two-conductor adapter, and connect the adapter wire to ground at the power outlet.

2-11. DC PLUG.

2-12. A dc plug is provided for operating from a dc line. The cable used for the dc power cord must be able to carry 2A of current with a voltage loss of less than 1 volt.

2-13. POWER REQUIREMENTS.

2-14. The Model 1707A can operate either from an AC or DC power source. For AC operation, the Model 1707A requires a 115–or 230–volt ±20%, single phase, 48 to 440 Hz source than can deliver 50 volt-amperes.

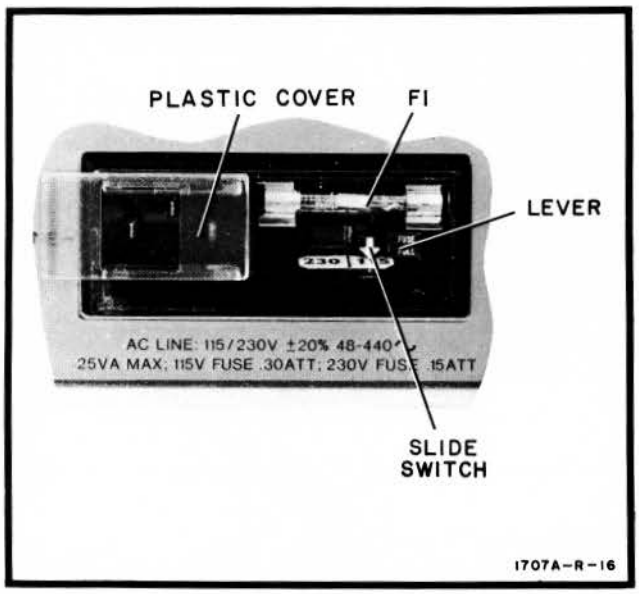


Figure 2-1. Rear Panel Module

2-15. A slide switch inside the power module (Figure 2-1) on the rear panel determines 115– or 230–volt operation. To check or change the position of this slide switch proceed as follows:

a. Turn instrument off and remove power cord from rear panel.

b. Move plastic cover to left (Figure 2-1).

c. Pull out lever under fuse. This removes fuse (0.5A/115V operation) from the instrument.

d. Check to see that slide switch (Figure 2-1) is to the right for 115V operation.

e. For 230V operation, move slide switch to the left and install a 0.25A slow-blow fuse.

2-16. For dc operation, the Model 1707A requires 11.5 to 36 volts 25 watts maximum. The instrument can also be operated from a battery pack. Depending on the power mode of operation, the POWER MODE switch (on rear panel) should be set to one of three positions: DC LINE, INTERNAL BATTERY, or AC LINE.

2-17. BATTERY INSTALLATION.

2-18. To install the battery pack in the Model 1707A see Figure 2-2 and proceed as follows:

NOTE

Read operating Note on battery before installation.

a. Set power switch to OFF and remove power cord from the rear-panel connector.

b. Set POWER MODE switch to INTERNAL BATTERY position.

c. Remove bottom cover.

d. Place battery pack in instrument as shown in Figure 2-2.

e. Fasten battery pack in place using screws provided.

f. Connect P1 to battery J1.

g. Replace bottom cover.

h. Set Power Switch to ON and observe POWER indicator. If power lamp is lighted resume normal operation.

CAUTION

If power lamp is flashing, battery is discharged. Damage to the battery will result if operated in this condition. Refer to Section III for battery charging procedure.

2-19. REPACKING FOR SHIPMENT.

2-20. If the Model 1707A 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.

2-21. Use the original shipping carton and packing material. If the original packing material is not available, the HP Sales/Service Office will provide information and recommendations on materials to be used. Materials used for shipping an instrument normally include the following:

a. A double-walled carton; refer to Table 2-1 for test strength required.

b. Heavy paper or sheets of cardboard to protect all instrument surfaces; use a nonabrasive material such as polyurethane or cushioned paper such as Kimpak around projecting parts.

c. At least 4 inches of tightly-packed, industry-approved, shock-absorbing material such as extra-firm polyurethane foam.

d. Heavy-duty shipping tape for securing outside of carton.

Table 2-1. Shipping Carton Test Strength

Gross Weight (lb)	Carton Test Strength (lb)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600

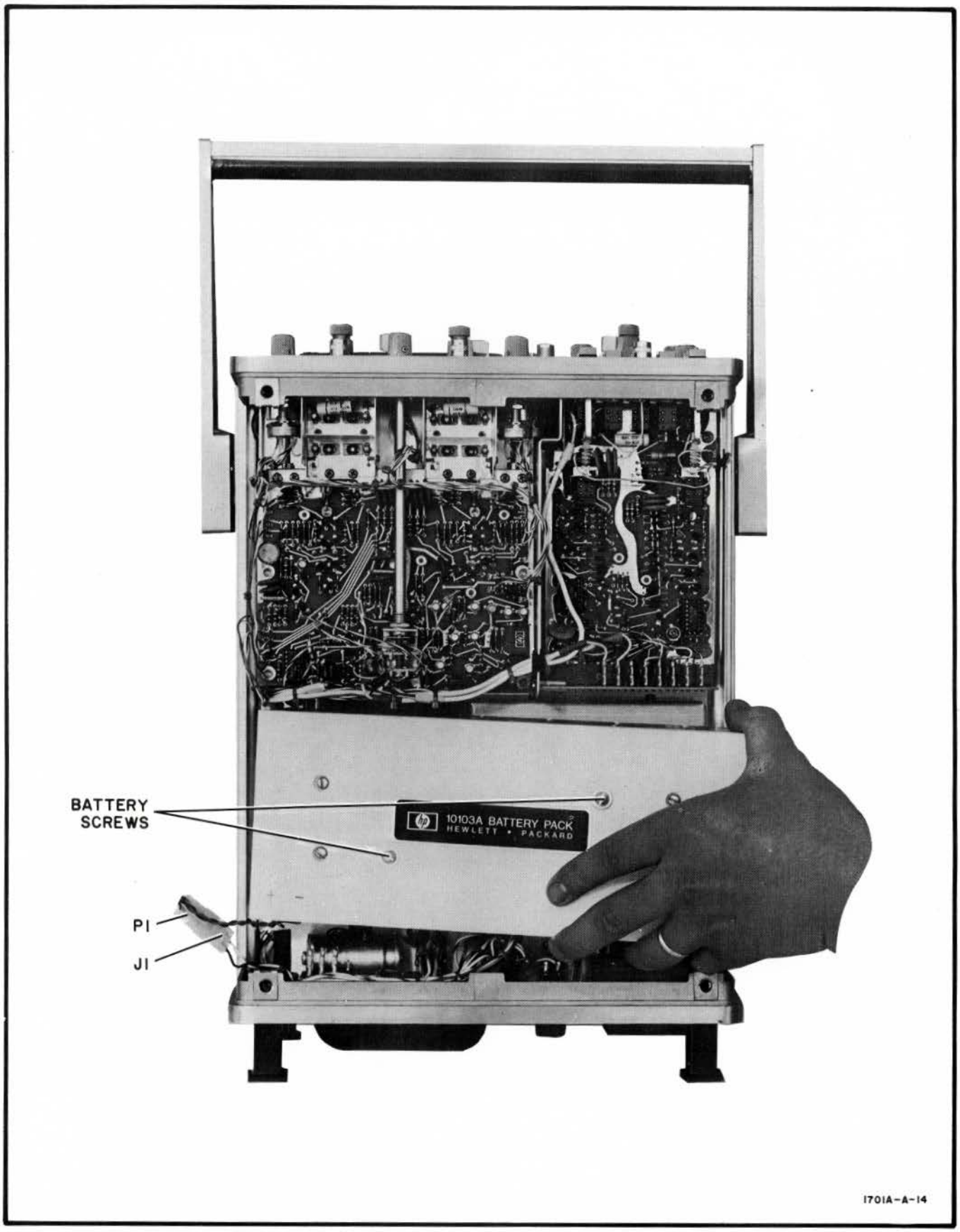


Figure 2-2. Battery Pack Installation

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides general operating instructions and applications information for the Model 1707A. Front- and rear-panel controls and connectors are identified and briefly described in Figure 3-1. General operating instructions are provided in Figures 3-2 thru 3-5 and operational adjustments are detailed in Figure 3-6. Delayed operation is detailed in Figure 3-7.

3-3. CONTROLS AND CONNECTORS.

3-4. The following paragraphs explain some of the controls and connectors in detail.

3-5. BEAM FINDER. Pressing this pushbutton increases the intensity and reduces amplifier gain enough to return beam to viewing area. This enables the operator to locate the beam and determine the action necessary to center a display (examples: reduce input signal amplitude, a change in coupling, adjust deflection factor, trigger level, dc balance, position controls, or intensity). When centered properly, the beam remains on the CRT when the pushbutton is released.

NOTE

Due to phosphor burn sensitivity, instruments with a P11 phosphor do not have the intensified function of the beam finder.

3-6. SCALE ILLUMINATION. This control adjusts the overall brightness of the CRT graticule. It should be adjusted for good contrast between the background and graticule. The SCALE ILLUM control is especially useful when using a hood to view the display or when photographing waveforms. Rotate the control to off when scale illumination is not needed.

3-7. TRACE ALIGN. The TRACE ALIGN adjustment compensates for external magnetic fields that may affect the alignment of the horizontal trace with the graticule. The alignment should be checked when the instrument is moved to a new location and adjustment made whenever necessary.

3-8. CALIBRATOR 1 VOLT. The 1 volt, 1 kHz square-wave output of the calibrator can be used for vertical sensitivity calibration and for divider probe compensation. The amplitude accuracy is ±1% and the frequency accuracy is ±10%.

3-9. FOCUS AND ASTIGMATISM. Both of these controls are used to obtain a sharp display. Normally, the ASTIGMATISM control need not be readjusted once it is set.

3-10. COUPLING (AC-GND-DC). This lever switch selects either capacitive (AC) or direct (DC) coupling of the input signal to the amplifier, or it grounds (GND) the amplifier input stage while disconnecting the input signal. The switch should be positioned to DC when viewing long duration pulses or dc levels of waveforms. AC should be selected when viewing ac waveforms having large dc levels. GND position is used to disconnect the signal source from the input of the amplifier and at the same time grounds the input of the amplifier. It is useful to use GND position to establish a reference.

3-11. DISPLAY. This control selects the type of display. Input signals may be displayed either singly or simultaneously as explained below.

a. Position A displays channel A input signal and selects channel A as a trigger source.

b. Position A + B displays the algebraic sum of the channel A and channel B input signal and selects the composite signal of channels A and B as a trigger source.

c. CHOP position presents a separate display of each input. Both inputs are displayed during the same sweep by switching between each channel at a rate of 100 kHz. This mode should be used to display low frequency signals. Trigger source in this mode is channel A.

d. ALT position presents each channel on alternate sweeps. This mode should be used to display high frequency signals. Trigger source in this mode is channel A.

e. Position B displays channel B input signal and selects channel B as a trigger source.

3-12. B POL. This control inverts the channel B display 180°. This control can also be used to present an A-B display. Set DISPLAY to A + B mode. Put B POL switch in INVT position. Display observed is A − B.

3-13. SWEEP DISPLAY. This switch is mounted concentric to the MAIN and DELAYED TIME/DIV controls

and determines the sweep display mode; MAIN SWEEP and DELAYED SWEEP are the two display modes. The function of each mode is as follows:

a. Main Sweep. In this mode, the main sweep sets a time base reference for the vertical signal. Main sweep controls are mounted on the right side of the front panel, and sweep speed is selected by MAIN TIME/DIV. If DELAYED TIME/DIV is set to OFF, sweep intensity is uniform. However, any other setting of DELAYED TIME/DIV causes the sweep to intensify during the time that the delayed sweep is generated. This feature makes it possible to select a point of interest on the main sweep time base before viewing in the DELAYED SWEEP mode.

b. Delayed Sweep. Main sweep is not displayed in this mode. Only the intensified portion of the sweep displayed in MAIN SWEEP is used as a time base. The sweep speed is controlled by DELAYED TIME/DIV.

3-14. TIME/DIV. MAIN and DELAYED TIME/DIV switches determine the amount of time to sweep horizontally one graticule division. Both controls are concentric and interlocked so the delayed sweep is always faster than the main sweep. Main sweep speeds are selectable by MAIN TIME/DIV in twenty ranges from 0.1 usec/div to 0.2 sec/div. Nineteen ranges of delayed sweep speeds from 0.1 usec/div to 0.1 sec/div are provided by DELAYED TIME/DIV. Also, by switching the MAG control to X10, a display can be expanded up to ten times, increasing the fastest sweep to 10 nsec/div.

3-15. VERNIER. Sweep speed is calibrated to TIME/DIV when both the MAIN and DELAYED VERNIER controls are set fully clockwise to the CAL detent position. As the VERNIER controls are turned counterclockwise, the VERNIER UNCAL indicator lights and sweep speeds decrease. The MAIN VERNIER control extends the slowest sweep to at least 0.5 sec/div. The DELAYED VERNIER control extends the slowest sweep to at least 0.25 sec/div. The vernier controls are useful for making continuous adjustments of sweep speed, however TIME/DIV readings are uncalibrated.

3-16. TRIGGER LEVEL. These controls select the point on the sync signal that starts the sweep. Triggering point is adjustable at any level on the displayed signal in INT position. In the EXT position the triggering point is adjustable from +1.5V to −1.5V along the sync signal. DELAYED TRIGGER LEVEL has no function when DELAYED SWEEP MODE is set to AUTO.

3-17. TRIGGER HOLDOFF. This adjustment is a dual purpose control. It is a log tapered potentiometer. When the control is rotated out of detent position, the first portion of the control acts as a high frequency stability control. This prevents double triggering on high frequency waveforms. As the control is rotated further out of detent position, it functions as a trigger hold off and allows the instrument to synchronize on complex waveforms.

3-18. SWEEP MODE. This group of controls selects the type of main and delayed sweep triggering. Main sweep free-runs in AUTO giving a bright base line in the absence of a sync signal. However, if a sync signal 40 Hz or greater is applied, it overrides free-run operation and triggers the sweep. Due to its convenience, the AUTO sweep mode can be used for most applications. Use NORM if the sync signal is erratic or is less than 40 Hz. A sync input signal is always needed in NORM to generate a sweep.

3-19. In the SINGLE mode, the sweep is generated only once. To sweep again, push RESET pushbutton and release. This arms the sweep circuit. This feature is particularly useful for viewing or photographing single transient waveforms.

3-20. When the DELAYED SWEEP MODE is set to AUTO, the delayed sweep starts at the end of the delay time. In the TRIG mode, the delayed sweep is started by the first sync signal after the delay time.

3-21. TRIGGER. Main and delayed trigger source is selected by this group of controls. In the INT position, sweep is synchronized to the vertical deflection signal.

3-22. When EXT is selected, the sweep is triggered by sync signals applied to the EXT TRIG INPUT connector.

3-23. Sync Coupling (AC-DC). These controls determine the type of main and delayed sync coupling. Direct coupling (DC) is normally used for sync signals from dc to less than 20 Hz. Capacitive coupling (AC) blocks the dc component of a sync signal and passes only the ac component. AC coupling does, however, attenuate signals below 20 Hz. LF REJ attenuates signals below approximately 15 kHz and is used to prevent power line or other low frequency signals from triggering the sweep. HF REJ attenuates signals above approximately 30 kHz and can be used to prevent high frequency noise from triggering the sweep.

3-24. SLOPE. These controls determine whether the sweep triggers on the positive-going (+) or negative-going (−) portion of the sync signal. When the DELAYED SWEEP MODE is set to AUTO, the DELAYED SLOPE control has no function.

3-25. BATTERY RECHARGE OPERATION.

3-26. To recharge Model 10103A Battery Pack proceed as follows:

a. Set front panel POWER switch to OFF.

b. Set rear panel POWER MODE switch to AC LINE.

c. Connect ac power to the instrument. Recharge time is approximately 14 hours.

d. To maintain a fully charged battery place POWER switch to ON position. This will apply a small trickle charge of about 40 mA to the batteries.

3-27. PREOPERATIONAL ADJUSTMENTS.

3-28. FOCUS AND ASTIGMATISM ADJUST.

To adjust focus and astigmatism proceed as follows:

a. Set all pushbuttons out.

b. Set channel A controls as follows:

VOLTS/DIV	.01
DISPLAY	A
POSITION	Center Trace on CRT

c. Set MAIN TIME/DIV to .2 SEC.

d. Turn MAIN VERNIER full ccw.

e. Set INTENSITY to observe dot.

f. Adjust FOCUS and ASTIGMATISM controls for best defined dot, as dot moves slowly across CRT.

3-29. INITIAL TURN-ON.

3-30. To place the Model 1707A into operation perform the following steps:

a. Set INTENSITY to full counterclockwise.

b. Set vertical POSITION A and B to midrange.

c. Set DISPLAY to CHOP.

d. Set VOLTS/DIV to 5V.

e. Set vertical vernier channel A and B to CAL detent.

f. Place B POL to NORM.

g. Set vertical coupling channel A and B to GND.

h. Set HORIZONTAL POSITION to midrange.

i. Set MAIN TIME/DIV to 1 mSEC.

j. Set DELAYED TIME/DIV to OFF.

k. Set MAIN and DELAYED VERNIER to CAL detent.

l. Set SWEEP MODE to AUTO.

m. Set TRIGGER to INT.

CAUTION

Verify proper position of POWER MODE switch located on rear panel.

n. Apply operating power and allow fifteen minutes warm up time.

3-31. OPERATING PROCEDURES.

3-32. Figures 3-2 thru 3-7 are operating plates containing step-by-step operating procedures indexed to photographs. The figures describe the operations to be accomplished in achieving the different modes of operation.

3-33. OPERATORS PERFORMANCE CHECK.

3-34. The operation of the Model 1707A may be checked without use of additional test equipment by using the CAL 1 VOLT output as a signal source. These operating tests will functionally check each of the operating display modes and the operation of the front-panel controls. To check specifications listed in Table 1-1, refer to Section V for Performance Checks. The operation check must be performed in the sequence given. Do not attempt to start a procedure in mid-sequence, as succeeding steps depend on control settings and results of previous steps. If any of the results are unobtainable, refer to Section V, Performance Checks and Adjustment Procedures, or Section VIII, Schematics and Troubleshooting.

a. Set Model 1707A controls as follows:

CHANNEL A	
VOLTS/DIV	.2
Coupling	AC
VOLTS/DIV Vernier	CAL
POSITION	as required
DISPLAY	A
B POL	NORM
CHANNEL B	
VOLTS/DIV	N/A
Coupling	N/A
VOLTS/DIV Vernier	N/A
POSITION	N/A
HORIZONTAL POSITION	as required
MAIN VERNIER	CAL
DELAYED VERNIER	CAL
Sweep Display	MAIN SWEEP
MAIN TIME/DIV	0.5 mSEC
DELAYED TIME/DIV	OFF
AUTO/NORM	AUTO
AUTO/TRIG	AUTO
TRIGGER	INT
MAIN SLOPE	+
DELAYED SLOPE	+
MAIN TRIGGER LEVEL	as required
DELAYED TRIGGER LEVEL	N/A
TRIGGER HOLDOFF	NORM
MAG	X1

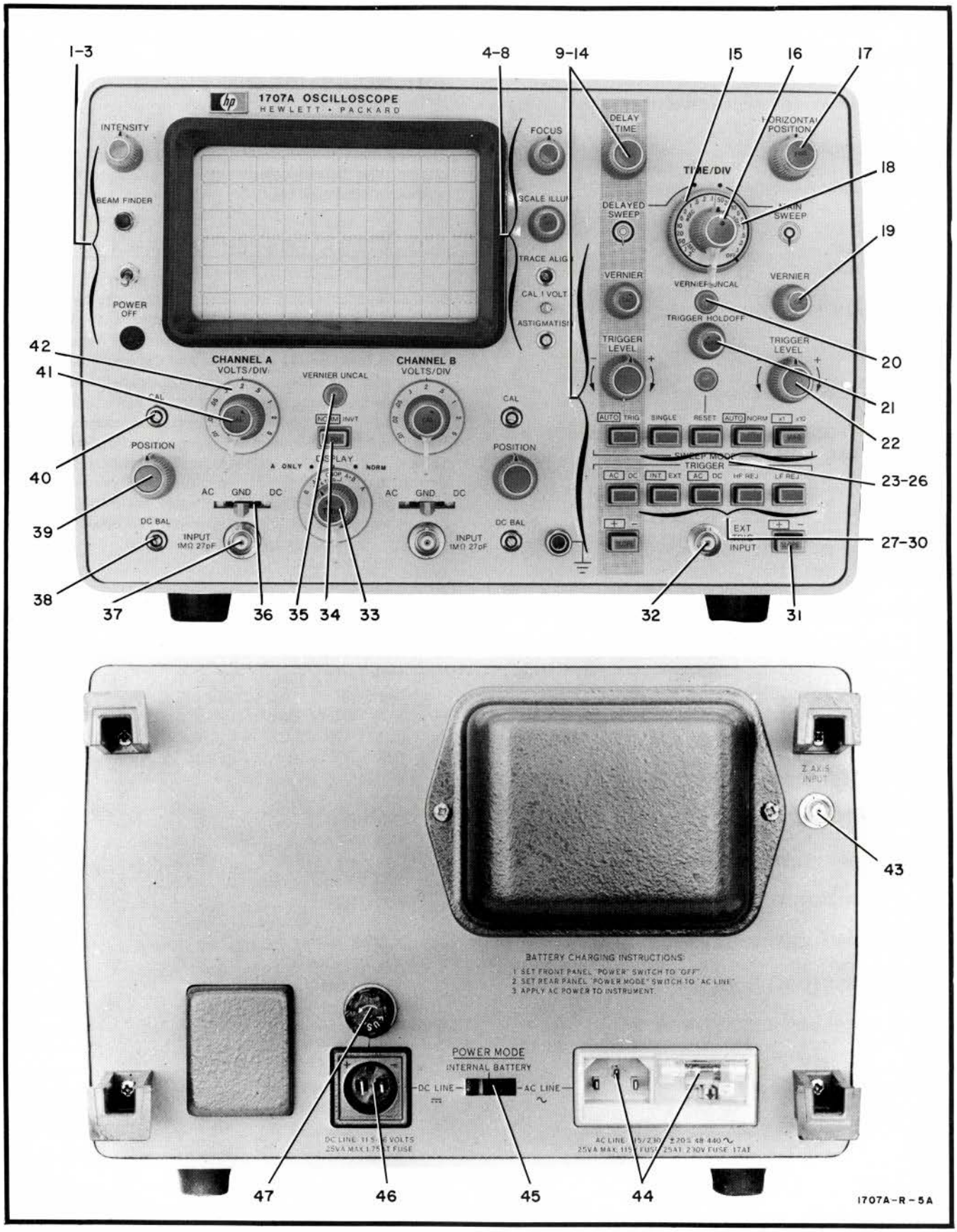
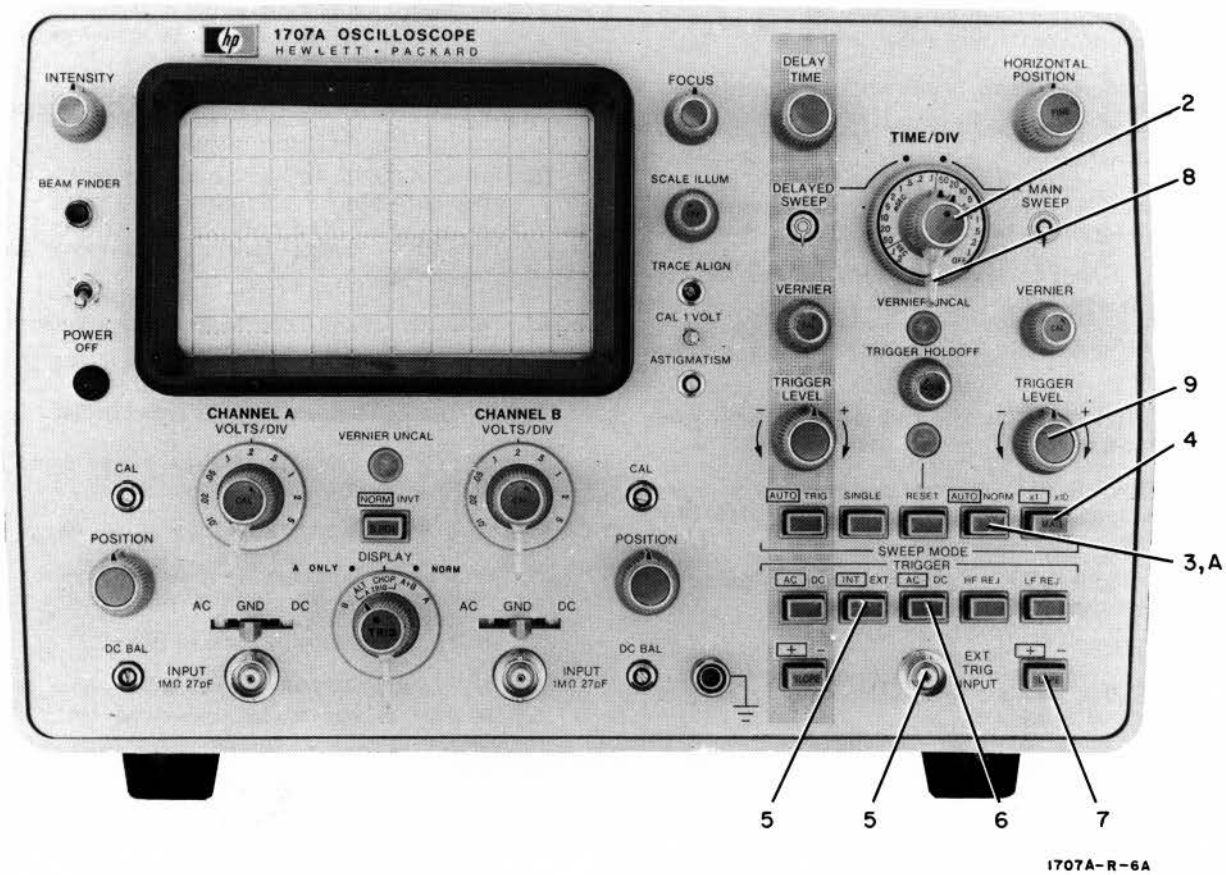


Figure 3-1. Controls and Connectors

1. INTENSITY. Controls brightness of display.
2. BEAM FINDER. Returns display to viewing area.
3. POWER-OFF. Toggle switch with indicator light for turning oscilloscope on and off. Light flashes when optional battery is discharged.
4. FOCUS. Adjusts writing beam for sharpest trace.
5. SCALE ILLUM. Controls brightness of scale illumination.
6. TRACE ALIGN. Adjust to align trace with horizontal graticule line.
7. CAL 1 VOLT. Provides a 1-kHz square wave at 1 volt ±1%.
8. ASTIGMATISM. Adjusts roundness of writing spot.
9. DELAY TIME. Selects time delay between start of main sweep and start of delayed sweep.
10. VERNIER. Provides continuous control of sweep time between calibrated positions of TIME/DIV switch.
11. TRIGGER LEVEL. Selects amplitude point on trigger signal that starts sweep.
12. AUTO/TRIG.
    a. AUTO. Delayed sweep starts automatically at end of delay time.
    b. TRIG. Delayed sweep arms at end of delay time and is ready to be triggered internally.
13. AC/DC Selects delayed sweep trigger signal coupling.
14. SLOPE +/−. Selects slope of delayed trigger signal that starts sweep.
15. TIME/DIV. Controls sweep time in DELAYED mode. Controls intensified portion of sweep in MAIN mode.
16. Display. Controls MAIN or DELAYED SWEEP.
17. HORIZONTAL POSITION. Controls coarse and fine horizontal position of display.
18. TIME/DIV. Controls sweep time in MAIN SWEEP mode.
19. VERNIER. Provides continuous control of sweep between calibrated positions of TIME/DIV switch.
20. VERNIER UNCAL. Lights when either MAIN or DELAY VERNIER is not in CAL position.
21. TRIGGER HOLDOFF. Provides continuous control of time between sweeps. NORM-hold off time is minimum.
22. TRIGGER LEVEL. Selects amplitude point on trigger signal that starts sweep.
23. SINGLE. Selects single or normal sweep operation.
24. RESET. Resets sweep in SINGLE sweep mode; reset light indicates when sweep is armed.
25. AUTO-NORM.
    a. AUTO. Automatic sweep in absence of trigger signal or triggered sweep by applying a trigger signal above 40 Hz rate.
    b. NORM. Sweep is triggered only by applying a trigger signal.
26. MAG X1/X10. In X10 position, sweep is magnified ten times.
27. INT-EXT. Selects internal or external sweep triggering.
28. AC/DC. Selects main sweep trigger signal coupling.
29. HF REJ. Attenuates trigger signals above 30 kHz.
30. LF REJ. Attenuates trigger signál below 15 kHz.
31. SLOPE +/−. Selects slope of trigger signal that starts a sweep.
32. EXT TRIG INPUT. External trigger input.
33. DISPLAY. Selects type of display; either single channel or dual channel and trigger source.
34. B POL. Controls channel B polarity.
35. VERNIER UNCAL. Lights when either vernier control is out of full clockwise CAL detent position.
36. Coupling (AC-GND-DC). Selects capacitive (AC) or direct (DC) coupling of input signal, or grounds the amplifier stage while disconnecting the INPUT.
37. INPUT. Input signal connects to BNC connector.
38. DC BAL. Adjust to minimize vertical shift of trace when Vernier is rotated.
39. POSITION. Varies vertical position of display.
40. CAL. Adjust to calibrate amplifier with setting of VOLTS/DIV switch.
41. Vernier (CAL). Provides continuous adjustments of volts/div between calibrated positions of VOLTS/DIV switch.
42. VOLTS/DIV. Selects the vertical deflection factor necessary for calibrated measurements.
43. Z-AXIS INPUT. Z-Axis input connector.
44. AC LINE. Power input from ac line. Power Module contains ac line fuse (.50 amp slow-blow for 115V, .25 amp slow-blow for 230V) and line selector switch.
45. POWER MODE. Selects line, ac line or internal battery operation.
46. DC LINE. Power input for dc line operation.
47. FUSE. 2 amp slow-blow fuse in circuit for all modes of operation.

Figure 3-1. Controls and Connectors (Cont'd)



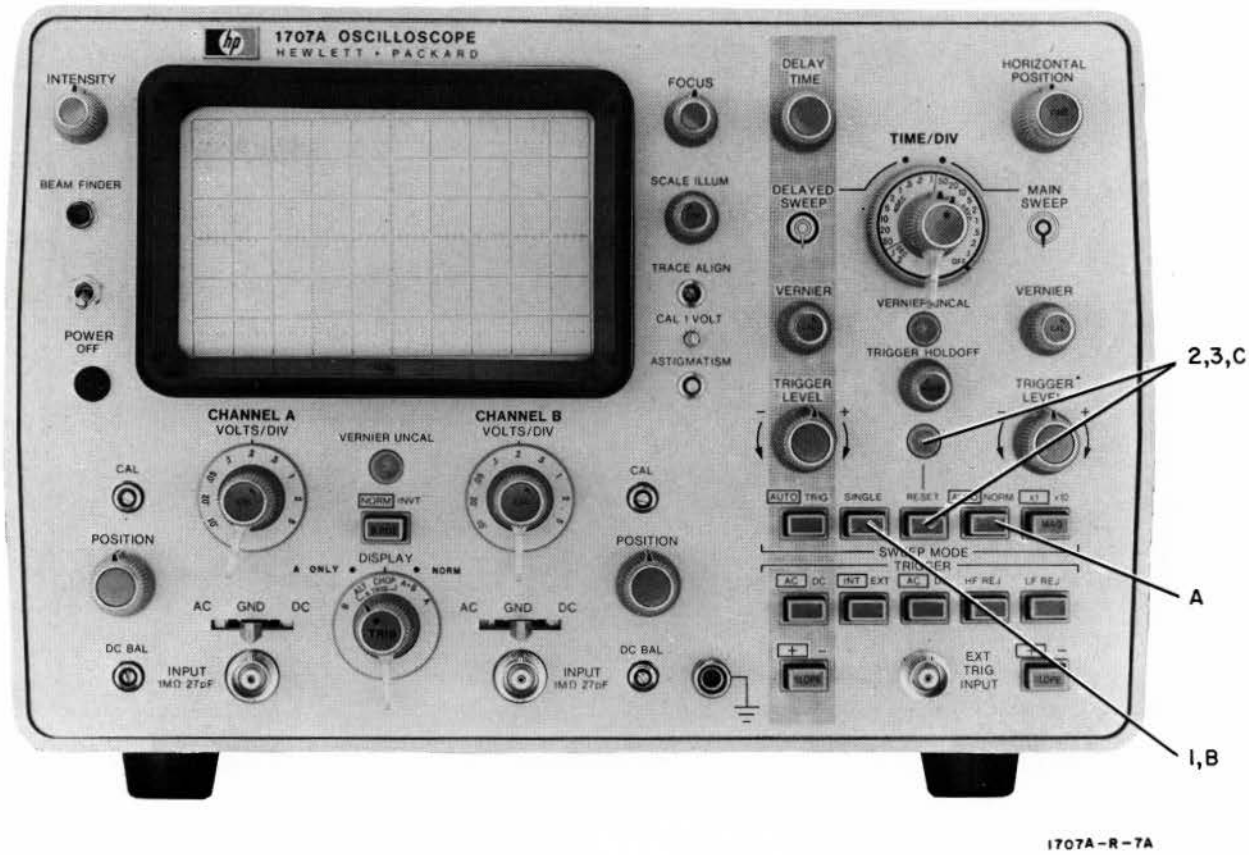
AUTO OPERATION

1. Adjust vertical controls for desired display, and connect vertical input signal.
2. Set display mode to MAIN SWEEP.
3. Set SWEEP MODE to AUTO.
4. Set MAG switch to X1.
5. Set TRIGGER to desired trigger source. If EXT trigger is selected, connect trigger signal to TRIG INPUT jack.
6. Set Coupling to desired position.
7. Set MAIN SLOPE to desired position.
8. Turn MAIN TIME/DIV to desired sweep speed.
9. Adjust MAIN TRIGGER LEVEL for stable display.

NORM OPERATION.

A. Press SWEEP MODE, AUTO/NORM pushbutton in.

Figure 3-2. Auto and Norm Operation



SINGLE (RESET) NORM OPERATION

1. Perform steps 1 through 8 for AUTO operation (Figure 3-2) except press SINGLE pushbutton in and AUTO/NORM in.
2. Press and release RESET pushbutton. RESET indicator lamp will light to indicate sweep circuit is armed.
3. When sweep is armed, the first trigger input will initiate sweep cycle. RESET lamp will extinguish at completion of cycle, and circuit must be rearmed for next cycle.

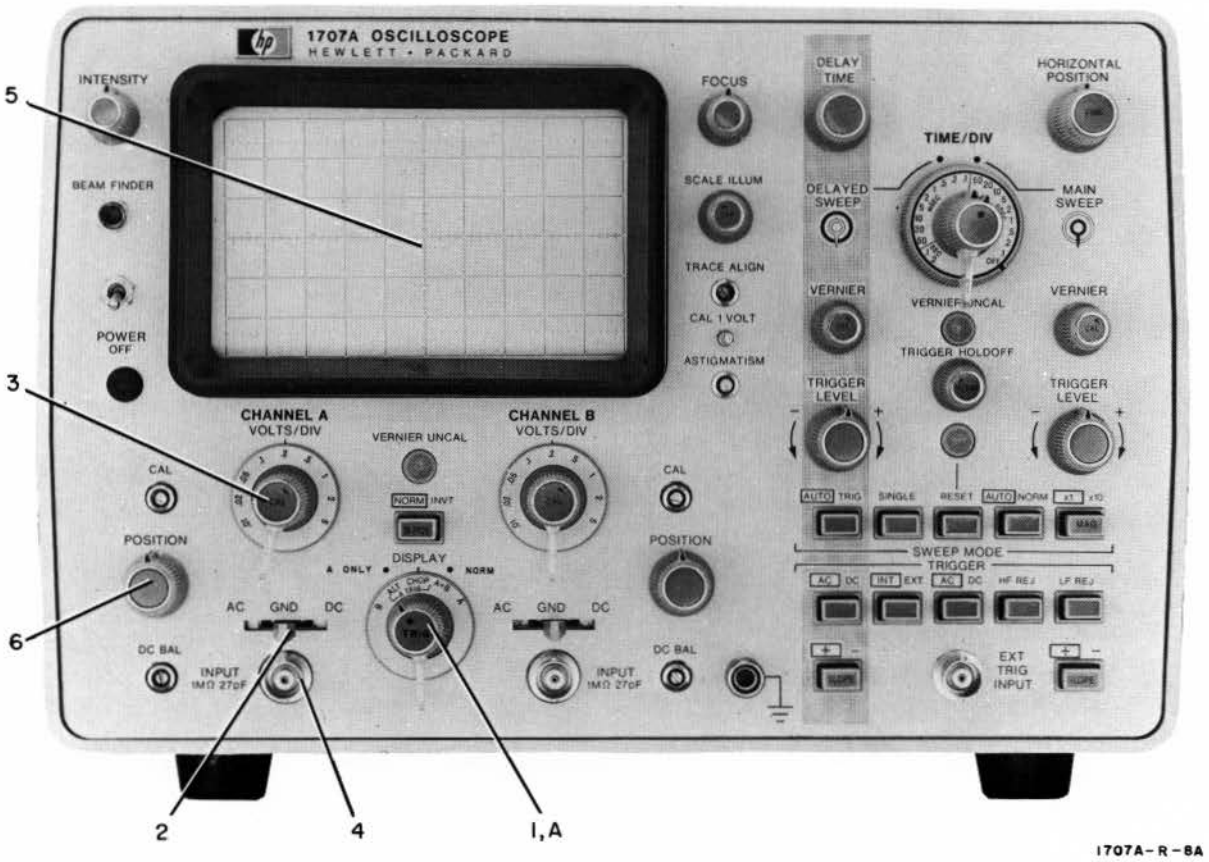
SINGLE (RESET) OPERATION

A. Perform steps 1 through 8 for AUTO operation (Figure 3-2).

B. Press SINGLE pushbutton.

C. Press and release RESET pushbutton. Sweep immediately starts due to auto circuit inside oscilloscope. These two modes of operation are ideal for use in photographing waveforms.

Figure 3-3. Single Sweep Operation



A OR B, SINGLE CHANNEL OPERATION

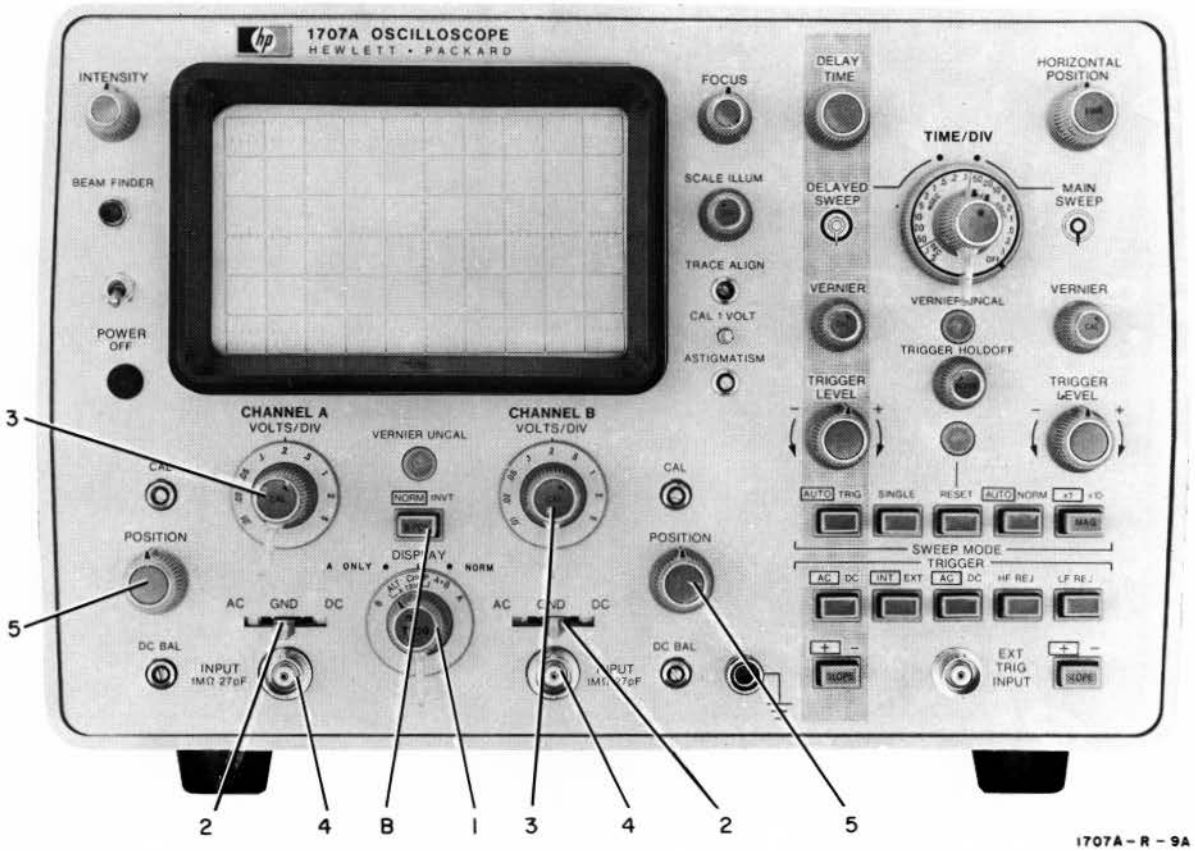
1. Set DISPLAY to A or B, and perform the following steps for the selected channel.
2. Set Coupling to AC or DC.
3. Set VOLTS/DIV to desired range.
4. Connect input signal to channel A or channel B INPUT connector.
5. Obtain a base line (Figure 3-1, 3-2).
6. Adjust POSITION for desired vertical position of display.

CHOPPED OR ALTERNATE, DUAL CHANNEL

A. Set DISPLAY to CHOP or ALT position.

B. Perform steps 2 through 6 (A or B, single channel) for both vertical channels.

Figure 3-4. Single and Dual Channel Operation



A + B OPERATION

1. Set DISPLAY to A + B.
2. Set Coupling to AC or DC.
3. Set VOLTS/DIV to desired range.
4. Connect desired vertical signals to channel A and channel B INPUT connector.
5. Adjust channel A POSITION and channel B POSITION controls for desired display on screen.

NOTE

In the A + B mode only one trace is observed. This trace is the sum of A + B and either channel POSITION control will vary the vertical position display.

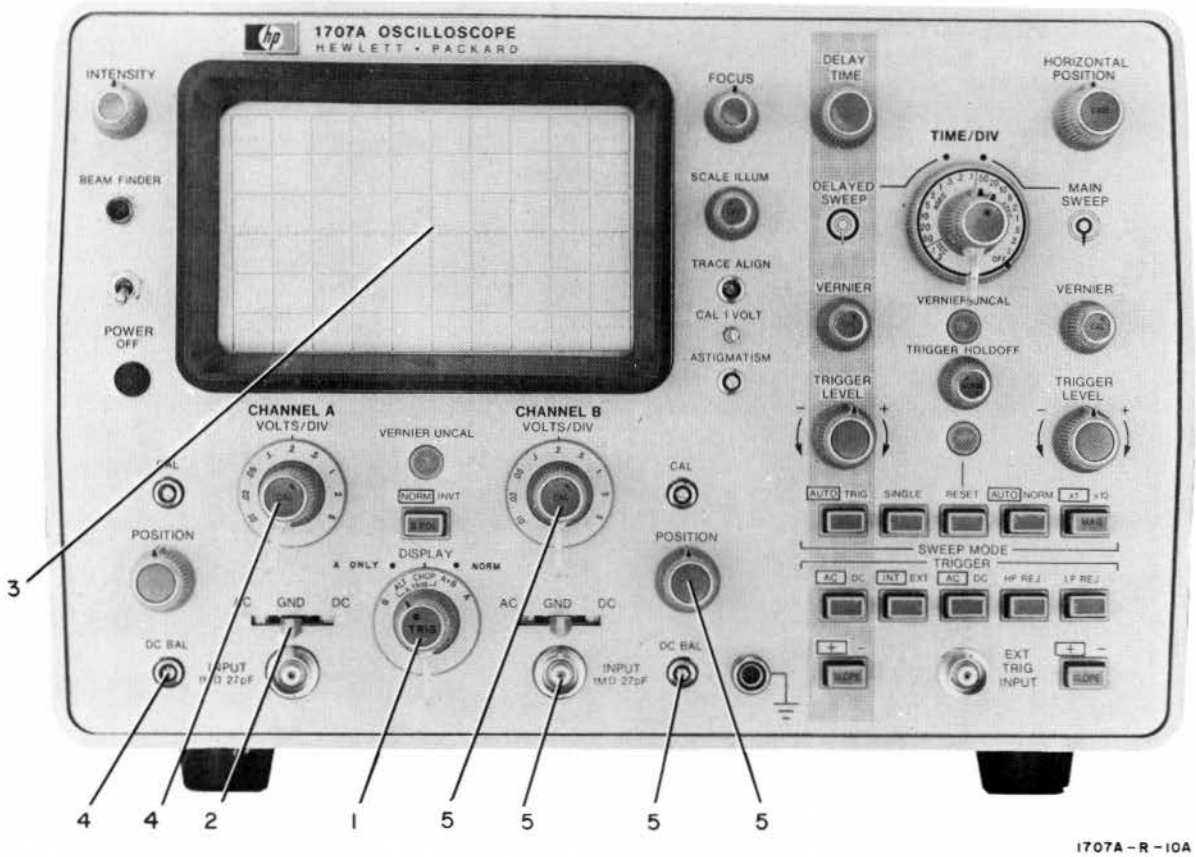
A – B OPERATION

A. Repeat steps 1 and 2 of A + B operation.

B. Press B POL pushbutton in (INVT).

C. Repeat steps 3 through 5 of A + B operation.

Figure 3-5. A + B and A – B Operation



DC BALANCE ADJUST

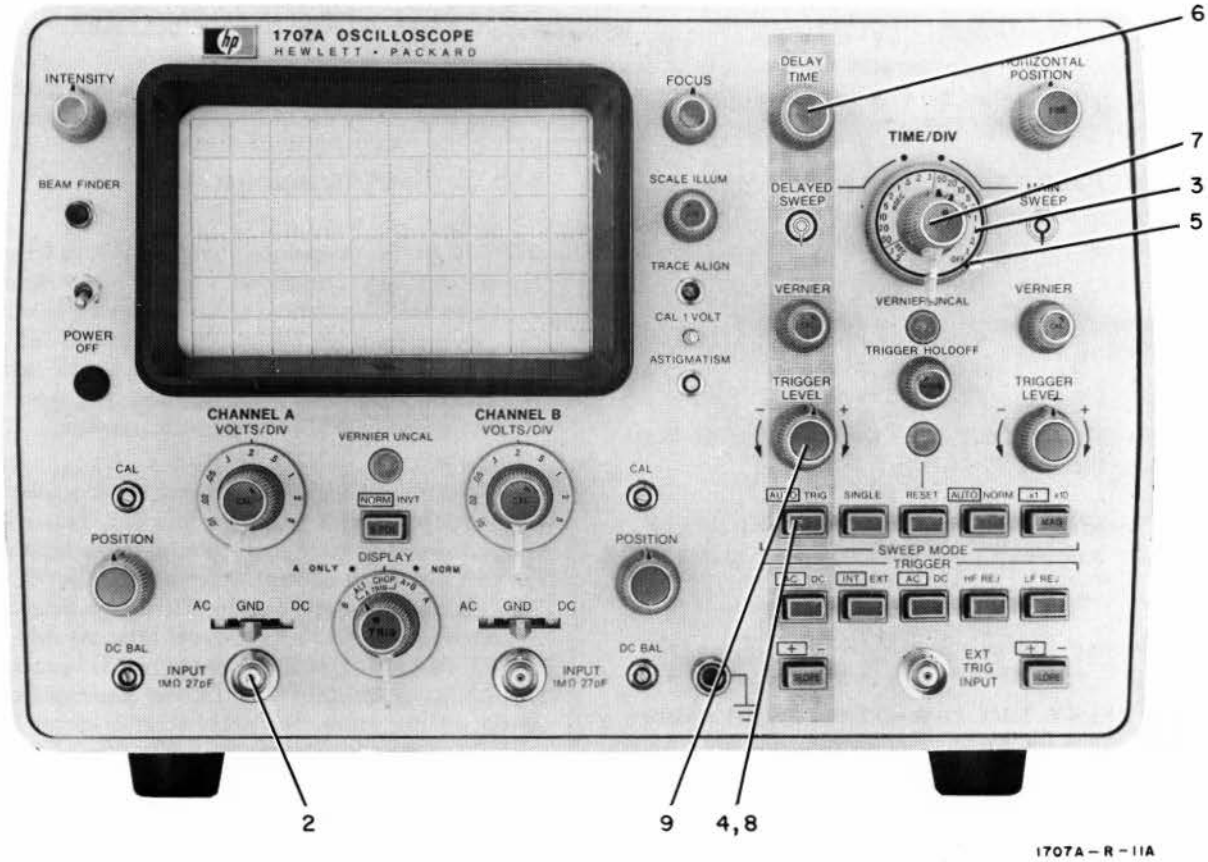
1. Set DISPLAY to A.
2. Set Coupling to GND.
3. Obtain a base line (Figure 3-2, AUTO).
4. Adjust DC BAL until vertical trace does not shift when turning VOLTS/DIV vernier from CAL to maximum attenuation.

NOTE

If trace is not on CRT screen. Press BEAM FINDER pushbutton and adjust DC BAL until trace remains on screen.

5. Repeat steps 1 thru 4 for channel B.

Figure 3-6. Amplifier Balance Adjust



1. Obtain a base line as shown in Figure 3-2.
2. Apply signal to channel A INPUT.
3. Set MAIN TIME/DIV to desired sweep speed.
4. Set DELAYED AUTO/TRIG to AUTO.
5. Set DELAYED TIME/DIV to desired setting.
6. Adjust DELAY TIME so intensified portion of trace is over area of trace to be investigated.
7. Turn sweep mode switch to DELAYED SWEEP. Intensified portion of main sweep is now displayed across entire CRT.
8. If jitter is observed on delay sweep, set DELAYED AUTO/TRIG to TRIG. This allows the instrument to trigger on the signal of interest and reduces jitter.
9. Adjust DELAYED TRIGGER LEVEL for a stable display.

Figure 3-7. Delayed Operation

b. Set INTENSITY, FOCUS and POSITION controls for desired display in center of screen.

c. Connect CAL 1 VOLT output to channel A INPUT.

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

e. Set DELAYED TIME/DIV to 0.2 mSEC. Observe an intensified portion of sweep.

NOTE

Intensified portion should cover 4 to 5 divisions.

f. Adjust DELAY TIME until the intensified portion is centered on the CRT.

g. Set sweep mode switch to DELAYED SWEEP. Observe that intensified portion is expanded to full 10 divisions.

h. Set sweep display switch to MAIN SWEEP.

i. Vary DELAY TIME control. Observe that intensified portion moves smoothly along the display.

j. Set DELAYED AUTO/TRIG control to TRIG.

k. Adjust DELAYED TRIGGER LEVEL for a stable intensified portion of the trace.

l. Vary DELAY TIME control. Observe that leading edge of intensified portion jumps from one positive slope leading edge to next.

m. Set DELAYED TIME/DIV to OFF.

n. Rotate MAIN VERNIER ccw to stop. Observe 15 or more pulses between first and eleventh graticule lines.

o. Disconnect calibrator signal from vertical amplifier.

p. Set MAIN TIME/DIV to .1 SEC and MAIN TRIGGER LEVEL to cw position.

q. Set AUTO/NORM to NORM and select SINGLE operation.

r. Press RESET pushbutton. Observe no sweep.

s. Rotate MAIN TRIGGER LEVEL to full ccw position. Observe one sweep and RESET indicator goes off after sweep.

t. Set AUTO/NORM to AUTO.

u. Press RESET pushbutton. Observe one sweep.

3-35. OPERATING INFORMATION.

3-36. The following paragraphs provide additional information concerning use of specific function over another.

3-37. AUTO VERSUS NORM.

3-38. In AUTO operation, there will always be a baseline except in trigger operation. A trigger of 40 Hz or higher overrides AUTO operation and produces a stable presentation. Adjustment of MAIN TRIGGER LEVEL 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 to generate a sweep.

3-39. AUTO delayed sweep operation is achieved when DELAYED AUTO/TRIG button is out. This causes the delayed sweep to start at the end of delay time as set by the DELAY TIME control. When the DELAYED AUTO/TRIG is in depressed position, TRIG, the delayed sweep is started by the first trigger signal after the delay time as set by DELAY TIME control. That is, providing the DELAYED TRIGGER LEVEL is adjusted for stable sweep. In this mode, the delay time is longer than that set by the DELAY TIME control.

3-40. AC VERSUS DC.

3-41. AC coupling removes the dc level of trigger signals and attenuates signals below about 20 Hz. For example, if the trigger signal contains vertical position voltage, extreme levels can cause the signal to move out of the trigger level range of the Model 1707A and lose the trigger operation. Use LF REJ coupling to prevent low frequency noise from triggering the sweep.

3-42. DELAYED SWEEP.

3-43. After obtaining a desired display, any portion can be expanded up to 10 ns per division with 5% accuracy (X10 magnification) or 100 ns per division with 3% accuracy. This permits viewing of critical risetimes or signal shapes with increased resolution. The portion to be expanded is selected by the DELAY TIME control in main sweep operation. It is then expanded to the sweep speed selected by the DELAYED TIME/DIV switch after delayed sweep operation is selected. Because the sweeps are independent, if the MAIN VERNIER is out of CAL position the delayed sweep is still calibrated.

3-44. Sweep jitter can be reduced by use of the delayed operation. By using TRIG mode instead of AUTO in delayed sweep operation, the delayed sweep starts on a new trigger. This reduces the jitter that has accumulated since start of the main sweep.

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains both an overall and detailed explanation of circuit theory. Refer to the overall block diagrams and Schematics in Section VIII while reading the theory.

4-3. GENERAL THEORY.

4-4. An overall explanation of circuit operation based on block diagrams (Figure 8-12 and Figure 8-13) is presented to generate a basic understanding of the instrument in preparation for the detailed theory that follows. For simplicity, the block diagrams are drawn for function and do not show all circuit details.

NOTE

For circuit theory, a logic high (1) is a more positive voltage and a logic low (0) is a less positive voltage.

4-5. This instrument consists of a CRT, line rectifier, gate assembly, and three modules. The modules are as follows: vertical amplifier modules containing attenuators, vertical preamplifier, delay line and vertical output amplifier; horizontal amplifier module containing trigger assembly, horizontal mother board, main and delayed integrator, main and delayed sweep time assembly, hold-off and comparator, horizontal mode assembly, horizontal preamplifier and horizontal output amplifier; and, power supply module containing low voltage mother board, low voltage converter, low voltage rectifier and filter, and high voltage oscillator.

4-6. BLOCK DIAGRAM (SCHEMATIC 1).

4-7. INPUT ATTENUATOR.

4-8. The attenuators are compensated voltage-divider types. They provide division ratios of 1, 2, 5, 10 and 100 giving nine separate sensitivities. Each input sensitivity range has an input capacitance adjustment and an attenuator compensation adjustment. Coupling (AC, GND, and DC) is also controlled in the attenuator stages.

4-9. VERTICAL PREAMPLIFIER.

4-10. The vertical preamplifier provides amplification to the input signals for drive to the vertical output amplifier. Channel A sync and composite sync signals originate in the vertical preamplifier. The sync signals are applied to the trigger assembly for internal triggering. Channel switching, chop operation, and display mode are also accomplished in the preamplifier (Schematic 7).

4-11. DELAY LINE.

4-12. The delay line provides approximately 160 ns delay to the vertical signal allowing the horizontal circuits sufficient time to react to the trigger signal so the display is in the proper time relationship.

4-13. VERTICAL OUTPUT AMPLIFIER.

4-14. The vertical output amplifier provides drive to the CRT vertical plates.

4-15. TRIGGER CIRCUITS.

4-16. The trigger assembly provides the main and delayed trigger signals. Sweep mode and trigger mode are selected in this assembly. The main trigger circuits provides two outputs to the main integrator (Schematic 10). One output is the main trigger and the other output is the bright line auto output. The bright line auto output is provided in AUTO mode only. The delayed trigger circuit provides the trigger to the delayed integrator (Schematic 12).

4-17. MAIN INTEGRATOR.

4-18. The main integrator initiates a horizontal sweep from the trigger input. When the trigger signal is applied to the input amplifier, the Miller integrator activates and produces the horizontal sweep ramp. The Miller integrator is connected to the main sweep timing components (Schematic 11). The MAIN TIME/DIV switch controls the ramp output from the Miller integrator. The output of the Miller integrator is amplified and applied to the horizontal amplifier circuits.

4-19. The horizontal sweep is also compared to a 12-volt reference by the ramp comparator which drives the main integrator set-reset multivibrator. The set-reset multivibrator, in conjunction with the hold-off and comparator circuit, controls the amplitude and timing sequence of the sweep ramp. When the sweep ramp reaches 12 volts, the ramp comparator turns on and resets the trigger set-trigger gates to a logic high (1). The signal from the hold-off amplifier determines the holdoff time of the circuits and sets the trigger set-trigger gates to a logic low (0) for a new sweep.

4-20. When the bright line auto circuit is used, the set-reset multivibrator provides a ground for the bright line auto signal and terminates the sweep. This allows the sweep signal to return to its starting point.

4-21. At the same time the main ramp is generated, an output is provided by the Alt amplifier back to the vertical preamplifier J-K flip-flop for ALT operation.

4-22. HOLD-OFF AND COMPARATOR.

4-23. The hold-off and comparator establishes the time interval between trigger points. This time interval is adjusted by the TRIGGER STABILITY control. A signal from the main integrator set-reset multivibrator activates the hold-off circuit. When the hold-off is activated, a ramp, determined by the hold-off amplifier RC circuits and the TRIGGER STABILITY control, is generated. When this ramp reaches a predetermined level, it activates the main integrator set-reset multivibrator. The set-reset multivibrator then sets the trigger set-trigger gates low for a new sweep.

4-24. The main horizontal sweep ramp from the Miller integrator also drives the comparator in the hold-off and comparator assembly. The main sweep is compared to a voltage set by the DELAY TIME control. When the main sweep is equal to this voltage, the Schmitt trigger sends a pulse to the delay integrator set-reset multivibrator. This sets the delayed trigger set-trigger gates low and arms the delayed integrator for a new sweep.

4-25. DELAYED INTEGRATOR.

4-26. The delayed integrator operates the same as the main integrator except for the following differences. This circuit has no bright line auto input. In the AUTO mode, a voltage is applied to the input amplifier which activates the Miller integrator for a delayed sweep signal. The Miller integrator is connected to its own RC components for generating the delayed sweep. Sweep limits are set by a comparator and set-reset multivibrator as in the main integrator.

4-27. The set-reset multivibrator has an input from the main integrator set-reset multivibrator. If the main sweep terminates, a voltage from the main integrator is sent to set-reset multivibrator. The multivibrator terminates the delayed sweep and arms the delayed trigger set-trigger gates for a new sweep.

4-28. HORIZONTAL MODE ASSEMBLY.

4-29. This assembly controls the main or delayed display and the trace intensity in these modes. A switch selects the main or delayed sweep signal to be displayed.

4-30. The blanking circuit blanks the trace in the MAIN SWEEP and DELAYED SWEEP modes. The blanking signal is applied to the gate assembly (Block Diagram 2) which controls the high voltage oscillator assembly.

4-31. Trace intensification of the delayed position of the sweep in the MAIN SWEEP mode is also provided by this circuit. When the DELAYED TIME/DIV switch is set to some position other than OFF, the main intensity is reduced and the delayed sweep intensity is held at a normal level providing trace intensification.

4-32. POWER SUPPLY BLOCK DIAGRAM (SCHEMATIC 2).

4-33. LOW VOLTAGE POWER SUPPLY.

4-34. The low voltage power supply operates from three different power sources. The sources are ac line, internal battery or external dc line. The ac line is applied to the input power module which is selectable for 115– or 230-volt operation and has an ac line protection fuse. The ac input is applied to a step-down power transformer.

4-35. The line rectifier rectifies and filters the power transformer ac output of approximately 36 volts. This voltage is applied to the voltage regulator and a ripple filter which filters out the 120 Hertz ripple.

4-36. The voltage regulator output is applied to the low voltage converter. This stage converts the input dc power to usable output dc of different voltage levels. The low voltage converter oscillates between 10 kHz and 45 kHz depending upon the input voltage and the output power.

4-37. The voltage coupled from the converter to the low voltage rectifier is filtered and applied to the low voltage mother board which provides low voltage distribution to the power supply module. A portion of the +15 and −15 volts is fed back to the low voltage regulator which determines the frequency and duty cycle of the converter for output voltage regulation.

4-38. The filtered voltages from the low voltage mother board are coupled to the gate assembly board. The gate assembly board provides filtering, fuse protection and distribution of the low voltage supplies to the rest of the Model 1701A circuits. The low voltage regulator output is also applied to the light driver which controls the brillance of the scale illumination lights. Scale illumination control (R3) controls the output of the light driver.

4-39. HIGH VOLTAGE POWER SUPPLY.

4-40. The high voltage power supply consists of the high voltage oscillator, power transformer, rectifying networks, and high voltage multiplier. When the instrument is turned on, the high voltage oscillator activates, coupling voltages from pins 1 and 2 into the secondary pins 6 and 7, 5, 8, and 9. Pins 11 and 10 are connected to the filaments of the CRT. The secondary voltage at pin 7 is connected thru a rectifying diode to the control grid of the CRT. Pin 8 of the secondary is connected thru a rectifying diode to the cathode. A correction voltage,coupled from this diode back thru a resistive divider network, controls the current source. The current source controls the oscillator amplitude and thus the high voltage oscillator output. The CRT voltages are negative except for the post-accelerator voltage.

4-41. The CRT cathode voltage is fed back to the current source. If the cathode voltage becomes more negative, less current is supplied to the high voltage (hv) oscillator. With less current supplied, the amplitude of the hv oscillator output is reduced and the cathode voltage will return to its normal operating value. If the cathode voltage becomes less negative, more current is supplied to the hv oscillator. The output amplitude now increases and the cathode voltage again returns to its normal operating value. A 6 kv peak-to-peak voltage is present at pin 9 of the power transformer. This voltage is applied to the high voltage multiplier circuit where it is tripled. The +18 kV output is applied to the post accelerator of the CRT.

4-42. GATE AMPLIFIER.

4-43. The gate amplifier has five inputs. One input is from the INTENSITY control, another input is the blanking from the horizontal mode assembly, a third input is the chop blanking input from the vertical preamplifier, a fourth input is from the BEAM FINDER when connected and a fifth input is from the Z-AXIS INPUT. All of these inputs control the intensity or the A-axis of the CRT. The output from the gate amplifier to the CRT grid increases or decreases the intensity of the display.

4-44. DETAILED CIRCUIT THEORY.

4-45. The following detailed theory is subdivided according to module and referenced to the fold-out Schematics in Section VIII. Each Schematic is numbered and indexed in the appropriate test for easy location.

4-46. INPUT ATTENUATORS (SCHEMATIC 3).

4-47. GENERAL INFORMATION.

4-48. The 75 MHz attenuators provide attenuation, coupling selection, attenuator compensation, and input capacitance adjustment. The attenuators are compensated voltage-divider types divided into two cascaded sections. The front section provides a division ratio of 1, 10, and 100. The rear section provides division ratios of 1, 2, and 5.

4-49. INPUT.

4-50. S1 provides a choice of coupling. Choices are AC, DC, or GND. C1 provides a cutoff frequency of 10 Hz in the AC position.

4-51. ATTENUATOR STAGES.

4-52. C8 and C9 provide attenuator compensation for the first portion of the attenuator. These two components are adjusted for best frequency response. C4 and C5 provide input capacitance adjustment. These two components standardize the input capacitance of the attenuator so that when a compensated probe is used its compensation remains constant as the attenuator ranges are switched. C18 and C19 provide attenuator compensation for the rear section of the attenuator. C13 and C14 provide input capacitance adjustment. RC networks A5C1/R1 protect the input FET A5A4Q1 from high input voltages if the attenuator is set to a high sensitivity range.

4-53. VERTICAL PREAMPLIFIER (SCHEMATIC 4, 5, 6 and 7).

4-54. GENERAL INFORMATION.

4-55. The vertical preamplifier circuits provide the following functions:

a. Amplification of signals from the input attenuators.

b. Generation of channel A and composite sync signals.

c. A + B and A − B operation.

d. Type of display.

4-56. Front-panel controls to the vertical preamplifier determine dc balance, position, calibrated amplification of the amplifiers, choice of display, and trigger.

4-57. INPUT STAGES (SCHEMATIC 4).

4-58. 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 described.

4-59. A5A4CR1/CR2/CR5/CR6 form an over-voltage protection circuit. If the input voltage from the attenuator exceeds 1.2 volts, these diodes conduct, limiting the voltage applied to the input of A5A4Q1. A5A4R1 limits the signal current to the gate of A5A4Q1. A5A4C3 ensures maximum response with no loss of high frequency signal.

4-60. The signal from the emitter of A5A4Q5 is applied to the differential cascode amplifier A5A4Q9/Q13 and A5A4Q10/Q14. The single-ended signal is converted to a differential signal by coupling A5A4Q9 and Q10 emitter current through A5A4R38. High frequency adjustment is accomplished by A5A4C25. The gain of the cascode amplifier is controlled by R5 and R11 which shunts current from the emitters of A5A4Q13/Q14. Differences in the base-to-emitter voltage drop of A5A4Q13/Q14 are compensated by adjusting Channel A DC Bal A5A4R43. The over-all DC level is adjusted by DC BAL R3.

4-61. The front-panel POSTION control A5A4R59 establishes the signal current at the emitters of A5A4Q22/Q23 determining the vertical postion of the trace on the CRT.

4-62. CHANNEL SWITCHES (SCHEMATIC 5).

4-63. Channel switches A5A4Q22/Q23 are controlled by A5A4Q20. A5A4Q20 is controlled by the J-K flip-flop, A5A4U2. A5A4U2 is controlled by the DISPLAY switch. If Channel A display is not used, the base of Q20 goes high, forward biasing Q20. This forward biases A5A4CR10/CR11 turning off A5A4Q22/Q23, preventing a display on this channel.

4-64. The Channel B switches operate in the same manner except there are two sets of transistors. A5A4Q25/Q26 are used for the B POL NORM polarity display. A5A4Q24/Q27 are used for the B POL INUT polarity display. The two transistor groups are controlled by the position of B POL switch A5S1. Depending upon the postion of A5S1, +5 volts is applied to the base of the appropriate transistors. The two displays are summed at the collectors of A5A4Q22/Q23 and applied to feedback amplifier A5A4Q28/Q29. A5A4R75/R76 compensates for the collector to base capacitance of the transistors.

4-65. CHANNEL A SYNC AMPLIFIER.

4-66. Transistor A5A4Q18 sums the current from A5A4Q5 and the channel A sync zero control A5A4R66. A5A4Q17 provides the amplifier a gain of 10. This gain provides 100 mV of signal for each division of display deflection. Emitter follower A5A4Q19 provides low impedance drive to the trigger circuit.

4-67. COMPOSITE SYNC AMPLIFIER.

4-68. A5A4Q30/Q31 are the composite sync take-off transistors. The collector output of A5A4Q30 is fed through the DISPLAY switch A5S2 to sync take-off amplifier A5A4Q38/Q39.

4-69. A5A4Q39 provides a low impedance output to drive the trigger circuit. Composit sync adjust A5A4R81 controls its output current to the sync take-off amplifier. A5A4R81 is adjusted for a sero-volt output from the composite sync amplifier with zero volts in.

4-70. DELAY LINE.

4-71. The delay line provides 160 ns delay to the vertical signal. This allows the horizontal circuits sufficient time to react so the display is in the proper time sequence.

4-72. VERTICAL OUTPUT AMPLIFIER.

4-73. The output signals from the delay line drive A5A5Q1/Q2. Complementary current from A5A5Q1/Q2 drives shunt feedback amplifiers A5A5Q4/Q5. High frequency adjustment A5A5C7 is adjusted for optimum pulse response shaping. Feedback in A5A5Q4/Q5 corrects pulse response due to collector to base capacitance. The outputs of the shunt amplifiers drive cascode amplifiers consisting of A5A5Q6/Q7/Q8/Q9. High frequency adjustments. A5A5C12/R30 adjusts the output for optimum pulse response.

4-74. BEAM FINDER.

4-75. Current for operation of the cascode amplifier flows through the normally closed contacts of the BEAM FINDER switch S3. When the switch is pressed, the contacts are opened and the current source for the amplifier is reduced by A5A5R15. This limits the output of the amplifier and returns the trace to the CRT.

4-76. STEERING LOGIC CIRCUIT (SCHEMATIC 7).

4-77. The gates of A5A4U1 drives multivibrator A5A4Q34/Q35 and A5A4U2. Inputs to A5A4U1 are from the DISPLAY switch and main integrator stage (Schematic 10). Gates U1A and U1B control the multivibrator and U1C and U1D control U2.

4-78. In all positions of the DISPLAY switch A5S2 (except CHOP), the first rear section (1R) is grounded. When a ground is connected, pin 2 of U1A is low, pin 3 of U1A is high, and pin 6 of U1B is low, holding A5A4Q34 base low. This prevents the multivibrator from running.

4-79. In the CHOP mode, this ground is removed and the multivibrator is activated. This is an astable multivibrator which free runs at approximately 100 kHz. The collector output of A5A4Q34 is applied to U1C pin 12. U1C and U1D drive U2. As the output of U1D pin 8 goes high and then low, the Q and Q outputs from U2 alternate high and low. In one state, U2 pin 9 (Q) and pin 4 are high, which turns on A5A4Q36. A5A4Q36 inverts the signal and drives channel control switch A5A4Q20 (Schematic 5). When another input pulse is applied to U2, pin 11 (Q) and pin 6 go high, turning on channel B control, A5A4Q37. This drives channel control switch A5A4Q21 (Schematic 5).

4-80. In the ALT mode, an input signal from the main integrator. is applied to U1C pin 13. This causes U2 to change state at the end of every sweep. When this happens, channel A A5A4Q36 is on for one sweep and channel B A5A4Q37 is on for the next sweep.

4-81. Chopped blanking from A5A4Q34/Q35 is provided through A5A4CR15 to the gate assembly (Schematic 16).

4-82. DISPLAY SWITCH.

4-83. The five section of the DISPLAY switch control chopped blanking, the type of signal applied to the trigger circuit, and operation of U2. Section 1R controls U1A and U1B which controls the multivibrator. Section 2R, in the A + B mode, applies +15 volts to the A + B BAL control which is adjusted for maximum dynamic range of amplifiers A5A4Q28/Q29 (Schematic 5). Section 2F picks the type of sync signal to be applied to the trigger circuit. In the A, B, A + B mode the sync signal applied to the trigger is on the signal display. In the ALT and CHOP modes, the channel A sync is used, Section 1F controls the state of U2. In the A position, U2 is locked up to turn A5A4Q36 on. In the A + B mode both A5A4Q36/Q37 are turned on. In the CHOP and ALT mode U2 is alternated per input signal from U1D. In the B mode of operation, U2 pin 11 and 5 (Q) is high and A5A4Q37 is on.

4-84. TRIGGER ASSEMBLY (SCHEMATIC 8,9).

4-85. GENERAL INFORMATION.

4-86. The trigger assembly consists of the main and delayed trigger circuits. The main trigger has choice of trig-

ger coupling. Choices are INT/EXT, AC/DC, LF REJ and HF REJ. The delayed trigger is triggered internally and has choice of AC or DC coupling.

4-87. The main trigger provides two outputs to the main integrator (Schematic 10). One output is the main trigger signal and the other is the bright line auto signal. The delayed trigger provides a trigger to the delayed integrator (Schematic 12).

4-88. MAIN TRIGGER (SCHEMATIC 8).

4-89. Input to the main trigger circuits is from the vertical preamplifier (Schematic 7) in the INT position, and from EXT TRIG INPUT, in EXT position. S2 provides AC or DC coupling. S3 and S4 provide LF REJ and HF REJ coupling.

4-90. Network A6A2R5/C3 protects FET A6A2Q1/Q2 from being overdriven. Diode array A6A2CR1 through CR4 protects A6A2Q1/Q2 from over voltage. These diodes on at 1.5 volts, clamping the input signal.

4-91. One half of the trigger circuit amplifies the signal and the other half determines the triggering point set by MAIN TRIGGER LEVEL R1. S5 (SLOPE) determines which half of the trigger circuit amplifies the signal and which half provides the triggering point. A6A2Q1/Q2 are connected in a source follower configuration providing high input impedance A6A2Q3/Q4 provide low impedance to drive the rest of the active components.

4-92. CURRENT STEERING SWITCHES (SCHEMATIC 9).

4-93. A6A2Q15/Q16 are current steering switches which drive the set-trigger gates (U1A and U1B). Normally the non-inverting outputs of both gates are high. When a trigger signal is applied, current through A6A2Q15 increases. This current is drawn through A6A2R52 causing U1A pin 4 to go low. When pin 4 goes low, pin 6 goes low. With pin 6 low, pin 11 of U1B is also low. Trigger sensitivity, A6A2R45, is adjusted so A6A2Q15 changes the state of U1A but A6A2Q16 has insufficient current to change the state of U1B. This allows U1B to set up one one-half cycle and change states on the other half.

4-94. As the current through A6A2Q16 increases, U1B pin 8 goes low and pin 9 goes high. When pin 8 goes low, A6A2Q19 turns on providing a trigger signal to main integrator A6A3Q1 (Schematic 10).

4-95. BRIGHT LINE AUTO CIRCUIT.

4-96. The bright line auto circuit consist of A6A2Q23/Q24/Q25/Q26 and Schmitt Trigger A6A2Q27/Q28. When U1B activates, A6A2Q20 turns off. A6A2Q23 turns on and saturates. The collector of A6A2Q23 is coupled to the base of A6A2Q24. This coupling keeps A6A2Q24 off and A6A2Q23 on even though A6A2Q20 is turned back on.

4-97. If a trigger signal has not been applied, the collector voltage of A6A2Q23 decays through RC network A6A2R61/C13. When the voltage decays to about 16 volts, A6A2CR7 is forward biased. This turns A6A2Q25/Q26 on. When A6A2Q26 turns on, Schmitt Trigger, A6A2Q27/Q28, is activated. Current through A6A2R69 turns on main integrator A6A3Q1 (Schematic 10). This activates the sweep.

4-98. DELAYED TRIGGER.

4-99. The delay functions are identical to the main trigger except it has no bright line auto circuit. The trigger signal is coupled from A6A2Q21 to delayed integrator A6A4Q1 (Schematic 12).

4-100. MAIN INTEGRATOR (SCHEMATIC 10).

4-101. GENERAL INFORMATION.

4-102. The main integrator in conjunction with the main sweep time assembly (Schematic 11) generates the main sweep ramp applied to the horizontal circuits (Schematic 15), provides main blanking to the horizontal mode assembly (Schematic 15), and alternate triggering to the vertical preamplifier (Schematic 7). The set-reset multivibrator terminates the main sweep, terminates the delayed sweep if the main sweep terminates, and set the trigger set-trigger gates high to initiate a new trigger.

4-103. INPUT.

4-104. A6A3Q1 has two inputs; one is the main trigger through pin K and the other input is the bright line auto signal through A6A3CR1/CR2. Either input will turn A6A3Q1 on. When A6A3Q1 turns on, A6A3Q4 turns off, inverting the signal on the collector of A6A3Q1. This inverted signal is the alternate triggering signal to the vertical preamplifier (Schematic 7).

4-105. Main blanking is also controlled when A6A3Q1 turns on. When A6A3Q1 is on, a ground is provided turning the horizontal mode blanking circuit off (Schematic 15). This allows the trace to be seen on CRT. When A6A3Q1 is off, the blanking circuit is on, blanking the CRT.

4-106. When A6A3Q1 is on, current is drawn through A6A3CR9 turning off A6A3Q6. With A6A3Q6 off, the Miller integrator A6A3Q7/Q8, in conjunction with the main timing components on Schematic 11, generates a positive-going ramp. The ramp is amplified by A6A3Q9 and applied to the horizontal mode assembly (Schematic 15).

4-107. COMPARATOR.

4-108. The ramp is also coupled back to comparator A6A3Q2/Q5. This circuit sets the ramp limits from +2 volts to +12 volts. The 2-volt limit is set by current flow through A6A3R9/CR12/Q5 to ground. The 12-volt limit is set as follows: When the ramp applied to A6A3Q5 reaches 12 volts, current through A6A3R8 flows through

A6A3Q2 which is referenced to +12 volts. This turns A6A3Q3 on which applies a low to U1 pin 5 of set-reset multivibrator U1. When pin 5 goes low, pin 6 goes high. This high is applied back to A6A2 trigger set-trigger gates U1A and U1B. When A6A2U1B goes high the sweep is terminated by turning Q1 off.

4-109. If the bright line auto signal is operating the following action will occur. When the ramp reaches 12 volts, pin 6 of U1B goes high. This high is applied to U1A pin 2. U1A pin 12 goes low, forward biasing A6A3CR3. This provides a ground, removing the bright line auto signal from A6A3Q1, terminating the sweep.

4-110. The hold-off time is also applied to the set-reset multivibrator. While the hold-off time is in process, pin 1 U1A is low. This causes U1B pin 6 output to be high, locking the trigger set-trigger gates preventing a sweep. At the completion of hold-off time, U1A pin 1 goes low which applies a low to the trigger set-trigger gates allowing the trigger circuit to function on the next trigger signal.

4-111. Light driver, A6A1Q1, turns off the RESET light DS2 when the output from U1B is high (sweep off).

4-112. MAIN SWEEP TIME ASSEMBLY (SCHEMATIC 11).

4-113. GENERAL INFORMATION.

4-114. The main sweep timing components are tied to the main sweep Miller integrator. Except for the two fastest sweep speeds (.1 and .2 usec) the RC timing is determined by the main sweep time assembly. The capacitor for the two fastest sweep speeds on the main integrator board is A6A3C8.

4-115. OPERATIONAL AMPLIFIER.

4-116. The operational amplifier, A6A5Q1A/B/Q2/Q3, is connected in an inverting configuration. Since it is referenced to a regulated positive voltage (+15 volts), it produces a negative voltage at its output. This negative voltage is connected through one of the timing resistors to the Miller integrator (Schematic 10). Feedback for the amplifier is provided by A6A5R10.

4-117. When VERNIER A6R4 is used (out of CAL position), the +15 volt reference is reduced to some other voltage. This causes the operational amplifier output to rise toward ground. When the output rises toward ground, the sweep runs more slowly.

4-118. DELAYED INTEGRATOR (SCHEMATIC 12).

4-119. GENERAL INFORMATION.

4-120. The delayed integrator in conjunction with the delayed sweep time assembly (Schematic 13) generates the delayed sweep ramp applied to the horizontal circuits (Schematic 15), and provides delayed blanking to the horizontal mode assembly (Schematic 15).

4-121. The set-reset multivibrator terminates the delayed sweep, and sets the delayed trigger set-trigger gates to a high state to initiate a new trigger.

4-122. A6A4Q1 has two inputs: one is the delayed trigger through pin K and the other is +15 volts for AUTO operation through A6A4CR1/CR2. Either input will turn A6A4Q1 on. Delayed blanking is controlled when A6A4Q1 turns on which provides a ground through A6A4Q1, turning the horizontal mode blanking circuit off (Schematic 15). This allows the trace to be seen on the CRT. When A6A4Q1 is off, the blanking circuit is on, blanking the CRT.

4-123. When A6A4Q1 is on, current is drawn through A6A4CR9 turning off A6A4Q6. With A6A4Q6 off, the Miller integrator A6A4Q7/Q8 in conjunction with the delayed timing components on Schematic 13, generates a positive going ramp. The ramp is amplified by A6A4Q9 and applied to the horizontal mode assembly (Schematic 15).

4-124. COMPARATOR.

4-125. The ramp is also coupled back to comparator A6A4Q2/Q5. This circuit sets the ramp limits from +2 volts to +12 volts. The 2-volt limit is set by current flow through A6A4R9/CR12/Q5 to ground. The 12-volt limit is set as follows. When the ramp applied to A6A4Q5 reaches 12 volts, current flows through A6A4R8/Q2 which is referenced to +12 volts. This action turns A6A4Q3 on, applying a low to U1 pin 5 of set-reset multivibrator. When pin 5 goes high, pin 6 goes high. This high is applied back to A6A2 trigger set-trigger gates U2A and U2B. When A6A2U2B goes high, the sweep is terminated by turning A6A4Q1 off.

4-126. In AUTO operation the following action will occur: when the ramp reaches +12 volts, pin 6 of U1B goes high. This high is applied to pin 2 of U1A. U1A pin 12 goes low forward biasing A6A4CR3. This provides a ground, removing the +15V drive to A6A4Q1, terminating the sweep.

4-127. The delayed set-reset multivibrator is controlled by two other inputs. One input is from the comparator Schmitt trigger (Schematic 14) and the other from the main integrator set-reset multivibrator (Schematic 10). The Schmitt trigger input activates the set-reset multivibrator when the main sweep voltage equals the voltage set by the DELAY TIME control. This input provides a ground for the +15 volts to A6A4Q1 in the AUTO mode and sets the trigger set-trigger gates (Schematic 9) for a new sweep in the TRIG mode.

4-128. The main integrator input terminates the delayed sweep if the main sweep terminates before the comparator Schmitt trigger is activated. U1B pin 4 goes low and pin 6

goes high resetting the trigger set-trigger gates high for a new sweep. With the trigger gates high, delay integrator A6A4Q1 turns off terminating the sweep.

4-129. DELAYED SWEEP TIME ASSEMBLY (SCHEMATIC 13).

4-130. GENERAL INFORMATION.

4-131. The delayed sweep timing components are tied to the delayed sweep Miller integrator. Except for the two fastest sweep speeds (.1 and .2 usec) the RC timing is determined by the main sweep time assembly. The capacitor for the two fastest sweep speeds on the delayed integrator board is A6A4C8.

4-132. OPERATIONAL AMPLIFIER.

4-133. The operational amplifier A6A6Q1A/B/Q2/Q3, is connected in an inverting configuration. Since it is referenced to a regulated positive voltage (+15 volts), it produces a negative voltage at its output. This negative voltage is connected through one of the timing resistors to the Miller integrator (Schematic 12). Feedback for the amplifier is provided by A6A6R10.

4-134. When VERNIER A6R5 is used (out of CAL position), the +15-volt reference is reduced to some other voltage. This causes the operational amplifier output to rise toward ground. When the output rises toward ground, the sweep runs more slowly.

4-135. HOLD-OFF AND COMPARATOR (SCHEMATIC 14).

4-136. GENERAL INFORMATION.

4-137. This assembly determines the hold-off time between sweeps. The output from the hold-off amplifier is connected to the main integrator set-reset multivibrator. The multivibrator prevents the trigger gates (Schematic 9) and main integrator (Schematic 10) from functioning during hold-off time.

4-138. The comparator circuit compares the main sweep against a voltage set by the DELAY TIME control. When the main sweep reaches the voltage level set by the DELAY TIME control, the comparator activates the Schmitt trigger. The Schmitt trigger output is applied to the delayed integrator. This output turns the delayed integrator off, terminating the delayed sweep.

4-139. RAMP GENERATOR.

4-140. When the main integrator set-reset multivibrator goes high at the end of a sweep, a high is applied to A6A7Q1. This high turns A6A7Q1 on and A6A7Q4 off. When A6A7Q4 turns off, an exponential ramp is generated at the collector of A6A7Q4. This ramp is determined by A6A7C5/C6/C7/C8/R13 and TRIGGER HOLD-OFF control A6R7. A6A7C5/C6/C7 are controlled by the position of the MAIN TIME/DIV control. The ramp starts at +15 volts and when it reaches approximately 0 volts, turns on hold-off amplifier A6A7Q7.

4-141. HOLD-OFF AMPLIFIER.

4-142. A6A7Q7 turns on when the ramp reaches 0 volt. This turns A6A7CR6 on and couples a low to the main integrator set-reset multivibrator. This activates the multivibrator and resets the trigger gates low to operate on the next trigger signal.

4-143. COMPARATOR.

4-144. Ramp comparator A6A7Q2/Q3/Q5/Q6 compare the main sweep against the voltage from the DELAY TIME control. When the voltage from the main sweep ramp equals the voltage from the DELAY TIME control, A6A7Q3 turns on. This turns on A6A7Q6 and Schmitt trigger U1. When U1 turns on, pin 12 goes from a high to a low state. This output pulse differentiated by A6A7C9/R15 and sent to the delayed integrator as a reset pulse.

4-145. HORIZONTAL MODE ASSEMBLY (SCHEMATIC 15).

4-146. GENERAL INFORMATION.

4-147. The horizontal mode assembly determines the type of display (main or delayed) and provides various blanking signals to the gate assembly (Schematic 16).

4-148. DISPLAY SWITCH.

4-149. Display switch S1 picks the main or delayed sweep signal to be applied to the horizontal preamplifier assembly.

4-150. BLANKING CIRCUIT.

4-151. The blanking circuit provides main blanking, delayed blanking, and trace intensification to the gate assembly. Input from the main and delayed integrator determine the output to the gate assembly. Normal blanking current flows through A6A8R2/CR3 and out pin 7 to the gate assembly (Schematic 16). Inputs to this circuit at pin 8 and pin J are such that when the sweep is off, a high is applied to the input and when the sweep is running a low is applied. When a high is applied from A6A3Q1 or A6A4Q1, A6A8CR3 is forward biased and blanking current is applied to the gate circuit. When a low is applied (A6A3Q1 or A6A4Q1 on), the blanking current is shunted to the integrator circuits (Schematics 10 and 12).

4-152. Trace intesification is provided when the DELAYED TIME/DIV switch is moved from the OFF position while in the MAIN SWEEP mode. A6A8CR1 is normally on in the OFF position. When the ground is removed, A6A8CR1 turns off and A6A8R1/CR2 increase current flow to the gate. This current dims the trace but is insuf-

ficient to blank the trace. When the delayed sweep turns on, this increase in current flow goes out pin J to A6A4Q1 returning trace intensity to a normal level. When delayed sweep is used, it controls the blanking as the main sweep did.

4-153. HORIZONTAL PREAMPLIFIER ASSEMBLY (SCHEMATIC 15).

4-154. GENERAL INFORMATION.

4-155. The horizontal preamplifier assembly amplifies the sweep signal, provides sweep length adjustments and controls the horizontal position of the trace. Trace magnification (X10) and trace centering is also provided by this circuit.

4-156. INPUT CIRCUIT.

4-157. The sweep signal is applied to A6A9Q1. A6A9Q1 sums the sweep and horizontal position currents. Feedback in this stage compensates for collector to base capacitance providing better pulse response. A6A9Q2 is a temperature compensation amplifier.

4-158. DIFFERENTIAL AMPLIFIER.

4-159. Differential amplifier A6A9Q3/Q4 converts the voltage signal from A6A9Q1/Q2 to a current signal. Trace magnification is also controlled by A6A9Q3/Q4. When the MAG (X10) pushbutton in engaged, the gain of the differential amplifier is increased by a factor of 10. When the BEAM FINDER is pressed, less current is supplied to A6A9Q3/Q4 limiting its amplification range. This allows the trace to return to the viewing area. U1 and U2 provide level shifting and drive the output amplifier assemblies.

4-160. HORIZONTAL OUTPUT AMPLIFIER (SCHEMATIC 15).

4-161. GENERAL INFORMATION.

4-162. The horizontal output amplifier is a class B amplifier used to drive the horizontal plates on the CRT.

4-163. OUTPUT AMPLIFIER.

4-164. As current is applied to input, A6A10Q3, feedback current from output A6A10Q5, is coupled back through A6A10R1. Since the input is connected to a relatively constant point, the output voltage changes to vary the feedback current. This voltage change is a reproduction of the input current and is applied to the horizontal plates of the CRT to move the trace.

4-165. GATE ASSEMBLY (SCHEMATIC 16).

4-166. GENERAL INFORMATION.

4-167. The gate assembly circuit sums current signals from five sources and developes an output level which sets the bias on the CRT and thus controls the display intensity. The current sources are: the input signal from the horizontal mode assembly; the chop blanking input from the vertical preamplifier assembly; the external Z-axis input (if any); the current through INTENSITY control R1; and the current through the BEAM FINDER switch when engaged.

4-168. INTENSITY CONTROL.

4-169. The intensity control establishes the reference bias level on the CRT by setting the current level through the summing amplifier. Increasing intensity of the display by means of INTENSITY control will increase the conduction of A4Q1.

4-170. SUMMING AMPLIFIER.

4-171. Summing amplifier A4Q1 adds the five input currents and the feedback current providing an output signal which is coupled through an emitter follower to the complementary output amplifiers A4Q5/Q6. The output amplifiers amplify the input signal to the CRT control grid controling the CRT trace intensity. A positive-going level will increase the conduction of the CRT and brighten the display.

4-172. MULTIVIBRATOR.

4-173. Emitter-coupled multivibrator A4Q7/Q8 provide a 1 kHz, 1 volt square wave output. A4Q9 amplifies the square wave. Cal Ampl Adj A4R29, provides amplitude adjustment of the output calibration signal.

4-174. LOW VOLTAGE POWER SUPPLY (SCHEMATIC 18).

4-175. GENERAL INFORMATION.

4-176. This Schematic contains the power module, line rectifier, part of the low voltage mother board and part of the A4 gate assembly. The A1 power module provides ac input power to the Model 1707A. The A2 line rectifier rectifies the incoming ac and provides some filtering. The trickle charge circuit for the battery is also contained on this board. The A3A1 low voltage mother board provides voltage regulation, filtering, and full charge current to the battery. The A4 gate assembly has the light driver for the scale illumination circuits and the low battery indicator circuit.

4-177. A1 POWER MODULE.

4-178. A1F1 is the ac input fuse. A1S1 provides selection between 115-and 230-volt operation. The ac input is applied to T1 which is a 3:1 stepdown transformer.

4-179. A2 LINE RECTIFIER.

4-180. A2Z1 rectifies the incoming signal. A2C1/C2 are ripple filter capacitors. A2R1/CR1 provides a trickle

charge of 40 milliamperes to the battery in AC LINE operation.

4-181. A3A1 LOW VOLTAGE MOTHER BOARD.

4-182. A3A1Q1 and A3Q2 form a series voltage regulator. A3A1R1 provides current to A3A1VR1 which sets the base reference voltage of A3A1Q1. A3A1R4 provides current limiting. A3A1CR1 is a protection diode for A3A1Q1 and A3Q2. A3A1C1/R3 form a ripple filter. A3A1R5/CR2 form the full charge circuit for the battery. When the instrument is OFF, approximately 400 milliamperes is applied to the battery. This charging current is always applied with the power MODE switch in AC LINE, the ac power connected and the instrument POWER switch set to OFF.

4-183. LINE SWITCHING.

4-184. POWER MODE switch S2, provides selection for AC LINE, INTERNAL BATTERY or DC LINE. S1 provides for power on or power off. F1 is in the line during all modes of operation. J2 provides for DC LINE input. This input should be limited between 11.5 to 36 volts, 22 watts maximum.

4-185. A4 GATE ASSEMBLY.

4-186. A4Q2 and associated circuitry form the light driver network. When the instrument is operated in any mode except INTERNAL BATTERY the circuit is off. Current flows through R11/CR10/DS1 when the instrument is turned on. When the instrument is operated in INTERNAL BATTERY and the battery voltage drops below 22.5 volts, A4Q2 turns on. A1DS1/R13/C10 form a relaxation oscillator which causes A4DS1 to flash. This is an indication that the battery is discharged and further operation may damage the battery.

4-187. A4Q10 and associated circuitry form the scale illumination circuit. The position of A4R3 (SCALE ILLUM) determine drive to A4Q10. Current from A4Q10 goes through A7DS1 and A7DS2. The more A4Q10 conducts, the brighter DS1 and DS2 will be. A4R36/CR11/CR13 provide current limiting to protect A4Q10. A4VR3 limits the voltage across the light circuits.

4-188. The scale illumination lights will become very dim if the instrument is operated from a dc line voltage below approximately 18 volts.

4-189. LOW VOLTAGE POWER SUPPLY (SCHEMATIC 19).

4-190. GENERAL INFORMATION.

4-191. This Schematic contains the low voltage converter protection circuits and the low voltage converter assembly. The protection circuit protects the instrument in the event that the regulator fails, the dc line input is more than 40 volts, or the polarity of the dc input is reversed.

4-192. A3A2 Low Voltage Converter assembly changes the input dc voltage to usable dc voltages of different levels. The low voltage converter assembly also contains the regulated network which controls the converter output.

4-193. A3A1 LOW VOLTAGE MOTHER BOARD.

4-194. A3A1CR3 protects the instrument against a dc voltage connected with the wrong polarity. If the wrong polarity is connected, A3A1CR3 turns on and the line fuse (F1, Schematic 18) opens. If a dc input over 40 volts is connected, A3A1VR3 conducts which turns on A3A1CR6 and opens F1 (Schematic 18).

4-195. If the regulated +15-volt supply goes above approximately 20 volts, bidirectional diode A3A1CR5 turns on. A3A1CR5/C2/R9 form a relaxation oscillator whose output is coupled across T1, rectified by A3A1CR4 and filtered by A3A1C3. This rectified voltage turns A3A1CR6 on opening line fuse F1.

4-196. LOW VOLTAGE CONVERTER ASSEMBLY.

4-197. A3A2Q2 with associated circuitry form the low voltage converter (Figure 4-1 and 8-69). This circuit changes the incoming dc voltage to useable dc voltages of different magnitudes A3A2R2/VR2 form a voltage source charging A3A2C7 through A3A2R6. A3A2C7 charges to the peak-point emitter voltage of the unijunction transistor A3A2Q1. At this voltage, A3A2Q1 conducts supplying current through A3A2R12 to the base of A3A1Q2 (Figure 4-1). This current turns on A3A2Q2 allowing current to flow in the primary winding of A3A3T1 and A3A2T1. As the current in these windings increases, primary winding 1 and 2 (A3A2T1) induce voltage into pins 3 and 4 in such a direction as to turn A3A2Q2 on harder. The primary current continues to increase until the core (A3A2T1) saturates. At this point there is no longer magnetic coupling in A3A2T1 and A3A2Q2 turns off. When A3A3Q2 turns off, an open circuit condition on pins 1 and 2 of A3A3T1 exists and the energy stored in the primary windings of A3A3T1 causes a fly back voltage to appear on the secondary of A3A3T1. This allows the secondary circuits to conduct, charging the capacitors to the required dc voltages.

4-198. A fly back voltage also appears in the secondary windings A3A2T1 pins 3 and 4. This fly back voltage turns on A3A2CR4 charging A3A2C8. When all the energy has left the core, the cycle is repeated with A3A2C8 aiding the turn on of A3A2Q2. The magnetic field in the transformers provide drive for the rest of the operation.

4-199. A3A2VR3 is a protection diode protecting A3A2Q2 from base to collector breakdown. A3A2C1/C2 isolate the power supply from ground. Unijunction transistor A3A2Q1 fires only when the instrument is first turned on. A3A2CR5 provides a discharge path for A3A2C7 preventing A3A2Q1 from being turned on again.

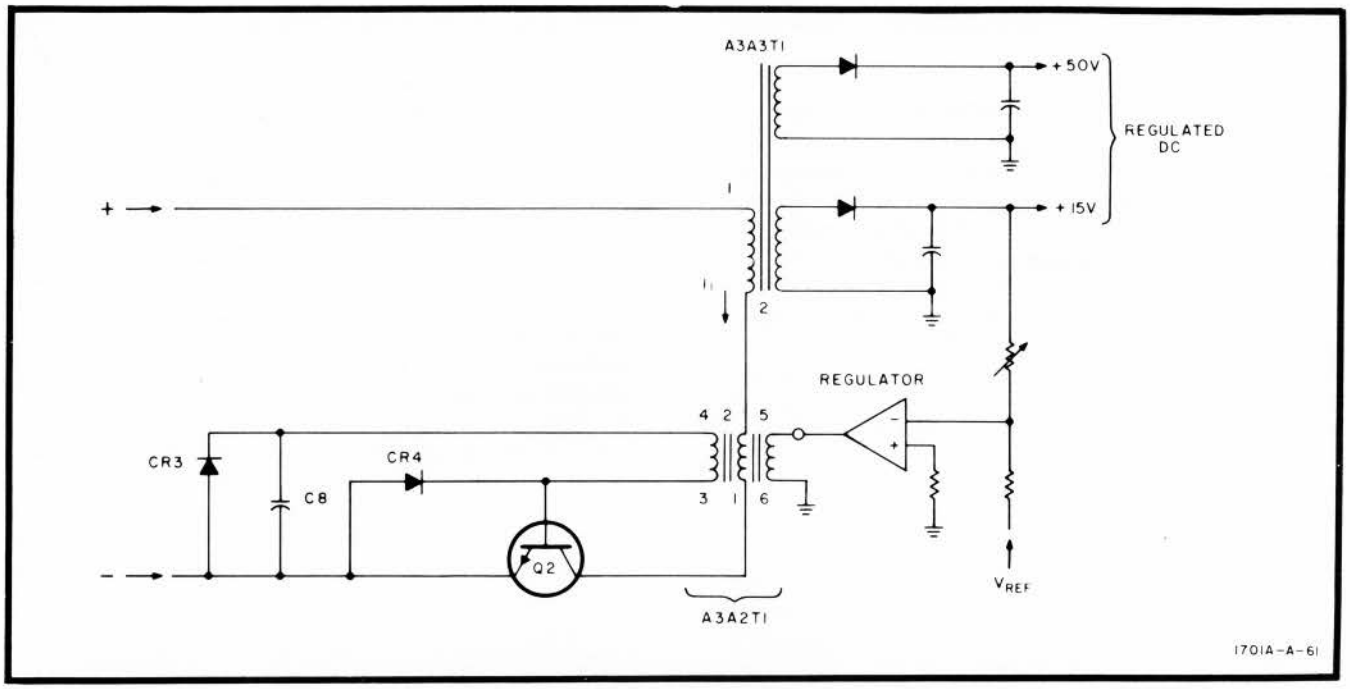


Figure 4-1. Simplified Low Voltage Converter Schematic

4-200. LOW VOLTAGE REGULATOR.

4-201. The low voltage regulator controls the duty cycle of the low voltage converter thus controlling the output voltage. Current into or out of pin 5 or A3A2T1 increases or decreases the duty cycle of the low voltage converter. An increase in current flow from pin 5 decreases the conduction time of A3A2Q2 which lowers the output voltage from the line rectifier filter network.

4-202. The regulated +15 volts is applied to pin 3 of the low voltage converter assembly. The regulated −15 volts is applied to pin 10. The −15 volts turns on reference diode A3A2VR1. The +15 volts is compared to the voltage reference through A3A2R3/R4. The different current, which results in a small voltage variation, is applied to operational amplifier U1 which is connected in the inventing mode. If the voltage at pin 2 increases, the output at pin 6 decreases. When the output of pin 6 decreases, A3A2Q4 turns on harder, drawing current through pins 6 and 5 of the transformer. This increase in dc current from pin 5 of A3A2T1 lowers the output voltage.

4-203. If +15 volts decreases, the voltage applied to pin 2 decreases causing an increase at the output of U1. When the voltage increases A3A2Q3 turns on providing more current into pin 5 and 6 of A3A2T1. The increase in dc current into pin 5 increases the conduction time of A3A2Q2 causing the output voltage to increase.

4-204. A3A2CR1/CR2 protect U1 input. A3A2C10/R13/C12 provides frequency compensation. U1 operates open loop dc and closed loop ac. The closed loop feedback is provided by A3A2C13/R14.

4-205. HIGH VOLTAGE POWER SUPPLY (SCHEMATIC 17).

4-206. GENERAL INFORMATION.

4-207. The high voltage power supply develops the voltages used to operate the CRT. The high voltage supply consists of a high voltage oscillator, current source, high voltage transformer. rectifying circuits, and a high voltage multiplier.

4-208. HIGH VOLTAGE OSCILLATOR.

4-209. High voltage oscillator A3Q1, activates when the instrument is turned on. Current is drawn through windings 1 and 2 of high voltage transformer A3A4A1T1. This current couples energy into windings 3 and 4. This energy is coupled back in phase to the base of A3A4Q1, turning A3A4Q1 on harder. The signal developed on pins 1 and 2 is stepped up by A3A4A1T1, rectified and filtered.

4-210. CRT CATHODE VOLTAGE.

4-211. AC for the CRT cathode supply is obtained from pins 8 and 5 of high voltage transformer A3A4A1T1. This voltage is rectified by A3A4CR8 and filtered by the associated capacitors, providing −1700 volts to the cathode. Feedback is coupled through RC network A3A4R5/R4, and A3R2/R3/C2 to the base of A3A4Q1. Resistors A3A4R1/R2/R3 form a reference network. Any variation in feedback voltage level is amplified by Darlington amplifier A3A4Q1/Q2 and applied to the base of A3A4Q3 to re-establish the proper output of −1700 volts.

4-212. If the cathode voltage goes in a more negative direction, the voltage at the base of A3A4Q1 will go more negative. This reduces the output from Darlington pair A3A4Q1 and Q2. This causes the base drive of A3A4Q3 to decrease, decreasing conduction. When A3A4Q3 decreases conduction, less current is applied to the base of A3Q1 causing the amplitude of oscillation to decrease reducing the magnitude of the output voltage. A3A4R10/C4 provide high frequency roll-off compensation.

4-213. CRT CONTROL GRID VOLTAGE AND BLANKING.

4-214. A3A4CR7 and associated circuitry provide −1700 volts to the CRT control grid. Blanking is provided to the CRT control through A3A4CR7 by the gate assembly. The blanking input completely blanks the CRT. As a less negative voltage is applied to the grid circuit the trace intensity becomes brighter. As more negative voltage is applied the trace intensity decreases until it is blanked.

4-215. CRT POST ACCELERATOR VOLTAGE.

4-216. The sine wave signal produced by high voltage oscillator A3Q1 is stepped up by the high voltage transformer, A3A4A1T1, which produces a peak-to-peak voltage of approximately 6000 volts between pins 9 and 5. This signal is applied to high voltage multiplier circuit which is a tripler circuit. The multiplier assembly rectifies the input voltage, inverts it, and multiplies it to approximately +20.2 K-volts to drive the CRT post accelerator.

Table 5-1. Recommended Test Equipment

Instrument Type	Instrument Model	Required Characteristics	Required for (see Note 1)
Voltmeter Calibrator	HP Model H01-738BR	Voltage: 0.5V to 150V Accuracy: to 0.1%	P, A
Oscillator	HP Model 204C	Frequency: 100 kHz Voltage output: 15 mV	P, A
Time Mark Generator	Tektronix Type 184A	Time marks: 0.1 usec to 0.5 sec	P, A
Square Wave Gen.	HP Model 211B	Frequency: 100 kHz; <5ns	P, A
Square Wave Gen.	Tektronix Model 106	Risetime: <1ns	P, A
Multifunction Digital Voltmeter	HP Model 3439A with 3444A	Voltage Range: 1000V Accuracy: ±0.1% Resistance Range: 10 megohms Accuracy: ±0.1%	P, A, T
Constant Amplitude Signal Generator	Tektronix Type 191B	Frequency: 50 kHz to 75 MHz Voltage Output: 50 mV to 5V p-p	P, A
LC Meter	Tektronix Type 130 LC	Range: 30 pF	P, A, T
Feed through Termination	HP Model 11048B	Resistance: 50 ohms	P, A
Termination	GR874	GR874 to BNC 50 ohms	P, A
Cable (1)	RG 213	50-ohm cable	P, A
Cable (2)	HP Model 10501A Cable Assembly	BNC 44"	P, A
Cable (2)	HP Model 10502A Cable Assembly	BNC 9"	P, A
Adapter	HP Model 10110A	Banana Jack to BNC	P, A
Adapter	HP Model 10111A	BNC to Binding Post	P, A
Adapter	HP Model 10219A	UHF to BNC Female Adapter	P, A
Test Leads	HP Model 11002A	Test Leads	P, A, T
Probe	HP Model 10004A	Divide ratio: 10:1 Accuracy: ±3%	A
RF Millivoltmeter	HP Model 411A	Range: 100 mV Accuracy: ±3%	P
High Voltage Probe	HP Model K05-3440A	Divide ratio: 1000:1 Accuracy: ±3%	P,A
Monitor Oscilloscope	HP Models 180A, 1801A and 1820A	Bandwidth: 50 MHz	P, A, T
Screwdriver	HP Part No. 8710-0900	Pozidrive	A, T
Service Kit	HP Part No. 01701-68701	Extender Boards and Board Puller	P, A, T

Note 1. P = Performance Check, A = Adjustment Procedure, T = Troubleshooting.

7000-A-19

SECTION V

PERFORMANCE CHECK AND ADJUSTMENT PROCEDURES

5-1. INTRODUCTION.

5-2. This section contains procedures for verifying the performance of the Model 1707A and adjustments necessary to calibrate the instrument. Procedures are arranged in numerical order. For best results, this order should be followed. Included in this section are test setups, procedures, and tips about tools and test equipment. Test point and adjustment location photograph (Figure 5-14) is located on fold-outs at the end of this section and may be referred to while performing the adjustments.

5-3. EQUIPMENT REQUIRED.

5-4. A complete list of test equipment and accessories is given in Table 5-1. In addition, each test procedure contains a list of test equipment required to make that test. Substitute test equipment may be used provided the substitute equipment has the required characteristics.

5-5. POZIDRIV SCREWDRIVERS.

5-6. Pozidriv screws are used in this instrument. To avoid damage to the screws slots, a Pozidriv screwdriver should be used.

5-7. HP 01701-68701 SERVICE KIT.

5-8. The HP 10701-68701 Service Kit is an accessory item available from Hewlett-Packard for use in maintaining the Model 1707A. This kit can be obtained by contacting your nearest HP Sales/Service Office. A list of HP field offices is included at the back of this manual.

5-9. PERFORMANCE CHECK.

5-10. The performance tests given in this section are suitable for incoming inspection, preventative maintenance, and troubleshooting. The tests are designed to verify the published instrument specifications. Perform the tests in the order given, and record the measurement information on the Performance Check Record at the end of this section.

5-11. The tests are arranged in the following order:

Para. No.	Test Description
5-22	Deflection Factor
5-23	Risetime
5-24	Bandwidth
5-25	Input RC
5-26	Common Mode Rejection Ratio (CMRR)
5-27	Main Sweep Time
5-28	Calibrator
5-29	Main Triggering
5-30	Trigger Level Range and Polarity
5-31	Ext Input RC
5-32	Delayed Sweep Time
5-33	Delayed Triggering
5-34	Delay Jitter

5-12. Each test is arranged so the specification is written out. Next, a description of the test and any special instructions or problem areas are included. Each test that requires test equipment has a test setup drawing and a list of required equipment and accessories. Each procedure gives the control settings required for that particular test.

5-13. ADJUSTMENTS.

5-14. The adjustment procedures are arranged in numerical order. Many adjustments are directly related to preceding or following adjustments. The following sets of adjustments are related, and if one adjustment in the set is made, the other procedures in that set should be checked or adjusted.

Para. No.	Description
	Power Supply and Gate Adjustments
5-36	Low Voltage Power Supply Adjustment
5-37	High Voltage Power Supply Adjustment
5-38	Intensity Limit Adjustment
5-39	Y Axis Alignment
5-40	Gate Amplifier Response Adjustment
	Horizontal Adjustments
5-41	Trigger Amplifier Balance and DC Level Adjustment
5-42	Trigger Sensitivity Adjustment
5-43	Position Centering Adjustment
5-44	Sweep Length Adjustment
5-45	Main Sweep Timing Adjustment
5-46	X10 Gain Adjustment
5-47	MAG Centering Adjustment
5-48	Calibrator Adjustment
5-49	Delayed Sweep Time Adjustment

Para. No.	Description
	Vertical Adjustments
5-50	Input Capacitance and Attenuator Compensation Adjustment
5-51	Pulse Response Adjustment

5-15. PERFORMANCE CHECK RECORD.

5-16. Each measurement point in the performance test is repeated in the Performance Check Record. This card is perforated and 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.

5-17. FRONT-PANEL ADJUSTMENTS.

5-18. Set the instrument up and perform initial adjustments outlined in Section III before proceeding with the Performance Checks or Adjustment Procedures.

5-19. FRONT-PANEL SETTINGS.

5-20. The control settings listed below are to be used in each performance test and adjustment procedure. If a control is to be set to another position it will be listed in the procedures. After the completion of each performance check or adjustment procedure, the controls should be set back to the original front-panel setting.

CHANNEL A

VOLTS/DIV 01
Coupling . . . . . AC
VOLTS/DIV Vernier . . . . . CAL
POSITION . . . . . Centered
DISPLAY . . . . . A

CHANNEL B

VOLTS/DIV 01
Coupling . . . . . AC
VOLTS/DIV Vernier . . . . . CAL
POSITION . . . . . Centered
B POL . . . . . NORM

HORIZONTAL POSITION . . . . . Centered
MAIN VERNIER . . . . . CAL
DELAYED VERNIER . . . . . CAL
Sweep Display . . . . . MAIN SWEEP
MAIN TIME/DIV . . . . . 5 uSEC
DELAYED TIME/DIV . . . . . OFF
SWEEP MODE . . . . . AUTO
TRIGGER . . . . . INT
Trigger Coupling . . . . . AC
MAIN SLOPE . . . . . +
DELAYED SLOPE . . . . . +
MAIN TRIGGER LEVEL . . . . . Centered
DELAYED TRIGGER LEVEL . . . . . Centered
TRIGGER STABILITY . . . . . NORM
MAG X1

Table 5-2. Deflection Factor Accuracy

Voltmeter Calibrator Settings (Volts p-p)	VOLTS/DIV Settings	Vertical Display (div)
0.05	.01	5± .15 div
0.1	.02	5± .15 div
0.3	.05	6± .18 div
0.5	.1	5± .15 div
1	.2	5± .15 div
3	.5	6± .18 div
5	1	5± .15 div
10	2	5± .15 div
30	5	6± .18 div

5-21. PERFORMANCE TESTS.

5-22. DEFLECTION FACTOR.

SPECIFICATION: Ranges: from 10 mV/div to 5 V/div (9 ranges) in 1, 2, 5 sequence. Accuracy: ±3% with vernier in the CAL position. Vernier: continuously variable between all ranges, extends maximum deflection factor to at least 12.5 V/div. VERNIER UNCAL light indicates when vernier is not in CAL position.

DESCRIPTION: The deflection factor is checked by applying a 400 Hz, voltage calibrated signal to the input. The displayed signal is compared against the voltage standard.

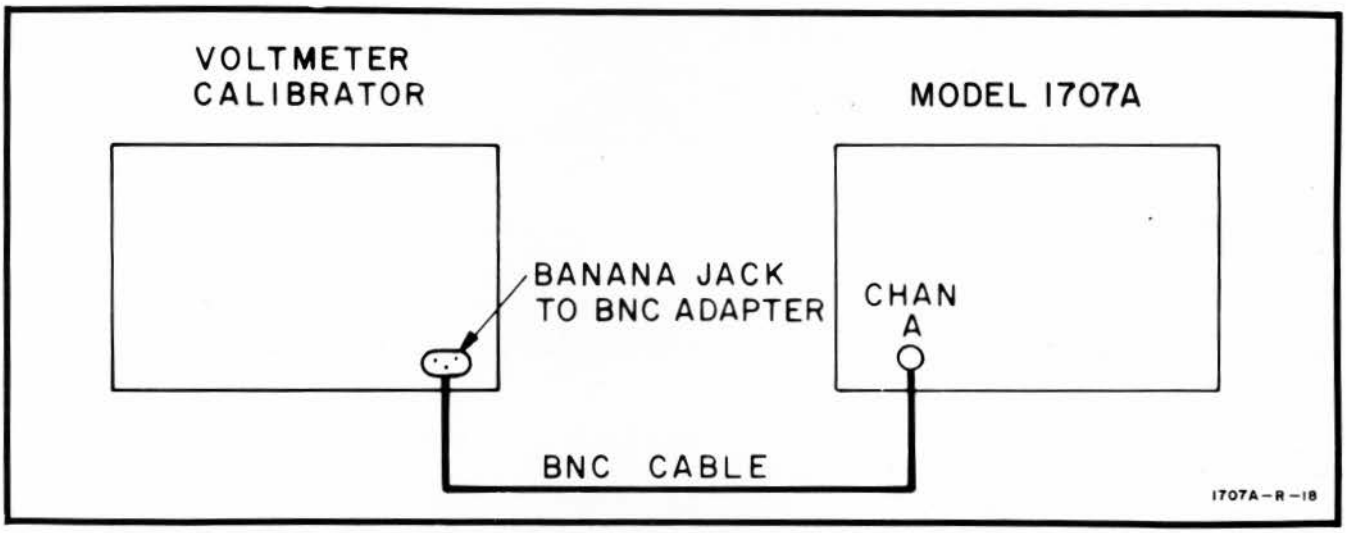


Figure 5-1. Deflection Factor Test Setup

EQUIPMENT:

Voltmeter Calibrator

Banana Jack to BNC Adapter

BNC Cable

NOTE

Make sure the front panel CAL has been adjusted before proceeding with this check.

PROCEDURE:

1. Connect instruments as shown in Figure 5-1.

2. Set instrument controls as follows:

   Model 1707A

   MAIN TIME/DIV . . . . . .5 mSEC

   Voltmeter Calibrator

   Adjust controls for a 400 Hz, 50 mV p-p output signal.

3. The display should be 5 vertical divisions ± 3%.

   .01 VOLTS/DIV 4.85 div _____5.15 div

4. Observe vertical deflection factors specified in Table 5-2.

5. With voltmeter calibrator output set for 30V and channel A VOLTS/DIV set to 5, rotate channel A vernier control fully counterclockwise. VERNIER UNCAL light should be lighted. The display reduction should be ≤2.4 div.

   Channel A Vernier_____≤2.4 div

6. Rotate Channel A vernier control fully clockwise into detent.

7. Connect voltmeter calibrator output to Channel B INPUT.

8. Set DISPLAY to B.

9. Repeat steps 2 through 6 for Channel B.

.01 VOLTS/DIV 4.85 div_____ 5.15 div

Channel B Vernier_____ ≤2.4 div

10. Remove test equipment.

11. Set Model 1707A controls as follows:

Channel A and B VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC

12. Refer to Paragraph 5-50 and Schematic 3 if any deflection factor is not within specifications.

5-23. RISETIME.

SPECIFICATION: Risetime is less than 4.6 ns; direct or with Model 10006A probe. Risetime is measured from 10% to 90% with a 6-division input step from a 25-ohm source.

DESCRIPTION: A 100-kHz signal with a risetime of less than 1.0 ns is applied to the vertical input of the instrument. The risetime displayed on the CRT is then checked to see that it is less than 4.6 ns.

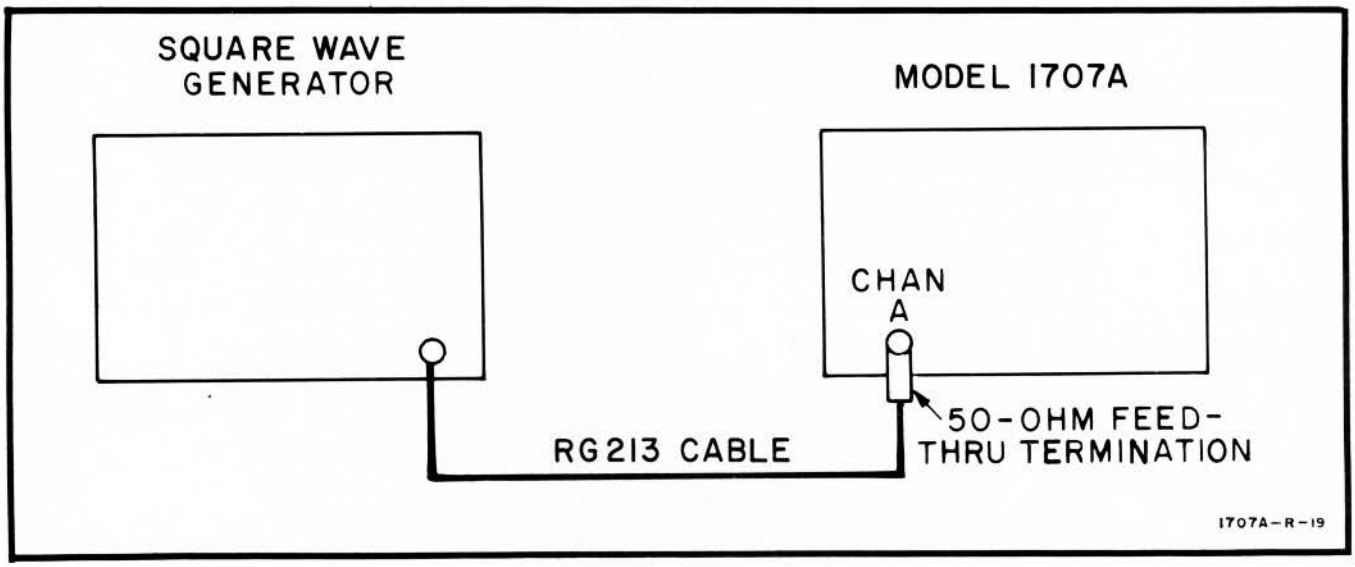


Figure 5-2. Risetime Test Setup

EQUIPMENT:

Square Wave Generator

50-ohm Feed-through Termination

RG 213 Cable

PROCEDURE:

1. Connect instruments as shown in Figure 5-2.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV 01
MAIN TIME/DIV . . . . . .1 uSEC

Square Wave Generator

Set controls for a 60 mV, 100-kHz output signal.

3. Adjust HORIZONTAL POSITION control so risetime portion of signal is in center of CRT.

4. Push MAG pushbutton in (X10).

5. Measure pulse risetime between 10% and 90% points (dotted lines on CRT). Risetime should be less than 4.6 ns.

Channel A risetime_____ < 4.6.ns

6. Move square wave generator output to Channel B INPUT.

7. Set DISPLAY to B.

8. Repeat steps 2 through 5 for Channel B risetime.

Channel B risetime_____ < 4.6 ns

9. Remove test equipment.

10. Set Model 1707A controls as follows:

DISPLAY . . . . . A
MAIN TIME/DIV . . . . . 5 uSEC
MAG X1

11. Refer to Paragraph 5-50 and Schematics 3 and 4 if the risetime specification is not met.

5-24. BANDWIDTH.

SPECIFICATION: (Direct or with Model 10006A probe, 3 dB down from 50 kHz, 6 div reference signal from 25-ohm source) DC-coupled: dc to 75 MHz, AC-coupled: 10 Hz to 75 MHz.

DESCRIPTION: To check bandwidth, a constant amplitude signal generator is used to apply a 6-division, 50-kHz signal to the input of the Model 1707A. The constant amplitude signal generator frequency is increased to 75 MHz. The signal amplitude displayed on the CRT must always be equal to or greater than 4.3 divisions to meet bandwidth specifications.

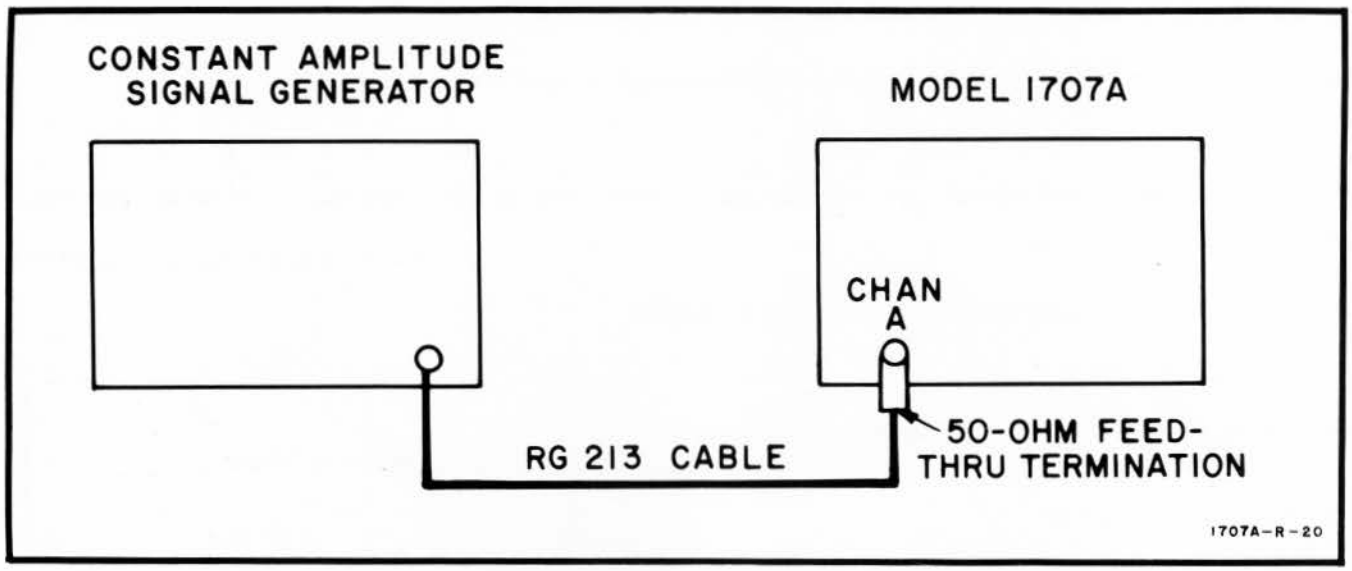


Figure 5-3. Bandwidth Test Setup

EQUIPMENT:

Constant Amplitude Signal Generator

50-ohm RG 213 Cable

50-ohm Feed-through Termination

PROCEDURE:

1. Connect instruments as shown in Figure 5-3.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC

Constant Amplitude Signal Generator

Set controls for 60 mV 50-kHz signal.

3. Adjust MAIN TRIGGER LEVEL for a stable display.

4. Adjust constant amplitude signal generator voltage vernier for 6 divisions of vertical display.

5. Set constant amplitude signal generator controls for a frequency output of 75 MHz. The vertical display on the CRT should be equal to or greater than 4.3 divisions.

Channel A Bandwidth ≥4.3 div_____

6. Connect constant amplitude signal generator to Channel B.

7. Set DISPLAY to B.

8. Repeat steps 2 through 5 for Channel B.

Channel B Bandwidth ≥4.3 div_____

9. Remove test equipment.

10. Set Model 1707A controls as follows:

DISPLAY ..... A

11. Refer to Schematics 3 through 7 if either channel does not meet the bandwidth specification.

5-25. INPUT RESISTANCE.

SPECIFICATION: The input is 1 megohm ±2% shunted by approximately 24 pF.

DESCRIPTION: The input resistance is measured with an ohmmeter to verify input impedance.

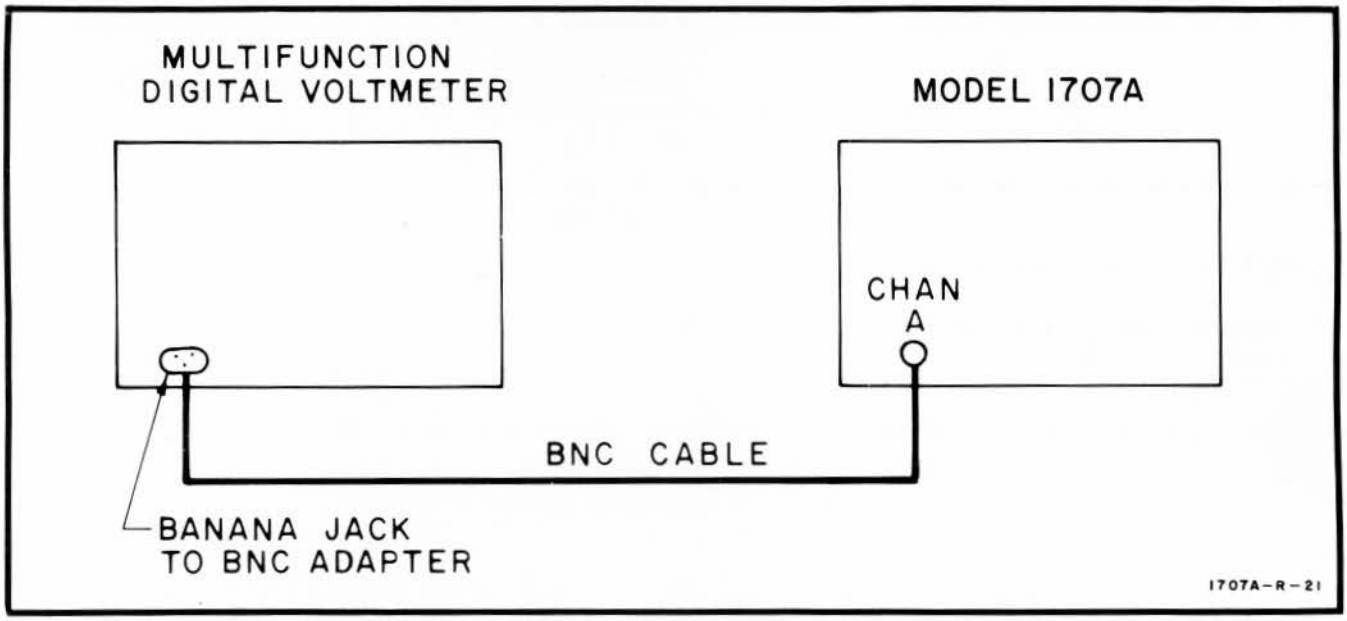


Figure 5-4. Input Resistance Test Setup

EQUIPMENT:

Multifunction Digital Voltmeter

BNC Cable

Banana Jack to BNC Adapter

PROCEDURE:

1. Connect instruments as shown in Figure 5-4.

2. Set instrument controls as follows:

Model 1707A

Channel A and B Coupling . . . . . DC

Multifunction digital voltmeter.

Set controls to measure 10 megohm.

NOTE

Use a range on the digital voltmeter having an output voltage of less than 1.2 volts. The input circuit is protected against voltages in excess of 1.2 volts.

3. Connect BNC cable to the Channel A INPUT. Channel A INPUT should measure 1 megohm ±2%.

Channel A Resistance 0.98 megohm_____1.02 megohm

4. Check all Channel A VOLTS/DIV ranges.

5. Move the BNC cable from Channel A to Channel B. Channel B input resistance should measure 1 megohm ±2%.

Channel B Resistance 0.98 megohm_____1.02 megohm

6. Check all Channel B VOLTS/DIV ranges.

7. Remove test equipment.

8. Set Model 1707A controls as follows:

Channel A and B VOLTS/DIV 01
Channel A and B Coupling . . . . . AC

9. Refer to Paragraph 5-50 and Schematics 3 and 4 if input resistance specifications are not met.

5-26. COMMON MODE REJECTION RATIO (CMRR).

SPECIFICATION: Frequency: dc to 1 MHz. Rejection ratio: At least 40 dB on 10 mV/DIV range, at least 20 dB on all other ranges with verniers set for optimum rejection. Common mode signal amplitude equal to 30 divisions.

DESCRIPTION: This measurement is made by applying identical signals to channel A and channel B and operating in the A + B (B INVT) mode. The signal displayed on the CRT will be the common mode signal.

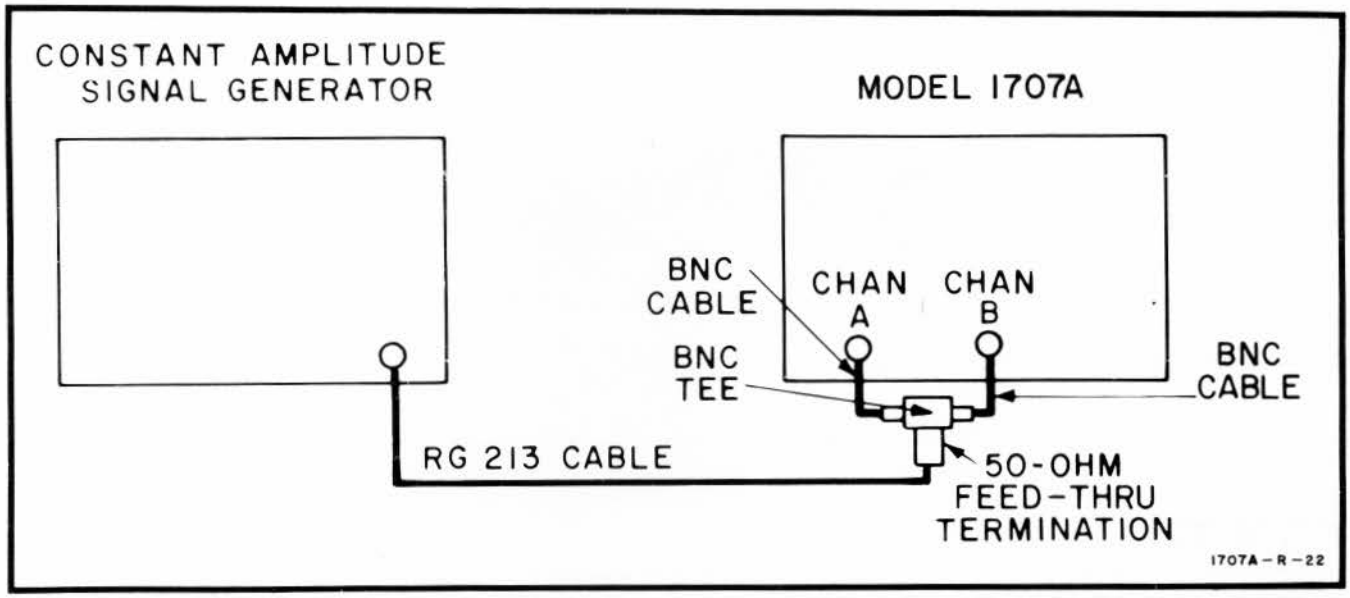


Figure 5-5. Common Mode Rejection Test Setup

EQUIPMENT:

Constant Amplitude Signal Generator

BNC Cable 9" (2)

BNC Tee

RG 213 Cable

50-ohm Feed-through Termination

PROCEDURE:

1. Connect instruments as shown in Figure 5-5.

2. Set instrument controls as follows:

   Model 1707A

   VOLTS/DIV ..... .05
   MAIN TIME/DIV ..... 5 uSEC

   Constant Amplitude Signal Generator

   Set controls for a 50-kHz, 0.3-volt p-p output signal.

3. Set DISPLAY switch to A + B mode.

4. Set Channel A and B VOLTS/DIV to .01.

5. Set B POL switch to INVT position. The display should be less than 0.3 division.

CMRR (50 kHz/0.01 VOLTS/DIV)_____<0.3 div

6. Increase constant amplitude signal generator frequency to 1 MHz. The display should be less than 0.3 division.

CMRR (1 MHz/0.01 VOLTS/DIV)_____<0.3 div

7. **For all other vertical sensitivity ranges (VOLTS/DIV), 30 divisions of signal at 1 MHz applied to Channel A and B** INPUT will result in a deflection factor equal to or less than 3 divisions. This deflection factor is with verniers adjusted for optimum rejection.

8. Remove test equipment.

9. **Set Model 1707A controls as follows:**

DISPLAY . . . . . A
B POL . . . . . NORM
Channel A and B VOLTS/DIV 01

10. Refer to Schematic 4 if the CMRR specification is not met.

5-27. MAIN SWEEP TIME.

SPECIFICATION:

Ranges: From 0.1 usec/div to 0.2 sec/div (20 ranges) and 1, 2, 5 sequence. Accuracy is ±3% with vernier in CAL position.

Vernier: Continuously variable between all ranges; extends slowest sweep to at least .5 sec/div. VERNIER UNCAL light indicates when vernier is not in CAL position.

Magnifier: Expands all sweeps by a factor of 10 and extends the fastest sweep speed to 10 ns/div. Accuracy is ±5%.

DESCRIPTION: The instrument time base is compared against a time mark generator to verify specifications.

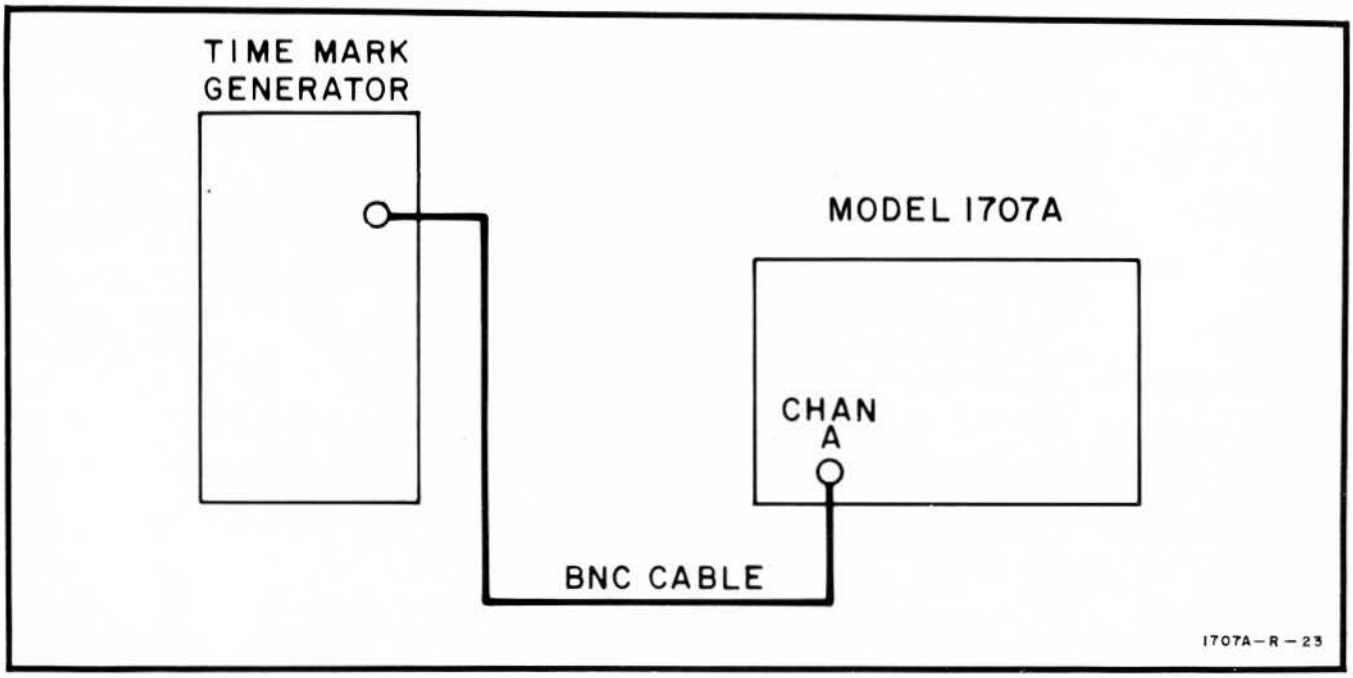


Figure 5-6. Main Sweep Time Test Setup

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect instruments as shown in Figure 5-6.

2. **Set instrument controls as follows:**

Model 1707A

Channel A VOLTS/DIV . . . . . As required
MAIN TIME/DIV . . . . . .1 uSEC

Time Mark Generator

Set output for 0.1 usec markers.

3. Adjust HORIZONTAL POSITION control so the first marker is aligned with the first left hand vertical graticule. Eleven markers should be present on the screen.

.1 uSEC _____ 11 markers in 10 div ±0.3 div

4. **Proceed to check the rest of the TIME/DIV settings using Table 5-3.**

5. Set TIME/DIV switch to 1 uSEC.

6. Set time mark generator for 5 usec time marks. Adjust HORIZONTAL POSITION control so three time marks appear on the CRT.

7. Rotate MAIN VERNIER full counterclockwise. VERNIER UNCAL light should be lighted. The time period between time marks should be less than 2 major divisions.

MAIN VERNIER Check _____ <2 div

8. Return MAIN VERNIER to CAL position.

9. Set time mark generator for 1 usec time marks. Eleven time marks should appear on CRT.

10. Press MAG pushbutton (X10). Adjust HORIZONTAL POSITION control until two time marks appear 10 divisions apart ±0.5 division.

MAG (X10) 9.5 div _____ 10.5 div

11. Remove test equipment.

12. **Set Model 1707A controls as follows:**

Channel A VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC
MAG X1

13. Refer to the following paragraphs and schematics if any of these tests fail:

a. Sweep ranges: Paragraph 5-45, Schematics 10 and 11.

b. Vernier check: Paragraph 5-45, Schematics 10 and 11.

c. MAG (X10) check: Paragraph 5-46, Schematic 15.

Table 5-3. Main Sweep Performance Check

Time Mark Generator	Main Time/Div	Time Marks To Check
.1 usec	.1 uSEC	11 in 10 div ±.3 div
.5 usec	.2 uSEC	5 in 10 div ±.3 div
.5 usec	.5 uSEC	11 in 10 div ±.3 div
1 usec	1 uSEC	11 in 10 div ±.3 div
5 usec	2 uSEC	5 in 10 div ±.3 div
5 usec	5 . uSEC	11 in 10 div ±.3 div
10 usec	10 uSEC	11 in 10 div ±.3 div
50 usec	20 uSEC	5 in 10 div ±.3 div
50 usec	50 uSEC	11 in 10 div ±.3 div
.1 ms	.1 mSEC	11 in 10 div ±.3 div
.5 ms	.2 mSEC	5 in 10 div ±.3 div
.5 ms	.5 mSEC	11 in 10 div ±.3 div
1 ms	1 mSEC	11 in 10 div ±.3 div
5 ms	2 mSEC	5 in 10 div ±.3 div
5 ms	5 mSEC	11 in 10 div ±.3 div
10 ms	10 mSEC	11 in 10 div ±.3 div
50 ms	20 mSEC	5 in 10 div ±.3 div
50 ms	50 mSEC	11 in 10 div ±.3 div
.1 sec	.1 SEC	11 in 10 div ±.3 div
.5 sec	.2 SEC	5 in 10 div ±.3 div

5-28. CALIBRATOR.

SPECIFICATION:

Type: 1 kHz ±10% square wave.

Voltage: 1 volt p-p ±1%.

DESCRIPTION: The frequency is checked by the Model 1707A. The calibrator amplitude is checked by comparing the p-p signal against a known 0.1% 1 volt p-p signal.

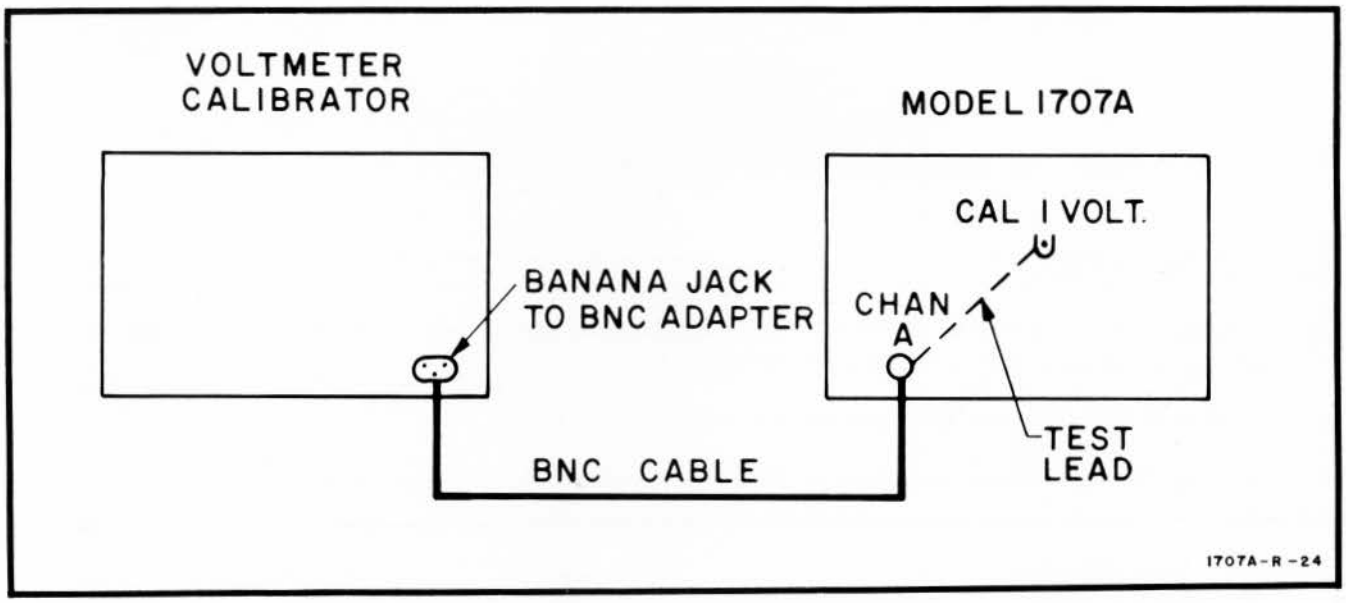


Figure 5-7. Calibrator Measurement Test Setup

EQUIPMENT:

Voltmeter Calibrator

Banana Jack to BNC Adapter

BNC Cable

Test Lead

PROCEDURE:

1. Connect instruments as shown in Figure 5-7.

2. Set instrument controls as follows:

   Model 1707A

   Channel A VOLTS/DIV 1
   Channel A Coupling . . . . . DC
   MAIN TIME/DIV . . . . . .2 mSEC

   Voltmeter Calibrator

   Set for 1V p-p output.

3. Adjust VOLTS/DIV Vernier knob so the display is exactly 6 divisions of vertical amplitude.

50-ohm Feed-Through Termination

Female BNC to GR874 Adapter

PROCEDURE:

1. Connect instruments as shown in Figure 5-8.

2. Set instrument controls as follows:

Model 1707A

MAIN TIME/DIV . . . . . .1 uSEC
MAG X10
Channel A VOLTS/DIV 1

Constant Amplitude Signal Generator

Set controls for a 35 MHz, 0.5 division display output signal.

3. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly.

Internal Triggering (35 MHz)_____(√)

4. Set constant amplitude signal generator controls for 75 MHz, 1.5 division display output signal.

5. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly.

Internal Triggering (75 MHz)_____(√)

6. Push INT/EXT pushbutton (EXT).

7. Set constant amplitude signal generator controls for 75 MHz, 35 mV RMS (100 mV p-p) signal as read on the RF millivoltmeter

8. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly.

External Triggering (75 MHz)_____(√)

9. Set constant amplitude signal generator controls for 35 MHz, 17.5 mV RMS (50 mV p-p) signal as read on the RF millovoltmeter.

10. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly.

External Triggering (35 MHz)_____(√)

11. Release INT/EXT pushbutton (INT).

12. Release MAG pushbutton (X1).

13. Disconnect the constant amplitude signal generator from the instrument.

14. Connect audio oscillator output to Channel A INPUT.

15. Set DISPLAY to CHOP.

16. Set Model 1707A TIME/DIV control to 2 uSEC.

17. Set oscillator controls for a 50 mV, 100 kHz output signal.

18. Adjust MAIN TRIGGER LEVEL for a stable display. A segmented display should be observed. This is a normal display.

Chop Triggering (100 kHz) (√)

19. Remove test equipment.

20. **Set Model 1707A controls as follows:**

DISPLAY . . . . . A
VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC

21. Refer to Paragraphs 5-41 and 5-42 and Schematic 8 and 9 if any of the triggering specifications are not met.

5-30. TRIGGER LEVEL RANGE AND POLARITY.

SPECIFICATION: The trigger level should adjust smoothly at any point on the vertical waveform for both the negative and positive portions of the slope. In the EXT mode, triggering should adjust from −1.5V to +1.5V.

DESCRIPTION: The trigger level range and polarity are checked against a calibrated input to ensure that the instrument triggers on both the negative and positive slopes of the input signal.

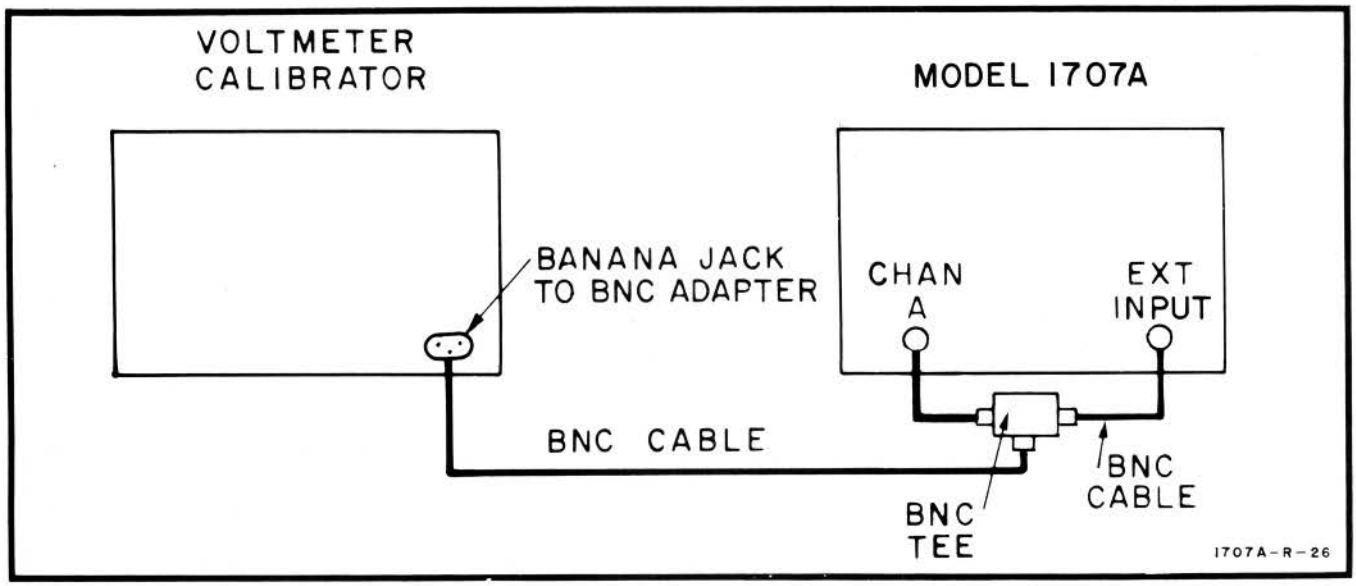


Figure 5-9. Trigger Range and Polarity Test Setup

EQUIPMENT:

Voltmeter Calibrator

BNC Cable

BNC Tee

Banana Jack to BNC Adapter

PROCEDURE:

1. Connect instruments as shown in Figure 5-9.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV 5
MAIN TIME/DIV . . . . . .5 mSEC

Voltmeter Calibrator

Set controls for a 5-volt, 400-Hz output signal.

3. Rotate MAIN TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across positive slope of the waveform displayed on the CRT.

INT Trigger Level (+)_____(√)

4. Press MAIN SLOPE pushbutton (−).

5. Rotate TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across negative slope of the waveform displayed on the CRT.

INT Trigger Level (−)_____(√)

6. Press INT/EXT pushbutton (EXT).

7. Repeat steps 1 through 5 in EXT position. Triggering in EXT for both positive and negative slope should operate smoothly −1.5V to +1.5V.

EXT Trigger Level (+) −1.5V_____+1.5V
EXT Trigger Level (−) −1.5V_____+1.5V

8. Remove test equipment.

9. **Set Model 1707A controls as follows:**

VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC
INT/EXT . . . . . INT
SLOPE . . . . . +

10. Refer to Paragraph 5-41 and Schematic 8 if any of these measurements are not met.

5-31. EXT INPUT RESISTANCE.

SPECIFICATION: The input is 1 megohm ±2% shunted by approximately 27 pF.

DESCRIPTION: The input resistance is measured with a meter to verify input impedance.

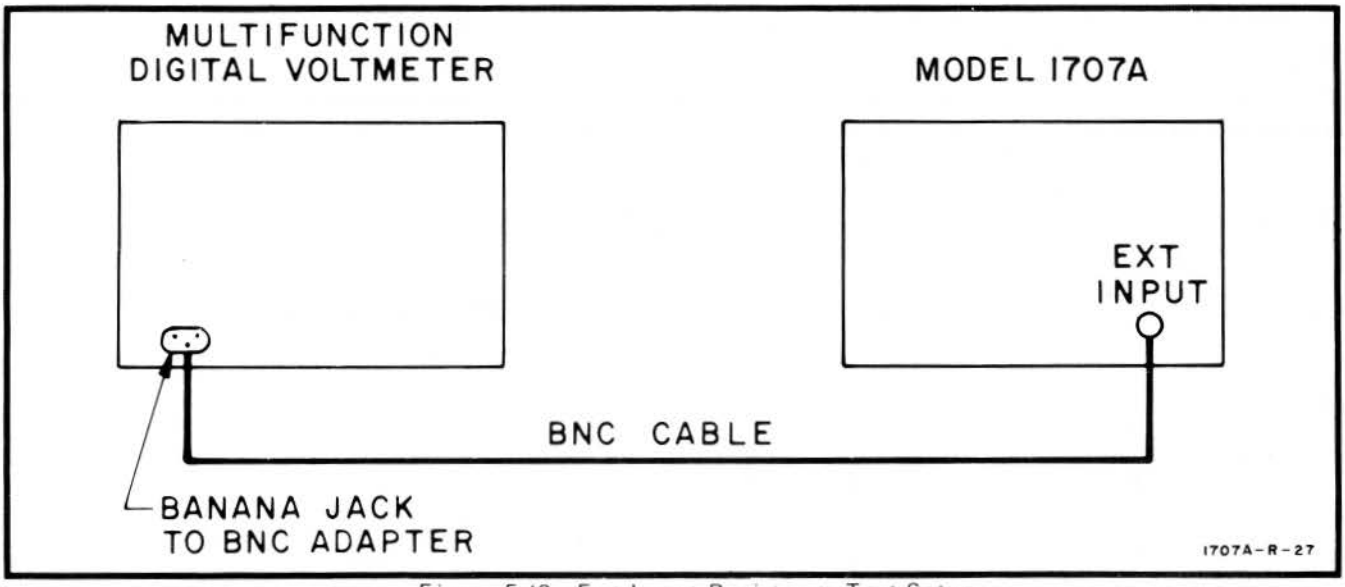


Figure 5-10. Ext Input Resistance Test Setup

EQUIPMENT:

Multifunction Digital Voltmeter

BNC Cable

Banana Jack to BNC Adapter

PROCEDURE:

1. Connect instruments as shown in Figure 5-10.
2. Set instrument controls as follows:

   Model 1707A

   MAIN AC/DC . . . . . DC

   INT/EXT . . . . . EXT

   Multifunction Digital Voltmeter

   Set controls to 10 megohm range.

NOTE

Use a range on the digital voltmeter having an output voltage of less than 1.2 volts. The input circuit is protected against voltages in excess of 1.2 volts.

3. Connect BNC cable to the EXT INPUT. Input resistance should measure 1 megohm ±2%.

   Input Resistance 0.98 megohm _____ 1.02 megohm

4. Set Model 1707A INT/EXT to INT.
5. Remove test equipment.
6. Refer to Schematic 8 if resistance specifications are not met.

5-32. DELAYED SWEEP TIME.

SPECIFICATION:

Ranges: From 0.1 usec/div to 0.1 sec/div (19 ranges) in a 1, 2, 5 sequence. Accuracy ±3% with vernier in CAL position.

Vernier: Continuously variable between all ranges; extends slowest sweep speed to at least .25 sec/div. VERNIER UNCAL light indicates when vernier is not in CAL position.

DESCRIPTION: The delayed time base is compared against a time mark generator to verify specifications.

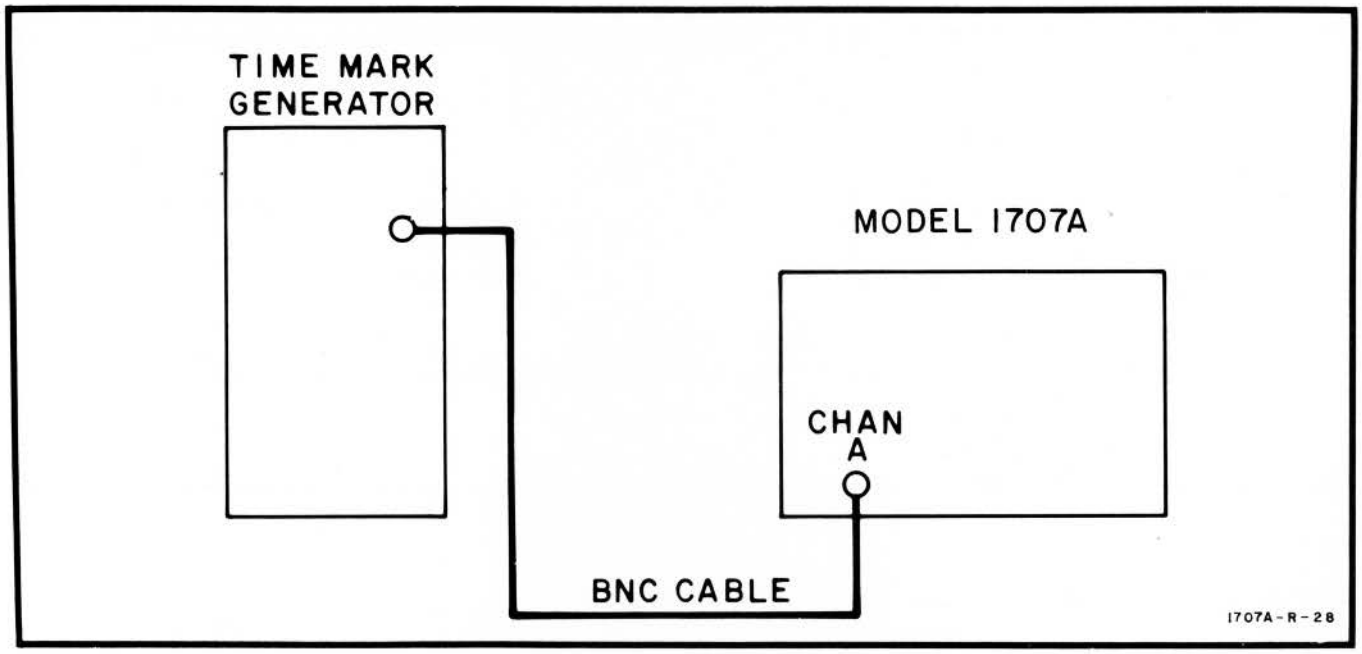


Figure 5-11. Delayed Sweep Time Setup

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect instruments as shown in Figure 5-11.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV . . . . . as required
DELAYED TIME/DIV . . . . . .1 uSEC
Display . . . . . DELAYED SWEEP
MAIN TIME/DIV. . . . . .2 uSEC

Time Mark Generator

Set output for .1 usec markers.

2. Adjust HORIZONTAL POSITION controls so the first marker is aligned with the first left hand vertical graticule. Eleven markers should be present on the screen.

.1 usec_____11 markers in 10 div ±.3 div

3. Proceed to check the rest of the DELAYED TIME/DIV settings using Table 5-4. The MAIN TIME/DIV control should be one step slower than DELAYED TIME/DIV.

Table 5-4. Delayed Sweep Performance

Time Mark Generator	Delayed Time/Div	Time Marks To Check
.1 usec	.1 uSEC	11 in 10 div ±.3 div
.5 usec	.2 uSEC	5 in 10 div ±.3 div
.5 usec	.5 uSEC	11 in 10 div ±.3 div
1 usec	1 uSEC	11 in 10 div ±.3 div
5 usec	2 uSEC	5 in 10 div ±.3 div
5 usec	5 uSEC	11 in 10 div ±.3 div
10 usec	10 uSEC	11 in 10 div ±.3 div
50 usec	20 uSEC	5 in 10 div ±.3 div
50 usec	50 uSEC	11 in 10 div ±.3 div
.1 ms	.1 mSEC	11 in 10 div ±.3 div
.5 ms	.2 mSEC	5 in 10 div ±.3 div
.5 ms	.5 mSEC	11 in 10 div ±.3 div
1 ms	1 mSEC	11 in 10 div ±.3 div

Table 5-4. Delayed Sweep Performance (Cont'd)

Time Mark Generator	Delayed Time/Div	Time Marks To Check
5 ms	2 mSEC	5 in 10 div ±.3 div
5 ms	5 mSEC	11 in 10 div ±.3 div
10 ms	10 mSEC	11 in 10 div ±.3 div
50 ms	20 mSEC	5 in 10 div ±.3 div
50 ms	50 mSEC	11 in 10 div ±.3 div
.1 sec	.1 SEC	11 in 10 div ±.3 div

4. Set DELAYED TIME/DIV switch to 1 mSEC.

5. Set time mark generator for 5 ms time marks.

6. Adjust DELAY TIME until three time marks appear on the CRT.

7. Rotate delay VERNIER full counterclockwise. VERNIER UNCAL light should be lighted. The time period should be equal to or less than two divisions.

NOTE

Sweep length decreases as VERNIER is turned counter-clockwise.

Delayed Vernier Check_____ ≤2 div

8. Return DELAYED VERNIER to CAL position.

9. Remove all test equipment.

10. Set Model 1707A controls as follows:

VOLTS/DIV 01
DELAYED TIME/DIV . . . . . OFF
Display . . . . . MAIN SWEEP

11. Refer to Paragraph 5-49 and Schematics 12 and 13 if any of the tests fail.

5-33. DELAYED TRIGGERING.

SPECIFICATION: Internal; DC to 35 MHz on signals causing one-half division or more of vertical deflection increasing to 1.5 divisions at 75 MHz in all display modes except chop; dc to 100 kHz in chop mode.

DESCRIPTION: Delayed triggering is checked with known input signals to ensure proper triggering.

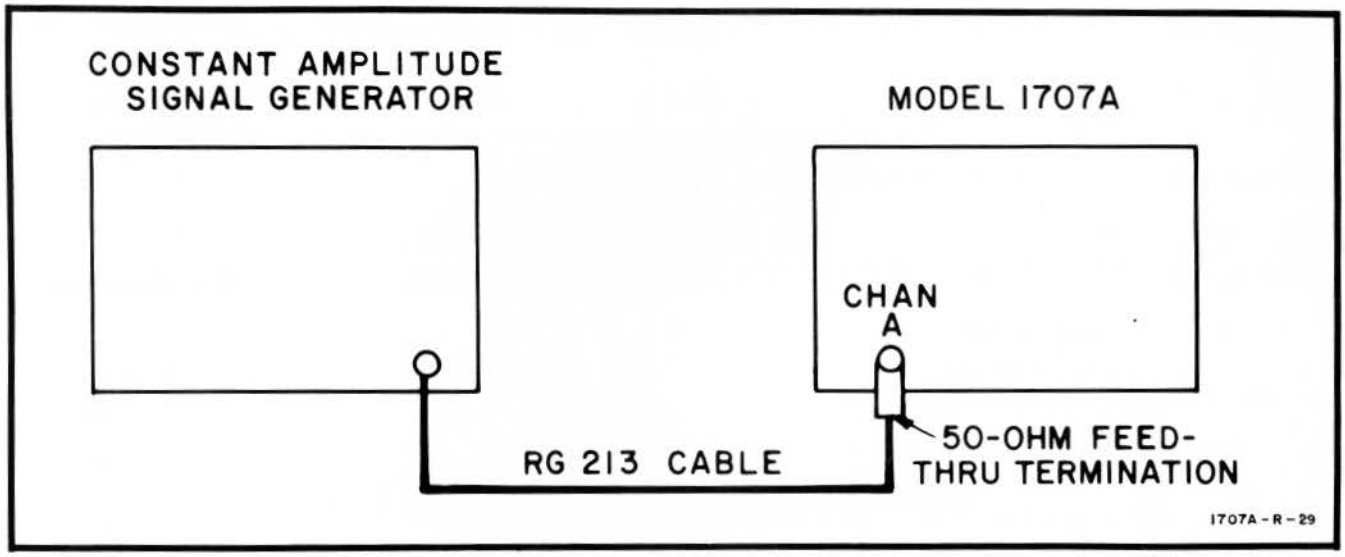


Figure 5-12. Delay Triggering Test Setup

EQUIPMENT:

Constant Amplitude Signal Generator

RG 213 Cable

50-ohm Feed-through Termination

PROCEDURE:

1. Connect instruments as shown in Figure 5-12.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV	.5
MAIN TIME/DIV	.2 uSEC
DELAYED TIME/DIV	.1 uSEC
DELAYED AUTO/TRIG	TRIG
Display	DELAYED SWEEP
MAIN TRIGGER LEVEL	ccw

Constant Amplitude Signal Generator

Set controls for a 35 MHz, 0.5 division display output signal.

3. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly.

Delayed Internal Triggering (35 MHz)_____(√)

4. Set constant amplitude signal generator controls for 75 MHz, 1.5 division display output signal.

5. Adjust MAIN TRIGGER LEVEL for a stable display. If a stable display is obtained, the instrument is triggering properly

Delayed Internal Triggering (75 MHz) (√)

6. Disconnect test equipment.

7. Set Model 1707A controls as follows:

VOLTS/DIV	.01
MAIN TIME/DIV	5 uSEC
DELAYED TIME/DIV	OFF
DELAYED AUTO/TRIG	AUTO
Display	MAIN SWEEP

8. Refer to Paragraph 5-42 and Schematics 8 and 9 if delayed triggering specifications are not met.

5-34. DELAY JITTER.

SPECIFICATION: Delay jitter should be less than .02%.

DESCRIPTION: The delay jitter is checked by expanding the sweep by 20,000 and visually monitoring the jitter.

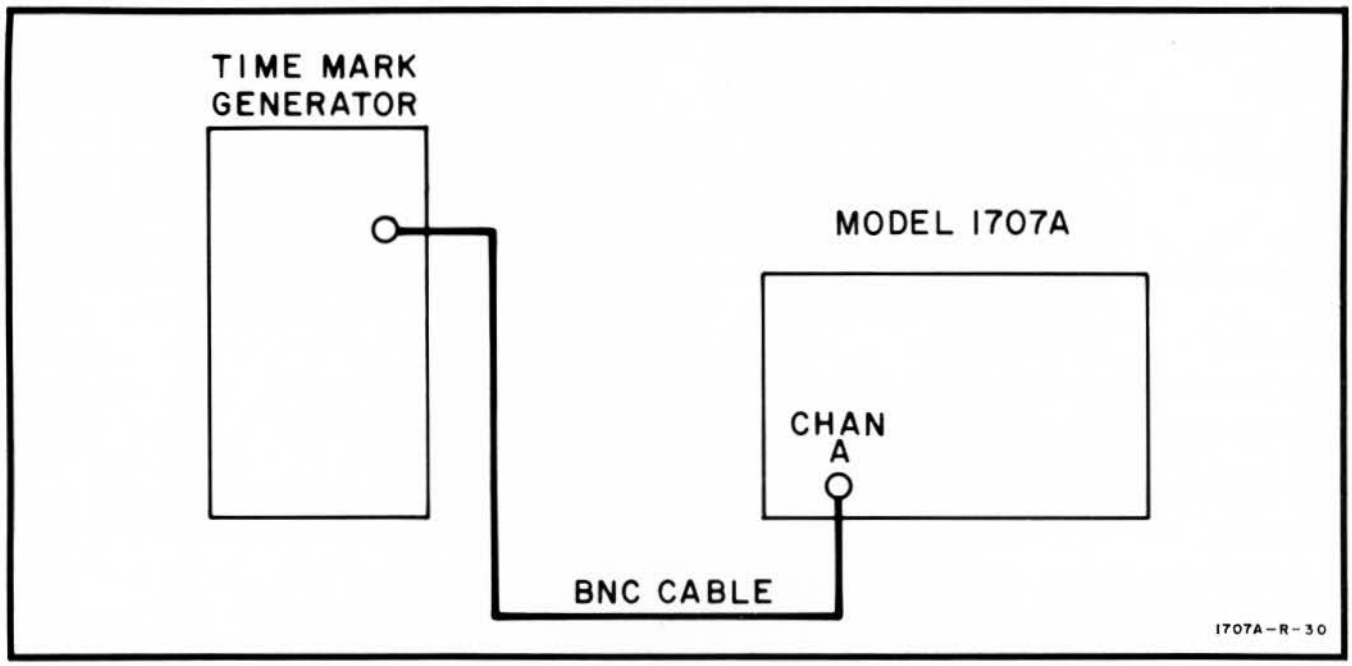


Figure 5-13. Delay Jitter Test Setup

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect instruments as shown in Figure 5-13.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV	.5
MAIN TIME/DIV	1 mSEC
DELAYED TIME/DIV	.5 uSEC
Display	MAIN SWEEP

Time Mark Generator

Set for 1 ms time marks.

3. Adjust DELAY TIME so intensified portion of sweep is at the 11th graticule line.

4. Turn display mode to DELAYED SWEEP.

5. Adjust DELAY TIME so display is centered.

6. **Display jitter should be less than 1 division which is equal to less than .02%.**

Display jitter_____<1 div

7. Remove test equipment.

8. **Set Model 1707A controls as follows:**

VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC
DELAYED TIME/DIV . . . . . OFF
Display . . . . . MAIN SWEEP

9. Refer to Schematics 8, 9, 12, 13, and 15 if specifications are not met.

PERFORMANCE CHECK RECORD

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS			
		MIN	ACTUAL		MAX
5-22	DEFLECTION FACTOR		Chan A	Chan B	
	.01 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	.02 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	.05 VOLTS/DIV	5.82 div	_____	_____	6.18 div
	.1 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	.2 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	.5 VOLTS/DIV	5.82 div	_____	_____	6.18 div
	1 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	2 VOLTS/DIV	4.85 div	_____	_____	5.15 div
	5 VOLTS/DIV	5.82 div	_____	_____	6.18 div
	Channel A Vernier		_____	_____	≤2.4 div
	Channel B Vernier		_____	_____	≤2.4 div
5-23	RISETIME				
	Channel A Risetime		_____		<4.6 ns
	Channel B Risetime		_____		<4.6 ns
5-24	BANDWIDTH				
	Channel A Bandwidth	≥4.3 div	_____		
	Channel B Bandwidth	≥4.3 div	_____		
5-25	INPUT RESISTANCE				
	Channel A Resistance	.98 megohm	_____		1.02 megohm
	Channel B Resistance	.98 megohm	_____		1.02 megohm
			_____		
			_____		
5-26	COMMON MODE REJECTION RATIO (CMRR)				
	CMRR (50 kHz/0.01 volts/div)		_____		<.3 div
	CMRR (1 MHz/0.01 volts/div)		_____		<.3 div
5-27	MAIN SWEEP TIME				
	.1 uSEC	11 in 9.7 div	_____		11 in 10.3 div
	.2 uSEC	5 in 9.7 div	_____		5 in 10.3 div
	.5 uSEC	11 in 9.7 div	_____		11 in 10.3 div
	1 uSEC	11 in 9.7 div	_____		11 in 10.3 div
	2 uSEC	5 in 9.7 div	_____		5 in 10.3 div
	5 uSEC	11 in 9.7 div	_____		11 in 10.3 div

PERFORMANCE CHECK RECORD (CONT'D)

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS		
		MIN	ACTUAL	MAX
5-27 (Cont'd)	10 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	20 uSEC	5 in 9.7 div	_____	5 in 10.3 div
	50 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	.1 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	.2 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	.5 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	1 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	2 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	5 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	10 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	20 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	50 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	.1 SEC	11 in 9.7 div	_____	11 in 10.3 div
	.2 SEC	5 in 9.7 div	_____	5 in 10.3 div
	Main Vernier Check		_____	<2 div
	Mag (X10) Check	9.5 div	_____	10.5 div
5-28	CALIBRATOR			
	Calibrator Amplitude	5.94 div	_____	6.06 div
	Calibrator Frequency	900 Hz	_____	1100 Hz
5-29	MAIN TRIGGERING			
	Internal Triggering (35 MHz)		_____	√
	Internal Triggering (75 MHz)		_____	√
	External Triggering (75 MHz)		_____	√
	External Triggering (35 MHz)		_____	√
	Chop Triggering (100 kHz)		_____	√
5-30	TRIGGER LEVEL RANGE AND POLARITY			
	Int Trigger Level (+)		_____	√
	Int Trigger Level (−)		_____	√
	Ext Trigger Level (+)	−1.5V	_____	+1.5V
	Ext Trigger Level (−)	−1.5V	_____	+1.5V
5-31	EXT INPUT RESISTANCE			
	Input Resistance	.98 megohm	_____	1.02 megohm
5-32	DELAYED SWEEP TIME			
	.1 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	.2 uSEC	5 in 9.7 div	_____	5 in 10.3 div

PERFORMANCE CHECK RECORD (CONT'D)

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS		
		MIN	ACTUAL	MAX
	.5 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	1 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	2 uSEC	5 in 9.7 div	_____	5 in 10.3 div
	5 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	10 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	20 uSEC	5 in 9.7 div	_____	5 in 10.3 div
	50 uSEC	11 in 9.7 div	_____	11 in 10.3 div
	.1 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	.2 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	.5 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	1 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	2 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	5 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	10 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	20 mSEC	5 in 9.7 div	_____	5 in 10.3 div
	50 mSEC	11 in 9.7 div	_____	11 in 10.3 div
	.1 SEC	11 in 9.7 div	_____	11 in 10.3 div
	Delayed Vernier Check		_____	≤2 div
5-33	DELAYED TRIGGERING			
	Delayed Internal Triggering (35 MHz)		_____	√
	Delayed Internal Triggering (75 MHz)		_____	√
5-34	DELAY JITTER			
	Delay Jitter		_____	<1 div

5-35. ADJUSTMENT PROCEDURES.

5-36. LOW VOLTAGE POWER SUPPLY ADJUSTMENT.

REFERENCE: Schematics 19 and 20, Figures 8-70, 8-71 and 8-72. Adjustment Locations Figure 5-14.

DESCRIPTION: The +15V is the only regulated voltage in this instrument. The rest of the voltages in this instrument are referenced to +15V. The voltage accuracy is set by using a digital voltmeter to monitor the +15V.

EQUIPMENT:

Digital Voltmeter

Test Leads

PROCEDURE:

1. Remove top and bottom covers.

2. Connect digital voltmeter to Gate Assembly wire (92).

WARNING

Power is present in the Line Rectifier Assembly, (A2) and Low Voltage Mother Board (A3A1) when POWER switch is OFF.

3. Turn instrument on.

4. Adjust A3A2R3, low voltage adjust for a meter indication of +15V ±10 mV.

Low Voltage Adj 14.99V_____15.01V

5. Check the rest of power supply output voltages as shown in Table 5-5.

Table 5-5. Power Supply Voltage Limits

Supply	Test Point	Limits	
+15V	A4 Wire (92)	+14.99V	+15.01V
−15V	A4 Wire (97)	−14.5V	−15.75V
+5V	A4 Wire (93)	+5.1V	+5.5V
+50V	A4 Wire (2)	+47V	+52V
−50V	A4 Wire (7)	−47V	−52V
+80V	A4 Wire (926)	+80V	+90V

6. Turn instrument off.

7. If any voltage measurement is inaccurate, refer to Schematics 18, 19 and 20 troubleshooting information.

5-37. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT.

REFERENCE: Schematics 17, Figures 5-14 and 8-58.

DESCRIPTION: The high voltage is adjusted by comparing it against a known calibrated voltage standard.

EQUIPMENT:

Digital Voltmeter

Voltmeter Calibrator

1000: 1 Divider Probe

PROCEDURE:

1. Remove CRT cover from rear of CRT.
2. Remove cover from rear of CRT socket.
3. Turn instrument on.
4. Connect digital voltmeter through 1000 to 1 divider probe to voltmeter calibrator.
5. Set voltmeter calibrator to −100-volt output.
6. Note voltmeter indication.
7. Multiply indication in step 6 by 21.5.
8. Monitor high voltage applied to CRT pin 2 (red wire) using 1000 to 1 divider probe and digital voltmeter.
9. Adjust A3A4R1, high voltage adjust, for value calculated in step 7.
10. Turn instrument off.
11. Disconnect test equipment and replace covers on socket and CRT.
12. Check high voltage power supply circuits on Schematic 17 if adjustment can not be made.

5-38. INTENSITY LIMIT ADJUSTMENT.

REFERENCE: Schematic 17, Figures 5-14 and 8-58.

DESCRIPTION: The intensity limit adjustment is set so the front panel INTENSITY control has complete range. This range is from extinguished to complete brightness.

PROCEDURE:

1. Turn instrument on.
2. Obtain a free-running trace (Figure 3-2).
3. Set INTENSITY control to 9 o'clock position.
4. Adjust A3A4R15, intensity limit, until trace is just extinguished.
5. Set INTENSITY control to 10 o'clock position and verify that trace is visible.
6. Check the high voltage power supply circuit on Schematic 17 if this adjustment cannot be made.

5-39. Y-AXIS ALIGNMENT.

REFERENCE: Schematics 16 and 17, Figures 5-14, 8-55 and 8-58.

DESCRIPTION: The internal orth adjust is set to align the trace on the Y-Axis.

EQUIPMENT:

Oscillator

NOTE

Make sure the horizontal trace is properly aligned before proceeding with this adjustment.

PROCEDURE:

1. Connect Audio Oscillator set for 10KHz, 60MV output to Channel A INPUT.
2. Set Sweep Display to DELAYED SWEEP (leave delayed sweep time OFF).
3. Adjust HORIZONTAL POSITION until vertical line is centered on CRT screen.
4. Adjust A4R35, ORTH adjust, until vertical line is aligned on major Y-Axis graticule.
5. Disconnect Audio Oscillator.
6. Set Sweep Display to MAIN SWEEP.
7. Refer to Schematics 16 and 17 if adjustment cannot be made.

5-40. GATE AMPLIFIER RESPONSE ADJUSTMENT.

REFERENCE: Schematic 16, Figures 5-14 and 8-58.

DESCRIPTION: The gate amplifier is adjusted for optimum response.

EQUIPMENT:

Monitor Oscilloscope

10:1 Divider Probe

PROCEDURE

1. Set MAIN TIME/DIV to 1 uSec.
2. Connect divider probe from monitor oscilloscope to wire (1) on A4 gate amplifier assembly board.
3. Set monitor oscilloscope controls as follows:

   a. Coupling ..... DC
   b. All others ..... Normal display

4. Adjust Model 1707A INTENSITY for 20V amplitude pulse as displayed on monitor oscilloscope.

5. Adjust A4C12, gate response adjust, for fastest risetime and flatest pulse of positive going signal.

6. Disconnect test equipment.

7. Set MAIN TIME/DIV to 5 uSEC.

8. Refer to Schematic 16 if this adjustment cannot be made.

5-41. TRIGGER AMPLIFIER BALANCE AND DC LEVEL ADJUSTMENT.

REFERENCE: Schematics 5 and 6, Figures 5-14 and 8-15.

DESCRIPTION: The Composite Sync adj and Channel A Sync adj are set so the instrument triggers at the same point on all signals.

EQUIPMENT:

Oscillator

PROCEDURE:

1. Connect oscillator to Channel A INPUT.

2. Set Channel A VOLTS/DIV to .1.

3. Set oscillator to 50-kHz output and 6-div amplitude.

4. Set MAIN TIME/DIV switch to 5 uSEC.

5. Adjust Vertical POSITION to center graticule.

6. Adjust TRIGGER LEVEL until sweep triggers at center graticule.

7. Set trigger coupling to DC.

8. Adjust A5A4R81, composite sync adj, until sweep triggers at the same point as in step 6.

9. Change DISPLAY to ALT.

10. Adjust A6A4R66, Channel A sync zero, until sweep triggers at some point as in step 6.

11. Disconnect test equipment.

12. Set Model 1707A controls as follows:

DISPLAY	A
VOLTS/DIV	.01

13. Refer to Schematics 5, 6 and 9 if this adjustment cannot be made.

5-42. TRIGGER SENSITIVITY ADJUSTMENT.

REFERENCE: Schematic 9, Figures 5-14 and 8-31.

DESCRIPTION: Trigger sensitivity is adjusted with a calibrated input to ensure proper triggering range.

EQUIPMENT:

Constant Amplitude Signal Generator

RG 213 Cable

50-ohm Feed-through Termination

PROCEDURE:

1. Set Model 1707A controls as follows:

Coupling	AC
DISPLAY	A
MAIN TIME/DIV	5 uSEC
Channel A VOLTS/DIV	1
Trigger Coupling	HF REJ
DELAYED AUTO/TRIG	TRIG

2. Connect constant amplitude signal generator to Channel A INPUT.

3. Set constant amplitude signal generator for a 0.5-volt, 1-MHz output.

4. Adjust A6A2R45, trigger sensitivity, and MAIN TRIGGER LEVEL until stable display occurs.

5. Recheck performance in accordance with Paragraph 5-29. Readjust A6A2R45 if necessary.

6. Set Model 1707A Display to DELAYED SWEEP.

7. Set constant amplitude signal generator for a 0.5-volt, 1-MHz output.

8. Set DELAYED TIME/DIV to .5 uSEC.

9. Set MAIN TRIGGER LEVEL counterclockwise.

10. Adjust A6A2R47, trigger sensitivity, and DELAYED TRIGGER LEVEL until stable triggering occurs.

11. Disconnect test equipment.

12. Set Model 1707A controls as follows:

MAIN TIME/DIV	5 uSEC
DELAYED TIME/DIV	OFF
Display	MAIN SWEEP
Channel A VOLTS/DIV	.01
DELAYED AUTO/TRIG	AUTO

13. Refer to Schematics 8 and 9 if this adjustment cannot be made.

5-43. POSITION CENTERING ADJUSTMENT.

REFERENCE: Schematic 4, 5 and 6, Figures 5-14 and 5-15.

DESCRIPTION: Internal controls are adjusted to center the display. This adjustment varies the amplifier dc reference thus establishing position.

PROCEDURE:

1. Set DISPLAY to B.
2. Center Channel B POSITION control.
3. Adjust front panel DC BAL for no vertical trace shift as B POL switch is changed from NORM to INVT.
4. Adjust A5A4R92, position centering adjust, to center trace vertically.
5. Adjust A5A4R46, internal DC bal, for no vertical trace shift as the Channel B vernier is rotated.
6. Repeat steps 2 through 5, if necessary, until there is no further change.
7. Set DISPLAY to A.
8. Center Channel A POSITION control.
9. Adjust front panel DC BAL to center trace.
10. Adjust A5A4R43, internal DC bal, for no vertical trace shift as the Channel A vernier is rotated.
11. Repeat steps 8 through 10, if necessary, until there is no further change.
12. Set DISPLAY to A + B.
13. Adjust A5A4R70, A + B bal, to center trace.
14. Set Model 1707A controls as follows:

    DISPLAY ..... A

15. Refer to Schematics 4, 5, 6 and 7 if this adjustment cannot be made.

5-44. SWEEP LENGTH ADJUSTMENT.

REFERENCE: Schematic 15, Figures 5-14 and 8-51.

DESCRIPTION: The X1 gain adjust of the horizontal preamplifier is adjusted to set sweep length to 11 divisions.

PROCEDURE:

1. Check to see that all controls are set according to Paragraph 5-20.
2. Adjust A6A9R1, X1 gain adjust, for a display length of 11 divisions.

NOTE

Adjust A6A9R1 for a display length of 10 divisions. Position right end of display 1 division to the left and readjust A6A9R1 to increase display length of 1 division.

3. Refer to Schematic 15 if this adjustment cannot be made.

5-45. MAIN SWEEP TIMING ADJUSTMENT.

REFERENCE: Schematics 10 and 11, Figures 5-14, 8-34 and 8-38.

DESCRIPTION: The main sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect time mark generator to Channel A INPUT.

2. Set instrument controls as follows:

   Model 1707A

   DELAYED TIME/DIV ..... OFF
   MAIN TIME/DIV ..... 1 uSEC
   Display ..... MAIN SWEEP
   VOLTS/DIV ..... as required

   Constant Amplitude Signal Generator

   Set time mark generator for 0.1 usec time marks.

3. Adjust A6A5R16, Cal adjust, for 11 time marks in 10 divisions.

Table 5-6. Sweep Time Adjustments

Time marks	MAIN TIME/DIV	Adjustment	Time marks
.1 usec	.1 uSEC	A6A5R16	11
1 usec	1 uSEC	A6A5R15	11
.1 msec	.1 mSEC	A6A5R14	11
10 msec	10 mSEC	A6A5R13	11

4. Complete the rest of the sweep time adjustments per Table 5-6.

5. Disconnect test equipment.

6. Set Model 1707A controls as follows:

   MAIN TIME/DIV ..... 5 uSEC
   VOLTS/DIV ..... .01

7. Refer to Schematics 10 and 11 if this adjustment cannot be made.

5-46. X10 GAIN ADJUSTMENT.

REFERENCE: Schematic 15, Figures 5-14 and 8-51.

DESCRIPTION: The horizontal preamplifier circuit X10 gain adjust is adjusted in the expand mode for X10 magnification.

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect time mark generator to Channel A INPUT.
2. Set instrument controls as follows:

   Model 1707A

   MAIN TIME/DIV . . . . . 1 mSEC
   VOLTS/DIV . . . . . as required

   Time Mark Generator

   Set time mark generator for 0.1 ms time marks.
3. Press MAG pushbutton (X10).
4. Adjust A6A9R21, X10 gain adj, for 1 division between time marks.
5. Disconnect test equipment.
6. Release MAG pushbutton (X1).
7. Refer to Schematic 15 if this adjustment cannot be made.

5-47. MAG CENTERING ADJUSTMENT.

REFERENCE: Schematic 15, Figures 5-14 and 8-51.

DESCRIPTION: The Mag centering adjust is set so the display is expanded around center screen.

EQUIPMENT:

Time Mark Generator

BNC Cables

PROCEDURE:

1. Connect time mark generator to Channel A INPUT.
2. Set instrument controls as follows:

Model 1707A

MAIN TIME/DIV . . . . . .2 mSEC
VOLTS/DIV . . . . . as required

Time Mark Generator

Set time mark generator for 1 ms time mark.

3. Adjust HORIZONTAL POSITION so middle time mark is on the center graticule.
4. Press MAG pushbutton (X10).
5. Adjust A6A9R2, Mag centering adjust, to re-center middle time mark.
6. Disconnect test equipment.
7. Set Model 1707A controls as follows:

MAIN TIME/DIV . . . . . 5 uSEC
MAG X1

8. Refer to Schematic 15 if this adjustment cannot be made.

5-48. CALIBRATOR ADJUSTMENT.

REFERENCE: Schematic 16, Figures 5-14 and 8-55.

DESCRIPTION: The calibrator output is compared against a voltmeter calibrator standard to accurately set the calibrator amplitude.

EQUIPMENT:

Voltmeter Calibrator

Test Leads

PROCEDURE:

1. Perform DC BAL Adjustment (Figure 3-6).
2. Set Channel A VOLTS/DIV to .1.
3. Set coupling to DC.
4. Connect voltmeter calibrator to Channel A INPUT.
5. Set voltmeter calibrator to 1-volt p-p output.
6. Adjust Channel A vernier for a display of 6 divisions.
7. Disconnect voltmeter calibrator.
8. Connect CAL 1 VOLT output to Channel A INPUT.
9. Adjust A4R29, cal ampl, for a 6-division display.
10. Disconnect CAL 1 VOLT output from Channel A.
11. Set Model 1707A controls as follows:

Channel A Vernier . . . . . CAL detent

12. Refer to Schematic 16 if this adjustment cannot be made.

5-49. DELAYED SWEEP TIME ADJUSTMENT.

REFERENCE: Schematics 12 and 13, Figures 5-14, 8-41 and 8-44.

DISCRIPTION: The delayed sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

EQUIPMENT:

Time Mark Generator

BNC Cable

PROCEDURE:

1. Connect time mark generator output to Channel A INPUT.

2. Set instrument controls as follows:

Model 1707A

VOLTS/DIV . . . . . as required
MAIN TIME/DIV . . . . . .2 uSEC
DELAYED TIME/DIV . . . . . .1 uSEC
Display . . . . . DELAYED SWEEP

Time Mark Generator

Set output for .1 usec time marks.

3. Adjust A6A6R16, cal adjust, for 11 marks in 10 divisions.

4. Complete the rest of the sweep time adjustments per Table 5-7. The MAIN TIME/DIV control should be one step slower than DELAYED TIME/DIV.

Table 5-7. Delayed Sweep Time Adjustments

Time Mark Generator	Model 1707A Delay Time/Div	Adjustment	Time Mark
.1 usec	.1 uSEC	A6A6R16	11
1 usec	1 uSEC	A6A6R15	11
1 msec	1 mSEC	A6A6R14	11
10 msec	10 mSEC	A6A6R13	11

5. Disconnect test equipment.

6. Set the Model 1707A controls as follows;

VOLTS/DIV 01
MAIN TIME/DIV . . . . . 5 uSEC
DELAYED TIME/DIV . . . . . OFF
Display . . . . . MAIN SWEEP

7. Refer to Schematic 12 and 13 if this adjustment cannot be made.

5-50. LOW-FREQUENCY PULSE RESPONSE ADJ.

REFERENCE: Schematic 6, Figures 5-14, 8-21 and 8-22.

DESCRIPTION: The low frequency compensation resistor in the vertical preamplifier is adjusted for optimum pulse response.

EQUIPMENT:

Square Wave Generator

50-ohm Termination

BNC Cable

PROCEDURE:

1. Connect output of square wave generator through a 50-ohm termination to the Channel A INPUT.

2. Set instrument controls as follows:

   Model 1707A

   Channel A VOLTS/DIV ..... .01
   MAIN TIME/DIV ..... 5 usec

   Square Wave Generator

   Adjust square wave generator output for a 6-division 50 KHz display.

3. Adjust A5A4R96, L.F. COMP ADJ, for the flattest pulse response.

4. Disconnect test equipment.

5. Refer to Schematic 6 if the adjustment cannot be made.

5-51. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION ADJUSTMENT.

DESCRIPTION: The input capacitance is adjusted to make the capacitance the same on all ranges. The attenuator compensation adjustment is made with a square wave input to provide optimum square wave response.

EQUIPMENT:

LC Meter

Square Wave Generator

BNC Cable

PROCEDURE:

1. Connect 600-ohm output from square wave generator to both Channels A and B INPUT.

2. Set instrument controls as follows:

   Model 1707A

   DISPLAY ..... ALT
   VOLTS/DIV (both channels) ..... .02
   MAIN TIME/DIV ..... 20 mSEC
   Coupling (both channels) ..... DC

3. Set square wave generator for a 10 KHz, 4 division display.

4. Perform the adjustments in Table 5-8 for best square wave response.

Table 5-8. Square Wave Adjustment

VOLTS/DIV	CHANNEL A	CHANNEL B
.02	A5A1C18	A5A2C18
.05	A5A1C19	A5A2C19
.1	A5A1C8	A5A2C8
.2	A5A1C13	A5A2C13
.5	A5A1C14	A5A2C14
1	A5A1C9	A5A2C9

5. Disconnect square wave generator.

6. Connect LC meter to appropriate channel as listed in Table 5-9 and measure input capacitance on .01 VOLTS/DIV range. Adjust appropriate capacitor to obtain same input capacitance as measured on .01 VOLTS/DIV range.

Table 5-9. Capacitance Adjustment

VOLTS/DIV	CHANNEL A	CHANNEL B
.01	REFERENCE	REFERENCE
.1	A5A1C4	A5A2C4
1	A5A1C5	A5A2C5

7. Disconnect test equipment.

8. Set the Model 1707A controls as follows:

VOLTS/DIV 01
DISPLAY . . . . . A
MAIN TIME/DIV . . . . . 5 uSEC
Coupling . . . . . AC

9. Refer to Schematics 3 and 4 if the adjustments cannot be made.

5-52. PULSE RESPONSE ADJUSTMENT.

REFERENCE: Schematic 6, Figures 5-14, 8-21, and 8-22.

DESCRIPTION: The high frequency compensation capacitors in the vertical amplifiers are adjusted for optimum pulse response.

EQUIPMENT:

Fast Rise Square Wave Generator

50-ohm Termination.

RG213 Cable

PROCEDURE:

1. Connect output square wave generator through a 50-ohm termination to the Channel B INPUT.

2. Set instrument controls as follows:

Model 1707A

DISPLAY . . . . . B

Channel B VOLTS/DIV	.01
MAIN TIME/DIV	.1 uSEC
MAG	X10

Square Wave Generator

Adjust square wave generator output for a 6-division, 100-kHz display.

3. Adjust A5A4C26, A5A4C46, A5A5C7, A5A5C12, and A5A5R30 for the best pulse response with a risetime of less than 4.6 ns.

4. Observe pulse response of Channel B in the NORM and INVT positions.

5. Readjust A5A4C26, if necessary, to obtain optimum pulse response for both positions with a risetime of less than 4.6 ns.

6. Connect square wave generator to Channel A INPUT.

7. Set DISPLAY to A.

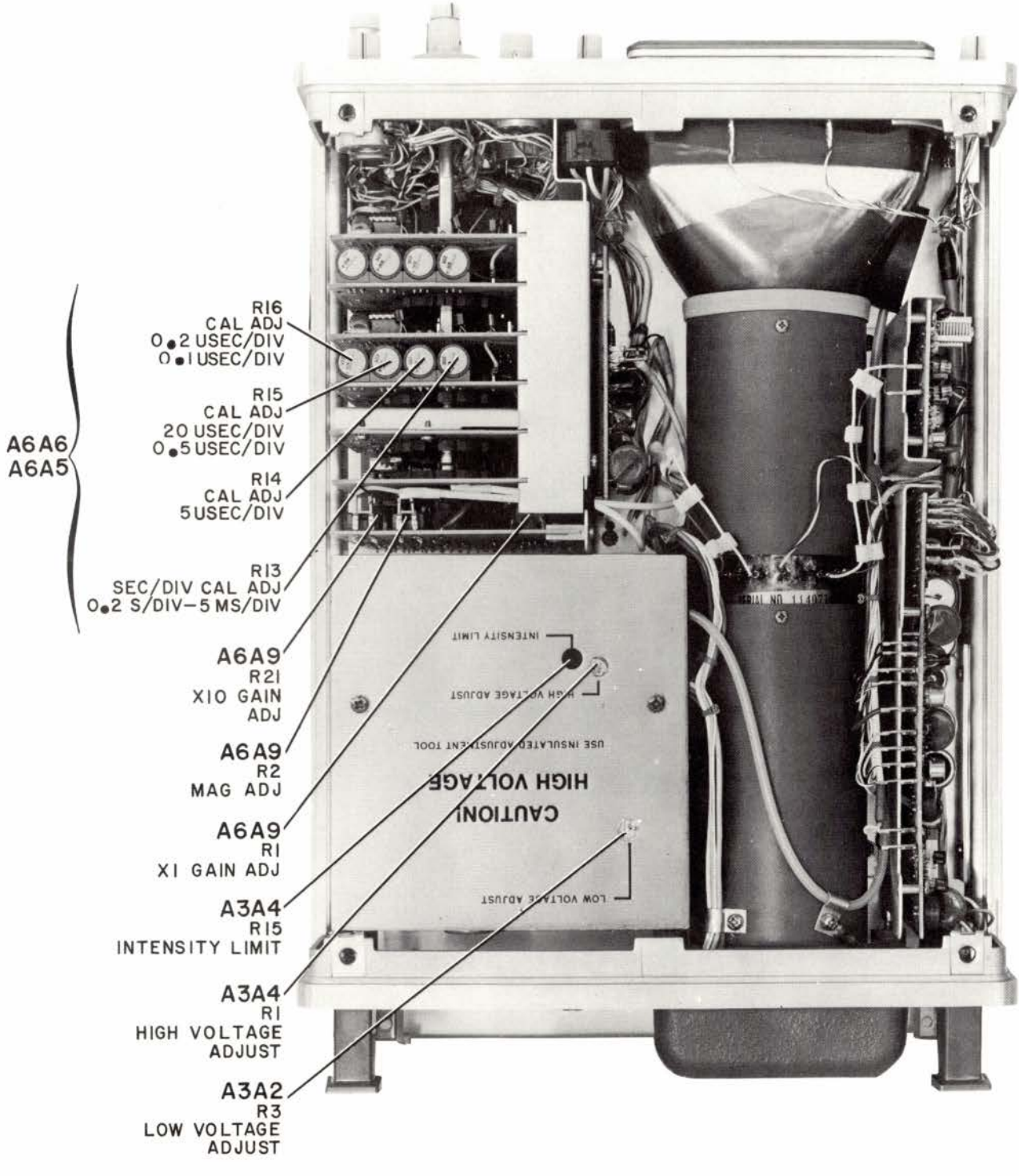
8. Adjust A5A4C5 for the best pulse response with a risetime of less than 4.6 ns.

9. Repeat steps 3 through 8 for optimum pulse response on both channels.

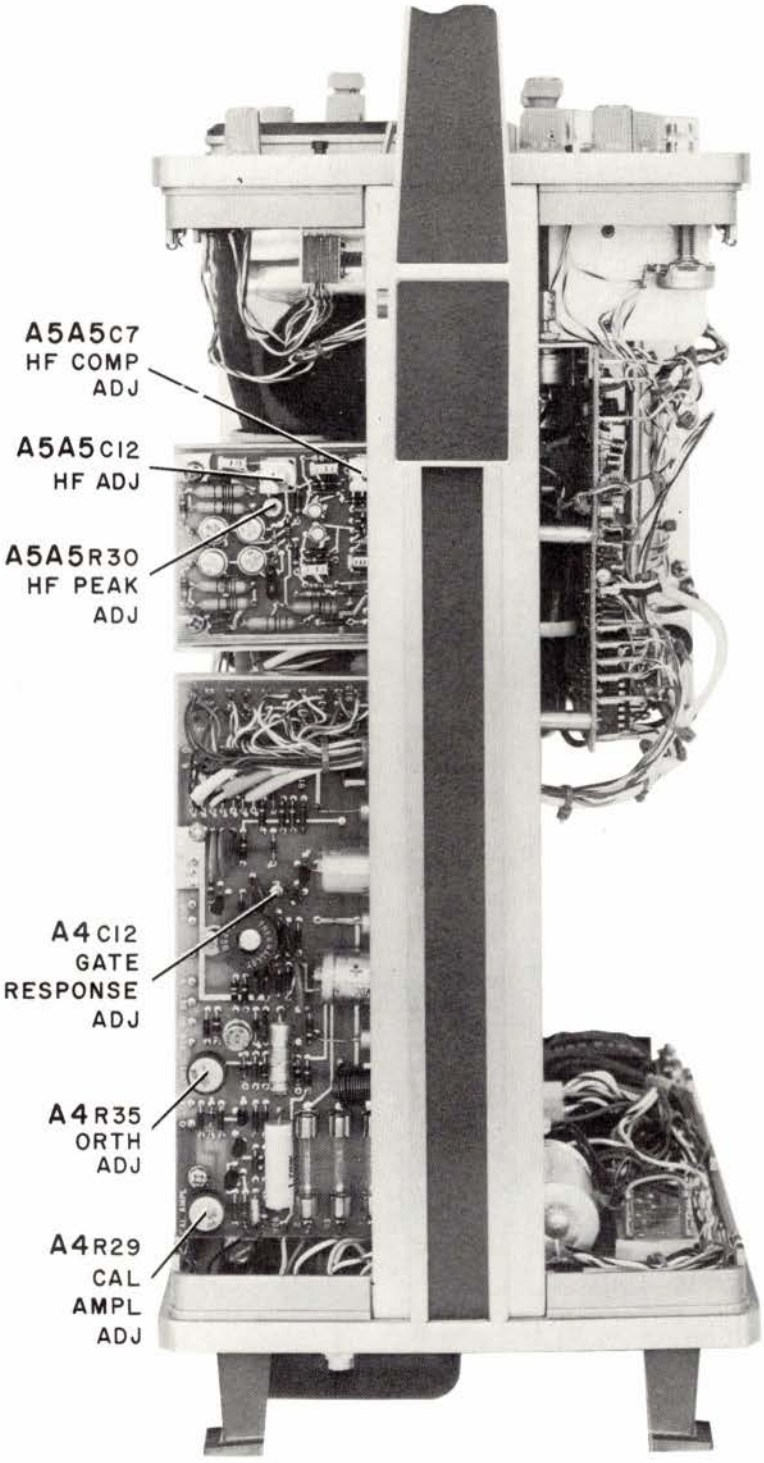
10. Disconnect test equipment.

11. Perform paragraph 5-24, bandwidth check, to ensure 75 MHz bandwidth is met.

12. Refer to Schematic 6 if this adjustments cannot be made.


A6A6
A6A5
R16
CAL ADJ
0.2 USEC/DIV
0.1 USEC/DIV
R15
CAL ADJ
20 USEC/DIV
0.5 USEC/DIV
R14
CAL ADJ
5 USEC/DIV
R13
SEC/DIV CAL ADJ
0.2 S/DIV–5 MS/DIV
A6A9
R21
X10 GAIN
ADJ
A6A9
R2
MAG ADJ
A6A9
R1
X1 GAIN ADJ
A3A4
R15
INTENSITY LIMIT
A3A4
R1
HIGH VOLTAGE
ADJUST
A3A2
R3
LOW VOLTAGE
ADJUST
INTENSITY LIMIT
HIGH VOLTAGE ADJUST
USE INSULATED ADJUSTMENT TOOL
CAUTION!
HIGH VOLTAGE
LOW VOLTAGE ADJUST

1701A–A–24


A5A5C7
HF COMP
ADJ
A5A5C12
HF ADJ
A5A5R30
HF PEAK
ADJ
A4C12
GATE
RESPONSE
ADJ
A4R35
ORTH
ADJ
A4R29
CAL
AMPL
ADJ

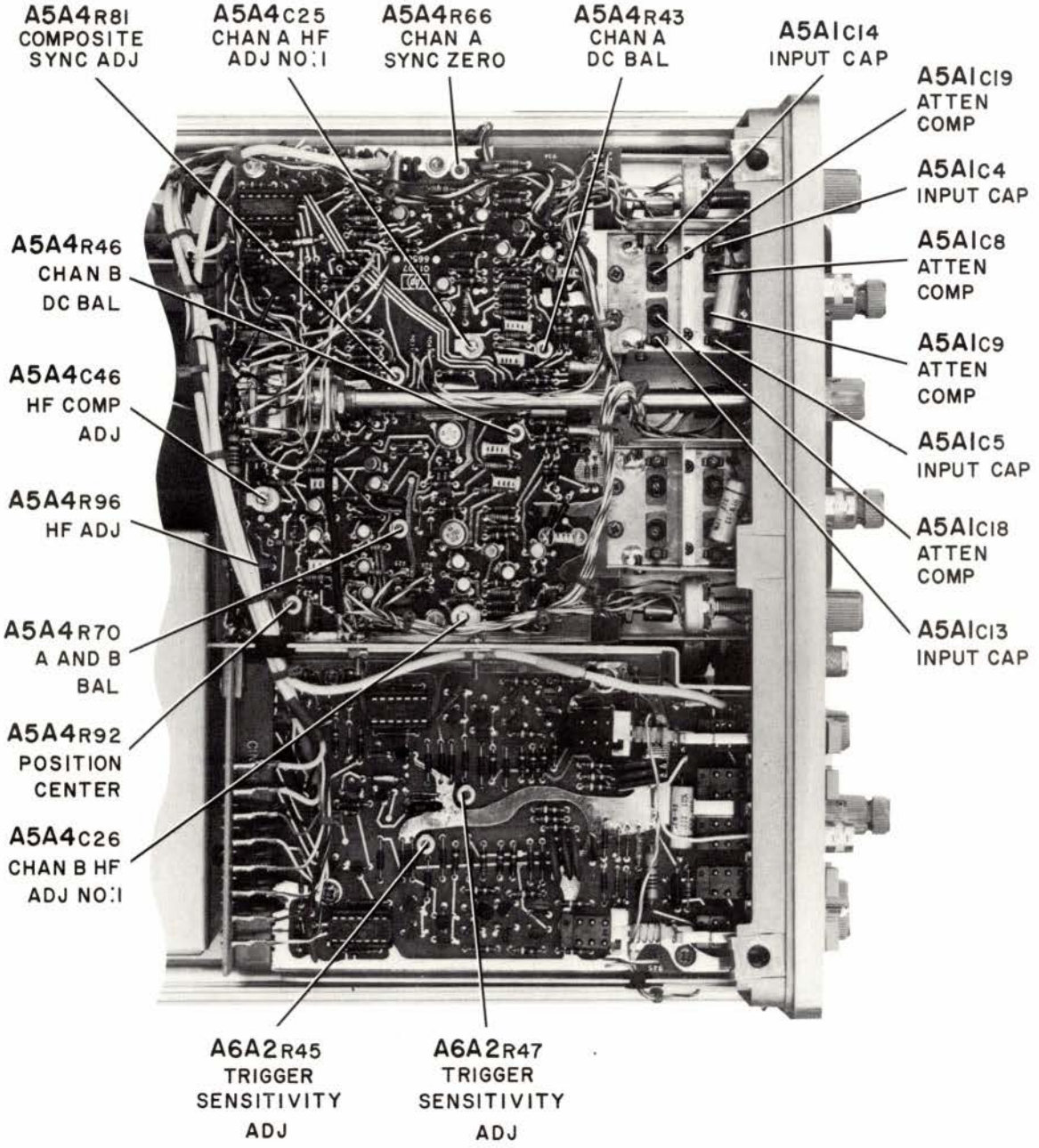


Figure 5-14.
Adjustment Locations

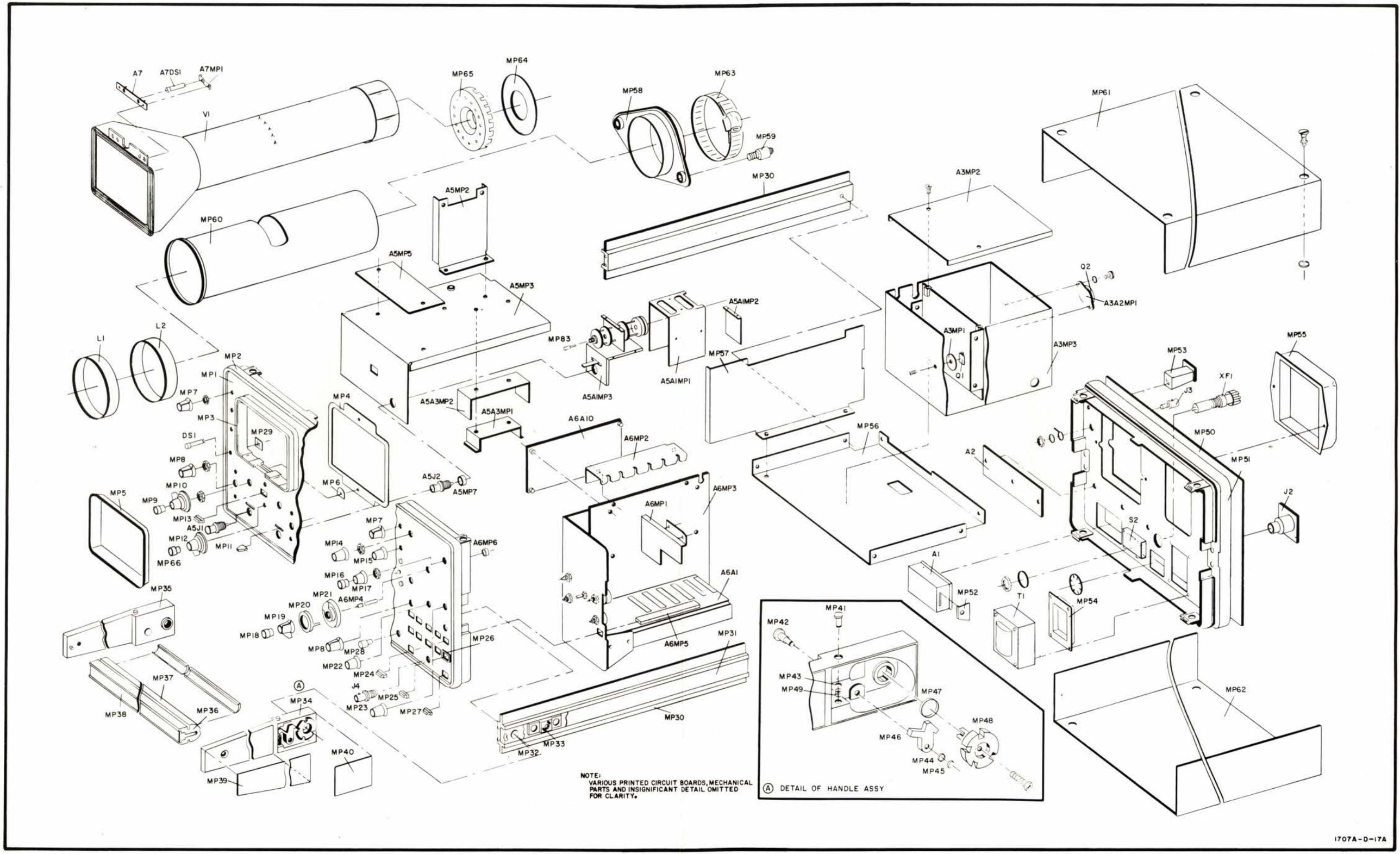


Figure 6-1. Exploded View

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

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

6-3. ORDERING INFORMATION.

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

a. Instrument model and serial number.

b. HP Part Number of item(s).

c. Quantity of part(s) desired.

d. Reference designator of part(s).

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

a. Instrument model and serial number.

b. Description of the part, including function and location in the instrument.

c. Quantity desired.

Table 6-1. Abbreviations for Replaceable Parts List

A	= ampere(s)
ASSY	= assembly
BD	= board(s)
BH	= binder head
BP	= bandpass
C	= centi (10^{-2})
CAR	= carbon
CCW	= counterclockwise
CER	= ceramic
CMO	= cabinet mount only
COAX	= coaxial
COEF	= coefficient
COMP	= composition
CONN	= connector(s)
CRT	= cathode-ray tube
CW	= clockwise
D	= deci (10^{-1})
DEPC	= deposited carbon
DP	= double pole
DT	= double throw
ELECT	= electrolytic
ENCAP	= encapsulated
EXT	= external
F	= farad(s)
FET	= field-effect transistor(s)
FH	= flat head
FIL H	= fillister head
FXD	= fixed
G	= giga (10^{9})
GE	= germanium
GL	= glass
GRD	= ground(ed)
H	= henry(ies)
HG	= mercury
HP	= Hewlett-Packard
HZ	= hertz
IF	= intermediate freq.
IMPG	= impregnated
INCD	= incandescent
INCL	= include(s)
INS	= insulation(ed)
INT	= internal
K	= kilo (10^{3})
KG	= kilogram
LB	= pound(s)
LH	= left hand
LIN	= linear taper
LOG	= logarithmic taper
LPF	= low-pass filter(s)
LVR	= lever
M	= milli (10^{-3})
MEG	= mega (10^{6})
MET FILM	= metal film
MET OX	= metal oxide
MFR	= manufacturer
MINAT	= miniature
MOM	= momentary
MTG	= mounting
MY	= mylar
N	= nano (10^{-9})
N/C	= normally closed
NE	= neon
N/O	= normally open
NPO	= negative positive zero (zero temperature coefficient)
NPN	= negative-positive-negative
NSR	= not separately replaceable
OBD	= order by description
OH	= oval head
OX	= oxide
P	= peak
PC	= printed (etched) circuit(s)
PF	= picofarads
PHL	= Phillips
PIV	= peak inverse voltage(s)
PNP	= positive-negative-positive
P/O	= part of
PORC	= porcelain
POS	= position(s)
POT	= potentiometer(s)
P-P	= peak-to-peak
PRGM	= program
PS	= polystyrene
PWV	= peak working voltage
RECT	= rectifier(s)
RF	= radio frequency
RFI	= radio frequency interference
RH	= round head or right hand
RMO	= rack mount only
RMS	= root mean square
RWV	= reverse working voltage
S-B	= slow-blow
SCR	= silicon controlled rectifier
SE	= selenium
SEC	= second(s)
SECT	= section(s)
SI	= silicon
SIL	= silver
SL	= slide
SP	= single pole
SPL	= special
ST	= single throw
STD	= standard
TA	= tantalum
TD	= time delay
TFL	= teflon
TGL	= toggle
THYR	= thyristor
TI	= titanium
TNLDIO	= tunnel diode(s)
TOL	= tolerance
TRIM	= trimmer
U	= micro (10^{-6})
V	= volts
VAR	= variable
VDCW	= dc working volt(s)
W	= watt(s)
W/	= with
WIV	= working inverse voltage
W/O	= without
WW	= wirewound

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	5060-1196	1	POWER MODULE:NON-FILTERED	28480	5060-1196
A1F1	2110-0018	1	FUSE:CARTRIDGE 0.25 AMP SLOW BLOW FOR 230V OPERATION	75915	313.250
A1F1	2110-0008	1	FUSE:0.50AMP 125V SLOW-BLOW FOR 115V OPERATION	71400	MDL 1/2
A1J1			N.S.R. PART OF A1		
A1S1			NSR P/O A1		
A2	01701-66502	1	BOARD ASSY:LINE RECTIFIER	28480	01701-66502
A2C1	0160-3453	26	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A2C2	0180-2351	1	C:FXD ELECT 2000 UF +75-10% 50VDCW	56289	39D243
A2CR1	1901-0045	5	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2R1	0811-1204	1	R:FXD WW 200 OHM 5% 5W	28480	0811-1204
A2R2	0687-1031	1	R:FXD COMP 10K OHM 10% 1/2W	01121	EB 1031
A2Z1	1906-0021	1	DIODE ASSY:SILICON	28480	1906-0021
A3	01701-611	1	POWER SUPPLY ASSY	28480	01701-611
A3MP1	0340-0450	2	WASHER:TRANSISTOR INSULATOR	04713	14852600F12
A3MP2	01701-04101	2	COVER:POWER BOX	28480	01701-04101
A3MP3	01701-65501	2	BOX:POWER ASSEMBLY	28480	01701-65501
A3Q1	5080-0476	1	TRANSISTOR ASSY:SI NPN	28480	5080-0476
A3Q2	1854-0063	1	TSTR:SI NPN	80131	2N3055
A3W1	01701-61602	1	CABLE:LOW TO HIGH VOLTAGE	28480	01701-61602
A3XQ2	1200-0077	1	INSULATOR:TRANSISTOR, MICA	16037	#112
A3A1	01701-66527	1	BOARD ASSY:MOTHER	28480	01701-66527
A3A1C1	0180-0141	1	C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A3A1C2	0150-0084	7	C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C41B5-CDH
A3A1C3	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A3A1C4	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C41B5-CDH
A3A1C5	0180-0269	1	C:FXD ELECT 1.0 UF +50-10% 150VDCW	56289	30D105F150BA2-DSM
A3A1C6	0180-0137	1	C:FXD ELECT 100 UF +75-10% 10VDCW	56289	150DX1070010R2-DYS
A3A1C7	0180-0230	9	C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A3A1CR1	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A1CR2	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A1CR3	1901-0418	1	DIODE:SILICON 400PIV 1N5000	04713	1N5000
A3A1CR4	1901-0040	61	DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A1CR5	1884-0094	1	THYRISTOR:BILATERAL SWITCH	04713	SPT-12
A3A1CR6	1884-0082	1	THYRISTOR:SCR JEDEC TYPE 2N4441	04713	2N4441
A3A1J1	01701-67601	1	CONNECTOR ASSY	28480	01701-67601
A3A1J2	1251-1968	2	CONNECTOR:PC 10 TUNING FORK TYPE CONT	02660	143-010-07-1158
A3A1J3	1251-1968		CONNECTOR:PC 10 TUNING FORK TYPE CONT	02660	143-010-07-1158
A3A1L1	9100-3139	10	COIL:75 UH	28480	9100-3139
A3A1L2	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L3	9100-1645	1	COIL/CHOKE 390.0 UH 5%	82142	19-1331-25J
A3A1L4	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L5	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L6	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L7	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L8	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L9	9100-3139		COIL:75 UH	28480	9100-3139
A3A1MP1	0890-1028	8	SLEEVING	28480	0890-1028
A3A1Q1	1854-0090	1	TSTR:SI NPN(SIMILAR TO 2N3053)	28480	1854-0090
A3A1R1	0761-0015	1	R:FXD MET OX 1500 OHM 5% 1W	28480	0761-0015
A3A1R2	0687-4711	2	R:FXD COMP 470 OHM 10% 1/2W	01121	EB 4711
A3A1R3	0684-1011	36	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A1R4	0687-2201	1	R:FXD COMP 22 OHM 10% 1/2W	01121	EB 2201
A3A1R5	0811-1673	1	R:FXD WW 3.9 OHM 5% 2W	28480	0811-1673
A3A1R6	0812-0086	1	R:FXD WW 5 OHM 5% 3W	28480	0812-0086
A3A1R7	0684-4701	2	R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A3A1R8	0684-4711	2	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A3A1R9	0687-4711		R:FXD COMP 470 OHM 10% 1/2W	01121	EB 4711
A3A1R10	0684-1041	13	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A1R11	0684-2731	4	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R12	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A1R13	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R14	0684-1031	11	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A1R15	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R16	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R17	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A1T1	01701-61104	1	TOROID:FERRITE	28480	01701-61104
A3A1VR1	1902-3302	1	DIODE BREAKDOWN:34.8V 2% 400 MW	28480	1902-3302
A3A1VR2	1902-3070	1	DIODE:BREAKDOWN 4.22V 5%	04713	SZ10939-74
A3A1VR3	1902-3315	1	DIODE BREAKDOWN:39.2V 2% 400 MW	28480	1902-3315
A3A2	01701-66504	1	BOARD ASSY:LOW VOLTAGE CONVERTER	28480	01701-66504
A3A2C1	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C41B5-CDH
A3A2C2	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C41B5-CDH
A3A2C3	0180-0098	2	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS

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
A3A2C4	0180-1802	1	C:FXD ELECT 150 UF +75-10% 40VDCW	56289	39D157G040EJ4-DSB
A3A2C5	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A2C6	0180-1780	2	C:FXD ELECT 500 UF +75-10% 10VDCW	28480	0180-1780
A3A2C7	0160-0168	4	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3A2C8	0160-0380	1	C:FXD MY 0.22 UF 10% 200VDCW	28480	0160-0380
A3A2C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A3A2C10	0160-3451	17	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A3A2C11	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A3A2C12	0160-2141	3	C:FXD CER 680 PF 80/20% 1000VDCW	91418	TYPE B
A3A2C13	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3A2C14	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3A2CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A2CR3	1901-0049	4	DIODE:SILICON 0.75A 50PIV	04713	SR1358-6
A3A2CR4	1901-0049		DIODE:SILICON 0.75A 50PIV	04713	SR1358-6
A3A2CR5	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A2L1	9140-0128	1	COIL:FXD RF 22 UH	28480	9140-0128
A3A2MP1	1205-0227	1	HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205-0227
A3A2Q1	1855-0010	1	TSTR:SI	80131	2N2646
A3A2Q2	1854-0476	1	TSTR:SI NPN	02735	2N3879
A3A2Q3	1854-0039	2	TSTR:SI NPN	80131	2N3053
A3A2Q4	1853-0027	1	TSTR:SI PNP	07263	S1554S
A3A2R1	0684-1221	7	R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A3A2R2	0684-2721	1	R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A3A2R3	2100-1760	2	R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A3A2R4	0757-0199	1	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A3A2R5	0757-0442	10	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3A2R6	0684-4721	7	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A3A2R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R8	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R9	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R10	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R11	0698-3159	2	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A3A2R12	0757-0401	14	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3A2R13	0684-1521	1	R:FXD COMP 1500 OHM 10% 1/4W	01121	CB 1521
A3A2R14	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A2R15	0684-2211	12	R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A3A2R16	0761-0014	1	R:FXD MET OX 180 OHM 5% 1W	28480	0761-0014
A3A2T1	9100-3152	1	TRANSFORMER	28480	9100-3152
A3A2U1	1820-0058	1	IC:LIN, OP AMPL	07263	SL21434
A3A2VR1	1902-0033	2	DIODE:BREAKDOWN 6.2V	04713	1N823
A3A2VR2	1902-3256	1	DIODE:BREAKDOWN SILICON 23.7V 5%	28480	1902-3256
A3A2VR3	1902-0197	1	DIODE BREAKDOWN:SILICON 82.5V 5%	28480	1902-0197
A3A2XU1	1200-0763	1	SOCKET:IC 8-PIN, FOR TO-5 CASE	71785	133-98-92-061
A3A3	01701-66534	1	BOARD ASSY:RECTIFIER FILTER	28480	01701-66534
A3A3C1	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A3A3C2	0180-2344	4	C:FXD ELECT 150 UF +75-10% 75VDCW	56289	39D-157G075EJ4
A3A3C3	0180-0098	3	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A3C4	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A3C5	0180-2344		C:FXD ELECT 150 UF +75-10% 75VDCW	56289	39D-157G075EJ4
A3A3C6	0180-0159	1	C:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A3A3C7	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A3C8	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3A3CR1	1901-0646	8	DIODE:SI 200V 1A	28480	1901-0646
A3A3CR2	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR3	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR4	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR5	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR6	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR7	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3CR8	1901-0646		DIODE:SI 200V 1A	28480	1901-0646
A3A3L1	9140-0096	7	COIL:FXD RF 1 UH	28480	9140-0096
A3A3L2	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3L3	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3L4	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3L5	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3L6	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3L7	9140-0096		COIL:FXD RF 1 UH	28480	9140-0096
A3A3MP1	0403-0175	1	BUMPER:RUBBER 0.750" DIA	77969	6657
A3A3T1	9100-3235	1	TRANSFORMER	28480	9100-3235
A3A4	01701-66528	1	BOARD ASSY:HIGH VOLTAGE OSCILLATOR	28480	01701-66528
A3A4A1	01701-61102	1	HIGH VOLTAGE TRANSFORMER ASSY	28480	01701-61102
A3A4A2	01701-61101	1	MULTIPLIER BOARD:HIGH VOLTAGE	28480	01701-61101
A3A4C1	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3A4C2	0160-2403	1	C:FXD CER 1500 PF 20% 5K VDCW	72982	828-025-X5R0-152M

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
A3A4C3	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A3A4C4	0180-0291	3	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3A4C5	0180-1746	5	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3A4C6	0170-0040	1	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A3A4C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A3A4C8	0160-3626	14	C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C9	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C10	DELETED				
A3A4C11	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C12	DELETED				
A3A4C13	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C14	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C15	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C16	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C17	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C18	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C19	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4C20	DELETED				
A3A4C21	0160-3626		C:FXD CER 5000 PF 20% 2K VDCW	56289	29C231A
A3A4CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A4CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A4CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A4CR5	1901-0049		DIODE:SILICON 0.75A 50PIV	04713	SR1358-6
A3A4CR6	1901-0049		DIODE:SILICON 0.75A 50PIV	04713	SR1358-6
A3A4CR7	1901-1022	2	DIODE:SI RECTIFIER HV, 10 MA	28480	1901-1022
A3A4CR8	1901-1022		DIODE:SI RECTIFIER HV, 10 MA	28480	1901-1022
A3A4CR9	1901-0033	1	DIODE:SILICON 100MA 180WV	07263	FD3369
A3A4DS1	2140-0018	2	LAMP:GLOW 1.0 MILLIAMPS 0.1W	08806	A9A-C(NE-2E1)
A3A4DS2	2140-0018		LAMP:GLOW 1.0 MILLIAMPS 0.1W	08806	A9A-C(NE-2E1)
A3A4F1	2110-0033	1	FUSE:0.75A 250V	75915	F02GR750A
A3A4L1	9100-2268	1	COIL:FXD 22.0 UH 10%	82142	09-1316-4K
A3A4MP1	5040-0402	1	MOUNT:TRANSFORMER	28480	5040-0402
A3A4MP2	5040-0430	1	MOUNT:TRANSFORMER	28480	5040-0430
A3A4MP3	2200-0125	1	SCREW:SST PAN HD POZI DR 4-40X1.500"LG	00000	OBD
A3A4MP4	2110-0269	12	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A3A4MP5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A3A4MP7	2200-0111	1	SCREW:PAN HD POZI DR 4-40 X 0.500" LG	00000	OBD
A3A4MP8	01701-26509	1	BOARD:ETCHED	28480	01701-26509
A3A4Q1	1854-0023	1	TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A3A4Q2	1854-0215	20	TSTR:SI NPN	80131	2N3904
A3A4Q3	1853-0036	19	TSTR:SI PNP	80131	2N3906
A3A4R1	2100-1762	6	R:VAR WW 20K 5% 1W	75042	CT-106-4
A3A4R2	0757-0467	1	R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A3A4R3	0698-7807	1	R:FXD MET FLM 8.5 MEGOHM 1% 2.0W	28480	0698-7807
A3A4R4	0698-5922	2	R:FXD MET FLM 1.8 MEGOHM 1.0% 1/2W	28480	0698-5922
A3A4R5	0698-5922		R:FXD MET FLM 1.8 MEGOHM 1.0% 1/2W	28480	0698-5922
A3A4R6	0757-0280	2	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3A4R7	0757-0438	10	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3A4R8	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A4R9	0757-0458	3	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A3A4R10	0684-1021	13	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A3A4R11	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A4R12	0757-0338	1	R:FXD MET FLM 1.00K OHM 1% 1/4W	28480	0757-0338
A3A4R13	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3A4R14	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3A4R15	2100-2692	1	R:VAR CERMET 1 MEGOHM 20% TYPE V 1/2W	28480	2100-2692
A3A4R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A4R17	0836-0002	1	R:FXD CARBON 20 MEGOHM 10% 1W	28480	0836-0002
A3A4R18	0684-1051	2	R:FXD COMP 1MEGOHM 1% 1/4W	01121	CB 1051
A3A4R19	0684-1531	4	R:FXD COMP 15K OHM 10% 1/4W	01121	CB 1531
A3A4R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A4R21	0684-4711		R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A3A4R22	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4	01701-66533	1	BOARD ASSY:GATE	28480	01701-66533
A4C1	0180-2344		C:FXD ELECT 150 UF +75-10% 75VDCW	56289	39D-157G075FJ4
A4C2	0180-0098	2	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A4C3	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A4C4	0180-2344		C:FXD ELECT 150 UF +75-10% 75VDCW	56289	39D-157G075FJ4
A4C5	0180-0137		C:FXD ELECT 100 UF 20% 10VDCW	56289	150D107X0010R2-DYS
A4C6	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A4C7	0160-2146	2	C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A4C8	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A4C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A4C10	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C4185-CDH

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
A4C11	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A4C12	0121-0168	1	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A4C13	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C4185-CDH
A4C14	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	56289	33C4185-CDH
A4C15	0180-0058	1	C:FXD ELECT 50UF -10%+100% 25VDCW	56289	30D506G025DD4M1
A4C16	0160-2432	1	C:FXD POLY 0.1 UF 5% 100VDCWW	84411	863T
A4C17	0180-0197	6	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A4CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR10	1901-0044	1	DIODE:SILICON 20MA/1V	28480	1901-0044
A4CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR12	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A4CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4F1	2110-0004	2	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A4F2	2110-0012	3	FUSE:0.5 AMP 250V	75915	312.500
A4F3	2110-0012		FUSE:0.5 AMP 250V	75915	312.500
A4F4	2110-0004		FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A4F5	2110-0012		FUSE:0.5 AMP 250V	75915	312.500
A4L1	9100-3139		COIL:75 UH	28480	9100-3139
A4L2	9100-3139		COIL:75 UH	28480	9100-3139
A4MP1	1205-0073	1	HEAT SINK:DUAL	13103	22108
A4MP2	1200-0185	1	PAD:TRANSISTOR MOUNTING	13103	7717-22N RED
A4MP3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP4	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP6	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP7	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP8	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP9	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP10	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP11	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP12	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q2	1853-0045	1	TSTR:SI PNP	80131	2N4036
A4Q3	1853-0036		TSTR:SI PNP	80131	2N3906
A4Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q5	1853-0037	3	TSTR:SI PNP	04713	SS 2109
A4Q6	1854-0271	3	TSTR:SI NPN	28480	1854-0271
A4Q7	1854-0071	2	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q9	1853-0036		TSTR:SI PNP	80131	2N3906
A4Q10	1854-0039		TSTR:SI NPN	80131	2N3053
A4R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R2	0698-3154	5	R:FXD MET FLM 4220 OHM 1% 1/8W	28480	0698-3154
A4R3	0757-0449	4	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A4R4	0757-0440	6	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A4R5	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A4R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R8	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R9	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R10	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R11	0684-5631	1	R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A4R12	0757-0457	1	R:FXD MET FLM 47.5K OHM 1% 1/8W	28480	0757-0457
A4R13	0684-1051		R:FXD COMP 1MEGOHM 1% 1/4W	01121	CB 1051
A4R14	0757-0273	8	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A4R15	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A4R16	0757-0416	1	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A4R17	0757-0437	1	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A4R18	0757-0281	1	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A4R19	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R20	0684-4701		R:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A4R21	0757-0453	1	R:FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A4R22	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R23	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R24	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A4R25	0757-0454	1	R:FXD MET FLM 33.2K OHM 1% 1/8W	28480	0757-0454
A4R26	0757-0418	3	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418

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
A4R27	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A4R28	0757-0284	7	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A4R29	2100-1770	1	R:VAR WW 100 OHM 5% TYPE H 1W	28480	2100-1770
A4R30	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A4R31	0684-2221	11	R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A4R32	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A4R33	Deleted				
A4R34	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R35	2100-1777	1	R:VAR WW 20K OHM 5% TYPE H 1W	28480	2100-1777
A4R36	0684-1001	13	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R37	0684-2231	6	R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A4VR1	1902-0052	1	DIODE BREAKDOWN:6.81V	28480	1902-0052
A4VR2	1902-0033		DIODE:BREAKDOWN 6.2V	04713	1N823
A4VR3	1902-0244	1	DIODE BREAKDOWN:30.1V	28480	1902-0244
A5	01707-65804	1	VERTICAL AMPLIFIER MOD ASSY	28480	01701-65804
A5C1	0160-2913	2	C:FXD CER 0.01 UF +85-20% 500VDCW	72982	811-014-Y5U0-103Z
A5C2	0160-2913		C:FXD CER 0.01 UF +85-20% 500VDCW	72982	811-014-Y5U0-103Z
A5C3	0160-2257	9	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A5C4	0160-2261	3	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5C5	0160-2204		C:FXD MICA 100 PF	72136	RDM15F101J3C
A5DS1	1450-0709	3	LIGHT:INDICATOR 90 VDC	72765	6140-000-603
A5J1	1250-0118	4	CONNECTOR:BNC	24931	28JR 128-1
A5J2	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
A5MP1	1490-0841	2	COUPLING:SHAFT 0.127" ID	28480	1490-0841
A5MP2	01701-00603	1	SHIELD:VERTICAL OUTPUT	28480	01701-00603
A5MP3	01701-00608	1	SHIELD:VERTICAL MODULE	28480	01701-00608
A5MP4	01701-01202	1	BRACKET:DISPLAY SWITCH	28480	01701-01202
A5MP5	01701-04107	1	PLATE:ATTENUATOR COVER	28480	01701-04107
A5MP6	01701-21701	4	BUSHING:POT	28480	01701-21701
A5MP7	01701-24701	2	SPACER:BNC	28480	01701-24701
A5MP8	01707-01201	2	BRACKET:POT	28480	01707-01201
A5MP9	01707-09102	1	SPRING:SHAFT GROUND	28480	01707-09102
A5MP10	01707-23701	2	SHAFT:POT EXTENDER	28480	01707-23701
A5R1	0757-0476	2	R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0476
A5R2	0757-0476		R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0476
A5R3	2100-3007	4	R:VAR COMP 50K OHM 20% LIN 1/4W	28480	2100-3007
A5R4	2100-3007		R:VAR COMP 50K OHM 20% LIN 1/4W	28480	2100-3007
A5R5	2100-2492	4	R:VAR COMP 5K OHM 20% LIN 1/2W	28480	2100-2492
A5R6	0757-0397	2	R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A5R7	0698-3432	4	R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A5R8	2100-2492		R:VAR COMP 5K OHM 20% LIN 1/2W	28480	2100-2492
A5R9	0757-0397		R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A5R10	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A5R11	2100-3099	4	R:VAR CERMET 5K OHM 10% LIN 2W	28480	2100-3099
A5R12	2100-3099		R:VAR CERMET 5K OHM 10% LIN 2W	28480	2100-3099
A5S1	3101-1396	2	SWITCH:PUSHBUTTON 2 POLE 1 STATION	28480	3101-1396
A5S2	3100-2557	2	SWITCH:ROTARY 2 POLE 1 STATION	28480	3100-2557
A5W1	01707-61604	1	CABLE ASSY:VERTICAL	28480	01707-61604
A5W2	01707-61605	1	CABLE ASSY:VERTICAL SUB	28480	01707-61605
A5A1	01707-63401	2	ATTENUATOR ASSY	28480	01707-63401
A5A1C1	0150-0115	2	C:FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K
A5A1C2	0170-0043	3	C:FXD MY 0.022UF 10% 400VDCW	24446	64FDA223
A5A1C3	0160-2204	6	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A5A1C4	0121-0407	16	C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C5	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C6	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A5A1C7	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A5A1C8	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C9	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C10	0150-0074	2	C:FXD CER 7 PF 5% 500VDCW	72982	301-000-C0H0 709D
A5A1C11	0160-2262	3	C:FXD CER 16 PF 5% 500VDCW	72982	301-000 C0G0 160J
A5A1C12	0140-0130	2	C:FXD MICA 220 PF 5% 500VDCW	72982	654-014(CB11RD221J)
A5A1C13	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C14	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C15	0160-2240	2	C:FXD CER 2.0 PF 500VDCW	72982	301-000-C0K0-209C
A5A1C16	0160-2254	2	C:FXD CER 7.5 PF 500VDCW	72982	301-000-C0H0-759C
A5A1C17	0160-2258		C:FXD CER 11 PF 5% 500VDCW	72982	301-000-C0G0-110J
A5A1C18	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1C19	0121-0407		C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A5A1L1	9100-3196	2	COIL:40 UH	28480	9100-3196
A5A1L2	9100-3195	2	COIL:50 UH	28480	9100-3195
A5A1MP	01701-3	2			
A5A1MP1	01701-00605	2	SHIELD:SWITCH OUTER	28480	01701-00605
A5A1MP2	01701-00607	2	SHIELD:SWITCH INNER	28480	01701-00607
A5A1MP3	01701-61201	2	BRACKET ASSY:SWITCH	28480	01701-61201
A5A1MP4	1750A-64A	4	HOLDER-TRIMMER	28480	1750A-64A
A5A1R1	0757-0997	2	R:FXD MET FLM 3.92 OHM 1.0% 1/2W	28480	0757-0997

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
A5A1R2	0757-0346	4	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A5A1R3	0698-3430	2	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A5A1R4	0698-3431	2	R:FXD MET FLM 23.7 OHM 1% 1/8W	28480	0698-3431
A5A1R5	0684-0271	2	R:FXD COMP 2.7 OHM 10% 1/4W	01121	CB 27G1
A5A1R6	0698-6400	2	R:FXD FLM 900K OHM 1.0% 1/4W	28480	0698-6400
A5A1R7	0698-6634	2	R:FXD FLM 990K OHM 1.0% 1/4W	28480	0698-6634
A5A1R8	0698-3109	2	R:FXD MET FLM 10.1K OHM 1% 1/8W	28480	0698-3109
A5A1R9	0698-3429	4	R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A5A1R10	0698-5470	2	R:FXD FLM 111K OHM 1% 1/8W	28480	0698-5470
A5A1R11	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A5A1R12	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A1R13	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A1R14	0698-3263	2	R:FXD MET FLM 500K OHM 1% 1/8W	28480	0698-3263
A5A1R15	0698-6654	2	R:FXD MET FLM 800K OHM 1% 1/4W	28480	0698-6654
A5A1R16	0757-0344	4	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5A1R17	0698-4011	2	R:FXD FLM 250K OHM 1% 1/8W	28480	0698-4011
A5A1R18	0757-0344		R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5A1S1			NSR P/O MP3		
A5A1S2	3100-3018	2	SWITCH:ROTARY 3 SECTION 9 POSITION	28480	3100-3018
A5A2			SAME AS A5A1, USE PREFIX A5A2		
A5A2	01707-63401		ATTENUATOR ASSY	28480	01707-63401
A5A3	01701-61616	1	DELAY LINE	28480	01701-61616
A5A3MP1	01701-01206		BRACKET:DELAY LOWER	28480	01701-01206
A5A3MP2	01701-01207		BRACKET:DELAY UPPER	28480	01701-01207
A5A4	01707-66501	1	BOARD ASSY:VERTICAL PREAMPLIFIER	28480	01707-66501
A5A4C1	0160-3443	30	C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C2	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C3	0160-2261		C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5A4C4	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C5	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A5A4C6	0160-2261		C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5A4C7	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C8	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C9	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C10	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C11	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A5A4C12	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C13	0150-0093	4	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A4C14	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C15	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A5A4C16	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A4C17	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C18	Deleted				
A5A4C19	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A5A4C20	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C21	Deleted				
A5A4C22	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C23	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C24	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C25	0121-0451	1	C:VAR AIR TRIMMER 1.7-11 PF 250VDC	74970	187-106-5
A5A4C26	0121-0455	2	C:VAR AIR 1.9 & 15.7 PF	74970	187-109-5
A5A4C27	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C28	0160-2264	5	C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A5A4C29	0160-2264		C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A5A4C30	0160-2264		C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A5A4C31	0160-2264		C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A5A4C32	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5A4C33	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C34	0160-2202	1	C:FXD MICA 75 PF 5%	28480	0160-2202
A5A4C35	0160-2141		C:FXD CER 680 PF 80/20% 1000VDCW	91418	TYPE B
A5A4C36	0160-2141		C:FXD CER 680 PF 80/20% 1000VDCW	91418	TYPE B
A5A4C37	0150-0059	4	C:FXD CER 3.3 PF 500VDCW	72982	301-000-C0J0-339C
A5A4C38	0150-0059		C:FXD CER 3.3 PF 500VDCW	72982	301-000-C0J0-339C
A5A4C39	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C40	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C41	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS
A5A4C42	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C43	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C44	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A4C45	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A4C46	0121-0455		C:VAR AIR 1.9 & 15.7 PF	74970	187-109-5
A5A4C47	0160-2207	2	C:FXD MICA 300 PF 5% 300VDCW	28480	0160-2207
A5A4C48	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5A4C49	0160-2200	1	C:FXD MICA 43 PF 5%	72136	RDM15E430J3C
A5A4C50	0140-0191	1	C:FXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A5A4C51	0160-2205	1	C:FXD MICA 120 PF 5%	28480	0160-2205

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
A5A4C52	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5A4C53	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A5A4CR1	1901-0376	4	DIODE:SILICON 35V	28480	1901-0376
A5A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR3	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A5A4CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR5	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A5A4CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR7	1901-0376		DIODE:SILICON 35V	28480	1901-0376
A5A4CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5A4L1	9100-2276	12	COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L2	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L3	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L4	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L5	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L6	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L7	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L8	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L9	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L10	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A4L11	9100-3194	2	COIL:MOLDED 6.5 TURNS	28480	9100-3194
A5A4L12	9100-3194		COIL:MOLDED 6.5 TURNS	28480	9100-3194
A5A4L13	9100-2247	1	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A5A4L14	9100-2257	1	COIL/CHOKE:0.82UH 10%	82142	09-4426-5K
A5A4Q1	1855-0085	4	TSTR:FET	28480	1855-0085
A5A4Q2	1855-0085		TSTR:FET	28480	1855-0085
A5A4Q3	1855-0085		TSTR:FET	28480	1855-0085
A5A4Q4	1855-0085		TSTR:FET	28480	1855-0085
A5A4Q5	1854-0345	8	TSTR:SI NPN	80131	2N5179
A5A4Q6	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q7	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q8	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q9	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q10	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q11	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q12	1854-0345		TSTR:SI NPN	80131	2N5179
A5A4Q13	1854-0280	4	TSTR:SI NPN DUAL	28480	1854-0280
A5A4Q14	1854-0280		TSTR:SI NPN DUAL	28480	1854-0280
A5A4Q15	1854-0280		TSTR:SI NPN DUAL	28480	1854-0280
A5A4Q16	1854-0280		TSTR:SI NPN DUAL	28480	1854-0280
A5A4Q17	1853-0015	11	TSTR:SI PNP	80131	2N3640
A5A4Q18	1854-0019	4	TSTR:SI NPN	28480	1854-0019
A5A4Q19	1854-0019		TSTR:SI NPN	28480	1854-0019
A5A4Q20	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q21	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q22	1854-0009	6	TSTR:SI NPN	80131	2N709
A5A4Q23	1854-0009		TSTR:SI NPN	80131	2N709
A5A4Q24	1854-0009		TSTR:SI NPN	80131	2N709
A5A4Q25	1854-0009		TSTR:SI NPN	80131	2N709
A5A4Q26	1854-0009		TSTR:SI NPN	80131	2N709
A5A4Q27	1854-0009		TSTR:SI NPN	80131	2N709
A5A4Q28	1854-0073	2	TSTR:SI NPN(SELECTED FROM 2N2857)	28480	1854-0073
A5A4Q29	1854-0073		TSTR:SI NPN(SELECTED FROM 2N2857)	28480	1854-0073
A5A4Q30	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4Q31	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4Q32	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4Q33	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4Q34	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q35	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q36	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q37	1854-0215		TSTR:SI NPN	80131	2N3904
A5A4Q38	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4Q39	1853-0015		TSTR:SI PNP	80131	2N3640
A5A4R1	0757-0398	4	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A5A4R2	0698-4130	2	R:FXD COMP 39 OHM 5% 1/8W	28480	0698-4130
A5A4R3	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A5A4R4	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R5	0757-0469	2	R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A5A4R6	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041

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
A5A4R7	0757-0469		R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A5A4R8	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R9	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A5A4R10	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R11	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A5A4R12	0698-4130		R:FXD COMP 39 OHM 5% 1/8W	28480	0698-4130
A5A4R13	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R14	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R16	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R17	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R18	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R19	0684-3901	36	R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R20	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R21	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R22	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R23	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A5A4R24	0757-0430	6	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A5A4R25	0757-0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A5A4R26	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A5A4R27	0757-0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A5A4R28	0757-0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A5A4R29	0684-8201	4	R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A5A4R30	0684-8201		R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A5A4R31	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R32	0684-8201		R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A5A4R33	0684-8201		R:FXD COMP 82 OHM 10% 1/4W	01121	CB 8201
A5A4R34	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A5A4R35	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A5A4R36	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A5A4R37	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A5A4R38	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5A4R39	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5A4R40	0757-0388	2	R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388
A5A4R41	0757-0388		R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388
A5A4R42	0698-3434	2	R:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A5A4R43	2100-2574	3	R:VAR FLM 500 OHM 10% LIN 1/2W	28480	2100-2574
A5A4R44	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A4R45	0698-3434		R:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A5A4R46	2100-2574		R:VAR FLM 500 OHM 10% LIN 1/2W	28480	2100-2574
A5A4R47	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A4R48	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R49	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R50	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R51	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R52	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R53	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A4R54	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5A4R55	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R56	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R57	0757-0392	1	R:FXD MET FLM 43.2 OHM 1% 1/8W	28480	0757-0392
A5A4R58	0757-0440	3	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5A4R59	2100-2517	2	R:VAR CERMET 5K OHM 10% LIN 1/2W	28480	2100-2517
A5A4R60	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5A4R61	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5A4R62	2100-2517		R:VAR CERMET 5K OHM 10% LIN 1/2W	28480	2100-2517
A5A4R63	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5A4R64	0757-0421		R:FXD COMP 825 OHM 10% 1/4W	28480	0757-0421
A5A4R65	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R66	2100-1986		R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A5A4R67	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R68	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R69	0757-0433	5	R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A5A4R70	2100-1986		R:VAR CERMET 1000 OHM 10% LIN 1/2W	28480	2100-1986
A5A4R71	0757-0433		R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A5A4R72	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R73	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R74	0757-0421	3	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A5A4R75	0757-0408	2	R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0408
A5A4R76	0757-0408		R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0408
A5A4R77	0757-0421		R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A5A4R78	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R79	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R80	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284

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
A5A4R81	2100-1738	1	R:VAR FLM 10K OHM 10% LIN 1/2W	28480	2100-1738
A5A4R82	0757-0931		R:FXD MET FLM 2K OHM 1% 1/8W	28480	0757-0931
A5A4R83	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R84	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R85	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R86	0757-0451	2	R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A5A4R87	0757-0451		R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A5A4R88	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A5A4R89	0757-0399	1	R:FXD MET FLM 82.5 OHM 1% 1/8W	28480	0757-0399
A5A4R90	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A5A4R91	0757-0415	5	R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A5A4R92	2100-2574		R:VAR FLM 500 OHM 10% LIN 1/2W	28480	2100-2574
A5A4R93	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A5A4R94	0757-0400	6	R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A4R95	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5A4R96	2100-2031		R:VAR MET FLM 50K OHM 10% 1/8W	28480	2100-2031
A5A4R97	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5A4R98	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A4R99	0757-0406	1	R:FXD MET FLM 182 OHM 1% 1/8W	28480	0757-0406
A5A4R100	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A4R101	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A4R102	0684-4731	2	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A5A4R103	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A5A4R104	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A5A4R105	0684-3321	6	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R106	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R107	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A5A4R108	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R109	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A5A4R110	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A5A4R111	0757-0421		R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A5A4R112	0757-0290	2	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A4R113	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R114	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R115	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R116	0757-0283	3	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5A4R117	0684-5621	2	R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A4R118	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A4R119	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R120	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4U1	1820-0094	1	IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
A5A4U2	1820-0308	1	IC:DTL CLOCKED FF RL:6K	07263	U6A994559X
A5A4VR1	1902-3059	1	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A5A4VR2	1902-3104	1	DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A5A4XU1	1200-0768	8	SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A5A4XU2	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A5A5	01707-66502	1	BOARD ASSY:VERTICAL OUTPUT	28480	01707-66502
A5A5C1	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5C2	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5C3	0160-2262		C:FXD CER 16 PF 5% 500VDCW	72982	301-000 COGO 160J
A5A5C4	0160-0157	3	C:FXD MY 4700 PF 10% 200VDCW	56289	192P47292-PTS
A5A5C5	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	1500474X9035A2-DYS
A5A5C6	0160-0157		C:FXD MY 4700 PF 10% 200VDCW	56289	192P47292-PTS
A5A5C7	0121-0166	2	C:VAR AIR 2.4-24.5 PF 650VDCW	28480	0121-0166
A5A5C8	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5C9	0150-0059		C:FXD CER 3.3 PF 500VDCW	72982	301-000-COJO-339C
A5A5C10	0150-0059		C:FXD CER 3.3 PF 500VDCW	72982	301-000-COJO-339C
A5A5C11	0140-0199	1	C:FXD MICA 240 PF 5%	28480	0140-0199
A5A5C12	0121-0166		C:VAR AIR 2.4-24.5 PF 650VDCW	28480	0121-0166
A5A5C13	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5C14	0160-2263	1	C:FXD CER 18 PF 5% 500VDCW	72982	301-000-COGO-180H
A5A5C15	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5C16	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A5L1	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A5L2	9100-2276		COIL/CHOKE 100 UH 10%	28480	9100-2276
A5A5L3	9100-2254	2	COIL:FXD RF 0.39 UH 10%	28480	9100-2254
A5A5L4	9100-2254		COIL:FXD RF 0.39 UH 10%	28480	9100-2254
A5A5Q1	1853-0218	4	TSTR:SI PNP	80131	2N2894
A5A5Q2	1853-0218		TSTR:SI PNP	80131	2N2894
A5A5Q3	1853-0036		TSTR:SI PNP	80131	2N3906
A5A5Q4	1853-0218		TSTR:SI PNP	80131	2N2894
A5A5Q5	1853-0218		TSTR:SI PNP	80131	2N2894
A5A5Q6	1854-0233	2	TSTR:SI NPN	80131	2N3866
A5A5Q7	1854-0233		TSTR:SI NPN	80131	2N3866
A5A5Q8	1854-0359	2	TSTR:SI NPN	28480	1854-0359

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
A5A5Q9	1854-0359		TSTR:SI NPN	28480	1854-0359
A5A5R1	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R2	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R3	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R4	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A5R5	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A5R6	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A5R7	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R8	0757-0410	3	R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A5A5R9	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R10	0757-0433		R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A5A5R11	0757-0433		R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A5A5R12	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5A5R13	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A5R14	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A5R15	0698-3159		R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A5A5R16	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5A5R17	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R18	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A5R19	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R20	0757-0411	1	R:FXD MET FLM 332 OHM 1% 1/8W	28480	0757-0411
A5A5R21	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A5R22	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A5R23	0684-2201	2	R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A5A5R24	0757-0802	2	R:FXD MET FLM 162 OHM 1% 1/2W	28480	0757-0802
A5A5R25	0757-0802		R:FXD MET FLM 162 OHM 1% 1/2W	28480	0757-0802
A5A5R26	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A5A5R27	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A5A5R28	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A5A5R29	0757-0280	1	R:FXD MET FLM 1000 OHM 1% 1/8W	28480	0757-0280
A5A5R30	2100-2061		R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
A5A5R31	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5A5R32	0698-5563	2	R:FXD CARBON 180 OHM 5% 1/8W	28480	0698-5563
A5A5R33	0698-5563		R:FXD CARBON 180 OHM 5% 1/8W	28480	0698-5563
A5A5R34	0757-0814	4	R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A5A5R35	0757-0814		R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A5A5R36	0757-0814		R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A5A5R37	0757-0814		R:FXD MET FLM 511 OHM 1% 1/2W	28480	0757-0814
A6	01701-65802	1	MODULE ASSY:HORIZONTAL AMPLIFIER	28480	01701-65802
A6DS1	1450-0709		LIGHT:INDICATOR 90 VDC	72765	6140-000-603
A6DS2	1450-0709		LIGHT:INDICATOR 90 VDC	72765	6140-000-603
A6MP1	01701-00609	1	SHIELD:HOLD-OFF	28480	01701-00609
A6MP2	01701-02301	1	KEEPER:PC BOARDS	28480	01701-02301
A6MP3	01701-60601	1	SHIELD ASSY:HORIZONTAL	28480	01701-60601
A6MP4	01701-63704	1	SHAFT ASSY:SWEEP TIME	28480	01701-63704
A6MP5	01701-63703	1	SHAFT ASSY:PB EXTENDER	28480	01701-63703
A6MP6	0510-1036	1	COLLAR:PRECISION SST	28480	0510-1036
A6MP7	01830-23201	1	COUPLER:BAL SHAFT	28480	01830-23201
A6R1	2100-1841	2	R:VAR 100K OHM 20% LIN 1/3W	28480	2100-1841
A6R2	2100-1841		R:VAR 100K OHM 20% LIN 1/3W	28480	2100-1841
A6R3	2100-3014	1	R:VAR COMP DUAL 20K OHM 20% LIN	28480	2100-3014
A6R4	2100-3009	2	R:VAR COMP 20K OHM 20% LIN	28480	2100-3009
A6R5	2100-3009		R:VAR COMP 20K OHM 20% LIN	28480	2100-3009
A6R6	2100-3006	1	R:VAR COMP 20K OHM 20% LIN 1/3W	28480	2100-3006
A6R7	2100-3015	1	R:VAR COMP 200K OHM 20% 2/10W	28480	2100-3015
A6W1	01701-61606	1	CABLE ASSY:COAX	28480	01701-61606
A6W2	01701-61610	1	CABLE ASSY:COAX	28480	01701-61610
A6W3	01701-61604	1	CABLE:HORIZONTAL	28480	01701-61604
A6A1	01701-66512	1	BOARD ASSY:HORIZONTAL MOTHER	28480	01701-66512
A6A1C1	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A1C2	0180-0094	2	C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A6A1C3	0180-0094		C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025DD2-DSM
A6A1J1	1251-1626	6	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1J2	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1J3	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1J4	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1J5	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1J6	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1Q1	1854-0087	1	TSTR:SI NPN	80131	2N3417
A6A1R1	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A1R2	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A1R3	0684-6821	1	R:FXD COMP 6.8K OHM 10% 1/4W	01121	CB 6821
A6A1R4	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A6A1R5	0757-0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A6A1R6	0757-0413	1	R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413

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
A6A1R7	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A1R8	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A1R9	0757-0407	1	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6A1S1	3101-1399	1	SWITCH:PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1S2			N.S.R. PART OF A6A1S1		
A6A1S3			N.S.R. PART OF A6A1S1		
A6A1S4	3101-1400	3	SWITCH:PUSHBUTTON DPDT	71590	PB-1
A6A1S5			N.S.R. PART OF A6A1S1		
A6A2	01701-66513	1	BOARD ASSY:TRIGGER	28480	01701-66513
A6A2C1	0170-0043		C:FXD MY 0.022UF 10% 400VDCW	24446	64FDA223
A6A2C2	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A2C3	0140-0203	3	C:FXD MICA 30 PF 5%	28480	0140-0203
A6A2C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A6A2C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A2C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A2C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C8	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C10	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C11	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C12	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C13	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A6A2C14	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C15	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A2C16	0160-2012	1			
A6A2CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2Q1	1855-0085	2	TSTR:FET (MATCHED PAIR)	28480	1855-0085
A6A2Q2	1855-0085		TSTR:FET (MATCHED PAIR)	28480	1855-0085
A6A2Q3	1854-0296	6	TSTR:SI NPN	28480	1854-0296
A6A2Q4	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q6	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q7	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2Q8	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2Q9	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2Q10	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2Q11	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2Q12	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2Q13	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2Q14	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2Q15	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q16	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q17	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q18	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q19	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q20	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q21	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q22	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q23	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q24	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2Q25	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2Q26	1853-0049	4	TSTR:SI PNP	28480	1853-0049
A6A2Q27	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A2Q28	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A2R1	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A2R2	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A2R3	0757-0367	1	R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A6A2R4	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A2R5	0757-0465	5	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A2R6	0757-0410		R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A6A2R7	0757-0410		R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A6A2R8	0757-0488	1	R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A6A2R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6A2R10	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R11	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R12	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6A2R13	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442

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
A6A2R14	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R15	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R16	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R17	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R18	0684-3311	2	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A6A2R19	0684-3311		R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A6A2R20	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R21	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R22	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R23	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R24	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R25	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R26	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R27	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R28	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R29	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R30	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R31	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R32	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2R33	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2R34	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R35	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R36	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R37	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R38	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R39	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R40	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R41	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R42	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R43	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R44	0757-0429	2	R:FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A6A2R45	2100-2216	2	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A6A2R46	0757-0429		R:FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A6A2R47	2100-2216		R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A6A2R48			NOT ASSIGNED		
A6A2R49			NOT ASSIGNED		
A6A2R50	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R51	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R52	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R53	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A2R54	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R55			NOT ASSIGNED		
A6A2R56	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R57	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R58	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6A2R59	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6A2R60	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A2R61	0684-3341	1			
A6A2R62	0684-1531		R:FXD COMP 15K OHM 10% 1/4W	01121	CB 1531
A6A2R63	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R64	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A2R65	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R66	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6A2R67	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6A2R68	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R69	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2S1	3101-1398	1	SWITCH:PUSHBUTTON 2 POLE 5 STATION	28480	3101-1398
A6A2S2			N.S.R. PART OF A6A2S1		
A6A2S3			N.S.R. PART OF A6A2S1		
A6A2S4			N.S.R. PART OF A6A2S1		
A6A2S5	3101-1400		SWITCH:PUSHBUTTON DPDT	71590	PB-1
A6A2S6	3101-1400		SWITCH:PUSHBUTTON DPDT	71590	PB-1
A6A2S7			N.S.R. PART OF A6A2S1		
A6A2U1	1820-0142	2	INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	04713	MC1004P
A6A2U2	1820-0142		INTEGRATED CIRCUIT:4INPUT,2-OR/NOR	04713	MC1004P
A6A2XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A2XU2	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A3	01701-66514	1	BOARD ASSY:INTEGRATOR	28480	01701-66514
A6A3C1	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C2	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C3	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C4	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C0238101F103ZS25-CDH
A6A3C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C0238101F103ZS25-CDH
A6A3C7	0160-3448	1	C:FXD CER 1000 PF 10% 1000VDCW	56289	C0678251F102KS25-CDH

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
A6A3C8	0160-2264		C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A6A3C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A3C10	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A6A3C11	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A6A3CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR4	1910-0030	1	DIODE:GERMANIUM 100 MA 0.65V	28480	1910-0030
A6A3CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3Q1	1854-0092	4	TSTR:SI NPN	80131	2N3563
A6A3Q2	1853-0036		TSTR:SI PNP	80131	2N3906
A6A3Q3	1854-0092		TSTR:SI NPN	80131	2N3563
A6A3Q4	1854-0092		TSTR:SI NPN	80131	2N3563
A6A3Q5	1853-0036		TSTR:SI PNP	80131	2N3906
A6A3Q6	1853-0276	1	TSTR:SI PNP	28480	1853-0276
A6A3Q7	1855-0057	1	TSTR:SI FET N-CHANNEL	28480	1855-0057
A6A3Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A6A3Q9	1854-0215		TSTR:SI NPN	80131	2N3904
A6A3R1	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R2	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R3	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R4	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R5	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R6	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R8	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A3R9	0757-0446	2	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A3R10	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6A3R11	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R12	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R13	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A3R14	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R15	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R17	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A3R18	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R19	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3U1	1820-0068	2	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A3XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A6A4			SAME AS A6A3, USE PREFIX A6A4.		
A6A5	01701-66515	1	BOARD ASSY:SWEEP TIME	28480	01701-66515
A6A5C1	0160-3324	1	C:FXD POLY 1 UF 5% 100VDCW	84411	HEW-132
A6A5C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A5C3	0140-0193	1	C:FXD MICA 82 PF 5%	28480	0140-0193
A6A5C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A5C5	0160-3541	1	C:FXD POLY 0.01 UF 5% 100VDCW	84411	HEW-192
A6A5MP1	0510-1101	3	SPRING:RETAINER(PC SWITCH)	28480	0510-1101
A6A5MP2	1460-1148	3	SPRING:TORSION	00000	DBD
A6A5MP3	01840-22502	3	ROLLER:DETENT	28480	01840-22502
A6A5Q1	1854-0221	1	TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A6A5Q2	1853-0086	1	TSTR:SI PNP	80131	2N5087
A6A5Q3	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A5R1	0757-0156	4	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A5R2	0757-0779	4	R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A5R3	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A5R4	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A5R5	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A5R6	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A5R7	0687-1231	1	R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231
A6A5R8	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A5R9	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A5R10	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A5R11	0757-0460	1	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A6A5R12	0757-0462	1	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462

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
A6A5R13	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A5R14	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A5R15	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A5R16	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A5R17	0684-1541	1	R:FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A6A5R18	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A5S1MP1	3130-0355	1	ROTOR ASSY:FEMALE	28480	3130-0355
A6A5S1MP2	3130-0354	1	ROTOR ASSY:MALE	28480	3130-0354
A6A6			SAME AS A6A5, USE PREFIX A6A6.		
A6A7	01701-66516	1	HOLDOFF COMP ASSY	28480	01701-66516
A6A7C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z S25-CDH
A6A7C2	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A7C3	0160-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A7C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z S25-CDH
A6A7C5	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A7C6	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A6A7C7	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A7C8	0140-0203		C:FXD MICA 30 PF 5%	28480	0140-0203
A6A7C9	0140-0203		C:FXD MICA 30 PF 5%	28480	0140-0203
A6A7CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A7MP1	0510-1101		SPRING:RETAINER(PC SWITCH)	28480	0510-1101
A6A7MP2	1460-1148		SPRING:TORSION	00000	DBD
A6A7MP3	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A7Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A6A7Q2	1853-0203	2	TSTR:SI PNP	28480	1853-0203
A6A7Q3	1853-0203		TSTR:SI PNP	28480	1853-0203
A6A7Q4	1853-0036		TSTR:SI PNP	80131	2N3906
A6A7Q5	1853-0036		TSTR:SI PNP	80131	2N3906
A6A7Q6	1854-0092		TSTR:SI NPN	80131	2N3563
A6A7Q7	1853-0036		TSTR:SI PNP	80131	2N3906
A6A7R1	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A7R2	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A7R3	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A7R4	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A7R5	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A7R6	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A7R7	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A7R8	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A7R9	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A7R10	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A7R11	0684-1831	1	R:FXD COMP 18K OHM 10% 1/4W	01121	CB 1831
A6A7R12	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A7R13	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A7R14	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A7R15	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A7R16	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6A7S1MP1	3130-0352	1	ROTOR ASSY:FEMALE	28480	3130-0352
A6A7S1MP2	3130-0353	1	ROTOR ASSY:MALE	28480	3130-0353
A6A7U1	1820-0068		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A7U1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A8	01701-66517	1	BOARD ASSY:HORIZONTAL MODULE	28480	01701-66517
A6A8C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z S25-CDH
A6A8C2	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A8C3	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A8CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8MP1	1460-1148		SPRING:TORSION	00000	DBD
A6A8MP2	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A8MP3	0510-1101		SPRING:RETAINER(PC SWITCH)	28480	0510-1101
A6A8R1	0757-0456	1	R:FXD MET FLM 43.2K OHM 1% 1/8W	28480	0757-0456
A6A8R2	0757-0793		R:FXD MET FLM 2000 OHM 1% 1/8W	28480	0757-0739
A6A8S1MP1	3130-0351	1	ROTOR ASSY:MALE	28480	3130-0351
A6A8S1MP2	3130-0350	1	ROTOR ASSY:FEMALE	28480	3130-0350
A6A9	01701-66535	1	BOARD ASSY:HORIZONTAL PRE-AMPLIFIER	28480	01701-66535
A6A9C1	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z S25-CDH
A6A9C2	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z S25-CDH
A6A9C3	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z S25-CDH
A6A9C4	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z S25-CDH
A6A9C5	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z S25-CDH
A6A9C6	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS

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
A6A9C7	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A9C8	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A9C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A9C10	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A9CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A9J1	1251-1604	2	CONNECTOR:PC 22 CONTACTS	28480	1251-1604
A6A9J2	1251-1604		CONNECTOR:PC 22 CONTACTS	28480	1251-1604
A6A9Q1	1854-0019		TSTR:SI NPN	28480	1854-0019
A6A9Q2	1854-0019		TSTR:SI NPN	28480	1854-0019
A6A9Q3	1853-0036		TSTR:SI PNP	80131	2N3906
A6A9Q4	1853-0036		TSTR:SI PNP	80131	2N3906
A6A9R1	2100-1760		R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A6A9R2	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A9R3	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6A9R4	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A9R5	0757-0441	1	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A6A9R6	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A9R7	0757-0472	3	R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A6A9R8	0757-0444	1	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A6A9R9	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A9R10	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A9R11	0757-0459	1	R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A6A9R12	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6A9R13	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6A9R14	0698-3161	2	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6A9R15	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6A9R16	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A9R17	0757-0472		R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A6A9R18	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A9R19	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A9R20	0757-0472		R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A6A9R21	2100-1755	1	R:VAR WW 100 OHM 5% TYPE V 1W	28480	2100-1755
A6A9R22	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A9R23	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A9R24	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A9R25	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A9R26	0757-0408		R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0408
A6A9U1	1821-0002	2	TRANSISTOR ARRAY:SI NPN	02735	CA3045
A6A9U2	1821-0002		TRANSISTOR ARRAY:SI NPN	02735	CA3045
A6A9XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A9XU2	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A10	01701-66519	1	BOARD ASSY:HORIZONTAL OUTPUT	28480	01701-66519
A6A10C1	0160-2235	2	C:FXD CER 0.75 PF 500VDCW	72982	301-000-COKO-758C
A6A10C2	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A10C3	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A10C4	0160-2235		C:FXD CER 0.75 PF 500VDCW	72982	301-000-COKO-758C
A6A10C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A10C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A10C7	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A10C8	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6A10C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A10C10	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A6A10Q1	1853-0036		TSTR:SI PNP	80131	2N3906
A6A10Q2	1853-0036		TSTR:SI PNP	80131	2N3906
A6A10Q3	1854-0215		TSTR:SI NPN	80131	2N3904
A6A10Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A6A10Q5	1854-0271		TSTR:SI NPN	28480	1854-0271
A6A10Q6	1854-0271		TSTR:SI NPN	28480	1854-0271
A6A10Q7	1853-0037		TSTR:SI PNP	04713	SS 2109
A6A10Q8	1853-0037		TSTR:SI PNP	04713	SS 2109
A6A10R1	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6A10R2	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A10R3	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A10R4	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6A10R5	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A10R6	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A10R7	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6A10R8	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6A10R9	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A10R10	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A10R11	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A6A10R12	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A6A10R13	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A10R14	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A10R15	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416

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
A6A10R16	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A6A10VR1	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A7	01701-66520	1	BOARD ASSY:SCALE ILLUMINATION	28480	01701-66520
A7DS1	2140-0253	2	LAMP:INCANDESCENT 28V 0.030A	08717	F838
A7DS2	2140-0253		LAMP:INCANDESCENT 28V 0.030A	08717	F838
A7MP1	01701-26520	1	BOARD:ETCHED	28480	01701-26520

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
BT1P1	1251-2510	1	BODY:R & P CONNECTOR 2 MALE CONTACT	27264	1545-P1
A0			CHASSIS PARTS		
DS1	1450-0710	1	LIGHT:INDICATOR 90 VDC	72765	6140-000-603
F1	2110-0002	1	FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
J1	1251-2505	1	BODY:R & P CONNECTOR 2 FEMALE CONTACT	27264	1545-R1
J2	01701-67602	1	CONNECTOR ASSY:DC POWER	28480	01701-67602
J3	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
J4	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
L1	01701-66001	2	COIL ASSY:ALIGNMENT	28480	01701-66001
L2	01701-66001		COIL ASSY:ALIGNMENT	28480	01701-66001
MP1	01707-00204	1	PANEL:FRONT	28480	01707-00204
MP2	01701-20501	1	FRAME:FRONT	28480	01701-20501
MP3	01701-24702	1	SUPPORT:CRT-CAMERA	28480	01701-24702
MP4	01701-07101	1	MASK:CRT	28480	01701-07101
MP5	4040-0814	1	BEZEL:OLIVE, BLACK	28480	4040-0814
MP6	01701-09103	2	SPRING:FILTER CONTRAST	28480	01701-09103
MP7	0370-1005	2	KNOB:JADE GREY	28480	0370-1005
MP8	0370-1099	3	KNOB:JADE GREY	28480	0370-1099
MP9	0370-0962	2	KNOB ASSY:DIV/CAL	28480	0370-0962 00
MP10	0370-0966	2	KNOB ASSY	28480	0370-0966
MP11	0370-0929	2	KNOB:LEVER, JADE GREY	28480	0370-0929
MP12	0370-2046	1	KNOB ASSY:DISPLAY	28480	0370-2046
MP13	0370-0972	1	PUSHBUTTON:-B-POL	28480	0370-0972
MP14	0370-1091	1	KNOB:JADE GREY	28480	0370-1091
MP15	0370-0959	1	KNOB ASSY:SCALE ILLUM	28480	0370-0959
MP16	0370-0963	1	KNOB:HORIZONTAL POSITION-FINE	28480	0370-0963
MP17	0370-1100	1	KNOB:JADE GREY	28480	0370-1100
MP18	0370-0964	1	KNOB ASSY	28480	0370-0964
MP19	0370-1108	1	KNOB:JADE GREY	28480	0370-1108
MP20	0370-0968	1	KNOB ASSY	28480	0370-0968
MP21	0370-1312	7	KNOB:JADE GREY	28480	0370-1312
MP22	0370-0957	1	KNOB ASSY(NORM)	28480	0370-0957
MP23	0370-0958	1	KNOB ASSY (CAL)	28480	0370-0958
MP24	0370-0971	1	PUSHBUTTON ASSY:MAG	28480	0370-0971
MP25	0370-0970	9	PUSHBUTTON ASSY:BLANK	28480	0370-0970
MP26	0370-0914	13	BEZEL:PUSHBUTTON KNOB, JADE GREY	28480	0370-0914
MP27	0370-0973	2	PUSHBUTTON ASSY:SLOPE	28480	0370-0973
MP28	1510-0038	8	BINDING POST	28480	1510-0038
MP29	0510-0097	4	RETAINER:PUSH-ON	78553	C185-014-240
MP30	01701-23708	2	RAIL:SIDE	28480	01701-23708
MP31	01701-04105	2	COVER:RAIL, REAR	28480	01701-04105
MP32	01701-64101	2	COVER ASSY:RAIL FRONT	28480	01701-64101
MP33	0050-1757	2	GEAR:SUPPORT	28480	0050-1757
MP34	01701-25002	1	HANDLE:ARM, LEFT	28480	01701-25002
MP35	01701-25001	1	HANDLE:ARM, RIGHT	28480	01701-25001
MP36	01701-27701	1	BODY:HANDLE	28480	01701-27701
MP37	01701-21702	1	GRIP:HANDLE	28480	01701-21702
MP38	7120-2473	1	NAMEPLATE	28480	7120-2473
MP39	01701-07201	2	INSERT:HANDLE FRONT	28480	01701-07201
MP40	01701-07202	2	INSERT:HANDLE REAR	28480	01701-07202
MP41	01701-27401	2	BUTTON	28480	01701-27401
MP42	01701-23707	2	SHAFT:PAWL	28480	01701-23707
MP43	0510-0091	2	RING:RETAINING STL EXTERNAL	79136	5103-25-S-MD
MP44	3050-0253	2	WASHER:SPRING	28480	3050-0253
MP45	0510-0956	2	RING:RETAINING 0.188" SHAFT	79136	5133-18-MD
MP46	0050-1758	2	PAWL	28480	0050-1758
MP47	2190-0924	2	WASHER:WAVE SPRING	28480	2190-0924
MP48	0050-1756	2	GEAR:HANDLE	28480	0050-1756
MP49	1460-0295	2	SPRING:COMPRESSION	00000	08D
MP50	01701-00202	1	PANEL:REAR(INCL S2)	28480	01701-00202
MP51	01701-20502	1	FRAME:REAR	28480	01701-20502
MP52	5000-5085	2	CLIP:FAN	28480	5000-5085
MP53	5040-0501	4	FOOT:REAR	28480	5040-0501
MP54	01701-04109	1	COVER:TRANSFORMER	28480	01701-04109
MP55	01701-04108	1	COVER:CRT	28480	01701-04108
MP56	01701-00101	1	DECK:BATTERY	28480	01701-00101
MP57	01701-00606	1	SHIELD:GATE	28480	01701-00606
MP58	1400-0798	1	CLAMP:CRT, OLIVE	28480	1400-0798
MP59	1520-0042	2	MOUNT:SHOCK	00000	08D
MP60	01701-00601	1	SHIELD:CRT	28480	01701-00601
MP61	01701-04102	1	COVER:TOP	28480	01701-04102
MP62	01701-04103	1	COVER:BOTTOM	28480	01701-04103
MP63	1400-0026	1	CLAMP:HOSE	66295	36H
MP64	1200-0408	1	COVER: CRT SOCKET	28480	1200-0408
MP65	1200-0037	1	SOCKET: CRT TUBE	28480	1200-0037
MP66	0370-2047	1	KNOB: POINTER	28480	0370-2047
P1	1251-2588	1	BODY:R & P CONNECTOR 12 MALE CONTACT	27264	1625-12P-1
P2	1251-2614	1	CONNECTOR:JONES TYPE 2 FEMALE CONTACT	71785	S-302-CCT

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
R1	2100-3023	1	R:VAR COMP 10K OHM 20% LIN 1/2W	28480	2100-3023
R2	2100-3017	1	R:VAR CERMET 2.5 MEGOHM 20% LIN	28480	2100-3017
R3	2100-3022	1	R:VAR COMP 10K OHM 20% LIN 1/5W	28480	2100-3022
R4	2100-0428	1	R:VAR COMP 20K OHM LIN 20% 0.2W	28480	2100-0428
R5	2100-3021	1	R:VAR COMP 100K OHM 20% LIN 1/5W	28480	2100-3021
S1	3101-0940	1	SWITCH:TOGGLE DPDT	28480	3101-0940
S2	3101-1391	1	SWITCH	28480	3101-1391
S2			PART OF REAR PANEL(SEE MP29)		
S3	3101-0977	1	SWITCH:PUSHBUTTON DPDT	82389	12S-1032
T1	9100-1134	1	TRANSFORMER	28480	9100-1134
V1	5083-2752	1	CRT:P31 ALUM. INT. GRATICULE	28480	5083-2752
W1	01701-61608	1	CABLE:COAX	28480	01701-61608
W1			(HORIZ. PREAMP TO GATE, BLUE CAP)		
W2	01701-61611	1	CABLE:COAX	28480	01701-61611
W2			(GATE TO CAL OUT JACK, RED CAP)		
W3	01701-61607	1	CABLE:COAX	28480	01701-61607
W3			(VERTICAL PREAMP TO GATE, WHITE CAP)		
W4	01701-61612	1	CABLE:COAX	28480	01701-61612
W4			(Z-AXIS INPUT, YELLOW CAP)		
W5	01701-61609	1	CABLE:COAX	28480	01701-61609
W5			(VERT. PREAMP TO HORIZ. PREAMP, RED CAP		
W6	01701-61613	1	CABLE:SHIELDED	28480	01701-61613
W6			(POWER SWITCH TO POWER MODE SWITCH)		
W7	01701-61605	1	CABLE ASSY:TWIN LEAD	28480	01701-61605
W7			(CRT TO VERTICAL & HORIZONTAL)		
W8	8120-1521	1	CABLE ASSY:POWER CORD 7.5 FT.	70903	KH 7147
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
XF1	10006A	2	PROBE:6' 1001	28480	10006A
XF1	10101A	1	STORAGE COVER	28480	10101A
XF1	7124-1759	1	LABEL:INFO	28480	7124-1759
XF1	10107A	1	CONTRAST:SCREEN	28480	10107A

See introduction to this section for ordering information

Table 6-3. List of Manufacturers' Codes

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U.S.A Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco, Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Mictron, Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp. Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00809	Croven, Ltd.	Whitby, Ontario, Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Cal.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Cal.
01281	TRW Semiconductors, Inc.	Lawndale, Cal.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co	Alliance, Ohio
01538	Small Parts Inc.	Los Angeles, Cal.
01589	Pacific Relays, Inc.	Van Nuys, Cal.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01960	Pulse Engineering Co	Santa Clara, Cal.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc	Sunnyvale, Cal.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Division	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Cal.
02875	Hudson Tool & Die	Newark, N.J.
03296	Nylon Molding Corp.	Springfield, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Cal.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div., Finderne Plant	Sumerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taruus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Cal.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Palo Alto Division of Hewlett-Packard Co.	Palo Alto, Cal.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Cal.
04673	Dakota Engr. Inc.	Culver City, Cal.
04713	Motorola Inc. Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Cal.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Cal.
04811	Precision Coil Spring Co.	El Monte, Cal.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Cal.
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Cal.
05397	Union Carbine Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Cal.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Cal.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Cal.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Cal.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Cal.
06980	Varian Assoc. Etmac Div.	San Carlos, Cal.
07088	Kelvin Electric Co.	Van Nuys, Cal.
07126	Digitran Co.	Pasadena, Cal.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp., Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Cal.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Cal.
07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Cal.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp, The	Monterey Park, Cal.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Cal.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Cal.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Cal.
07980	Hewlett-Packard Co., New Jersey Division	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Cal.
08289	Blinn, Delbert Co.	Pomona, Cal.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Cal.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Cal.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div. of CBS Inc	Lowell, Mass.
08806	General Electric Co., Miniature Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Cal.
09097	Electronic Enclosures Inc.	Los Angeles, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Cal.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09795	Pennsylvania Florocarbon	Clifton Heights, Penn.
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Cal.
10411	Ti-Tal, Inc.	Berkeley, Cal.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Cal.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Cal.
11314	National Seal	Downey, Cal.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Cal.
11711	General Instrument Corp., Semiconductor Division Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Cal.
11870	Melabs, Inc.	Palo Alto, Cal.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc., Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Cal.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Airco Supply Co., Inc.	Witchita, Kansas
13061	Wilco Products	Detroit, Mich.
13103	Thermolloy	Dallas, Texas
13327	Solitron Devices Inc.	Tappan, N.Y.
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Cal.
14193	Calif. Resistor Corp	Santa Monica, Cal.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, a Div. of Int. Telephone and Telegraph Corporation	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dublier Electric Corp	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Cal.
14960	Williams Mfg. Co.	San Jose, Cal.
15106	The Sphere Co., Inc.	Little Falls, N.J.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Cal.
15291	Adjustable Bushing Co.	N. Hollywood, Cal.
15558	Micron Electronics.	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Cal.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Cal.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mountain View, Cal.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Detroit, Ill.
16352	Computer Diode Corp.	Lodi, N.J.
16554	Electroid Co.	Union, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Cal.
16688	Ideal Prec. Meter Co., Inc., De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Cal.
17474	Tranex Company	Mountain View, Cal.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Cal.
17856	Siliconix Inc.	Sunnyvale, Cal.
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Cal.
18083	Clevite Corp. Semiconductor Div.	Palo Alto, Cal.
18324	Signetics Corp.	Sunnyvale, Cal.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18565	Chomerics	Plainville, Mass.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison	West Orange, N.J.
19589	Concoa	Baldwin Park, Cal.

00015-49
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From: Handbook Supplements
H4-1 Dated January 1970

Table 6-3. List of Manufacturers' Codes (Cont'd)

Code No.	Manufacturer	Address
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21355	Fafnir Bearing Co., The	New Britian, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23020	General Reed Co.	Metuchen, N.J.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division, Nela Park,	Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobert File Co. of America, Inc.	Carlstadt, N.J.
26851	Compac Hollister Co.	Hollister, Cal.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products, Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto, Ontario, Canada
37942	P.R. Mallory & Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
40931	Honeywell Inc.	Minneapolis, Minn.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	HP Co., Med. Elec. Div.	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & System Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
58474	Superior Elect. Co.	Bristol, Conn.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electric Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincey, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst, L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Cal.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Cal.
71471	Cinema, Div. Aerovox Corp.	Burbank, Cal.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap Division	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Cal.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Cal.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Cal.
73445	Amperex Elect. Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries, Inc.	Philadelphia, Pa.
73734	Federal Screw Products, Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Cal.
73957	Groove-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronic Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights, Inc.	Sandwich, Ill.
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago; Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Cal.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Cal.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Cal.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Cal.
77075	Pacific Metals Co.	San Francisco, Cal.
77221	Phaostran Instrument and Electronic Co.	So. Pasadena, Cal.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Division	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Cal.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Cal.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Cal.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80033	Prestole Corp.	Toledo, Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Standard tube or semi-conductor device, any manufacturer.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Cal.
80411	Arco Div. of Robertshaw Controls Co.	Columbus, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Cal.
80583	Hammarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Inst. Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Cal.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Cal.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp., Space & Defense Systems Div.	Paramus, N.J.
82209	Magurie Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod., Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc., Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rolton Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Cal.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Cal.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Cal.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisades Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp., Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Cal.
84411	TRW Capacitor Div.	Ogallala, Neb.

Table 6-3. List of Manufacturers' Codes (Cont'd)

Code No.	Manufacturer	Address
94870	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Cal.
85474	R.M. Bracamonte & Co.	San Francisco, Cal.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Division	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Cal.
87034	Marco Industries	Anaheim, Cal.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Cal.
87664	Van Waters & Rogers Inc.	San Francisco, Cal.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Cal.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89479	Security Co.	Detroit, Mich.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	U.S. Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90365	Belleville Speciality Tool Mfg., Inc.	Belleville, Ill.
90763	United Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Cal.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Cal.
91345	Miller Dial & Nameplate Co.	El Monte, Cal.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91673	Epiphone Inc.	New York, N.Y.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Cal.
91886	Malco Mfg., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Division	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Cal.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury, L.I., N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Pallisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Cal.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp., Electronics Div.	East Patterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95146	Alco Elect. Mfg. Co.	Lawrence, Mass.
95236	Allies Products Corp.	Diania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West, Inc.	Sunnyvale, Cal.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Mfg. Co.	Los Angeles, Cal.
96396	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Cal.
96508	Xcelite, Inc.	Orchard Park, N.Y.
96733	San Fernando Elec. Mfg. Co.	San Fernando, Cal.
96881	Thomson Ind. Inc.	Long Island, N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Cal.
98220	Hewlett-Packard Co., Medical Elec. Div.	Pasadena, Cal.
98278	Microdot, Inc.	So. Pasadena, Cal.
98291	Sealectro Corp.	Mamaronech, N.Y.
98376	Zero Mfg. Co.	Burbank, Cal.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Division of Hewlett-Packard Co.	Palo Alto, Cal.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Cal.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Cal.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Cal.
99707	Control Switch Division, Controls Co. of America	El Segundo, Cal.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Rembrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp., Semiconductor Division	El Monte, Cal.
99957	Technology-Instrument Corp. of California	Newbury Park, Cal.

The following HP Vendors have no number assigned in the latest supplement to the Federal Supply Code for Manufacturers Handbook.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Comp. Co.	Van Nuys, Cal.
000CS	Hewlett-Packard Co., Colorado Springs Div.	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Cal.
000NN	A "N" D Mfg. Co.	San Jose, Cal.
000QQ	Cooltron	Oakland, Cal.
000WW	California Eastern Lab	Burlington, Cal.
000YY	S.K. Smith Co.	Los Angeles, Cal.

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SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update 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 a serial prefix as shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, refer to Table 7-1 for changes necessary to backdate the manual to the instrument. When making changes from Table 7-1, make the change with the highest number first. If the serial prefix of the instrument is not listed either in the title page or in Table 7-1, refer to an 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
1111A–	1

CHANGE 1

Table 6-2,

A5: Change to HP Part No. 01707-65801.
MP1: Change to HP Part No. 01707-00201.
MP12: Change to HP Part No. 0370-0965.
A5S2: Change to HP Part No. 3100-2557.
MP66: Delete

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 way 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. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

Table 7-2. Model 1707A Options

Option	Description
001	Instrument wired at factory for 230V operation. Replace A1F1 with Fuse, .25 ASB HP Part No. 2110-0017.
002	Replace standard P31 phosphor CRT (V1) with internal graticule P2 phosphor CRT (V1) HP Part No. 5083-2722.
003	Standard Model 1707A without Model 10101A storage cover.
006	Calibrated Delayed Sweep. Replace Delay Time MP-14 with HP Part No. 1140-0036 and replace Horizontal Mod A6 with HP Part No. 1140-0036.
007	Replace standard P31 phosphor CRT V1 with internal graticule P7 phosphor HP Part No. 5083-2732.
011	Replace standard P31 phosphor CRT (V1) with internal graticule P11 phosphor CRT (V1) HP Part No. 5083-2742.
012	Standard Model 1707A with Battery Pack HP Part No. 10103A.
090	Standard Model 1707A without Probe Model 10006A.
091	Replace standard probes Model 10006A with two Model 10005B 10:1 Divider Probes.
092	Replace standard probes Model 10006A with two Model 10004B 10:1 Divider Probes.
093	Replace standard probes Model 10006A with two Model 10007B 10:1 Divider Probes.
094	Replace standard probes Model 10006A with two Model 10008B 10:1 Divider Probes.
602	Replace standard P31 phosphor CRT (V1) with non-graticule P2 phosphor CRT (V1) HP Part No. 5083-2721.
607	Replace standard P31 phosphor CRT (V1) with non-graticule P7 phosphor CRT (V1) HP Part No. 5083-2731.
611	Replace standard P31 phosphor CRT (V1) with non-graticule P11 phosphor CRT (V1) HP Part No. 5083-2741.
631	Replace standard P31 phosphor CRT (V1) with non-graticule P31 phosphor CRT (V1) HP Part No. 5083-2751.

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. Table 8-3 defines symbols and conventions used on the Schematics. A disassembly and assembly procedure for repair and replacement of modules is also contained in this section.

8-3. SCHEMATICS.

8-4. Schematics are printed on fold-out 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. MIL-standard symbols and conventions used in the Schematics are defined in Table 8-3.

8-5. The Schematics are numbered in sequence with a bold number in a box at the lower right-hand corner of each page. These numbers are used to cross reference signal connections between Schematics. At each circuit breaking point, a notation is made of the signal and a number (in bold type). This number indicates the associated Schematic which contains the source or destination of the signal. To find the source or destination of any point on a given Schematic, turn to the Schematic referred to by number and find the name of the signal in question.

8-6. A reference designations table on each Schematic lists all components shown on the Schematic. Component reference designators which have been deleted from the Schematic are listed below the table.

8-7. All components within the shaded areas of a Schematic are physically located on etched circuit boards. Components not physically located on an etched circuit board are shown in the unshaded 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 number. This letter-number combination is the basic reference designation. Components which are not part of an assembly have only 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 (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 in photos 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 photo is printed next to the Schematic that shows most of the circuitry on the assembly. Assemblies locations are identified in Figure 8-10. The locations of all adjustments are shown in Section V. An exploded-view drawing that shows mechanical (and some electrical) parts is located in Section VI.

8-14. TROUBLESHOOTING.

8-15. The most important prerequisite for successful troubleshooting is understanding how the instrument is designed to operate and correct use of front-panel controls. Suspected malfunctions may be caused by improper control settings or circuit connections. Read Section III (Operation) for an explanation of controls and connectors and general operating considerations, and Section IV (Principles of Operation) for an explanation of circuit theory before attempting to isolate a suspected trouble.

8-16. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that might suggest a source of trouble. Check to see that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check the power supply voltages in the unit. Prior to any extensive troubleshooting, check the external power sources also.

8-17. TROUBLESHOOTING AIDS.

8-18. If trouble is suspected in the main integrator or main sweep time assembly, they may be replaced with the delayed integrator or the delayed sweep time assembly to isolate the trouble to the particular assembly.

8-19. DC VOLTAGES.

8-20. On some of the Schematics, dc voltages are indicated for active components (transistors, etc). Conditions for making the voltage measurements are listed adjacent to each Schematic. Since the conditions for making these measurements may differ from one circuit to another, always check the specific conditions listed adjacent to the Schematic.

8-21. WAVEFORMS.

8-22. Waveform measurement points (▽ with a number enclosed) are placed on the Schematics along main signal paths. The numbers inside the measurement point symbols (▽) are keyed to corresponding waveforms adjacent to each Schematic. Conditions for making the waveform measurements are also listed adjacent to each Schematic. Like the dc voltage measurement conditions, waveform measurement conditions may vary from one circuit to another.

8-23. TEST POINTS.

8-24. Test points are shown on the Schematics with this symbol (◎). Test points correspond to pins protuding from etched circuit boards and do not necessarily correspond to waveform measurement points.

8-25. TEST EQUIPMENT REQUIRED.

8-26. Test equipment and accessories required to troubleshoot the Model 1707A are listed in Table 5-1. Test instruments other than those listed may be used provided their required characteristics meet or exceed those listed.

8-27. SERVICE KIT.

8-28. The Service Kit, HP Part No. 01701-68701 is an accessory item for the Model 1707A. It is recommended that the service kit be used when servicing the Model 1707A. The kit can be obtained by contacting the nearest HP Sales and Service Office. A list of these offices is included in the back of this manual.

8-29. The board puller is used to remove the A3A2 Low Voltage Converter Assembly and the A3A3 Low Voltage Rectifier and Filter Assembly. Connect the hook portion of the board puller around the metal standoffs that connect the two assemblies and pull assemblies out.

8-30. DISASSEMBLY AND ASSEMBLY PROCEDURES.

8-31. The following paragraphs provide instructions reqqired to remove circuits, modules, knob assemblies and CRT from the Model 1707A. Follow each procedure carefully to avoid damage to the instrument. All procedures should be followed with the instrument turned off and source of power removed.

8-32. CRT REMOVAL AND REPLACEMENT.

8-33. To remove the CRT refer to Figure 6-1 and proceed as follows:

WARNING

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

a. Remove instrument top cover.

b. Remove rear panel CRT socket cover.

c. Remove front-panel CRT light shield MP5 by squeezing at midpoint on the bottom and rotate outward and upward.

d. Remove contrast screen if in use.

e. Remove two screws holding vertical output amplifier shield A5MP2 and tilt to side of instrument.

f. Remove five wires from neck of CRT and unplug post accelerator connector.

NOTE

Do not attempt to remove lead from CRT glass.

g. Remove two wires from scale illumination board A7.

h. Remove CRT shock mounting nuts on rear panel.

i. Remove two screws from rear of CRT shield MP60.

j. Loosen screw of CRT clamp.

k. Carefully remove CRT socket MP65.

l. Disengage CRT shield shock mounts MP59 by squeezing two screws inward and rotating shield.

m. Pull shield back MP60.

n. Place one hand on CRT face and use other hand to slide CRT toward rear of instrument until front of CRT can be raised upward and out of instrument.

o. To reinstall CRT reverse removal procedure.

8-34. CRT SHIELD REMOVAL.

8-35. To remove CRT shield, proceed as follows:

a. Remove four wires (0, 0, 928, 938) from gate assembly board.

b. Move CRT shield forward and upward to remove from the instrument.

c. To reinstall CRT shield, reverse the procedure.

8-36. VERTICAL MODULE REMOVAL AND REPLACEMENT.

8-37. To remove the vertical module assembly from the Model 1707A, proceed as follows:

a. Using an allen wrench, loosen allen set screws of the POSITION, VOLTS/DIV and DISPLAY controls.

b. Remove control knobs.

c. Pull plastic covers from coupling switches.

d. Remove top and bottom covers of instrument.

e. Disconnect main harness wires from vertical preamplifier assembly.

f. Disconnect two wires from the delay line to the vertical output amplifier.

g. Remove two screws holding vertical output amplifier to the vertical amplifier module.

h. Remove vertical output amplifier assembly.

i. Hold vertical preamplifier assembly.

j. Remove nuts on VOLTS/DIV and POSITION controls.

k. Gently lift vertical module assembly out.

l. To reinstall vertical module assembly, reverse removal procedure.

8-38. DELAY LINE REMOVAL AND REPLACEMENT.

8-39. To remove the delay line from the vertical module assembly proceed as follows:

a. Remove vertical module assembly per Paragraph 8-36.

b. Unsolder two wires (2,6) from end of delay line to vertical preamplifier assembly.

c. Remove two center screws on the bottom side of vertical module assembly (C, Figure 8-1).

d. Rotate delay line slightly and remove from vertical module.

NOTE

> The two wires to the vertical output amplifier assembly go thru a rubber grommet. These two wires must be carefully brought thru the grommet during removal of the delay line.

e. To reinstall the delay line, reverse removal procedure.

8-40. ATTENUATOR REMOVAL AND REPLACEMENT.

8-41. To remove the attenuator assemblies from the vertical module assembly proceed as follows:

a. Remove the vertical module assembly from the instrument as described in Paragraph 8-36.

b. Remove the locking nuts (A, Figure 8-1).

c. Remove the six screws on the bottom side of the vertical module assembly (B and C, Figure 8-1).

d. Remove delay line as described in Paragraph 8-38.

e. Unsolder C1 from BNC input connectors (Figure 8-2).

f. Remove nuts holding BNC connectors to shield.

g. Remove BNC connectors.

h. Slide vertical preamplifier back from shield.

i. Raise vertical preamplifier up and unsolder components connected between attenuators and vertical preamplifier board.

j. Remove two screws for each attenuator from top side of preamplifier board.

k. Lift attenuators from board.

l. To reinstall the attenuators, reverse removal procedure.

8-42. HORIZONTAL MODULE ASSEMBLIES REMOVAL AND REPLACEMENT.

8-43. The following paragraphs provide information required to remove and replace various assemblies in the horizontal module.

8-44. TIME/DIV SWITCH REMOVAL AND REPLACEMENT. To remove the TIME/DIV switch proceed as follows:

a. Set TIME/DIV controls as follows:

Display Mode	DELAYED SWEEP
MAIN TIME/DIV	2 SEC
DELAYED TIME/DIV	20 uSEC

b. Loosen the set screw on the locking collar on the inside front panel of the instrument.

c. Pull TIME/DIV switch out.

d. To reinstall TIME/DIV switch, reverse removal procedure.

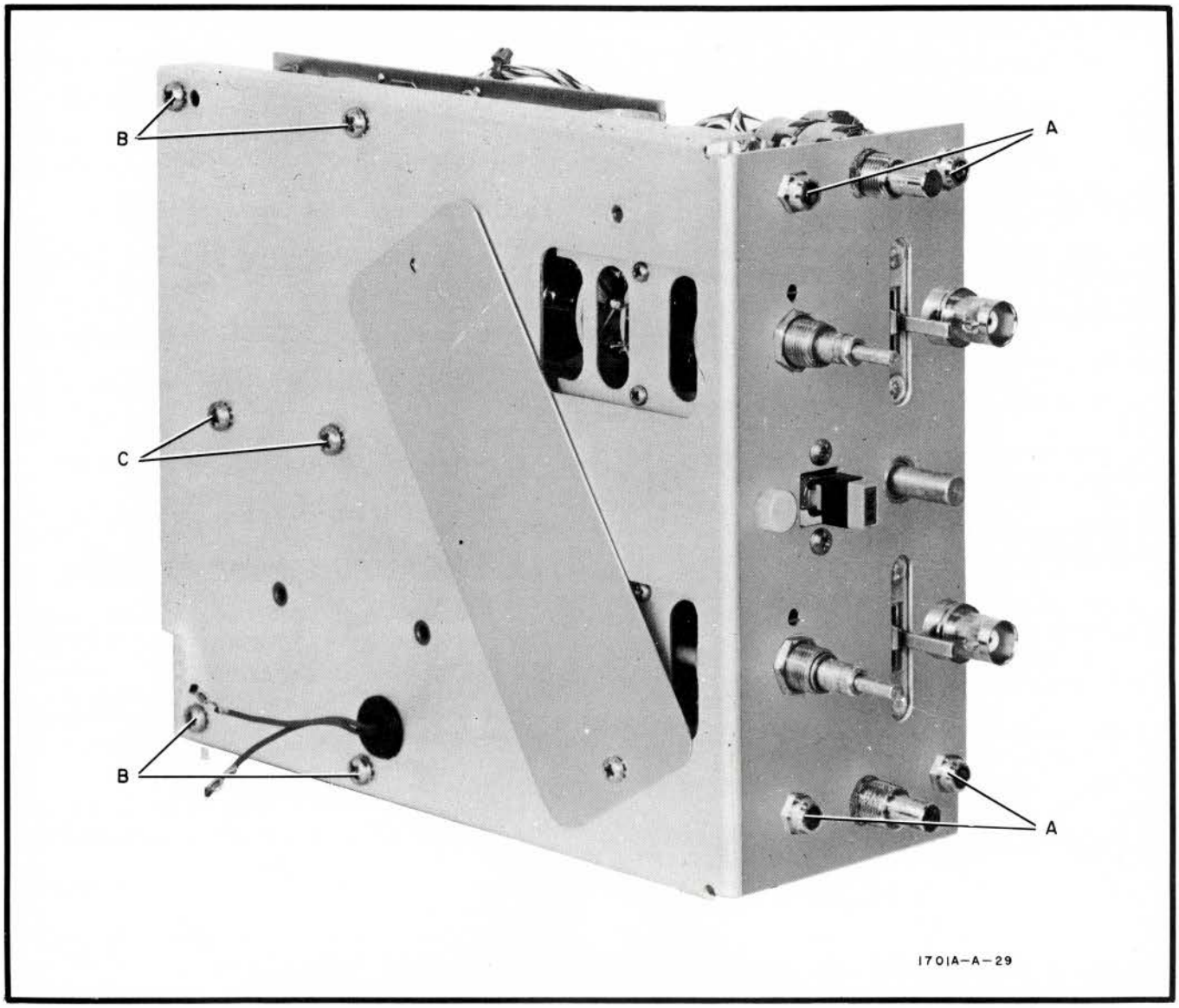


Figure 8-1. Vertical Module Mechanical Parts Removal

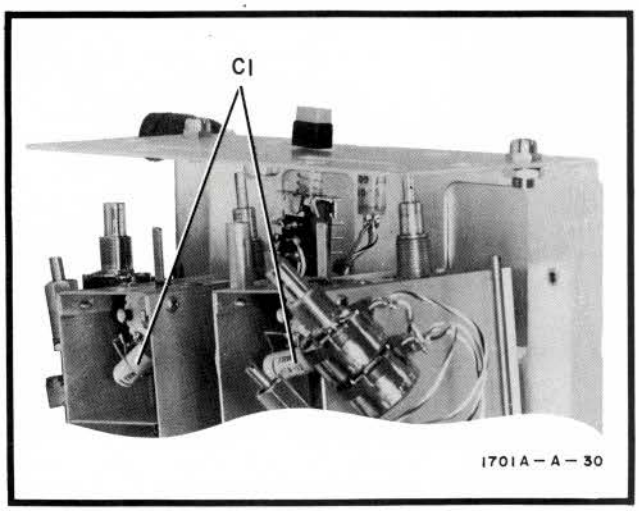


Figure 8-2. Attenuator Removal

8-45. HORIZONTAL MOTHER BOARD REMOVAL AND REPLACEMENT.

8-46. TRIGGER ASSEMBLY AND HORIZONTAL MOTHER BOARD REMOVAL AND REPLACEMENT. To remove the trigger assembly proceed as follows:

a. Remove TIME/DIV switch as described in Paragraph 8-44.

b. Remove the six assemblies that plug into the horizontal mother board.

c. Disconnect wires to horizontal preamplifier assembly.

d. Disconnect wires to the trigger assembly.

e. Separate trigger assembly and horizontal mother board from horizontal preamplifier.

f. Remove horizontal preamplifier assembly.

g. Hold trigger assembly and remove four screws that hold the assembly in.

h. Carefully remove the trigger assembly.

i. The horizontal mother board can be removed by disconnecting the wires connected to it.

j. To reinstall, reverse removal procedure.

8-47. POWER SUPPLY MODULE REMOVAL AND REPLACEMENT.

8-48. To remove power supply module from instrument, proceed as follows:

a. Turn instrument off and remove power cord.

b. Remove instrument top and bottom cover.

c. Unplug the CRT Post Accelerator Lead.

NOTE

Do not attempt to remove lead from CRT glass.

d. Turn instrument on its side.

e. Remove battery if instrument is option 012.

f. Unplug A3J1 connecting power supply to main cable assembly.

g. Using a #1 Pozidrive screwdriver, remove two flat head screws (directly in front of power transformer, T1) holding the power supply module in the instrument.

h. To reinstall power supply module, reverse removal procedure.

8-49. POWER SUPPLY MODULE DISASSEMBLY AND ASSEMBLY. To disassembly power supply module, proceed as follows:

a. Remove power box cover.

b. Using board puller furnished with the service kit, hook it on inside of standoffs between the two low voltage boards and pull straight out.

c. Disconnect Q2 from low voltage mother board.

d. Disconnect both ends of wires from low voltage mother board to high voltage oscillator.

e. Unscrew four screws holding low voltage mother board.

f. Carefully compress sides of A3J1 to release it from the power box.

g. Lift low voltage mother board from power box.

h. Discharge (to ground) high voltage points where high-voltage wires are connected.

WARNING

Failure to discharge high-voltage can result in bodily injury from electrical shock.

i. Disconnect wires from high-voltage transistor.

j. Pull high-voltage oscillator from power box.

k. To reinstall, reverse removal procedure.

8-50. GENERAL SERVICE INFORMATION.

5-51. SWITCH MAINTENANCE.

8-52. The switches on the main sweep time assembly, delayed sweep time assembly, horizontal mode assembly, and hold off and comparator can be repaired or replaced easily. To remove the assembly so the switches can be serviced or replaced proceed as follows:

a. Remove the front panel MAIN and DELAYED TIME/DIV knob assembly and shaft per Paragraph 8-44.

b. Remove the pc board keeper from the horizontal mode assembly.

c. Remove the assembly or assemblies to be serviced (See Figure 8-10 for assembly location).

8-53. The main sweep time assembly will be used as an example (Figure 8-38) for disassembly of the switch. Remove retainer ring (MP1). The two rotor sections, S1MP1 and S1MP2, can now be separated from the printed circuit board. If the contact areas of the printed circuit board or the two rotors show excessive wear, replace the worn parts. If the contact areas needs cleaning, spray with a degreaser comparable to MS/180 FREON TF DEGREASER produced by Miller-Stevenson Chemical Company, Inc. After spraying, lightly lubricate the contact areas of the printed circuit boards and rotor sections. Lubricate contact areas with lubricant comparable to LUBRIPLATE produced by Fisk Brothers Refining Company (Part No. B-105TH).

8-54. To assemble the switches reverse the above procedure (Paragraph 8-53). To reinstall the assemblies on the horizontal mother assembly (Paragraph 8-52), the open part of the switches must be in the following positions. The open portion of the delayed sweep time assembly switch

should be pointed to the top of the board (12:00 o'clock position). For the rest of the switches, the open portion should be pointed toward the bottom of the pc board (6:00 o'clock position). To reinstall assemblies reverse removal procedure (Paragraph 8-52).

8-55. ATTENUATOR SERVICING.

8-56. A metal plate provides access to the attenuators for servicing. This plate is located just under the front portion of the CRT. Service for the attenuators is accomplished by removing the CRT (Paragraph 8-32) and metal plate. After the attenuators have been serviced replace the metal plate and CRT (Paragraph 8-32).

8-57. PART LOCATION AIDS.

8-58. The locations of chassis-mounted parts and major assemblies are shown in Figure 8-10. The locations of individual components mounted on printed circuit boards or other assemblies are shown on the appropriate Schematic diagram page or on the page opposite it. The part reference designator is the assembly designator plus the part designator. (Example: A4R9 is R9 on the Gate Assembly A4). For specific component description and ordering information refer to the parts list in Section VI.

8-59. DIAGRAM NOTES.

8-60. Table 8-3, Schematic Notes, provides information relative to symbols and measurement units shown in Schematic diagrams.

8-61. FACTORY SELECTED COMPONENTS.

8-62. Some components values are selected at the time of final checkout at the factory. Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated components. These components are identified on individual Schematics by an asterisk. The recommended procedure for replacing a factory-selected part is as follows:

a. Try the original value, then perform the calibration test specified for the circuit in the performance and adjustment sections of this manual.

b. If calibration cannot be accomplished, try the typical value shown in the parts list and repeat the test.

c. If calibration still cannot be accomplished, perform the calibration test using various values until calibration is accomplished.

Table 8-1. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47 1/2-56 1/2 Tip Temp: 850-900 degrees	Ungar #775 handle with *Ungar #4037 Heating Unit
Soldering* Tip	Soldering Unsoldering	*Shape: pointed	*Ungar #PL111
De-soldering 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

*For working on Model 1701A boards: use Ungar No. 1237 Heating Unit (37, 5W, tip temp of 750-800 degrees and Ungar No. PL113 1/8" chisel tip.

**General Electric Co., Silicone Products Dept., Waterford, New York, U. S. A.

8-63. ETCHED CIRCUITS.

8-64. The etched circuit boards in the Model 1707A are of the plated-thru type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended thru the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 8-1 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unneccessary component substition; it can result in damage to the circuit board, adjacent components, or both.

b. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 8-1) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THRU CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 8-1 for recommendations.

8-65. ETCHED CONDUCTOR REPAIR. A broken or burned section of conductor can be repaired by bridging the damage section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

8-66. COMPONENT REPLACEMENT.

a. Remove defective component from board.

NOTE

Axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection, and clip off excess lead.

b. If component was unsoldered, remove solder from mounting holes, and position component as original was positioned. DO NOT FORCE LEADS INTO MOUNTING HOLES; sharp lead ends may damage plated-thru conductor.

8-67. TRANSISTOR REPLACEMENT.

8-68. Solid state transistors are in many physical forms. This sometimes results in confusion as to which lead is the collector, which is the emitter, and which is the base. Figure 8-3 shown epoxy and metal case transistors and the means of identifying the leads.

8-69. To replace the transistor proceed as follows:

a. Do not apply excessive heat; see Table 8-1 for recommended soldering tools.

b. Use long-nose pliers between transistor and hot soldering iron as a heat sink. The instant solder is melted, use pliers to pull lead free of board.

c. When installing replacement transistor ensure sufficient lead length to dissipate soldering heat by using about the same length of exposed lead as used for original transistor.

d. Some transistors are mounted for good heat dissipation. This requires good thermal contact with mounting surfaces. To assure good thermal contact for a replacement transistor, coat both sides of the black insulator with Dow Corning #5 silicone compound or equivalent before fastening the transistor to the chassis. Dow Corning #5 compound is available in 8-oz tubes from Hewlett-Packard; order HP Part No. 8500-0059.

8-70. DIODE REPLACEMENT.

8-71. Solid state diodes are in many physical forms. This sometimes results in confusion as to which lead or connection is for the cathode (negative) or anode (positive), since not all diodes are marked with the standard symbols. Figure 8-3 shows examples of some diode marking methods. If doubt exists as to polarity, an ohmmeter may be used to determine the proper connection. It is necessary to know the polarity of the ohms lead with respect to the common lead for the ohmmeter used. (For the HP Model 410B Vacuum Tube Voltmeter, the ohms lead is negative with respect to the common; for the HP Model 412A DC Vacuum Tube Voltmeter, the ohms lead is positive with respect to the common.) When the ohmmeter indicates the least diode resistance, the cathode of the diode is connected to the ohmmeter lead which is negative with respect to the other lead.

NOTE

Replacement instructions are the same as those listed for transistor replacement.

8-72. LOGIC CIRCUITS AND SYMBOLS.

8-73. The following paragraphs and illustrations provide basic information about logic circuits and symbols. While

a complete treatment of the subject is not within the scope of this manual, it is believed that this material will help the technician experienced with analog devices, who has had little or no experience with digital circuits. Table 8-2 is a condensed listing of the following logic information.

8-74. The circuits discussed are digital in nature; their outputs are always in one of two possible states, a "1" or "0". These two states are also referred to as being either high (H) or low (L). The high and low states are relative; low must be less positive (more negative) than high, both states may be positive or negative, or high may be positive and low negative. In positive logic the more positive (H) state is a logical "1" and the more negative (L) state is a logical "0". In negative logic the more negative (L) state is a logical "1" and the more positive (H) state is a logical "0"

8-75. BASIC GATES.

8-76. Two of the basic "building blocks" of logic circuits are the AND and OR gates. The symbols and truth tables for basic AND and OR gates are shown in Figure 8-4.

8-77. BASIC AND GATE (Positive logic). The basic AND gate is a circuit which produces an output "1" when, and only when a "1" is applied to all inputs. As shown in Figure 8-4, terminal X will be high only when terminals A and B are both high. The dot ( ) shown in the AND gate is the logic term for AND. The term for a simple two input AND gate is X = A B (X equals A and B). AND gates may be designed to have as many inputs as required to full a specific requirement.

8-78. BASIC OR GATE (Positive logic). The basic OR gate is a circuit which produces a "1" output when any one, or

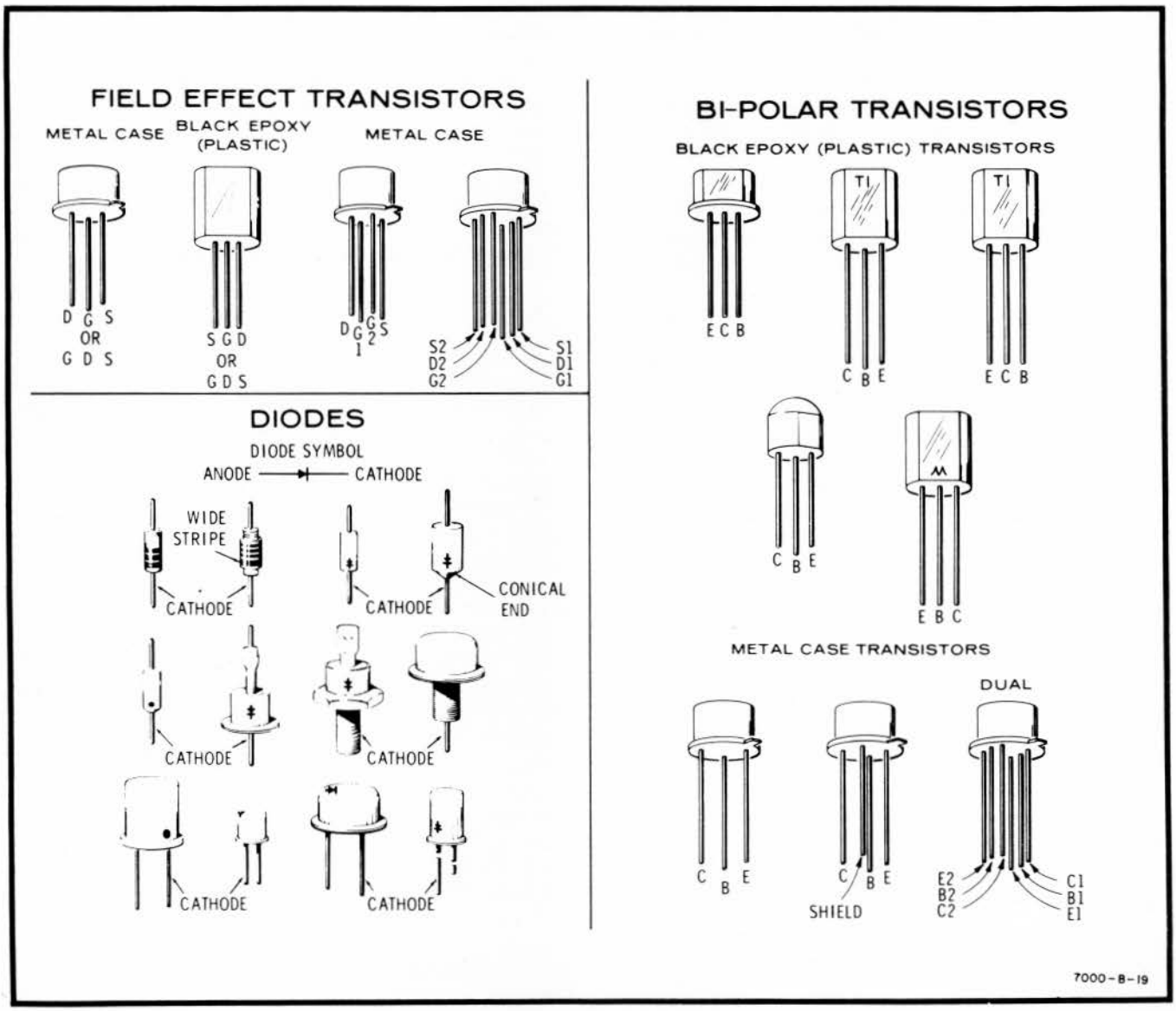
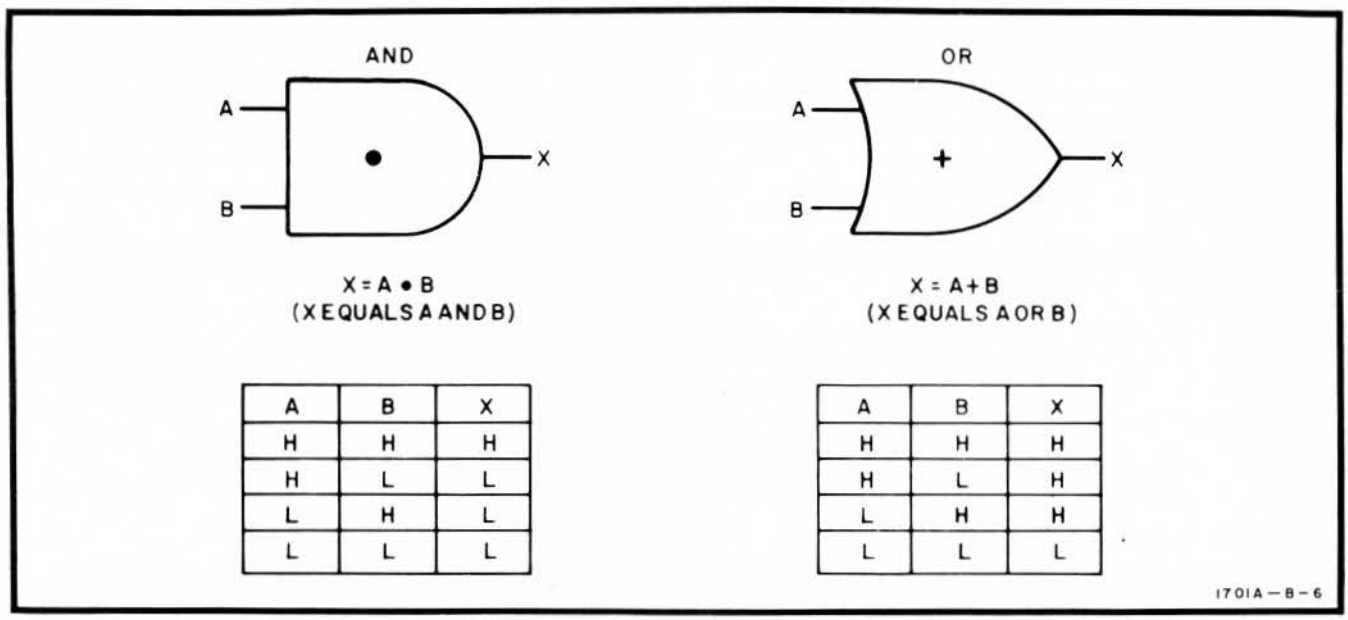


Figure 8-3. Examples of Diode and Transistor Making Methods



A	B	X
H	H	H
H	L	L
L	H	L
L	L	L

A	B	X
H	H	H
H	L	H
L	H	H
L	L	L

Figure 8-4. Basic AND and OR Gates

all of the inputs are in a "1" state. As shown in Figure 8-4, terminal X will be high when either terminal A or terminal B, or both are high. The + shown in the OR gate symbol is the logic term for OR. The term for a simple two input OR gate is X = A + B (X equals A or B). OR gates may be designed to have as many inputs as required for specific needs.

8-79. The symbols for AND and OR gates differ in that AND gate symbols have a flat input side and a rounded output side while OR gate symbols have a concave input side and a pointed output side.

8-80. TRUTH TABLES. Truth tables provide a means of presenting the output state of logic devices for any set of inputs in tabular form. Truth tables contain one column for each of the inputs and a column for the output. In basic truth tables the column notations are usually H or L (for high and low) or, for binary notation, "1" or "0". More complex truth tables use other terms which will be explained where these tables appear in the test.

8-81. LOGIC INVERSION. Adding inversion to AND and OR gates changes their characteristics. Inversion is usually accomplished by adding an inverter stage (common emitter) in front of an input or after an output. A circle added to the input or output leads indicates the portion of the circuit in which the inversion takes place. The simplest of these devices are AND and OR gates in which the output is inverted. These gates are called NAND (for Not AND) and NOR (for Not OR). Basic NAND and NOR gates are shown in Figure 8-5. When all inputs and outputs of an AND gate are inverted, it functions as an OR gate. When all inputs and outputs of an OR gate are inverted, it functions as an AND gate. Figure 8-6 provides information relative to various gate inversion functions.

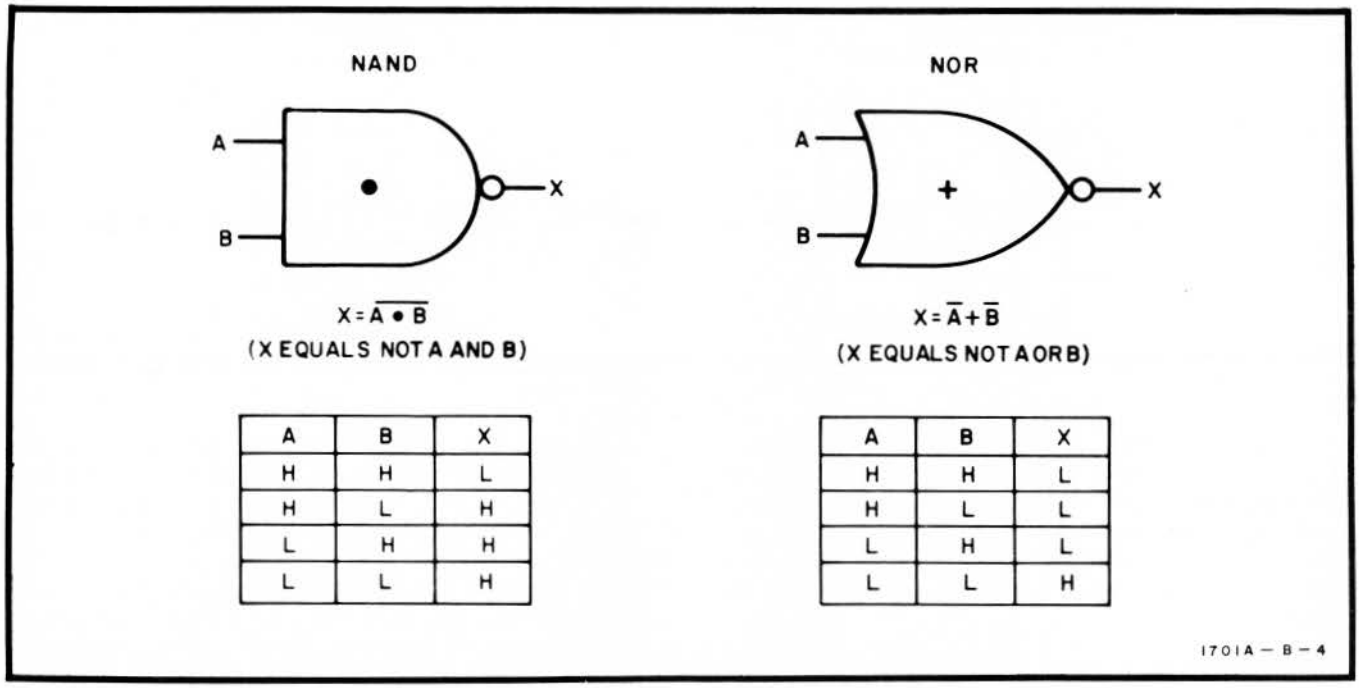
8-82. When inversion is used the designation at the inverted terminal is frequently termed A (not A), B (not B), X (not X), etc. Table 8-2 shows basic logic, circuits and associated symbology.

8-83. BINARY CIRCUITS. Many types of flip-flops are used in binary circuits. Each half of a flip-flop is in one of two states at any given time. The outputs are complementary; when one state is on, the other is off. The outputs are termed 1 and 0, high and low, or true and false, by the same rules that apply to AND and OR gates. The outputs may be identified in many different ways. This text identifies these outputs as Q and $\overline{Q}$ for the sake of uniformity. Basic flip-flops which are particularly adaptable to binary circuits and combinations of flip-flops are discussed in the following paragraphs.

8-84. BASIC NOR GATE FLIP-FLOP. Figure 8-7 illustrates a flip-flop construced with two NOR gates. Operation of the circuit is described below. Assume that initially Q is high and $\overline{Q}$ is low, and A and B are both low. When a high is applied to input A, Q goes low and since there are now two lows applied to NOR gate 2, $\overline{Q}$ will go high. The Q high is applied back to NOR gate 1, but since Q is already low, no change in state results. When a high is applied to input B the flip-flop again reverses state. Since the flip-flop will remain in the last state to which it is set, it "remembers" which signal was last received, and can be used as a memory circuit.

8-85. TRIGGERED FLIP-FLOP. Figure 8-8 illustrates a triggered flip-flop which changes state each time a pulse of a given polarity is applied to the input. The output of a triggered flip-flop is a square wave of one half the frequency of the input triggers. In the circuit shown in Figure 8-8 the input may be negative going triggers or a square

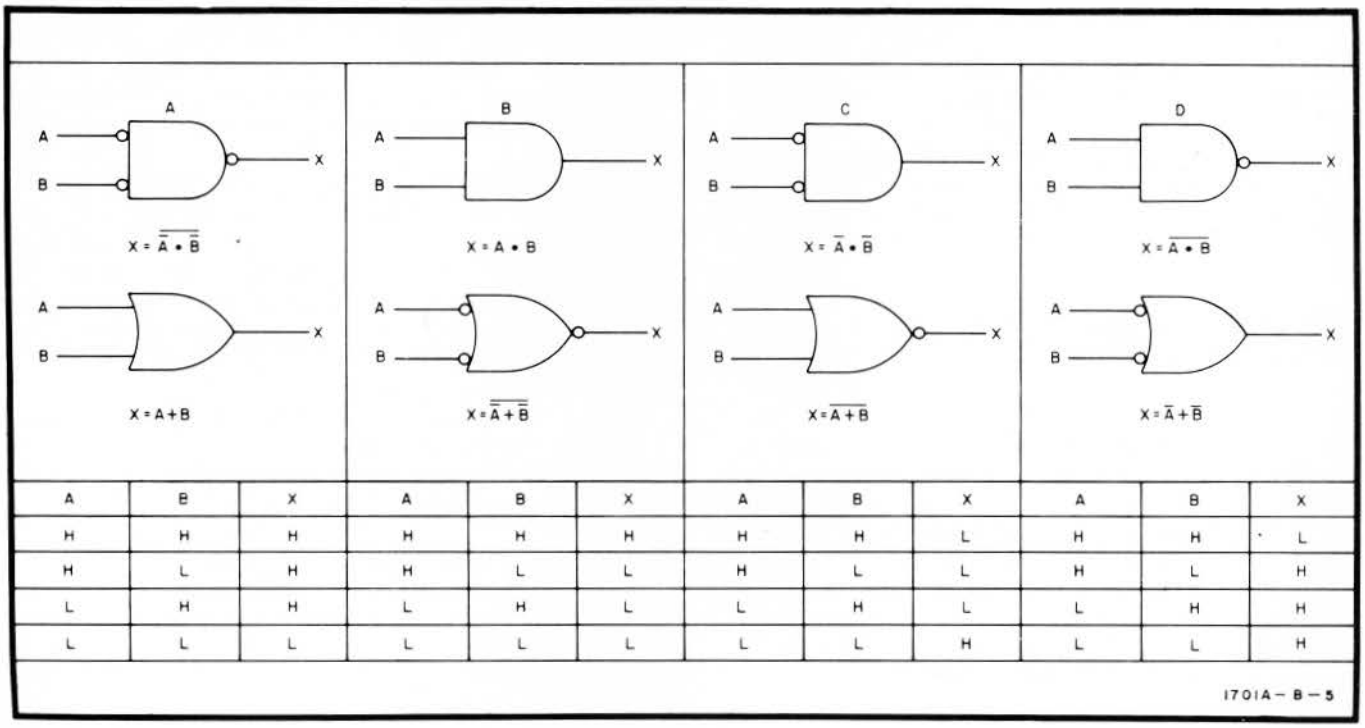
wave. If the input is a square wave it will be differentiated by C2 to produce both negative going and positive going pulses. Assume that initially $\overline{Q}$ is low (Q1 on) and Q is high (Q2 off). When a negative going trigger appears at the junction of CR1 and CR2 it has no effect on Q1 thru CR1 because output $\overline{Q}$ is low. However, CR2 is forward biased by the high at $\overline{Q}$ and the trigger is coupled to the collector of Q2. As the collector of Q2 is driven in a negative direction the trigger is also coupled thru C3 to the base of Q1. As Q1 begins to cut off, the positive going collector voltage is coupled to the base of Q2 thru C1 to drive Q2 into conduction. The process is regenerative; Q1 cuts off quickly and Q2 goes into saturation. The next negative-going trigger reverses the procedure just described.



A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

A	B	X
H	H	L
H	L	L
L	H	L
L	L	H

Figure 8-5. Basic NAND and NOR Gates



A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	H	H	L	L	H	L	L	H	L	H
L	H	H	L	H	L	L	H	L	L	H	H
L	L	L	L	L	L	L	L	H	L	L	H

Figure 8-6. Logic Comparison Diagrams

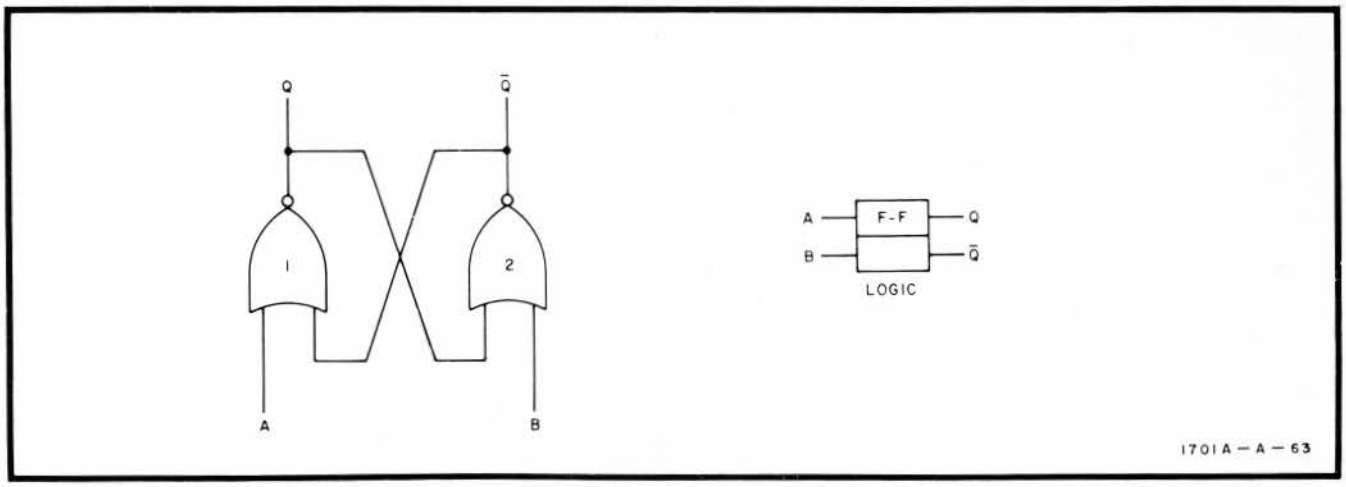


Figure 8-7. Basic NOR Gate Flip-Flop

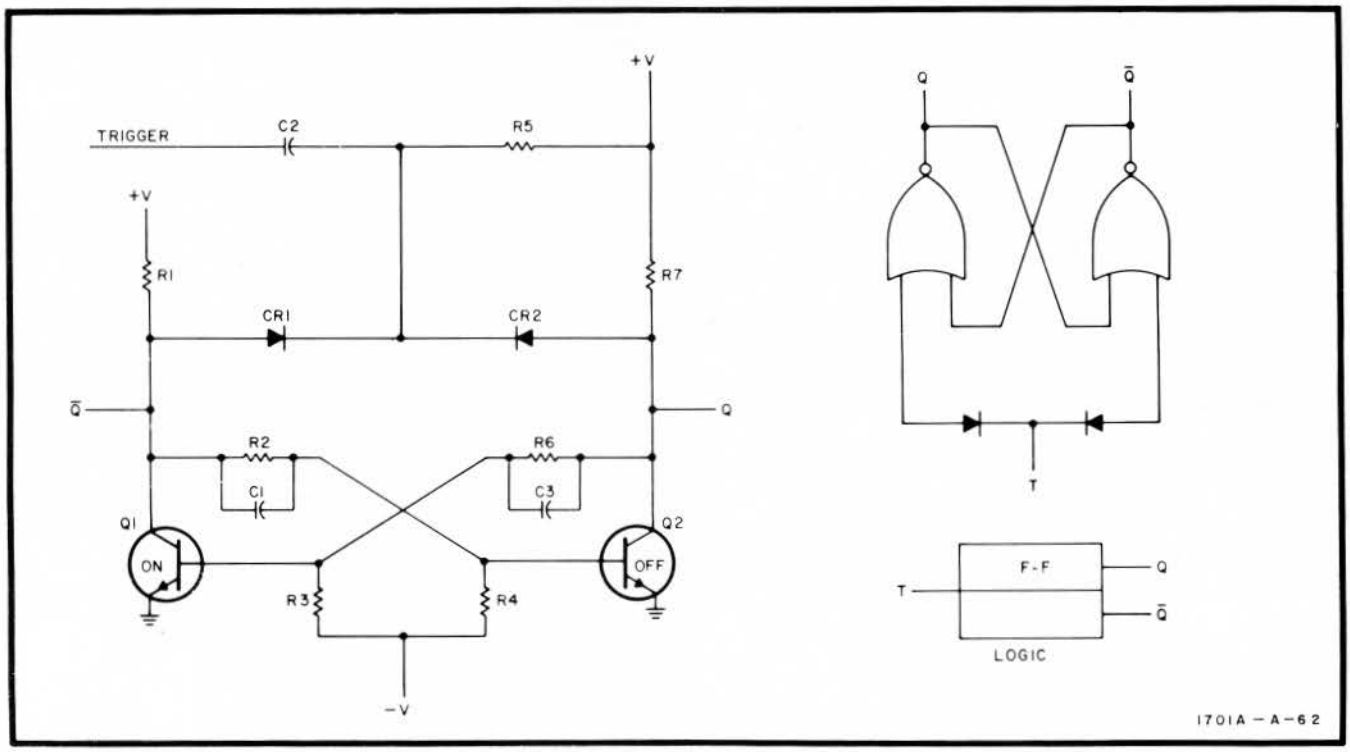


Figure 8-8. Triggered Flip-Flop

1 indicates true signal

0 indicates false signal

on symbol indicates logical inversion (not necessarily electrical) of the input or output signal(s). The logic indicated within the symbol remains the same.

indicates direction of signal flow.

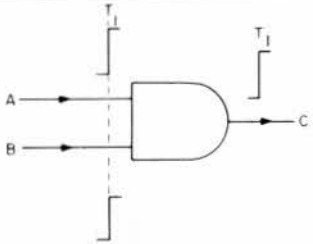
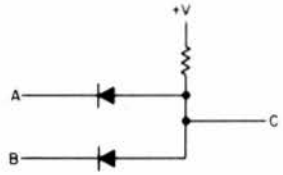
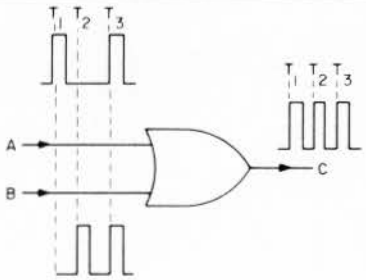
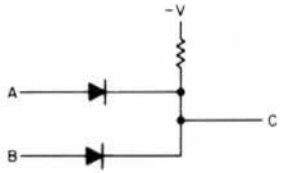
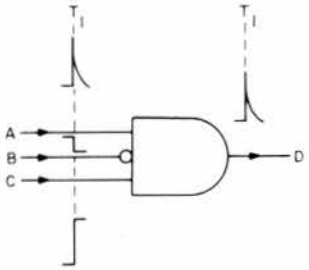
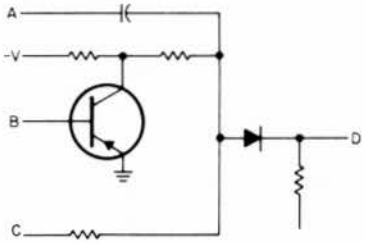
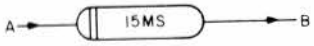
Designation	Logic Symbol	Description	Truth Table	Typical Circuit
AND Gate (Positive True)		Both input signals (A and B) must be true simultaneously to produce a true output at C.	A B C 0 0 0 0 1 0 1 0 0 1 1 1	
OR Gate (Positive True)		If either input signal (A or B) or both is true, the output at C is true.	A B C 0 0 0 0 1 1 1 0 1 1 1 1	
Multiple Input Gate (Positive True)		Any combinations of inputs may be used with an AND or OR Gate to obtain a desired output. In the AND gate shown, input B is inverted and inputs A and C are without inversion. Inputs A and C must be true and input B must be false simultaneously to produce a true output at D.	A B C D 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 1 1 1 0 0 1 1 1 0	
Time Delay		Input signal delayed by the time indicated. True input at A produces a true output at B after a 15 ms delay		RC and RL Coupling

Table 8-2. Logic Symbology

Table 8-2. Logic Symbology (Cont'd)

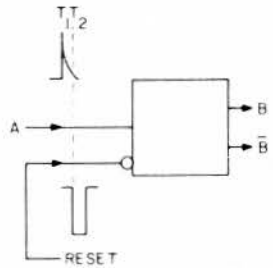
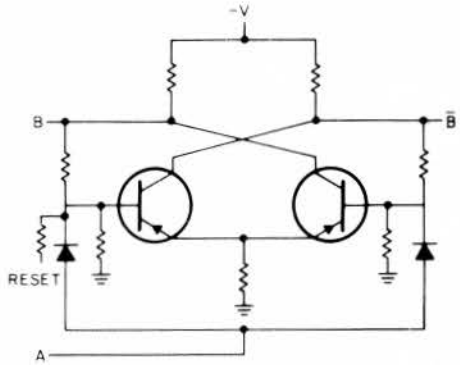
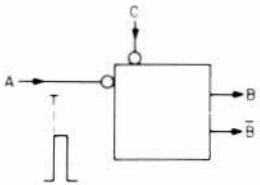
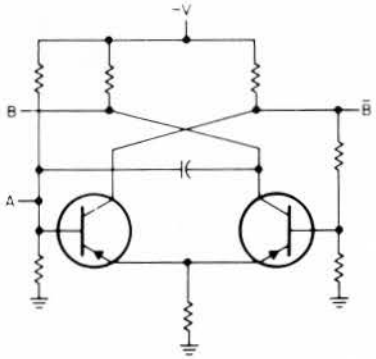
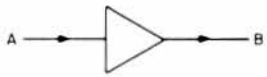
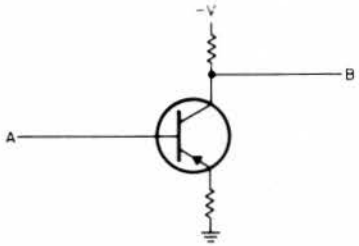
Designation	Logic Symbol	Description	Truth Table	Typical Circuit
Trigger		The binary is a flip-flop which changes state with every true input pulse at A. Since A is applied to the bases of both transistors, it is shown centered in the symbol. The negative pulse produces the same effect as a positive pulse applied to the opposite base. To preserve the positive logic, the reset pulse is shown inverted and applied to the opposite side. A reset pulse sets $\overline{B}$ true.		
One-Shot		True input at A sets the one-shot to unstable state (active) and produces a true output at B. In the symbol shown, the A input must be false (positive) with respect to negative true logic of the one-shot. During the stable state, the $\overline{B}$ output is true. A true input at C (direct set) holds the one-shop in the unstable state.		
Amplifier		True input at A produces amplified true output at B. An amplifier will function with either positive true or negative true signals.		

Table 8-2. Logic Symbology (Cont'd)

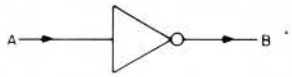
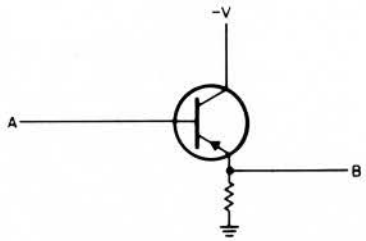
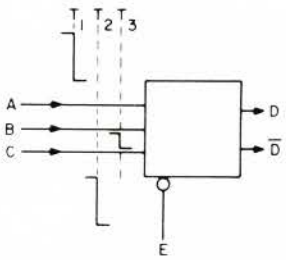
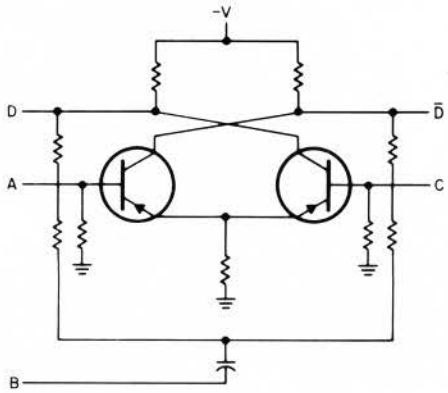
Designation	Logic Symbol	Description	Truth Table	Typical Circuit
Inverter Amplifier		True input at A produces false output at B and false input at A produces a true output at B (inverts the input logic level).		
Flip-Flop		Outputs $\overline{D}$ and D are always in opposite states. – if D is true, $\overline{D}$ is false. A true input will cause the output directly across to go true – true input at A sets output D true. With no input, the flip-flop remains in the state set by the last input signal. A true input at B will cause the flip-flop to reverse state A true input at the direct reset input E holds the flip-flop in the $\overline{D}$ true state.		

Table 8-3. Schematic Notes

Refer to MIL-STD-15-1A for schematic symbols not listed in this table.

= Etched circuit board

= Front-panel marking

= Rear-panel marking

= Front-panel control

= Screwdriver adjustment

P/O = Part of

CW = Clockwise end of variable resistor

NC = No connection

3 = Waveform test point (with number)

A = Common electrical point (with letter) not necessarily ground

= 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

= Wire connected to pressure-fit socket on board

= Main signal path

= Primary feedback path

= Secondary feedback path

G D S = Field-effect transistor (P-type base)

G D S = Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

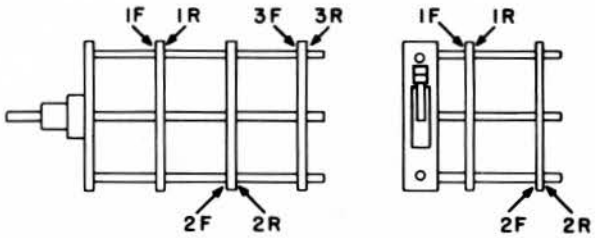
= Step-recovery diode

= 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.

(925) = Wire colors are given by numbers in parentheses 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

Switch wafers are identified as follows:



* = 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

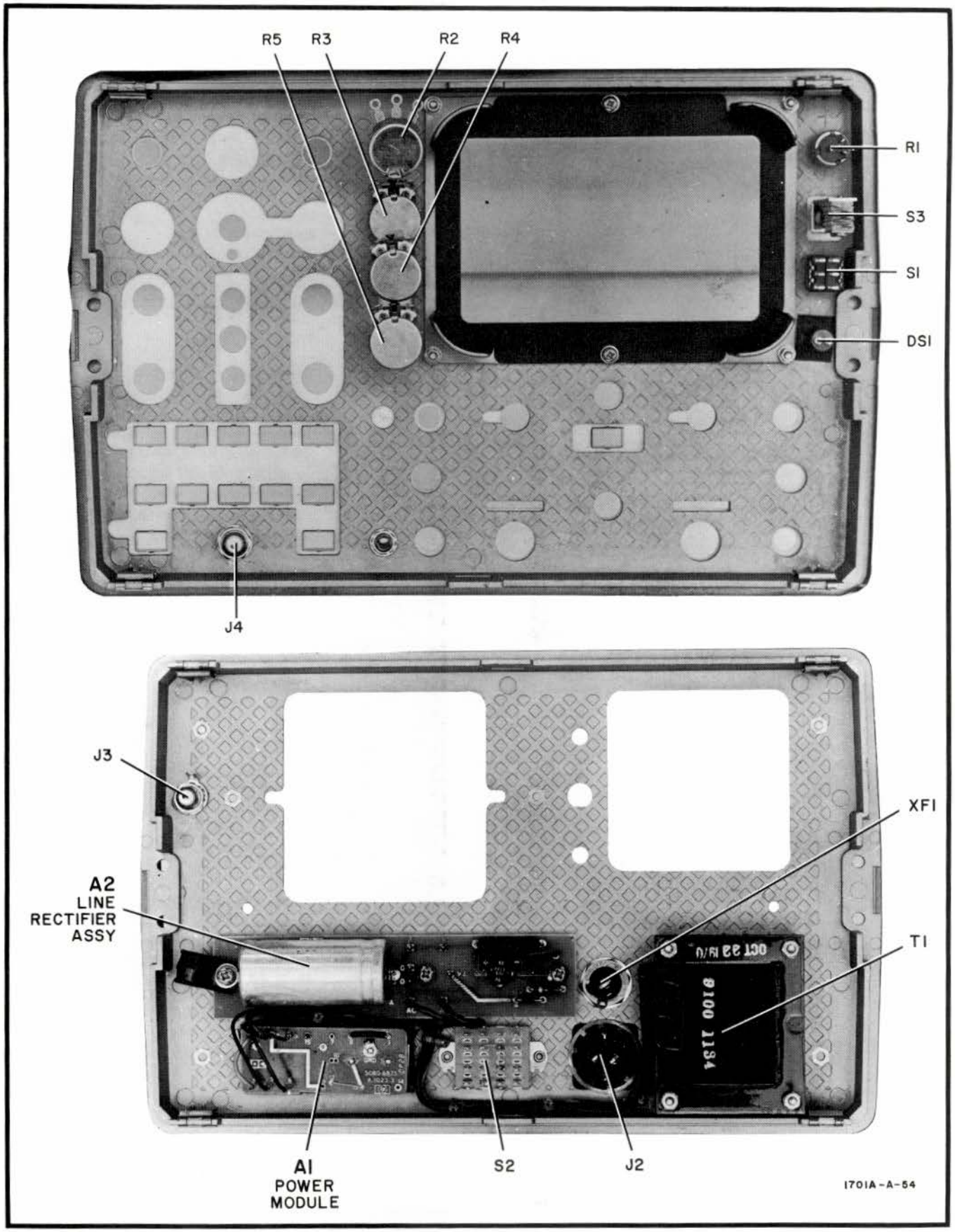
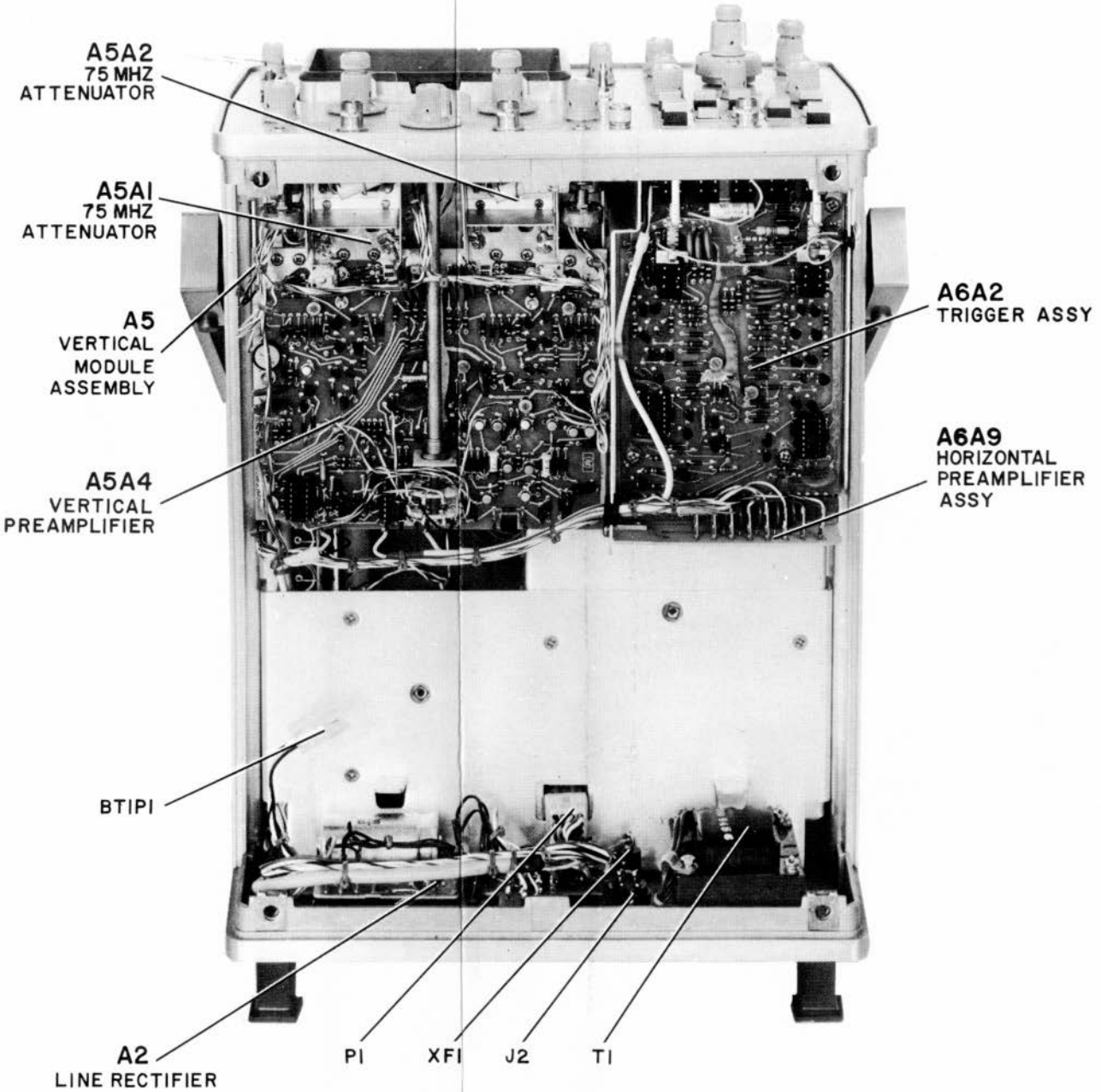


Figure 8-9. Component Identification, Interior Front and Rear Panel


A5A2
75 MHZ
ATTENUATOR
A5A1
75 MHZ
ATTENUATOR
A5
VERTICAL
MODULE
ASSEMBLY
A5A4
VERTICAL
PREAMPLIFIER
A6A2
TRIGGER ASSY
A6A9
HORIZONTAL
PREAMPLIFIER
ASSY
BT1P1
A2
LINE RECTIFIER
P1
XF1
J2
T1

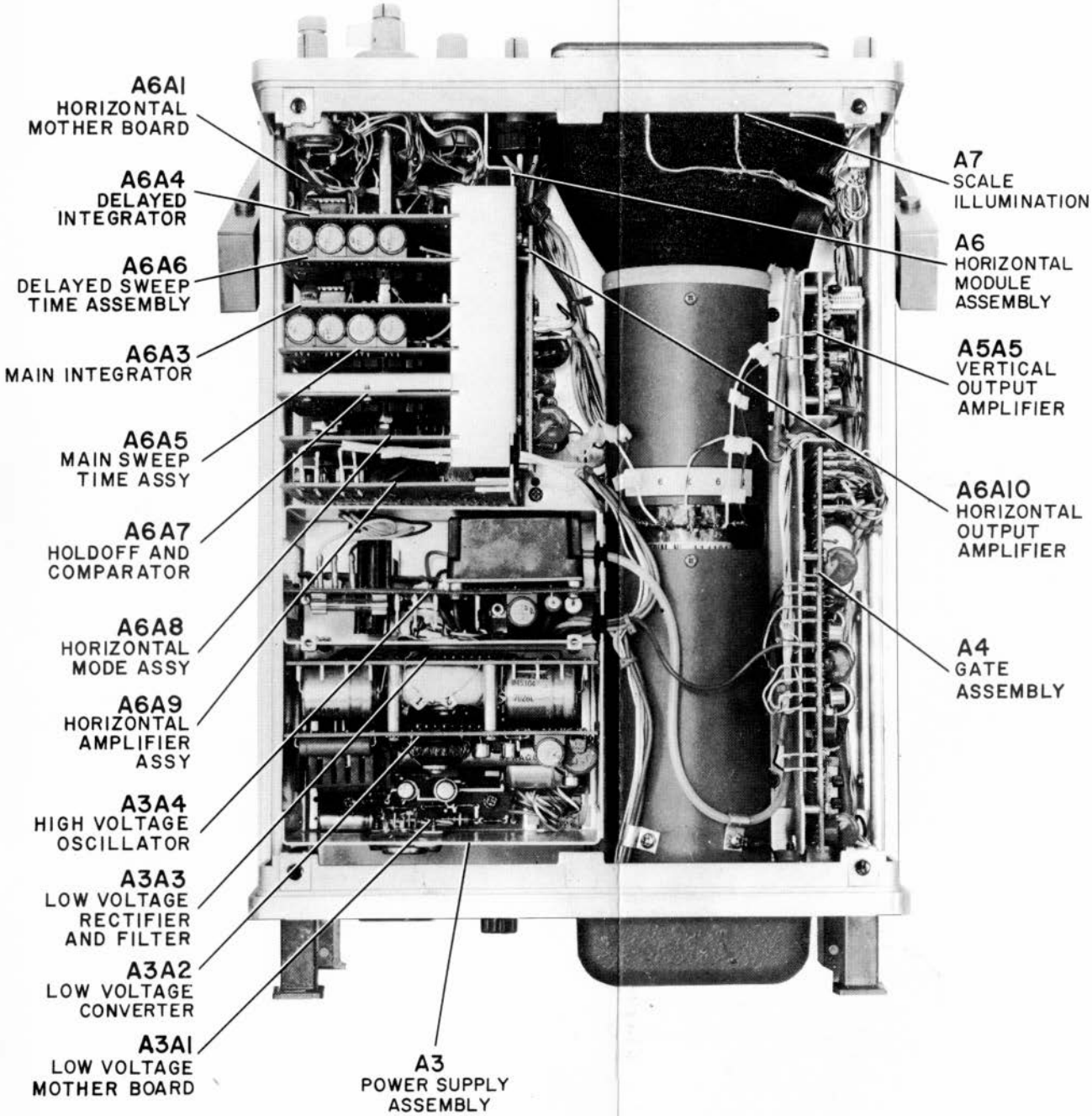


Figure 8-10. Component and Assembly Locations

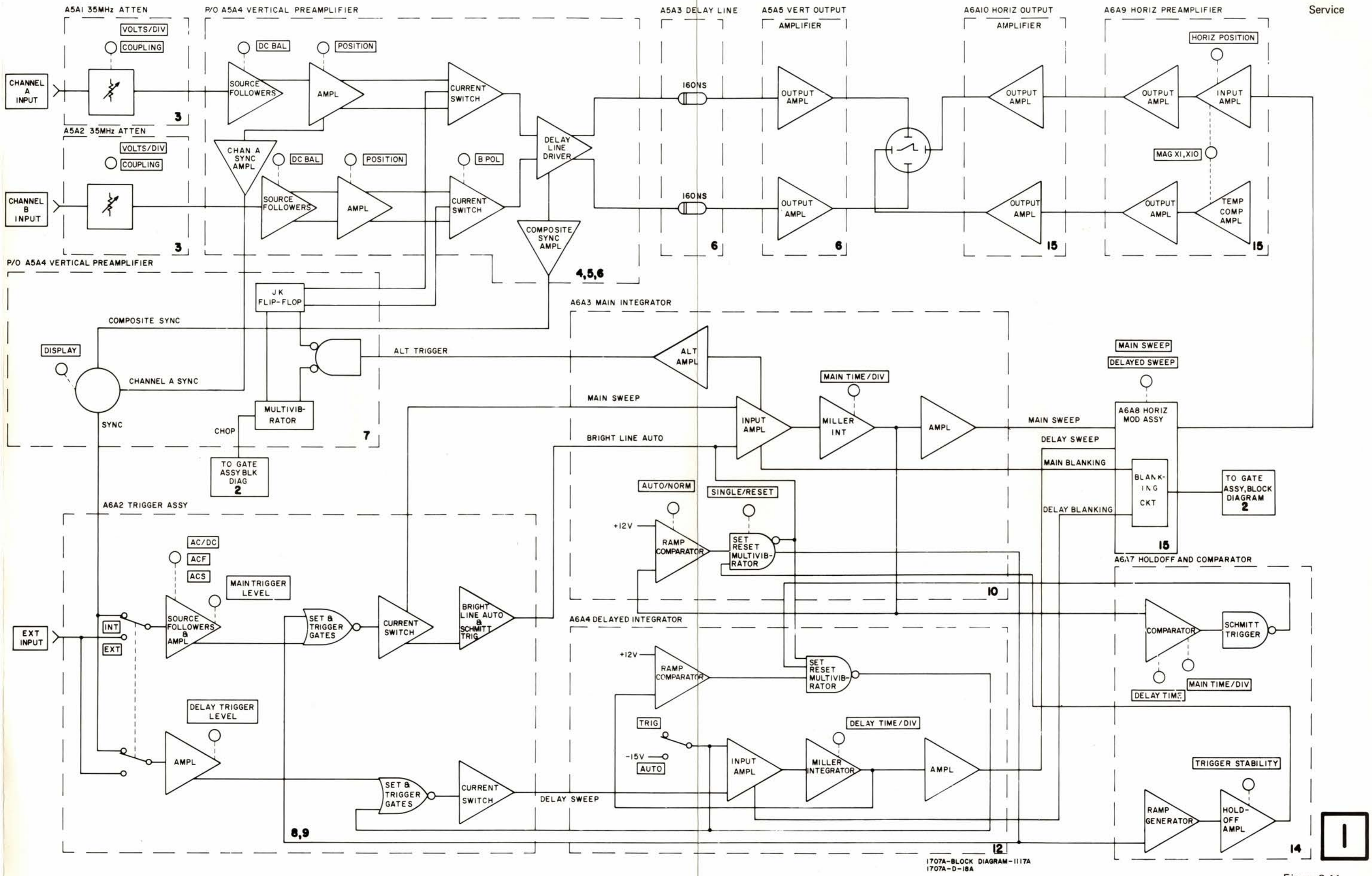
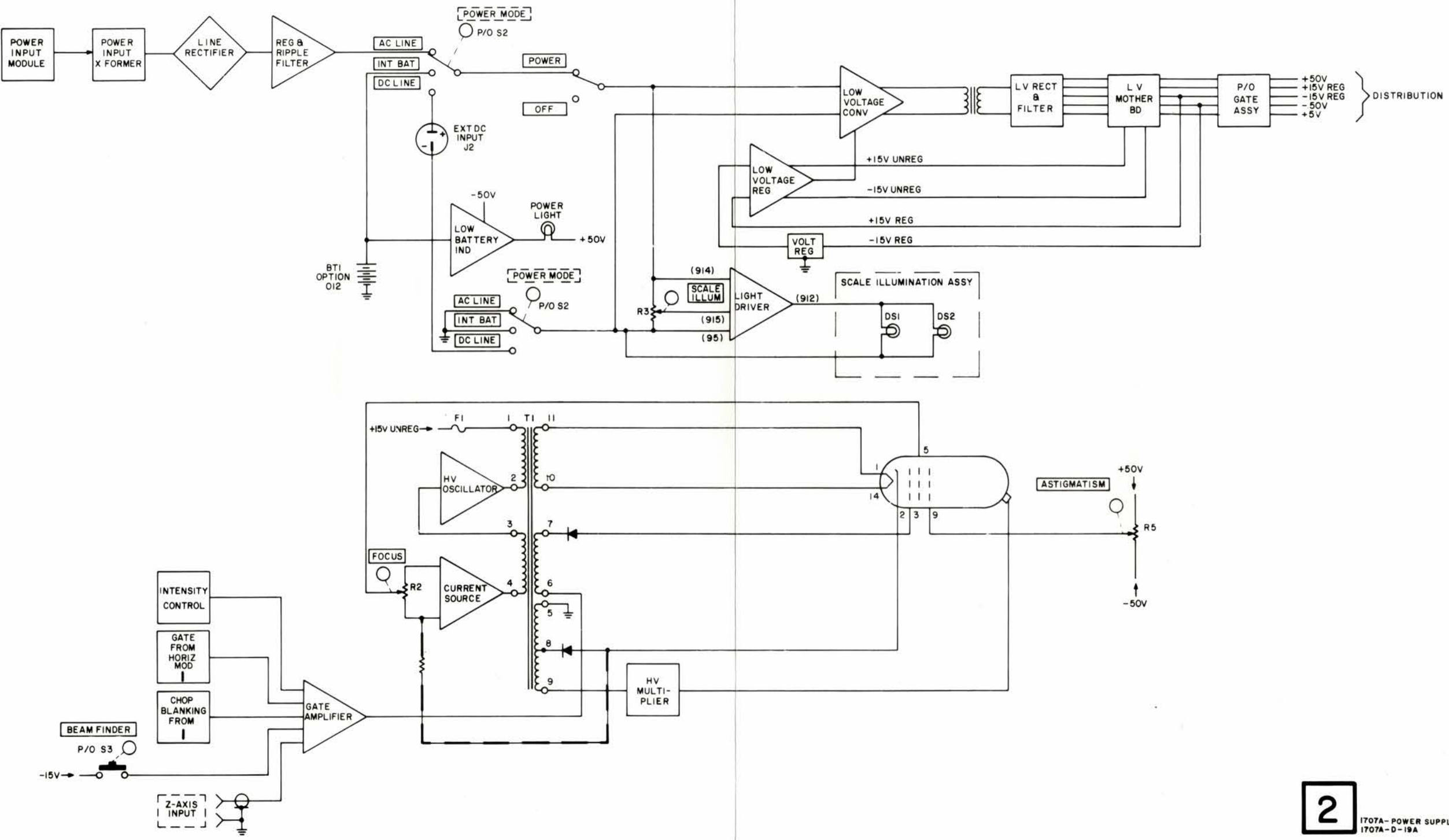


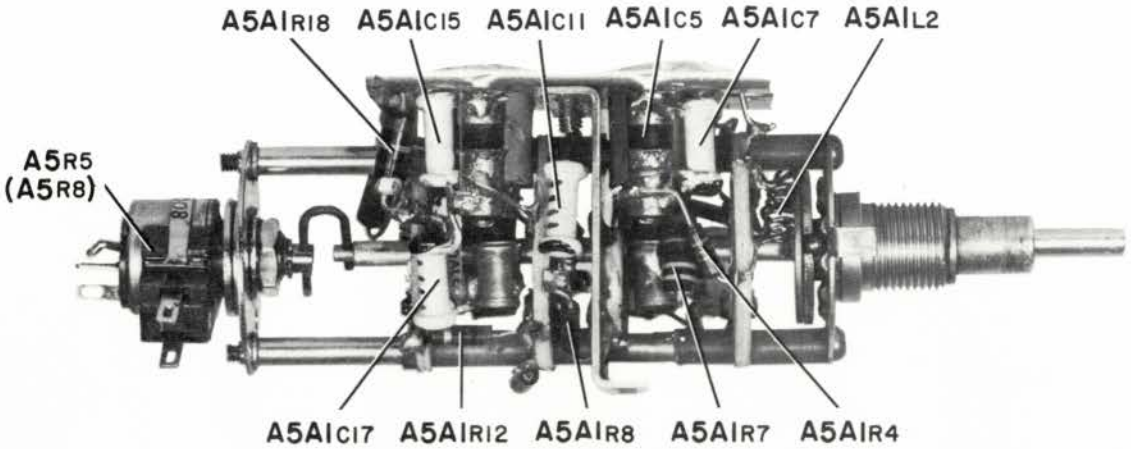
Figure 8-11.
Main Block Diagram
8-19/8-20

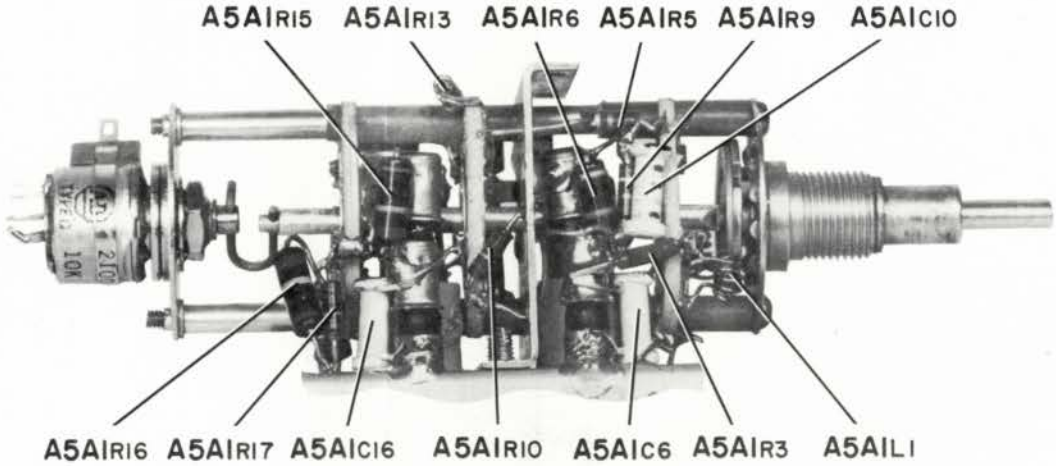


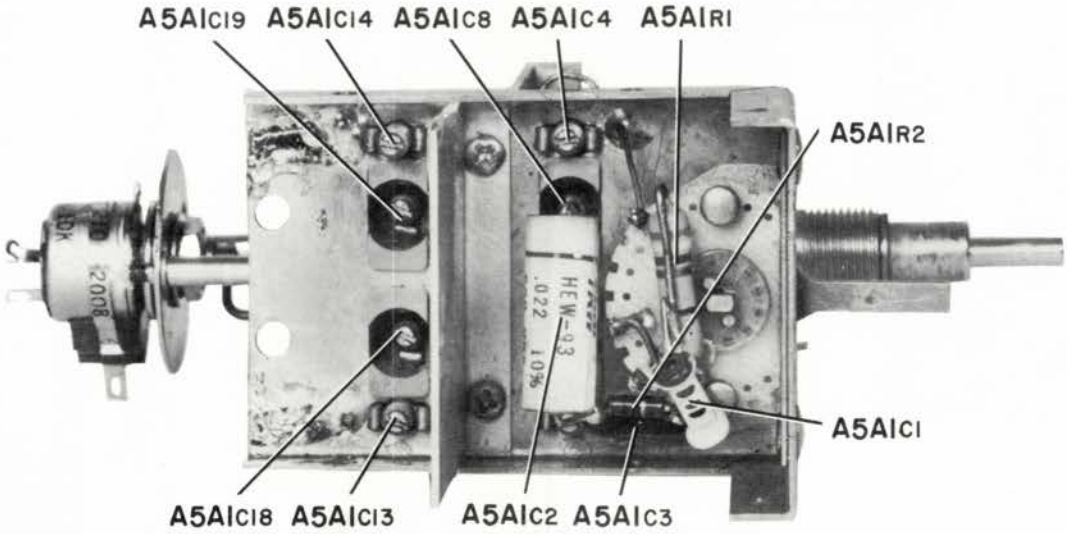
2

1707A-POWER SUPPLY-1117A
1707A-D-19A

Figure 8-12.
Power Supply Block Diagram







NOTE

Parts on A5 Assembly in parenthesis are Channel B parts. Those not in parenthesis are Channel A parts.

1707A-R-13

Figure 8-13. 75 MHz Attenuator Component Identification

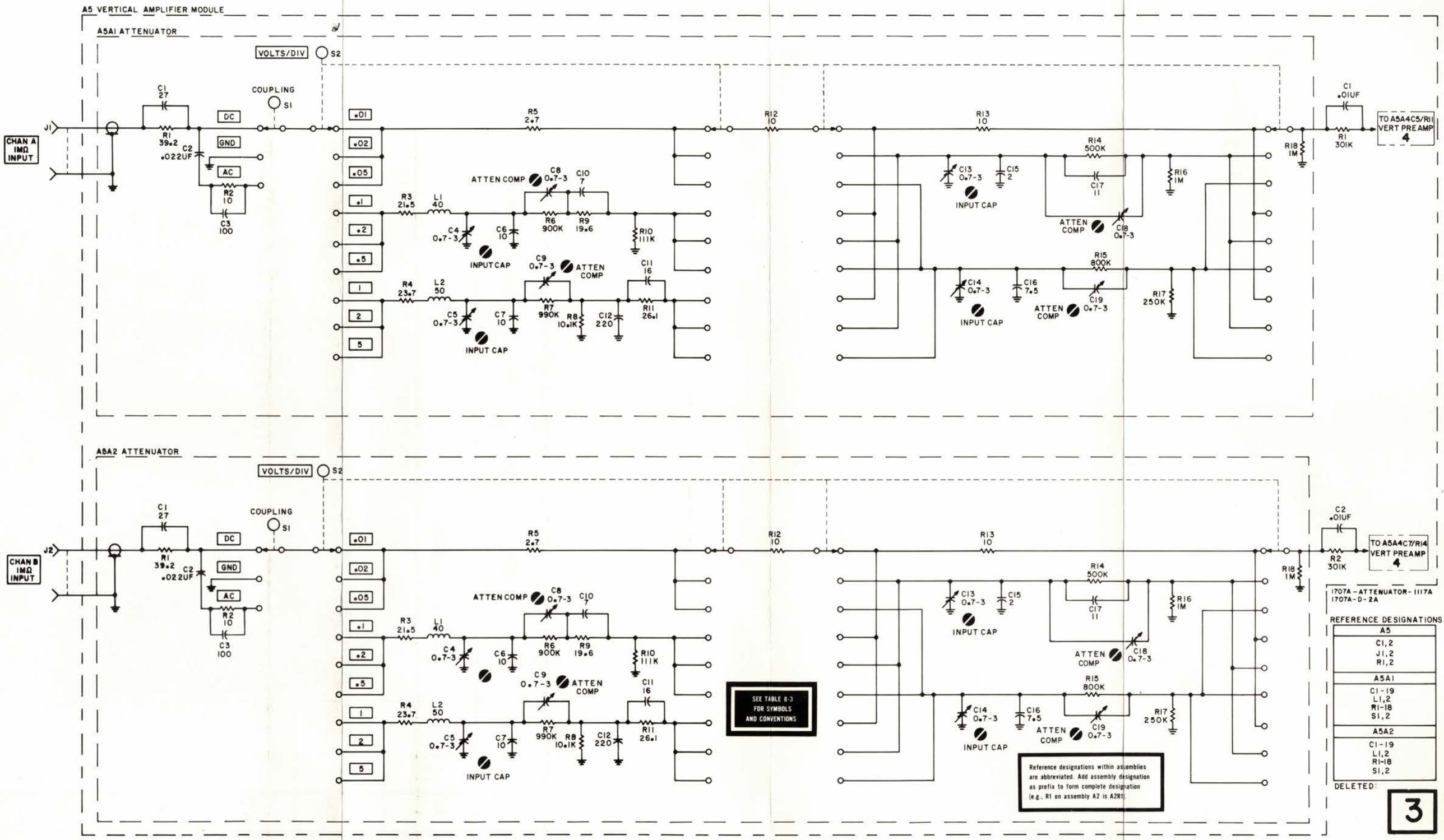
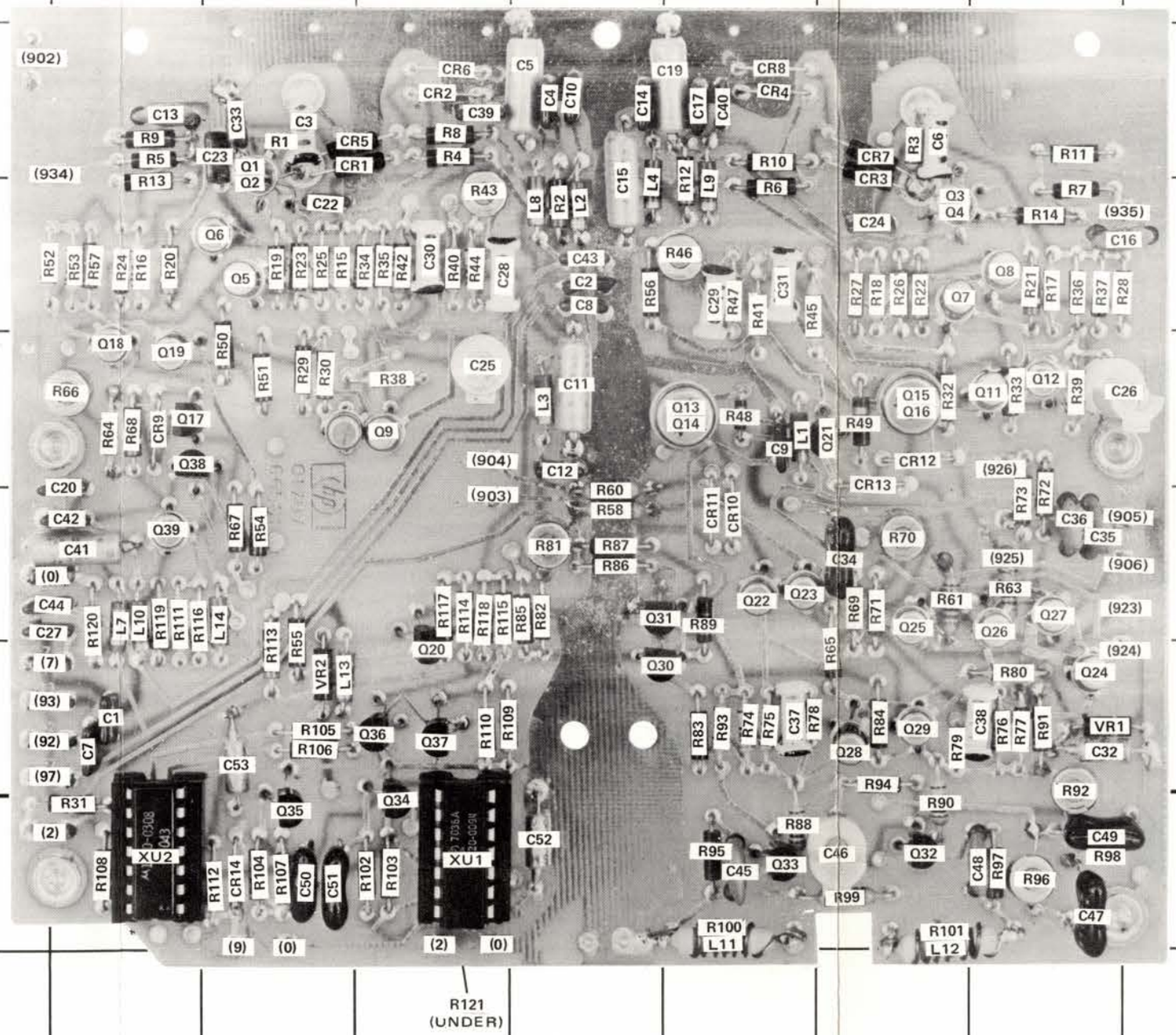


Figure 8-14.
75 MHz Attenuator Schematic

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-6	Q5	C-3	R46	F-3
C2	E-3	Q6	C-3	R47	F-3
C3	C-2	Q7	G-3	R48	F-4
C4	E-2	Q8	H-3	R49	G-4
C5	E-2	Q9	D-4	R50	C-4
C6	G-2	Q10	C-4	R51	C-4
C7	B-6	Q11	H-4	R52	B-3
C8	E-3	Q12	H-4	R53	B-3
C9	F-4	Q13	F-4	R54	C-5
C10	E-2	Q14	F-4	R55	C-6
C11	E-4	Q15	G-3	R56	E-3
C12	E-4	Q16	G-3	R57	B-3
C13	B-2	Q17	B-4	R58	E-5
C14	E-2	Q18	B-4	R60	E-5
C15	E-3	Q19	B-4	R61	G-5
C16	H-3	Q20	D-6	R63	H-5
C17	F-2	Q21	G-4	R64	B-4
C19	F-2	Q22	F-5	R65	G-6
C20	B-5	Q23	F-5	R66	B-4
C22	C-3	Q24	H-6	R67	C-5
C23	C-2	Q25	G-5	R68	B-4
C24	G-3	Q26	H-5	R69	G-5
C25	D-4	Q27	H-5	R70	G-5
C26	H-3	Q28	G-6	R71	G-5
C27	B-5	Q29	G-6	R72	H-5
C28	D-3	Q30	E-6	R73	H-5
C29	F-3	Q31	E-5	R74	F-6
C30	D-3	Q32	G-7	R75	F-6
C31	F-3	Q33	F-7	R76	H-6
C32	H-6	Q34	D-7	R77	H-6
C33	C-2	Q35	C-7	R78	F-6
C34	G-5	Q36	D-6	R79	G-6
C35	H-5	Q37	D-6	R80	H-6
C36	H-5	Q38	B-4	R81	E-5
C37	F-6	Q39	B-5	R82	E-5
C38	H-6	R1	C-2	R83	F-6
C39	D-2	R2	E-3	R84	G-6
C40	F-2	R3	G-2	R85	E-5
C41	B-5	R4	D-2	R86	E-5
C42	B-5	R5	B-2	R87	E-5
C43	E-3	R6	F-3	R88	F-7
C44	B-5	R7	H-3	R89	F-5
C45	F-7	R8	D-2	R90	G-7
C46	G-7	R9	B-2	R91	H-6
C47	H-7	R10	F-2	R92	H-7
C48	H-7	R11	H-2	R93	F-6
C49	H-7	R12	F-2	R94	G-6
C50	C-7	R13	B-3	R95	F-7
C51	C-7	R14	H-3	R96	H-7
C52	E-7	R15	C-3	R97	H-7
C53	C-6	R16	B-3	R98	H-7
CR1	C-2	R17	H-3	R99	G-7
CR2	D-2	R18	G-3	R100	F-7
CR3	G-2	R19	C-3	R101	G-7
CR4	F-2	R20	B-3	R102	D-7
CR5	C-2	R21	H-3	R103	D-7
CR6	D-2	R22	G-3	R104	C-7
CR7	G-2	R23	C-3	R105	C-6
CR8	F-2	R24	B-3	R106	C-6
CR9	B-4	R25	C-3	R107	C-7
CR10	F-5	R26	G-3	R108	B-7
CR11	F-5	R27	G-3	R109	D-6
CR12	G-4	R28	H-3	R110	D-6
CR13	G-4	R29	C-4	R111	B-5
CR14	C-7	R30	C-4	R112	C-7
L1	F-4	R31	B-7	R113	C-6
L2	E-3	R32	G-4	R114	D-5
L3	E-4	R33	H-3	R115	D-5
L4	E-3	R34	D-3	R116	B-5
L7	B-5	R35	D-3	R117	D-5
L8	E-3	R36	H-3	R118	D-5
L9	F-2	R37	H-3	R119	B-5
L10	B-5	R38	D-4	R120	B-5
L11	F-7	R39	H-3	R121	D-8
L12	G-7	R40	D-3	U1	D-7
L13	C-6	R41	F-3	XU1	D-7
L14	C-5	R42	D-3	U2	B-7
Q1	C-2	R43	D-3	XU2	B-7
Q2	C-3	R44	D-3	UR1	H-6
Q3	G-3	R45	F-3	UR2	C-6
Q4	G-3				

1707A-B-2

Figure 8-15. Vertical Preamplifier Assembly A5A4 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   DISPLAY . . . . . A
   Vertical POSITION (A and B) . . . . . midrange
   Vertical vernier (A and B) . . . . . CAL
   VOLTS/DIV (A and B) 2
   Vertical coupling (A and B) . . . . . GND
   B POL . . . . . NORM

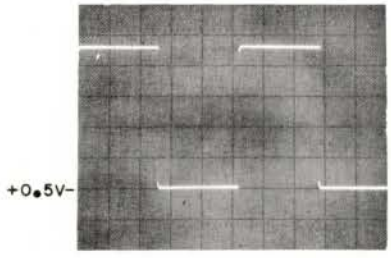
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

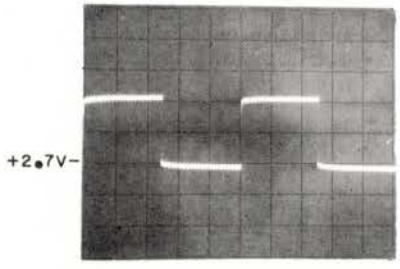
1. Set:
   DISPLAY . . . . . A
   Vertical POSITION (A and B) . . . . . midrange
   Vertical vernier (A and B) . . . . . CAL
   VOLTS/DIV (A and B) 2
   Vertical coupling (A) . . . . . AC
   Vertical coupling (B) . . . . . GND
   B POL . . . . . NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



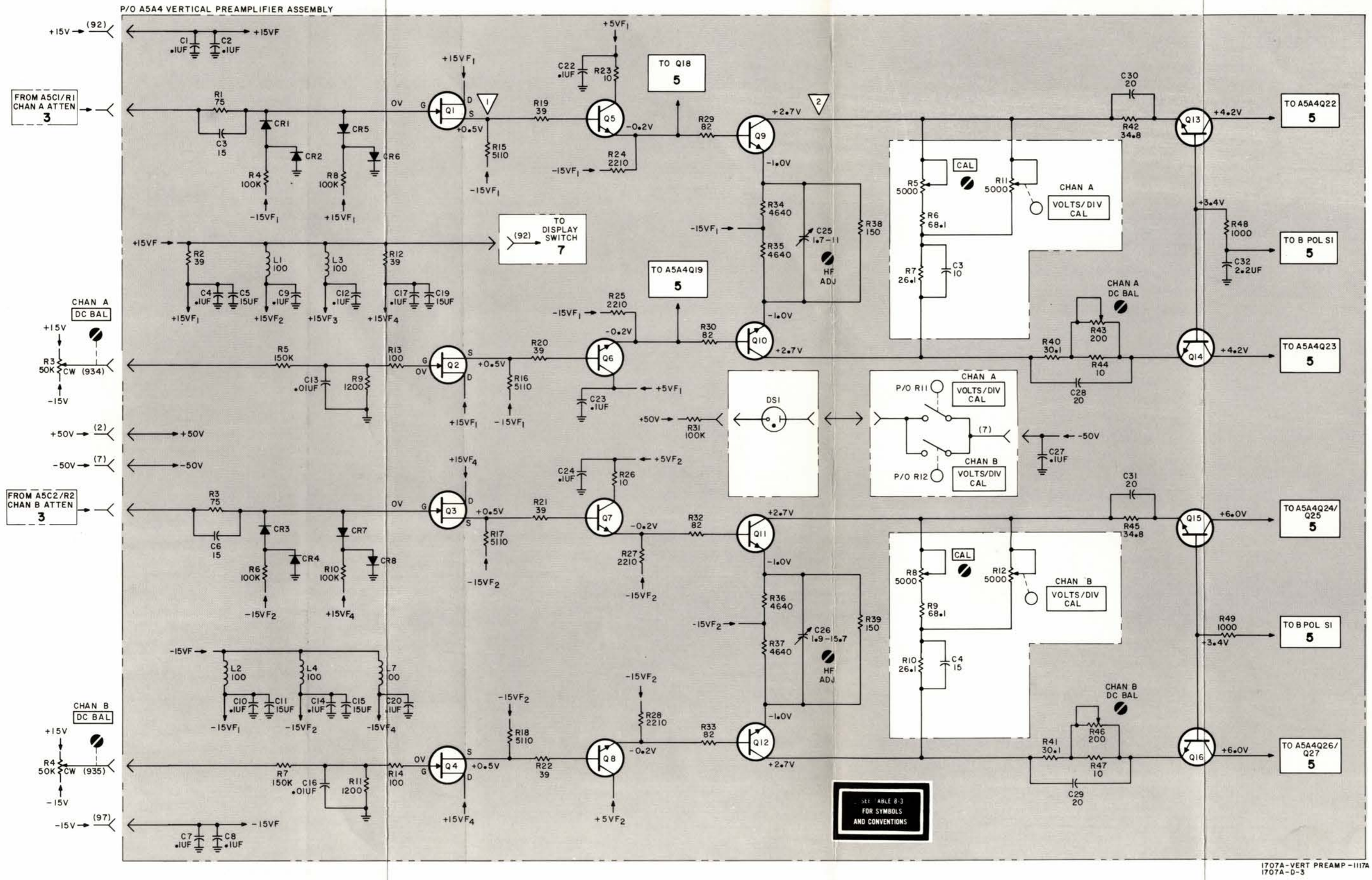
1 10 MV/DIV
0.2 MSEC/DIV



2 5 MV/DIV

1707A-R-14

Figure 8-16. Channel A Preamplifier Measurement Conditions and Waveforms



NOTE:
Q1/Q2, Q3/Q4, Q13/Q14, AND Q15/Q16 ARE DUAL TRANSISTORS.

Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assemby A2 is A2R1).

P/O A5
C3,4 DS1 R3-12
A5A4
C1-17,19,20 22-32 CR1-8 L1-4,7 Q1-16 R1-49
CHASSIS

4

DELETED: A5A4: C18,C21,L5,L6

Figure 8-17.
Vertical Preamplifier Assembly A5A4
8-25/8-26

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   DISPLAY . . . . . A
   Vertical POSITION (A and B) . . . . . midrange
   Vertical vernier (A and B) . . . . . CAL
   VOLTS/DIV (A and B) 2
   Vertical coupling (A and B) . . . . . GND
   B POL . . . . . NORM

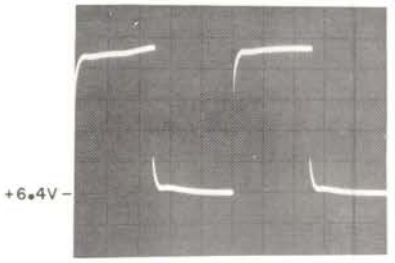
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

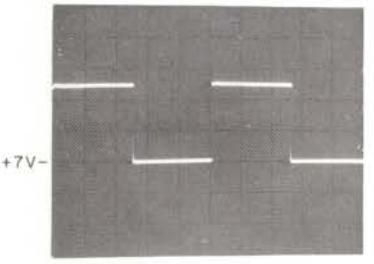
1. Set:
   DISPLAY . . . . . A
   Vertical POSITION (A and B) . . . . . midrange
   Vertical vernier (A and B) . . . . . CAL
   VOLTS/DIV (A and B) 2
   Vertical coupling (A) . . . . . AC
   Vertical coupling (B) . . . . . GND
   B POL . . . . . NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



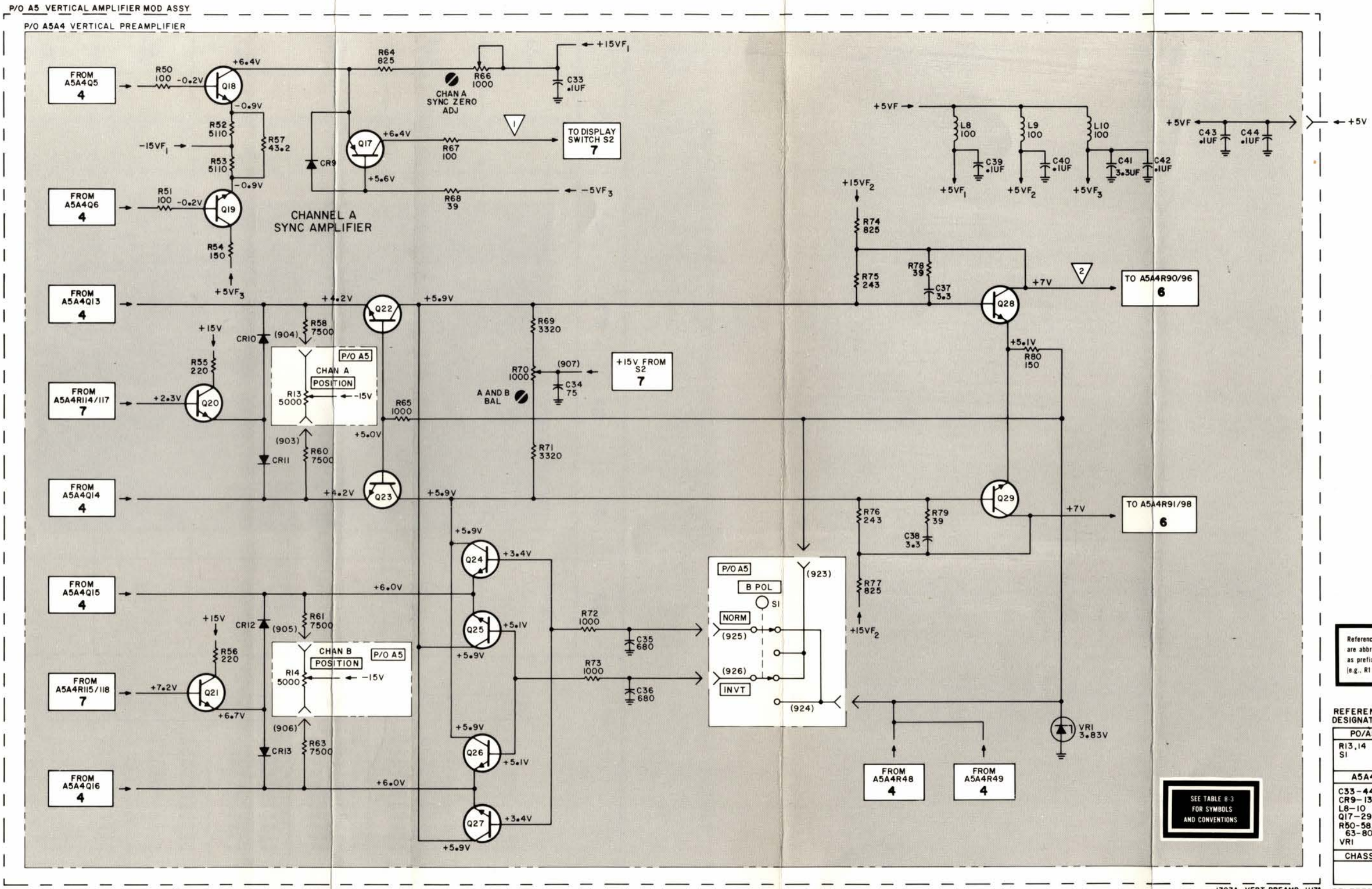
1 10 MV/DIV



2 20 MV/DIV

1707A-A-1

Figure 8-18. Channel A Preamplifier Measurement Conditions and Waveforms



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

REFERENCE DESIGNATIONS

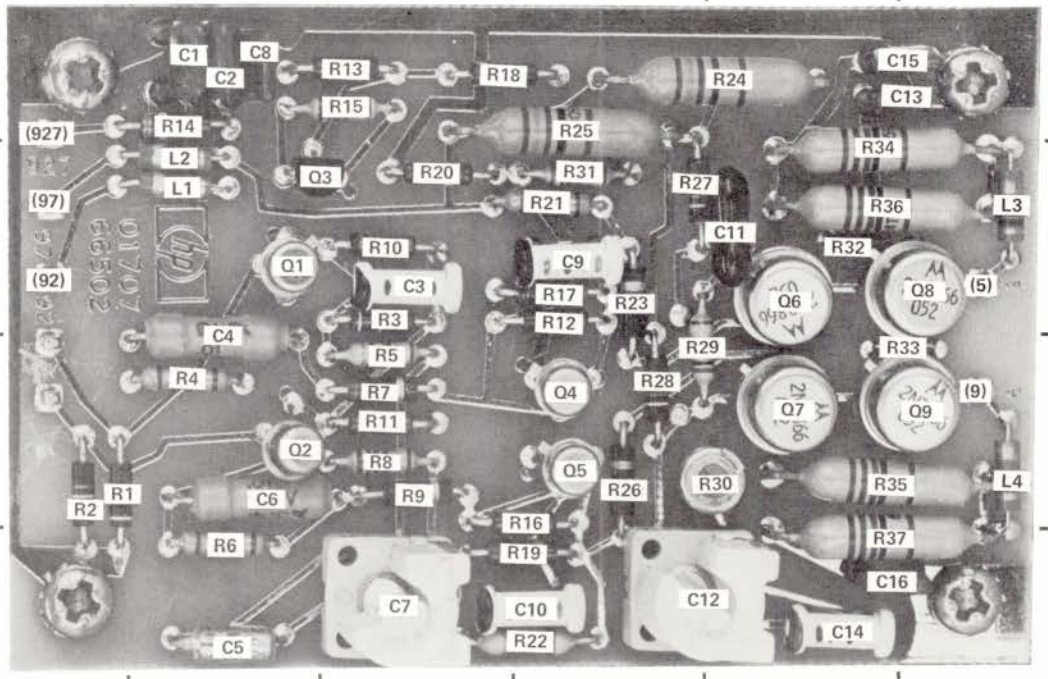
PO/A5
R13,14 S1
A5A4
C33-44 CR9-13 L8-10 Q17-29 R50-58,60,61 63-80 VR1
CHASSIS

5

DELETED: A5A4: R59, R62

Figure 8-19.
Vertical Preamplifier A5A4

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



A5A5

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	C12	E-5	Q3	B-3	R5	C-4	R16	D-4	R27	D-3
C2	B-2	C13	F-2	Q4	D-4	R6	B-5	R17	D-3	R28	D-4
C3	C-3	C14	E-5	Q5	D-4	R7	C-4	R18	C-2	R29	D-4
C4	B-4	C15	F-2	Q6	E-3	R8	C-4	R19	D-5	R30	E-4
C5	B-5	C16	E-5	Q7	E-4	R9	C-4	R20	C-3	R31	D-3
C6	B-4	L1	B-3	Q8	F-3	R10	C-3	R21	D-3	R32	E-3
C7	C-5	L2	B-3	Q9	F-4	R11	C-4	R22	D-5	R33	F-4
C8	B-2	L3	F-3	R1	A-4	R12	D-3	R23	D-3	R34	E-3
C9	D-3	L4	F-4	R2	A-4	R13	C-2	R24	C-2	R35	E-4
C10	D-5	Q1	B-3	R3	C-3	R14	B-2	R25	D-2	R36	E-3
C11	E-3	Q2	B-4	R4	B-4	R15	C-2	R26	D-4	R37	E-5

1707A – R – 2

Figure 8-20. Vertical Output Amplifier A5A5 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   - DISPLAY . . . . . A
   - Vertical POSITION (A and B) . . . . . midrange
   - Vertical vernier (A and B) . . . . . CAL
   - VOLTS/DIV (A and B) 2
   - Vertical coupling (A and B) . . . . . GND
   - B POL . . . . . NORM

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   - DISPLAY . . . . . A
   - Vertical POSITION (A and B) . . . . . midrange
   - Vertical vernier (A and B) . . . . . CAL
   - VOLTS/DIV (A and B) 2
   - Vertical coupling (A) . . . . . AC
   - Vertical coupling (B) . . . . . GND
   - B POL . . . . . NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.

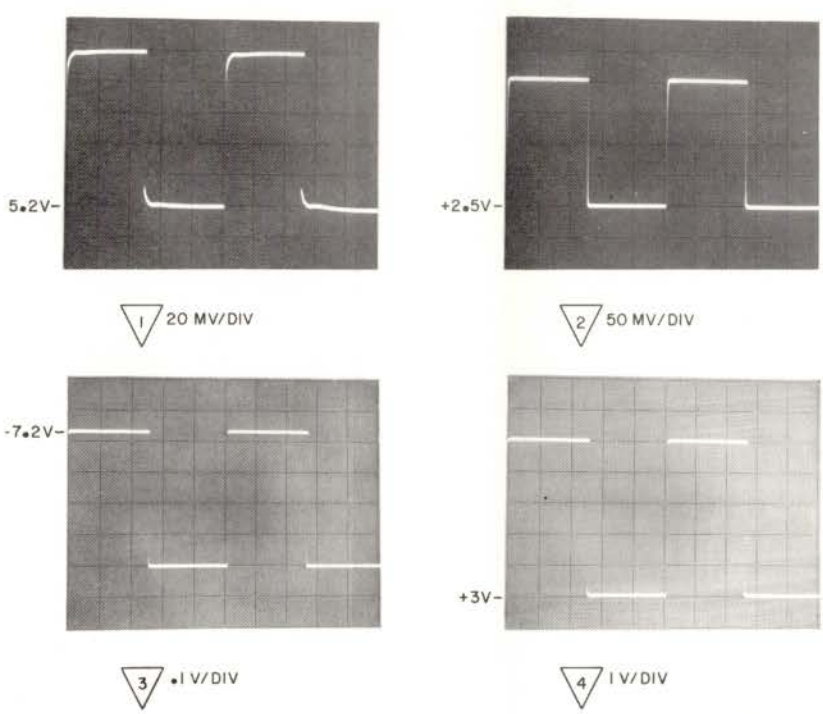
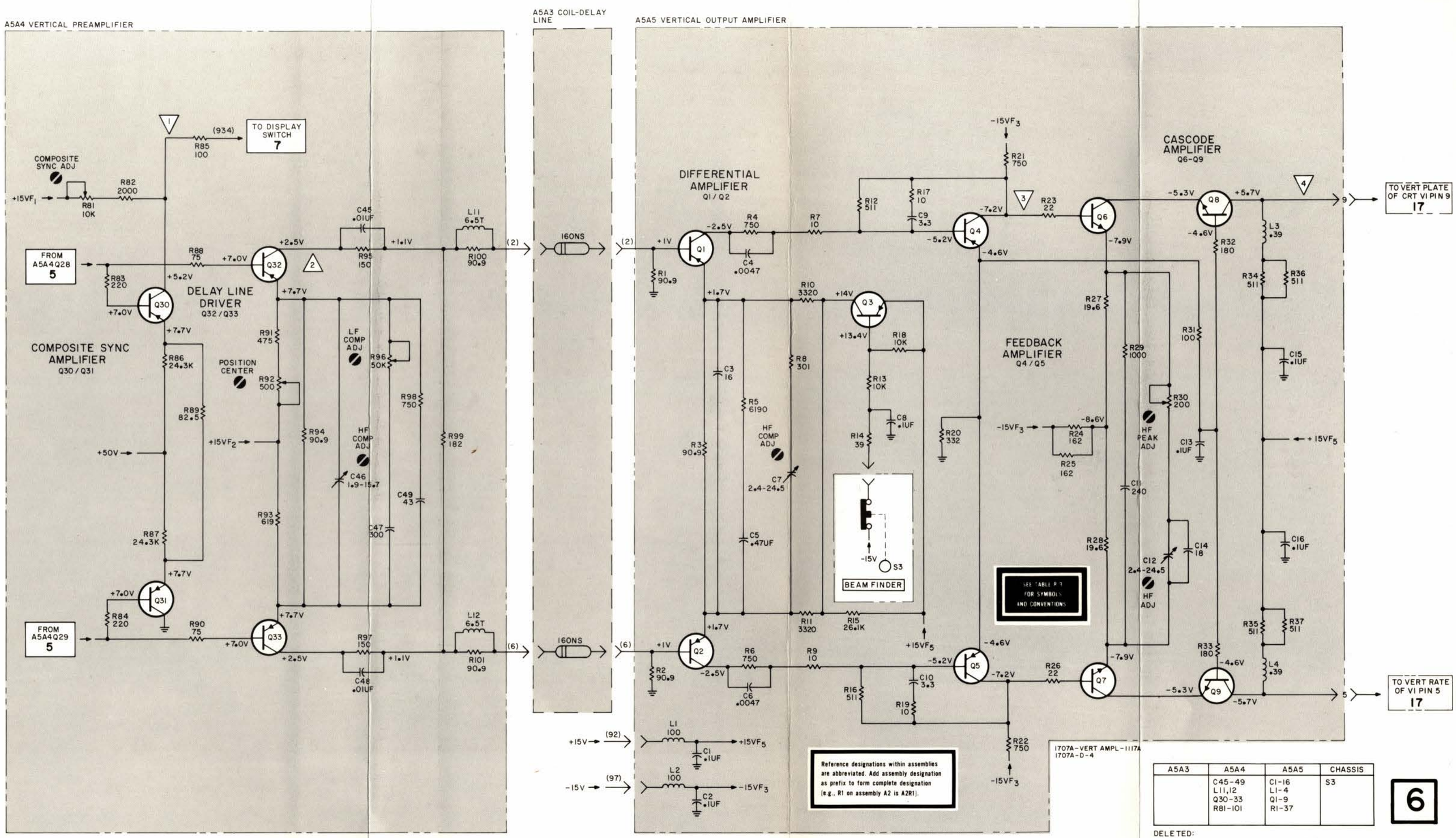


Figure 8-21. Vertical Preamplifier and Output Amplifier Measurement Conditions and Waveforms



A5A3	A5A4	A5A5	CHASSIS
	C45-49 L11,12 Q30-33 R81-101	C1-16 L1-4 Q1-9 R1-37	S3

DELETED:

6

Figure 8-22.
Vertical Preamplifier A5A4 and Vertical Output Amplifier A5A5

DC VOLTAGE MEASUREMENT CONDITIONS

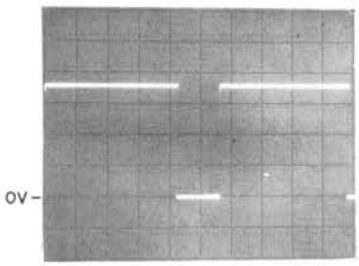
1. Set:
   - DISPLAY . . . . . A
   - Vertical POSITION (A and B) . . . . . midrange
   - Vertical vernier (A and B) . . . . . CAL
   - VOLTS/DIV (A and B) 2
   - Vertical coupling (A and B) . . . . . GND
   - B POL . . . . . NORM

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

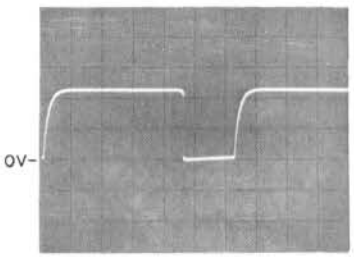
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   - DISPLAY . . . . . CHOP
   - Vertical POSITION (A and B) . . . . . midrange
   - Vertical vernier (A and B) . . . . . CAL
   - VOLTS/DIV (A and B) 2
   - Vertical coupling (A and B) . . . . . GND
   - B POL . . . . . NORM
   - TRIGGER . . . . . INT
   - TIME/DIV . . . . . .2 mSEC
   - SWEEP MODE . . . . . AUTO

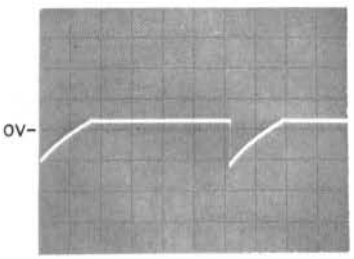
2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



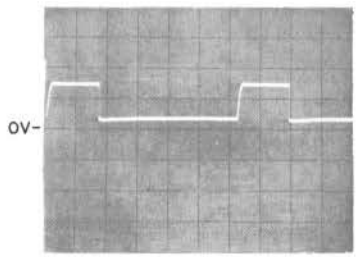
1 0.5 V/DIV 0.5 MSEC/DIV



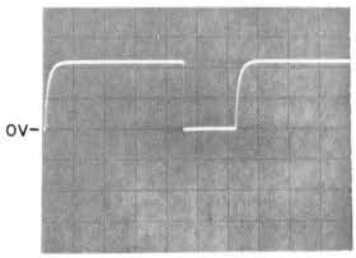
2 2 V/DIV 1 USEC/DIV



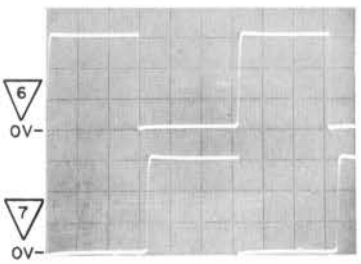
3 2 V/DIV 1 USEC/DIV



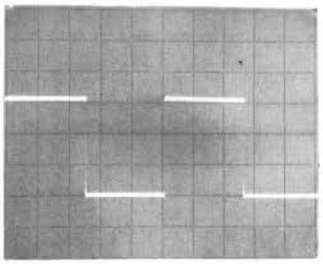
4 2 V/DIV 1 USEC/DIV



5 2 V/DIV 1 USEC/DIV



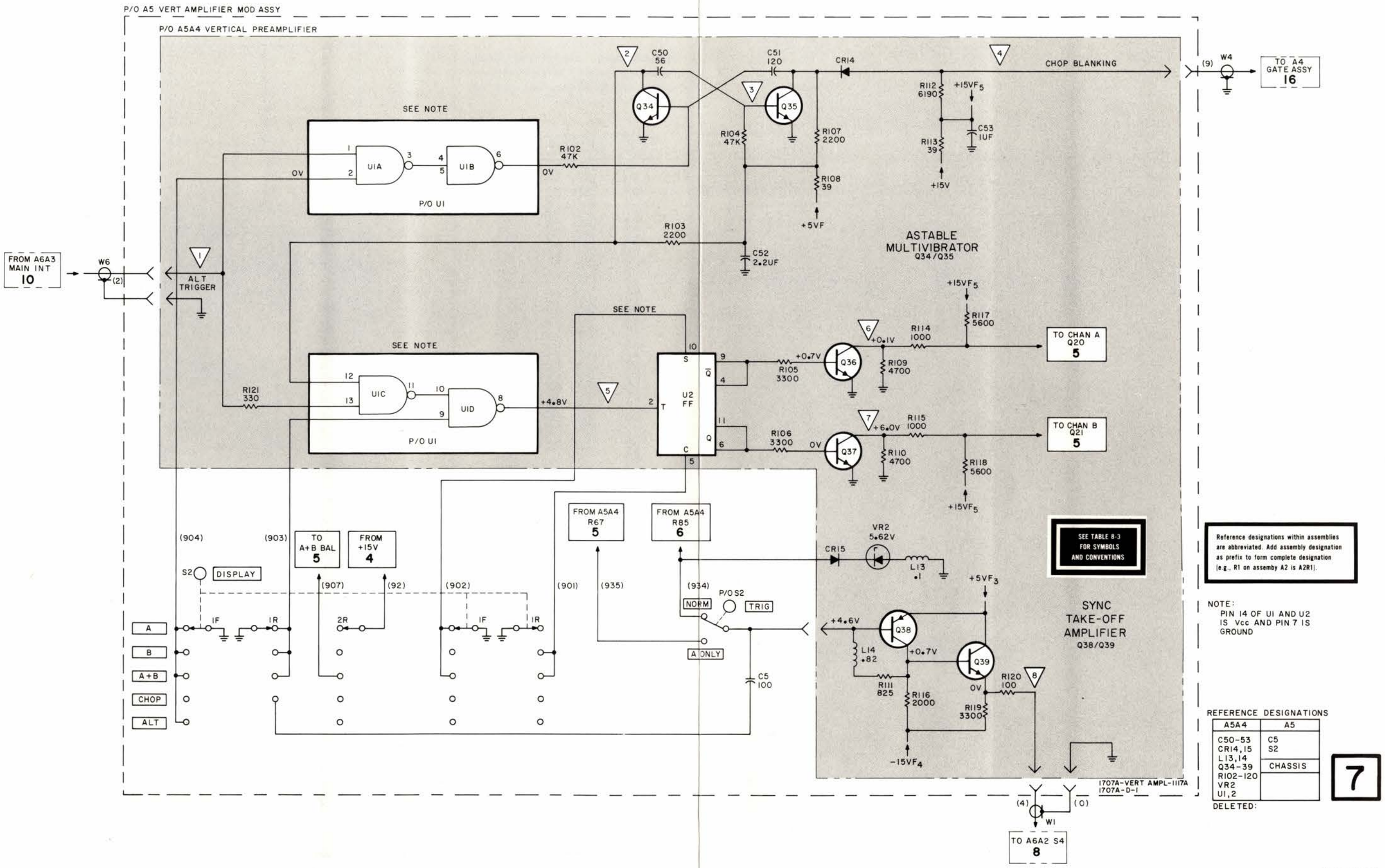
2 V/DIV 2 USEC/DIV



8 0.2 V/DIV

1707A-R-15

Figure 8-23. Vertical Preamplifier Measurement Conditions and Waveforms



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assemby A2 is A2R1).

NOTE:
PIN 14 OF U1 AND U2 IS Vcc AND PIN 7 IS GROUND

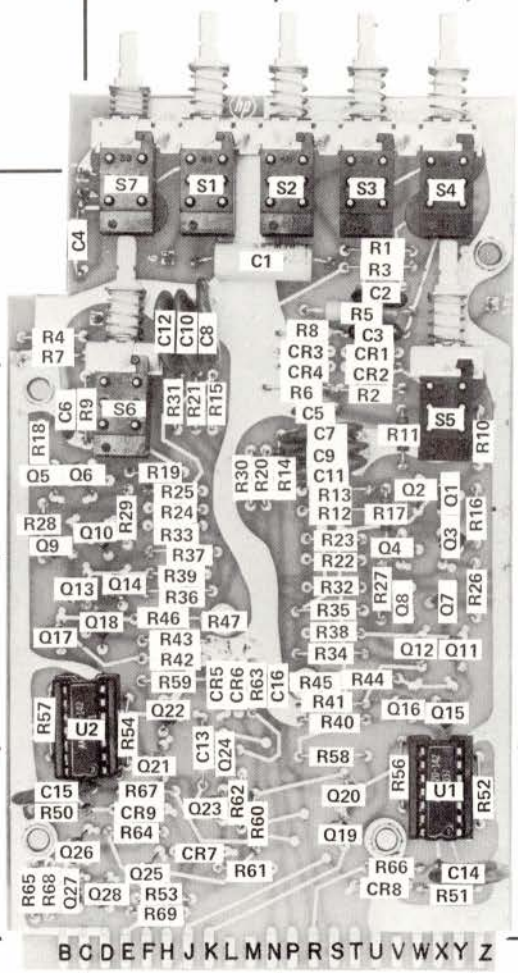
REFERENCE DESIGNATIONS

A5A4	A5
C50-53 CR14,15 L13,14 Q34-39 R102-120 VR2 U1,2	C5 S2 CHASSIS

DELETED:

7

Figure 8-24.
Vertical Preamplifier A5A4



A6A2

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-3	R12	C-4
C2	C-3	R13	C-4
C3	C-3	R14	C-4
C4	A-3	R15	B-4
C5	C-4	R16	D-4
C6	A-4	R17	C-4
C7	C-4	R18	A-4
C8	B-3	R19	B-4
C9	C-4	R20	B-4
C10	B-3	R21	B-4
C11	C-4	R22	C-5
C12	B-3	R23	C-4
C13	B-6	R24	B-4
C14	C-6	R25	B-4
C15	A-6	R26	D-5
C16	B-5	R27	C-5
CR1	C-3	R28	A-4
CR2	C-4	R29	B-4
CR3	C-3	R30	B-4
CR4	C-4	R31	B-4
CR5	B-5	R32	C-5
CR6	B-5	R33	B-4
CR7	B-6	R34	C-5
CR8	C-6	R35	C-5
CR9	B-6	R36	B-5
Q1	C-4	R37	B-4
Q2	C-4	R38	C-5
Q3	C-4	R39	B-5
Q4	C-4	R40	C-5
Q5	A-4	R41	C-5
Q6	A-4	R42	B-5
Q7	C-5	R43	B-5
Q8	C-5	R44	C-5
Q9	A-4	R45	C-5
Q10	B-4	R46	B-5
Q11	C-5	R47	B-5
Q12	C-5	R50	A-6
Q13	A-5	R51	C-6
Q14	B-5	R52	D-6
Q15	C-5	R53	B-6
Q16	C-5	R54	B-5
Q17	A-5	R56	C-6
Q18	B-5	R57	A-5
Q19	C-6	R58	C-6
Q20	C-6	R59	B-5
Q21	B-6	R60	B-6
Q22	B-5	R61	B-6
Q23	B-6	R62	B-6
Q24	B-6	R63	B-5
Q25	B-6	R64	B-6
Q26	A-6	R65	A-6
Q27	A-6	R66	C-6
Q28	B-6	R67	B-6
R1	C-3	R68	A-6
R2	C-4	R69	B-6
R3	C-3	S1	B-3
R4	A-3	S2	C-3
R5	C-3	S3	C-3
R6	C-4	S4	C-3
R7	A-3	S5	C-4
R8	C-3	S6	B-4
R9	B-4	S7	B-3
R10	D-4	U1	C-6
R11	C-4	U2	A-5

1701A-A-43

Figure 8-25. Trigger Assembly A6A2 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

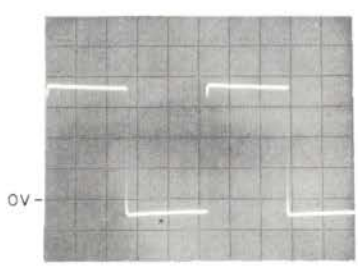
1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER ..... INT
   MAIN and DELAYED TRIGGER LEVEL ... CW
   Sweep Display ..... MAIN SWEEP

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

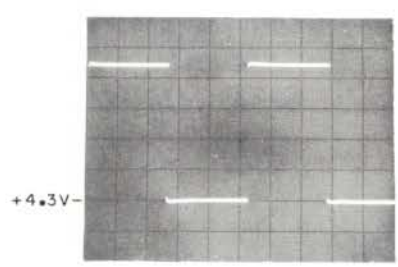
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER ..... EXT
   Sweep display ..... MAIN SWEEP
   SLOPE..... +
   TIME/DIV ..... .2 mSEC

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1 0.2V/DIV
0.2 MSEC/DIV



2 0.1V/DIV
0.2 MSEC/DIV

1701A-A-50

Figure 8-26. Trigger Assembly Measurement Conditions and Waveforms

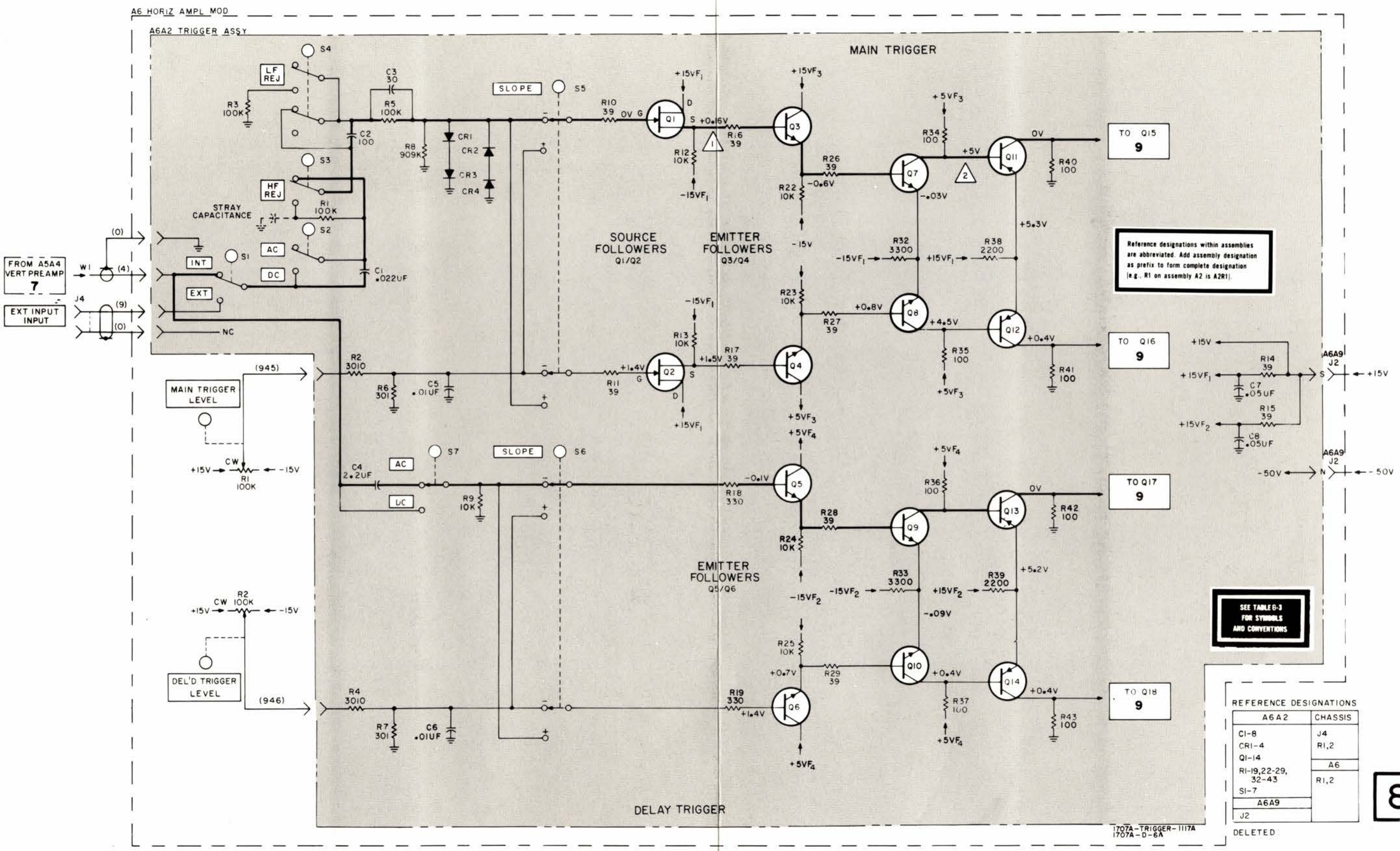


Figure 8-27.
Trigger Assembly A6A2

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER ..... EXT
   Sweep Display ..... MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVEL ..... CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

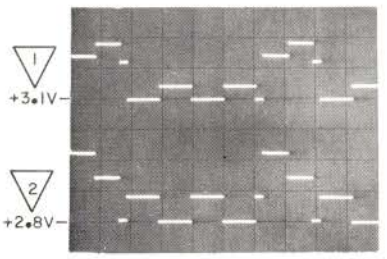
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER ..... EXT
   Sweep display ..... MAIN SWEEP
   SLOPE ..... +
   TIME/DIV ..... .2 mSEC

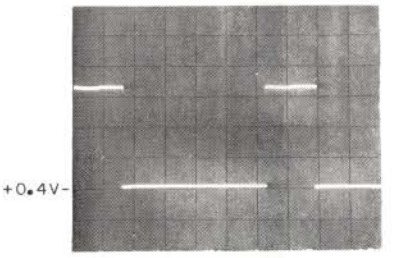
2. Connect the CAL 1 VOLT signal to EXT INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.

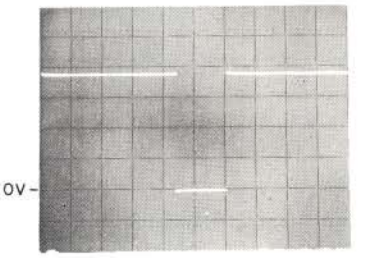
4. * 6 Bright line auto waveform is obtained by removing CAL 1 VOLT signal from EXT INPUT. * 6 will be at 0V when triggered.



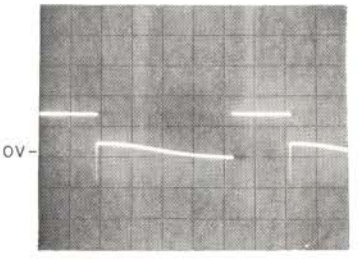
0.5V/DIV
0.5MSEC/DIV



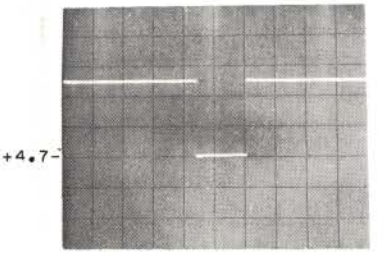
3 1V/DIV
0.5MSEC/DIV



4 0.2V/DIV
0.5MSEC/DIV



5 0.5V/DIV
0.5MSEC/DIV



6 0.5V/DIV
0.5MSEC/DIV

1701A-B-2

Figure 8-28. Trigger Assembly Measurement Conditions and Waveforms

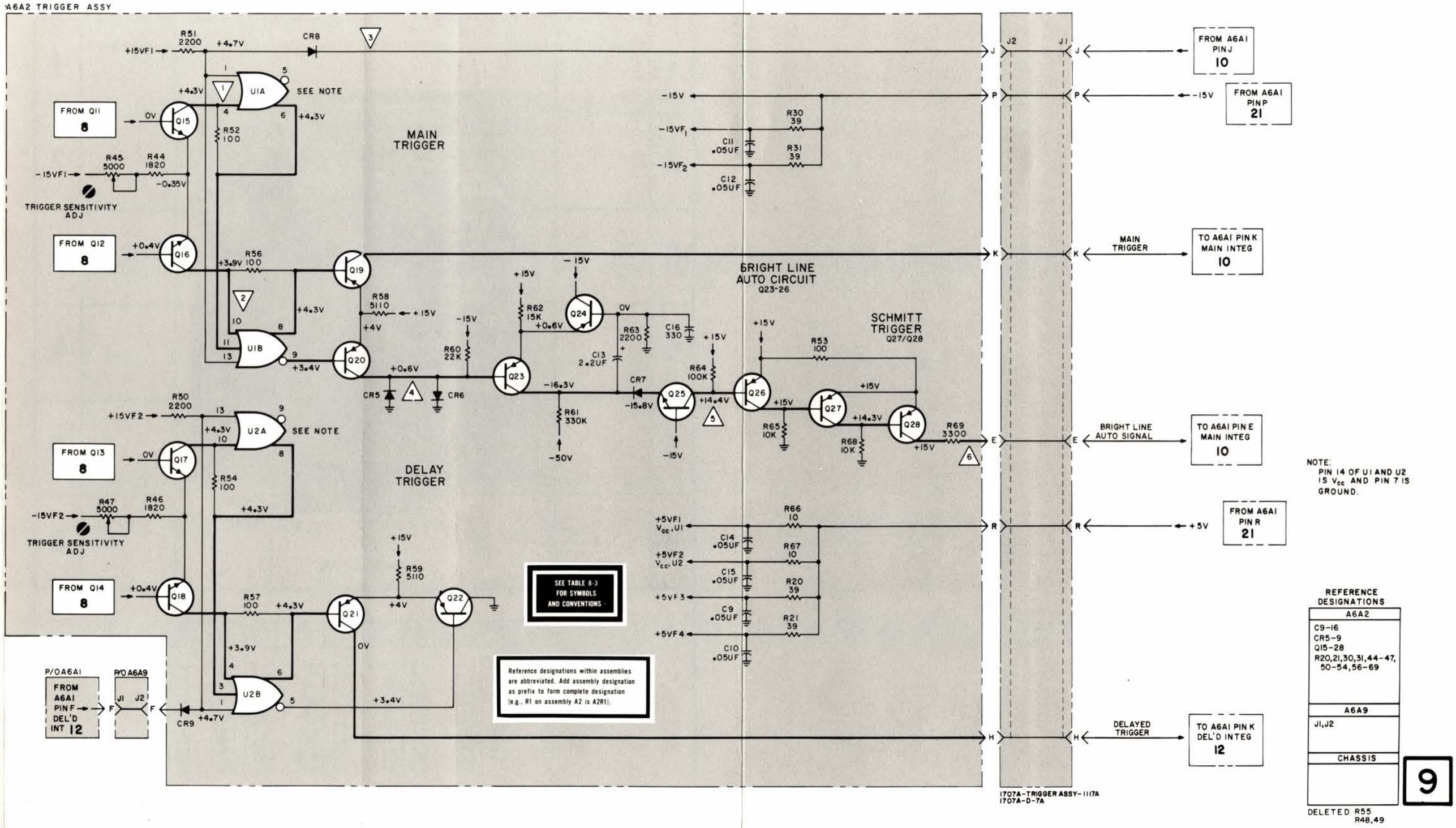
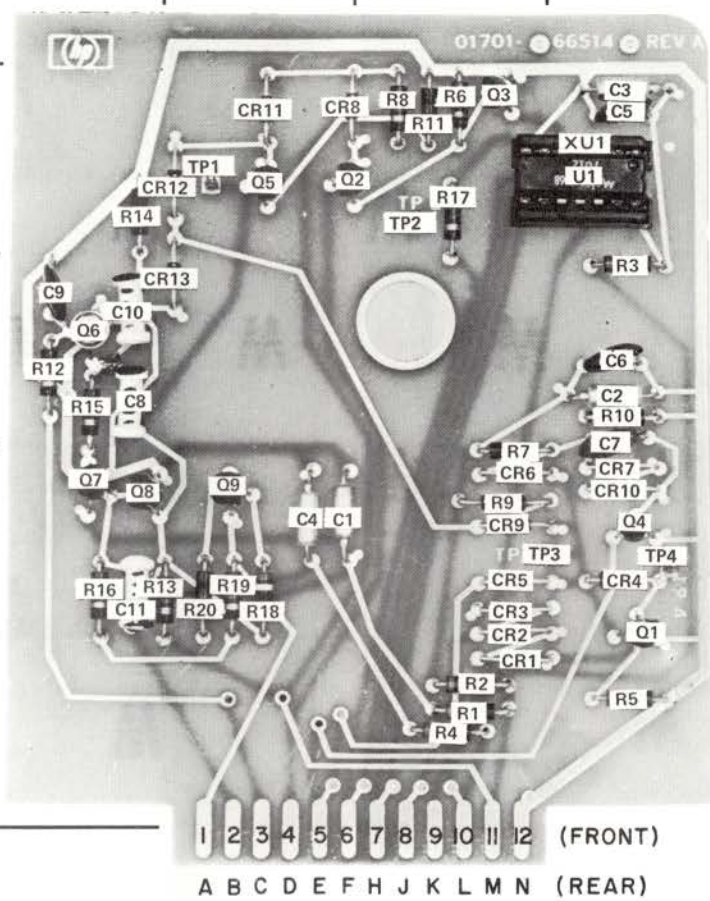


Figure 8-29.
Trigger Assembly A6A2

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

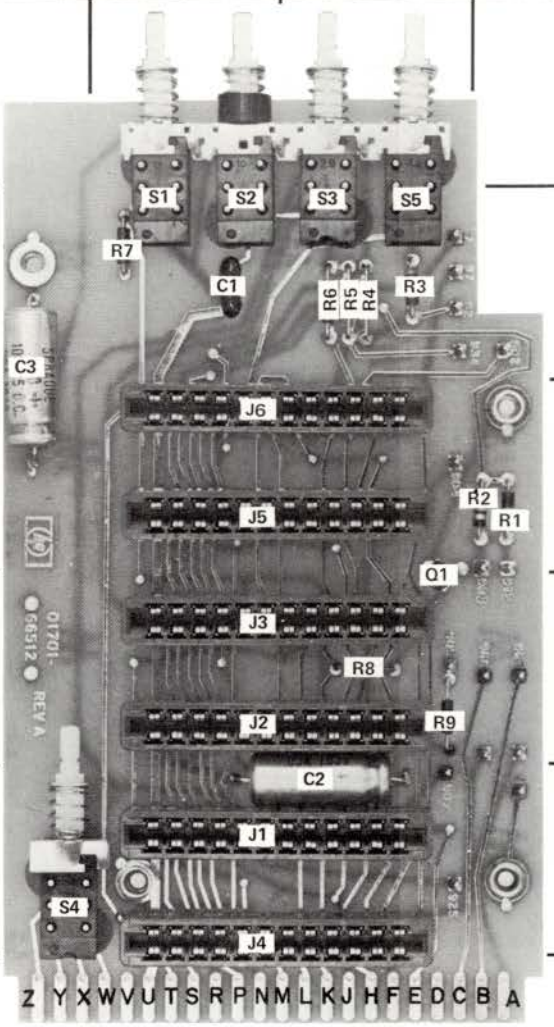


A6A3, A6A4

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	CR1	D-5	CR13	C-3	R3	E-3	R15	B-3
C2	E-3	CR2	D-5	Q1	E-4	R4	D-5	R16	B-4
C3	E-2	CR3	D-4	Q2	C-2	R5	E-5	R17	D-2
C4	C-4	CR4	E-4	Q3	D-2	R6	D-2	R18	C-4
C5	E-2	CR5	D-4	Q4	E-4	R7	D-4	R19	C-4
C6	E-3	CR6	D-4	Q5	C-2	R8	D-2	R20	C-4
C7	E-3	CR7	E-4	Q6	B-3	R9	D-4	TP1	C-2
C8	B-3	CR8	C-2	Q7	B-4	R10	E-3	TP2	D-2
C9	B-3	CR9	D-4	Q8	B-4	R11	D-2	TP3	E-4
C10	B-3	CR10	E-4	Q9	C-4	R12	B-3	TP4	E-4
C11	B-4	CR11	C-2	R1	D-5	R13	B-4	U1	E-2
		CR12	B-2	R2	D-5	R14	B-2	XU1	E-2

1701A—A—12

Figure 8-30. Main Integrator A6A3 Component Identification



Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-3	R3	C-3
C2	C-6	R4	C-3
C3	A-3	R5	C-3
J1	B-6	R6	C-3
J2	B-5	R7	B-3
J3	B-5	R8	C-5
J4	B-6	R9	C-5
J5	B-4	S1	B-3
J6	B-4	S2	B-3
Q1	C-5	S3	C-3
R1	D-4	S4	A-6
R2	D-4	S5	C-3

1701A-A-44

Figure 8-31. Horizontal Mother Board A6A1 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER ..... INT
   Sweep display ..... MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVEL ..... CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER ..... INT
   Sweep display ..... MAIN SWEEP
   SLOPE ..... +
   TIME/DIV ..... .2 mSEC

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using 1:1 probe) and sweep speed settings are shown below each waveform photograph.

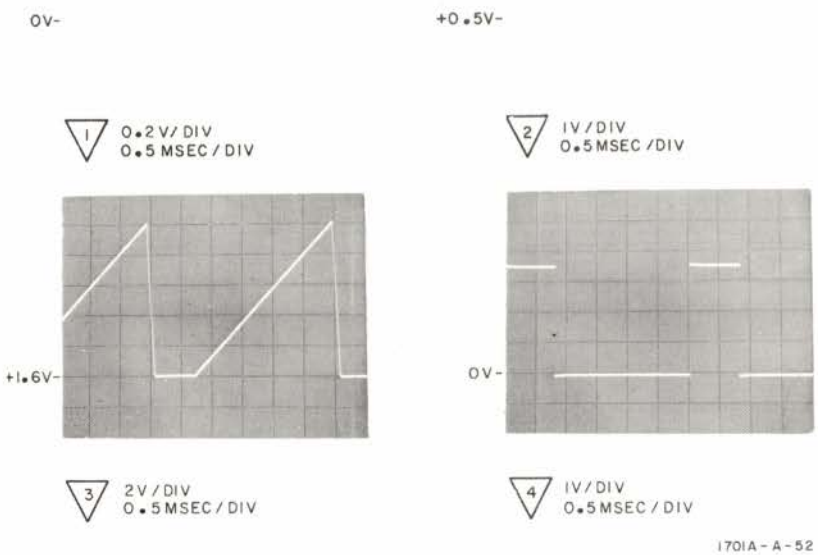


Figure 8-32. Main Integrator Measurement Conditions and Waveforms

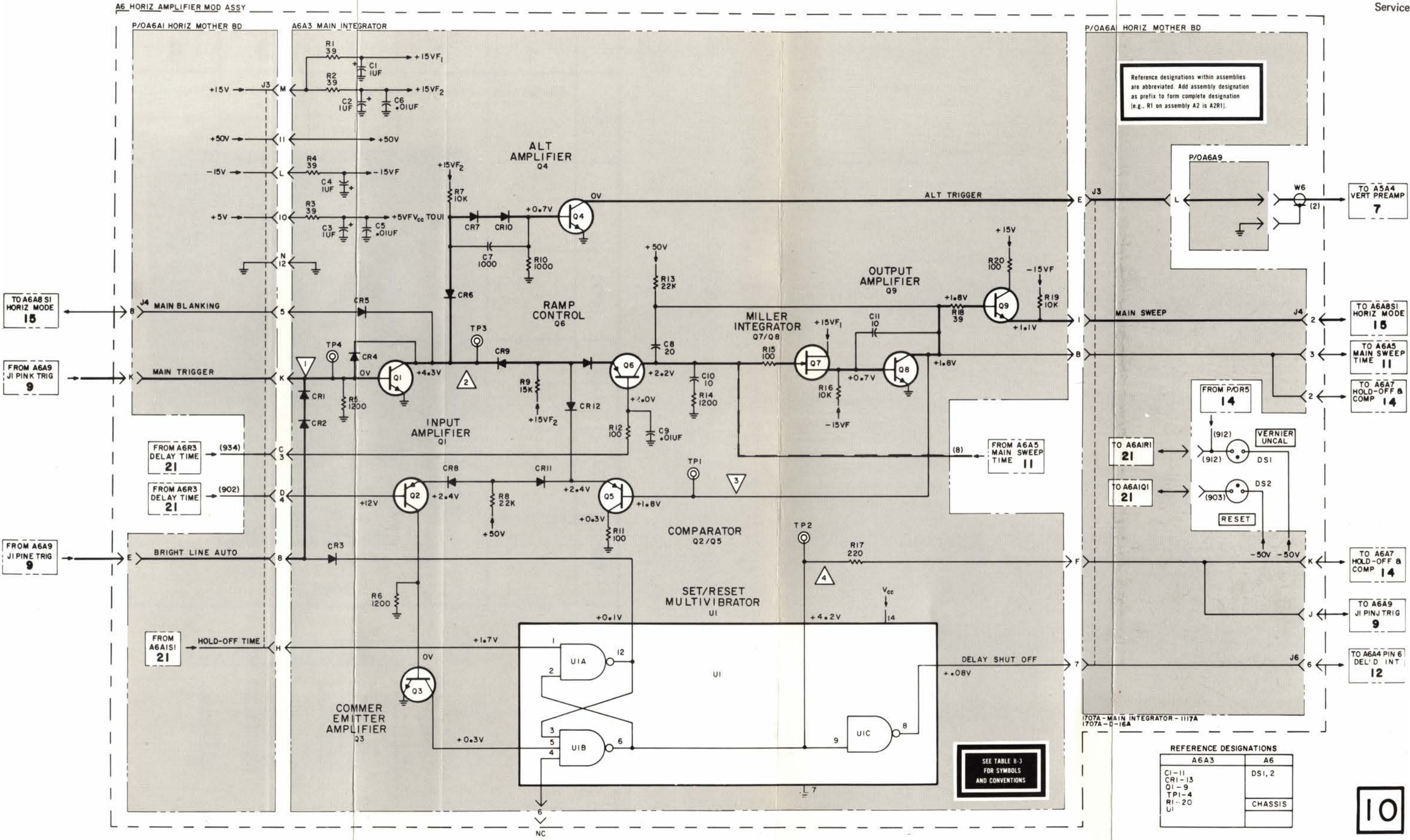
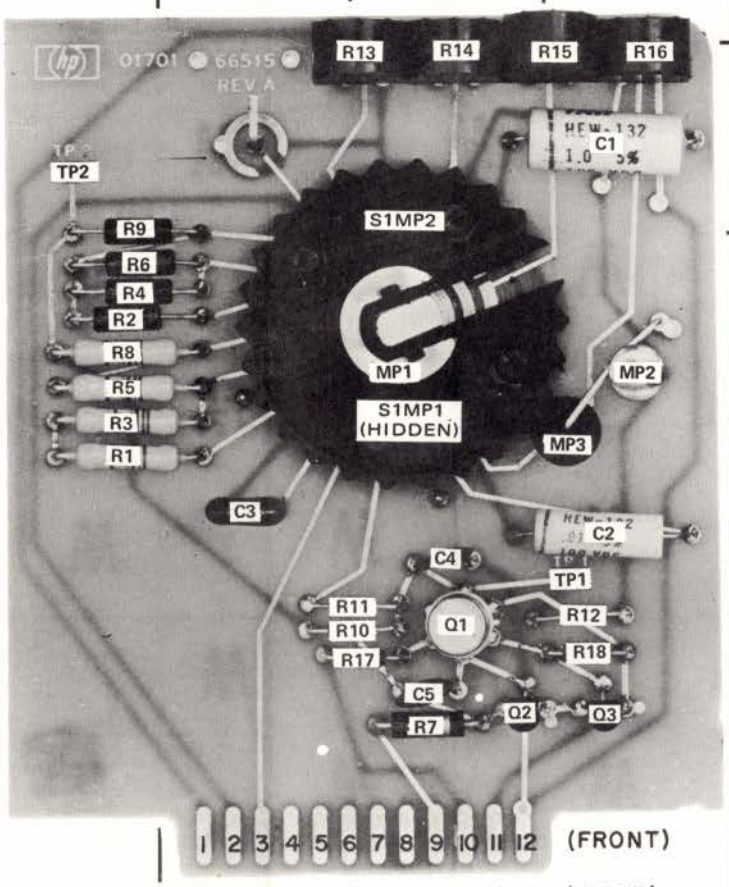


Figure 8-33.
Main Integrator A6A3

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



A6A5, A6A6

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	R1	B-4	R12	E-4
C2	E-4	R2	B-3	R13	D-2
C3	C-4	R3	B-3	R14	D-2
C4	D-4	R4	B-3	R15	E-2
C5	D-5	R5	B-3	R16	E-2
MP1	D-3	R6	B-3	R17	C-5
MP2	E-3	R7	D-5	R18	E-5
MP3	E-4	R8	B-3	S1MP1	D-3
Q1	D-5	R9	B-2	S1MP2	D-2
Q2	D-5	R10	C-5	TP1	E-4
Q3	E-5	R11	C-4	TP2	B-2

1701A-A-10

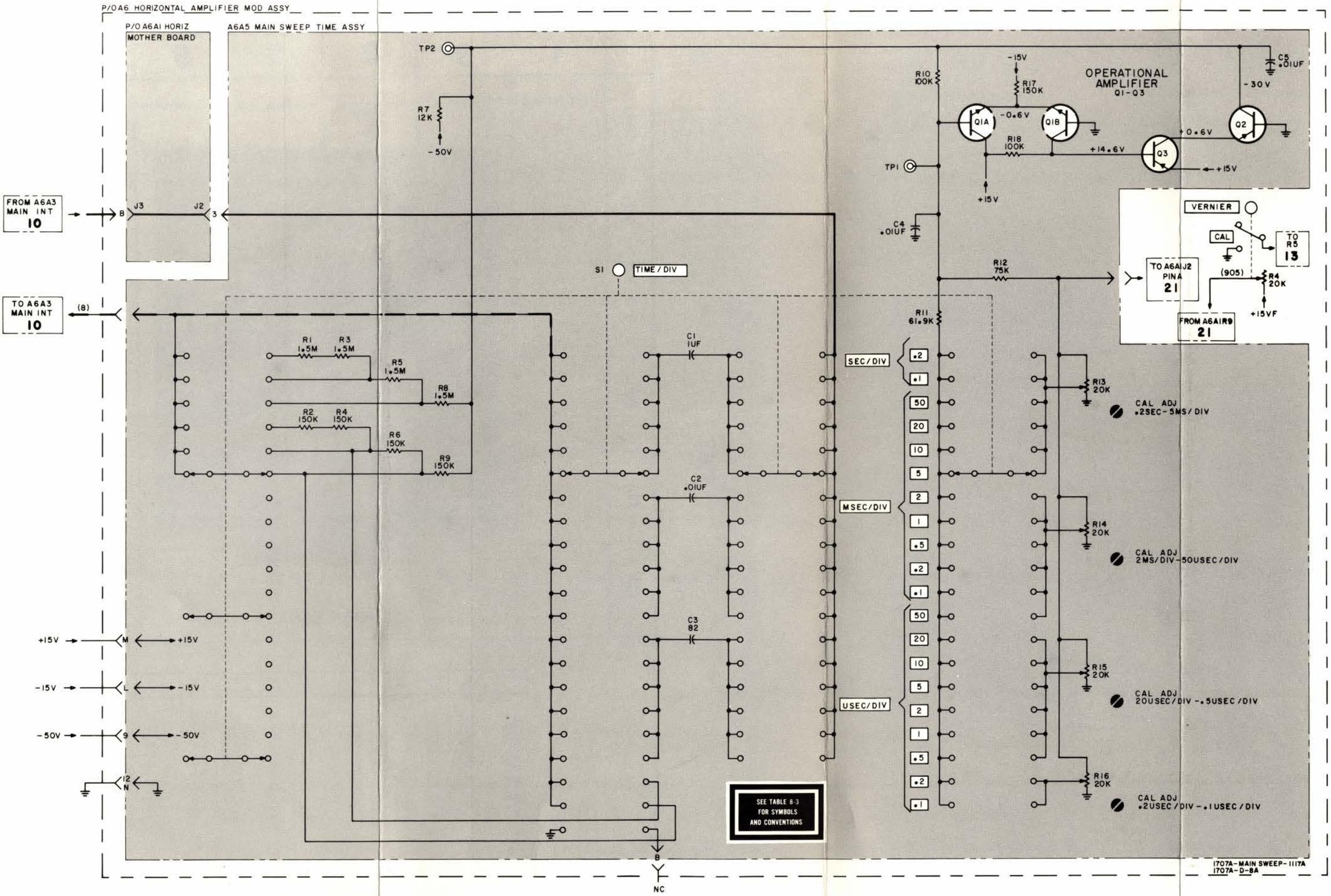
Figure 8-34. Main Sweep Time Assembly A6A5 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER . . . . . INT
   SWEEP DISPLAY . . . . . MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVEL . . . . . CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

Figure 8-35. Main Sweep Time Measurement Conditions



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

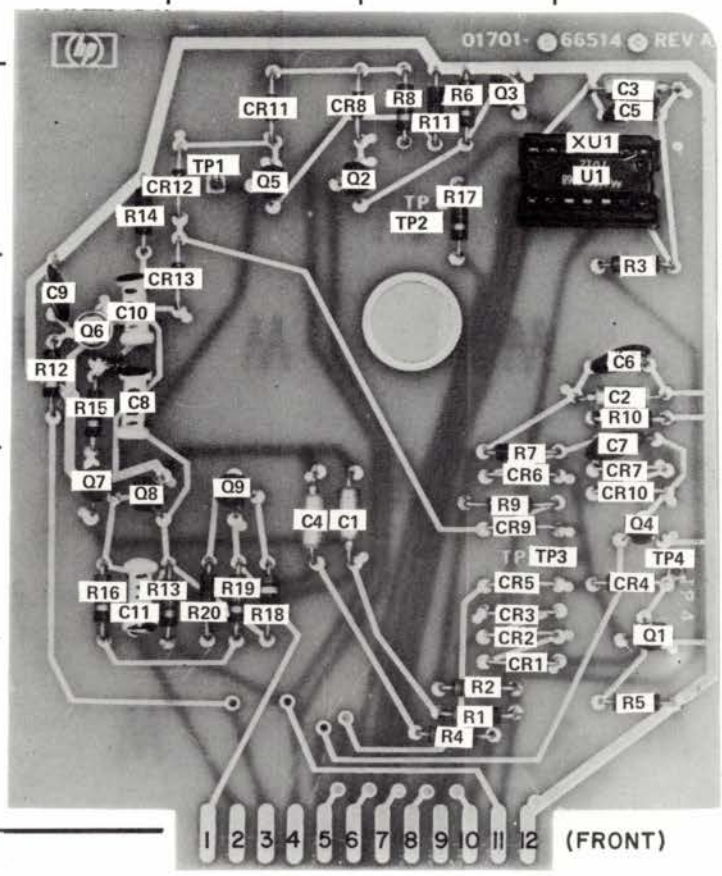
REFERENCE DESIGNATIONS

A6A5	
C1-5 Q1-3 R1-18 S1 TP1,2	
A6	CHASSIS
R4	

DELETED:

Figure 8-36.
Main Sweep Time Assembly A6A5

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



A6A3, A6A4

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	CR1	D-5	CR13	C-3	R3	E-3	R15	B-3
C2	E-3	CR2	D-5	Q1	E-4	R4	D-5	R16	B-4
C3	E-2	CR3	D-4	Q2	C-2	R5	E-5	R17	D-2
C4	C-4	CR4	E-4	Q3	D-2	R6	D-2	R18	C-4
C5	E-2	CR5	D-4	Q4	E-4	R7	D-4	R19	C-4
C6	E-3	CR6	D-4	Q5	C-2	R8	D-2	R20	C-4
C7	E-3	CR7	E-4	Q6	B-3	R9	D-4	TP1	C-2
C8	B-3	CR8	C-2	Q7	B-4	R10	E-3	TP2	D-2
C9	B-3	CR9	D-4	Q8	B-4	R11	D-2	TP3	E-4
C10	B-3	CR10	E-4	Q9	C-4	R12	B-3	TP4	E-4
C11	B-4	CR11	C-2	R1	D-5	R13	B-4	U1	E-2
		CR12	B-2	R2	D-5	R14	B-2	XU1	E-2

1701A—A—12

Figure 8-37. Delayed Integrator A6A4 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER . . . . . INT
   Sweep display . . . . . MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVEL . . . . . CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER . . . . . INT
   Sweep display . . . . . MAIN SWEEP
   SLOPE . . . . . +
   TIME/DIV . . . . . .2 mSEC

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using 1:1 probe) and sweep speed settings are shown below each waveform photograph.

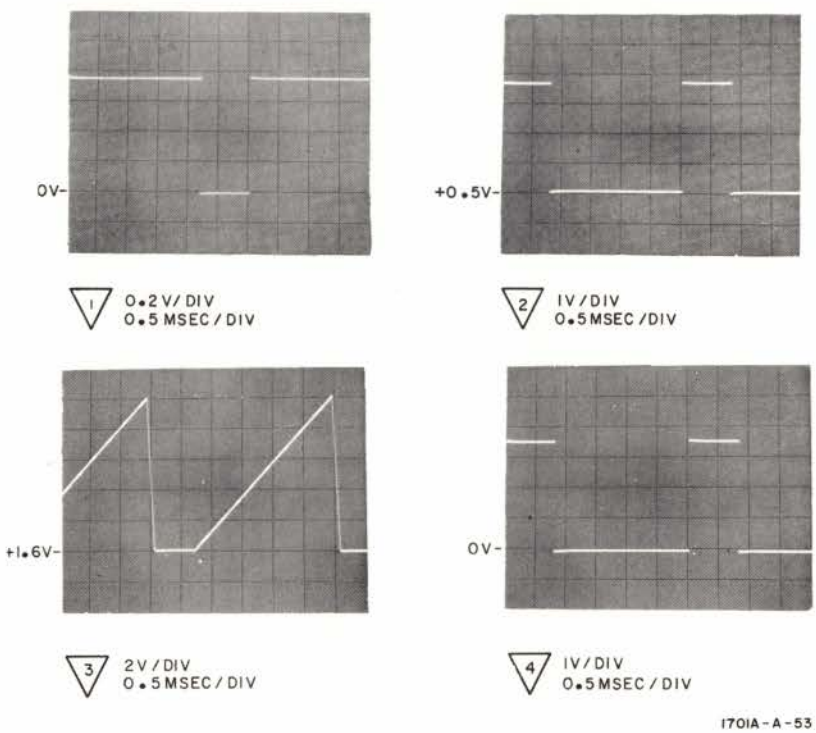
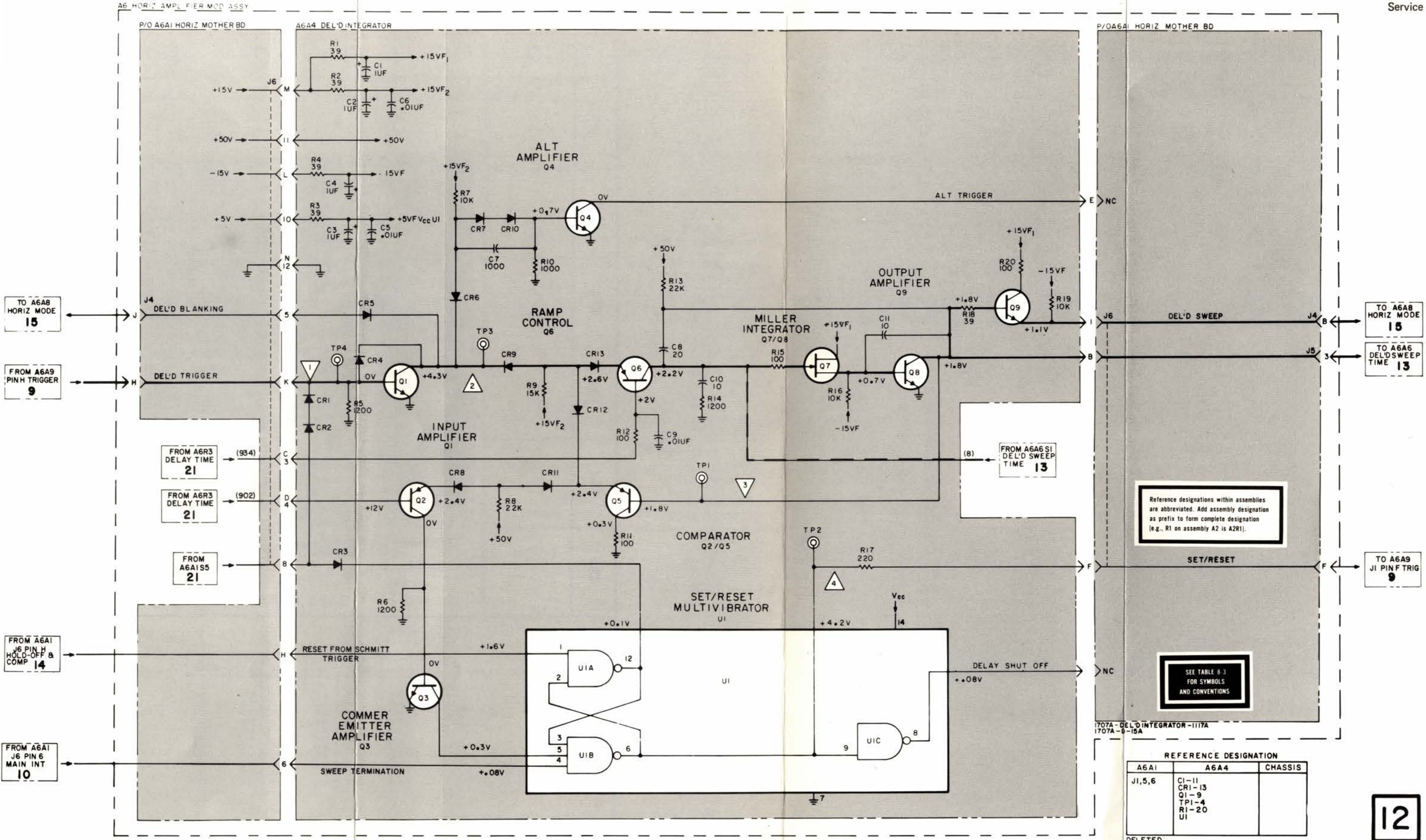


Figure 8-38. Delayed Integrator Measurement Conditions and Waveforms



REFERENCE DESIGNATION

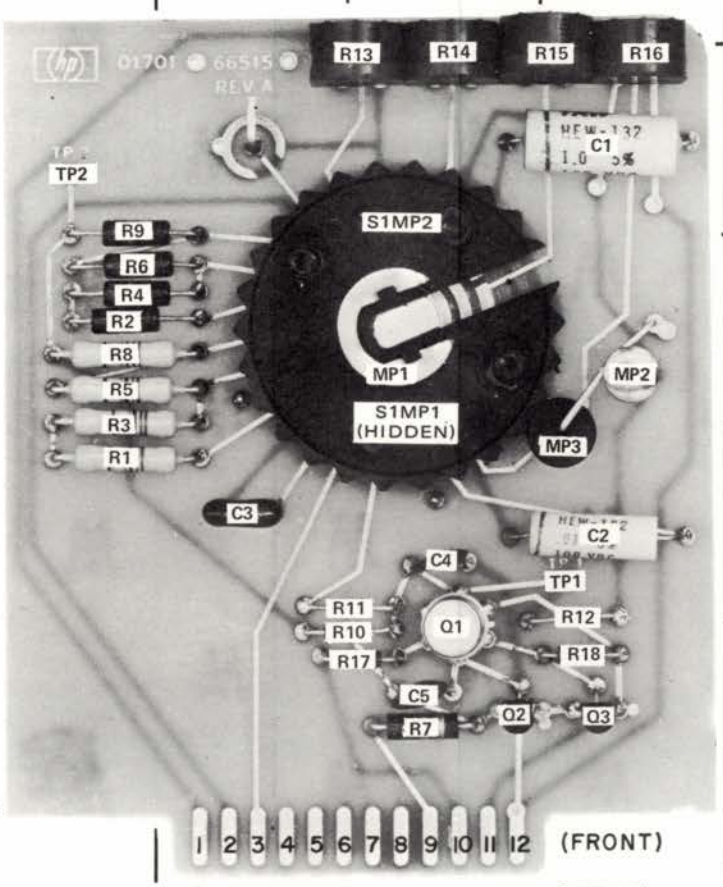
A6A1	A6A4	CHASSIS
J1,5,6	C1-11 CR1-13 Q1-9 TP1-4 R1-20 U1	

DELETED

12

Figure 8-39.
Delayed Integrator A6A4

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



A6A5, A6A6

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	R1	B-4	R12	E-4
C2	E-4	R2	B-3	R13	D-2
C3	C-4	R3	B-3	R14	D-2
C4	D-4	R4	B-3	R15	E-2
C5	D-5	R5	B-3	R16	E-2
MP1	D-3	R6	B-3	R17	C-5
MP2	E-3	R7	D-5	R18	E-5
MP3	E-4	R8	B-3	S1MP1	D-3
Q1	D-5	R9	B-2	S1MP2	D-2
Q2	D-5	R10	C-5	TP1	E-4
Q3	E-5	R11	C-4	TP2	B-2

1701A-A-10

Figure 8-40. Delayed Sweep Time Assembly A6A6 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER . . . . . INT
   SWEEP DISPLAY . . . . . MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVEL . . . . . CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

Figure 8-41. Delayed Sweep Time Measurement Conditions

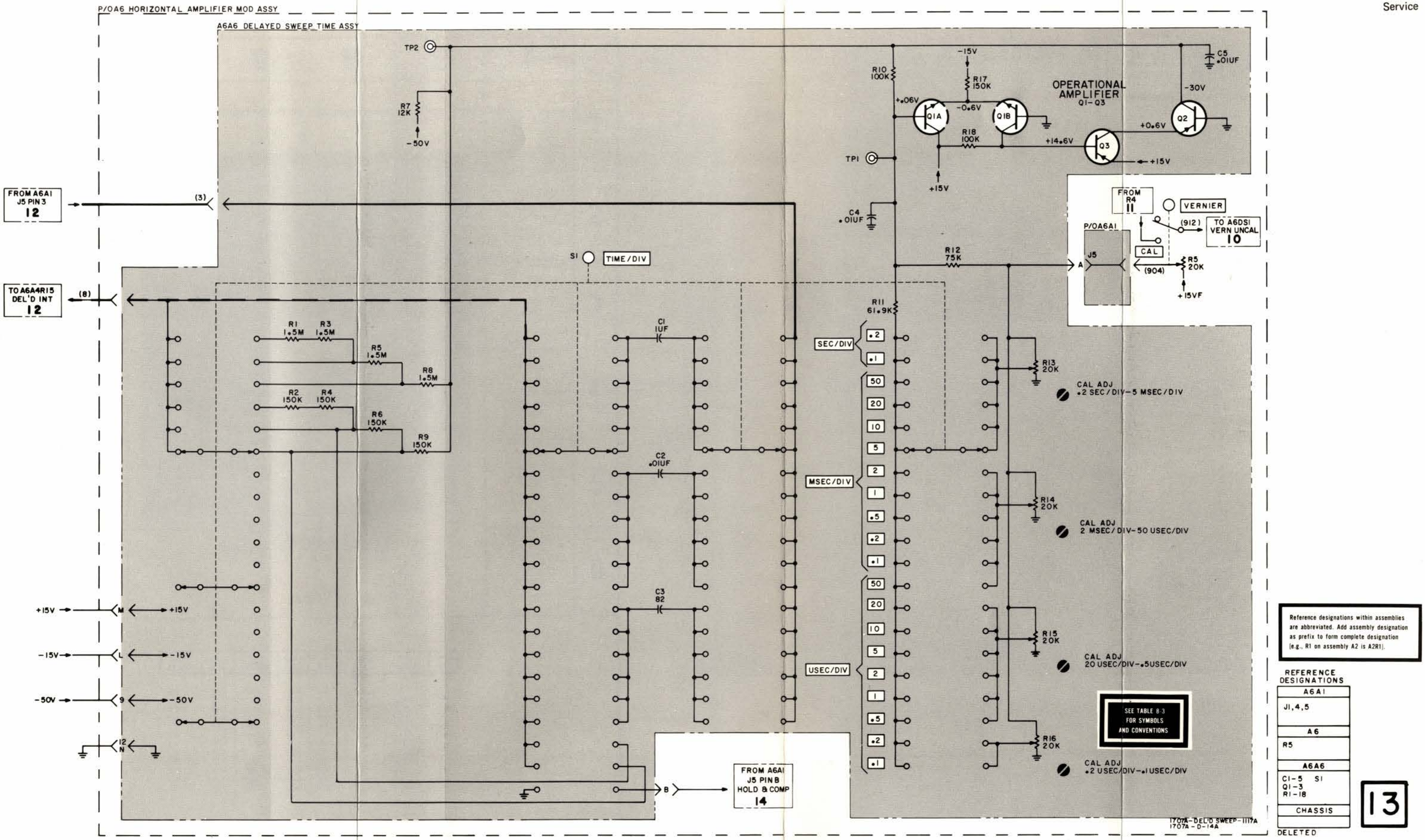
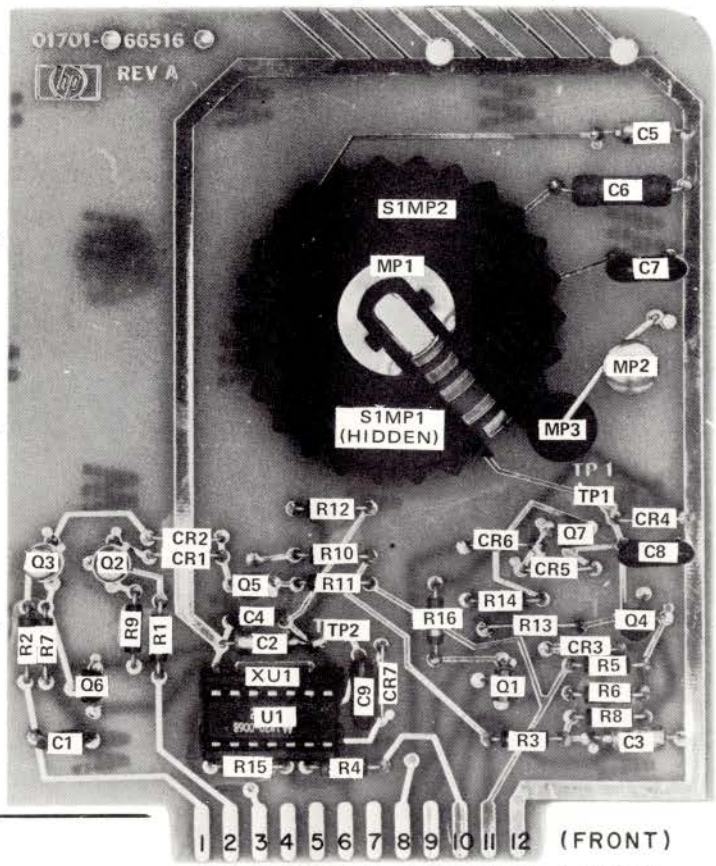


Figure 8-42.
Delayed Sweep Time Assembly A6A6

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	CR4	E-4	Q6	B-5	R11	C-4
C2	C-5	CR5	E-4	Q7	E-4	R12	C-4
C3	E-5	CR6	D-4	R1	B-5	R13	D-4
C4	C-4	CR7	D-5	R2	B-5	R14	D-4
C5	E-2	MP1	D-3	R3	D-5	R15	C-5
C6	E-2	MP2	E-3	R4	C-5	R16	D-4
C7	E-3	MP3	E-3	R5	E-5	S1MP1	D-3
C8	E-4	Q1	D-5	R6	E-5	S1MP2	D-2
C9	D-5	Q2	B-4	R7	B-5	TP1	E-4
CR1	C-4	Q3	B-4	R8	E-5	TP2	C-5
CR2	C-4	Q4	E-4	R9	B-5	U1	C-5
CR3	E-5	Q5	C-4	R10	C-4	XU1	C-5

1701A—A—13

Figure 8-43. Holdoff and Comparator A6A7 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

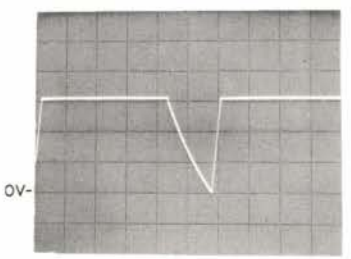
1. Set:
   SWEEP MODE AUTO/SINGLE/X1
   TRIGGER ..... INT
   SWEEP DISPLAY ..... MAIN SWEEP
   MAIN/DELAYED TRIGGER LEVELS ..... CW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

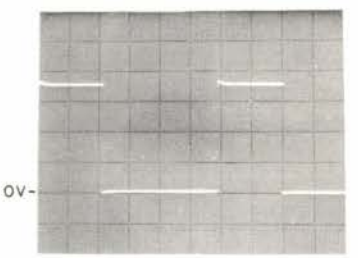
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER ..... INT
   Sweep display ..... DELAYED SWEEP
   SLOPE ..... +
   MAIN TIME/DIV..... .2 mSEC
   DELAYED TIME/DIV ..... .1 mSEC

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



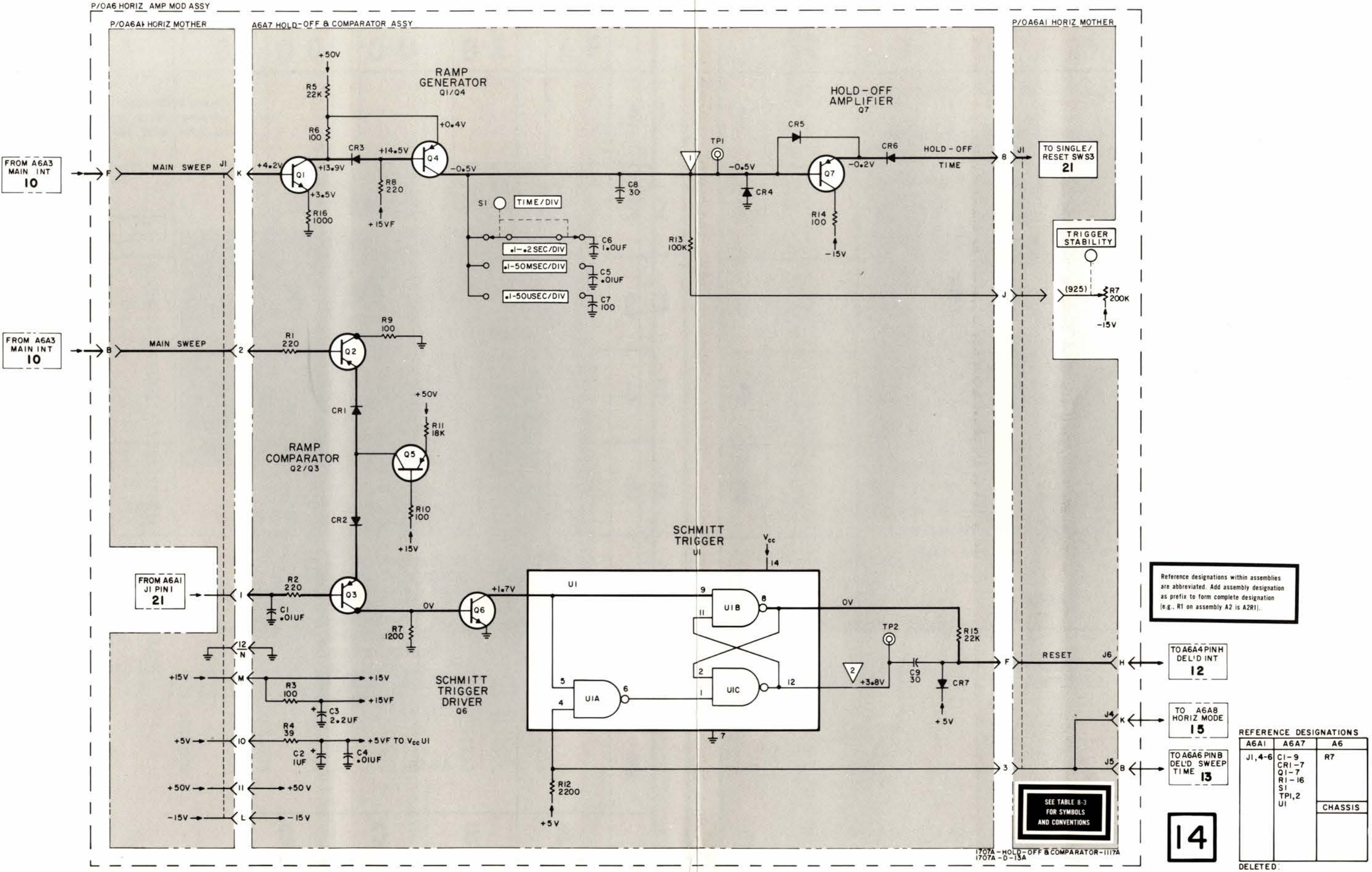
1 5V/DIV
0.5MSEC/DIV



2 1V/DIV
0.5MSEC/DIV

1701A-A-51

Figure 8-44. Holdoff and Comparator Measurement Conditions and Waveforms



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

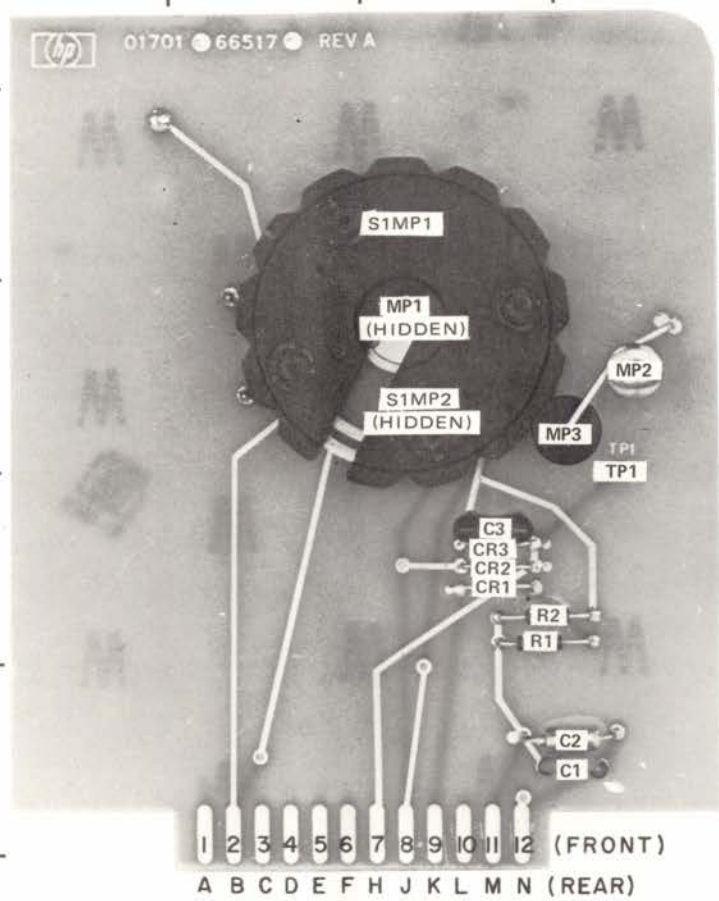
REFERENCE DESIGNATIONS

A6A1	A6A7	A6
J1,4-6	C1-9 CR1-7 Q1-7 R1-16 S1 TP1,2 U1	R7
		CHASSIS

DELETED

Figure 8-45.
Holdoff and Comparator A6A7

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

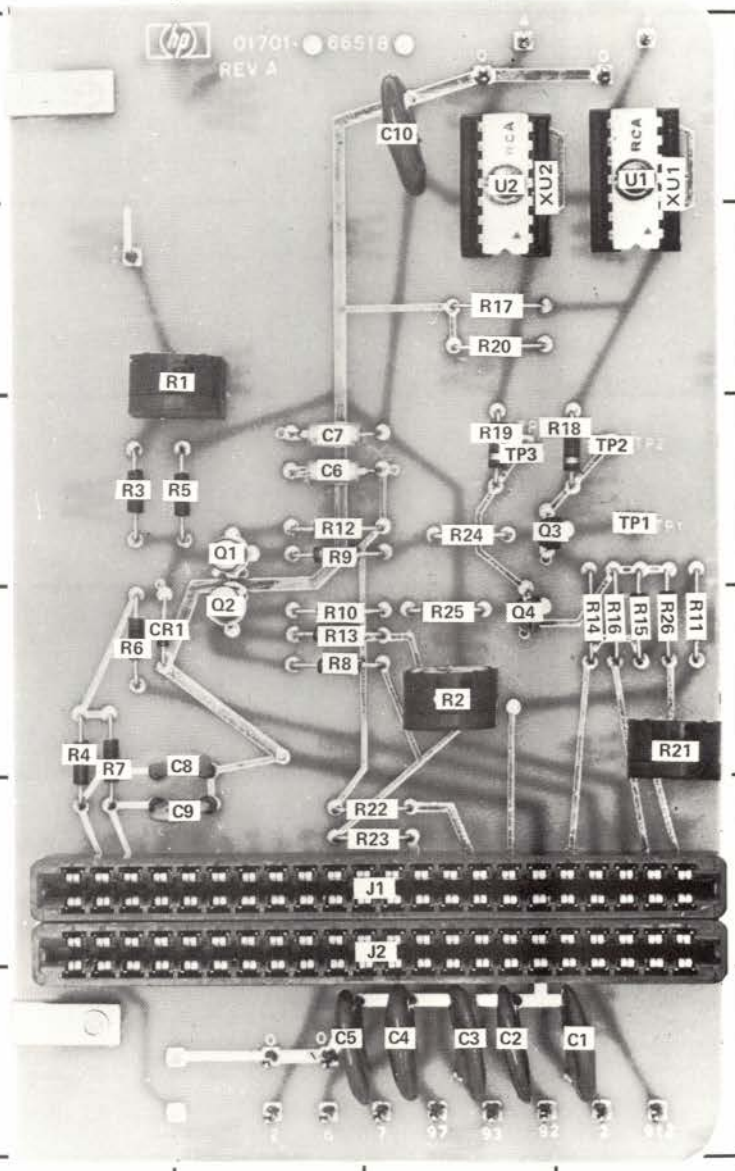


A6A8

REF DESIG	GRID LOC
C1	E-5
C2	E-5
C3	D-4
CR1	D-4
CR2	D-4
CR3	D-4
MP1	D-3
MP2	E-3
MP3	D-3
R1	D-4
R2	D-4
S1MP1	D-2
S1MP2	D-3
TP1	E-4

1701A-A-2

Figure 8-46. Horizontal Mode Assembly A6A8 Component Identification



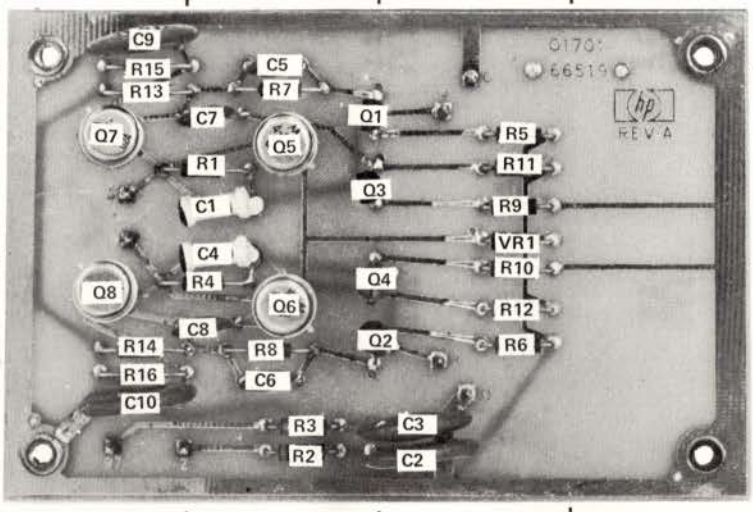
A6A9

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC
C1	D-7
C2	C-7
C3	C-7
C4	C-7
C5	B-7
C6	B-4
C7	B-4
C8	B-5
C9	B-6
C10	C-2
CR1	A-5
J1	C-6
J2	C-6
Q1	B-4
Q2	B-5
Q3	C-4
Q4	C-5
R1	A-3
R2	C-5
R3	A-4
R4	A-5
R5	B-4
R6	A-5
R7	A-5
R8	B-5
R9	B-4
R10	B-5
R11	D-5
R12	B-4
R13	B-5
R14	D-5
R15	D-5
R16	D-5
R17	C-3
R18	D-4
R19	C-4
R20	C-3
R21	D-5
R22	C-6
R23	C-6
TP1	D-4
TP2	D-4
TP3	C-4
U1	D-2
U2	C-2
XU1	D-2
XU2	C-2

1701A-A-1

Figure 8-47. Horizontal Preamplifier Assembly A6A9 Component Identification



A6A10

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-3	C8	C-4	Q5	C-3	R4	C-4	R11	D-3
C2	D-4	C9	B-2	Q6	C-4	R5	D-3	R12	D-4
C3	D-4	C10	B-4	Q7	B-3	R6	D-4	R13	B-3
C4	C-3	Q1	C-3	Q8	B-4	R7	C-3	R14	B-4
C5	C-2	Q2	C-4	R1	C-3	R8	C-4	R15	B-3
C6	C-4	Q3	C-3	R2	C-4	R9	D-3	R16	B-4
C7	C-3	Q4	C-4	R3	C-4	R10	D-4	VR1	D-3

1701A-A-11

Figure 8-48. Horizontal Output Amplifier Assembly A6A10 Component Identification

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE AUTO/X1
   TRIGGER . . . . . INT
   Sweep display . . . . . MAIN SWEEP
   SLOPE . . . . . +
   TIME/DIV . . . . . .2 mSEC

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.

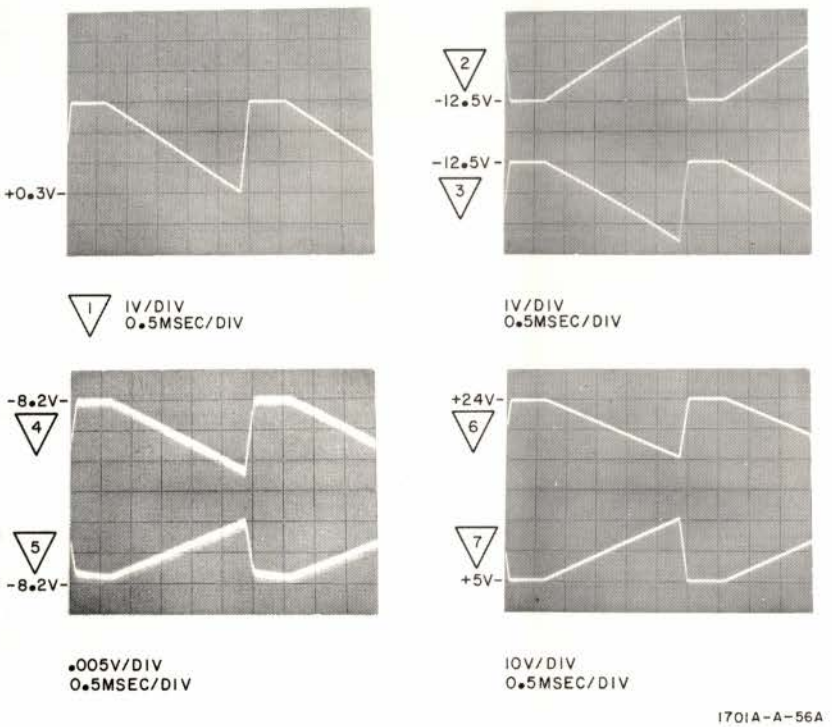
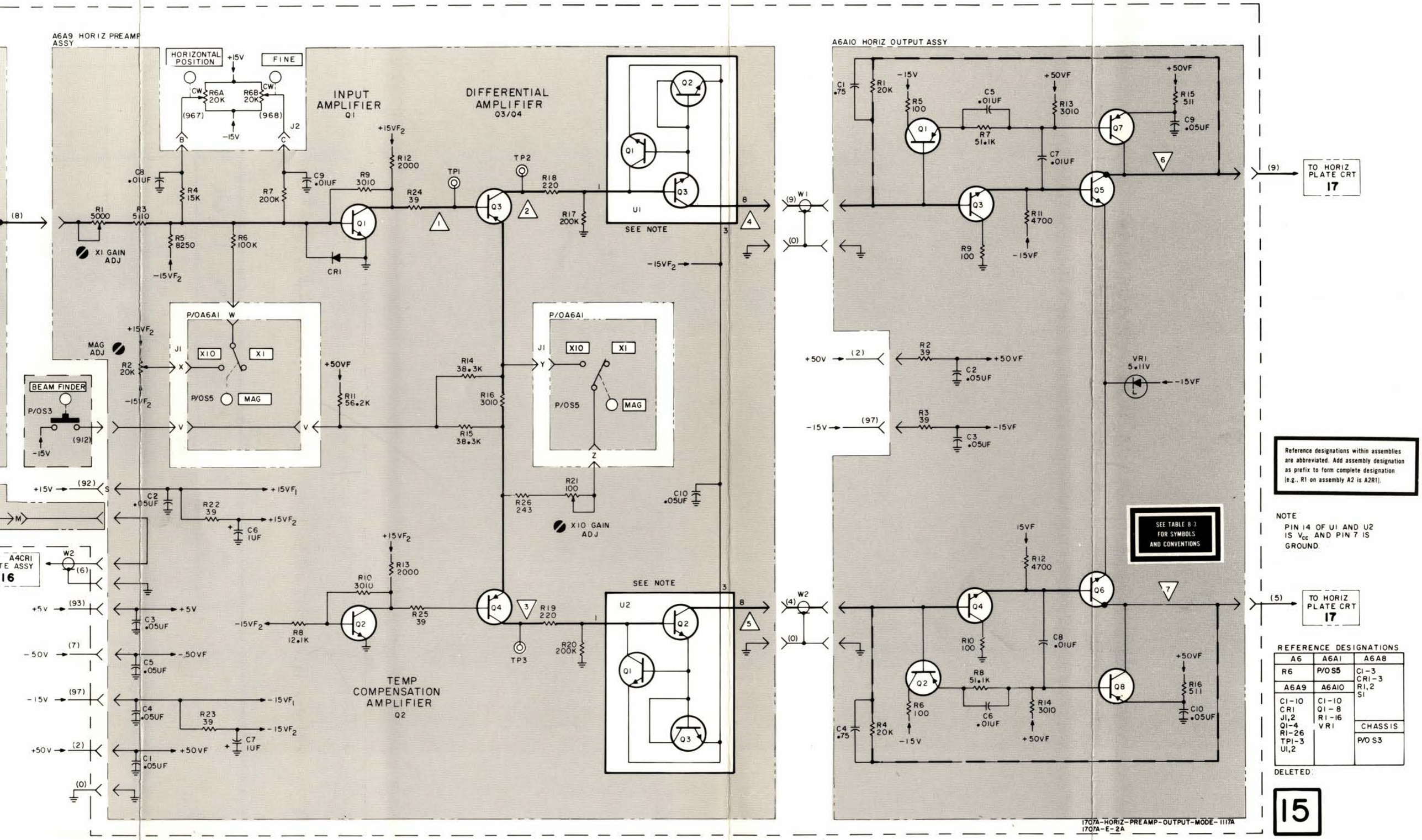


Figure 8-49. Horizontal Preamplifier and Output Amplifier Measurement Conditions and Waveforms



Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

NOTE
PIN 14 OF U1 AND U2 IS V_{cc} AND PIN 7 IS GROUND.

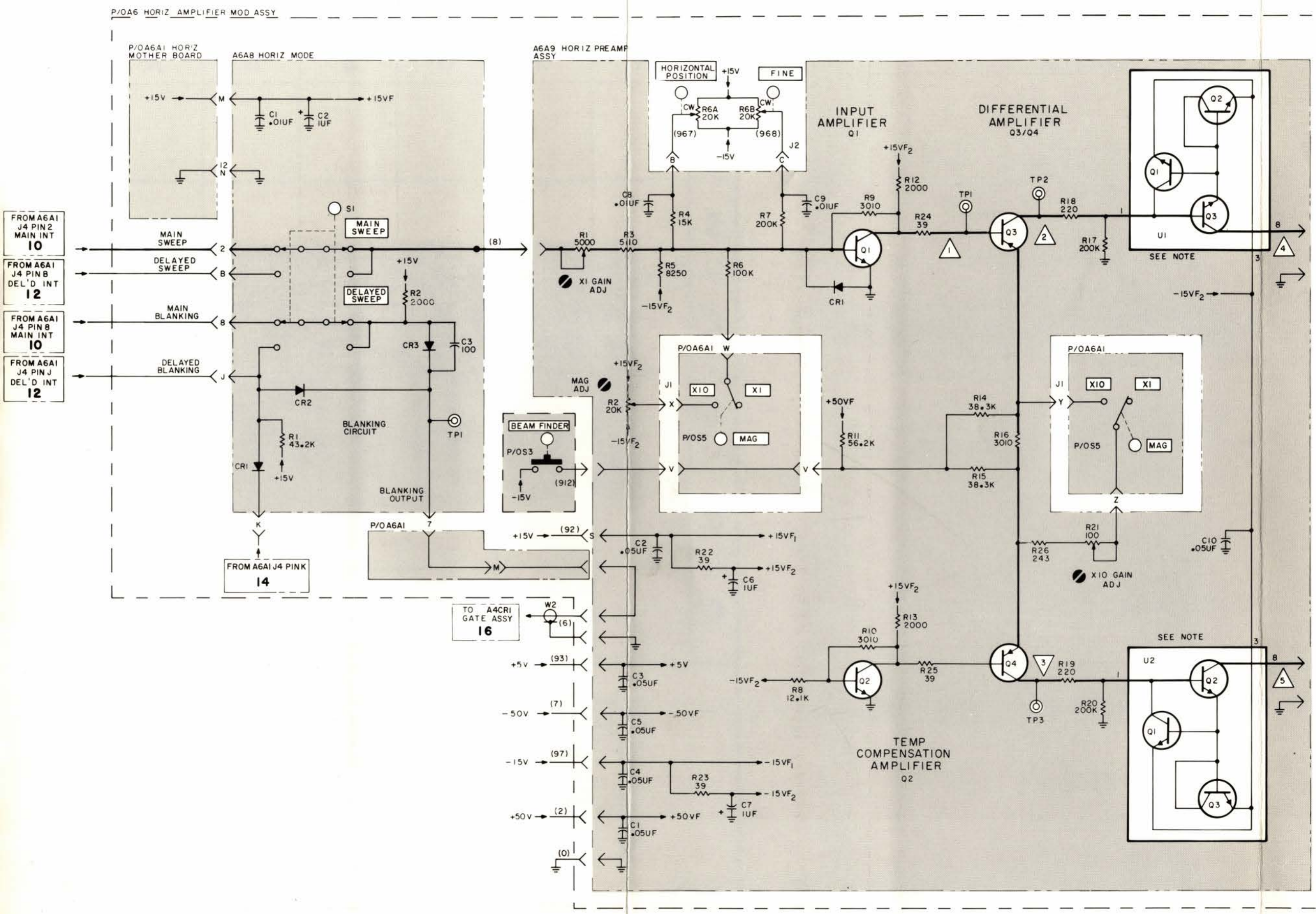
REFERENCE DESIGNATIONS

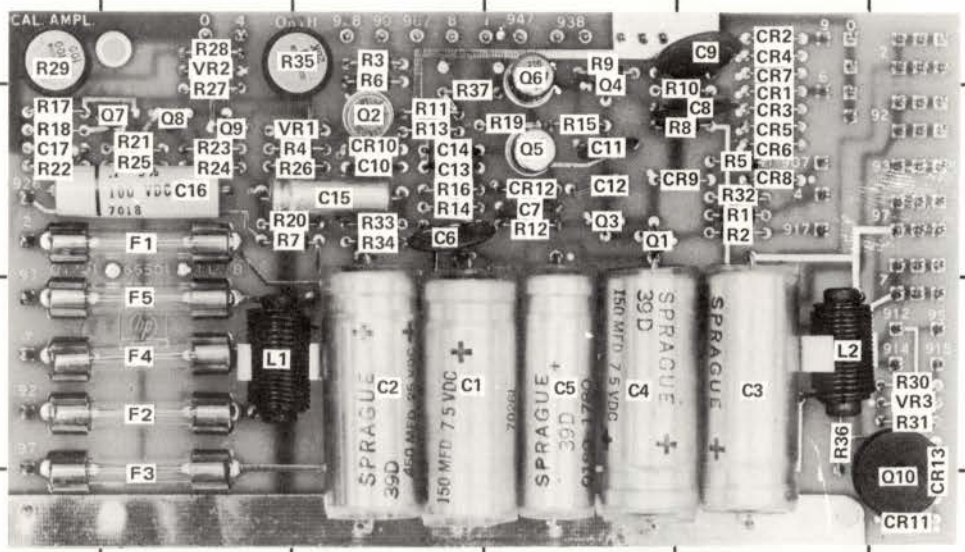
A6	A6A1	A6A8
R6	P/O S5	C1-3 CR1-3 R1,2 S1
A6A9	A6A10	
C1-10 CR1 J1,2 Q1-4 R1-26 TP1-3 U1,2	C1-10 Q1-8 R1-16 VR1	CHASSIS P/O S3

DELETED

15

Figure 8-50.
Horizontal Mode A6A8, Preamplifier A6A9 and Output Amplifier A6A10


P/OA6 HORIZ AMPLIFIER MOD ASSY
P/OA6A1 HORIZ MOTHER BOARD
A6A8 HORIZ MODE
A6A9 HORIZ PREAMP ASSY
FROM A6A1 J4 PIN 2 MAIN INT 10
FROM A6A1 J4 PIN B DEL'D INT 12
FROM A6A1 J4 PIN 8 MAIN INT 10
FROM A6A1 J4 PIN J DEL'D INT 12
MAIN SWEEP
DELAYED SWEEP
MAIN BLANKING
DELAYED BLANKING
BLANKING CIRCUIT
BLANKING OUTPUT
BEAM FINDER
FROM A6A1 J4 PIN K 14
TO A4CR1 GATE ASSY 16
HORIZONTAL POSITION
FINE
INPUT AMPLIFIER Q1
DIFFERENTIAL AMPLIFIER Q3/Q4
X1 GAIN ADJ
MAG ADJ
X10 GAIN ADJ
SEE NOTE
TEMP COMPENSATION AMPLIFIER Q2



A4

Circuit boards have plated-through component holes. This permit soldering from either side of the board.

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	C15	C-3	CR12	D-3	Q6	D-2	R11	C-3	R26	C-3
C2	C-4	C16	B-3	CR13	F-5	Q7	B-3	R12	D-3	R27	B-3
C3	E-4	C17	A-3	F1	B-3	Q8	B-3	R13	C-3	R28	B-2
C4	D-4	CR1	E-3	F2	B-4	Q9	B-3	R14	C-3	R29	A-2
C5	D-4	CR2	E-2	F3	B-4	Q10	F-5	R15	D-3	R30	F-4
C6	C-3	CR3	E-3	F4	B-4	R1	E-3	R16	C-3	R31	F-4
C7	D-3	CR4	E-2	F5	B-4	R2	E-3	R17	A-3	R32	E-3
C8	E-3	CR5	E-3	L1	B-4	R3	C-2	R18	A-3	R33	C-3
C9	E-2	CR6	E-3	L2	E-4	R4	C-3	R19	D-3	R34	C-3
C10	C-3	CR7	E-2	Q1	D-3	R5	E-3	R20	B-3	R35	C-2
C11	D-3	CR8	E-3	Q2	C-3	R6	C-2	R21	B-3	R36	E-4
C12	D-3	CR9	E-3	Q3	D-3	R7	C-3	R22	A-3	R37	C-3
C13	C-3	CR10	C-3	Q4	D-2	R8	E-3	R23	B-3	VR1	C-3
C14	C-3	CR11	F-5	Q5	D-3	R9	D-2	R24	B-3	VR2	B-2
						R10	E-3	R25	B-3	VR3	F-4

1701A-A-59

Figure 8-51. Gate Assembly A4 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   SWEEP MODE . . . . . SINGLE
   INTENSITY . . . . . normal

5. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   DISPLAY . . . . . CHOP
   Vertical coupling (A and B) . . . . . GND
   SWEEP MODE . . . . . AUTO
   INTENSITY . . . . . normal

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.

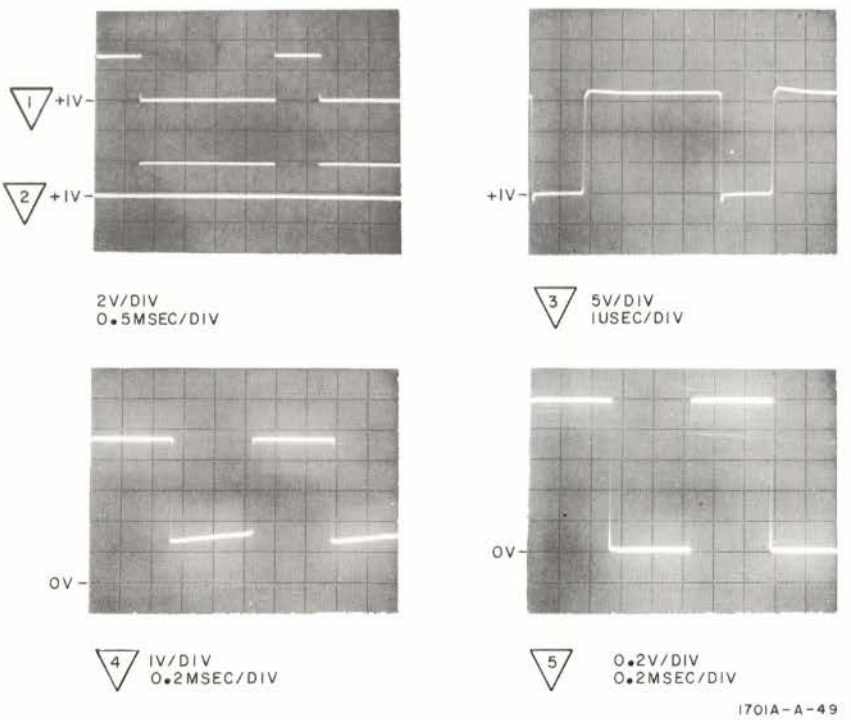
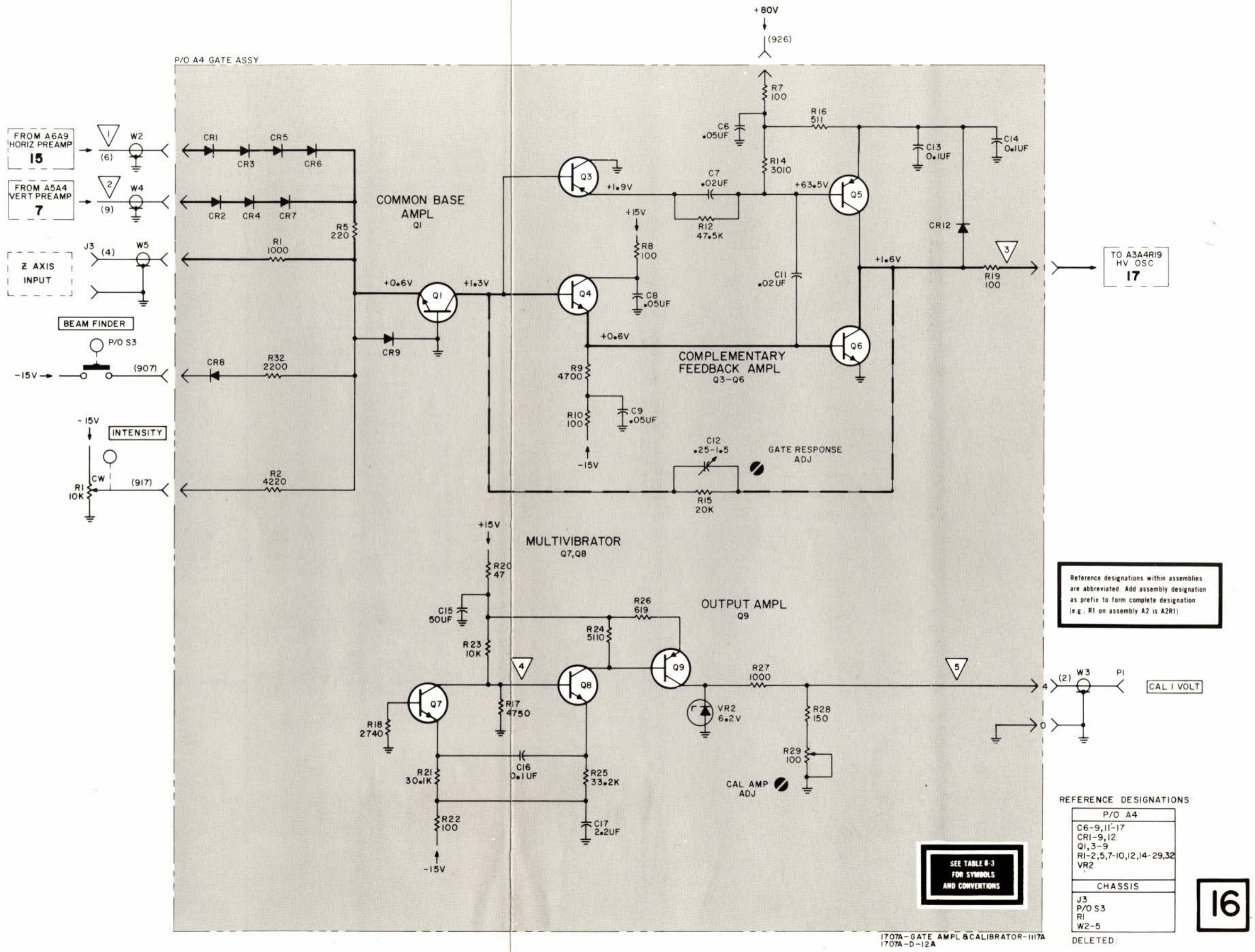


Figure 8-52. Gate Measurement Conditions and Waveforms



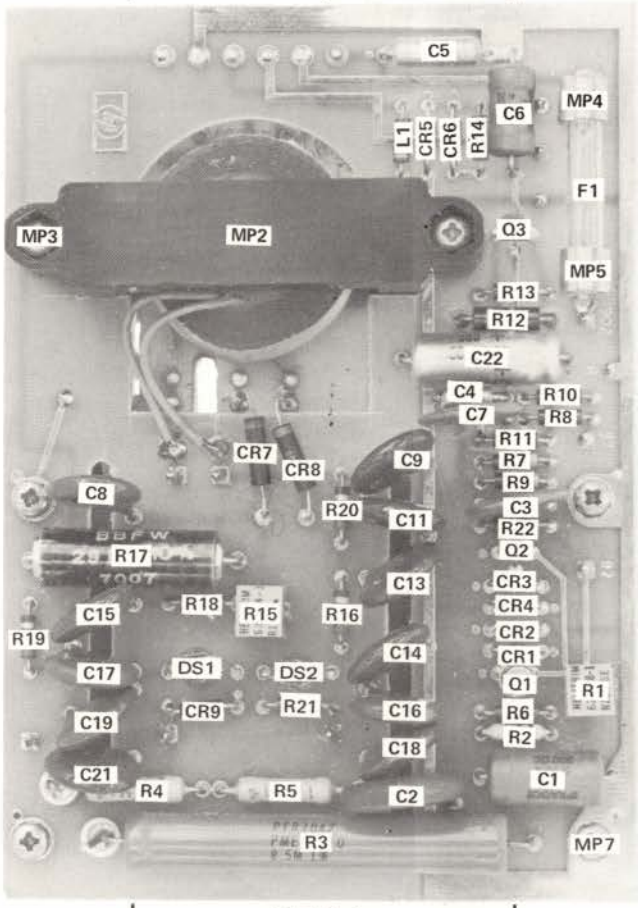
REFERENCE DESIGNATIONS

P/O A4
C6-9,11-17 CR1-9,12 Q1,3-9 R1-2,5,7-10,12,14-29,32 VR2
CHASSIS
J3 P/O S3 R1 W2-5

DELETED:

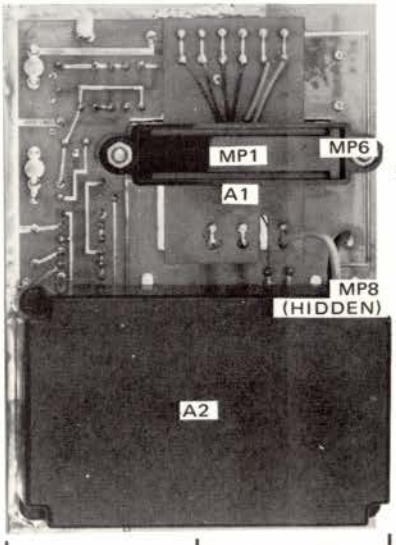
16

Figure 8-53.
Gate Assembly A4



A3A4

A3A4A1



A3A4A2

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1	C-7	L1	C-1
A2	B-8	MP1	C-6
C1	D-5	MP2	B-2
C2	C-5	MP3	A-2
C3	C-3	MP4	D-1
C4	C-3	MP5	D-2
C5	C-1	MP6	C-6
C6	C-1	MP7	D-5
C7	C-3	MP8	C-7
C8	A-3	Q1	C-4
C9	C-3	Q2	C-3
		Q3	C-2
C11	C-3	R1	D-4
		R2	C-4
C13	C-4	R3	B-5
C14	C-4	R4	A-5
C15	A-4	R5	B-5
C16	C-4	R6	C-4
C17	A-4	R7	C-3
C18	C-4	R8	C-3
C19	A-4	R9	C-3
		R10	C-3
C21	A-4	R11	C-2
CR1	C-4	R12	C-2
CR2	C-4	R13	C-2
CR3	C-4	R14	C-1
CR4	D-4	R15	B-4
CR5	C-1	R16	C-4
CR6	C-1	R17	B-4
CR7	B-3	R18	A-4
CR8	B-3	R19	A-4
DS1	B-4	R20	B-3
DS2	B-4	R21	B-5
F1	D-2	R22	C-3

1707A-R-31

Figure 8-54. High Voltage Oscillator A3A4 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

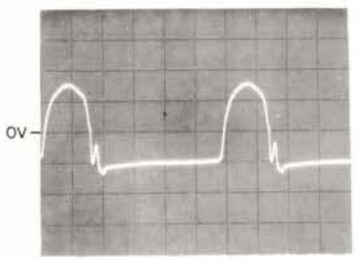
1. Set:
   POWER . . . . . on
   INTENSITY . . . . . CCW

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

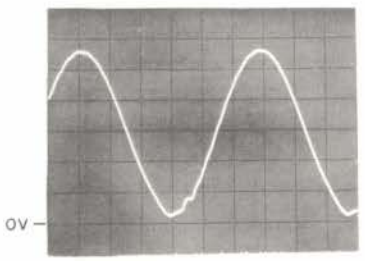
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   POWER . . . . . on
   INTENSITY . . . . . CCW

2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed setting are shown below each waveform photograph.



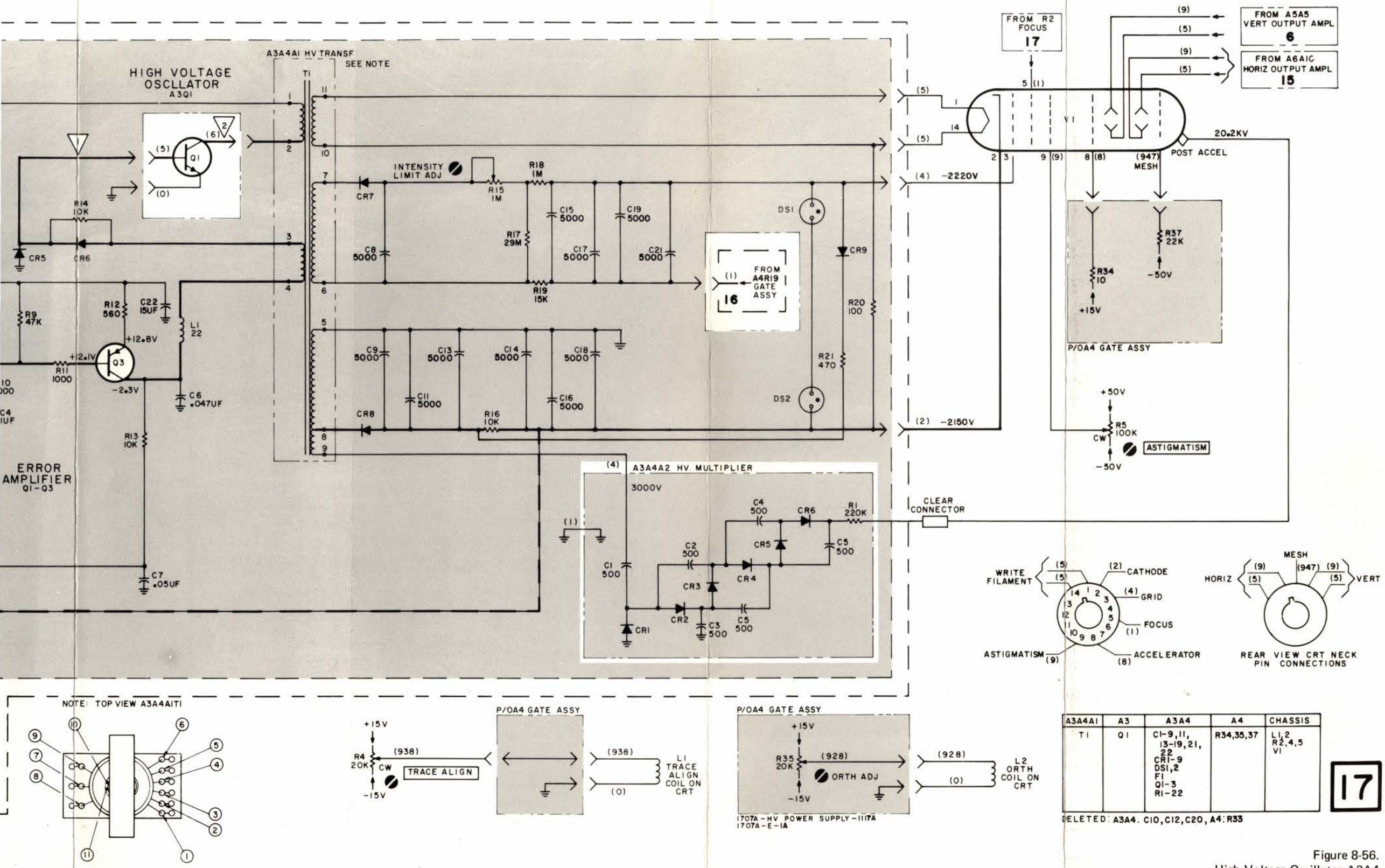
1 0.5V/DIV
5USEC/DIV



2 5V/DIV
5USEC/DIV

1701A-A-45

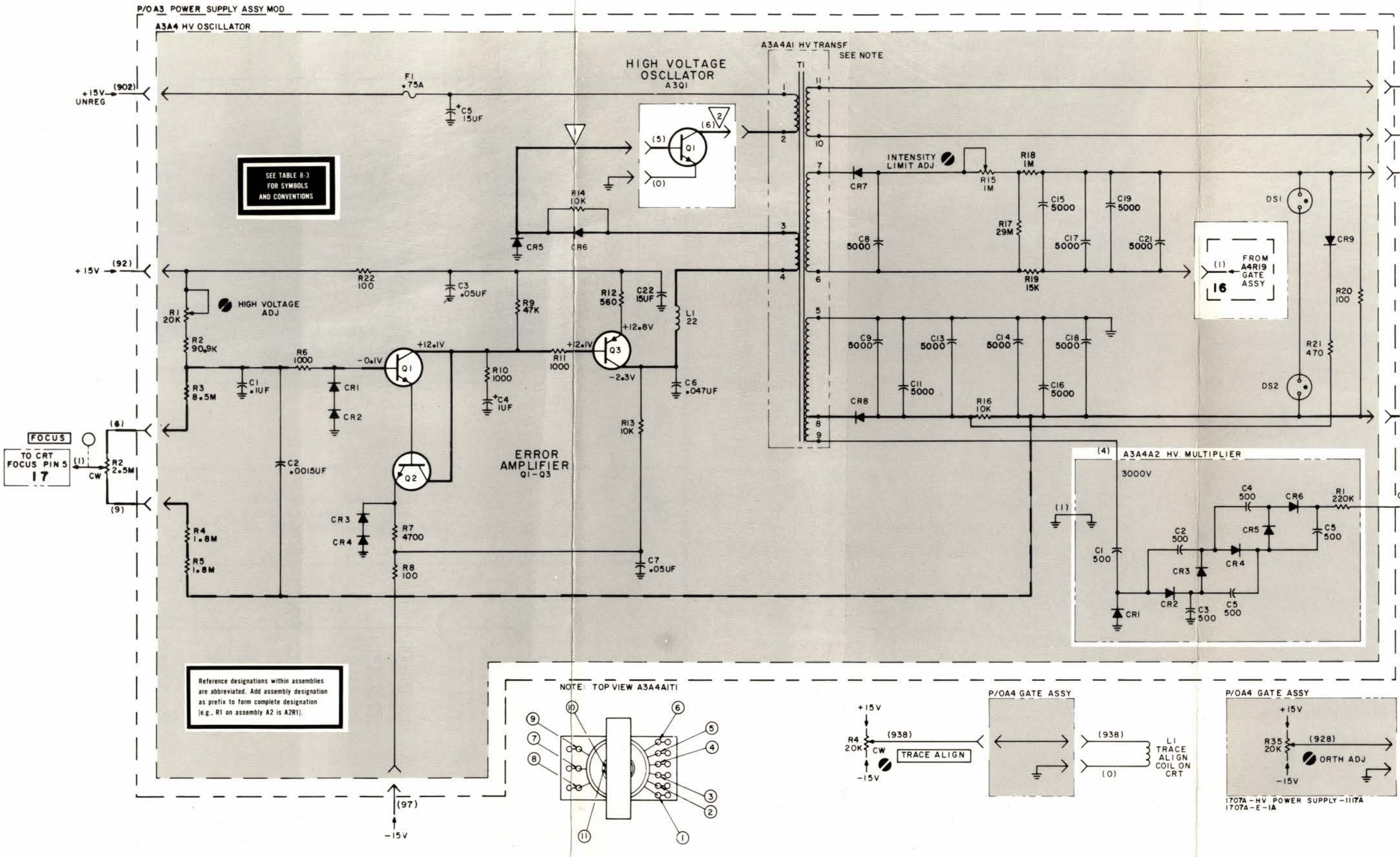
Figure 8-55. High Voltage Oscillator Measurement Conditions and Waveforms

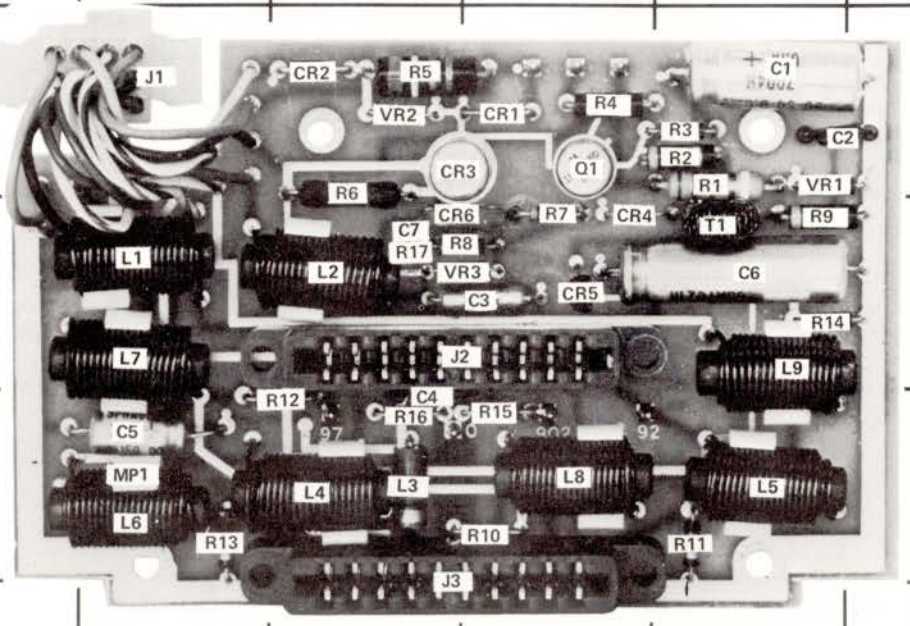


A3A4A1	A3	A3A4	A4	CHASSIS
T1	Q1	C1-9,11, 13-19,21, 22 CR1-9 DS1,2 F1 Q1-3 R1-22	R34,35,37	L1,2 R2,4,5 V1

DELETED: A3A4. C10, C12, C20, A4: R33

Figure 8-56.
High Voltage Oscillator A3A4


P/O A3 POWER SUPPLY ASSY MOD
A3A4 HV OSCILLATOR
+15V UNREG (902)
F1 .75A
C5 15UF
HIGH VOLTAGE OSCILLATOR A3Q1
Q1
(5)
(6)
(0)
SEE TABLE 8-3 FOR SYMBOLS AND CONVENTIONS
R14 10K
CR5
CR6
+15V (92)
R22 100
C3 .05UF
R9 47K
R12 560
C22 15UF
+12.8V
L1 22
HIGH VOLTAGE ADJ
R1 20K
R2 90.9K
R6 1000
+12.1V
-0.1V
Q1
R10 1000
R11 1000
+12.1V
Q3
-2.3V
C6 .047UF
R3 8.5M
C1 .1UF
CR1
CR2
C4 1UF
R13 10K
FOCUS
TO CRT FOCUS PIN 5
17
(1)
CW
R2 2.5M
(6)
(9)
C2 .0015UF
Q2
ERROR AMPLIFIER Q1-Q3
CR3
CR4
R7 4700
R4 1.8M
R5 1.8M
R8 100
C7 .05UF
(97)
-15V
A3A4A1 HV TRANSF
SEE NOTE
T1
INTENSITY LIMIT ADJ
CR7
R15 1M
R18 1M
C15 5000
C19 5000
R17 29M
C17 5000
C21 5000
C8 5000
R19 15K
DS1
CR9
FROM A4R19 GATE ASSY
16
R20 100
C9 5000
C13 5000
C14 5000
C18 5000
R21 470
C11 5000
C16 5000
DS2
CR8
R16 10K
A3A4A2 HV. MULTIPLIER
3000V
(4)
(1)
C4 500
CR6
R1 220K
C2 500
CR5
C5 500
C1 500
CR4
CR3
CR2
C3 500
C5 500
CR1
Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).
NOTE: TOP VIEW A3A4A1T1
+15V
R4 20K
CW
(938)
TRACE ALIGN
-15V
P/O A4 GATE ASSY
(938)
(0)
L1 TRACE ALIGN COIL ON CRT
P/O A4 GATE ASSY
+15V
R35 20K
(928)
ORTH ADJ
-15V
1707A-HV POWER SUPPLY-1117A
1707A-E-1A



A3A1

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	CR4	D-3	L4	C-4	R2	E-2	R11	E-4
C2	E-2	CR5	D-3	L5	E-4	R3	E-2	R12	C-4
C3	D-3	CR6	C-3	L6	B-4	R4	D-2	R13	B-4
C4	C-4	J1	B-2	L7	B-3	R5	C-2	R14	E-3
C5	B-4	J2	C-3	L8	D-4	R6	C-2	R15	D-4
C6	E-3	J3	C-5	L9	E-3	R7	D-3	R16	C-4
C7	C-3	L1	B-3	MP1	B-4	R8	D-3	R17	C-3
CR1	D-2	L2	C-3	Q1	D-2	R9	E-3	T1	E-3
CR2	C-2	L3	C-4	R1	E-2	R10	D-4	VR1	E-2
CR3	C-2							VR2	C-2
								VR3	D-3

1701A-A-8

Figure 8-57. Low Voltage Mother Board A3A1 Component Identification

DC VOLTAGE MEASUREMENT CONDITION

1. Set:
   POWER MODE . . . . . AC Line (115V ac)
   POWER . . . . . on

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

Figure 8-58. Low Voltage Power Supply Measurement Conditions

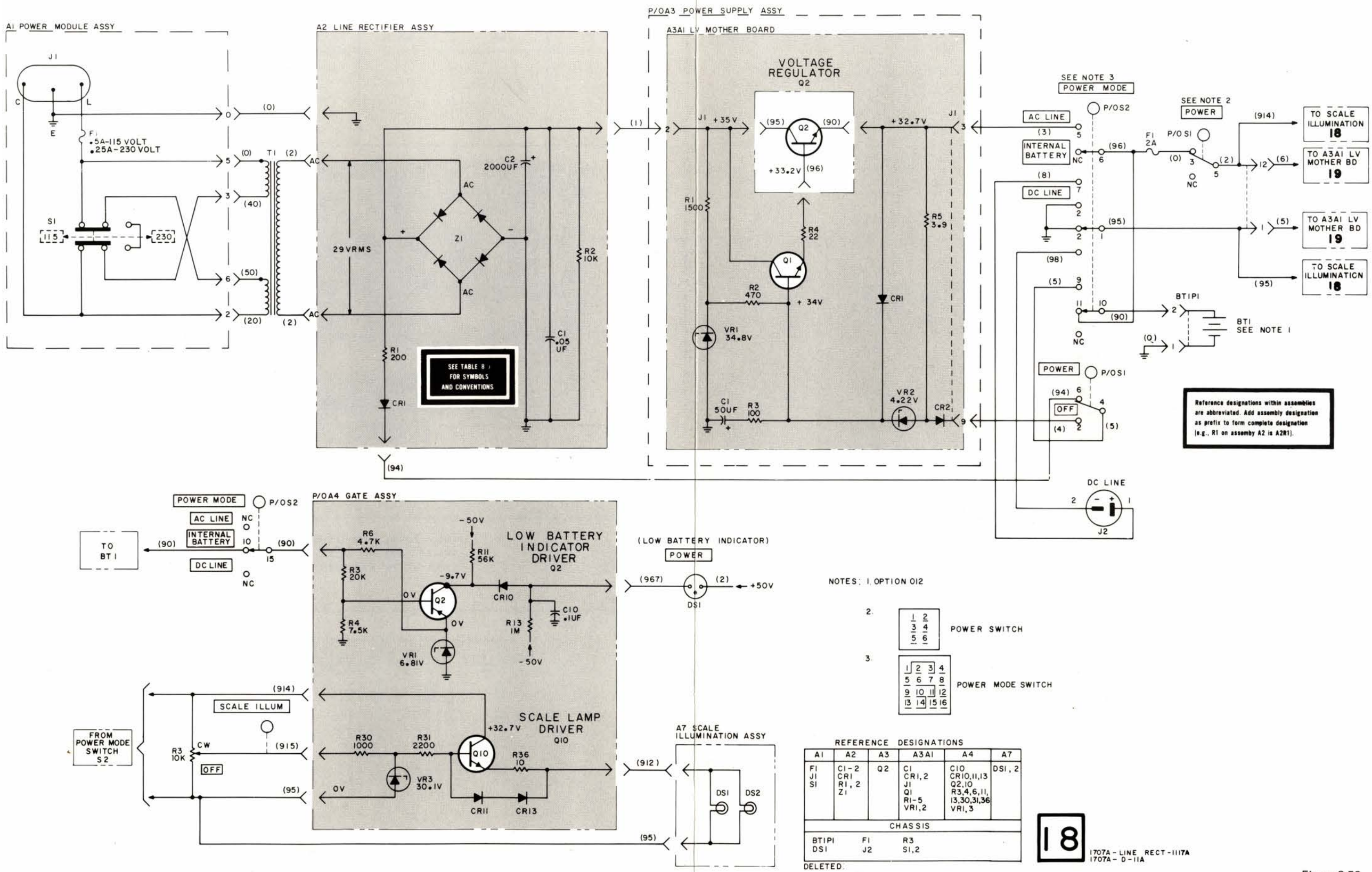
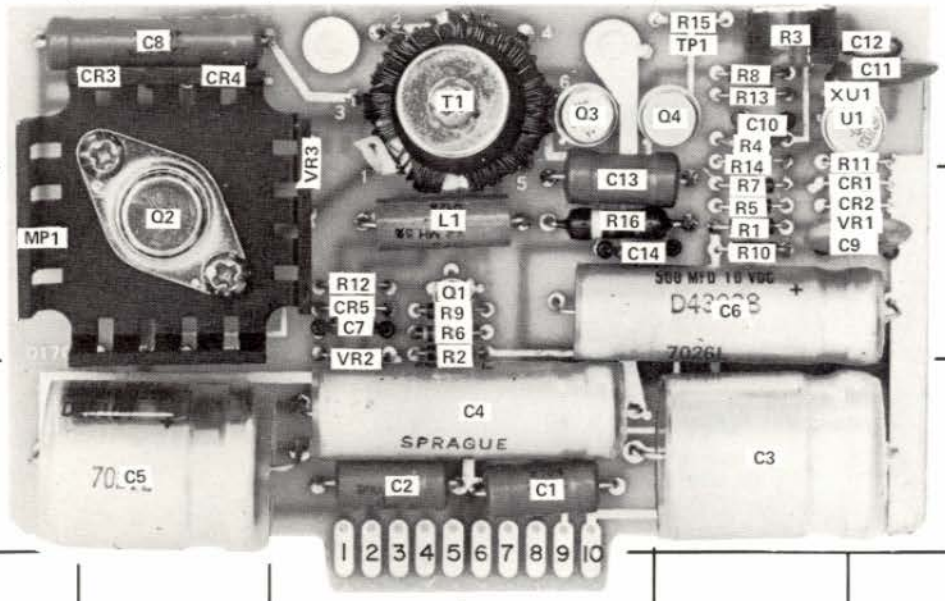


Figure 8-59.
Power Input and Line Rectifier



A3A2

Circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-4	C13	D-3	Q4	E-2	R12	C-3
C2	C-4	C14	D-3	R1	E-3	R13	E-2
C3	E-4	CR1	F-3	R2	C-3	R14	E-2
C4	D-4	CR2	F-3	R3	E-2	R15	E-2
C5	B-4	CR3	B-2	R4	E-2	R16	D-3
C6	E-3	CR4	B-2	R5	E-3	T1	C-2
C7	C-3	CR5	C-3	R6	C-3	TP1	E-2
C8	B-2	L1	C-3	R7	E-3	U1	F-2
C9	F-3	MP1	A-3	R8	E-2	VR1	F-3
C10	E-2	Q1	C-3	R9	C-3	VR2	C-3
C11	F-2	Q2	B-3	R10	E-3	VR3	C-3
C12	F-2	Q3	D-2	R11	F-2	XU1	E-2

1701A—A—9

Figure 8-60. Low Voltage Converter Assembly A3A2 Component Identification

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   POWER switch . . . . . on

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

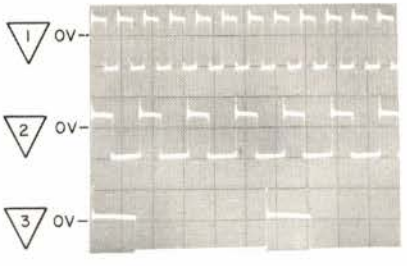
1. Set:
   POWER switch . . . . . on
   POWER MODE switch . . . . . DC LINE

2. Connect:
   EXT DC INPUT. . . . . 36 VDC
   observe ▽1

3. Connect:
   EXT DC INPUT. . . . . 24 VDC
   observe ▽2

4. Connect:
   EXT DC INPUT. . . . . 11.5 VDC
   observe ▽3

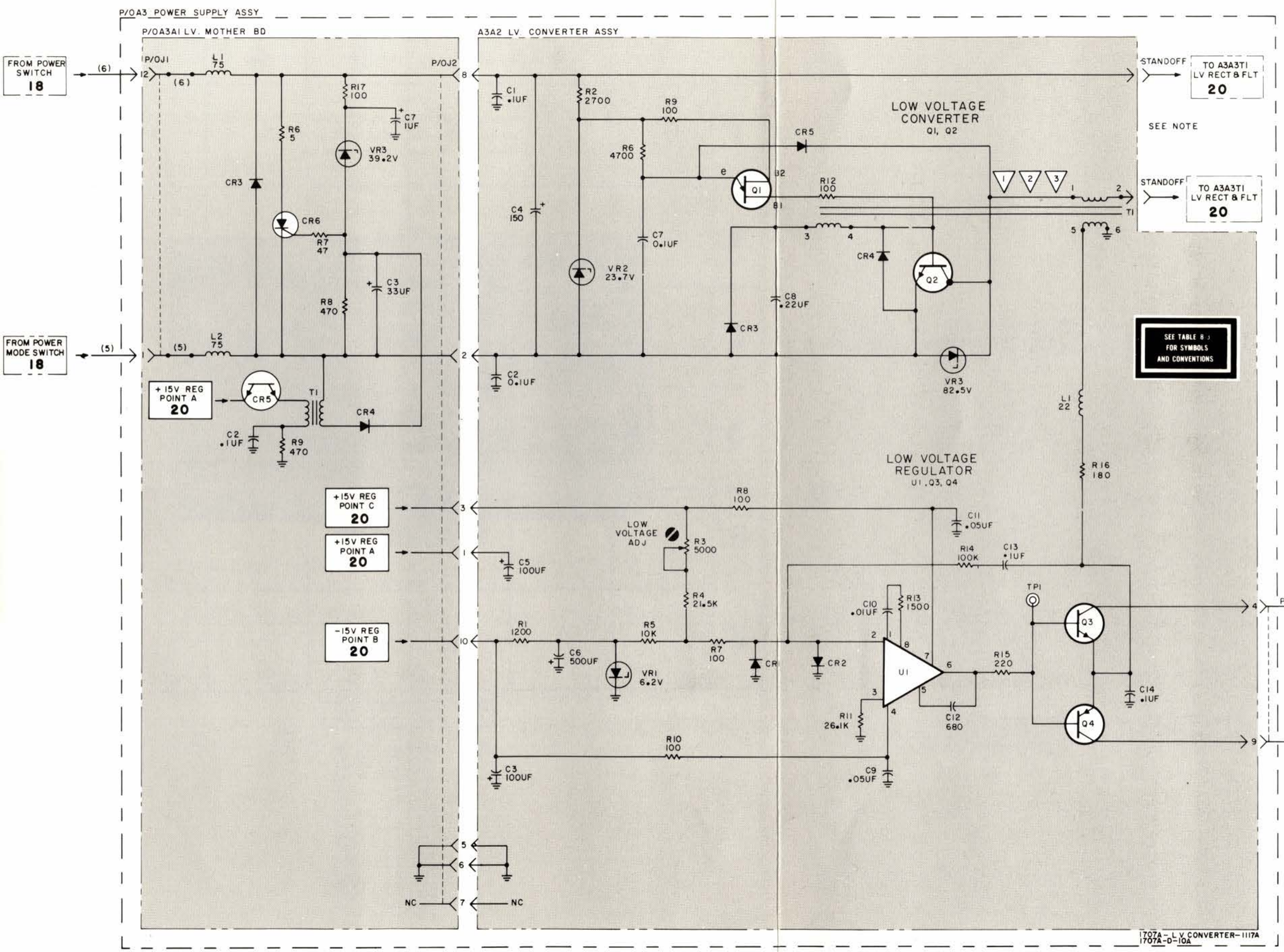
5. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



50V/DIV
10USEC/DIV

1701A-A-56B

Figure 8-61. Low Voltage Converter Measurement Conditions and Waveforms



NOTE

THE STANDOFFS ARE METAL CONDUCTORS PROVIDING ELECTRICAL CONNECTION BETWEEN THE A3A2 AND A3A3 ASSEMBLES.

Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

REFERENCE DESIGNATIONS

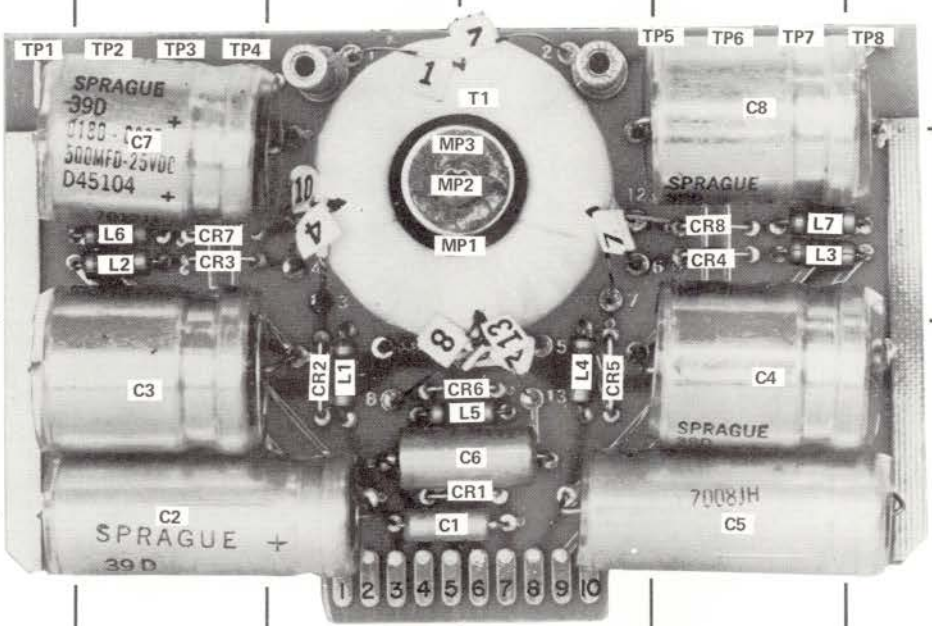
A3A1	A3A2
C2,3 CR3-6 J1,2 L1,2 R6-9 T1 VR3	C1-14 CR1-5 L1 Q1-4 R1-16 T1 U1 VR1-3
CHASSIS	

DELETED

19

Figure 8-62.
Low Voltage Converter A3A2

Circuit boards have plated-through component holes. This permits soldering from either side of the board.



A3A3

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-5	L2	B-3
C2	B-5	L3	E-3
C3	B-4	L4	D-4
C4	E-4	L5	D-4
C5	E-5	L6	B-3
C6	D-4	L7	E-3
C7	B-3	MP1	C-3
C8	E-2	MP2	C-3
CR1	D-4	MP3	C-3
CR2	C-4	T1	D-2
CR3	B-3	TP1	A-2
CR4	E-3	TP2	B-2
CR5	D-4	TP3	B-2
CR6	D-4	TP4	B-2
CR7	B-3	TP5	E-2
CR8	E-3	TP6	E-2
L1	C-4	TP7	E-2
		TP8	F-2

1701A-A-4

Figure 8-63. Line Rectifier and Filter A3A3 Identification

DC VOLTAGE MEASUREMENT CONDITIONS

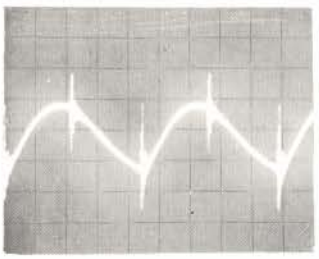
1. Set:
   POWER switch . . . . . on
   SCALE ILLUM . . . . . OFF

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

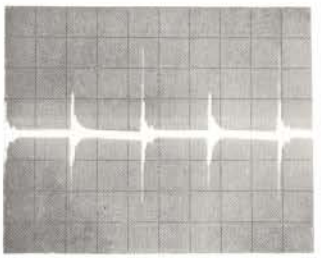
WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   POWER switch . . . . . on

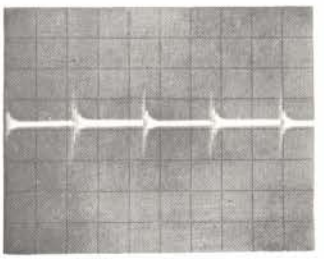
2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



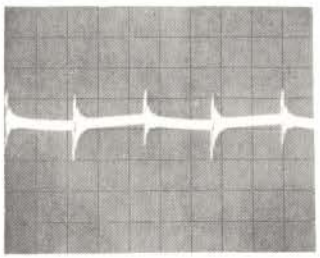
1 5MV/DIV 5USEC/DIV



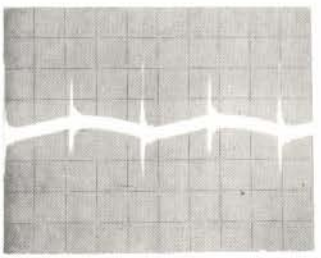
2 5MV/DIV 5USEC/DIV



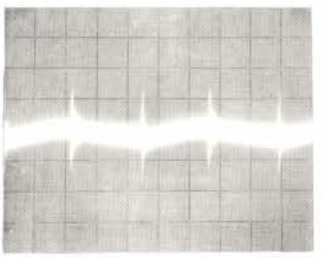
3 5MV/DIV 5USEC/DIV



4 5MV/DIV 5USEC/DIV



5 5MV/DIV 5USEC/DIV



6 5MV/DIV 5USEC/DIV

1701A-8-1

Figure 8-64. Gate Assembly Measurement Condtions and Waveforms

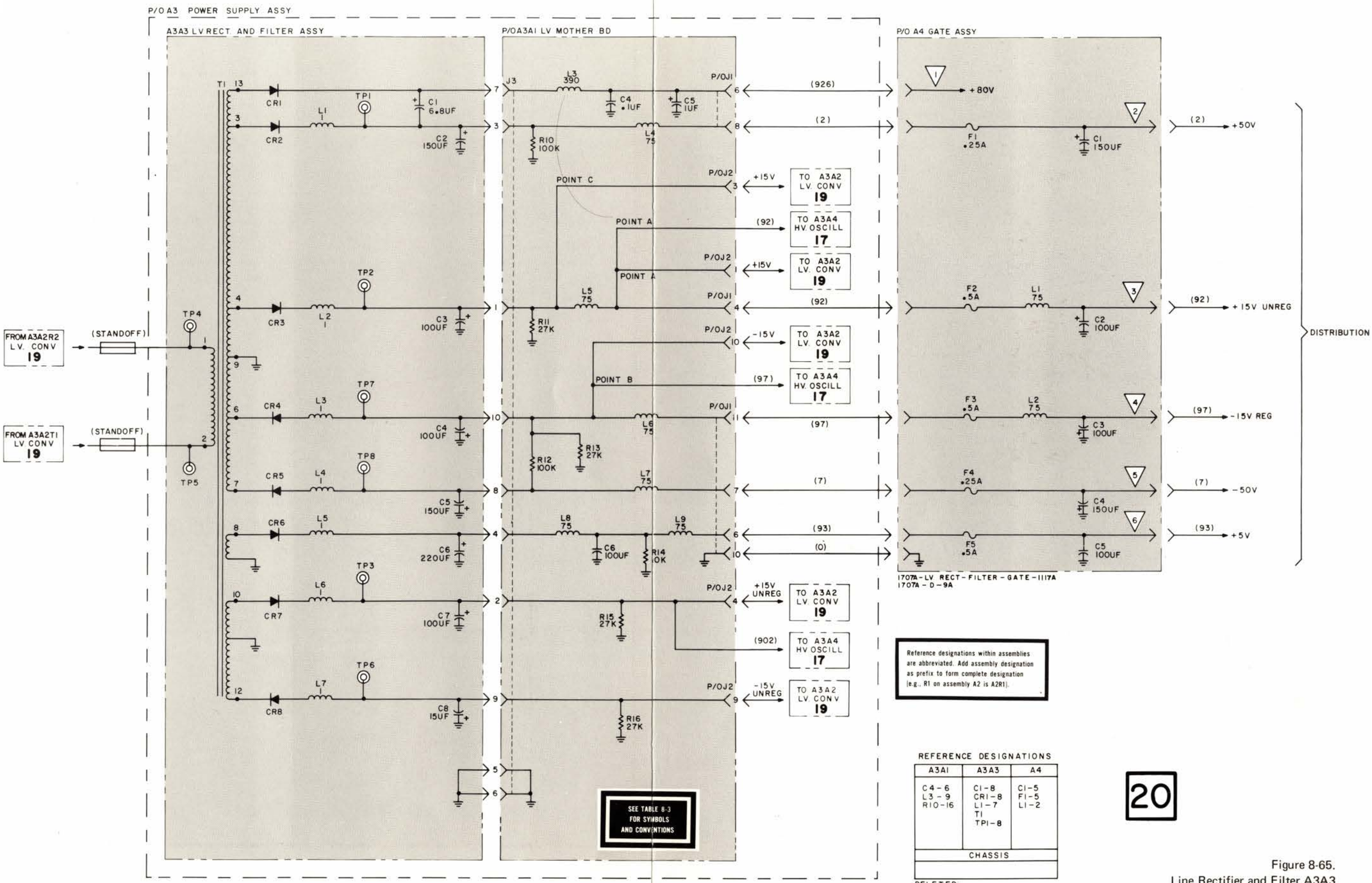


Figure 8-65.
Line Rectifier and Filter A3A3
8-57/8-58

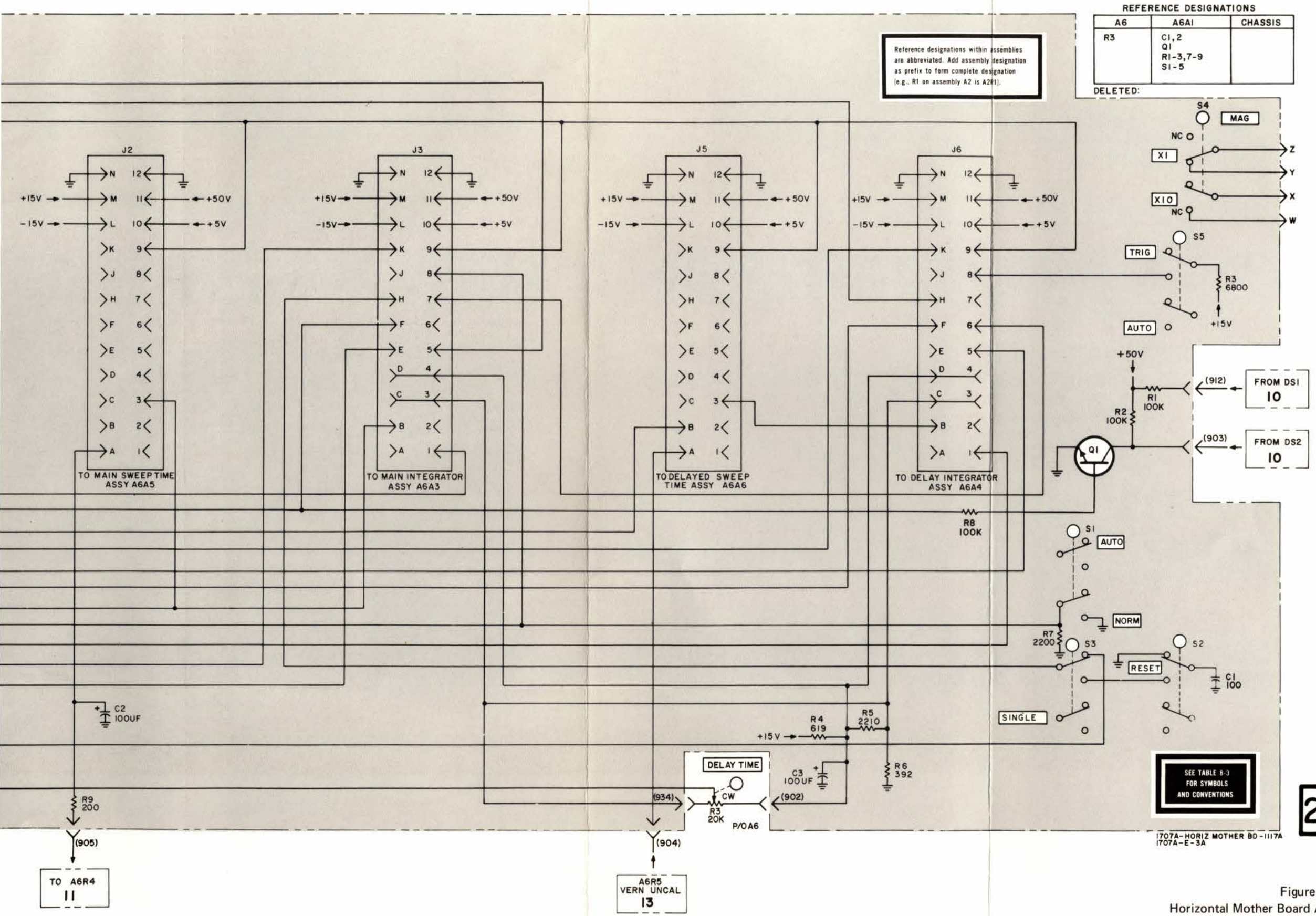
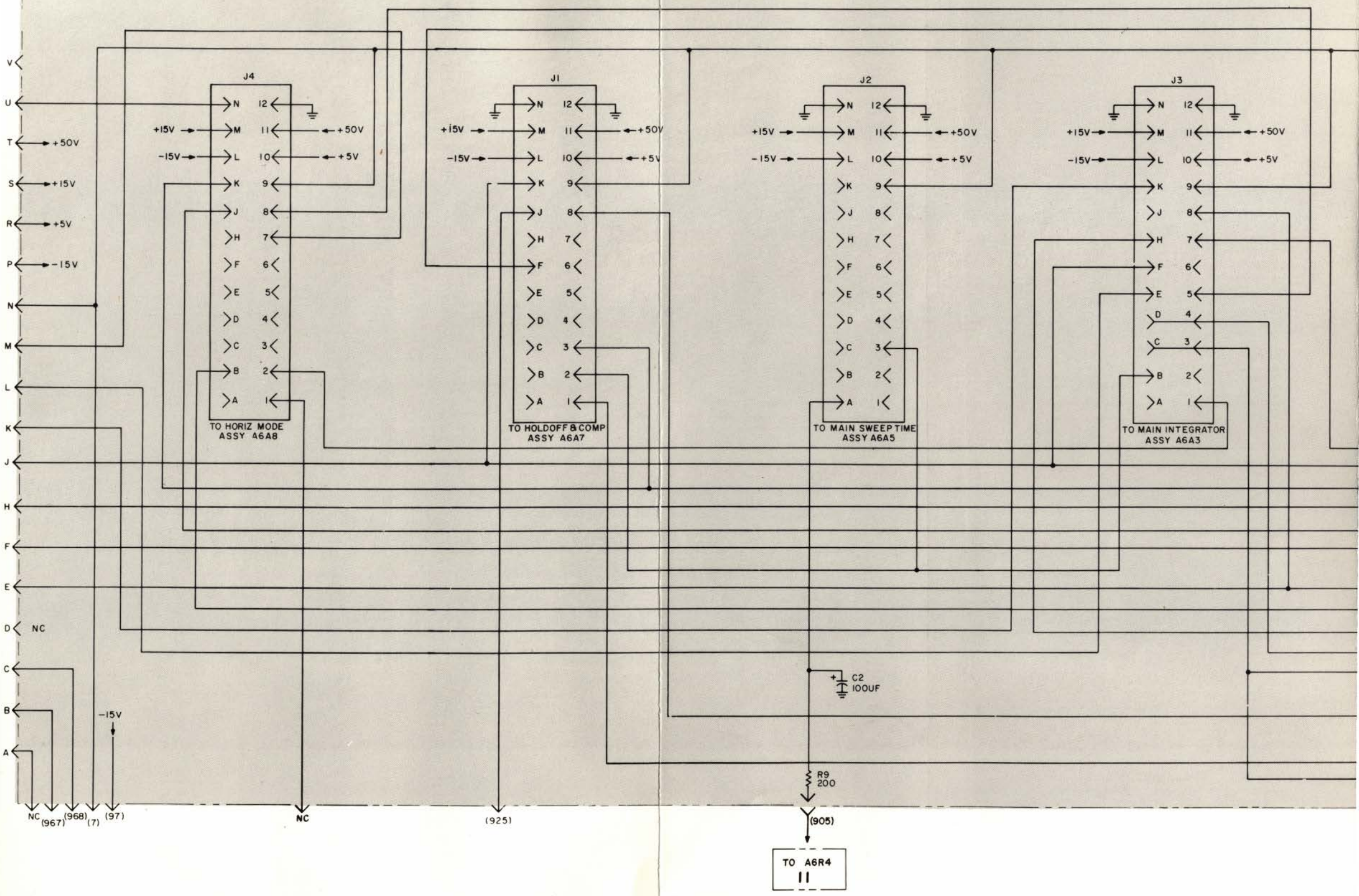


Figure 8-66.
Horizontal Mother Board A6A1
8-59/8-60

A6A1 HORIZ MOTHER BD



HEWLETT hp PACKARD

CATHODE-RAY TUBE WARRANTY

The cathode-ray tube (CRT) supplied in your Hewlett-Packard Oscilloscope and replacement CRT's purchased from hp are warranted by the Hewlett-Packard Company against electrical failure for a period of one year from the date of sale. Broken tubes and tubes with phosphor or mesh burns are not included under this warranty. If the CRT is broken when received, a claim should be made with the responsible carrier. All warranty claims with Hewlett-Packard should be processed through your nearest Hewlett-Packard Sales/Service Office (listed at rear of instrument manual).

We would like to evaluate every defective CRT. This engineering evaluation helps us to provide a better product for you. Please fill out the CRT Failure Report on the reverse side of this sheet and return it with the defective CRT to:

Hewlett-Packard Company
1900 Garden of the Gods Road
Colorado Springs, Colorado 80907

Attention: CRT QA

To avoid damage to the tube while in shipment, please follow the shipping instructions below; warranty credit is not allowed on broken tubes.

SHIPPING INSTRUCTIONS

It is preferable that the defective CRT be returned in the replacement CRT carton. If the carton or packaging material is not available, pack the CRT according to the instructions below:

1. Carefully wrap the tube in 1/4 inch thick cotton batting or other soft padding material.

2. Wrap the above in heavy kraft paper.

3. Pack wrapped tube in a rigid container which is at least 4 inches larger than the tube in each dimension.

4. Surround the tube with at least 4 inches of packed excelsior or similiar shock absorbing material; be sure the packing is tight all around the tube.

Thank you,

CRT Department

5950-7124

HEWLETT hp PACKARD

CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

ADDRESS _____

1. HP instrument MODEL NO. _____
2. HP instrument SERIAL NO. _____
3. CRT SERIAL NO. _____
4. Please describe the failure and, if possible, show the trouble on the appropriate CRT face below.

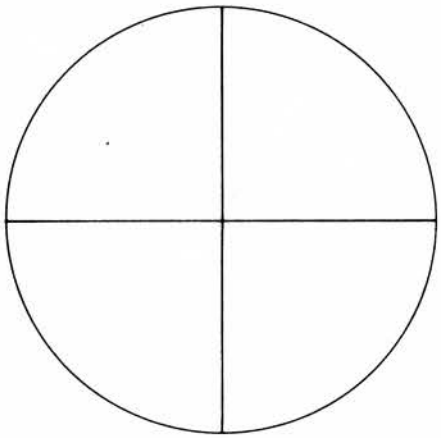
_____

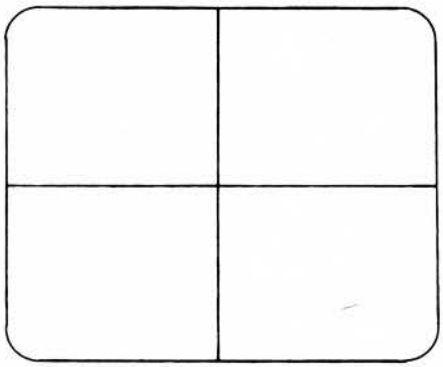
_____

_____

_____

_____





5. Warranty claimed ? Yes _____ No _____
6. HP Sales/Service Office _____ Repair Order No. _____

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Southfield 48075
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TWX: 810-224-4882

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TWX: 910-563-3734

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TWX: 910-760-1670

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Paramus 07652
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TWX: 710-990-4951

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Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

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TWX: 910-989-1665

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TWX: 910-881-2645

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